

Appendix No. 4 to the SMR ETE EIA Documentation

Summary Report on Surface Water and Groundwater for SMR ETE

**Juranová E., Marešová D., Vyskoč P., Vizina A., Datel J. V.,
Hrabánková A., Eckhardt P., Prchalová H. and Rosendorf P.**

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Name and registered office of the organization:

Výzkumný ústav vodohospodářský T. G. Masaryka, v. v. i.
Podbabská 30, 160 00 Prague 6

Director:

Ing. Tomáš Fojtík

Client:

Amentum Clean Energy s.r.o.
Křenová 58, 602 00 Brno

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Deputy Director for Research and Professional Activities:

Ing. Libor Ansorge, Ph.D.

Department Head:

Ing. Eva Juranová, Ph.D.

Principal Investigator:

Ing. Eva Juranová, Ph.D.

Co-investigators:

RNDr. Diana Marešová, Ph.D., Ing. Petr Vyskoč, Ing. Adam Vizina, Ph.D., RNDr. Josef Vojtěch Datel, Ph.D., Ing. Anna Hrabánková, Mgr. Pavel Eckhardt, RNDr. Hana Prchalová and Mgr. Pavel Rosendorf

Contents

1	Introduction	1
2	Surface Water in the Affected Area	2
2.1	Surface-Water Quantity: Vltava River	2
2.1.1	Current State of Surface-Water Quantity	2
2.1.2	Effect of the SMR ETE Project on Surface-Water Quantity	19
2.1.3	Effect of the SMR ETE Project on the Vltava Cascade	34
2.2	Surface-Water Quality: Vltava River	47
2.2.1	Current state of surface-water quality	48
2.2.2	Effect of the SMR ETE Project on Surface-Water Quality	65
2.3	Affected Minor Watercourses	86
2.3.1	Current state of the affected minor watercourses	86
2.3.2	Effect of the SMR ETE Project on the Affected Minor Watercourses	94
3	Groundwater in the Affected Area	100
3.1	Current state of groundwater quantity and quality	100
3.1.1	Definition of the groundwater area of interest	100
3.1.2	Hydrogeological conditions in ETE area of interest	102
3.1.3	Groundwater monitoring network	103
3.1.4	Legislative requirements for groundwater	107
3.1.5	Current precipitation conditions	107
3.1.6	Groundwater-level regime	108
3.1.7	Groundwater quality: non-radiological parameters	111
3.1.8	Groundwater quality: radioactivity parameters	113
3.1.9	Water withdrawals and water-source protection zones	114
3.2	Effect of the SMR ETE project on groundwater quantity and quality at the Temelín site	115
3.2.1	Current hydrogeological conditions at the SMR ETE site	116
3.2.2	Anticipated changes in hydrogeological and runoff conditions during SMR ETE construction	119
3.2.3	Anticipated Changes in Hydrogeological and Runoff Conditions during SMR ETE Operation	122
3.3	Hydrogeological Conditions at the SMR ETE Site in Relation to Stormwater Infiltration	124

3.3.1	Hydrogeological conditions decisive to water infiltration	125
3.3.2	Planned modifications at the SMR ETE site	126
3.3.3	Stormwater infiltration	127
3.3.4	Exclusion criteria for permitting stormwater infiltration	128
3.3.5	Assessment of the situation and conclusion	129
4	Status of Surface Water Bodies and Groundwater Bodies	131
4.1	Surface water bodies	131
4.1.1	Current Status of Surface Water Bodies.....	131
4.1.2	Effect of the SMR ETE Project on Surface-Water-Body Status	136
4.2	Groundwater bodies	144
4.2.1	Current status of groundwater bodies.....	144
4.2.2	Effect of the SMR ETE project on the status of groundwater bodies	154
5	Summary.....	164
5.1	Surface waters	164
5.2	Groundwater.....	171
5.3	Response to requirements arising from the EIA screening conclusion.....	174
	References	183
	List of figures	194
	List of tables	196
	List of abbreviations	201
	List of parameter symbols and abbreviations	202

1 Introduction

The purpose of this report is to summarize surface-water and groundwater issues associated with the New SMR Power Plant at the Temelín site (SMR ETE), focusing on an assessment of the current situation and, in particular, the effects of SMR ETE on surface water and groundwater, including its cumulative effects with the other parts of ETE: the existing Temelín Nuclear Power Plant (Units 1 and 2) and the New Nuclear Power Plant at the Temelín site (New NPP ETE). The report is intended for use as Appendix No. 4 to the EIA Documentation for the SMR ETE project (SMR ETE EIA Documentation).

This report was prepared by the Výzkumný ústav vodohospodářský T. G. Masaryka, v. v. i. (VÚV TGM, v. v. i.); the client is Amentum Clean Energy s.r.o. Client purchase order No. WC003349; contractor contract No. SMLP-2026-022-000008.

The report primarily summarizes the studies conducted to date by VÚV TGM, v. v. i., for the SMR ETE project in the fields of surface water and groundwater and is divided into five main parts:

The first part is the Introduction, which defines the purpose of the report in accordance with the terms of reference. Chapter 2 describes surface water in the area of interest, namely the area affected by the SMR ETE project. It describes the current state of surface water and the estimated effect of the SMR ETE project on both surface-water quantity and quality, not only in the Vltava River, but also in the affected minor watercourses near the SMR ETE project. Chapter 3 addresses groundwater in the affected area, describes its current quantitative and qualitative status, and also describes the effect of the SMR ETE project on groundwater. Chapter 4 addresses the status of water bodies under the Water Framework Directive (2000/60/EC) [1], covering both surface water bodies and groundwater bodies, and describes their current status and the effect of the SMR ETE project. Chapter 5 provides an overall summary and addresses the water-related requirements arising from the conclusions of the EIA screening procedure.

2 Surface Water in the Affected Area

2.1 Surface-Water Quantity: Vltava River

Chapter prepared by: Ing. Adam Vizina, Ph.D., Ing. Petr Vyskoč

The chapter is based on background studies [2], [3] and [4].

2.1.1 Current State of Surface-Water Quantity

This chapter summarizes the current state of surface-water quantity in the area affected by the SMR ETE project, focusing on the Vltava River and the associated water-management system as far as the Kořensko weir-pool profile. It is based on the DP20 background study, Initial Assessment of the SMR ETE Project, of May 2025 [2]; the subsequent DP20A background report for the SMR ETE EIA Documentation, of November 2025 [3]; and the DP07 background study, Surface Water: Quantity, for the New NPP ETE [4]. For the purposes of this chapter, report DP20A [3] is regarded as the updated background document because it expands and refines the methodological sections, the description of climate models, and the scope of the hydrological data. The original report DP20 [2] is used primarily to explain the water-management modeling method and to establish continuity with earlier assessments.

This part describes the baseline hydrological and water-management conditions. The assessment of the effect of the SMR ETE project on surface-water quantity is presented in the following chapter 2.1.2. The conclusions presented here therefore do not assess the contribution of the new project itself, but characterize water availability, hydrological regimes, the available data series, the principal water-management relationships, and the current ability of the system to stabilize the flow regime in the affected reach of the Vltava River.

Definition of the affected area and principal water-management relationships

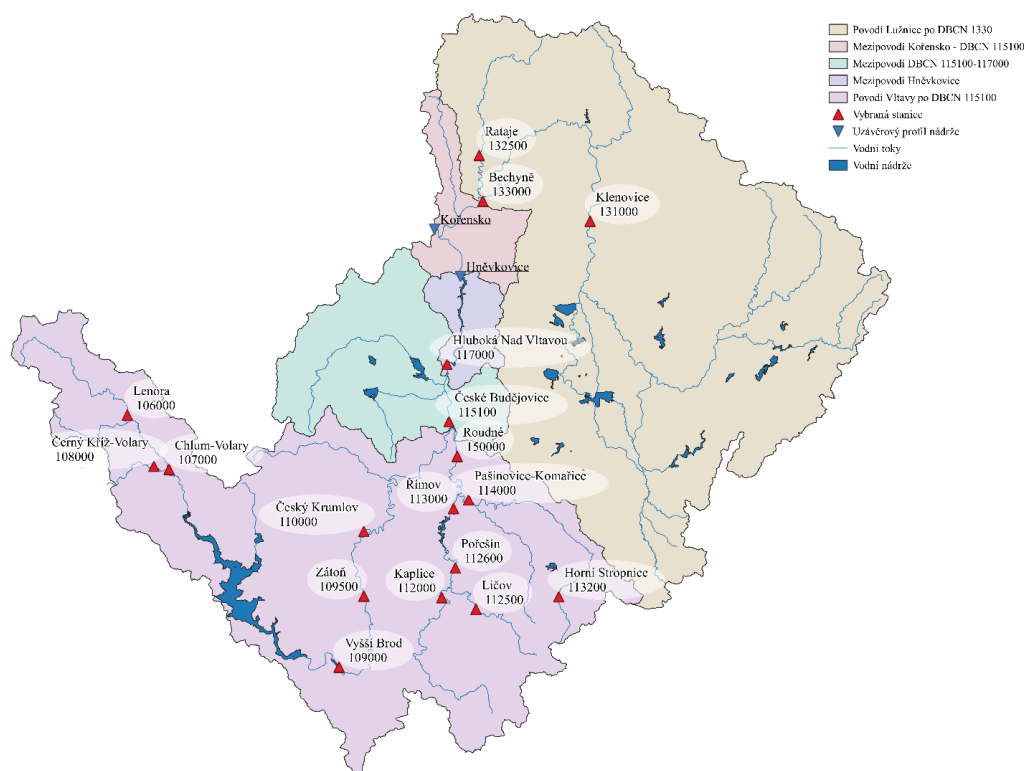
The affected area (Fig. 1) is defined as the Vltava River basin from the upper part of the Vltava Cascade to the Kořensko profile, including the major Malše and Lužnice tributaries. For the SMR ETE project, the decisive profiles are those at the Lipno I, Lipno II, Hněvkovice, and Kořensko waterworks, together with the Vyšší Brod, České Budějovice, Hluboká nad Vltavou, and Bechyně gauging stations. A key consideration in assessing the current situation is that the flow regime of the Vltava River in this part of the basin has long been affected by water storage and controlled releases from reservoirs. Observed discharges therefore cannot be interpreted solely as the natural response of the river basin, but as a combination of the natural hydrological situation and water-management operations.

The Hněvkovice waterworks is the water source for the Temelín site. In water-management calculations, wastewater discharge from the ETE site is considered at the Kořensko profile, which is also one of the principal control profiles for maintaining the minimum flow. Flow augmentation in the system is provided primarily by the storage volume of the Lipno I water

2 Surface Water in the Affected Area

reservoir in cooperation with the Hněvkovice water reservoir. Consequently, both the local hydrological situation at Hněvkovice and the upper Vltava regime and long-term management of stored water reserves are relevant.

2 Surface Water in the Affected Area



Povodní lužnice po DBCN1330	Lužnice basin up to DBCN 1330
Mezipovodí Kořensko – DBCN 115100	Kořensko incremental catchment: DBCN 115100
Mezipovodí DBCN 115100-117000	Incremental catchment DBCN 115100–117000
Mezipovodí Hněvkovice	Hněvkovice incremental catchment
Povodí Vltavy po DBCN 115100	Vltava basin up to DBCN 115100
Vybraná stanice	Selected station
Uzávěrový profil nádrže	Reservoir closure profile
Vodní toky	Watercourses
Vodní nádrže	Water reservoirs

Fig. 1 Area of interest showing the delineation of individual incremental catchments, major gauging stations, and water reservoirs. Source: [4].

2 Surface Water in the Affected Area

Dividing the area into individual incremental catchments makes it possible to supplement discharge series with the hydrological contribution of reaches for which continuous discharge measurements are unavailable. This procedure is particularly important between the České Budějovice profile, the inflow to the Hněvkovice water reservoir, the confluence with the Lužnice River, and the Kořensko profile. In these reaches, contributions from the incremental catchments were modeled using spatial climate data, the hydrological balance, and subsequent model calculations (see the list of selected profiles in Table 1).

Table 1 Selected profiles for which climatological data were derived and evaluated [3].

DBCN	Station	Watercourse	Area [km²]
109000	Vyšší Brod	Vltava	997.38
112600	Pořešín	Malše	436.83
115100	České Budějovice	Vltava	2849.82
117000	Hluboká nad Vltavou	Vltava	3400.45
133000	Bechyně	Lužnice	4055.13

Data sources and processing

Two main groups of data were used for the current assessment. The first group comprises long-term climatological data, particularly precipitation totals and air temperatures, processed for the period 1961–2022. The second group comprises hydrological data, primarily observed discharge series, derived natural discharges, data on evaporation from water surfaces, and operating data from Povodí Vltavy. For the current assessment, daily data through 2023 were added to background study DP07 [4], making it possible to compare the current situation with the period used in preparing the earlier EIA Documentation for the New NPP ETE.

The climatological data were derived from a 500 × 500 m raster grid created from measurements by the Czech Hydrometeorological Institute. Processing included verification and homogenization of station data, followed by interpolation to a spatial grid using regression kriging with external parameters such as elevation, slope, skewness, terrain roughness, and other characteristics. Spatial averages for individual basins, sub-basins, water reservoirs, and other areas of interest were derived from this raster layer. This procedure ensures that the climatological inputs to the hydrological calculations are not tied solely to point stations, but represent the spatial conditions of the assessed river basins as a whole [3], [4].

The hydrological data include both observed discharges and so-called natural discharges. Natural discharges represent the flow regime derived after eliminating the effects of water-management uses, particularly water withdrawals, discharges, and operations at waterworks. Their use is essential both for calibrating the hydrological model and for modeling the water-management system, because it makes it possible to separate the natural hydrological response of the river basin from the effects of operational interventions. In practice, naturalized, or natural, series are therefore used alongside observed water-level series.

2 Surface Water in the Affected Area

For the Hněvkovice water reservoir, background study DP07 [4] used non-homogenized daily data from Povodí Vltavy, for 2003–2023. These data include the date, reservoir water level, water and air temperatures, precipitation totals, information on snow and ice, reconstructed inflows, outflows, and withdrawals. Erroneous or implausible values were filtered, corrected, and supplemented, including by means of linear interpolation. The purpose of these adjustments was to obtain a consistent time series suitable for subsequent water-balance assessment. An overview of the data used is provided in Table 2.

Table 2 Overview of the data types used and their role in assessing the current state of surface-water quantity. Prepared according to [3], [4].

Climatological characteristics of the current situation

From a climatological perspective (Table 3), the current situation is characterized by a clear increase in air temperatures and a less clear trend in precipitation totals. Background study DP20A gives basic statistical characteristics of precipitation and temperature for five principal river basins for the period 1961–2022. A highly statistically significant trend in air temperature was identified in all assessed basins, whereas a statistically significant trend in precipitation totals occurs only locally. This combination is important for the water balance: even with relatively stable annual precipitation totals, higher temperatures may result in higher potential evapotranspiration and changes in the seasonal distribution of runoff.

Data type	Data characteristics	Use in the chapter
Climatological data	Spatial averages of precipitation and air temperature at a daily time step	Assessment of climate trends and inputs to the BILAN model
Observed discharges	Series of measured or operationally recorded discharges	Description of the hydrological regime actually observed
Natural discharges	Discharges after removal of the effects of withdrawals, discharges, and reservoirs	Model calibration and comparison with the affected regime
Operating data for the Hněvkovice water reservoir	Water levels, outflows, withdrawals, temperatures, precipitation, and other data	Reconstruction of reservoir inflow and the water balance
Modeled contributions from incremental catchments	Runoff contributions derived using a hydrological model	Supplementation of discharges in reaches without direct measurements

2 Surface Water in the Affected Area

Table 3 Basic statistical air-temperature and precipitation-total variables for 1961–2022 [3].

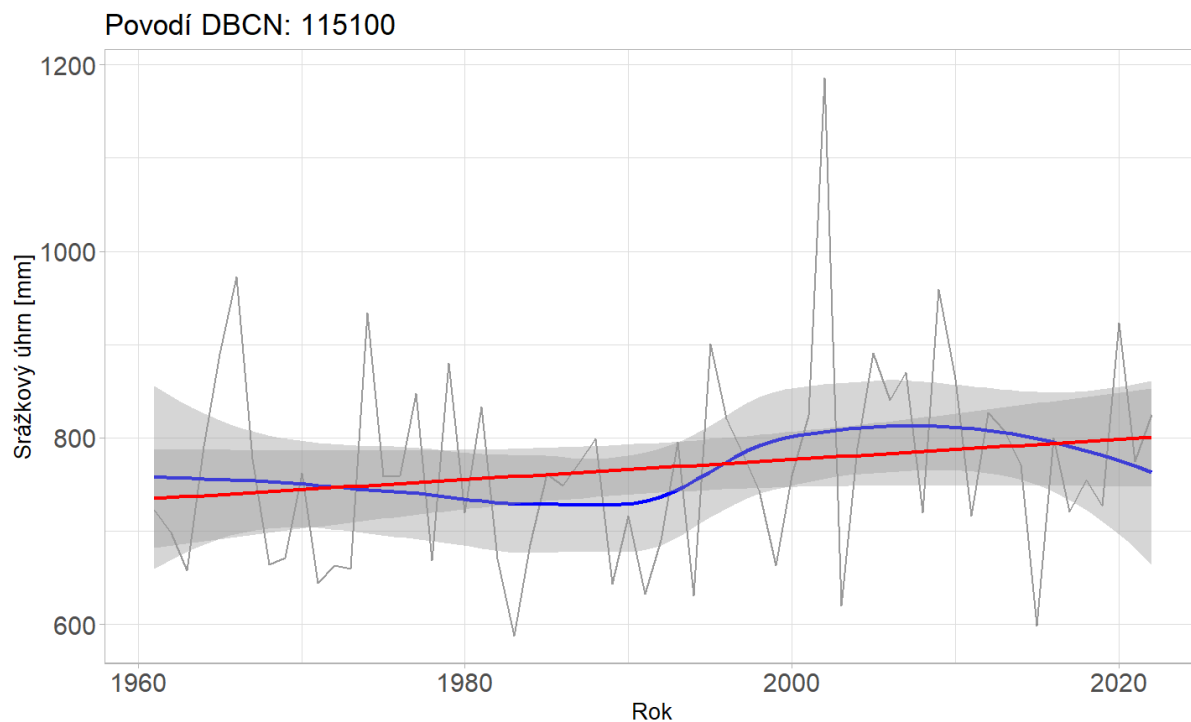
DBCN	Station	Watercourse	Mean T [°C]	T p-value	Mean P [mm]	P p-value
109000	Vyšší Brod	Vltava	5.48	0.000	871.20	0.171
112600	Pořešín	Malše	6.65	0.000	777.85	0.046
115100	České Budějovice	Vltava	6.57	0.000	767.68	0.156
117000	Hluboká nad Vltavou	Vltava	6.86	0.000	740.73	0.160
133000	Bechyně	Lužnice	7.71	0.000	663.93	0.324

The results confirm a strong temperature signal throughout the river basin. In the Vyšší Brod basin, the mean temperature for the assessed period is 5.48 °C, whereas farther downstream, in the Lužnice basin up to Bechyně, it reaches 7.71 °C. The differences correspond to the elevation and spatial gradients, but the p-value for the temperature trend is reported as 0.000 for all profiles. This means that rising temperatures are one of the most important long-term factors affecting the hydrological balance under current conditions.

Precipitation totals exhibit a spatial gradient from higher values in the upper Vltava basin to lower values in the Lužnice basin. The mean annual precipitation total is 871.20 mm in the Vyšší Brod basin and 663.93 mm in the Bechyně basin. The long-term precipitation trend is not statistically significant in most cases; the exception is the Pořešín basin, for which the p-value is reported as 0.046. For the assessment of surface-water quantity, it is therefore important that precipitation alone does not explain the current state of water availability in full. Temperature, evaporation, and changes in seasonality also play important roles.

The development of precipitation totals and air temperatures for the entire area of interest as far as the Kořensko water reservoir, represented by the DBCN 115100 České Budějovice profile, is shown in Fig. 2 and Fig. 3.

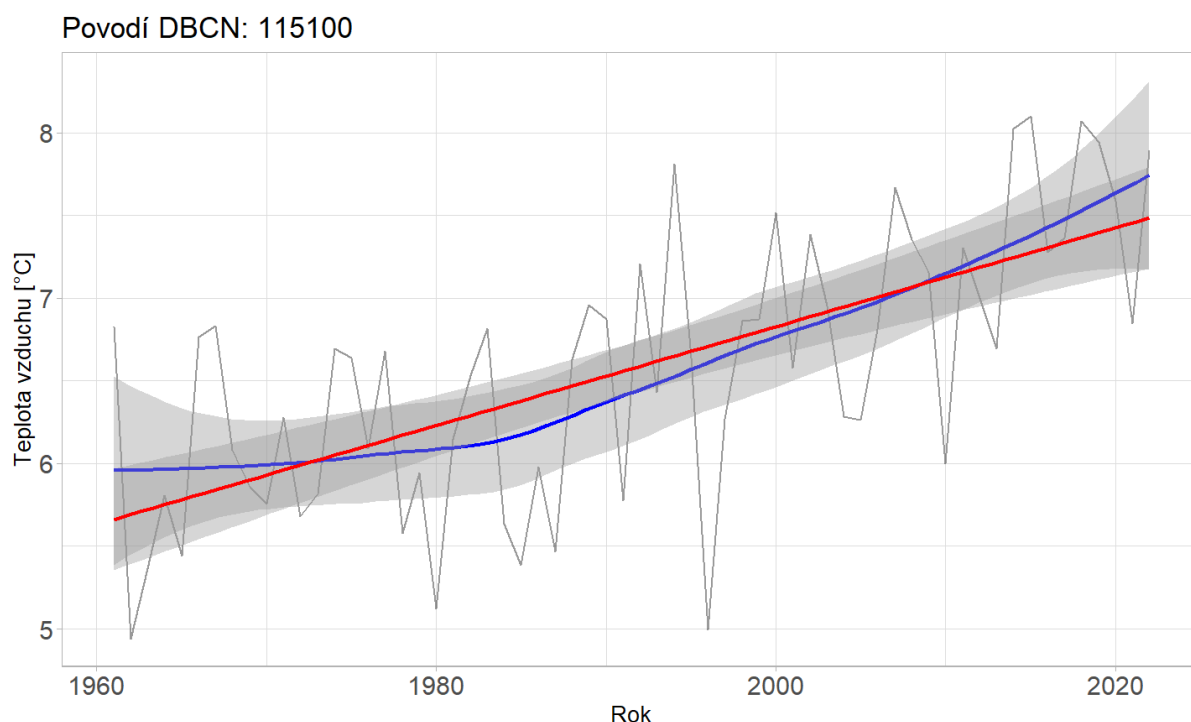
2 Surface Water in the Affected Area



Povodní DBCN: 115100	Basin DBCN: 115100
Srážkový úhrn [mm]	Precipitation total [mm]

Fig. 2 Trend in annual precipitation totals for the entire area of interest as far as the Kořensko water reservoir, using the DBCN 115100 České Budějovice profile as an example. Source: [3].

2 Surface Water in the Affected Area



Povodní DBCN: 115100	Basin DBCN: 115100
Teplota vzduchu [°C]	Air temperature [°C]

Fig. 3 Trend in annual air temperatures for the entire area of interest as far as the Kořensko water reservoir, using the DBCN 115100 České Budějovice profile as an example. Source: [3].

The ongoing changes should also be described by comparing the periods 2003–2009 and 2010–2023. This comparison is important because 2003–2009 corresponds to the wetter reference period used in the earlier EIA Documentation for the New NPP ETE [5], whereas 2010–2023 is more representative of current hydrological conditions. For 2010–2023, the entire area of interest has a lower mean annual precipitation total and, at the same time, a higher mean air temperature than in 2003–2009. A summary is provided in Table 4.

Table 4 Difference in mean precipitation and temperature values for the entire area of interest. Adapted from [4].

Area	P 2003–2009 [mm]	P 2010–2023 [mm]	Change in P [mm]	T 2003–2009 [°C]	T 2010–2023 [°C]	Change in T [°C]
Entire area of interest	723.88	695.03	-28.85	8.06	8.55	0.49
Incremental catchment DBCN 115100–117000	636.62	615.05	-21.57	8.80	9.42	0.62
Vltava basin up to DBCN 115100	787.48	753.57	-33.91	7.65	8.06	0.41
Lužnice basin up to DBCN 133000	676.12	649.71	-26.41	8.37	8.94	0.57

2 Surface Water in the Affected Area

Košensko incremental catchment: DBCN 115100	608.07	611.27	3.20	8.59	9.23	0.64
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Hydrological regime and discharge modeling

The hydrological regime of the area of interest is assessed using observed discharges, natural discharges, and modeled runoff series. Observed discharges reflect the actual situation in the river, meaning the situation affected by the operation of waterworks, water withdrawals, and discharges. Natural discharges represent the reconstructed regime without the direct effects of these water uses and serve as inputs to hydrological and water-management modeling. This dual perspective is essential for assessing the current situation: observed discharges describe the actual conditions in the watercourse, whereas natural discharges make it possible to determine whether changes in water availability are attributable primarily to climate trends or to operations and withdrawals.

The BILAN model was used to model the hydrological balance. This is a chronological catchment hydrological-balance model that calculates the fundamental balance relationships at the catchment surface, in the aeration zone, and in the groundwater zone at a daily or monthly time step. The inputs primarily comprise precipitation totals, mean temperatures, observed runoff depths, potential evapotranspiration, and water-use data. The model can simulate potential evapotranspiration, actual evapotranspiration, infiltration, percolation, snow-water storage, soil-water storage, and groundwater storage. Runoff is understood in the model as the sum of several components, including direct runoff and baseflow [3]. The list of profiles is provided in Table 5.

2 Surface Water in the Affected Area

Table 5 Discharge profiles used to assess the hydrological regime. Adapted from [3].

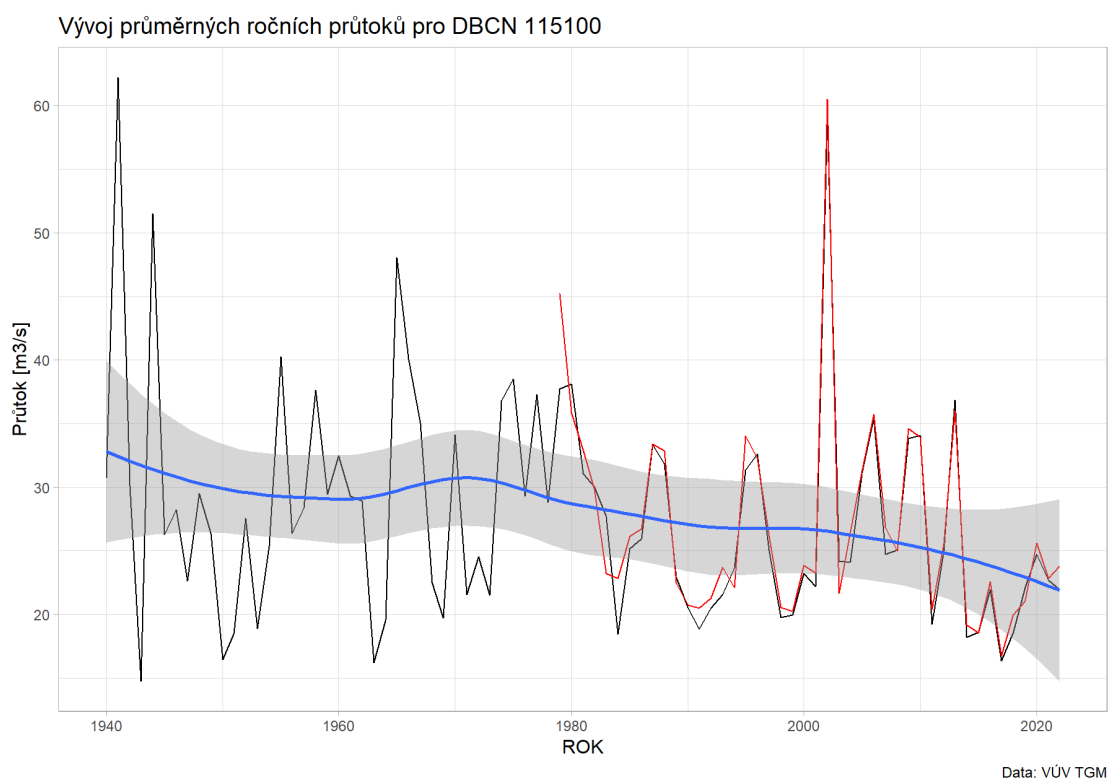
DBCN	Station	Watercourse	Area [km ²]
106000	Lenora	Teplá Vltava	175.80
107000	Chlum-Volary	Teplá Vltava	347.01
108000	Černý Kříž-Volary	Studená Vltava	103.17
109000	Vyšší Brod	Vltava	997.38
109500	Zátoň	Vltava	1303.76
110210	Český Krumlov, old gauge	Vltava	1545.44
112000	Kaplice	Malše	257.67
112500	Ličov	Černá	126.57
112600	Pořešín	Malše	436.83
113000	Římov	Malše	493.89
113200	Horní Stropnice	Stropnice	25.34
114000	Pašínovice-Komařice	Stropnice	400.66
115000	Roudné	Malše	962.69
115100	České Budějovice	Vltava	2849.82
116500	Lékařova Lhota	Bezdrevský Stream	
131000	Klenovice	Lužnice	3152.01
132500	Rataje	Smutná	217.62
133000	Bechyně	Lužnice	4055.13

Table 6 Basic discharge characteristics at the principal profiles. Adapted from [3].

DBCN	Station	Watercourse	p-value	Mean [m ³ /s]	Minimum [m ³ /s]	Maximum [m ³ /s]
106000	Lenora	Teplá Vltava	0.13	2.90	1.77	5.23
107000	Chlum-Volary	Teplá Vltava	0.01	5.52	3.48	9.60
108000	Černý Kříž-Volary	Studená Vltava	0.04	2.09	1.41	3.40
109000	Vyšší Brod	Vltava	0.27	13.31	7.72	25.54
109500	Zátoň	Vltava	0.83	15.42	9.50	31.91
112000	Kaplice	Malše	0.49	1.97	1.15	4.42
112500	Ličov	Černá	0.19	1.27	0.62	2.94
112600	Pořešín	Malše	0.73	3.82	2.18	8.32
113000	Římov	Malše	0.24	3.01	0.89	8.40
113200	Horní Stropnice	Stropnice	0.68	0.22	0.10	0.49
114000	Pašínovice-Komařice	Stropnice	0.74	2.06	0.90	6.36
115000	Roudné	Malše	0.80	5.97	2.94	16.78
115100	České Budějovice	Vltava	0.73	25.27	16.38	59.21
116500	Lékařova Lhota	Bezdrevský Stream	0.19	0.47	0.22	1.27
131000	Klenovice	Lužnice	0.75	16.86	7.45	43.80
132500	Rataje	Smutná	0.36	0.94	0.42	2.69
133000	Bechyně	Lužnice	0.76	20.83	9.31	54.47

2 Surface Water in the Affected Area

It is apparent from Table 6 that, in terms of long-term means, the Vltava River itself is the principal water source, with the Lužnice River also making a substantial contribution. The mean flow in the České Budějovice basin is $25.27 \text{ m}^3/\text{s}$, compared with $20.83 \text{ m}^3/\text{s}$ for the Lužnice River at Bechyně. The relationship between the two series is significant for the Kořensko profile, which lies downstream of the confluence of the Vltava and Lužnice Rivers and also serves as the control profile for the water-management solution. The development of mean annual discharges for DBCN 115100 České Budějovice is shown in Fig. 4.



Vývoj průměrných ročních průtoků pro DBCN 115100	Development of mean annual discharges for DBCN 115100
Průtok [m ³ /s]	Discharge [m ³ /s]
ROK	YEAR
Data: VÚV TGM	Data: TGM WRI

Fig. 4 Development of mean annual discharges for DBCN 115100 České Budějovice. Source: [3].

2 Surface Water in the Affected Area

Hněvkovice water reservoir and inflow reconstruction

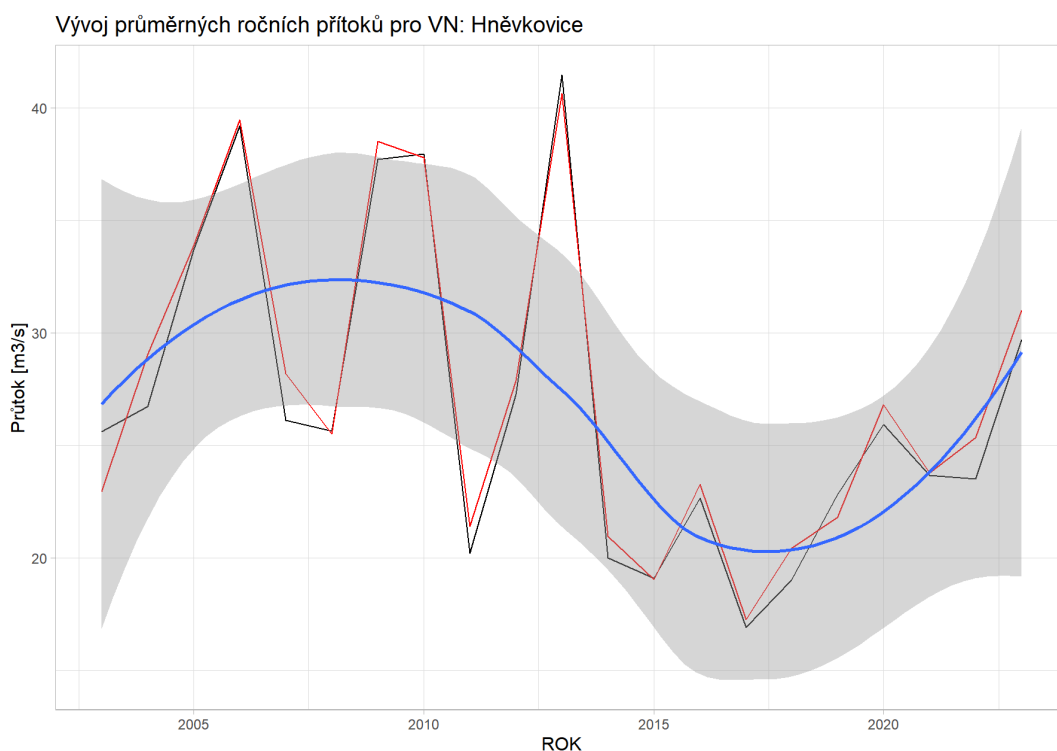
The Hněvkovice water reservoir is essential for supplying the Temelín site with surface water. The inflow to the reservoir is not measured directly and was therefore reconstructed in DP07 [4] using the water-balance method. The reconstruction inputs comprised reservoir outflow, evaporation from the water surface, water withdrawals, and the change in reservoir water volume. The background study expressed the basic balance relationship such that reservoir inflow equals the sum of outflow, evaporation, withdrawal, and the change in stored water volume. The volume derived in this manner was then converted to a discharge in m^3/s .

The inflow reconstruction was verified against the observed discharge at the České Budějovice-Vltava gauging station (DBCN 115100) and the modeled contribution from the incremental catchment between that station and the inflow to the Hněvkovice water reservoir. The incremental catchment was not monitored continuously, so its contribution was derived by means of a hydrological balance based on precipitation and air temperature. This procedure is important to the assessment of the current situation for two reasons. First, it makes it possible to use a consistent series of reservoir inflows for 2003–2023. Second, it takes into account local contributions from the incremental catchment, which can be significant during low and medium flows.

The Hněvkovice profile is also important to the current situation because a required minimum flow is specified there. According to DP20A and DP20, the minimum-flow requirement at the Hněvkovice profile is $6.5 \text{ m}^3/\text{s}$, compared with $9.5 \text{ m}^3/\text{s}$ at the Kořensko profile; a minimum of $6.0 \text{ m}^3/\text{s}$ is required at the profile downstream of Lipno II [2], [3].

The annual inflow series for the Hněvkovice water reservoir (Fig. 5) shows substantial interannual variability. In 2003–2023, wetter years with mean annual inflows exceeding $35\text{--}40 \text{ m}^3/\text{s}$ alternated with dry periods in which mean annual inflows fell below $20 \text{ m}^3/\text{s}$. The dry period after 2014 is clearly apparent in the series and corresponds to the multi-year drought that affected the entire Central European region. Discharges increase partially toward the end of the period, but the overall water-availability conditions in 2010–2023 remain less favorable than in 2003–2009 [4].

2 Surface Water in the Affected Area



Vývoj průměrných ročních průtoků pro VN: Hněvkovice	Development of mean annual discharges for the following water reservoir: Hněvkovice
Průtok [m³/s]	Discharge [m³/s]
ROK	YEAR

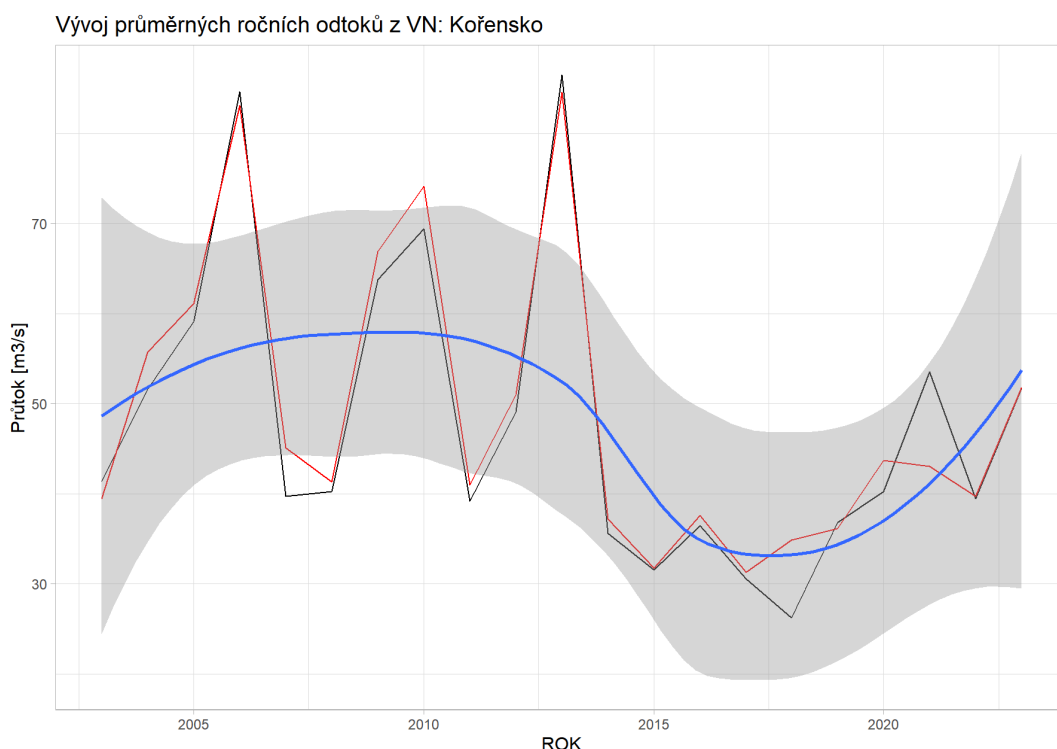
Fig. 5 Mean annual inflows to the Hněvkovice water reservoir in 2003–2023. Source: [4].

Discharges downstream of Hněvkovice, Lužnice inflow, and the Kořensko profile

In DP07 [4], the Vltava discharge at the profile downstream of the Hněvkovice reservoir was determined from corrected reservoir outflows and the modeled contribution from the incremental catchment between Hněvkovice and the confluence of the Vltava and Lužnice Rivers. In addition to the Vltava discharge, the Lužnice inflow, represented by the Bechyně gauging station, is also important to the Kořensko profile. The outflow from Kořensko was therefore derived by combining observed discharges, contributions from incremental catchments, and the Lužnice discharge. This procedure reflects the fact that Kořensko represents a synthetic profile in the lower part of the area of interest, incorporating both the Vltava regime and the Lužnice regime.

2 Surface Water in the Affected Area

In terms of the long-term mean, discharge at the Kořensko profile is higher than at the Hněvkovice profile, but it is also significantly affected by the hydrological situation in the Lužnice basin. The importance of the Lužnice River increases particularly during periods of low flow, when local differences among the individual parts of the river basin can significantly affect the resulting water balance. To assess the current situation, it is therefore necessary to consider not only the withdrawal at Hněvkovice, but also the subsequent balance situation downstream of the confluence with the Lužnice River and at the Kořensko profile. Mean annual outflows from the Kořensko water reservoir are shown in Fig. 6.



Vývoj průměrných ročních průtoků pro VN: Kořensko	Development of mean annual discharges for the following water reservoir: Kořensko
Průtok [m ³ /s]	Discharge [m ³ /s]
ROK	YEAR

Fig. 6 Mean annual outflows from the Kořensko water reservoir in 2003–2023. Source: [4].

A summary of annual discharges at the Hněvkovice and Kořensko profiles is provided in Fig. 6 and Table 7. The values shown indicate that lower water availability is apparent in both natural and affected discharges. The differences between the mean and affected regimes are relatively small, supporting the conclusion that the change between the periods is attributable

2 Surface Water in the Affected Area

primarily to climatic and hydrological conditions rather than solely to operational measures. However, the water-management infrastructure mitigates the differences and stabilizes the course of discharges, particularly during periods of low flow [4]. The discharge-characteristic values confirm that the current period is hydrologically less favorable than the reference periods used in some older background documents. The current situation must therefore be described using updated series through 2023, rather than being limited to the earlier periods.

Table 7 Summary of annual discharges at the Hněvkovice and Kořensko profiles. Calculated from the annual values provided in [4].

Profile	Period	Mean affected Q [m ³ /s]	Mean natural Q [m ³ /s]	Minimum year	Minimum Q [m ³ /s]	Maximum year	Maximum Q [m ³ /s]
Inflow to the Hněvkovice water reservoir	2003–2009	30.68	31.08	2003	25.62	2006	39.22
Inflow to the Hněvkovice water reservoir	2010–2023	25.03	25.54	2017	16.93	2013	41.46
Inflow to the Hněvkovice water reservoir	2003–2023	26.91	27.39	2017	16.93	2013	41.46
Outflow from the Kořensko water reservoir	2003–2009	54.37	56.13	2007	39.73	2006	84.66
Outflow from the Kořensko water reservoir	2010–2023	44.74	45.56	2018	26.23	2013	86.46
Outflow from the Kořensko water reservoir	2003–2023	47.95	49.08	2018	26.23	2013	86.46

Function of the water-management system and importance of the water reservoirs

The current flow regime of the Vltava River in the area of interest is significantly modified by waterworks (Table 8). The storage function is provided primarily by the Lipno I and Hněvkovice water reservoirs in conjunction with the other elements of the Vltava Cascade. According to the DP20 and DP20A background documents, the water-management model represents a system comprising elements that perform a control function, elements representing withdrawals and discharges, and control profiles with minimum-flow requirements (Table 9).

The water-management modeling method uses a simulation model of the storage function of the water-management system. At each time step, the requirement at a profile is compared with the affected inflow to that profile. If the profile is within the augmentation range of a reservoir's storage volume, the flow deficit can be made up in accordance with the operating rules. This

2 Surface Water in the Affected Area

principle is important to the current situation because the observed discharge is the result not only of the current inflow, but also of decisions concerning the management of stored water [2], [3].

Table 8 Storage volumes of the principal water reservoirs considered in the water-management model [3].

Water reservoir	Watercourse	Storage volume [million m³]	Storage-volume elevation [m a.s.l.]
Lipno I	Vltava	252.991	724.90
Římov	Malše	30.0162	470.65
Hněvkovice	Vltava	12.155	370.10

Table 9 Minimum-flow requirements at the principal control profiles [3].

Profile ID	Profile name	MQ [m³/s]	Specification
NAD112002	Lipno II	6.000	Waterworks Operating Rules
NAD111003	Hněvkovice	6.500	Waterworks Operating Rules
NAD1193900	Kořensko	9.500	Waterworks Operating Rules

Lipno I is the principal storage element in the system and can augment flows farther downstream. The operating rules include maintaining the minimum flow downstream of Lipno II, supplementing flows toward Hněvkovice and Kořensko, and supporting withdrawals for the ETE site in cooperation with the Hněvkovice water reservoir. During the summer, the Lipno I recreational target water level is also taken into account in the operating rules where hydrological and operating conditions permit [2], [3].

The Hněvkovice water reservoir has a smaller storage volume than Lipno I, but it is of immediate and decisive importance to the Temelín site. The background documents define its storage volume as lying between elevations 363.60 and 370.10 m a.s.l. and having a volume of 12.155 million m³. During exceptional low-flow situations and hydrological failures, the reservoir is assumed to be managed in conjunction with supplementation from Lipno I and the need to maintain water withdrawals for the ETE site and the minimum flow downstream of the reservoir [2], [3].

The water-management system therefore does not currently function as a passive reflection of natural discharge, but as a controlled system that uses storage to moderate differences between wet and dry periods. This fact is important when interpreting the data: observed discharges downstream of the reservoirs are stabilized, but this stabilization results from the operational management of water storage. As natural discharges decrease over the long term or dry periods occur more frequently, the importance of storage volumes and the rules governing their use increases.

2 Surface Water in the Affected Area

Assessment of reliability and current hydrological conditions

Although the assessment of the project effects is presented in Chapter 2.1.2, it is relevant to the description of the current situation that the water-management modeling in DP20A [3] also verified the functioning of the system under current hydrological conditions. For the 5 600 MWe capacity option plus the SMR ETE project (the SMR ETE project is not assessed in isolation solely as a separate withdrawal, but in terms of its cumulative effects with the existing Units 1 and 2 and the proposed New NPP ETE), DP20A [3] reported current reliability by supplied volume of 100.0% and reliability by duration of 99.9%. The same reliability by duration of 99.9% was also reported under current conditions for the minimum flows downstream of Lipno II, Hněvkovice, and Kořensko.

These values confirm that, under current hydrological conditions, the system is capable of meeting the water-withdrawal and minimum-flow requirements with a high degree of reliability. However, these results must be interpreted in relation to the assumed operating conditions, particularly the use of the Lipno I storage volume for water storage and flow augmentation. Current reliability is therefore not solely a property of the natural flow regime, but a result of the management of the water-management system.

Seasonal changes in the flow regime

The current state of surface-water quantity is also characterized by changes in seasonality (Table 10). A comparison of 2003–2009 and 2010–2023 shows that the greatest differences occur primarily in spring, particularly in March and April. The decrease in discharge is associated with lower precipitation in 2010–2023, as well as with increases in temperature and evapotranspiration. In other words, even similar precipitation totals can result in lower runoff if evaporation is higher and the growing season begins earlier.

Table 10 Selected monthly changes in affected discharges between 2003–2009 and 2010–2023 [4].

Profile	Month	Q 2003–2009 [m³/s]	Q 2010–2023 [m³/s]	Change [m³/s]
Inflow to the Hněvkovice water reservoir	March	50.50	32.16	-18.34
Inflow to the Hněvkovice water reservoir	April	44.95	28.27	-16.68
Inflow to the Hněvkovice water reservoir	May	30.77	24.13	-6.64
Inflow to the Hněvkovice water reservoir	July	32.80	23.87	-8.93
Inflow to the Hněvkovice water reservoir	August	28.21	22.79	-5.42
Inflow to the Hněvkovice water reservoir	September	20.81	19.20	-1.61

2 Surface Water in the Affected Area

Outflow from the Kořensko water reservoir	March	104.14	64.07	-40.07
Outflow from the Kořensko water reservoir	April	95.28	47.98	-47.30
Outflow from the Kořensko water reservoir	May	48.38	39.01	-9.37
Outflow from the Kořensko water reservoir	July	56.77	35.86	-20.91
Outflow from the Kořensko water reservoir	August	41.50	36.57	-4.93
Outflow from the Kořensko water reservoir	September	34.33	33.58	-0.75

These values show that lower water availability is apparent both in inflows to Hněvkovice and in affected discharges. The differences between the natural and affected regimes are relatively small, supporting the conclusion that the change between the periods is attributable primarily to climatic and hydrological conditions rather than solely to operational measures. However, the water-management infrastructure mitigates the differences and stabilizes the course of discharges, particularly during periods of low flow [4].

2.1.2 Effect of the SMR ETE Project on Surface-Water Quantity

This chapter assesses the effect of the SMR ETE project on surface-water quantity in the Vltava River and the associated water-management system. It builds on the description of the current situation provided in Chapter 2.1.1 and primarily uses the updated DP20A background report, SMR ETE Water-Management Study: Quantity, Background Report for the SMR ETE EIA Documentation [3]. The original DP20 study, Water-Management Study: Quantity, Initial Assessment of the SMR ETE Project [2], is used primarily to explain the broader methodology and compare the options because DP20A [3] refines and supersedes it with respect to some of the options assessed.

The effect of the project is assessed as part of the cumulative water-management configuration of the Temelín site. This means that the SMR ETE project is not assessed in isolation solely as a separate withdrawal, but in terms of its cumulative effects with the existing Units 1 and 2 and the proposed New NPP ETE. For further work, the updated DP20A study [3] considers the 5 600 MWe capacity option, comprising Units 1 and 2 ($2 \times 1\,100$ MWe) and two 1 700 MWe New NPP ETE units, supplemented by the 500 MWe SMR ETE project. This approach satisfies the requirement for the EIA Documentation to assess the project in relation to other activities of water-management significance at the site.

2 Surface Water in the Affected Area

Nature of the effect assessed

The direct effect of the project on surface-water quantity is primarily associated with raw-water withdrawal from the Hněvkovice waterworks and subsequent wastewater discharge at the Kořensko weir-pool profile. Withdrawal at Hněvkovice reduces the available discharge in the part of the Vltava River under consideration, whereas discharge at the Kořensko profile returns part of the water withdrawn to the watercourse. The decisive factors in terms of quantity are therefore not only the absolute withdrawal, but also the difference between withdrawal and discharge, its seasonal distribution, and the ability of the water-management system to augment flows from stored water reserves.

The indirect effect of the project is associated with the operation of water reservoirs, particularly Lipno I and Hněvkovice. In the model, these reservoirs provide withdrawals for the ETE site while also meeting the minimum-flow requirements at the control profiles. If the combination of increased withdrawal requirements and unfavorable hydrological conditions were to lower the water levels in the reservoir storage volumes, this would initially result in reduced reliability of the Lipno I recreational target water level and potentially in failures to meet withdrawal or minimum-flow requirements. The assessment therefore considers the reliability of meeting the requirements, not merely a single mean flow.

When interpreting the results, it is important to note that the assessed values are not obtained simply by subtracting the withdrawal from the discharge in the Vltava River. The water-management system is controlled, with withdrawals, discharges, minimum flows, and reservoir water levels interlinked. The project is therefore assessed using a simulation model of the storage function of the water-management system that takes into account the chronological sequence of hydrological situations, reservoir storage volumes, operating rules, and water-use requirements.

Water-withdrawal and discharge requirements

For the 5 600 MWe capacity option plus the SMR ETE project, the updated DP20A study assumes a total annual raw-water withdrawal of 134 922.91 thousand m³ and total annual wastewater discharge of 30 039.56 thousand m³ (Table 11) [3]. Expressed as mean year-round discharges, this corresponds to approximately 4.28 m³/s for withdrawal, 0.95 m³/s for discharge, and 3.33 m³/s for the difference between withdrawal and discharge. The contribution of the SMR ETE project itself is 12 000 thousand m³ withdrawn per year and 3 564 thousand m³ discharged per year, giving a net difference of approximately 8 436 thousand m³ per year, equivalent to approximately 0.27 m³/s.

The SMR ETE project's share of the total cumulative withdrawal under the 5 600 MWe plus SMR option is approximately 8.9%. For discharge, the SMR share is approximately 11.9%. In terms of the overall balance, the SMR ETE project therefore represents a smaller proportion of the water requirements than the principal capacity option for the Temelín site. Nevertheless, its

2 Surface Water in the Affected Area

inclusion is important to the EIA Documentation because it increases the existing and planned raw-water withdrawal requirements.

Table 11 Monthly water-withdrawal and discharge balance for the 5 600 MWe plus SMR ETE project option. Adapted from [3].

Month	Withdrawal, 5 600 MWe + SMR [thousand m³]	Discharge, 5 600 MWe + SMR [thousand m³]	Withdrawal minus discharge [thousand m³]
January	10287.7	2288.4	7999.3
February	9436.3	2097.1	7339.3
March	10858.0	2416.5	8441.5
April	11011.9	2451.1	8560.8
May	12008.8	2675.1	9333.7
June	11961.1	2664.4	9296.7
July	12588.0	2805.3	9782.7
August	12530.1	2805.3	9724.8
September	11688.1	2603.1	9085.1
October	11521.6	2565.6	8955.9
November	10523.3	2341.3	8182.0
December	10508.0	2337.9	8170.1
Year	134922.9	30039.6	104883.4

The monthly distribution of requirements shows that the highest withdrawal values occur during the summer, particularly in July and August. This is significant from a water-management perspective because summer is also a period of increased evaporation, higher water temperatures, and more frequent low flows. The project-effect assessment must therefore verify whether the system can maintain the withdrawal when high seasonal water demand coincides with unfavorable hydrological conditions.

The difference between withdrawal and discharge represents water that does not return to the assessed profile as discharged wastewater. This is not automatically a permanent loss of water from the river basin in hydrological terms because some of the water is part of operating and technological processes; however, this value is key to the flow balance between the withdrawal and discharge profiles. For this reason, the model considers the spatial separation between withdrawal at the Hněvkovice waterworks and discharge at the Kořensko profile.

Water-management system model

The water-management model includes the Vltava River basin as far as the Kořensko weir-pool profile. The solution includes the Lipno I, Lipno II, Římov, Hněvkovice, and Kořensko waterworks, together with selected gauging profiles serving as hydrological inputs and control points (Fig. 7). Hydrological conditions are represented by time series of natural monthly

2 Surface Water in the Affected Area

discharges. The effects of other withdrawals and discharges in the river basin are included in the model on the basis of water-balance records maintained under the applicable regulations [3].

At each monthly step, the simulation model compares the water available at the individual profiles with withdrawal and minimum-flow requirements. If the natural or currently affected inflow does not meet a requirement, the model simulates augmentation from the storage volume of the water reservoirs in accordance with the operating rules. The output comprises not only the course of discharges, but also the course of reservoir water levels and storage, together with an assessment of failures to meet the individual requirements.

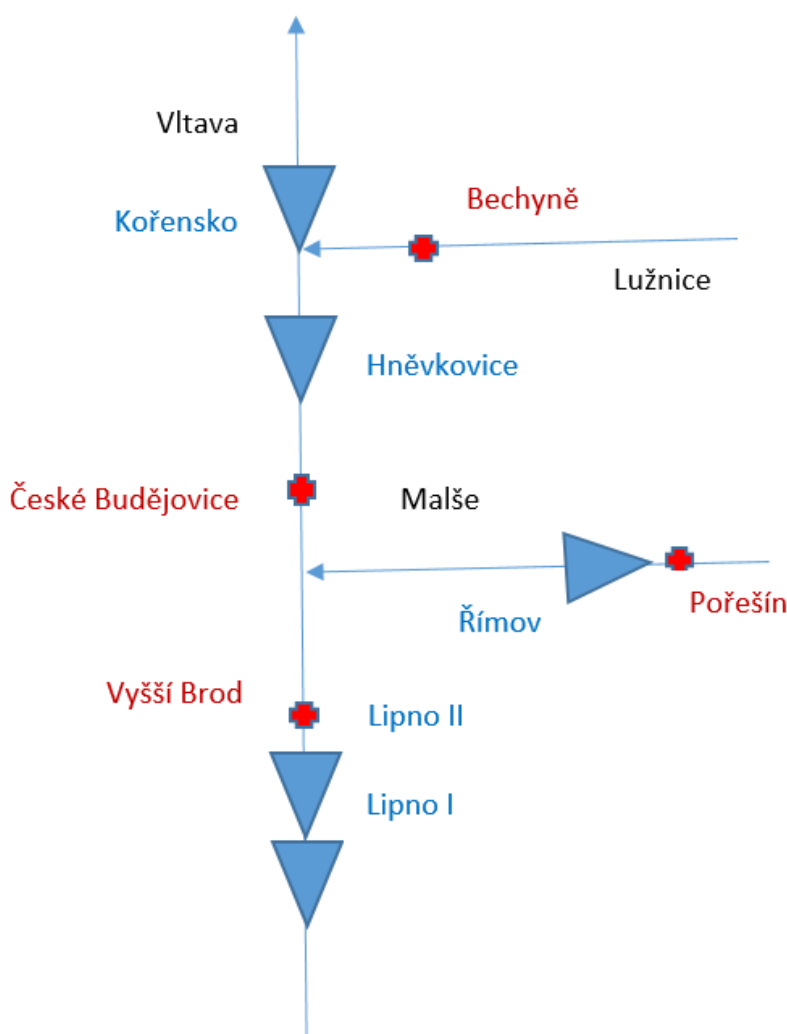


Fig. 7 Diagram of the water-management system used to assess the effect of the SMR ETE project on surface-water quantity. Source: [3].

2 Surface Water in the Affected Area

The figure shows that the project is assessed within a broader system of interconnected waterworks and flow relationships. The storage and control functions of Lipno I are essential to maintaining the withdrawal at Hněvkovice, whereas the Kořensko profile is decisive for evaluating the river flow after wastewater discharge and Lužnice inflow are taken into account. The effect of the SMR ETE project therefore cannot be assessed solely at the withdrawal point, but must be related to the entire system from the upper Vltava to Kořensko.

Hydrological-condition options assessed

The updated DP20A assessment [3] is based on the decision to continue detailed work with emissions scenario SSP2-4.5¹ and the 5 600 MWe capacity option plus the SMR ETE project. The assessment used four climate models, comprising three CMIP6 global climate models (GCMs), EC-Earth3, MPI-ESM1-2-HR, and TaiESM1, and one regional climate model (RCM), ALADIN-CLIMATE/CZ. EC-Earth3 is a European global climate model used within CMIP6, MPI-ESM1-2-HR is a high-resolution global model developed by the Max Planck Institute, and TaiESM1 is a global Earth-system model developed in Taiwan. ALADIN-CLIMATE/CZ is a regional climate model adapted to the conditions of Czechia and Central Europe. Using multiple models captures uncertainty in future climate development.

The assessment was conducted for the reference years 2060 and 2080. Current hydrological conditions and a simple sensitivity option involving warming of 2 °C relative to the present were also evaluated [3].

The original DP20 study [2] considered a broader set of options, including a 4 600 MWe capacity option plus SMR and multiple emissions scenarios. For the SMR ETE EIA Documentation, however, the updated DP20A set [3] is decisive because it includes the additional ALADIN-CLIMATE/CZ simulation and narrows the further assessment to scenario SSP2-4.5 and the 5 600 MWe plus SMR option. The original DP20 results [2] are therefore used in this chapter primarily to explain the methodology and provide context for the sensitivity of the results to the selected capacity option and climate scenario. An overview of the options assessed is provided in Table 12.

Table 12 Overview of water-management modeling options assessed in the updated DP20A study [3].

Withdrawal option	Reference period	Scenario	Model/conditions	Note
5 600 MWe + SMR	2060	SSP2-4.5	EC-Earth3	Climate projection

¹ SSP2-4.5 is an intermediate emissions scenario that assumes a continuation of current socioeconomic trends and only gradual implementation of climate measures. It is neither a distinctly low-emissions nor a high-emissions option, but a so-called “middle-of-the-road” development pathway. The scenario assumes moderate technological progress, gradual reductions in greenhouse-gas emissions, and an intermediate level of warming during the 21st century.

2 Surface Water in the Affected Area

5 600 MWe + SMR	2060	SSP2-4.5	MPI-ESM1-2-HR	Climate projection
5 600 MWe + SMR	2060	SSP2-4.5	TaiESM1	Climate projection
5 600 MWe + SMR	2060	SSP2-4.5	ALADIN-CLIMATE/CZ	Climate projection
5 600 MWe + SMR	2080	SSP2-4.5	EC-Earth3	Climate projection
5 600 MWe + SMR	2080	SSP2-4.5	MPI-ESM1-2-HR	Climate projection
5 600 MWe + SMR	2080	SSP2-4.5	TaiESM1	Climate projection
5 600 MWe + SMR	2080	SSP2-4.5	ALADIN-CLIMATE/CZ	Climate projection
5 600 MWe + SMR	Present	Hist	HIST	Current hydrological conditions
5 600 MWe + SMR	-	Hist+2	Warming of 2 °C	Warming of 2 °C

All options assume that the entire storage volume of the Lipno I water reservoir is used for water storage and flow augmentation. This is a significant assessment assumption. The results therefore characterize the functioning of the system on the assumptions that the operating options corresponding to the selected model configuration are available and that the requirements are prioritized as assumed in the water-management model.

Reliability criteria and their significance to the effect assessment

The assessment of the effect on surface-water quantity is expressed primarily as reliability by duration p_t and reliability by supplied volume p_d . Reliability by duration is the proportion of time steps in which the requirement is met, whereas reliability by supplied volume is the proportion of the total required water volume that is actually supplied. The maximum failure depth and maximum continuous failure duration are also assessed as supplementary criteria.

For indicative interpretation, the results were compared with the values specified in ČSN 75 2405 [6]. Significance class A, with recommended reliability by duration $p_t = 99.5\%$, is relevant to withdrawals for a nuclear power plant. For minimum residual flows and minimum outflows from water reservoirs, the relevant value is $p_t = 98.5\%$. The recreational water level in the Lipno I water reservoir is monitored separately in the assessment as a supplementary indicator, with an indicative value of $p_t = 95\%$ for recreational use [3].

In terms of the effect of the SMR ETE project, the key issue is whether including SMR withdrawal and discharge in the cumulative 5 600 MWe plus SMR option results in failures to maintain water withdrawals or minimum flows. The results for current hydrological conditions must also be distinguished from those for climate projections because unfavorable climate-

2 Surface Water in the Affected Area

change options can reduce the river basin's available water yield substantially more than the incremental requirements associated with the SMR ETE project itself.

Results for current hydrological conditions and warming of 2 °C

Under current hydrological conditions, water-withdrawal reliability for the ETE site under the 5 600 MWe plus SMR option was assessed as failure-free. The same result was obtained for the option with hydrological conditions involving warming of 2 °C (Table 13). In both cases, reliability by duration is $p_t = 99.9\%$ and reliability by supplied volume is $p_d = 100.0\%$. Both the maximum failure depth and maximum continuous failure duration are zero [3].

Table 13 Water-withdrawal reliability for the 5 600 MWe plus SMR ETE project option under current hydrological conditions and with warming of 2 °C. Adapted from [3].

Hydrological conditions	Pt [%]	Pd [%]	Maximum failure depth [%]	Maximum failure duration [months]	Assessment
Present	99.9	100.0	0	0	Failure-free supply
Warming of 2 °C	99.9	100.0	0	0	Failure-free supply

The result means that, under the assumed current hydrological conditions and model assumptions, the cumulative requirement of Units 1 and 2 plus two 1 700 MWe New NPP ETE units plus the 500 MWe SMR ETE project can be met in terms of raw-water withdrawal. Including the SMR ETE project therefore does not in itself result in a failure of the system's storage function or in failure to supply the required water volume under current hydrological conditions.

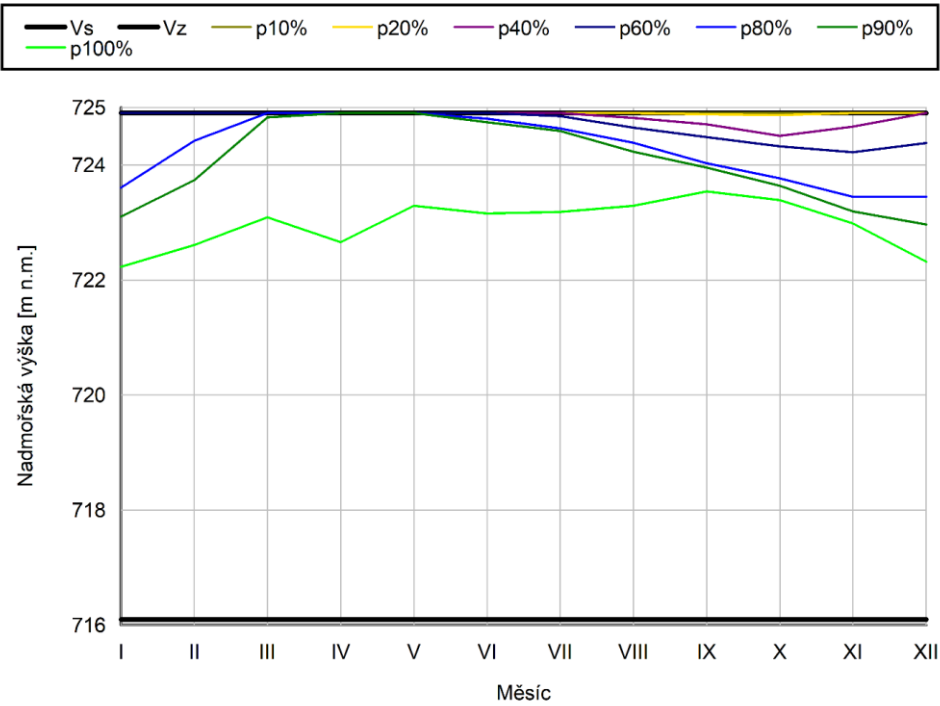
A similar conclusion applies to minimum flows downstream of the Lipno II, Hněvkovice, and Kořensko waterworks. Both under current conditions and with warming of 2 °C, minimum-flow reliability is assessed as $p_t = 99.9\%$. However, the effect of warming is more pronounced for the Lipno I recreational water level, whose reliability decreases from 97.1% to 75.5% (Table 14). This result indicates that climate warming and increased evaporation may affect the operating water levels and recreational function of Lipno I more than the reliability of withdrawals and minimum flows themselves. The probability fields of water levels are provided in Fig. 8 and Fig. 9.

Table 14 Reliability of the Lipno I minimum flows and recreational water level under current hydrological conditions and with warming of 2 °C [3].

Hydrological conditions	MQ Lipno II Pt [%]	MQ Hněvkovice Pt [%]	MQ Kořensko Pt [%]	Lipno I recreational water level Pt [%]	Interpretation
Present	99.9	99.9	99.9	97.1	Minimum flows met

2 Surface Water in the Affected Area

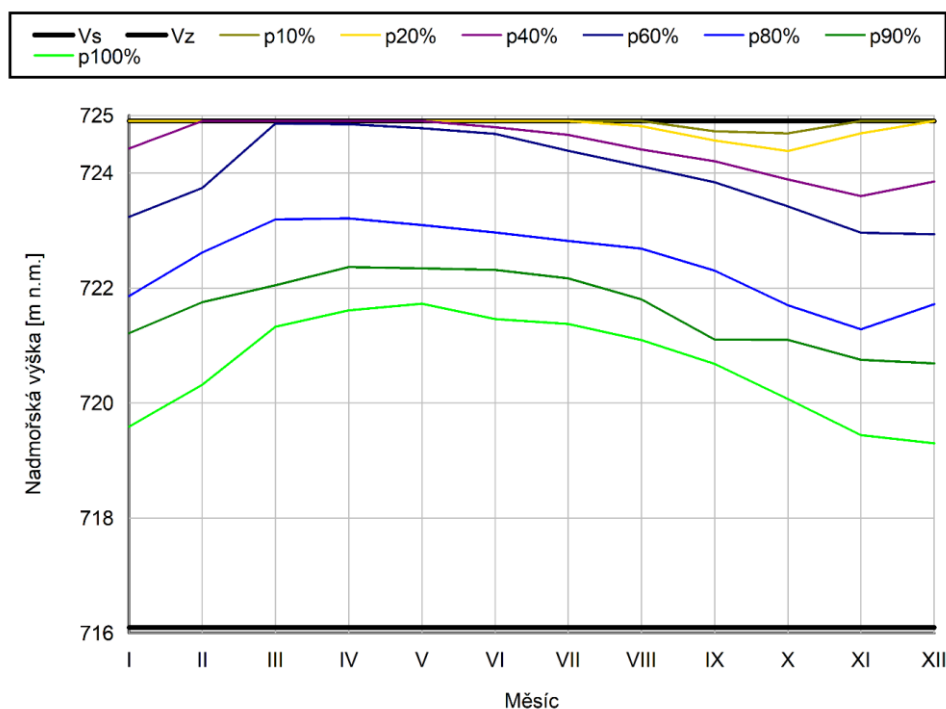
Warming of 2 °C	99.9	99.9	99.9	75.5	Minimum flows met; reduced reliability of the recreational water level
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Nadmořská výška [m n.m.]	Elevation [m a.s.l.]
Měsíc	Month

Fig. 8 Probability field of water levels attained in the Lipno I water reservoir for the 5 600 MWe plus SMR ETE project option under current hydrological conditions. Source: [3].

2 Surface Water in the Affected Area



Nadmořská výška [m n.m.]	Elevation [m a.s.l.]
Měsíc	Month

Fig. 9 Probability field of water levels attained in the Lipno I water reservoir for the 5 600 MWe plus SMR ETE project option with warming of 2 °C [3].

Comparison of the water-level probability fields confirms that the 2 °C warming option results in greater use of the Lipno I storage volume. For the assessment of the effect on surface-water quantity, it is important that even this sensitivity option does not result in a failure to maintain withdrawals for the ETE site or minimum flows at the assessed profiles. However, it also shows that the system's reserve decreases under warmer conditions and that the importance of the Lipno I storage function increases.

Results under climate-change conditions: water withdrawals

Assessment (Table 15) of climate projections for scenario SSP2-4.5 shows that the results have different sensitivities depending on the climate model used. For EC-Earth3, MPI-ESM1-2-HR, and ALADIN-CLIMATE/CZ, withdrawals for the ETE site are maintained without failure in both the 2060 and 2080 reference periods. The TaiESM1 model produces different results and represents the most conservative option in terms of water availability in the assessed area [3]. For interpretation purposes, TaiESM1 must therefore be understood as a boundary climate option on the conservative side, rather than as a representative result for the entire set of

2 Surface Water in the Affected Area

projections. For the other models used, including the regional ALADIN-CLIMATE/CZ model, withdrawal supply was assessed as failure-free.

For the 2060 reference year, TaiESM1 gives withdrawal reliability of $p_t = 98.5\%$ and $p_d = 99.3\%$, with a maximum failure depth of 79% and a maximum continuous failure duration of two months. This does not reach the indicatively recommended p_t reliability of 99.5% for nuclear-power-plant withdrawals. For the 2080 reference year, TaiESM1 indicates a more substantial failure: $p_t = 87.9\%$, $p_d = 91.8\%$, a maximum failure depth of 95%, and a maximum failure duration of 11 months. These results represent a limiting climate option, not a result typical of all the models assessed. The presentation of TaiESM1 values in the following text focuses primarily on defining the boundary conditions for the functioning of the water-management system. However, the conclusion on the acceptability of the project must relate to the full set of models, in which three of the four projections for both the 2060 and 2080 reference years show no failures in maintaining withdrawals.

2 Surface Water in the Affected Area

Table 15 Water-withdrawal reliability for the 5 600 MWe plus SMR ETE project option under SSP2-4.5 for the 2060 and 2080 reference years [3].

Reference period	Model	Pt [%]	Pd [%]	Maximum failure depth [%]	Maximum failure duration [months]	Assessment
2060	EC-Earth3	99.9	100.0	0	0	Failure-free supply
2060	MPI-ESM1-2-HR	99.9	100.0	0	0	Failure-free supply
2060	TaiESM1	98.5	99.3	79	2	Recommended value for class A withdrawals not attained
2060	ALADIN-CLIMATE/CZ	99.9	100.0	0	0	Failure-free supply
2080	EC-Earth3	99.9	100.0	0	0	Failure-free supply
2080	MPI-ESM1-2-HR	99.9	100.0	0	0	Failure-free supply
2080	TaiESM1	87.9	91.8	95	11	Significant reliability failures under the unfavorable scenario
2080	ALADIN-CLIMATE/CZ	99.9	100.0	0	0	Failure-free supply

These results show that the effect of the SMR ETE project on surface-water quantity is acceptable in terms of maintaining withdrawals under most of the hydrological options assessed; however, the system is sensitive to the combination of high cumulative water demand and substantially unfavorable climate development. TaiESM1 for 2080 is particularly important because it represents the scenario with the greatest reduction in reliability in DP20A.

It must be emphasized that the failure assessed under unfavorable climate projections does not indicate the effect of the SMR ETE project in isolation from the other requirements at the site. The calculation includes the cumulative effects of Units 1 and 2, the New NPP ETE, and the SMR ETE project. The SMR ETE project itself adds approximately 12 million m³ per year to the cumulative withdrawal, whereas the 5 600 MWe capacity option accounts for the principal part of the requirement. The result must therefore be interpreted as an assessment of the acceptability of the entire cumulative water-management configuration, in which the SMR ETE project increases the water requirement but is not the sole determining factor.

Results under climate-change conditions: minimum flows

The same set of climate options was used to assess the reliability of minimum flows downstream of the Lipno II, Hněvkovice, and Kořensko waterworks. The required minimum-flow reliability is met under most options (Table 16). More significant failures again occur primarily for TaiESM1 for the 2080 reference year, in which minimum-flow reliability falls below the value recommended for class B. Here too, this is the most conservative projection in the set of climate models used. The results of the other models, particularly ALADIN-CLIMATE/CZ and EC-Earth3, indicate that high minimum-flow reliability will be maintained.

2 Surface Water in the Affected Area

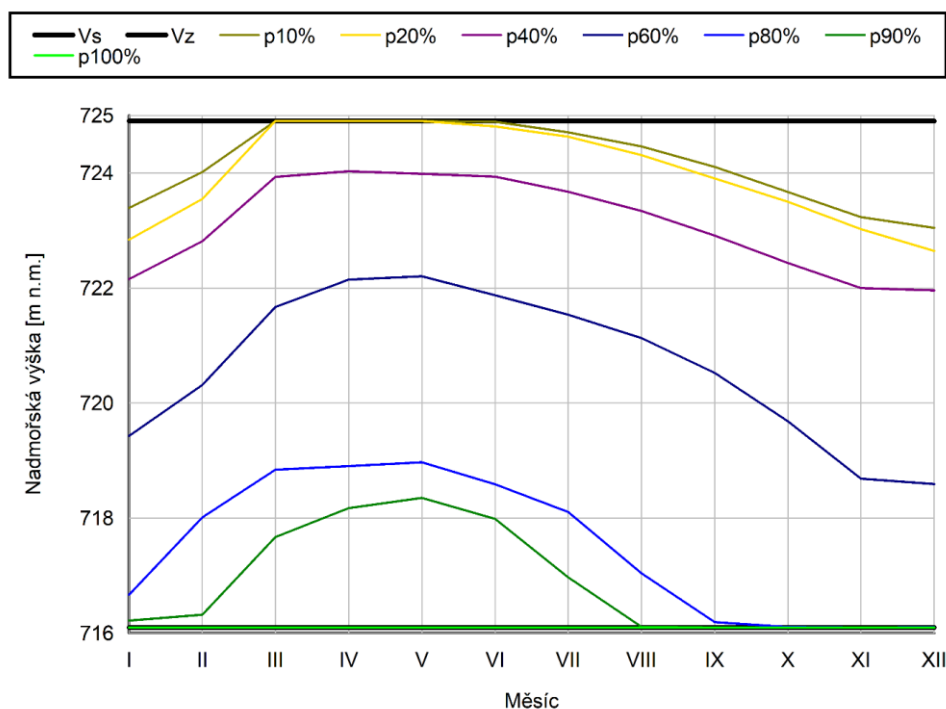
Table 16 Reliability of minimum flows and the Lipno I recreational water level for the 5 600 MWe plus SMR ETE project option under SSP2-4.5 [3].

Reference period	Model	MQ Lipno II Pt [%]	MQ Hněvkovice Pt [%]	MQ Kořensko Pt [%]	Lipno I recreational water level Pt [%]
2060	EC-Earth3	99.9	99.9	99.9	93.3
2060	MPI-ESM1-2-HR	99.9	99.9	99.9	97.1
2060	TaiESM1	99.1	98.9	98.9	68.5
2060	ALADIN-CLIMATE/CZ	99.9	99.9	99.9	97.1
2080	EC-Earth3	99.9	99.9	99.9	96.4
2080	MPI-ESM1-2-HR	99.9	99.7	99.7	84.8
2080	TaiESM1	88.8	88.2	89.4	40.7
2080	ALADIN-CLIMATE/CZ	99.9	99.9	99.9	84.0

For the 2060 reference period, even under the less favorable TaiESM1 model, minimum flows are maintained with $p_t = 99.1\%$ for Lipno II and $p_t = 98.9\%$ for Hněvkovice and Kořensko. These values exceed the indicative minimum-flow threshold of 98.5%. However, a substantial decrease occurs for the Lipno I recreational water level, where p_t falls to 68.5% under TaiESM1.

For the 2080 reference period, TaiESM1 already shows a decrease in minimum-flow reliability to 88.8% downstream of Lipno II, 88.2% at Hněvkovice, and 89.4% at Kořensko. In this limiting case, the model results do not indicate that minimum-flow reliability is sufficient. However, the other models produce more favorable results even for 2080, with minimum flows maintained at high reliability (the water-level probability field is provided in Fig. 10).

2 Surface Water in the Affected Area



Nadmořská výška [m n.m.]	Elevation [m a.s.l.]
Měsíc	Month

Fig. 10 Probability field of water levels attained in the Lipno I water reservoir for the most conservative option, SSP2-4.5, TaiESM1, reference year 2080. Source: [3].

The most conservative option shows substantial drawdown of the Lipno I storage volume. For the assessment of the effect on surface-water quantity, this is important as an indication of the limits of the entire water-management system under long-term dry and warm conditions. The effect of the SMR ETE project increases the cumulative withdrawal requirement under this option, but failures are caused primarily by the concurrence of this requirement with unfavorable climate development and the overall composition of withdrawals at the Temelín site.

Effect on the flow regime between Hněvkovice and Kořensko

The spatial separation of withdrawal and discharge is essential to interpreting the effect on the Vltava River. Raw-water withdrawal is assumed at the Hněvkovice waterworks, whereas wastewater discharge is included at the Kořensko profile. The reach between these profiles is therefore affected primarily by the withdrawal, which is only partially offset by discharge farther downstream. During periods of low flow, this difference may be more significant than during normal or high flows.

2 Surface Water in the Affected Area

Under the 5 600 MWe plus SMR option, the annual difference between withdrawal and discharge is approximately 104.9 million m³, equivalent to a mean of 3.33 m³/s. Of this, the SMR ETE project itself represents a net difference of approximately 8.44 million m³ per year, or approximately 0.27 m³/s. In terms of the long-term mean, this value is relatively small compared with the total water availability of the Vltava River, but it becomes more significant during dry periods because the available discharge is low and the system relies more heavily on reservoir storage volumes.

At the Kořensko profile, part of the water withdrawn is returned to the watercourse as wastewater discharge. In terms of water quantity, the project therefore does not act merely as a withdrawal, but as a combination of withdrawal and return of part of the water farther downstream. However, this return cannot fully offset the effect of the withdrawal in the reach between the withdrawal and discharge points and does not take into account the qualitative aspects of discharge, which are addressed in the subsequent chapters on surface-water quality.

The minimum-flow reliability results indicate that, under current hydrological conditions and with warming of 2 °C, the effect of the project on the flow regime at the Hněvkovice and Kořensko profiles is not assessed as limiting. Under unfavorable climate projections, however, the system's reserve decreases, resulting in greater sensitivity to prolonged dry episodes. Under such conditions, the effect of the project can no longer be separated from the broader issue of water availability for the cumulative operation of the entire site.

Comparison with the initial DP20 assessment

The initial DP20 assessment [2] included Units 1 and 2 (assumed as $2 \times 1\,100$ MWe) in combination with two New NPP ETE capacity options ($2 \times 1\,200$ MWe and $2 \times 1\,700$ MWe), giving totals of 4 600 MWe or 5 600 MWe, plus the effect of SMR ETE with a bounding capacity of 500 MWe, and was evaluated for a broader set of emissions scenarios. For the purposes of the SMR ETE EIA Documentation, the updated DP20A report [3] retains only the 5 600 MWe plus SMR option and emissions scenario SSP2-4.5, while adding the ALADIN-CLIMATE/CZ model. DP20A is consequently a more precise and up-to-date basis for the EIA Documentation itself, whereas DP20 documents how the results vary over a broader range of capacity and climate options.

DP20 shows that increasing the capacity option from 4 600 MWe plus SMR to 5 600 MWe plus SMR increases the annual withdrawal requirement from approximately 113.0 million m³ to 134.9 million m³. The difference of approximately 22.0 million m³ per year is greater than the contribution of the SMR ETE project itself. This supports the conclusion that the resulting reliability is determined by the cumulative capacity configuration of the entire site and the hydrological scenario, not solely by the inclusion of the SMR ETE project.

The main conclusions of the two studies are consistent. Under current hydrological conditions, withdrawals and minimum flows are maintained without failure. Under the less favorable

2 Surface Water in the Affected Area

effects of climate change, the water-management system's reserve decreases, particularly for combinations involving TaiESM1 and the later reference period of 2080. The updated DP20A study refines this conclusion by also presenting the ALADIN-CLIMATE/CZ results, which are more favorable for the assessed options than the limiting TaiESM1 model.

Assessment of effect significance

Based on the water-management modeling results, the effect of the SMR ETE project on surface-water quantity can be assessed differently according to the hydrological conditions. Under current hydrological conditions and with sensitivity warming of 2 °C, the effect of the project on the reliability of withdrawals and minimum flows is negligible to minor because the model identifies no withdrawal or minimum-flow failures. However, the project increases total water demand and thereby reduces the system's operating reserve.

Under climate-change conditions, the effect must be assessed with regard to the uncertainty of the hydrological projections. Most of the assessed models under SSP2-4.5 confirm failure-free withdrawal supply even in the 2060 and 2080 reference periods. However, one of the climate models used, specifically TaiESM1, indicates that, under unfavorable development, the cumulative 5 600 MWe plus SMR configuration may fail to attain the recommended withdrawal reliability and may result in minimum-flow failures. This result should be understood as an indication of the system's climate sensitivity and of the need to update the water-management data continually.

A summary interpretation of the effect of the SMR ETE project on surface-water quantity is provided in Table 17.

Table 17 Summary interpretation of the effect of the SMR ETE project on surface-water quantity.

Aspect assessed	Conclusion for Chapter 2.1.2
Raw-water withdrawal	The SMR ETE project increases cumulative annual withdrawal by 12.0 million m ³ ; under the 5 600 MWe plus SMR option, total withdrawal is 134.9 million m ³ per year.
Wastewater discharge	Part of the water withdrawn is returned at the Kořensko profile; total discharge under the 5 600 MWe plus SMR option is 30.0 million m ³ per year.
Current hydrological conditions	Both withdrawals and minimum flows are maintained without failure; p _t = 99.9%, p _d = 100.0%.
Warming of 2 °C	Withdrawals and minimum flows remain failure-free, but the reliability of the Lipno I recreational water level decreases.
SSP2-4.5 scenario, 2060/2080	Most models confirm failure-free supply; the limiting TaiESM1 model shows significant failures, particularly for 2080.
Overall assessment	The effect of the SMR ETE project is acceptable under current conditions, but cumulatively with the New NPP ETE and under unfavorable climate options, it reduces the water-management system's reserve.

2 Surface Water in the Affected Area

Uncertainties and interpretation conditions

The model assessment results depend on the input assumptions. The most important include the assumed extent of use of the Lipno I storage volume, the validity of the operating rules, the accuracy of estimated future withdrawals and discharges, and uncertainty in climate projections. A change in any of these assumptions may affect the resulting reliability of withdrawals and minimum flows.

Particular attention must be paid to the fact that the climate projections differ among models. The favorable results of EC-Earth3, MPI-ESM1-2-HR, and ALADIN-CLIMATE/CZ cannot be transferred mechanically to all possible future hydrological situations. Conversely, the unfavorable TaiESM1 model cannot be interpreted as the only probable development pathway, but as an important limiting option for verifying the resilience of the water-management system.

For subsequent stages of project preparation, the hydrological data, technical information on the actual water demand of the SMR ETE project, and the operating conditions for withdrawals and discharges should therefore be updated continually. At the same time, coordination with the operating management of the Vltava Cascade and the rules for managing storage volumes should be maintained because these rules determine the system's resilience during dry periods.

2.1.3 Effect of the SMR ETE Project on the Vltava Cascade

Chapter prepared by: Ing. Adam Vizina, Ph.D., Ing. Petr Vyskoč

This chapter is based on background study [7], which follows study [3].

This chapter summarizes the results of report DP29, Water-Management Study: Quantity, EIA Screening Conclusion Requirement Concerning the Project's Effect on the Vltava Cascade [7]. Report DP29 [7] follows the underlying water-management assessment DP20A [3], which addressed the reliability of withdrawals for the ETE site and minimum flows as far as the Kořensko profile. Compared with DP20A [3], it extends the assessed area farther downstream along the Vltava River to the Prague-Velká Chuchle gauging-station profile and focuses on possible effects on the storage function of the Orlík and Slapy water reservoirs and the associated maintenance of the minimum flow downstream of the Vrané waterworks and the minimum residual flow at the Prague-Chuchle profile.

The assessment covers cumulative operation of the Temelín site, meaning the combined effects of the existing Units 1 and 2, the proposed New NPP ETE, and the SMR ETE project. The effect of the SMR ETE project is therefore not assessed in isolation solely as a separate withdrawal, but as part of the overall 5 600 MWe capacity option plus the SMR ETE project. This approach satisfies the requirement for the EIA Documentation to assess the project in relation to other activities of water-management significance in the Vltava River basin.

2 Surface Water in the Affected Area

Scope of the assessment and relationship to preceding chapters

Chapters 2.1.1 and 2.1.2 describe the current state of surface-water quantity and the direct effect of the SMR ETE project on surface-water quantity in the withdrawal and discharge area, primarily in relation to the Hněvkovice waterworks and the Kořensko profile. Chapter 2.1.3 extends this assessment farther downstream along the Vltava River and evaluates whether the increased water requirements for the ETE site, including the SMR ETE project, may affect the functioning of the principal storage elements in the lower part of the Vltava Cascade.

From the perspective of the water-management system, the Vltava Cascade is not merely a sequence of individual reservoirs, but a set of interconnected elements involved in regulating outflow, augmenting flows, maintaining withdrawals, providing flood protection, and meeting the requirements specified in operating rules. During unfavorable hydrological periods, an increase in water withdrawal in the upper part of the reach under consideration may therefore also affect water management in the storage reservoirs farther downstream.

DP29 [7] primarily addresses the part of the river basin downstream of the Kořensko profile as far as the Prague-Velká Chuchle profile; the chapter focuses on the Orlík, Slapy, and Vrané water reservoirs and the Prague-Chuchle profile. For the Orlík and Slapy water reservoirs, complete depletion of the reservoir storage volume was regarded as a failure to perform the storage function.

Methodological approach

A simulation model of the storage function of the water-management system with a monthly time step was applied for the assessment. Compared with the previous studies, the area of interest was extended to include the Vltava River basin as far as the Prague-Velká Chuchle profile. The modeled system comprised the Lipno I, Lipno II, Římov, Hněvkovice, Kořensko, Orlík, Slapy, Švihov, and Vrané waterworks. The model uses time series of natural mean monthly discharges and requirements for withdrawals, discharges, and minimum flows. The profiles relevant to assessing the storage function in the area of interest downstream of the Kořensko profile are provided in Table 18.

Hydrological conditions were represented by 44-year time series. For the climate-change scenarios, EC-Earth3, MPI-ESM1-2-HR, TaiESM1, and ALADIN-CLIMATE/CZ were used under SSP2-4.5 for the 2060 and 2080 reference periods. The current hydrological option was also evaluated. The modeling output is reliability by duration p_t , compared indicatively with the values recommended in ČSN 75 2405 [6].

The color coding in the DP29 tables [7] distinguishes three interpretation categories. Green indicates failure-free reliability, yellow indicates reliability in accordance with the recommended value in the standard, and red indicates reliability that does not attain the

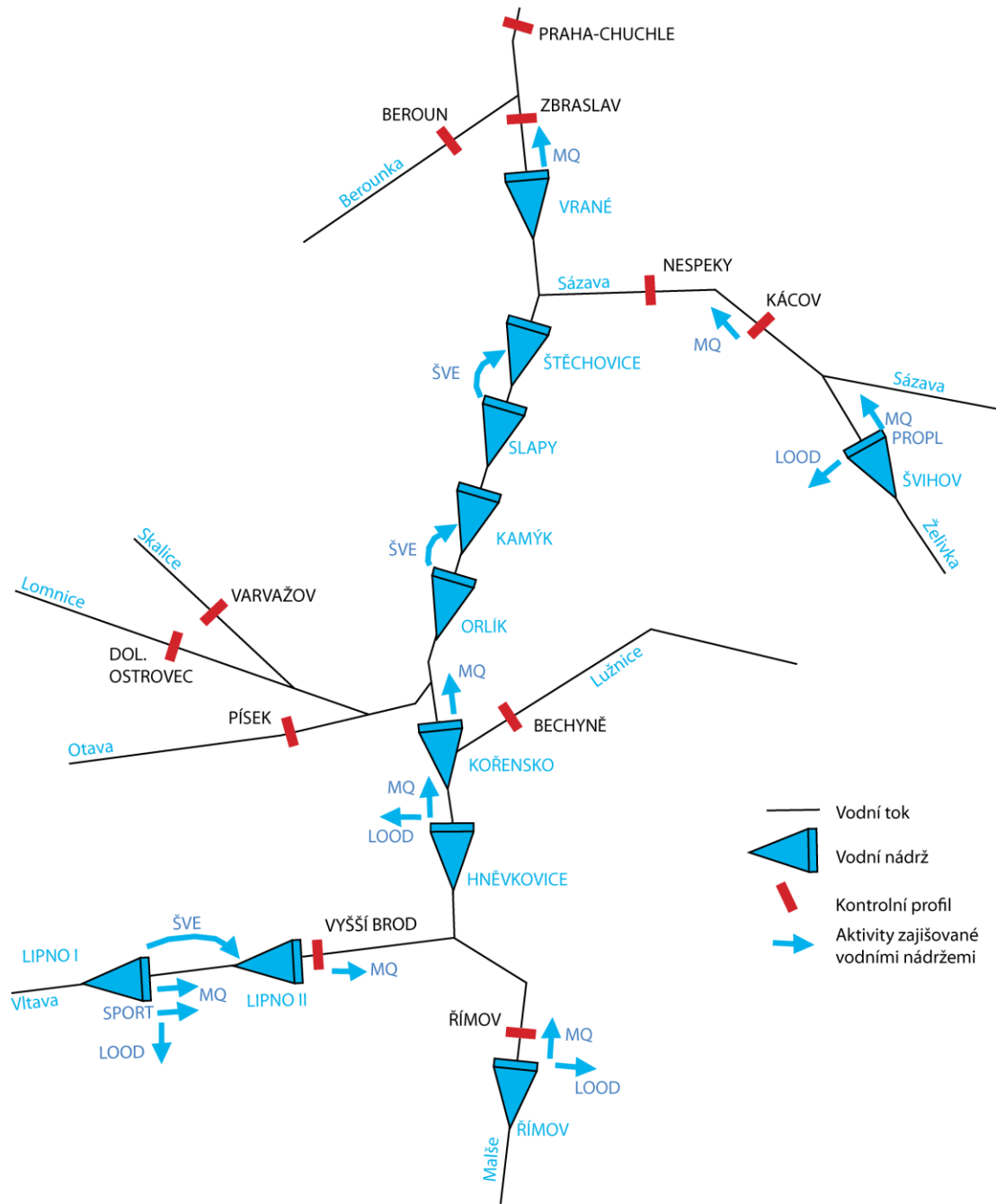
2 Surface Water in the Affected Area

recommended value. For withdrawals for the ETE site, DP29 [7] gives $p_t \geq 99.5\%$ as the recommended value; for minimum flows, $p_t \geq 98.5\%$.

Table 18 Selected water-management system profiles relevant to assessing the effect of the project on the Vltava Cascade [3].

Profile ID	Profile type	Profile	Watercourse	Role in the assessment
NAD1193900	Weir pool	Kořensko	Vltava	End profile of the preceding DP20A assessment
NAD120702	Water reservoir	Orlík	Vltava	Storage function for the Kořensko-Vrané reach
NAD120501	Water reservoir	Slapy	Vltava	Cooperation with Orlík for the Slapy-Vrané reach
NAD120503	Water reservoir	Vrané	Vltava	Minimum-flow control profile
BPS169000	Gauging station	Zbraslav	Vltava	Input for the lower part of the system
BPS200100	Gauging station	Prague-Chuchle	Vltava	Minimum-residual-flow control profile

2 Surface Water in the Affected Area



Vodní tok	Watercourse
Vodní nádrž	Water reservoir
Kontrolní profil	Control profile
Aktivity zajišťované vodními nádržemi	Functions provided by water reservoirs

2 Surface Water in the Affected Area

Fig. 11 Diagram of the water-management system extended to the Prague-Chuchle profile [3].

The water-management system diagram (Fig. 11) shows that the reach as far as Kořensko is only one part of the interconnected system. The Orlík and Slapy water reservoirs, which help meet minimum-outflow requirements downstream of the Vrané waterworks and stabilize flow conditions in the lower Vltava, are particularly important to the assessment of effects on the Vltava Cascade. The Prague-Chuchle profile was used as the downstream control profile for the assessment.

Water reservoirs and operational relationships

In DP29 [7], the Orlík and Slapy water reservoirs are assessed as the principal storage elements in the lower part of the Vltava Cascade. In the model, Orlík is used preferentially to meet the requirements in the Kořensko-Vrané reach. Once the specified elevation is reached, the Slapy water reservoir is brought into operation to meet the requirements, after which the remaining storage volume of Orlík is used again. This procedure corresponds to the model representation of the operating rules described in report DP29 [7].

The Kamýk reservoir has no separate storage volume and is not a decisive element in the simulation assessment of the storage function. The Štěchovice reservoir primarily serves to partially balance discharges downstream of Slapy, but it too is not a principal storage element for assessing long-term maintenance of minimum flows. The Vrané waterworks represents a control profile at which maintenance of the minimum flow of 40 m³/s is assessed.

The water reservoirs of significance to assessing the storage function of the Vltava Cascade are provided in Table 19.

Table 19 Storage volumes of selected water reservoirs and their role in the assessment [3].

Water reservoir	Watercourse	Storage volume [million m³]	Permanent-storage elevation [m a.s.l.]	Storage-volume elevation [m a.s.l.]	Role
Lipno I	Vltava	252.991	716.10	724.90	Flow augmentation for the upper part of the system
Hněvkovice	Vltava	12.155	364.60	370.10	Raw-water withdrawal for the ETE site
Kořensko	Vltava	-	-	-	Weir pool; wastewater-discharge profile
Orlík	Vltava	343.078	329.60	349.90	Principal storage element for the lower Vltava
Slapy	Vltava	200.500	246.60	270.60	Cooperation with Orlík to maintain MQ at Vrané

2 Surface Water in the Affected Area

Vrané	Vltava	-	-	-	Outflow balancing and minimum-flow maintenance
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The table shows that Orlík and Lipno I have the largest storage volumes in the modeled part of the system. For the assessment of the lower Vltava, however, Orlík and Slapy are of primary importance. In DP29 [7], Orlík functions as the principal storage element for meeting the requirements in the Kořensko-Vrané reach, while Slapy cooperates in meeting the requirements in the Slapy-Vrané reach. This cooperation is particularly important during dry periods and under scenarios with higher evapotranspiration and lower discharges.

Minimum-flow requirements

The model considered the minimum flows specified in the operating rules for the relevant waterworks and the minimum residual flow at the Prague-Chuchle profile (Table 20). Two downstream control requirements are particularly important to Chapter 2.1.3: the minimum flow of 40 m³/s downstream of the Vrané waterworks and the minimum residual flow of 45.55 m³/s at the Prague-Chuchle profile. The requirements upstream of the Kořensko profile are provided to establish continuity with the preceding chapter.

Table 20 Minimum-flow requirements used in the water-management modeling [3].

Profile	MQ/MRF requirement [m ³ /s]	Note
Lipno II	6.000	Waterworks operating rules
Hněvkovice	6.500	Waterworks operating rules
Kořensko	9.500	Waterworks operating rules
Vrané	40.000	Waterworks operating rules
Prague-Chuchle	45.550	Minimum residual flow

In the model, minimum flows serve as requirements that must be met even during periods of hydrological drought. If the natural inflow in a given monthly step is insufficient, the model simulates flow augmentation from reservoir storage volumes in accordance with the operating rules. Minimum-flow reliability is therefore one of the principal indicators of whether cumulative withdrawals for the ETE site, including the SMR ETE project, may have a significant effect on the lower part of the Vltava Cascade.

Water-management solution options

The basic option assessed is the 5 600 MWe capacity configuration plus the SMR ETE project, comprising Units 1 and 2 (2 × 1 100 MWe), two 1 700 MWe New NPP ETE units, and the 500 MWe SMR ETE project. This option represents the cumulative water-management load of the Temelín site. To distinguish the effect of climate change from the effect of increased

2 Surface Water in the Affected Area

withdrawals, DP29 [7] also added a comparison option comprising the current Units 1 and 2 without the New NPP ETE and the SMR ETE project. An overview of the solution options is provided in Table 21.

Table 21 Overview of water-management modeling options relevant to Chapter 2.1.3 [3].

Withdrawal option	Reference period	Scenario	Model/conditions
5 600 MWe + SMR	2060	SSP2-4.5	EC-Earth3
5 600 MWe + SMR	2060	SSP2-4.5	MPI-ESM1-2-HR
5 600 MWe + SMR	2060	SSP2-4.5	TaiESM1
5 600 MWe + SMR	2060	SSP2-4.5	ALADIN-CLIMATE/CZ
5 600 MWe + SMR	2080	SSP2-4.5	EC-Earth3
5 600 MWe + SMR	2080	SSP2-4.5	MPI-ESM1-2-HR
5 600 MWe + SMR	2080	SSP2-4.5	TaiESM1
5 600 MWe + SMR	2080	SSP2-4.5	ALADIN-CLIMATE/CZ
5 600 MWe + SMR	Present	Hist	Current hydrological conditions
Units 1 and 2	2060/2080	SSP2-4.5	Comparison option without New NPP + SMR

The specific effect of the SMR ETE project is reflected in the cumulative 5 600 MWe plus SMR option in DP29 [7]. However, the results cannot be interpreted as meaning that all changes in reliability are caused solely by the SMR ETE project. The decisive factor is the concurrence of the future capacity configuration of the Temelín site, hydrological conditions, and the operational capabilities of the Vltava Cascade. Comparison with the Units 1 and 2 option shows the extent to which the resulting sensitivity is attributable to climate change itself and to the increase in withdrawal requirements.

Results for current hydrological conditions

For current hydrological conditions, DP29 [7] assessed the reliability of requirements at the Vrané and Prague-Chuchle profiles and the storage function of the Orlík and Slapy water reservoirs (Table 22). The results show that, under the assumed cumulative 5 600 MWe plus SMR capacity option, the downstream minimum flows are maintained at a very high level of reliability. The reliability of the minimum flow downstream of the Vrané waterworks and the minimum residual flow at the Prague-Chuchle profile is 99.9%. The same value was assessed for the storage function of the Orlík and Slapy water reservoirs.

Table 22 Reliability of minimum flows and the storage function of Orlík and Slapy for the 5 600 MWe plus SMR option under current hydrological conditions [3].

Hydrological conditions	MQ Vrané 40 m³/s Pt [%]	MRF Prague-Chuchle 45.55 m³/s Pt [%]	Orlík water reservoir storage function Pt [%]	Slapy water reservoir storage function Pt [%]
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2 Surface Water in the Affected Area

Present	99.9	99.9	99.9	99.9
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The current results confirm that, under existing hydrological conditions, the cumulative effect of the SMR ETE project and the New NPP ETE does not limit the maintenance of minimum flows in the lower part of the Vltava Cascade. Under these conditions, the system has sufficient control capacity, and the requirements at the Vrané and Prague-Chuchle profiles are met without any significant failure being identified.

Results for climate scenarios under the 5 600 MWe plus SMR option

Under climate-change conditions, the results are more varied (Table 23). For the 2060 reference year, two of the four options assessed are failure-free, with p_t of 99.9%. Under EC-Earth3, the reliability of the requirements is 99.5% to 99.1%, which is above the values recommended in the standard. Under TaiESM1, values of 98.7%, 98.5%, and 98.5% are attained for Vrané, Prague-Chuchle, and Orlik, respectively, compared with 97.8% for Slapy. This option therefore shows a reduction in the system's reserve.

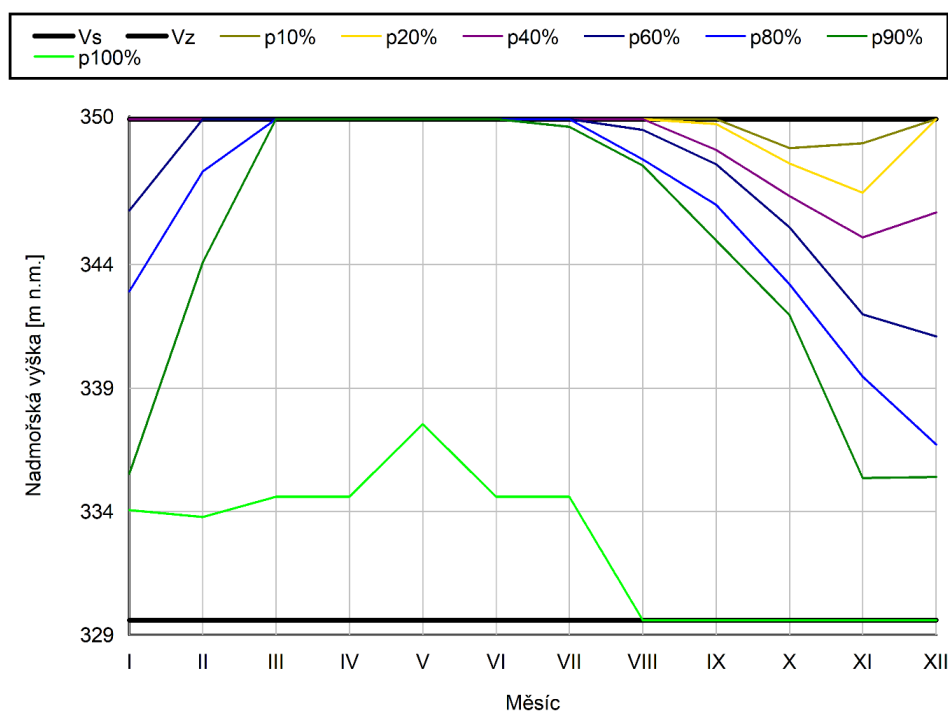
For the 2080 reference year, EC-Earth3 is the most favorable option, with all assessed indicators at 99.9%. ALADIN-CLIMATE/CZ also remains favorable, with values ranging from 99.3% to 99.7%. MPI-ESM1-2-HR already exhibits a decrease in reliability to between 98.9% and 99.1%. TaiESM1 is the most conservative option, with reliability of 97.6% for the Vrané minimum flow, 97.2% for the Prague-Chuchle MRF, 97.2% for the Orlik storage function, and 95.7% for the Slapy storage function.

Table 23 Reliability of minimum flows at the Vrané and Prague-Chuchle profiles and the storage function of the Orlik and Slapy water reservoirs for the 5 600 MWe plus SMR option under climate-change conditions. Adapted from [3].

Reference period	Scenario	Model	MQ Vrané Pt [%]	MRF Prague-Chuchle Pt [%]	Orlik storage function Pt [%]	Slapy storage function Pt [%]
2060	SSP2-4.5	EC-Earth3	99.5	99.5	99.5	99.1
2060	SSP2-4.5	MPI-ESM1-2-HR	99.9	99.9	99.9	99.9
2060	SSP2-4.5	TaiESM1	98.7	98.5	98.5	97.8
2060	SSP2-4.5	ALADIN-CLIMATE/CZ	99.9	99.9	99.9	99.9
2080	SSP2-4.5	EC-Earth3	99.9	99.9	99.9	99.9
2080	SSP2-4.5	MPI-ESM1-2-HR	99.1	99.1	98.9	98.9
2080	SSP2-4.5	TaiESM1	97.6	97.2	97.2	95.7
2080	SSP2-4.5	ALADIN-CLIMATE/CZ	99.7	99.5	99.5	99.3

2 Surface Water in the Affected Area

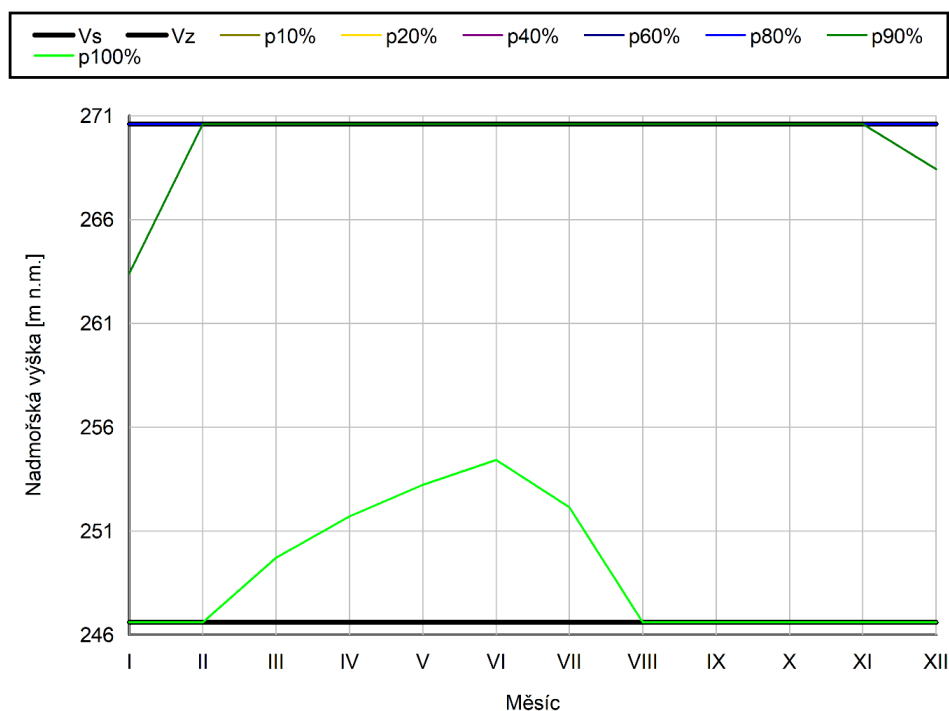
The results show that the decisive factor for the Vltava Cascade is an unfavorable combination of climate model and reference period. For 2060, the system is still assessed as having adequate reliability under most options. For 2080, the differences among the models increase. The limiting option is TaiESM1, representing a scenario with a more pronounced reduction in runoff and a greater need to augment flows from storage volumes.



Nadmořská výška [m n.m.]	Elevation [m a.s.l.]
Měsíc	Month

Fig. 12 Probability field of water levels attained in the Orlik water reservoir for the 5 600 MWe plus SMR option, SSP2-4.5 scenario, TaiESM1, reference year 2060 [3].

2 Surface Water in the Affected Area

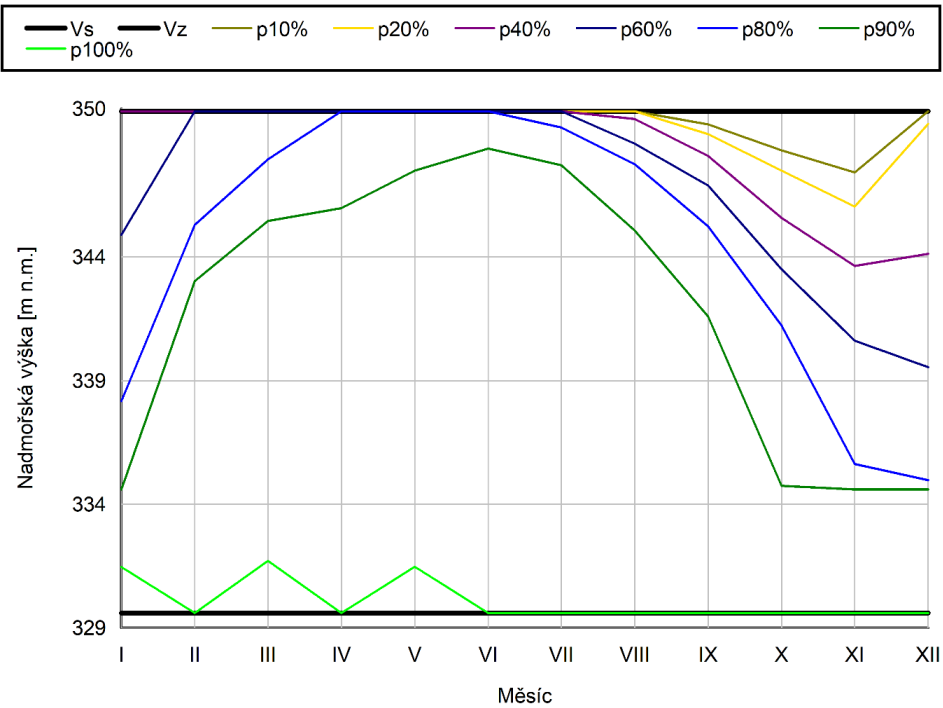


Nadmořská výška [m n.m.]	Elevation [m a.s.l.]
Měsíc	Month

Fig. 13 Probability field of water levels attained in the Slapy water reservoir for the 5 600 MWe plus SMR option, SSP2-4.5 scenario, TaiESM1, reference year 2060 [3].

The probability-field graphs for water levels attained in the Orlík and Slapy water reservoirs for 2060 (Fig. 12 and Fig. 13) show that, even under the less favorable TaiESM1 option, the storage volumes of both Orlík and Slapy are drawn down, but to an extent that still allows the recommended reliability values to be attained or exceeded for most indicators. Slapy exhibits greater sensitivity to the course of the dry period, corresponding to its role in cooperation with Orlík in the lower part of the cascade.

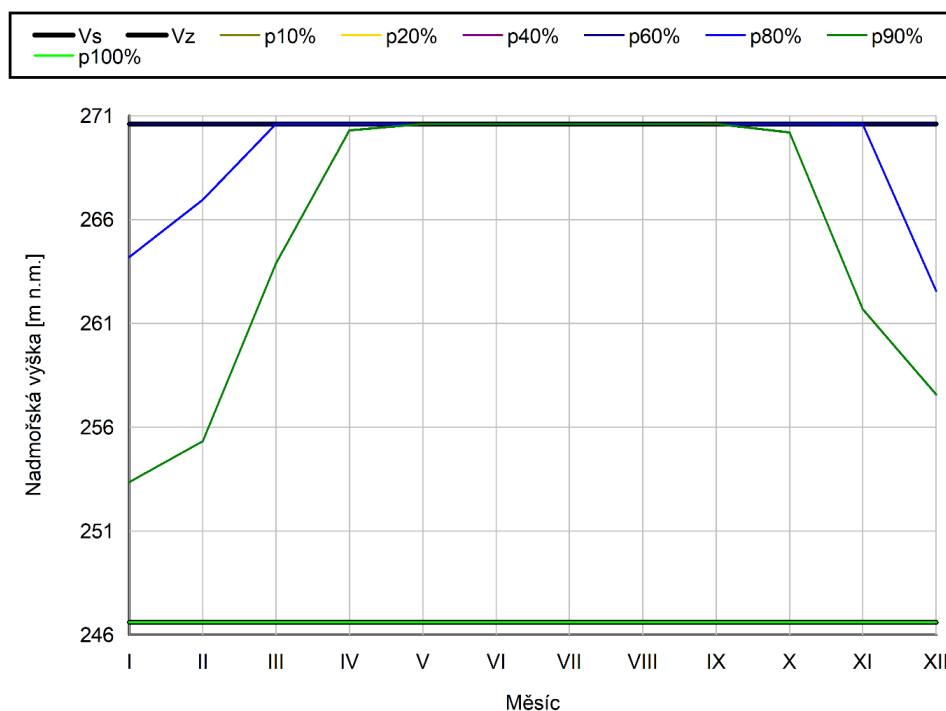
2 Surface Water in the Affected Area



Nadmořská výška [m n.m.]	Elevation [m a.s.l.]
Měsíc	Month

Fig. 14 Probability field of water levels attained in the Orlik water reservoir for the 5 600 MWe plus SMR option, SSP2-4.5 scenario, TaiESM1, reference year 2080 [3].

2 Surface Water in the Affected Area



Nadmořská výška [m n.m.]	Elevation [m a.s.l.]
Měsíc	Month

Fig. 15 Probability field of water levels attained in the Slapy water reservoir for the 5 600 MWe plus SMR option, SSP2-4.5 scenario, TaiESM1, reference year 2080 [3].

The probability-field graphs for water levels attained in the Orlík and Slapy water reservoirs for the 2080 reference year (Fig. 14 and Fig. 15) show a more pronounced decrease in water levels and more frequent use of storage volumes, particularly during unfavorable months of the year. For Orlík, the probability curves show a decrease in the second half of the year; for Slapy, seasonal depletion of the storage volume is more pronounced. These results demonstrate that, under unfavorable climate development, the lower part of the Vltava Cascade is sensitive to the concurrence of low inflows, increased evaporation, and cumulative water requirements.

Comparison with the Units 1 and 2 option

To distinguish the effect of increased withdrawals for the future Temelín site configuration from the effect of climate change itself, DP29 [7] also presents results for the Units 1 and 2 capacity option (Table 24). This option represents the situation without the New NPP ETE and the SMR ETE project. The comparison shows that climate change itself reduces the reliability of some requirements, particularly under TaiESM1. However, under these unfavorable

2 Surface Water in the Affected Area

conditions, the cumulative 5 600 MWe plus SMR option results in a further reduction of the operating reserve.

Table 24 Reliability of minimum flows and the storage function for the Units 1 and 2 comparison option under climate-change conditions. Adapted from [3].

Reference period	Scenario	Model	MQ Vrané Pt [%]	MRF Prague-Chuchle Pt [%]	Orlík storage function Pt [%]	Slapy storage function Pt [%]
2060	SSP2-4.5	EC-Earth3	99.7	99.5	99.5	99.3
2060	SSP2-4.5	TaiESM1	99.1	98.7	98.7	98.0
2080	SSP2-4.5	MPI-ESM1-2-HR	99.1	99.3	99.1	98.9
2080	SSP2-4.5	TaiESM1	98.0	97.4	97.4	96.3
2080	SSP2-4.5	ALADIN-CLIMATE/CZ	99.7	99.7	99.7	99.3

Comparison with the Units 1 and 2 option shows that the classification according to the recommended values in ČSN 75 2405 [6] is similar to that of the 5 600 MWe plus SMR option for many options, but the absolute reliability values are generally slightly higher for Units 1 and 2. The difference is most apparent under the unfavorable TaiESM1 option for 2080, in which the 5 600 MWe plus SMR option attains values of 97.6%, 97.2%, 97.2%, and 95.7%, compared with 98.0%, 97.4%, 97.4%, and 96.3% for the Units 1 and 2 option. This means that the increased withdrawals alone are not the sole cause of reduced reliability, but under limiting climate conditions they increase pressure on the cascade's storage function.

Interpretation of the effect on the Vltava Cascade

The results of DP29 [7] indicate that, under current hydrological conditions, the cumulative effect of the SMR ETE project, Units 1 and 2, and the New NPP ETE on the Vltava Cascade is not assessed as significantly adverse. The minimum flow downstream of the Vrané waterworks and the minimum residual flow at the Prague-Chuchle profile are maintained with very high reliability. The model does not indicate any situation in which the assessed capacity option would limit the meeting of these requirements under current conditions.

Under climate-change conditions, the assessment depends on the specific climate model. The results of EC-Earth3, MPI-ESM1-2-HR, and ALADIN-CLIMATE/CZ confirm that, for most options, the requirements continue to be met at the recommended reliability levels even for the 2060 and 2080 reference years. TaiESM1 is the most conservative option, particularly for 2080. Under this option, the reliability of minimum flows and of the storage function of Orlík and Slapy falls below the recommended values.

2 Surface Water in the Affected Area

The results therefore do not indicate a universal and unequivocal collapse of the functioning of the Vltava Cascade as a result of the SMR ETE project. However, they show that the system's reserve decreases under unfavorable climate conditions and that the cumulative requirements of the Temelín site may become one of the factors increasing demand on the Orlik and Slapy storage volumes. Under such options, the resulting failure is caused by the concurrence of climate development, river-basin water availability, and increased withdrawals, not solely by the SMR ETE project itself.

For EIA purposes, it is therefore essential to distinguish current conditions from future conditions. Under current conditions, the effect of Units 1 and 2 plus the New NPP ETE plus the SMR ETE project on the Vltava Cascade would be acceptable. With respect to future development, the hydrological and climate data must be updated continually and the actual technological requirements for water withdrawal and discharge monitored during subsequent stages of preparation and long-term project operation; the preparation period will be short compared with the operating period.

A summary interpretation of the effect of the SMR ETE project on the Vltava Cascade is provided in Table 25.

Table 25 Summary interpretation of the effect of the SMR ETE project on the Vltava Cascade.

Aspect assessed	Conclusion for Chapter 2.1.3
Scope of assessment	DP29 [7] extends the assessment from the Kořensko profile to the Prague-Chuchle profile and assesses Orlik, Slapy, Vrané, and the minimum residual flow at Prague-Chuchle.
Current conditions	The Vrané minimum flow, the Prague-Chuchle MRF, and the Orlik storage function are maintained with $p_t = 99.9\%$. Under current conditions, the system is not limited by the assessed project.
Year 2060	Most options are failure-free or attain the recommended values. TaiESM1 is limiting, particularly for the storage function of the Slapy water reservoir.
Year 2080	The differences among the climate models increase. TaiESM1 represents an unfavorable limiting option with values below the recommended reliability levels.
Comparison with Units 1 and 2	Climate change itself reduces reliability, but under the limiting scenarios, the cumulative 5 600 MWe plus SMR option further reduces the operating reserve.
Overall assessment	The effect of the SMR ETE project on the Vltava Cascade is acceptable under current conditions. In the long term, uncertainty in climate development and the need to update the underlying data continually are significant. In view of possible climate-change development, the operating rules for the waterworks may also be reassessed in the future, for example by reducing the required flow, which would produce different reliability results; this would be essentially independent of the project because the effect of climate change will be dominant.

2.2 Surface-Water Quality: Vltava River

*Chapter prepared by: RNDr. Diana Marešová, Ph.D. and Ing. Eva Juranová, Ph.D.
This chapter is based on background study [8].*

2 Surface Water in the Affected Area

2.2.1 Current state of surface-water quality

Area of interest

The SMR ETE project is located near the existing Temelín Nuclear Power Plant site in South Bohemia, near Týn nad Vltavou. Wastewater from the SMR ETE project is planned to be discharged to the Vltava River at Kořensko, at the profile shared with Units 1 and 2 and the New NPP ETE.

The Vltava Cascade, extending from the Orlík water reservoir to the Vrané water reservoir, begins immediately downstream of the Kořensko waterworks structure at the discharge point. The Vltava then flows through Prague and enters the Elbe approximately 200 km downstream of the Kořensko waterworks. The major tributaries of the Vltava in this reach are: The Lužnice, which enters the Vltava in the Kořensko water reservoir just upstream of the SMR ETE wastewater outfall; the Otava, which enters the Orlík water reservoir; and the Sázava and Berounka, which enter the Vltava upstream of Prague.

The area of interest is defined on the basis of an assessment of surface-water quality requirements downstream of the SMR ETE wastewater outfall and the selection of critical profiles, as described in greater detail below.

In addition, the area of interest includes reference watercourse reaches that are unaffected by wastewater discharge from the project, namely the reach of the Vltava upstream of the outfall and the Lužnice and Otava tributaries of the Vltava.

The area of interest is described below in terms of assessing surface-water status/potential, water uses (drinking-water sources and bathing waters), the designation of waters suitable for fish life (fish waters), and nature conservation (water-dependent sites of Community importance designated within the Natura 2000 network).

According to the Upper Vltava Sub-basin Plan [9] and the Lower Vltava Sub-basin Plan [10], six surface water bodies affected by wastewater discharge are designated in this study's area of interest for the assessment of the ecological status/potential and chemical status of surface water bodies: four standing surface water bodies (lake category), including the Otava arm of the Orlík water reservoir, and two running surface water bodies (river category). To evaluate surface-water quality and, in particular, the potential future effect of wastewater discharge from the SMR ETE project, future monitoring must also include reference reaches upstream of the outfall or unaffected tributaries, representing a further six surface water bodies. A list of the bodies included in the assessment area of interest, both those affected by wastewater discharge and the reference bodies, together with their characteristics, is provided in Table 26.

2 Surface Water in the Affected Area

Table 26 List of surface water bodies (SWBs) in the watercourse reach of interest and their basic characteristics

SWB ID	SWB name	Watercourse	SWB category	SWB hydromorphological character	SWB type	SWB location relative to the SMR ETE project
HVL_0460	Vltava from the Malše to the backwater of the Hněvkovice reservoir, including the Bezdrevský Stream from the Bezdrev fishpond dam to its confluence with the Vltava	Vltava	River	Heavily modified	1223	Reference
HVL_0475_J	Hněvkovice reservoir on the Vltava	Vltava	Lake	Heavily modified	2BC21F21	Reference
HVL_3030	Vltava from the Hněvkovice reservoir dam to the backwater of the Kořensko reservoir	Vltava	River	Heavily modified	1213	Reference
HVL_1035_J	Kořensko reservoir on the Vltava	Vltava	Lake	Heavily modified	2BC11F11	Reference
HVL_1010	Lužnice from the Košínský Stream to the backwater of the Kořensko reservoir	Lužnice	River	Natural	1213	Reference
HVL_2410	Otava from the Blanice to the backwater of the Orlík II reservoir	Otava	River	Natural	1213	Reference
HVL_1055_J	Orlík I reservoir on the Vltava	Vltava	Lake	Heavily modified	2BC21F21	Modified
HVL_1525_J	Orlík II reservoir on the Otava	Otava	Lake	Heavily modified	2BC21F21	Modified
DVL_0015_J	Orlík III reservoir on the watercourse	Vltava	Lake	Heavily modified	2BC21F22	Modified
DVL_0030	Vltava from the Orlík reservoir dam to the backwater of the Slapy reservoir	Vltava	River	Heavily modified	1213	Modified
DVL_0095_J	Slapy reservoir on the Vltava	Vltava	Lake	Heavily modified	2BC21F22	Modified
DVL_0110	Vltava from the Slapy reservoir dam to the Sázava	Vltava	River	Heavily modified	1113	Modified

2 Surface Water in the Affected Area

There are eight surface-water abstractions for human consumption (public water-supply use) in the Vltava reach within the area of interest [9, 10]; all are recorded as current sources in the 2024 records [11]. In the past, abstraction point 120714 for human consumption (Municipality of Milešov nad Vltavou, Trhovky campsite) also existed in the Orlík water reservoir area, but no water has been abstracted there for this purpose since 2016 [11], and it is not listed as an abstraction for public water-supply purposes in the most recent Lower Vltava Sub-basin Plan [10]. Protection zones that also include the Vltava watercourse have been established for four of these surface-water sources for human consumption [11]. A list of surface-water abstractions for human consumption is provided in Table 27.

Table 27 Surface-water abstractions for human consumption and their protection zones in the Vltava reach of interest [10, 11]

Structure name	Abstraction ID	Water use	Abstraction volume in the reference year (thousand m ³)	Reference year (most recent year in records)	Protection zone		SWB ID
					ID	Name	
1.SčV Příbram Solenice Vltava	120706	M	171.614	2024	178202 178302	Solenice surface-water abstraction	DVL_0030
1.SčV Příbram Dublovice Zvírotice	120715	M	5.71	2023	227102 227202	Dublovice surface-water abstraction from the Vltava	DVL_0095_J
VHS Benešov Živohošť WTP	120120	M	2.336	2024			DVL_0095_J
Měřín Military Recreation Facility	120517	O	41.4	2024			DVL_0095_J
VHS Benešov Nová Rábyně	120502	M	8.833	2024			DVL_0095_J
Municipality of Slapy, Slapy WTP	120522	O	24.784	2024	165002 165102 165202	Slapy Přestavky surface-water abstraction	DVL_0095_J
VHS Benešov Třeбенice-Štěchovice, Slapy reservoir	120501	M	11.409	2024	232402	Třeбенice surface-water abstraction, Slapy Lake	DVL_0110
VHS Benešov Štěchovice	120519	M	65.632	2024			DVL_0110

Notes: M: municipal; O: other

With respect to recreational water use, 12 bathing-water areas were identified in the Vltava reach of interest [11], in the Orlík and Slapy water reservoir areas. A list is provided in Table 28.

Government Decree No. 71/2003 Coll. [12] designates surface waters suitable for the life and reproduction of native fish species and other aquatic animals and defines so-called salmonid and cyprinid waters. The Decree establishes water-quality requirements for these waters.

2 Surface Water in the Affected Area

Salmonid waters are designated in the Vltava reach of interest from Štěchovice, at the confluence with the Kocába River, to the confluence with the Sázava River. Cyprinid waters are designated in the Otava arm of the Orlík water reservoir.

With respect to the Natura 2000 network of protected sites, no water-dependent sites of Community importance were identified in the Vltava watercourse reach of interest.

2 Surface Water in the Affected Area

Table 28 Bathing-water areas in the Vltava watercourse reach of interest [11]

Area ID	Area name	SWB ID
KO310801	Orlík water reservoir: Podolsko public campsite	HVL_1055_J
KO310701	Orlík water reservoir: Radava campsite	DVL_0015_J
KO212301	Orlík water reservoir: Podskalí	DVL_0015_J
KO212303	Orlík water reservoir: Trhovky	DVL_0015_J
KO212001	Orlík water reservoir: Lavičky	DVL_0015_J
KO212302	Orlík water reservoir: Popelíky	DVL_0015_J
KO210702	Slapy water reservoir: Županovice	DVL_0095_J
KO210103	Slapy water reservoir: Nová Živohošť	DVL_0095_J
KO210701	Slapy water reservoir: Živohošť	DVL_0095_J
KO210101	Slapy water reservoir: Měřín	DVL_0095_J
KO210501	Slapy water reservoir: Ždán	DVL_0095_J
KO210102	Slapy water reservoir: Nová Rabyně	DVL_0095_J

Non-radiological parameters

The legislative requirements for surface-water quality in relation to non-radiological parameters, including temperature, arise primarily from Act No. 254/2001 Coll., on Water and on Amendments to Certain Acts (the Water Act), as amended [13], and its implementing regulation, Government Decree No. 401/2015 Coll. [14]. In addition to permissible surface-water pollution in general, the latter specifies permissible pollution of surface waters used for particular purposes; these values reflect the requirements of other regulations: Decree No. 428/2001 Coll. [15] for waters used as a source for drinking-water treatment, Decree No. 238/2011 Coll. [16] for waters used for bathing, and Government Decree No. 71/2003 Coll. [12] for water-quality requirements for the life and reproduction of native fish species and other aquatic animals.

Furthermore, Annex 3, Table 1b, to Government Decree No. 401/2015 Coll. [14] contains environmental quality standards for priority substances and certain other pollutants in accordance with Directive 2013/39/EU of the European Parliament and of the Council [17], while Table 1c contains environmental quality standards for river-basin-specific pollutants in surface water bodies and permissible pollution values for surface waters used for public water-supply purposes in accordance with Decree No. 428/2001 Coll. on waters used as a source for drinking-water treatment [15]. These tables list dozens of parameters, comprising individual substances or groups: Table 1b contains 64 parameters and Table 1c a further 92. The values for chemical-status parameters and river-basin-specific pollutants used to assess ecological status/potential are established independently of the water-body type.

2 Surface Water in the Affected Area

In addition to the regulations listed above, the analysis includes methodologies approved by the Ministry of the Environment for assessing the ecological status/potential of surface waters [18–25], the chemical status of waters [26], and the status of protected areas designated to protect water-dependent habitats and species [27]. The parameters specified in the methodology for assessing ecological status in terms of river-basin-specific pollutants [23] and in the methodology for assessing chemical status [26] correspond to those established in Annex 3, Tables 1b and 1c, to Government Decree No. 401/2015 Coll. [14]. The methodologies for assessing the ecological status/potential of running waters (river category) [24, 25] or standing waters (lake category) [18] assess ecological status/potential using general physicochemical or chemical parameters describing thermal conditions, oxygenation conditions, salinity, acidification status, and nutrient conditions. These methodologies establish values specific to the water-body type for the individual parameters.

The assessment of the ecological status/potential of surface waters also includes assessment of the biological quality elements: phytoplankton, macrophytes, and fish fauna for standing waters [18]; and benthic invertebrates, phytobenthos, phytoplankton, macrophytes, and fish fauna for running waters [19–22, 28]. The documents listed may specify different values for individual parameters in surface waters because they consider water quality from different perspectives; they may also differ among individual sites because of different local requirements.

The general permissible-pollution parameters under Government Decree No. 401/2015 Coll. [14] are among the basic parameters relevant to assessing the effect of the SMR ETE project. Other relevant parameters are the general physicochemical parameters used to assess the ecological status/potential of surface water bodies under the methodologies [18, 24, 25]. Most parameters used to assess the ecological status/potential of surface water bodies are also listed as permissible-pollution parameters in Government Decree No. 401/2015 Coll. [14]; the methodologies [18, 24, 25] additionally include only orthophosphate phosphorus (P-PO_4^{3-}) for running water bodies and transparency for standing water bodies. Water oxygen saturation must be assessed both as dissolved-oxygen concentration and as percent saturation.

In addition to the general physicochemical and chemical water-quality parameters, the following additional parameters must not be omitted: chemical-status parameters under the methodology [26] and Annex 3, Table 1b, to Government Decree No. 401/2015 Coll. [14]; and river-basin-specific pollutants under the methodology [23] and Annex 3, Table 1c, to Government Decree No. 401/2015 Coll. [14]. Because this represents a large number of substances or groups of substances, the relevant ones were selected. The selection is based on the condition that wastewater discharge should neither jeopardize good water status nor impede its attainment. The assessment includes parameters that cause failure to attain good water status or for which such failure could occur. For preliminary identification of the parameters, the results of the assessment of ecological status/potential in terms of river-basin-specific pollutants and the results of the assessment of the chemical status of surface water bodies in the Upper Vltava Sub-basin Plan [9] and Lower Vltava Sub-basin Plan [10] were analyzed. This analysis identified additional significant parameters, as described below.

2 Surface Water in the Affected Area

The assessment in connection with wastewater discharge from the SMR ETE project therefore also included parameters for which emission standards are established for industrial wastewater from the corresponding industrial sector, namely electricity and heat generation, under Annex 1, Table 2, to Government Decree No. 401/2015 Coll. [14]. These are water reaction (pH), suspended solids (SS), dissolved inorganic salts (DIS), and C₁₀-C₄₀ hydrocarbons. DIS is measured in wastewater; in surface water it corresponds approximately to DS₅₅₀.

Parameters corresponding to the anticipated wastewater composition and selected by the preliminary analysis as relevant to assessing the effect of the SMR ETE project on water quality:

General physicochemical and chemical parameters: transparency; water temperature; water reaction (pH); oxygen (O₂) as dissolved-oxygen concentration and water oxygen saturation; biochemical oxygen demand (BOD₅); chemical oxygen demand (COD_{Cr}); total organic carbon (TOC); total phosphorus (P_{total}); orthophosphate phosphorus (P-PO₄³⁻); total nitrogen (N_{total}); nitrate nitrogen (N-NO₃⁻); nitrite nitrogen (N-NO₂⁻); ammoniacal nitrogen (N-NH₄⁺); dried dissolved solids (DS₁₀₅); ignited dissolved solids (DS₅₅₀); suspended solids (SS₁₀₅); chlorides (Cl⁻); sulfates (SO₄²⁻); magnesium (Mg); and calcium (Ca).

River-basin-specific pollutants and chemical-status parameters: C₁₀-C₄₀ hydrocarbons.

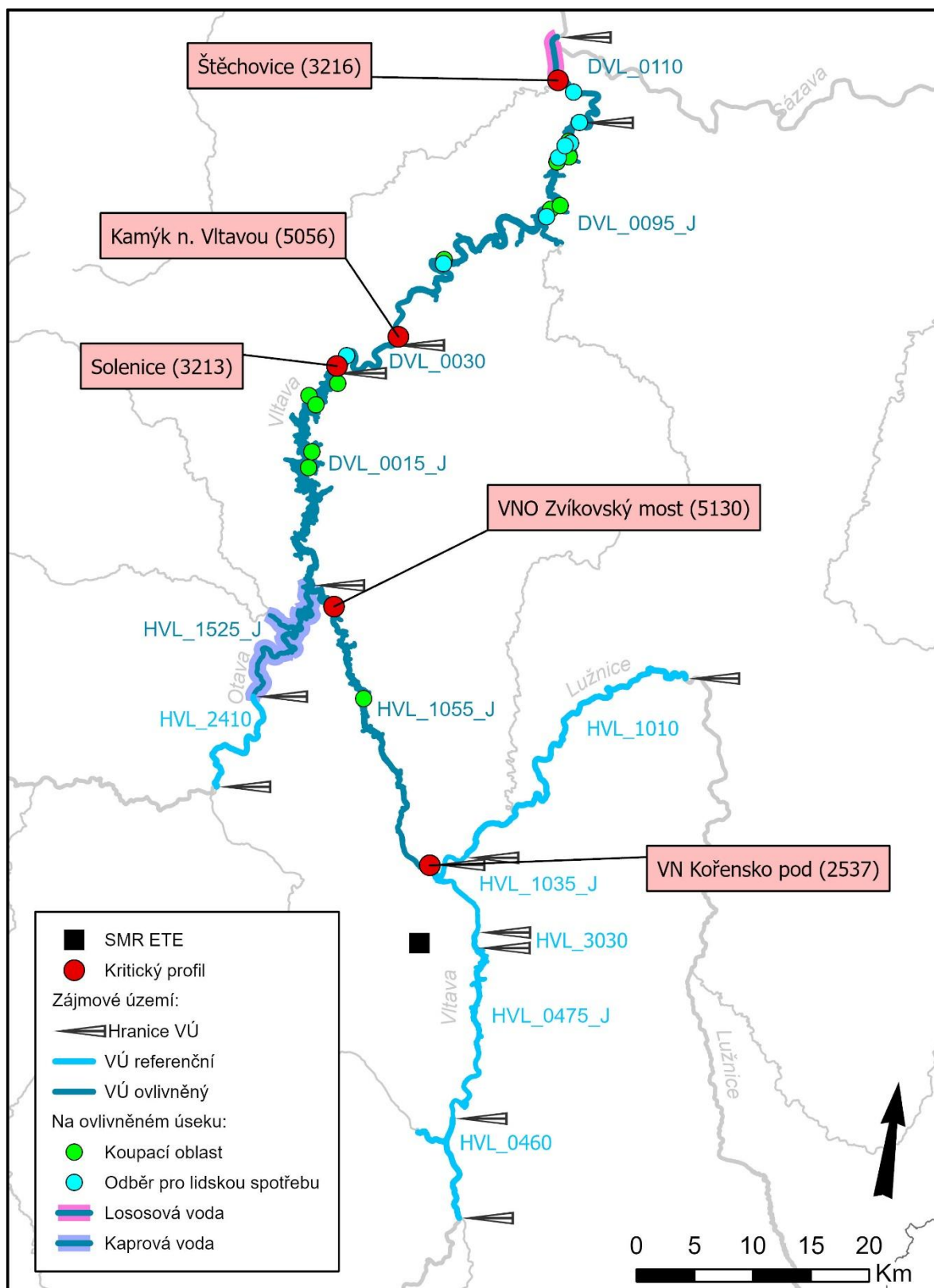
Additional parameters resulting from the detailed data analysis. Chemical-status parameters: fluoranthene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, nickel and its compounds (Ni). Non-radiological river-basin-specific pollutants: AOX, alachlor metabolites, metolachlor and its metabolites, terbuthylazine and its metabolites, phenanthrene, pyrene, aluminum (Al), and EDTA.

Biological and microbiological parameters were not included in the studies of the SMR ETE project's effect on surface-water quality because insufficient data are available. It is recommended that these parameters be included in future monitoring and assessment of the effects of SMR ETE operation because biological quality elements are part of water-status assessment under the methodologies [18–22, 28], while microbiological parameters form part of the assessment of the suitability of water for bathing and for drinking-water treatment.

The analysis of legislative requirements showed that the legislative requirements for surface-water quality, meaning both the range of parameters assessed and their values, may differ among watercourse reaches depending on the purpose of the assessment. Critical profiles for assessing the effect of the SMR ETE project were selected taking into account the changing requirements along the reach of the Vltava affected by SMR ETE discharge.

The selected critical profiles, together with the other profiles at which surface-water quality was assessed, are provided in Table 29. An overview of the area of interest, including the critical profiles, is provided in Fig. 16. For these critical profiles, the parameters used to assess the effect of the SMR ETE project on surface-water quality were specified so as to correspond to the surface-water quality requirements relevant to each critical profile.

2 Surface Water in the Affected Area



2 Surface Water in the Affected Area

SMR ETE	SMR ETE
Kritický profil	Critical profile
Zájmové území:	Area of interest:
Hranice VÚ	SWB boundary
VÚ referenční	Reference SWB
VÚ ovlivněný	Affected SWB
Na ovlivněném úseku:	In the affected reach:
Koupací oblast	Bathing-water area
Odběr pro lidskou spotřebu	Abstraction for human consumption
Lososová voda	Salmonid waters
Kaprová voda	Cyprinid waters

Fig. 16 Area of interest and critical profiles for assessing the effect of the SMR ETE project on surface-water quality

Table 29 Profiles included in the processing of selected non-radiological parameters, including temperature; critical profiles are shown in bold, together with the purpose of assessment

Profile ID	Watercourse	Profile name	Purpose of critical-profile assessment
1042	Vltava	Hluboká nad Vltavou	---
2095/6992	Vltava	Hněvkovice water reservoir, composite sample at dam	---
2535	Vltava	Downstream of Hněvkovice water reservoir	---
3960	Vltava	Týn nad Vltavou downstream	---
2537	Vltava	Downstream of Kořensko water reservoir	Direct effect of SMR ETE discharge, permissible surface-water pollution, bathing-water area
5130/6957	Vltava	Orlík WR, Zvíkov Bridge	Permissible surface-water pollution, ecological potential of the SWB (standing waters), bathing-water area
5150/6955	Vltava	Orlík water reservoir, composite sample at dam	---
3213	Vltava	Solenice	Public water-supply use
5400/6963	Vltava	Slapy water reservoir, composite sample at center of dam	---
5056	Vltava	Kamýk nad Vltavou	Ecological potential of the SWB (running waters)
3216	Vltava	Štěchovice	Salmonid waters
4004	Lužnice	Bechyně	---
4005	Otava	Topělec	---
2334/6956	Otava	Orlík WR, Plazy Bridge, composite sample	---

2 Surface Water in the Affected Area

The available surface-water quality data for the area of interest, at the profiles listed in Table 29, were compiled for 2015–2024. The area is monitored under the Program for Monitoring and Assessing the Environmental Effects of the Temelín Nuclear Power Plant [29–38], specifically Surface-Water and Groundwater Quality Monitoring at the Temelín Nuclear Power Plant, prepared by VÚV TGM, v. v. i. [39–48]; and by the surface-water quality monitoring program of Povodí Vltavy (PVL), from which data were requested for this study [49]. Because the quality monitoring under the Program for Monitoring and Assessing the Environmental Effects of the Temelín Nuclear Power Plant covers fewer profiles and a narrower range of monitored substances than the background study, and does not include the Lužnice and Otava tributaries entering the Orlik water reservoir, data from Povodí Vltavy, státní podnik, were used for the work. At critical profiles, data were processed for the parameters significant to each profile; at profiles upstream of the outfall and on unaffected tributaries, they were processed to the maximum extent available, based on the requirements for the profile downstream of the Kořensko water reservoir. Temporal trends, meaning trends in the values of monitored parameters over time, were assessed at the individual profiles. The analysis showed that the range of monitored parameters differs among profiles and that data are missing for some profiles. A brief assessment of each parameter and a comparison of the assessed values with the applicable permissible-pollution values under Government Decree No. 401/2015 Coll. [14] are provided below.

For temperature, the permissible-pollution value (maximum 29 °C) under Government Decree No. 401/2015 Coll. [14] was not attained or exceeded anywhere along the longitudinal profile of the Vltava or in its tributaries. No statistically significant decreasing or increasing trend in values was identified for the parameter at any profile during the monitored period.

For water reaction (pH), the values identified were outside the permissible-pollution range (maximum 9, minimum 5) under Government Decree No. 401/2015 Coll. [14] at the Hněvkovice water reservoir composite dam profile, Týn nad Vltavou, the Kořensko water reservoir composite dam profile, the profile downstream of the Kořensko water reservoir, the Slapy water reservoir composite central dam profile, and Bechyně; at these profiles, the identified maximum value was higher than that given in [14]. A statistically significant increasing trend in the parameter was identified during the monitored period at the Hluboká nad Vltavou profile, while decreasing trends were identified downstream of the Hněvkovice water reservoir, at Solenice, and at Kamýk nad Vltavou.

For dissolved oxygen, an annual mean below the permissible-pollution requirement (>9 mg/l) under Government Decree No. 401/2015 Coll. [14] was assessed at the Vltava-Solenice, Kamýk nad Vltavou, and Štěchovice profiles. A statistically significant change in the parameter was assessed only at the Kamýk profile, where values decreased during the monitored period, representing deterioration.

For BOD₅, the permissible-pollution value (annual mean 3.8 mg/l) under Government Decree No. 401/2015 Coll. [14] was attained or exceeded at the Kořensko water reservoir composite dam profile, downstream of the Kořensko water reservoir, and at Bechyně. The value for public

2 Surface Water in the Affected Area

water-supply use (annual mean 2.7 mg/l) was attained or exceeded at Týn nad Vltavou, the Kořensko water reservoir composite dam profile, downstream of the Kořensko water reservoir, Bechyně, and Topělec. The value for salmonid waters (annual mean 1.8 mg/l) was exceeded along almost the entire longitudinal profile and in the tributaries, except at the Kamýk and Štěchovice profiles. The value for cyprinid waters (annual mean 3.2 mg/l) was exceeded at Bechyně, the Kořensko water reservoir composite dam profile, and the profile downstream of the Kořensko water reservoir. No statistically significant decreasing or increasing trend in the parameter was identified at any profile during the monitored period.

For COD_{Cr} , the permissible-pollution value (annual mean 26 mg/l) under Government Decree No. 401/2015 Coll. [14] was attained or exceeded at the profile downstream of Kořensko and at Bechyně. The value for public water-supply use (annual mean 5.9 mg/l) was attained or exceeded at every profile for which data were available. A statistically significant increasing trend in the parameter, meaning deterioration over time, was identified during the monitored period at Hluboká nad Vltavou, downstream of the Hněvkovice water reservoir, Solenice, Bechyně, and Topělec.

For TOC, the permissible-pollution value (annual mean 10 mg/l) under Government Decree No. 401/2015 Coll. [14] was attained or exceeded at the Hněvkovice water reservoir composite dam profile, the Kořensko water reservoir composite dam profile, downstream of the Kořensko water reservoir, the Orlík water reservoir Zvíkov Bridge composite profile, Bechyně, and the Orlík water reservoir Plazy Bridge composite profile. The value for public water-supply use (annual mean 4.5 mg/l) was attained or exceeded at every profile for which data were available. A statistically significant increasing trend in the parameter was identified during the monitored period at the Hněvkovice water reservoir composite dam profile, downstream of the Hněvkovice water reservoir, the Kořensko composite dam profile, and Solenice.

For P_{total} , the permissible-pollution value (annual mean 0.15 mg/l) under Government Decree No. 401/2015 Coll. [14] was attained or exceeded at the Bechyně profile. The value for salmonid waters (annual mean 0.05 mg/l) was attained or exceeded at every profile except the Orlík water reservoir composite dam profile. A statistically significant increasing trend in the parameter was identified at the Solenice profile during the monitored period.

For N_{total} and $N\text{-NO}_3^-$, the permissible-pollution values (annual means 6 mg/l and 5.4 mg/l, respectively) under Government Decree No. 401/2015 Coll. [14] were not attained or exceeded. For N_{total} , a statistically significant increasing trend was identified during the monitored period downstream of the Hněvkovice water reservoir, at the Zvíkov Bridge composite profile, and at the Orlík water reservoir Plazy Bridge composite profile. For $N\text{-NO}_3^-$, no statistically significant decreasing or increasing trend was identified at any profile during the monitored period.

For $N\text{-NO}_2^-$, the permissible-pollution values (annual means 0.08 mg/l and 0.12 mg/l, respectively) under Government Decree No. 401/2015 Coll. [14] were not attained or exceeded

for salmonid and cyprinid waters. A statistically significant increasing trend in the parameter was identified during the monitored period at Kamýk nad Vltavou.

For N-NH_4^+ , the permissible-pollution value (annual mean 0.23 mg/l) under Government Decree No. 401/2015 Coll. [14] was not attained or exceeded. The value for salmonid waters (0.03 mg/l) was attained or exceeded along the entire longitudinal profile and in the tributaries. The value for cyprinid waters (0.16 mg/l) was attained or exceeded downstream of the Hněvkovice water reservoir and at Týn nad Vltavou. A statistically significant decreasing trend in the parameter was identified during the monitored period at Hluboká nad Vltavou, Týn nad Vltavou, downstream of the Kořensko water reservoir, and at Bechyně; an increasing trend was identified at the Orlík water reservoir Zvíkov Bridge composite profile.

DS_{105} was monitored only at the Hluboká, Týn nad Vltavou downstream, Bechyně, and Topělec profiles. At all profiles, the assessed mean was substantially below the permissible-pollution value (annual mean 750 mg/l) under Government Decree No. 401/2015 Coll. [14]. A statistically significant increasing trend in the parameter was identified during the monitored period at the Topělec profile.

DS_{550} was not monitored at any profile.

For SS_{105} , the permissible-pollution value (annual mean 20 mg/l) under Government Decree No. 401/2015 Coll. [14] was attained or exceeded at the Bechyně profile. No statistically significant decreasing or increasing trend in the parameter was identified at any profile during the monitored period.

Cl^- was monitored only at the Hluboká nad Vltavou, Hněvkovice water reservoir composite dam, downstream Kořensko water reservoir, Bechyně, and Topělec profiles. At all profiles, the assessed mean was substantially below both the permissible-pollution value (annual mean 150 mg/l) under Government Decree No. 401/2015 Coll. [14] and the stricter value for public water-supply use (annual mean 65 mg/l). A statistically significant increasing trend in the parameter was identified during the monitored period at the Hněvkovice water reservoir composite dam and Topělec profiles.

SO_4^{2-} was monitored only at the Hluboká nad Vltavou, Hněvkovice water reservoir composite dam, downstream Kořensko water reservoir, Solenice, Bechyně, and Topělec profiles. At all profiles, the assessed mean was substantially below both the permissible-pollution value (annual mean 200 mg/l) under Government Decree No. 401/2015 Coll. [14] and the stricter value for public water-supply use (annual mean 180 mg/l). A statistically significant decreasing trend in the parameter was identified during the monitored period downstream of the Kořensko water reservoir and at Solenice and Bechyně.

For Mg and Ca, the assessed mean at all profiles was substantially below the permissible-pollution values (annual means 120 mg/l and 190 mg/l, respectively) under Government Decree No. 401/2015 Coll. [14]. For Ca, a statistically significant decreasing trend was identified during the monitored period at the Orlík water reservoir composite dam, Solenice, and Bechyně profiles, while an increasing trend was identified at the Orlík water reservoir Plazy Bridge

2 Surface Water in the Affected Area

composite profile. For Mg, a statistically significant increasing trend was identified during the monitored period at the Orlík water reservoir Plazy Bridge composite profile.

C₁₀-C₄₀ hydrocarbons were monitored only at the Hluboká nad Vltavou and Týn nad Vltavou downstream. At both profiles, most values were <LOQ, with the LOQ at the permissible-pollution value (annual mean 0.1 mg/l) under Government Decree No. 401/2015 Coll. [14]; an assessment therefore cannot be made. It was not possible to assess the development of values over time for the parameter.

Fluoranthene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, dissolved Ni, AOX, aluminum, phenanthrene, pyrene, and EDTA were monitored only at the Hluboká nad Vltavou, Bechyně, and Topělec profiles.

For fluoranthene, the annual-average environmental quality standard (EQS-AA) of 0.0063 µg/l under Government Decree No. 401/2015 Coll. [14] was attained or exceeded at all profiles; the maximum allowable concentration environmental quality standard (EQS-MAC) of 0.12 µg/l was not attained at any profile. A statistically significant decreasing trend in the parameter was identified during the monitored period at the Bechyně and Topělec profiles.

For benzo[a]pyrene, the EQS-AA of 1.7×10^{-4} µg/l under Government Decree No. 401/2015 Coll. [14] was attained or exceeded at all profiles; the EQS-MAC of 0.27 µg/l was not attained at any profile. No statistically significant decreasing or increasing trend in the parameter was identified at any profile during the monitored period.

For benzo[b]fluoranthene, the EQS-MAC of 0.017 µg/l under Government Decree No. 401/2015 Coll. [14] was attained or exceeded at the Hluboká nad Vltavou.

For benzo[k]fluoranthene, the EQS-MAC of 0.017 µg/l under Government Decree No. 401/2015 Coll. [14] was not attained or exceeded.

For benzo[g,h,i]perylene, the EQS-MAC of 8.2×10^{-3} µg/l under Government Decree No. 401/2015 Coll. [14] was attained or exceeded at the Hluboká nad Vltavou and Bechyně profiles. For benzo[b]fluoranthene, benzo[k]fluoranthene, and benzo[g,h,i]perylene, statistically significant decreasing trends were identified during the monitored period at the Bechyně profile.

For dissolved Ni, neither the EQS-AA of 4 µg/l nor the EQS-MAC of 34 µg/l under Government Decree No. 401/2015 Coll. [14] was attained or exceeded at any profile. A statistically significant increasing trend in the parameter was identified during the monitored period at the Topělec profile.

For AOX, the EQS-AA of 25 µg/l was attained or exceeded; the stricter permissible-pollution values for public water-supply use of 12 µg/l under Government Decree No. 401/2015 Coll. [14] were exceeded at all profiles.

For phenanthrene, pyrene, and EDTA, the respective EQS-AA values of 0.03 µg/l, 0.024 µg/l, and 5 µg/l were not attained or exceeded at any profile. For AOX and phenanthrene, statistically

significant decreasing trends were identified during the monitored period at Hluboká nad Vltavou, Bechyně, and Topělec, meaning at every profile for which data are available. For pyrene, a statistically significant decreasing trend was identified during the monitored period at the Bechyně and Topělec profiles. For EDTA, a statistically significant decreasing trend was identified during the monitored period at Hluboká nad Vltavou, and an increasing trend was identified at the Orlík water reservoir Plazy Bridge composite profile.

For Al, neither the EQS-AA of 1 000 µg/l nor the stricter permissible-pollution value for public water-supply use of 380 µg/l under Government Decree No. 401/2015 Coll. [14] was attained or exceeded at any profile. No statistically significant decreasing or increasing trend in the parameter was identified at any profile during the monitored period.

Alachlor metabolites, metolachlor and its metabolites, and terbuthylazine and its metabolites were monitored only at the Hluboká nad Vltavou, downstream Hněvkovice water reservoir, Bechyně, and Topělec profiles. The EQS-AA of 0.1 µg/l for alachlor metabolites was attained or exceeded only at the Bechyně profile. For alachlor metabolites, a statistically significant decreasing trend was identified during the monitored period at Hluboká nad Vltavou, Bechyně, and the Orlík water reservoir Plazy Bridge composite profile. For metolachlor and its metabolites, a statistically significant increasing trend was identified during the monitored period at Hluboká nad Vltavou and Topělec. For terbuthylazine and its metabolites, no statistically significant decreasing or increasing trend was identified at any profile during the monitored period.

For the Orlík water reservoir Zvíkov Bridge composite, Orlík water reservoir composite dam, Kamýk nad Vltavou, Slapy water reservoir composite, and Štěchovice profiles, the assessed parameters were also compared with values of the general physicochemical and chemical parameters used to assess the ecological potential of running or standing surface water bodies, meaning the good/moderate potential boundary, for the given water-body type [18, 23, 25]. A higher value for total phosphorus (P_{total}) was assessed at the Zvíkov Bridge composite, Orlík water reservoir composite dam, Kamýk nad Vltavou, and Slapy water reservoir composite profiles. At the Kamýk nad Vltavou and Štěchovice profiles, lower minimum temperatures for April, May, and June and lower oxygen saturation were identified. Values below the minimum were assessed for oxygen saturation at the Kamýk nad Vltavou, Slapy water reservoir composite, and Štěchovice profiles. Details of the assessment of SWB status/potential are provided in Chapter 4.1.1.

For the critical Štěchovice profile, the assessed parameters were also compared with the surface-water quality values suitable for the life and reproduction of native fish species and other aquatic animals under Government Decree No. 71/2003 Coll. [12]. In this comparison, the target value for ammoniacal nitrogen, or ammonium ions, of 0.030 mg/l was not met. For dissolved oxygen, neither the target value nor the permissible value was met (9 mg/l and 7 mg/l, respectively).

Radioactivity parameters

The legislative requirements for surface-water quality in relation to radioactivity parameters arise primarily from Act No. 254/2001 Coll. (the Water Act) [13] and its implementing regulation, Government Decree No. 401/2015 Coll. [14], Annex 3, Table 1a, which defines the parameters and permissible-pollution values for radioactive substances, alongside general and microbiological parameters. In addition to permissible surface-water pollution in general, the table in the Government Decree specifies permissible pollution of surface waters used for particular purposes. In relation to radioactivity parameters, this concerns the use of waters as a source for drinking-water treatment; the values reflect the requirements of other regulations: Act No. 263/2016 Coll., the Atomic Act, as amended [50], which is implemented by Radiation Protection Decree No. 422/2016 Coll. [51]. The parameters are tritium (^3H), strontium-90 (^{90}Sr), cesium-137 (^{137}Cs), radium-226 (^{226}Ra), gross alpha activity concentration ($c\alpha$), gross beta activity concentration ($c\beta$), and gross beta activity concentration after subtraction of the ^{40}K contribution ($c\beta\text{-}^{40}\text{K}$).

These radioactive substances are also listed among the river-basin-specific pollutants in Annex 3, Table 1c, to Government Decree No. 401/2015 Coll. [14], which gives their environmental quality standards and permissible-pollution values for surface waters used for public water-supply purposes in accordance with [51]. These radioactive substances are also listed in methodology [23], although its values do not correspond to those in Government Decree No. 401/2015 Coll. [14] because the methodology has not yet been updated following the amendment to the Government Decree that modified the environmental quality standards for radioactive substances.

Different values may be specified for some radioactivity parameters at different locations in surface waters, particularly in view of the use of surface waters as a source for public water-supply purposes.

At the time background study [8] was prepared, the Atomic Act and its implementing regulations were being amended; the assessment was therefore based primarily on the requirements of Government Decree No. 401/2015 Coll. [14]. The amendment to Act No. 263/2016 Coll. (the Atomic Act) [50] introduced a provision prohibiting the supply of drinking water if the tritium activity concentration exceeds the maximum permissible value. This maximum permissible value is established by an implementing regulation, in this case Radiation Protection Decree No. 422/2016 Coll. [51]. The Decree establishes a maximum permissible value of 3 500 Bq/l for tritium in drinking water and a reference level of 1 000 Bq/l for tritium in drinking water; it also requires the activity concentration of gamma-emitting radionuclides to be measured where tritium in drinking water exceeds 100 Bq/l. The investigation level for ^{137}Cs is 0.5 Bq/l; if exceeded, the indicative dose must be determined. Similar provisions are established for surface waters into which radioactive substances are discharged from a workplace with a nuclear power installation: An investigation level of 100 Bq/l for tritium, above which it must be assessed whether the discharge procedures have been breached and whether the investigation level for ^{137}Cs has been exceeded; an investigation

2 Surface Water in the Affected Area

level of 0.5 Bq/l for ^{137}Cs , above which the customer abstracting water for drinking-water treatment must be informed of the results of artificial-radionuclide activity-concentration determination if the exceedance occurs at a drinking-water abstraction point; an action level of 1 000 Bq/l for tritium, above which it must be assessed whether the discharge procedures have been breached and corrective or preventive measures must be established, where appropriate, with the aim of not exceeding an annual mean tritium activity concentration of 1 000 Bq/l; and a maximum permissible value of 3 500 Bq/l for tritium. The values in Government Decree No. 401/2015 Coll. [14] are therefore consistent with the values introduced by the amendment to the atomic legislation and with the study prepared [8], and correspond to the requirements of the legislation currently in force.

Radioactivity parameters are essential to assessing the effect of the SMR ETE project because of the nature of the installation assessed. This applies particularly to artificial radionuclides that may be produced during the operation of nuclear installations. Based on Government Decree No. 401/2015 Coll. [14] and methodology [23], the assessment of the effect of the SMR ETE project on water quality should therefore include the following radioactivity parameters: ^3H , ^{90}Sr , ^{137}Cs , α , $\text{c}\beta$, $\text{c}\beta$ - ^{40}K .

The analysis shows that the legislative requirements for surface-water quality, meaning both the range of parameters assessed and their values, may differ among watercourse reaches depending on the purpose of the assessment. No other criteria are relevant from the perspective of radioactive substances. Critical profiles for assessing the effect of the SMR ETE project were selected taking into account the changing requirements along the reach of the Vltava affected by SMR ETE discharge. The selected critical profiles, together with the other profiles at which surface-water quality was assessed, are provided in Table 30. For the critical profiles, the parameters used to assess the effect of the SMR ETE project on surface-water quality were specified so as to correspond to the surface-water quality requirements relevant to each critical profile.

Table 30 Profiles included in the processing of selected radioactivity parameters; critical profiles are shown in bold, together with the purpose of assessment

Profile ID	Watercourse	Profile name	Purpose of assessment
1042	Vltava	Hluboká nad Vltavou	---
-	Vltava	Downstream of Hněvkovice	---
-	Vltava	Upstream of Kořensko	---
2537	Vltava	Downstream of Kořensko water reservoir	Direct effect of SMR ETE discharge; permissible surface-water pollution
5130	Vltava	Orlík WR, Zvíkov Bridge	Permissible surface-water pollution; ecological potential of the SWB (standing waters)
-	Vltava	Hladná	---
3213	Vltava	Solenice	Public water-supply use

2 Surface Water in the Affected Area

-	Lužnice	Koloděje	---
-	Otava	Topělec ^{***})	---

The available surface-water quality data for the area of interest, at the profiles listed in Table 30, were compiled for 2015–2024. Radioactivity parameters are monitored in the area under the ETE Effluent Monitoring Program [52–61] and the Program for Monitoring and Assessing the Environmental Effects of the Temelín Nuclear Power Plant [29–38], specifically Surface-Water and Groundwater Quality Monitoring at the Temelín Nuclear Power Plant, prepared by VÚV TGM, v. v. i. [39–48]; and by the surface-water quality monitoring program of Povodí Vltavy, from which data were requested for this study [49]. At critical profiles, data were processed for the parameters significant to each profile; at reference profiles, they were processed to the maximum extent available, based on the requirements for the profile downstream of the Kořensko water reservoir. The range of monitored parameters differs among profiles, data are missing at some profiles, and the character of the data also differs among the individual suppliers. A brief assessment of each parameter and a comparison of the assessed values with the applicable permissible-pollution values under Government Decree No. 401/2015 Coll. [14] are provided below.

For $c\alpha$, no values exceeding the permissible-pollution values (annual mean 0.2 Bq/l, maximum 0.3 Bq/l) under Government Decree No. 401/2015 Coll. [14] were recorded at any monitored profile. A statistically significant decrease in activity concentrations during the monitored period was assessed for the parameter at the Hladná profile. At the other profiles for which data were available, the trend was not significant or could not be assessed.

For $c\beta$, no values exceeding the permissible-pollution values (annual mean 0.5 Bq/l, maximum 1 Bq/l) under Government Decree No. 401/2015 Coll. [14] were recorded at any monitored profile. For gross beta activity concentration ($c\beta$), a statistically significant increase in activity concentrations during the monitored period was assessed downstream of the Hněvkovice water reservoir. At the other profiles for which data were available, the trend was not significant.

For $c\beta$ - ^{40}K , no values exceeding the permissible-pollution values (annual mean and maximum 0.5 Bq/l) under Government Decree No. 401/2015 Coll. [14] were recorded at any monitored profile. No statistically significant increase or decrease in activity concentrations during the monitored period was assessed for the parameter at any profile.

For ^{137}Cs and ^{90}Sr , no values exceeding the permissible-pollution values (maximum 2 Bq/l and 1 Bq/l, respectively) or the EQS-AA values (0.5 Bq/l and 0.2 Bq/l, respectively) under Government Decree No. 401/2015 Coll. [14] were recorded. For ^{137}Cs , a statistically significant decrease in activity concentrations during the monitored period was assessed at the Hladná and Topělec profiles. At the other profiles for which data were available, the trend was not significant. For ^{90}Sr , a statistically significant decrease in activity concentrations during the monitored period was assessed downstream of the Hněvkovice water reservoir, upstream of the

2 Surface Water in the Affected Area

Kořensko water reservoir, and at Koloděje and Topělec. At the other profiles for which data were available, the trend was not significant.

For ^3H , no values exceeding the permissible-pollution value (maximum 3 500 Bq/l) or the EQS-AA value (1 000 Bq/l) under Government Decree No. 401/2015 Coll. [14] were recorded at any monitored profile. A statistically significant decrease in activity concentrations during the monitored period was assessed for the parameter at Hluboká nad Vltavou and Solenice. At the other profiles for which data were available, the trend was not significant.

2.2.2 Effect of the SMR ETE Project on Surface-Water Quality

The effect of the SMR ETE project on surface-water quality was assessed in study [8], which served as the basis for this chapter.

Estimated effect of project operation on surface water

Concentrations at the critical profiles were modeled for two project capacity alternatives:

1. SMR ETE + Units 1 and 2
2. SMR ETE + Units 1 and 2 + two 1 700 MWe New NPP ETE units

For both alternatives, surface-water quality at the critical profiles was modeled for two hydrological situations:

1. “Normal flow”: long-term mean flow (Q_a) was used for the modeling
2. “Drought, effect of climate change”: flow Q_{355} was used for the modeling

In addition, the minimum reliable discharge (Q_{rel}) was modeled at the profile downstream of the Kořensko water reservoir to estimate extreme parameter values, meaning maxima, for comparison with values established by legislation as annual maxima, or minima in the case of dissolved oxygen. The discharges used are provided in Table 31.

Table 31 Discharge data at the profiles for assessing the effect of the SMR ETE project; critical profiles are shown in bold

Watercourse	Profile name	Q_a [m ³ /s]	Q_{rel} [m ³ /s]	Q_{355} [m ³ /s]
Lužnice	Bechyně (Koloděje)	21.6		2.63
Otava	Topělec	23.2		5.88
Vltava	Týn nad Vltavou (downstream of the Hněvkovice waterworks dam)	27.3		9.86
Vltava	Downstream of Kořensko water reservoir	49.1	9.5 *	13
Vltava	Orlík WR, Zvíkov Bridge	49.9		13.7
Vltava	Solenice	76.5		21.1
Vltava	Kamýk nad Vltavou	75.6		30.9
Vltava	Štěchovice	77.9		31.0

2 Surface Water in the Affected Area

Data source: communication with the Czech Hydrometeorological Institute [62–64] (* Hněvkovice-Kořensko operating rules [65])

The modeling was also conducted for two discharge scenarios:

1. **Average Discharge:** Actual concentrations measured in wastewater from Units 1 and 2, averaged over 2015–2024, were used in the calculation. The same concentrations were also used for the SMR ETE project and the New NPP ETE [66]. For radioactivity parameters, the actual measured discharged-activity values from Units 1 and 2, averaged over 2015–2024, were used. For the other parts of the assessed project capacity alternative, meaning the SMR ETE project and, where applicable, the New NPP ETE, the specified SMR source term [67] or, where applicable, the design radionuclide discharges according to the New NPP ETE EIA Documentation (2010) [68] were used conservatively.
2. **Maximum Discharge:** For Units 1 and 2, the “maximum” emission limits [t/year and Bq/year], or “m” where applicable, established in the permit for wastewater discharge from Units 1 and 2 [69] were used in the calculation. For the other parts of the assessed capacity alternatives, meaning the SMR ETE project and, where applicable, the New NPP ETE, the same approach as for the Average Discharge scenario was used. It represents an extreme boundary condition that has not been attained in practice by Units 1 and 2.

The data used for Units 1 and 2 are presented below: Data on the quantity and quality of raw water withdrawn and wastewater discharged were taken from the ETE environmental-protection reports [29–38] and the effluent and radiation-monitoring reports [48–57] for 2015–2024. Directly measured concentration data in wastewater from Units 1 and 2 are not available for all parameters identified as significant in this study. For the purposes of estimating the project's effect on surface-water quality, the wastewater concentration of these parameters was calculated as the parameter concentration in raw water multiplied by the concentration factor at which the existing Units 1 and 2 were operated during 2015–2024. This ratio, the concentration factor, is 4.4. Limit values for concentrations discharged in wastewater have been established for Units 1 and 2: emission limits “p”, which may be exceeded to the extent defined in [14]; “m”, which may not be exceeded; and “maximum” values in [g/s] and [t/year] [69]. Under this permit [69], the maximum wastewater discharge from Units 1 and 2 is 10.8 million m³/year. Radioactivity parameters in wastewater comprise the contribution from the power plant and that from raw water, which also contains radioactive substances that are concentrated in the cooling circuit and discharged with wastewater. Data on the power plant's contribution in discharged wastewater were taken from the ETE environmental-protection reports [29–38] and effluent and radiation-monitoring reports [52–61] for 2015–2024. The contribution of raw water to the discharge of radioactivity parameters is calculated as its activity concentration in raw water multiplied by a concentration factor of 4.4, except for tritium, for which a concentration factor of 1 is used in view of its properties.

2 Surface Water in the Affected Area

The data used for the New NPP ETE are presented below: Data on the quantity and quality of raw water withdrawn and the quantity of wastewater discharged were taken from reports prepared as background documents for the New NPP ETE EIA Documentation; for the quality of wastewater discharged, the emission limits proposed in a report by VÚV TGM, v. v. i. [66], were used. For the two 1 700 MWe New NPP ETE units, the EIA Documentation [68] assumes raw-water withdrawal of 67 million m³/year, averaging 2.12 m³/s. Wastewater discharge, comprising process wastewater and sewage, is assumed to be 15.156 million m³/year, averaging 0.48 m³/s. The same raw-water quality as for Units 1 and 2 is assumed for the New NPP ETE, with raw water for the New NPP ETE assumed to be withdrawn at the same location. Because the operation will be fundamentally similar from a water-management perspective, the wastewater composition is assumed to be the same as that of Units 1 and 2 [68]. For wastewater quality in terms of radioactivity parameters, the design annual discharge data for the two 1 700 MWe units provided in the New NPP ETE EIA Documentation [68] were used. Beta emitters are included under c β and c β -⁴⁰K, except ³H, which is not included in those parameters. No alpha emitters are anticipated in the New NPP ETE design discharge. For wastewater discharged from the New NPP ETE, the parameter concentrations were assumed to be values derived from the “maximum” emission limits for wastewater discharge from the New NPP ETE proposed in report [66] for the two 1 750 MWe unit capacity alternative, which is closest to the two 1 700 MWe unit capacity alternative assessed here. Where “maximum” limits in t/year were not established for temperature, dissolved oxygen, and pH, the “m” values were used. For parameters for which no emission limits were proposed, the concentrations used in wastewater were values based on experience with Units 1 and 2, meaning the mean concentration in wastewater from Units 1 and 2 in 2015–2024, or their concentration in raw water multiplied by the concentration factor.

The data used for the SMR ETE project are presented below: In some cases, data relating directly to the SMR ETE project were available [67]. Where these data were unavailable, experience from operation of the existing Units 1 and 2, which should be fundamentally similar in water-management terms, was used. The SMR ETE project is assumed to withdraw a maximum of 12 million m³ of raw water per year, averaging 0.38 m³/s, under the conservative SSP5-8.5 climate scenario; wastewater discharge is estimated at 3.6 million m³/year [67], averaging 0.11 m³/s. Operating experience from Units 1 and 2 can be used to estimate the behavior of substances in the SMR ETE cooling circuit because its operation, including the anticipated number of cycles of concentration, is assumed to be fundamentally similar to that of Units 1 and 2 [67]. For each parameter, the concentration ratio used to estimate its behavior in the cooling circuit was therefore calculated using operating data from Units 1 and 2. For several other parameters, concentration-ratio values could be taken from an earlier study by VÚV TGM, v. v. i. [70]; these primarily included PAHs, for which the concentration ratio was found to be substantially higher than the cooling-circuit concentration factor in many cases, and Ni. Radioactive substances in wastewater from the SMR ETE project will comprise the sum of the radioactive substances introduced with raw water and those added as a result of operating the SMR ETE reactor. According to information from the client [67], the SMR ETE cooling

circuit is expected to operate at 4.0–4.3 cycles of concentration, which may be considered close to the number of cycles of concentration at which the existing Units 1 and 2 are operated. According to their nature, the radionuclides listed are included under the individual radioactivity parameters assessed. Beta emitters are included under $c\beta$ and $c\beta$ - ^{40}K , except ^3H , ^{14}C , and gaseous isotopes (xenon and krypton), which are not covered by those parameters. No alpha emitters are anticipated in the SMR ETE source term. Radioactivity parameters in wastewater comprise the contribution from the power plant and that from raw water, which also contains radioactive substances that are concentrated in the cooling circuit and discharged with wastewater. No data are available for estimating the concentration of radioactive substances originating from the raw water itself; a value of 4.4 is therefore used for the concentration of radioactivity parameters, excluding the power plant's contribution, except for tritium, for which a concentration factor of 1 is used in view of its properties.

The effect of the SMR ETE project on surface-water quality was estimated for the critical profiles using the model described in detail in study [8]:

1. Downstream of Kořensko water reservoir: non-radiological parameters, including temperature; radioactivity parameters;
2. Orlík water reservoir, Zvíkov Bridge: non-radiological parameters, including temperature; radioactivity parameters;
3. Solenice: non-radiological parameters, including temperature; radioactivity parameters;
4. Kamýk nad Vltavou: non-radiological parameters, including temperature;
5. Štěchovice: non-radiological parameters, including temperature; radioactivity parameters.

The effect of tritium on the watercourse was also assessed at the Podolí and Hřensko profiles.

Non-radiological parameters

At the profile downstream of the Kořensko water reservoir, the modeled concentrations were assessed in terms of permissible pollution under Government Decree No. 401/2015 Coll. [14], taking into account that the Orlík water reservoir Podolsko public campsite bathing-water area lies downstream of this profile. Concentrations of significant parameters modeled for the effect of the capacity alternative comprising SMR ETE and Units 1 and 2 on the watercourse under the “Average Discharge” scenario are provided in Table 32, and those under the “Maximum Discharge” scenario in Table 33. Concentrations of significant parameters modeled for the effect of the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE on the watercourse under the “Average Discharge” scenario are provided in Table 34, and those under the “Maximum Discharge” scenario in Table 35. The tables also provide the applicable permissible-pollution values under Government Decree No. 401/2015 Coll. [14]: permissible-pollution annual average/environmental quality standard annual average (AA); permissible-pollution maximum/environmental quality standard maximum allowable concentration (MAX); permissible-pollution minimum (MIN); permissible-pollution annual average/environmental quality standard annual average for public water-supply use (LIM-B); permissible-pollution annual average/environmental quality standard annual average for a

2 Surface Water in the Affected Area

bathing-water area (LIM-C); permissible-pollution annual average/environmental quality standard annual average for salmonid waters (LIM-D); and permissible-pollution annual average/environmental quality standard annual average for cyprinid waters (LIM-E). Attainment or exceedance of the applicable value is indicated by color formatting.

The modeled concentration values show that the permissible-pollution annual average may be exceeded for BOD₅, COD_{Cr}, TOC, and the PAHs fluoranthene and benzo[a]pyrene; P_{total} does not meet the requirements for bathing waters. It must be noted, however, that the legislative requirements for these parameters are already not being met at present; the principal cause of this situation can be attributed to pollutant input from the Lužnice River. This is also reflected in the apparently paradoxical fact that, for some parameters, the situation under low-flow drought conditions appears better than under normal flows. This is because the influence of the Lužnice is less significant under drought conditions than under normal flows. Comparison of the modeled concentration values with the legislative requirements for annual maxima, or minima where applicable, showed that the maximum values may be exceeded for pH, benzo[b]fluoranthene, and benzo[g,h,i]perylene. Here too, the cause must be sought primarily in the pollution entering the Vltava from the Lužnice.

2 Surface Water in the Affected Area

Table 32 Modeled concentrations of significant parameters at the profile downstream of the Kořensko water reservoir for the capacity alternative comprising SMR ETE and Units 1 and 2 under the “Average Discharge” scenario for Q_a (normal flow), Q_{355} (drought, effect of climate change), and Q_{guar} (assessment of extremes and comparison with requirements specified as maxima or minima, as applicable).

SMR ETE + Units 1 and 2 Profile: Downstream of Kořensko water reservoir Scenario: Average Discharge		Modeled concentration at discharge:			Legislative requirements			
Parameter	Unit	Q_a	Q_{355}	Q_{rel} (max)	AA	MAX	MIN	LIM-C
T	°C	11.5	11.7	24.5		29		
pH		7.8	7.7	9.2		9	5	
O ₂	mg/l						9	
O ₂ saturation	%							
BOD ₅	mg/l	4.1	3.4	-	3.8			
COD _{Cr}	mg/l	32	29	-	26			
TOC	mg/l	12	11	-	10			
P _{total}	mg/l	0.13	0.11	-	0.15			0.05
P-PO ₄ ³⁻	mg/l	0.04	0.04	-				
N _{total}	mg/l	2.6	2.3	-	6			
N-NO ₃ ⁻	mg/l	1.6	1.5	-	5.4			
N-NO ₂ ⁻	mg/l	0.02	0.02	-				
N-NH ₄ ⁺	mg/l	0.13	0.15	-	0.23			
DS ₁₀₅	mg/l	168	158	-	750			
DS ₅₅₀	mg/l	-	-	-	470			
SS ₁₀₅	mg/l	14.6	11.8	-	20			
Cl ⁻	mg/l	19	16	-	150			
SO ₄ ²⁻	mg/l	20	20	-	200			
Mg	mg/l	5.2	4.8	-	120			
Ca	mg/l	18	16	-	190			
C ₁₀ -C ₄₀	mg/l	0.05	0.05	-	0.1			
Fluoranthene	µg/l	0.012	0.013	0.051	0.0063	0.12		
Benzo[a]pyrene	µg/l	0.004	0.005	0.020	0.000017	0.27		
Benzo[b]fluoranthene	µg/l	0.004	0.004	0.018		0.017		
Benzo[k]fluoranthene	µg/l	0.002	0.002	0.009		0.017		
Benzo[g,h,i]perylene	µg/l	0.003	0.004	0.016		0.0082		
Phenanthrene	µg/l	0.008	0.009	-	0.03			
Pyrene	µg/l	0.010	0.011	-	0.024			
Al	µg/l	227	240	-	1000			
Ni	µg/l	1.5	1.3	3.1	4	34		
AOX	µg/l	22	22	-	25			
Alachlor	µg/l	0.063	0.048	-	0.1			
Metolachlor	µg/l	0.075	0.054	-	0.2			
Terbutylazine	µg/l	0.029	0.021	-	0.5			
EDTA	µg/l	3.0	3.0	-	5			
Notes on legislative requirements:								
AA Permissible pollution, annual average/EQS-AA [14]								
MAX Permissible pollution, maximum/EQS-MAC [14]								
MIN Permissible pollution, minimum [14]								
LIM-C Permissible pollution, annual average/EQS-AA (bathing waters) [14]								

2 Surface Water in the Affected Area

Table 33 Modeled concentrations of significant parameters at the profile downstream of the Kořensko water reservoir for the capacity alternative comprising SMR ETE and Units 1 and 2 under the “Maximum Discharge” scenario for Q_a (normal flow), Q_{355} (drought, effect of climate change), and Q_{guar} (assessment of extremes and comparison with requirements specified as maxima or minima, as applicable).

SMR ETE + Units 1 and 2 Profile: Downstream of Kořensko water reservoir Scenario: Maximum Discharge		Modeled concentration at discharge:			Legislative requirements			
Parameter	Unit	Q_a	Q_{355}	Q_{rel} (max)	AA	MAX	MIN	LIM-C
T	°C	11.6	12.0	25		29		
pH		7.8	7.9	9.3		9	5	
BOD ₅	mg/l	4.2	3.8	-	3.8			
COD _{Cr}	mg/l	32	29	-	26			
P _{total}	mg/l	0.14	0.13	-	0.15			0.05
P-PO ₄ ³⁻	mg/l	0.04	0.04	-				
N-NO ₃ ⁻	mg/l	1.7	1.8	-	5.4			
DS ₅₅₀	mg/l	-	-	-	470			
SS ₁₀₅	mg/l	15	12	-	20			
SO ₄ ²⁻	mg/l	21	25	-	200			
C ₁₀ -C ₄₀	mg/l	0.05	0.05	-	0.1			
Notes on legislative requirements:								
AA Permissible pollution, annual average/EQS-AA [14]								
MAX Permissible pollution, maximum/EQS-MAC [14]								
MIN Permissible pollution, minimum [14]								
LIM-C Permissible pollution, annual average/EQS-AA (bathing waters) [14]								

2 Surface Water in the Affected Area

Table 34 Modeled concentrations of significant parameters at the profile downstream of the Kořensko water reservoir for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE under the “Average Discharge” scenario for Q_a (normal flow), Q_{355} (drought, effect of climate change), and Q_{guar} (assessment of extremes and comparison with requirements specified as maxima or minima, as applicable).

SMR ETE + Units 1 and 2 + New NPP ETE Profile: Downstream of Kořensko water reservoir Scenario: Average Discharge		Modeled concentration at discharge:			Legislative requirements			
Parameter	Unit	Q_a	Q_{355}	Q_{rel} (max)	AA	MAX	MIN	LIM-C
T	°C	11.7	12.4	25.3		29		
pH		7.8	7.8	9.2		9	5	
O ₂	mg/l						9	
O ₂ saturation	%							
BOD ₅	mg/l	4.1	3.5	-	3.8			
COD _{Cr}	mg/l	32	31	-	26			
TOC	mg/l	12	12	-	10			
P _{total}	mg/l	0.13	0.13	-	0.15			0.05
P-PO ₄ ³⁻	mg/l	0.04	0.04	-				
N _{total}	mg/l	2.7	2.6	-	6			
N-NO ₃ ⁻	mg/l	1.7	1.8	-	5.4			
N-NO ₂ ⁻	mg/l	0.02	0.03	-				
N-NH ₄ ⁺	mg/l	0.14	0.15	-	0.23			
DS ₁₀₅	mg/l	173	177	-	750			
DS ₅₅₀	mg/l	-	-	-	470			
SS ₁₀₅	mg/l	15	12	-	20			
Cl ⁻	mg/l	19	18	-	150			
SO ₄ ²⁻	mg/l	21	24	-	200			
Mg	mg/l	5.3	5.4	-	120			
Ca	mg/l	19	18	-	190			
C ₁₀ -C ₄₀	mg/l	0.05	0.06	-	0.1			
Fluoranthene	µg/l	0.013	0.015	0.052	0.0063	0.12		
Benzo[a]pyrene	µg/l	0.004	0.005	0.020	0.000017	0.27		
Benzo[b]fluoranthene	µg/l	0.004	0.005	0.019		0.017		
Benzo[k]fluoranthene	µg/l	0.002	0.003	0.010		0.017		
Benzo[g,h,i]perylene	µg/l	0.003	0.005	0.016		0.0082		
Phenanthrene	µg/l	0.009	0.010	-	0.03			
Pyrene	µg/l	0.010	0.013	-	0.024			
Al	µg/l	236	274	-	1000			
Ni	µg/l	1.5	1.4	17.6	4	34		
AOX	µg/l	23	25	-	25			
Alachlor	µg/l	0.065	0.053	-	0.1			
Metolachlor	µg/l	0.076	0.059	-	0.2			
Terbutylazine	µg/l	0.029	0.023	-	0.5			
EDTA	µg/l	3.1	3.4	-	5			
Notes on legislative requirements:								
AA		Permissible pollution, annual average/EQS-AA [14]						
MAX		Permissible pollution, maximum/EQS-MAC [14]						
MIN		Permissible pollution, minimum [14]						
LIM-C		Permissible pollution, annual average/EQS-AA (bathing waters) [14]						

2 Surface Water in the Affected Area

Table 35 Modeled concentrations of significant parameters at the profile downstream of the Kořensko water reservoir for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE under the “Maximum Discharge” scenario for Q_a (normal flow), Q_{355} (drought, effect of climate change), and Q_{guar} (assessment of extremes and comparison with requirements specified as maxima or minima, as applicable).

SMR ETE + Units 1 and 2 + New NPP ETE Profile: Downstream of Kořensko water reservoir Scenario: Maximum Discharge		Modeled concentration at discharge:			Legislative requirements			
Parameter	Unit	Q_a	Q_{355}	Q_{rel} (max)	AA	MAX	MIN	LIM-C
T	°C	11.9	13.2	25.8		29		
pH		7.9	8.0	9.3		9	5	
BOD ₅	mg/l	4.2	3.9	-	3.8			
COD _{Cr}	mg/l	33	32	-	26			
TOC	mg/l	12	13	-	10			
P _{total}	mg/l	0.14	0.14	-	0.15			0.05
P-PO ₄ ³⁻	mg/l	0.04	0.05	-				
N-NO ₃ ⁻	mg/l	1.8	2.5	-	5.4			
N-NH ₄ ⁺	mg/l	0.14	0.17	-	0.23			
DS ₅₅₀	mg/l	-	-	-	470			
SS ₁₀₅	mg/l	15	13	-	20			
SO ₄ ²⁻	mg/l	25	38	-	200			
C ₁₀ -C ₄₀	mg/l	0.05	0.06	-	0.1			
Notes on legislative requirements:								
AA		Permissible pollution, annual average/EQS-AA [14]						
MAX		Permissible pollution, maximum/EQS-MAC [14]						
MIN		Permissible pollution, minimum [14]						
LIM-C		Permissible pollution, annual average/EQS-AA (bathing waters) [14]						

Like the profile downstream of the Kořensko water reservoir, the Orlík water reservoir Zvíkov Bridge profile was assessed in terms of permissible pollution under Government Decree No. 401/2015 Coll. [14], taking into account that additional bathing-water areas in the lower part of the Orlík water reservoir lie downstream of this profile. This profile is also the representative profile for water body HVL_1055_J, Orlík I Reservoir on the Vltava, so compliance with the ecological-potential values established by methodology [18] was also assessed. Concentrations of significant parameters modeled for the effect of the capacity alternative comprising SMR ETE and Units 1 and 2 on the watercourse under the “Average Discharge” scenario are provided in Table 36, and those under the “Maximum Discharge” scenario in Table 37. Concentrations of significant parameters modeled for the effect of the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE on the watercourse under the “Average Discharge” scenario are provided in Table 38, and those under the “Maximum Discharge” scenario in Table 39.

As at the profile downstream of the Kořensko water reservoir, TOC and P_{total} remain problematic parameters at the Orlík water reservoir Zvíkov Bridge profile. Other parameters for which the requirements were not met at the profile downstream of the Kořensko water reservoir (BOD₅, COD_{Cr}, fluoranthene, and benzo[a]pyrene) could not be assessed because data were unavailable for them. In addition to the criteria listed above, the values for cyprinid waters were also considered at this profile because of the possible effect on the Otava arm of the Orlík

2 Surface Water in the Affected Area

water reservoir. However, the modeled data show that the cyprinid-water requirements are not at risk of exceedance for nitrite nitrogen or ammoniacal nitrogen; for BOD₅, it can be concluded that the contribution of the assessed project capacity alternative to any exceedance of the values is negligible.

Table 36 Modeled concentrations of significant parameters at the Orlik water reservoir Zvíkov Bridge profile for the capacity alternative comprising SMR ETE and Units 1 and 2 under the “Average Discharge” scenario for Q_a (normal flow) and Q₃₅₅ (drought, effect of climate change)

SMR ETE + Units 1 and 2 Profile: Orlik WR, Zvíkov Bridge Scenario: Average Discharge		Modeled concentration at discharge:		Legislative requirements:					
Parameter	Unit	Q _a	Q ₃₅₅	AA	MAX	MIN	LIM-C	LIM-E	LIM-F
T	°C				29			28*	20
pH					9	5		6–9*	5–10
O ₂	mg/l					9		≥7*	
O ₂ saturation	%							50*	50–200
BOD ₅	mg/l			3.8				3.2	
COD _{Cr}	mg/l			26					
TOC	mg/l	11	10	10					
P _{total}	mg/l	0.08	0.07	0.15			0.05		0.04
P-PO ₄ ³⁻	mg/l	0.02	0.02						
N _{total}	mg/l	1.8	1.6	6					
N-NO ₃ ⁻	mg/l	1.0	0.9	5.4					
N-NO ₂ ⁻	mg/l	0.02	0.02					0.12	
N-NH ₄ ⁺	mg/l	0.09	0.10	0.23				0.16	
NH ₃	mg/l							0.025*	
DS ₁₀₅	mg/l			750					
DS ₅₅₀	mg/l			470					
SS ₁₀₅	mg/l			20					
Cl ⁻	mg/l			150					
SO ₄ ²⁻	mg/l			200					
Mg	mg/l	4.7	4.3	120					
Ca	mg/l	16	15	190					
C ₁₀ -C ₄₀	mg/l			0.1					
Fluoranthene	µg/l			0.0063	0.12				
Benzo[a]pyrene	µg/l			0.000017	0.27				
Benzo[b]fluoranthene	µg/l				0.017				
Benzo[k]fluoranthene	µg/l				0.017				
Benzo[g,h,i]perylene	µg/l				0.0082				
Phenanthrene	µg/l			0.03					
Pyrene	µg/l			0.024					
Al	µg/l			1000					
Ni	µg/l			4	34				
AOX	µg/l			25					
Alachlor	µg/l			0.1					
Metolachlor	µg/l			0.2					
Terbutylazine	µg/l			0.5					
EDTA	µg/l			5					

Notes on legislative requirements:
AA Permissible pollution, annual average/EQS-AA [14]

2 Surface Water in the Affected Area

MAX	Permissible pollution, maximum/EQS-MAC [14]
MIN	Permissible pollution, minimum [14]
LIM-C	Permissible pollution, annual average/EQS-AA (bathing waters) [14]
LIM-E	Permissible pollution, annual average/EQS-AA (cyprinid waters) [14] (* permissible values from the Government Decree [12])
LIM-F	Good ecological-potential requirement [23]

Table 37 Modeled concentrations of significant parameters at the Orlik water reservoir Zvíkov Bridge profile for the capacity alternative comprising SMR ETE and Units 1 and 2 under the “Maximum Discharge” scenario for Q_a (normal flow) and Q_{355} (drought, effect of climate change)

SMR ETE + Units 1 and 2 Profile: Orlik WR, Zvíkov Bridge Scenario: Maximum Discharge		Modeled concentration at discharge:		Legislative requirements:					
Parameter	Unit	Q_a	Q_{355}	AA	MAX	MIN	LIM-C	LIM-E	LIM-F
T	°C				29			28*	20
pH					9	5		6–9*	5–10
BOD ₅	mg/l			3.8				3.2	
COD _{Cr}	mg/l			26					
P _{total}	mg/l	0.08	0.08	0.15			0.05		0.04
P-PO ₄ ³⁻	mg/l	0.02	0.03						
N-NO ₃ ⁻	mg/l	1.0	1.1	5.4					
DS ₅₅₀	mg/l			470					
SS ₁₀₅	mg/l			20					
SO ₄ ²⁻	mg/l			200					
C ₁₀ -C ₄₀	mg/l			0.1					
Notes on legislative requirements:									
AA		Permissible pollution, annual average/EQS-AA [14]							
MAX		Permissible pollution, maximum/EQS-MAC [14]							
MIN		Permissible pollution, minimum [14]							
LIM-C		Permissible pollution, annual average/EQS-AA (bathing waters) [14]							
LIM-E		Permissible pollution, annual average/EQS-AA (cyprinid waters) [14] (* permissible values from the Government Decree [12])							
LIM-F		Good ecological-potential requirement [23]							

2 Surface Water in the Affected Area

Table 38 Modeled concentrations of significant parameters at the Orlik water reservoir Zvíkov Bridge profile for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE under the “Average Discharge” scenario for Q_a (normal flow) and Q_{355} (drought, effect of climate change)

SMR ETE + Units 1 and 2 + New NPP ETE Profile: Orlik WR, Zvíkov Bridge Scenario: Average Discharge		Modeled concentration at discharge:		Legislative requirements:					
Parameter	Unit	Q_a	Q_{355}	AA	MAX	MIN	LIM-C	LIM-E	LIM-F
T	°C				29			28*	20
pH					9	5		6–9*	5–10
O ₂	mg/l					9		≥7*	
O ₂ saturation	%							50*	50–200
BOD ₅	mg/l			3.8				3.2	
COD _{Cr}	mg/l			26					
TOC	mg/l	11	11	10					
P _{total}	mg/l	0.08	0.08	0.15			0.05		0.04
P-PO ₄ ³⁻	mg/l	0.025	0.027						
N _{total}	mg/l	1.8	1.8	6					
N-NO ₃ ⁻	mg/l	1.0	1.1	5.4					
N-NO ₂ ⁻	mg/l	0.02	0.03					0.12	
N-NH ₄ ⁺	mg/l	0.09	0.10	0.23				0.16	
NH ₃	mg/l							0.025*	
DS ₁₀₅	mg/l			750					
DS ₅₅₀	mg/l			470					
SS ₁₀₅	mg/l			20					
Cl ⁻	mg/l			150					
SO ₄ ²⁻	mg/l			200					
Mg	mg/l	4.8	4.9	120					
Ca	mg/l	17	16	190					
C ₁₀ -C ₄₀	mg/l			0.1					
Fluoranthene	µg/l			0.0063	0.12				
Benzo[a]pyrene	µg/l			0.000017	0.27				
Benzo[b]fluoranthene	µg/l				0.017				
Benzo[k]fluoranthene	µg/l				0.017				
Benzo[g,h,i]perylene	µg/l				0.0082				
Phenanthrene	µg/l			0.03					
Pyrene	µg/l			0.024					
Al	µg/l			1000					
Ni	µg/l			4	34				
AOX	µg/l			25					
Alachlor	µg/l			0.1					
Metolachlor	µg/l			0.2					
Terbutylazine	µg/l			0.5					
EDTA	µg/l			5					
Notes on legislative requirements:									
AA Permissible pollution, annual average/EQS-AA [14]									
MAX Permissible pollution, maximum/EQS-MAC [14]									
MIN Permissible pollution, minimum [14]									
LIM-C Permissible pollution, annual average/EQS-AA (bathing waters) [14]									
LIM-E Permissible pollution, annual average/EQS-AA (cyprinid waters) [14] (* permissible values from the Government Decree [12])									
LIM-F Good ecological-potential requirement [23]									

2 Surface Water in the Affected Area

Table 39 Modeled concentrations of significant parameters at the Orlik water reservoir Zvíkov Bridge profile for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE under the “Maximum Discharge” scenario for Q_a (normal flow) and Q_{355} (drought, effect of climate change)

SMR ETE + Units 1 and 2 + New NPP ETE Profile: Orlik WR, Zvíkov Bridge Scenario: Maximum Discharge		Modeled concentration at discharge:		Legislative requirements:					
Parameter	Unit	Q_a	Q_{355}	AA	MAX	MIN	LIM-C	LIM-E	LIM-F
T	°C				29			28*	20
pH					9	5		6–9*	5–10
BOD ₅	mg/l			3.8				3.2	
COD _{Cr}	mg/l			26					
TOC	mg/l	12	12	10					
P _{total}	mg/l	0.08	0.08	0.15			0.05		0.04
P-PO ₄ ³⁻	mg/l	0.026	0.032						
N-NO ₃ ⁻	mg/l	1.1	1.6	5.4					
N-NH ₄ ⁺	mg/l	0.09	0.11	0.23				0.16	
DS ₅₅₀	mg/l			470					
SS ₁₀₅	mg/l			20					
SO ₄ ²⁻	mg/l			200					
C ₁₀ -C ₄₀	mg/l			0.1					
Notes on legislative requirements:									
AA Permissible pollution, annual average/EQS-AA [14]									
MAX Permissible pollution, maximum/EQS-MAC [14]									
MIN Permissible pollution, minimum [14]									
LIM-C Permissible pollution, annual average/EQS-AA (bathing waters) [14]									
LIM-E Permissible pollution, annual average/EQS-AA (cyprinid waters) [14] (* permissible values from the Government Decree [12])									
LIM-F Good ecological-potential requirement [23]									

At the Solenice profile, surface-water quality is assessed in terms of use for public water-supply purposes because abstraction point 1 is located there. SčV Příbram Solenice Vltava. Concentrations of significant parameters modeled for the effect of the capacity alternative comprising SMR ETE and Units 1 and 2 on the watercourse are provided in Table 40. Concentrations of significant parameters modeled for the effect of the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE on the watercourse are provided in Table 41. The modeled concentration values show that the values for public water-supply use are not met for TOC. Compliance with the limits cannot be assessed for the other parameters because data are unavailable.

2 Surface Water in the Affected Area

Table 40 Modeled concentrations of significant parameters at the Solenice profile for the capacity alternative comprising SMR ETE and Units 1 and 2 at Q_a (normal flow) and Q_{355} (drought, effect of climate change)

SMR ETE + Units 1 and 2 Profile: Solenice		Discharge scenario:				Legislative requirement s:
		Average		Maximum		
		Modeled concentration at discharge:				
Parameter	Unit	Q _a	Q ₃₅₅	Q _a	Q ₃₅₅	LIM-B
T	°C					
pH						
O ₂	mg/l					
O ₂ saturation	%					
BOD ₅	mg/l					2.7
COD _{Cr}	mg/l					5.9
TOC	mg/l	8.7	8.2	8.7	8.2	4.5
P _{total}	mg/l	0.07	0.06	0.07	0.07	
P-PO ₄ ³⁻	mg/l	0.04	0.04	0.04	0.05	
N-NO ₃ ⁻	mg/l	2.1	2.0	2.2	2.3	
N-NO ₂ ⁻	mg/l	0.015	0.016	0.015	0.016	
N-NH ₄ ⁺	mg/l	0.09	0.09	0.09	0.09	
SO ₄ ²⁻	mg/l					180
Mg	mg/l	5.5	5.2	5.5	5.2	
Ca	mg/l	19	18	19	18	
Notes on legislative requirements:						
LIM-B Permissible pollution, annual average/EQS-AA (public water-supply use) [14]						

Table 41 Modeled concentrations of significant parameters at the Solenice profile for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE at Q_a (normal flow) and Q_{355} (drought, effect of climate change)

SMR ETE + Units 1 and 2 + New NPP ETE Profile: Solenice		Discharge scenario:				Legislative requirement s:
		Average		Maximum		
		Modeled concentration at discharge:				
Parameter	Unit	Q _a	Q ₃₅₅	Q _a	Q ₃₅₅	LIM-B
T	°C					
pH						
O ₂	mg/l					
O ₂ saturation	%					
BOD ₅	mg/l					2.7
COD _{Cr}	mg/l					5.9
TOC	mg/l	8.8	8.7	9.0	9.2	4.5
P _{total}	mg/l	0.07	0.07	0.07	0.07	
P-PO ₄ ³⁻	mg/l	0.043	0.045	0.044	0.050	
N-NO ₃ ⁻	mg/l	2.2	2.3	2.3	2.8	
N-NO ₂ ⁻	mg/l	0.02	0.02	0.02	0.02	
N-NH ₄ ⁺	mg/l	0.09	0.09	0.09	0.10	
SO ₄ ²⁻	mg/l					180
Mg	mg/l	5.6	5.6	5.6	5.6	
Ca	mg/l	19	19	19	19	
Notes on legislative requirements:						
LIM-B Permissible pollution, annual average/EQS-AA (public water-supply use) [14]						

The Kamýk nad Vltavou profile is the representative profile for water body DVL_0030, Vltava from the Orlík reservoir dam to the backwater of the Slapy reservoir. Concentrations of significant parameters modeled for the effect of the capacity alternative comprising SMR ETE

2 Surface Water in the Affected Area

and Units 1 and 2 on the watercourse are provided in Table 42. Concentrations of significant parameters modeled for the effect of the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE on the watercourse are provided in Table 43. Comparison of the modeled value with the ecological-potential values established by methodology [25] showed that the good ecological-potential requirements for water-body phosphorus concentrations, both total phosphorus and orthophosphate phosphorus, are not met.

Table 42 Modeled concentrations of significant parameters at the Kamýk nad Vltavou profile for the capacity alternative comprising SMR ETE and Units 1 and 2 at Q_a (normal flow) and Q_{355} (drought, effect of climate change)

SMR ETE + Units 1 and 2 Profile: Kamýk nad Vltavou		Discharge scenario:				Legislative requirement s:
		Average		Maximum		
		Modeled concentration at discharge:				
Parameter	Unit	Q _a	Q ₃₅₅	Q _a	Q ₃₅₅	LIM-F
T	°C					14
pH						6–8.5
O ₂	mg/l					
O ₂ saturation	%					60–150
BOD ₅	mg/l					2.2
P _{total}	mg/l	0.061	0.055	0.062	0.060	0.05
P-PO ₄ ³⁻	mg/l	0.037	0.036	0.038	0.040	0.035
N-NO ₃ ⁻	mg/l	2.1	2.0	2.2	2.3	3.2
N-NH ₄ ⁺	mg/l	0.06	0.07	0.06	0.07	0.1
Notes on legislative requirements:						
LIM-F Good ecological-potential requirement [25]						

Table 43 Modeled concentrations of significant parameters at the Kamýk nad Vltavou profile for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE at Q_a (normal flow) and Q_{355} (drought, effect of climate change)

SMR ETE + Units 1 and 2 + New NPP ETE Profile: Kamýk nad Vltavou		Discharge scenario:				Legislative requirement s:
		Average		Maximum		
		Modeled concentration at discharge:				
Parameter	Unit	Q _a	Q ₃₅₅	Q _a	Q ₃₅₅	LIM-F
T	°C					14
pH						6–8.5
O ₂	mg/l					
O ₂ saturation	%					60–150
BOD ₅	mg/l					2.2
P _{total}	mg/l	0.06	0.06	0.06	0.06	0.05
P-PO ₄ ³⁻	mg/l	0.038	0.040	0.039	0.044	0.035
N-NO ₃ ⁻	mg/l	2.2	2.3	2.3	2.8	3.2
N-NH ₄ ⁺	mg/l	0.06	0.07	0.07	0.07	0.1
Notes on legislative requirements:						
LIM-F Good ecological-potential requirement [25]						

The last profile assessed was Štěchovice, where salmonid waters occur. Concentrations of significant parameters modeled for the effect of the capacity alternative comprising SMR ETE and Units 1 and 2 on the watercourse are provided in Table 44. Concentrations of significant parameters modeled for the effect of the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE on the watercourse are provided in Table 45. The modeled

2 Surface Water in the Affected Area

concentrations at this profile exceed the salmonid-water requirements for N-NH_4^+ . The concentration of N-NO_2^- meets the requirements; data are unavailable for the other parameters.

Table 44 Modeled concentrations of significant parameters at the Štěchovice profile for the SMR ETE plus Units 1 and 2 plus at Q_a (normal flow) and Q_{355} (drought, effect of climate change)

SMR ETE + Units 1 and 2 Profile: Štěchovice		Discharge scenario:				Legislative requirement s:
		Average		Maximum		
		Modeled concentration at discharge:				
Parameter	Unit	Q _a	Q ₃₅₅	Q _a	Q ₃₅₅	LIM-D
T	°C					21.5*
pH						6–9*
O ₂	mg/l					≥9*
O ₂ saturation	%					50*
BOD ₅	mg/l					1.8
N-NO ₂ ⁻	mg/l	0.011	0.012	0.011	0.012	0.08
N-NH ₄ ⁺	mg/l	0.035	0.037	0.035	0.037	0.03
NH ₃	mg/l					0.025*
Notes on legislative requirements: LIM-D Permissible pollution, annual average/EQS-AA (salmonid waters) [14] (* permissible values from the Government Decree [12])						

Table 45 Modeled concentrations of significant parameters at the Štěchovice profile for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE at Q_a (normal flow) and Q_{355} (drought, effect of climate change)

SMR ETE + Units 1 and 2 + New NPP ETE Profile: Štěchovice		Discharge scenario:				Legislative requirements:
		Average		Maximum		
		Modeled concentration at discharge:				
Parameter	Unit	Q _a	Q ₃₅₅	Q _a	Q ₃₅₅	LIM-D
T	°C					21.5*
pH						6–9*
O ₂	mg/l					≥9*
O ₂ percent saturation	%					50*
BOD ₅	mg/l					1.8
N-NO ₂ ⁻	mg/l	0.012	0.015	0.012	0.015	0.08
N-NH ₄ ⁺	mg/l	0.036	0.040	0.036	0.040	0.03
NH ₃	mg/l					0.025*
Notes on legislative requirements: LIM-D Permissible pollution, annual average/EQS-AA (salmonid waters) [14], (* permissible values from the Government Decree [12])						

Radioactivity parameters

At the profile downstream of the Kořensko water reservoir, the modeled concentrations were assessed in terms of permissible pollution under Government Decree No. 401/2015 Coll. [14]. Activity concentrations of significant radioactivity parameters modeled for the effect of the capacity alternative comprising SMR ETE and Units 1 and 2 on the watercourse under the “Average Discharge” scenario are provided in Table 46, and those under the “Maximum Discharge” scenario in Table 47. Activity concentrations of significant radioactivity parameters modeled for the effect of the capacity alternative comprising SMR ETE, Units 1 and 2, and

2 Surface Water in the Affected Area

New NPP ETE on the watercourse under the “Average Discharge” scenario are provided in Table 48, and those under the “Maximum Discharge” scenario in Table 49. All modeled activity-concentration values for the radioactivity parameters meet the permissible-pollution annual average, maximum, and EQS-AA requirements.

Table 46 Modeled activity concentrations of significant parameters at the profile downstream of the Kořensko water reservoir for the capacity alternative comprising SMR ETE and Units 1 and 2 under the “Average Discharge” scenario for Q_a (normal flow), Q_{355} (drought, effect of climate change), and Q_{guar} (assessment of extremes and comparison with values specified as maxima).

SMR ETE + Units 1 and 2 Profile: Downstream of Kořensko water reservoir Scenario: Average Discharge		Modeled concentration at discharge:			Legislative requirements	
Parameter	Unit	Q_a	Q_{355}	Q_{rel} (max)	AA	MAX
$c\alpha$	Bq/l	0.02	0.03	0.06	0.2	0.3
$c\beta$	Bq/l	0.14	0.12	0.25	0.5	1
$c\beta\text{-}^{40}\text{K}$	Bq/l	0.05	0.04	0.08	0.5	0.5
^{137}Cs	Bq/l	0.001	0.001	0.001	0.5	2
^{90}Sr	Bq/l	0.003	0.003	0.006	0.2	1
^3H	Bq/l	31	115	158	1000	3500
Notes on legislative requirements: AA Permissible pollution, annual average/EQS-AA [14] MAX Permissible pollution, maximum/EQS-MAC [14]						

Table 47 Modeled activity concentrations of significant parameters at the profile downstream of the Kořensko water reservoir for the capacity alternative comprising SMR ETE and Units 1 and 2 under the “Maximum Discharge” scenario for Q_a (normal flow), Q_{355} (drought, effect of climate change), and Q_{guar} (assessment of extremes and comparison with values specified as maxima).

SMR ETE + Units 1 and 2 Profile: Downstream of Kořensko water reservoir Scenario: Maximum Discharge		Modeled concentration at discharge:			Legislative requirements	
Parameter	Unit	Q_a	Q_{355}	Q_{rel} (max)	AA	MAX
$c\beta$	Bq/l	0.14	0.12	0.25	0.5	1
^3H	Bq/l	61	228	312	1000	3500
Notes on legislative requirements: AA Permissible pollution, annual average/EQS-AA [14] MAX Permissible pollution, maximum/EQS-MAC [14]						

Table 48 Modeled activity concentrations of significant parameters at the profile downstream of the Kořensko water reservoir for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE under the “Average Discharge” scenario for Q_a (normal flow), Q_{355} (drought, effect of climate change), and Q_{guar} (assessment of extremes and comparison with values specified as maxima).

SMR ETE + Units 1 and 2 + New NPP ETE Profile: Downstream of Kořensko water reservoir Scenario: Average Discharge		Modeled concentration at discharge:			Legislative requirements	
Parameter	Unit	Q_a	Q_{355}	Q_{rel} (max)	AA	MAX

2 Surface Water in the Affected Area

cα	Bq/l	0.02	0.03	0.06	0.2	0.3
cβ	Bq/l	0.15	0.17	0.31	0.5	1
cβ- ⁴⁰ K	Bq/l	0.06	0.09	0.14	0.5	0.5
¹³⁷ Cs	Bq/l	0.001	0.001	0.002	0.5	2
⁹⁰ Sr	Bq/l	0.003	0.004	0.006	0.2	1
³ H	Bq/l	109	408	558	1000	3500
Notes on legislative requirements:						
AA		Permissible pollution, annual average/EQS-AA [14]				
MAX		Permissible pollution, maximum/EQS-MAC [14]				

Table 49 Modeled activity concentrations of significant parameters at the profile downstream of the Kořensko water reservoir for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE under the “Maximum Discharge” scenario for Q_a (normal flow), Q₃₅₅ (drought, effect of climate change), and Q_{guar} (assessment of extremes and comparison with values specified as maxima).

SMR ETE + Units 1 and 2 + New NPP ETE Profile: Downstream of Kořensko water reservoir Scenario: Maximum Discharge		Modeled concentration at discharge:			Legislative requirements	
Parameter	Unit	Q _a	Q ₃₅₅	Q _{rel} (max)	AA	MAX
cβ	Bq/l	0.15	0.17	0.32	0.5	1
³ H	Bq/l	139	520	712	1000	3500
Notes on legislative requirements:						
AA		Permissible pollution, annual average/EQS-AA [14]				
MAX		Permissible pollution, maximum/EQS-MAC [14]				

Like the profile downstream of the Kořensko water reservoir, the Orlik water reservoir Zvíkov Bridge profile was assessed in terms of permissible pollution under Government Decree No. 401/2015 Coll. [14]. This profile is also the representative profile for water body HVL_1055_J, Orlik I Reservoir on the Vltava, so compliance with the water-body ecological-potential values established by methodology [23] was also assessed. Activity concentrations of significant radioactivity parameters modeled for the effect of the capacity alternative comprising SMR ETE and Units 1 and 2 on the watercourse are provided in Table 50; those for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE are provided in Table 51. As at the profile downstream of the Kořensko water reservoir, all modeled activity-concentration values for the radioactivity parameters meet these requirements.

Table 50 Modeled activity concentrations of significant parameters at the Orlik water reservoir Zvíkov Bridge profile for the capacity alternative comprising SMR ETE and Units 1 and 2 at Q_a (normal flow) and Q₃₅₅ (drought, effect of climate change)

SMR ETE + Units 1 and 2 Profile: Orlik WR, Zvíkov Bridge		Discharge scenario:				Legislative requirements:		
		Average		Maximum				
		Modeled concentration at discharge:						
Parameter	Unit	Q _a	Q ₃₅₅	Q _a	Q ₃₅₅	AA	MAX	LIM-F
cα	Bq/l					0.2	0.3	
cβ	Bq/l					0.5	1	
cβ- ⁴⁰ K	Bq/l					0.5	0.5	
¹³⁷ Cs	Bq/l					0.5	2	
⁹⁰ Sr	Bq/l					0.2	1	

2 Surface Water in the Affected Area

³ H	Bq/l	31	115	61	228	1000	3500	1000
Notes on legislative requirements:								
AA	Permissible pollution, annual average/EQS-AA [14]							
MAX	Permissible pollution, maximum/EQS-MAC [14]							
LIM-F	Good ecological-potential requirement [23]							

2 Surface Water in the Affected Area

Table 51 Modeled activity concentrations of significant parameters at the Orlik water reservoir Zvíkov Bridge profile for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE at Q_a (normal flow) and Q₃₅₅ (drought, effect of climate change)

SMR ETE + Units 1 and 2 + New NPP ETE Profile: Orlik WR, Zvukov Bridge		Discharge scenario:				Legislative requirements:		
		Average		Maximum				
		Modeled concentration at discharge:						
Parameter	Unit	Q _a	Q ₃₅₅	Q _a	Q ₃₅₅	AA	MAX	LIM-F
cα	Bq/l					0.2	0.3	
cβ	Bq/l					0.5	1	
cβ- ⁴⁰ K	Bq/l					0.5	0.5	
¹³⁷ Cs	Bq/l					0.5	2	
⁹⁰ Sr	Bq/l					0.2	1	
³ H	Bq/l	109	409	139	520	1000	3500	1000
Notes on legislative requirements:								
AA		Permissible pollution, annual average/EQS-AA [14]						
MAX		Permissible pollution, maximum/EQS-MAC [14]						
LIM-F		Good ecological-potential requirement [23]						

At the Solenice profile, surface-water quality is assessed in terms of public water-supply use because abstraction point 1 is located there. SčV Příbram Solenice Vltava. Activity concentrations of significant radioactivity parameters modeled for the effect of the capacity alternative comprising SMR ETE and Units 1 and 2 on the watercourse are provided in Table 52; those for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE are provided in Table 53. The modeled concentration values show that the indicative tritium value for public water-supply use is exceeded under the unfavorable concurrence of maximum discharge and low flows for both capacity alternatives assessed. For the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE, this situation also occurs at low flows under average discharge. The indicative value of 100 Bq/l for tritium in water used for drinking-water purposes is based on Czech and European legislation: Government Decree No. 401/2015 Coll. [14], Council Directive 2013/51/Euratom [71], and the amended atomic legislation [50]. This tritium activity concentration does not in itself represent a significant health risk, but may indicate the presence of other, more serious artificial radionuclides. If this value is exceeded, the source of the radioactive pollution should be identified [14] and, where applicable, the presence of other artificial radionuclides must be analyzed [71].

Table 52 Modeled activity concentrations of significant parameters at the Solenice profile for the capacity alternative comprising SMR ETE and Units 1 and 2 at Q_a (normal flow) and Q₃₅₅ (drought, effect of climate change)

SMR ETE + Units 1 and 2 Profile: Solenice		Discharge scenario:				Legislative requirement s:
		Average		Maximum		
		Modeled concentration at discharge:				
Parameter	Unit	Q _a	Q ₃₅₅	Q _a	Q ₃₅₅	LIM-B
ca	Bq/l					0.2
cβ- ⁴⁰ K	Bq/l	0.04	0.04	0.04	0.04	0.5
³ H	Bq/l	21	75	40	148	100
Notes on legislative requirements:						
LIM-B Permissible pollution, annual average/EQS-AA (public water-supply use) [14]						

2 Surface Water in the Affected Area

Table 53 Modeled activity concentrations of significant parameters at the Solenice profile for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE at Q_a (normal flow) and Q_{355} (drought, effect of climate change)

SMR ETE + Units 1 and 2 + New NPP ETE Profile: Solenice		Discharge scenario:				Legislative requirement s:
		Average		Maximum		
		Modeled concentration at discharge:				
Parameter	Unit	Q _a	Q ₃₅₅	Q _a	Q ₃₅₅	LIM-B
ca	Bq/l					0.2
cβ- ⁴⁰ K	Bq/l	0.08	0.21	0.08	0.21	0.5
³ H	Bq/l	71	265	91	338	100
Notes on legislative requirements: LIM-B Permissible pollution, annual average/EQS-AA (public water-supply use) [14]						

The effect of tritium on the watercourse farther downstream, at the Podolí and Hřensko profiles, was also estimated. The discharges published by the Czech Hydrometeorological Institute in the ISVS VODA information system [72] were used as Q_a and Q_{355} to estimate tritium activity concentrations at the Podolí and Hřensko profiles: Prague-Chuchle gauging station (200100) for the Podolí profile and Elbe-Hřensko gauging station (245000) for the Hřensko profile. In view of the activity concentration at Solenice, the tritium activity concentration in Vltava tributaries unaffected by discharges of tritiated water can be disregarded. According to this estimate (Table 54), the tritium activity-concentration values, for both capacity alternatives and both flow scenarios, are in the dozens of Bq/l. A value slightly exceeding 100 Bq/l was estimated at the Podolí profile for the capacity alternative comprising concurrent operation of the SMR ETE project, Units 1 and 2, and the New NPP ETE under the Maximum Discharge scenario during low flows due to climate-change drought. The permissible-pollution maximum for tritium in surface water is 3 500 Bq/l [14]; however, the tritium activity-concentration value must also be considered in view of the fact that a surface-water abstraction for public water-supply purposes is located at Prague-Podolí, for which an indicative value of 100 Bq/l is established [14].

Table 54 Estimated tritium activity concentrations at the Solenice, Podolí, and Hřensko profiles under normal-flow conditions (Q_a) and climate-change drought conditions (Q_{355}) for the SMR ETE plus Units 1 and 2 and the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE.

Capacity alternative:		SMR ETE + Units 1 and 2		SMR ETE + Units 1 and 2 + New NPP ETE	
Discharge scenario:		Average	Maximum	Average	Maximum
Normal-flow conditions	Q_a [m ³ /s]	$c(^3\text{H})$ [Bq/l]			
Solenice	76.5	21	40	71	91
Podolí	134	12	23	41	52
Hřensko	291	5	11	19	24
Climate-change drought conditions	Q_{355} [m ³ /s]	$c(^3\text{H})$ [Bq/l]			
Solenice	21.1	75	148	265	338
Podolí	47.4	33	66	118	151
Hřensko	99.2	16	32	56	72

2 Surface Water in the Affected Area

Modeling the effects of both project alternatives assessed, the SMR ETE plus Units 1 and 2 and the SMR ETE plus Units 1 and 2 plus the New NPP ETE, showed that under low-flow conditions, the indicative tritium value may be exceeded along the longitudinal profile of the Vltava affected by wastewater discharge at profiles subject to a stricter requirement because of abstractions for public water-supply purposes, namely Solenice and potentially Podolí.

In the future, discharges from the individual parts of the assessed project capacity alternatives, namely the SMR ETE project, Units 1 and 2, and the New NPP ETE, may need to be coordinated with one another and with the current flow in the receiving water so that legislative requirements, particularly for tritium, are not exceeded.

2.3 Affected Minor Watercourses

*Chapter prepared by: RNDr. Diana Marešová, Ph.D. and Ing. Eva Juranová, Ph.D.
This chapter is based on background study [73].*

In addition to the Vltava, which will receive wastewater from the SMR ETE project, the effects on several minor watercourses near the ETE site were also assessed in relation to the drainage of precipitation falling on the SMR ETE site and the pumping of groundwater to lower the groundwater level at the site.

The SMR ETE site and construction-facility Areas I and H are located in hydrological basin No. 1-08-03-0793 (Dvorčický Stream); construction-facility Area J lies partly in the Dvorčický Stream basin and partly in basin No. 1-08-03-0792 (Temelínský Stream); Area G lies in basin No. 1-06-03-0730 (Strouha Stream); and Area C lies in basin No. 1-06-03-0770 (Palečkův Stream). [74]

After construction of the SMR ETE project is completed, the construction-facility sites (C, H, G, I, and J) are expected to be restored to their original condition. The original runoff conditions are expected to be restored at the construction-facility sites; the Temelínský and Palečkův Streams are therefore not assessed further. In addition to the change in land use at the SMR ETE site, the hydrogeological conditions will be decisively affected by climate change during SMR ETE operation [74]. The project effects on the Strouha and Dvorčický Streams and Dvorčice Pond are assessed in detail [73].

2.3.1 Current state of the affected minor watercourses

Strouha Stream

On the basis of information from the Czech Hydrometeorological Institute, Valočík [75] summarizes the situation of minor watercourses near the ETE site. The Strouha is a third-order stream draining the southeastern slope below Units 1 and 2; it includes Karlovec Pond, with an

2 Surface Water in the Affected Area

area of approximately 1.8 ha, at which the Strouha begins. Karlovec is located very close to Units 1 and 2. A cascade of three fishponds, with a total area of up to 2.25 ha, was constructed on the Strouha in the past at an elevation of approximately 450 m a.s.l. These are Libívský, Mlýnský, and Nový fishponds near Býšov.

The Strouha watercourse receives treated water discharged from the stormwater sewer system at Units 1 and 2, which enters the stream downstream of the safety basins between Libívský and Mlýnský fishponds. Mlýnský fishpond serves as a retention basin that attenuates the incoming water volume.

A system of fishponds has also been constructed on Hůrecký Stream, a left-bank tributary of the Strouha that rises below the village of Březí nad Vltavou; these fishponds are not affected by stormwater drainage from Units 1 and 2. The largest of these is Hůrecký fishpond, with an area of approximately 4.5 ha. The other three fishponds, Pohrobný, Barbora, and Starý, have a total area of up to 2.25 ha [75].

The Strouha is a left-bank tributary of the Vltava and enters the Hněvkovice waterworks at river kilometer 214.118 near Buzkov. Its catchment area is 13.19 km² [75]. Over its approximately 6.5 km course, it descends by approximately 114 m. The smaller settlements along it are Hůrka, Knín, Býšov, Strouha, Jeznice, and Buzkov.

The watercourses and fishponds listed are shown on the map in Fig. 17.

2 Surface Water in the Affected Area

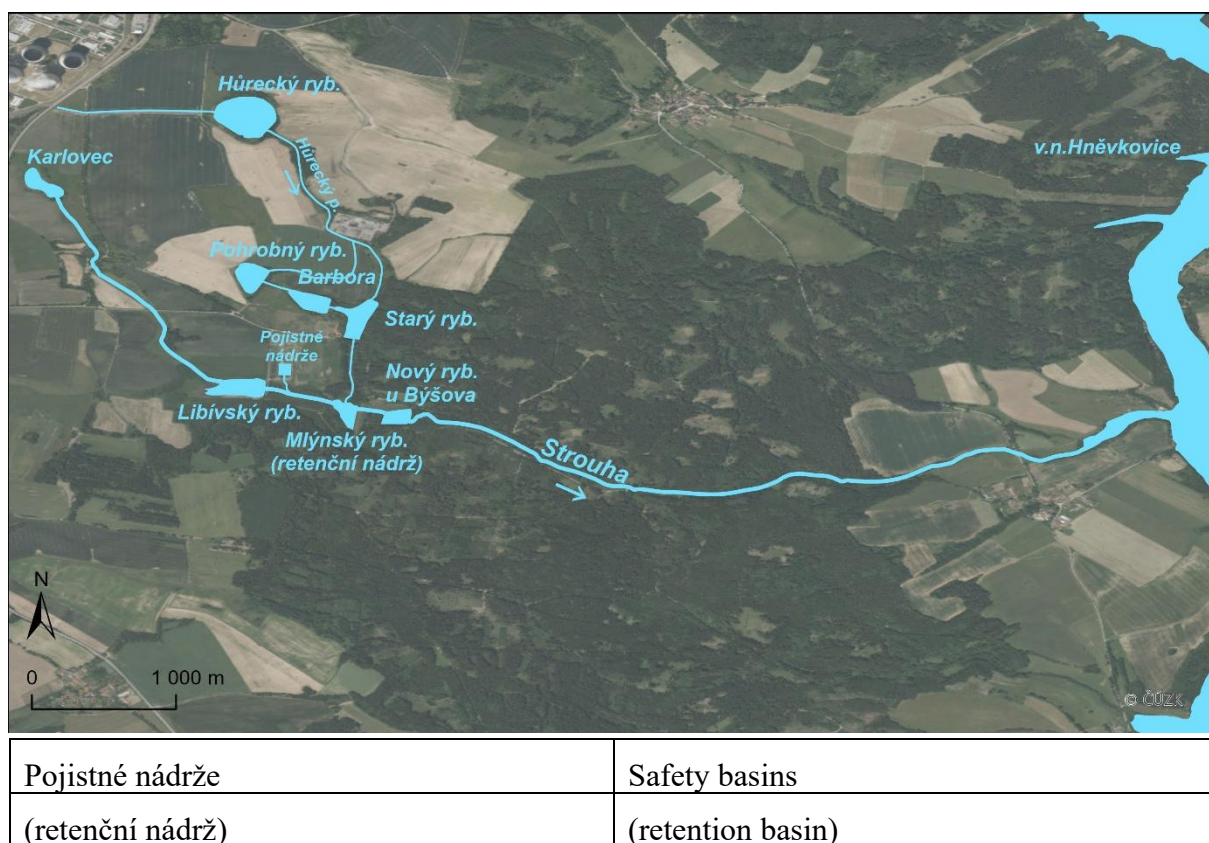


Fig. 17 Overview of minor watercourses and fishponds in the Strouha catchment

The basic hydrological characteristics of the Strouha are provided in Table 55 to Table 57 [75].

Table 55 Characteristics of the Strouha watercourse profile (class IV) [75]

Watercourse:	Strouha	A [km ²]	P_a [mm]	Q_a[*] [m ³ /s]
Hydrological basin number:	1-06-03-0730-0-00			
At profile:	1.4 km downstream of the Karlovec Pond dam	1.04	610	0.003

* Long-term mean (reference period 1991–2020)

Table 56 M-day discharges of the Strouha watercourse (class IV) [75]

M	30	60	90	120	150	180	210	240	270	300	330	355	364
Q_M [l/s]	6.4	4.2	3.2	2.4	1.8	1.3	0.9	0.6	0.3	0.2	0.1	0.0	0.0

Table 57 N-year discharges of the Strouha watercourse (class IV) [75]

N	1	2	5	10	20	50	100	1000
Q_N [m³/s]	0.30	0.60	1.20	1.80	2.60	3.85	5.00	9.30

Note: Q₁₀₀₀ was determined by extrapolation from the parameters of the theoretical probability distribution.

At this location, the ETE Laboratories take measurements twice monthly at the Býšov Retention Basin profile (0UL068). Regular monitoring data are also available on the Strouha from PVL at profiles 112243 Temelín NPP Strouha safety basins, at the outflow from the safety basins; 112243 Temelín NPP Strouha retention basins, at the outflow from the retention basin; and Strouha-Jeznice (2544), at frequencies of twice yearly and 12 times yearly, respectively.

The ETE Laboratories monitor pH, electrical conductivity, COD_{Cr}, non-polar extractable substances, C₁₀-C₄₀ hydrocarbons, and tritium twice monthly. Of these parameters, the permissible-pollution value (annual mean 26 mg/l) under Government Decree No. 401/2015 Coll. [14] was attained or exceeded for COD_{Cr}. For C₁₀-C₄₀ hydrocarbons, most values were below the limit of quantification, which is at the permissible-pollution value (annual mean 0.1 mg/l) under Government Decree No. 401/2015 Coll. [14]; an assessment therefore cannot be made. For the other parameters, the permissible-pollution values under Government Decree No. 401/2015 Coll. [14] were attained or exceeded for total organic carbon (annual mean 10 mg/l). As stated above, these results must be regarded as indicative only because of the very limited sampling frequency.

At the Strouha-Jeznice profile, where PVL conducts regular monitoring, the permissible-pollution annual-average values under Government Decree No. 401/2015 Coll. [14] were attained or exceeded for COD_{Cr}, suspended solids, and total organic carbon.

For the purposes of this study, the measurements were supplemented by VÚV TGM, v. v. i., monitoring conducted monthly from January through March 2026 at the Strouha upstream and downstream profiles. The results indicate that the quality of water in the Strouha is affected by water discharged from the safety basins, comprising a mixture of stormwater or runoff from the Units 1 and 2 site and pumped groundwater. The effect is particularly apparent for SS₁₀₅, for which there is a substantial improvement, although this may merely be a transient current situation. Conversely, increases were identified in pH and chloride concentrations, although all measured chloride values remained below the permissible-pollution annual-average value; the increase may also have been influenced by the monitoring period and winter treatment of the site surfaces. The situation was similar for the PAHs fluoranthene and benzo[a]pyrene, whose measured values exceeded the EQS-AA on average under Government Decree No. 401/2015 Coll. [14]. However, it must again be emphasized that the supplementary monitoring comprised only three campaigns, or sampling dates, during a limited part of the year, from January through March, which is generally a period of increased PAH occurrence in the environment. PAHs enter water primarily through atmospheric deposition from air polluted by fuel combustion during the heating season. For O₂, both concentration and saturation, the values at the Strouha upstream profile were probably reduced by the frozen water surface and were influenced by the monitoring period, so they cannot be considered representative. Measurements by the ETE Laboratories downstream of the retention basin show that electrical conductivity and pH improve in the retention basin, Mlýnský fishpond; an assessment of other parameters is not possible because of the range of parameters determined by the individual laboratories.

2 Surface Water in the Affected Area

Dvorčický Stream and Dvorčice Pond

Dvorčický Stream (hydrological basin No. 1-08-03-0793-0-00-00), with Dvorčice Pond covering approximately 1.8 ha, drains the southern slope below Units 1 and 2, and the SMR ETE site extends into its catchment [75]. Water from Dvorčický Stream flows successively into Malešický Stream, Temelíněcký Stream, and then Bílý Stream, whose name subsequently changes to Radomilický Stream, before flowing into the Blanice, Otava, and Vltava Rivers. Within the same basin, Dvorčický Stream is a left-bank tributary of Malešický Stream, a seventh-order watercourse, and descends by approximately 82 m over its 5 km course. A diversion channel at an elevation of approximately 457 m a.s.l. supplies a system of fishponds on Dříteňský Stream (hydrological basin No. 1-08-03-079/6) [75]. According to findings from November 2025 [74], this millrace was not functional. During the field survey conducted as part of the supplementary monitoring for this study, from January through March 2026, Dvorčický Stream was dammed and the water redirected into the diversion channel, although the sluice gate also allowed some water to continue into Dvorčický Stream.

Neither pumped groundwater nor stormwater from the Units 1 and 2 site is currently discharged to Dvorčický Stream.

The watercourses listed near the SMR ETE project are shown clearly on the map in Fig. 18.

2 Surface Water in the Affected Area

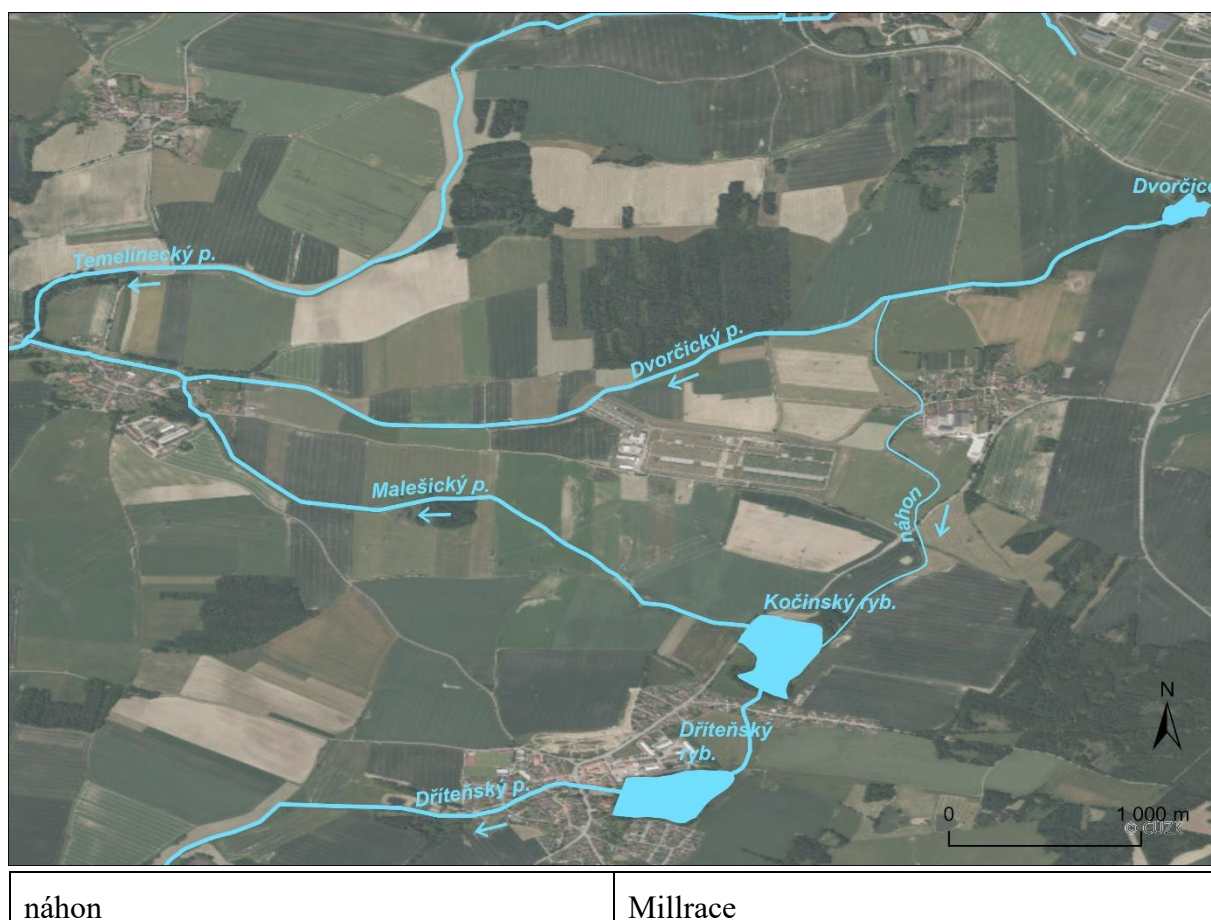


Fig. 18 Watercourses and fishponds near the SMR ETE project in the Dvorčický Stream area

The Czech Hydrometeorological Institute does not perform measurements on Dvorčický Stream, so discharge data determined according to its methodology are unavailable. Hydrological monitoring was conducted at this location in 2015–2017 [76] and used to calculate the discharge characteristics provided in Table 58. According to that study [76], Dvorčický Stream has the lowest total-runoff and baseflow values among the minor watercourses near the ETE site. The water regime is not optimal; during the summer, the stream dries up for an average of one to two months.

No existing water-quality data were identified for Dvorčický Stream, Dvorčice Pond, or the other associated minor watercourses, including the millrace serving as a water-diversion channel between the Dvorčický and Dříteňský Streams through the village of Kočín. Supplementary monitoring was therefore conducted as part of this study.

2 Surface Water in the Affected Area

Table 58 Measured M-day discharges on Dvorčický Stream at profile P4 (Fig. 19) for 8/2015–7/2017

Catchment area [km ²]		1.536
Mean flow [l/s]		1.847
Mean specific discharge [l/s/km ²]		1.2
M-day discharges:	M	Q [l/s]
	30	4.578
	60	3.229
	90	2.569
	120	2.045
	150	1.599
	180	1.255
	210	1.039
	240	0.815
	270	0.605
	300	0.310
	330	0.007
	355	0
	364	0

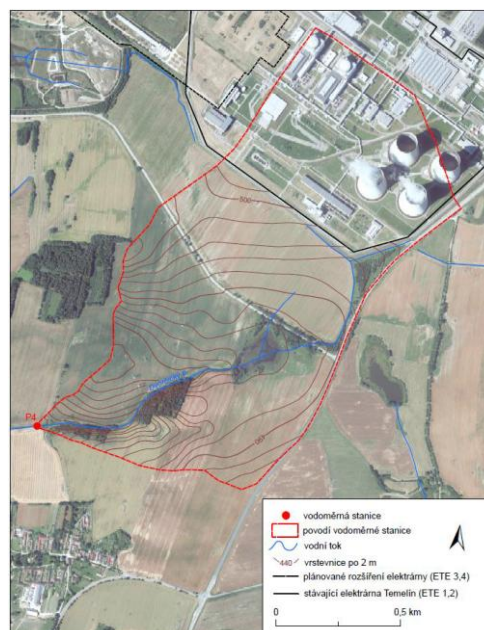


Fig. 19 Catchment of Dvorčický Stream profile P4, measured in 8/2015–7/2017 [76]

vodoměrná stanice	Gauging station
povodní vodoměrné stanice	Gauging-station catchment
vodní tok	Watercourse
vrstevnice po 2 m	Contours at 2 m intervals
plánované rozšíření elektrárny (ETE 3,4)	Planned power plant expansion (New NPP ETE)
stávající elektrárna Temelín (ETE 1,2)	Existing Temelín Nuclear Power Plant (Units 1 and 2)

For the purposes of this study, the measurements were supplemented by VÚV TGM, v. v. i., monitoring conducted monthly from January through March 2026 at the Dvorčický Stream and Municipality of Kočín profiles. The supplementary analyses covered the following parameters: water temperature (field); pH (field); electrical conductivity (field); dissolved-oxygen concentration (field); oxygen saturation (field); chlorides; suspended solids dried at 105 °C (SS₁₀₅); C₁₀-C₄₀ hydrocarbons; and the polycyclic aromatic hydrocarbons (PAHs) benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, indeno[1,2,3-cd]pyrene, and fluoranthene. Most monitored parameters in the water did not exceed the values established by Government Decree No. 401/2015 Coll. [14]. The exceptions were the PAHs fluoranthene and, at the Municipality of Kočín sampling point, benzo[a]pyrene, whose measured values exceeded the EQS-AA on average. It must be emphasized, however,

2 Surface Water in the Affected Area

that the supplementary analyses were conducted during a period limited to winter, when increased PAH occurrence in the environment is generally observed. PAHs enter water primarily through atmospheric deposition from air polluted by fuel combustion during the heating season. At the Municipality of Kočín profile, a noticeable deterioration in water quality was also present for several other parameters, such as SS₁₀₅; this may also be caused by the effects of the municipality's built-up area and by the season in which monitoring was conducted. It must again be noted that, because of the timeframe of the study, the scope of the supplementary monitoring was very limited and therefore not fully representative; comparison of the measured values with the values established by legislation is indicative.

Description of the site in terms of the territorial system of ecological stability (affected biocenters and biocorridors)

In the area of interest in the Dvorčický Stream catchment, the territorial system of ecological stability (TSES), designated under Act No. 114/1992 Coll., on Nature and Landscape Protection [77], and Decree No. 395/1992 Coll. implementing certain provisions of Czech National Council Act No. 114/1992 Coll., on Nature and Landscape Protection, as amended [78], comprises local biocenter LBC 1a Dvorčice, consisting of Dvorčice Pond and the surrounding riparian vegetation, and LBC 0205 Na Studánkách, located at the confluence of Dvorčický Stream and an unnamed right-bank tributary and also including parts of the surrounding agricultural land. The two biocenters are connected by local biocorridor LBK 2a, comprising the channel of Dvorčický Stream and its riparian vegetation. Local biocorridor LBK 0332 continues westward from biocenter LBC 0205 Na Studánkách along Dvorčický Stream toward the village of Malešice. This biocorridor comprises the channel of Dvorčický Stream and its immediate surroundings, which lack substantial riparian woody vegetation. The overall configuration of the territorial system of ecological stability in the Dvorčický Stream catchment is apparent from the figure (Fig. 20).

On the other affected minor watercourse, the Strouha, biocorridor LBK 3 Karlovec is designated in the upper part of the catchment, beginning at Karlovec Pond and continuing south as biocorridor LBK 4a Knín, followed by biocorridor LBK 7c Strouha II and LBK 8c Strouha III, which already lies downstream of the Units 1 and 2 safety-basin outfall [79, 80].

2 Surface Water in the Affected Area

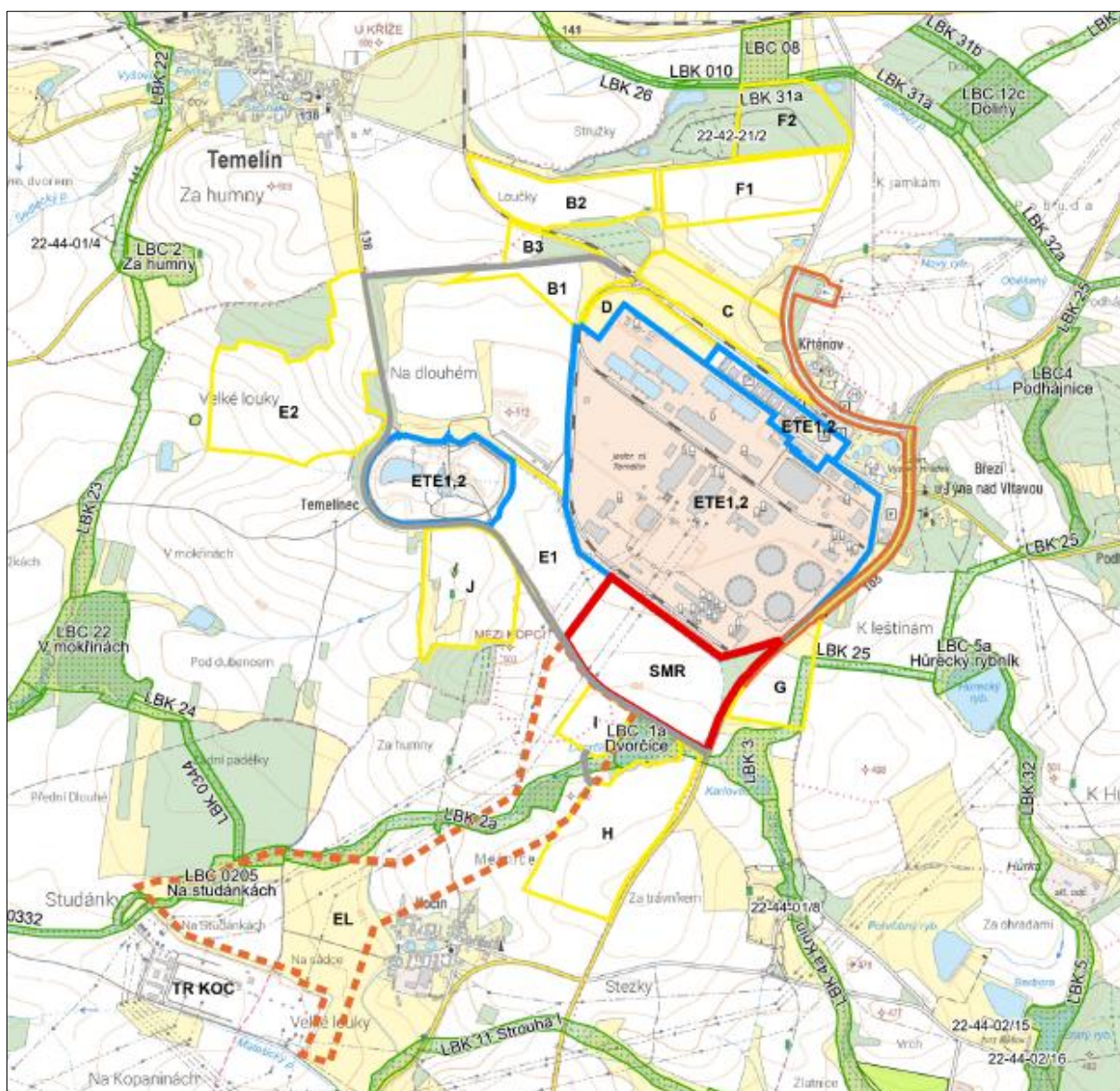


Fig. 20 Location map showing the local biocorridors and local biocenters in the area affected by the SMR ETE project (taken from study [81]).

2.3.2 Effect of the SMR ETE Project on the Affected Minor Watercourses

Effect of the SMR ETE project on the Strouha

The Strouha currently receives groundwater and stormwater discharged from the Units 1 and 2 site; pumped groundwater and stormwater from the SMR ETE site are expected to be discharged in the same manner. These discharged waters will enter between Libívský and Mlýnský fishponds.

The highest estimated total quantity of stormwater and pumped groundwater discharged from the SMR ETE site is up to 238 000 m³/year, averaging 7.5 l/s [73]. The total for all three parts

of the project, namely the SMR ETE project, Units 1 and 2, and the New NPP ETE, may be up to 759,000 m³/year, averaging 24 l/s [73].

According to information provided by the client [82, 83], stormwater from within the 18.3 ha inner fenced SMR ETE site will be discharged to the Strouha via a 3 200 m³ retention basin at the northeastern tip of the site and the existing stormwater drains for Units 1 and 2. The 11.2 ha outer part of the site will be drained by a stormwater sewer to Dvůrčice Pond, with an anticipated mean flow of 1.2 l/s, together with pumped groundwater at a mean flow of 1 l/s [83, 84]; however, most stormwater and pumped groundwater will be directed to the Strouha. This means a mean increase of approximately 5.3 l/s for the SMR ETE project alone and as much as 11.8 l/s for all three parts of the project, namely the SMR ETE project, Units 1 and 2, and the New NPP ETE, compared with the current operation of Units 1 and 2, averaging 13 l/s, comprising 10 l/s discharged from Units 1 and 2 plus 3 l/s, the Q_a of the Strouha downstream of Karlovec Pond.

The mixture of groundwater and stormwater, including surface runoff, may exhibit poorer quality for certain parameters, as indicated by the results of indicative PVL monitoring at the outflow from the existing safety basins. This applies primarily to P_{total} , SS_{105} , ammoniacal nitrogen, and TOC.

As indicated by the results of supplementary water-quality monitoring in the Strouha area, the discharge of stormwater, including surface runoff, and groundwater from the Units 1 and 2 site has a fundamental effect on water quality in the Strouha, which is also a result of the water availability in the stream upstream of the outfall and the quantity of water discharged. The fishponds on the Strouha downstream of the safety-basin outfall, namely Mlýnský fishpond/retention basin and Nový fishpond near Býšov, can then contribute to improved water quality by increasing retention time. This is also confirmed by measurements by the ETE Laboratories at the Býšov Retention Basin outflow profile, meaning the outflow from the retention basin at Mlýnský fishpond. Nevertheless, data measured by PVL at the Strouha-Jeznice profile show that slightly elevated values for some parameters, namely organic substances represented by TOC and COD_{Cr} , and SS_{105} , persist along the entire Strouha as far as its confluence with the Vltava in the Hněvkovice water reservoir. Because no significant change in the quality of discharged water is anticipated in connection with commissioning the SMR ETE project, with the main change consisting of an increase in the quantity of water discharged, no significant change in water quality in the Strouha is anticipated either. The shorter retention time in the fishponds along the watercourse due to the higher overall discharges may have a minor adverse effect.

In terms of the current quality parameters of these discharged waters, the waters meet the requirements of Government Decree No. 401/2015 Coll. [14] for most parameters. Certain parameters in Strouha Stream, particularly total phosphorus, SS_{105} , ammoniacal nitrogen, TOC, and PAHs, nevertheless show slightly impaired quality, as demonstrated by the available data supplemented by monitoring conducted as part of study [73]. Elevated concentrations of these substances may adversely affect eutrophication in the affected surface waters. Because no

2 Surface Water in the Affected Area

significant change in the composition of the discharged waters is anticipated, only an increase in their quantity, no fundamental change in water quality in the Strouha is expected. However, an increase in the total substance load entering the receiving water may be expected in view of the increased discharge. Expansion of systematic monitoring of water quantity and quality in the affected watercourses should be recommended.

In addition to being affected as a recipient of discharged groundwater and stormwater, the upper part of the Strouha, including Karlovec Pond, may be affected by reduced groundwater drainage at the SMR ETE site; see Chapter 3.2.3 for further details. Karlovec Pond is significantly dependent on groundwater inflow. Although expert opinion [85] rules out a direct effect of groundwater-level lowering at the SMR ETE site on replenishment of Karlovec Pond, an indirect effect cannot be ruled out. This could reduce the fishpond's area and outflow to the upper part of the Strouha and potentially prolong periods during which the upper Strouha is completely dry. To eliminate these potential adverse effects, expert opinion [85] recommends supplementing Karlovec Pond with stormwater collected from part of the SMR site or using nature-based measures to provide for infiltration of part of the precipitation runoff into groundwater, which could then replenish Karlovec Pond.

Effect of the SMR ETE project on Dvorčický Stream, Dvorčice Pond, and the village of Kočín

Like Karlovec Pond, Dvorčice Pond is significantly dependent on groundwater inflow. Unlike Karlovec Pond, however, inflow to Dvorčice Pond will be directly affected by reduced drainage of stormwater in the area and by groundwater-level lowering at the SMR ETE site [74]; see Chapter 3.2.3 for further details.

According to study [74], construction and operation of the SMR ETE project will cause substantial reductions in surface and groundwater runoff and their redistribution over the course of the year, including seasonal changes in precipitation distribution and greater effects from individual extreme events. This will result in an overall reduction in precipitation infiltration into groundwater at and near the SMR site. As a result of reduced groundwater recharge, shallow groundwater levels are expected to fall by several meters below the ground surface on average compared with current levels in the monitoring wells. A fundamental effect on local minor watercourses will be that groundwater drains into them farther downstream rather than in the current headwater areas immediately at the foot of the ETE site elevation, meaning north of Dvorčice Pond in the case of the SMR ETE project. Overall, over a 30–50-year horizon, surface and groundwater runoff in the catchment terminating at the Dvorčice Pond dam can be expected to decrease from approximately 0.3 l/s to 0.1–0.2 l/s, while pumping from beneath the reactor building can be expected to decrease from 1.5 l/s to 0.7–1.0 l/s. The manner in which stormwater and pumped groundwater are routed will be decisive for the future of Dvorčice Pond and Dvorčický Stream.

If the discharge of stormwater and groundwater into Dvorčice Pond were not planned during operation, the residual natural inflow to the fishpond of 0.3–0.4 l/s would preserve less than

2 Surface Water in the Affected Area

one-quarter of the water-surface area. The fishpond would instead become a marshy area that could dry out temporarily during summer, and Dvorčický Stream would become only an intermittent recipient of water from torrential rainfall [74].

Study [74] concludes that discharging pumped groundwater and, where applicable, part of the stormwater to Dvorčice Pond is essential to preserving the fishpond and Dvorčický Stream. If the controlled artificial inflow to Dvorčice Pond approaches 1.0 l/s, giving a total inflow to the fishpond of 1.3 l/s, which is the upper estimate, the fishpond is likely to be preserved in a condition generally only slightly poorer than at present. However, there will be longer periods of zero discharge from the fishpond into Dvorčický Stream, potentially several summer months each year. It is currently assumed that water from the SMR ETE site will be discharged into Dvorčice Pond and Dvorčický Stream, comprising 1 l/s of groundwater and potentially 1.2 l/s of stormwater [82–84]. Under these conditions, the anticipated total artificial replenishment will be 2.2 l/s, a quantity sufficient for optimal preservation of Dvorčice Pond and Dvorčický Stream [82].

A historic millrace connecting Dvorčický Stream with the Dříteňský Stream catchment passes through the village of Kočín. If Dvorčický Stream were to disappear, the millrace would also lose its function. However, if Dvorčice Pond and Dvorčický Stream were used to discharge part of the stormwater and groundwater from the SMR ETE site, the millrace could be used to supply the fishpond system near Dříteň, particularly when managing higher torrential-rainfall flows.

No data are available on the current water quality in Dvorčice Pond, Dvorčický Stream, or the millrace in the village of Kočín. Supplementary monitoring was therefore conducted at this location as part of the background study, although it was limited in terms of both the range of parameters and the period covered, so the results must be regarded as indicative. Nevertheless, the data obtained showed that water quality is currently good in terms of the parameters monitored, with the exception of several PAH and O₂ parameters, which is related to the season in which the monitoring was conducted.

Groundwater from the SMR ETE site is of suitable quality for replenishing Dvorčice Pond and Dvorčický Stream; however, a mixture with stormwater, including site runoff, may be of poorer quality in terms of phosphorus, ammoniacal nitrogen, and TOC, as indicated by the results of indicative PVL monitoring at the outflow from the existing safety basins. Input of these substances into Dvorčice Pond would introduce nutrients that could promote eutrophication, impair conditions for fish life, and have an overall adverse effect on the fishpond's aquatic ecosystem. Dvorčice Pond itself may then improve water quality for these parameters at the outflow into Dvorčický Stream as a result of retention time and biological degradation.

To prevent deterioration of water quality in Dvorčice Pond and the connected watercourses, meaning Dvorčický Stream and the millrace through the village of Kočín, as a result of the potential discharge of stormwater including surface runoff, measures are required to reduce the input of the pollutants listed above into surface waters. One example is an upstream retention basin in which aeration would oxidize ammoniacal nitrogen, followed by sedimentation of

2 Surface Water in the Affected Area

suspended solids, reducing SS_{105} and P_{total} in particular, and flow attenuation. Measures to prevent petroleum pollution, represented by C_{10} - C_{40} , should also be implemented by installing oil-water separators before stormwater, including surface runoff, is discharged from the SMR ETE site. Systematic monitoring of water quantity and quality in the affected watercourses should also be recommended.

Effect on the local territorial system of ecological stability

Because the local biocorridors and biocenters in the Dvorčický Stream catchment as far as the village of Malešice consist largely of Dvorčice Pond, Dvorčický Stream, and its tributaries, their function is clearly closely related to the functioning of the watercourse and Dvorčice Pond situated on it.

Without controlled discharge of groundwater and stormwater into Dvorčický Stream, the anticipated effect of constructing and operating the SMR ETE project would be a substantial reduction in surface and groundwater runoff and their redistribution over the course of the year. This would result in a decrease in the water level of Dvorčice Pond and gradual conversion of the fishpond area into a wetland, with parts of the biocenter potentially drying out partially, accompanied by changes in vegetation and riparian stands. In the connected local biocorridor LBK 2a, flows would decrease overall throughout the year, and the risk of the watercourse drying out for longer periods during the warm part of the year would increase. This would affect the riparian stands along the watercourse, change the vegetation composition, and shift representation from wetland species toward species that tolerate the site drying out. Most likely, only fragments of the watercourse would remain as small pools in depressions in the original channel. This change would restrict the migration of aquatic animals and could lead to their longer-term disappearance as a result of prolonged drying. The biocenters and biocorridors would continue to function for possible migration of terrestrial animals, provided that the riparian vegetation along the original watercourse channel and in the biocenters did not undergo more substantial degradation.

In terms of preserving the hydrological regime, the anticipated effect of constructing and operating the SMR ETE project under the current option, with pumped groundwater and part of the stormwater discharged into Dvorčický Stream, would be more positive than under the option without discharge. Compared with the option without stormwater discharge, watercourse continuity for the migration of aquatic organisms in Dvorčický Stream could be preserved. One uncertainty is the possible contamination of stormwater in the Strouha identified by monitoring conducted by Povodí Vltavy, státní podnik, at the outflow from the safety basins. Elevated nutrient concentrations, particularly phosphorus and nitrogen, could adversely affect the trophic status of Dvorčice Pond and secondarily impair habitat quality in the connected local biocorridor LBK 2a along Dvorčický Stream. Despite some adverse effects under this option, the functions of the local TSES elements can be expected to remain preserved compared with the current situation.

2 Surface Water in the Affected Area

With respect to the effect of the SMR ETE project on the biocorridors along the upper Strouha, expert opinion [85] indicates that groundwater-level lowering at the SMR ETE site may also have an indirect effect on Karlovec Pond and the connected upper reach of the Strouha. Groundwater replenishment of Karlovec Pond may decrease, reducing its area and its outflow to the Strouha. This could affect biocorridors LBK 3 Karlovec and LBK 4a Knín and part of LBK 7c Strouha II. For this reason, opinion [85] recommends measures to eliminate these adverse effects. After the inflow from the safety basins enters, the Strouha flow will increase again.

3 Groundwater in the Affected Area

Chapter prepared by: RNDr. Josef Vojtěch Datel, Ph.D., Ing. Anna Hrabánková

This chapter is based on background studies [74], [86] and [87]. Other reports listed in the references were also taken into account when preparing the text.

3.1 Current state of groundwater quantity and quality

For the assessment of the SMR ETE project, it is significant that the site lies immediately adjacent to the existing Temelín NPP Units 1 and 2 site and within a broader area previously assessed hydrogeologically in connection with the New NPP ETE project and long-term monitoring of the effects of Temelín Nuclear Power Plant operation. Relatively long time series of groundwater levels and quality are therefore available, generally covering 2009–2024 in the report cited above and supplemented in some places by shorter time series from newly constructed wells. Older data dating from 2001 are also available, as are, to a limited extent, data from the 1990s [88], when the groundwater monitoring network was being constructed. This scope of data makes it possible to assess both the current state of groundwater and longer-term trends in groundwater levels and quality.

The primary purpose of the report is to summarize the hydrogeological conditions in the area that may be significant to further preparation of the SMR ETE project. It also aims to define the area's principal hydrogeological characteristics, identify natural and anthropogenic factors affecting groundwater, and describe the importance of the monitoring network for future monitoring of potential project effects.

3.1.1 Definition of the groundwater area of interest

The area of interest for assessing groundwater in connection with the SMR ETE project is defined with regard to possible effects on groundwater flow and quality, including hypothetical transport of substances from the project site. Because the SMR ETE project is very close to the existing Units 1 and 2 site and the previously assessed New NPP ETE project, the previously established regional and detailed hydrogeological delineations of the area can be used. The regional framework is based on the conceptual groundwater-flow model prepared for the Temelín site and its surroundings [89]. The broader regional area of interest is elongated approximately north to south, with a length of approximately 30 km, and is up to approximately 14 km wide east to west. The area thus delineated includes the principal directions of shallow and deeper groundwater flow from the morphological elevation of the ETE site toward local and regional drainage bases. The Vltava is a significant regional drainage base to the east; the southern and southwestern parts of the area are associated with a system of streams, ditches, and fishponds. The northern and northwestern boundary is defined primarily by the watershed.

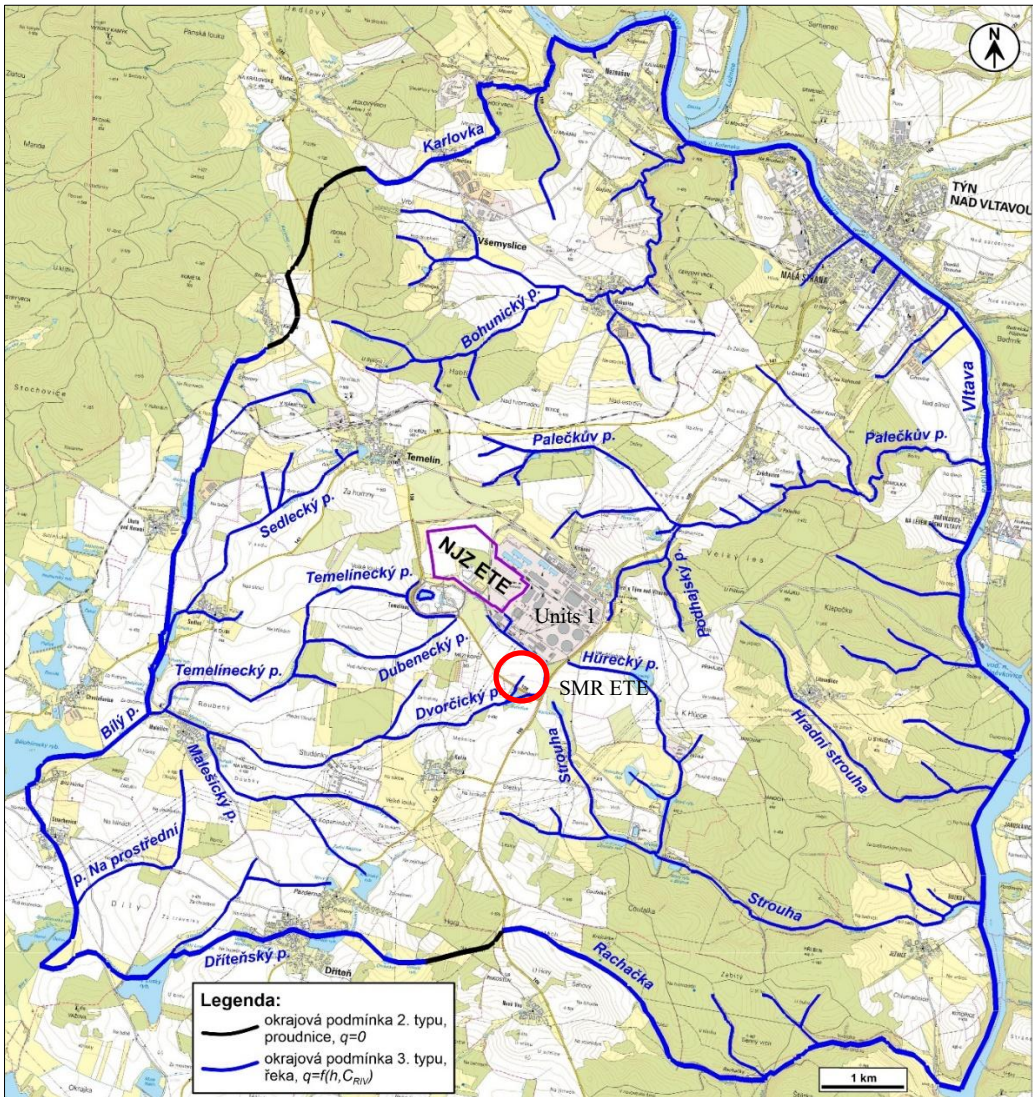
For a more detailed assessment, the narrower area of interest in the detailed mathematical model of groundwater flow and substance transport, defined in report [90] and confirmed as

3 Groundwater in the Affected Area

appropriately delineated by report [91], is important; see Fig. 21. This area includes parts that could be affected by the transport of substances through groundwater flow from ETE, New NPP ETE, and now also SMR ETE sites.

In terms of hydrogeological regionalization, hydrogeological region HGR 6320, Crystalline Rocks in the Middle Vltava Basin, is fundamental to the area of interest. In a broader spatial context, the documentation also mentions the boundary with hydrogeological region HGR 2160, České Budějovice Basin. However, the SMR ETE project and the nearest monitoring wells are located primarily in a crystalline-rock environment, where groundwater flow is associated mainly with weathered and fractured zones in the rock mass. For the area of interest in the assessment of the SMR ETE project, the primary directions of significance are those of groundwater runoff from the SMR site toward local drainage bases, particularly the Dvorčický Stream valley. These directions are consistent with the results of earlier conceptual and mathematical groundwater-flow models.

3 Groundwater in the Affected Area



Legenda:	Key:
okrajová podmínka 2. typu, proudnice, $q=0$	Type 2 boundary condition, flow line, $q=0$
okrajová podmínka 3. typu, řeka, $q=f(H_p, C_{riv})$	Type 3 boundary condition, river, $q=f(H_p, C_{riv})$

Fig. 21 Groundwater area of interest also applicable to the SMR ETE project [90] and [91]

3.1.2 Hydrogeological conditions in ETE area of interest

The hydrogeological conditions in the area of interest are determined primarily by the area's geological structure, which consists mainly of crystalline rocks. Gneissic rocks predominate in the rock environment, locally penetrated by irregular veins and bodies of granitoid rocks. In the near-surface zone, these rocks are weathered, locally decomposed to kaolinized, crushed, and overlain by weakly consolidated sandy-loamy soils. The weathered and fractured zones are

3 Groundwater in the Affected Area

particularly important hydrogeologically, allowing shallow to moderately deep fracture flow to develop.

Shallow and intermediate groundwater flow in the area of interest is predominantly related to the relief. The ETE site lies on a morphological elevation from which groundwater flows toward the surrounding drainage bases. At the Units 1 and 2 site, groundwater levels are approximately 497–502 m a.s.l.; immediately around the site, including the SMR ETE site, they decrease to approximately 485–496 m a.s.l.; and toward the southwest they may fall to approximately 463–480 m a.s.l. In the broader surroundings, the groundwater level decreases further in association with the falling terrain and the drainage effect of watercourses.

It is hydrogeologically significant that monitoring confirms the existence of shallow, intermediate, and partly deeper groundwater flow systems. In several deeper wells, typically approximately 100 m deep or more, the groundwater level is recorded near ground level or above ground level within the well casing. This indicates confined conditions in the deeper fractured aquifer. In some pairs of wells of different depths, the similar temporal course of the groundwater levels indicates connectivity between shallow and intermediate flow down to depths of approximately 60–70 m. The deeper flow system cannot be regarded as completely isolated; its hydraulic communication with the shallow and intermediate systems may differ locally depending on fracturing of the rock mass.

The area is also characterized by a combination of natural and anthropogenic effects. The natural groundwater-level regime is affected primarily by precipitation, seasonal infiltration, and the drainage effect of terrain depressions and watercourses. Anthropogenic effects may occur locally, for example as a result of withdrawals, sampling-related pumping, technical interventions in wells, operation of drainage systems, or legacy contamination around landfills. Nevertheless, the overall assessment shows that the groundwater-level conditions are stable over the long term and exhibit no changes indicative of significant disruption of the hydrogeological regime.

3.1.3 Groundwater monitoring network

The groundwater monitoring network at the Temelín site is long-term and has been operated since the 1990s in connection with monitoring the effects of Units 1 and 2 and preparing other projects at the site. Groundwater quantity and quality are monitored in a network of monitoring wells distributed throughout and around the power plant site; see Fig. 22. The monitoring results are assessed over the long term in regular annual reports.

The original monitoring network comprised 22 wells with long time series, some of which also extend to periods before 2009 [88]. Since 2020, the network has been supplemented by four B-series wells, designated B1a, B1b, B2a, and B2b [92], situated in the northern forefield of ETE. Since 2023, a further four wells, HG1, HG2, HG3, and HG4 [93], located directly on the site considered for the SMR ETE project, have been included in the monitoring. These wells are

3 Groundwater in the Affected Area

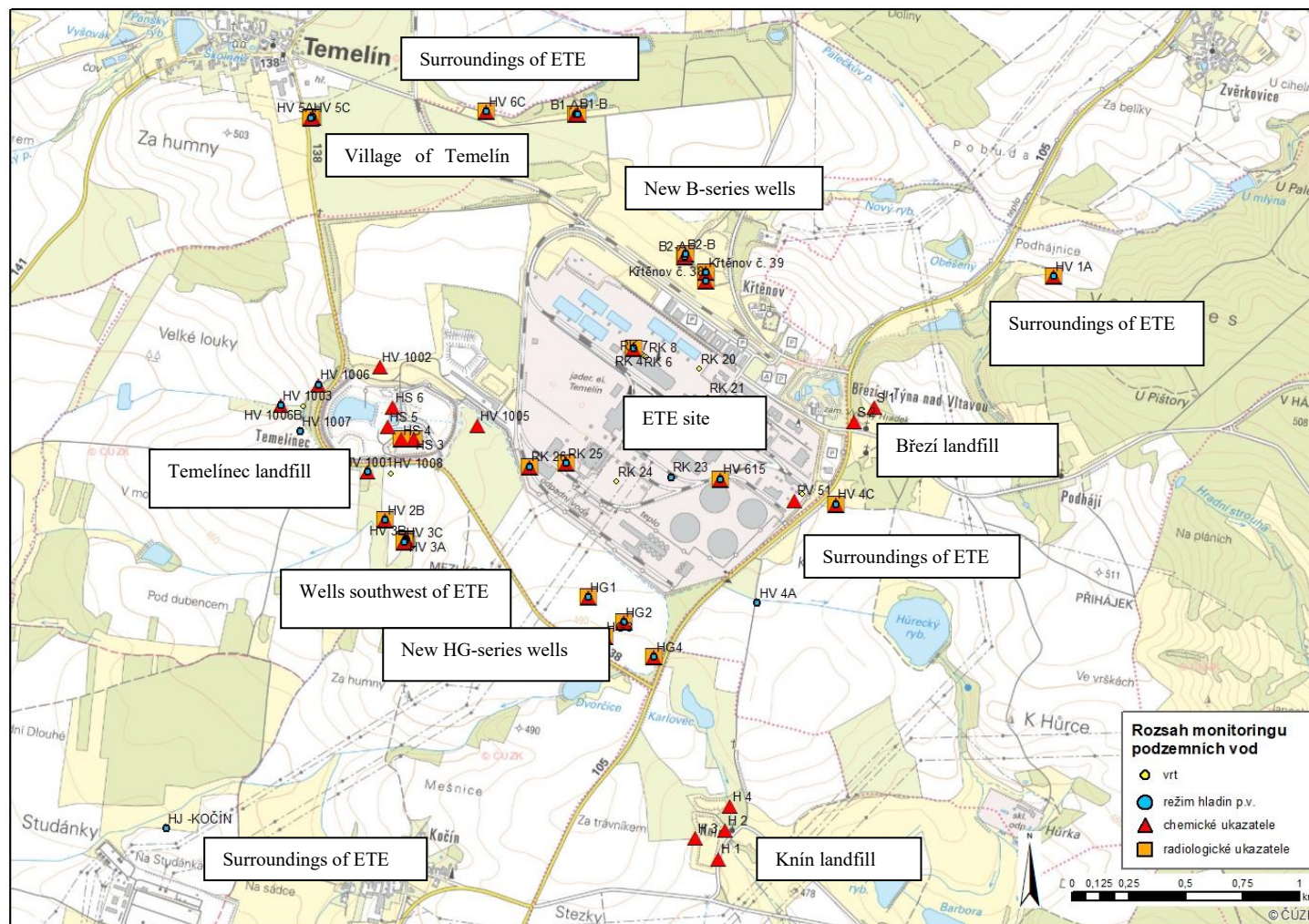
particularly important to the future project because they provide information on local conditions at the planned construction site.

Groundwater levels are currently monitored using automatic level gauges in 30 wells. For interpretation purposes, the wells are divided into subareas comprising the Units 1 and 2 site, the surroundings of Units 1 and 2, the Temelínec landfill, wells southwest of Units 1 and 2, and the new B- and HG-series wells. For assessing groundwater quality, the area is divided in greater detail because not all wells are used for the same scope of monitoring and the individual well groups represent different hydrochemical situations and potentially different anthropogenic effects. For the quality assessment, separate distinctions are therefore made among, for example, the Břeží, Knín, and Temelínec landfills; the village of Temelín area; wells southwest of Units 1 and 2; and the new B- and HG-series wells.

Non-radiological groundwater-quality parameters are monitored at a total of 34 wells. All principal monitoring components, meaning water levels, non-radiological quality, and radiological quality, are monitored concurrently at 19 wells. Only some parts of the monitoring are performed at the other wells. The different ranges of parameters monitored reflect the historical development of the monitoring network, in which the individual well groups were created for different purposes. For future monitoring of the SMR ETE project, the scope of monitoring should be further harmonized and optimized so that the network reflects its main current purpose: monitoring the quantitative and qualitative state of groundwater and promptly identifying any groundwater effects originating at the Units 1 and 2, New NPP ETE, or SMR ETE sites.

The current monitoring network provides an adequate basis for assessing the current state of groundwater in the area of interest. However, the current network alone will not be fully adequate for specific monitoring of the SMR ETE area after the project is commissioned. It should therefore be supplemented and modified to provide better coverage of the anticipated flow directions from the SMR ETE site, local drainage bases, and potential sensitive receptors in the surrounding area.

3 Groundwater in the Affected Area



3 Groundwater in the Affected Area

Okolí ETE	Surroundings of ETE
Oblast obce Temelín	Village of Temelín area
Nové vrty řady B	New B-series wells
Okolí ETE	Surroundings of ETE
Skládka Temelínec	Temelínec landfill
Areál ETE	ETE site
Skládka Březí	Březí landfill
Vrty jz. od ETE	Wells southwest of ETE
Okolí ETE	Surroundings of ETE
Nové vrty řady HG	New HG-series wells
Skládka Knín	Knín landfill
Rozsah monitoringu podzemních vod	Scope of groundwater monitoring
vt	Well
režim hladin p.v.	Groundwater-level regime
chemické ukazatele	Chemical parameters
radiologické ukazatele	Radiological parameters

Fig. 22 **Location of monitoring wells around ETE**

3 Groundwater in the Affected Area

3.1.4 Legislative requirements for groundwater

The groundwater assessment in connection with the SMR ETE project must be related to the legal framework currently in force. The regulations governing the quality of raw water for drinking-water treatment, drinking-water requirements, and radioactivity parameters in water are particularly relevant to assessing groundwater quality.

Decree No. 428/2001 Coll., as amended [15], particularly in relation to Decree No. 448/2017 Coll. [94], is significant to assessing groundwater as a potential source of raw water for drinking-water production. This legislation distinguishes raw-water treatability categories A1, A2, and A3 according to the level of treatment required to produce drinking water.

Decree No. 252/2004 Coll. [95], establishing public-health requirements for drinking water and hot water and the scope of drinking-water monitoring, applies to a comprehensive assessment of water quality. Although this regulation is intended for drinking water, its limit values are also commonly used in Czechia as a reference framework for assessing groundwater where its potential usability or degree of impact needs to be evaluated.

Radioactivity parameters are governed by Act No. 263/2016 Coll. [50] and Decree No. 422/2016 Coll. [51]. Radon activity concentration, gross alpha activity concentration, and gross beta activity concentration are of particular significance to drinking water. For radon, levels of 100 Bq/l, the reference level, and 300 Bq/l, the maximum permissible value, are distinguished; the higher value means that the parameters for supplying water for public use are not met. The investigation level is 0.2 Bq/l for gross alpha activity and 0.5 Bq/l for gross beta activity. If these values are exceeded, the specific radionuclides must be identified.

The range of parameters monitored under the current groundwater monitoring program at the Temelín site is generally adequate. One disadvantage is the different range of parameters used for individual well groups, which arose historically in connection with their different purposes. Some parameters, such as PAHs, pesticides, and other specific organic substances, are monitored only at selected wells and do not have time series long enough for a full statistical assessment. For long-term monitoring of the SMR ETE project, consideration should therefore be given to harmonizing or at least systematizing the monitoring program.

3.1.5 Current precipitation conditions

Precipitation conditions are one of the principal factors affecting the groundwater-level regime in the area of interest. The most recent assessment is based on monthly precipitation totals at the Temelín station of the Czech Hydrometeorological Institute for 2009–2024. Monthly, annual, and growing-season precipitation totals are available, making it possible to assess both the longer-term trend and the effects of dry and wetter periods on groundwater recharge.

3 Groundwater in the Affected Area

Annual precipitation totals in 2009–2024 ranged widely from 480 to 724 mm. The mean annual total for the assessed period was 619.5 mm. Compared with Czechia's long-term annual normal of 684 mm for 1991–2020, the total at Temelín is approximately 91% of the normal. In terms of precipitation, the site can therefore be assessed as slightly drier than the Czech average.

The driest year in the assessed period was 2015, when the annual total was only 480.2 mm. Conversely, the highest annual totals were recorded in 2009 and 2010, when annual precipitation exceeded 724 mm, and in 2024, when the total reached almost 710 mm. A slightly decreasing precipitation trend is apparent over the assessed period, influenced primarily by the drier period of 2015–2019. However, the higher totals in 2020 and 2024 partly mitigate this trend. The available data therefore do not support inferring a stable long-term decrease in precipitation, but rather fluctuation with a pronounced dry period in the second half of the monitored series.

During the growing season, meaning April through September, the mean precipitation total was 434.3 mm. The highest growing-season total, 566.2 mm, was identified in 2010, while the lowest, only 256.3 mm, was recorded in 2015. The growing season is less effective for groundwater recharge than the cold part of the year because a significant proportion of precipitation is consumed by evapotranspiration. Nevertheless, a substantially dry growing season may subsequently affect both soil-moisture conditions and the shallow groundwater level.

Mean monthly precipitation totals range from approximately 22.8 to 94.7 mm. The highest precipitation generally occurs in June, followed by July, August, and May. The lowest precipitation generally occurs in February, December, March, and January. This seasonality is important to interpreting groundwater-level conditions because groundwater levels respond not only to the annual precipitation balance, but also to the distribution of precipitation over the year, temperature conditions, evapotranspiration, and saturation of the rock environment.

3.1.6 Groundwater-level regime

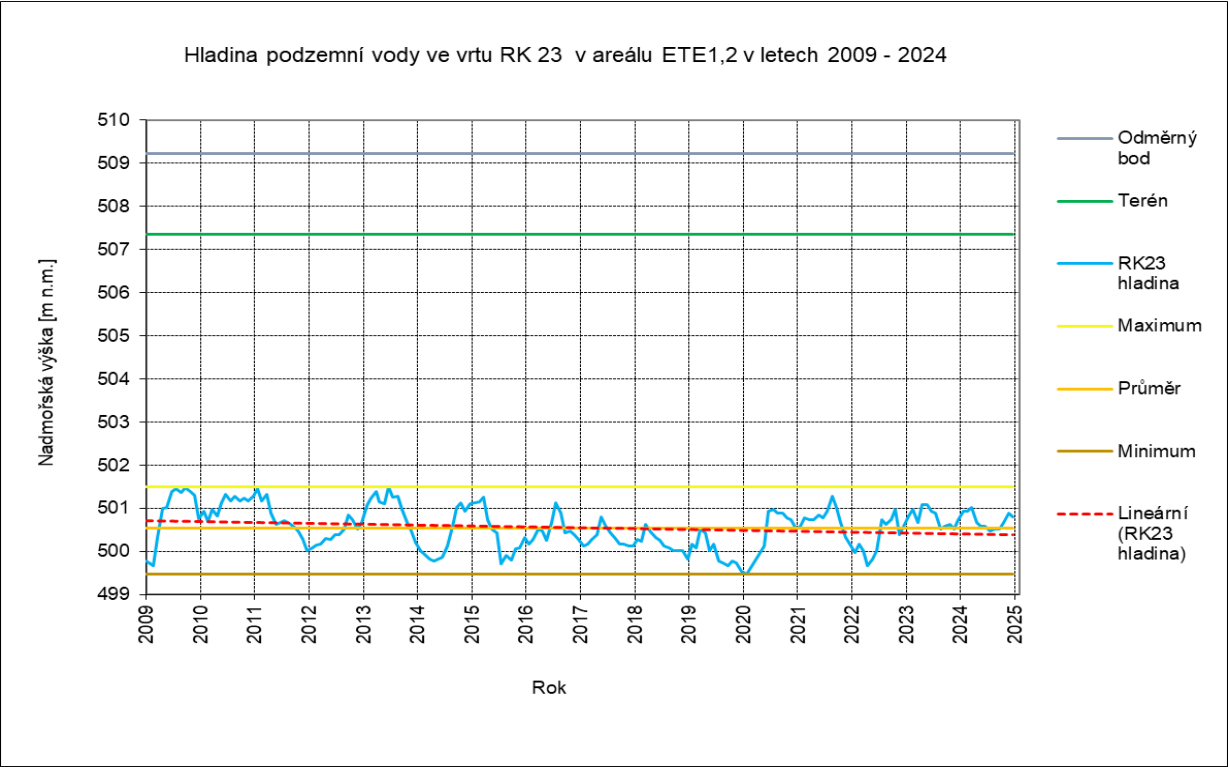
The groundwater-level regime at and around the ETE site was assessed using time series from 30 monitoring wells for 2009–2024, or shorter periods for newly constructed wells. The fundamental conclusion is that groundwater-level conditions have been stable over the long term throughout the assessed area. Water-level fluctuation during the monitored period is within several meters and is consistent with expectations based on the natural behavior of groundwater levels in the area. This fluctuation is explained primarily by the seasonal course of precipitation, dry and wetter periods, and, locally, artificial interventions, particularly drainage.

Time series covering the entire period 2009–2024 are available for the original 22 wells. The four B-series wells have provided data since 2020, while the four HG-series wells situated on the SMR ETE site have been monitored since 2023. Although the time series for the new wells are shorter, they confirm the basic character of the area's hydraulic regime, and the HG-series wells provide important information on hydrogeological conditions at the SMR ETE site.

3 Groundwater in the Affected Area

At the Units 1 and 2 site, the groundwater level in the monitoring wells is generally several meters below ground level. Some wells representing shallow to intermediate flow exhibit a regular seasonal course and, in some cases, slight long-term fluctuation depending on precipitation conditions. Well RK 2 represents shallow near-surface flow in loosened crystalline bedrock and exhibits a stable long-term groundwater level with a seasonal course. Well HV 615 represents intermediate flow in fracture-permeable crystalline rock and also exhibits a stable regime, locally affected by sampling-related pumping. In addition to seasonality, wells RK 23, RK 25, and RK 26 exhibit certain irregularities that may be related to technical or operating effects. The graph from well RK 23 is provided in Fig. 23 as an example of groundwater-level assessment.

3 Groundwater in the Affected Area



Hladina podzemní vody ve vrtu RK 23 v areálu ETE 1,2 v letech 2009 - 2024	Groundwater level in well RK 23 at the Units 1 and 2 site in 2009–2024
Nadmořská výška [m n.m.]	Elevation [m a.s.l.]
Odměrný bod	Reference point
Terén	Ground level
RK23 hladina	RK23 water level
Maximum	Maximum
Průměr	Mean
Minimum	Minimum
Lineární (RK23 hladina)	Linear (RK23 water level)

Fig. 23 Hydrograph of the water level in well RK 23 in 2009–2024

Around the Temelínec landfill and southwest of Units 1 and 2, the groundwater levels are at lower elevations, corresponding to runoff from the morphological elevation of the ETE site

3 Groundwater in the Affected Area

toward local drainage bases. Some wells have water levels near ground level or even exhibit a confined water level. These phenomena correspond to fracture flow in crystalline rocks and local interconnection of flow paths at different depths.

The overall groundwater-level trend for 2009–2024 is slightly decreasing, primarily as a result of the dry period of 2014–2019. The total decreases in groundwater level in the individual wells range from approximately 0.2 to 2.0 m over 16 years. Minimum groundwater levels were generally recorded around 2020. In recent years, particularly since 2020, levels have stabilized and increased slightly in some places, corresponding to the occurrence of years with higher precipitation at the end of the assessed period.

For the future assessment of the SMR ETE project, it is important that groundwater levels at and around the site confirm the groundwater runoff directions consistent with earlier conceptual and model assumptions. At the SMR ETE project site, the Dvůrčický Stream valley is the principal local drainage base. The existing groundwater-level regime exhibits no signs of anthropogenic effects.

For some of the deeper wells, the design and technical condition should be verified, for example by borehole geophysical logging and camera inspection, to establish which deep flow system they actually represent. This applies particularly to wells whose depth indicates monitoring of intermediate flow but whose water levels respond very sensitively to precipitation events. Such verification is important for correctly interpreting the monitored data and for future optimization of the monitoring network throughout the area of interest.

3.1.7 Groundwater quality: non-radiological parameters

Groundwater quality in terms of non-radiological parameters was assessed with respect to natural groundwater chemistry, existing anthropogenic effects, and the usability of the monitoring wells for monitoring potential effects of the SMR ETE project. The assessment is based on data for 2009–2024, with shorter time series available for the newer wells. Sampling is generally conducted two or three times per year, so the interpretation is based primarily on the mean, minimum, and maximum values for the assessed period.

The chemical composition of groundwater in the area of interest is determined primarily by the crystalline-rock geological environment, the intensity of weathering, flow velocity, water residence time in the rock environment, and the degree of local anthropogenic impact. The water is typically soft to very soft, with low mineralization, often with higher iron and manganese concentrations, locally with elevated conductivity and low hardness. The lower nitrate concentrations compared with those commonly found in many areas of Czech agricultural landscapes probably result from restrictions on settlement and agricultural activities around ETE since the power plant was constructed.

At the Units 1 and 2 site, most parameters have values typical of groundwater in an anthropogenically affected industrial area. Elevated values for suspended solids and

3 Groundwater in the Affected Area

conductivity, and also for chlorides in maximum values, warrant attention. The C₁₀–C₄₀ parameter, indicating the presence of organic substances, particularly petroleum hydrocarbons, is borderline, although at a level typical of an industrially used area. Higher iron concentrations and lower hardness are interpreted primarily as manifestations of natural conditions. No significant changes in chemical composition or adverse effects of operating Units 1 and 2 were identified during the assessed period. Wells HV 615, RK 25, and RK 26 are particularly significant in this area for monitoring the SMR ETE site because they provide groundwater-quality data from the upgradient direction.

A minor anthropogenic effect is apparent in the Březí landfill area, particularly elevated conductivity and chemical oxygen demand, indicating the presence of degradable organic substances. This is an expected level in the context of a waste-landfill area. No adverse effect of operating Units 1 and 2 on groundwater quality was identified here either. The wells around the Březí landfill cannot be assumed to be usable for monitoring the SMR ETE site.

Minor organic contamination has occurred over the long term in the Knín landfill area, as demonstrated by elevated chemical oxygen demand. In the maximum values, some metals and metalloids, particularly chromium, nickel, lead, and arsenic, are near the limits. These values correspond to the character of a waste-landfill site and are not assessed as a change from the previous condition. If some wells are to be used for SMR ETE monitoring, their structural and technical condition should be assessed.

Water in the Temelínec landfill area also exhibits minor organic contamination, particularly in relation to chemical oxygen demand. In maximum values, fluoride, nickel, lead, and arsenic exceed the limits; however, these values are expected and acceptable in the context of the site. No significant changes in chemical composition or effects of Units 1 and 2 were demonstrated. In view of the location of this group of wells, they cannot be assumed to be usable for direct monitoring of the SMR ETE site.

The wells southwest of Units 1 and 2 characterize groundwater in shallow and deeper flow systems in that runoff direction. Most parameters correspond to values typical of a crystalline-rock environment. Low hardness, low calcium concentrations, and elevated iron, suspended-solids, and conductivity values are typical. The values are assessed as acceptable and predominantly governed by natural conditions. These wells are partly usable for monitoring the western surroundings of the SMR ETE site.

In the village of Temelín area, values failing to meet some of the limits used occur more frequently, both for parameters naturally affected by the rock environment and for parameters of anthropogenic origin. Elevated chemical oxygen demand and ammonium-ion values indicate possible effects from agriculture or sewage. However, because of their distance and upgradient position relative to the SMR ETE site, these wells are not considered usable for monitoring SMR ETE effects.

The new B-series wells contain soft water with a slightly acidic to neutral pH and low mineralization of approximately 200–300 mg/l dissolved solids. The chemical type can be

3 Groundwater in the Affected Area

characterized as Ca-Mg-(Na)-HCO₃-SO₄-(Cl). Mineralization in the deeper B-series wells is slightly lower than in the shallower wells. Traces of pesticides and polyaromatic substances are near the detection limits and do not represent a measurable risk. Elevated iron, manganese, and, in some cases, arsenic and TOC values are explained by conditions in the wells and redox processes rather than anthropogenic contamination. The wells are not usable for SMR ETE monitoring.

The new HG-series wells at the SMR ETE site contain slightly acidic, very soft groundwater with low mineralization of approximately 130–170 mg/l dissolved solids. The chemical type is Ca-Na-(Mg)-HCO₃-SO₄-(Cl). The water probably contains a component from the deeper flow system that may drain in the SMR ETE site area. In terms of quality, the water is typical of the crystalline-rock environment in the area of interest. Elevated iron and manganese values are interpreted as natural or as a result of redox and biochemical processes in the wells. From a structural and engineering perspective, attention should be drawn to the low hardness, low pH, and slight to moderate aggressiveness associated with the occurrence of aggressive CO₂. Because the wells will be removed in connection with construction of the SMR ETE project, they can be used only during the preconstruction stage.

Overall, groundwater quality in terms of non-radiological parameters can be assessed as stable over the long term, with no significant adverse changes identified. Local exceedances or elevations of selected parameters occur, but they are generally occasional exceedances in maximum values resulting from legacy contamination at landfills or the natural chemistry of crystalline rocks. No adverse effect of operating Units 1 and 2 on the chemical composition of groundwater was demonstrated.

3.1.8 Groundwater quality: radioactivity parameters

Groundwater quality in terms of radioactivity parameters is assessed primarily using tritium and cesium-137. These parameters have been monitored over the long term in 15 wells; data for 2020–2024 are available for the new B-series wells, and 2024 data are available for the HG-series wells. In the past, the aggregate parameters gross alpha and beta activity concentration and potassium-40 (⁴⁰K) were also monitored; however, regular monitoring was discontinued in 2006 because they characterize the natural rock environment rather than effects of the nuclear power plant.

In most cases, the measured values of radioactivity parameters are below or near the detection limit. No values, changes, or trends indicating an effect of the power plant on the monitored radioactivity parameters were identified in the monitored wells during the assessed period. Tritium and cesium-137 activity concentrations remained very low throughout the assessed period of 2009–2024. Measurable tritium values in some samples reflect the existence of a nearby tritium source but are far below the values used as references for water intended for human consumption.

3 Groundwater in the Affected Area

Czech legislation does not establish separate limit values for tritium in groundwater as such. For indicative comparison, the value of 100 Bq/l used for water intended for human consumption may be applied. The values identified by monitoring are far below this level, in the single-digit Bq/l range. Cesium-137 was also predominantly below the detection limit in the monitored samples.

Groundwater quality in terms of radioactivity parameters can therefore be assessed as stable, with no significant effect of operating Units 1 and 2 identified. For future monitoring of the SMR ETE project, tritium and cesium-137 monitoring should continue in wells situated in the downgradient directions from the SMR ETE site.

3.1.9 Water withdrawals and water-source protection zones

Recorded groundwater withdrawals in the area of interest are assessed using data reported by the river-basin authorities under the legislation applicable to the water balance. These records include withdrawals exceeding 6 000 m³ per year or 500 m³ per month. Smaller individual withdrawals, below approximately 0.19 l/s, are not recorded centrally and must be understood as minor local groundwater uses, for example through domestic wells.

The recorded groundwater withdrawals in the area of interest are not significant and are associated with hydrogeological region 6320, Crystalline Rocks in the Middle Vltava Basin, primarily involving shallow groundwater flow. The recorded withdrawals include ČEZ Temelín NPP Břeží, close to the SMR ETE site, with a mean withdrawal of approximately 1.69 l/s in 2009–2024. The WIENERBERGER Týn nad Vltavou brickworks withdrawal, with a mean of approximately 0.23 l/s, is also recorded, although it was not reported in 2024 because production had ended. The overview also includes the Slavětice Quarry mine-water withdrawal, with a mean of approximately 1.34 l/s; this is formally classified as a surface-water withdrawal even though it is effectively more in the nature of a groundwater withdrawal.

Most of the region's population receives drinking water from regional water-supply systems. The principal source for most of the region's population is the South Bohemia Water-Supply System, supplied by surface water from the Římov water-supply reservoir and groundwater from the Vidov well. Both sources are a considerable distance from ETE, approximately 30–40 km to the south-southeast. The Dolní Bukovsko Water-Supply System is also significant to the northeastern surroundings of ETE; its abstraction area lies approximately 12 km east, beyond the drainage line of the deep Vltava valley.

The municipalities immediately surrounding ETE, including Bohunice, Temelín, Knín, Kočín, Lhota pod Horami, Sedlec, Všemyslice, and Zvěrkovice, are supplied by the regional South Bohemia Water-Supply System. The former municipalities of Břeží u Týna nad Vltavou, Křtěnov, Podhájí, and Temelínec are uninhabited. In some local sections or at individual properties, old domestic wells using shallow local groundwater sources may remain in use, particularly for occasional supply, irrigation, or other supplementary purposes.

3 Groundwater in the Affected Area

No officially designated water-source protection zones are recorded in the groundwater area of interest for the SMR ETE project. The nearest officially designated water-source protection zones lie north of ETE, in the Újezd and Albrechtice nad Vltavou areas, approximately 6 km and 9 km from ETE. However, no current groundwater withdrawals are recorded at these locations; they may therefore be either historical abstraction areas no longer in use or locations with below-threshold withdrawals not subject to central recording.

With respect to the current state of groundwater withdrawals for public water supply, it can be concluded that the significant regional abstraction areas for drinking-water supply lie beyond the reach of surface-water and groundwater flow from ETE and therefore also from the SMR ETE project. Local withdrawals in the area of interest are limited, generally small, and associated with shallow groundwater flow in crystalline rocks. For future monitoring of potential effects of the SMR ETE project on groundwater in more distant areas, it is important to monitor potential effects on the nearest local sources in the Dvůrčický Stream basin, particularly in the villages of Kočín and Malešice, and to maintain an overview of individual wells not included in the central records. It should be noted, however, that any potential threat to these sources in the event of contaminant release would not be associated with transport through groundwater, but through surface water in Dvůrčický Stream.

3.2 Effect of the SMR ETE project on groundwater quantity and quality at the Temelín site

The following text presents an expert hydrogeological assessment of the anticipated effects of the SMR ETE project, meaning a small modular reactor at the Temelín Nuclear Power Plant site, on groundwater quantity and quality during both construction and operation. Particular attention is paid to the interaction between groundwater and surface water, especially in relation to Dvůrčický Stream and Dvůrčice Pond, which constitute a local drainage base as well as significant aquatic and ecological features near the planned construction.

The SMR ETE project is situated immediately adjacent to the existing Units 1 and 2 site, at the southeastern edge of the power plant site. The assessed area includes the SMR ETE site itself and the associated construction-facility areas designated C, G, H, I, and J. The assessment is based on long-term knowledge of hydrogeological conditions at the Temelín site, groundwater monitoring results, exploratory hydrogeological wells HG1 through HG4 constructed directly at the SMR ETE site [93], and hydrodynamic tests conducted in these wells. Of particular significance are the results of longer hydrodynamic tests conducted in 2025 [96], which made it possible to refine the hydraulic parameters of the rock environment, estimate the pumping rate required to lower the groundwater level, and formulate recommendations for designing the future dewatering system.

In terms of potential project effects, the construction and operating periods must be distinguished. During construction, changes in hydrogeological and runoff conditions will be associated primarily with earthworks, temporary use of construction-facility areas, changes in

3 Groundwater in the Affected Area

infiltration conditions, surface drainage of paved areas, and construction-related groundwater pumping from the reactor-building excavation. During operation, in addition to the permanent change in the use of the SMR ETE site, the long-term effect of climate change will also be significant, particularly rising temperatures, increased evapotranspiration, changes in the seasonal distribution of runoff, and an anticipated reduction in groundwater infiltration.

In terms of groundwater quality, it is decisive that under normal operating conditions, implementation of the project does not itself constitute a source of groundwater pollution, provided that the proposed engineering, operating, and monitoring measures are observed. The risks are associated primarily with the construction period, when soil wash-off, releases of petroleum products from construction machinery, changes in the stormwater runoff regime, and handling of soil and construction materials may occur. These risks can be addressed technically using standard preventive measures, water pretreatment, inspection of drainage systems, and appropriately configured monitoring.

3.2.1 Current hydrogeological conditions at the SMR ETE site

The hydrogeological environment in the area of interest is characterized by a combination of intergranular permeability in Quaternary cover sediments and weathered material and fracture permeability in the underlying crystalline rocks. More intensive groundwater flow occurs in the shallow zone and is closely linked to precipitation infiltration and local terrain morphology. The frequency and transmissivity of fractures decrease with depth; nevertheless, isolated fracture systems may allow groundwater flow to depths of several dozen meters and locally deeper. The exploratory work at the SMR ETE site indicates that bedrock is present within several meters of the ground surface. Weathering extends to variable depths, locally exceeding 16 m. Beneath the Quaternary cover and weathering mantle are biotite-sillimanite paragneisses, locally with quartz veins, quartzitic layers, and aplite bodies. The permeability of the rock environment is therefore highly heterogeneous. Groundwater flow is associated primarily with weathered and fractured zones and locally transmissive fractures.

Four 30 m deep exploratory and monitoring hydrogeological wells, HG1 through HG4, were constructed at the SMR ETE site [93]. These wells were designed and located on the basis of geophysical-survey results. Their purpose was to verify local geological and hydrogeological conditions and subsequently serve as part of the monitoring network. The wells are screened to intercept shallow to intermediate fractured-rock groundwater flow. Since 2023, they have been fitted with automatic water-level gauges and used to record groundwater levels and temperatures regularly.

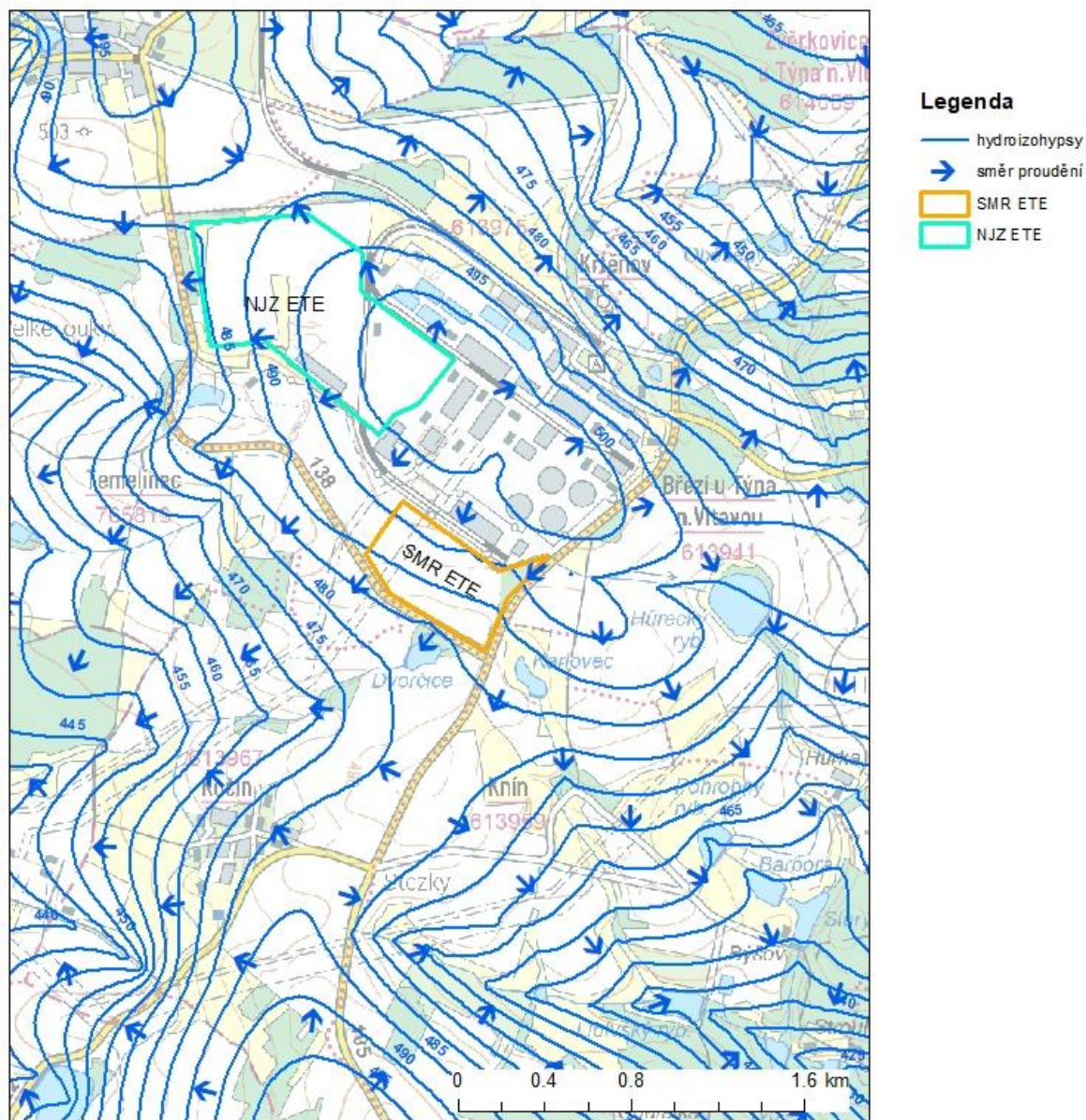
The groundwater level at the SMR ETE site is shallow beneath the ground surface. The mean depth to groundwater is approximately 0.5–3.6 m below ground level. During some periods of higher precipitation, the water level locally rises above ground level in the well casing, particularly in HG1 and HG4, demonstrating locally confined conditions. These conditions probably result from a combination of lower permeability in the cover and weathered

3 Groundwater in the Affected Area

formations, uneven distribution of fractures, and water inflow from deeper parts of the fracture system. Based on the model representation of groundwater contours [91], the groundwater level at the SMR ETE site is approximately 485–496 m a.s.l.; see Fig. 24. Groundwater flows southwest to south-southwest, toward the Dvůrkický Stream basin. Dvůrkický Stream is the local drainage base for the SMR ETE site and adjacent Areas H and I. Part of Area J drains toward Temelínský Stream, Area C toward Palečkův Stream, and Area G toward Strouha Stream. The future drainage design must therefore respect natural hydrological basin boundaries and minimize transfers of water between them.

Along the southern to southeastern edge of the SMR ETE site and farther toward Dvůrkice Pond, shallow and partly deeper groundwater is drained through minor concealed springs and potentially through land-drainage features. This is demonstrated by the high water levels in some HG-series wells, particularly HG1 and HG4, and occasional waterlogging in the southern and southeastern parts of the site.

3 Groundwater in the Affected Area



Legenda	Key
hydroizohypsy	Groundwater contours
směr proudění	Flow direction
SMR ETE	SMR ETE
NJZ ETE	New NPP ETE

Fig. 24 Model groundwater-contour map from the mathematical groundwater-flow model [91]

3 Groundwater in the Affected Area

Hydrodynamic tests showed that the rock environment has low overall permeability but is heterogeneous. The short tests conducted in 2023 [93] were supplemented in 2025 by longer individual pumping and recovery tests, which refined the hydraulic parameters [96]. The longer tests demonstrated slightly higher permeability and transmissivity of the rock environment than indicated by the initial indicative tests. The mean radius of influence of the cone of depression during pumping from the HG-series wells was assessed as several dozen meters, typically 40–50 m. The results can be used to derive the anticipated inflows to the excavation and design the parameters of the dewatering system. Future groundwater-level lowering in the reactor-building area is expected to require a system of approximately six to seven dewatering wells, 35–40 m deep, located primarily in the northern and western parts of the area to be dewatered, from which the principal groundwater inflow can be expected. The long-term steady-state pumping rate is estimated at approximately 1.5–2.0 l/s, potentially decreasing gradually to 1.0–1.5 l/s. At the start of pumping, however, inflows may temporarily be higher, exceptionally reaching several l/s, as a result of pumping static groundwater storage around the excavation.

3.2.2 Anticipated changes in hydrogeological and runoff conditions during SMR ETE construction

During SMR ETE construction, hydrogeological and runoff conditions will be affected primarily by temporary changes in land use, earthworks, paving of some areas, changes in stormwater infiltration, surface drainage of construction-site areas, and groundwater pumping from the excavation. However, the available background information indicates that the overall groundwater-flow directions will not change fundamentally. Any changes will be predominantly local and temporary.

Construction-related pumping associated with construction of the reactor building will be the most significant intervention in the groundwater regime. The building is assumed to have a deep foundation approximately 14 m below the future construction-site elevation of 495 m a.s.l., or approximately at elevation 481 m a.s.l. This means that the bottom of the excavation will be well below the current groundwater level. It will therefore be necessary to lower the groundwater level below the excavation bottom, approximately 17 m below the future construction-site elevation, and provide drainage against potential inflows through the bottom or fracture systems. Anticipated long-term steady-state inflows to the excavation are estimated at 1.5–2.0 l/s, with a slightly decreasing tendency over time. At the start of pumping, the rate may be temporarily higher because static groundwater storage in the immediate vicinity of the excavation will be pumped out. In addition to lowering the groundwater level using wells around the excavation, direct drainage from the excavation, for example using sumps or at groundwater discharge points, will probably also be required.

Grading the SMR ETE site to a uniform elevation of 495 m a.s.l. will require a combination of fills and cuts. The terrain will be raised in the southern part of the site, while cuts of several meters are anticipated in the northern part adjacent to the existing Units 1 and 2 site. Cutting work in the northern part of the site may expose the groundwater level or water-bearing

3 Groundwater in the Affected Area

fractures. Continuous water drainage using surface drains and ditches will therefore be required even during this work.

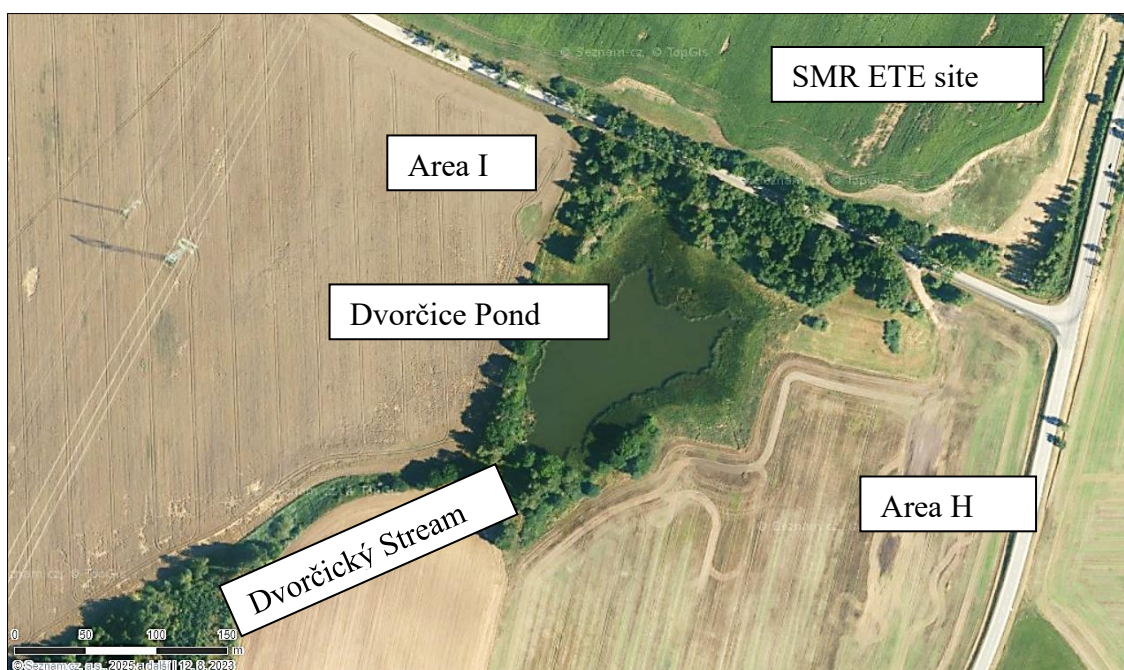
Construction-related pumping and temporary covering of part of the terrain will reduce stormwater infiltration into groundwater. At the SMR ETE site itself, infiltration is expected to decrease from approximately 0.15 l/s to approximately 0.07 l/s. This reduction is small in terms of the regional balance, but significant locally, particularly because the SMR ETE site lies in the headwater area of Dvorčický Stream and near Dvorčice Pond. Reduced infiltration and the change in the hydraulic gradient caused by pumping may substantially reduce the natural groundwater inflow to the fishpond.

The effects of the individual construction-facility areas will depend on their location, the nature of the modifications, and the drainage method. Area C north of ETE will be used for transshipment, storage, and production, potentially including concrete production and a recycling line. The earthworks there will probably not extend below the groundwater level. However, infiltration will decrease as a result of paving and surface modifications. The area will drain toward Palečkův Stream. Area G east of the SMR ETE construction area will serve primarily as the central construction parking lot. In view of the anticipated groundwater level, the earthworks may extend below it, requiring water drainage using surface drains and ditches. Stormwater from the parking lot is to be pretreated in an oil-water separator and routed through a retention basin into the sewer system toward the Strouha receiving water. Area H south of the SMR ETE site will probably be used for operating construction facilities, topsoil, subsoil, and soil stockpiles, and potentially warehouses or transshipment areas. The earthworks should not extend below the groundwater level. Surface drainage will be graded toward Dvorčický Stream and partly toward Dvorčice Pond. Pretreatment of water from paved areas will be important, particularly in view of petroleum products and potential construction-site runoff. Area I also lies in the Dvorčický Stream basin and will serve as a support area for the main construction facilities. The earthworks there are to be performed above the groundwater level. Stormwater from paved areas will be pretreated and discharged to Dvorčický Stream, while water from grassed and gravel areas will partly recharge groundwater flowing toward Dvorčice Pond and Dvorčický Stream. Area J south of the Temelínec landfill will serve as the main construction-facility area, including administrative buildings, warehouses, parking, and other operating facilities. According to the available background information, the earthworks there will not extend below the groundwater level. In view of the area's location, surface drainage will be directed primarily toward Dubenecký and Temelínecký Streams. Infiltration there will decrease to approximately half the current value.

Overall, construction activities are expected to reduce groundwater infiltration in the areas of interest by approximately 0.3 l/s, of which approximately 0.15 l/s is attributable to the Dvorčický Stream basin. However, dewatering of the excavation is more significant to the local balance because it may reduce natural groundwater replenishment of Dvorčice Pond and Dvorčický Stream. It is therefore essential that the pumped groundwater remain within the affected basin and ideally be discharged to Dvorčice Pond or its inflow area.

3 Groundwater in the Affected Area

Dvorčice Pond is one of the most sensitive features in terms of assessing the project effects. It lies immediately adjacent to the SMR ETE site, in the headwater area of Dvorčický Stream, and is an important habitat containing protected species; see Fig. 25 and Fig. 26. The fishpond is currently supplied by surface and subsurface runoff from the surrounding land, land-drainage inflows, and concealed groundwater inflows. Natural groundwater inflow is essential to preserving the water surface. Construction of the SMR ETE project may substantially reduce natural groundwater inflow to the fishpond because pumping from the excavation will alter the hydraulic gradient toward the dewatered area. Natural groundwater replenishment of the fishpond is estimated to potentially decrease from approximately 1.1 l/s to no more than 0.1 l/s. This loss should be replaced with groundwater pumped from the excavation. If approximately 1–2 l/s is pumped and discharged to Dvorčice Pond, it should be possible to preserve the fishpond at approximately its current extent, although its present hydrological condition is not optimal and the water level already falls and the outflow from the fishpond dries up during summer. During construction, soil wash-off, releases of petroleum products and other harmful substances, and pollutant input into surface watercourses must be consistently prevented to protect water quality.



Plocha SMR ETE	SMR ETE site
Plocha I	Area I
Rybník Dvořice	Dvořice fishpond
Dvořický potok	Dvořický Stream
Plocha H	Area H

Fig. 25 Dvorčice Pond, aerial photograph (<https://mapy.com>)

3 Groundwater in the Affected Area



Fig. 26 Dam and outlet structure of Dvorčice Pond at a lowered water level in November 2025

Discharging part of the collected stormwater from the SMR ETE construction area into Dvorčice Pond may be beneficial to the water balance, but requires a detailed assessment of rainfall-runoff conditions, fishpond retention capacity, outlet-structure capacity, and Dvorčický Stream channel capacity. An indicative assessment shows that, if the fishpond and its outlet are in suitable technical condition, capture of the design rainfall may be acceptable. However, the Dvorčický Stream channel, fishpond outlet, culverts, and other critical locations must also be maintained in good technical condition.

3.2.3 Anticipated Changes in Hydrogeological and Runoff Conditions during SMR ETE Operation

After construction is completed, the construction-facility areas are expected to be restored to conditions close to the original runoff regime. Long-term significant changes will therefore primarily concern the SMR ETE site itself in the context of the broader effects of climate change. According to preliminary considerations, a substantial proportion of the SMR ETE site, potentially up to approximately 60% of the total area, can be expected to consist of paved areas and roofs. For a site area of approximately 29.5 ha, this represents approximately 17 ha of paved and roofed surfaces.

Under one option considered, water from paved areas is to be collected centrally and connected to the existing system discharging stormwater from Units 1 and 2 to the Strouha receiving

3 Groundwater in the Affected Area

water. Such a solution would reduce surface runoff toward Dvorčice Pond in the Dvorčický Stream basin. Permanent groundwater-level lowering around the reactor building is also assumed during operation, as at some structures at the existing Units 1 and 2 site; by reducing groundwater inflow, this would further reduce water replenishment of Dvorčice Pond and Dvorčický Stream. To preserve water conditions in the fishpond and Dvorčický Stream, consideration should therefore be given to whether at least some of the collected stormwater from SMR ETE paved areas and roofs, particularly from the western part of the site, and pumped groundwater could be discharged in a controlled manner to the upper part of the Dvorčický Stream basin or directly to Dvorčice Pond; see Chapter 2.3.2 for further details. However, this solution must respect the fishpond's retention capacity and the capacity of the Dvorčický Stream channel.

As stated by Datel [85], a certain minor risk is also associated with an indirect reduction in drainage of groundwater supplying Karlovec Pond in the headwater area of the Strouha along the eastern boundary of the SMR ETE site; see Chapter 2.3.2 for further details.

Climate change is the most significant long-term factor affecting groundwater in the area. During SMR ETE operation, particularly over the 2060 and 2080 horizons, temperatures are expected to continue increasing, evapotranspiration to increase, and the seasonal distribution of runoff to change. Mean annual precipitation totals may not decrease significantly, but their distribution over the year is expected to change, with a relatively more favorable winter and a substantially less favorable warm season. During summer, a greater proportion of precipitation will be consumed by evapotranspiration or carried away by rapid surface runoff during torrential rainfall, and a smaller proportion will contribute to groundwater infiltration.

These changes can be expected to reduce groundwater recharge and baseflow. Shallow groundwater levels may fall several meters farther below the ground surface on average. Locations where groundwater naturally drains into local watercourses may shift farther downslope, away from the current headwater areas at the foot of the ETE site elevation. For Dvorčický Stream, this means a risk of lower water availability in the upper reach, particularly during summer.

Surface runoff may increase slightly during winter because precipitation will more frequently be liquid and there will be more days with temperatures above freezing. During summer, however, both surface and groundwater runoff are expected to decrease because of higher evapotranspiration. Overall, surface runoff is estimated to decrease by approximately one-third compared with the current situation. Groundwater runoff may decrease even more substantially, by an estimated 40–50%. A similar decrease of approximately 35–40% may be expected in the long-term groundwater pumping rate from beneath the reactor-building foundation because some of the water will originate in the deeper confined flow system, in which the effects of climate change will be delayed and partly smoothed over time.

For Dvorčice Pond and Dvorčický Stream, this means a risk of gradual deterioration in the water balance. Over a longer horizon, inflows to the fishpond can be expected to decrease to

3 Groundwater in the Affected Area

approximately 1 l/s, or approximately 60% of the current value. If pumped groundwater continues to be discharged to the fishpond, it will probably be possible to preserve the fishpond approximately in its current, although hydrologically suboptimal, condition. However, Dvorčický Stream may have longer periods of zero discharge, particularly during summer.

An unfavorable situation would arise if pumped groundwater were not discharged to Dvorčice Pond during operation. The residual inflow could be so low that the fishpond could not be maintained at its current extent. The water surface could shrink substantially, and the fishpond could gradually become a wetland or marshy area at risk of seasonal drying. The upper part of Dvorčický Stream would then become predominantly intermittent, conveying water primarily after torrential rainfall.

To mitigate these risks, consideration should be given to controlled discharge of some of the collected stormwater from SMR ETE roofs and paved areas, particularly from the western half of the SMR ETE site, into Dvorčice Pond. Such a measure could help maintain the water surface and partly extend the periods of outflow from the fishpond into Dvorčický Stream, which is also related to preserving the functionality of local biocorridors; see Chapter 2.3.2 for further details. However, it must be designed on the basis of a detailed rainfall-runoff study assessing the fishpond's retention capacity, outlet-structure capacity, Dvorčický Stream channel capacity, and the quality of the discharged water. The solution is planned in EGP study [83], option A; see Chapter 10 of the study for further details.

In relation to the village of Kočín, it was assessed that the hydrogeological conditions in the village area are not directly connected with those in the SMR ETE area. Groundwater in the Kočín area is recharged predominantly from the east to southeast and drains toward Malešický Stream. Conversely, runoff from the SMR ETE area flows toward Dvorčický Stream and passes north of Kočín. Effects of SMR ETE construction and operation on groundwater in the village of Kočín can therefore be ruled out.

Monitoring of local surface watercourses must be added to groundwater monitoring in order to verify the actual effects of SMR ETE construction and operation. It is particularly important to restore gauging profile P4 on Dvorčický Stream, which would make it possible to monitor discharge and potentially water quality continuously in the reach important to Dvorčice Pond and biocorridor LBK 2a. The entire broader network of profiles P1–P8 on local watercourses around ETE that was operated in 2015–2017 [97] should be restored to allow a comprehensive hydrological balance to be prepared for the entire ETE area and the data to be used for detailed hydrological and hydrogeological modeling of runoff conditions [91].

3.3 Hydrogeological Conditions at the SMR ETE Site in Relation to Stormwater Infiltration

This text summarizes the hydrogeological and hydrological conditions at the planned SMR ETE project site in relation to the feasibility of infiltrating stormwater at the project site [87]. It focuses on assessing the natural and engineering conditions that are decisive to the design of

3 Groundwater in the Affected Area

stormwater management, particularly in terms of the feasibility of infiltration into the rock environment.

Under the Water Act, stormwater infiltration is one of the priority methods for reducing surface-water runoff resulting from atmospheric precipitation falling on structures. However, infiltration may be designed only where natural, engineering, spatial, and safety conditions permit. For the SMR ETE site, the specific character of the location must be taken into account: shallow groundwater levels, locally confined conditions in the fractured aquifer, low to limited permeability of the rock environment, the planned extensive grading, the future deep foundation of the reactor building, and the need for long-term artificial groundwater-level lowering.

The current stormwater management design assumes that stormwater from the SMR ETE area will be discharged through retention basins into surface watercourses. The question is therefore whether stormwater infiltration at the SMR ETE site itself would be feasible, safe, and appropriate from an expert hydrogeological perspective.

3.3.1 Hydrogeological conditions decisive to water infiltration

The hydrogeological conditions in the broader surroundings and at the SMR ETE site are described adequately in preceding Chapters 3.1 and 3.2. Only the principal information essential to assessing the feasibility of water infiltration into the rock environment is therefore provided below.

The rock environment is heterogeneous in terms of permeability. In the near-surface zone, intergranular permeability in the cover and weathered formations is primarily relevant; with increasing depth, fracture permeability in the crystalline bedrock predominates. Deeper groundwater flow is associated with a small number of more permeable fractures and potentially with fractured granitoid-type vein rocks. Overall, however, the environment has low permeability and a limited ability to receive and convey larger quantities of water.

For the SMR ETE site, the findings from exploratory and monitoring hydrogeological wells HG1, HG2, HG3, and HG4 constructed in the project area are decisive [93]. The wells are 30 m deep and penetrate the Quaternary cover, weathering mantle, and upper part of the fracture-permeable crystalline rock mass. The Quaternary cover and weathering mantle were identified at thicknesses of approximately 2–3.5 m. Beneath them are biotite-sillimanite paragneisses, locally with quartz veins, quartzitic layers, and an aplite body. Weathering processes, intense fracturing, and loosening of the rock were encountered to variable depths, locally exceeding 16 m.

The groundwater level at the SMR ETE site is shallow beneath the ground surface. The mean depth to groundwater is approximately 0.5–3.6 m below ground level. During some periods of higher precipitation, the water level locally rises above ground level in the well casing, particularly in HG1 and HG4, demonstrating locally confined conditions. These conditions probably result from a combination of lower permeability in the cover and weathered

3 Groundwater in the Affected Area

formations, uneven distribution of fractures, and water inflow from deeper parts of the fracture system. Part of the deeper groundwater also enters the area, potentially flowing from greater distances to the northwest, from the Písecké Mountains area. The local groundwater-flow direction is southwest to south-southwest, toward the Dvorčický Stream basin.

Hydrodynamic tests conducted in wells HG1 through HG4 in 2025 [96] refined the hydraulic parameters of the rock environment. Hydraulic conductivity coefficients are approximately 10^{-6} m/s, although locally they approach the order of 10^{-7} m/s. This corresponds to a rock environment with low to limited permeability. For infiltration purposes, it is significant that such an environment has only limited ability to receive larger volumes of stormwater over a short period.

3.3.2 Planned modifications at the SMR ETE site

The SMR ETE site covers approximately 29.5 ha and will be used for the principal construction activities associated with constructing the SMR installation. According to the available background information, the site will be graded to a uniform elevation of 495 m a.s.l. The current terrain is a gentle slope with elevations ranging from approximately 488 m a.s.l. in the southeast to 501 m a.s.l. in the north. The grading will therefore include both cuts and fills.

In the southern part of the site, the terrain is expected to be raised using fill to a maximum thickness of approximately 6–7 m. Conversely, a cut of approximately 5–6 m will be made in the northern part adjacent to the existing Units 1 and 2 site. This cut may locally expose fractured bedrock and, in some places, water-bearing fractures or the groundwater level. Continuous drainage of inflowing water using surface drains and ditches will therefore be required even during the cutting work.

Construction of the reactor building will be the most significant activity in terms of the hydrogeological regime. It is to have a foundation approximately 14 m below the graded terrain, at approximately elevation 481 m a.s.l. Because this level will be below the current groundwater level, the groundwater level will have to be permanently lowered below the excavation bottom and subsequently below the deep-founded reactor building. The groundwater level is expected to be lowered to approximately elevation 478 m a.s.l., about 17 m below the graded terrain elevation.

Groundwater-level lowering is to be provided by a system of dewatering wells distributed around the reactor building; during construction, direct drainage from the excavation will probably also be used. The estimated long-term pumping rate is approximately 1.5–2 l/s. Clean pumped groundwater should be discharged to surface waters, with the possibility of discharge to Dvorčický Stream or Dvorčice Pond being assessed in order to support their water balance.

After construction is completed, a high proportion of paved and roofed areas can be expected. According to the available data, buildings and paved surfaces may cover up to 60% of the total SMR ETE site, or approximately 17 ha of the total 29.5 ha. These areas will be a significant

3 Groundwater in the Affected Area

source of precipitation surface runoff. The anticipated solution is to drain this water centrally out of the Dvorčický Stream basin by connecting it to the existing system that discharges stormwater from the Units 1 and 2 site to the Strouha receiving water. Alternatively, discharge of part of the water to the upper Dvorčický Stream basin is being considered, but only subject to an assessment of Dvorčice Pond capacity and Dvorčický Stream channel capacity. The preceding chapter also mentions a proposal to provide some support for Karlovec Pond by discharging part of this collected stormwater there [85].

3.3.3 Stormwater infiltration

The legislative framework for stormwater management is based primarily on Section 5(3) of Act No. 254/2001 Coll., on Water [13]. Under this provision, a developer is to limit stormwater runoff through storage and subsequent use, infiltration, or evaporation, or, where these methods are infeasible or inadequate, through retention and controlled discharge. Infiltration is therefore one of the preferred options, but not the only solution irrespective of local conditions.

The engineering requirements for stormwater infiltration are addressed primarily by ČSN 75 9010, Stormwater Infiltration Facilities [98], and TNV 75 9011, Stormwater Management [99]. The hydrogeological assessment must primarily consider the permeability of the rock environment, depth to groundwater, available storage volume in the unsaturated zone, safety in relation to surrounding structures, slope stability, and the possibility of affecting neighboring land or water sources.

For the Temelín site, the design rainfall is assumed to be the one-year maximum rainfall with a duration of 15 minutes and an intensity of 133.3 l/s/ha. For an assumed built-up and paved area of approximately 17 ha, the volume of stormwater to be captured, stored, and potentially infiltrated would be approximately 2 200 m³. In terms of the annual balance, with a mean annual precipitation total of approximately 620 mm, approximately 20–30 thousand m³ of stormwater would have to be infiltrated per year, depending on the actual evaporation and the effectiveness of the retention and storage measures.

Volumes of this magnitude are highly problematic to infiltrate under the conditions at the SMR ETE site. The rock environment has only limited permeability, the groundwater level is very shallow, and part of the site, in the south and southeast, is naturally waterlogged and drained. Infiltration would therefore require very extensive retention and infiltration areas capable of safe emptying within the period required by the applicable regulations. In view of the planned high proportion of built-up land, the required protective distances from structures, and the area affected by groundwater-level lowering, it is not feasible to delineate areas at the SMR ETE site that are both sufficiently large and safe for infiltration.

A fundamental engineering problem is the conflict between the planned permanent groundwater-level lowering around the reactor building and potential infiltration of stormwater into the same rock environment. The purpose of the dewatering system will be to keep the groundwater level safely below the reactor-building foundation level. Conversely, infiltration

3 Groundwater in the Affected Area

would introduce additional water into this area and increase pumping requirements. Under the assumed annual balance of infiltrated water, mean inflow from infiltration could be on the order of 1 l/s, representing a significant increase over the estimated long-term pumping rate of 1.5–2 l/s. Such a solution would be technically and economically inappropriate and, from a structural-safety perspective, unsuitable and potentially hazardous to the structures.

3.3.4 Exclusion criteria for permitting stormwater infiltration

To permit stormwater infiltration, it must be assessed whether any exclusion criteria are present in the area. At the SMR ETE site, several fundamental constraints apply whose combination constitutes a significant obstacle to the design and implementation of infiltration facilities.

The first criterion is low permeability of the rock environment. A hydraulic conductivity coefficient of approximately 10^{-7} m/s is generally regarded as the limiting value at which infiltration capacity is already substantially restricted. Values at the SMR ETE site were predominantly approximately 10^{-6} m/s, but locally at the boundary of 10^{-7} m/s. The environment must therefore be assessed as having low permeability and limited suitability for infiltration. Infiltration would be slow, would require extensive retention and large infiltration areas, and would be sensitive to seasonal saturation of the rock environment, with a risk of surface waterlogging in the infiltration areas.

The second criterion is a high groundwater level. If the groundwater level is less than 1 m below ground level, the rock environment does not contain sufficient free volume for safe infiltration. At the SMR ETE site, the groundwater level is approximately 0.03–3.55 m below ground level, with maximum levels locally rising above the ground surface. The southern and southeastern parts of the site in particular therefore do not meet the requirement for an adequate thickness of unsaturated zone above the groundwater level.

The third and most serious criterion is the risk of waterlogging of structures and installations. The SMR ETE site will contain the reactor building and other technically significant structures for which contact with an elevated groundwater level is undesirable and unacceptable from a safety perspective. This is precisely why artificial groundwater-level lowering to approximately 478 m a.s.l., about 17 m below the graded ground surface, is planned. Stormwater infiltration in the area affected by the cone of depression would reduce the effectiveness of this hydraulic protection and increase the risk of waterlogging or an undesirable rise in the groundwater level.

The fourth criterion is the risk of impairing the stability of slopes and fills. After the site is graded to an elevation of 495 m a.s.l., sloping areas will be created in its northern and southern parts, particularly in the fill area along the southern boundary. Infiltration into the rock environment or fill bodies may result in soil saturation, groundwater discharge on the slope, erosion, waterlogging, and potentially slope movement. This risk is significant particularly in the southern part of the site, where a shallow groundwater level and concealed drainage toward Dvorčice Pond already occur.

3 Groundwater in the Affected Area

Another constraint is the lack of suitable space. The SMR ETE site will be used intensively for buildings, process equipment, roads, and other paved areas. When the built-up area, groundwater-level-lowering zone, protective distances from structures, sloping areas, and site boundaries are taken into account, a sufficiently large area for safe and effective stormwater infiltration cannot realistically be delineated.

Conversely, water-source protection zones and contaminated areas are not decisive criteria in this case. No water-source protection zones that would directly preclude infiltration have been identified at the SMR ETE site, and no contamination that would in itself prevent infiltration because of a risk of leaching harmful substances into groundwater is assumed there. This does not change the overall assessment because the decisive obstacles are the high groundwater level, waterlogging risk, low permeability, and engineering implications of reactor-building dewatering.

3.3.5 Assessment of the situation and conclusion

From an expert hydrogeological perspective, the SMR ETE site is unsuitable for stormwater infiltration. This unsuitability is not caused by one isolated factor, but by a combination of several unfavorable natural and engineering conditions that reinforce one another. These primarily comprise the shallow groundwater level, which locally rises above the ground surface; limited permeability of the rock environment; the planned deep foundation of the reactor building; the need for long-term groundwater-level lowering; the risk of waterlogging of structures; and the risk of destabilizing fill and sloping areas.

The shallow groundwater level and locally confined conditions significantly restrict the free volume available in the rock environment for infiltration. In some parts of the site, particularly in the south and southeast, the groundwater level is so shallow that infiltration could occur practically directly into the saturated zone or cause groundwater discharge and waterlogging in lower parts of the site. Such conditions conflict with the requirement for safe and controlled infiltration.

The low to limited permeability of the rock environment means that exceptionally extensive retention and infiltration facilities would have to be designed to capture and infiltrate water from paved and roofed areas. For an assumed paved and roofed area of approximately 17 ha, the design-rainfall volume would be on the order of 2 200 m³ and the annual volume potentially requiring infiltration would be tens of thousands of cubic meters. Such a solution is not realistically feasible in view of the site's limited area and high proportion of built-up land.

However, the most serious argument against infiltration is the planned permanent lowering of the groundwater level around the reactor building. Infiltrating stormwater into an area in which the groundwater level is to be artificially lowered to a safe level below the foundation base would be technically counterproductive. It would mean introducing water into an environment from which it would subsequently have to be pumped. Such a solution would increase the

3 Groundwater in the Affected Area

required capacity and reliability of the dewatering system and could also reduce the safety margin against groundwater contact with deep-founded structures.

Another substantial risk is potential saturation of fill soils and subsequent impairment of slope stability, particularly along the southern boundary of the SMR ETE site. In this part, the terrain is to be raised by several meters, and it is also an area of natural drainage toward Dvorčice Pond. Infiltration there could cause groundwater discharge on the slope, erosion, waterlogging, and local slope movement.

Based on the assessment of hydrogeological, hydrological, engineering, and safety conditions, stormwater infiltration at the SMR ETE site cannot be recommended. Significant exclusion criteria for designing infiltration facilities are present in the area, particularly the risk of waterlogging of structures and installations, the risk of impaired stability of fills and slopes, the high groundwater level, and low to limited permeability of the rock environment.

A more appropriate stormwater management solution is retention, storage, and controlled discharge to surface waters, potentially combined with partial use of stormwater where technically and operationally feasible. The Strouha or Dvorčický Stream are the primary potential receiving waters, provided in each case that their capacity is respected and water from higher-risk areas is pretreated. This solution would also have the advantage of protecting important local habitats with aquatic and water-dependent ecosystems, including Dvorčice Pond, Dvorčický Stream with biocorridor LBK 2a, and Karlovec Pond; see Chapter 2.3.2 for further details.

Overall, it can be concluded that hydrogeological conditions at the SMR ETE site are unfavorable in relation to stormwater infiltration. Infiltration would be neither a safe nor an appropriate stormwater management method and could conflict with engineering requirements for protecting deep-founded structures, particularly the reactor building. Other stormwater management methods must therefore be preferred, particularly retention, potential use, and controlled discharge to surface waters, where the water could have a positive effect on stabilizing hydrological conditions in local watercourses and reservoirs.

4 Status of Surface Water Bodies and Groundwater Bodies

4.1 Surface water bodies

Chapter prepared by: Ing. Eva Juranová, Ph.D. and RNDr. Diana Marešová, Ph.D.

This chapter is based on background study [100].

4.1.1 Current Status of Surface Water Bodies

Assessment of surface-water-body status is a comprehensive process based on European legislation, namely the Water Framework Directive (2000/60/EC) [1], and implemented in Czech law by the Water Act [13] and related legislation, particularly Decree No. 98/2011 Coll., on the method for assessing the status of surface water bodies, the method for assessing the ecological potential of heavily modified and artificial water bodies, and the particulars of surface-water status monitoring and assessment programs, known as the Surface-Water Monitoring Decree [101], and by methodologies of the Ministry of the Environment. The objective is to achieve good status in all water bodies.

The overall status of surface water bodies, which are designated by Decree No. 49/2011 Coll. [102], comprises two principal components, ecological and chemical status, which are further assessed using the following parameters:

- Ecological status: reflects the quality of aquatic ecosystems
 - Biological quality elements (phytoplankton, phytobenthos, macrophytes, benthic invertebrates, fish fauna)
 - Physicochemical quality elements
 - General parameters: Temperature; oxygenation conditions, including biochemical oxygen demand (BOD₅) and dissolved oxygen (O₂); pH; nutrients, including phosphorus and nitrogen; and salinity.
 - River-basin-specific pollutants
 - Hydromorphological quality elements (hydrological regime, river continuity, morphological conditions)
- Chemical status: assessed using concentrations of priority substances established at the EU level.

It is assessed by comparison with reference conditions. The assessment has several classes designated verbally or numerically:

- Ecological status/potential: High (1), Good (2), Moderate (3), Poor (4), Bad (5)
- Chemical status: Good (2), Failing to Achieve Good Status (3), Unknown (U)

The key rule governing the entire assessment is that if any individual quality element, whether biological, chemical, or physicochemical, is worse than good, the entire water body is classified as failing. Thus:

4 Status of Surface Water Bodies and Groundwater Bodies

- Overall status
 - Good (ecological status is high or good and chemical status is good)
 - Failing (ecological status is moderate, poor, or bad, or chemical status is failing to achieve good status)

Under Decree [102], surface-water-body status assessment is type-specific, meaning that different conditions are established for water bodies depending on their characteristics, including category, hydromorphological character, and type. The surface-water-body categories are “lake” for standing waters and “river” for running waters. Depending on the physical nature of the water body and the degree to which it is affected by human activity, its hydromorphological character is “natural,” “heavily modified,” or “artificial.” Surface-water-body type includes additional attributes. For the river category these are the drainage basin, elevation, geology, and watercourse order; for the lake category they are elevation, latitude and longitude, maximum depth, geology, area, mean depth, and retention time. The water-body type is then expressed by a numerical code comprising the attributes listed above.

For heavily modified water bodies, meaning water bodies substantially modified for navigation, power generation, or flood protection, such as dams, and for artificial water bodies, ecological potential is assessed instead of ecological status.

Assessment is conducted in six-year cycles, known as planning periods, as part of the River Basin Management Plans and serves as a basis for proposing corrective measures, such as watercourse restoration or construction of wastewater treatment plants. The third planning period/cycle is currently underway and the fourth planning cycle is being prepared [103].

The assessment of the SMR ETE project's effects in study [100] focused on chemical status and, for ecological status, on the physicochemical quality elements that affect the biological quality elements. The assessed water bodies are those affected in these components by wastewater discharge, meaning those downstream of the outfall in the Kořensko water reservoir dam structure.

Hydromorphological quality elements, which include the hydrological regime, may also be affected farther upstream along the Vltava, primarily because the withdrawal of process water for the SMR ETE project will reduce the discharge in the river. However, no specific assessment of effects on the hydromorphological quality elements was conducted because a methodology for assessing hydromorphological quality elements in lake-type surface water bodies and sufficient background data are lacking.

The ecological-status/potential and chemical-status assessment data for the area of interest were taken from the Upper Vltava Sub-basin Plan [9] and the Lower Vltava Sub-basin Plan [10], specifically their updates for the third planning period. The assessment results in these documents are based on monitoring data for 2016–2018; because data for the following three-year period were unavailable when the plans were prepared, the status for 2021 was estimated as part of these River Basin Management Plans. This is currently the most recent published

4 Status of Surface Water Bodies and Groundwater Bodies

update to the River Basin Management Plans; the update for the fourth planning period is being prepared and has not yet been published [103].

Table 59 summarizes the ecological-status and ecological-potential assessment results for the assessed water bodies in the area of interest, including a list by name of the parameters and quality elements that caused failure to achieve good status in the affected water bodies [9, 10].

In the ecological-status/potential assessment, water bodies HVL_1055_J, HVL_1525_J, DVL_0015_J, and DVL_0030 are classified as poor; DVL_0110 is classified as moderate; and only DVL_0095_J is classified as good. Biological quality elements determine the overall ecological-status/potential assessment for most water bodies because they have the worst classification. The poorer assessment for general physicochemical quality elements is most commonly caused by nutrient conditions, particularly P_{total} , followed by temperature and O_2 saturation.

Chemical status is reported as unknown for most water bodies in the assessed reach and as good only for DVL_0110 (Table 60).

Overall status is assessed as failing for all water bodies covered by this study except DVL_0095_J (Table 60).

The SMR ETE project is located near the existing Temelín Nuclear Power Plant site in South Bohemia, near Týn nad Vltavou. Wastewater from the SMR ETE project is planned to be discharged to the Vltava River at Kořensko, through the profile shared with Units 1 and 2 and the New NPP ETE. According to the current water-body status assessment under the third planning cycle [9, 10], the status of most of these water bodies is assessed as failing. The only exception is the status of the Slapy Reservoir on the Vltava SWB (DVL_0095_J), which is assessed as good. The other water bodies fail because they do not achieve good ecological status/potential, which is attributable, in addition to the biological quality elements, primarily to P_{total} and, in some cases, O_2 saturation or temperature.

4 Status of Surface Water Bodies and Groundwater Bodies

Table 59 Surface-water-body chemical-status assessment results in the area of interest for the third planning period: verbal assessment (numerical assessment) [9, 10].

SWB ID	Water-body name	Ecological status/potential assessment					
		Biological quality elements	Hydromorphological quality elements	General physicochemical quality elements	River-basin-specific pollutants	Overall	Failing parameters
HVL_1055_J	Orlík I reservoir on the Vltava	Poor (4)	Unknown (NA)	Moderate (3)	Good (2)	Poor potential (4)	Phytoplankton, P _{total}
HVL_1525_J	Orlík II reservoir on the Otava	Poor (4)	Unknown (NA)	Moderate (3)	Good (2)	Poor potential (4)	Phytoplankton, P _{total}
DVL_0015_J	Orlík III Reservoir on the Vltava	Poor (4)	Unknown (NA)	Moderate (3)	Good (2)	Poor potential (4)	Phytoplankton, P _{total}
DVL_0030	Vltava from the Orlík reservoir dam to the backwater of the Slapy reservoir	Poor (4)	Moderate (3)	Moderate (3)	Good (2)	Poor potential (4)	Benthic invertebrates, temperature, O ₂ saturation, P _{total}
DVL_0095_J	Slapy reservoir on the Vltava	Good (2)	Unknown (NA)	Good (2)	Good (2)	Good (2)	---
DVL_0110	Vltava from the Slapy reservoir dam to the Sázava	Good (2)	Moderate (3)	Moderate (3)	Good (2)	Moderate (3)	Temperature, O ₂ saturation,

Table 60 Overall surface-water-body status assessment results in the area of interest for the third planning period: verbal assessment (numerical assessment) [9, 10].

SWB ID	Water-body name	SWB category	Heavily modified or artificial SWB	Assessment of SWB ecological status and ecological potential	Assessment of SWB chemical status	Overall SWB status assessment
HVL_1055_J	Orlík I reservoir on the Vltava	Lake	YES	Poor (4)	Unknown (U)	Failing
HVL_1525_J	Orlík II reservoir on the Otava	Lake	YES	Poor (4)	Unknown (U)	Failing
DVL_0015_J	Orlík III Reservoir on the Vltava	Lake	YES	Poor (4)	Unknown (U)	Failing
DVL_0030	Vltava from the Orlík reservoir dam to the backwater of the Slapy reservoir	River	YES	Poor (4)	Unknown (U)	Failing

4 Status of Surface Water Bodies and Groundwater Bodies

DVL_0095_J	Slapy reservoir on the Vltava	Lake	YES	Good (2)	Unknown (U)	Good
DVL_0110	Vltava from the Slapy reservoir dam to the Sázava	River	YES	Moderate (3)	Good (2)	Failing

4 Status of Surface Water Bodies and Groundwater Bodies

4.1.2 Effect of the SMR ETE Project on Surface-Water-Body Status

The assessment of the effect of SMR ETE operation on surface-water-body status/potential conducted in background study [100] was based on modeled values from DP20 study [8], which describes the model in detail. Concentrations at the critical profiles defined in study [104] were modeled in study [8] for two capacity scenarios:

1. SMR ETE + Units 1 and 2
2. SMR ETE + Units 1 and 2 + two 1 700 MWe New NPP ETE units

For both alternatives, surface-water quality at the critical profiles was modeled for two hydrological situations:

1. “Normal flow”: long-term mean flow (Q_a) was used for the modeling
2. “Drought, effect of climate change”: flow Q_{355} was used for the modeling

Modeling was conducted for two discharge scenarios:

1. Average Discharge: Actual concentrations measured in wastewater from Units 1 and 2, averaged over 2015–2024, were used in the calculation. The same concentrations were also used for the SMR ETE project and the New NPP ETE [66]. For radioactivity parameters, actual measured discharged-activity values from Units 1 and 2, averaged over 2015–2024, were used. For the other parts of the assessed project capacity alternative, meaning the SMR ETE project and, where applicable, the New NPP ETE), the specified SMR source term [67] or, where applicable, the design radionuclide discharges according to the New NPP ETE EIA Documentation (2010) [68] were used conservatively.
2. Maximum Discharge: For Units 1 and 2, the “maximum” emission limits [t/year and Bq/year], or “m” where applicable, established in the permit for wastewater discharge from Units 1 and 2 [69] were used in the calculation. For the other parts of the assessed capacity alternatives, meaning the SMR ETE project and, where applicable, the New NPP ETE, the same approach as for the Average Discharge scenario was used. This scenario was prepared only for parameters listed in permit [69]. It represents an extreme boundary condition that has not been attained in practice by Units 1 and 2.

Modeled concentrations taken from study [8] and calculated at the critical profiles were used to assess the effect of SMR ETE operation on the status/potential of the assessed surface water bodies. The first critical profile was the profile downstream of the Kořensko water reservoir, followed by others depending on the purpose, including bathing-water areas, abstractions for drinking-water purposes, assessment of surface-water-body status, and waters for fish life.

Ecological-status/potential assessment: general physicochemical quality-element parameters

The poorer assessment of the current status in terms of general physicochemical quality elements is most commonly caused by nutrient conditions, particularly P_{total} , followed by temperature and O_2 saturation. P_{total} is the only general physicochemical quality-element

4 Status of Surface Water Bodies and Groundwater Bodies

parameter for which modeled values according to [8] are available for assessing the status of surface water bodies, specifically water bodies HVL_1055_J and DVL_0030. A comparison of the current status assessed according to [8], the type-specific values for general physicochemical ecological-status/potential parameters [18, 25], and the values modeled according to [8] for the individual scenarios is provided in Table 61. No model data are available for the other parameters.

Table 61 Comparison of the current status assessed according to [8], the type-specific value for P_{total} at the good/moderate potential boundary, and values modeled according to [8] for the individual scenarios

SWB ID	Current status, mean/median*	Specific value D/W	SMR + Units 1 and 2				SMR + Units 1 and 2 + New NPP			
			Average Discharge		Maximum Discharge		Average Discharge		Maximum Discharge	
			Q _a	Q ₃₅₅	Q _a	Q ₃₅₅	Q _a	Q ₃₅₅	Q _a	Q ₃₅₅
HVL_1055_J	0.067	0.04	0.08	0.07	0.08	0.08	0.08	0.08	0.08	0.08
HVL_1525_J	**	0.04	-	-	-	-	-	-	-	-
DVL_0015_J	0.030	0.03	-	-	-	-	-	-	-	-
DVL_0030	0.053*	0.05	0.061	0.055	0.062	0.06	0.06	0.06	0.06	0.06
DVL_0095_J	0.029	0.03	-	-	-	-	-	-	-	-
DVL_0110	0.053*	0.07	-	-	-	-	-	-	-	-

* Median; ** not assessed in study [8]

Note: format indicating attainment/exceedance of the type-specific value

The first SWB affected by the SMR ETE project is HVL_1055_J, Orlick I Reservoir on the Vltava, in which P_{total} is one of the causes of failure to achieve good status/potential. The results clearly show that the modeled P_{total} concentrations in the watercourse [8] under the individual scenarios are also higher than the type-specific value at the good/moderate potential boundary. The contribution of the project itself to the values calculated at the wastewater outfall at the profile downstream of the Kořensko water reservoir is only 0.5–2.4% under the individual scenarios, while the “background,” meaning the P_{total} mass flow in the Vltava and Lužnice Rivers, accounts for 90.2–97.7%. In the other water bodies farther downstream, dilution by tributaries, particularly the Otava River, will make the project's contribution even smaller relative to background mass flows. Nevertheless, P_{total} is currently one of the parameters causing failure to achieve good status in SWB DVL_0030 and, as is apparent from the modeled values, will remain a critical parameter causing failure to achieve good status/potential in terms of the general physicochemical quality elements.

No model data on the concentrations of substances in the receiving water according to [8] are available for the other general physicochemical quality-element parameters in the individual water bodies assessed because the underlying data are lacking. Nevertheless, the project itself contributes up to 5.3% to the values calculated at the wastewater outfall at the profile downstream of the Kořensko water reservoir for the individual parameters and scenarios, as provided in Table 62–Table 65; this is similar to P_{total} , while the “background” is the principal mass flow. It can be assumed that, in the other affected water bodies farther downstream, dilution, particularly by the Otava River and other tributaries, will make the project's contribution to background mass flows even smaller than at the wastewater outfall, particularly

4 Status of Surface Water Bodies and Groundwater Bodies

under normal-flow conditions. For Q_{355} , which was used to model drought due to climate change, the project's contribution is greater.

Temperature and O_2 saturation are additional failing parameters causing failure to achieve good status/potential in SWBs DVL_0030 and DVL_0110. For these parameters, the conditions result from operations at the water reservoirs upstream of the water bodies, and the calculated contribution from the project is even smaller than for P_{total} .

Overall, the SMR ETE project's contribution to the general physicochemical quality-element parameters in the ecological-status/potential assessment can be summarized as very small under normal flow (Q_a), at approximately 1%. The principal source underlying failure to achieve good ecological status/potential in the assessed water bodies is background mass flow in the Vltava, Lužnice, and Otava Rivers.

Table 62 Contributions of individual sources to mass flows of the general physicochemical quality elements at the profile downstream of the Kořensko water reservoir, Average Discharge scenario, SMR ETE plus Units 1 and 2, according to [8]

Parameter	Q_a			Q_{355}		
	SMR ETE	Units 1 and 2	Background	SMR ETE	Units 1 and 2	Background
T	0.4%	1.2%	98.4%	1.5%	4.5%	94.0%
pH	0.2%	0.7%	99.0%	1.0%	2.8%	96.2%
BOD ₅	0.1%	0.3%	99.5%	0.5%	1.5%	98.0%
P_{total}	0.6%	1.7%	97.7%	2.4%	7.4%	90.2%
$P-PO_4^{3-}$	1.1%	3.3%	95.6%	4.2%	12.7%	83.1%
$N-NO_3^-$	1.3%	4.1%	94.6%	5.3%	16.1%	78.7%
$N-NH_4^+$	0.3%	0.8%	99.0%	0.9%	2.7%	96.4%

Table 63 Contributions of individual sources to mass flows of the general physicochemical quality elements at the profile downstream of the Kořensko water reservoir, Average Discharge scenario, SMR ETE plus Units 1 and 2 plus New NPP ETE, according to [8]

Parameter	Q_a				Q_{355}			
	SMR ETE	Units 1 and 2	New NPP ETE	Background	SMR ETE	Units 1 and 2	New NPP ETE	Background
T	0.4%	1.2%	1.7%	96.7%	1.4%	4.2%	5.9%	88.4%
pH	0.2%	0.7%	1.0%	98.0%	0.9%	2.7%	3.8%	92.5%
BOD ₅	0.1%	0.3%	0.5%	99.1%	0.5%	1.5%	2.1%	95.9%
P_{total}	0.5%	1.7%	2.3%	95.5%	2.2%	6.7%	9.3%	81.8%
$P-PO_4^{3-}$	1.0%	3.2%	4.5%	91.3%	3.6%	10.8%	15.1%	70.5%
$N-NO_3^-$	1.3%	3.8%	5.4%	89.5%	4.3%	13.1%	18.4%	64.2%
$N-NH_4^+$	0.3%	0.8%	1.1%	97.9%	0.9%	2.6%	3.6%	92.9%

4 Status of Surface Water Bodies and Groundwater Bodies

Table 64 Contributions of individual sources to mass flows of the general physicochemical quality elements at the profile downstream of the Kořensko water reservoir, Maximum Discharge scenario, SMR ETE plus Units 1 and 2, according to [8]

Parameter	Q _a			Q ₃₅₅		
	SMR ETE	Units 1 and 2	Background	SMR ETE	Units 1 and 2	Background
T	0.4%	1.9%	97.7%	1.4%	7.1%	91.5%
pH	0.2%	0.8%	98.9%	0.9%	3.1%	96.0%
BOD ₅	0.1%	2.3%	97.6%	0.5%	9.7%	89.8%
P _{total}	0.5%	4.6%	94.9%	2.1%	18.0%	79.8%
P-PO ₄ ³⁻	1.0%	8.3%	90.7%	3.5%	27.7%	68.8%
N-NO ₃ ⁻	1.3%	8.4%	90.3%	4.5%	29.4%	66.2%
N-NH ₄ ⁺	0.3%	0.8%	99.0%	0.9%	2.7%	96.4%

Table 65 Contributions of individual sources to mass flows of the general physicochemical quality elements at the profile downstream of the Kořensko water reservoir, Maximum Discharge scenario, SMR ETE plus Units 1 and 2 plus New NPP ETE, according to [8]

Parameter	Q _a				Q ₃₅₅			
	SMR ETE	Units 1 and 2	New NPP ETE	Background	SMR ETE	Units 1 and 2	New NPP ETE	Background
T	0.4%	1.9%	2.6%	95.1%	1.3%	6.4%	9.0%	83.3%
pH	0.2%	0.8%	1.1%	97.8%	0.9%	3.0%	4.2%	92.0%
BOD ₅	0.1%	2.3%	0.9%	96.7%	0.4%	9.4%	3.8%	86.4%
P _{total}	0.5%	4.5%	2.1%	92.9%	2.0%	16.6%	7.7%	73.6%
P-PO ₄ ³⁻	1.0%	7.9%	4.2%	86.8%	3.0%	24.1%	12.9%	60.0%
N-NO ₃ ⁻	1.1%	7.6%	10.2%	81.1%	3.2%	21.1%	28.4%	47.4%
N-NH ₄ ⁺	0.2%	0.7%	4.3%	94.7%	0.8%	2.3%	13.5%	83.4%

Ecological-status/potential assessment: river-basin-specific pollutants

River-basin-specific pollutants do not cause failure to achieve good status/potential in the assessed SWBs. According to assessment [9, 10], all water bodies are classified as having good status/potential in this category. Radioactivity parameters are also included among the river-basin-specific pollutants. Tritium is the only parameter in this group for which modeled values were calculated according to [8] for the individual scenarios; the results are provided in Table 66. For SWB DVL_0030, the modeled values for the Vltava-Solenice profile were used. No model data are available for the other parameters, primarily because of insufficient input data; these substances are not monitored in the assessed water bodies.

4 Status of Surface Water Bodies and Groundwater Bodies

Table 66 Comparison of the current tritium activity concentrations assessed according to [8], the EQS-AA, and the values modeled for the individual scenarios according to [8]

Activity concentration of ^3H [Bq/l] SWB ID	Current Current-status mean	EQS-AA	SMR ETE + Units 1 and 2				SMR ETE + Units 1 and 2 + New NPP			
			Average Discharge		Maximum Discharge		Average Discharge		Maximum Discharge	
			Q_a	Q_{355}	Q_a	Q_{355}	Q_a	Q_{355}	Q_a	Q_{355}
HVL_1055_J	31.0 *	1 000	31	115	61	228	109	409	139	520
HVL_1525_J	**		-	-	-	-	-	-	-	-
DVL_0015_J	**		-	-	-	-	-	-	-	-
DVL_0030	23.2 ***		21	75	40	148	71	265	91	337
DVL_0095_J	**		-	-	-	-	-	-	-	-
DVL_0110	**		-	-	-	-	-	-	-	-

* Vltava-Hladná; ** not assessed in study [8]; *** Vltava-Solenice

The table shows that tritium is not expected to cause failure to achieve good status/potential.

For the other river-basin-specific pollutants, the calculated contributions from the SMR ETE project at the profile downstream of the Kořensko water reservoir according to [8], provided in Table 67–Table 70, may be used; radioactivity parameters are provided separately in Table 71–Table 74. As with the general physicochemical quality elements, the calculated contribution from the SMR ETE project is very small, up to 4%. It can be assumed that, in the other affected water bodies farther downstream, dilution, particularly by the Otava River and other tributaries, will make the project's contribution to background mass flows even smaller than at the wastewater outfall, particularly under normal-flow conditions, and that river-basin-specific pollutants, including radioactivity parameters, will not cause failure to achieve good ecological status/potential in the future either.

Table 67 Contributions of individual sources to mass flows of the assessed river-basin-specific pollutants at the profile downstream of the Kořensko water reservoir, Average Discharge scenario, SMR ETE plus Units 1 and 2, according to [8]

Parameter	Q_a			Q_{355}		
	SMR ETE	Units 1 and 2	Background	SMR ETE	Units 1 and 2	Background
C ₁₀ –C ₄₀	0.5%	1.4%	98.2%	1.7%	5.1%	93.2%
Phenanthrene	1.0%	2.9%	96.1%	3.4%	10.4%	86.2%
Pyrene	1.1%	3.3%	95.6%	3.6%	10.9%	85.5%
AI	0.9%	2.9%	96.2%	3.4%	10.3%	86.4%
AOX	1.0%	3.1%	95.8%	3.9%	11.8%	84.4%
Metolachlor and its metabolites	0.4%	1.2%	98.3%	2.2%	6.6%	91.3%
Terbutylazine and its metabolites	0.4%	1.3%	98.3%	2.2%	6.7%	91.1%
EDTA	0.9%	2.6%	96.6%	3.2%	9.8%	87.0%

4 Status of Surface Water Bodies and Groundwater Bodies

Table 68 Contributions of individual sources to mass flows of the assessed river-basin-specific pollutants at the profile downstream of the Kořensko water reservoir, Average Discharge scenario, SMR ETE plus Units 1 and 2 plus New NPP ETE, according to [8]

Parameter	Q _a				Q ₃₅₅			
	SMR ETE	Units 1 and 2	New NPP ETE	Background	SMR ETE	Units 1 and 2	New NPP ETE	Background
C ₁₀ -C ₄₀	0.4%	1.3%	1.9%	96.3%	1.6%	4.8%	6.7%	87.0%
Phenanthrene	0.9%	2.8%	4.0%	92.3%	3.0%	9.1%	12.7%	75.2%
Pyrene	1.0%	3.2%	4.4%	91.4%	3.1%	9.4%	13.3%	74.2%
AI	0.9%	2.8%	3.9%	92.5%	3.0%	9.0%	12.6%	75.5%
AOX	1.0%	3.0%	4.2%	91.8%	3.3%	10.1%	14.2%	72.4%
Metolachlor and its metabolites	0.4%	1.2%	1.7%	96.6%	2.0%	6.0%	8.4%	83.6%
Terbutylazine and its metabolites	0.4%	1.3%	1.8%	96.5%	2.0%	6.1%	8.6%	83.2%
EDTA	0.8%	2.5%	3.5%	93.2%	2.8%	8.6%	12.1%	76.5%

Table 69 Contributions of individual sources to mass flows of the assessed river-basin-specific pollutants at the profile downstream of the Kořensko water reservoir, Maximum Discharge scenario, SMR ETE plus Units 1 and 2, according to [8]

Parameter	Q _a			Q ₃₅₅		
	SMR ETE	Units 1 and 2	Background	SMR ETE	Units 1 and 2	Background
C ₁₀ -C ₄₀	0.3%	0.8%	99.0%	0.9%	2.7%	96.4%

Table 70 Contributions of individual sources to mass flows of the assessed river-basin-specific pollutants at the profile downstream of the Kořensko water reservoir, Maximum Discharge scenario, SMR ETE plus Units 1 and 2 plus New NPP ETE, according to [8]

Parameter	Q _a				Q ₃₅₅			
	SMR ETE	Units 1 and 2	New NPP ETE	Background	SMR ETE	Units 1 and 2	New NPP ETE	Background
C ₁₀ -C ₄₀	0.2%	0.7%	4.3%	94.7%	0.8%	2.3%	13.5%	83.4%

Table 71 Contributions of individual sources to activity fluxes of the assessed radioactive substances at the profile downstream of the Kořensko water reservoir, Average Discharge scenario, SMR ETE plus Units 1 and 2, according to [8]

Parameter	Q _a			Q ₃₅₅		
	SMR ETE	Units 1 and 2	Background	SMR ETE	Units 1 and 2	Background
¹³⁷ Cs	0.8%	4.4%	94.8%	3.0%	16.5%	80.5%
⁹⁰ Sr	0.9%	8.1%	91.0%	2.8%	25.2%	72.0%
³ H	10.3%	86.2%	3.5%	10.6%	88.5%	0.9%

4 Status of Surface Water Bodies and Groundwater Bodies

Table 72 Contributions of individual sources to activity fluxes of the assessed radioactive substances at the profile downstream of the Kořensko water reservoir, Average Discharge scenario, SMR ETE plus Units 1 and 2 plus New NPP ETE, according to [8]

Parameter	Q _a				Q ₃₅₅			
	SMR ETE	Units 1 and 2	New NPP ETE	Background	SMR ETE	Units 1 and 2	New NPP ETE	Background
¹³⁷ Cs	0.8%	4.3%	3.6%	91.4%	2.6%	14.5%	12.1%	70.8%
⁹⁰ Sr	0.9%	7.8%	3.7%	87.7%	2.5%	22.5%	10.7%	64.3%
³ H	3.0%	24.9%	71.2%	1.0%	3.0%	25.1%	71.7%	0.3%

Table 73 Contributions of individual sources to activity fluxes of the assessed radioactive substances at the profile downstream of the Kořensko water reservoir, Maximum Discharge scenario, SMR ETE plus Units 1 and 2, according to [8]

Parameter	Q _a			Q ₃₅₅		
	SMR ETE	Units 1 and 2	Background	SMR ETE	Units 1 and 2	Background
³ H	5.3%	92.9%	1.8%	5.4%	94.2%	0.5%

Table 74 Contributions of individual sources to activity fluxes of the assessed radioactive substances at the profile downstream of the Kořensko water reservoir, Maximum Discharge scenario, SMR ETE plus Units 1 and 2 plus New NPP ETE, according to [8]

Parameter	Q _a				Q ₃₅₅			
	SMR ETE	Units 1 and 2	New NPP ETE	Background	SMR ETE	Units 1 and 2	New NPP ETE	Background
³ H	2.3%	41.0%	55.9%	0.8%	2.3%	41.2%	56.2%	0.2%

Assessment of chemical-status parameters

Chemical status is unknown for most assessed SWBs, and only DVL_0110 has good chemical status [9, 10]. No values for the chemical-status parameters were modeled according to [8] for the individual scenarios, primarily because of insufficient input data on the concentrations of these substances in the affected SWBs. The assessment can be based on the SMR ETE contributions calculated according to [8] at the profile downstream of the Kořensko water reservoir, as provided in Table 75 and Table 76. As with the general physicochemical quality elements, the calculated contribution from the SMR ETE project is very small, up to 6%. However, the PAH input may be significant, particularly in combination with the other parts of the ETE site under unfavorable flow conditions. For benzo[g,h,i]perylene, the maximum contribution at Q₃₅₅ is calculated as 38% for the SMR ETE plus Units 1 and 2 plus New NPP ETE capacity option, and the inputs of the other PAHs are not negligible either. The cause is the scrubbing of PAHs from the atmosphere into cooling water at the cooling towers, followed by their discharge to the receiving water in blowdown as wastewater. Elevated atmospheric PAH values are associated primarily with the heating season, so the highest concentrations can be expected during winter. Even so, the background pollutant mass flow from the Vltava and Lužnice Rivers exceeds the input from the SMR ETE project, including in combination with the other parts of the ETE site.

4 Status of Surface Water Bodies and Groundwater Bodies

Although PAH parameters warrant attention in terms of the effect of the SMR ETE project on surface-water chemical status, it can be assumed that, in the other affected water bodies farther downstream, dilution, particularly by the Otava River and other tributaries, will make the project's contribution to background mass flows even smaller than at the wastewater outfall, particularly under normal-flow conditions, and that chemical-status parameters will not cause failure to achieve good status at the representative profiles of the affected SWBs in the future either.

Table 75 Contributions of individual sources to mass flows of the assessed chemical-status parameters at the profile downstream of the Kořensko water reservoir, Average Discharge scenario, SMR ETE plus Units 1 and 2, according to [8]

Parameter	Q _a			Q ₃₅₅		
	SMR ETE	Units 1 and 2	Background	SMR ETE	Units 1 and 2	Background
Fluoranthene	0.8%	2.5%	96.6%	2.8%	8.6%	88.5%
Benzo[a]pyrene	1.4%	4.3%	94.3%	4.4%	13.3%	82.3%
Benzo[b]fluoranthene	1.7%	5.1%	93.3%	5.2%	15.7%	79.1%
Benzo[k]fluoranthene	1.5%	4.4%	94.1%	4.6%	14.0%	81.4%
Benzo[g,h,i]perylene	1.9%	5.7%	92.4%	5.7%	17.2%	77.2%
Ni	0.4%	1.1%	98.5%	1.6%	4.9%	93.5%
Alachlor metabolites	0.5%	1.4%	98.1%	2.3%	7.1%	90.6%

Table 76 Contributions of individual sources to mass flows of the assessed chemical-status parameters at the profile downstream of the Kořensko water reservoir, Average Discharge scenario, SMR ETE plus Units 1 and 2 plus New NPP ETE, according to [8]

Parameter	Q _a				Q ₃₅₅			
	SMR ETE	Units 1 and 2	New NPP ETE	Background	SMR ETE	Units 1 and 2	New NPP ETE	Background
Fluoranthene	0.8%	2.4%	3.4%	93.3%	2.5%	7.7%	10.8%	79.0%
Benzo[a]pyrene	1.3%	4.0%	5.6%	89.0%	3.7%	11.2%	15.8%	69.3%
Benzo[b]fluoranthene	1.6%	4.7%	6.6%	87.1%	4.2%	12.9%	18.0%	64.9%
Benzo[k]fluoranthene	1.4%	4.2%	5.9%	88.6%	3.9%	11.7%	16.4%	68.0%
Benzo[g,h,i]perylene	1.7%	5.3%	7.4%	85.6%	4.6%	13.8%	19.4%	62.2%
Ni	0.4%	1.1%	1.6%	96.9%	1.5%	4.6%	6.4%	87.5%
Alachlor metabolites	0.5%	1.4%	2.0%	96.2%	2.1%	6.5%	9.1%	82.4%

Assessment of achievement or failure to achieve good water-body status

The ecological-status/potential and chemical-status assessments are aggregated for the overall assessment of the status of the affected water bodies. The overall status/potential assessment is failing for most assessed SWBs, and only DVL_0095_J is good [9, 10]. The biological and general physicochemical quality elements are the principal reason for failure to achieve good status.

4 Status of Surface Water Bodies and Groundwater Bodies

In general, failure to achieve good status in the biological quality elements is caused in most cases by poorer status in one of the supporting quality elements, particularly the general physicochemical quality elements, or other quality elements assessed as failing. Modeled values for the general physicochemical quality elements according to [8] are available only for P_{total} , although this is one of the most common causes of failure to achieve good status. The assessment showed that P_{total} will remain a critical parameter causing failure to achieve good status/potential in the general physicochemical quality elements at the assessed profiles. The estimated contribution of the SMR ETE project to the other general physicochemical quality-element parameters in the ecological-status/potential assessment is very small. The principal source underlying failure to achieve good ecological status/potential in the assessed water bodies is background mass flow in the Vltava, Lužnice, and Otava Rivers.

River-basin-specific pollutants do not cause failure to achieve good status/potential. According to assessment [9, 10], all water bodies are classified as having good status/potential in this category. Tritium is the only parameter in this group for which modeled values were calculated according to [8] for the individual scenarios. Under no option is tritium expected to cause failure to achieve good status/potential. For the other river-basin-specific pollutants, including radioactivity parameters, the calculated contribution from the SMR ETE project is very small, in the single-digit percent range. It can be assumed that, in the other affected water bodies farther downstream, dilution, particularly by the Otava River and other tributaries, will make the project's contribution to background mass flows even smaller than at the wastewater outfall, particularly under normal-flow conditions, and that river-basin-specific pollutants will not cause failure to achieve good status/potential in the future either.

Chemical status is unknown for the assessed SWBs [9, 10], except DVL_0110, which has good chemical status. No values for the chemical-status parameters were modeled according to [8] for the individual scenarios. Based on the project contributions calculated at the profile downstream of the Kořensko water reservoir [8], it can be assumed that chemical-status parameters will not cause failure to achieve good status in the future. PAH parameters are a potential risk: the contribution from the SMR ETE project alone is small under normal conditions, but may become significant in combination with the other parts of the project, meaning the SMR ETE plus Units 1 and 2 plus the New NPP ETE, and at reduced flows (Q_{355}).

4.2 Groundwater bodies

Chapter prepared by: Mgr. Pavel Eckhardt and RNDr. Hana Prchalová

This chapter is based on background study [105].

4.2.1 Current status of groundwater bodies

The requirement to assess groundwater-body status in European Union Member States arises from Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, hereinafter the

4 Status of Surface Water Bodies and Groundwater Bodies

Water Framework Directive [1], and its daughter instrument, Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration [106], as amended by Commission Directive 2014/80/EU of 20 June 2014 [107], hereinafter the Groundwater Directive. The requirements for assessing the chemical and quantitative status of groundwater bodies were transposed into Czech law primarily by Title III of Act No. 254/2001 Coll., on Water and on Amendments to Certain Acts (the Water Act), as amended [13], and Decree No. 5/2011 Coll., on the designation of hydrogeological regions and groundwater bodies, the method for assessing groundwater status, and the particulars of groundwater status monitoring and assessment programs, as amended [108], known as the Groundwater Monitoring Decree.

Principle of groundwater-body status assessment

The procedures for assessing the quantitative and chemical status of groundwater bodies differ significantly. Whereas quantitative-status assessment is based on a balance procedure, namely the ratio of actual withdrawals to natural resources at the hydrogeological-region level, chemical-status assessment is much more complex: status is assessed first at the level of individual monitoring sites, then at the level of the groundwater body's working units, and only then is the result aggregated for the groundwater body. The method is described in detail in the methodology for assessing chemical and quantitative status for the second River Basin Management Plan cycle [109]. Groundwater-body status is determined by whichever of the chemical- and quantitative-status assessments is worse. Chemical-status assessment is determined by the assessment results for individual parameters and their aggregation. Quantitative status is assessed using the balance method.

Under the Water Framework Directive (2000/60/EC) [1], both chemical and quantitative status are assessed as either good or poor.

For the purposes of assessing the effect of the SMR ETE project on groundwater-body status, the most recent groundwater-body chemical- and quantitative-status assessment, prepared for the plan update using data for 2019–2024, the fourth cycle, was used. The plan update will be published in September 2026, but these are official new data that differ quite substantially from the third-cycle results.

Assessment of groundwater-body quantitative status

Under the Water Framework Directive [1], good groundwater quantitative status is achieved where the monitored groundwater-level regime indicates that the available resource exceeds the long-term mean annual rate of abstraction. Furthermore, anthropogenic effects on groundwater quantitative status must not cause:

- Failure to achieve the environmental objectives established for surface water bodies hydraulically connected with the groundwater
- Any significant deterioration in the status of such waters

4 Status of Surface Water Bodies and Groundwater Bodies

- Any significant damage to terrestrial ecosystems directly dependent on the groundwater body
- Local changes in flow direction causing or potentially causing intrusion of lower-quality or polluted water

The fundamental quantitative-status parameter is the groundwater level in wells. It is also recommended that the assessment use the following additional parameters: spring yields, surface-water flows, baseflow, and characteristic water levels of significant groundwater-connected surface-water environments. In addition to current conditions, historical long-term intensive withdrawals must also be taken into account when assessing quantitative status. Their effects may persist to the present even though they have already been reduced to an acceptable level.

The methodology used in Czechia is based on the principles of assessing the groundwater-quantity balance and on data provided for the balance and, for Quaternary groundwater bodies, on verification of minimum mean water levels and quantities abstracted.

To assess quantitative status, withdrawal ratios were calculated relative both to natural-resource values for the individual years 2019–2024 and to long-term groundwater natural-resource values for 1991–2020, expressed as medians, or 50th-percentile values, and 80th-percentile values, using data from the Czech Hydrometeorological Institute [110] and the Groundwater Resources Reassessment [111]. The Reassessment also specifies available resources for most assessed water bodies, indicating the quantity of groundwater that can be abstracted without deterioration in the status of surface waters or terrestrial ecosystems. Because fewer data are available, natural-resource values from the Hydrogeological Regionalization are expressed as long-term means. The assessment itself then consists of evaluating the ratio of actual withdrawals to natural or available groundwater resources, with the individual ratios not permitted to exceed the good-status limit, or critical thresholds.

The following values were compared for the quantitative-status assessment:

- Mean values of all groundwater withdrawals over the six-year period against long-term natural-resource values expressed as the median and 8th percentile, using Czech Hydrometeorological Institute data;
- Mean values of all groundwater withdrawals over the six-year period against long-term natural-resource values expressed as the median and 80th percentile and against available resources, using data from the Groundwater Resources Reassessment project;
- Mean values of all groundwater withdrawals over the six-year period against long-term natural-resource values;
- Mean values of all groundwater withdrawals in a given year against normal natural-resource values in that year, using Czech Hydrometeorological Institute data;
- Maximum values of all groundwater withdrawals in a given year, meaning the highest mean annual withdrawals, against the lowest normal annual natural-resource values over the entire assessed period.

4 Status of Surface Water Bodies and Groundwater Bodies

When comparing withdrawals with available resources, a simple ratio is not used. Instead, the proportion of available resources remaining after the actual withdrawal is calculated: the actual withdrawal is first subtracted from the available resources, and the result is divided by the available-resource value. If the resulting ratio is less than or equal to 0.2, meaning that less than 20% of the available resources remain in the region after the withdrawal, the result is poor.

The overall quantitative-status assessment also included aggregation of the individual results: if a water body failed in relation to mean values of either long-term or annual natural resources, it was classified as poor. If it failed only at the 80th percentile and/or for the ratio of the highest withdrawals to the lowest natural resources, it was classified, for working purposes, as potentially poor.

Assessment of groundwater-body chemical status

Unlike surface-water chemical status, the Groundwater Directive (2006/118/EC) [106] requires each Member State to assess parameters that may pose a risk to the natural environment or to the use of groundwater for drinking-water purposes. The assessment must cover both groundwater itself and associated aquatic and terrestrial systems. The good-status limits are then established in accordance with these requirements and, for naturally occurring substances, should also take account of background values, meaning that the good-status limit should not be lower than the natural background. For all substances, the limits should also take account of the requirements for good ecological and chemical status of associated surface water bodies, requirements for protected terrestrial ecosystems directly dependent on groundwater, and requirements for raw groundwater used for drinking-water supply. It is clear that the limits may differ for different requirements, so different limits for a single parameter may apply concurrently in one groundwater body. In such a case, the stricter requirements need be met only at locations representative of those requirements.

The assessment was therefore first conducted at the monitored sites. The characteristics of values measured by Czech Hydrometeorological Institute monitoring, including means and maximum values, were compared with threshold values for the groundwater receptor and, at selected monitoring stations, with the type-specific nitrate and ammonium-ion limits for the surface-water receptor. Because the type-specific limits for surface water are stricter than those for the groundwater receptor, these results were taken into account in the assessment only if the groundwater limit was met; otherwise, the results automatically also failed for surface water. For the assessment of groundwater use for drinking-water purposes, quality data from groundwater abstractions for drinking-water purposes were included. Their assessment procedure was essentially the same as for the Czech Hydrometeorological Institute monitoring data, except that the maximum rather than the mean was used because of the small number of values.

The assessment results for the monitoring sites and groundwater abstractions were then applied to the working units and subsequently to the groundwater bodies according to the proportion of contaminated areas. The following chemical-status parameters were assessed for groundwater

4 Status of Surface Water Bodies and Groundwater Bodies

bodies according to the good-status limits listed; see Table 77. Where associated surface waters, meaning surface waters with a significant groundwater component, were present in a groundwater body, the stricter type-specific values for good ecological status of surface waters were adopted for ammonium ions and nitrates in groundwater; see Table 78.

4 Status of Surface Water Bodies and Groundwater Bodies

Table 77 Parameters used to assess the chemical status of groundwater bodies and their limits

CAS No.	Substance name	Unit	Good-status limit
	Sum of 1,1,2-trichloroethene and tetrachloroethene (PCE)	µg/l	10
288-88-0	1,2,4-Triazole	µg/l	0.1
2008-58-4	2,6-Dichlorobenzamide	µg/l	0.1
	Acetochlor and its metabolites	µg/l	0.1
	Alachlor and its metabolites	µg/l	0.1
83643-88-3	AMPA	µg/l	0.1
7440-38-2	Arsenic and its compounds	µg/l	10
	Atrazine and its metabolites	µg/l	0.1
25057-89-0	Bentazone	µg/l	0.1
71-43-2	Benzene	µg/l	1
50-32-8	Benzo(a)pyrene	µg/l	0.01
205-99-2	Benzo(b)fluoranthene	µg/l	0.03
191-24-2	Benzo(g,h,i)perylene	µg/l	0.002
207-08-9	Benzo(k)fluoranthene	µg/l	0.03
1702-17-6	Clopyralid	µg/l	0.1
	Dimethachlor and its metabolites	µg/l	0.1
	Dimethenamid and its metabolites	µg/l	0.1
1071-83-6	Glyphosate	µg/l	0.1
51235-04-2	Hexazinone	µg/l	0.1
7429-90-5	Aluminum and its compounds	µg/l	200
	Chloridazon and its metabolites	µg/l	0.1
	Chlorothalonil metabolites	µg/l	0.1
193-39-5	Indeno(1,2,3-cd)pyrene	µg/l	0.002
7440-43-9	Cadmium and its compounds	µg/l	0.25
	Metazachlor and its metabolites	µg/l	0.1
	Metolachlor and its metabolites	µg/l	0.1
	Metribuzin and its metabolites	µg/l	0.1
91-20-3	Naphthalene	µg/l	0.1
7439-92-1	Lead and its compounds	µg/l	1.2
106700-29-2	Pethoxamid	µg/l	0.1
	Sum of pesticides and their metabolites	µg/l	0.5
7439-97-6	Mercury and its compounds	µg/l	0.05
7440-02-0	Nickel and its compounds	µg/l	20
67-66-3	Trichloromethane	µg/l	2.5
	Acid-neutralizing capacity to pH 4.5*	mmol/l	0.2
	Ammonium ions	mg/l	0.5
	Nitrates	mg/l	50
	Nitrites	mg/l	0.5
	Chlorides	mg/l	200
	Phosphates	mg/l	0.5
	Cyanides	mg/l	0.05
	Sulfates	mg/l	400
	Hydrogen carbonates	mg/l	10

4 Status of Surface Water Bodies and Groundwater Bodies

Table 78 Parameters used to assess the chemical status of groundwater bodies in relation to associated surface waters and their limits

CAS No.	Substance name	Unit	Good-status limit
	Ammonium ions	mg/l	0.21; 0.3
	Nitrates	mg/l	15.5; 16.82; 19.92

Current status assessment of groundwater bodies potentially affected by SMR ETE construction and operation

The planned SMR ETE development itself lies in groundwater body 63201, Crystalline Rocks in the Middle Vltava Basin, Southern Part. For the purposes of assessing the effect of the SMR ETE project, however, other groundwater bodies or working units must also be taken into account.

Groundwater bodies potentially affected by construction of the SMR ETE project

Groundwater bodies potentially affected by construction may include those affected by changes in water quantity and chemical composition, primarily basic-layer groundwater body 63201, Crystalline Rocks in the Middle Vltava Basin, Southern Part. More distant basic-layer bodies are 21600, České Budějovice Basin; 63101, Crystalline Rocks in the Upper Vltava and Úhlava Basins; and 21510, Třeboň Basin, Northern Part; together with upper-layer body 12300, Quaternary Deposits of the Otava and Blanice. The location of groundwater bodies around SMR ETE is shown in the following figure (Fig. 27).

4 Status of Surface Water Bodies and Groundwater Bodies

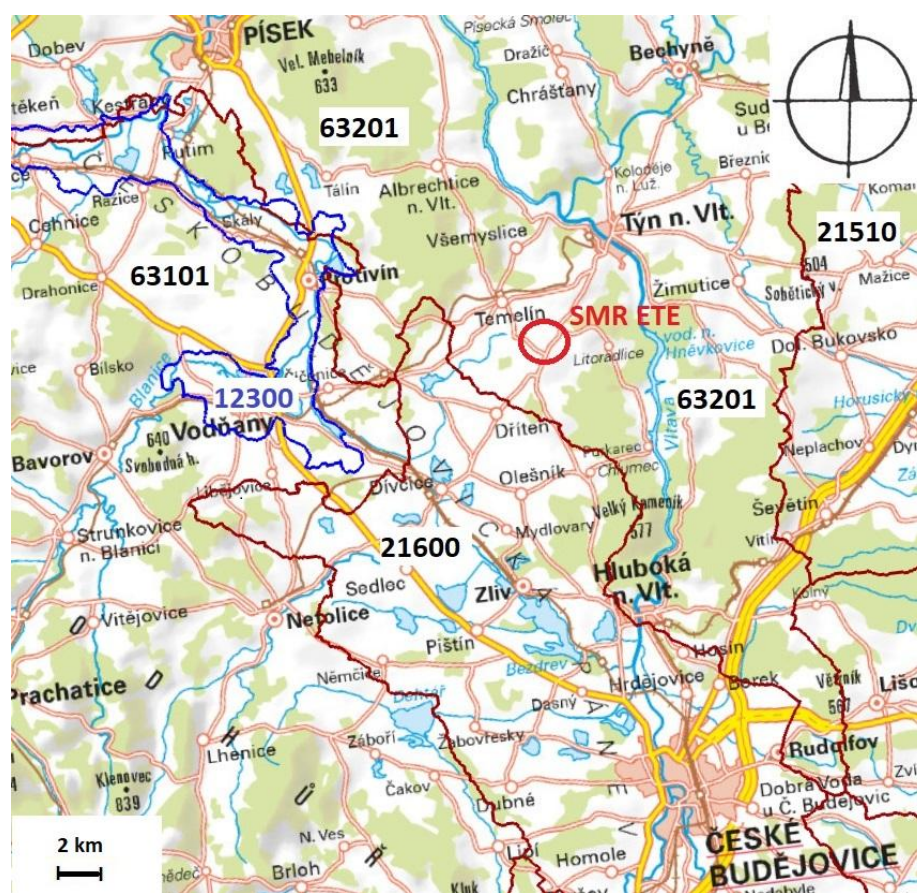


Fig. 27 Location of groundwater bodies surrounding the SMR ETE project. Upper-layer bodies are shown in blue and basic-layer bodies in black

The construction effect will decrease downstream along the watercourses and will be unmeasurable at the latest after the confluence with Bílý Stream, or after homogenization and retention in Bělohůrecký fishpond. Similarly, the effect of construction on groundwater will not be measurable after Strouha Stream and Palečkův Stream enter the Vltava. Consequently, the more distant groundwater bodies will not be affected by construction and are not assessed further. The effect of construction of the SMR ETE project on groundwater bodies could therefore be significant only for body 63201 and the somewhat more distant body 21600. The boundary between these bodies runs approximately through the confluence of Temelínský Stream with Bílý Stream; Bělohůrecký fishpond already lies within groundwater body 21600. The current status assessment of the bodies potentially affected by the project is presented clearly in Table 79 (in the direction away from the SMR ETE site):

Table 79 Status assessment of groundwater bodies potentially affected by construction of the SMR ETE project

Body ID	Groundwater body name	Area (km ²)	Quantitative status assessment	Chemical status assessment
63201	Crystalline rocks in the Middle Vltava catchment – southern part	2,852.8	good	poor (pesticides)
21600	České Budějovice Basin	449.1	good	good

4 Status of Surface Water Bodies and Groundwater Bodies

Some groundwater bodies are too extensive, so the assessment must be presented by working unit or, where applicable, by individual monitoring point. In this case, the České Budějovice Basin consists of only one working unit, so the status of the body is identical to that of the working unit. The situation is different for body 63201, which is divided into 38 units.

The entire SMR ETE construction area lies within two working units with areas of 38.7 and 25.9 km²; however, neither contains an assessed monitoring point. Given the minimal significant anthropogenic pressures other than agricultural land use, it may be assumed that, as in the neighboring working units, chemical status is good except for certain pesticide metabolites.

Groundwater bodies and working units potentially affected by operation of the SMR ETE project

Groundwater bodies potentially affected by operation of the SMR ETE project are located both around the facility itself and along the Vltava downstream of the Kořensko waterworks, where wastewater will be discharged. The assignment for this study required an assessment of the effect on groundwater bodies along the Vltava from the discharge point at Kořensko to the confluence with the Sázava. These comprise basic-layer groundwater body 63201 – Crystalline rocks in the Middle Vltava catchment – southern part, which extends from the discharge point at Kořensko to the confluence of the Vltava and Otava rivers (the backwater of Orlík Reservoir). The Vltava then flows through basic-layer groundwater body 63204 – Crystalline rocks in the Middle Vltava catchment – northern part; downstream of Kamýk nad Vltavou it flows through body 63203 – Crystalline rocks in the Middle Vltava catchment – Vltava inter-catchment from the confluence with Vápenický Stream to Slapy; and downstream of the Slapy Dam it again flows through groundwater body 63204. Downstream of the Štěchovice Dam, the right bank remains within groundwater body 63204, while the left bank lies within basic-layer body 62500 – Proterozoic and Paleozoic rocks in the catchments of the Vltava tributaries, as far as the confluence of the Vltava and Sázava rivers. The locations of the groundwater bodies in the section of interest along the Vltava from Kořensko to the confluence with the Sázava are shown in Fig. 28; their current status assessments are presented in Table 80.

4 Status of Surface Water Bodies and Groundwater Bodies



Fig. 28 Locations of groundwater bodies in the section from Kořensko to the mouth of the Sázava

Table 80 Current status assessment of groundwater bodies potentially affected by operation of the SMR ETE project

Body ID	Groundwater body name	Area (km ²)	Quantitative status assessment	Chemical status assessment
63201	Crystalline rocks in the Middle Vltava catchment – southern part	2,852.8	good	poor (pesticides)
63204	Crystalline rocks in the Middle Vltava catchment – northern part	2,393.1	good	good
63203	Crystalline rocks in the Middle Vltava catchment – Vltava inter-catchment from the confluence with Vápenický Stream to Slapy	264.6	good	poor (nitrates, pesticides)
62500	Proterozoic and Paleozoic rocks in the catchments of the Vltava tributaries	1,181.5	good	good

4 Status of Surface Water Bodies and Groundwater Bodies

In the area that may be affected by wastewater discharge at Kořensko, all groundwater bodies except 63203 are too large, and the relevant working units must therefore be considered, as shown in the following Table 81.

Table 81 Assessment of relevant groundwater-body working units

Body ID	Groundwater-body working unit ID	Area (km ²)	Chemical status assessment
63201	632010225	27.4	unknown
63201	632010227	255.6	unknown
63204	632040246	121.6	unknown
63204	632040247	54.6	unknown
63204	632040248	45.9	poor (nitrates, pesticides)
63204	632040254	14.1	unknown
63203	632030280	264.6	poor (nitrates, pesticides)
63204	632040256	31.2	unknown
62500	625000115	313.2	good (only the nitrate criterion for associated aquatic ecosystems is not met)

Note: The working units are ordered downstream along the Vltava from Kořensko.

4.2.2 Effect of the SMR ETE project on the status of groundwater bodies

The assessment of the effect of the SMR ETE project on the status of groundwater bodies in the wider area is divided into an assessment of effects during construction, an assessment during facility operation, and overall summaries for the chemical and quantitative status of groundwater bodies. The assessment is based on the underlying study [105].

Effect of construction on groundwater in the wider area during the construction phase

This part of the assessment addresses temporary effects during construction.

During construction, topsoil and subsoil will be stripped at the site and rough grading will be carried out, leveling the construction area. Extensive impermeable surfaces will be created and stormwater will be drained from them.

The construction site will be dewatered. The most intensive pumping will take place in the excavation on the SMR site (excavation dimensions 50 × 50 m, depth 26 m).

The site and supporting areas will contain construction facilities, accommodate a larger workforce and greater numbers of construction machines, trucks and passenger vehicles, and be used for parking and equipment maintenance. Topsoil and subsoil will be stripped from part of the area and rough grading will be carried out. Heating will be provided by a boiler plant.

4 Status of Surface Water Bodies and Groundwater Bodies

A local lowering of the groundwater level will therefore occur in the SMR ETE construction area over an area of 50×50 m; the cone of depression may extend over an area of up to approximately 150×150 m.

Pumped groundwater and stormwater from paved surfaces will be conveyed to Dvorčice Pond and nearby watercourses. These are the headwater areas of the watercourses, so the difference between the pumped water and the water naturally discharged from springs will be small. The effect of the discharge will diminish downstream along the watercourses. The watercourses have a drainage function in the area of interest.

Operation of machinery and the boiler plant may locally increase the concentrations of certain substances, particularly C_{10} – C_{40} hydrocarbons, in shallow groundwater. The production and placement of concrete mixtures may locally increase concentrations of calcium, bicarbonates, and total dissolved solids in shallow groundwater. The listed parameters are not relevant to assessment of groundwater-body status.

Conversely, the application of substances from existing agricultural activity, particularly fertilizers and pesticides, will cease and the associated input to groundwater will decrease. This may reduce certain parameters, for example concentrations of nitrates, ammonium ions, individual pesticides, or total phosphorus.

Conveying stormwater to surface waters will not have a material effect on groundwater quality, because some stormwater would enter the watercourses in any event, shallow groundwater has low dissolved-solids content, and the watercourses have a drainage function in the area. Consequently, there is no substantial infiltration of surface water from the watercourses into groundwater.

No significant groundwater abstraction area used for drinking-water purposes lies within the reach of changes in watercourse quality and flow caused by construction of the SMR ETE project. The nearest groundwater abstraction (groundwater abstraction ID 111068) is located within the Units 1 and 2 site. It lowers the groundwater level beneath building foundations at a rate of approximately 1.6 l/s [11]. The second-nearest registered groundwater abstraction is located north of the area of interest (groundwater abstraction ID 111155). It supplies water for industrial use by Dynín Bohunice nad Vltavou agricultural services, specifically for the production of industrial livestock feed, at a rate of 0.4 l/s [11]. This abstraction is located near the municipality of Bohunice nad Vltavou outside the catchment of interest and will not be affected by construction or normal operation of the SMR ETE project. The third-nearest registered groundwater abstraction is located east-northeast of the SMR ETE construction site (groundwater abstraction ID 111117). It is a former abstraction for agricultural livestock production operated by ZD Nova Lhota pod Horami until 2021 at a rate of approximately 0.25 l/s [11]. The abstraction took place in the Bílý Stream catchment northwest of the settlement of Lhota pod Horami. This abstraction was outside the catchment of interest and will not be affected by construction or normal operation of the SMR ETE project.

The area of interest around Units 1 and 2 was depopulated in the past, including the municipalities of Křtěnov, Knín, and Temelínec. The nearest existing municipality, Kočín, does

4 Status of Surface Water Bodies and Groundwater Bodies

not lie within a catchment where groundwater could be affected by construction of the SMR ETE project; the same applies to the built-up area of the municipality of Temelín.

On the basis of the available information, it may be concluded that construction is not expected to cause even a temporary deterioration in the chemical or quantitative status of groundwater bodies or in the status of their working units. With respect to chemical status during construction, no significant input of pollutants relevant to groundwater-body status assessment is expected. With respect to quantitative status, although water will be pumped from the excavation, the scale of pumping and the extent of the cone of depression mean that the effect will be local only and will not affect the status of groundwater bodies.

Effect of construction on groundwater in the wider area during operation

This part of the assessment addresses effects on the wider surroundings of the SMR ETE project during operation. The groundwater bodies in the wider area are shown on the maps in Fig. 27 and Fig. 28. Effects on the more distant surroundings, including wastewater discharge, are addressed in the next subsection.

During operation of the SMR ETE project, the activities potentially affecting groundwater bodies around the facility will consist primarily of pumping groundwater from beneath building foundations and conveying stormwater to the surrounding watercourses.

Pumping groundwater from beneath the SMR ETE building foundations will create a local cone of depression with a maximum extent of 150×150 m. The average groundwater pumping rate will be up to approximately 2.5 l/s.

Compared with the current situation, in which some precipitation infiltrates into groundwater, some runs off over the surface, and some evaporates, stormwater averaging approximately 1 l/s will be conveyed to local watercourses. Stormwater has a lower dissolved-solids content and lower pH than groundwater. Because this is a headwater area on crystalline bedrock, the groundwater has a low dissolved-solids content. The watercourses have a drainage function in the area of interest, so there will be no significant infiltration of surface water into groundwater and conveying stormwater will therefore have no material effect on groundwater quality.

No significant groundwater abstraction area used for drinking-water purposes lies within the reach of changes in watercourse quality and flow caused by operation of the proposed SMR ETE facility. The nearest groundwater abstraction (groundwater abstraction ID 111068) is located within the Units 1 and 2 site. It lowers the groundwater level beneath building foundations at a rate of approximately 1.6 l/s [11]. The second-nearest registered groundwater abstraction is located north of the area of interest (groundwater abstraction ID 111155). It supplies water for industrial use by Dynín Bohunice nad Vltavou agricultural services, specifically for the production of industrial livestock feed, at a rate of 0.4 l/s [11]. This abstraction is located near the municipality of Bohunice nad Vltavou outside the catchment of interest and will not be affected by construction or normal operation of the SMR ETE project. The third-nearest registered groundwater abstraction is located east-northeast of the SMR ETE construction site (groundwater abstraction ID 111117). It is a former abstraction for agricultural

4 Status of Surface Water Bodies and Groundwater Bodies

livestock production operated by ZD Nova Lhota pod Horami until 2021 at a rate of approximately 0.25 l/s [11]. The abstraction took place in the Bílý Stream catchment northwest of the settlement of Lhota pod Horami. This abstraction was outside the catchment of interest and will not be affected by construction or normal operation of the SMR ETE project.

The area of interest around Units 1 and 2 was depopulated in the past, including the municipalities of Křtěnov, Knín, and Temelínec. The nearest existing municipality, Kočín, does not lie within a catchment where groundwater could be affected by construction of the SMR ETE project; the same applies to the built-up area of the municipality of Temelín.

With respect to groundwater-body status, it may be concluded that operation in the vicinity of the SMR ETE project is not expected to cause even a temporary deterioration in the chemical or quantitative status of groundwater bodies or in the status of their working units. With respect to chemical status, operation of the SMR ETE project is not expected to cause any significant input of relevant pollutants around the construction site. With respect to quantitative status, although water will be pumped from the excavation, the scale of pumping and the extent of the cone of depression mean that the effect will be local only and will not affect the status of groundwater bodies.

Effect of operation of the SMR ETE project on groundwater-body status

While construction will primarily affect minor watercourses around ETE, operational effects will, to some extent, also affect the Vltava and its surroundings downstream of Kořensko Reservoir. The assessment of project effects is based on the available information (for details, see [105]).

No significant groundwater abstraction area that could be affected by normal operation of the SMR ETE project lies within the reach of changes in watercourse quality and flow caused by such operation; for details, see [105]. The area of interest around Units 1 and 2 was depopulated in the past, including the municipalities of Křtěnov, Knín, and Temelínec. No significant hydrogeological structures occur at the site of interest or in its immediate vicinity.

Effect of surface-water abstraction and wastewater discharge on groundwater-body status

Wastewater from the SMR ETE project is planned to be discharged into the Vltava at Kořensko through the shared outlet used by Units 1 and 2 and the New NPP ETE. As required by the assignment, the cumulative effect on groundwater bodies of surface-water abstraction and wastewater discharge from all three facilities was assessed for the section from Kořensko to the confluence of the Sázava and Vltava rivers.

Water consumption by the existing Units 1 and 2 is already included in the flow values. Based on the annual quantities of raw water abstracted and wastewater discharged, average water consumption of 0.27 m³/s is assumed for the SMR ETE project and 1.64 m³/s for the New NPP ETE. This change in flow is negligible compared with the long-term mean flow at the Kořensko profile (49.1 m³/s). No significant change in Q₃₅₅ flow is expected because, during dry periods, low flows in the Vltava will be augmented through reservoir operations on the Vltava. Surface-

4 Status of Surface Water Bodies and Groundwater Bodies

water abstraction for the SMR ETE project will therefore have no significant effect on groundwater quantity or levels.

The Kořensko waterworks, where the discharge occurs, is immediately followed by the next part of the Vltava Cascade. The Vltava then flows through Prague and enters the Elbe approximately 200 km downstream of the Kořensko waterworks.

When assessing the effect of the SMR ETE project on groundwater status, a distinction must be made between the groundwater-body level, the level of relevant working units, and groundwater sources used for drinking-water purposes.

For quantitative status, there is no reason to consider the sources in use: all are too far away, and even if a source were affected in quantitative terms, this would not mean that the effect was significant enough to jeopardize the quantitative status of the entire body. Moreover, given the available data on natural and available groundwater resources, quantitative status can be assessed at the level of the entire groundwater body and only exceptionally at working-unit level. With respect to quantitative status, the effect of operation of the SMR ETE project will be the same as during construction, because groundwater pumping will continue on approximately the same or a smaller scale. An adverse effect on body status can therefore be excluded.

Distinguishing the effect of the SMR ETE project at the individual levels is relevant only to the assessment of chemical status. In general, given the scale involved, the SMR ETE project may have its greatest adverse effect on sources in use; any effect on working units will certainly be smaller, and the effect on groundwater bodies smaller still. For this reason, groundwater sources used for drinking-water purposes are assessed first.

Discharges from the SMR ETE project can affect groundwater sources in use only where significant infiltration of surface water into groundwater occurs. The entire assessed section of the Vltava from the wastewater discharge point at Kořensko to Štěchovice lies in crystalline bedrock, comprising hydrogeologic-massif rocks that generally have only low fracture permeability. There are no significant hydrogeologic structures through which infiltrated water could spread farther from the Vltava than tens or the first few hundreds of meters. Apart from the more permeable parts of floodplains and river terraces, there are no highly permeable hydrogeologic environments. Much of the floodplain along the original Vltava channel was depopulated and inundated by reservoir water in the past. These inundated areas are not used as groundwater sources.

More substantial infiltration of surface water into groundwater may occur in the area of interest through induced bank filtration, whereby higher groundwater pumping rates can draw surface water from the Vltava at suitable locations. Some infiltration of surface water into groundwater may also occur near reservoir dams, where there is a significant difference between surface-water levels upstream and downstream of the dam.

Analysis of the locations and configuration of abstraction areas identified six groundwater abstraction areas in the area of interest, from Kořensko to the confluence of the Vltava and Sázava rivers, that could be affected by Vltava surface water downstream of the SMR ETE

wastewater discharge. These abstraction areas were therefore characterized in greater detail and examined more closely for potential effects of SMR ETE wastewater discharge on the sources. In downstream order along the Vltava, these abstraction areas are:

- Municipality of Milešov, Orlické Zlátkovice (groundwater abstraction ID: 121739)
- Municipality of Kamýk nad Vltavou (groundwater abstraction ID: 120702)
- VLTAVA Smilovice training facility (groundwater abstraction ID: 120720)
- VOS Benešov, Štěchovice (groundwater abstraction ID: 120527)
- VHS Davle, Hradištko (groundwater abstraction ID 120502)
- A-Z THERM, Štěchovice, Masečín Hvozd (groundwater abstraction ID 120539)

The assessment found that only two of the six abstraction areas examined were relevant to potential effects on the quality of abstracted groundwater: the Municipality of Kamýk nad Vltavou abstraction and the VHS Davle Hradištko abstraction. The individual abstraction areas examined and the results of the examination are characterized and assessed in greater detail in report [105].

Municipality of Kamýk nad Vltavou groundwater abstraction

This is an existing groundwater abstraction used for the public water supply of Kamýk nad Vltavou. The abstraction area lies on the right bank of the Vltava immediately north of the built-up area of Kamýk nad Vltavou.

In the most recent reporting year, 2024, the average abstraction rate was 1.2 l/s. Abstraction took place throughout the year. The maximum permitted abstraction volume was 60,000 m³ per year. The actual volume abstracted in 2024 was 39,170 m³. Abstraction has been taking place for many years. Annual abstraction volumes are also stable over the long term, at least since 2006.

A representative of Povodí Vltavy, s.p., noted that the reported abstraction is the sum of two abstractions from two abstraction areas. In addition to the Na Pile abstraction area of interest on the right bank of the Vltava, the second abstraction area for Kamýk nad Vltavou is near Humenná hill and has two abstraction wells. It lies on the left bank of the Vltava in the Zduchovický Stream catchment, beyond the potential reach of infiltration from the Vltava.

The source of interest on the right bank of the Vltava is a medium-sized groundwater source used to supply drinking water to the population. The abstraction structures lie near the Vltava in its floodplain. Some groundwater originates from precipitation infiltrating in the hinterland on the right bank of the Vltava, particularly in the water-source protection zone. Some groundwater, particularly at higher pumping rates and when inflow from the higher parts of the protection zone is lower, may originate as surface water from the Vltava that enters groundwater through induced bank filtration.

The hydrogeologic catchment, or hinterland, of the abstraction area of interest on the right bank of the Vltava covers approximately 0.3 km². Groundwater recharge in this area is based on

4 Status of Surface Water Bodies and Groundwater Bodies

precipitation totals; long-term baseflow under dry conditions was based on the driest year in the 2010-2019 period.

The map of long-term mean baseflow [112], meaning dynamic natural groundwater resources, prepared by the Czech Geological Survey, gives a baseflow of 0.41–0.6 l/s/km² for 1991–2010 and only 0.01–0.2 l/s/km² under dry conditions. Given the small hinterland area and low baseflow values, inflow from the hinterland is approximately 0.15 l/s under mean conditions and only 0.03 l/s under dry conditions.

If a maximum average of 1.2 l/s of groundwater is abstracted from the abstraction area of interest on the right bank of the Vltava, for example if the other groundwater source is unavailable, inflow of water infiltrated from the Vltava is approximately 1.05 l/s under normal mean conditions, representing 87.5% of the abstracted quantity, and up to 1.17 l/s under dry conditions, representing 97.5% of the abstracted groundwater quantity. These figures should be regarded as maxima because the registered abstraction for Kamýk nad Vltavou also draws from another independent source and is therefore less dependent on the quality of water in the Vltava.

For the purpose of assessing the effect of the SMR ETE project on the Kamýk nad Vltavou groundwater abstraction, the high proportion of water infiltrated from the river allows the conservative assumption that only surface water will be abstracted.

The SMR ETE wastewater discharge will impair certain parameters of the quality of surface water infiltrating from the Vltava into groundwater. Changes in Vltava surface-water quality are modeled in study [8]. The described Kamýk nad Vltavou profile should be relevant to the site of interest; however, because only a minimum number of parameters were modeled at the Kamýk profile, the upstream Kořensko profile was used. As with the proportion of infiltrated water, this is a conservative assumption because the Kořensko profile can be expected to be the most affected by the SMR ETE project. Although a drinking-water source in use is being assessed here, the groundwater good-status limits are applied because they are either equal to or stricter than drinking-water limit values and also cover additional parameters not included in drinking-water requirements, such as phosphates and certain polycyclic aromatic hydrocarbons. Of the modeled values, the median values at Q₃₅₅ flow were used, again representing the most conservative case.

The results are summarized in [105] and show that, even using the most conservative values, only aluminum fails to meet the good-status limit. The current-status results for abstraction [105] show that aluminum could not be assessed because of the high limit of quantification. The relatively stringent aluminum limit applies to a filtered sample, and filtered groundwater aluminum values are significantly lower than unfiltered values. The current aluminum concentration can likewise be expected to be similar, because the SMR ETE contribution to aluminum concentrations is only 3.4%.

If future concentrations were calculated from the modeled shares for all monitored current-status parameters, the results would be similar: at Q₃₅₅ flow, the highest estimated SMR ETE share for nonradioactive parameters is 5.7%, for benzo[g,h,i]perylene, while all monitored

parameters that could be assessed reach no more than 30% of the limit. They are therefore unlikely to exceed it.

It may therefore be concluded that operation of the SMR ETE project will not cause deterioration of groundwater chemical status at the Kamýk nad Vltavou abstraction.

VHS Davle Hradištko groundwater abstraction

The abstraction area lies on the right bank of the Vltava near the river, downstream of Štěchovice Reservoir. The abstraction wells lie on the right bank of the Vltava and draw from a shallow aquifer in Quaternary sediments and the near-surface fractured zone of the bedrock. This is an existing groundwater source used to obtain drinking water for the public water supply [11]. In the most recent reporting year, 2024, the average abstraction rate was 3.2 l/s. Abstraction took place throughout the year. The maximum permitted abstraction rate was 5 l/s. The actual volume abstracted in 2024 was 100,742 m³. Abstraction has been taking place for many years. Annual abstraction volumes are also stable over the long term, with the quantity abstracted increasing over the past decade from 1.6 l/s in 2013 to 3.2 l/s in 2024. The hydrogeologic catchment, or hinterland, of the abstraction area on the right bank of the Vltava covers approximately 1.7 km². Groundwater recharge in this area is based on precipitation totals; long-term baseflow under dry conditions was based on the driest year in the 2010–2019 period. The map of long-term mean baseflow [112], meaning dynamic natural groundwater resources, prepared by the Czech Geological Survey, gives a baseflow of 0.81–1.0 l/s/km² for approximately the lower third, or western part, of the infiltration area of interest, and 0.61–0.8 l/s/km² under dry conditions, both for 1990–2010. For approximately the upper two-thirds, or eastern part, of the infiltration area of interest, baseflow according to the same source is 0.61–0.8 l/s/km², or 0.2–0.4 l/s/km² under dry conditions. This gives a median groundwater inflow of approximately 1.3 l/s from the abstraction-area hinterland, and only 0.73 l/s under dry conditions.

If groundwater is abstracted from the abstraction area at an average rate of 3.2 l/s, inflow of water infiltrated from the Vltava is approximately 1.9 l/s under normal mean conditions, representing 59% of the abstracted quantity, and up to 2.5 l/s under dry conditions, representing 78% of the abstracted groundwater quantity.

For the purpose of assessing the effect of the SMR ETE project on the VHS Davle Hradištko groundwater abstraction, the simplifying, conservative assumption may be made that only surface water will be abstracted.

The SMR ETE wastewater discharge will impair certain parameters of the quality of surface water infiltrating from the Vltava into groundwater. Changes in Vltava surface-water quality are modeled in study [8]. The described Štěchovice profile should be relevant to the site of interest; however, because only a minimum number of parameters were modeled at the Štěchovice profile, the upstream Kořensko profile was used. As with the proportion of infiltrated water, this is a conservative assumption because the Kořensko profile can be expected to be the most affected by the SMR ETE project. Although a drinking-water source in use is being assessed here, the groundwater good-status limits are applied because they are

4 Status of Surface Water Bodies and Groundwater Bodies

either equal to or stricter than drinking-water limit values and also cover additional parameters not included in drinking-water requirements, such as phosphates and certain polycyclic aromatic hydrocarbons. Of the modeled values, the median values at Q₃₅₅ flow were used, again representing the most conservative case.

The results correspond to the drinking-water source assessment, meaning that only aluminum fails to meet the limit. The current-status results for abstraction [105] show that aluminum was below the limit of quantification, which was equal to one-half of the limit, so the limit is not expected to be exceeded during operation of the SMR ETE project.

If future concentrations were calculated from the modeled shares for all monitored current-status parameters, the results would differ most for nitrates, which currently reach 98% of the limit. Because nitrate concentrations in surface water are significantly lower even at present, any future exceedance of the good-status limit, which is highly probable, would not be caused by operation of the SMR ETE project. All other monitored parameters that could be assessed reach no more than 25% of the limit, so they are not expected to exceed it.

It may therefore be concluded that operation of the SMR ETE project will not cause deterioration of groundwater chemical status at the VHS Davle Hradištko abstraction.

Assessment of operational effects on the chemical status of groundwater bodies

When the chemical status of groundwater bodies is assessed, status is first assessed at individual monitoring sites, then at the level of a groundwater-body working unit, and only then is the result aggregated to groundwater-body level. Chemical-status assessment is determined by the assessment results for individual parameters and their aggregation.

With respect to the chemical status of groundwater bodies, no significant input of relevant pollutants is expected around the construction site during construction or operation of the SMR ETE project. No significant groundwater abstraction area used for drinking-water purposes lies within the reach of changes in watercourse quality and flow caused by construction of the SMR ETE project. Pumping groundwater from the excavation and subsequently from beneath building foundations will have no effect on the chemical status of groundwater bodies.

Wastewater from the SMR ETE project is planned to be discharged into the Vltava at Kořensko through the shared outlet used by Units 1 and 2 and the New NPP ETE. As required by the assignment, the cumulative effect on groundwater bodies of surface-water abstraction and wastewater discharge from all three facilities was assessed for the section from Kořensko to the confluence of the Sázava and Vltava rivers. An analysis was conducted of the potential effects of wastewater discharge on groundwater abstraction areas within the reach of the discharge. The assessment found that existing significant groundwater sources used for drinking-water purposes will not be affected with respect to parameters determining the assessment of groundwater chemical status. Operation of the SMR ETE project will therefore not cause deterioration of groundwater chemical status at groundwater abstractions used for drinking-water purposes.

4 Status of Surface Water Bodies and Groundwater Bodies

Operation of the SMR ETE project will not impair the chemical status of the individual relevant groundwater abstractions used for drinking-water purposes. Because the individual abstractions are most sensitive to the effects of operation of the SMR ETE project, it follows that operation will not impair the chemical status of either the working units or the groundwater bodies.

Assessment of operational effects on the quantitative status of groundwater bodies

The quantitative-status assessment of groundwater bodies is based on a water-balance method, namely the ratio of actual abstractions to natural resources at the hydrogeologic-region level.

With respect to quantitative status, water will be pumped from the excavation during construction, and groundwater will be pumped from beneath building foundations during operation of the SMR ETE project. Given the scale of pumping and the extent of the cone of depression, the effect will be local only and will not affect the status of groundwater bodies. No significant groundwater abstraction area used for drinking-water purposes lies within the reach of changes in watercourse flow caused by construction and operation of the SMR ETE project. Consequently, groundwater abstraction areas used for drinking-water purposes that are relevant to the assessment cannot be affected in any way by the planned groundwater pumping.

As demonstrated above, operation of the SMR ETE project will have no significant effect on the quantitative status of groundwater bodies.

Assessment of whether good groundwater-body status will be achieved

Under the Water Framework Directive (2000/60/EC) [1], both chemical and quantitative status are assessed as either good or poor. Groundwater-body status is determined by whichever of the chemical- and quantitative-status assessments is worse.

Neither construction nor operation of the SMR ETE project will impair the chemical status of groundwater bodies. Neither construction nor operation of the SMR ETE project will have any significant effect on the quantitative status of groundwater bodies.

On the basis of the work performed and findings described above, it may be concluded that construction and operation of the SMR ETE project will not affect whether good status of groundwater bodies is achieved.

5 Summary

5.1 Surface waters

Surface-Water Quantity: Vltava River

The current surface-water quantity in the affected area can be characterized as stabilized by water management but sensitive to climate. The climatological data show a clear increase in air temperatures, while precipitation totals predominantly exhibit altitudinal and spatial variability without an equally clear long-term trend. Higher temperatures nevertheless increase evapotranspiration demand and change the relationship between precipitation and runoff. Flows may therefore decrease even where annual precipitation totals do not show a substantial decrease.

From a hydrologic perspective, the key finding of DP07 is that 2010–2023 had lower flows than 2003–2009. Annual flows in the main profiles decreased by approximately 15–19% between the two periods. The greatest differences occur in the spring months, particularly March and April, when lower precipitation, higher temperatures, and higher evapotranspiration act in combination. At the same time, it is confirmed that water-management infrastructure mitigates, but does not eliminate, these differences [4].

From the perspective of water-management-system operation, Lipno I and Hněvkovice are the principal stabilizing elements. Lipno I has substantially greater active storage and allows flows to be augmented at downstream Vltava profiles. Hněvkovice is the immediate raw-water source for the Temelín site and also a profile at which accurate water-balance assessment is particularly important. Kořensko is the downstream control profile incorporating the effects of the Vltava, the Lužnice, the incremental catchment, and discharges from the ETE site.

For the EIA Documentation, it is important that current conditions cannot be assessed solely from historical averages or solely from observed flows. The current 2010–2023 period, long-term climatological data, derived natural flows, reservoir operating data, and water-management-system modeling results must be combined. This combination is used in supporting documents DP20, DP20A, and DP07 and provides a consistent framework for the subsequent assessment of the effects of the SMR ETE project.

In summary, the current quantity of surface water in the area of interest is sufficient under normal and modeled current hydrologic conditions to meet existing water-management requirements, including minimum flows at the main control profiles. At the same time, trends and changes are apparent that reduce flows in the current period compared with the higher-flow reference period 2003–2009 and increase the importance of managing reservoir active storage. These facts constitute the baseline conditions for the subsequent assessment of project effects on surface-water quantity. In terms of surface-water quantity, the SMR ETE project represents an additional requirement for raw-water abstraction from the Hněvkovice waterworks and additional wastewater discharge at the Kořensko profile. In the cumulative 5,600 MWe plus SMR ETE scenario, total annual abstraction is 134.9 million m³ and total annual discharge is

5 Summary

30.0 million m³. The SMR ETE project itself accounts for approximately 8.9% of total abstraction and approximately 11.9% of total discharge.

Water-management modeling for current hydrologic conditions and warming of 2 °C demonstrates reliable abstraction for ETE and compliance with minimum-flow requirements downstream of the Lipno II, Hněvkovice, and Kořensko waterworks. Under these conditions, the effect of the SMR ETE project on surface-water quantity is not assessed as significantly adverse.

Under climate-change conditions, the overall assessment depends on the climate model used. For the EC-Earth3, MPI-ESM1-2-HR, and ALADIN-CLIMATE/CZ models, abstractions under scenario SSP2-4.5 are reliable for both 2060 and 2080. The TaiESM1 model, however, indicates a significant reduction in the reliability of abstractions and minimum flows, particularly by 2080. This result is an important limiting signal and indicates that under adverse climate development the total cumulative load on the water-management system, rather than the isolated contribution of the SMR ETE project, may be decisive.

In summary, under current conditions and most modeled future conditions, the SMR ETE project is compatible with the functioning of the Vltava water-management system in terms of surface-water quantity. At the same time, the assessment confirms the need to update hydrologic and climate data continuously and to monitor actual technological water-abstraction and discharge requirements during subsequent preparation stages and long-term project operation. Compared with the operating life, and potential climate-change development, the preparation period will be relatively short.

DP29 [7] confirms that, under current hydrologic conditions, the Vltava Cascade can meet the minimum-flow requirement at the Vrané waterworks profile and the minimum residual-flow requirement at the Prague-Chuchle profile for the assumed 5,600 MWe plus SMR ETE capacity scenario. The reliability of meeting these requirements is 99.9%, and under current conditions the SMR ETE project is not a limiting factor for the lower part of the cascade.

The uncertainty of climate models becomes significant under climate-change conditions. Under the more favorable or intermediate models, the reliability of meeting requirements remains predominantly very high. The most adverse model, TaiESM1, indicates a reduction in reliability below the recommended values, particularly for reference year 2080. This scenario is important as a limiting case for assessing system resilience.

The effect of the SMR ETE project on the Vltava Cascade therefore cannot be assessed in isolation. Its significance lies in increasing the cumulative water-abstraction requirement at the Temelín site. Under current conditions, this requirement is met by the water-management system; under adverse climate projections, however, it reduces the reserve available in reservoir active storage, particularly at Orlík and Slapy.

The EIA Documentation should therefore state that the effect of the SMR ETE project on the Vltava Cascade is acceptable under current hydrologic conditions, but its long-term assessment is conditional on regular updates of climate scenarios, hydrologic series, actual technological water requirements, and the operating assumptions governing Vltava Cascade operations. In

view of potential climate-change development, waterworks operating rules may also be reassessed in the future, for example by reducing the required flow, which would produce different reliability results. The effect of the project itself would essentially be negligible because climate change would be the dominant influence.

Surface-water quality – Vltava

Data on selected nonradioactive parameters and temperature available for the area of interest were processed to describe current surface-water quality in 2015–2024 in terms of legislative requirements, specifically Government Decree No. 401/2015 Coll. [14], covering the general assessment of permissible surface-water pollution and use for drinking-water treatment and bathing; the assessment of the ecological potential of flowing or standing surface-water bodies, specifically the good/moderate potential boundary for the relevant water-body type [18, 23, 25]; and requirements for the protection of waters suitable for fish life and reproduction [12].

The range of parameters monitored differs among profiles, and data are missing at some profiles, so the assessment is limited by data availability at each profile. With respect to Government Decree No. 401/2015 Coll. [14], the requirements were reliably met for temperature, N_{total} , $N\text{-NO}_3^-$, $N\text{-NO}_2^-$, $N\text{-NH}_4^+$, DS_{105} , Cl^- , SO_4^{2-} , Mg, Ca, benzo[k]fluoranthene, dissolved Ni, phenanthrene, pyrene, EDTA, Al, metolachlor and its metabolites, and terbuthylazine and its metabolites. Attainment or exceedance of the requirements at least at one profile was identified for pH, dissolved oxygen, BOD_5 , COD_{Cr} , TOC, P_{total} , SS_{105} , fluoranthene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, AOX, and alachlor metabolites. The assessment shows that attainment or exceedance of requirements for many parameters occurs not only in the catchment affected by the existing Units 1 and 2 and, in the future, by the SMR ETE project and New NPP ETE, but also at reference profiles upstream of the affected area. From this perspective, the most problematic tributary is the Lužnice, assessed at the Lužnice-Bechyně profile. With respect to requirements for the protection of waters suitable for fish life and reproduction [12], attainment or exceedance of the requirements was assessed for $N\text{-NH}_4^+$, or NH_4^+ , and dissolved oxygen. Assessment of temporal development in 2015–2024 identified no statistically significant trend in temperature or in the concentrations of BOD_5 , $N\text{-NO}_3^-$, SS_{105} , benzo[a]pyrene, Al, or terbuthylazine and its metabolites. Improvement, meaning decreasing concentrations over time, or increasing concentrations in the case of oxygen, was assessed at least at one profile for pH, oxygen, $N\text{-NH}_4^+$, SO_4^{2-} , Ca, fluoranthene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, AOX, phenanthrene, pyrene, EDTA, and alachlor metabolites. Conversely, deterioration, meaning a significant upward trend in values or a downward trend in the case of oxygen, was identified at least at one profile in 2015–2024 for pH, oxygen, COD_{Cr} , TOC, P_{total} , N_{total} , $N\text{-NO}_2^-$, $N\text{-NH}_4^+$, DS_{105} , Cl^- , SO_4^{2-} , Mg, Ca, dissolved Ni, and metolachlor and its metabolites.

Data on selected radioactivity parameters available for the area of interest were processed to describe conditions in 2015–2024 in terms of the legislative requirements of Government Decree No. 401/2015 Coll. [14]. The significant radioactivity parameters α , $c\beta$, $c\beta$ - ^{40}K , ^{137}Cs , ^{90}Sr , and ^3H were assessed. The range of parameters monitored differs among profiles, and data

5 Summary

are missing at some profiles, so the assessment is limited by data availability at each profile. With respect to Government Decree No. 401/2015 Coll. [14], the requirements were reliably met for all parameters assessed. Assessment of temporal development identified no statistically significant trend in activity concentrations for $c\beta$ - ^{40}K . Improvement, meaning a decrease in activity concentrations during the period monitored, was assessed at least at one profile for $c\alpha$, ^{137}Cs , ^{90}Sr , and ^3H . Conversely, a significant upward trend in values during the period monitored was identified for $c\beta$ at the Hněvkovice downstream profile.

The effect of operation of the SMR ETE project on surface-water quality was estimated for concurrent operation with the existing Units 1 and 2 and, where applicable, the New NPP ETE, resulting in two capacity scenarios:

1. SMR ETE + Units 1 and 2
2. SMR ETE + Units 1 and 2 + two 1 700 MWe New NPP ETE units

For both scenarios, the effect of operation of the SMR ETE project was modeled at critical profiles for two hydrologic situations:

1. “Normal flow”: long-term mean flow (Q_a) was used for the modeling
2. “Drought, effect of climate change”: flow Q_{355} was used for the modeling

In addition, maximum or minimum values were modeled at the profile downstream of Kořensko Reservoir using the minimum guaranteed flow (Q_{guar}).

The modeling was also conducted for two discharge scenarios:

1. Average Discharge.
2. Maximum Discharge

At the profile downstream of Kořensko Reservoir, immediately downstream of the project wastewater outfall, the modeled average concentrations were assessed as failing for organic-matter and oxygen-regime parameters (BOD_5 , COD_{Cr} , TOC), P_{total} in terms of bathing-water requirements, and PAH parameters (fluoranthene, benzo[a]pyrene), for both capacity scenarios and both flow situations (Q_a and Q_{355}). In terms of maximum values, additional PAH parameters failed to meet the requirements: benzo[b]fluoranthene, benzo[g,h,i]perylene, and also benzo[k]fluoranthene for capacity scenario 2, together with pH. It should be noted that inflow from the Lužnice is the principal contributor to this pollution of the Vltava at the downstream Kořensko profile, particularly under normal flow conditions.

Another profile assessed was the Zvíkovský Bridge profile on Orlík Reservoir, which is the representative profile for water body HVL_1055_J – Orlík I Reservoir on the Vltava. Only a limited range of data was available at this profile, so it was not possible to model project effects for all parameters. Of the parameters modeled, TOC and P_{total} remain problematic for both capacity scenarios and both flow situations (Q_a and Q_{355}).

The Solenice profile was assessed with respect to surface-water abstraction for drinking-water purposes. From this perspective, TOC remains problematic for both capacity scenarios and both flow situations (Q_a and Q_{355}).

Another critical profile was Kamýk nad Vltavou. This is the representative profile for water body DVL_0030 – Vltava from the Orlík Reservoir dam to the backwater of Slapy Reservoir. The modeled concentrations failed to meet the requirements for good ecological potential of the water body for both total phosphorus and phosphate phosphorus, under both capacity scenarios and both flow situations (Q_a and Q_{355}).

The final profile assessed was Štěchovice, where salmonid waters occur. Modeled concentrations exceeded the requirement for $N-NH_4^+$ for both capacity scenarios and both flow situations (Q_a and Q_{355}). The project contribution to the $N-NH_4^+$ load is insignificant.

Overall, at the profile downstream of Kořensko Reservoir and at other critical profiles farther downstream along the affected Vltava, water quality fails to meet legislative values derived from different types of requirements. The existing surface-water quality, particularly polluted water from the Lužnice, is the decisive influence. The SMR ETE contribution to this pollution is very small: wastewater from the SMR ETE project accounts for tenths of a percent to several percent of the mass flow of the assessed parameters in the receiving water.

In summary, under both capacity scenarios the receiving water meets the legislative requirements for radioactivity parameters in both flow situations (Q_a and Q_{355}). The exception is tritium, which fails to meet the indicative value for water intended for drinking-water use at the Solenice profile under the adverse combination of maximum discharge and climate-change flow conditions, meaning low flows. This problem may also be reflected farther downstream at the Prague-Podolí profile. Modeling of maximum activity concentrations showed that they will not normally fail to meet the requirements at the profile downstream of Kořensko Reservoir. Concurrent discharges from the individual components of the assessed capacity scenarios must nevertheless be coordinated, and the flow situation in the receiving water must be taken into account, to prevent the extreme simultaneous occurrence of a very low receiving-water flow and discharge of the maximum permitted instantaneous quantity of these parameters.

For the future, supplementary surface-water quality monitoring may also be recommended for assessing the effects of the SMR ETE project.

Minor watercourses around the SMR ETE project

Of the minor watercourses, Strouha Stream and Dvůrkický Stream may be affected.

Strouha Stream will be the main receiving water for stormwater and pumped groundwater drained from the SMR ETE site. These waters will enter Strouha Stream through the safety basins between Libívský and Mlýnský fishponds. Downstream of the outfall, these waters will affect both the quantity, or flow, and the quality of Strouha Stream.

The anticipated quantity of stormwater and pumped groundwater from the entire SMR ETE site is up to 238,000 m³/year; from all three parts of ETE, namely Units 1 and 2, the New NPP ETE, and the SMR ETE project, it may reach up to 759,000 m³/year. Conveyance of some of this water to Dvůrkice Pond and Dvůrkický Stream is currently being considered. The quantities currently discussed average approximately 1.2 l/s of stormwater and 1 l/s of groundwater, or

5 Summary

2.2 l/s in total. Most water drained from the site will nevertheless continue to be directed to Strouha Stream. Based on the above, the average flow in Strouha downstream of the drained-water outfall may be expected to increase by approximately 5.3 l/s compared with the current flow of approximately 13 l/s.

As regards the current qualitative parameters of these drained waters, they meet the requirements of Government Decree No. 401/2015 Coll. for most parameters. [14] However, their quality is slightly impaired for certain parameters, specifically total phosphorus, SS₁₀₅, ammoniacal nitrogen, TOC, and PAHs. Because no significant change is expected in the composition of the drained water compared with the current situation, namely water drained from Units 1 and 2, and only its quantity will increase, no fundamental change in the quality of water in Strouha Stream is expected. The total input of substances to the receiving water may nevertheless increase.

In addition to the drained-water outfall, minor watercourses around the SMR ETE project may be affected by lowered groundwater levels caused by pumping and reduced precipitation infiltration. The headwater areas of both watercourses, Strouha Stream and Dvorčický Stream, lie immediately adjacent to the SMR ETE site, where the streams flow from Karlovec Pond and Dvorčice Pond, respectively. Groundwater inflow accounts for a decisive share of water inflow to these fishponds and will be reduced by the lowering of groundwater levels.

This effect on Karlovec Pond and Strouha Stream flowing from it is only indirect and partial; for Dvorčice Pond and Dvorčický Stream, this factor is decisive. Weakening the natural headwater area upstream of Dvorčice Pond as a result of construction of the SMR ETE project would jeopardize the very existence of Dvorčice Pond and of Dvorčický Stream, which it supplies. Controlled augmentation of Dvorčice Pond and Dvorčický Stream with water drained from the SMR ETE site at an average rate of 2.2 l/s appears to be essential to preserving their ecological functions.

A historic millrace runs through the municipality of Kočín and connects Dvorčický Stream with the Dříteňský Stream catchment. At higher flows resulting from the conveyance of some stormwater and groundwater from the SMR ETE site, this millrace could be used to supply the fishpond system near Dříteň.

No systematic data are available on water quality in Dvorčice Pond, Dvorčický Stream, or the millrace in Kočín, so only short-term, limited monitoring conducted for the study could be used. This monitoring showed that current water quality in the Dvorčický Stream catchment is good. Groundwater from the SMR ETE site that could be used to augment Dvorčice Pond and Dvorčický Stream is suitable in terms of quality. Stormwater, including runoff from the site, may nevertheless have impaired quality with respect to phosphorus, nitrogen, and TOC. Measures are therefore required to prevent deterioration of water quality in Dvorčice Pond and the connected watercourses, Dvorčický Stream and the millrace through Kočín. These may include an upstream retention basin within the SMR ETE site and oil separators.

Furthermore, given the lack of flow and water-quality data for the minor watercourses affected by the SMR ETE project, systematic monitoring of both water quantity and quality in these watercourses should be recommended.

Several biocenters and biocorridors forming part of the territorial system of ecological stability are designated along both watercourses, Strouha Stream and Dvorčický Stream. Under the scenario without conveyance of groundwater and stormwater to Dvorčický Stream, the anticipated effects of construction and operation of the SMR ETE project will include a significant reduction in surface-water and groundwater runoff, with a significant adverse effect on the functioning of the local territorial system of ecological stability. Under the scenario involving controlled augmentation of the Dvorčický Stream catchment with the recommended quantity of water, runoff will not decrease compared with current conditions and the function of the biocorridors and biocenters will be preserved for aquatic organisms during most of the year. Suitable measures are similarly recommended to compensate for the adverse effect on Karlovec Pond and the upper reach of Strouha Stream.

Status of surface-water bodies

The assessment of the effect of operation of the SMR ETE project on the status or potential of affected surface-water bodies focused on the Vltava downstream of the discharge point at Kořensko, including the reservoirs of the Vltava Cascade: Orlík, Kamýk, Slapy, and Štěchovice. This section contains a total of six water bodies.

According to the current water-body status assessment under the third planning cycle [9, 10], the status of most of these water bodies is assessed as failing. The only exception is the status of the Slapy Reservoir on the Vltava SWB (DVL_0095_J), which is assessed as good. The other water bodies fail because they do not achieve good ecological status/potential, which is attributable, in addition to the biological quality elements, primarily to P_{total} and, in some cases, O_2 saturation or temperature.

The assessment of the effect of the SMR ETE project on surface-water-body status was based on a study prepared in 2025 [8], which modeled concentrations of selected substances in the receiving water for wastewater from the SMR ETE project. Two capacity scenarios were modeled: concurrent operation of the SMR ETE project and the existing Units 1 and 2, and concurrent operation of the SMR ETE project, Units 1 and 2, and the future New NPP ETE. Two hydrologic situations were assessed for these scenarios: normal flow (Q_a) and climate-change-affected dry conditions (Q_{355}). The modeling used mean- and maximum-substance-discharge scenarios based on the available data.

The modeling results show that the contribution of the SMR ETE project itself to the total load in the receiving waters is generally very small. For P_{total} , which is critical to the failure of water bodies to achieve good status, the project contribution at Kořensko accounts for only 0.5–2.4% of the total mass flow at the profile downstream of Kořensko Reservoir. When the project is assessed concurrently with the other parts of ETE, the P_{total} input ranges from 2.3% for SMR ETE plus Units 1 and 2 at Q_a and average discharge to 18.2% for SMR ETE plus Units 1 and 2

5 Summary

plus the New NPP ETE at Q₃₅₅ and maximum discharge. The background, meaning the mass flow conveyed by the Vltava and Lužnice, accounts for the dominant share of pollution and represents 81.8–97.7% of the total load. The effect on temperature and O₂ saturation is minimal; current adverse values for these parameters primarily result from reservoir operations in the Vltava Cascade.

Of the specific pollutants, particular attention is paid to tritium, which is also the key parameter for effects on the receiving water in terms of radioactivity. For tritium, however, the modeled activity concentrations remain well below the annual-average environmental quality standard (EQS-AA = 1,000 Bq/l). At the profile downstream of Kořensko Reservoir, the SMR ETE contribution for the other specific pollutants assessed is several percent, below 4%. When the project is assessed concurrently with the other parts of ETE, the highest contribution is 28%, for AOX from SMR ETE plus Units 1 and 2 plus the New NPP ETE at Q₃₅₅. The background, meaning the mass flow conveyed by the Vltava and Lužnice, remains the greatest source of pollution. Further dilution downstream will reduce the contribution of the discharge further, so it will not cause a failure to achieve good status in terms of specific pollutants in the downstream water bodies either.

The effect of the SMR ETE project on chemical-status parameters is likewise assessed as very small, contributing up to 6% of the total mass flow at the profile downstream of Kořensko Reservoir. When assessed concurrently with the other parts of ETE, the maximum contribution is 38%, for benzo[g,h,i]perylene from SMR ETE plus Units 1 and 2 plus the New NPP ETE at Q₃₅₅. In addition to benzo[g,h,i]perylene, inputs of other PAHs are also non-negligible. They arise when PAHs are scrubbed from the atmosphere into cooling water in the cooling towers and subsequently discharged to the receiving water as wastewater in the blowdown. Even so, the background pollution mass flow from the Vltava and Lužnice predominates over the input from the SMR ETE project, including when the project operates concurrently with the other parts of ETE.

Operation of the SMR ETE project, either alone or concurrently with other parts of ETE, namely Units 1 and 2 or the New NPP ETE, will therefore have no significant adverse effect on future achievement of good status in the affected surface-water bodies. Most of these bodies already fail to achieve good status, and the main cause must be sought in the catchment upstream of the project. In connection with the assessment of project effects on water status, the lack of data on specific pollutants and chemical-status parameters in the affected water bodies should also be noted. Expanded monitoring of at least selected parameters would clearly improve future knowledge of ETE's effect on surface-water status.

5.2 Groundwater

Groundwater quantity and quality

On the basis of available data for 2009–2024, current groundwater quantity and quality in the area around the SMR ETE project can be assessed as stable over the long term. The area of

interest is well defined hydrogeologically in relation to earlier regional and detailed groundwater-flow models for the Temelín site. The SMR ETE project is located in crystalline rocks, where groundwater flow is associated with weathered and fracture-permeable zones in the rock mass. The principal flow directions are determined by the terrain morphology and run from the elevation of the ETE site toward local drainage bases, particularly Dvůrčický Stream.

The groundwater monitoring network provides an adequate basis for assessing current conditions. The long time series from the original wells are supplemented by newer B-series and HG-series wells, of which the HG wells are particularly important for direct monitoring of the SMR ETE site. Although the existing network allows current conditions to be assessed effectively, it should be expanded for comprehensive project monitoring after commissioning.

The groundwater-level regime is stable. Level fluctuations correspond to natural seasonality, precipitation conditions, and local operational interventions. Groundwater levels exhibited a slight downward trend in 2009–2024, caused primarily by the dry period of 2014–2019. Since 2020, levels have stabilized and in some places risen slightly in response to years with more favorable precipitation. No changes indicating significant disturbance of the hydrogeologic regime were identified.

Groundwater quality with respect to nonradioactive parameters is stable over the long term. The natural chemistry is consistent with a crystalline-rock environment and is typically characterized by soft water, lower dissolved-solids content, elevated iron and manganese, and locally lower hardness. Anthropogenic effects occur locally, particularly as elevated chemical oxygen demand and, in some places, chlorides, C₁₀–C₄₀ hydrocarbons, ammonium ions, or certain metals and metalloids around landfills. These findings are consistent with the long-term characteristics of the specific sites, are not assessed as environmentally significant, and represent stable conditions. No adverse effect of operating Units 1 and 2 on the chemical composition of groundwater was demonstrated.

Groundwater radioactivity parameters show no significant values or trends indicating a material adverse effect from the power plant. During the period assessed, tritium and cesium-137 were predominantly below the detection limit or at very low measurable levels. The tritium values identified are far below the screening indicative value used for water intended for human consumption.

No officially designated water-source protection zones used for public water supply are registered in the area of interest. Significant regional public water-supply sources serving the surrounding municipalities lie beyond the reach of flow from ETE. Registered local abstractions are limited and concern shallow groundwater circulation in crystalline rocks. Individual small wells may be present in the area but are not included in the central register if they do not reach the statutory abstraction thresholds.

Overall, the current groundwater quantity and quality in the area around the SMR ETE project can be concluded to be stable and well monitored. The available data indicate no significant adverse condition or trend in the level regime or the chemical or radiological quality of groundwater. For subsequent preparation stages and any implementation of the SMR ETE

project, it is essential to maintain and develop the monitoring system, focus on flow directions from the project site toward local drainage bases, harmonize the range of parameters monitored, and verify continuously the technical condition of wells to be used for long-term assessment of project effects.

The SMR ETE project can be considered feasible with respect to groundwater, provided that the proposed technical, operational, adaptation, and monitoring measures are implemented. The most important measures include retaining pumped groundwater within the Dvorčický Stream catchment, considering controlled conveyance of some stormwater to Dvorčice Pond, potentially also providing partial support to Karlovec Pond, and ensuring continuous groundwater and surface-water monitoring.

Overall, the identified effects of the SMR ETE project on groundwater quantity and quality will be predominantly local and technically manageable. The most sensitive issue is not a threat to public water-supply sources but preservation of the local water balance of Dvorčice Pond and Dvorčický Stream. Some augmentation of inflows to Karlovec Pond is also recommended, particularly in combination with future climate-change effects. Implementation of the recommended measures can minimize adverse effects and preserve the function of the affected aquatic and ecological features in the area.

Status of groundwater bodies

An assessment was conducted of the potential effect of construction and operation of the SMR ETE project on groundwater-body status. Both the quantitative and chemical status of groundwater bodies and the potential risks and effects of any deterioration in groundwater-body status were assessed.

The quantitative-status assessment of groundwater bodies is based on a water-balance method. The study found that neither construction nor operation of the SMR ETE project will have any significant effect on the quantitative status of groundwater bodies. Construction and operation of the SMR ETE project will likewise not impair the chemical status of the individual relevant groundwater abstractions used for drinking-water purposes. Because the individual abstractions are most sensitive to the effects of operation of the SMR ETE project, it follows that operation will not impair the chemical status of either the working units or the groundwater bodies. On the basis of the work performed and the findings, it may be concluded that construction and operation of the SMR ETE project will not affect whether good status of groundwater bodies is achieved.

5.3 Response to requirements arising from the EIA screening conclusion

10) With respect to surface water and groundwater, prepare:

- a) a comprehensive assessment of the project's effects on the water regime, always including the combined effects of the existing ETE units and the planned New Nuclear Power Plant at the Temelín site (hereinafter the “New NPP ETE”), in all phases of project implementation (construction, operation, and decommissioning), also taking account of the anticipated effects of ongoing climate change;*

A comprehensive assessment of the project's effects on the surface-water regime in terms of quantity was conducted in relation to the Vltava and the connected water-management system. The assessment focuses particularly on raw-water abstraction from the Hněvkovice waterworks, discharge of some of the abstracted water back to the river at Kořensko, maintenance of minimum flows, and use of reservoir storage functions. The SMR ETE project is not assessed in isolation but as part of the cumulative water-management configuration of the Temelín site, meaning in combination with the existing Units 1 and 2 and the proposed New NPP ETE. This satisfies the requirement to assess the project in the broader water-management context and in relation to other significant surface-water-use requirements at the site.

Of the individual implementation phases, operation is decisive for surface-water quantity because it involves long-term water abstraction from the Hněvkovice waterworks and wastewater discharge at Kořensko. During construction and decommissioning, predominantly temporary changes in water-management requirements and runoff conditions may be expected. These phases must therefore be managed organizationally and technically to prevent adverse effects on minimum flows or disruption of water-management-system function. During decommissioning, operational requirements for abstraction and discharge may generally be expected to decrease gradually; controlled and supervised water management will nevertheless remain essential.

The direct quantitative effect of the project is determined primarily by the difference between abstraction and discharge, its seasonal distribution, and the system's ability to augment flows from stored water. The decisive factor is therefore not simply the absolute abstraction quantity, but the overall balance between the Hněvkovice abstraction profile and the Kořensko profile, including the fact that some abstracted water is returned to the Vltava farther downstream. The assessment is therefore based on modeling of the managed water-management system, not merely on a simple comparison of abstraction with long-term flow.

Under current hydrologic conditions, high reliability of water abstractions and minimum flows was demonstrated for the cumulative 5,600 MWe plus SMR ETE scenario. Water-management modeling indicates that the system can meet abstraction and minimum-flow requirements under current conditions. This reliability, however, results from managed use of active storage, particularly at Lipno I and Hněvkovice reservoirs. Under current conditions, the project therefore has no significantly adverse effect on surface-water quantity, but it increases the cumulative water requirement and thereby reduces the system's operating reserve.

Climate-change effects were taken into account through current hydrologic conditions, a sensitivity scenario involving warming of 2 °C, and SSP2-4.5 scenarios for reference years 2060 and 2080. The results show that, in most modeled future scenarios, abstraction and minimum-flow requirements continue to be met reliably or at an acceptable level. The most adverse climate scenarios nevertheless indicate a potential reduction in reliability, particularly when low flows, higher evapotranspiration demand, and the cumulative requirements of the Temelín site coincide. These results should therefore be understood as indicating the system's climate sensitivity and the need for continuous updating of hydrologic and climate data.

From the perspective of the wider Vltava Cascade, the project is assessed as acceptable under current hydrologic conditions. The assessment confirms that the minimum flow at the Vrané waterworks profile and the minimum residual flow at the Prague-Velká Chuchle profile are maintained with high reliability under the assumed cumulative scenario. In the long term, however, adverse climate development may reduce the reserve available in reservoir active storage, particularly at Orlík and Slapy. The resulting effect therefore cannot be attributed solely to the SMR ETE project but must be understood as the combined effect of climate development, catchment flow conditions, the operating options of the Vltava Cascade, and the cumulative requirements of the entire Temelín site.

b) an assessment of the effect of the planned surface-water abstraction from the major Vltava watercourse on the affected surface-water bodies, including hydrologic relationships with upstream and downstream bodies, with emphasis on effects on the natural hydrologic regime;

Assessment of the ecological status of surface-water bodies in accordance with the Water Framework Directive [1] also includes assessment of the hydromorphologic quality element, which, for river-category bodies, includes assessment of the impact of anthropogenic pressures on the natural hydrologic regime. Under the Water Framework Directive [1], hydromorphology is a supporting element in ecological-status assessment; the status of biological elements is decisive. For surface-water bodies designated as heavily modified, ecological potential is assessed instead of ecological status. In simplified terms, this means that the requirements for achieving good status or potential may be adjusted, or reduced, in view of the water use for which the bodies were designated as heavily modified.

Seven river-category water bodies are designated along the Vltava between Lipno I and Prague-Velká Chuchle. Except for body HVL_0140, Vltava from Větší Vltavice to the Polečnice/Kájovský Stream, where hydrologic-regime status is classified as good, the hydrologic regime of these bodies is classified as moderate or worse, the lowest category.

Surface-water abstraction and water storage or flow augmentation are always associated with modification of the natural flow regime. Increased water-abstraction requirements for ETE will lead to greater flow augmentation in the Lipno I to Hněvkovice Reservoir section. They should therefore have no adverse effect on the ecological status of water bodies in this section. Flows will decrease in the Vltava section downstream of Kořensko. However, given the low ratio of the increased water-abstraction requirements for ETE to the long-term flow characteristics at

Kořensko and farther downstream along the Vltava, the effect on ecological status in this section can likewise be expected to be insignificant. For dry conditions, the studies assessed the reliability of the required minimum flows at the Kořensko, Vrané, and Prague-Velká Chuchle profiles.

c) a water-management assessment of the project's effects on the purposes and functions of the Vltava Cascade waterworks, including their filling and drawdown regimes, with regard to all purposes for which the reservoirs are used;

Increased water abstraction for ETE relates to maintaining the storage function of Lipno I, Hněvkovice, Orlik, and Slapy reservoirs. Maintaining water abstractions and minimum flows is the primary purpose of these reservoirs and was addressed in the studies listed in Sections 2.1.2 and 2.1.3. Other related purposes are maintaining reservoir levels for recreation and navigation and operating hydroelectric power plants. For Lipno I Reservoir, the studies also assessed the reliability of maintaining the recreational water level. With respect to operation of the hydroelectric power plant at this reservoir, increased abstraction requirements do not reduce total reservoir outflow. However, the need for greater use of active storage to maintain water abstractions for ETE may reduce the scope for discretionary operations and consequently the ability to optimize power-plant operation. Flows will decrease in the Vltava section downstream of Kořensko. However, given the low ratio of the increased water-abstraction requirements for ETE to the long-term flow characteristics at Kořensko and farther downstream, the increased abstractions for ETE cannot be expected to have a significant effect on maintaining water levels for recreation and navigation or on the operation of hydroelectric power plants. The studies, see Section 2.1.3, indicate that any adverse effect on the storage function of Orlik and Slapy reservoirs could be caused to a greater extent by the effect of climate change on Vltava flows.

d) an assessment of the effect of discharging process wastewater and treated domestic wastewater into the major Vltava watercourse, including quantitative and qualitative characterization of the discharged water, with regard to physicochemical and radiochemical parameters and an assessment of the potential occurrence of radioactive substances;

The estimated effect of operation of the SMR ETE project is described in detail in Section 2.2.2. The estimate was prepared for concurrent operation with the existing Units 1 and 2 and, where applicable, the New NPP ETE, resulting in two capacity scenarios:

1. SMR ETE + Units 1 and 2
2. SMR ETE + Units 1 and 2 + two 1 700 MWe New NPP ETE units

For both scenarios, the effect of operation of the SMR ETE project was modeled at critical profiles for two hydrologic situations:

1. “Normal flow”: long-term mean flow (Q_a) was used for the modeling
2. “Drought, effect of climate change”: flow Q_{355} was used for the modeling

5 Summary

In addition, maximum or minimum values were modeled at the profile downstream of Kořensko Reservoir using the minimum guaranteed flow (Q_{guar}).

The modeling was also conducted for two discharge scenarios:

1. Average Discharge.
2. Maximum Discharge

The effect of the SMR ETE project on surface-water quality was estimated for the following critical profiles:

- Downstream of Kořensko water reservoir: non-radiological parameters, including temperature; radioactivity parameters;
- Orlík water reservoir, Zvíkov Bridge: non-radiological parameters, including temperature; radioactivity parameters;
- Solenice: non-radiological parameters, including temperature; radioactivity parameters;
- Kamýk nad Vltavou: non-radiological parameters, including temperature;
- Štěchovice: non-radiological parameters, including temperature; radioactivity parameters.

The effect of tritium on the watercourse was also assessed at the Podolí and Hřensko profiles.

At the profile downstream of Kořensko Reservoir, immediately downstream of the project wastewater outfall, the modeled average concentrations were assessed as failing for organic-matter and oxygen-regime parameters (BOD_5 , COD_{Cr} , TOC), P_{total} in terms of bathing-water requirements, and PAH parameters (fluoranthene, benzo[a]pyrene), for both capacity scenarios and both flow situations (Q_a and Q_{355}). In terms of maximum values, additional PAH parameters failed to meet the requirements: benzo[b]fluoranthene, benzo[g,h,i]perylene, and also benzo[k]fluoranthene for capacity scenario 2, together with pH. It should be noted that inflow from the Lužnice is the principal contributor to this pollution of the Vltava at the downstream Kořensko profile, particularly under normal flow conditions.

Another profile assessed was the Zvíkovský Bridge profile on Orlík Reservoir, which is the representative profile for water body HVL_1055_J – Orlík I Reservoir on the Vltava. Only a limited range of data was available at this profile, so it was not possible to model project effects for all parameters. Of the parameters modeled, TOC and P_{total} remain problematic for both capacity scenarios and both flow situations (Q_a and Q_{355}).

The Solenice profile was assessed with respect to surface-water abstraction for drinking-water purposes. From this perspective, TOC remains problematic for both capacity scenarios and both flow situations (Q_a and Q_{355}).

Another critical profile was Kamýk nad Vltavou. This is the representative profile for water body DVL_0030 – Vltava from the Orlík Reservoir dam to the backwater of Slapy Reservoir. The modeled concentrations failed to meet the requirements for good ecological potential of the water body for both total phosphorus and phosphate phosphorus, under both capacity scenarios and both flow situations (Q_a and Q_{355}).

The final profile assessed was Štěchovice, where salmonid waters occur. Modeled concentrations exceeded the requirement for N-NH_4^+ for both capacity scenarios and both flow situations (Q_a and Q_{355}). The project contribution to the N-NH_4^+ load is insignificant.

Overall, at the profile downstream of Kořensko Reservoir and at other critical profiles farther downstream along the affected Vltava, water quality fails to meet legislative values derived from different types of requirements. The existing surface-water quality, particularly polluted water from the Lužnice, is the decisive influence. The SMR ETE contribution to this pollution is very small: wastewater from the SMR ETE project accounts for tenths of a percent to several percent of the mass flow of the assessed parameters in the receiving water.

In summary, under both capacity scenarios the receiving water meets the legislative requirements for radioactivity parameters in both flow situations (Q_a and Q_{355}). The exception is tritium, which may exceed the indicative value for water intended for drinking-water use at the Solenice profile under the adverse combination of maximum discharge and climate-change flow conditions, meaning low flows. This problem may also be reflected farther downstream at the Prague-Podolí profile. Modeling of maximum activity concentrations showed that they will not normally fail to meet the requirements at the profile downstream of Kořensko Reservoir. Concurrent discharges from the individual components of the assessed capacity scenarios must nevertheless be coordinated, and the flow situation in the receiving water must be taken into account, to prevent the extreme simultaneous occurrence of a very low receiving-water flow and discharge of the maximum permitted instantaneous quantity of these parameters.

e) an assessment of the effect of the planned conveyance of stormwater to minor watercourses, particularly Strouha Stream, focusing on potential effects on receiving-water quality and taking account of the obligations under Section 5(3) of Act No. 254/2001 Coll., on Waters (the Water Act), as amended;

The hydrogeologic conditions at the SMR ETE site are unfavorable for stormwater infiltration. Infiltration would be neither a safe nor an appropriate stormwater management method and could conflict with engineering requirements for protecting deep-founded structures, particularly the reactor building. Other stormwater management methods must therefore be preferred, particularly retention, potential use, and controlled discharge to surface waters, where the water could have a positive effect on stabilizing hydrological conditions in local watercourses and reservoirs. This is described in detail in Section 3.3.

The effect of conveying stormwater to minor watercourses was addressed in Section 0 of this study. Strouha Stream is currently used to convey pumped groundwater and stormwater from the Units 1 and 2 site in a quantity of approximately 316,000 m³/year, averaging 10 l/s. The anticipated quantity of stormwater and pumped groundwater from the entire SMR ETE site is up to 238,000 m³/year. During operation of the SMR ETE project, water from within the fenced SMR ETE site is expected to be conveyed to Strouha Stream together with water conveyed from the Units 1 and 2 site and, where applicable, the New NPP ETE site. For this purpose, a retention basin at the northeastern corner of the SMR ETE site and the existing storm sewer should be used. If water from the outer SMR ETE site is conveyed to Dvůrčice Pond and

Dvorčický Stream, the average outflow to Strouha Stream should increase by approximately 6.3 l/s compared with the current situation.

As regards the current qualitative parameters of this conveyed water, it meets the requirements of Government Decree No. 401/2015 Coll. for most parameters. In Strouha Stream, however, the quality is slightly impaired for certain parameters, particularly total phosphorus, SS₁₀₅, ammoniacal nitrogen, TOC, and PAHs, as shown by the available data supplemented by monitoring conducted for this study. The input of these substances may adversely affect eutrophication in the affected surface waters. Because no significant change in the composition of the discharged waters is anticipated, only an increase in their quantity, no fundamental change in water quality in the Strouha is expected. However, an increase in the total substance load entering the receiving water may be expected in view of the increased discharge. Expansion of systematic monitoring of water quantity and quality in the affected watercourses should be recommended.

f) an assessment of the effect of expanding the system of drainage wells for artificially lowering the groundwater level, particularly in terms of potential effects on the possible use of groundwater as a drinking-water source in the wider area.

A significant intervention in the area's water regime will be the lowering of the groundwater level in the excavation for construction of the reactor building, followed by permanent lowering beneath its foundations, as currently occurs on the adjacent Units 1 and 2 site using OTKA-series wells. To minimize the effect on the water balance of the affected catchment, support flows in Dvorčický Stream, and preserve the important habitat of Dvorčice Pond, this water should be retained within the relevant catchment.

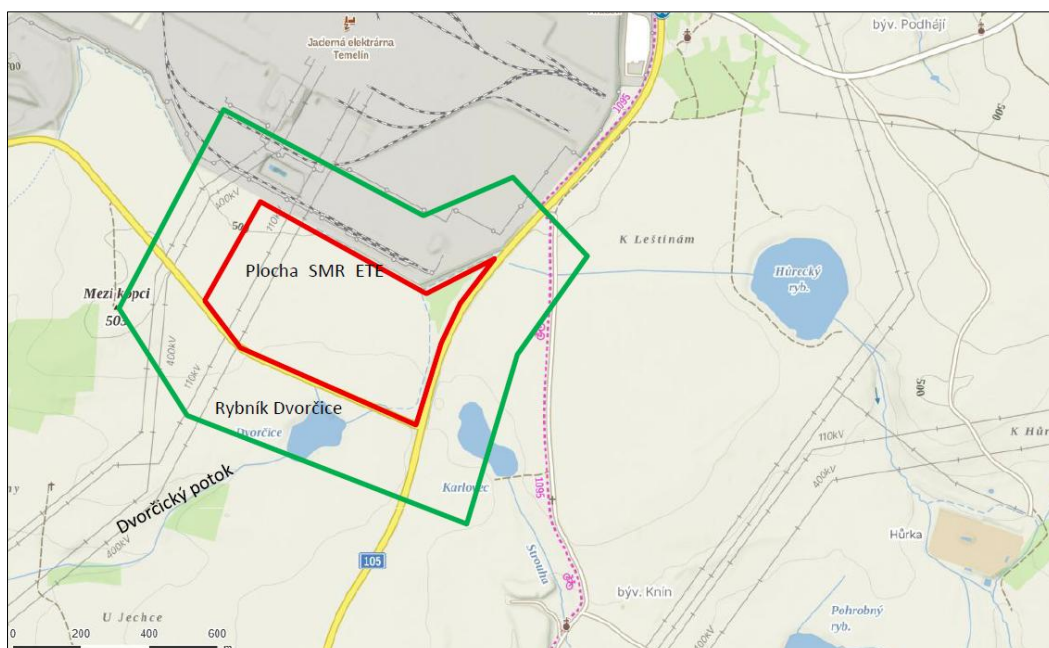
After conditions stabilize, average inflows are estimated at approximately 1.5–2 l/s. This intervention and development of the site will reduce stormwater infiltration into groundwater within the cone of depression. All findings to date indicate that the effects of artificially lowering the groundwater level using drainage wells on the SMR ETE site will be local only. Under the most adverse conditions, the drainage wells will be located near the boundaries of the SMR ETE construction area, meaning that the cone of depression will extend several dozen meters beyond the construction-area boundary. Under the precautionary principle, a maximum drawdown reach of up to 100 m from the boundaries of the SMR ETE construction area may be assumed.

To prevent the cones of depression from potential groundwater abstractions from overlapping the reach of drawdown at the SMR ETE site, a 200 m zone may be defined around the SMR ETE construction area, see Fig. 29, within which any groundwater abstractions could be affected by lowering the groundwater level beneath the reactor building. No groundwater sources in use or potentially usable are located within this distance. There is no development or other need for groundwater drinking-water sources in this area. Karlovec Pond, which is significantly dependent on groundwater inflow, extends partly into this zone around the construction area (Fig. 29). The risk that it will be adversely affected by lowering the groundwater level around the reactor building is not considered high. Nevertheless, as a

5 Summary

preventive measure, steps are recommended to stabilize this water body in the future, when the effects of climate change will become fully apparent. The proposed measures are listed in [85]. They primarily involve slowing stormwater runoff and promoting infiltration in the Karlovec Reservoir catchment, and potentially conveying some stormwater to Strouha Stream through Karlovec Reservoir.

Hydrogeologic region HGR 6320 contains no significant hydrogeologic structure with substantial groundwater reserves. Only smaller water sources of local importance are located in the wider area. Potential groundwater sources in the wider area that could be used for drinking-water supply and are located more than 200 m from the SMR ETE site will not be affected in any way by the planned drainage or otherwise impacted.



Jaderná elektrárna Temelín	Temelín Nuclear Power Plant
Plocha SMR ETE	SMR ETE site
Rybník dvořice	Dvořice fishpond
Dvořický rybník	Dvořický fishpond

Fig. 29 The 200 m zone (green) around the SMR ETE construction area (red) within which groundwater abstractions may be affected (<https://mapy.com>)

Brief summary of opinions and comments on the published project notification:

Municipality of Temelín, dated December 18, 2024: The municipality requires (...) an assessment of (...) effects on surface water and groundwater in relation to the municipality of Kočín and the nearby biocorridor (...).

The effects of the SMR ETE project on water in relation to the municipality of Kočín and the nearby biocorridor are discussed in greater detail in Section 0 of this study.

A historic millrace connecting Dvorčický Stream with the Dříteňský Stream catchment passes through the village of Kočín.

Dvorčice Pond is naturally supplied by drainage from the southern slope below Units 1 and 2. No water from the Units 1 and 2 site is currently conveyed to Dvorčice Pond or Dvorčický Stream. As noted above, use of this receiving water to convey some pumped groundwater and stormwater is being considered as part of implementation of the SMR ETE project. The reasons are not only the question of sufficient capacity in the existing storm sewer if all three parts of ETE are implemented, namely Units 1 and 2, the New NPP ETE, and the SMR ETE project, but also reduced natural inflow to Dvorčice Pond resulting from weakening of the natural headwater area upstream of the fishpond due to construction of the SMR ETE project. This would jeopardize the very existence of Dvorčice Pond and of Dvorčický Stream, which it supplies. Controlled augmentation of Dvorčice Pond and Dvorčický Stream with water drained from the SMR ETE site is therefore a condition for preserving their functions. If groundwater and some stormwater from the SMR ETE site are drained to Dvorčice Pond at an anticipated average rate of 2.2 l/s, the artificial augmentation will be sufficient to preserve the ecological functions.

If Dvorčický Stream were to disappear, the millrace would also lose its function. However, if Dvorčice Pond and Dvorčický Stream were used to discharge part of the stormwater and groundwater from the SMR ETE site, the millrace could be used to supply the fishpond system near Dříteň, particularly when managing higher torrential-rainfall flows.

No data are available on water quality in Dvorčice Pond, Dvorčický Stream, or the millrace in Kočín. Supplementary monitoring was therefore conducted at this location as part of study [73]. The monitoring was limited in both the range of parameters and the monitoring period, so its results must be regarded as indicative. Nevertheless, the data obtained showed that water quality is currently good in terms of the parameters monitored, with the exception of several PAH and O₂ parameters, which is related to the season in which the monitoring was conducted. Groundwater from the SMR ETE site is of suitable quality for augmenting Dvorčice Pond and Dvorčický Stream, and conveying it would not impair surface-water quality parameters. Stormwater, including runoff from the site, may nevertheless have impaired quality with respect to phosphorus, nitrogen, and TOC. Measures are therefore required to prevent any deterioration of water quality in Dvorčice Pond and the connected watercourses, Dvorčický Stream and the millrace through Kočín, caused by any conveyance of stormwater runoff. These may include an upstream retention basin within the SMR ETE site and oil separators. Systematic monitoring of water quantity and quality in the affected watercourses should also be recommended.

5 Summary

The hydrogeologic conditions around the municipality of Kočín are entirely unrelated to those around ETE. Groundwater at Kočín is recharged by inflow from the east to southeast, whereas outflow from the SMR ETE site runs southwest along Dvorčický Stream and passes north of Kočín. Any effect on groundwater, including individual wells, caused by drawdown is therefore entirely excluded [74].

Under the scenario without conveyance of groundwater and stormwater to Dvorčický Stream, the anticipated effects of construction and operation of the SMR ETE project would include a fundamental reduction in surface-water and groundwater runoff, with a significant adverse effect on the function of the local territorial system of ecological stability, which consists of local biocenters and biocorridors in the Dvorčický Stream catchment. Long-term drying of the fishpond and, particularly, the stream would be accompanied by changes in riparian stands and vegetation. The function supporting migration of aquatic organisms would be significantly restricted. Preserving the functions of the biocenter and biocorridors therefore requires controlled augmentation with water from the SMR ETE site by conveying some groundwater and stormwater to the Dvorčický Stream catchment at an average rate of 2.2 l/s. Runoff will consequently not decrease compared with current conditions and the function of the biocorridors and biocenters will be preserved for aquatic organisms during most of the year.

Biocorridors designated along the upper reach of Strouha Stream may also be partially affected by the indirect consequences of groundwater-level drawdown at the SMR ETE site. Augmentation of water inflow to Karlovec Pond is therefore also recommended.

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List of figures

Fig. 1 Area of interest showing the delineation of individual incremental catchments, major gauging stations, and water reservoirs. Source: [4].	4
Fig. 2 Trend in annual precipitation totals for the entire area of interest as far as the Kořensko water reservoir, using the DBCN 115100 České Budějovice profile as an example. Source: [3].	8
Fig. 3 Trend in annual air temperatures for the entire area of interest as far as the Kořensko water reservoir, using the DBCN 115100 České Budějovice profile as an example. Source: [3].	9
Fig. 4 Development of mean annual discharges for DBCN 115100 České Budějovice. Source: [3].	12
Fig. 5 Mean annual inflows to the Hněvkovice water reservoir in 2003–2023. Source: [4].	14
Fig. 6 Mean annual outflows from the Kořensko water reservoir in 2003–2023. Source: [4].	15
Fig. 7 Diagram of the water-management system used to assess the effect of the SMR ETE project on surface-water quantity. Source: [3].	22
Fig. 8 Probability field of water levels attained in the Lipno I water reservoir for the 5 600 MWe plus SMR ETE project option under current hydrological conditions. Source: [3].	26
Fig. 9 Probability field of water levels attained in the Lipno I water reservoir for the 5 600 MWe plus SMR ETE project option with warming of 2 °C [3].	27
Fig. 10 Probability field of water levels attained in the Lipno I water reservoir for the most conservative option, SSP2-4.5, TaiESM1, reference year 2080. Source: [3].	31
Fig. 11 Diagram of the water-management system extended to the Prague-Chuchle profile [3].	38
Fig. 12 Probability field of water levels attained in the Orlický water reservoir for the 5 600 MWe plus SMR option, SSP2-4.5 scenario, TaiESM1, reference year 2060 [3].	42
Fig. 13 Probability field of water levels attained in the Slapy water reservoir for the 5 600 MWe plus SMR option, SSP2-4.5 scenario, TaiESM1, reference year 2060 [3].	43
Fig. 14 Probability field of water levels attained in the Orlický water reservoir for the 5 600 MWe plus SMR option, SSP2-4.5 scenario, TaiESM1, reference year 2080 [3].	44
Fig. 15 Probability field of water levels attained in the Slapy water reservoir for the 5 600 MWe plus SMR option, SSP2-4.5 scenario, TaiESM1, reference year 2080 [3].	45
Fig. 16 Area of interest and critical profiles for assessing the effect of the SMR ETE project on surface-water quality	56
Fig. 17 Overview of minor watercourses and fishponds in the Strouha catchment	88
Fig. 18 Watercourses and fishponds near the SMR ETE project in the Dvůřický Stream area	91
Fig. 19 Catchment of Dvůřický Stream profile P4, measured in 8/2015–7/2017 [76]	92
Fig. 20 Location map showing the local biocorridors and local biocenters in the area affected by the SMR ETE project (taken from study [81]).	94
Fig. 21 Groundwater area of interest also applicable to the SMR ETE project [90] and [91]	102
Fig. 22 Location of monitoring wells around ETE	106
Fig. 23 Hydrograph of the water level in well RK 23 in 2009–2024	110

List of figures

Fig. 24	Model groundwater-contour map from the mathematical groundwater-flow model [91]	118
Fig. 25	Dvorčice Pond, aerial photograph (https://mapy.com)	121
Fig. 26	Dam and outlet structure of Dvorčice Pond at a lowered water level in November 2025	122
Fig. 27	Location of groundwater bodies surrounding the SMR ETE project. Upper-layer bodies are shown in blue and basic-layer bodies in black.....	151
Fig. 28	Locations of groundwater bodies in the section from Kořensko to the mouth of the Sázava	153
Fig. 29	The 200 m zone (green) around the SMR ETE construction area (red) within which groundwater abstractions may be affected (https://mapy.com)	180

List of tables

List of tables

Table 1	Selected profiles for which climatological data were derived and evaluated [3].	5
Table 2	Overview of the data types used and their role in assessing the current state of surface-water quantity. Prepared according to [3], [4].	6
Table 3	Basic statistical air-temperature and precipitation-total variables for 1961–2022 [3].	7
Table 4	Difference in mean precipitation and temperature values for the entire area of interest. Adapted from [4].	9
Table 5	Discharge profiles used to assess the hydrological regime. Adapted from [3].	11
Table 6	Basic discharge characteristics at the principal profiles. Adapted from [3].	11
Table 7	Summary of annual discharges at the Hněvkovice and Kořensko profiles. Calculated from the annual values provided in [4].	16
Table 8	Storage volumes of the principal water reservoirs considered in the water-management model [3].	17
Table 9	Minimum-flow requirements at the principal control profiles [3].	17
Table 10	Selected monthly changes in affected discharges between 2003–2009 and 2010–2023 [4].	18
Table 11	Monthly water-withdrawal and discharge balance for the 5 600 MWe plus SMR ETE project option. Adapted from [3].	21
Table 12	Overview of water-management modeling options assessed in the updated DP20A study [3].	23
Table 13	Water-withdrawal reliability for the 5 600 MWe plus SMR ETE project option under current hydrological conditions and with warming of 2 °C. Adapted from [3].	25
Table 14	Reliability of the Lipno I minimum flows and recreational water level under current hydrological conditions and with warming of 2 °C [3].	25
Table 15	Water-withdrawal reliability for the 5 600 MWe plus SMR ETE project option under SSP2-4.5 for the 2060 and 2080 reference years [3].	29
Table 16	Reliability of minimum flows and the Lipno I recreational water level for the 5 600 MWe plus SMR ETE project option under SSP2-4.5 [3].	30
Table 17	Summary interpretation of the effect of the SMR ETE project on surface-water quantity.	33
Table 18	Selected water-management system profiles relevant to assessing the effect of the project on the Vltava Cascade [3].	36
Table 19	Storage volumes of selected water reservoirs and their role in the assessment [3].	38
Table 20	Minimum-flow requirements used in the water-management modeling [3].	39
Table 21	Overview of water-management modeling options relevant to Chapter 2.1.3 [3].	40
Table 22	Reliability of minimum flows and the storage function of Orlík and Slapy for the 5 600 MWe plus SMR option under current hydrological conditions [3].	40
Table 23	Reliability of minimum flows at the Vrané and Prague-Chuchle profiles and the storage function of the Orlík and Slapy water reservoirs for the 5 600 MWe plus SMR option under climate-change conditions. Adapted from [3].	41

List of tables

Table 24	Reliability of minimum flows and the storage function for the Units 1 and 2 comparison option under climate-change conditions. Adapted from [3].....	46
Table 25	Summary interpretation of the effect of the SMR ETE project on the Vltava Cascade.	47
Table 26	List of surface water bodies (SWBs) in the watercourse reach of interest and their basic characteristics.....	49
Table 27	Surface-water abstractions for human consumption and their protection zones in the Vltava reach of interest [10, 11]	50
Table 28	Bathing-water areas in the Vltava watercourse reach of interest [11]	52
Table 29	Profiles included in the processing of selected non-radiological parameters, including temperature; critical profiles are shown in bold, together with the purpose of assessment.....	56
Table 30	Profiles included in the processing of selected radioactivity parameters; critical profiles are shown in bold, together with the purpose of assessment.....	63
Table 31	Discharge data at the profiles for assessing the effect of the SMR ETE project; critical profiles are shown in bold	65
Table 32	Modeled concentrations of significant parameters at the profile downstream of the Kořensko water reservoir for the capacity alternative comprising SMR ETE and Units 1 and 2 under the “Average Discharge” scenario for Q_a (normal flow), Q_{355} (drought, effect of climate change), and Q_{guar} (assessment of extremes and comparison with requirements specified as maxima or minima, as applicable).....	70
Table 33	Modeled concentrations of significant parameters at the profile downstream of the Kořensko water reservoir for the capacity alternative comprising SMR ETE and Units 1 and 2 under the “Maximum Discharge” scenario for Q_a (normal flow), Q_{355} (drought, effect of climate change), and Q_{guar} (assessment of extremes and comparison with requirements specified as maxima or minima, as applicable).....	71
Table 34	Modeled concentrations of significant parameters at the profile downstream of the Kořensko water reservoir for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE under the “Average Discharge” scenario for Q_a (normal flow), Q_{355} (drought, effect of climate change), and Q_{guar} (assessment of extremes and comparison with requirements specified as maxima or minima, as applicable).....	72
Table 35	Modeled concentrations of significant parameters at the profile downstream of the Kořensko water reservoir for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE under the “Maximum Discharge” scenario for Q_a (normal flow), Q_{355} (drought, effect of climate change), and Q_{guar} (assessment of extremes and comparison with requirements specified as maxima or minima, as applicable).....	73
Table 36	Modeled concentrations of significant parameters at the Orlík water reservoir Zvíkov Bridge profile for the capacity alternative comprising SMR ETE and Units 1 and 2 under the “Average Discharge” scenario for Q_a (normal flow) and Q_{355} (drought, effect of climate change)	74
Table 37	Modeled concentrations of significant parameters at the Orlík water reservoir Zvíkov Bridge profile for the capacity alternative comprising SMR ETE and Units 1 and 2 under the “Maximum Discharge” scenario for Q_a (normal flow) and Q_{355} (drought, effect of climate change)	75

List of tables

Table 38	Modeled concentrations of significant parameters at the Orlík water reservoir Zvíkov Bridge profile for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE under the “Average Discharge” scenario for Q_a (normal flow) and Q_{355} (drought, effect of climate change)	76
Table 39	Modeled concentrations of significant parameters at the Orlík water reservoir Zvíkov Bridge profile for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE under the “Maximum Discharge” scenario for Q_a (normal flow) and Q_{355} (drought, effect of climate change)	77
Table 40	Modeled concentrations of significant parameters at the Solenice profile for the capacity alternative comprising SMR ETE and Units 1 and 2 at Q_a (normal flow) and Q_{355} (drought, effect of climate change)	78
Table 41	Modeled concentrations of significant parameters at the Solenice profile for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE at Q_a (normal flow) and Q_{355} (drought, effect of climate change)	78
Table 42	Modeled concentrations of significant parameters at the Kamýk nad Vltavou profile for the capacity alternative comprising SMR ETE and Units 1 and 2 at Q_a (normal flow) and Q_{355} (drought, effect of climate change)	79
Table 43	Modeled concentrations of significant parameters at the Kamýk nad Vltavou profile for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE at Q_a (normal flow) and Q_{355} (drought, effect of climate change)	79
Table 44	Modeled concentrations of significant parameters at the Štěchovice profile for the SMR ETE plus Units 1 and 2 plus at Q_a (normal flow) and Q_{355} (drought, effect of climate change)	80
Table 45	Modeled concentrations of significant parameters at the Štěchovice profile for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE at Q_a (normal flow) and Q_{355} (drought, effect of climate change)	80
Table 46	Modeled activity concentrations of significant parameters at the profile downstream of the Kořensko water reservoir for the capacity alternative comprising SMR ETE and Units 1 and 2 under the “Average Discharge” scenario for Q_a (normal flow), Q_{355} (drought, effect of climate change), and Q_{guar} (assessment of extremes and comparison with values specified as maxima).	81
Table 47	Modeled activity concentrations of significant parameters at the profile downstream of the Kořensko water reservoir for the capacity alternative comprising SMR ETE and Units 1 and 2 under the “Maximum Discharge” scenario for Q_a (normal flow), Q_{355} (drought, effect of climate change), and Q_{guar} (assessment of extremes and comparison with values specified as maxima).	81
Table 48	Modeled activity concentrations of significant parameters at the profile downstream of the Kořensko water reservoir for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE under the “Average Discharge” scenario for Q_a (normal flow), Q_{355} (drought, effect of climate change), and Q_{guar} (assessment of extremes and comparison with values specified as maxima).	81
Table 49	Modeled activity concentrations of significant parameters at the profile downstream of the Kořensko water reservoir for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE under the “Maximum Discharge” scenario for Q_a (normal flow), Q_{355} (drought, effect of climate change), and Q_{guar} (assessment of extremes and comparison with values specified as maxima).	82
Table 50	Modeled activity concentrations of significant parameters at the Orlík water reservoir Zvíkov Bridge profile for the capacity alternative comprising SMR ETE and Units 1 and 2 at Q_a (normal flow) and Q_{355} (drought, effect of climate change)	82

List of tables

Table 51	Modeled activity concentrations of significant parameters at the Orlík water reservoir Zvíkov Bridge profile for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE at Q_a (normal flow) and Q_{355} (drought, effect of climate change)	84
Table 52	Modeled activity concentrations of significant parameters at the Solenice profile for the capacity alternative comprising SMR ETE and Units 1 and 2 at Q_a (normal flow) and Q_{355} (drought, effect of climate change)	84
Table 53	Modeled activity concentrations of significant parameters at the Solenice profile for the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETE at Q_a (normal flow) and Q_{355} (drought, effect of climate change).....	85
Table 54	Estimated tritium activity concentrations at the Solenice, Podolí, and Hřensko profiles under normal-flow conditions (Q_a) and climate-change drought conditions (Q_{355}) for the SMR ETE plus Units 1 and 2 and the capacity alternative comprising SMR ETE, Units 1 and 2, and New NPP ETEs.	85
Table 55	Characteristics of the Strouha watercourse profile (class IV) [75]	88
Table 56	M-day discharges of the Strouha watercourse (class IV) [75]	88
Table 57	N-year discharges of the Strouha watercourse (class IV) [75].....	88
Table 58	Measured M-day discharges on Dvůrký Stream at profile P4 (Fig. 19) for 8/2015–7/2017 ...	92
Table 59	Surface-water-body chemical-status assessment results in the area of interest for the third planning period: verbal assessment (numerical assessment) [9, 10].....	134
Table 60	Overall surface-water-body status assessment results in the area of interest for the third planning period: verbal assessment (numerical assessment) [9, 10].....	134
Table 61	Comparison of the current status assessed according to [8], the type-specific value for P_{total} at the good/moderate potential boundary, and values modeled according to [8] for the individual scenarios	137
Table 62	Contributions of individual sources to mass flows of the general physicochemical quality elements at the profile downstream of the Kořensko water reservoir, Average Discharge scenario, SMR ETE plus Units 1 and 2, according to [8]	138
Table 63	Contributions of individual sources to mass flows of the general physicochemical quality elements at the profile downstream of the Kořensko water reservoir, Average Discharge scenario, SMR ETE plus Units 1 and 2 plus New NPP ETE, according to [8]	138
Table 64	Contributions of individual sources to mass flows of the general physicochemical quality elements at the profile downstream of the Kořensko water reservoir, Maximum Discharge scenario, SMR ETE plus Units 1 and 2, according to [8]	139
Table 65	Contributions of individual sources to mass flows of the general physicochemical quality elements at the profile downstream of the Kořensko water reservoir, Maximum Discharge scenario, SMR ETE plus Units 1 and 2 plus New NPP ETE, according to [8]	139
Table 66	Comparison of the current tritium activity concentrations assessed according to [8], the EQS-AA, and the values modeled for the individual scenarios according to [8]	140
Table 67	Contributions of individual sources to mass flows of the assessed river-basin-specific pollutants at the profile downstream of the Kořensko water reservoir, Average Discharge scenario, SMR ETE plus Units 1 and 2, according to [8]	140

List of tables

Table 68	Contributions of individual sources to mass flows of the assessed river-basin-specific pollutants at the profile downstream of the Kořensko water reservoir, Average Discharge scenario, SMR ETE plus Units 1 and 2 plus New NPP ETE, according to [8]	141
Table 69	Contributions of individual sources to mass flows of the assessed river-basin-specific pollutants at the profile downstream of the Kořensko water reservoir, Maximum Discharge scenario, SMR ETE plus Units 1 and 2, according to [8]	141
Table 70	Contributions of individual sources to mass flows of the assessed river-basin-specific pollutants at the profile downstream of the Kořensko water reservoir, Maximum Discharge scenario, SMR ETE plus Units 1 and 2 plus New NPP ETE, according to [8]	141
Table 71	Contributions of individual sources to activity fluxes of the assessed radioactive substances at the profile downstream of the Kořensko water reservoir, Average Discharge scenario, SMR ETE plus Units 1 and 2, according to [8]	141
Table 72	Contributions of individual sources to activity fluxes of the assessed radioactive substances at the profile downstream of the Kořensko water reservoir, Average Discharge scenario, SMR ETE plus Units 1 and 2 plus New NPP ETE, according to [8]	142
Table 73	Contributions of individual sources to activity fluxes of the assessed radioactive substances at the profile downstream of the Kořensko water reservoir, Maximum Discharge scenario, SMR ETE plus Units 1 and 2, according to [8]	142
Table 74	Contributions of individual sources to activity fluxes of the assessed radioactive substances at the profile downstream of the Kořensko water reservoir, Maximum Discharge scenario, SMR ETE plus Units 1 and 2 plus New NPP ETE, according to [8]	142
Table 75	Contributions of individual sources to mass flows of the assessed chemical-status parameters at the profile downstream of the Kořensko water reservoir, Average Discharge scenario, SMR ETE plus Units 1 and 2, according to [8]	143
Table 76	Contributions of individual sources to mass flows of the assessed chemical-status parameters at the profile downstream of the Kořensko water reservoir, Average Discharge scenario, SMR ETE plus Units 1 and 2 plus New NPP ETE, according to [8]	143
Table 77	Parameters used to assess the chemical status of groundwater bodies and their limits	149
Table 78	Parameters used to assess the chemical status of groundwater bodies in relation to associated surface waters and their limits	150
Table 79	Status assessment of groundwater bodies potentially affected by construction of the SMR ETE project	151
Table 80	Current status assessment of groundwater bodies potentially affected by operation of the SMR ETE project	153
Table 81	Assessment of relevant groundwater-body working units	154

List of abbreviations

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CHMI	Czech Hydrometeorological Institute
DBCN	identifier of the gauging station whose profile is used as the catchment outlet
DOC	documentation
DP	partial deliverable
EIA	environmental impact assessment
ETE	general term for the nuclear power plant at the Temelín site without distinguishing whether it refers to Units 1 and 2, the New NPP ETE, or their concurrent operation; the meaning varies and follows from the context
Units 1 and 2	existing Temelín Nuclear Power Plant (Temelín NPP)HGR hydrogeologic region
LBC	local biocenter
LBK	local biocorridor
LIM-B	permissible pollution – annual average/EQS-AA (public water -supply use)
LIM-C	permissible pollution – annual average/EQS-AA (bathing waters)
LIM-D	permissible pollution – annual average/EQS-AA (salmonid waters)
LIM-E	permissible pollution – annual average/EQS-AA (cyprinid waters)
LIM-F	good ecological potential requirement
MDA	minimum detectable activity
LOQ	limit of quantification
EQS	environmental quality standard
EQS-MAC	environmental quality standard, maximum allowable concentration
EQS-AA	environmental quality standard, annual average
New NPP ETE	New Nuclear Power Plant at the Temelín site
GD	Government Decree of the Czech Republic
PVL	Povodí Vltavy, státní podnik
Q ₃₅₅	flow equaled or exceeded on average for 355 days per year over the long term
Q _a	long-term mean annual flow
Q _{guar}	minimum guaranteed flow
SMR ETE	New SMR Power Plant at the Temelín site
TSES	territorial system of ecological stability
WW	waterworks
Res.	water reservoir
WB	water body
VÚV TGM, v. v. i.	Výzkumný ústav vodohospodářský T. G. Masaryka, veřejná výzkumná instituce

List of parameter symbols and abbreviations

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^{137}Cs	cesium-137
^3H	tritium
^{90}Sr	strontium-90
AOX	adsorbable organically bound halogens
BOD ₅	biochemical oxygen demand
C ₁₀ -C ₄₀	C ₁₀ -C ₄₀ hydrocarbons
Ca	calcium
Cl ⁻	Chlorides
c α	total alpha activity concentration
c β	total beta activity concentration
c β - ^{40}K	total beta activity concentration after subtraction of the potassium-40 contribution
EDTA	ethylenediaminetetraacetic acid
CODCr	chemical oxygen demand using potassium dichromate
K	potassium
Mg	magnesium
Na	sodium
sat. O ₂	water oxygen saturation
N _{total}	total nitrogen
NH ₃	free ammonia, calculated
Ni	nickel
SS ₁₀₅	suspended solids
N-NH ₄ ⁺	ammoniacal nitrogen
N-NO ₃ ⁻	nitrate nitrogen
O ₂	dissolved oxygen
PAHs	polycyclic aromatic hydrocarbons
P _{total}	total phosphorus
pH	pH
P-PO ₄ ³⁻	phosphate phosphorus
DIS	dissolved inorganic salts
DS ₁₀₅	dried dissolved solids
DS ₅₅₀	ignited dissolved solids
SO ₄ ²⁻	Sulfates
T	water temperature
TOC	total organic carbon