

THE ENVIRONMENT



of the City of Pilsen



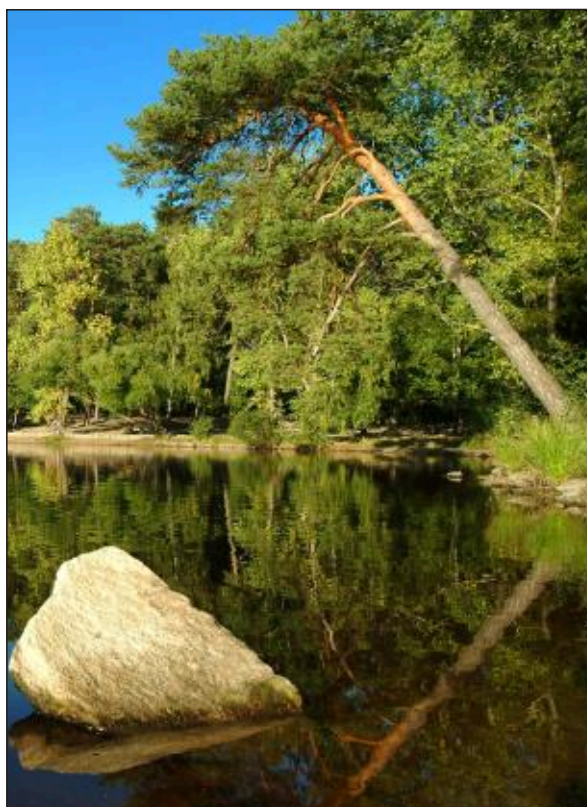
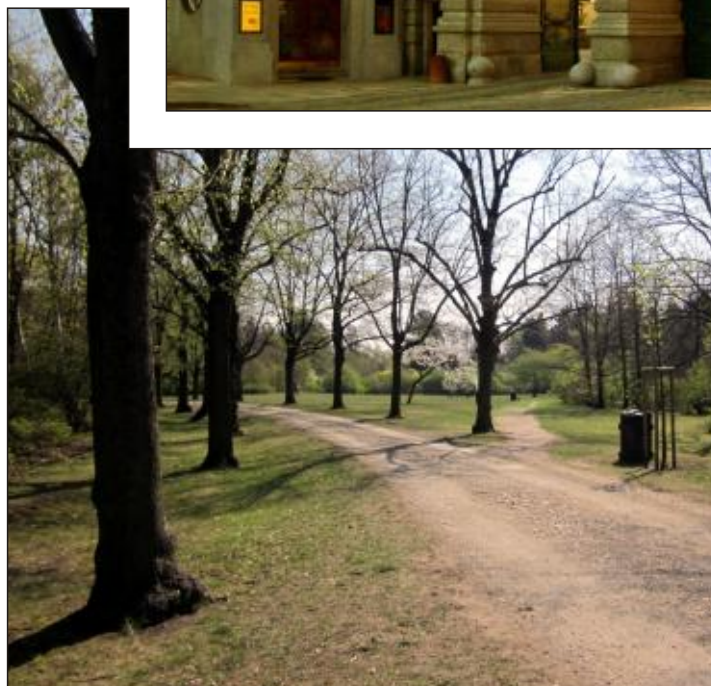
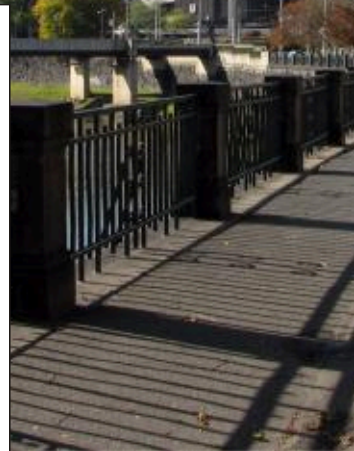
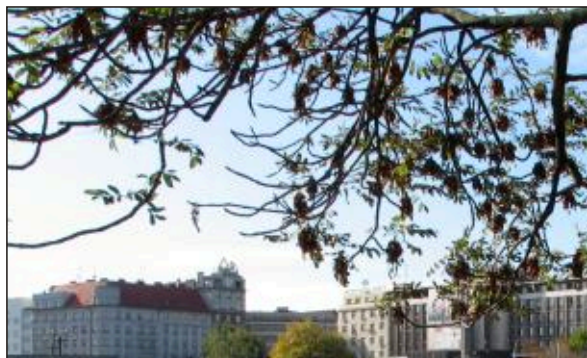
CHARTERED City of Pilsen
ENVIRONMENT DEPARTMENT, Municipality of Pilsen



Pilsen (in Czech: Plzeň) is the fourth largest city in the Czech Republic. It is a dominant industrial, business, cultural and administrative center of the western part of Bohemia. The city is believed to have been founded in 1295 by the Czech king Wenceslas II. Thanks to its advantageous location between Prague and the western border of the state, the city soon began to flourish.

The City of Pilsen lies in the Pilsen Basin at the confluence of four rivers: Mže, Radbuza, Úhlava and Úslava, which merge to create the Berounka River. The altitude of the city center is about 310 meters above sea level. On the outskirts of the city, there are several hills with elevations over 500 meters.

THE ENVIRONMENT of THE City of PILSEN



CHARTERED City of PILSEN
ENVIRONMENT DEPARTMENT
Municipality of PILSEN

FOREWORD



1

Dear Reader,

Let me offer a few thoughts and facts before you begin exploring this publication. The environment in which we live is a complex system with multifarious relationships and interdependences. There is also the profound impact we have on both biotic and abiotic parts of nature. Our ancestors left us a good place to live and now, the place we will hand down to our children is up to us. They will be the ones to correct our mistakes and to deal with all resulting problems and the consequences of our choices.

Protection of the environment in the Czech Republic underwent great changes after 1989. The key act, No. 17/1992 on the environment was passed, and stipulated basic principles of, and obligations for its protection and improvement. In the same year, Act No. 144/1992 on nature and landscape protection, Act No. 244/1992 on environmental impact assessment and other equally important regulations were passed as well.

It was growing interest among guests and professionals from abroad in this line of Czech publications on environment that led to a decision to publish this English language brochure. Foreign as well as English speaking Czech students of this field may find this edition useful too.

The first chapters of this brochure are devoted to geography, geology, climate and the history of our city. They are followed by sections on the value and protection of nature and landscape and by information on water courses and bodies of water in Pilsen. Additional topics covered include air quality, energy use, waste disposal, planning and zoning, development of the transportation system and environment-oriented projects conducted in the city.


This publication, along with the previous volumes, is available at: <http://ozp.plzen.eu>

Let me express my gratitude to the team of authors, the graphic designer, the translators, and all other contributors and consultants whose efforts made this edition come to life. I hope you will find it interesting and useful.

Pilsen, March 2012

Miroslav Klán, Editor
Environment Department
Municipality of Pilsen

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1. GEOGRAPHY AND HISTORY



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Kopecký Park in the city center

GEOGRAPHY

Geographical Location

Pilsen, the administrative center of the Pilsen Region, lies in the heart of West Bohemia. It is the fourth largest city in the Czech Republic. The region is a link between the central part of Bohemia and the Bavarian Danube region and has always been the crossroads of important routes between the East and the West. Its central parallel of latitude and central line of longitude are 49°45' north and 13°23' east, respectively. The city's territory has an area of 137.67 km² (on December 31, 2010). Its shape is circular, with a central basin encircled by neighboring uplands and the Radyně Upland. Important rivers of West Bohemia, Mže, Radbuza, Úhlava and Úslava, flow into this area, where they merge to form the Berounka River. The average elevation of the city's center is 310 m. Its lowest-lying point is at 293 meters above sea level, whereas the highest point is at an elevation of 452 meters.

Geology

The majority of the territory of the city falls in the Bohemum regional geological block (the Teplá-Barrandian Unit) comprising an older level (Precambrian, Proterozoic) and a younger level (Paleozoic). The Precambrian rocks include three basic types: clayey shales, lydites and igneous rocks (metabasalts). At the end of the Carboniferous period (about 320 million years ago), a lacustrine basin formed in this area. Sedimentary cover was deposited in the Paleogene period. During the next early Neogene period, the base of present stream pattern emerged. It continued to develop, with rivers carving their bedrock and creating terraces, in the Quaternary period. In this period, loess loam banks, colluvial deposits and flood loams were created in the flood plains. A major part of the city lies on Pleistocene river gravel on underlying basement rocks consisting of conglomerate, arkose and feldspathic

sandstone. It is in this feldspathic sandstone that the corridors making up today's historical underground of the city were carved. It was also frequently used for foundations of buildings at the end of 19th century. The area in the vicinity of Pilsen recently yielded unique finds of organisms of the Carboniferous period: a giant club-moss *Lepidodendron lycopodioides* (displayed in the hall of the Museum of West Bohemia) and wings of a giant dragonfly.

Relief

The city of Pilsen lies in the north-east corner of the expansive Pilsen Basin, which is a flat denudation-accumulation depressed area. The bottom of the Pilsen Basin is mildly undulating and dissected by a tree-like pattern of the rivers Mže, Radbuza, Úhlava, Úslava and Berounka with their small tributaries. The elevation of the basin ranges between 300 and 370 meters above sea level. The surrounding hills (parts of the Pilsen Upland) have an elevation of 400 meters. The highest peaks in the vicinity of Pilsen are Radyně (567 meters) and Krkavec (504 meters).

Climate

The Pilsen Basin is in the moderate climatic region (MT 11 according to Quitt's classification of the climate of the Czech Republic). In the east, south-east, south and north-west, it borders on higher-elevation areas where summers are more humid and precipitation is more frequent. Pilsen's mesoclimate is marked by frequent fog and low-level clouds in fall and winter, accompanied by inversion situations (inverted change of temperature with altitude) in the surrounding hills.

Records from the period between 1971 and 2000 at the Pilsen-Bolevec climatological station, which provides representative weather data, show an **annual mean temperature** between 6.4 and 9.1 °C and mean monthly temperature in summer just below 18 °C. The mean winter temperature is about -1 °C. **Long-term mean rainfall** in Pilsen is 524 mm and the maximum snow depth



4

Sutice – a quartzite rock south of the city



5 Pilsen from north-west during a nighttime storm

duration of sunshine in Pilsen is between 1,200 and 1,800 hours. **Wind direction and velocity within the surface layer** strongly depend on the orientation of river valleys. South-westerly and westerly winds prevail (20 – 25% occurrence) in the urban agglomeration. The annual rate of calm air situations is about 15 – 20%.

Water

The main streams here are the Mže, Radbuza, Úhlava and Úslava Rivers. They merge at various points in the city’s territory, creating the Berounka River. The widest flow regime fluctuations occur in the Úslava River. The flow regimes of the Mže and Radbuza Rivers are controlled by the operations of the Hracholusky Reservoir (outside the city territory) and the České Údolí Reservoir, respectively.

The formerly meandering river courses were channelized in the inner city district. The Úhlava River is the only river that retains its natural bed configuration. Between 2008 and 2012, the city has participated in the international project REURIS (Revitalisation of Urban River Spaces). Under this project, general studies on Pilsen’s rivers were completed and a number of additional detailed studies of specific locations or features were commissioned. Tributaries of Pilsen’s rivers are low volume water courses. Among them, the Bolevec Stream stands out with a notable system of lakes, the foundations of which were laid as early as the 1460s.

The municipal waterworks draws water from the Úhlava River, supplying Pilsen, as well as 20 other towns and communities. It serves 99.1% of Pilsen’s population and all of the industry, businesses and public buildings in the city. Including the supply to the former Pilsen-North and Pilsen-

in winter months is between 5 cm and 30 cm. **The shortest mean duration of sunshine** – about 40 hrs/month – occurs in winter months, whereas the values for July and August are up to 200 hrs/month. The annual

South administrative districts, the number of customers of the waterworks reaches 200,000. The Radbuza River is the backup source for emergency situations. The homes of 98% of the city’s inhabitants and all industrial plants are connected to the sewer system. A major part of the system consists of a combined sewer. Nowadays, separate sanitary sewer and storm drain systems are preferred, where practicable.

Soil Types

The city of Pilsen lies on the boundary between two soil regions. Its southern part belongs to a brown soil region comprising loess loams and dust loams, whereas the northern part is in the region of saturated and acid cambisols. In addition, there are expansive areas of fluvisols on alluvial and wind deposits in the Pilsen Basin and its surroundings.

Vegetation and Flora

From the phytogeographic viewpoint, the territory of the city falls in the region of Central European flora and vegetation of the medium altitudinal belt. This region is characterized by the absence of plant species and vegetation



7 Zábělá Nature Reserve



6 View of the city center from the north-east across the Mže River flood plain

types restricted to regions of the oceanic climate, warm lowlands or mountains. The local flora is influenced by two adjacent landscape units, the Pilsen Upland and the Krivoklátsko forest area.

The territory of the city has been deforested, except for large areas in the north, south-east and east. Of the city’s territory, 43.5% is used for agriculture. Forests take up 18.8% of the area, whereas the built-up and urban areas cover 34.5% of the territory. The native vegetation has been profoundly affected by long-term human activity. The formerly reported diversity of species continues to decline, according to data of comparative research studies.

More information can be found in the section on nature conservation.

Fauna

The fauna of Pilsen’s territory is similar to those of most cities of Central Europe, where urban and suburban biotopes are directly influenced by human activity. Profound changes in recent decades have accelerated the anthropization of Pilsen’s urban environment.

Despite that, there are a number of remarkable and rare species of insects to be found, particularly in the Bolevec woods. Valuable locations include wetlands, pools and ditches along the lower courses of the Mže and Úslava Rivers, with relatively rare species of water mollusks, e.g. the keeled ram’s horn snail (*Planorbis carinatus*) and moss bladder snail (*Aplexa hypnorum*). Unfortunately, recent



8 Red squirrel (*Sciurus vulgaris*)



9 KEELED RAM’S HORN SNAIL
(*Planorbis carinatus*)

10 PAINTED lady (*Cynthia cardui*)

years have brought a rise in populations of invasive species of gastropods: the Portuguese slug (*Arion lusitanicus*) and New Zealand mudsnail (*Potamopyrgus antipodarum*).

Diverse conditions in urban housing areas and varying proportions of green space are favourable for bird populations. In the 1993–2003 period, 143 species of birds were found here during nesting seasons. The common swift (*Apus apus*) and northern house-martin (*Delichon urbica*) tend to seek human settlements. The crested lark (*Galerida cristata*) is more common in built-up areas than in the open landscape. Forest populations of the Eurasian blackbird (*Turdus merula*) overwinter here, while its urban populations do not. The urban populations of the Eurasian kestrel (*Falco tinnunculus*), the European magpie (*Pica pica*) and Eurasian jackdaw (*Corvus monedula*) are growing. In winter, large populations of rooks (*Corvus frugilegus*) and growing populations of woodpigeons (*Columba palumbus*) are found in the city. Numbers of feral domestic pigeons (*Columba livia f. domestica*) have dropped, thanks to systematic efforts (such as blocking attic windows, fitting anti perch spikes on the ledges of buildings, and for, some time, reintroduction of the peregrine falcon (*Falco peregrinus*), which nested right on the church tower in the main square until 2003). The bird wintering grounds on the Berounka River in the north-eastern part of the city is an important location. The largest populations here consist of mallards (*Anas platyrhynchos*) and mute swans (*Cygnus olor*). Large flocks of cormorants (*Phalacrocorax carbo*) deplete fish stock in the area. Additional species include goosanders (*Mergus merganser*) and others.

In the hunting grounds around the city, there are European roe deer (*Capreolus capreolus*), wild boar (*Sus scrofa*), limited populations of small game, and non-native European mouflon (*Ovis musimon*) and Japanese sika deer (*Cervus nippon nippon*). Red fox (*Vulpes vulpes*) are moving nearer to the city, whereas the beech marten (*Martes foina*) has fully adapted to life in the urban area, frequently damaging cables in cars. Eurasian red squirrel (*Sciurus vulgaris*) is a common species in the woods and parks. Recently, traces of activity of the Eurasian beaver (*Castor fiber*) were found on some rivers in Pilsen. Its population has been growing thanks to its active protection in the

Czech Republic. Although it occasionally enters the area of the city, it has not caused any significant damage yet.

An area in the north-western part of the city, where the hermit beetle (*Osmoderma eremita*) occurs, has become a protected area thanks to its European-scale significance.

Population and Territorial Development



11 ONE OF THE BUSIEST PEDESTRIAL MALLS IN THE CITY CENTER

In the mid 19th century, Pilsen with its suburbs had a population of over 10,000 in 640 houses, of which the inner city had 333 houses with 7,000 inhabitants. Owing to industrial growth, the population reached 65,000 in 2,410 houses by 1900. In 1924, the city incorporated four neighboring communities. In 1942, seven more villages merged with Pilsen. In that year, the city of Pilsen became the administrative center of its surrounding district areas. Since 1945, the city has been growing in terms of both population and territory. On January 1, 1949, it became the regional capital. In 1950, there were approximately 124,000 inhabitants in 11,440 houses in Pilsen. After 1953, housing development on the outskirts of the city greatly expanded the existing urban area, and more communities merged with Pilsen. The highest number of inhabitants ever was reported in 1985 (population of 175,200) but since then, the number has been decreasing.

As of October 31, 2010, Pilsen had a population of 168,808, of which there were 81,947 men and 86,861 women. According to the age structure, there are

21,746 persons between 0–14 years of age, 116,966 inhabitants between 15 and 64 years and 30,096 people aged 65 or more. Over the course of the year 2010, 3,240 people entered the city, of which 641 came from abroad, whereas 4,451 left the city. 1,819 children were born and 1,735 persons died. There were 806 marriages and 504 divorces.

The city comprises 10 city districts, the first four of which are the largest and most populated ones. On January 1, 2000, when the Czech Republic was divided into 14 regions, Pilsen became the administrative center of the Pilsen Region.

Internet Links

- <http://www.pilsen.eu/about-the-city/information-about-the-city/geography/geography.aspx>

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12 PILSEN BASIN WITH THE CITY CENTER VIEWED FROM THE NORTH

HISTORY

The first traces of human settlement in the territory of Pilsen are of small hunting settlements that emerged in the Paleolithic and Mesolithic Periods (about 9000-5500 BCE) at elevated locations, mostly on the north side of the Mže River valley. Archaeological finds from the city’s territory reveal the presence of man in all prehistoric periods. However, there is no evidence of human presence in the Pilsen Basin in the late Bronze Age (about 2000–1700 BCE). At the time of the transmigration of nations (about 400–700 CE), the extent of settlements in the region declined. The current conclusion of historical knowledge is that the first Slavs arrived in today’s greater Pilsen area as late as the 8th century. Farmers’ settlements occupied favorable fertile parts of the basin. In the 8th century, a hillfort was built on a prominent promontory overlooking the right bank of the Berounka River, near today’s village of Bukovec. The Přemyslids’ taking control of West Bohemia around the mid-10th century was closely tied to taking control of crucial long-distance trade routes. For a period of time during the 10th century, the Regensburg Route, the most significant of these, became the main route connecting Western Europe to Lesser Poland and the Kievan Rus. It also bore great political significance for the ruling

Přemyslids. Periodic journeys to Regensburg, the ecclesiastical centre of these lands, were essential for the ruling prince, as he attended the sessions of the Imperial Diet there. Today’s Hůrka Hillfort in Starý Plzenec was probably established as a new fortified settlement, following the destruction of the Bukovec Hillfort in the 10th century. Today’s Hůrka Hillfort is the first location that bore the name Pilsen. The first conclusive evidence of then Pilsen and the whole of West Bohemia being part of the Přemyslid state is a chronicle mentioning a military clash in 976 between the emperor Otto II and the prince Boleslav II in the vicinity of Pilsen castle. Initially, the local name Pilsen denoted the hillfort or early medieval castle and the settlement below it. Later, the name was also used for growing municipal districts established in relation to this early medieval settlement.

A new era in the evolution of the center of West Bohemia began at the end of the 13th century when the center of power was transferred from the hillfort to a new settlement approximately 9 kilometers to the northwest, at the confluence of the Mže and Radbuza Rivers. The new city was founded in an already inhabited and agriculturally utilized landscape, through which the Nuremberg route passed. This transfer took place at a time in which the importance of Nuremberg was rising among other cities in



13 Hand-drawn map of Pilsen and its surroundings based on the survey by a group of military land surveyors headed by lieutenant Kirelli. The top of the map is approximately north-north-west. The map’s scale is approximately 1:40000. It is displayed in its original colors. This 1781 map is a rare proof of the layout of the city shortly before its profound transformations in terms of both architecture and landscape. Courtesy of the Museum of West Bohemia in Pilsen, Department of Medieval History

the empire, which was certainly reflected in the trade route traffic. The year 1295, commonly believed to be the founding year of the New Pilsen, is mentioned in a contemporary chronicle. It appears, however, that the city's fortification walls with four gates were erected as late as the second quarter of the 14th century. Early suburbs along the roads outside the city gates probably began to emerge concurrently with the city. Thanks to the previous municipal settlement and experience associated with Old Pilsen, i.e. today's Hůrka Hillfort, the growth of New Pilsen was relatively fast. The core of its inhabitants was certainly a group of burghers from Old Pilsen. One can, however, assume that the new city was open to newcomers as well. The growing city of Pilsen owned land and had feudal authority over neighboring villages. Its economy was based predominantly on trade and crafts. As an important junction of routes joining Prague with Nuremberg, Regensburg, Cheb and north-German cities, it had an excellent growth potential. Its major exports included cattle and Pilsen white cloth. The city rapidly acquired great political importance and dominance in the region. Its population before the Hussite Wars in the first half of the 15th century was between 3,500 and 4,000. There were 290 houses within the city walls but there were houses outside the city walls as well.

Over the period of the Hussite Wars, Pilsen grew to become a powerful and proud city pursuing its own political agenda at a time of the declining power of the state. Its estate and economic activities continued to expand. After 1460, new lakes began to be built according to modern principles of pond management. The current Great Bolevec Lake was the first one of those. The system of lakes was the first enterprise to be operated by the city itself, followed by beer brewing, the first evidence of which dates back to the 1490s. The construction boom of the 16th century attracted Italian craftsmen and builders. One of those, Giovanni de Statia, rebuilt the town hall in Renaissance style between 1554 and 1559. In the 16th century, the city acquired additional property. At the time, it owned 27 villages and farmsteads and expanded its economic activities even further. However, on November 21, 1618, Pilsen was conquered for the first time in its history. The attack of the Estates' forces commanded by the general Ernst von Mansfeld was the first battle of the Thirty Years' War. The consequences of the war were severe: the city was deep in debt, many houses were abandoned, the population dropped due to plague epidemics and production and trade declined. In the first quarter of the 18th century, Pilsen rose back to its former position of the second city in Bohemia after Prague in terms of economy. It owned ten large farmsteads, six sheep farms, five water mills, thirty-two fishponds, several forest districts and three breweries. The city also founded its iron works (blast furnaces and iron mills) near the iron ore deposits in Ejpovice. The Baroque style came to Pilsen no sooner than 1700. The leading builder in the region was Jacob Auguston Jr. In the 18th century, Pilsen's elite followed the current trends by building pleasure-houses in the suburbs and adjacent areas.



14 AUGUST C. HAUN: PILSEN FROM THE SOUTH-WEST (PRIOR TO 1860).
COURTESY OF THE MUSEUM OF WEST BOHEMIA, THE ETHNOGRAPHIC MUSEUM
OF THE PILSEN REGION, ITEM NO. 40 525

The city's fortifications were pulled down gradually between 1795 and 1849. New houses and grand buildings in the prevailing Classical style were erected in this newly-formed space lined with parks and promenades. At that time, the unsuccessful effort to turn Pilsen into a spa city resulted in establishing the extensive Lochotín Park with a popular dancing hall and a restaurant. In the second half of the 19th century, the urbanization of inner suburbs continued. Pilsen became a railroad hub and its industrial premises began to expand greatly. The development of health care services, education facilities and technical infrastructure followed suit. A number of prominent buildings were erected: the museum, theatre, the Sokol Union House, Měšťanská Beseda Burghers' Association House, the Great Synagogue and several new churches.

Until the second half of the 18th century, Pilsen remained a predominantly Czech city. The period of the Enlightenment, however, brought Germanization efforts. In the 19th century, the German language prevailed over Czech, particularly in the higher classes of society, although the majority of Pilsen's citizens still spoke both languages. Czech became the only official language as late as 1897. In 1905, there were 290 registered associations in Pilsen (including 50 German ones). By 1937, their number rose to 874. German occupation curtailed the activities of associations. After a brief restoration between 1945 and 1948, associations were effectively abolished by the merger of all their activities into the National Front organizations.

The first manufacturing plants to emerge in Pilsen were leatherworks (1825), a ceramics factory (1836), and a company, the establishment of which turned out to be very important, the Burghers' Brewery (1842). The city transformed into a regional industrial hub in the 1850s and 1860s. Data from 1874 shows that there were more than 40 factories in the city. One of them was to play a prominent role in the future: a new branch of Count Waldstein's machine works (established 1859 – 1860), which later became The Škoda Works. The breweries and The Škoda Works grew into the main industrial companies in Pilsen.

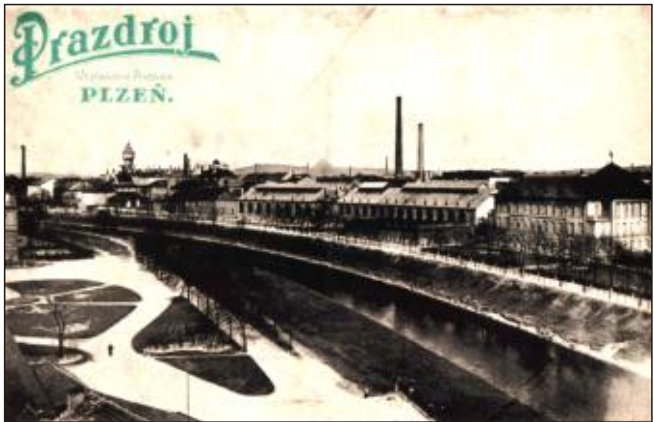
In the early 1880s, the inventor František Křižík established his workshop in Pilsen where he invented the arc-lamp. Industry flourished in the regions around Pilsen as well, with municipal iron works, iron mills, and chemical plants.

In the mid-1880s, The Škoda Works focused primarily on steelmaking and production of arms. The number of its employees soared over the course of World War I: from 10,388 in 1913 to 30,722 in 1917, most of them working in weapons production. After the war, peace-time production was restored and expanded with the manufacturing of locomotives and electrical equipment. The Škoda Works became a corporation of worldwide importance. The German occupation after the outbreak of World War II led to the incorporation of the company into the Hermann Göring Werke concern. As a prominent weapons factory, it was a target for several air raids but it was severely hit in only the last one on April 24, 1945. After World War II, the company was nationalized. Throughout its history, The Škoda Works has had a profound impact on the geographical features of the city as well. Its large factory complexes in the west and east restricted the growth of the city in these directions.

In 1839, the poor quality of beer brewed in Pilsen prompted a group of Pilsen’s brewers to establish a new modern brewery to make bottom-fermented Bavarian-style beer. Below the buildings of the new plant, maturation cellars and drainage adits for removing ground water were carved into the underground. In 1842, a group of experts headed by a brewer named Josef Groll was brought from Bavaria. On October 5, beer production was launched. There were 7 other breweries and 11 malthouses in Pilsen at that time. However, the new enterprise outperformed them soon, thanks to modern production techniques. Besides, its final product was different from others. The new bottom-fermented beer quickly became popular. In 1873, the Burghers’ Brewery supplied almost one thousand establishments and even exported to the USA.

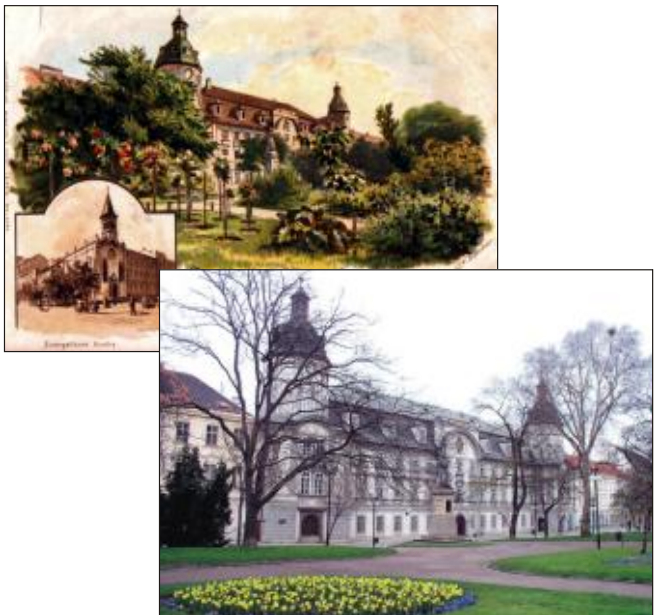


15 THE FORMER MILL RACE AND THE WATER TOWER: IN 1920 AND AT PRESENT



17 BURGHERS’ BREWERY, 1920S

From 1900, a special beer train was sent to Vienna every day. Later, there were special trains to Bremen, Germany as well. The brewery registered its Pilsner Bier trademark in 1895. With the increasing popularity of the beer, the trade mark proved insufficient and “Pilsner beer” even became a general term for a certain type of beer. Today’s Plzeňský Prazdroj (Pilsner Urquell) trademark for the beer from the Burghers’ Brewery was registered as late as 1898. In 1869, První plzeňský akciový pivovar, another brewery adjacent to the Burghers’ Brewery, was founded. Since 1919, its beer bears the name Gambrinus. The growing fame of Pilsner beer inspired attempts to establish new breweries either in the city or in its vicinity. Among these, Plzeňský společenský pivovar, known as The Prior Brewery, was founded in 1893 and another, Světovar was established in 1910. In 1924, a law was tailored to the needs of the existing breweries, prohibiting establishment of any new breweries in the districts of the newly incorporated communities. This was to prevent the formation of new companies producing the Pilsner beer. In 1930s, the breweries in Pilsen merged. The whole concern was nationalized in 1946 and renamed as



16 SMETANA’S PARK: IN 1910 AND TODAY



18 This romanticized panorama of Pilsen in the early 17th century, on a postcard from 1901, shows the natural and man-made water courses on the north-east side of the city.

Plzeňské pivovary. The extensive premises of the existing breweries and the adjacent railroad station still hinder the transport connection between the city's core and its eastern part.

Their contact with the U.S. Army, that entered Pilsen on May 6, 1945 and stayed for half a year, strengthened democratic traditions among the citizens of Pilsen. After the end of the war, Pilsen retained its traditional position as the administrative center of the region. Despite the heavy damage it suffered, it still belonged to key industrial and transportation hubs of the Czechoslovak Republic. The 1948 coup, in which the communist party took over power, was no different in Pilsen than in other industrial areas. The first higher-education institution in Pilsen was founded in 1945. Since 1953, housing complexes have been built around the city in line with the military-oriented economic strategy, which emphasized heavy industry and required a large workforce. As a result, the landscape character in those areas was altered. The undesirable concentration of dwelling zones with a lack of employment opportunities and services exerted pressure on expanding the public transit network. The ideology of the regime brought with it the loss of awareness of essential values associated with urban development and architecture. Numerous buildings in the city core and its surroundings were torn down to provide space for high-capacity roads. Extensive demolition plans for the very center of the city were prevented by declaring Pilsen's center a historical reserve on April 19, 1989. By 1989, however, more than three hundred houses and nine entire streets had been lost in the center of Pilsen.

After the fall of the totalitarian communist regime in 1989, Pilsen began to evolve in a more natural way again. Events resulting from the societal changes include the Freedom Days, an annual celebration of the city's liberation by the U.S. Army, the founding of the University of West Bohemia in 1991 and the establishment of the Roman Catholic Diocese of Pilsen in 1993. In 2006, the highway bypass of Pilsen was completed. The D5 highway links Prague to Germany. Changes in the economy after 1989 led to the collapse of the largest employer in Pilsen, The Škoda Works, where some plants were privatized and others closed down. However, an influx of foreign investment at the same

time created new jobs. In collaboration with these investors, the city built at its southern outskirts one of the largest industrial parks in the country. The brewery Plzeňský Prazdroj was acquired by South African Breweries (SAB) in 1999. After subsequent mergers in the Czech Republic, the Plzeňský Prazdroj group, now owned by SABMiller, has an annual output of 10 million hl of beer.

As in other cities, a number of supermarkets operated by transnational chains emerged in Pilsen. Housing development comprising contemporary types of apartment blocks and single-family houses continues in the city, whereas satellite towns are springing up in the vicinity of neighboring communities.

Internet Links

- <http://www.pilsen.eu/about-the-city/history/traces-of-the-pilsen-history-1/traces-of-the-pilsen-history.aspx>
- <http://www.plzen.eu/o-meste/multimedia/ebook/knihy/ebook-historicky-atlas.aspx>

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19 Karel Liebscher: Saint George's Church (about 1890). COURTESY OF THE MUSEUM OF WEST BOHEMIA, ETHNOGRAPHIC MUSEUM OF THE PILSEN REGION, ITEM NO. 71 777

2. NATURE CONSERVATION AND LANDSCAPE PROTECTION IN THE CITY OF PILSEN



20 OAK-HORNBEAM FORESTS (*MELAMPYRO NEMOROSI-CARPINETUM*) WERE ONCE THE CORE OF THE ORIGINAL STANDS ALONG PILSEN'S RIVERS.

Conservation of nature in a city may sound like a contradiction in terms. However, in the city too, or – better to say – in the city in particular, conservation of nature plays an irreplaceable role. Although the urban environment may seem to have been altered by man far beyond the point where any space is left for the nature, it is not so. The city is a diverse environment where many types of habitats are found in a small area, although in the open landscape such habitats would be very remote. At the same time, nature and landscape face increasing pressure from urbanization. Many plant and animal species, that used to be common until recently, cannot be found in Pilsen anymore. A number of valuable habitats have been lost. This applies to the original natural biotopes, as well as to locations within the cultural landscape. Dry slopes along river banks, home to numerous

thermophytes and xerophytes, were used for grazing for many years in the past. Eventually, they became overgrown or were planted with honey locust trees. The change in agricultural methods caused the formerly abundant wildflower meadows to lose their diversity. Spring anemone (*Pulsatilla vernalis*), a critically endangered species, is not found in the pine forests in the north of Pilsen anymore. Neither is the formerly common gray-hair grass (*Corynephorus canescens*) or other species common to sand communities. The extensive peat bog by the Kamenný Lake has shrunk to a small patch. Most of the diverse and widespread wetland vegetation of the lake area in the north of Pilsen has been lost as well. Only a small part of the native wood stands with a natural composition of woody species can still be found in Pilsen. Over the last 150 years, many changes swept through the relatively diverse cultural landscape. The remaining valuable areas are under strict protection now. At the same time, a number of new typical biotopes were created in the city, becoming home to many animal and plant species of the open landscape. The drawbacks of these biotopes are their isolation and small size. It has been recognized that establishing a network of linked sites of natural and near-natural character is all the more important in an urban environment. Another typical example of a nature conservation issue in urban areas, known in Pilsen as well, is the protection of wildlife that nests on buildings.

The following section will introduce selected nature and landscape conservation instruments available in the Czech Republic, particularly those relevant to Pilsen. Several sites in Pilsen's territory, that are of high interest in terms of natural sciences, will be presented as well.



BOX 1 – NATURE CONSERVATION IN THE CZECH REPUBLIC: BASIC INFORMATION

Nature conservation in the Czech Republic is governed by the Act No. 114/1992 Sb. on nature and landscape protection and by the regulation No. 395/1992 Sb. The compliance with these regulations is overseen on the national scale by the Ministry of Environment of the Czech Republic. On regional and municipal scales, it is overseen by Regional and Municipal Authorities. Large-size protected areas (national parks and protected landscape areas) are administered by their own authorities. Additional authorities with a nationwide jurisdiction include: The Czech Environmental Inspectorate, an independent inspection authority, and the Agency for Nature Conservation and Landscape Protection of the Czech Republic, which provides specialist support for nature conservation.

The Czech Act on Nature Conservation and Landscape Protection makes a distinction between two basic forms of nature and landscape protection: general protection of landscape, its natural and aesthetic values, and all plant and animal species, and special protection of specific valuable areas and rare plant and animal species. Both types of protection rely on special instruments, some of which are applied in the territory of the city of Pilsen.

Table 1: INSTRUMENTS OF NATURE AND LANDSCAPE PROTECTION IN THE CZECH REPUBLIC

General protection of nature and landscape		Special protection of nature and landscape	
General territorial protection	Territorial system of ecological stability (TSES) Significant landscape component (SLC) Landscape character Nature park Temporarily protected areas	Special territorial protection	National parks Protected landscape areas National nature reserves National nature monuments Nature reserves Natural monuments
	General protection of plants and animals Protection of wild birds Protection of woody plants growing outside forests	Special territorial protection and protection of species (NATURA 2000)	Sites of European importance Bird areas
General protection of species	Protection of caves	Special protection of species	Tree monuments Specially protected plants Specially protected animals
Protection of abiotic nature	Protection of paleontological finds		

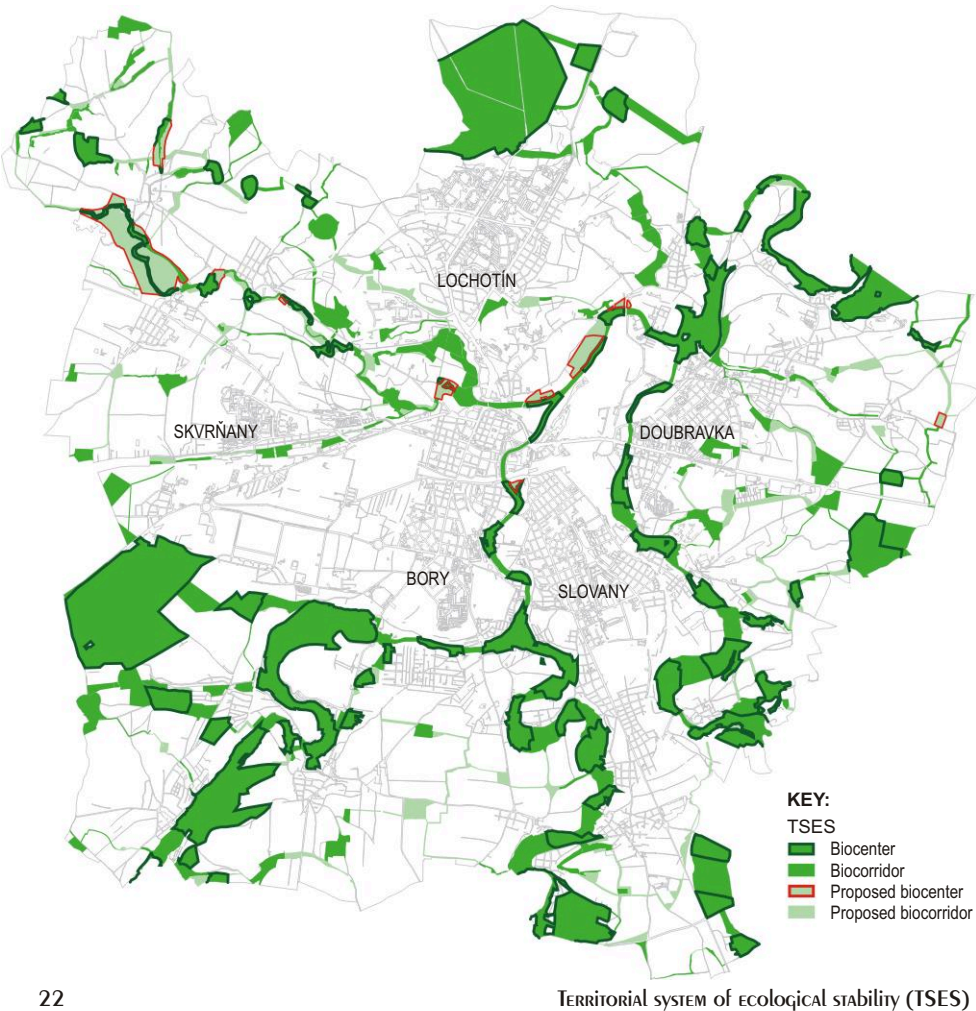
Instruments of protection of nature and landscape used in the territory of the city of Pilsen Instruments not used in Pilsen's territory

GENERAL PROTECTION OF NATURE AND LANDSCAPE IN THE TERRITORY OF THE CITY OF PILSEN

Territorial System of Ecological Stability (TSES)

One of the burning issues of today’s landscape protection in the Czech Republic is landscape fragmentation. The expansion of building development to still intact areas (i.e. construction of satellite towns, new logistic and manufacturing facilities and access roads and large transport infrastructure projects) causes the landscape to become fragmented. The resulting small areas cannot support the life of some species and the boundaries of such areas become impenetrable barriers to their migration. Sustainable balance of nature in this type of landscape cannot be achieved by mere conservation: there must be continuous active stabilization efforts. One of the active approaches to landscape planning consists of building ecological networks. Its purpose is to create a network of sites of natural and near-natural character in order to preserve valuable parts of landscape and to exert positive influence on the adjoining less

stable parts of the landscape. The concept of ecological networks began to be developed in what is today the Czech Republic at the end of the 1970s. Nowadays, it is one of the most elaborate frameworks of its kind in Europe. In the first half of the 1990s, it was incorporated into Czech legislation in the form of the “territorial system of ecological stability” (TSES) and became a powerful nature conservation tool in the Czech Republic.



BOX 2: TERRITORIAL SYSTEM OF ECOLOGICAL STABILITY OF LANDSCAPE (TSES)

The TSES is an interconnected network of natural and near-natural ecosystems that maintain the balance of nature and protect natural resources.

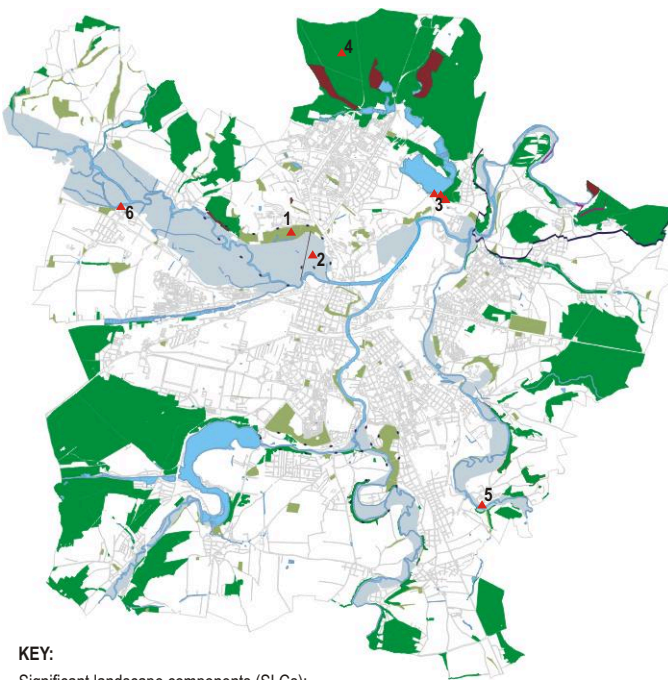
TSES systems are defined at three levels: local, regional and supraregional. The law stipulates that the protection of TSES is the duty of all owners and users of land. Building TSES systems is a public interest shared by owners of the land, communities and the state.

A TSES consists of two types of elements: biocenters and biocorridors.

A biocenter is a part of landscape capable of supporting the permanent existence of a natural or near-natural ecosystem. Examples of biocenters may include a remaining patch of wood in an agricultural landscape or a fishpond with bank vegetation. The size of a biocenter should be sufficient for fulfilling its functions and varies with the type of the biotope. For instance, the area of a regional biocenter with rock communities should be at least 5 hectares, whereas that of a forest biocenter may range between 10 and 60 hectares.

A biocorridor is a territory that allows organisms to migrate between biocenters, and provides a link between separate biocenters in the network. Natural biocorridors are, for instance, water courses with adjacent vegetation or balks in fields.

A TSES in Pilsen's territory is defined as a continuous network. Some of its parts, however, are still only proposed. The important fact is that a TSES is a mandatory part of master plans and an important tool in the care of landscape in its entirety.



BOX 4: SIGNIFICANT LANDSCAPE COMPONENTS (SLC)

SLCs are valuable landscape components that define the landscape's typical appearance or enhance its stability. In the Czech Republic, selected types of biotopes – woods, peatlands, water courses, man-made and natural lakes and flood plains – are under general protection. Whenever an activity might affect these elements, the person intending to perform this activity is required to request an assessment from a nature conservation authority. At the same time, this person must protect these elements from destruction and damage. Besides these exhaustively listed types of SLCs, other parts of landscape (e.g. wetlands, steppe grasslands, hedgerows, balks in fields, mineral and fossil deposits, rock formations and even valuable vegetation in residential areas, including historical gardens and parks) can be registered as SLCs by a nature conservation authority, upon discussion with their owners.

The most significant and even unique landscape components in the strongly urbanized territory of Pilsen are flood plains of large rivers. With the exception of the city center, where the Radbuza and Mže Rivers were confined by high stone embankments, these flood plains have remained free from any building development. The largest

BOX 3: ACCESS TO COUNTRYSIDE

The Act on Nature Conservation and Landscape Protection stipulates a public right of way on land owned or leased by the state, by a community, or by a legal person, provided that exercising this right causes no property damage or harm to another person. This rule excludes, for instance, built-up land, lots intended for building development, courtyards and gardens.



24 ÚSLAVA – CHANNELIZED RIVER IN PILSEN’S LETNÁ QUARTER

flood plain in Pilsen is that of the Mže River with its width of almost one kilometer. A major part of it is intensively used for agriculture. Although the rivers in the city have been affected by technical interventions, such as channelization and channel lining, in some reaches they have retained their natural meandering character. Those locations offer vast potential for preserving and cultivating



25 Flood plain with ash-alder stand along the Úslava River downstream of KOTEROV

the attitude of urban people to the landscape. Pilsen is taking part in the international REURIS project, which aims to develop this potential. (The project is discussed in greater detail in a separate article.) All types of SLCs that are defined by the law, including peat bogs, can be found in Pilsen’s territory. Expanses of woods, lakes and water courses are covered in more detail in other chapters of this publication.

In addition to the SLCs defined by the law, there are 70 additional specially-registered significant landscape components in Pilsen. They comprise a majority of those large urban green spaces, which are not inherently protected by the law. About one third of these additional specially-registered 70 SLCs are natural or near-natural locations. They include the slopes along rivers with remaining dry grassland and vegetation on rock formations, significant geomorphologic formations, hedgerows and balks in fields. The balks fulfill aesthetic and landscape-forming functions. In addition, they prevent water and wind erosion and furnish wild animals with shelter and food. They also provide habitat for plant species, for which the intensively utilized landscape does not offer space anymore. The remaining two thirds of these specially-registered SLCs include city parks, valuable gardens or cemeteries landscaped as parks.

The most significant landscape components are also part of the TSES, which means that their protection is guaranteed by two instruments at the same time.

Specially Registered Significant Landscape Components in Pilsen

Some of Pilsen’s specially registered significant landscape components are true gems. The following is a list of dominant features that are valuable from both scientific and cultural viewpoints and as relics of historical farming and land management methods.



26 **Hradiště SLC** (registered in 1994): ONE OF THE MOST VALUABLE LOCATIONS IN PILSEN’S TERRITORY. IT IS HOME TO XEROPHILOUS SPECIES-RICH GRASSLAND COMMUNITIES, NOW RARE IN PILSEN, AND COMMUNITIES OF SHALLOW PRIMITIVE SOILS ON SPILITE FORMATIONS. A BOTANICAL SURVEY TOOK PLACE HERE IN 2006 IN ORDER TO ASSESS THE NUMBER OF SPECIES PRESENT, TO EVALUATE THE CONDITION OF THE LOCATION AND TO PROPOSE OPTIMUM MANAGEMENT METHODS FOR PRESERVING ITS SCIENTIFIC VALUE. THE PROPOSED MEASURES INCLUDE A REMOVAL OF LOCUST TREES AND RE-INTRODUCTION OF CONTROLLED SHEEP GRAZING.



27 Litice Castle SLC (registered in 2001): A prominent spilite hill with remnants of a 13th century castle: traces of buildings and massive earth ramparts. Until recently, the ramparts used to be grazed by sheep. Xerothermic grassland has been preserved in this location even today. Some of it is still being cut. The location is important from the landscape viewpoint as well.



28 Tyrš Orchard SLC (registered in 1999): ONE OF THE LAST HEATHS IN PILSEN. Biotopes of this type used to be more widespread in Pilsen but now they survive as small patches. This location is threatened by overgrowing self-seeding woody plants.



29 Luft's Garden (registered in 1997): A park-type significant landscape component. This garden was remodeled by the lawyer Vilém Luft at the beginning of 20th century. At that time, it included two fishponds, a pavilion, sculptures by Pilsen artist Otokar Walter and a number of exotic and local woody plants. The garden was owned by the state between 1959 and 1991 and became rather dilapidated. The city of Pilsen acquired the garden in 1991. A gradual restoration began in 1996. In 2010, the garden was open to the public for the first time.



30 Meditation Garden SLC (registered in 1999): ONE OF THE PARK-TYPE significant landscape components. Luboš Hruška, a political prisoner, began to transform his former fruit grove into today's Victim of Evil Memorial, after being released from the communist jail in 1960. This unique English landscape park features Stations of the Cross carved in sandstone between 1986 and 1991 by the sculptor Roman Podrázský and a chapel of the Saint Maximilian Kolbe built in 1993–1995. The garden is open to the public.

Landscape Character

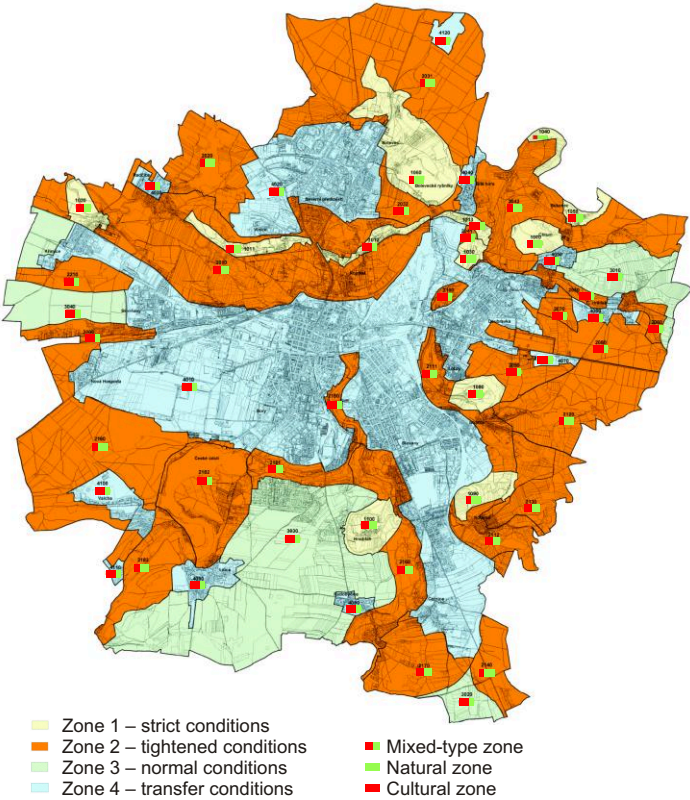
Does a city qualify as landscape? Can one consider an urbanized area to be landscape? On closer examination, we find that the answer is yes. However, an urban landscape is a peculiar space. In Pilsen, densely built-up areas on plateaus above large rivers alternate with almost unbuilt flood plains and the urban space includes expansive fields and woods as well. Diverse types of landscape are found in a relatively small area here.

In 2000, a study examined Pilsen's territory from the landscape viewpoint and classified the area into four zones with different requirements for the protection of landscape value. One of its outcomes was a database of areas with associated indicators, such as landscape values and land use specifications.

Although the outcomes of this study were not followed up, it continues to offer a valuable insight into the landscape values of Pilsen's territory.



31 The Bolevec Lakes and Chlum Hill belong to the most valuable parts of Pilsen's landscape.



32 ZONES FOR CONSERVATION OF NATURAL, CULTURAL AND HISTORICAL VALUES

BOX 5: THE CONCEPT OF LANDSCAPE CHARACTER AS AN INSTRUMENT OF CZECH LANDSCAPE PROTECTION

The Act on Nature Conservation defines the concept of landscape character as the natural, cultural and historical characteristics of an area. Landscape character should be protected from activities, that might reduce its aesthetic and natural values. The planning of a structure should entail an analysis of its impact on the landscape character of the area. Authorities may impose conditions and require compensation measures for structures with significant impact on landscape character. Planning and zoning instruments play an important role in landscape protection as well. Potential consequences for the landscape character of an area should always be considered in drafting new zoning plans.

Several methodological guidelines authored by landscape architects and naturalists are being used for landscape character assessment. They are intended for assessment of the current condition of an area in terms of landscape values, as well as for defining the limitations for use of the area and evaluating the impact of building plans on the landscape character.

Landscape protection does not apply just to valuable areas, but to the entire landscape.

Nature Park

For the purpose of protection, an area with valuable landscape character may be designated as a nature park. Pilsen’s territory



33 HORNÍ BEROUNKA NATURE PARK

includes a part of the Horní Berounka nature park, which was established in 1995 to protect the canyon of the Berounka River and its features.

General Protection of Plants and Animals

The Act on Nature Conservation provides for protection of all plant and animal species. As the Czech Republic is a member of the European Union, in which special attention is paid to bird protection, the Czech Act on Nature Conservation includes sections dedicated exclusively to this issue. The concept of general protection of nature also deals with the issue of intentional dispersion of crossbreeds and non-indigenous species, which is only allowed with the approval of a nature protection authority. Despite that, some non-indigenous species have begun to spread spontaneously, altering the composition of indigenous communities. The situation in the Czech Republic and Europe has not escalated as much as in other parts of the world but negative effects of such invasions do occur. Invasive species can be found in Pilsen’s territory as well, such as giant hogweed (*Heracleum mantegazzianum*), Japanese knotweed or giant knotweed (*Reynoutria japonica*, *R. sachalinensis*), American mink (*Mustela vison*), and others.

The concept of general protection of nature encompasses the care for animals, which are temporarily incapable to survive in the wild. For this purpose, animal rescue stations are established in accordance with the law. One of those is operated in Pilsen by the citizen association DESOP. In addition to running the animal rescue station, the association is very active in environmental education, focusing predominantly on children and youth.



34 FIELD TRIP TO THE ANIMAL RESCUE STATION

Special Protection of Nature and Landscape

A number of significant natural features have been preserved in Pilsen's territory, which are protected through the instrument of special protection of nature and landscape.

Special Territorial Protection of Nature and Landscape

One of the most important instruments in protecting nature and landscape is the concept of protected areas: these comprise large-size areas, such as national parks and protected landscape areas, and small-size protected areas. The latter are designated in scientifically and aesthetically exceptional locations. Every protected area has its management manual, a "cookbook", which is continuously updated. This manual contains measures aimed at



35, 36

ROUNDLEAF SUNDEW IN THE KAMENNÝ LAKE NATURE RESERVE



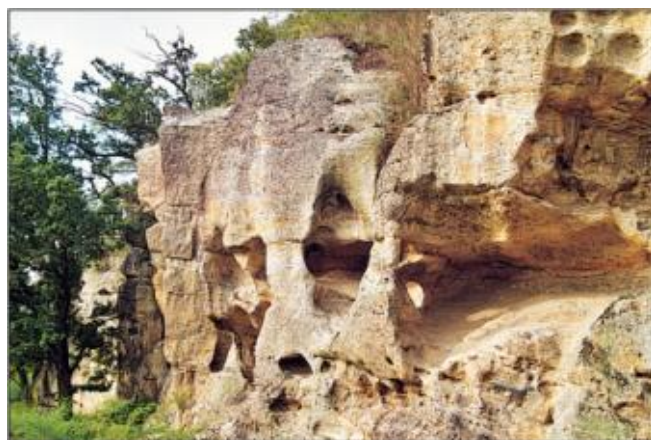
37

THE PETROVKA NATURE RESERVE PROTECTS ONE OF THE OLDEST PEAT BOGS OF THE GREATER PILSEN AREA, WET MEADOW COMMUNITIES WITH A NUMBER OF PROTECTED AND ENDANGERED SPECIES, A PINE FOREST ECOSYSTEM WITH THE LOCAL ECOTYPE OF SCOTS PINE AND GEOMORPHOLOGICAL FORMATIONS (SUCH AS THE PECULIAR PETROVSKÁ CAVE IN THE PHOTOGRAPH).

maintaining or enhancing the condition of the area. The management manual is also used as a source document for other planning documents and as a basis for decisions made by the nature protection authorities.

There is no large-size protected area in Pilsen. Out of the four categories of small-size specially protected areas, two can be found in Pilsen. They are the nature reserves and natural monuments. These

protected areas are of regional importance. Nature reserves are small areas with concentrated valuable natural features and ecosystems typical of and significant for the geographic region. Natural monuments are natural formations found in small areas, predominantly geological and geomorphologic formations, deposits of rare minerals or habitats of endangered species in fragments of ecosystems, typically of regional ecological, scientific or aesthetic significance.



38

THE ČERTOVA KAZATELNA NATURAL MONUMENT IS A LINE OF SPECTACULAR ROCK FORMATIONS CREATED BY SELECTIVE WEATHERING OF CARBONIFEROUS SEDIMENTS IN THE PILSEN AREA.

BOX 6: KAMENNÝ LAKE: AN ENDANGERED FORMER GEM

The Kamenný Lake nature reserve (designated in 1953 and expanded in 1997, with an area of 11.4 hectares) is the oldest protected area in Pilsen. The first records of species that are significant in terms of nature conservation date back to late 1874. The area is a remnant of an important and regionally unique peat bog existing in a littoral zone of a man-made lake. Rare plant and animal species used to be and are still found in the area. In the eleven-hectare reserve, sources report the presence of a total of 165 plant species. The significant ones include, for instance, the carnivorous plant roundleaf sundew (*Drosera rotundifolia*), small cranberry (*Oxycoccus palustris*), bog blueberry (*Vaccinium uliginosum*), slender sedge (*Carex lasiocarpa*) and Siberian iris (*Iris sibirica*). However, the diversity of species in this protected area has declined in the last century. Almost 60% of the 52 most significant species in this area have been reported extinct as recently as 1980s. Disturbance in the hydric regime of the location threatens the peatland vegetation (including the expanses of common reed (*Phragmites australis*)). The setting of this specially protected area in the middle of a frequented recreational area is an additional negative aspect.



39 Old oak tree in Zábělá:
A suspected habitat of hermit beetle

In Pilsen’s territory, three areas have been designated as nature reserves and four locations as natural monuments.

Special Territorial and Species Protection: the European Network of Protected Areas NATURA 2000

Natura 2000 is a network of protected areas of European importance. It is being built in accordance with unified criteria for all European Union member states. Two types of protected areas are established as part of this network: bird areas for conservation of bird species of European importance and sites of European importance for the protection of plant and animal species of European importance and for conservation of selected types of natural habitats.

Between 2000 and 2004, a survey covering the entire territory of the Czech Republic was undertaken for the purpose of designating sites of European importance. The survey was also carried out in urbanized areas, which included Pilsen’s territory as well. In 2004, the results of the survey were used to compile a national list of sites of European importance. Their number is 1082 in the Czech Republic alone. Following the requirements of the European Union, this list was extended and promulgated in the form of a government decree.

Pilsen’s territory includes a part of one location from the national list. This site was designated in order to protect the hermit beetle (*Osmoderma eremita*), a species of European importance. The hermit beetle is confined to old solitary trees in sunny habitats. The Pilsen site is one of the 54 Czech sites of European importance designated to protect this species.

There is no bird area in Pilsen’s territory, but the Pilsen Region includes two of those (Šumava and Krivoklátsko).

Special Protection of Species

Tree Monuments

Important trees, their groups and parkways may be designated as tree monuments. The law protects tree monuments from damage, destruction and disturbance of

their natural development. Any treatment applied to such trees must be approved by the authority which designated them.

Today, there are 6 tree monuments and one protected tree alley in Pilsen’s territory. Their protection is complicated by their health and the increased level of stress in the urban area.

Between 2003 and 2004, the Environment Department of the Municipality of Pilsen working with the Urban Planning and Development Institute of the City of Pilsen compiled a database of important trees in Pilsen’s territory. It contains records of 60 trees, their groups and parkways (with a total of more than 130 trees), serving as the pool of candidates for future tree monuments. These are trees notable for their size, age or landscape or historical context. All trees in the database were chartered and entered in the Geographic Information System of the City of Pilsen.

Specially Protected Plant and Animal Species

Special protection may be applied to protect plant and animal species that are endangered, rare or scientifically or culturally important. These species are classified into three categories: critically endangered, highly endangered, and endangered species. The list of specially protected species in the Czech Republic is part of the Annex to the Regulation



40 KÖRNER’S Oak in the Zoological and Botanical Garden is one of the six tree monuments in Pilsen. A Japanese garden has been built in its vicinity.



41 BROAD-LEAVED MARSH ORCHID (*Dactylorhiza majalis*) IS ONE OF 15 SPECIALLY PROTECTED PLANT SPECIES IN PILSEN. THE PLANT GROWS IN WET AND MARSHY MEADOWS.

time, the legal protection applies to 19 species of amphibians, whereas the Red List mentions just 13 species.

The protection covers all underground parts and shoots and all growth stages of specially protected plants, as well as their biotopes. It is prohibited to harvest, pick up, dig up, damage or destroy these plants or disturb their growth. It is

No. 395/1992 Sb. It should be noted that for various reasons this list does not quite match the Red Lists of Threatened Plant and Animal Species for the Czech Republic. For instance, the special protection applies to 487 species out of all species of vascular plants in the Czech Republic. On the other hand, the Red List comprises 1148 species in the critically endangered, highly endangered and endangered categories. This amounts to 45% of the vascular plant species of the Czech Republic. At the same



43 SIBERIAN IRIS (*Iris sibirica*) IN WET FEN AND PEATY MEADOWS.

also prohibited to possess, grow, transport, sell, exchange or offer for sale or exchange these plants.

About 64 specially protected species have been reported in Pilsen's territory. About 15 of those have survived to this day. They include Siberian iris (*Iris sibirica*), broad-leaved marsh orchid (*Dactylorhiza majalis*) and roundleaf sundew (*Drosera rotundifolia*). A number of rare wetland species confined to littoral zones of lakes, small pools and water courses have disappeared. Interesting species of xerophilous grasslands, heaths and sands in the north of Pilsen have been lost as well, such as the critically endangered spring anemone (*Pulsatilla vernalis*). The highly endangered and formerly widespread everlasting flower (*Helichrysum arenarium*) became extinct in Pilsen, as did most species of orchids.

Specially protected animals are under protection at all growth stages, as are their natural and artificial homes and their biotopes. The conditions of their protection are similar to those of specially protected plant species.

Pilsen's territory is inhabited by a number of specially protected animal species, which can be found even in locations that were substantially transformed by man, such as abandoned quarries (see the Box 7), industrial premises, military areas or even buildings. A well-known example, highly debated in the Czech Republic



42 YOUNG COMMON SWIFT TAKEN OUT FROM THE GAP BETWEEN PANELS FOR RINGING



44, 45

INSTALLATION OF SPECIAL NESTING BOXES FOR COMMON SWIFTS



46 THE LARGEST CZECH OWL SPECIES, THE EAGLE OWL (*Bubo bubo*), IS ONE OF THE SPECIALLY PROTECTED SPECIES IN PILSEN'S TERRITORY.

recently, is the common swift (*Apus apus*), a bird of the order *Apodiformes*, which used to nest in crevices in rocks and tree cavities. Over time, it has abandoned these locations and began to nest in structures built by man (up to 95% of the population of swift in the Czech Republic is reported to be found in cities and villages). The present restoration efforts in housing complexes, are threatening the common swift populations nesting in gaps between concrete panels or in ventilation outlets. Fortunately, the installation of bird boxes on restored blocks of apartments in order to provide an alternative nesting opportunity has already become common in locations where the presence of common swift was proven.

BOX 7: THE HÁJE QUARRY NEAR KOTEROV

Habitats created or heavily transformed by man may play an important role in maintaining the diversity of species. For instance, abandoned quarries often become unique habitats, and a refuge for species, that have disappeared from the landscape.

The former spilite quarry Háje near the Koterov community is an interesting location within the greater Pilsen area. Mining in this four-bench quarry ended more than 30 years ago. Since then, the area has been abandoned. Over this period, it became a scientifically valuable location, which is important in terms of vast expanses of rock vegetation, as well as due to the presence of relatively rare species of birds, lizards and thermophilous and xerophilous insects. It should be noted that these positive changes in a location, formerly heavily disturbed by man, occurred without any costly recultivation measures. From the naturalist viewpoint, the time given to nature to deal with the consequences of human intervention was the best investment. Nature recultivates slowly but the quality of its results tends to be higher than even the best planned human efforts – and it works for free.

The entire area of the quarry in Koterov has a vast educational and tourist potential. There are several high points offering great views. Geological aspects of the quarry deserve attention as well, since the mining revealed several sections of pillow lava formations. Its significance is illustrated by the fact that it was chosen as a destination of one of the field trips of the International Geological Congress held in Prague in 1968.



47 VIEW OF THE ÚSLAVA RIVER valley from Háje quarry located south-east of Pilsen with the bridge on the PRAGUE-NUREMBERG highway in the middle and ruins of the medieval Radyně Castle at the top left. BOTTOM-RIGHT INSET: A CLOSE-UP VIEW OF THE SO-CALLED LAVA PILLOWS

3. PILSEN AND WATER

Pilsen is a place where four rivers named Mže, Úhlava, Radbuza and Úslava (Table 2) meet to create the Berounka River, a river that drains the entirety of West Bohemia. Besides these rivers, there are several small streams in Pilsen's territory which are mostly in poor hydromorphological condition and should be considered for restoration. Standing waters can be found both on the northern outskirts of the city, where there is a historical system of man-made lakes (the Bolevec Lakes), and on the Radbuza River which was dammed to form the České Údolí Reservoir. However, Pilsen inhabitants also visit the vast impounding Hracholusky Reservoir on the Mže River, lying about 20 kilometers from the city. Small bodies of water, with the exception of the Košutka Lake, do not play a significant role in the system.

Running Waters

The quality of river water in Pilsen has improved over time to its current good level (Table 3), and those river sections which have not been channelized, are now appealing again. Sport fishing is also a commonplace activity even in the center of the city.

Tables 2,3: BASIC CHARACTERISTICS OF THE FOUR RIVERS IN PILSEN

	Length	Drainage area	Mean flow Qa
	km	km ²	m ³ .s ⁻¹
Mže	108	1824.2	8.85
Úhlava	109	915.1	5.85
Radbuza	111	1266.5	5.66
Úslava	96	755.7	3.61

Qa = long-term mean flow through the outlet section.

	pH	BOD ₅	P tot	NO ₃ -N	N tot.	Ca	Mg	SO ₄ ²⁻	Cl ⁻	Chl a
						mg.l ⁻¹				µg.l ⁻¹
Mže	7.7	2	0.085	2.5	3.1	24.7	8	34.5	21.8	2.1
Úhlava	7.9	2.1	0.138	3.5	3.9	23.5	6.8	25.4	18.1	14.8
Radbuza	8.2	4.4	0.135	3.8	4.9	31.4	9.4	38	35.7	99
Úslava	7.8	3.5	0.131	3	3.8	33.9	10	36.2	28.1	47.2
Berounka	7.6	2.7	0.109	3.2	4	28	8.5	33.8	25.9	22.4

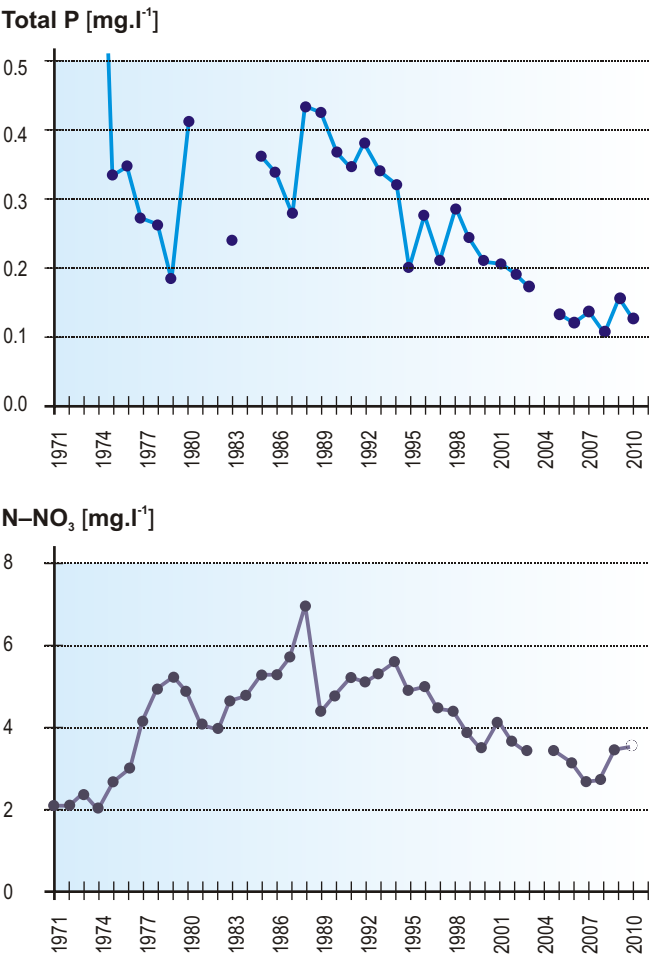
Basic characteristics of the rivers in Pilsen: Mže, Úhlava, Radbuza and Úslava Rivers at their mouths, and the Berounka River downstream of the city. These are mean values for the two-year period 2009/2010. An exception is the phytoplankton biomass expressed as the chlorophyll-a concentration, which is the mean value for just the vegetation period. BOD₅: biological oxygen demand, P tot: total phosphorus, N-NO₃: nitrate nitrogen, N tot: total nitrogen, Ca: calcium, Mg: magnesium, SO₄²⁻: sulfates, Cl⁻: chlorides, Chl a: chlorophyll-a.

The Mže River is the largest of Pilsen's rivers by the volume of water. Upstream of Pilsen, it flows into and out of the Hracholusky Reservoir where self-purification eliminates a major part of its contaminants. It owes its good water quality in part to the fact that in recent years the small communities in the vicinity of Pilsen markedly improved their treatment of wastewater, which used to be the major source of microbiological contamination. Although the Mže River leaving the impounding reservoir is rather cold, the place where it enters the city's territory is traditionally used for swimming.



The **Úhlava River** originates in an unpolluted wooded mountain range but then flows through a rather densely populated catchment area, which is greatly affected by agricultural production. This is reflected in the water quality. The water quality in the Úhlava River and in its catchment area is monitored systematically. Since 1889, the Úhlava River has been the only source of drinking water for Pilsen and now for its entire agglomeration. Graphs 1, 2 show the development of water quality in the Úhlava River at the point of abstraction for the waterworks. The example of nitrate nitrogen concentration (N-NO_3) illustrates the impacts of farming. It clearly shows that replacing the “heavy” agricultural intensification with a more balanced approach at the beginning of the 1990s became a turning point. Greater environmental friendliness of agricultural techniques eliminated the shock contamination episodes resulting from cattle breeding and reduced pesticide contamination. The effects of point sources of pollution, namely the wastewater from residential areas, are well illustrated in the graph of total phosphorus concentrations. Rebuilding of old wastewater treatment plants and construction of new ones began no sooner than the early

GRAPHS 1, 2: THE ÚHLAVA RIVER – CONCENTRATIONS OF NITRATE NITROGEN (N-NO_3) AND TOTAL PHOSPHORUS



Average annual concentrations of nitrate nitrogen (N-NO_3) and total phosphorus, reflecting the changing impact of agriculture and wastewater treatment in the catchment area.



50 WATER mill ON THE ÚHLAVA RIVER IN THE village of Radobyčice

1990s. After that, however, phosphorus concentrations began to decline, organic discharge into the river was significantly reduced, and the water quality began to improve in bacteriological terms. All in all, the positive developments in the catchment area of the Úhlava River stabilized the water quality, which is very important given its use as a drinking water source.

The Radbuza River flows through a relatively densely populated catchment area, which is used for agricultural production. This is reflected in its water quality, particularly the increased nutrient content, and complicates the recreational use of the České Údolí Reservoir. The phytoplankton from this reservoir in turn degrades the water quality downstream (Table 3, chlorophyll-a concentration).

The Úslava River drains an area, the character of which is similar to that of the Radbuza River, with an additional strong influence of fishponds. This means both increased nutrient concentration and higher levels of phytoplankton and cyanobacteria during the vegetation period. Consequently, the Úslava River exhibits strong blooms during summer, becoming less attractive for recreational activities.

The Berounka River receives water from all Pilsen’s rivers and also all pollution discharged in the urban agglomeration. Trends in the Berounka River’s pollution with easily degradable organic substances downstream of the city, shown in Graphs 3 and 4, are illustrative. The pollution level is measured as the BOD_5 parameter (biological oxygen demand). At the beginning of the 1960s, the situation reached its peak: the river, with floating patches of persistent foam, exuded a foul odor, and the riverbed was covered in a thick layer of whitish-grey biomass of filamentous bacteria and fungi. Untreated wastewater was discharged into the river from both households and food industry plants. For instance, the



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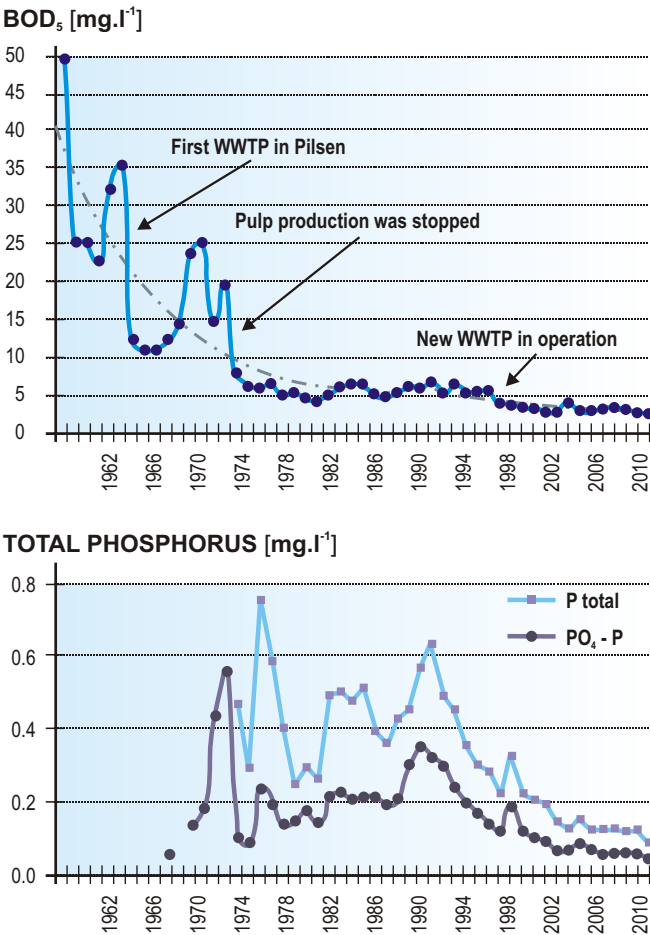
THE BEROUNKA RIVER VALLEY DOWNSTREAM OF PILSEN

brewery in Pilsen emitted as much pollution as the rest of the city. A problem of its own kind was the production of cellulose by the sulfite process in the paper works in Pilsen. The wastewater from this plant was found to degrade the water quality as far downstream as the Vltava River in Prague. The situation took a turn for the better as late as the 1970s and 1980s. A new wastewater treatment plant began to operate in 1964 and the production of cellulose in the paper works ceased in 1973. The conditions in the Berounka River improved enough to support the life of resistant fish species. This was, however, severely impaired by fatal oxygen deficits each summer. It was only after an entirely new wastewater treatment plant had been built in 1996 that the water quality improved in terms of organic pollution, nutrient levels and phosphorus (Graphs 3 and 4, Table 3). The latter are very important, as controlling the enrichment of water with nutrients is still imperative. The environmental condition of the Berounka River has improved substantially and its valley, while still valuable to science, also has begun to appeal to visitors as well.

Overall, the quality of flowing waters in Pilsen is relatively good these days. However, major deficiencies

remain in the hydromorphological conditions in Pilsen’s territory, where former adaptations of water courses both degraded their environmental value, and excluded the rivers from the lives of the city’s inhabitants. This has devalued the urban space and the urban experience of its inhabitants, and affected the potential for using contact with the water surface for environmental education.

Graphs 3,4: THE BEROUNKA RIVER – CONCENTRATION OF BOD₅, AND TOTAL PHOSPHORUS AND ORTHOPHOSPHATE PHOSPHORUS



The Berounka River: Development of the organic substance level represented as BOD₅ concentration and total phosphorus and orthophosphate phosphorus levels. The data is annual means. WWTP: Wastewater treatment plant.

Drinking Water Supply

The first modern waterworks was put into operation in 1889. It began to withdraw water from the Úhlava River and used slow sand filtration. Its processes were continuously upgraded, with the most recent rebuilding taking place in the 1990s. The present plant includes stages with mechanical cleaning, coagulation with Al-based agents, sand filtration and ozone treatment. Water treated in this manner is then hardened and disinfected with chlorine. The total capacity of the plant of 1,500 l.s⁻¹ is not utilized in full, as the waterworks currently delivers only about 570 l.s⁻¹.

Wastewater Treatment

The first wastewater treatment plant was put into operation in 1964 but it was immediately overloaded in terms of both volume and contamination load. As a result, the efficiency and stability of the treatment process were poor. A new, modern, mechanical-biological wastewater treatment plant using anaerobic stabilization of sludge and nutrient removal processes was commissioned in 1996. The efficiency of removal of organic pollution (BOD₅) and nitrogen is 98.8% and 78.5%, respectively. Phosphorus is removed by biological treatment at 96.4% efficiency, which brings its concentrations at the treatment plant outlet to 0.3 mg.l⁻¹. Two retention tanks with the combined capacity of 12,500 m³ are an important part of the plant, collecting the initial and most polluted portion of stormwater runoff. Once the precipitation ceases, their content is treated in the standard fashion. These retention tanks are of immense importance to the Berounka River’s ecosystem, as short summer rainstorms would otherwise flush large one-time



52 Bolevec Lakes – the Great Bolevec Lake

amounts of pollution into the river. This would lead to rapid depletion of dissolved oxygen, killing fish and other organisms. This occurred in 1999 when about 3 tonnes of fish were killed.

Standing Waters

The Bolevec Lakes, which have already celebrated 550 years of their existence, are part of valuable landscape and dominate the popular recreational area. The quality of water in the lakes is very good and its changes over time are monitored systematically. Aquaculture activities were subordinated to water quality requirements and extensive fish farming techniques without feeding and fertilization were adopted. This protects well-developed near-shore strips with aquatic and wetland plants as environmentally valuable habitats.

The largest body of water here is the Great Bolevec Lake, which has been used for recreational purposes for more than one hundred years. In the second half of the last

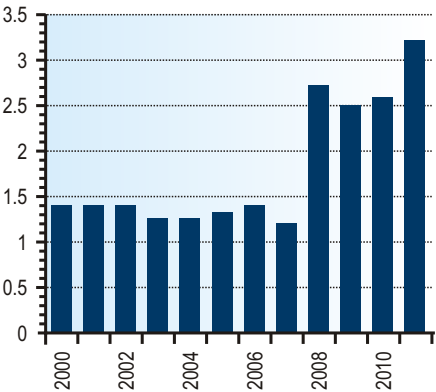
century, the lake suffered from several adverse impacts: an inflow of untreated wastewater, the runoff from the newly built-up portion of its catchment area being diverted away from the lake by the sewer system, which severely disrupted the lake’s hydrological regime, and the increasing intensity of fish farming, which eliminated all submerged aquatic vegetation. The tipping point came in 2000 when the character of the entire lake ecosystem changed abruptly. Water bloom occurred and for a part of the summer season, the levels of cyanobacteria were above the safe limits for water used for swimming. The issue was explored through a five-year research effort, after which a project for water quality improvement was proposed. The project, which was launched in 2006, combines several measures: reducing the fish stock biomass by about 90% and enlarging the predator fish population, applying Al coagulant to enhance the sediment’s ability to absorb phosphorus, the key nutrient, and supporting the reintroduction of a wide range of aquatic plants stabilizing the fish stock and retarding the phosphorus circulation.



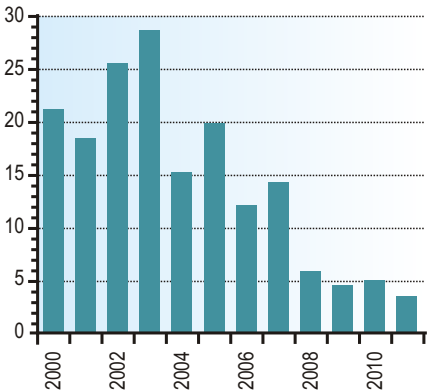
53 A small pike among aquatic plants

Graphs 5, 6, 7: Evolution of quality of water in the Great Bolevec Lake

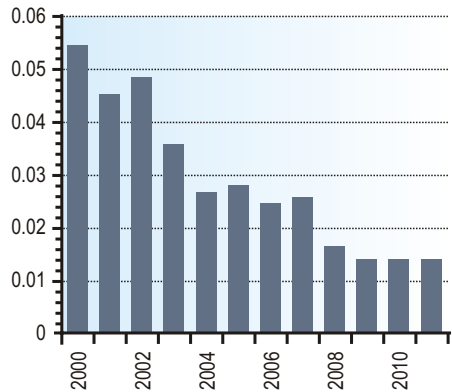
TRANSPARENCY [m]



CHLOROPHYLL a [$\mu\text{g.l}^{-1}$]



TOTAL PHOSPHORUS [mg.l^{-1}]



Phytoplankton biomass level is expressed as chlorophyll-a concentration. Mean values for the vegetation period.

The third year of the project (2008) brought very good water quality and a transparency depth of 2–3 m in the summer season (Graph 5). In 2011, however, the excessive growth of submerged aquatic plants due to good water transparency became a serious problem. In the upcoming years, the growth of aquatic plants will have to be controlled in order to maintain conditions for swimming and boating.

The successful project for enhancing the quality of water in the Great Bolevec Lake has been recognized on an international scale as well: winning third place in the environmentally sustainable project category of the LivCom competition (The International Awards for Liveable Communities).

The Košutka Lake is a flooded former sandstone quarry and sandpit. Thanks to its picturesque sandstone wall, park-like landscape and good water quality, it has been a popular swimming destination for more than 70 years. Water in the lake exhibits increased salinity, as the lake is connected with ground water spaces. The water quality is still acceptable, but the sediments on the lake bottom disrupt its oxygen regime. They also release nutrients, which continue to impair the water quality. This issue will have to be dealt with in the future.

There are several small water reservoirs in the territory of Pilsen, which were used as fire water sources. Most of them still await adequate integration into the modern urban space, although projects are underway for some of these locations.



54 THE KOŠUTKA LAKE

The České Údolí Reservoir was built in 1973 exclusively for the recreation of the inhabitants of the city. However, its design is not adequate for this purpose. It is fed by the nutrient-rich Radbuza River and the water residence time in the impounding reservoir is relatively short. Consequently, the supply of nutrients, predominantly phosphorus, causes formation of vast amounts of phytoplankton biomass and common occurrence of cyanobacterial bloom. As a result, the water is not fit for swimming. A water quality enhancement project consisting



55 THE ČESKÉ ÚDOLÍ RESERVOIR – CYANOBACTERIAL WATER BLOOM

of building a bypass would require substantial intervention in the structural elements of the location and in the past it has been rejected due to high costs.

Pilsen’s inhabitants, however, have strong ties to bodies of water outside the city as well, predominantly to the **Hracholusky Reservoir**. It was built in the early 1960s by damming the Mže River in a valley about 20 kilometers from Pilsen. In its vicinity, weekend houses sprung up immediately, forming extensive areas. The Hracholusky Reservoir has long been suffering from eutrophication, which is an excessive addition of nutrients. This is evidenced by the cyanobacterial bloom, particularly in the upper portion of the reservoir, rendering the water unfit for swimming. The quality of water in the lower part of the reservoir varies greatly from year to year. In summer, however, the occurrence of health-hazardous cyanobacteria is normally within acceptable limits. The only way to improve water quality is through the consistent removal of phosphorus from the point sources of pollution, in the watershed of the reservoir.



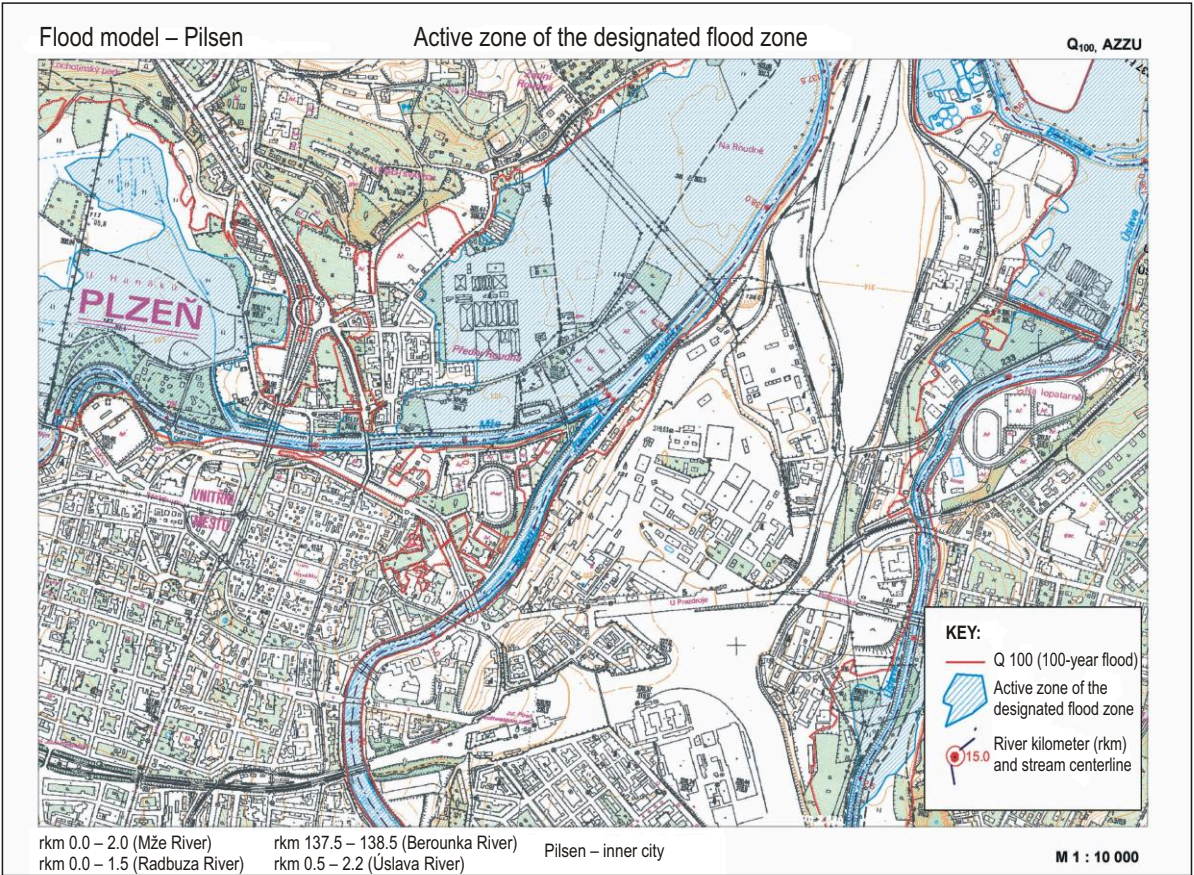
56 THE HRACHOLUSKY RESERVOIR

FLOOD PREVENTION IN PILSEN

Given its location at the confluence of four rivers, the city of Pilsen cannot afford to ignore the flood hazard. Our ancestors were aware of this and did much to protect the city, particularly at the turn of 20th century. They built stone embankments in the city center, erected bridges with sufficient flow capacity and kept most building development at a safe distance from the rivers. Moreover, they preserved significant vacant areas upstream of the city, which allowed floods to spread, slowing down the flood water rise in the city and lowering the peak flood levels somewhat.

Designated flood zones were identified, on the basis of calculations and the experience of experts, for a majority of important water courses in Pilsen at the end of 1970s. This gave the city an effective tool for regulating the building development in locations where inundation by a flood may be expected. In the second half of the 1990s, the city commissioned a comprehensive study on its flood protection, which led to the development of a mathematical model of flooding in 2004. The required data began to be

collected in 2000. In this year, a digital topographic model of relevant areas was constructed and longitudinal profiles and cross sections of the water courses and associated structures were measured. The model was continuously upgraded to capture significant topographic changes and hydrological data. As a result, the city of Pilsen and the watershed administration authority, Povodí Vltavy, s.p., co-owners of the mathematical model, obtained a powerful tool for assessing various building plans. The model is updated and upgraded periodically. It contains information on the area of designated flood zones, depths and flow speeds during floods and other useful data. The initial model was predominantly one-dimensional but its present version is two-dimensional for the entire territory of the city. On the basis of this model, preparations are now underway for resizing the current designated flood zones and their active zones (areas experiencing major flow during flooding) in the city. Specific proposals of flood-control measures for the city's territory were built into the mathematical model in 2004. The most important one – enlarging the capacity of the flow cross-section on the Berounka River draining the territory of the city – has already been realized. Small-scale measures, such as sewer system gates, are implemented on a continuous basis, depending on the funds available from the city and investors for individual structures.



57 Map of the designated flood zone of a part of the city: an example output from the model, scaled down 70%

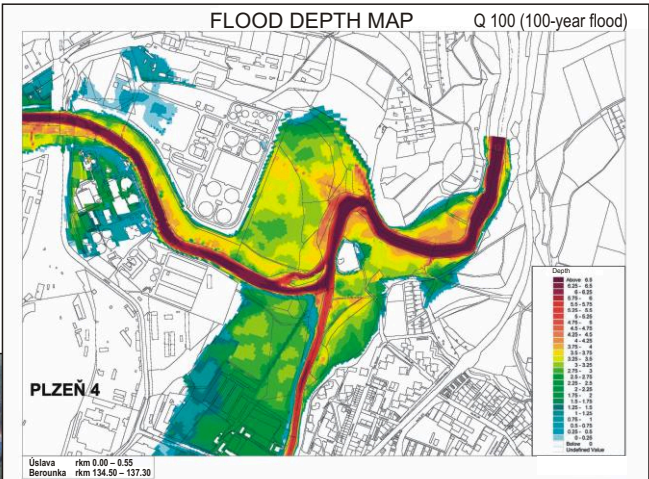
History of Floods in Pilsen

The largest documented flood in the city’s history, until the end of 20th century, hit the Berounka River and almost its entire watershed in September 1890. In Pilsen, the river reached a level practically corresponding to a 100-year flood (780 m³/s). There have been several significant floods since then, including those in April 1975 and July 1981. However, the 1890 flooding was only exceeded in August 2002. At that time, the peak flood flow through the Berounka – Bílá Hora section was almost 860 m³ per second, which is more than a 100-year flood level. The other rivers in Pilsen have reached between 100-year and 1000-year peak flood flows, the highest being those of Úhlava and Úslava, whereas the Mže River peaked at a mere Q5. This flood paralyzed the city for a short time, causing significant damage. Fortunately, it did not claim any human lives.

There were insignificant flood events in January 2003, March and May 2006, and January 2011. However, the last one surprised the inhabitants by the increased flow through the Mže River, which entered the city at a level between 15-year and 20-year flood (the discharge from the Hracholusky Reservoir was 144 m³/s). This was the highest discharge level since the construction of the Hracholusky dam in 1960s. However, the reservoir operations (its inflow

reached up to 240 m³/s) successfully transformed the river flow trends and protected the city of Pilsen from any substantial damage.

Explanation:
Qn indicates that this flow in the particular water course is statistically probable to occur once over an n-year period.
Examples:
Q100 (100-year flood) – is a flow magnitude which, according to statistical probability, may occur in the particular water course once in 100 years.
Q15 (15-year flood) – is a flow magnitude with a recurrence period of 15 years, according to statistical probability.



58, 59 COMPARISON BETWEEN THE REAL-WORLD SITUATION AND THE flood depth map AT THE CONFLUENCE OF THE Úslava AND BEROUNKA RIVERS by St. George’s church in the DOUBRAVKA QUARTER

PILSEN’S RIVER LANDSCAPE IN THE EUROPEAN CONTEXT

Our ancestors typically built their settlements in the vicinity of water courses. There are very few cities that can boast of the unique urban layout across multiple flood plains that the city of Pilsen has. Pilsen was founded in 1295 by king Wenceslas II at the confluence of four rivers: Mže, Radbuza, Úhlava and Úslava.

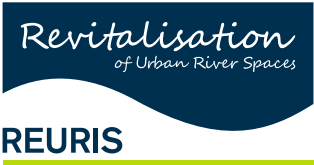
The significance of water courses in the life of man has been changing with the evolution of needs and values of human civilization. Unfortunately, developments in society, the increasing demand for space and technical interventions in the 20th century have separated city inhabitants from urban rivers. Water courses have lost their natural place on flood plains and have become a dreaded menace during flood events. People have ceased to view the river landscape around their homes as a place to rest and enjoy their co-existence with nature. At the beginning of 21st century, the approach to water courses in urban areas began to change slowly once again. River landscapes are now being restored and their importance to the value of nature in urban space is increasing. Attention is paid to all issues related to rivers; be they environmental or economic: the unique character of river landscape, riverfronts in the historical city center that are attractive to tourists or recreational and sports routes along river valleys.

Today’s view of rivers calls for a comprehensive approach to their restoration, taking into account a functional use of their adjacent area. Hence, a number of environmental, socio-economic and political questions must be answered. There should be consistent interdisciplinary collaboration concerning water management and hydrology, agriculture and forestry, zoning and urbanism. Municipal and regional governments, non-governmental organizations and citizen associations, the general public and also the owners of the land must participate in this effort. Water course restoration and adequate flood control measures are further complicated by the need for collaboration across entire catchment areas rather than within cadastral territories or city districts.



60 PRESENTATION of the REURIS project for the general public in the ring of parks around the city core

The REURIS International Project



Water is one of the most important landscape forming elements that played a role in the establishment and growth of cities in the past. Issues arising from water courses cutting through urban areas are encountered by many cities and communities.

In the year 2008, the city of Pilsen, represented by its Urban Planning and Development Institute, entered the international REURIS project (Revitalisation of Urban River Spaces) under the auspices of the Transnational Territorial Cooperation Operational Programme: Central Europe. The project preparation began in 2007 when six partner cities joined their forces in an effort to restore their riverbanks: Pilsen and Brno in the Czech Republic, Stuttgart and Leipzig in Germany, and the Polish cities of Katowice and Bydgoszcz.

The project, which explores approaches to the utilization of water courses and river landscape in urbanized areas of all of Central Europe ended in January 2012. The project’s partners are sharing their experience and new water course revitalization methods and are using the project funding for preparing project documents and conducting pilot projects. The total budget of the REURIS project is EUR 3,409,303.

Although water courses and flood plains in the Czech Republic are protected as significant landscape components, pursuant to the Act on Protection of Nature and Landscape (Act No. 114/1992 Sb.), their actual condition, particularly in cities, does not appear to reflect this. REURIS project partners decided to tackle this issue and to draft an international manual of good practice in the revitalization of water courses in cities, drawing on examples and experience from various local projects.

Under the project, a clearly arranged collection of the most successful water course revitalization projects in urban areas across the Czech Republic, Poland and Germany was prepared. Its purpose was to explore and gather the experience in preparing and conducting water course restoration projects in urban environments and to highlight the key success factors, typical obstacles and financial costs.

In an effort to ensure the success of the project, independent experts from outside have been invited to comment on the plans and documents in the following three fields: environment and water course revitalization, economical aspects and community planning.

As part of the REURIS project, the city of Pilsen held public debates on these documents in the city hall. At these events, the inhabitants of the city were informed about completed studies and about future plans concerning the flood plains of Pilsen’s rivers. Those interested in river landscape and water courses had an opportunity to survey the documents and discuss them with their authors.

In addition, the issue of revitalizing water courses in urban areas was explored at a state-wide conference for the professional public and for representatives of the state administration and local government. Case studies of

successful restoration projects were used to demonstrate that nature-inspired rehabilitation of water courses is possible in urban areas. However, maintaining their flow capacity and stability is still the key priority. In almost all cases it is possible to enhance the environmental value and appeal of the water course as part of restoration and flood control measures.

Key Principles of the Restoration of Rivers in Pilsen

In February 2009, the Council of the City of Pilsen passed a planning and zoning study entitled “Restoration of Riverfronts in Pilsen – Úslava” as a follow-up to a study on sports and recreational routes along river valleys (the so-called greenways). It was the first one of a series of studies serving as source documents for zoning and planning decisions. The study set out fundamental principles to be followed in revitalizing water courses in built-up urban areas and on non-built-up land:

- Preferring more natural forms of restoration over technical interventions in the landscape
- Rivers and streams need more space
- Allowing water courses to spread across flood plains
- Returning streams to their original courses and protecting them from being culverted
- Prohibiting artificial raising of the original ground for new building development in active zones of designated flood zones
- Expanding the bank vegetation and associated green areas along water courses
- Increasing the water retaining capacity of the landscape by creating elements of the territorial system of ecological stability as defined by the Act No. 114/1992 Sb. (e.g. wetland communities)

Rivers and their flood plains are natural ecological corridors of supraregional and regional systems of ecological stability. At the same time, they are a part of the active zones within designated flood zones. A compromise solution is sought in order to comply with environmental protection and water management legislation. At the same time, the extraordinary potential and beauty of the river landscape should be used for the purpose of active recreation for Pilsen’s inhabitants.



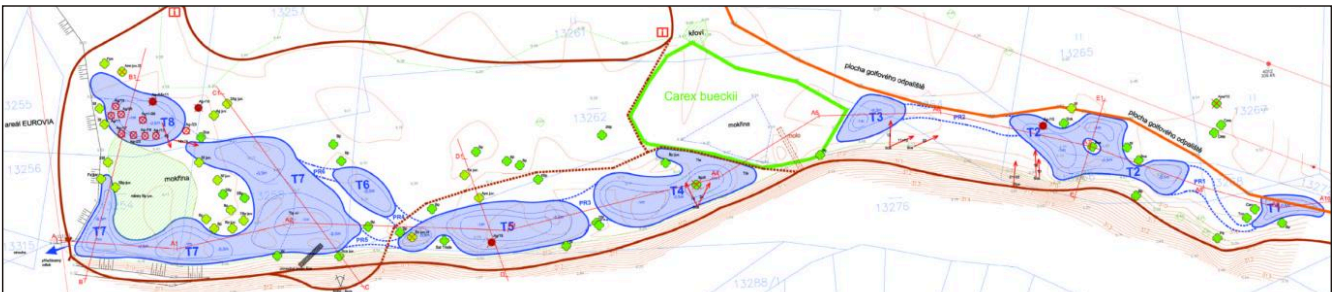
62 Wetland habitat on a fill terrace of the Úslava River

Revitalizing the Riverfronts in Pilsen

Under the REURIS project, the city of Pilsen is preparing a comprehensive study on revitalizing its riverfronts in the following order: Úslava, Mže, Úhlava, Radbuza and Berounka. Its main objective is to preserve and enhance the value of river landscapes in the territory of the city in terms of urban layout, recreation and sports, ecology, the character of the landscape and flood protection.

One of the goals of the comprehensive study is to identify suitable locations for sports and recreational activities and facilities along the routes in river valleys. These are designated as “relaxation spots”. For such spots, detailed documentation will be drafted. The spots will be equipped with street furniture (benches, trash barrels, bicycle stands, information panels, signposts and direction signs). Along the routes, there will be children’s playgrounds and foot bridges.

In terms of nature and landscape, the riverfront revitalization studies suggest the following: expanding and restoring the strips of bank vegetation and adjoining vegetation areas along the river, assessing the risk of erosion of slopes along the flood plains and remodeling the rivers’ courses to allow water to spread over grassed flood plains during floods. Restoration of the existing elements of the



61 New pools and wetland habitat on a fill terrace of the Úslava River

territorial system of ecological stability and the introduction of new elements as defined above, and protection of wetland communities on flood plains, will enhance the diversity of species and improve the microclimate and the aesthetic impact of the landscape.

Sports and Recreational Routes along River Valleys in Pilsen

The above-mentioned earlier study on sports and recreational routes along the valleys of rivers in Pilsen was used as a source document for smaller-scale follow-up studies. It demonstrated the need for and the popularity of mixed-use paths among pedestrians, cyclists and other non-motorized users. Since long ago, Pilsen’s rivers have been the backbone of development and transportation for the region. The sports and recreational routes – greenways – revive the age-long pattern of roads and the significance of river valleys to the Pilsen region. The former channels for expansion of early European civilization are now becoming lively sports, relaxation, social and cultural zones.

The flood plains represent natural green corridors for establishing the greenways. Thanks to the radial configuration of the sports and recreational routes along water courses, the city center is easy to access and, at the same time, the city is connected with its environs. The routes offer safe cycling paths for journeys to work, school or to businesses. They also provide opportunities for active recreation in the very center of the city in the likeable natural environment of these remarkable river landscapes. There are several outdoor leisure facilities and attractions in the valleys of Pilsen’s rivers. Some of them have existed for some time; others are being built or planned. They include a zoological garden, several outdoor sports facilities, the České Údolí Reservoir and the river island in Božkov. Greenways provide safe paths between them for cyclists, inline skaters and pedestrians.

European Award for Pilsen’s Greenways

In 2009, the city of Pilsen received a prestigious European award in the fourth European Greenways Award competition. The project, entitled Sports-Recreational Greenways Routes, ranked second in the Mobility category. This biennial competition is held jointly by the department for Culture, Media and Tourism of the Ministry of the German-Speaking Community of Belgium and by the European Greenways Association (EGWA).

The city of Pilsen entered in the competition its program



63 3D RENDERING OF THE PROPOSED FOOT BRIDGE ON THE BOŽKOV ISLAND OVER THE ÚSLAVA RIVER

for building sports-recreational routes – the greenways. This system already comprises 13 kilometers of routes, 7 footbridges and additional 5 footbridges that provide crosswise connections with other existing routes. The single most important goal for the upcoming period is connecting the isolated route segments to create more extensive networks. The interest expressed by the city’s inhabitants is an indication that these capital expenditures are justified. In good weather, the busiest path by the Radbuza River near the former paperworks is used by some 1,200 people a day, including 700 cyclists and 500 inline skaters and pedestrians.

The Božkov Island, Pilot Study under the REURIS Project

Every city taking part in the REURIS project chose one location for a pilot project. The city of Pilsen focused on the Božkov Island, one of the most interesting areas in Pilsen’s flood plains (shown in map 48 on page 22).

The Božkov Island offers a vast potential for sports and recreational activities along the cycling path through the Úslava River. A part of the location has been used by the sports teams of the Božkov Physical Training Association. However, most of the island lying between the Úslava River and a mill race has remained unused and neglected.

The goal of the Božkov Island project is to expand and upgrade sports facilities, while maintaining the natural and landscape qualities of this unique location. In addition, there



64 VICINITY PLAN OF THE BOŽKOV ISLAND ACCORDING TO THE PROJECT



65

LANDSCAPE DESIGN FOR THE BOŽKOV ISLAND

will be a new cycling path across the Božkov Island connected by a new footbridge to the sports-recreational route and a new parking lot on the left bank of the Úslava River.

According to the plan, the mill race may be relieved during floods by a bypass diverting the flow across the island back to the Úslava River. Besides making the area more attractive, the bypass would also protect the present and future sports facilities from frequent inundation. This broad channel with flowing water should be 15 – 32 meters wide and 220 meters long. Its bed with a constant gradient should be 0.8 – 1.8 m below the current ground level. The depth of water there will be between 0.2 – 0.5 m. Varying water level will allow it to spread to several ponds and pools set along the channel. The middle reach of the channel will become a children's waterpark: a playground with water attractions including a pontoon track across the water surface, a rope bridge and devices based on scientific and technical principles, such as a water wheel, water turbine and a sweep well. These will provide children with safe and direct contact with water and an opportunity to explore the laws of physics while playing. At the mouth of the channel in the Úslava River, there will be access to water intended primarily for visitors walking their dogs.

The project also includes the restoration of the multi-function sports ground, adding two beach volleyball courts and two pétanque grounds, an inline skating track, a ropes course for children and a physical training track.

New trees and shrubs will be planted to compensate for the newly-built hard-surfaced areas.

Selected parts of the basic planning and zoning study of the Božkov Island were further elaborated to become zoning and planning documents. The plan for the new flood-protection bypass with a flowing stream was explored and refined in a feasibility study to ensure it meets its purpose to protect the adjacent built-up area and sports grounds from floods with up to five-year peak flows. A two-dimensional model of flooding of the Božkov Island was constructed to evaluate all proposed solutions by simulating the velocities, depths and directions of flood flow.

There are also design documents for a new recreational inline skating track, for walking trails and for a fitness trail intended primarily for senior citizens. Their configurations respect the present full-grown vegetation on the island. A restoration project for the original mill race and a dendrological study were drafted. The study examines the condition of vegetation and proposes new landscaping.

The subproject of vegetation restoration on the entire Božkov island (felling trees and planting new trees and shrubs, and maintaining the existing ones) received a 75% subsidy (EUR 25 thousand) from the Environment Operation Program, Priority Axis 6 – Improving the Condition of Environment and Landscape, Support Area 6.5 – Supporting the Restoration of Urban Landscape.

The subproject for building walking trails (955 m) with hard-surfaced areas from natural materials and 7 stations with exercising equipment, instructions and with small pieces of street furniture received a 85% subsidy (EUR 163 thousand) from the Regional Operational Programme South West under Convergence objective, priority 3 – Development of tourism, support area 3.1. – Development of tourism infrastructure.

Educational Trails along the Valleys of Pilsen's Rivers

Plans for educational trails along all rivers were drafted under the REURIS project. Locations for information signs on the trails along the rivers Mže, Radbuza, Úhlava, Úslava and Berounka will be chosen with regard to sports and recreational routes. The educational trails along rivers should highlight locations of natural, historical, cultural and technical interest on the flood plains. The first trail, along the Úslava River, was built in 2011. In the future, signs will be installed along all the remaining trails. Trails along rivers will complement the existing network of trails, which include: Sigmond's Nature Trail, In František Maloch's Footsteps, Zábělá Forestry Nature Trail, Homolka Nature Trail and Sofronka Nature Trail.

More information on REURIS project can be found at <http://ukr.plzen.eu> and <http://www.reuris.gig.eu>



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INFORMATION SIGNS FOR THE ÚSLAVA VALLEY NATURE TRAIL IN PILSEN'S DOUBRAVKA QUARTER

4. Air Quality AND Energy



67 VIEW OF THE ŠKODA WORKS FROM THE EAST ACROSS WHAT TODAY IS KORANDA STREET. PHOTOGRAPH FROM AROUND 1908. COURTESY OF THE MUSEUM OF WEST BOHEMIA, ETHNOGRAPHIC MUSEUM OF THE PILSEN REGION

AIR QUALITY

In the era when belching smokestacks were thought to be symbols of prosperity, Pilsen suffered from a severe load of emissions. They arose from production in engineering works and metallurgical plants, and from generation of producer gas, heat and power by The Škoda Works, with plants located predominantly in the western part of the city. These adverse conditions were further aggravated by the generation of town gas, domestic heating sources using solid fuel, by the fact that the city was a large railway junction (at the time of prevailing steam traction) with breweries and additional small but heavily polluting industrial plants. In addition, iron ore was mined and processed in nearby areas to the east of the city (Ejovice), as were kaolin and building materials in the north and south (Třemošná, Horní Bříza, Chlumčany), which burdened Pilsen's territory predominantly with dust loading.

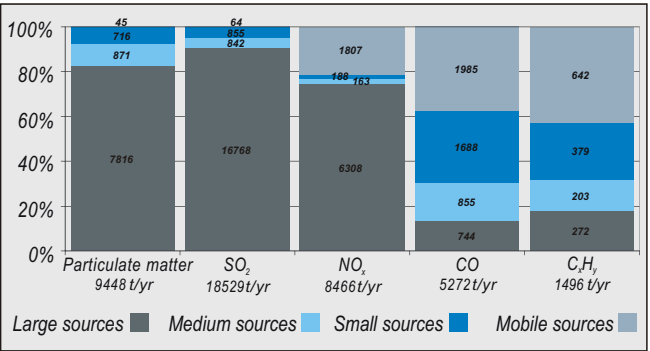
The air quality is not aided by the city's geographic location at the confluence of four rivers, as the basin tends to experience poor dispersion conditions. Severely adverse dispersion conditions occur in Pilsen on no more than 15 days a year, predominantly in the winter season.

For a long time, air quality issues were not given adequate attention in the legislation of the Czechoslovak Socialist Republic. The actual air quality monitoring in Pilsen and its surroundings was equally neglected. The positive developments in the society after 1989 led to profound changes in air quality control. Air quality regulations in the Czech Republic were gradually tightened until they were finally harmonized with EU legislation.

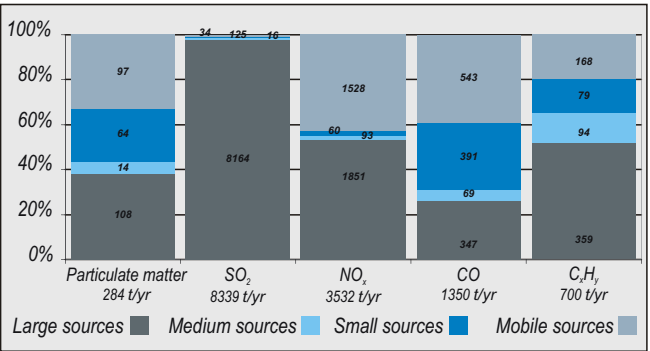
The systems for monitoring the **quantities of basic pollutants** – emissions (particulate matter, sulfur dioxide (SO₂), nitrogen oxides (NO_x), carbon monoxide (CO) and hydrocarbons) released mainly from large industrial sources and schemes for maintaining the data in the Register of Emissions and Air Pollution Sources (REAPS) improved gradually. The REAPS began to be used later for assessing

charges for air pollution in line with the current Czech legislation. Emission levels began to decrease in Pilsen, as well as throughout the Czech Republic. This trend was most pronounced in the case of SO₂ and particulate matter. Changes in the structure of industry were reflected in the total amount of emissions and also in the proportions of contributions by various groups of emission sources. Decreasing emission levels were also the result of activities of the Municipality of Pilsen. In the 1990s, it subsidized the conversion from solid fuel to gas or electricity in domestic heating sources. In the following years, the Municipality launched additional programs aimed at air quality improvement: Sun for Pilsen (Slunce pro Plzeň), the nationwide program Green Light for Savings (Zelená úsporám), and others. The decrease in concentrations of hydrocarbons, CO and NO_x could have been steeper, were it not for soaring road transport volumes, even though the vehicles had better technical parameters. Among the largest emitters in Pilsen were four local heating plants (these have been shut down and replaced with central cogeneration plants with dust removal and desulfurization facilities), two large district heating plants and numerous sources in engineering and metallurgical factories; the successors of plants belonging to The Škoda Works. The severity of the impact of individual groups of emission sources on the air quality depends on the particular city quarter. In many locations, local heating sources, primarily those with solid fuel combustion, have a greater impact on air pollution than large emission sources with high smokestacks, and the same is true of transport in virtually all parts of the city. The share of total air pollutants released by waste incinerators in

Graph 8: SOURCES OF EMISSIONS IN PILSEN, 1991



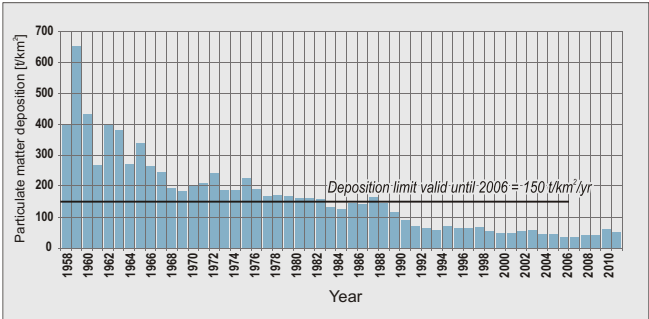
Graph 9: SOURCES OF EMISSIONS IN PILSEN, 2009



Pilsen is almost negligible, in part due to the absence of any large municipal waste incinerator in the city.

The first air quality monitoring efforts in Pilsen and its surroundings date back to the end of the 1950s. Data on particulate matter deposition in Pilsen’s territory measured by the public health service has been available since 1958. The particulate matter deposition levels have fallen to almost one tenth over the decades of measurement.

Graph 10: MEAN ANNUAL PARTICULATE MATTER DEPOSITION LEVELS IN PILSEN



In the mid-1960s, the ambient air quality – ambient pollutant concentrations – began to be monitored: The public health service started to measure daily average values of sulfur dioxide ambient concentrations (the records, however, are only available since 1983). In the early 1980s, the service launched manual monitoring of suspended particulate matter levels and then nitrogen oxide concentrations.

In the first half of the 1990s, the quality of ambient air and its monitoring in Pilsen went through profound changes. There was a transitional period, in which the public health service purchased a mobile measuring station – the HORIBA van and the effort of the Pilsen branch office of the Czech Hydrometeorological Institute (CHMI) led to the installation of six semi-automatic coulometric monitoring instruments measuring SO₂ concentrations. However, dramatic changes in the measuring network followed after 1995. This was thanks to funding from the PHARE program used for establishing the Pils Automatic Monitoring Network (AMN). The stations operating presently in the territory of the city of Pilsen include 7 fixed automatic measuring stations (1 AAQM-CHMI station, 5 Pilsen AMN stations and 1 HI station) and 1 manually operated station (run by the CHMI). Pilsen uses an additional mobile station for monitoring various locations. It is a measuring trailer acquired as part of the AMN Pils project under PHARE program. For most stations, the quality of measurement is guaranteed by the contract between the Municipality of Pilsen and CHMI, which is an authorized body for air quality monitoring in the Czech Republic.

In addition to fixed station measurement, data is

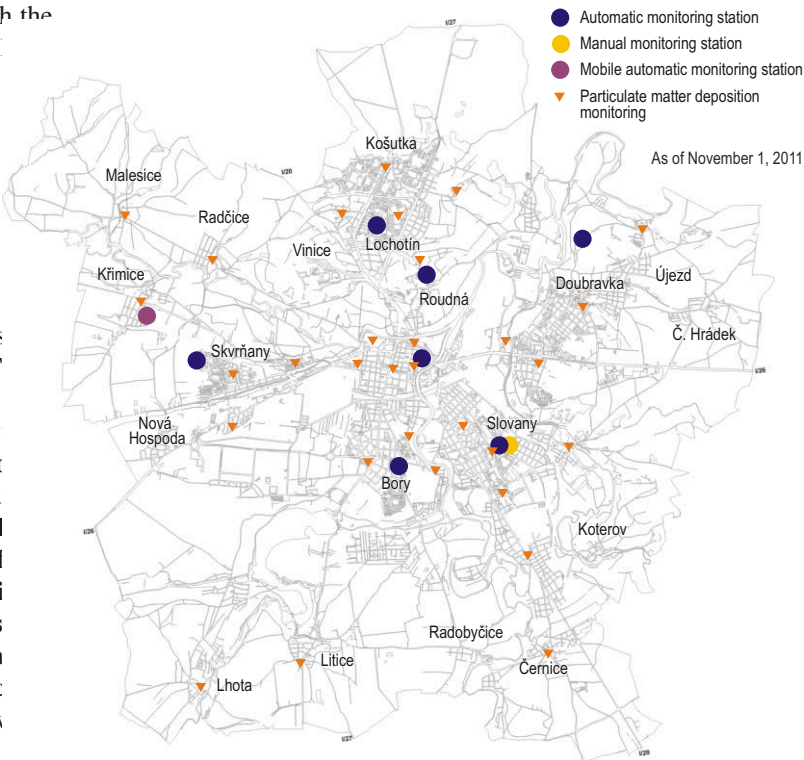


68 MONITORING STATION IN PILSEN’S SLOVANY QUARTER

gathered in various short-term drives and purpose-oriented monitoring efforts in the city’s territory. These may include assessment of the impact of vehicular traffic or construction of highway sections on air quality. Measurement results for individual compounds over the entire monitoring period in the city of Pilsen reveal the following trends:



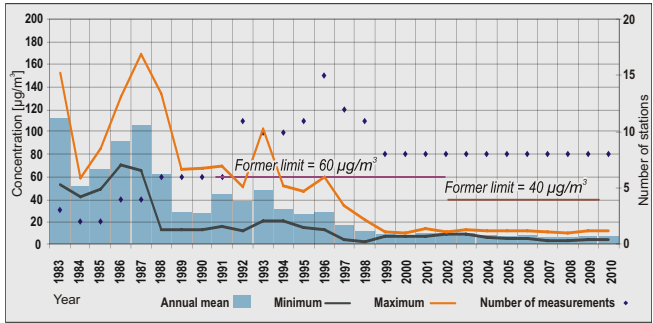
69 AIR QUALITY MONITORING VAN



70 AIR QUALITY MONITORING STATIONS IN PILSEN

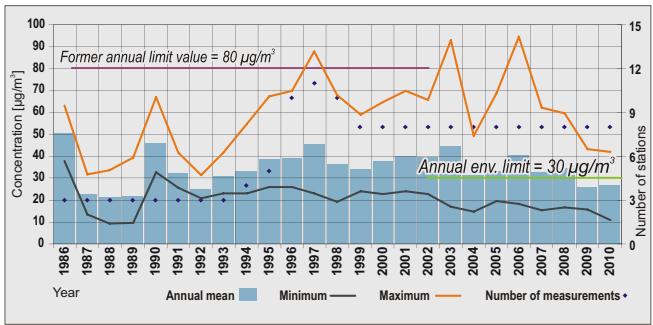
The ambient concentration of sulfur dioxide (SO₂) has been decreasing at the rate of more than 5 µg/m³ per year in the period after the start of measurement. This may be attributed to changes in the fuels and heating sources used by a range of emitters from the large ones down to local furnaces (domestic stoves), where solid fuel (high-sulfur lignite) was replaced with natural gas. This development was supported by the policy of the Municipality of Pilsen, by the changes in production orientation of the former Škoda Works and other enterprises in Pilsen's territory, and thanks to desulfurization facilities being installed by the largest emitters, SO₂ ceased to be the key pollutant in Pilsen. Initial SO₂ concentration values with annual averages for the entire Pilsen territory reaching 100 µg/m³ fell to today's typical concentration of less than 10 µg/m³.

Graph 11: MEAN ANNUAL sulfur dioxide CONCENTRATIONS 1983–2010, PILSEN



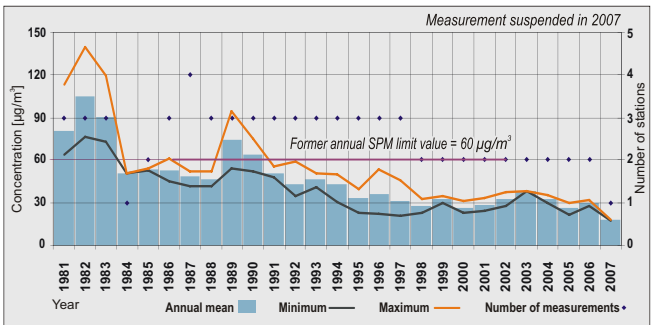
The ambient concentrations of nitrogen oxides (NO_x) were growing slowly at the annual rate of 2 µg/m³ until 1997. In the years that followed, the concentrations declined or plateaued. However, along busy roads in central city areas, the short-term limit value of 200 µg/m³ was exceeded on an almost daily basis, particularly in the morning hours. This was due to sharply increasing car traffic with obsolete vehicles, very slow decrease in NO_x emissions from heat generation, and due to the slow upgrade of technologies in industry. Upon changes in the legislation, levels of nitrogen dioxide NO₂ began to be measured in Pilsen in 2002. This change in regulations profoundly transformed the conditions for the assessment of air quality in Pilsen in terms of NO₂ pollution, as now its limits are not exceeded in the vicinity of its sources, or elsewhere. The NO₂ concentrations followed the same path as NO_x but at lower levels.

Graph 12: MEAN ANNUAL nitrogen oxide CONCENTRATIONS 1986–2010, PILSEN

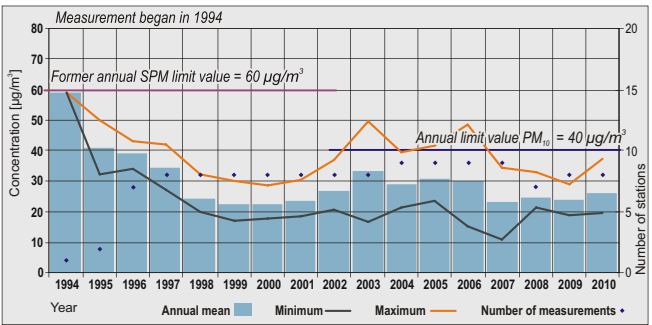


The concentrations of suspended particulate matter (SPM), later classified as (PM₁₀) have been decreasing since the launch of measurement, although less steeply than those of SO₂. The annual rate of change was almost 4 µg/m³. As with SO₂, the causes can be identified as the changes in fuel and heating sources, particularly in local furnaces (domestic stoves), where typical solid fuels (with high ash content) have been replaced with gas or electricity. There was also a non-negligible contribution to the improvement from changes in production of the former Škoda Works. Those changes led to the shutting down of some significant emission sources and to cutting back metallurgical production. The concentrations of suspended particulate matter also depend on the quality of cleaning of roads and open spaces in various parts of the city. Stirred-up (resuspended) dust represents a substantial share of the total dust burden on majority of Pilsen territory. The initial average concentrations of SPM for the entire territory of Pilsen exceeding 100 µg/m³ were found to decline since 2007 to less than 25 µg/m³ of PM₁₀. The daily average concentrations of PM₁₀ in recent years rarely exceed the reduced limit of 50 µg/m³ and the number of exceedances permitted by regulations. Today's key pollutants in Pilsen include the suspended PM₁₀ particles and related metals, polycyclic aromatic hydrocarbons and other substances. In accordance with the new legislation, PM_{2.5} levels began to be measured in recent years.

Graph 13: MEAN ANNUAL suspended PARTICULATE MATTER CONCENTRATIONS SPM 1981–2007, PILSEN

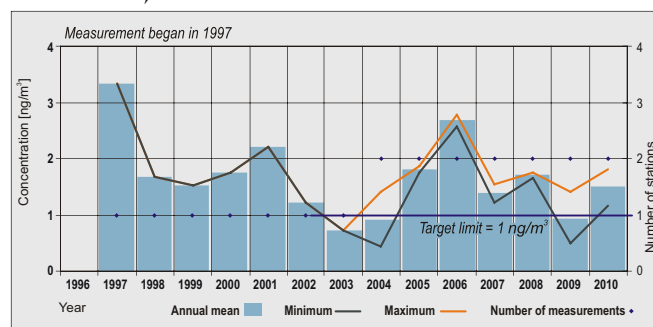


Graph 14: MEAN ANNUAL suspended PARTICULATE MATTER CONCENTRATIONS PM10 1994–2010, PILSEN



Ambient concentrations of carbon monoxide (CO) on the outskirts of the city and far from busy roads have been diminishing gradually. This might have been due to changes in types of fuel and local heating sources (domestic stoves) where solid fuel combustion with poor regulation was replaced with more efficient gas burning or by the use of electricity. Shutting down the production of producer gas at The Škoda Works cut the ambient concentrations of CO, namely in the vicinity of the main plant and the city center. Along busy roads, however, CO concentrations, as well as those of NO_x, kept increasing until 1997, and then plateaued, reflecting the trends of road traffic. Carbon monoxide, however, is not the key pollutant in Pilsen.

Graph 15: MEAN ANNUAL BENZO[A]PYRENE CONCENTRATIONS 1996–2010, PILSEN



Ground-level ozone (O₃) concentrations follow regular daily cycles but their role is only significant during the warmer part of the year when photochemical reactions raise their levels. Since the launch of monitoring, its eight-hour running averages have exceeded the limit value of 120 µg/m³ in several cases. The O₃ concentrations fluctuate greatly, depending upon both concentrations of its precursors and on weather conditions. Higher values are found more frequently in peripheral parts of the city than in its center.

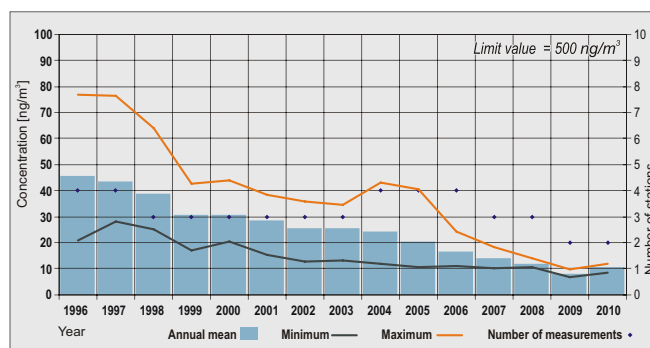
Ambient concentrations of volatile organic compounds (VOC) have not been mapped sufficiently yet. The relatively small amount of results from two stations and the outcomes of ad-hoc measurements do not suffice for comprehensive assessment of ambient concentrations of benzene, toluene, xylene and ethylbenzene. Benzene is the only substance from the group of volatile organic compounds, for which the annual average limit is stipulated. The few results obtained so far suggest that elevated ambient concentrations of benzene are found predominantly around busy roads, filling stations and plants processing paints and other volatile organic compounds. The limit value for benzene has not been found to have been exceeded in Pilsen yet.

Ambient concentrations of polycyclic aromatic hydrocarbons (PAH). Since 2004, they have been measured in two stations. The environmental burden from

PAH in the territory of the city is higher during the colder part of the year. It is bound up with concentrations of suspended particle matter PM₁₀. Considering the readings obtained up to now, the PAH limit value appears to be rather tight. It is likely to be exceeded in a number of places in Pilsen. This is confirmed by the classification of the territory of the city as an area with deteriorated air quality in terms of PAH.

Ambient concentrations of selected metals (As, Cd, Hg, Ni, Pb). Except for Hg, they are monitored in relation to the total suspended particulate levels in the territory of Pilsen. Concentrations of these metals have declined due to falling PM₁₀ levels after changes in the production in the Škoda metallurgical plants and the end of distribution of leaded gasoline. Since 2004, only two stations have been used for taking samples from PM₁₀ material. According to results from these two stations, the limit values for selected monitored metals are not exceeded in Pilsen.

Graph 16: MEAN ANNUAL LEAD CONCENTRATIONS 1996–2010, PILSEN



Ambient concentrations of ammonia (NH₃) are not routinely measured or monitored in Pilsen. There are no plans for routine measurement, as the scale of agricultural production and resulting emissions are negligible.

Since 1992, the Pilsen city leaders have been paying continuous attention to the air quality and its improvement. In recent years, these activities became part of the **Air Quality Improvement Program of the City of Pilsen (Program ke zlepšování kvality ovzduší města Plzně)** passed by the city government in 2008 and updated in 2010. The program documents state that the air quality in Pilsen, the fourth largest city in the Czech Republic, is better than in other large cities (Prague, Brno, Ostrava). However, it does not fully comply with standards stipulated by the law or meet all requirements related to the quality of life of the city's inhabitants. The Program defines and proposes measures in three groups (priorities):

A – Abatement of air pollution caused by suspended particulate matter PM₁₀, nitrogen dioxide, and benzo[a]pyrene from road traffic,

B – Abatement of air pollution caused by suspended particulate matter PM₁₀, nitrogen dioxide, and benzo[a]pyrene from local heating sources using solid fuel, and

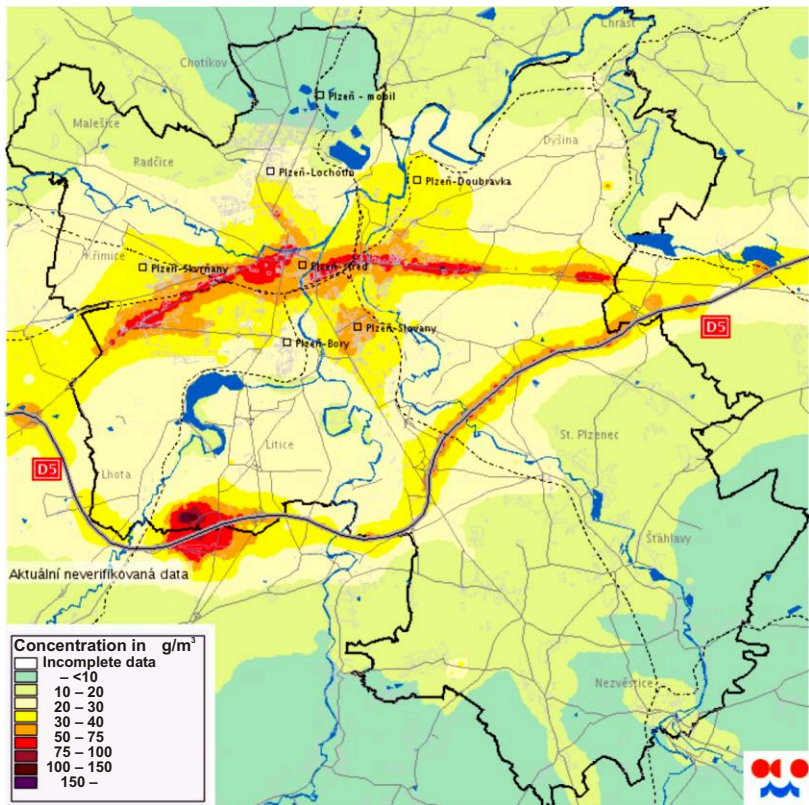
C – Abatement of particulate matter deposition per unit area and the secondary deposition (resuspension of emitted particles).

Of these priorities, the greatest attention is paid to priority A with the following categories of measures:

- A1: Improving traffic flow in the city
- A2: Moving traffic out from densely populated parts of the city
- A3: Restricting the traffic in the city

As measures A2 and A3 are rather difficult to implement on a large scale (a large share of traffic will always be present in the city), the A1 measure should be the key focus. Better traffic flow will have beneficial side effects, including reduced level of emissions of the major greenhouse gas: carbon dioxide. The debate on the Program and the process of its approval in the city council led to a number of measures, including for instance the Abatement of deposition of dust from building activities and road surfaces. The council also passed a subsidy scheme for converting domestic heating installations to more environmentally friendly and cleaner, low-emission facilities. These measures are intended to:

- Eliminate violations of limit values of suspended particles PM₁₀ established for protecting human health.



71 24-HOUR AVERAGE CONCENTRATION OF SUSPENDED PARTICULATE MATTER PM₁₀ DURING THE INVERSION SITUATION ON NOVEMBER 28, 2011

STATUTÁRNÍ MĚSTO PLZEŇ INFORMACE O STAVU OVZDUŠÍ						
10-33		2 120 12		KONCENTRACE V [µg / m³]		
MÍSTO	SO ₂	NO ₂	PRACH PM ₁₀	OZON	CO	
PLZEŇ - STŘED (PÁLLOVA ul.)	111	229	45			
PLZEŇ - SLOVANY (KOTEROVSKÁ ul.)	80	339	45	453	2 137	
PLZEŇ - BORY (TRANSFÚZNÍ STANICE)	12	153	26	404	3237	
PLZEŇ - LOCHOTÍN (SOKOLOVSKÁ ul.)	61	140	53	507		
PLZEŇ - SKVRŇANY (ul. T. BRZKOVÉ)	56	113	24			
PLZEŇ - DOUBRAVKA (CHLUM)	91	352	36	447	2360	
PLZEŇ - MOBILNÍ		191	39	432	43	
LIMITY DLE NAŘÍZENÍ VLÁDY číslo 597 / 2006 Sb.						
IMISNÍ LIMIT [µg / m³]	125	200	50	120	10000	
DOBA PRŮMĚROVÁNÍ [hod]	24	1	24	8	8	

72 Air quality information panel used in Pilsen’s public buildings, showing current levels and limit values

- Eliminate by 2010 the risks of exceeding nitrogen dioxide limit values established for protection of human health. As shown by the results of measurement, this objective was met in 2010.
- Eliminate by 2012 the risk of exceeding the target values for benzo[a]pyrene.
- Gradually reduce the exceedance of the ozone target value.
- Control the concentrations of other pollutants, for which limit values or target values have been prescribed, at current below-the-limit levels.

All measured values are available to the general public on information panels, in periodic publications on the environment of Pilsen and on the website of CHMI. They can also be found on the website of the city of Pilsen, together with other materials and information on air quality in Pilsen.

Notes

Ambient concentration – amount of pollutant per volume unit of air

Limit value – the highest ambient concentration permitted by law

AAQM – Automated Air Quality Monitoring, a public automatic air quality monitoring network

HI – Health Institute, the former public health service

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ENERGY

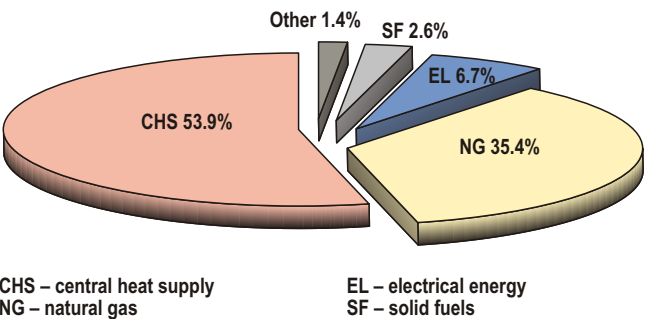
The Chartered City of Pilsen, with 170,000 inhabitants and a number of big industrial plants, is the fourth largest city in the Czech Republic. A major share of the energy demand of the city (almost 58%) results from heating and hot water preparation. The heat for these purposes is generated predominantly in two central cogeneration plants (providing both heat and electric power) and delivered via the central heat supply system. An interesting feature is the largest biomass-fired cogeneration unit in the Czech Republic installed in one of these district heating plants in Pilsen.

Meeting the energy demand in all aspects of urban life requires a large number of energy sources, which have a substantial impact on the city’s environment. Those who remember what Pilsen looked like some twenty years ago know how radically it has changed in this respect. Thanks to the systematic long-term approach of the city leaders, the current air quality is significantly better than decades ago. As early as 1993, Pilsen adopted the Program for Air Quality Improvement (Program na ozdravění ovzduší). It was successful in displacing local solid fuel-fired heating sources and in desulfurizing both of its district heating plants. In the year 2000, the Program for Reducing Energy Requirements (Program snižování energetické náročnosti) launched systematic efforts toward achieving energy savings in buildings. Subsidies from the Operational Programme Environment (Structural Funds of the European Union) and from Norway Grants are also used for this purpose. In all buildings owned by the city, an energy management scheme has been established and is continuously being improved. Its elements include appointing an energy manager, consumption monitoring and evaluation, drafting implementation plans and other efforts.

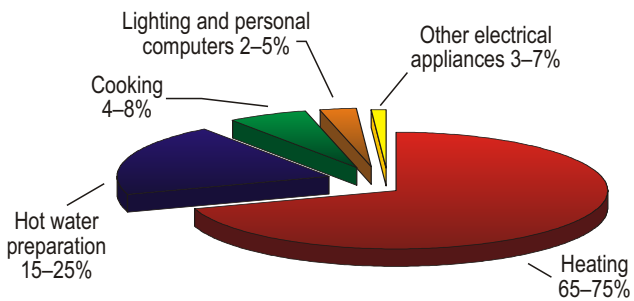
A new energy policy was passed by the city in 2000. Its four thrusts of development include shutting down the remaining mostly obsolete solid fuel-fired small heating sources, developing the central heat supply system, reducing the energy demand and expanding the use of renewable energy sources.

To enforce this policy, the city passes and continuously implements action plans containing a number of measures. A very significant item in this context is the by-law defining

Graph 17: Types of fuel and energy used for heating and hot water preparation



Graph 18: ENERGY CONSUMPTION BREAKDOWN



the required method of heating in individual parts of the city. There are three categories of areas in the city: areas with “clean” heating, where central heat supply is preferred, areas with preferred natural gas heating sources and areas where neither of these utilities is available, mostly on the outskirts of the city. Renewable energy sources are recommended to be used there in biomass-fired boilers, heat pumps and solar panels. This by-law, combined with the energy policy, spurred the preparation of a new municipal subsidy scheme. Its aim was to support the installation of renewable energy technologies in Pilsen by covering a portion of the installation costs. The scheme was operated between 2004 and 2009. The currently running project ENERGY TARGET (ENERGETICKÝ TERČ) focuses on reducing energy requirements in buildings. It relies on developing energy management techniques and cultivating energy-awareness among occupants of such buildings. This project was awarded the “Environmental Oscar” in the E.ON ENERGY GLOBE AWARD ČR 2010 competition.

Reducing the energy requirements of buildings, transforming the space heating (shutting down old local solid fuel-fired sources, introducing natural gas as fuel or connecting to the central heat supply system) and focusing on renewable energy sources result in continuous improvement in air quality in Pilsen. These efforts have already proven to be the right choice and the city is committed to following this course.

More information on the energy issues can be found at <http://energetika.plzen.eu>

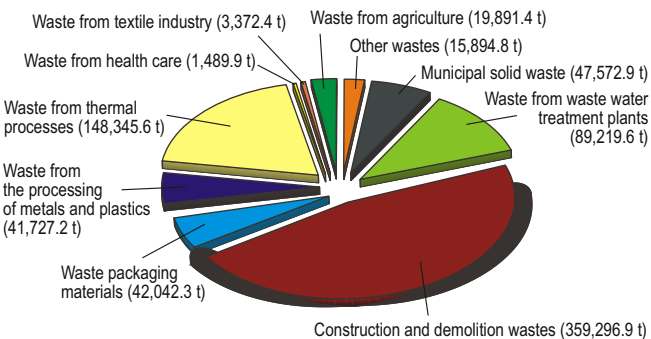


73 Cooling towers and chimney stacks of the upgraded heating plant on the premises of The Škoda Works. As the plant has a modern and efficient flue gas cleaning facility, the stack discharges mostly steam. The older high stack is only used in emergency situations.

5. WASTE

The amount of waste generated, and its composition reflect a society's way of life. In the year 2010, 768,853 tonnes of waste were generated in the territory of Pilsen. This comprises all types of waste: the waste from industry, construction, health care and municipal solid waste. A major portion of this includes soil and stones, iron and steel, concrete, waste from coal burning and slags. Non-hazardous waste makes up 98% and hazardous waste represents 2% of the total amount. Waste from health care accounts for the major part of hazardous waste.

GRAPH 19: TOTAL WASTE GENERATION



Total waste generation 768,853 t

In the city of Pilsen, legal obligations in the field of waste management are performed by the city's ten districts. Their main activities include the following:

- Separate collection of fractions of municipal waste, namely paper and cardboard, glass, plastics, beverage cartons and biodegradable waste
- Provision of dumpsters for bulky waste
- Operation of waste yards, i.e. facilities where citizens can dispose of hazardous waste and certain types of non-hazardous waste
- Providing the pickup of hazardous fractions of waste twice a year in those city districts where no waste yard is available
- Clearing of illegal dumping sites

Municipal Solid Waste

Municipal solid waste collection and disposal services are provided by authorized waste management companies according to their contracts with waste producers. The municipal waste from the city's territory is deposited in sanitary landfills: predominantly the Chotíkov landfill, 7 kilometers north-west from the city, and in the Vysoká landfill, 11 kilometers to the south. There is no landfill in Pilsen's territory.

The city is the majority owner of the Chotíkov landfill with the city of Město Touškov and the Chotíkov community being the co-owners. More than 46 thousand tonnes of waste are dumped in the Chotíkov landfill each year. In 2010, a new composting plant was put into operation on the premises. It processes biowaste from

separately collected fractions and waste from the management of the city's green spaces.

Separately Collected Fractions of Municipal Waste

At present, there are more than 500 stations with separate fractions containers in Pilsen. The number of stations was established based upon the types and population of built-up areas. The city takes part in the packaging waste collection and recycling program. The program is operated by EKO-KOM, an authorized packaging waste processing company, that performs the joint legal obligation of taking back and reusing waste packaging materials.

Waste Yards

In order to meet its legal requirements, the city of Pilsen has opened 8 waste yards in its territory. Most of them are owned by the city and operated by contractors that are authorized packaging waste processing companies. Waste yards are the places in which Pilsen's citizens can dispose of hazardous waste free of charge, such as medications, contaminated packaging materials, oils and construction waste containing asbestos. Other types of waste accepted in waste yards include bulky waste, construction waste, biodegradable waste and tires. Products included in take-back schemes are collected in the waste yards as well: electronic equipment, fluorescent tubes and rechargeable and non-rechargeable batteries.

Waste-to-Energy Plant

The company Plzeňská teplárenská a.s., the city of Pilsen and the Regional Authority of The Pilsen Region are preparing to build a waste-to-energy incineration plant. It is to be located in the reclaimed area of the Chotíkov landfill. The facility, with a turbine generator of 7.3 MW rated capacity, is planned to supply the city's central heating system and to process 95 thousand tonnes of waste from the Pilsen Region per year.



6. Public GREEN SPACES, Pilsen's Woods



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FLOWER BEDS IN THE LOCHOTÍN PARK (1911 POSTCARD)

PUBLIC GREEN SPACES

History of Public Green Spaces

The origins of public green spaces in Pilsen date back to the early 19th century. After tearing down the fortification walls and filling up the moats, a space became available for building tree-lined promenades: today's Smetana, Kopecký, Šafařík, Křižík and Pětatřicátníků Parks. The first parks were established by the order of the Grand Burgrave Count Karel Chotek and upon an initiative of the Mayor, Martin Kopecký. Smetana and Kopecký Parks were founded in 1880.

Lochotín Park with its amenities was established in the first half of the 19th century, around a spring in the north of the city. However, the resort, with a spa colonnade, a hotel, restaurant and baths, failed to prosper. Despite that, the complex was maintained for more than 100 years for the benefit of the public, which was a rather exceptional effort at that time.

A majority of other parks in the city were founded before the First World War. Today's Bory Park dates back to 1914. With its 42 hectares, it is the largest park area in Pilsen. Today's Šafařík and Křižík Parks and the green spaces in Pall Street were established in the 1920s. Municipal parks flourished the most between the two world wars.

In the 1970s and 1980s, in turn, the ring of green space around the city's historical center suffered several blows. At the same time, new green spaces were created concurrently with the construction of housing complexes. Their subsequent maintenance, however, declined and included no more than essential treatment.

In addition to classical parks, park squares are important parts of the urban green space. The oldest one in Pilsen is Míru Square, which was founded in 1889 – 1899. The squares Mikulášské, Masaryk, Jirásek, Habrmann and Hus were established at the beginning of the 20th century.

The areas that fulfill the functions of parks include two cemeteries, which are not in active use any more. Mikulášský Cemetery was established in 1414. For some time, this was Pilsen's main cemetery. Amongst those

buried here are J. K. Tyl, an actor, playwright and author of the lyrics of the Czech anthem, J. F. Smetana, uncle of the composer Bedřich Smetana, and Emil Škoda, the founder of The Škoda Works. The cemetery was turned into a park in the 1960s. The cemetery U Věch Svatých in the city quarter Roudná dates back to the 12th or 13th century, if not earlier. Over the last decade, it has been transformed into a park.

Public spaces, including parks, began to be improved only after 1990. The most extensive restoration effort took place between 1990 and 2010 and focused on the ring of green space around the city core. The most recent reconstruction was that of the former mill race in Pall Street.

Parkways and tree alleys form a special category in urban green spaces. In Pilsen, planting and tending trees has a long tradition. Parkway trees were built as part of the expansion in new city quarters. Valuable tree-lined streets of these periods can be found in the suburb Jižní předměstí (Na Hvězdě roundabout) and around Jirásek Square. More recent tree populations were planted during the expansion of the Slovany suburb.

The 1960s – 1980s was the period of creating green spaces in the housing complexes built around the city. There, the trees were often planted by inhabitants in an unplanned and uncoordinated manner. Consequently, these areas now suffer from problems arising from inappropriately located trees.

A 1997 survey of the condition of parkway trees showed that there are 14,070 trees in 411 streets. Their species ranked in the order of population size are as follows: bigleaf linden (2,020 trees; 14.36% of the total number), littleleaf linden (2,005 trees, i.e. 14.25%), European ash (1,259 trees making up 8.95% of the total population) and Norway maple (1,177 trees; 8.37%). These four taxa together represent 45.93% of parkway trees. Subdominant species with populations of more than 280 (i.e. 2% of the total population) include sycamore, Japanese cherry tree (the Kanzan cultivar), Norway maple (the Globosum cultivar), European horse chestnut, sycamore, Crimean linden, sweet cherry tree, poplar and the Globosum cultivar of European ash, making up altogether 27% of the total number of



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PLAYGROUND IN HOMOLKA PARK



77 Šafařík Park in the ring of parks around the city core: Spejbl and Hurvínek (popular marionettes by Josef Skupa, a Pilsen puppeteer)

parkway trees. In the survey, 119 species of parkway trees were found.

Over the last 8 years, approximately 4,000 new trees were planted on land owned by the city. Trees are planted as part of the city’s construction projects, as well during construction of various buildings on land that is owned by other organizations but accessible to the general public. These include parking lots near shopping malls, premises of manufacturing plants and trading companies, and driveways.

Dying, hazardous and inappropriately located trees are being removed as required by safety considerations and during building projects. It is important to keep trees in a condition that does not threaten, encroach on or degrade the appearance of public spaces. For this purpose, pruning cuts are used (crown reduction, safety and reduction pruning), trees are treated against diseases and pests, and technical measures are applied (anchors, fences, ground containers with a high rim, drainage systems and aeration tubes).

Water features are important parts of green spaces. Today, there are 26 fountains, 4 drinking fountains and 8 hand water pumps in the city.

The operation of fountains starts on May 1 and continues, if weather is favorable, through the end of October.

Ring of Green Spaces Around the Historical City Core

Historical accounts likened the ring of parks (Smetana, Kopecký, Šafařík, Křižík, 5. Května and Pětatřicátníků Parks) to a tropical grove. The reason was that a number of tropical plants (banana trees, dracaenas and date palms) were placed in the parks every year.

The ring of parks is now protected as a cultural heritage monument. It has been restored in stages since 1989. The reconstruction of the Mlýnská Mill Race (the north-eastern part of the ring) was the most demanding project in technical terms. In this space – at the foot of the city

fortification walls – a small pond was built in 2010 as a reminder of the former mill race. Today, the last restoration step to be taken is the reconstruction of the northern part of the ring.

Exotic plants have not been placed in the parks since World War II. The exceptional quality of the ring of parks is achieved through attention to details: flower beds with flowering bulbs, annual plants, biennials, perennials and climbing plants, recreational lawns, fountains, drinking fountains and memorials.

Kopecký Park was named after Martin Kopecký (1777–1854), Pilsen’s Mayor in 1828-1850. His larger than life size statue was unveiled on July 28, 1861 in the middle of Kopecký Park. He played a key role in opening up the city by tearing down the medieval fortification walls. In the newly-formed space, he established today’s ring of parks.

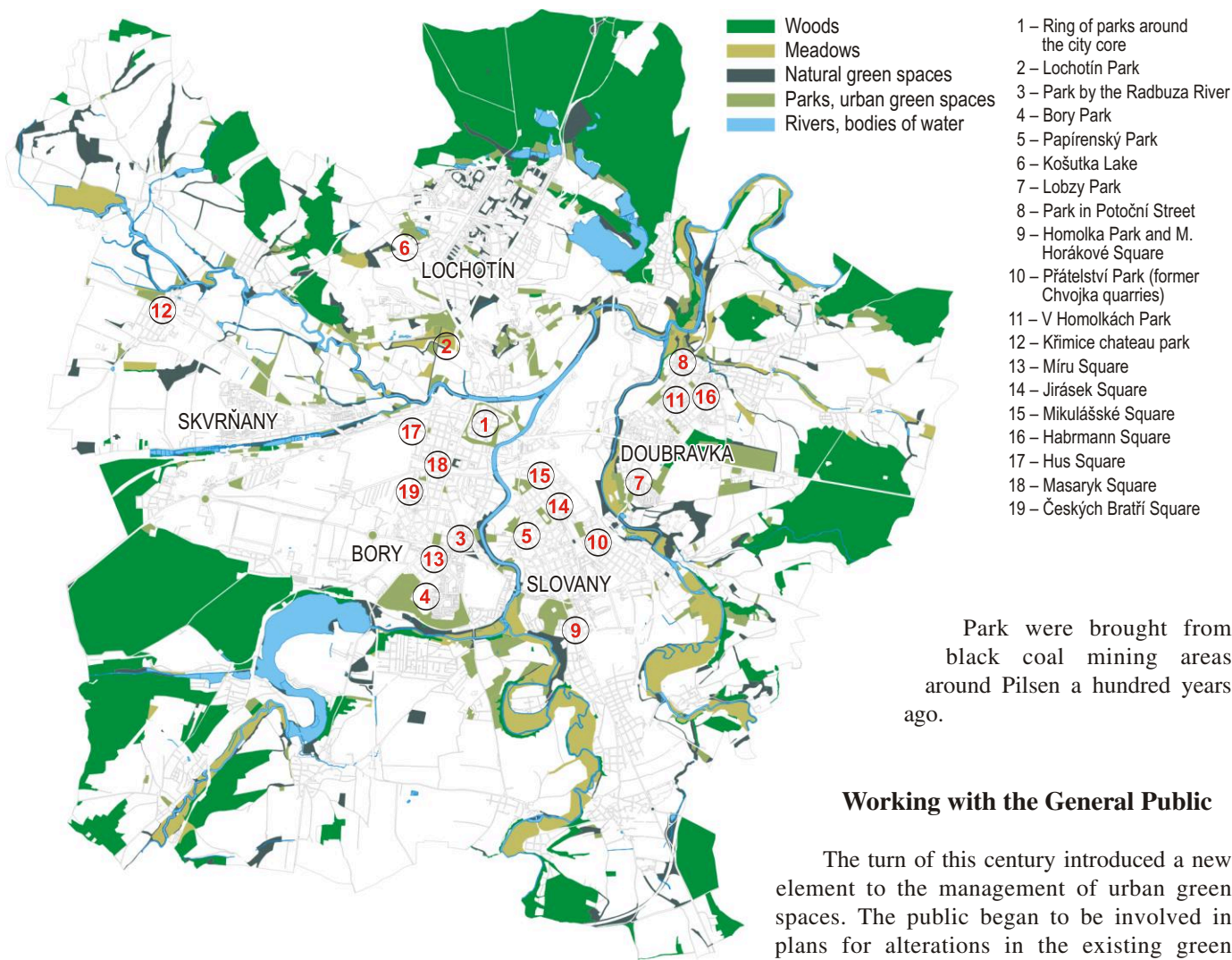
Křižík park is decorated with the bust of František Křižík, the inventor of the arc lamp. Smetana Park is named after Josef František Smetana, a grammar school teacher, whose monument was unveiled in front of today’s Education and Research Library on 12 November 1874.

Botanical Facts and Curiosities

Every May, the city center is decorated with some 12,000 newly-planted annual plants. In spring, the flower beds of tulips, daffodils, grape hyacinths and pansies are blooming. Between May and the end of September,



78 SMETANA Park in the ring of parks around the city core: JOSEF FRANTIŠEK SMETANA’S STATUE FROM 1874 IN FRONT OF THE EDUCATION AND RESEARCH LIBRARY OF THE PILSENER REGION



Park were brought from black coal mining areas around Pilsen a hundred years ago.

Working with the General Public

The turn of this century introduced a new element to the management of urban green spaces. The public began to be involved in plans for alterations in the existing green spaces, as well as in the establishment of new parks. These efforts led to the building of two “parks on request” in places voted for by people in opinion polls: Zemník in the Košutka housing complex and a meadow by Špitálský Wood in Doubravka city quarter. In the community planning process, stakeholders commented on the planned layout of the park and took part in planting the woody species and in creating new lawns.



FORMER mill RACE, rebuilt in 2010

gardeners showcase their art by making a sign out of flowers showing the current date at the foot of the statue of Josef František Smetana.

However, the main plants in parks are the trees. The upright pedunculate oak (*Quercus robur Fastigiata*) in front of the Museum of West Bohemia in Kopecký Park was probably planted at the time of completion of this building. A prominent common ginkgo (*Ginkgo biloba*) can be found in Pall Street in the former mill race. The space in front of the building of the Faculty of Education in 5. Května Park is dominated by a Japanese pagoda tree (*Sophora japonica*), which flowers at the end of July, showing clusters of small yellow flowers. A tulip magnolia (*Liriodendron tulipifera*) was planted in 1995 as part of restoration of Šafařík Park near the Museum of West Bohemia. Southern catalpa (*Catalpa bignonioides*) can be found in the location U Zvonu (Šafařík Park, end of Dřevěná and Zbrojnická Streets). The size of the Turkish hazel (*Corylus colurna*) in Pětařicátníků Park across the street from the Great Synagogue makes it an exceptional specimen.

The petrified trunks of trees – *Araucaroides* – in the ivy-covered area by the Museum of West Bohemia in Šafařík

The restoration of Bory Park was carried out in the same fashion. The park administration gathered the ideas of park visitors through an opinion poll in the park, by distributing questionnaires, and during tours organized on two weekends. The wishes and requests of citizens were used in the the planning of the project. The project was then carried out by a specialist company.

Statistics

The city of Pilsen owns approximately 820 ha of publicly accessible urban green spaces. These include parks, park squares, and green spaces in housing complexes, forest parks and cemeteries administered by the city’s organizational branches.

Table 4: Statistics of selected GREEN SPACES

Lawns	529 ha
Woody plants	142 ha
Roses	0.67 ha
Flowers	1.26 ha
Hard-surfaced areas and technical features	26 ha
Parkway trees	17,907
Benches	4,020
Water features: drinking fountains and fountains	52
Children’s playgrounds	2.93 ha
Statues, memorials, plaques, sculptures	114

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PILSEN’S WOODS

The Pilsen Basin is encircled by an almost continuous strip of woods, except for a gap in the north-east. There are some large expanses and a number of smaller woods. Tree populations comprise many species of oak, pine and even fir in higher-altitude locations. The few remaining patches of near-natural forest stands are protected as natural monuments or reserves. The woods in the vicinity of the city are used for recreation. These designated recreational areas span 400 hectares.

Pilsen acquired its property between the 15th and 20th centuries through purchases from noble families in the region, from other communities and from the state. Since the 19th century, the area of the city’s property of 3,500 ha has not varied significantly. Woods with a similar area of 3,800 hectares were returned to the city of Pilsen in 1992 as part of the restitution after the end of the communist regime. The city assigned the management of the woods to its organizational branch, Správa veřejného statku města Plzně (Administration of Pilsen Municipal Property). At present, the Administration is responsible for 4,120 hectares of the city’s woodland.

The forest stands show relatively good ecological stability. There is no direct exposure to ground-level pollutants, nor any extensive damage. Although windthrow events in previous years have disrupted the continuity of the forest stands in a number of places, they caused only local damage. The objective of forest management in the city’s woodland is to introduce broadleaved and ecologically valuable woody species in the appropriate sites.

Forest Management Regulations

The legal framework for management of the city’s woods is provided by the Act No. 289/1995 Sb. on woods. It stipulates an obligation to prepare a forest management plan. Pilsen’s current forest management plan covers the period from 2005 to 2014.

Forest Management Plan 2005–2014

Mean optimum age for forest regeneration:	116 years
Localized harvests in 2005–2014:	
Harvest cutting volume (in mature stands)	136,097 m ³
Intermediate cutting volume (tending young stands)	35,260 m ³
Total cutting volume in 2005–2014	171,357 m ³

The current actual felling volume in municipal woods ranges between 14 and 17 thousand m³.

Forest Tending and Regeneration

Commercial thinning	222 ha
Juvenile thinning	44 ha

Every year, an area of 30 – 35 hectares is reforested after harvesting. The ratio of natural regeneration is about 10%. Common tree species include pine (50%), oak (35%), beech, spruce, larch, Douglas fir, ash, maple, linden, alder and hornbeam.

Categories of Woods

Pilsen’s woods are used for commercial, as well as non-production purposes. The 2005–2014 forest management plan classifies the woods into the following categories:

Commercial forest	3,352.98 ha
Protection forest	79.09 ha
Special-purpose forest	687.82 ha

Special-purpose forests include natural monuments and nature reserves, recreational forests, forest research areas and forests required for preservation of biodiversity.

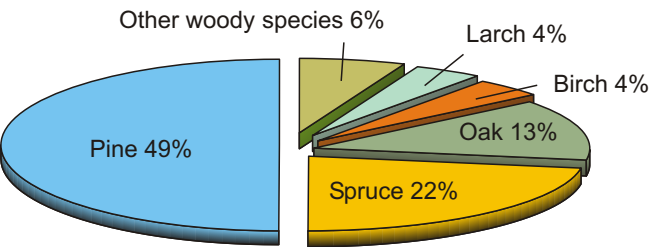
Forest Nurseries

The Administration operates two forest nurseries with the combined area of 5.78 ha. They produce pine, oak, spruce, larch and beech seedlings and small quantities of seedlings of woody species, including ornamental ones. Their annual output is more than 0.5 million seedlings.

Area Coverage of Woody Plants

The area coverage by various species in percentage terms is shown in Graph 20.

Graph 20: AREA COVERAGE OF WOODY PLANTS, PILSEN



Suburban and Recreational Forest

The largest recreational area is the woodland around the Bolevec Lakes in the north of Pilsen. Eight recreational lakes and a number of other attractive locations are set amidst romantic mixed forests of Scots pine, pedunculate oak, sessile oak and other species, including exotics.

The Kamenný Lake, Petrovka nature reserve and the natural monument Doubí are valuable areas with patches of the original stand. They show the history of transformation of the region and forest management that took place over several centuries. Well-arranged networks of paths lead visitors through the most interesting parts of protected areas and help to preserve the natural wealth of the area.

Five educational trails wind through the municipal woods, providing information on forestry and nature conservation in the region. Their combined length is about 35 kilometers. The trails are often used by schools and by groups of interested visitors for forestry lessons (interactive forestry programs).

Ostende Forest Park

Planning and development efforts in recreational areas are governed by special documents prepared by the city of Pilsen. These range from general studies to specific documents regulating the use of woodland areas and other zones in the vicinity of the city. One of the latter is the Project for Revitalization of the Ostende Forest Park. This has been a popular recreational area for more than 100 years. The specific documents deal with restoration of roads, construction of new paths, pavilions and crosswise connecting paths, installation of benches and other items along with the tending of vegetation.

The project for the Ostende Forest Park revitalization distinguishes between zones used intensively for recreation (beaches of the Great Bolevec Lake), the actual forest park zones intended for other activities, and zones for which the purpose is to enhance the ecological stability of the whole area. The beaches will be separated from the forest park areas by a promenade. In the forest park, new paths will be built and provided with pavilions, benches and information signs. This area should serve for walks in a likeable natural environment. Amenities for the Ostende area will be provided in a multi-functional building with a restaurant and dressing rooms to be built in the place of the former Ostende restaurant from the interwar period. New beach volleyball and volleyball courts will be constructed around the building. Throughout the area, new sandy and grass beaches will be established.



7. EDUCATIONAL TRAILS



84 IN FRANTIŠEK MALOCH'S FOOTSTEPS

Sigmond's Nature Trail

The trail lies north of the city center, in the Bolevec Lakes recreational area.

It commemorates a notable forestry expert and academic, Prof. Dr. Ing. Josef Sigmond (1868–1956), taking hikers through the city's woodland and past the results of his work.

Zábělá Forestry Nature Trail

The trail can be found in the Zábělá recreational area north-east of the city center.

The trail winds through places of natural and historical significance in the landscape, the main feature of which is the deep valley of the Berounka River with its steep slopes. The key theme of the trail is forestry and related activities.

Homolka Nature Trail

This trail is part of the Homolka Park, south-east of the city. It is intended for children, and its themes and way of presenting the information are designed accordingly.

Nature's Development During the Quaternary Period

This trail can be found on the premises of the Zoological and Botanical Garden of the city of Pilsen.

In addition to typical flora and fauna of the era (the European bison, musk ox, bear and wolf), the trail offers views of prehistoric life including homes, agricultural structures, and reconstructions of prehistoric humans. It results from a pioneering biogeographic and biotope-oriented approach to building exhibits which was adopted during modernisation of the formerly outdated zoo.

Sofronka Nature Trail

The trail lies north of the city centre, in the Bolevec Lakes recreational area.

Over 60 species of pine, in an area of about 22 hectares, have been planted in the arboretum since its founding in 1956. This is one of the largest collections of its kind in Europe and Asia. Signs placed by the trees list basic information on selected pine species, particularly on their natural habitat regions.

In František Maloch's Footsteps

The trail can be accessed from the north-east part of the city.

Its head is in the city part Bílá Hora and it cuts through the natural park Horní Berounka along the left bank of the Berounka River. It commemorates the botanist František Maloch (1862–1940).

Úslava Valley Nature Trail

This trail follows the part of the Úslava River that winds through the territory of the city.

It is intended to become part of a network of sports and recreational trails to be gradually built along the valleys of rivers in the city's territory. It is also part of the project for restoration of river banks. Additional trails will follow: Mže and Berounka Valley Nature Trail, Radbuza Valley Nature Trail and Úhlava Valley Nature Trail.

There are ample opportunities to learn about Pilsen's environs on a number of other educational trails leading through neighbouring communities.

There are also thematic trails following geologic, historical and other places of interest, which are not blazed. Their topics include theatre, galleries, churches, works of the architect Adolf Loos, river banks, former city fortifications, The Škoda Works and Jewish monuments. Maps and descriptions of these trails have already been published. These trails are based in part on the study *Fine Art in Public Places (Výtvarné umění na veřejných prostranstvích)* by Architektonické studio Hysek s.r.o. from 2010.

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NATURE'S DEVELOPMENT DURING THE QUATERNARY PERIOD
(AN EDUCATIONAL TRAIL ON THE PREMISES OF THE ZOOLOGICAL AND BOTANICAL GARDEN OF THE CITY OF PILSEN)

8. PLANNING, ZONING AND TRANSPORTATION SYSTEM

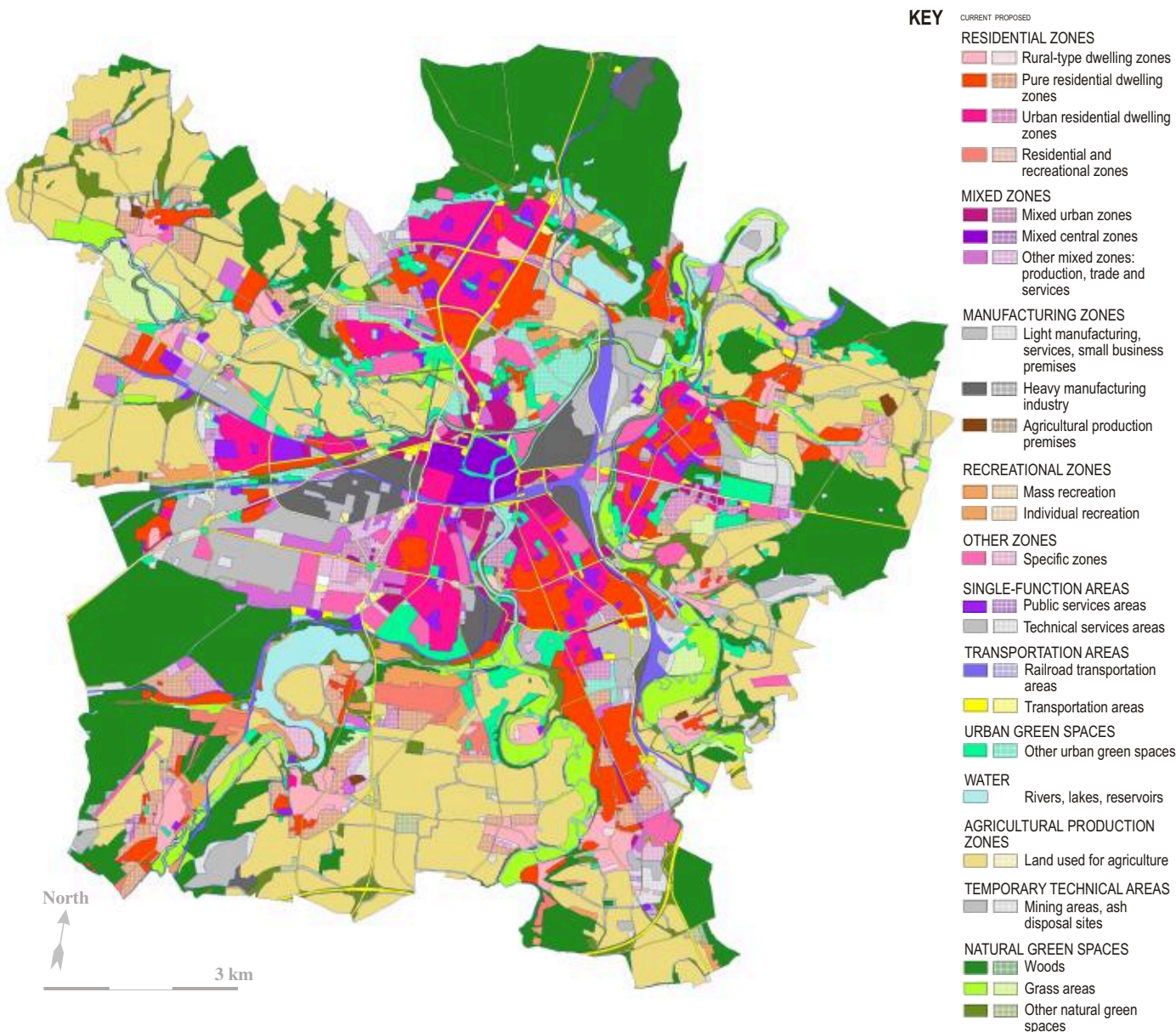
PLANNING AND ZONING

Historical Development

As in other cities, the urban development of Pilsen throughout history reflected its geographical conditions (an area dissected by the courses of four rivers) and the societal changes. The new city was founded with a quadrangular layout and a grid-like network of streets between blocks of houses set around a square located in the exact center of the city. Its landmarks were the church of St. Bartholomew in the center of the square (with the highest church tower in Bohemia, reaching 102.6 m), a church of the Franciscan monastery and a church of the Dominican monastery, pulled down in 18th century. This layout has been preserved and until the 19th century it was completely sufficient for the life of the city with its suburbs. The beginning of

industrialization in the second half of the 19th century, with its industrial plants and railway corridors, spurred a rapid growth of the suburbs. This, in turn, called for structural planning and led to the establishment of the city's building authority (1874).

After World War I, the new city leaders took up the pre-war concepts of urban development. Once the neighboring communities were incorporated into the city in 1924, a new master plan had to be drafted. This was in the period when the principles of functionalist urbanism were growing from a number of sources, including the Vienna modernism, the influence of Le Corbusier and Soviet constructivism theorists. The first modernist urban projects in Czechoslovakia (Hradec Králové, Zlín) took place many years before the Athens Charter of 1933 set down the functionalist requirement for spatial separation of functions of a city: dwelling, work, and others.



87 LAND USE DEFINED IN THE MASTER PLAN OF THE CITY OF PILSEN AS OF OCTOBER 1, 2011. COURTESY OF THE URBAN PLANNING AND DEVELOPMENT INSTITUTE OF THE CITY OF PILSEN

After World War II, these were the principles followed by the authors of the new master plan. The apartment blocks in the central area of the city surrounding the historical core were to be pulled down and replaced with new structures built in the open space along high-capacity roads. However, the roads of supra-municipal importance were still converging in the city center. These sweeping rebuilding plans were not realized in full but the completed parts of the road network (particularly the west-east and north-east through roads dissecting the central area of the city) pose a difficult-to-solve problem now, once the significance of the inner city and the historical core began to be appreciated. The next urban plan (1966) and the other plans drafted before 1989 continued to expand new housing complexes. Those were built from concrete panels and intended primarily for new employees of the state-sponsored heavy machinery industry. These apartment blocks were often built on the farming fields belonging to the former communities existing around the city. A very complicated process was the evolution of the route of the Prague – Nuremberg highway. Its current design came into existence only after 1990. Until then, it was a rather theoretical concept, as the western border of the country was practically closed.

After 1989, the legal institution of private ownership was restored and the city’s historical buildings began to be repaired by their owners. The new developments were reflected in the new master plan from 1995. The so-called flow-line construction of housing complexes was



88 THE BOLEVEC LAKES RECREATIONAL AREA



89 SOUTH EDGE OF THE CITY: THE BORY HOUSING COMPLEX

discontinued. However, the privatization of individual apartments in them fixed the existence of these buildings for a long period of time. Their renovation projects are supported by the state. New housing areas, predominantly for single-family houses, and areas for small-scale industry were identified; the largest industrial premises in the city, The Škoda Works, began to undergo gradual transformation. However, Pilsen failed to resist the wave of international corporations constructing shopping malls. New stores were built not only on the outskirts but even in the central part of the city. The rate of motorization soared as well. There were efforts to relocate national roads and highways to copy the railway routes but the key through roads remained unchanged. In this period, the master plan was updated every two years.

The Current Master Plan of the City of Pilsen

The master plan of the city of Pilsen responds to societal and economic developments, the issues of ownership and other factors, and remains consistent with its fundamental urban development concepts, requirements of the transport system, infrastructure and ecological stability. Its binding section was promulgated in the form of a by-law. The master plan classifies the territory of the city into areas and zones with prescribed use. These are stipulated in the land use specifications for particular types of zones and areas. The basic type of land use can therefore be defined for every plot in the city of Pilsen

The New Master Plan

A new master plan to become effective in 2015 is currently under preparation. The requirement for a new master plan is set out in the Czech Building Act. It also stems from the need to reflect current societal and economic developments. The plan will consistently follow the principles of sustainable development, laying down a framework for further growth of the economic base of the city, its increase in population and for controlling suburbanization. The drafting principles of the new master

plan were debated in 2011. The source materials for preparing the plan will include the winning conceptual draft for the central urban area arising from a public tender. The new plan must provide for balanced sustainable development of the territory, taking into account all the strategic thrusts, conserving and protecting natural, cultural and civilization values.

General Principles of the Urban Development Strategy

- Assessing the present condition and development of the city, identifying and enhancing the positive aspects of its urban structure and layout, and defining future urban planning priorities.
- Cultivating the elements that form the character of the city and its landscape.
- Understanding that the city is a system comprising areas and elements of both natural and human origin.
- Defining the need for growth areas based on strategic objectives and allocating them in accordance with the potential and requirements of the city as a whole, rather than on the basis of the administrative division of the city.
- Identifying suitable growth areas within the city through matching the character of each particular zone and the intended function, taking into account the technical and economical viability of infrastructure requirements.
- Supporting the regeneration of fundamental functions and systems of the city in the existing areas, hence preventing extensive city sprawl.
- Supporting the development of the city within its compact concentric layout by using quality spare areas.
- Respecting the character of flat-top ridges and river terraces separated by rather shallow and broad river valleys.
- Stabilizing and developing on a commensurate scale the ring of originally autonomous neighboring villages.
- Respecting and protecting landmark buildings, the most prominent of which is the cathedral of St. Bartholomew. It dominates the square and the entire city center and its tower helps create the unique skyline of the city.



90

CITY CENTER DOMINATED BY THE ST. BARTHOLOMEW'S CATHEDRAL



91

HORNÍ BEROUNKA NATURE PARK

Principles of Landscape Planning and Zoning – Natural Features

- Protecting Pilsen's unique natural feature, the stream valley pattern, from building development, advancing its recreational value for the city's inhabitants, and preserving its importance for the ventilation of built-up areas (by prohibiting building development in river valleys). Pilsen's characteristic feature is the network of four rivers with confluences of two rivers at a time: Úhlava and Radbuza, Radbuza and Mže and Úslava and Berounka. Space-forming elements, however, include both the water courses and the entire flood plains and slopes which, to a great extent, have retained their natural character.
- Protecting and developing the existing system of urban and natural green spaces.
- Preserving and developing important expanses of woods for their commercial, recreational, and protecting functions in the landscape. Prohibiting building development in forest areas.
- Preparing a program for the territorial system of ecological stability, as stipulated in the Act No. 114/1992 Sb., incorporating its principles in land-use plans and securing its proper functioning.
- Respecting alleys of trees in the open landscape, as well as along streets.
- Sensitive and prudent acquisition of arable land for urban purposes, considering the actual needs of the city development and the quality of the land acquired.
- Protecting bodies of water. In terms of Pilsen's urban composition, large bodies of water represent an extraordinary element. In the north of the city, there is the unique system of Bolevec Lakes; the České Údolí Reservoir lies on its southern border.

TRANSPORTATION SYSTEM
DEVELOPMENT STRATEGY
IN THE CITY OF PILSEN

Traffic is a significant source of environmental pollution, which is particularly true of busy traffic in large cities. The severity of its impact depends on the proportion of private car traffic in the traffic system and also on the road network configuration. Like many large cities, Pilsen struggles with traffic issues. In this respect, it faces an adverse geomorphological setting given by its location at the confluence of four rivers and suffers from the consequences of historical development. Successful abatement of the problems of the transportation system depends on how well suitable principles of further development will be implemented.

Historical Context

The origins of the city of Pilsen date back to 1295. It was the last city in Bohemia to be founded on a greenfield

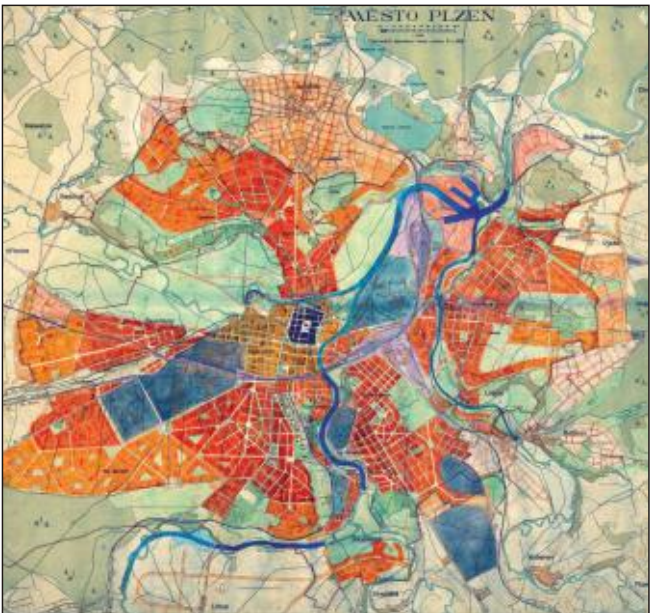


92, 93 Network of radial imperial roads was built around the city in 18th century. © 2nd Military Survey, Austrian State Archive, © DATA SOURCES OF THE MINISTRY OF ENVIRONMENT OF THE CZECH REPUBLIC (92) Imperial roads became arteries of urban districts, growing around the city's core. Year 1931. (93)

site. With it, the medieval era of founding new towns in Bohemia ended. Other notable cities established before Pilsen include Klatovy (1260) and České Budějovice (1260). Pilsen's founders, relying on experience from previous years, chose a crossroads of trade routes for building one of the most important cities in Bohemia. In the 18th century, a network of radial imperial roads was constructed around this dominating West-Bohemian city (Figure 92). These roads became the arteries of urban districts expanding around the city's core. As a result, the street network became radial as well (Figure 93).

Evolution of the Road Network in Urban Plans

By incorporating its neighbouring communities, the city expanded a great deal in the 1920s. Its further growth now had to be controlled through master plans. One of the key aims was to coordinate the developing street network. It is interesting to observe the evolution of opinions on this issue. In the 1930s, the threat of rapid motorization had not yet been perceived. The proposed network mostly followed an urban design concept and did not provide for significant traffic loads (Figure 94).



94 Proposed master plan for the City of Pilsen, 1929–1932

The post-war master plan from 1948 focuses on reshaping the city according to functionalist principles. Its authors drew on their extensive experience from abroad and planned for a massive expansion of car traffic. They proposed a network of newly rebuilt radial roads and two ring roads encircling the city. However, the functionalist approach and post-war enthusiasm for building a new future were reflected in the low respect for the existing built-up area. The city center including the road system was to be rebuilt in a blanket manner (Figure 95).



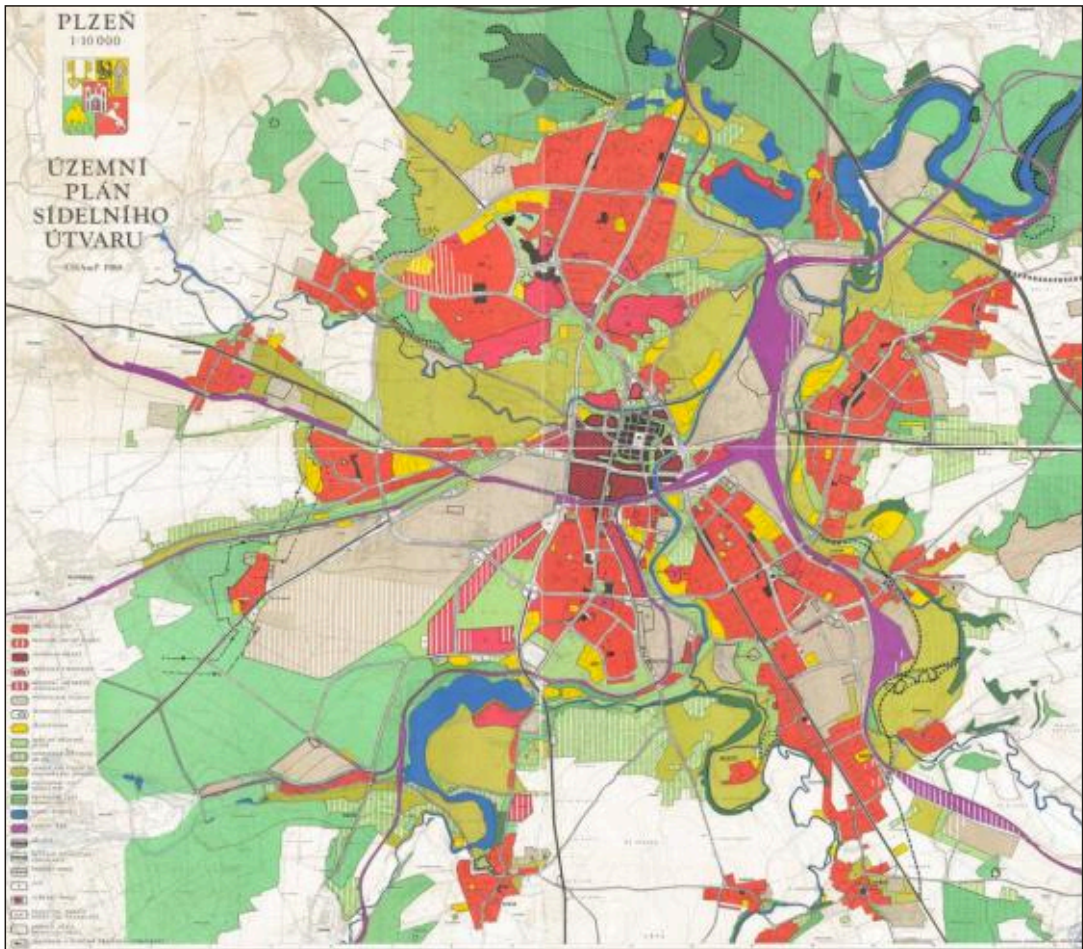
95 Guide development plan of the CHARTERED City of Pilsen by FRANTIŠEK SAMMER AND JINDŘICH KRIESE, 1948. DETAILED solution for the city CORE; THE STATE FROM 1948 AND THE PROPOSED LAYOUT



96 MASTER plan of the city of Pilsen, Zbyšek Tichý ET AL., 1964, city CENTER

The amount of vehicular traffic in the city began to rise steeply in the 1960s. The automobile became a symbol of the modern world, and the issue of car traffic dominated urban planning. Highways cut through the city center and streams of cars were seen as a sign of progress. At the same time, the authors did not fully appreciate the harmful effects of transportation (Figure 96).

The 1970s and 1980s were decades of rectification of the most grave mistakes of the 1960s. The highway was displaced outside the built-up area. However, the radial thoroughfares allowing smooth transit through the city center remained the key element of the road network (Figure 97).



97 Guide development plan of the city of Pilsen, 1986, JAROMÍR ŠESTÁK ET AL.



KEY
Solid yellow lines – roads built before 1989
Dashed yellow line – planned and abandoned reconstruction of the Slovanská Avenue
Solid red lines – road sections built between 1989 and 2010
Dashed red lines – road sections planned for the period after 2010

98 High-capacity road network built before and after the changes in society in 1989

The master plan from 1995 seeks to harmonize transportation and other functions of the city. The new approach is reflected in the protection of the city core and in relocating the Karlovy Vary – Pilsen – České Budějovice road from the city center to a city ring road (Figure 87).

The principles of balancing out the transport requirements with other functions and protecting the city center from excessive vehicular traffic loads must be embedded even more deeply in the new master plan, which is expected to be drafted in 2014.

Progress in Building the Road System

In the 1960s, a wave of motorization began in Pilsen. At that time, extensive blocks of flats from concrete panels



99, 100

began to be built on the outskirts of the city. The combination of these developments led to an urgent need for a new high-capacity road system. Meeting this need over a relatively short period of time was not easy. Both financial resources and construction capacities were limited. In response to these rapidly increasing requirements, high-capacity roads leading to the city center were built in the 1970s and 1980s. Suburbs were connected with the center and, through the center, with one another. These new corridors were built in place of the historical radial roads. Slovanská Avenue was the only one not to be rebuilt in this period due to lack of time (Figure 98). By constructing new transport corridors, the city managed to sustain the rise in vehicular traffic and establish conditions for further development. On the negative side, large volumes of traffic were brought into the center of the city and historical boulevards were devastated (Figure 99, 100).

After societal changes in 1989, the rebuilding of the city’s historical radial roads was stopped. New efforts were aimed at inner and outer ring roads, the highway, and its feeders (Figure 98). Despite these positive changes taking place since 1989, full balance between the functioning of the road network and other functions of the city has not been achieved. The city does not operate as an integral whole, in which individual functions support and complement one another. This is particularly true of its parts affected by road rebuilding in the 1970s and 1980s. At the same time, the city failed to build the ring road or even any continuous part of it, wasting the opportunity to displace any significant part of traffic away from its congested center. The city core continues to experience the heaviest traffic. On Tyrš Street, which winds around the center of the city, the daily traffic volumes reach up to 19 thousand vehicles in each direction. Karlovarská Avenue passing over Tyrš Street carries a traffic volume of almost 22 thousand vehicles daily in each direction (Figure 101).

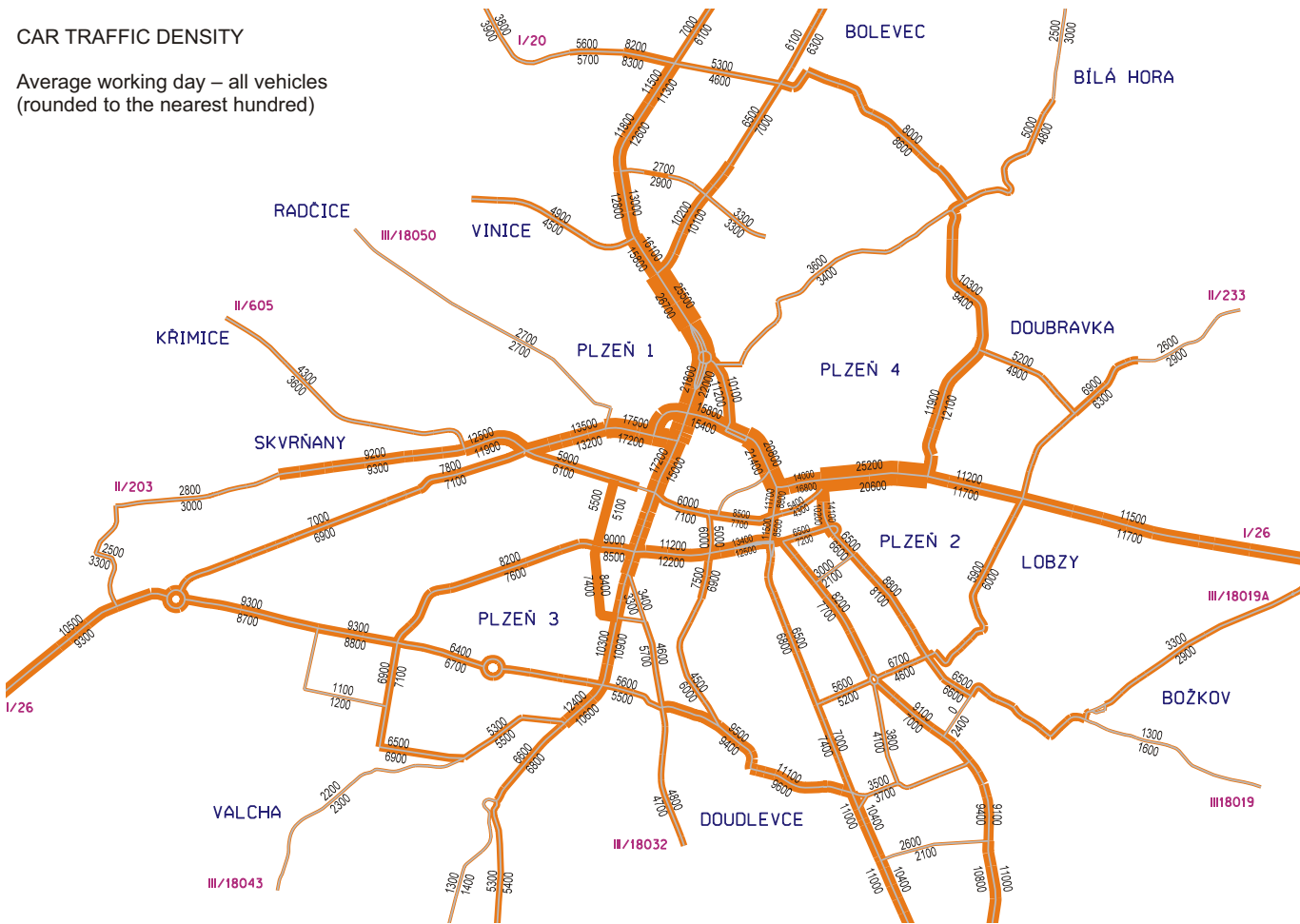
The objective of further development of the road network is to relocate key corridors outside the city center and to eliminate traffic overloading of the city’s core.



Klatovská Avenue, one of the main boulevards in 1935 and today (rebuilt into a four-lane road in the 1970s)

CAR TRAFFIC DENSITY

Average working day – all vehicles
(rounded to the nearest hundred)



101

Map of traffic density on Pilsen's roads in 2005



102

ONE OF KŘIŽÍK'S FIRST EIGHTEEN CARS FROM 1899

Municipal Public Transport

The beginnings of public transport in Pilsen are linked with the name of a notable Czech inventor, František Křižík who launched the streetcar service in Pilsen in 1899. His comprehensive project included not just the tracks and streetcars but a maintenance facility and the necessary power plant as well. Křižík's streetcar network was at the foundation of today's public transport in the city.

Bus services began to operate in the 1820s and 1830s. At the time of the occupation by the Third Reich during World War II, the lack of diesel fuel compelled the replacement of bus transport with further expansion of electric traction, this time the trolleybus service. A trolleybus line was built in 1941 from the city center to the Doubravka quarter.

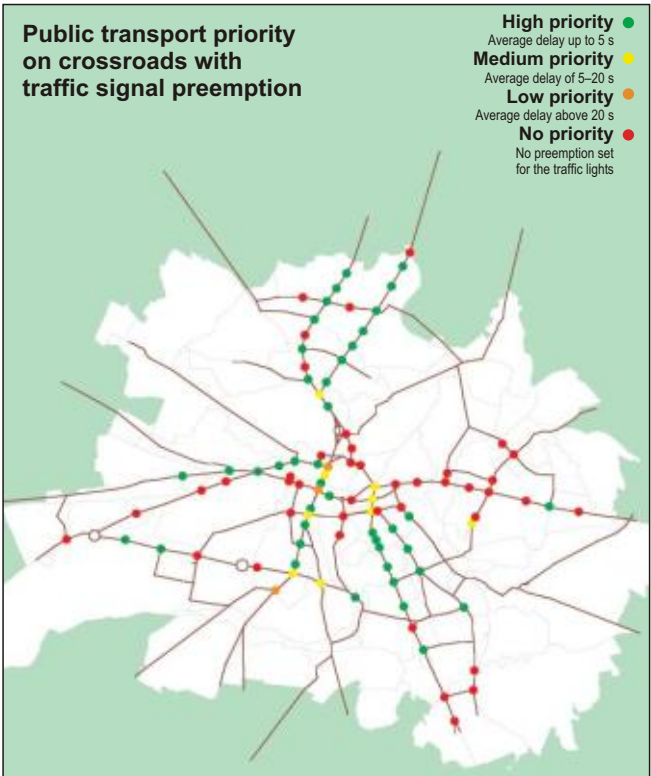


103

ONE OF THE FIRST TROLLEYBUSES IN PILSEN, ŠKODA 3 TR, ON ROKYCAŇSKÁ AVENUE

The trolleybus service continued to develop in the post-war years. Its advantages included rapid addition of routes and utilization of existing roads, along which the posts with overhead lines and power supply facilities were erected. The network of streetcar and trolleybus lines kept growing but the character of the system remained unchanged. It is based on a radial pattern of streetcar and trolleybus routes, complemented by a half-ring bus line. There are additional bus services operating in peripheral areas of the city, or substituting for the incomplete parts of streetcar and trolleybus lines. Pilsen has 21.6 kilometers of streetcar lines, 44 km of trolleybus routes, and 185.6 km of bus lines. As the network expands, the rolling stock is being upgraded as well. The number of low-floor vehicles is rising, their current share being over 50%. The effect of private car traffic on bus and trolleybus lines is a certain drawback of the system, as the public transport vehicles are slowed down on congested roads. To tackle this, traffic light preemption systems which give priority to public transport vehicles are being introduced (Figure 104). The operation of public transport is effectively controlled from a central dispatching center. Thanks to a GPS-based system, the dispatchers can track the current position of all vehicles and organize the service. A well-developed public transport network is Pilsen's great advantage. However, over the last twenty years public transport has been losing its prominent status to car travel.

The objective of the development of the city's public transport is to improve its modal share.



104 Traffic light preemption giving priority to public transport in the transportation system of Pilsen

Suburban Train and Bus Services

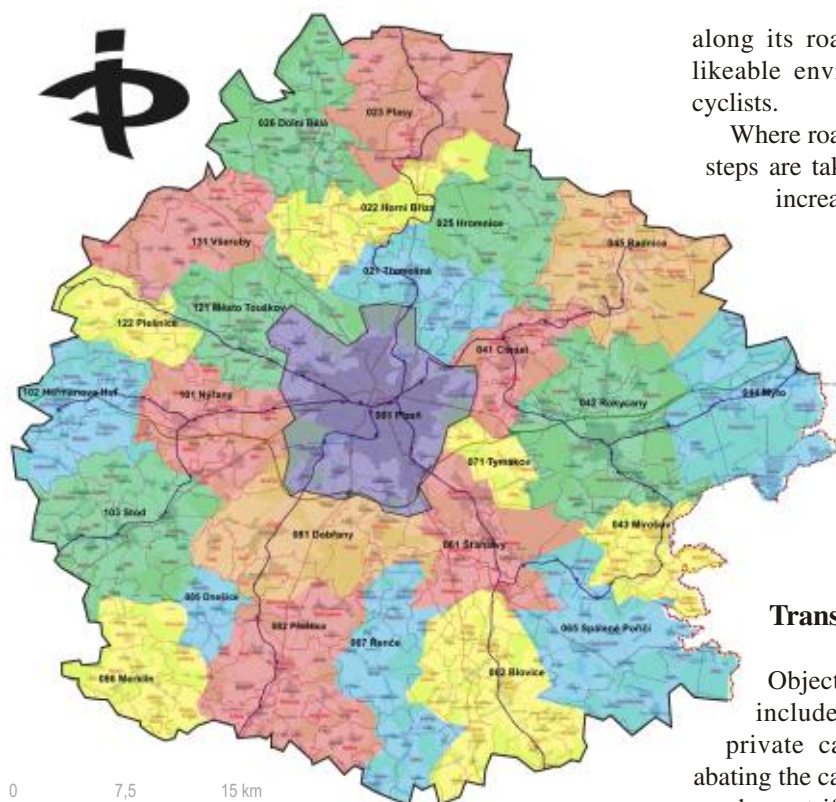
As a significant regional center, Pilsen attracts large volumes of suburban transport. At the end of the 19th and for almost the entire 20th century, six train routes were bringing thousands of commuters from a large area outside the city to The Škoda Works and other industrial plants every day. Operation of the transportation system was dependable, rapid and had low space and operational requirements.



105 Main train station in Pilsen at the beginning of the 20th century

In addition to a railway service, bus lines began to emerge. This was first in regions lacking public transport and later, at the time of inexpensive fuel, bus routes began to cover areas already served by the railway. Later, private car travel, being more flexible, convenient and affordable, began to cause difficulties for public transport, taking over a great portion of passengers from both trains and buses. This had an adverse impact on the performance of the road network and brought about a need for additional parking capacity in Pilsen. The railway transportation system in Pilsen's urban agglomeration is in a neglected condition and does not fully utilize its potential. The continuous long-term loss of passengers who turned to buses and later to private car travel led to the cutting of capital and operational funding. The convenience of this mode of travel therefore declined, reducing the demand even further.

Reversing the unsatisfactory condition of the suburban transport requires a systematic effort. Rail travel must be restored to its former importance as the backbone of regional transport, connected to a system of feeder bus routes and a network of P+R (park and ride) car parks and B+R (bike and ride) facilities located by the train stops. The entity organizing the public transport system is the company POVED s.r.o. which was founded for this purpose in May 2010. It is owned by the city of Pilsen and by the Pilsen Region. The objective of the development of suburban transport is to interconnect the rail, bus and urban public transport networks to provide a cost-effective and operation-efficient system able to compete against car travel.



106

Pilsen REGION AREA COVERED by the INTEGRATED
Pilsen TRANSPORTATION SYSTEM

along its roads, overloaded with traffic, fail to offer a likeable environment for inhabitants or safe routes for cyclists.

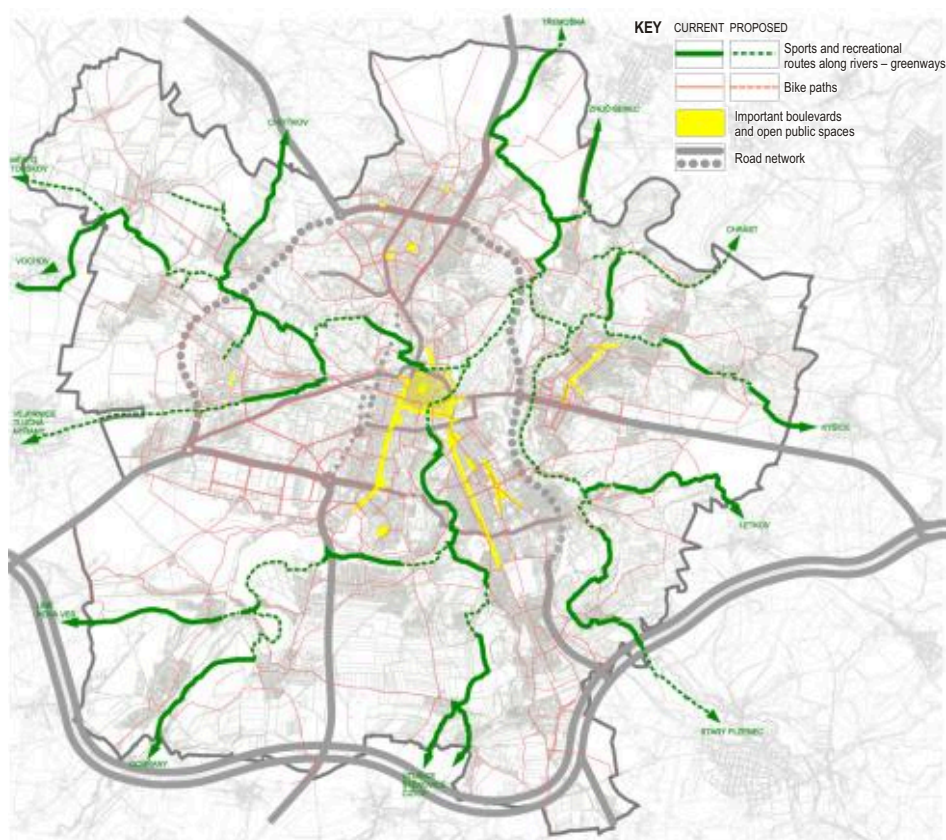
Where roads and other public spaces undergo rebuilding, steps are taken to make the public space more attractive, increase pedestrian safety, and provide comfortable access to public transport stops, to name a few aspects. The city continues to expand the network of bike paths in its built-up area, as well as the network of recreational and long-distance routes along the valleys of Pilsen's rivers. This systematic effort to improve conditions for pedestrians and cyclists is intended to benefit the transportation system, as well as to support the social importance of these activities.

Transportation System Development Strategy

Objectives of the further development of the city include stopping the growth of the proportion of private car traffic in the transportation system and abating the car traffic load on the city core. These objectives can be met if individual modes of transport are interlinked in their development and the operation of the entire transportation system is integrated.

Pedestrian and Bicycle Transportation

Neither pedestrian nor bicycle transportation have any substantial impact on the nature of the transportation system. However, walking is a mode of travel that is involved in almost all trips, although it is normally combined with other modes. Conditions for pedestrian traffic are important not only for transportation purposes, but for other functions as well. Pedestrian transport in a city fulfills social and relaxation functions too. People walk to enjoy their leisure time or to exercise. Equally, cycling infrastructure does not just serve the purpose of transportation, but is used for recreational cycling as a social activity. It is mainly in the greater city that there is a major gap between the needs and the present conditions. The areas

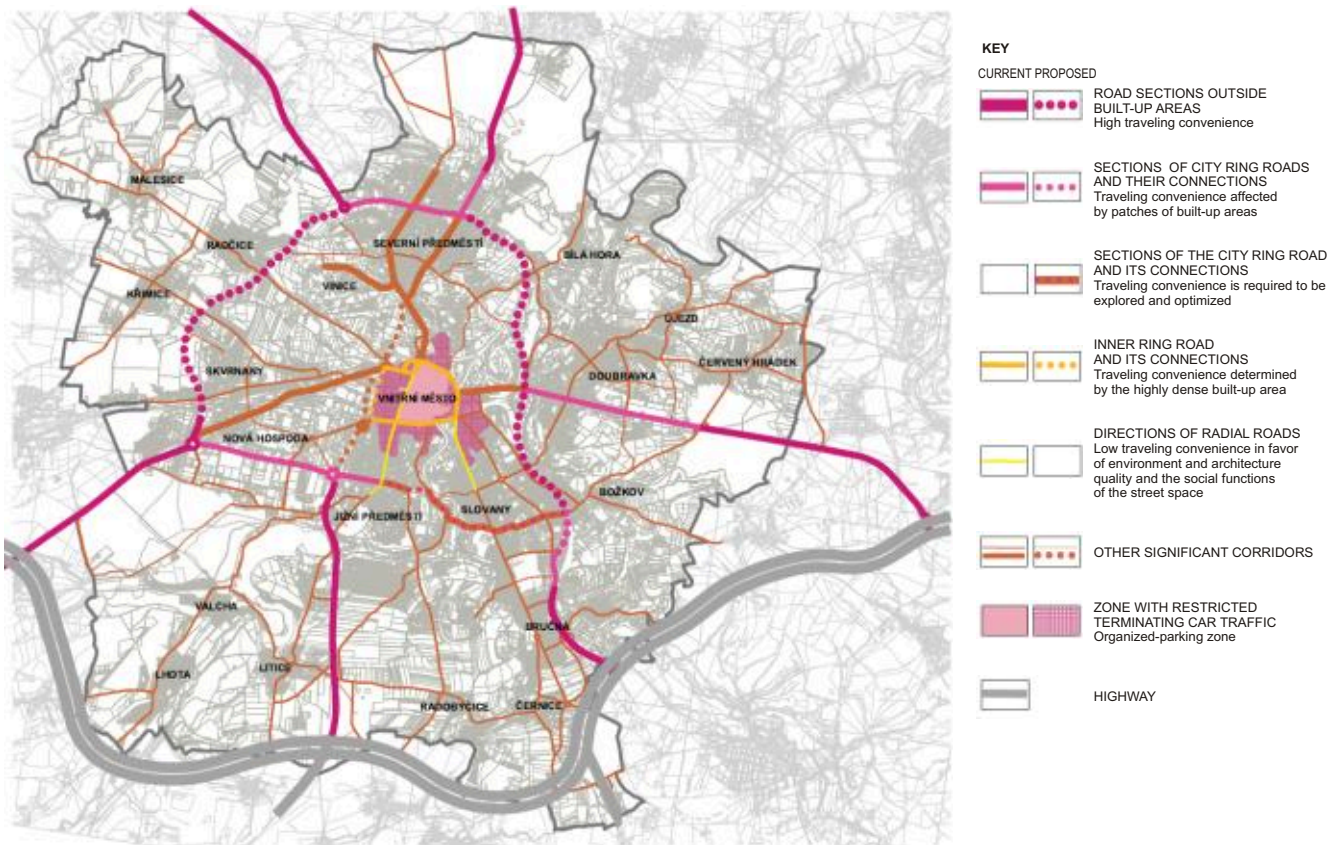


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Outline of development of bicycle transportation

Key Principles of This Approach Include:

1. Building a road network with different levels of traveling convenience. On ring roads, good conditions for a rapid and comfortable ride should compensate for the drawback of the longer trip. At the same time, restoration of roads in the city core should reflect primarily the needs of the urban environment, public transport and those of pedestrians, cyclists and resident traffic.
2. Parking in the city center should be based on regulated zones and centered on the network of park-and-go facilities at the edge of the city core and park-and-ride facilities served by public transport by the arteries entering the city.
3. Giving priority to public transport to ensure its competitiveness in the transportation system.
4. Using railway as the backbone of suburban transport.
5. Improving conditions for pedestrians and cyclists.
6. Enforcing a unified transportation and urbanistic concept interlinking the transportation system with the development of the territory. Steering the development of the territory away from creating unnecessarily demanding transportation relations. Designing the road network in a manner which prevents unnecessary degradation of adjacent areas.
7. Developing information technologies for transportation system control in order to increase the efficiency of use of the transportation system infrastructure and improve the interconnection between various modes of transport.



9. ENVIRONMENTAL Education



109 THE FACE OF THE EARTH – EARTH AND LIFE. PAINTED BY CHILDREN IN AN AFTER-SCHOOL CLUB AT PILSEN'S 2ND ELEMENTARY SCHOOL

The Environment Department of the Municipality of Pilsen organizes several annual events focused on environmental education in relation to significant European and world days devoted to various issues.

In observance of Earth Day on April 22, art and creativity contests on various themes (e.g. Seasons in Pilsen, Forest – an Ecosystem, The Face of

the Earth) are held for pupils of elementary, special and art schools in Pilsen. Among participants in these projects, there are schools from Pilsen's partner cities abroad. Exhibitions of the winning entries and their ceremonial openings take place in the City Hall.

On the occasion of the June 1 Children's Day, environment and sports-oriented outings for children from

Pilsen's kindergartens take place throughout June. The children learn about water animals and birds in various locations, identify broadleaved and coniferous trees and edible and poisonous mushrooms.



111

CHILDREN'S DAY – A FAIRY TALE TRACKING GAME



110

"WHAT DO YOU IMAGINE THE FUTURE MEANS OF TRANSPORT WOULD LOOK LIKE?" – A DRAWING CONTEST.
1ST PLACE – H. FERENZOVÁ, D. HOFRAITROVÁ, V. HULINSKÝ, A. STUPKOVÁ

ENVIRONMENT of the City of Pilsen

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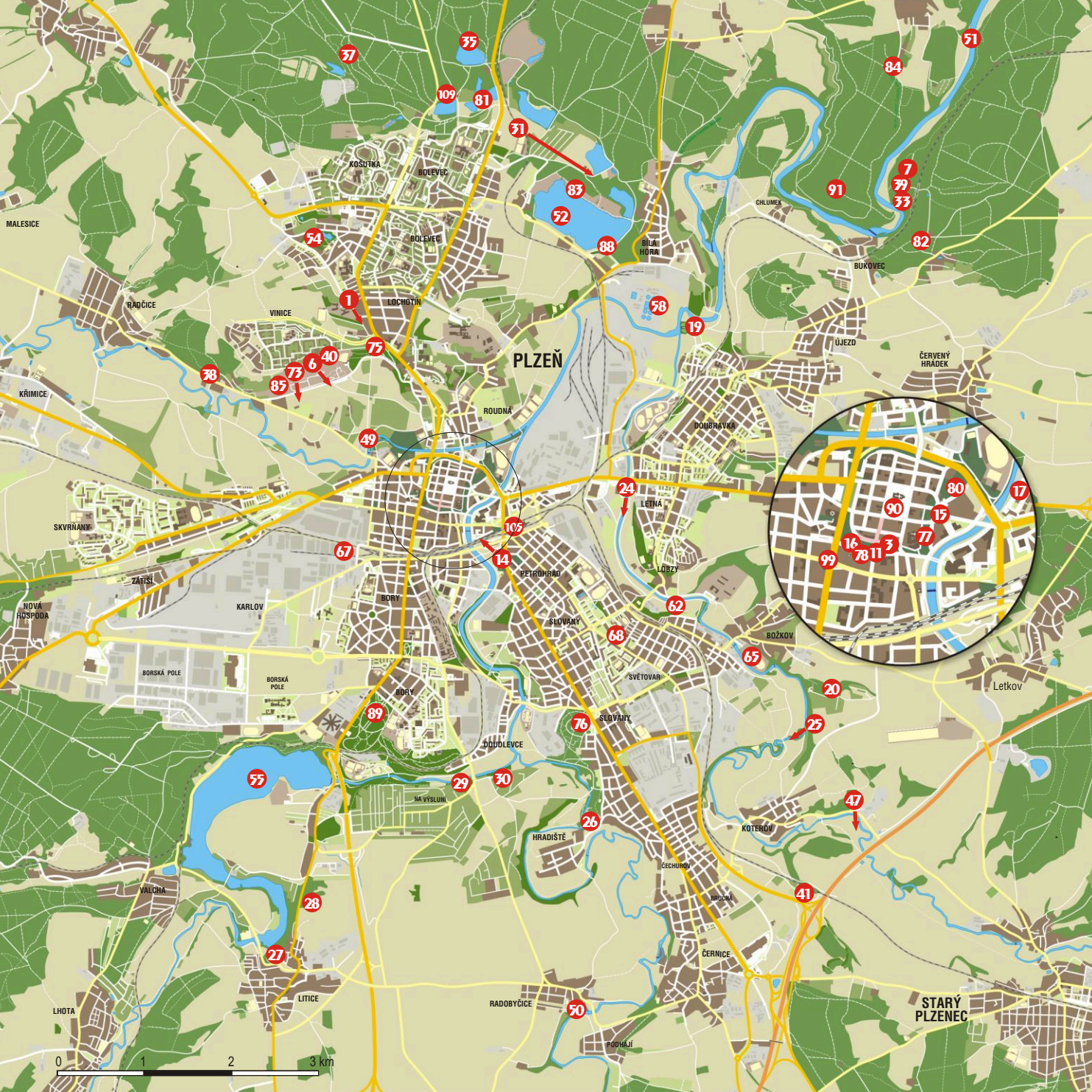
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