SEWER MUSEUM
VISITOR GUIDE

VILLE DE **BRUXELLES**
STAD **BRUSSEL**
CITY OF **BRUSSELS**

WELCOME TO THE SEWER MUSEUM!

YOU ARE ABOUT TO GO ON AN UNUSUAL JOURNEY INTO THE MOST HIDDEN PART OF BRUSSELS, ONE WHICH IS ALSO VITAL FOR ITS FUNCTIONING. IT IS A LIVING MUSEUM LIKE NO OTHER, WITH THE SENNE IN THE SPOTLIGHT. A MUSEUM THAT EXPLAINS WHEN, WHY AND HOW THE SEWERS WERE BUILT, WHAT THE WORK OF THE PEOPLE IN THIS UNDERGROUND WORLD INVOLVES, AND THE WATER CYCLE OF THE CITY. THIS TEXT WILL ACCOMPANY YOUR MULTI-SENSORY EXPERIENCE.

01

THE VALLEYS OF BRUSSELS

TOPOGRAPHICAL MAP AND PLAN

The Senne valley forms the backbone of the network of Brussels valleys. As it flows through the capital, it gathers around twenty tributaries (smaller rivers flowing off of the main river), which account for the topography of the region.

The topography of the territory of the Brussels region varies by several hundred metres, from the bottom of the Senne valley to the highest points in the Bois de la Cambre and the Sonian Forest. The Senne is and has always been the natural container for all the water flowing over and under the city.

Most of the region's rivers have disappeared from the surface as a result of urban development. They have been channelled underground and are now part of the main lines of the waste water drainage network. However, the topography of the valleys is still noticeable. It accounts for the formation of the city, meaning that the infrastructure, drainage, parks and ponds are closely linked to the topography.

THE MOLENBEEK

The Molenbeek emerges at Dilbeek in Flemish Brabant. Contrary to what you might think, this stream with its gentle gradient, and therefore low flow, was unsuitable for watermills.

THE SENNE

The Senne begins its course in Naast in Hainaut province, and flows for 90 km before joining the waters of the Dyle, which flows into the Rupel, a tributary of the Scheldt.
The river is closely related to the history of Brussels, whose name (Bruoc-zele, or "hamlet in the marsh") reminds us that the city was founded in the damp valley of the Senne.

THE PÈDE

The Pède begins its course at Lennik-Saint-Martin in Flemish Brabant. Its name changes from village to village, and it finally joins the Senne at the Petite Ile district in Forest.

THE CANAL

Dug in the plains of the Senne Valley, the Canal consists of two distinct sections: the Willebroeck canal, dug out in the 16th century to improve the link between Brussels and the port of Antwerp and then the sea, and the Charleroi canal, for which construction was completed in 1832.

THE MAELBEEK

The Maelbeek appears in the gardens of the Abbey of La Cambre. The history of this river has often been associated with severe flooding, partly due to the gradual disappearance of the many ponds along its banks.

THE WOLUWE

The main tributary of the Senne, the Woluwe emerges in the Sonian Forest and follows a route of nearly 20 km before joining the river in the Flemish region. The fact that it is away from the urban core meant that it was developed later on, but efforts were made to preserve the valley.

02

BRUSSELS OVER THE CENTURIES

OLD MAPS

1550

This first known plan of Brussels shows the alluvial plain of the Senne and the development of the city on the eastern side of the valley. Three main streams flowed down this shore and already allowed the inhabitants to discharge their waste water into the Senne. These were the Coperbeke, Savelbeke and Ruysbroeck. These streams no longer appear on the map, the Coperbeke was probably covered towards the end of the 15th century. The Willebroeck Canal, under construction at the time, is sketched on the map.

1567

The Willebroeck Canal (1) has now been completed, and the Sainte Catherine basin (2) is taking shape at the Place des Fossés in the inner ring. The grasslands on the banks of the Senne, which are clayey and damp, and therefore suitable for the installation of laundries, are still visible near the Porte d'Anderlecht (3) (site of the current museum).

1640

The urban centre is becoming denser and we can see the appearance of the various resulting 'impasses' (dead ends). Similarly, the formation of the Port of Brussels goes hand in hand with the urban development of the basin district. On this plan, we can see the "Mestback", literally "manure tank" which was intended to house the city's rubbish before it was removed by boat. It was mixed with the sludge collected during the cleaning of the city's sewers and streams.

1777

Since the 17th century, the city has witnessed the development of an actual sewer network, which is intended primarily for the cleaning of street water.
However, the network remained unfinished.
Some of the city's officials invited craftsmen, merchants and private individuals to get rid of their rubbish in the Senne, especially at the back of the Temple des Augustins.

1835

Geometric map of Brussels drawn by W. B. Craan, 1835. Archives of the City of Brussels.
Unhygienic conditions in the city has reached its peak: Brussels has 45.5 km of sewerage but the network remains unfinished, unsuitable and in poor condition.
The Senne gets increasingly polluted. The wide river carrying dirt and dead animals threatens to overflow in rainy weather, and dries up in summer, releasing disease-ridden fumes.
Moreover, suffering from the industrial development of the Canal, the Senne gradually loses its economic function and is limited to its use as a city sewer.
Likewise, in the middle of the 19th century, private connections to the

public sewer system, which were forbidden up until that point, were tolerated or even encouraged by various municipal regulations.
The sewerage intensifies...

CENTRAL DISPLAYS

(LEGENDS FROM LEFT TO RIGHT)

- Ordinance of 1341 made all dumping of waste in the Senne illegal.
  Various types of waste must be collected by the inhabitants in their homes and disposed of at their own expense. The ordinance also specifies that the maintenance of gutters and small open sewers running in the middle of the streets must be done by the residents themselves, although the City is responsible for the disposal of the sludge collected.
- Ordinance of 1360 prohibiting the throwing of dead animals and rubbish into 'poelen'.
  Apart from the Senne, the inhabitants of Brussels have three other sources of water in the Middle Ages: wells, mainly situated on the eastern slope of the valley, fountains that collected their water on the same slope, or 'poelen': pits dug in the ground and supplied by rainwater or groundwater.
  These reservoirs of undrinkable water were used for animals, domestic tasks or firefighting.
  Some of the poelen located on the banks of the Senne also served as holding basins for mud which gushed down the slopes during heavy rains.
- Oath of the Moddermeyer (master of sludges) made around the middle of the 15th century.
  The master of sludges was an official appointed by the City to clean the poelen, streams and drainage ditches.
- Profile of the sewer leading from the City Hall to the Senne, 16 January 1710.
  In the 18th century, the city's sewers gradually developed into real, working network, although it was rather disorganised. Certain sewers flowed either underground or in the open air, others had insufficient slopes or were still of uneven or insufficient size.
  In addition, private connections to the network were multiplying, leading to regular clogging of the sewers, which were only intended to receive street water and maintain acceptable cleanliness.
- Instructions for cleaning the sewer from Mont Sainte-Elisabeth to the Senne, 15 November 1784.
- Complaint made in December 1793 about the infection caused by water, excrement and rubbish from the military hospital established in the former convent of Les Minimes, and flowing in the open air up to Rue Haute.
- Copper plate used to print the *'Chronique de l'industrie'* (Industrial Chronical), 1872.

Cross-sections of the covered Senne and floodgates of the Grande Écluse building. The shape and present location of the Grande Écluse (Large Lock) are due to the first covering, of which it formed the mouth. It remained in service until the diversion of the Senne in 1955, and made it possible to control the flow of the river under the city.

→ Foreman's notebook for monitoring the construction site of the Senne covering, detail of the tunnel sewers.

→ Minutes of the ceremony to lay the first stone of the covering in the presence of King Leopold II and Queen Marie-Henriette on 6 May 1867.

→ The engraved silver trowel used for the occasion is on display at the Brussels City Museum, located at the King's House on the Grand Place.

→ Coins bearing the effigy of Kings Leopold I and II found in a lead case sealed in the cornerstone of the tunnel sewer on the right bank near the current Boulevard Baudouin.

→ Opening ceremony of the boulevards on the Senne in the absence of the king, who was unavailable due to the political crisis of the time, 30 November 1871.

→ Illustration dedicated to the defenders of our liberty.
Engraving by H. Biberstein, in the style of E. De Geneffe

→ Cover of *Globe Illustré*,
29 August 1897.
The crowning achievement of the development of the new boulevards in the centre, the Anspach fountain was erected in memory of the mayor on the current Place de Brouckère, which occupied the site of the Temple des Augustins.

→ From an urban development perspective, Haussmann-style boulevards provided better north-south communication, but they formed a cut-off in the lower part of the city which compromised the development of its western part.
In addition, provincial commissioner Victor Besme estimated that 7,000 housing units needed to be rebuilt to compensate for the demolition of the 1,000 buildings which were claimed for the work. The city did not grant this request.

→ The *Événement Illustré*,
13 January 1917
Archives of the City of Brussels
Views of the floods of 1932 in the municipalities of Forest and Anderlecht.

→ The boundaries of the covering.
Although the covering turned out to be effective against flooding in the Brussels city centre, it did not improve security in the neighbouring municipalities.
They suffered from the ever more frequent floods since Brussels closed its water locks – which were used for lowering and raising boats in the city – in the event of risk.

03

A RIVER THROUGH THE CITY

"Rundown, worm-eaten houses, flowered with velvety mosses, with wild cloves in the crevasses, with sections of wall thrown up all along the Senne, overloaded with wooden cubicles overhanging the earthy waters, and bristling with stone overflows through which household laundry dripped. (...)

The river meandered through this collection of small compacted houses (...); its stems stretched everywhere, plunging into the heart of this hardship, with billowing yellowish scum at the dams, whirlpools of boiling vapours along the factories, slow drags of oily puddles all along its course.
It had ended up being the dumping site, not only of the industries grouped together on its shores, but of all the houses along its banks; it was not uncommon to see the bloated belly of a floating dog, jumbled with calves and household waste, drifting from its swill and heavy waters."
Camille Lemonnier, excerpts from "La Belgique" (translation), Paris, 1888.

In the 19th century, the growing industrialisation and overpopulation of the city have serious consequences on the pollution of the Senne. Regular water draining to supply the Willebroek Canal mean that the river gradually was filled up of sludge. While the authors of the previous century still agreed on portraying a picturesque landscape, the descriptions of the 19th century go in the opposite direction.

"CLEANING OF THE SENNE", BRUSSELS, 1867.

PHOTOGRAPHIC VIEWS TAKEN AT THE LOCATION OF THE NEW BOULEVARD TO BE OPENED ACROSS THE CITY. PHOTOGRAPHS, 1867, LOUIS GHÉMAR (1820-1873).

1 The Impasse des Meuniers bordered the Senne near Bon-Secours. The photograph was taken from the Pont de Bon-Secours to the mill of the same name.

2 View from the Pont du Miroir which made it possible to cross the Senne from the Rue des Pierres. This photograph shows the installations of the Borgval mill.

3 View of the "L'Ours" estaminet taken from the Middeleer bridge. The decay of the gables along the Senne is telling of the lack of hygiene in the houses in the lower part of the city.

4 Arm of the Senne surrounding île Saint-Gery. View of the "Ruismolen" mill and the "l'Ours" cabaret.

5 View taken from the Pont de la Carpe (in the street of the same name) facing west.

6 The Quai des Poissonniers built in 1771 above a secondary arm of the Senne.

7 View taken from the Pont des Vanniers downstream.

8 View of the Rue de la Fiancée towards the Temple des Augustins (now Place de Brouckère). The temple was demolished following the covering work of the Senne and rebuilt on the Parvis de la Trinité in Ixelles (Sainte Trinité).

9 View from the Pont Neuf towards the Pont Saint Jean Népomucène.

10 The Senne flowing alongside the buildings of Brussels' first gas plant (located on the right bank, unfortunately invisible in this photo), in the Saint-Roch district, seen from the Saint-Jean Népomucène bridge to the Pont Neuf.

11 The first Gare du Midi, adjacent to one of the many twists of the Senne, was located within the city walls on the present-day Avenue de Stalingrad.

04

THE CLEANING UP OF THE SENNE

JULES VICTOR ANSPACH, MAYOR OF BRUSSELS FROM 1863 TO 1879.

(translation) *"This is our constant preoccupation: to clean up and beautify our city, to make it the jewel of the collection, the centre of industry, trade and wealth, without increasing municipal taxes in this respect."* Declaration of Mayor Jules Anspach in March 1874.

The most important work carried out during the term of Mayor Anspach, and the largest civil engineering works carried out in Brussels throughout the 19th century, are undoubtedly the cleaning works on the Senne. Although the primary aim of the authorities was to reduce pollution in the river and prevent periodic flooding, the complete restructuring of the lower part of the city was an additional motivation. The twisting alleys and unhealthy impasses would give way to wide Haussmann-style boulevards bringing air and light, and greatly improve communication between the city's two railway stations.

THE CLOSELY RELATED REASONS THAT JUSTIFIED COVERING THE SENNE:

1. Eliminating the causes of unhealthy conditions, to avoid outbreaks of disease (particularly cholera)
2. Avoid flooding in the urban centre
3. Transforming the face of Brussels to give it the image of a modern capital
4. Creating a fast connection between the Nord and Midi railway stations
5. Attracting the upper classes to the lower part of the city
6. Improving the living conditions of the working classes

It was at the request of Mayor Anspach that the plans to clean up the Senne were studied in 1861 and officially proposed on 2 October 1865. Around forty projects were submitted to the Municipal Administration. Cleaning up the river, breaking through the larger boulevards and creating squares, rail links, or building a new port, were just some of the variants proposed by engineers and architects. However, among these, two in particular stood out: one was to divert the river, so as to bypass Brussels from the west, and the other was to cover the Senne throughout the city. After various assessments and counter-assessments, it was decided to cover the river.

TWO ILLUSTRATIVE PROJECTS:

The project of Pierre-Théodore Keller, a public works contractor, proposed creating a wide central boulevard above the covered river.
The opening of the Senne was joined by tunnel sewers and an underground railway track, to connect the Nord and Midi railway stations.
Keller also planned to build a central station on this new urban central line.
Jules Anspach described this project as a "remarkable design" but rejected it because of its railway element, which was considered impractical.
Project submitted to the municipal council by the association "Keller et Compagnie" on 30 June 1864.

The project of François Splingard, Roadways and Bridges Engineer, planned to divert the Senne and build tunnel sewers to carry the city's waste water to a settling basin and a treatment plant. Like Keller, he proposed creating a wide boulevard on the former bed of the Senne.
Splingard fiercely opposed covering the Senne in the city centre, which he considered to be a "scientific and practical heresy".
Project submitted to the Union des intérêts communaux by François Splingard in April 1864.

THE PROJECT OF LÉON SUYS (HORIZONTAL PLAN)

PLAN OF THE ROUTE OF THE NEW BOULEVARDS OF THE CENTRE, LÉON SUYS, 1865 © CIDEP NON-PROFIT ORGANISATION.

In 1865, the municipal council selected the project by the architect Léon Suys.
In the end, this proposal won despite the uncertainties of those who considered the principle of covering the Senne too costly and inefficient.
The covering was in the form of a double brick arch lined by tunnel sewers over a distance of two kilometres. The underground route from the new building of the lock at Midi station crossed the lower part of the city, resurfacing at the Boulevard d'Anvers.
At the surface, wide arteries were dotted with regular squares, major buildings and monuments. The work was initially entrusted to the Belgian Public Works Company, then, after various twists, to the City of Brussels.

"Anspach and the Senne", caricature published in L'espiègle, 8 March 1866. Unfortunate controversies plagued the construction site, and almost cost Mayor Anspach his place in the 1869 municipal elections.

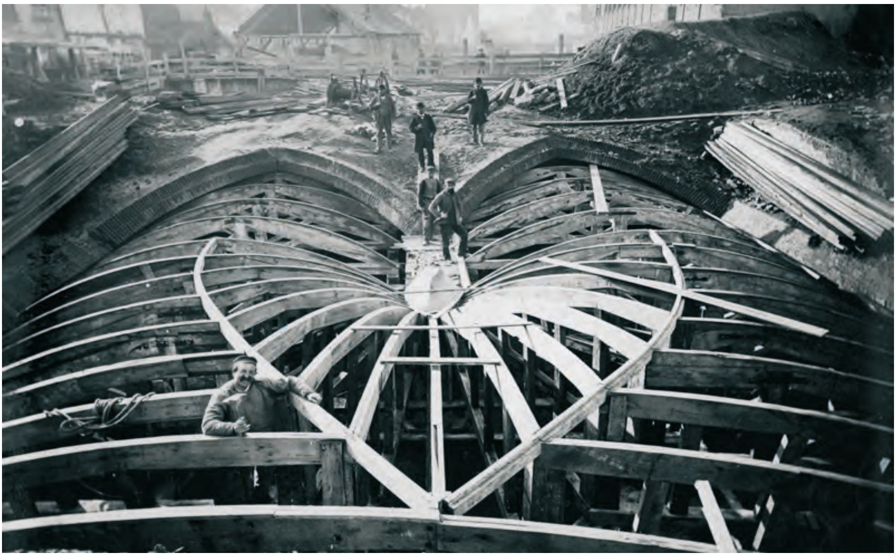
05

COVER IT OR DIVERT IT?

PHOTOGRAPHS OF THE FIRST COVERING

(LEGEND FROM TOP TO BOTTOM AND FROM RIGHT TO LEFT):

- View of the bypass of the gas plant on the central line of the present-day Boulevard Emile Jacqmain.
- A group of workers and engineers during the construction of the tunnel sewer.
- The covering of the Senne also led to the development of the sewerage network. Here is the flow of the Molenbeek tunnel sewer under the Charleroi canal at the Porte de Ninove.
- Construction work on the tunnel sewer, the characteristic cross-section of which is recognisable.
- Construction of the Senne covering and tunnel sewers in front of the future Bourse towards the Rue Marché aux Poulets.
- Closing of the covering at the former Marché au Beurre, now Place de la Bourse.
- Construction of the openings for the flow of the Senne and their nearby tunnel sewers.
- View from the Boulevard du Midi during the destruction of the large lock, before it was rebuilt along the same widened line.



06

PLACING THE FIRST STONE

In the early 1980s, during the work to build the tunnel under Boulevard Léopold II, the fascinating cornerstone of the tunnel sewer on the right bank of the Senne was unsealed and studied. Featuring a relief bearing the monogram of the second Belgian sovereign, this cornerstone had been placed on 6 May 1867 to commemorate the start of the clean-up work. Embedded in the heart of the stone, a lead case contained 8 gold and silver coins bearing the portraits of the first two kings.

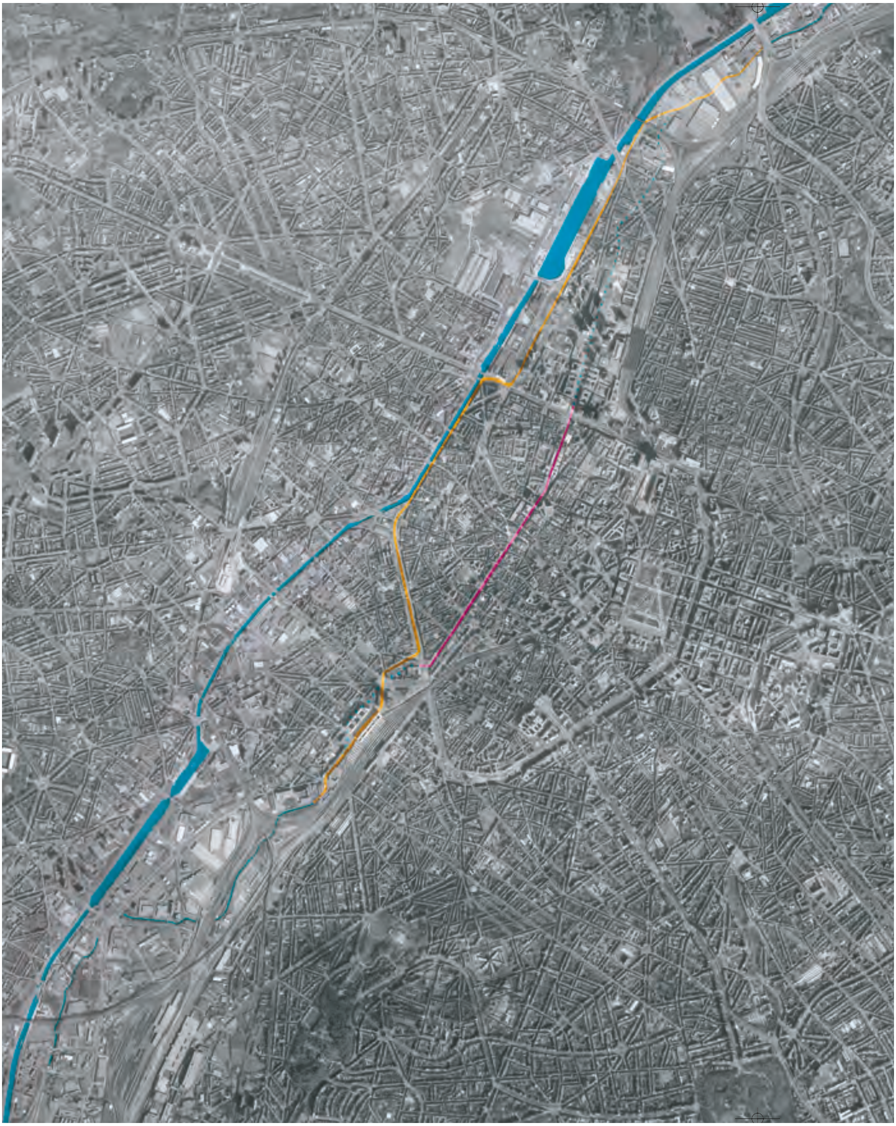
A CAPITAL CITY UNDER CONSTRUCTION

DIVERTING THE SENNE

Photographs of the works to divert the Senne on the Place de l'Yser, near the Allée Verte.
Among the difficulties of the construction site: crossing Place Sainctelette. At the time, Brussels tramways and by-ways all joining at the Place de l'Yser. The covering was supposed to cross this mass of rails at the exit of the Allée Verte.
As such, a bridge had to be installed under the tracks.

07

THE SECOND COVERING



1931-1955, DIVERTING THE SENNE

As soon as the covering was installed in 1871, the effectiveness of the major works undertaken in the capital was limited to the lower part of the city. The municipalities located upstream and downstream of the section were still exposed to flooding when the river overflowed. At the end of the century, various studies began to consider the possibility of discharging the floodwater overflow into the canal. Various special structures were consequently built for this purpose. But it was not until the inter-war period that the project to divert the Senne via the outer boulevards began. From 1931 to 1955, it took the 'Société intercommunale pour le détournement et le voûtement de la Senne' (Intermunicipal association for the diversion and covering of the Senne) more than 20 years to divert the river six kilometres to and along the canal, from Midi station to Pont Van Praet.

PLAN LEGEND:

- Route of the Senne during the first covering in the city centre. 1867-1871
- Route of the covered Senne following the second covering. 1931-1955
- Former route of the Senne
- Charleroi canal, Willebroeck canal and Senne in the open air

PHOTO LEGEND FROM TOP TO BOTTOM:

→ Progression of the work along the Quai des Usines, at the railway bridge. Divided into five sections, the site progresses from upstream to downstream.

→ Completion of the new openings of the diverted Senne. The two nearby openings are made of reinforced concrete on a moveable metal casing.

→ Progression of the work along Boulevard Poincaré. Impressive view of the scale of the works.

→ Construction site for the diversion of the Senne at the Square de l'Aviation towards the Rue de l'Autonomie. At this location, traffic was maintained on half of the narrow roadway during the works.

GO DOWN THE STAIRS
TO CONTINUE THE VISIT.
TIME TO IMMERSE OURSELVES!

08

FROM THE HOME TO THE SEWER

In Brussels, waste water and storm water are washed away in the same way, via the public sewer. This includes not only water from domestic use that is discharged to the sewer, but also all water from human activity, including from industry, offices, communities, etc. It also includes rainwater collected on the roof or in the drains along roadways.
Finally, there are the clear waters known as ''parasite water'' coming from drainage or infiltration from the ground water.

MIXED OR SEPARATED NETWORK

When it comes to drainage, two principles of water collection coexist. The mixed network, the most common method, washes away all water in a single circuit.
The separated network, resulting from technical and environmental considerations, diverts domestic and industrial water to waste water treatment plants, and carries rainwater and drainage water to rivers.

THE MIXED NETWORK

ADVANTAGES

By avoiding a double collection, the mixed network makes it possible to reduce construction costs and drainage management costs.
In addition, rainwater and parasite water run-off make waste water more fluid, thereby limiting the risk of clogging pipes.

DISADVANTAGES

Climatic conditions considerably influence the flow of collected water, making treatment more complex. In the event of a major storm, some of the water is lead to the river without acceptable treatment.

THE SEPARATED NETWORK

ADVANTAGES

There is a constant flow of domestic and industrial water, making it easier to calculate the capacity of the sewer network and the treatment plant. This makes the operation of the system more efficient and less costly.
In rural areas, the direct return of rainwater to the natural environment offers an excellent ecological advantage.

DISADVANTAGES

A dual network implies more attention to the site and also investment, as well as attentive maintenance and monitoring of the installations.
In urban areas, run-off water generally has traces of pollution.

AND IN BRUSSELS?

Like most historic European cities, Brussels has a mixed network based on its history and long evolution. However, one district is an exception within the City's territory: the Champ du Vert Chasseur, whose rainwater supplies the Bois de la Cambre pond via a separate network.

09

WHEN BRUSSELS RESIDENTS BRUSH THEIR TEETH

CONSUMPTION AND DISCHARGE OF DOMESTIC WATER

Within the territory of the City of Brussels, around 350km of sewers carry approximately 200,000m³ of waste water every day in dry weather. On average, the water consumption of Brussels households amounts to nearly 120 litres per person per day. Community needs (offices, hospitals, fire departments, road cleaning, etc.) and industry increase this volume to about 180 litres.

With an average flow rate of around 2.30 m³ per second, this is the equivalent of about 40 Olympic swimming pools sent every day to the Brussels North waste water treatment plant.
In the event of violent storms, this flow can be three times as large.

BREAKDOWN OF DOMESTIC WATER CONSUMPTION

DRINKING	1%
KITCHEN	6%
MISCELLANEOUS	6%
CAR – GARDEN	6%
WASHING DISHES	10%
LAUNDRY	12%
SANITATION	20%
BATH AND SHOWER	39%

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THE COMPOSITION OF WASTE WATER

The water flowing into the sewers is commonly referred to as "waste water".
This description therefore downgrades its condition after use, and the fact that it has become unfit for consumption.

As such, on average, 1 litre of domestic waste water carries 1 to 2 grams of waste in the form of soluble and colloidal organic matter (small particles).
In addition to suspended solids or dissolved compounds, waste water also contains a number of bacterial, viral or parasitic micro-organisms.
Various tests to determine the composition of this water are regularly carried out in waste water treatment plants.
Filtering, reaction of organic matter to oxidation, salt measurement, and calculation of pH levels are all analyses that account for the variety of chemical compounds present.

11

THE COLLECTION NETWORK

SEWER NETWORK, WASTE WATER COLLECTION

The sanitation network in the Brussels-Capital Region includes two main river basins. The first is situated to the north, the second to the south. Tunnel sewers, which are major flow routes, run through these areas and drain all the capital's sewers in their path. Some of these, which were once simple covered watercourses, now form the backbone of the sewer network.
Downstream of the Senne river basin, the channelled river and the canal are lined by outfall tunnel sewers, designed to carry all the water drained on their respective basins to the North treatment plant. The form of the tunnel sewers depends on when they were built.

There are three characteristic types: the brick tunnel sewers, which are the oldest, then, the reinforced concrete frame openings and finally, the circular reinforced concrete pipes, laid by drilling.

The width is based on the required drainage capacity. Systematic oversizing enables tunnel sewers to handle variations in flow up to a certain threshold. Beyond that, excess water is diverted to the Senne, the canal or into storm basins.

THE BRICK TUNNEL SEWERS

The old brick tunnel sewers are characterised by their coverings in various shapes.
In the shape of a mushroom, the railed tunnel sewer, which is the most common, consists of a central chamber. It has platforms on both sides to make it easier for sewer workers to move around. Built on a low gradient (30cm per kilometre), it allows valve-carts to pass through, which clean the structure.
The first tunnel sewers of this type were built at the same time as the first covering of the Senne.

THE REINFORCED CONCRETE FRAME OPENINGS

These structures consist of a reinforced concrete frame inside which a brick tunnel and bench have been installed. Adopting new construction techniques, these tunnel sewers were built from the start of the 20th century.

PIPES IN REINFORCED CONCRETE

These days, tunnel sewers are installed via drilling. Reinforced concrete pipes are mechanically interlocked underground. Trusted pumping techniques are used to raise the water at the end of the process to its outlet.
An optimal flow slope can therefore be established, regardless of the natural slope.

OUTFALL TUNNEL SEWERS

Outfall tunnel sewers collect the water from the various other sewers and drains, and direct it directly to the treatment plant.

SPILLWAYS

The city's main tunnel sewers are equipped with one or more spillways along their route. Most of these are dry openings which, in the event of overflow, carry excess water from the network to the Senne. It is one of the safety measures put in place against flooding during large storm floods.

INTERACTIVE MAP

The tunnel sewers follow an invisible underground route whose multiple branches primarily converge according to the topography towards two outlets to the north and south of the city.

ENTER THE RECONSTRUCTED SEWER TO GET AN IDEA OF ITS DIMENSIONS. YOU WILL THEN ARRIVE IN THE ROOM FROM WHERE FLOODS ARE TACKLED.

12

FACILITATING EVACUATION

The evacuation of Brussels water was originally designed using the principle of gravity, which ensured its natural flow towards its outlet at the lowest point: the Senne.

The sewer network is only one of the many engineering works that criss-cross subterranean Brussels. Various cables and pipes, road tunnels, the metro and canal are all urban installations competing with the existing drainage system.
Specific structures or installations therefore make it possible to overcome, or even bypass, certain obstacles inherent in the variations in the city's topography, and the complexity of its subterranean world.

SIPHONS

The principle of a siphon allows water to pass under the underground installations which block it, without the need for pumping.
Although it is a simple hydraulic principle, maintaining and operating siphons can be relatively expensive as they easily get clogged up with residue.

In some cases, a reservoir upstream of the structure allows pressurised water to be flushed through for cleaning.

The siphons were originally designed to allow sewage from the left bank to pass through the canal. Since the authorization of the outfall tunnel sewer, they are now used as evacuators towards the Senne in the event of rain.

PUMPING STATIONS

Various pumping stations are located throughout the sewer network and are used to manage it.
By diverting the water from the Senne, they facilitate cleaning in the tunnel sewers.
But their main contribution is security measures against flooding. Indeed, the flood control systems put in place include a series of pumps that either divert water to relieve the system or empty storm water basins once the rainfall has passed.
A remote monitoring and management programme for pumping stations provides continuous information on the level of saturation of the drainage infrastructure.

Data relating to the functioning of each pumping station is collected and sent to the central computer where it can be examined in real time.

13

GLOSSARY OF THE BRUSSELS SEWERS

DRAIN → Cast iron element designed to receive run-off from gutters.

BENCH → The raised side part of a railed tunnel sewer used as a platform for sewer workers, and as a runner for the valve-cart used for cleaning.

STORM BASIN → Underground reservoir that can temporarily contain excess water from the sewer system in the event of heavy rainfall.

MANHOLE → Vertical duct allowing access to sewers. The ducts are located at regular intervals and have steps.

TUNNEL SEWER → A large section structure that collects waste water from the network of sewers connected to it.

EFFLUENT → All waste water, run-off and parasite water discharged through sewers.

PARASITE WATER → All clear water coming from drainage or infiltration from the water table.

DOMESTIC WASTE WATER →
All waste water from domestic use. A distinction is made between black water from the toilet and grey water from the kitchen, bathroom and house cleaning.

SEWER PIPE → A watertight, underground pipe that collects waste water from a given territory and discharges it into a waste water treatment plant.

POPULATION EQUIVALENT →
Theoretical concept, established on the basis of various parameters, which indicates the polluted load of waste per inhabitant, per day.
In Brussels, the population equivalent is calculated on the basis of a daily production of 150 litres of waste water per person.

MANHOLE COVER → Circular cast iron plate covering the manholes to the sewers. It has holes to ventilate the network.

OPENING → The opening of the Senne - underground channel allowing the underground flow of the river.

SANITATION NETWORK → All facilities involved in the collection, transport and treatment of waste water.

HYDROGRAPHIC NETWORK →
Part of the physical geography relating to watercourses.

RUN-OFF → Surface run-off of rainwater.

COVERING → The covering constructed over the Senne River in Brussels in the 19th century.

14

IN THE EVENT OF A STORM

VIDEO

Although drainage is intended to discharge waste water, it also plays a key role in absorbing run-off water, thereby preventing flooding in the city.
Brussels is regularly subject to violent and sudden rainfall.
The widespread sealing of surfaces in urban areas (roofs, roads, car parks, etc.) strongly limits the infiltration of water into the ground.
It flows into the sewer network and significantly increases the flow of waste water.
The centre of Brussels is protected from flooding thanks to a series of structures, the first of which was the covering of the Senne in 1871.

15

MANAGING RAINWATER

THE COMPLEXITY OF THE UNDERGROUND NETWORK (MODEL)

The boulevards of the city centre are the focal point of waste water collection in Brussels.
They recover a significant proportion of the city's discharged water on a daily basis.
Nearby to the tunnel sewers, various structures provide this daily transport and are located alongside urban subterranean infrastructures.

UNDER THE BOULEVARDS OF THE CITY CENTRE

The tunnel sewers of the city centre which remained in place after the Senne was diverted are fitted with a series of water absorption devices along their route.

Positioned between the metro stations, the old openings of the Senne recover the water overflowing from the tunnel sewers and extend into a discharge aqueduct towards the river.
Stormwater basins have also been constructed under the Anneessens and Bourse metro stations, and can hold 10,300 and 15,300 m^3 of flood water respectively if required.

A floodgate system triggered by floats automatically gives access to these large underground tanks when the water level in the tunnel sewers exceeds the alert threshold.
The accumulated water is then pumped and discharged to the discharge aqueduct.

The former covering of the Senne is currently used as a storm basin. The storm basin at the Bourse, an underground chasm 245 m long and 25 m wide, can hold 15,300 m³ of flood water.

BETWEEN THE TOWERS OF THE NORTHERN DISTRICT

Duplicating the tunnel sewer at Boulevard Albert II, the storm basin located near the World Trade Center extends over 500 m and has a total capacity of 12,515 m³. The WTC storm basin, in direct contact with the tunnel sewer, operates whenever there is an overflow.
Outside the city centre, the two central tunnel sewers line the old bed of the Senne, which is now a discharge aqueduct, before converging to form the outlet tunnel sewer on the right bank.
Under the boulevard, the tunnel sewer is flanked by a long storm basin which operates whenever there is an overflow.
The water thus collected is then pumped back to the Senne via the discharge channel.

UNDER THE BOULEVARD DU MIDI

Under the Boulevard du Midi, near the station, the sanitation network forms a complex web. It is intended, firstly, to discharge excess water from the tunnel sewers into the Senne in rainy weather, and secondly to supply the tunnel sewers of the centre with river water in dry weather to facilitate their cleaning.

The 1m70-high tunnel sewer under Boulevard Maurice Lemonnier collects water from the upper part of the city centre, as well as from a section of Saint-Gilles and Anderlecht.
To prevent the network getting clogged, a series of overflow spillways allow each tunnel sewer individually to discharge their excess water to the Senne. Communication between the tunnel sewers located on either side of the boulevards of the city centre also makes it possible to balance flows and provides additional security against the infrastructure becoming saturated.

→ RETRACE YOUR STEPS TO CONTINUE YOUR VISIT IN THE NEXT ROOM.

16

THE SEWER IN ALL ITS FORMS

Worries about getting rid of waste water are as old as the city itself. All of the streets and dead ends of Brussels may now be served by an efficient and comprehensive sewer system, but this is the result of a long evolution.

THE DITCH

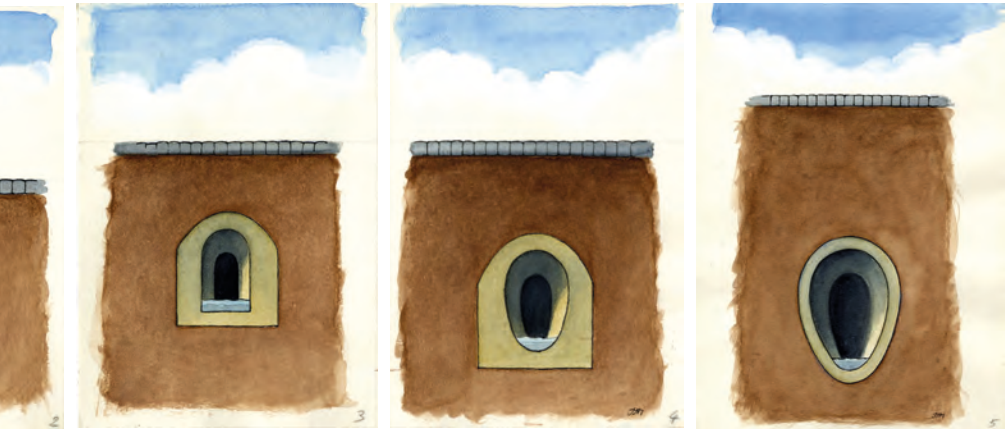
In the Middle Ages, despite practices to recover organic matter (to be used as fertilizer in particular), a lot of discharge was collected on vacant land, on the slopes of the city limits, and in the streets. The largest streets were crossed by small ditches where run-off water carried some of these unwanted discharges to the Senne. Installing wooden boards made it possible to cross these ditches, but since the wood was a useful fuel source, they were often stolen.

SQUARE SEWER

The square sewers are the oldest found in Brussels. Several rare sections can still be found in the city centre. As actual channelled ditches, some of these sewers did not have an invert. As such, the water flowed directly from the ground, or even on a wooden or covered surface. Installed just below the roadway, these sewers were sometimes covered with simple wooden boards or stone slabs.

THE CHAPEL SEWER

As the first advanced form of urban sewerage, the chapel sewer was made entirely of brickwork. Its arched covering, from where it gets its name, offered better resistance to the pressure of the land and wagons. They were used until the mid-19th century.



EVOLUTION
OF THE CHAPEL SEWER

Around 1850, the chapel sewer was improved by a rounded culvert that allowed for better water drainage. Combined with a rectangular external profile, this shape required a larger volume of bricks, which consequently made construction more expensive.

THE OVAL-SHAPED SEWER

The oval-shaped section first appeared in 1867 and was extended to the network following the city's sanitation works and the creation of the tunnel sewers in the city centre. Large enough to allow sewer workers to move around in them, this type of brickwork sewer was coated with a cement mortar to improve its watertightness and water flow.

Its shape meant that considerable savings could be made on the materials. Wherever the elevation and shape of the roadway allowed, its invert was installed at a depth of at least 4m50. The section of the oval-shaped sewer was designed in the 19th century by the English engineer Baldwin Latham (1836-1917). The narrowing of the bottom of the tunnel accelerates the flow of water, thereby ensuring that the structure is self-cleaning.

17

CONSTRUCTION MATERIALS

Although brickwork is still used, the evolution of materials and construction techniques now makes it possible to incorporate prefabricated circular ducts.
The material is chosen according to the width, context and construction method, among other things.

IN BRICKWORK...

Traditional oval-shaped sewers made of brickwork are still built today. This method is very durable over time and also allows for easy repairs. However, the high cost of implementing it often means that other materials are used instead.

IN SANDSTONE...

Sandstone, or hardened clay, offers excellent resistance to the harsh environment of sewers. This natural material is traditionally used to build non-accessible sewers. Although it can be used for larger-width sewers, its fragility makes construction more delicate.

OR IN CONCRETE

Concrete is the most commonly used material. It lends itself to all gauges of sewers and is easy to implement. On the other hand, qualities of concrete are highly variable, and their resistance to weathering of the environment is a crucial factor.
For example, the sewers laid in the 1930s, at the start of the development of concrete, have not aged very well at all. Many of them had to be renovated in the decades following their installation.

THE “VILLE DE BRUXELLES” DRAIN

Designed to collect surface water, drains are placed along the roadway at regular intervals. Developed by the City Department in the early 20th century, the “Ville de Bruxelles” drain is still the reference drain.

Composed of a container and a cast iron grid, it weighs about 130 kg. Its uniqueness lies in its siphon design, which prevents odours from the sewer from rising to the surface. The grid collects any objects which might clog the drain.

MANHOLE COVERS AND ACCESS HATCHES

As gateways to the sewers, manhole covers and hatches give access to the manholes which lead down to the network.
Attentive observers will notice that there are two types: round and square. Made of cast iron and weighing nearly 90 kg, the round cover is sunk into the road approximately every 50 metres. Often welded to the ground by the effect of traffic, the cover needs to be lifted with a crowbar. This is no problem for sewer workers, with their expert hands.
The typical movie scenes with an action hero lifting up a manhole cover with his bare hands are therefore pure fantasy.
The square hatches give access to the tunnel sewers via an underground gallery.
Located on the pavement, it also opens from the inside to allow sewer workers to get out in an emergency, for example in the event of a sudden rise in water levels.

CONNECTION TO THE SEWERS

"Connections of the drains of a private individual to the public sewer shall be made under public property, by the municipal administration and at the expense of the owner, in accordance with the provisions of the tax regulations on the subject." Extract from Article 130 of the Regulation on Buildings of the City of Brussels (translation).
Within the territory of the City of Brussels, the required connection to the public sewers can only be made using a pipe in glazed stoneware or HDPE.
As a general rule, pipes are connected at right angles to the axis of the public sewer.
For accessible sewers, connections are made 30 cm above the invert to ensure the comfort and hygiene of the sewer workers.
With a slope of at least 3%, connections in buildings have a diameter ranging from 15 to 40 cm. They are maintained at the request and expense of the owner, by the City's Sewerage Department or by a private company.

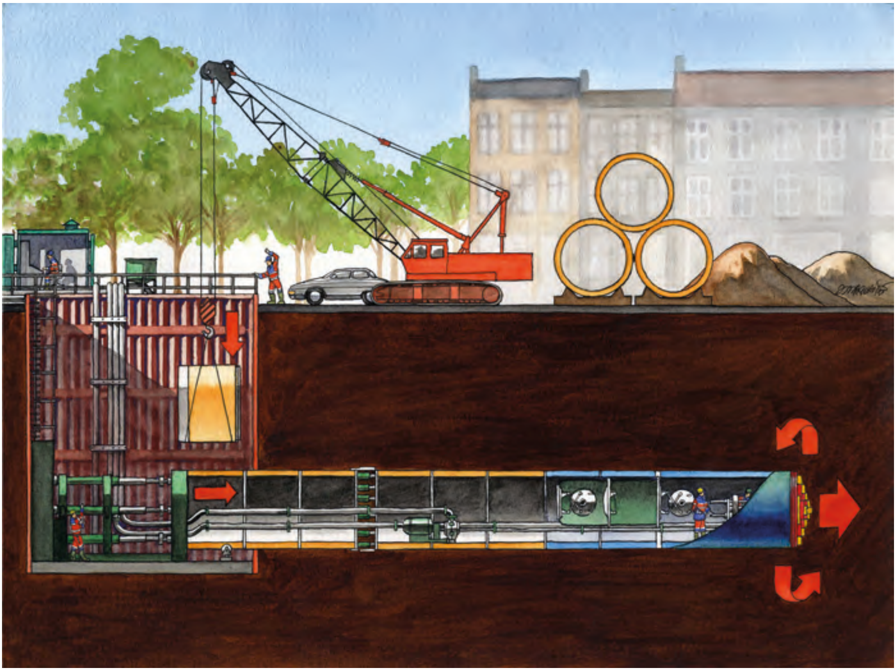
HDPE PIPES

High-density polyethylene (HDPE) is primarily used for connecting drains or buildings to the public sewers. Other plastics are available on the market, such as PVC and polypropylene, but only HDPE is allowed under the public domain of the city of Brussels.

18

BUILD

MODEL OF A TUNNEL BORING MACHINE



OPEN TRENCH

“Open trench” is the most common method of constructing sewers. An open trench dug in the public roadway makes it possible to install circular prefabricated elements, or construct oval-shaped brick sewers. In the second case, the cover is made using a wooden template.

In urban areas, maintaining the dug up sections is essential to ensure the safety of workers against the risk of landslides, but also the stability of neighbouring constructions and the smooth progression of the works. There are various reinforcement methods and they are chosen according to the depth of the trench, the type of work to be carried out and

the nature of the soil. A sand bed is installed at the base of the excavation if it does not have the necessary load-bearing capacity.
Once the pipework is installed, the trench is backfilled in consecutive layers, which are carefully compacted.

THE UNDERGROUND MINING METHOD

The construction of a sewer using the underground method is carried out in a previously supported and reinforced gallery, similar to the practice used in mines.
This method is used in situations where it is necessary to minimise the impact on the surface, particularly on road traffic.
A pit jack, the only visible element, provides access to the site.
Once the sewer is constructed, the pit jack is replaced by an access shaft, while the steel beams and sheet piling used to shore up and reinforce the mine are left in the ground.

THE DRILLING PROCESS

Another method of underground construction, drilling is generally reserved for wide pipes such as tunnel sewers, at significant depths and over long distances.
This technique uses a tunnel boring machine, which is controlled by a laser guidance system as it advances. The drilling tool penetrates upstream, and is brought to the surface downstream by two pits located at the ends of the section.
They are rectangular, and have a limited footprint which does not affect traffic.
They also make it possible to evacuate the soil and lower down the essential parts as the tunnel is built.
A system of hydraulic cylinders installed in the first pit ensures that the reinforced concrete pipes move forward as the drilling progresses.

METHODS

(LEGEND FOR THE HORIZONTAL ILLUSTRATIONS, FROM LEFT TO RIGHT)

→ Reinforcement with wooden sheet piling

→ Reinforcement with metal sheet piling

→ Reinforcement with prefabricated caissons

→ Access pit towards the tunnel

→ Progression of the tunnel

→ Construction of the sewer

→ Access pit

→ Elements in reinforced concrete

→ Tunnel boring machine

19

AND REBUILD

PROBLEMS...

The increasing chemical aggressiveness of waste water, the vibrations caused by ever-increasing car traffic, water infiltration, the city's everlasting construction sites, the roots of plants and the tunnels dug by rats are all factors which damage the Brussels sewers.
There are various consequences: poor flow conditions, watertightness problems and the degradation of the structure.

Close monitoring and rapid intervention make it possible to maintain the network in good condition, some sections of which are more than 200 years old.

... AND REMEDIES

There are many different methods to repair the sewers. Nevertheless, they can be grouped into 3 distinct categories relating to the technique used:

- For small-scale interventions in specific spots, the first aspect will be the occasional repair of the brickwork.
- This is followed by touch-ups with concrete or cement, sometimes combined with injections of cement mortar.
- Finally, the methods of laying prefabricated elements are used on all or part of the section and on various lengths.

Choosing the appropriate technique is based on the general condition of the sewer and how accessible it is.

LAYING PREFABRICATED ELEMENTS

This technique involves assembling synthetic material bodies in existing pipework. This intervention makes it possible to structurally maintain a sewer which is in poor condition, and improve water flow thanks to the perfectly smooth coating.
The prefabricated elements, incorporated by specially dug pits, can be of various shapes and sizes. The remaining gap between the installed elements and the sewer is filled by injecting a cement mortar. This method does not interfere with the road traffic on the surface or the water flow through the sewer, which remains in operation for the duration of the works.

THE JACKETING TECHNIQUE

The jacketing technique, also known as the "sock method", involves inserting a flexible covering made of composite material into the defective pipe. This is done with water or air pressure and it moulds to the walls of the sewer.
By increasing the water temperature, or under the effect of UV, the covering filled with resin (sticky matter formed by some types of trees) solidifies to form a seamless pipe. The connections are finished manually.
The speed of the intervention and the limited footprint of the site make this sustainable method an advantageous solution compared with completely replacing an equivalent section. It is also handy if the sewer is inaccessible.

LAYING PREFABRICATED SANDSTONE ELEMENTS

Sandstone, a material which is prized for its high resistance to aggressive environments, is regularly used for restoring degraded sewers. The invert can therefore easily be renovated using prefabricated sandstone culverts.
For larger interventions, pre-assembled ceramic tile elements are used.
They can be adapted to any shape of the sewer, both angles and curves, from the tunnel to the covering.
The joints between the elements are finished with epoxy resin.

NOW HEAD
TO THE NEXT ROOM

20

NETWORK UNDER CLOSE SUPERVISION

CLEANING WITH A LANCE

As a replacement for the previous bucket and brush cleaning method, the lance is the standard technique for maintaining the network.
Although most of the city's sewers have a sufficient slope to ensure that they clean themselves, small defects related to the ageing of the structure can increase the roughness of the pipes and result in clogging. Once identified, these sewers are cleaned with a lance connected to a hydrant.
Tunnel sewers in reinforced concrete, the former openings of the Senne, the spillways and the discharge tunnels are also cleaned with pressurised water, as are the side platforms and covering of the railed tunnel sewers.
Handling the lance in a sewer requires a certain dexterity that allows the sludge to be collected at a single point and the water to flow freely to the pumping area.

THE HYDRODYNAMIC CLEANER

Used for sewer maintenance, the hydrodynamic cleaner is reserved for operations needing strong water pressure.
Lowered down through an access shaft, the "rat" consists of a bullet-shaped metal head connected to a truck on the surface by a reinforced rubber hose.
Pressurised water breaks down the sludge which is clogging up the sewer. When directed towards the rear, the jets then propel the device upstream, while pushing displaced remains downstream.
The sludge is blocked by a cofferdam at the access shaft and is pumped by the hydrodynamic cleaner.
The cylindrical tank on the truck at the surface consists of two compartments, one to contain the sludge pumped from the sewer, the other containing the water which will be sent, pressurised, to the "rat".
The "rat" consists of a flexible tube with a metal head that delivers pressurised water. There are different widths, depending on the size of the sewer to be cleaned.

TRAVELLING IN THE SEWERS

The network is continually monitored by sewer workers.
However, certain sections narrower than one metre are not large enough for a person to pass through. This means that other techniques need to be used.

Specialist firms are called in to visit the sewers using a robot camera. The robot is lowered into the sewer via an inspection chamber, and is controlled from the surface. It takes pictures of the pipelines as it moves along.
These pictures make it possible to observe the condition of the structure, and make an assessment as to whether or not repair or replacement work is required.

Inspection camera robot used for taking pictures of inaccessible sewers (Riotec).

SEWER WORKERS AT WORK

VIDEO AND MODEL

THE VALVE-CART

Working exclusively in the railed tunnel sewer which it cleans, the valve-cart, which operates by simple hydraulic pressure, has been moving around under our feet since 1870. Since they only have a gentle slope, railed tunnel sewers tend to get clogged and therefore need to be cleaned regularly. The metal cart used for this purpose moves around on the side platforms of the tunnel sewer, thanks to the pressure of the water, the flow rate of which can be increased by drawing on the Senne or the canal. The valve-cart car is equipped with a move-able panel to

regulate the flow of water through the tunnel sewer. The hydraulic pressure created by lowering this valve releases the sludge collected at the bottom of the tunnel, like a toilet flush, which then carries the residue downstream.

Metal handwheel used to adjust the height of the valve according to the desired travelling speed, and the water pressure required for cleaning.

The branches of the sewer network extend under the streets of the city of Brussels.
In total, more than 350 km of pipes of various shapes and sizes need to be maintained and monitored.
If the gradient is only small or there is insufficient flow, the so-called "self-cleaning" speed cannot be reached. The suspended solids carried by the water then settle at the bottom of the pipe, making the available section narrower and, ultimately, clogging up the sewer.
Regular cleaning and maintenance of the sewers is essential to ensure effective water drainage and prevent flooding.

The narrow, harsh and damp environment of the sewers means that using burning or electric engines is out of the question. As such, the valve-cart, which can weigh up to 5 tons, does not have a motor, and at the end of the journey, needs to be towed to its starting point by the sewer workers.

Working conditions back in the day.
The old method of cleaning the tunnel sewers was to draw water from them with a bucket held by a strap, then rinse and brush the covering.

Working conditions have changed since the middle of the 20th century, when hygiene measures were largely unheard of.
Back then, sewer workers only had a basic uniform which they put on in the tunnel sewer itself, and which they didn't even take off at break time.
The workers primarily came from the countryside, an environment that allowed them to get some fresh air after a hard day's work.

Beneath the display: Dutch-made pocket revolver (around 1897) discovered by Johnny Vasseur in the sewer of Rue des Petits Carmes.

21

FAUNA IN THE SEWERS

THE CITY RAT

Rattus norvegicus, the brown rat, or Norway rat, is the most common species in urban areas. Always scavenging for water and food, this animal has chosen the sewer system as its preferred habitat.
To nourish themselves, rats can eat anything: paper, cloth, rubber, plastic and even lead.
Their presence in the City's underground world can cause considerable damage.
The viruses and parasites they carry make them a carrier of disease for both humans and other animals.

FOR CENTURIES, RATS HAVE LIVED CLOSE TO HUMANS, AND AT THEIR COST

The habitat of the brown rat is found underground in the lower parts of houses, inspection chambers and cellars.
They also burrow under urban wastelands or inaccessible bush, and the tunnels they dig often cause collapsing of the land.
Nighttime hunters, rats, which need a lot of water, use the sewers as a network of access corridors to their hunting grounds. They find their food partly in the sewers themselves, but also in the cellars and in the open air, where they enjoy the food which has been thrown for pigeons.

GETTING RID OF RATS

Since 1963, the city of Brussels has carried out two annual rat extermination campaigns, one in spring and the other in autumn.
Rats are fertile from the age of 2 months..., their pregnancy lasts 22 days, they give birth to 6 to 22 young per mating cycle... This extraordinary reproductive capacity makes tackling rat overpopulation highly complex.
This is on top of the incredible cleverness of this animal to outsmart the traps that are set for it. As such, the techniques to hunt rats need to be constantly improved and adapted.
The poison used in rat extermination campaigns kills the animal after a few days. This means that the other

rats don't make the connection between the dead rat and the product it ate a few days earlier.

ANIMAL LIFE IN THE SEWERS

Rats aren't the only inhabitants of the sewers.
Indeed, this aggressive environment seems to be perfectly suited to a variety of animal species. It is not uncommon to come across slugs, mosquitoes, frogs, and even alligators...
At the start of the route, some sewers that collect clear water from streams have a low pollution rate that is suitable for amphibians such as frogs.
The sanitation system, in its vast spread, has many irregularly flooded areas. The stagnant water forms an ideal habitat for mosquito larvae.

AND ALLIGATORS?

"There are alligators in the sewers of New York. Originally brought back to the city as pets, they were then flushed out of too-narrow apartments via the toilet, colonising the sewers which they then made their home."
Everyone is familiar with this story, and Brussels is sometimes the setting for similar stories. However, it is an urban, collective and anonymous legend.
But you never know..

22

MOBILE VALVES

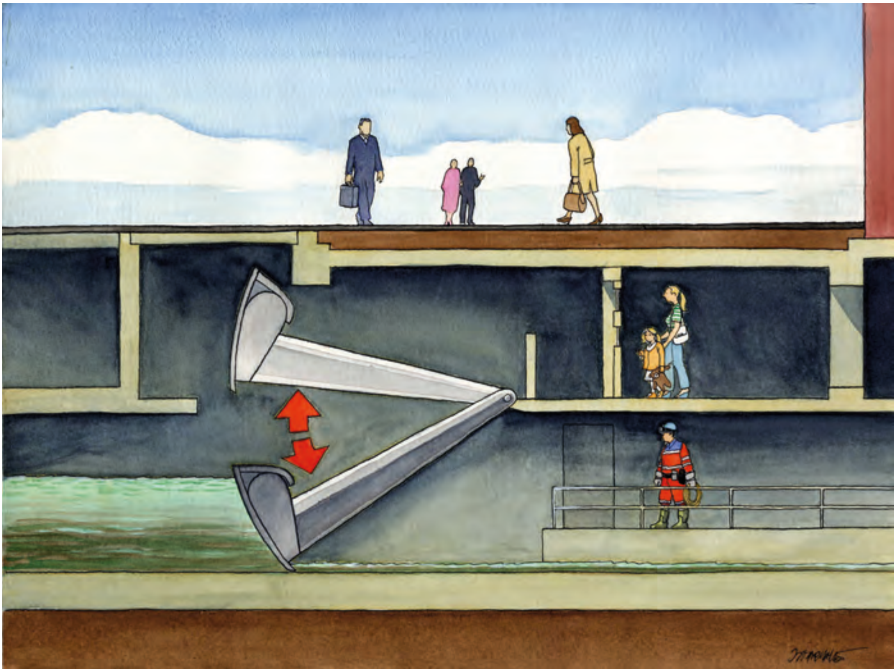
BENEATH THE MUSEUM ARE MOBILE VALVES

A system to regulate the Senne is installed in the opening of the second covering, under the toll houses that house the museum.

Two mobile valves make it possible to block each opening of the Senne separately, so they can be dried for possible maintenance work.
The openings of the river are also closed to raise the water level upstream of the station and allow a portion of it to be diverted to the tunnel sewers of the centre when it is cleaned by the valve-cart.

The mobile valves were installed under the toll houses of the Porte d'Anderlecht when they were dismantled and moved as part of the work on the second covering.
The segmented valves are electrically or manually operated, and each measures 6.20 m wide by 2 m high.

LOOK THROUGH THE WINDOW TO SEE ONE OF THESE TWO MOBILE VALVES



THE SENNE AND THE SEWERS

You are about to descend into the bowels of Brussels. In a few moments, you will dive into the underground atmosphere of the city over a route of around 100 metres.
The Senne flows past at the bottom of the stairs, following the route of the inner ring since being diverted in 1955.
Follow the course of the river to reach the tunnel sewer of the Chaussée de Mons, which runs through a siphon under the Senne.
Continue your visit of this short section from the tunnel sewer to the valve-cart.
Finally, retrace your steps and go back to the second toll house to continue your journey in the museum.

23

THE SEWERS UNDER HIGH SURVEILLANCE

AN ESSENTIAL MAINTENANCE SERVICE

Since the appointment of a master of sludges at the end of the 14th century to the current Sewerage Department, the city has been responsible for meeting the public health needs of its citizens.
Despite technical advances, the role of the Sewerage Department has not changed significantly over the centuries. A glance at the current and past requests of the inhabitants of Brussels reveals that their concerns are still the same.
The Sewerage Department attentively takes care of the repairs and improvements necessary to resolve these problems.

Gentlemen,
Mr d'Hannetaire respectfully informs you that at the bottom of Rue des Choux, leading to Rue du Damier (?) more or less opposite the church of Finisterre, there is a sewer which is in such a state that the waters and filth of the city cannot freely flow through it. Which, in heavy rain, produces in the distance a backflow of said waters, which deposit a bothersome sludge hindering passage by pedestrians completely impossible; whereby I ask you, gentlemen, on behalf of the whole neighbourhood, to kindly advise on what would need to be done to remedy this inconvenience, either by cleaning the said sewer, or by widening it, and consequently to give an order or permission to make the

necessary repairs in this respect as soon as possible. Graciously yours. PS. Mr. d'Hannetaire takes the liberty of adding a new observation to this request; which is that, for the past three years, he has contributed to the funds of the City Hall nearly three thousand florins of exchange by the various sales or purchases he has had made, houses he has acquired; which may merit some consideration from the Magistrates and Treasurers of the city to comply with the request of the beseecher and his neighbourhood.

AT YOUR SERVICE!

Integrated into the roadworks department, the Sewerage Department of the city of Brussels now has around fifty members of staff who, supervised by technicians, monitor and maintain some 350 km of sewers.
The Sewerage Department ensures the proper functioning of the collection system and its installations, for the benefit of users and the community.
It is responsible for the regular cleaning of the structures, repairing identified defects and constructing new structures or private connections.
It also manages the technical follow-up of the various construction projects entrusted to external private companies in the context of public gaining.

SUPERVISION

The Sewerage Department is managed by a team of engineers and technicians who are responsible for planning and managing the interference teams and monitoring the various sites.
These are organised according to a pre-established annual programme, in addition to the many emergency interferences made necessary by bad weather, or accidental deterioration.
This supervision on the ground goes hand in hand with various administrative tasks such as drafting specifications, updating the cartography, the hydraulic management of the network, contact with the public, etc.

MONITORING

Two workers permanently monitor the control of the existing network. This continuous monitoring of the condition of the pipes makes it possible to identify any failures of the structures, make an appropriate diagnosis and organise essential preventive or repair interferences.

CLEANING

A team of around twenty staff work every day to clean up the City's sewer network, to avoid clogging.
Cleaning sewers and tunnel sewers, basins or siphons, maintaining connections, unclogging drains or private connections are all tasks that they regularly carry out. They are

assisted in this particularly difficult work by mechanised tools such as the "hydrodynamic cleaner" or the "valve-cart" in the tunnel sewers. They are also responsible for maintaining the few open-air ditches that still exist within the City's territory.

BUILDING SITES

Almost twenty-five bricklayers, cement manufacturers, pipelayers, woodworkers and ironworkers make up the site team.
Their primary underground activity is renovating sections of sewers that are outdated, or which no longer meet the required safety levels.
On the surface, their second task is to install manhole covers or drains, the external and visible elements of the network.
Finally, this unit also takes care of the construction of new small structures in greenfield sites and the construction of certain private connections to the public sewer.

ELECTRO-MECHANICAL ENGINEERING

A team of five qualified workers operates the network's electro-mechanical installations: pumping stations, valves, measuring facilities, etc.
The service can also count on their urgent assistance in the event of breakdowns identified by the central computer.

THE MUSEUM

An original and undoubtedly unique approach within the City's departments, the Sewerage Department was responsible for the direction and management of the museum from 1989 to 2015.
The museum is now managed by the Department for Culture. This cultural and educational activity requires the collaboration of various individuals, including former sewer workers, whose skills and experience provide an irreplaceable perspective for the organisation of waste water collection, and the history and practice of the profession.

24

BRIEF HISTORIES OF SEWER WORKERS

VIDEO OF TESTIMONIES BY SEWER WORKERS ABOUT THEIR FIRST DAY OF WORK.

25

THE RIGHT KIT

DANGERS

WARNING SEWER WORKERS IN THE EVENT OF DANGER

The first gas detector appeared in the 1950s.
This made it possible to specifically measure harmful gas.
Complicated and heavy, it required the transport of bulky equipment.
The current smaller gas detectors continuously monitor the levels of oxygen, hydrogen sulphide and carbon monoxide, and simultaneously calculate the risk of an explosion.
As soon as an alert threshold is exceeded, an audible signal warns the sewer worker, who must then evacuate the area as soon as possible.

THE DANGERS OF SEWER WORK

The work of a sewer worker in the accessible networks is difficult.
Despite their attentiveness, they are exposed to various risks.
The sewer environment is hostile.
It is a dark and damp environment, full of putrid odours.
Both the working conditions and moving around are difficult.
The ground is muddy, uneven and scattered with waste and obstacles.
Tasks are physically demanding, and workers have to stand in awkward

positions. In addition, there are many hazards due to illegal discharges of toxic substances, or by insects, rats and disease-spreading micro-organisms contained in water.
And despite all this, around fifty workers move around every day in the bowels of the City to ensure our comfort.

PHYSICAL DANGERS

Most accidents are related to the physical form of the working environment.
Falls into access shafts or onto slippery surfaces are the most common types of accident.
Uncomfortable walking and working positions can also cause back pain, and handling the heavy sewer covers is not without the risk of crushed limbs.
Wearing the prescribed protective equipment is essential to ensure the safety of sewer workers.

DROWNING

In the event of a storm, it only takes a few minutes to put the sewers under pressure, leaving very little time for workers to get to the surface.
Knowledge of the network and strict application of safety rules help prevent accidents.

THE RISK OF INFECTION

There is a long list of diseases threatening sewer workers, and there are various pathways of contamination. Scratching or biting rats, contact with contaminated water and the mucous membranes of the nose, mouth, eyes or inhalation of micro-organisms can all cause diseases with alarming names such as tetanus, leptospirosis, brucellosis, hookworm, poliomyelitis, tuberculosis, typhoid, etc.
That is why sewer workers must carefully comply with hygiene and equipment standards, and are subject to regular medical checks.

THE RISK OF INTOXICATION

The presence of gas in the sewer air can cause suffocation due to lack of oxygen, but can also cause intoxication hazards.
Hydrogen sulphide is the most dangerous of these gases.
Many other elements can also be found in sewers (carbon monoxide, butane, propane, chlorine, etc.).
Originating from illegal or accidental discharges, these gases increase the risk of explosion. To protect themselves, sewer workers use a detector.

Lighting the subterranean world
In the old days, sewers were lit with carbide lamps.
This device had the advantage of generating diffuse light, unlike current electric torches where the light beam only highlights a specific spot.
In addition, the flame wavered under pressure differences, warning of the forthcoming arrival of any water cascades.
However, the flame of these lamps was also a potential explosion hazard.
These days, rechargeable headlamps have an autonomy of one day.

Attached to the sewer worker's helmet and therefore leaving their hands free, they offer workers a certain ease of movement in their work.

The professional equipment of sewer workers is provided by the city and includes their complete outfit, from headgear to underwear.
Besides safety reasons, the clothing ensures optimal comfort for workers in their often demanding tasks.
The work clothing needs to be washed and disinfected regularly, and cannot be taken home for obvious hygiene reasons. Sewer workers are sometimes required to work on the surface, so their uniform also has reflective strips.

Central display: the equipment of sewer workers in the City of Brussels in the 20th century was made of cotton and leather, which are penetrable materials.

PHOTO OF THE MODERN EQUIPMENT OF SEWER WORKERS

- → Headlamp
- → Helmet
- → Gas detector
- → Gloves
- → Portable spotlight
- → Waterproof boots

→ NEED A BIT OF FRESH AIR? IT'S TIME TO GO BACK TO THE SURFACE...

26

MAKING THE WATER CLEAN AGAIN

WATER TREATMENT IN BRUSSELS

The flow of waste water in the Brussels-Capital Region goes via three sub-basins that bring the network of tunnel sewers down to the bottom of the Senne valley.
It is at this low point in the topography that there are two Brussels waste water treatment plants. They treat all the waste water from their respective sub-basins, namely the 360,000 population equivalents of the southern part of the Region for the South station and the 1,100,000 population equivalents of the North and Woluwe sub-basins for the North station.

Before the treatment plants were build, all the waste water from the Brussels-Capital Region was returned directly to the environment, without prior treatment.

WHY TREAT THE WATER?

A natural process allows rivers to purify themselves.
However, beyond a certain level of pollution, this no longer has an effect.
It is therefore necessary to treat the water before it is discharged.
Bacteria which is naturally present in the water break down organic matter.
In highly polluted water, this oxygen-consuming process leads to an ecological imbalance in watercourses that affects the survival of living organisms.
By optimising this mechanism in time and space, waste water treatment plants can initiate the elimination of waste water pollution before it is discharged into the environment.
The plants also eliminate nutrients, such as nitrogen and phosphorus, which promotes algae growth, which are major nighttime consumers of oxygen.
Finally, water treatment eliminates heavy metals and other micro-pollutants, which are toxic to aquatic organisms.

THE SENNE, THE SCHELDT, EUROPE

Waste water treatment in the Brussels-Capital Region is part of a sustainable management plan for the International Scheldt River Basin District.
This district is managed by France, the three regions of Belgium as well as the federal authority and the Netherlands. These various authorities have set up a permanent structure.
The International Scheldt Commission (ISC): the objective of this commission is to coordinate the implementation of the European Directive, known as the Water Framework Directive, which aims to protect European waters in order to ensure sustainable water use throughout Europe.

TREATMENT

The history of sludge in Brussels
The sludge farm and its basin were enlarged and moved out of the city centre around 1850.
At the same time as the covering of the Senne in 1871, the installation of a systematic drainage system ensured the evacuation of the waste water that returned to the Senne when it left the city.
The Farm now houses the central secretariat of the Road Works Department of the City of Brussels, which is responsible for the Sewerage Department.
It is still called Mestback by sewer workers.

TWO STATIONS FOR THE REGION

The region has two stations which are responsible for purifying all Brussels waters, and some water from peripheral Flemish municipalities.

SOUTH WASTE WATER TREATMENT PLANT

- **DATE OF COMMISSIONING** 2000
- **RIVER BASINS CONCERNED**
  South sub-basin
- **NOMINAL CAPACITY**
  360,000 population equivalents
- **DAILY VOLUME** 65,160 m³ per day

NORTH WASTE WATER TREATMENT PLANT

- **DATE OF COMMISSIONING** 2007
- **RIVER BASINS CONCERNED**
  North sub-basin and Woluwe
- **NOMINAL CAPACITY**
  1,100,000 population equivalents
- **DAILY VOLUME** 325,000 m³ per day

The tunnel sewers follow an invisible underground route whose multiple branches primarily converge according to the topography towards two outlets to the north and south of the city.

THE WATER TREATMENT STAGES

Most waste water treatment plants operate in a similar way, allowing cleaner water to be discharged into the environment after a process lasting about 24 hours.

GRIT REMOVAL / DE-OILING

A first, smaller tank allows the sands and gravel to settle at the bottom. These are then washed and can be reused in concrete production. At the same time, injecting air bubbles causes oils and grease to rise to the surface of the water, where they are removed by scraping.
tunnel sewers is filtered through. These are and discharged.

PRIMARY TREATMENT

A large tank in which the water stays longer allows suspended solids to settle at the bottom. This primary sludge is then scraped up and removed.

BIOLOGICAL TREATMENT

The biological tank is fitted with air blowing devices that allow bacteria which are naturally present in the water to develop and multiply.
These micro-organisms feed on organic matter and clump together to form clusters of organic sludge.

SECONDARY TREATMENT

The mixture of water and sludge is sent to a settling tank called a clarifier.
This tank makes it possible to separate the two elements.
The sludge thus recovered is pumped to the treatment installations.
In Brussels, the treated water is finally returned to the Senne.

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BLUE PLANET IN DANGER?

THE BLUE GOLD

Our planet is essentially covered with water.
Yet freshwater is a limited resource, and how it is divided up is often considered a source of future conflicts between countries.
Less than 1% of the world's water supply is accessible to humans and other living organisms. Of this small volume, only a tiny proportion is usable for drinking water production.
Agriculture and its watering infrastructure account for 69% of the world's water consumption, industry 23%. Domestic use accounts for 8%.
During the 20th century, global consumption of water increased at a rate twice as fast as population growth.
If this growth continues, humanity could use up more than 90% of freshwater resources by 2025.
Our planet has huge water reserves, but this is primarily salt water.
Glaciers contain 3/4 of the world's fresh water, and the rest is mainly buried in the subsoil.

→ **GROUNDWATER** 23.1%

→ **SURFACE WATER** 0.3%

→ **GLACIERS** 76.7%

Aquifers, which are groundwater bodies, are very unevenly distributed around the world. Some regions desalt sea water to supply their country with fresh water. Such freshwater production represents 0.1% of world consumption.

Worldwide, about 2,500 km^3 of water is used annually for irrigation, an increase of 60% over 40 years.

POPULATIONS DEPRIVED OF DRINKING WATER

One third of the world's population is deprived of access to safe drinking water, including half of the population of Sub-Saharan Africa.
Along with air, water is the only natural resource that humans cannot live without. Indeed, our bodies are made up of 70% water. Yet a large and growing part of the world's population does not have access to it.

Various factors are responsible for this situation:

- the unequal distribution of aquifers around the world,
- water stress caused by large water withdrawals
- and population growth, as well as the various forms of pollution that the environment suffers.

VARIABLE CONSUMPTION

Ideally, a human being should be able to have access to an average of 40 litres of water per day for food and hygiene.
However, the average American consumes nearly 380 litres of water, 20 times more than the average African.
Average water consumption per capita varies greatly from one country to another.
This of course depends on water accessibility.
However, mentality and lifestyle also play a decisive role.
In Belgium, for example, greater awareness has led to a stabilisation or even reduction in the consumption of drinking water.

AVERAGE CONSUMPTION PER INHABITANT:

- NORTH AMERICA 380 l per day
- ITALY 251 l per day
- SWITZERLAND 242 l per day
- SPAIN 210 l per day
- SWEDEN 203 l per day
- LUXEMBOURG 178 l per day
- NETHERLANDS 171 l per day
- FRANCE 147 l per day
- BELGIUM 120 l per day
- AFRICA 20 l per day

VIRTUAL WATER

Everything around us contains water and everything we produce inevitably consumes water.
This is what is known as virtual water. Water is essential in industrial and food production processes.
It is used as a raw material, for cooling, solvent, means of transport and energy source.
In order to eat a steak, for example, you need to raise a cow for three years. Over this period, the cow will consume 1.3 tons of grain and 7.2 tons of grass.
The amount of the water required to grow these plants, the water absorbed by the animal, and the water used for its breeding indicates that 15,340 litres of virtual water will have been consumed
to obtain 1 kg of beef.

- → 100 SHEETS OF A4 PAPER 1000 litres
- → 10 EGGS 1,350 litres
- → 10 GLASSES OF MILK 2,000 litres
- → 10 PACKETS OF CRISPS 1,850 litres
- → 1 HAMBURGER 2,400 litres
- → 1 COTTON T-SHIRT 4,100 litres
- → 100 ELECTRONIC CHIPS 3,200 litres
- → 100 APPLES 7,000 litres
- → 1 PAIR OF SHOES 8,000 litres
- → 1 CAR 120,000 litres

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WATER CONSUMPTION IN BELGIUM

In our country, 700 million m^3 of fresh water is drawn from natural water sources each year.
Over the last 20 years, freshwater abstractions in Belgium have decreased by nearly 28%.
This overall decrease is primarily due to industrial decline and technological developments, as it goes hand in hand with population growth and intensive agriculture. However, it must be noted that the Belgian population has become aware of the vital nature of water and is beginning to ensure more economical consumption.

- → POWER STATIONS 64%
- → INDUSTRY 20%
- → AGRICULTURE 0.7%
- → PUBLIC NETWORK 11%
- → HOUSEHOLD SECTOR 0.003%
- → OTHER ACTIVITIES 4%

ENOUGH RESERVES?

Average annual rainfall in Belgium is around 25 billion m^3. Only 3 billion m^3 permeate the subsoil and supply the aquifers.

Apart from periods of prolonged drought, our country has sufficient water resources. However, the country's significant urbanisation reduces it's relative impermeability and prevents some rainwater from sinking into the ground. This is a problem, because aquifers do not recharge quickly enough.
On the other hand, by increasing the flow of water to be discharged, we increase the risk of flooding and limit the efficiency of our waste water treatment plants.

SMART HABITS TO CONSUME LESS TAP WATER ARE POSSIBLE FOR ALL OF US:

STOP LEAKS!

A leaking flush or dripping tap can cost a lot of money! Over the course of one year, a tap leak will have sent between 100 and 200 m^3 of water to the sewers.

CHECK YOUR WATER METER BEFORE GOING TO BED.

When you wake up, if it displays a different figure, all you have to do is find the leak.

CHANGE YOUR WASHING HABITS

Save 10 litres of water a day by turning off the tap when you brush your teeth. Taking a shower instead of a bath will save you more than 60 litres.

ORGANIC GARDENING

A good hoeing is worth two sprinkler sessions! By breaking the surface crust of the soil, you will keep it moist and aerated, and control weeds more effectively. A good watering once a week is more effective than in small regular quantities. Finally, don't water your lawn: even if it turns yellow, it will recover quickly.

EQUIP YOURSELF BETTER

An economical flush reduces water consumption by half, or even two-thirds. On older models, place a brick in the cistern to reduce the volume. Your dishwasher and washing machine are heavy water consumers. When purchasing, make sure that you choose the most economical model available.

BE SMART

Collect rainwater in tanks for watering the garden, cleaning the car and house. If you have the opportunity, install a parallel circuit to supply your toilets or washing machines. Rainwater is abundant, free, and without limescale, so you will start benefiting quickly.

CLEAN DIFFERENTLY

Always use your dishwasher and washing machine at full load, and avoid pre-washing. Wash your car with a bucket and sponge instead of a hose.

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WATER DISTRIBUTION IN BRUSSELS

WATER SUPPLY IN BRUSSELS IN THE MIDDLE AGES

At the end of the 13th century, Brussels constructed underground water supply networks, to supply a series of monumental fountains distributed at the city's key points.

In the Middle Ages, water supply was mainly provided by the Senne and a series of family wells taken over in the 15th century under the City's supervision.
The few public fountains were first supplied by the City's main streams, the Coperbeek, Zavelbeek and Ruisbroek.
In the 17th century, Brussels purchased aquifers in Saint-Gilles and completed its network of monumental fountains.
On the eve of the industrial revolution, most Brussels residents were still using wells and tanks in their homes. The City had clever but incomplete water distribution systems.

Built around 1600, the hydraulic machine raised about a hundred cubic metres of water every day to the gardens and palace of Coudenberg. Since water had become a fundamental element in the redevelopment of the princely gardens, this installation propelled water from the Broebelaar, a tributary of the Maelbeek, towards a reservoir tower installed on the edge of the park. It also provided water for many of the palace's outbuildings and various religious institutions in the surrounding area. However, the irregularity of the flow of the stream made operating the facility dangerous.
The machine disappeared in the 19th century, when the City set up a general water distribution network.

IN 1855, THE FIRST PUBLIC WATER SUPPLY SYSTEM WAS INAUGURATED.

By capturing the waters of the Hain, around thirty kilometres south of Brussels, the City included water distribution among the missions of the public service for the first time. However, consumers had to pay for the service, and the public water points, which were considered unsanitary, were abolished. Paradoxically, these decisions increased the social divide because of access to safe water.
The Compagnie Intercommunale des Eaux (Intermunicipal Water Company) was founded in 1891 by four municipalities on the outskirts of the city: Ixelles, Saint-Gilles, Saint-Josse and Schaerbeek.
Outraged by the prices charged in the city, they decided to set up their own supply system by collecting water

from the springs of the Bocq, located nearly 80 km from Brussels. It was not until 1933 that the two water utilities merged and joined forces to expand water catchments.

FROM THE FOUNTAIN TO THE TAP

In the 14th century, Brussels had 35 family water points and around a dozen ceremonial fountains.
The city, which numbered 40,000 inhabitants at the time, appears to have been exceptionally well equipped. However, the fountains, which at the time formed a striking feature of the city, were not specifically designed for distributing water to citizens, but above all establishing the power of the city, by enhancing the public space with these majestic structures.

THE CITY'S WATER TENTACLES

2,000 kilometres of pipelines supply the 19 municipalities of Brussels with 60 billion litres of drinking water every year. These days, a public company is responsible for the production and supply of drinking water for the entire Brussels-Capital Region. It covers barely 3% of its needs through groundwater abstraction in the Sonian Forest and the Bois de la Cambre. The rest primarily comes from areas located in the Walloon Region. At the entrance to the Brussels-Capital Region, water is stored before being managed by the Intercommunale Bruxellois de Distribution d'Eau (Brussels Intermunicipal company for water distribution - VIVAQUA), which organises distribution throughout the Region. Regular and very strict controls ensure the drink-ability of the water.

THE SEWER IS NOT A WASTE BIN

Although waste water treatment plants are responsible for purifying our waste water, their efficiency depends on a certain balance that needs to be respected.
The waste water treatment plants are designed to be able to digest any form of pollution which is inherent in any normal use of sewers.
By discharging unsuitable substances into the sewerage system, we risk serious consequences for nature, on the one hand, but we also put sewer workers at risk by exposing them to explosive and toxic substances.

Pouring oil down a drain constitutes anti-social and dangerous behaviour, which is punishable by a fine...
... The same goes for cleaning and laundry products...
... For medicines and cosmetics...
... And harmful solvents.

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THE TOLL HOUSES - PORTE D'ANDERLECHT

PORTE D'ANDERLECHT

Up until the end of the 18th century, seven toll houses were scattered around the Brussels' city wall, which provided access to the city. Travellers coming from the Chaussée de Mons arrived in Brussels via the Porte d'Anderlecht. This tower of the city wall was converted into a prison in the middle of the 18th century before being demolished in 1784. The city's old ramparts suffered the same fate in 1810, and following orders from Napoleon that they be demolished, they were replaced by the boulevards of the inner ring.
At the same time, an office was set up on the site of the Porte d'Anderlecht to collect the toll, an indirect tax on consumer goods entering the city.
At the time, the outer boulevards were lined by ditches and palisades which meant that the only way to enter the city was via the toll gates.

THE TOLL HOUSES

In 1831, the city's architect, Auguste Payen, called for the demolition of the old rundown offices. He then drew up plans for the two present-day buildings, which were completed in 1836.
Decorated with two decorative pediments, one representing the City of Brussels and the other representing Commerce, the toll

houses remained in operation until 1860, when the urban toll was abolished in all Belgian cities.

Elevations of the facades of the left toll gate.
The spandrel has a pediment which represents trade.

FROM TOLL HOUSE TO MUSEUM

The diversion of the Senne under the outer boulevards resulted in the demolition of the buildings of the Porte d'Anderlecht in 1950. Once the openings of the second covering had been completed, the toll houses were rebuilt identically, but slightly further apart from each other in order to facilitate traffic in the middle of the Chaussée de Mons. Portable dams were installed to replace the disused floodgates of the Grande Écluse on Boulevard Poincaré. Ever since, the toll houses have been used by the Sewerage Department of the City of Brussels.

RATS: FRIEND OR FOE?

Before you leave, take a look at the private rat collection of our sewer workers. Friend or foe? It's difficult to decide but the sewer workers have made them their mascot!

THANK YOU FOR YOUR VISIT!

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TEXTS

Sewer Museum

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