For living waterways

WSV.de

Federal Waterways
and Shipping
Administration

# The Kiel Canal

## International lifeline for maritime traffic and maritime pearl of Schleswig-Holstein

# Contents

# Connecting seas, countries and people – the Kiel Canal

The Kiel Canal is the world's busiest man-made waterway navigable by seagoing ships. It is used by a similar number of ships as the Panama and Suez Canals together. However, this also includes smaller ships. Linking two seas, the canal directly connects the North Sea ports with the ports of the Baltic Sea region. For the German seaports of Hamburg, Bremen, Bremerhaven and Wilhelmshaven, in particular, the transit route via the Kiel Canal creates the conditions for an efficient maritime hinterland connection. But also for the network of European sea motorways, the Kiel Canal plays a key role in linking the European seaports on the North Sea with those in the Baltic Sea region.

The Kiel Canal's benefit for the transport industry results from its advantages in terms of distance and thus time. Compared to the longer shipping route around Skagen, the average passage through the canal is around 260 nautical miles (around 480 kilometres) shorter; this reduces the required time for a common sea-going ship by around 16 hours.

For transport operations from the German North Sea ports, time savings are even higher (up to 350 nautical miles/around 650 kilometres). However, the shorter route not only saves time but also reduces the ships' fuel costs while enabling higher turn-round times between the North Sea and Baltic Sea ports.

Last but not least, these distance-related benefits also save many tonnes of climate-damaging emissions from ships. For a journey from Hamburg to Danzig via the Kiel Canal, for example, this reduces the $CO_2$ emissions from an average ship by around 40 tonnes. Therefore, maintaining the Kiel Canal as an efficient and safe waterway that relieves environmental pressure is of key national and European importance.

## Canal data

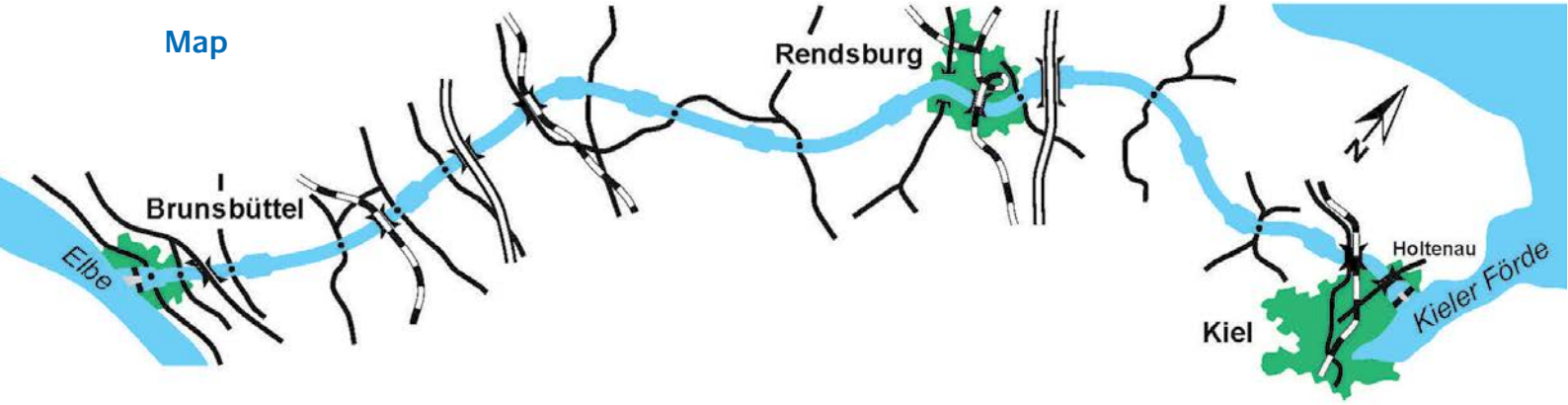
| | |
|---|---|
| **Length:** | 98.6 km |
| **Water depth:** | 11 m |
| **Construction period:** | 1887–1895 |
| **Bridges:** | 10 |
| **Tunnels:** | 2 |
| **Ferries:** | 14 |
| **Construction costs:** | 156 million German Reichsmark |
| **Soil movement during construction:** | more than 80 million $m^3$ |
| **Opening:** | on 21 June 1895 by Emperor Wilhelm II as "Kaiser Wilhelm Canal" |
| **Name change:** | renamed "Kiel Canal" in 1948 |
| **Direct predecessor:** | Eider Canal, opened in 1784 |
| **Upgrading:** | first, from 1907–1914; second, from 1965–2002 |
| **Sidings:** | 12 (enabling large ships to pass each other) |
| **Core feature:** | saves ships a circuitous route of around 480 km (around 260 nautical miles) |
| **Record:** | is the largest man-made receiving body of water in Schleswig-Holstein |

Locks at Brunsbüttel


Time- and distance-related benefits of the Kiel Canal

# 98.26 kilometres – the direct route between the North Sea and the Baltic Sea

## Map




## Course

The Kiel Canal links the Elbe at Brunsbüttel to the Kiel Fjord. In a series of bends and straights, it crosses marshland in the West that is up to three metres lower and then cuts through the Geest Ridge, which is up to 25 metres high. Subsequently, the canal follows the Eider lowland and then reaches the hilly region of Holstein. After around 100 kilometres, it flows into the Kiel Fjord at Kiel-Holtenau.

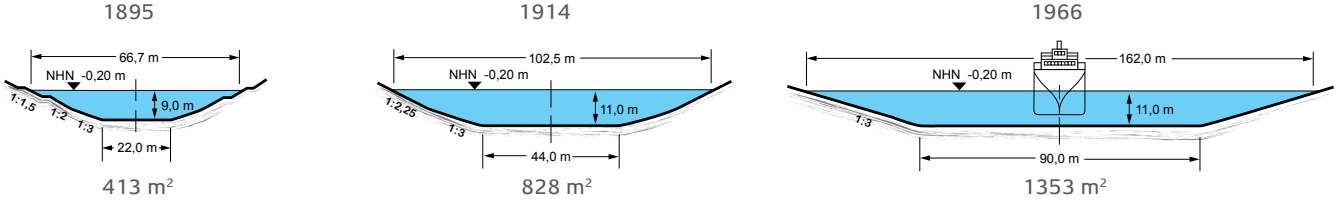
## Canal bed

Initially, the canal was built with a bottom width of 22 metres. Starting from the flat bottom, the canal embankments were designed as slightly inclined, wherever possible.

Given the more demanding requirements, a first upgrading to achieve a bottom width of 44 metres was carried out already in 1914. The widening of the canal bottom between Brunsbüttel and Königsförde to 90 metres in 1966 established the current development status.

Between Brunsbüttel and Königsförde (at around canal kilometre 80), the canal exhibits mainly curve radii of over 3,000 metres and a width at the waterline of 162 metres. The remaining narrower section up to the Kiel Fjord has not been widened since 1914. This approximately 20 kilometres long section is characterized by sharp bends and a significantly lower waterline width of 102 metres. Widening this section and increasing the curve radii is part of an ongoing investment programme for the Kiel Canal.

Cross sections




NHN = standard elevation zero

Lock installation at Kiel-Holtenau

Because of the heavy forces exerted on the banks by the wash of the waves, the lowering of the water level and the wake from passing ships, the permissible speed for ships on the canal is limited to 12 or 15 kilometres per hour, and paved banks are absolutely essential in the water-level fluctuation zone.

The maximum permissible speeds depend on the size of the ships and the stresses and strains they exert on the canal bed. As larger and more powerful ships cause higher levels of stresses and strains, it cannot be ruled out that further speed restrictions will be imposed in the future to protect the canal bed.

## Sidings

To make it possible for a large ship to pass other ships, passing places, aka sidings, have been constructed. In the sidings, the canal is significantly wider than the rest of the waterway, which means that ships can wait there for ships approaching from the opposite direction, and slow ships or towed convoys can be overtaken.

## Locks

These structures enable ships to move between different water levels. Due to the tides, in Brunsbüttel, the maximum height difference between the Elbe and the Kiel Canal is around 3.2 metres; between the Kiel Fjord and the Kiel Canal, it is usually only 0.5 metres. Because of the larger tidal range, the medium locking time in Brunsbüttel is up to 45 minutes, while in Kiel-Holtenau, locking only takes 25 minutes on average and is thus significantly faster.

When the Kiel Canal was opened in 1895, only two lock chambers each were available at Brunsbüttel and Kiel-Holtenau. Today, these are referred to as the Small Locks. As early as 1914, two additional, larger lock chambers were added at both locations. Today, these are referred to as the Large Locks.

Lateral and branch canals at the Small Locks and at the Large Lock in Holtenau reduce currents and turbulence in the lock chamber when the water level is being changed.

Due to its poor structural condition, the Small Lock at Kiel-Holtenau is not operated anymore. It is to be completely removed and replaced by a new structure with two lock chambers. According to current plans, ships with a maximum length of 155 metres, a maximum width of 22.5 metres and a maximum draught of 8.5 metres will be able to use the Small Lock.

Comprehensive information on the status of the construction project can be found under the following link (in German only): https://www.wna-nord-ostsee-kanal.wsv.de/

### Lock data

Small Locks with two chambers at Brunsbüttel

| | |
|---|---|
| **Construction period:** | 1887–1895 |
| **Usable length:** | 125 m |
| **Usable width:** | 22 m |
| **Depth on sill*:** | – 10.20 m (standard elevation zero) – Brunsbüttel |
| **Depth on sill:** | – 9.80 m (standard elevation zero) – Holtenau |

Large Locks, each with two chambers, at Brunsbüttel and Kiel-Holtenau

| | |
|---|---|
| **Construction period:** | 1911–1914 |
| **Usable length:** | 310 m |
| **Usable width:** | 42 m |
| **Depth on sill:** | – 14.00 m (standard elevation zero) – Brunsbüttel |
| **Depth on sill:** | – 14.00 m (standard elevation zero) – Holtenau |

*Distance between the water surface and the jamb wall over which the lock gate is located

# A link between economic areas – the Kiel Canal, a major transport artery

Vessels passing each other – container shipping on the Kiel Canal

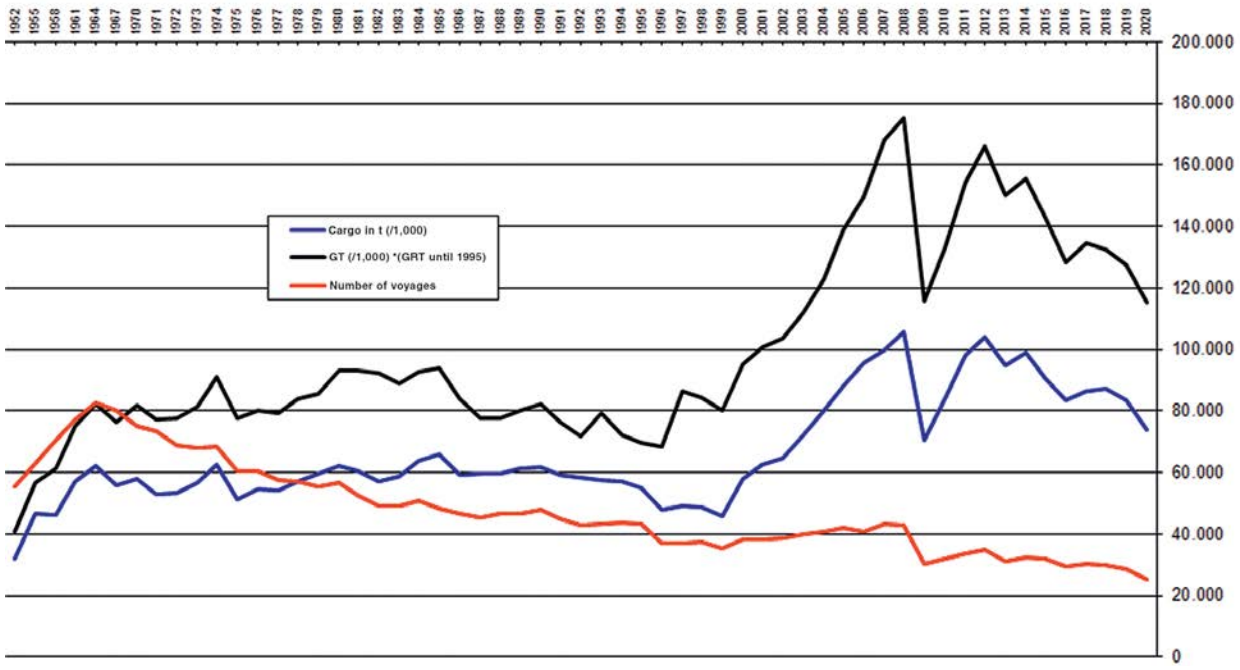
The Kiel Canal, which is a federal waterway, has been one of the most important maritime transport routes in Northern Europe for more than 125 years. It connects Scandinavia and the Baltic States to international maritime traffic via a short link and provides an attractive connection between the North Sea ports on the English Channel and the Baltic Sea ports in Germany.

The opening of the Iron Curtain in the early 1990s and the collapse of the economies of Eastern Europe initially resulted in a sharp decline in external trade and hence in shipping traffic. From the late 1990s until the 2008/2009 economic crisis, there was a steady rise in the volume of shipping traffic on the Kiel Canal. In 2008, over 105 million tonnes of cargo were transported on the Kiel Canal. This was the highest annual result in the history of the canal. The Baltic States (Latvia, Estonia and Lithuania) in particular, but also Poland and Russia, have contributed to a steady growth in the volume of cargo carried and to an increase in the volume of shipping traffic on the Kiel Canal. However, the Scandinavian ports in Sweden, Finland and Denmark remain the most important transport links in terms of volume of cargo carried.

Over the course of decades, the fleet structure on the Kiel Canal has steadily changed, both in terms of the vessel types used and the ship sizes. Until the 1970s, motor coasters, as allrounders for all kinds of cargo, dominated the traffic environment. Today, container feeders, ro-ro ships for wheeled cargo as well as tank ships form the majority. In 1996, the average gross tonnage (GT) of the ships navigating the Kiel Canal was 1,848 GT; this figure had risen to over 4,576 GT by 2020. That is equivalent to a growth rate of 248 percent.

According to a study commissioned by the then Federal Ministry of Transport and Digital Infrastructure (BMVI), now the Federal Ministry for Digital and Transport (BMDV), on the maritime traffic forecast, the volume of cargo handled at German seaports is expected to grow over the period to 2030. This can mean increasing numbers of movements in the long term for the Kiel Canal, too, if it remains possible to offer shipping services that meet current and future demands through infrastructure construction projects on the canal and at its locks and by ensuring a high level of availability of the transit route.

Development of the Kiel Canal‘s shipping traffic (1952–2020)




[1] Vincent Stamer, Gabriel Felbermayr, Klaus Schrader and Jürgen Stehn; “Economic benefit of the Kiel Canal”; Institute for the World Economy of the University of Kiel, Kiel 2021

## Revenues and costs

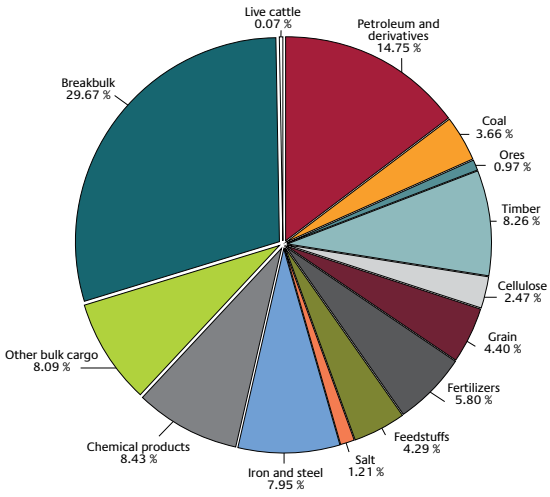
Maintenance of the Kiel Canal is partly funded through charges paid by its users. However, these transit charges only cover part of the operation and maintenance costs and were suspended in 2020 and 2021 by the BMVI (the present-day BMDV) to support the shipping sector on the Kiel Canal, which was burdened by the corona crisis. The main part of the funding comes from tax revenues. This is justified by the fact that the canal compensates for the resources invested in it many times over through the economic effects it generates in the region, in Northern Germany and also in the other parts of Germany. Even at European level, the Kiel Canal generates a particular benefit for the European Union in terms of both the economy as a whole and the transport sector in the context of the Trans-European Transport Networks. A 2021 study of the Institute for the World Economy in Kiel concludes that the Kiel Canal generates a positive welfare effect for the economy of Germany that amounts to around 570 million euros annually. Germany’s neighbouring states also benefit significantly from the Kiel Canal. For Denmark and Sweden, for example, welfare effects amounting to almost 90 million euros were calculated.

As part of the German transport infrastructure network, the canal – just like the federal trunk roads – is a component of the state services of general interest. Therefore, a simple comparison from an economic point of view of its costs with the revenue generated through shipping traffic is not informative. Ships transiting the Kiel Canal also have to pay additional service costs (pilot and steersperson fees) and pilotage dues. The purpose of pilotage dues is to fund the pilotage infrastructure such as shore-side and seaborne pilot stations as well as the pilot boats. Pilot and steersperson fees are the income of the pilots and canal steerspersons and are paid out to them in their entirety.

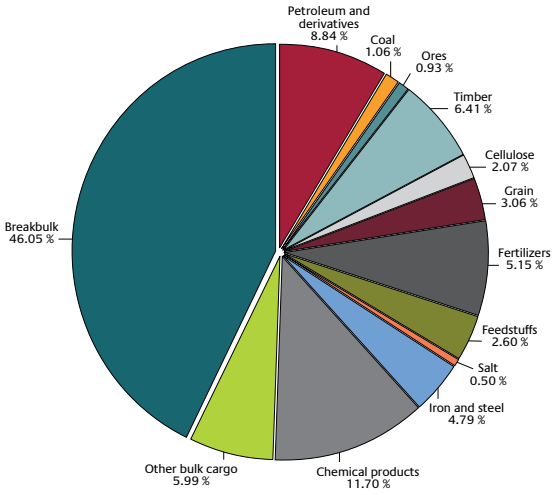
## Volume of traffic and goods

From the 1960s, the traffic figures of the Kiel Canal remained relatively constant over long periods. Only the number of ships decreased steadily from the beginning of the 1960s. This means that the constant, and later increasing, cargo volumes were carried with fewer, but ever larger ships. At the beginning of the new millennium, both cargo volumes (diagram: blue line) and ship sizes began to grow very dynamically. The traffic on the Kiel Canal again experienced significant growth.

Types of goods in 1990




Types of goods in 2020




The volume of cargo carried on the Kiel Canal rose continuously until 2008. In 1990, 61.7 million tonnes of cargo were transported. By 2008, this figure had risen to 105.9 million tonnes. The following economic crisis resulted in a downward trend, although the figures were still relatively high. In 2021, 85.2 million tonnes of cargo were transported on the canal.

International factors such as the worldwide stagnation of the volume of cargo handled, low bunker oil prices, a fall in shipping traffic to and from China and the economic sanctions imposed by the EU on Russia in mid-2014 have resulted in a drop in tonnage and the number of ships on the Kiel Canal in recent years. The global pandemic also resulted in a significant decline in traffic volumes on the Kiel Canal, in particular in 2020. Moreover, the types of goods transported on the Kiel Canal have changed significantly in the past three decades.

At the beginning of the 1990s, breakbulk cargo (containerized and individually packed) was the main type of goods transported and accounted for around 30 percent. The transport of petroleum and derivatives was in second place with around 15 percent, followed by ‘other bulk cargo’.

Over the period to 2020, the share of breakbulk cargo increased to about 43 percent. Petroleum and derivatives, which were the second most important types of goods transported in the 1990s with around 15 percent, decreased to around 9 percent by 2020 and rank third. The transport of chemical products now ranks second with a share of 12.3 percent.

## Ports

The inland port of Brunsbüttel, the oil port of Brunsbüttel, the port of Ostermoor, the district port of Rendsburg, the heavy-duty port of Rendsburg, Rendsburg Port at Osterrönfeld, Kiel northern port and the inland port of Kiel-Holtenau are located directly on the Kiel Canal. In 2021, around 5.8 million tonnes of cargo were transported via the Kiel Canal to and from the canal ports. Cargo volumes have generally decreased in the last few years.

In the immediate vicinity of the Kiel Canal is the Elbe port of Brunsbüttel. The seaport of Kiel is both a cargo handling site, in particular for ro-ro (roll-on/roll-off) traffic, and a place of departure for passengers travelling to Scandinavia and the Baltic States. It has also become a popular destination for many cruise ships.

Old district port of Rendsburg

## Shipyards

There are several shipyards on the Kiel Canal, at Rendsburg and Schacht-Audorf. There is also a large shipyard at the port of Kiel. Numerous smaller shipyards are located in the west and east of the Kiel Fjord. The shipyards provide jobs in the maritime environment and in turn benefit from the vibrant transport artery that is the Kiel Canal.

## Shipbrokers

At the locks in Kiel and Brunsbüttel, shipbrokers are represented, who provide their customer-focused services around the clock. They take care of the paperwork required for a passage through the canal (shipping police approvals, dangerous goods notifications, customs documents, payments, etc.) and organise, for example, tugboats, berths or equipment.

# For a risk-free transport route – maritime safety

The International Maritime Organization (IMO), a specialized agency of the United Nations, has required state governments to establish traffic safety services wherever the density of traffic or the hazard level is especially high. The Federal Waterways and Shipping Administration (WSV) operates Vessel Traffic Service (VTS) centres along the entire German coast between the Dutch, Danish and Polish borders.

These VTS centres inform, support and regulate shipping traffic on the German coast and on the federal waterways (maritime traffic safety). The VTS centres operated by the Waterways and Shipping Administration are executive bodies of the river and shipping police with the following sovereign responsibilities:
- traffic safety;
- averting threats to the safety and efficiency of navigation;
- preventing dangers and harmful environmental impacts that emanate from shipping.

## Vessel traffic service centres

The functions of the VTS centres are performed by experienced nautical officers who are all certificate holders and have been thoroughly prepared for these tasks during a demanding training course of the Waterways and Shipping Administration.
Their responsibilities include:
- informing shipping about traffic in the VTS areas;
- assisting the masters by providing information, warnings and advice;
- regulating and organizing traffic;
- initiating enforcement measures.

## Maritime traffic safety

Maritime traffic safety on the Kiel Canal is the responsibility of the Kiel Canal VTS centre at Brunsbüttel, whose main focus is on the following tasks:
- regulating and organizing traffic around the clock;
- locking ships into and out of the canal at the intersections with the Elbe and the Kiel Fjord;
- taking counter-terrorist measures;
- checking the canal-worthiness of vessels.

For these functions to be performed safely and rapidly, shipping traffic on the Kiel Canal and at its locks must be detected, observed and monitored. This is done using state-of-the-art equipment. On the one hand, radar is used to detect the vessels, and on the other hand, the ships automatically identify themselves via an Automatic Identification System (AIS) at short, regular intervals. This involves transmitting all available ship data, such as size, name, position, course and speed to the VTS centre and the surrounding ships.

AIS is of fundamental importance for maritime traffic safety. This system was introduced worldwide in 2004 and made mandatory for all sea-going ships of 300 GT or more.

The basis of on-board positioning is the Global Positioning System (GPS). The nautical officers at the VTS centre use the collected and processed data to plan the locking-in and locking-out of the ships at Brunsbüttel and Kiel-Holtenau. Between the locks, the flow of traffic on the Kiel Canal is supervised and organized by the VTS centre in such a way that there are no unauthorized encounters or delays.

Panoramic photo (top of page): Kiel Canal VTS Centre (interior view); Kiel Canal VTS Centre (exterior view)


RH COLOR Rasterscan
PILOT

## Pilotage services

Pilots are statutorily required advisors to shipmasters. In difficult and busy pilotage waters along the coasts, they contribute their extensive knowledge of the area and their on-board experience. They thus play a crucial part in ensuring the safety of shipping. Up to now, nautical officers had to have at least two years of professional experience in a responsible navigational position and complete an additional 8-month course of theory and practical training as a pilot candidate. Following a training reform, nautical officers can now also work as pilots after having undergone an intensive 2-year training in the pilot associations.

There are two maritime pilots' associations on the Kiel Canal: NOK I in Brunsbüttel and NOK II for Kiel, Lübeck and Flensburg in Kiel-Holtenau, both of which are responsible up to the halfway point of the canal. The change of pilots on the ships takes place at Rüsterbergen pilot station near Rendsburg.

The ships navigating the canal are sometimes so large that no water is visible from the bridge. On such a narrow and busy channel, with frequent oncoming traffic and few opportunities for passing, it is imperative that masters be provided with advice by a person with knowledge of the local area. Entering and exiting the locks at Brunsbüttel and Holtenau is a difficult manoeuvre that requires a competent advisor.

Maritime pilots do not work shifts but in a sequence in which the pilot who has most recently worked takes their place at the bottom of the list. Working hours depend on the volume of traffic and are thus difficult to predict. The pilot fees, which constitute their income, are determined by an official tariff (Tariff Ordinance for District Pilotage).

## Canal steerspersons

The occupational profile of the canal steersperson has been in existence on the Kiel Canal for over 100 years. It is the only canal where this profession exists in addition to that of the maritime pilot. In the early days of canal passages, accidents were a frequent occurrence.

The causes were mostly to be found in the hydrodynamic effects of the narrow channel. Almost one in every 20 ships became wrecked, because the helmsmen and masters were not sufficiently familiar with the physical interaction between the ship and the embankment and between meeting ships. For this reason, the then canal authority, the Imperial Canal Office, decided that only approved canal steerspersons should be allowed to steer the ships, in order to significantly defuse the accident situation. The specially trained professionals (who must also be nautical officers) amalgamated to form the Association of Canal Steerspersons and are supervised by today's Federal Waterways and Shipping Agency.

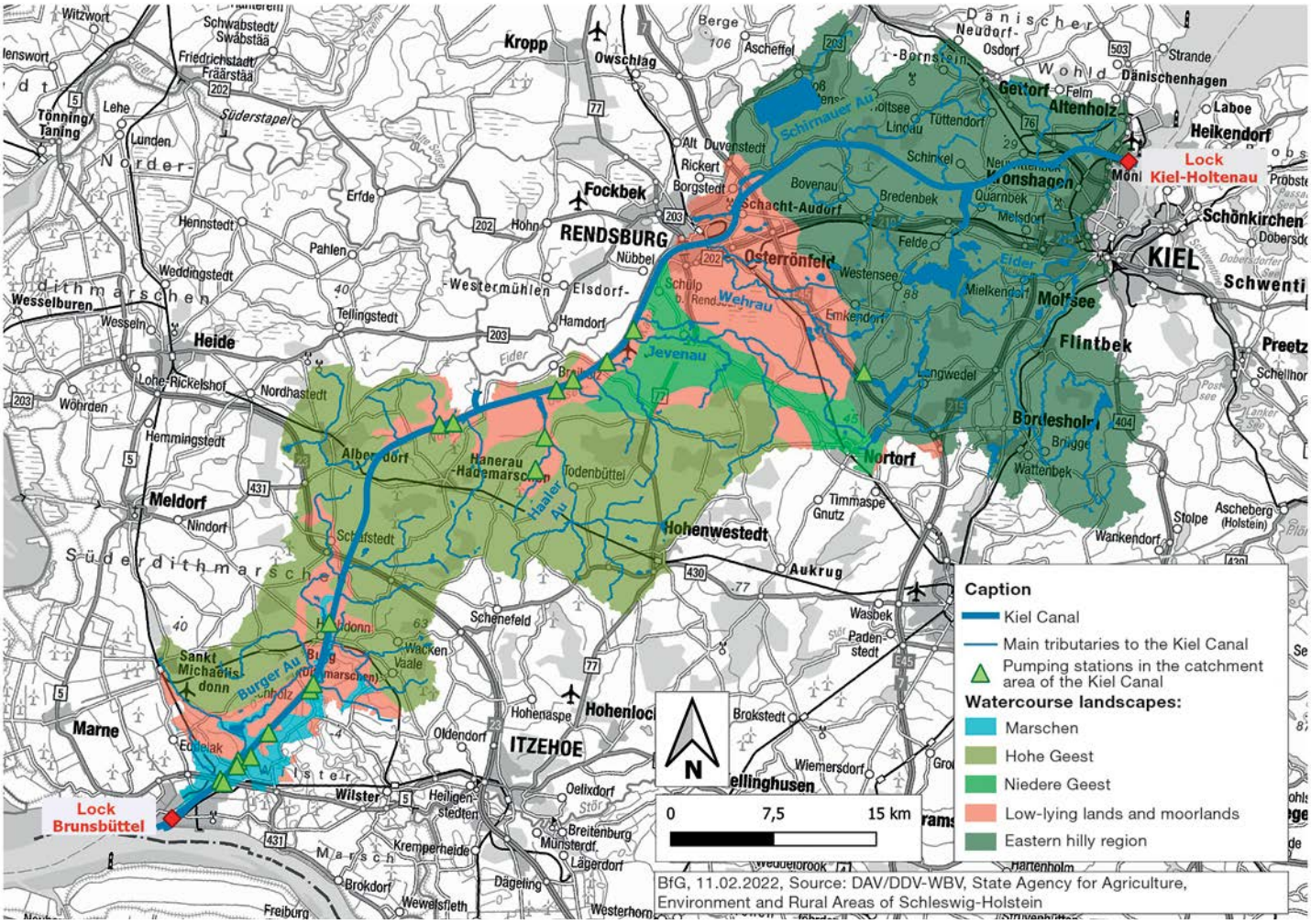
Pilot transfer on the Kiel Canal

# Managing enormous quantities of water

Construction of the Kiel Canal resulted in a sustained improvement in precipitation runoff in a large part of Schleswig-Holstein. The canal receives water from a catchment area of around 1,530 km², with an area of around 250 km² also being drained with the help of pumping stations.

The fact that the canal is connected to a section of the Eider and numerous other small rivers – or their upper reaches – means that their water flows via the canal, the Elbe and the Kiel Fjord into the North Sea and Baltic Sea. Thus, the Kiel Canal serves as a receiving body of water for ten percent of the area of Schleswig-Holstein.

By means of the drainage facilities of the locks in Brunsbüttel and the drainage sluice in Kiel, the water level in the canal can be kept at approximately sea level.



Inlet structure near Projensdorf

A water level that is as constant as possible is important for both shipping and the stability of the embankments and structures. It also ensures uniform bridge clearances and smooth cross traffic with the canal ferries. Without water management, the run-off rainwater entering the canal would disrupt shipping operations and build up in the tracts of land in the catchment area. When balancing the interests of shipping, the requirements of the ferry crossings and hydrological and meteorological conditions, the drainage facilities of the Kiel Canal must be controlled such that the water does not exceed or fall below its maximum and minimum levels respectively.

## High water

In particular weather constellations, for instance stormy weather and persistent heavy precipitation, the water level in the canal cannot be prevented from rising. In this case, an additional speed limit is imposed on shipping to protect the embankments and dykes against damage by wave action. In very rare cases, shipping must be suspended completely. In addition, ferry operations may be discontinued, because interaction between a ferry and a landing stage is no longer possible when there are high water levels. In recent years, there have repeatedly been those exceptional situations in which shipping and ferry operations have had to be temporarily suspended.

## Adaptation to climate change

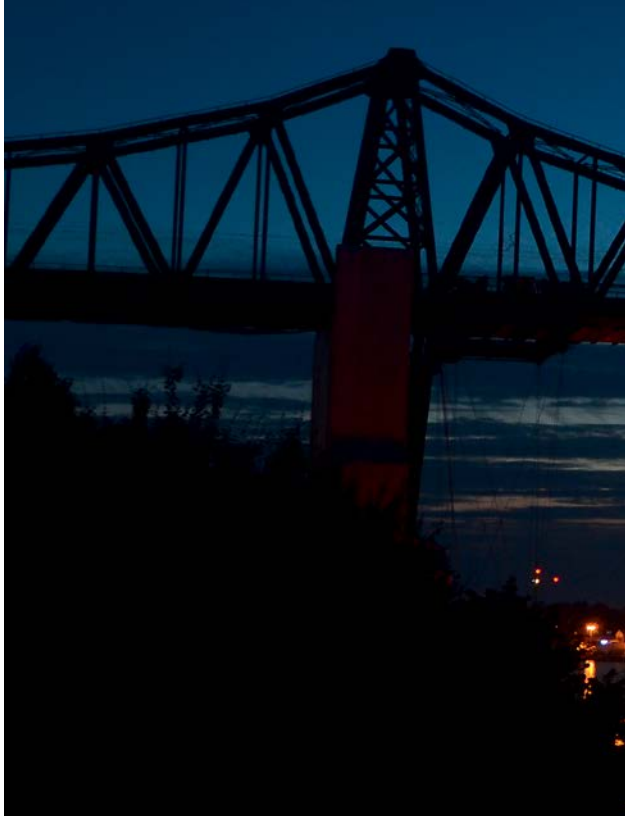
To counteract the adverse impacts of the looming climate change, the Federal Government adopted the German Strategy for Adaptation to Climate Change and the German Action Plan II. A water management model is being developed for the Kiel Canal to optimize water management by means of anticipatory drainage of reserves and adapted inflow control.

Furthermore, the water management model can be used to study and appraise long-term options for action, such as the creation of retention areas (floodplains) or the construction of a new pumping station to drain the Kiel Canal in the case of rising sea levels. Therefore, the federal state of Schleswig-Holstein and the water and soil boards were involved in the creation of the water management model.

### Facts and figures

- **Catchment area:**
  1,530 km², of which 250 km² are low-lying areas that are drained into the canal via 18 pumping stations. After Eider, Trave and Stör, it is the fourth largest, and the largest man-made, catchment area in the federal state of Schleswig-Holstein.
- **Kiel Canal drainage:**
  around 10 % of the area of Schleswig-Holstein.
- **Inflow into the Kiel Canal:**
  around 20 m³/s of water in average; equivalent to an annual volume of 630 million m³ or four to five times the water content of the Kiel Canal.
- **Mean daily drainage:**
  2.7 hours in Kiel-Holtenau and 2.1 hours in Brunsbüttel.
- **Maximum discharge:**
  Kiel-Holtenau achieves only one tenth of the 600 m³/s that can be discharged in Brunsbüttel at low tide (600 m³/s is equivalent to the mean discharge of the Oder).

# The Kiel Canal bridges – structures full of charm and history



Construction of the Kaiser Wilhelm Canal resulted in the severing of existing land routes. Bridges and ferry links closed the gaps that had been created. In addition to the high-level bridges at Grünental and Levensau, four swing bridges and one (movable) pontoon swing bridge initially provided links across the canal. The swing bridges soon proved to be a serious obstacle to shipping, rail and road traffic. During the first canal widening, all of them were removed or replaced by high-level bridges.

Together with the high-level road bridge in Kiel-Holtenau and the high-level railway bridge in Hochdonn, the high-level bridge in Rendsburg was constructed between 1911 and 1913 and today is the city's landmark. With a length of 2,486 metres and a mass of 17,700 tonnes, this giant bridge installation for the mainline from Hamburg via Neumünster to Flensburg was the largest and, technologically, the most spectacular steel structure.

In the construction of the bridge, the engineers used a trick that had never previously been used in flat country for such differences in height. A self-intersecting 4.5 kilometres long loop was constructed on the then undeveloped land between the canal and the Eider, making it possible to reconnect Rendsburg station, which is only about 1,000 metres from the canal bank, despite the bridge crossing the canal with a clear height above the waterline of 42 metres.

The high-level bridge at Rendsburg has become especially noted for the transporter bridge suspended below the central girder.

It is one of the last eight structures of this type in the world and has been in operation since 1913, carrying road vehicles, cyclists and passengers. In 2016, the transporter bridge was irreparably damaged in a collision with a ship.

Also because of the uniqueness of the transporter bridge, the Federal Government decided to reconstruct it with the same appearance. Since the beginning of 2022, the new transporter bridge has been in operation again.

## Bridge data

Clearance of all bridges: 42 m

| Type of bridge | Road link | Length | Con-struct-ed | Responsible authority |
|---|---|---|---|---|
| Brunsbüttel high-level road bridge | B 5 | 2,830 m | 1979/83 | Federation (LBV.SH) |
| Hochdonn high-level railway bridge | – | 2,218 m | 1913/20 | Federation (WSV) |
| Hohenhörn high-level motorway bridge | A 23 | 391 m | 1985/89 | Federation (Autobahn GmbH) |
| Grünental high-level rail/ road bridge | L 316 | 405 m | 1984/86 | Federation (WSV) |
| Rendsburg high-level railway bridge | – | 2,486 m | 1911/13 | Federation (WSV) |
| Rade high-level motorway bridge | A 7 | 1,498 m | 1969/72 | Federation (Autobahn GmbH) |
| 1st Levensau high-level rail/ road bridge | K 27 | 180 m | 1893/94 | Federation (WSV) |
| 2nd Levensau high-level road bridge | B 76 | 365 m | 1980/83 | Federation (LBV.SH) |
| 1st Holtenau high-level road bridge | B 503 | 518 m | 1992/96 | Federation (LBV.SH) |
| 2nd Holtenau high-level road bridge | B 503 | 518 m | 1969/72 | Federation (LBV.SH) |

from top to bottom:
Rendsburg railway bridge at night
Levensau high-level rail/road bridge
Hochdonn railway bridge with Arlau hybrid ferry


GETREIDE AG

# Ferries and tunnels – connecting canal banks and municipalities

Rendsburg transporter bridge

## Ferries

14 ferries cross the Kiel Canal. In all places where roads or municipalities were partly severed as a result of the construction of the Kiel Canal, these ferries link the two banks. Use of the ferries is free of charge. Because of the high volume of traffic, two ferries are in operation at Brunsbüttel and Nobiskrug near Rendsburg. A passenger ferry shuttles between the Kiel districts of Holtenau and Wik. The skippers of the ferries must be in possession of a certificate of competency for navigation. A deck hand assists them in loading and unloading the ferry.

The ferries on the Kiel Canal have a standard deadweight capacity of 45 tonnes and can carry up to eight cars or one loaded heavy goods vehicle per trip. The payload of the ferries operating regularly at Brunsbüttel is 100 tonnes. They can carry over 20 passenger cars at the same time. Due to their age, these ferries are being replaced by a new generation of craft. Replacement will be completed over the next few years. The new ferries are low-emission craft; the low level of emissions is achieved by using electric powertrains (hybrid power system). The first three new hybrid ferries have been in service since 2021.

The transporter bridge below the high-level railway bridge at Rendsburg, which is six metres above the water level, offers what is arguably the most unusual crossing of the canal. It is electrically powered and carries pedestrians, cyclists and up to four vehicles not exceeding 3.5 tonnes in weight. The staff operating the transporter bridge does not require a certificate but must have knowledge of radar and VHF marine radio.

Rendsburg pedestrian tunnel

## Tunnels

Two tunnels cross below the Kiel Canal at Rendsburg. Motorized road users pass through the tunnel that forms part of the B 77 and was completed in 1961 to replace the swing bridge. This tunnel comprises two 640 m long bores, each with two lanes. Frost and de-icing salt had damaged the 50-year-old structure so badly that it was in need of restoration to strengthen it for the decades ahead. Alongside the installation of a cathodic corrosion protection system for the concrete, the outdated technical installations and fire safety equipment were brought up to the state of the art. Because the tunnel is of outstanding importance not only for the city and region of Rendsburg but also for the entire road network in central Schleswig-Holstein, the road had to remain open to traffic while the works were being carried out.

At the Rendsburg pedestrian tunnel, which was completed in 1965, two escalators and one elevator on each side lead down to a depth of around 21 meters below the canal water level. The approximately 56-metre-long escalators leading down to the circular 130-metre-long tunnel bore were the longest escalators in Western Europe at the time of their installation in 1965. Models at the new control centre on the Rendsburg side of the tunnel provide information about the two tunnel structures.

## Ferry and tunnel data

| Ferry crossing | Ferry operating hours | Heaviest single vehicle |
|---|---|---|
| Brunsbüttel | 00:00–24:00 | 38 t |
| 2nd ferry: | | |
| Apr.–Oct. | 05:00–23:00 | |
| Nov.–Mar. | 05:00–22:00 | |
| Ostermoor | 00:00–24:00 | 38 t |
| Kudensee | 00:00–24:00 | 38 t |
| Burg | 00:00–24:00 | 38 t |
| Hochdonn | 00:00–24:00 | 38 t |
| Hohenhörn | 00:00–24:00 | 38 t |
| Fischerhütte | 06:00–22:00 | 38 t |
| Oldenbüttel | 00:00–24:00 | 38 t |
| Breiholz | 00:00–24:00 | 38 t |
| Rendsburg transporter bridge | | 3.5 t |
| Apr.–Sept. | 05:00–23:00 | |
| Oct.–Mar. | 05:00–22:00 | |
| Nobiskrug | 00:00–24:00 | 38 t |
| 2nd ferry: | | |
| Mon.– Sat. | 06:00–20:00 | |
| Sun. and holidays | 13:00–20:00 | |
| Sehestedt | 00:00–24:00 | 38 t |
| Landwehr | 00:00–24:00 | 38 t |

Holtenau-Wik (passengers only)
Mon.–Fri. 06:30–22:00
Sat.–Sun. and holidays 09:30–22:00

Rendsburg road tunnel:
- Overall length: 1,278 m
- Enclosed tunnel section: 640 m
- Two bores, each with two lanes and a width of 6.80 m
- Lowest point: upper edge of tunnel: 14.55 m below standard elevation zero
- Upper edge of carriageway: 20.15 m below standard elevation zero

Rendsburg pedestrian tunnel:
- One bore with a length of 130 m
- Inner diameter: 4.5 m
- In the canal axis: upper edge of tunnel: 17.88 m below standard elevation zero
- Upper edge of footway: 21.47 m below standard elevation zero

Hybrid ferry of the Federal Waterways and Shipping Administration

# Safety of installations and operation – for a complex system

Replacement of a sliding gate at the Brunsbüttel lock

To ensure the safety and efficiency of vessel traffic around the clock, the Kiel Canal and its physical structures have to be maintained continuously. The condition of the structures, installations and aids to navigation is regularly monitored and documented to ensure a high level of maritime and operational safety.

The reliable operation of the lock installations in Brunsbüttel and Kiel, for example, is particularly important for shipping. Therefore, they have to be maintained regularly. Moreover, they are part of the federal state of Schleswig-Holstein's flood protection, which must be guaranteed at all times.

## Water depths

Knowledge of the water depths both of the Kiel Canal and the lock approaches of the Elbe and the Kiel Fjord is of vital importance for the safety of shipping. For this reason, the Kiel Canal's sounding vessels regular survey the bottom and underwater slopes so that sufficient water depths can be guaranteed.

In the area around the Brunsbüttel locks, sediment from the Elbe is carried in continuously. Therefore, an excavator is permanently working to remove shoals, especially in both lock approaches, but also in the locks themselves. The sediment input is returned to the Elbe.

Also in the other parts of the Kiel Canal, shoals have to be removed by dredging at intervals of several years. The material excavated here is relocated to especially deep areas within the canal. The tools used to remove shoals are mainly water injection equipment and hopper dredgers.

Hopper dredger

The Orka sounding vessel

# Investment into the future

To make the Kiel Canal fit for the future, the Federal Government will invest more than 2.6 billion euros in the capacity of this waterway over the period to 2030 and beyond.

## Three upgrade projects in the Federal Transport Infrastructure Plan

The upgrading of the eastern section of the Kiel Canal is already listed as an ongoing project in the Federal Transport Infrastructure Plan. The eastern section of the Kiel Canal between Königsförde siding and Kiel, which is approx. 18 kilometres long and was last upgraded in 1914, today is a bottleneck for shipping. This section is currently being upgraded to achieve a minimum bottom width of 70 metres, and sharp curves are widened. The upgrading of the eastern section will allow today's largest ships (length = 253 metres, width = 32.5 metres, draught = 7.0 metres) to have higher laden draughts, and by providing more passing points, transit times will be reduced. This will result in significant improvements in cargo transport costs and times and will benefit mainly the German seaports with their great share of Baltic Sea trade.

The realignment of the Saatsee Curve has been included in the Federal Transport Infrastructure Plan as a first priority project. After completion of the eastern section, this curve near Rendsburg will be the last remaining bottleneck because of its tight radius.

Another first priority project is the deepening of the Kiel Canal by one metre over its entire length with the goal of removing bottlenecks. The project has also been included in the Preparation Act for obtaining planning permission by acts to adopt measures in the field of transport (Preparation Act for Acts to Adopt Measures – MgvG).

With this decision, the long-term trend towards larger ships was taken into account. In the future, the shipping industry will be able to use the Kiel Canal with higher laden draughts, which will increase transport capacity. This project will only be implemented after the upgrading of the eastern section and the realignment of the Saatsee Curve.

## Investment in replacement infrastructure

In the area of the eastern section, the Levensau combined rail/road bridge, which, at over 125 years old, is the oldest bridge over the Kiel Canal, will be replaced by a new one. The bridge has almost reached the end of its useful life. In addition, the horizontal clearance under the arch bridge has become insufficient for the ever larger ships and has made it a bottleneck of the Kiel Canal.

Construction of the fifth lock chamber at Brunsbüttel

To ensure the reliable availability of the Kiel Canal, investment in replacement infrastructure is required at the Brunsbüttel and Kiel locks. In Brunsbüttel, the two large lock chambers are in urgent need of repair. For this purpose, an additional large lock chamber that is to serve as a kind of bypass will be constructed beforehand so that two large chambers will continue to be available, permitting unrestricted shipping while the existing large lock chambers will have to be closed, one at a time, for refurbishment for several years.

In Kiel, the existing Small Lock had to be taken out of service in 2014 due to considerable structural damage and the resulting risks to users. Therefore, the two small lock chambers will have to be replaced. Unlike in Brunsbüttel, it will not be necessary to construct a fifth lock chamber in Kiel, because here one large and two small lock chambers will be sufficient for shipping traffic for a temporary period. One reason for this is the slightly lower need for locking operations in Kiel, as some ships only call at ports on the Kiel Canal via Brunsbüttel. Another reason is that due to the lower water level differences between the canal and the Baltic Sea, faster locking times can be achieved here compared to the tidal North Sea and the Elbe.

After the construction of a replacement structure for the Small Lock, the consecutive repair of the two large lock chambers can begin.

Since the locks are also an element of Schleswig-Holstein's flood protection, the latest findings on the sea level rise and the higher water levels to be expected as a result will be taken into account in the construction of replacement structures and the repair work, and the structures will be designed accordingly.

Other major investment measures will include, for example, the construction of a new gate repair dock in Brunsbüttel for the regular maintenance and repair of all sliding gates used in the large lock chambers on the Kiel Canal or the complete renewal of the anti-corrosive coating plus repair of the steel structure of the high-level railway bridge in Hochdonn.

In addition to the investment in these major measures, the Federal Government is spending an average of 30 million euros per year for keeping the structures on the Kiel Canal operational. More detailed information on these investment measures can be found on the Internet at:
www.wna-nord-ostsee-kanal.wsv.de and
www.kuestendaten.de/NOK (both in German only).


MAERSK

# Committed to the environment

Although the Kiel Canal is a civil engineering structure, it constitutes an important element in the ecosystem. Thanks to its biotope structures, which have evolved over decades, it offers a wide range of different habitats for native fauna and flora.

The Kiel Canal is home to many different species of fish. The most well-known are herrings, eels, pike-perch, roach, bream, carp and flounder. Alongside the suspended solids and oxygen content, the salt content of the water is a key parameter for the resident fish communities. The Kiel Canal also constitutes an important channel for migratory fish species such as maraena whitefish, sea trout and river and sea lampreys.

In addition to the canal bottom and the body of water, the embankments, in particular the stones used to protect them, also have a special importance as a habitat. This hard, man-made substrate with its system of gaps is densely populated, for instance by invertebrates such as mysids and polychaetes, which in turn form the staple diet of the fish.

On both banks of the canal, a continuous 100 kilometres long belt has evolved comprising a diverse range of semi-natural and natural habitats such as grasslands, woody strips, tuffaceous limestone sources or drylands, so that the Kiel Canal is part of the integrated system of protected areas and biotopes in Schleswig-Holstein.

The areas of the canal embankments that are exposed to the sun and richly structured are especially important for reptiles, among other things.

Thus, for instance, there is an incidence of common vipers that is significant on a state-wide basis. In the immediate vicinity of the canal, there are also important foraging habitats for bats, which are among the species protected by European law, such as the common noctule and the common pipistrelle. The abutments of the old high-level bridge at Levensau constitute a winter roosting site that is of Europe-wide importance because they provide ideal hibernation opportunities for the bats. Therefore, the southern abutment will be preserved on a permanent basis after construction of the replacement bridge.

Along the Kiel Canal, there is also a series of spoil fields onto which the dredged material has been, or still is, pumped and deposited. Valuable biotopes have developed in those places. Some of the old spoil fields have even been designated as protected areas. The characteristic feature of the spoil field complexes is a small-scale diversity of specific habitats such as dry grassland, fenland, forest and shrubland biotopes and small bodies of water. One example that deserves mention is the incidence of orchids at the now disused Reichswald spoil field near Rendsburg with five different species of the orchis genus.

Whenever upgrade schemes or routine maintenance work are carried out, the aspects of nature conservation and water resource management have to be taken into account. Thus, for instance, when the copses are pruned back as part of maintenance activities, care is taken to avoid the breeding seasons of birds. In the individual plan approval procedures for the upgrade schemes, the ecological encroachments have to be identified and appropriately compensated for. Prior to every procedure, there is close cooperation with the respective specialist environmental authorities to identify and take into account the range of species protected under national and European law.

Common noctule, photo: Florian Gloza-Rausch

Indigenous orchid/orchis, photo: Helga Panknin

# Living, working and active recreation on the Kiel Canal

## The recreational value of the Kiel Canal

With its lively international shipping traffic, the Kiel Canal is a very attractive destination. As an amenity area, it is just as popular among tourists as among the residents of Schleswig-Holstein. Because of their quiet and scenic location, the residential areas around the Kiel Canal are highly sought after, too.

Working on the Kiel Canal

Therefore, the almost 100 kilometres long canal is not only an important transit route for international shipping. It is also considered a symbol of the 'land between the seas', as the federal state of Schleswig-Holstein is called.

There is a wide range of sporting and leisure facilities along the Kiel Canal. The banks of the canal are ideal places for resting, fishing, hiking and cycling. The long-distance cycle route along the Kiel Canal is divided into different sections. These individual sections vary in terms of distance and difficulty and all have their own individual highlights. Thousands of locals, guests and amateur photographers follow the passages of the cruise ships, container ships, sailing ships and yachts. Every year, up to 15,000 pleasure craft use the opportunity to switch between the attractive cruising grounds of the North Sea and the Baltic Sea.

The Kiel Canal also safeguards several thousand jobs in the region. These include pilots, canal steerspersons and employees of the Federal Waterways and Shipping Administration but also persons working for shipbroking agencies, ferry crews, shipyards, craft enterprises, ship chandlers, tourism agencies, restaurants and hotels. In the rural regions along the Kiel Canal, it is principally tourism that contributes to the development of the regional economy and thus to the safeguarding of many jobs.

The employees of the Federal Waterways and Shipping Administration not only ensure the smooth operation and maintenance of the Kiel Canal. They also provide help and advice to residents and tourists as well as to sailboaters and motor boat operators. The Federal Waterways and Shipping Administration is committed to the harmonious co-existence of culture and nature and is involved in festivals and sporting events around the Kiel Canal.

Recreation on the Kiel Canal

In Schleswig-Holstein, the maritime industry is an important economic factor, not only along the Kiel Canal. Throughout Schleswig-Holstein, thousands of companies are directly or indirectly involved in the production of maritime products and the provision of associated services. Schleswig-Holstein's ports handle around 40 million gross tonnes of goods and many millions of passengers per year. Schleswig-Holstein also provides numerous home ports for a large fleet of pleasure craft and fishing cutters.

**Federal Waterways and Shipping Agency**

Am Propsthof 51
53121 Bonn
gdws@wsv.bund.de
www.wsv.de

**To order more copies, contact:**
info@wsv.bund.de

**As at:** September 2022

**Set and printed by:**
Federal Maritime and Hydrographic Agency (BSH)