Rijkswaterstaat
*Ministry of Infrastructure and Water Management*

# Annual Report Rijkswaterstaat 2018

Coverphoto:
*Sand banks along the Houtribdijk*

# Annual Report Rijkswaterstaat 2018

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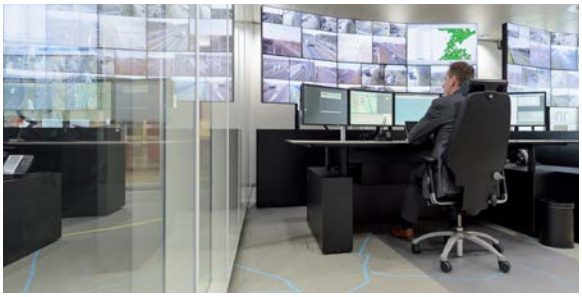






## Foreword

# ‘Working together to keep the Netherlands safe, liveable and accessible’

Climate change, the energy transition, our growing use of data, increasing mobility and out-of-date infrastructure. In these buoyant times it is becoming an increasingly complex challenge to keep the Netherlands safe, liveable and accessible.

In the decades to come we will face a major challenge. We must be fully prepared. We will need smart, new, sustainable solutions. And close cooperation with the general public, the private sector and our civil society partners will be key.

Rijkswaterstaat did some excellent work in 2018. Take the way in which we dealt with the drought, for example. Working with the water authorities and our other partners, we managed to keep fresh water supplies as stable as possible. Through clever operation of our water system.

In working on a sustainable living environment, we also engage with local residents. The A9 Gaasperdammerweg project is an excellent example of area development. On top of the 3 kilometre-long motorway tunnel we are building, we plan to construct a park, designed with input from local residents. Work on the park will be carried out in 2020.

Sustainability is increasingly essential in our work. At Kampen we have built the first reusable viaduct in the Netherlands. And along the A50 at Uden, we are installing an innovative noise barrier that generates solar energy. These are steps towards working on a fully circular basis, our goal for 2030.

With the economy growing, the roads were busier once again in 2018. To keep the Netherlands safely on the move, we are holding trials with smart technologies and modern data services. In 2018 we carried out trials with truck platooning in which a total of 250 heavy goods vehicles took part. Each vehicle is equipped with a smart system that automatically adjusts its speed to the speed of the vehicle in front. That improves traffic circulation, reduces fuel consumption and leads to fewer $CO_2$ emissions.

More goods transport by inland waterway also leads to less congestion on the road network. A modern inland waterway vessel can carry as much cargo as hundreds of goods vehicles. With the new lock at Limmel, the largest category of goods vessels can now make good headway. And in January 2019 Princess Beatrix opened the new, larger chamber in the Princess Beatrix Lock.

Rejuvenation, renewal and sustainability were the key words in 2018. From now to 2028 we will be conducting more than 80 projects to renovate or replace out-of-date infrastructure. And in the process, we will ensure it is more sustainable, and install the technology needed for smart mobility and smart water management.

Innovation, sustainability and cooperation. Step by step, Rijkswaterstaat continues to develop and to prepare for the challenges of the future, engaging with members of the public, civil society partners, the private sector and knowledge institutions. This is a source of inspiration and pride for me.

This annual report presents a fascinating view of Rijkswaterstaat's vital, exciting and many-faceted work. It shows how 9,000 committed staff members work closely together every day to keep the Netherlands dry, sustainable and on the move.

Enjoy your read!

Michèle Blom,
director-general, Rijkswaterstaat

# 1 2018 at a glance

Everyone in the Netherlands wants to live and work in safety behind the dikes and dunes. We want to travel safely and quickly to our destinations. And we want a constant supply of clean water in a country where the quality of the living environment is high. In 2018, too, Rijkswaterstaat's 9,000 staff members worked hard to achieve these objectives.

Working to ensure that the Netherlands is safe, liveable and accessible: that is Rijkswaterstaat's mission. Much of our country is below sea level. We make it safe by protecting it from flooding. We make it liveable for people and wildlife by carefully designing infrastructure to harmonise with the landscape. And we lay the basis for freedom of movement and prosperity by working on accessibility. To carry out these tasks, Rijkswaterstaat had a budget of around 4.7 billion euros in 2018.

**Unpredictable weather and water events**

2018 was an unpredictable year for weather and water events. In early January, river discharges were extremely high. In the same month, water levels on the coast were so high that we had to close five storm surge barriers. Yet less than six months later, water levels inland dropped to a record low. We had the hottest summer in 300 years, with the driest spell on record since the bumper summer of 1976. But Rijkswaterstaat and the water authorities managed to keep water supplies well under control – through close cooperation and smart operation of the water system.

According to the Royal Netherlands Meteorological Institute (KNMI), extreme weather events are likely to occur three to

*The coast at Scheveningen*

four times more frequently in the future than at present. This is due to climate change. Sea level will also rise faster than we think. The latest version of the Delta Programme published on the opening of parliament in 2018 contained an annexe describing the various scenarios we need to prepare for. Increasingly, we will need to look at water issues – flood safety, flooding, drought, low water levels and water quality – in relationship to each other. This means that water management parties will need to work together to seek a balance between discharging and retaining water.

### High water protection

The Delta Programme encompasses a whole new flood defence policy. The aim is not only to reduce the risk of flooding, but also to mitigate the possible impact of a water event. Up to 2050, the water authorities and Rijkswaterstaat will work together to ensure that dikes, dunes and storm surge barriers meet new, more exacting standards. Between now and 2023, we will be upgrading more than 922 kilometres of water defences and 470 locks and pumping stations. Apart from these tangible measures, Rijkswaterstaat and the water authorities are also looking for smart, new sustainable ways of ensuring that the Netherlands is both, water resilient and climate proof.

### Water quality

Rijkswaterstaat is working to achieve a good chemical and ecological status for Dutch surface waters. They need to meet the targets set out in the EU Water Framework Directive by 2027 at the latest. In 2018 we took several steps towards improving the quality of our surface waters, and worked on more wetland nature areas and better wildlife habitats. Setting the Haringvliet sluices ajar and the construction of the Marker Wadden were good examples.

### Accessibility by road

The economic upswing means that traffic volumes are growing. People are travelling longer distances more often, and there are more goods vehicles on the road. A study conducted by the Mobility Policy Expertise Centre in 2018 showed that congestion on the roads is likely to increase even further in the next five years. But the capacity of the road network is not growing fast enough to keep pace. So we'll probably be held up in even longer traffic jams for the next five

*Water management parties work together to seek a balance between discharging and retaining water*

# Rijkswaterstaat mission

Rijkswaterstaat is the executive organisation that sustainably develops and manages the national infrastructure networks on behalf of the minister of and state secretary for Infrastructure and Water Management.

**Rijkswaterstaat works on**

- sustainable living environment
- protection against flooding
- sufficient clean water
- smooth and safe transport by road and water
- reliable and useful information

**Social roles**

Rijkswaterstaat manages and develops 3 main infrastructure networks in the Netherlands:

- the main road network
- the main waterway network
- the main water system

years. Each percentage of economic growth leads to a 9 per cent increase in traffic jams. The Mobility Policy Expertise Centre points out that motorists can expect travel times to increase by more than a third between now and 2023.

### Road construction projects

To tackle bottlenecks in the road network, Rijkswaterstaat constructed 178 kilometres of additional motorway lanes in 2018. Another 1,100 kilometres of additional motorway lanes are planned between now and 2032. But we're not only widening busy roads. We're also improving the links between roads and converting rush-hour lanes into permanent lanes. In the next ten years, we'll be investing in new sections of road – the A24 and the Blankenberg Tunnel near Vlaardingen, and the link between the A15 and A12 near Arnhem and Nijmegen are major projects, just like the link between the A13 and A16 near Rotterdam and work on the Hoevelaken intersection. We will also be working on the Utrecht ring road and will be widening the A10 South near Amsterdam as part of the Zuidasdok project.

### Smart mobility

Smart technologies to ensure safe, smooth traffic circulation are developing fast. Rijkswaterstaat is now engaged in a whole series of trials with new traffic management technologies, intelligent transport systems and smart traffic information. These new technologies present us with fresh opportunities for better use of our roads and waterways and improving services for road users and reduce carbon emissions.

To achieve the ambitions set out in the coalition agreement, Rijkswaterstaat changed course in 2018. Until then we had been focusing on testing and experimenting with smart mobility. Now the focus is on widespread practical application, with direct impact.

In October 2018 we carried out a practical trial with 250 goods vehicles equipped with smart systems. This led to a visible and measurable improvement in traffic circulation, with a 6 to 14 per cent reduction in fuel use and – as a result – a reduction in carbon emissions.

### Congestion plan for 2020

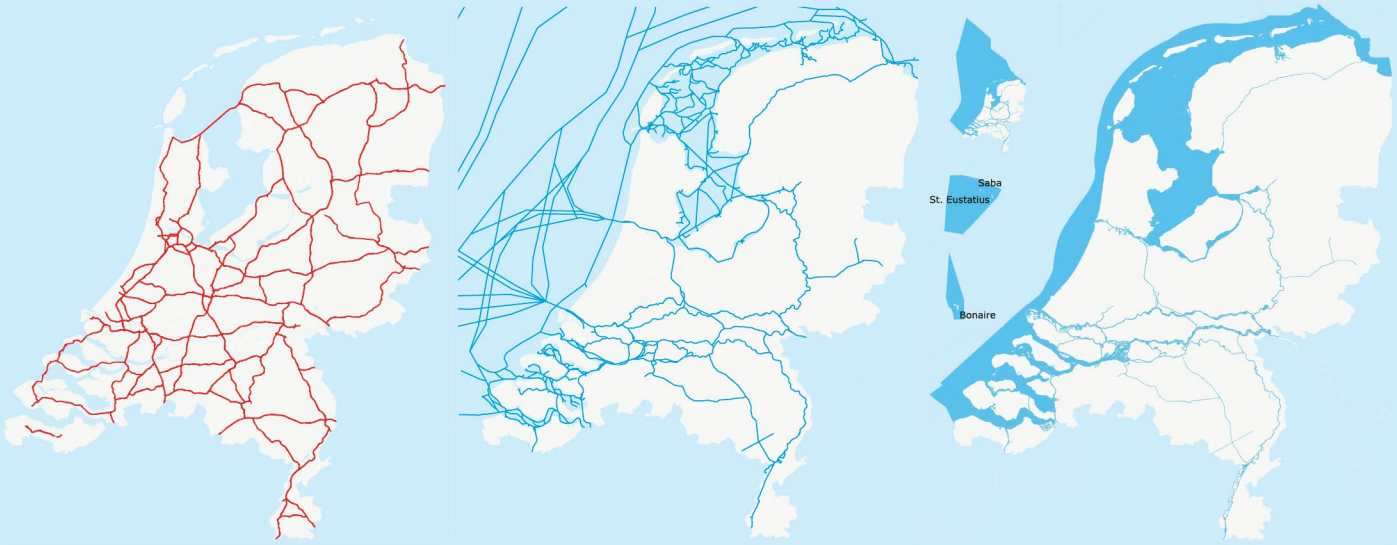
Rijkswaterstaat is also working on smart, short-term solutions to prevent traffic jams. Under the Congestion Plan for 2020 banner, we're exploring new solutions for the 34 most urgent hot spots. For example, in the aftermath of incidents we're ensuring heavy goods vehicles are salvaged more quickly, we're deploying road inspectors at congestion-prone locations and opening rush-hour lanes earlier in the day. By providing road users with better traffic information, we help them make smarter choices on the route they take, ensuring more reliable journey times. The government has earmarked 100 million euros for these short-term measures.

### Main waterway network

Transport by water is a good way of relieving congestion on the roads and railways. It is more environmentally friendly and contributes to our transport economy. Rijkswaterstaat is therefore working on the quality of the main waterway network. Many of the main waterways have been given a facelift, and been widened and deepened in recent years. Locks have been enlarged and bridges reinforced and given greater clearances. Rijkswaterstaat continued with this work in 2018. We constructed the sea lock at Terneuzen, work on which was started in 2017, and completed work on the Eefde Lock. In January 2019 the third chamber in the Princes Beatrix Lock in the Lek Canal came into service, allowing ships to pass the lock much faster. We are now working on a new sea lock at IJmuiden. It will be the biggest in the world.

In its role as waterway traffic manager, Rijkswaterstaat wants to ensure safe, uninterrupted journeys on shipping routes far into Europe. Traffic controllers in the traffic control centres are using an increasing array of new technologies to ensure smooth operation of locks and bridges and to provide vessels with useful traffic information. To give the shipping sector an extra incentive to innovate, we are encouraging smart shipping. In 2018, working with ministry colleagues and the Human Environment and Transport Inspectorate, we opened a desk where companies can register trials with

## The Rijkswaterstaat networks




**Main road network**
- 3,100 km of motorways
- 1,723 km of access, exit and connecting roads
- 2,920 viaducts
- 54 wildlife crossings
- 27 tunnels
- 17 aqueducts
- 798 bridges

**Main waterway network**
- 3,437 km of inland waterways
- 3,646 km of waterways in open waters
- 91 locks
- 128 lock chambers
- 333 bridges

**Main water system**
- 90,192 km² of surface water
- 45 km of dunes
- 154 km of dikes and dams
- 10 major dams
- 6 storm surge barriers
- Afsluitdijk and Houtribdijk

Source: NIS

computer-driven, autonomous vessels. Together, we organise pilot projects on the waterways.

### Facelift for infrastructure

To keep the Netherlands safe and on the move, we need to work from the basis and ensure a robust infrastructure. Technical failure or malfunction leads to inconvenience, traffic jams, unsafe situations and economic losses, and must of course be prevented. But many bridges and tunnels date from the 1950s and 1960s and are now approaching the end of their lifespan. To give our infrastructure the thorough facelift it needs, Rijkswaterstaat will be carrying out at least 80 projects between now and 2028.

In 2018 we worked hard on the preparations for this major maintenance operation. Our strategy is to minimise inconvenience through clever planning, and at the same time cooperate more closely with the private sector and promote innovation. We plan to use these projects to future-proof our infrastructure, and to put the technology in place to enable smart mobility and smart traffic management systems.

### Sustainability and quality of life

By working on roads, water and flood defences in every region in the Netherlands, we are making our living environment more attractive, with more areas of natural beauty and more opportunities for leisure pursuits. And in other ways, too, Rijkswaterstaat is working to make the Netherlands more sustainable. We want our infrastructure networks to be energy self-sufficient by 2030. And in the same year we want to be working on a fully circular basis. Of course, we won't go it alone. We work closely together with members of the public, interest groups and our partners in government, the market and the knowledge sector. In 2018, for example, we carried out an increasing number of sustainability projects for other government authorities.

### Sustainable energy pilot programme

At the request of the Ministry of Economic Affairs and Climate Policy, Rijkswaterstaat, the Central Government Real Estate Agency and the Netherlands Enterprise Agency (RVO.nl) are launching a pilot programme for the generation of sustainable energy. In the next four or five years, we will investigate how central government can give the market access to its domains for large-scale generation of solar energy, on both land and water. Opportunities for wind farms and other sources of renewable energy may follow in the future.

*Our infrastructure networks must be energy self-sufficient by 2030*

# 2 Sustainable living environment

Rijkswaterstaat wants the Netherlands to be a clean, green, pleasant place to live for future generations too. That's why we work with other parties on sustainable accessibility and sustainable water management. We carefully design roads, waterways and flood defences to harmonise with the landscape and living environment, and we use sustainable materials and energy. Our aim is to achieve full circularity by 2030.

## Sustainable area development

**Rijkswaterstaat likes to engage with spatial planning initiatives that give careful consideration to both the living environment and wildlife habitats. We call this sustainable area development.**

### Area-based approach

Residents, users and companies each have their own interests and needs when it comes to their living and working environments. And these exist long before new plans are made to construct or renovate a road, bridge or tunnel, for instance. So Rijkswaterstaat takes part in the public consultations on spatial planning projects at the earliest possible stage. Our aim is to gain a comprehensive view of the various interests at stake to determine whether a bridge or tunnel is the best solution, or whether there are better alternatives. The ultimate goal is to work together to create a safe, accessible living environment in which it is pleasant to live, work and enjoy leisure time.

*The solar highway near Uden (A50)*

### Room for water and nature

The Room for the River Programme is an excellent example of an area-based approach. Under this programme, which was launched in 2007, Rijkswaterstaat has been working to improve flood safety in the river basin by giving the river more room. We have also created many new areas of natural beauty and opportunities for leisure pursuits. In the Noordwaard and Overdiepse Polder we have even built houses and farms on artificial mounds so that local residents could continue to live and work in these flood-prone areas.

The Marker Wadden project is also a good example of how we are developing wetland nature reserves. Since 2016, Rijkswaterstaat has been constructing islands in the Markermeer to provide a healthy habitat for birds, fish and aquatic plants. Find out more about the Marker Wadden in chapter 4 - Integrated water management.

### Sustainable roads

Sustainable spatial planning calls for roads that are designed to harmonise with the landscape. For this reason, Rijkswaterstaat constructs some sections of road below ground level. In urban areas, we build tunnels. A good example is the A2 motorway tunnel in Maastricht, which Rijkswaterstaat built between 2011 and 2016. Through-traffic no longer pollutes the city's air. Districts that for years were separated by the A2 have now been linked together again. A tree-lined avenue has been constructed on top of the 2.3 kilometre-long tunnel for pedestrians and cyclists, flanked by access roads for local traffic. The avenue was officially opened by King Willem-Alexander in 2018. New houses and apartments are now being built there. They should be completed by 2026.

*A9 Gaasperdammerweg tunnel*

The A9 Gaasperdammerweg project is a similar example of sustainable urban development. Rijkswaterstaat is working on a 3 kilometre-long tunnel, with a park on top. This park will link the various districts of Southeast Amsterdam.

### Fast cycle routes

Cycling is a healthy, sustainable alternative to car travel. So it is hardly surprising that cycling is becoming an increasingly important element of the Netherlands'

*Roads that are designed to harmonise with the landscape*

**Aim:**

200,000
commuters switching
from car to bike

mobility strategy. The aim of the third Rutte government is to persuade 200,000 commuters to switch from car to bike for their journey to work, and, by the end of its term in office, for everyone in the Netherlands altogether to cycle a total of 3 billion kilometres more than in 2018. For this reason, Rijkswaterstaat is increasingly investing in the construction of cycle paths.

Rijkswaterstaat now manage 400 kilometres of cycle path, and that could easily become far more. Along the canals, for example, there is often enough room to construct regional fast cycle paths. The green areas along the Amsterdam-Rhine Canal, for example, could be used for a fast cycle route from Utrecht to Amsterdam. This route will be developed in the next few years. Rijkswaterstaat is working on this project with the local authorities, NS (Dutch Railways), ProRail, the private sector and the provincial authorities.

*The reusable viaduct near Kampen*

## Circular economy

**Rijkswaterstaat is committed to the principles of the circular economy. Our aim is to work on a fully circular basis by 2030. That means working without producing waste. The challenge is to make all the material from our infrastructure part of the sustainable cycle and to reuse it.**

Central government agencies want to cut their use of primary resources by at least 50 per cent by 2030. As the country's major client for civil and hydraulic engineering projects, Rijkswaterstaat can make the difference. We encourage our contractors to work with sustainable materials and to cooperate with us in developing sustainable new working methods. To promote innovation, Rijkswaterstaat frequently applies these sustainable new methods in its own work.

### Sustainable asphalt

Increasingly, Rijkswaterstaat is using sustainable asphalt. It is produced at a relatively low temperature and emits 25 per cent less $CO_2$ than traditional asphalt. And it comprises around 60 per cent recycled material. On an increasing number of roads, the lifespan of existing asphalt is being extended using an asphalt rejuvenator. These roads need to be resurfaced less often, which radically cuts the costs of maintenance and reduces the impact on the environment.

### Reusable viaduct

In 2018 Rijkswaterstaat constructed the Netherlands' first reusable viaduct. Located near Kampen, the viaduct provides access for vehicles to the Reeve Lock construction site, part of the IJsseldelta Room for the River project. The viaduct, which is made up of 40 concrete elements, can be fully disassembled, moved to another location and rebuilt. No new raw materials are needed. Traditionally built viaducts are ready for demolition after 30 to 50 years, but the reusable viaduct has a lifespan of 200 years, which is around six times as long. Rijkswaterstaat is monitoring the viaduct carefully, so that the design can be developed further. We will share the knowledge we

gain with other parties in the construction sector, so that they can also build similar, reusable viaducts.

### Trials with sludge

There is too much sludge in the water in the Eems-Dollard nature reserve in the north of the Netherlands. The water is muddy and is thus an inconvenience to shipping too. Rijkswaterstaat wants to remove the excess sludge from the River Eems and put it to good use. We are now carrying out trials along the Eems and in the Dollard bay. We deposited sludge from the river in a nearby field where it is gradually turning into clay. In the autumn of 2018 we carried out studies to see which processing method produces the best clay, for example for dike reinforcement. We are also making building blocks from the sludge and are now investigating whether we can use them in noise barriers along national roads, or for the banks of the Lemmer-Delfzijl waterway.

### Sustainable lighting column protectors

Lighting columns are sometimes damaged due to collisions or maintenance work. Rijkswaterstaat has now installed protectors on lighting columns in the province of South Holland. These are made from a material based on potato or corn starch. It has similar properties to PVC, but no oil is used in its production. And it is fully recyclable. We filled the gap between the protector and the column with soil and nectar-producing plants, since the area is popular with bees. In this way, we not only prevent damage to the lighting colums, but also save costs, contribute to the circular economy and promote biodiversity.

### Greener noise barriers

In 2018 the noise barrier along the A15 near Tiel was integrated into the landscape of the Betuwe region using an unusual method. We planted climbing plants on either side of the barrier and then installed stainless steel frames with netting to support the plants as they grow. The concrete panels, which were defaced with graffiti, are no longer visible. This was an immediate improvement. In the course of 2018 we monitored the barrier to see whether it was developing into the three-dimensional green structure we had in mind. And we measured the impact on local biodiversity. With the knowledge we have gained, Rijkswaterstaat plans to continue working on biodiversity and the greening of noise barriers.

### Plastic soup

Plastic often ends up as waste in the world's oceans and seas. In some places, it piles up, forming plastic soup. Boyan Slat's 'The Ocean Cleanup', a Dutch startup, has developed a solution. Long barriers that float on the water harvest the plastic, so that it can easily be removed and recycled. Rijkswaterstaat facilitated the first trials with this structure both financially and by providing a test site on the North Sea where its stability, robustness and effectiveness could be tested. The trials were completed in mid-2018, and the system is now being tested at a site in the Pacific Ocean.

## Energy and climate

**Rijkswaterstaat wants to work on an energy-neutral basis, using energy from renewable sources. We are also encouraging and facilitating companies to generate energy in the land and water areas we manage.**

Rijkswaterstaat is working in four different ways to achieve climate and energy neutrality. First, we procure energy from renewable sources, like green electricity and biodiesel. And we are planning to switch from fossil fuels to sustainable energy. We also do all we can to save energy and we generate sustainable energy in the areas we manage.

### Hydroelectric, solar and wind energy

Rijkswaterstaat is committed to enabling the Ministry of Infrastructure and Water Management to achieve its goal of operating on a fully climate-neutral basis by 2030. We want to reduce $CO_2$ emissions resulting from our electricity and fuel consumption, our procurements and our contracts to zero by generating energy ourselves. Rijkswaterstaat manages large areas of land and water where this is possible – for example, road verges, motorway intersections, noise barriers, sludge depots and areas flanking canals.

*Fast cycle route along the Amsterdam-Rhine Canal, between Breukelen and Utrecht*

*We want to reduce our $CO_2$ emissions by generating energy ourselves*

*The energy self-sufficient Ramspol Bridge*

*In 2018 we worked on the first energy self-sufficient motorway in the Netherlands*

We are already enabling wind turbines to be installed on the areas of land and water we manage – along roads and waterways, on dikes, on the Maasvlakte and in the North Sea. The 31 wind turbines in the Kreekraksluis wind farm in Zeeland generate enough energy to meet the needs of around 55,000 households. Hydroelectric power is being generated in the Maas at Linne and at Lith. And the waterfall produced by the lock in the Wilhelmina Canal in Tilburg generates energy for around 250 households. The five turbines installed in the tidal gullies of the Eastern Scheldt storm surge barrier supply 1,000 households with electricity. But now we are upscaling. In 2018 we did the groundwork for the installation of a wind farm on the edge of Second Maasvlakte. The turbines will supply around 100 megawatts of electricity – enough for as many as 100,000 households.

### Sustainable energy pilot programme

At the request of the Ministry of Economic Affairs and Climate Policy, since 2018 Rijkswaterstaat, the Central Government Real Estate Agency and the Netherlands Enterprise Agency (RVO.nl) have been working on a pilot programme for the generation of sustainable energy. Together we are looking at how central government can give the market access to its domains for the generation of renewable energy. In the next four or five years, we will be exploring the scope for large-scale generation of solar energy, on both land and water. Opportunities for wind farms and other sources of renewable energy may follow in the future.

### Floating solar panels

Solar panels produce sustainable energy, but they take up a lot of space. Solar energy generated on water is a possible solution for this problem. In 2017 more than 30 parties, including Rijkswaterstaat, launched the National Sun on Water Consortium. The consortium is now holding trials with solar panels floating on rafts on the waters of the Slufter, a large storage basin for polluted sediment at Second Maasvlakte. The trials focus not only on technical performance, but also on the stability of the panels. The consortium is also exploring how Rijkswaterstaat can interest other parties in investing in and operating these solar panels. Find out more on page 18.

### Energy self-sufficient bridges, locks and pumping stations

Rijkswaterstaat increasingly uses roads, waterways and structures – like bridges, locks and pumping stations – to generate energy. New bridges and locks all generate energy themselves. The Ramspol Bridge at Kampen is a good example. This is the first energy self-sufficient moveable bridge in the world. Following this example, we are also making the Princess Beatrix Lock and the lock at Terneuzen energy self-sufficient. Here, energy will be generated by the movement of the lock gates. A second, energy self-sufficient chamber was added to Eefde Lock in January 2018. Here, solar panels are used to generate the energy needed to operate the lock.

### Energy self-sufficient roads

In 2018 Rijkswaterstaat worked on the first energy self-sufficient motorway in the Netherlands. The A6 motorway between Almere Havendreef and Almere Buiten-Oost is being widened over a distance of more than 13 kilometres, giving each carriageway four lanes. Solar panels will generate enough energy for the traffic signs and lighting. In constructing the road, fewer or recycled materials are being used, with lower $CO_2$ emissions. The two new lanes northbound to Lelystad were completed on 12 November 2018. The lanes southbound to Muiden will be opened in mid-2019.

### Solar panels in the road surface

There is too little space in the Netherlands for the construction of solar parks. So

Rijkswaterstaat and contractor BAM are investigating the scope to insert solar panels in road surfaces. In May 2018 a strip of solar panels was inserted in the surface of the N401 near Kockengen. These panels are protected by a thin layer of transparent synthetic resin and polymer. They can only be used on the hard shoulder since they would produce too much noise if used on the carriageway. Tests were also launched with this construction on the A2 to Utrecht in September 2018. In total, 74 square metres of solar panels are being tested. Hard shoulders on Dutch roads occupy a total area of 20 million square metres. If we installed solar panels on every hard shoulder in the country, we would be able to supply 400,000 households with electricity each year.

### A50 solar highway

Rijkswaterstaat is working with the private sector to develop an innovative noise barrier that also produces energy. In constructing the barrier, we used solar panels that can generate energy on both sides. It came into service in mid-October 2018 on the A50 eastbound near Uden. In total, the 400 metre-long barrier comprises 136 glass solar panels measuring 6x2 metres each. This 'solar highway' started supplying electricity in December 2018. For the next eighteen months we will measure the yield, and get an idea of maintenance requirements, performance and financial return.

### Energy savings with LED lighting

Rijkswaterstaat has gradually been introducing LED lighting along the motorways. In 2016 it was installed on the Holendrecht-Maarssen section of the A2. This is the first multi-lane motorway in the world to use LED lighting. We save around 241,600 kWh a year on this section of road. LED lighting also cuts $CO_2$ emissions by 62 per cent compared to traditional lighting.

LED lighting in the Benelux Tunnel has resulted in a 22 per cent reduction in energy consumption. Rijkswaterstaat is also replacing the lights in light buoys, lighthouses and tunnels. LED lights not only save energy. As they last 10 to 50 times longer than conventional lights, they will also save about 1 million euros a year in maintenance costs.

### Reducing our carbon footprint

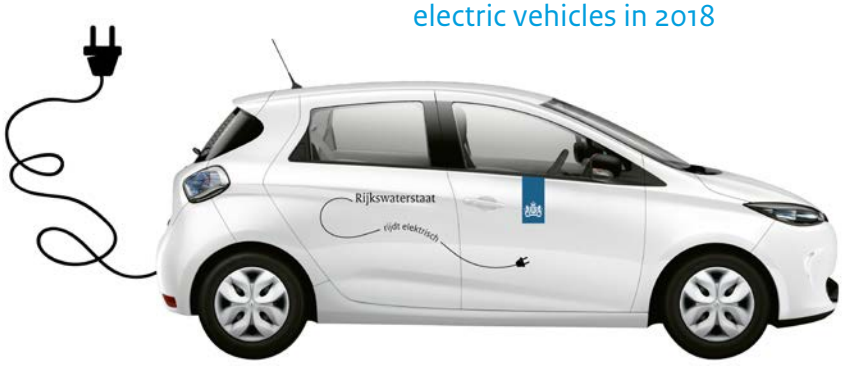
Rijkswaterstaat wants to reduce the $CO_2$ emissions from its activities by 20 per cent by 2020. So in January 2018 we replaced hundred old diesel vehicles in our pool of shared cars by new electric cars. Now, 7 per cent of our total fleet comprises electric vehicles. Our ultimate aim is to have a fully electric, emission-free fleet by 2030. In the long term, we plan to use electricity generated by solar panels installed on our buildings and land to charge the batteries.

*Government Shipping Company*

Rijkswaterstaat's ships can play a major role in cutting $CO_2$ emissions. Deployment of the 110 Government Shipping Company vessels is responsible for 44 per cent of the Ministry of Infrastructure and Water Management's total emissions. Since 2017 the twelve largest seagoing vessels have been running for 30 per cent on biodiesel, which is made from recycled cooking oil.

**7%**

of our fleet comprised electric vehicles in 2018



Sustainable
living environment

In a country where space is at a premium, where can you put solar panels without defacing the landscape? Rob Portielje is doing an in-depth study of floating solar panels. His dream is to make the Netherlands climate and energy neutral without spoiling the landscape with solar parks and wind farms.

*'It's a process of trial and error, with setbacks and lucky breaks'*

'I've run across many innovative ideas since I started work at the Innovation Test Centre. But this one is really special. Space in the Netherlands is scarce and finding the room to generate enough renewable energy is a difficult challenge. But we do have a lot of water. Rijkswaterstaat manages large areas of land and water where we can do all kinds of things. Within the Sun on Water Consortium, we're testing floating solar panels to see what they yield and whether they're weather proof. I'm originally an environmental scientist, so I'm well aware of the impact of $CO_2$ emissions on the climate, and also of the impact of the energy transition on the landscape. So ideas like this make my heart skip a beat.'

### Consortium

'We first started on a small scale, with tests in the Slufter, the sediment storage basin on Second Maasvlakte. We worked with the Port of Rotterdam Authority – the joint manager of the storage basin – and a supplier of floating solar panels. The Slufter is a sealed-off area. It contains polluted sediments, with a layer of water on top. This is where we did the first tests. And we soon attracted the attention of other government authorities and businesses. So two years ago, the consortium was set up, with more than 30 members. They include various suppliers of floating solar panels, knowledge institutions, provincial and municipal authorities, water authorities and stakeholders like drinking water and energy suppliers and network managers. And the Netherlands Enterprise Agency (RVO.nl) is providing funding.'

### Testing systems

'Now that we're in the consortium, we're looking further than how much electricity the solar panels can generate and the

# Space for the energy transition

**Rob Portielje** | Project leader at Rijkswaterstaat's Innovation Test Centre

impact of the weather. We're now looking at financing and licensing, and testing various systems. The differences mainly have to do with construction: whether the solar panels should be sealed together into a single unit or whether there should be more space between them. A single unit produces more electricity, but more space between the panels is more nature-friendly, since it lets in more light for the plants and wildlife in the water beneath, reducing the impact on them. These factors all influence decisions on finance and licensing.'

## Multiple use of space

'Though the Slufter has a total surface area of 2 square kilometres, we're only using a very small part of it for the pilot project. But imagine what it would look like to have solar panels more or less covering an entire storage basin this size! We'd have room for half a million solar panels. But we can't go that far, because the Slufter's main function is to store polluted sediment. Yet it would be a good example of multiple use of space. The Slufter is now cut off from the outside world because it is surrounded by dikes. As it is, no one lives on Second Maasvlakte, but panels on open water would be immediately visible. You need to take account of that in your design.'

## The elements

'It's a process of trial and error, with setbacks and lucky breaks. During the tests, the systems were exposed to the elements. And that sometimes led to improvements. Of course it's frustrating if something goes wrong. But testing innovations is always exciting, because of the risks attached. The members of the consortium are prepared to take these risks. So I take my hat off to them, especially the companies that designed the systems.'

## Spatial plans

'Now we've reached the stage where we know the possible impact on the water system and have identified some guiding principles for the licensing procedure. We expect to complete the pilot project in the summer of 2019 and then we'll be able to open up the Slufter to the market, so that solar energy can be generated on a larger scale. Rijkswaterstaat, the Central Government Real Estate Agency and RVO.nl will be responsible, with the Ministry of Economic Affairs and Climate Policy as client. The designs that came out of the test well will of course be able to compete for contracts. My dream is for everyone in the Netherlands to work towards renewable energy. The energy transition will put a lot of pressure on our economy and the available space in our country, but it will also present opportunities. It's therefore an urgent social theme to see exactly how this process can be integrated into economic and spatial plans.'

# 3 Smart mobility

Road transport is the lifeblood of the Dutch economy. Optimal access to economic centres is vital. Private motorists must also be able to reach their destinations safely and quickly. Rijkswaterstaat is working on smart solutions to keep the Netherlands on the move.

Every day around three million motorists take to the roads in the Netherlands. But not all roads are able to cope with the volume of traffic. This leads to traffic jams and much irritation among road users. But that's not all. Slow-moving or stationary goods vehicles cost the Dutch transport industry more than 1 billion euros a year. Dutch transport policy therefore has two goals: reliable journey times and better accessibility.

### More intensive use

In 2018 Dutch road users travelled 72.4 billion kilometres on the main road network, 1.9 per cent more than in 2017. More people took to the roads at the start of the rush hour and in the daytime in particular. In 2018 congestion (length x duration of traffic jams) rose by 2.2 per cent to 11.4 million kilometre-minutes, compared to 2017. Journey times increased by 5.1 per cent, mainly because motorists spent more time in traffic jams.

The main cause of congestion in 2018 was the growing use of the main road network, especially in the rush hour. Accidents and incidents were again a major cause.

Rijkswaterstaat wants to keep the main road network in good condition. But roadworks lead to inconvenience. In 2006 it was agreed with parliament that roadworks should not account for more than 10 per cent of total congestion. At 3.7 per cent in 2018,

A1 motorway with the railway bridge near Muiderberg

the percentage of traffic jams caused by roadworks was far below the agreed norm.

### Working on accessibility

Construction, utilisation measures, traffic management and good maintenance – these are key to keeping the Netherlands accessible. To eliminate traffic bottlenecks, Rijkswaterstaat is building new stretches of road and widening existing roads by adding more lanes. But wider roads are not enough to accommodate the growing volumes of traffic. So we are making smarter use of our existing infrastructure. Traffic management helps us minimise congestion and keep journey times as reliable as possible. And we are experimenting with smart new mobility measures to keep traffic moving smoothly, safely and sustainably.

### Congestion plan for 2020

Under the Congestion Plan for 2020 banner, Rijkswaterstaat is also working on smart solutions for the 34 most urgent congestion hot spots. Where possible, we're turning rush-hour lanes into permanent lanes and making minor adjustments to the roads to improve traffic circulation.

We're providing road users with better traffic information to help them make smarter choices on the route they take and deploying road inspectors at congestion hot spots. Most of these measures will be in place by 2021 at the latest.

## Causes of traffic jams

69% congestion

19% accidents

7% incidents

5% roadworks, weather conditions and other


*A road inspector clears the carriageway*

## Fines issued by road inspectors

2018
**1,650**

2017
**1,050**

# Traffic management

**Traffic management measures enable Rijkswaterstaat to keep the traffic on Dutch roads circulating smoothly. Traffic controllers working in our traffic control centres operate a whole array of installations, including traffic signals, information panels and matrix panels. And we have around 300 road inspectors patrolling the motorways in their yellow vehicles. Their job is to help road users reach their destinations smoothly and safely.**

### Incident management

It's not only accidents that cause traffic jams. A vehicle with a flat tyre or a stray object on the carriageway can also lead to hold-ups. A minute's disruption leads directly to a five-minute traffic jam. In 2018 Rijkswaterstaat spent 40 million euros on incident management measures, i.e. measures to clear the carriageway faster after accidents or breakdowns. By working closely with the emergency services – the police and the fire and ambulance services, for example – and with salvagers, we can remove heavy goods vehicles faster from the scene of an incident. We have already achieved a 30 per cent reduction in traffic jams caused by accidents or breakdowns.

### Special enforcement officers

Road users often cause dangerous situations – by ignoring 'lane closed' signs on the motorway for example, or parking on the hard shoulder. That's not only dangerous for salvagers, road inspectors and road users, but also leads to longer traffic jams. In 2015 Rijkswaterstaat started training road inspectors as special enforcement officers. Special enforcement officers can draw up official reports on offences like these. In 2018 these road inspectors issued 1,650 fines. This was a record number and nearly 600 more than in 2017. In 2017 around 50 Rijkswaterstaat road inspectors had special enforcement officer status. This number will be doubled in 2019.

### Flashing blue lights and siren

Wherever an accident or incident occurs, Rijkswaterstaat's road inspectors deal with the aftermath as quickly and as safely as possible. They make sure that the ambulance and fire services and the police can work in safety and that the rest of the traffic can pass smoothly and safely. In the past, it was often difficult for road inspectors to reach the scene of an incident on the motorway. In 2015 Rijkswaterstaat launched a trial in which 24 road inspectors were trained to drive vehicles with flashing blue lights and a siren. The trial was a success. On average,

road inspectors arrived at the scene of an incident 20 per cent faster because road users made way for them. And they were safer, because they were more clearly visible and recognisable. In 2018 another 140 road inspectors received this special training, so that 306 road inspectors are now qualified to drive vehicles with flashing blue lights. Since only emergency services may use these vehicles, Rijkswaterstaat was officially given emergency service status in 2017.

## Smart mobility

**Smart mobility presents many opportunities to meet our growing transport needs safely and sustainably. So Rijkswaterstaat will be focusing on smart mobility in the period up to 2030.**

### Amsterdam practical trials

Cars that communicate with each other and traffic lights that adapt to levels of congestion on the road. This sounds like science fiction, but Rijkswaterstaat is already working on innovations like these. With trials on the Amsterdam ring road, we are studying ways of improving traffic circulation in congested regions using new roadside and in-car technology. By combining data intelligently, we can give motorists customised travel advice and lead them to their destination by the fastest route. Rijkswaterstaat is carrying out the Amsterdam practical trials in partnership with the province of North Holland, the Amsterdam transport region, the municipality of Amsterdam, the National Data Warehouse for Traffic Information, the private sector and knowledge institutions.

*Overview of the traffic situation*

One of the results of the Amsterdam practical trials is the development of a system that gives an overview of the traffic situation in a wider area. This enables traffic controllers to assess at a glance the situation on the roads and in car parks and, for example, to take account of social media content on the traffic situation. When major events take place, they can decide quickly and easily on approach and exit routes and distribution of cars among car parks. The system was tested successfully in the area around the Amsterdam ArenA when U2 and the Rolling Stones gave concerts there, and when the Dutch football team and Ajax Amsterdam played major fixtures.

### Intelligent traffic light control system

In the past few years, Rijkswaterstaat has been testing the use of an intelligent traffic light control system. This system enables traffic lights to communicate with each other and with vehicles, contributing to smoother traffic circulation. Goods vehicles don't have to make too many unnecessary stops, and thus produce fewer emissions. In 2017 Rijkswaterstaat converted the first 50 traffic lights to this system, followed by another 800 by the summer of 2018. The aim is to convert between 2,000 and 3,000 traffic lights within the next five years.

### Intelligent road-side systems

Intelligent road-side systems allow Rijkswaterstaat's traffic controllers to communicate with the technical systems on and next to the road, like matrix panels and rush-hour lane information panels, enabling them to monitor the situation closely and ensure traffic circulates smoothly. Rijkswaterstaat installed the first four of these intelligent road-side systems along the A9 motorway to the north of the Wijker Tunnel in mid-July 2018.

### Online traffic information panels

Rijkswaterstaat's traffic information panels have now gone online. The online version is being used increasingly frequently in the event of roadworks. As soon as a road-user approaches the roadworks, an app gives them a spoken message advising them of alternative routes.

### Talking Traffic

From 2018 more than 1.2 million road users have been receiving customised messages warning them that they are approaching a congestion hot spot or traffic jam or that local weather conditions have changed suddenly. Users of the Flitsmeister app were the first to benefit from this kind of real-time information. It is the first live service to be produced by Talking Traffic, a partnership in which Rijkswaterstaat works with the traffic industry, telecom and internet companies and the automotive sector.

*By combining data intelligently, we can give motorists customised travel advice*


*Truck platooning: heavy goods vehicles in convoy*

*We used smart technology to enable 250 trucks to drive in convoy*

Rijkswaterstaat takes part as the road authority and supplier of data. At a later date, we will also be responsible for delivering the service.

### Trucks in convoy

During the Experience Week Connected Transport in October 2018, we used smart technology to enable 250 trucks to drive in convoy. The trucks were equipped with a system that automatically controls their speed, adjusting it to the speed of the vehicle in front. The convoys departed from six locations in the Netherlands, travelling along six routes in the transport corridors between Amsterdam and Antwerp and Rotterdam and the Ruhr.

*Green lights*

One of the trials used an app that communicates with traffic lights. As a heavy goods vehicle approaches and the situation is safe, the lights change to green. The vehicle automatically adapts its speed. That not only improves traffic circulation, but also cuts fuel consumption by between 6 and 14 per cent, thus reducing $CO_2$ emissions. And it also cuts waiting times for drivers. The trial was successful and proceeded without incident. Find out how one of the drivers experienced the trial on page 26.

*Truck platooning*

The trial with Adaptive Cruise Control should also pave the way for truck platooning – virtually linked trucks driving in convoy. From 2020 the Ministry of Infrastructure and Water Management aims for 100 platoons a day, with a total of 500 trucks. Rijkswaterstaat is pooling the resources of government authorities, entrepreneurs and educational institutions to make this happen. Ten leading service providers in the transport and logistics sector took part at the Experience Week Connected Transport in October 2018. Together they account for more than 5 per cent of the heavy goods vehicles that use our main road network every day.

## Smart road management

**The smartest way of working on smooth, safe traffic circulation is to keep the roads in good condition. Through careful planning of maintenance operations, we bring our roads up to scratch before they show signs of wear and tear. And we also prevent dangerous situations.**

### Winter maintenance

Rijkswaterstaat has 350 snow ploughs at its disposal to clear the roads in wintry conditions. During the winter season, which runs from 1 October to 1 May, we also have 546 salt spreaders ready for action. Within two hours, they can spread a preventive layer of salt on around 3,260 square kilometres of road surface – Rijkswaterstaat's entire national road network. If necessary, the salt spreaders can be equipped with a

*A salt depot in Breda*

snow plough. In the winter of 2017-2018, 90 million kilograms of salt was spread on the roads. That was much more than in previous years, despite the mild start to the winter. In the winter of 2016-2017, we used 75 million kilograms of salt, and in the 2015-2016 winter 41 million kilograms.

### Road safety

Road safety is one of this government's main priorities. The Netherlands wants its roads to continue to be among the safest in the world. Though we use the motorways for around 50 per cent of our journeys, there are relatively few fatal accidents. So the risk of road deaths and injuries is lowest on our national roads.

There were slightly fewer road deaths in 2017 than in 2016. But for the first time, the majority of the victims were not motorists but cyclists. The Minister of Infrastructure and Water Management is now working on a new strategic plan for road safety. Rijkswaterstaat is also taking measures. In 2018 we removed obstacles from road verges at around 150 locations. Information on road safety in 2018 was not yet available when this annual report was published.

### MONO campaign

Irresponsible use of smartphones while driving can lead to dangerous situations. So on 13 September 2018 Rijkswaterstaat and the Ministry of Infrastructure and Water Management launched the MONO campaign to help focus motorists' attention on the road. It should be accepted as normal for people not to be online while driving, so that they can focus their attention on the road. The MONO campaign encourages motorists and cyclists to download apps that block messages posted on social media but allow mobile traffic apps.

*Data*

Rijkswaterstaat contributes to safe mobile traffic apps by supplying data – e.g. on 'lane closed' signs, maximum speeds and other applications. Our data was recently added to the Flitsmeister app, for instance. Rijkswaterstaat hopes to reinforce the MONO campaign's impact with billboards along the motorways and slogans on the matrix panels above the motorways. The campaign was launched in cooperation with the Royal Dutch Touring Club ANWB, Flitsmeister, the Dutch road safety organisation Veilig Verkeer Nederland, the Dutch Cyclists' Union, youth organisation TeamAlert, Nederland ICT and the provincial authorities.

## Winter maintenance

350
snow ploughs

546
salt spreaders

Salt spread within
2 hours

3,260 km
of road surface

2017-2018:
90 million
kg of salt


With more than 20 years' experience as a truck driver, Cornelissen Groep's Jos van Loon was ready for a new challenge. So he decided to have an adventure. He agreed to drive in a convoy of smart, autonomous heavy goods vehicles. The convoy was one of the events of the Experience Week Connected Transport. On 1 October, Jos and two of his colleagues set off up north. This is his report.

*'Heavy goods traffic could be much smarter and more energy-efficient'*

'8.00. Today we set out for real with our convoy of trucks. It's an idea I support, because heavy goods traffic should be much smarter and more fuel-efficient. By driving in convoy you use between 6 and 14 per cent less fuel. That doesn't only save money. It also reduces $CO_2$ emissions. And traffic circulates faster. Truck platooning is based on an adaptive cruise control system (ACC). This controls the speed of the truck, and adjusts it to the speed of the vehicles in front. The truck at the head of the convoy determines the speed and the route, and the trucks behind follow at a short distance from each other. Like a train.'

### Totally reliant

'9.00. For a moment I think, 'What have I let myself in for?' There's huge interest in connected transport. I'm interviewed by people from various media. There's a crowd of people to see us off. I'm a bit overwhelmed. We've already spent a day at DAF's test circuit in Sint-Oedenrode. And everything went to plan. But as I switch on the ignition I suddenly think 'What if the ACC doesn't work properly?' A heavy goods vehicle has a much longer braking distance than a car, so if the system doesn't work, we could have a really serious accident. It feels very strange to be totally reliant on a computerised system.'

### Useful app

'9.15. We're on our way. We leave Tilburg in three trucks. I'm heading for the Albert Heijn supermarket in Elst (Utrecht) and from there I'll drive to Geldermalsen. One of my colleagues will drive to Utrecht, and the other to Den Bosch. So the third truck will be leaving the convoy quite soon. We're on a provincial road, so we probably won't


# We need to be fuel-efficient

**Jos van Loon** | Driver at Cornelissen Groep logistics

save as much fuel as we could, because of all the traffic lights. We've been given a special smartphone with a useful app that communicates with the traffic lights so that they turn green as we approach. Very useful, because you can keep on moving, and don't have to use your brakes. And that saves fuel, too. But the traffic lights on our route are not all tuned into the app, so we have to stop quite often and once we even have to leave the last truck standing at a red light. That's a pity.'

### All went well

'11.00. I arrive in Elst, pleased that everything went well. As we travelled along I gradually got used to the ACC system, and was hardly aware that the trucks in the convoy were so close together. I talk to my colleagues. Like me, they found it exciting, and didn't feel at all unsafe. I can't really give a proper opinion on the basis of a route like this. But over longer distances and with longer convoys I'm sure we can save quite a lot of fuel.'

### Longer convoys

'18.00. At dinner, I talk to my family about today's adventure. I've heard that the minister is planning on 100 platoons a day by 2020, with a total of 500 trucks. I wonder how her plans will work in practice. How do you deal with vehicles entering and exiting the motorway, for example? Will the convoy have right of way? I wonder. I'll be the first in line to take part in follow-up tests. Fuel-efficiency is an aim I support. So I'll be happy to drive the test vehicles.'

*'A useful app communicates with the traffic lights so that they turn green as we approach'*

# 4 Integrated water management

Water is vital, but it can also be life-threatening. So Rijkswaterstaat works every day to protect the Netherlands against flooding and to provide sufficient clean fresh water to meet the needs of each user. And we take measures to ensure the Netherlands is both climate-proof and flood-proof.

As the national water authority, Rijkswaterstaat has a whole range of responsibilities. We work on flood safety while ensuring sufficient supplies of clean water. And we're responsible for a sustainable, ecologically healthy water system and for spatial planning measures that ensure the Netherlands is climate-proof. We call this integrated water management.

## Climate change

Climate change could have serious consequences for the Netherlands, including extreme water events and extremely dry periods. Storms will be more severe and more frequent. Sea level rise and soil subsidence also threaten our country's safety and liveability. Current climate scenarios indicate that by 2100 sea level will rise by up to 85 centimetres.

*Unpredictable weather*

The weather is becoming less predictable. That was more evident in 2018 than ever before. January started off with a number of heavy storms. For the first time in history, Rijkswaterstaat had to temporarily close five storm surge barriers. In the spring, cloudbursts led to flooding at some locations and high-water levels in the rivers. But the most exceptional event was the long, dry, extremely hot summer. The summer of 2018 was the hottest in 300 years, with the driest spell on record since the bumper summer

*Hagestein Dam in the River Lek*

of 1976. Working with its water management partners, Rijkswaterstaat did its utmost to ensure fair distribution of the available water to users and water-dependent sectors alike.

## Sufficient fresh water

**Sufficient fresh water is essential for wildlife and shipping and to secure drinking water supplies. Rijkswaterstaat works on a daily basis to ensure its availability. Working with our water management partners, we operate our dams and pumping stations to distribute water to every user.**

### Drought

On 2 August 2018 the Netherlands was officially declared in drought. July in particular had been very hot, with too little rainfall, too much evaporation and too little water entering the country through the major rivers. Water levels in the rivers, canals and lakes were much lower than normal. This made us vulnerable, since 17 per cent of the Dutch economy relies on sufficient supplies of fresh water. The agriculture and shipping sectors and industry faced problems. And the drought also had an impact on nature and water quality.

*Consequences*

In early August there were reports of botulism, blue-green algae and fish deaths. So there were fewer stretches of open water where it was safe to swim. Ships also had to take account of the low water levels when taking on cargo, because they could run aground on the river or canal bed. And because of the shortage of fresh water in the rivers, lakes and canals, saltwater intrusion also posed a threat.

*Water Act*

The Water Act sets out the measures to be taken to address this situation. From 2 August to 28 September the Water Shortages Management Team – in which Rijkswaterstaat works with the water authorities and water companies – coordinated distribution of water for agriculture, shipping, industry, recreational shipping and nature. This joint approach proved successful. Drinking water supplies were never at risk, and no seriously unsafe

*We did our utmost to ensure fair distribution of the available water*

*Rijkswaterstaat used a smart new method to prevent salinisation: a bubble screen*

*Bubble screen in the Amsterdam-Rhine Canal*

incident occurred. In July the water authorities had already started spraying vulnerable peat dikes with water to prevent them drying out, bursting or subsiding.

### Fresh water reservoir

In June 2018 the minister of Infrastructure and Water Management issued an order setting new water levels for the IJsselmeer. Since then, extra fresh water may be stored in the IJsselmeer, Markermeer and Volkerak-Zoommeer so that the lakes can be used as a national freshwater reservoir. In the event of a serious drought, fresh water supplies for the surrounding region can be guaranteed for longer.

### Reverse water flows

On 24 July 2018 Rijkswaterstaat and the water authorities to the west of the Amsterdam-Rhine Canal reversed the water flows. Through smart operation of sluices and dams, we channelled fresh water from the IJsselmeer through rivers and canals to the dry areas in the west of the country. This enabled us to reverse saltwater intrusion from the sea and protect the peat dikes from drying out.

### Bubble screen

Rijkswaterstaat also used a smart new method to prevent salinisation of the water in the Amsterdam-Rhine Canal. By installing perforated tubing on the canal bed and pressing air through it, we created a screen of air bubbles in the water. The bubbles drive the saltwater to the surface where it mixes with the fresh water and can easily be discharged into the sea through the sluices at IJmuiden. Similar bubble screens are used in some locks to prevent saltwater intrusion when the lock gates open.

### Abating drought

In mid-September it started to rain again. So the drought gradually abated and the crisis officially came to an end on 28 September. The Water Shortages Management Team no longer needed to meet, though the National Water Distribution Coordination Committee continued to monitor the situation carefully. River discharges remained low until mid-December, so that inland waterway vessels could carry far less cargo, if any. Groundwater levels in the higher sand soil areas in the east of the country remained low for a prolonged period. It also took some time to improve the quality of the water and reverse salinisation in the IJsselmeer. And right up to early December the water authorities continued to monitor the dikes in their areas for bursts and cracks.

*Normal management*

The Netherlands was officially declared drought-free on 20 December 2018. On the same day the threat level was scaled down to zero, i.e. normal management level. This was mainly due to the heavy rainfall in the Rhine and Maas river basins in mid-December. Yet groundwater levels were still low at the end of December. They will only rise to normal after a prolonged period of rainfall. It will take some time for the country, and nature areas in particular, to make a full recovery from the drought.

## High water protection

**The Netherlands is vulnerable to flooding. Without our primary flood defences – the dunes, dikes, dams and storm surge barriers managed by Rijkswaterstaat – nearly 60 per cent of the country would be either permanently or regularly under water.**

Shortly after New Year the Netherlands was hit by a storm, accompanied by high water levels along the coast. So on 3 January 2018 five storm surge barriers – the Maeslant Barrier, Hartel Barrier, Eastern Scheldt Barrier, Ramspol Barrier and Hollandsche IJssel Barrier – were closed at the same time.

### Room for river water

Water levels in the rivers were also extremely high in early 2018. Due to heavy rainfall in Germany, the water level in the Rhine at Lobith rose to a peak of 14.64 metres above NAP (Amsterdam Ordinance Datum) on 10 January 2018. And levels went on to peak in the Lower Rhine, the Waal and the IJssel. To discharge the water as fast as possible, Rijkswaterstaat opened the dams in the Lower Rhine and Lek at Driel, Amerongen and Hagestein. And water was pumped into the sea through the sluices in the

Haringvliet Dam and the Barrier Dam (*Afsluitdijk*).

Levels as high as these occur only once every five years. Yet safety was not at risk anywhere. Flood protection in the river basin is better than ever before, thanks to the Room for the River Programme. Over the past 12 years, measures have been taken at more than 30 locations in the Netherlands to increase the discharge capacity of our rivers. Rijkswaterstaat and the water authorities have increased the maximum discharge capacity of the Rhine and its distributaries from 15,000 to 16,000 cubic metres per second, enhancing the safety of the four million people living and working in the river basin.

In the past 11 years measures have also been taken to improve flood safety in the area flanking the Maas in Limburg. The river bed has been widened by hundreds of hectares over a length of 43 kilometres, and 12 kilometres of dike have been strengthened.

### Primary flood defences

Rijkswaterstaat is also working on the safety of the primary flood defences, i.e. the defences that protect us against flooding from the sea and large open stretches of water. In the period up to 2023 we will be working with the water authorities on measures to strengthen more than 922 kilometres of flood defences. These will need to meet the Delta Programme's new, stricter safety standards. We are also working on 470 structures, including locks and dams. By the end of 2018 we had strengthened 75 kilometres of dike, and 24 structures had been brought up to standard. By the end of 2024 we expect to have brought 368 kilometres of dike up to standard.

### Dikes

Raising and widening dikes is a costly, complicated and demanding operation. And wider dikes take up more space, which isn't always available in this densely populated country. So we are proofing some dikes against the impact of waves breaking over the top. Though we may occasionally get wet feet, the dikes will still protect us against storm surges and strong waves.


*Water level meter at the Maeslant storm surge barrier*

Because they don't give way, a catastrophic disaster is much less likely. One of these dikes is the Barrier Dam (*Afsluitdijk*). It was built 85 years ago, and is in need of renovation. Find out more about the renovation of the Barrier Dam in chapter 5 - A major construction challenge.

### Beach nourishment

The sandy Dutch coast is a major defence protecting the north and west of the country from flooding. But wind, sea level rise and the strong current can carry the sand away or erode it. Every year Rijkswaterstaat monitors whether the coastline is up to strength, and deposits sand at the locations where too much has disappeared. This operation is known as beach nourishment, and we carry it out on the beach or underwater just off the coast. In 2018 the beach was nourished with a total of 10.8 million cubic metres of sand. That is equivalent to around seven times the content of the Kuip football stadium in Rotterdam.

### Sand banks along the Houtribdijk

The Houtribdijk between Lelystad and Enkhuizen is 30 kilometres long, and was built as part of the reclamation of the Markermeer. The dike also protects the residents of the surrounding provinces from storm surges in the IJsselmeer and Markermeer. In mid-December 2018 Rijkswaterstaat started depositing large volumes of sand against the sides of the Houtribdijk to create a wide sand bank on either side of the dike between Enkhuizen and Trintelhaven. In the event of a storm, the bank will cushion the impact of waves

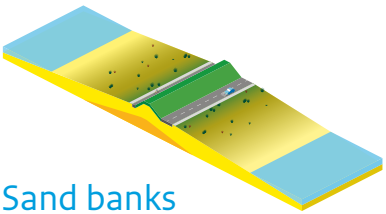
## Water level

On 10 January 2018 water levels in the Rhine at Lobith peaked at

**14.64 m**

above NAP

## Houtribdijk



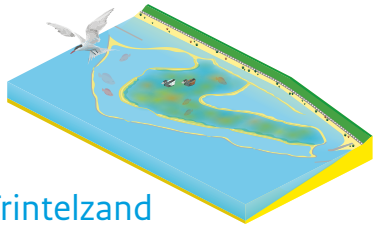
Sand banks

70 m

above water, 70m under water

Quarry stone banks

The dike doesn't burst if water levels are extremely high, not even if waves break over the top



Trintelzand

370 ha

of nature reserve with sand flats, mud flats and reed banks

from the Markermeer and IJsselmeer. We are strengthening 25 kilometres of the dike – the stretch between Trintelhaven and Lelystad – with asphalt and quarry stone, i.e. irregularly shaped natural stone.

*Trintelzand*

Next to the Houtribdijk, Rijkswaterstaat is constructing Trintelzand. This is a new wetland nature area covering 370 hectares and comprising dams and shallow ponds. It will form a new habitat for mussels, snails and aquatic insects, as well as a fish nursery. And this aquatic wildlife will provide food for birds like tufted ducks, terns and grebes. In this way, Rijkswaterstaat is improving the water quality and strengthening the ecological system in the Markermeer. This project will involve shifting a total of 10 million cubic metres of sand. This is equivalent to the amount we use each year for beach nourishment on the North Sea coast. Work on the Houtribdijk should be completed by mid-2020.

# Clean and healthy water

**In 2018 Rijkswaterstaat worked hard to improve the quality of our surface and ground water. Working with our water management partners, we want to ensure that the surface water in the Netherlands satisfies the requirements of the EU Water Framework Directive by 2027.**

The quality of the Dutch surface and ground water has improved significantly in the past decades. Most Dutch waters are clean enough to be turned into drinking water and for growing crops, watering livestock and bathing. But concentrations of chemical substances in the environment are still too high.

### Ecology

In 2018 the national waters were not yet able to provide healthy habitats for all plants and animals. So Rijkswaterstaat is continually seeking new ways of improving wildlife habitats, for example by creating more ecotone habitats between land and water. The many measures that have been taken to improve the quality of our waters are now bearing fruit. The common nase has now returned, along with a number of fish species that thrive in moving waters, such as chub, barbell and dace. The river clubtail dragonfly has made its appearance around the Dutch rivers, and osier willows are growing again along the Rhine. These are all examples of how Dutch water management policy has led to recovery of the ecosystem.

### Haringvliet sluices partially open

The Haringvliet sluices were set ajar on 15 January 2019. At the touch of a button, seawater once again mixed with the fresh water of the Haringvliet. For the first time since 1971, migrant fish species like the salmon will be able swim upriver to their breeding grounds in the Swiss Alps.
The Haringvliet sluices are part of the Haringvliet Dam which connects the islands of Voorne-Putten and Goeree-Overflakkee. Since its completion in 1970, this dam has formed a hard barrier between the saltwater of the North Sea and the fresh water of the Haringvliet. The transition area, in which sea and river gradually met, disappeared, taking with it the wildlife for which it was a habitat. All of this changed on 15 January 2019. After pumping surplus river water into the sea, Rijkswaterstaat left one of the 17 sluice gates around a metre open all morning at incoming tide. This was the first step in the restoration of the nature area between the two islands. Rijkswaterstaat continually monitors the saltwater flowing into the Haringvliet through the opening to ensure it intrudes no further than the line between Middelharnis and the River Spui.

*Commitment*

The decision to set the sluices ajar was taken on 20 June 2013. Since then, the Hollandse Delta water authority and water company Evides have been taking measures to ensure sufficient supplies of fresh water once the sluices are open. They have installed pumping stations and inlets for fresh water for farms and drinking water, while canals and channels have been dug to supply users with water. New nature areas have also been constructed, like an island for the birds that will be taking advantage of the improved fish stocks. In the run-up to the opening of the Haringvliet sluices, nature conservation organisation Natuurmonumenten, the

World Wide Fund for Nature, Staatsbosbeheer, the Society for the Protection of Birds, nature conservation organisation ARK Natuurontwikkeling and anglers' organisation Sportvisserij Nederland made a commitment to restoring the Haringvliet to its original state. Find out more about how Natuurmonumenten experienced the opening of the Haringvliet sluices on page 34.

*Start postponed*

Because the long period of drought had led to low water levels in the Netherlands, the official opening of the Haringvliet sluices had to be postponed several times. But on 15 November 2018 infrastructure minister Cora van Nieuwenhuizen performed the opening ceremony. Several trial openings were held in December 2018, but on 15 January the sluice was opened properly for the first time. After a long period of drought, water discharges in the rivers had returned to their normal volumes.

## Marker Wadden

In September 2018 the first island in the Marker Wadden was opened to the public. This is one of a series of five islands which Natuurmonumenten and Rijkswaterstaat have been constructing in the Markermeer since September 2016. Together, the islands form a new, wetland nature area – an archipelago with lagoons, reed marshes and mudflats, providing a healthy habitat for birds, fish and aquatic plants.

*Birds are returning*

With this project too, Rijkswaterstaat is restoring the ecology to something approaching its original state. In 1976 the Markermeer was closed off from the IJsselmeer by the construction of the Houtribdijk between Enkhuizen and Lelystad. Since then the ecological status of the water has deteriorated fast. But now the new islands have been built, birds are returning. In the past few years thousands of birds have come here to breed, including endangered species like the little tern, the common tern and the Kentish plover.

*Building with nature*

Contractor Boskalis will finish work on the five islands in late 2020. Up to then, sand nourishment will continue to prevent the islands subsiding. For the construction of the Marker Wadden, Rijkswaterstaat entered into an alliance with nature conservation organisation Natuurmonumenten in 2014. By constructing the islands, and researching their impact, Rijkswaterstaat is also strengthening Dutch expertise in building with nature.

## Wildlife-friendly banks

Between December 2017 and March 2018 Rijkswaterstaat worked on the banks of the Maas-Waal canal between Weurt and Heumen, over a distance of 13.5 kilometres. We created wildlife access points at three locations on either side of the canal – layers of stone that can be used by animals to get to and from the water safely and easily. The work was completed in March 2018.

## Clean-up

On 23 June 2018 the Bow Jubail, an 183-metre tanker, collided with the landing stage in the Third Petroleumhaven in the Botlek area of the Port of Rotterdam. More than 200,000 litres of fuel spilled into the water. A major clean-up operation ensued. Contaminated sections of bank had to be replaced. Around 1,000 swans were covered in oil and had to be cleaned. The swans were taken to a temporary shelter near the Maeslant storm surge barrier in the Hook of Holland. Volunteers washed them thoroughly and gave them the necessary care. The swans were then put in special outdoor swimming pools where they could preen and restore the waterproof pattern of their feathers. The first of these swans were returned to the wild at Oude-Tonge on 14 July 2018. The rest followed later in the year.

**1,000 swans**
had to be cleaned

# Boost for nature in the delta

**Frans van Zijderveld** | Policy adviser on the Southwest delta area at nature conservation organisation Natuurmonumenten

Frans van Zijderveld comes from the area and knows all about the Haringvliet inlet and its natural beauty. He is delighted with the partial opening of the Haringvliet sluices. Migrant fish species will now be able to pass through the sluices on the way to their breeding grounds upstream or at sea.

*'You don't re-open a former sea inlet every day'*

'It's difficult for us to imagine what the Haringvliet looked like before the Haringvliet Dam was completed in 1971, cutting it off from the sea. It was the estuary of the Rhine and Maas rivers – a delta where the tides and the natural transition from fresh to sea water created an area of natural beauty, with a wealth of species unique to the Netherlands. An area rich with migrant fish, coastal birds and other wildlife. It's such a shame that the closure of the Haringvliet put an end to all this. Although, looking at it from the viewpoint of flood safety I can understand why it had to be done. I come from the area and I know all about the destructive power of the sea.'

## Dynamic delta

'I grew up in the area near the Haringvliet. After several years away from home for study and work, I decided to return to my roots. I can see the water from my house. And I often go out on it in my canoe or sailing boat. The best thing is that my work for Natuurmonumenten has to do with the Haringvliet too. In the past few years I've been committed to making the Haringvliet the vibrant delta it once was. I'm in the sounding board group that Rijkswaterstaat set up for this project. And Natuur-monumenten is working with several other nature conservation organisations to give the area an extra boost.'

## Approval

'It was far from easy to get everyone's approval for the opening of the sluices. I can understand that. There were – and still are – concerns about fresh water supplies and safety. Rijkswaterstaat, water company Evides and the Hollandse Delta water authority have taken the necessary measures. As a member of the sounding board group, I saw for myself how carefully Rijkswaterstaat

went to work. But at the same time, I think we could put more stress on the fact that fish migration was the ultimate goal of setting the sluices ajar – with due regard for freshwater supplies and safety. Of course I do realise that this is a unique project. You don't re-open a former sea inlet every day.'

### Understanding through research

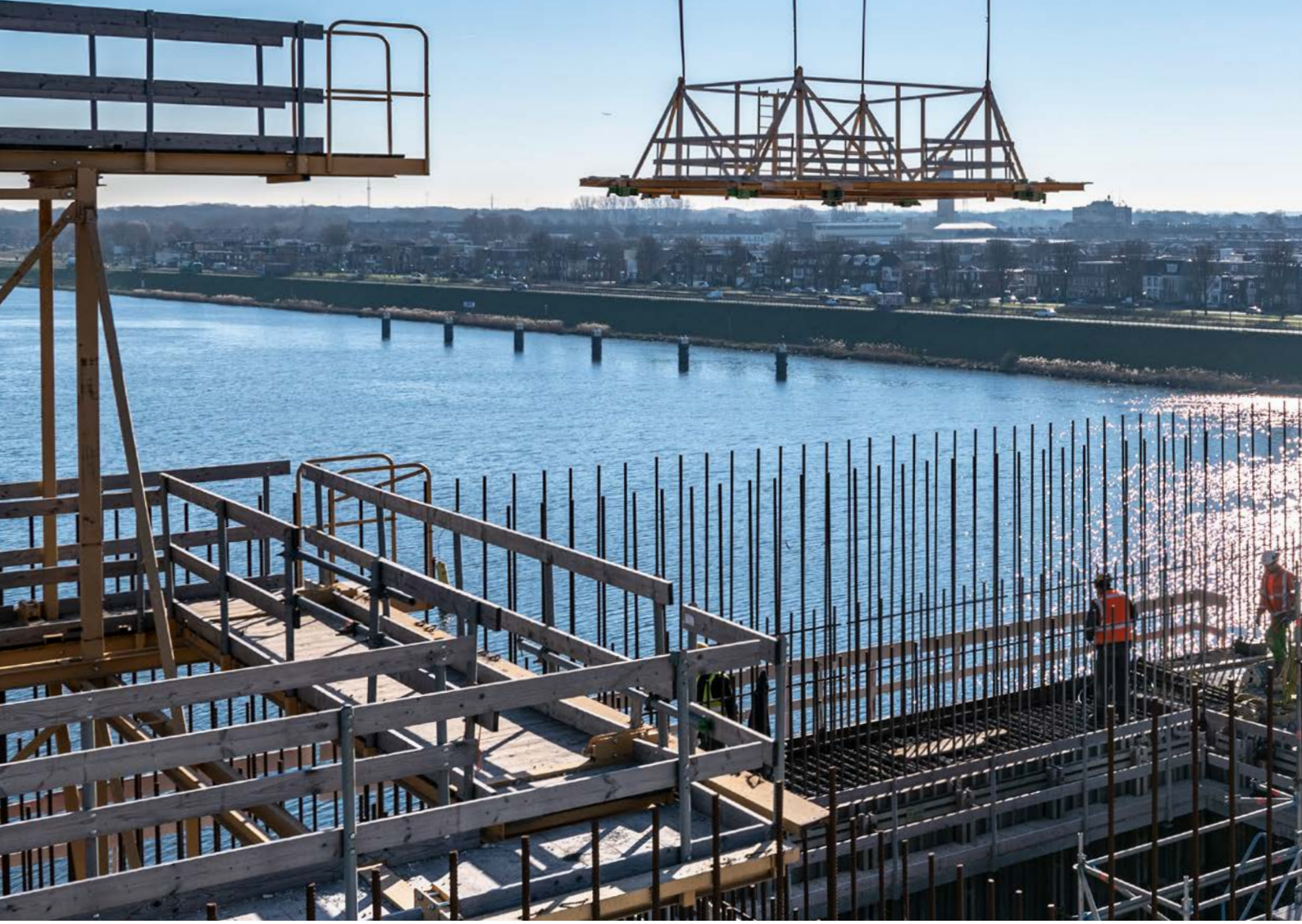
'It's a good thing that an extensive research programme was launched to accompany the opening of the sluices. Rijkswaterstaat is trying to take as many requests and interests on board as possible. I'm pleased to say that they're keeping the sounding board group well informed. Personally, I'm looking forward to the studies that show how the system both above and beneath the water reacts – studies of fish migration, birds and plant growth.
And I'm also interested in the results of the study into the shift in the transition from fresh to sea water. It's all very exciting because this is about how the Haringvliet behaves in a more natural situation.'

### A more natural Haringvliet

Natuurmonumenten, with the World Wide Fund for Nature, Staatsbosbeheer, the Society for the Protection of Birds, nature conservation organisation ARK Natuur-ontwikkeling and anglers' organisation Sportvisserij Nederland, applied for funding from the postcode lottery. We were successful and the money enabled us to take the first step towards returning the Haringvliet closer to its original state.
With the grant we received of 13.5 million euros we've been able to do a lot of work in the past few years. I myself am really happy with the work we've done on the Korendijkse Slikken nature area.
By working with Rijkswaterstaat we've been able to do even more here than we planned. The Haringvliet now attracts more tourists. We've installed hides for birdwatchers and set out nature walks. I've been there to have a look and they really give you a wonderful view.'

### Celebration

'In the weeks running up to 15 November 2018 – the day of the official opening – I was rather nervous. Was it really going to happen? And when it did, we had a celebration. But the best moment of all was when the sluices were actually opened. That was last January. It was wonderful to see how fresh and sea water mixed together. The ecosystem in the Haringvliet will slowly return to the pre-1970 situation. I can hardly wait!'



# 5 A major construction challenge

Keeping the Netherlands liveable, safe and accessible calls for well-maintained, future-proof infrastructure. So Rijkswaterstaat builds high-quality roads, viaducts, tunnels and bridges, and reliable dikes, dunes, locks, dams and storm surge barriers.

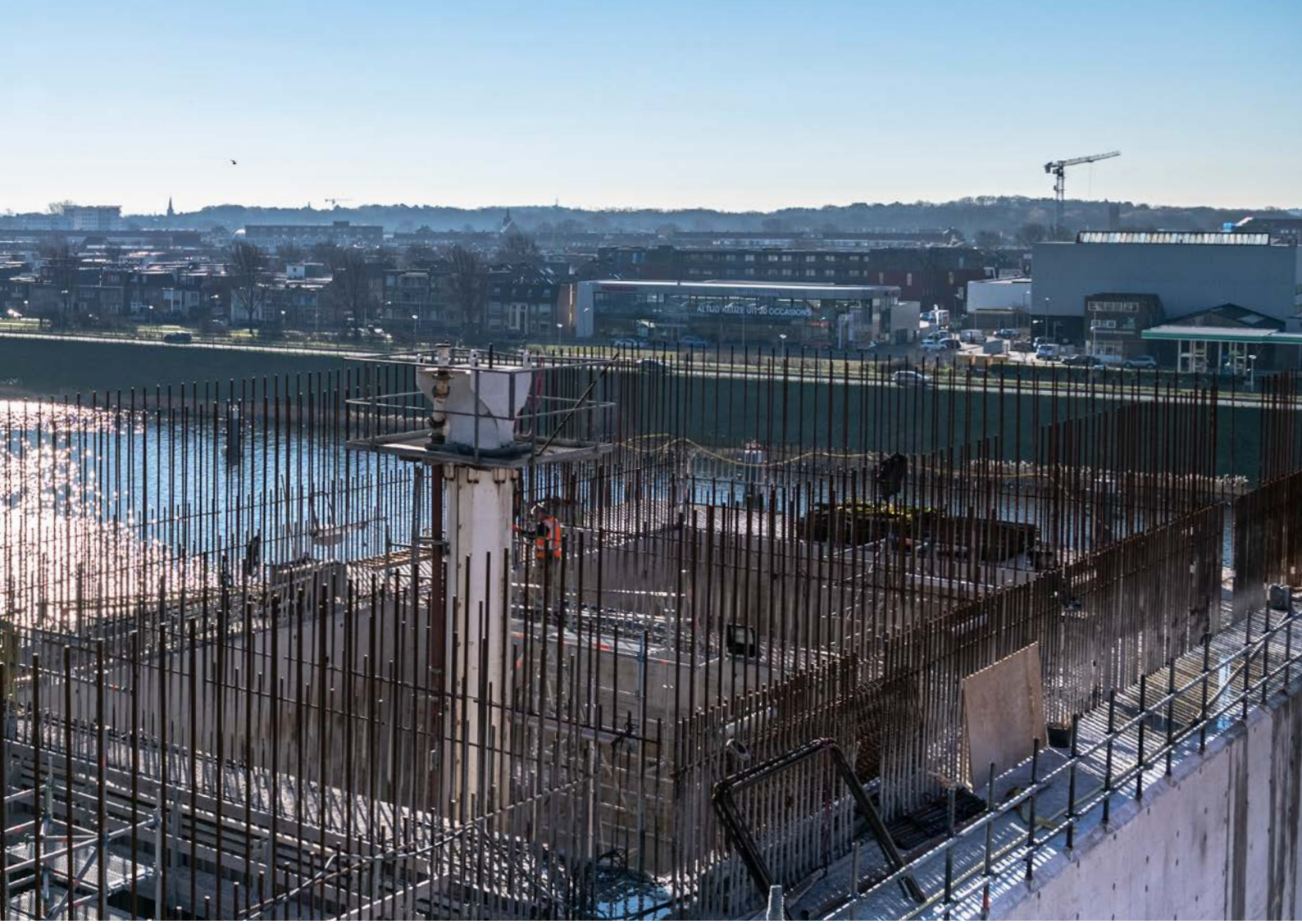
The infrastructure in the Netherlands is among the best in the world. Our dikes, dams and storm surge barriers are all feats of sustainable civil engineering. We have the busiest inland waterway network in the world. And road users say that our roads are in very good condition. A survey held in 2018 shows that drivers of heavy goods vehicles are highly satisfied with the quality and safety of our roads. Of course, Rijkswaterstaat will do its level best to keep them this way. At the same time, we are making our infrastructure more sustainable and future-proof.

## Road construction

**Forecasts show that traffic will continue to grow between now and 2022. To cater for this growth, Rijkswaterstaat will continue to eliminate traffic bottlenecks. In 2018 we laid a total of 178 kilometres of new asphalt – to widen roads, eliminate congestion hotspots and fill in missing links in the main road network.**

### Schiphol-Amsterdam-Almere corridor

In 2018 Rijkswaterstaat worked hard on the Netherlands' biggest road construction project –widening the road between Schiphol, Amsterdam and Almere (SAA). The aim of this project, which we started



*Work on the landward wall of IJmuiden Sea Lock*

in 2012 and aim to complete in 2024, is to keep the north of the Randstad conurbation accessible. The project entails construction of additional lanes over a stretch of 63 kilometres on the busy A1, A6, A9 and A10 motorways between Schiphol, Amsterdam and Almere, as well as construction of two tunnels, two major bridges and an aqueduct, remodelling of five intersections and around hundred other structures.

*A1/A6 at Muiderberg completed*

On 9 March 2018 work on a major part of the Schiphol-Amsterdam-Almere project was completed: the 23-kilometre section of the A1/A6 between Diemen and Almere Haven. In the rush hour, motorists on each carriageway now have five lanes at their disposal, as well as two reversible lanes. In the past few years, Rijkswaterstaat has also built a second Hollandse Bridge, a new railway bridge at Muiderberg and a new bridge on the Amsterdam-Rhine Canal. The A1 now passes beneath the River Vecht, which is carried by the widest aqueduct in Europe. This section was opened in October 2017 and traffic circulation has greatly improved. There are fewer traffic jams on adjoining roads, too, even though traffic

In 2018, 15 new sections of road were opened, as part of the following 5 road construction projects:

- A N18 Varsseveld - Enschede
- B N35 Zwolle - Wijthmen
- C A27/A1 Utrecht North - Eemnes-Bunschoten intersection
- D A4 Vlietland - N14 Leidschendam
- E A1/A6 Diemen - Almere Haven

## Beatrix Lock, 3rd chamber

Lek Canal north widened by
**40-90 m**

Lek Canal south widened by
**105 m**

3rd chamber accommodating vessels with a draught of
**4 m**

Weight of the lock gate:
**490 tonnes**

**10,000 m³**
cement used in each wall

density has grown by around 13 per cent since 2014. The quality of the living environment has also improved. The motorway is now 300 metres further away from the town of Muiden and fewer cars are using rat runs.

*Five stages*

We are carrying out the Schiphol-Amsterdam-Almere project in five stages. The road-widening operation on the A1/A2 at Muiderberg, completed in 2018, was the second stage. The additional lanes in the A10 eastbound/A1 Diemen came into service in 2015 and 2016. Work on the A9 Gaasperdammerweg and the A6 between Almere Havendreef and Almere Buiten-Oost was still under way in 2018. In 2019 the additional lanes in the A6 at Almere will be opened to traffic. And in 2020 work will start on the fifth and final stage of the project – widening of the A9 near Amstelveen.

# Main waterway network

**Transport by water is a good alternative to road and rail transport. It is more environmentally friendly and contributes to our transport economy. So Rijkswaterstaat is investing in the quality and capacity of our main waterway network.**

### IJmuiden sea lock

At IJmuiden, Rijkswaterstaat is building the world's biggest sea lock. It will replace the old, smaller Noorder Lock, which dates from 1929 and is too small to accommodate the increasingly larger, wider container vessels and cruise ships of the future. The new sea lock will ensure continued access to the terminals and businesses along the North Sea Canal. The lock will be 500 metres long, 70 metres wide and 18 metres deep. The first of the three lock gates arrived in IJmuiden on 20 January 2019. Each gate is 72 metres long, 24 metres high and 11 metres wide, and weighs around 2,900 tonnes.

The OpenIJ consortium of contractors is building the new sea lock for Rijkswaterstaat. Originally, the work should have been completed in 2020. But in mid-2018, we discovered that this target would not be met. Due to setbacks and delays, the lock will probably not be opened until January 2022.

### Princess Beatrix Lock

On 6 February 2019 Princess Beatrix opened the third chamber of the Princess Beatrix Lock. This lock is an important link between the ports of Amsterdam and Rotterdam for inland waterway shipping. Every year, 50,000 vessels pass the lock, and this number is likely to grow in the future. Since new vessels are larger, the lock needed to be expanded to prevent the complex becoming a bottleneck. It now has a third chamber, large enough to accommodate ships of the largest category, i.e. up to 135 metres long. It took two and a half years to build. The two lock heads each measure 30 by 60 metres and contain two gates. These are 28 metres wide, 14 metres high and 6.25 metres thick, and weigh 490 tonnes each. When the gates were hoisted into the lock in 2018, crowds of people came to watch.

*Lek Canal widened*

To create space for the third lock and to provide vessels with enough room to manoeuvre, we have also widened the Lek Canal by between 40 and 90 metres. To the south of the Princess Beatrix Lock, the canal has been widened by 105 metres. Work will be completed on the lock in 2019. Up to 4 March 2019 trials will be held with the third lock chamber, after which it will be formally opened to shipping. The two older chambers will then be renovated over the course of several months. Expansion of the lock complex with a third, larger chamber will benefit our transport economy. And it will also prevent congestion, enabling inland shipping to make a contribution to improving air quality.

### Juliana Canal

In 2013 Rijkswaterstaat started widening the Juliana Canal. The aim was to enable inland waterway vessels up to 190 metres long to navigate between Maastricht and Maasbracht and thus reach major industrial areas in Germany, France, Belgium and the Netherlands. The work should have been completed in 2019, but the opening of the newly widened canal has had to be post-poned to 2023. A few years ago, excavation work on the channel caused leakages into

the surrounding land. And in 2016 rising groundwater levels caused flooding in the cellars of houses in the village of Obbink. We haven't yet found a solution for this problem, and in November 2018 Rijkswaterstaat decided to put the remaining work out to tender again.

### Limmel Lock in service

At the end of May 2018 the new control lock at Limmel was officially opened. For more than 80 years, the old double-gated lock protected the low-lying land behind it from flooding. It has now made way for a new lock, which has two cylindrical towers and a steel door. This new lock not only protects the land behind it from flooding but also accommodates larger inland waterway vessels. The lock is 46.9 metres wide and can accommodate vessels up to 190 metres long and 11.4 metres wide, with a draught of 3.5 metres. The new bridge over the canal has separate lanes for cars and bikes, improving road safety for the residents of Itteren and Borgharen.

### New lock at Terneuzen

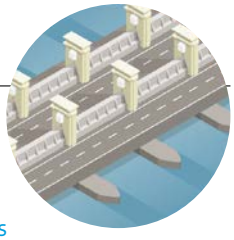
Rijkswaterstaat started work on a new lock at Terneuzen in November 2017. The lock will form a major link in the inland waterway network between Rotterdam and Paris. Smaller vessels can now navigate through Ghent and Terneuzen to Paris. But a new canal, 106 kilometres long, is now being constructed at Cambrai in France between the Rivers Seine and Scheldt. Once this canal has been completed, inland waterway vessels six times as large will be able to navigate directly from the Western Scheldt to Paris. They will be able to deliver cargo from the giant container vessels putting into Rotterdam to destinations further into Europe. The new lock at Terneuzen will form the gateway to this new inland waterway network. The first vessel is expected to pass the lock on its way to the port of Ghent in 2022. The project will cost more than 900 million euros and is mainly being funded by Flanders.

### Barrier Dam

In April 2018 the designs were completed for the renovation work on the Barrier Dam (*Afsluitdijk*). This dike, which has protected large parts of the Netherlands from flooding since it was built in 1932 is badly in need of a facelift. 75,000 giant concrete blocks, each weighing 6,500 kilograms, will be used as cladding to resurface the old dike. At Den Oever, on the North Holland side of the dike, extra sluices will be constructed to discharge water from the IJsselmeer. Pumps will be installed that can handle as much as 235,000 litres of water per second. The energy needed to operate them will be generated on site with solar panels.

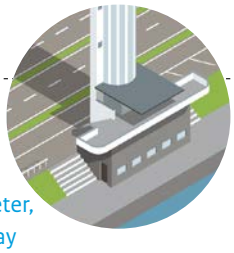
While we are working on the dike, we will also construct a special fish passage enabling fish to reach their natural habitats and breeding grounds. The dike will be smart, so that we will be able to generate energy where the fresh water of the IJsselmeer meets the saltwater of the Waddenzee. The Barrier Dam will also have a cycle track and footpath along its entire length, with viewpoints. The project will cost 927 million euros and should be completed by 2022. The project – and the next 25 years of maintenance work – is in the hands of the Levvel consortium, with contractors BAM, Van Oord and Rebel. The contractors will start work on 1 April 2019.

## Barrier Dam



**60**

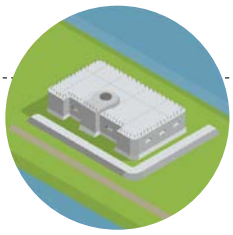
monumental towers adorn the sluice complex, 36 at Den Oever and 24 at Kornwerderzand



The last gap in the Barrier Dam, de Vlieter, was closed off in May

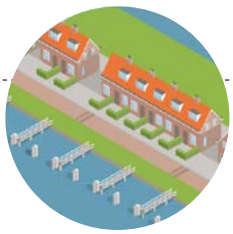
**1932**

A monument designed by architect Willem Dudok marks the spot



The bunkers were in service in the Cold War until

**1960**



Since

**2007**

the village of Kornwerderzand has been listed as protected heritage under the former Monuments and Historic Buildings Act

*Benelux Tunnel*

*Rijkswaterstaat replace or renovate many hundreds of bridges, tunnels, viaducts, floodgates and locks in the years to come*

## Rejuvenation, renewal and sustainability

**Regular maintenance of bridges, locks and other structures is vital for the Netherlands. Technical failure and malfunction cause great inconvenience. They lead to traffic jams and unsafe situations and harm the economy. The best way to keep the Netherlands safe and on the move is to keep existing infrastructure in good condition.**

Rijkswaterstaat faces a major, far-reaching challenge. Hundreds of tunnels, bridges, viaducts, floodgates and sluices will need to be renovated or replaced in the coming years. We plan to take a proactive approach, working closely with our partners, with smart, sustainable solutions. And we plan to keep inconvenience to users and local residents to a minimum.

### Main challenge

Much of our infrastructure dates from the 1950s and 1960s. Since then, traffic has grown explosively. For many years, roads, bridges, tunnels and viaducts have been having to deal with far greater volumes of traffic than they were designed for. As a result they are reaching the end of their lifespan earlier than expected. So Rijkswaterstaat will have to replace or renovate many hundreds of bridges, tunnels, locks and viaducts in the years to come. By the end of 2018 around 40 projects were either completed or still under way. In 2018 we decided to start planning another 40 projects.

*Launch*

In January 2018, infrastructure minister Cora van Nieuwenhuizen launched a major operation to rejuvenate, renew and future-proof the infrastructure in South Holland. In this region, eight main bridges, including the Van Brienenoord Bridge, the Haringvliet Bridge and the Spijkenisser Bridge, are urgently in need of maintenance. Nine tunnels in South Holland, including the Benelux Tunnel and the Drecht Tunnel, are among the 40 projects earmarked in 2018.

### National strategy

We face a huge challenge. The 80 projects in progress or at the planning stage involve replacement or renovation of hundreds of structures. If we overhaul a section of road, we also replace or renovate all the structures on it – viaducts, bridges and tunnels. Examples of rejuvenation, renewal and future-proofing operations outside South Holland include updating the operating systems of several locks in the Maas, work on the IJssel bridges on the A12 motorway and renovation of the ferry landing stages in Den Helder and Texel. The total budget for replacing and renovating our infrastructure will grow rapidly in the next few years, from an average of 150 million euros a year up to 2020, increasing to more than 350 million euros a year in the years to follow.

### Safety first

Rijkswaterstaat closely monitors older structures for wear and tear. Inspections show that our infrastructure is safe for now. But if we find that a structure is damaged, we repair it immediately. And if necessary,

we take other measures, such as limiting axle loads or extra inspections.

*Preparations*
If a bridge is set to reach the end of its lifespan within five to eight years, Rijkswaterstaat immediately starts preparations for renovation or replacement. This gives us enough time to prepare measures to reduce inconvenience and to coordinate the work with other maintenance or construction projects. During our inspections, we sometimes unexpectedly come across unsafe situations. In that case, unscheduled maintenance work may be needed. This might mean having to close a bridge or tunnel temporarily to avoid unnecessary risks to road users, local residents or road workers.

### Planning, spreading, coordinating

How do we prevent the Netherlands coming to a standstill? Limiting inconvenience to road users will be one of Rijkswaterstaat's main challenges while carrying out this major maintenance operation. We aren't planning to do all the work at once, since this would lead to too much inconvenience. Instead, we are spreading it over many years.

We also want to coordinate this work with the other road and government authorities in the regions. We will need the municipal and provincial roads to divert traffic. So it would be a problem if the other road authorities decided to do maintenance work on their own roads, bridges, tunnels and viaducts at the same time. Close cooperation and harmonisation are thus indispensable.

Rijkswaterstaat is also planning to work closely with industry bodies in the civil, highway and hydraulic engineering sectors. Our aim is to use scarce capacity and expertise as intelligently as possible and to share knowledge. We also want to work on a joint labour market strategy to ensure sufficient knowledge, manpower and equipment to deliver these major maintenance projects in the years to come.

### Nijkerker Bridge overhauled

The Nijkerker Bridge was one of the structures overhauled in 2018. After a year's intensive renovation work, it was re-opened to traffic on 27 August 2018. Vehicles with a maximum weight of 60 tonnes can now use the bridge again and its lifespan has been prolonged by 30 years. The clearance over Slingerweg has been raised to 4.5 metres. The cycle paths on either side of the bridge were re-surfaced, and the drainage system improved. One section of the bridge was replaced and nine cubic metres of cement added to its pillars. The crossbeams were reinforced with carbon panels. A unique method was used to prevent corrosion of the steel reinforcements. They were treated by applying very weak electric pulses.

The Nijkerker Bridge is part of the N301, and is a major link in the province's road network. To minimise inconvenience to road and waterway users, the bridge was renovated rather than replaced. Find out more about the renovation of the Nijkerker Bridge on page 42.

### Future-proof infrastructure

In carrying out this major renovation and replacement operation, Rijkswaterstaat is not only focusing on overhauling bridges and tunnels. We are also rejuvenating infrastructure using smart technology. While doing maintenance work on bridges, tunnels and viaducts, for example, we are introducing technologies that will enable us to prevent technical failure and malfunction in the future. We're also installing new technology in the road to enable smart mobility and smart traffic management, with other innovations to make our roads safer, more sustainable and more user-friendly.

*We are spreading the work over many years*

*Van Brienenoord Bridge*

# A major construction challenge

What if you approached a construction project from a completely different angle? What if client and contractor were to work as partners to give the customer what they really want and need? For the renovation of the Nijkerker Bridge Jan-Co van den Doel, project manager at Mourik Infra entered into a completely new relationship with client Rijkswaterstaat.

*'Together, we dared to go for the best solution'*

'Imagine a contractor entering into a partnership with their client to achieve the best results. This is exactly how the Mourik-BESIX consortium and Rijkswaterstaat approached the renovation of the Nijkerker Bridge between 2016 and 2018. This was the first of the DOEN projects. The idea behind DOEN is to achieve maximum value for the client and fair pay for fair work through cooperation and a constant focus on results.'

## Unique opportunities

'In the construction world, we're not used to working on an equal footing with our clients. But working together as partners presents some unique opportunities. I was enthusiastic right from the start, but our organisations clearly found it difficult at first. When the project was put out to tender, there was neither a package of requirements nor a budget. And the selection procedure was something else. Rijkswaterstaat didn't look at the price, because we decided on this together later. Instead they looked at how well we worked with their team. When we finally got the contract, we first sat down with the Rijkswaterstaat team to decide on the best way of renovating the bridge. We made the designs together, drew up the contract together and decided on the price together.'

## Same site hut

'On the construction site too, a new form of partnership developed. While the work was in progress, we shared the same site hut. And that worked incredibly well. We talked to each other, got to know each other's worlds, and had no secrets from each other.

# A different approach to construction projects

**Jan-Co van den Doel** | Project manager at Mourik Infra

Financial reports were left open on the table when a Rijkswaterstaat colleague came to my desk. Local residents, provincial and municipal authorities and sub-contractors often had no idea whether they were talking to someone from Rijkswaterstaat or from Mourik-BESIX. We were just the Nijkerker Bridge team.'

## From the bottom up

'Together, we dared to go for the best solution. In renovating the bridge, we managed to work from underneath, for example, to cause the least possible inconvenience to road users. As a result, we only had to close the bridge on two weekends instead of the nine that were planned. Using various renovation techniques, we extended the bridge's lifespan, so that it will last as long as the rest of the complex. This combination of renovation techniques had never been applied on this scale before. I'm convinced that this solution wouldn't have been possible without the special DOEN project partnership approach.'

## Sofa

'But there were setbacks. For instance, the Human Environment and Transport Inspectorate rapped our knuckles for putting the environment at risk, despite shrink-wrapping the scaffolding under the bridge. I was sick as a parrot about that. And brooding birds put another spanner in the works. But I really had to count to ten when we found asbestos in a delivery of blasting grit. That led to a five-week delay. It was a difficult period for all of us. But even then, communications between us were good. It helped that I'd installed a large sofa in the middle of our hut on which we could sit and enjoy a cup of coffee together. We had many good conversations on that sofa.'

## Innovation and workmanship

'The municipality and the province are really happy with the result. The bridge will last another 30 years. Rijkswaterstaat is happy, and so are we. The project went to plan, in terms of both time and money. The bridge was finished on time, and very little additional work was needed. That's unusual for a renovation project. And this was because we worked closely together right from the start. This project has given me a new understanding of my profession. In our usual projects we focus so much of our attention on the process and the contract, that workmanship suffers. The DOEN projects provide scope for clever ideas and innovation, with a more efficient way of working.'

# 6 Information provision

Smart information technology and data services are becoming increasingly important in our daily lives. Rijkswaterstaat wants to make optimum use of them to make its work more efficient, safer, more customer-friendly and less costly. We also want to provide the public with information on water levels and the situation on the roads and waterways.

Developments in information technology and data are moving fast – including in Rijkswaterstaat's field of work. We are currently running trials with self-driving vehicles. Locks, bridges and tunnels are now connected to each other and share information. Sensors warn if roads are icy or bridges or locks are in need of maintenance. Satellites monitor the stability of our storm surge barriers. And in the future, drones will be doing many of our tasks faster and more accurately.

## Smart mobility

The Netherlands is an ideal international testing ground for smart mobility, with its closely knit network of roads and waterways and sophisticated technology. In 2018 Rijkswaterstaat worked on all kinds of projects to develop wireless communication between vehicles and roadside systems. At the same time, the Ministry of Infrastructure and Water Management has decided to take the development of smart mobility a stage further – from testing new technology to applying it in practice.

*Future-proof*

In 2018, Rijkswaterstaat decided to future-proof its infrastructure. Every road we construct or upgrade will be equipped with the digital technology needed for smart new

*Road traffic controller at the innovation centre in Helmond*

mobility services, smart traffic management and self-driving cars. Find out more in chapter 3 (Smart mobility) and chapter 5 (A major construction challenge).

### Remote sensing

Rijkswaterstaat uses satellites to collect information on bridges, locks, roads and dikes, and on the quality of the water in the lakes and rivers and the status of the coastline and storm surge barriers. This information is a useful substitute for or supplement to data collected using conventional methods. Instead of measuring once a year, satellites supply updates twice a month, so that we can take immediate action, if necessary. We also need fewer vehicles and vessels to take measurements. This saves energy, reduces our carbon footprint and often saves money. And there is no inconvenience to traffic. In 2018, Rijkswaterstaat worked with the Ministry of the Interior and Kingdom Relations on the development of a satellite information database for joint use.

### On-board information panel

In 2018 Rijkswaterstaat ran a trial with an on-board information panel on the rivers around Gorinchem and Dordrecht. A panel normally used on our road inspectors' vehicles was installed on patrol vessel RWS71.

*Reason*

The captains of Rijkswaterstaat's patrol vessels usually contact vessels on the water by radio telephone. But many recreational craft are not equipped with a radio telephone. And the people on board these vessels don't always know what's expected of them or are unaware of the dangers of navigating busy commercial routes. Issuing warnings to recreational craft by radio telephone often leads to too much interference on radio channels, to the annoyance of commercial vessels.

*Faster and more visible*

Information on panels can be seen from a distance, so that people on board recreational craft know what to do and Rijkswaterstaat staff don't have to contact them by radio telephone. Thanks to the panel, vessels passed under the bridge on the Oude Maas much faster. And it heightened the visibility of patrol boats. Each corner of the panel was fitted with the same blue lights as the panels on road inspectors'

*The Netherlands is an ideal international testing ground for smart mobility*


*Information panel on a patrol vessel*

vehicles. They can be used to alert waterway users in an emergency. The panel definitely contributes to safety on the water. In 2019 we will decide whether to equip other vessels with them.

### Smart surveillance

Rijkswaterstaat's inspectors are our eyes and ears on the water. They monitor safety and safeguard the environment on our waterways. They check, for example, whether waterway users comply with traffic regulations and whether installations are still intact.

*Drones are a reliable aid in responding faster and more effectively to incidents*

This work can be done more smartly and efficiently with smart cameras on board inland waterway vessels. Trials conducted in 2018 showed that these cameras can see whether beacons and buoys are still in place and whether signs on the side of the waterway are still legible. This enables us to carry out repair work promptly, ensuring safety on the waterways.

*Drones*

Drones are proving to be a reliable aid in responding faster and more effectively to incidents. They are more flexible and less expensive than the helicopters now in use. And they are very useful, because the panorama images they supply enable us to take immediate action. In 2017 and 2018 Rijkswaterstaat's waterway traffic controllers conducted trials with drones under the Smart Patrol programme, where we work with the private sector and other partners, including the police, fire service and ProRail. Our traffic controllers received assistance from thirteen specially trained drone pilots who ran the tests while carrying out the work they normally do for Rijkswaterstaat.

Working with the drones, we have now managed to limit the impact of oil spills and detected fly tipping in the flood meadows. The drones also enabled us to monitor and manage waterway traffic at events like Sail Harlingen. In the winter, they helped us see which waterways were frozen over and measure the depth of the ice. And in the summer of 2018 the drones recorded the damage done to the rivers by the drought.

So drones can help us do difficult jobs faster. We are now investigating whether we can deploy drones on a more routine basis,

and at much larger distances. That will enable us to respond even faster. Another good example is the development of a self-navigating drone for reliable, affordable collection of the data needed for management and maintenance of our rivers. For more information on this project, go to page 50.

## Vulnerable operating systems

Technical failure often affects Rijkswaterstaat's bridges, tunnels and rush-hour lanes. This is because the complex IT systems used in new structures are vulnerable, while in older structures IT components have reached the end of their service life. Rijkswaterstaat is working hard on solutions to make these operating systems less vulnerable. In the next few years, they will be replaced by reliable new systems. These are now being tested at the Wantij Bridge and in the Heinenoord Tunnel.

*Sensors*

Rijkswaterstaat is conducting trials with sensors that continually monitor the status of our bridges and locks to prevent unexpected technical failure. Sensors in the moving parts of the Prince Bernhard Lock detect problems like wear and friction. This information also enables us to plan maintenance work better and to reduce energy consumption and use of raw materials.

*Building blocks*

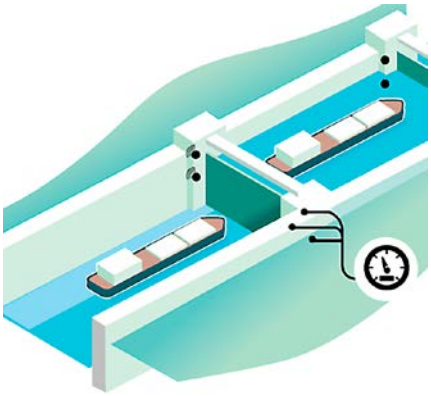
Rijkswaterstaat wants to arrive at modular, standardised hardware and software systems for all its structures, what we call 'building blocks' for industrial-scale computerisation. This will mean that all our bridges, locks, dams, floodgates and tunnels will operate on the basis of the same secure IT systems. This is how we plan to proof our structures for the future – to be reliable, maintenance-friendly and hacker proof. The technical standards for operating and monitoring them will also be more uniform, more reasonable and easier to comply with.

## Smart road maintenance

Every year Rijkswaterstaat spends around 200 million euros on road maintenance. We could easily cut costs here. We often resurface roads before it is needed, leading to wastage of resources, which is not sustainable. Or we wait until maintenance is overdue, leading to expensive, unplanned repairs.

*Predicting the service life of asphalt*

In 2016 Rijkswaterstaat's Datalab started collecting data on the status of every 100 metres of motorway, together with information on traffic density and the environment. By analysing all this data, we can predict the service life of asphalt more accurately, and plan maintenance



By constantly analysing data collected by sensors, this smart lock can tell us when maintenance work is needed

**Go to waterinfo.rws.nl**

2018
**2,500,000**
times

2017
**900,000**
times

work in time. This is not only cheaper, but leads to less inconvenience for road users and fewer $CO_2$ emissions.

*Asphalt innovation programme*
Rijkswaterstaat has launched an asphalt innovation programme (*Asfalt-Impuls*) in which it works with the private sector, knowledge institutions and partner government authorities. The aim is to develop data application, monitoring and data analysis instruments. As well as a general model for more accurate prediction of the service life of asphalt. This will enable faster application of innovative, sustainable types of asphalt. The parties are also exploring whether they can set up a platform to share and analyse their data. It will probably take around two years for the platform to be operational.

### Climate-proof work

The climate is changing. Rainfall is heavier, and more frequent. So there is a greater risk of flooding on our motorways. Rijkswaterstaat is working with Deltares, Delft University of Technology and the private sector to develop a mathematical model to predict the effects of cloudbursts on the motorway – where puddles will form, the source of the water and how it drains into the asphalt. The model is not only important for predicting where flooding will occur. It also generates knowledge for use in road construction and maintenance.

### Intelligent water management

Intelligent distribution of water over the water system can help prevent flooding. And in the event of a drought, scarce water can be distributed intelligently. In 2018 water shortages gave rise to problems for nature, agriculture, industry and shipping. Information provision is an effective instrument in encouraging water management parties to work together. In the past, they tended to look mainly at their own areas and data. Now, Rijkswaterstaat and our partners pool and share information within the Intelligent Water Management project. This enables us to calculate how best to distribute water over the entire system. We are also running trials in the Haringvliet with sensors that measure salt levels in the water. Saltwater intrusion is bad for farming and needs to be prevented at locations where water is extracted for drinking. The Intelligent Water Management project is a partnership between the Dutch Water Authorities, the Foundation for Applied Water Research (STOWA), Deltares and other knowledge institutions.

## Up-to-the-minute information for all

**Rijkswaterstaat's aim is to provide the public with up-to-the-minute information on water levels and the situation on the roads and waterways. We are increasingly able to provide practical information on water levels. Many people made use of this information in 2018.**

### Water report

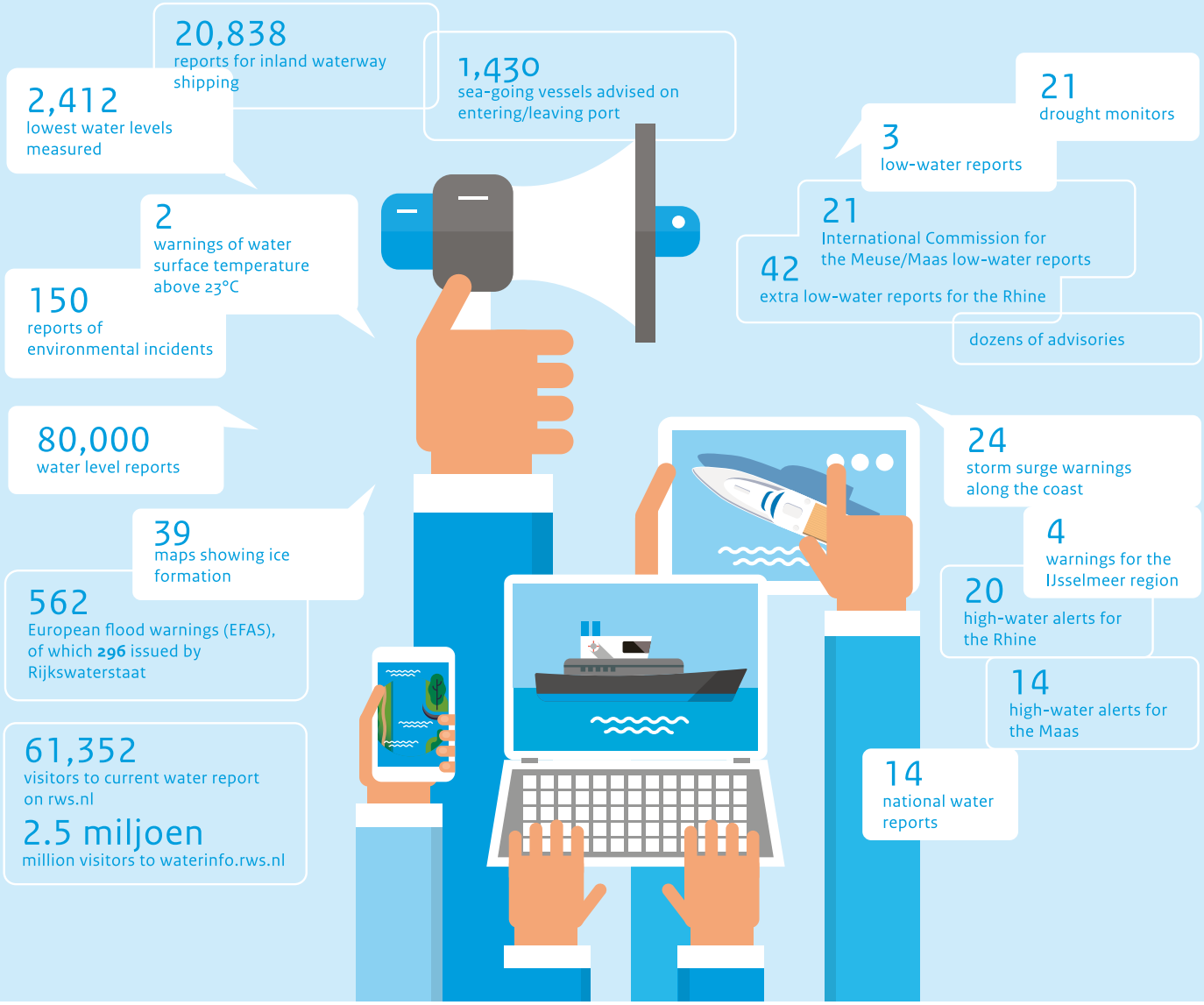
Anyone wanting to know the status of the water in the main water system can go to Rijkswaterstaat's website, rws.nl, where the daily water report is published. A map of the Netherlands, with colour codes, shows whether the current or expected situation is normal, unusual or exceptional. In 2018 the water report was consulted around 61,500 times – over 49,500 times more often than in 2017.

The website Waterinfo.rws.nl also proved popular. This app provides data on current and past water levels, and shows at a glance whether water levels are abnormal. It was used 2.5 million times in 2018 – around 1.6 million times more than in 2017.

*Unpredictable*
The increasing numbers of people visiting our website or downloading our app had a lot to do with the unpredictable weather in 2018. Visitor numbers peaked in early 2018, when there were heavy storms on the coast and in the IJsselmeer, combined with high discharges in the Rhine and Maas. There was a similar peak in the summer, when the Netherlands was confronted by low water levels and drought. In this period, we also issued extra reports on water levels in the Rhine, with extra forecasts for shipping

# Water management centre

The Netherlands Water Management Centre (WMCN) in Lelystad is the national information hub on water quality and water quantity. The WMCN issues reports on water levels, droughts, flood threats and storms, water quality and ice formation. It is also home to the Water Help Desk, the contact point for all questions on water management and water policy.




covering the next few months rather than a couple of weeks.

*Mijn Waterstanden (my water levels)*

Around the start of the storm season, in early October 2018, Rijkswaterstaat launched Mijn Waterstanden (my water levels), a new app giving the current water levels in users' immediate vicinity, and alerting them to the danger of flooding. By the end of 2018 the app was giving real-time information on around 50 locations in the Netherlands, with more to follow. In future, the app will also provide water level forecasts.


# Towards sustainable data collection

**Yuri Wolf** | Innovation manager at Rijkswaterstaat

How can we collect the data needed for the management and maintenance of our rivers more sustainably, more reliably and at lower cost? With this question in the back of his mind, Yuri Wolf, innovation manager at Rijkswaterstaat, is working on the development of a self-navigating drone.

*'The drone is a vessel full of technology. But how do we get all the data on land?'*

'To put it simply, we're working on a vessel full of technology. Put less simply, we're working on an aquatic drone: a self-navigating drone that we're using to monitor the bed of the River IJssel and – at the same time – collect data. It's every young boy's dream. And I'm making a contribution. That's exciting.'

### Hobby horses

'How did we come up with this idea? That's an interesting story. During the World Port Days in Rotterdam in 2014, I met someone who works for Deltares. We talked about innovation in the performance-based contract for the Twente Canal and IJssel Delta. The contract also covers management and maintenance of the River IJssel. And that is one of my hobby horses. I think this work can be done far more efficiently, more reliably and more sustainably. Take the way we measure water depths, for instance. We use special boats for this purpose. They map the river bed several times a year, and collect a lot of data. The contractor uses this data to decide whether to dredge. But this method isn't exactly sustainable. These boats use a lot of fuel and produce the inevitable emissions. We came up with the idea of a flying drone. That would lead to a big reduction in $CO_2$ emissions, and save money.'

### Perfect opportunity

'It was a good idea, but difficult to put into practice, because monitoring has to be extremely accurate to meet Rijkswaterstaat's standards. Then we came up with the idea of a self-navigating aquatic drone. I was immediately enthusiastic. The great thing about the performance-related contract for the Twente Canal and IJssel Delta is its innovation clause. This is a set of provisions encouraging Rijkswaterstaat, the contractor, Deltares and other parties to work together

on social and technological innovation. This presented us with the perfect opportunity to develop the idea of a self-navigating aquatic drone and to use it for monitoring in innovation pilot projects.'

### Considerable achievement

'No sooner said than done. In the past few years we've taken some big steps forward, though it wasn't always easy. One of the first prototypes was a small drone, an aquabot. But it didn't work. The drone was far too light for the wave movement and current in the River IJssel – the fastest flowing river in the Netherlands. We now have a functioning prototype: a drone measuring 4.5 metres by 1.8 metres, packed with equipment. We've completed the first tests on the River IJssel. And they were successful! This was in itself a considerable achievement. And I'm very proud to have been part of it.'

### Getting data on land

'Of course, I'm not working on my own. Apart from our partners in the Self Supporting River System (SSRS) innovation partnership – the BAM/Van den Herik consortium and Deltares – we are also working with Aquatic Drones, the company developing the drone. It's thanks to the cooperation between all these parties that we've got this far. But we still have a long way to go. The drone is a vessel full of technology, with a very accurate GPS system, depth gauges, sensors and software to do the calculations. But how do we get all the data on land? And how do we enable all our instruments to communicate with each other? Which algorithms do we need to use? We also want the drone to be fully self-navigating. So we are going to use applications from the automotive industry. We took the necessary steps in 2018, and in 2019 we'll move forward. I'm confident that we'll manage to produce the drone we're all aiming for.'

### Young boy's dream

'What do I hope to achieve? First – and that probably doesn't sound too exciting – my aim is for Rijkswaterstaat to acquire sustainable, reliable and affordable data in future. Developing a drone is a means to an end, not an end in itself. But of course I want to build a fully operational self-navigating drone. That would be the crowning achievement. And it would be a young boy's dream come true.'


# 7 Changes in the organisation

Rijkswaterstaat wants to respond flexibly and professionally to the challenges facing society today. That is the aim of Strategy 2020, our customer-driven organisational approach. Based on this strategy, our 9,000 staff members work together to keep the Netherlands safe, liveable and accessible. Moving forward to 2030, Rijkswaterstaat is now investing in more innovation and closer cooperation.

Society is changing radically and more rapidly. Many of these changes – climate change and the energy transition, for instance, as well as new technologies, the importance of data, the tight labour market, increasing mobility and public participation – touch on Rijkswaterstaat's work, tasks and remit. What's more, much of the infrastructure in the Netherlands is approaching the end of its technological lifespan.

## Challenge

Rijkswaterstaat will face a major, complicated and labour-intensive challenge in the years following 2030 – a challenge we want to meet head on. So we are already preparing for it. We have identified five priority themes for the development of our services and products in the years to come. These are: rejuvenation, renewal and sustainability; smart mobility; sustainable living environment; information and data; and the Environment and Planning Act.

*Balance*

Our sixth priority is cooperation. In order to tackle the five themes listed above, cooperation is essential – both within


*Road inspectors clearing a road block*

Rijkswaterstaat and with our civil society partners, the private sector and knowledge institutions. At the same time, we need to continue delivering top quality in our day-to-day work. So the challenge for Rijkswaterstaat's organisational change process in the years to come is to achieve results while striking the right balance between meeting current and future needs.

### Groundwork and innovation

To meet our remit in 2030 and beyond, we will need new services, products and working methods. So Rijkswaterstaat plans to promote innovation throughout the organisation. We plan to work on new services and products for society.

We did the groundwork in 2018. We drafted plans and a timetable for each priority theme and appointed a member of the board to monitor activities. A few staff members were freed up to develop new products and services and to test them in pilot projects. They will start work in 2019. The first innovations will be rolled out within the organisation from 2020.

## Our priorities

### Rejuvenation, renewal and sustainability

In the years to come, the Netherlands will face the biggest maintenance operation ever, with much of its infrastructure needing replacing or renovating. Keeping roads, bridges, tunnels and viaducts safe, reliable and accessible will have the highest priority in Rijkswaterstaat's work in the foreseeable future. Careful planning and programming will be crucial to prevent and limit inconvenience and disruption. At the same time, we will be putting the technology in place for smart mobility and smart traffic management. We will need to exploit every opportunity for standardisation and innovation. And we will have to ensure that we have high-quality staff and the knowledge and expertise needed to do the job.

### 2. Sustainable living environment

Working on a sustainable, high-quality living environment touches on every one of Rijkswaterstaat's services and products. With the Sustainability and Living Environment Programme, we want to anchor sustainable working methods in all parts of our organisation and in our

*Rijkswaterstaat plans to promote innovation throughout the organisation*

*We will continue to invest in cooperation with market partners, partner government authorities and in alliances*

work processes. Rijkswaterstaat's aim is to develop as the executive organisation not only of the Ministry of Infrastructure and Water Management, but also of other central government agencies. In putting out contracts to tender, we focus on reducing $CO_2$ emissions, and in implementing projects we recycle as much material as possible. We are also planning to generate sustainable energy with our infrastructure and on the land and water we manage. Our ambition is to be energy self-sufficient by 2030.

### 3. Smart mobility

Rijkswaterstaat wants to exploit opportunities for smart mobility to improve traffic management, manage roads more efficiently and provide services for road users. In the next few years, we plan to make our roadside systems smart-mobility-proof and work with a carefully thought-out, intelligent traffic management plan. We know that smart mobility will have a huge impact on our work and networks and on society in the next 15 years. The self-driving car is already up and running, so it's time to determine our strategy and distribute tasks accordingly.

### 4. Information and data

Rijkswaterstaat also wants to make optimum use of online information provision, data and innovative technology. This will enable us to respond better to the wishes of our users, with real-time, customised travel information. And we will be able to fulfil our role as infrastructure and traffic manager more efficiently, computerise vulnerable major structures and traffic systems, and secure them against technical failure and hackers.

### 5. The Environment and Planning Act

The Environment and Planning Act is expected to come into force in 2021. It will enable government agencies to work together more efficiently and more actively on a sustainable living environment, driven by the needs of our customers. The new act will impact on the work of around 4,000 members of Rijkswaterstaat staff. We will have to involve the general public and the regional authorities more closely in our work – at both the preparatory stage and during implementation of projects. This is already our standard strategy.

### 6. Partnership

Rijkswaterstaat cannot carry out all its tasks for society unassisted. Partnerships are vital. So we will continue to invest in cooperation with market parties and partner government authorities and in alliances. To improve relations with the market, Rijkswaterstaat took a close look at its contracts in 2018. The aim was to reach agreement and conclude contracts that are fair, encourage innovation and efficiency, and reduce quality failure costs. And in the spirit of the Environment and Planning Act, we will make an even greater effort to engage with municipal and provincial authorities and the general public.

## Our staff

### Internal cooperation

Internal cooperation between the various Rijkswaterstaat departments is high on our strategic agenda. We face two challenges – to keep our day-to-day operations running and introduce the necessary improvements, while working on essential innovations. Management plays a key role in the organisational change process. In 2018 we launched a strategy aimed at strengthening management's focus on the world outside Rijkswaterstaat, improving cooperation between the various tiers of management, and improving guidance within the organisation.

### New work culture

Our staff are proud to work for Rijkswaterstaat. But a survey conducted in 2018 showed that they feel that pressure of work is high and that there is too much bureaucracy. To create a sense of calm within the organisation, we plan to make as few changes as possible to our organisational structure in the next few years. New leadership should lead to even better internal cooperation, more unity and a culture of connectivity. Less bureaucracy should enable staff members to focus their talents, skills and attention on the services and products they provide for society. So we are eliminating unnecessary internal regulation.

# Rijkswaterstaat organisation


Staff members must each feel that they own their work, and that they have the freedom to do it as they see fit. In this way, Rijkswaterstaat will continue to be an attractive employer.

### Capacity management

Skilled workers, equipped with the right knowledge and expertise, are becoming a scarce commodity on the labour market. Ensuring that the right knowledge is available in the right place in the organisation is becoming an increasingly important task for Rijkswaterstaat. Within 10 years, 40 per cent of the current workforce will have retired or moved on. At the same time, the labour market is becoming tighter. So Rijkswaterstaat wants to maintain its profile as an attractive employer. In 2018 we ran a campaign to actively recruit staff for our maintenance operations. In the next few years we will need to recruit more staff, given the expansion of our activities, increased products and services, and the number of staff coming up for retirement.

Investments in our image and in employer branding are now bearing fruit. Rijkswaterstaat occupied 11th place in the rankings of favourite employers. We even came second in the category not-for-profit organisations. So, despite the tight labour market, we still succeed in attracting the right candidates to work in our organisation.

*Ensuring the right knowledge in the right place*

# 8 Summary annual accounts 2018

## Statement of income and expenditure 2018

| *All amounts in thousands of euros* | **31 - 12 - 2018** | **31 - 12 - 2017** |
|---|---|---|
| **Income** | | |
| Income from parent ministry | 2,284,709 | 2,212,833 |
| Income from other ministries | 68,989 | 38,677 |
| Income from third parties | 221,723 | 179,317 |
| Provisions released | 15,227 | 3,324 |
| Extraordinary income | 2,093 | 2,348 |
| | 2,592,740 | 2,436,499 |
| **Expenditure** | | |
| Management and maintenance costs | 1,437,526 | 1,321,514 |
| Other costs: | | |
| Personnel costs | 847,366 | 827,364 |
| Equipment costs | 235,311 | 203,768 |
| Depreciation and amortisation | 26,482 | 29,086 |
| Interest expenses | 3,673 | 3,707 |
| Additions to provisions | 2,548 | 12,449 |
| Extraordinary expenses | 2,329 | 10,728 |
| | 2,555,235 | 2,408,615 |
| **Net income and expenditure** | **37,505** | **27,884** |
| Agency share of corporation tax | 16,158 | 7,885 |
| Addition to Government Shipping Company reserve | 8,165 | 8,305 |
| **Unallocated result** | **13,182** | **11,694** |

# Balance sheet as at 31 December 2018 (before allocation of result)

| *All amounts in thousands of euros* | 31 - 12 - 2018 | | 31 - 12 - 2017 | |
|---|---|---|---|---|
| **Assets** | | | | |
| **Fixed assets** | | | | |
| Intangible fixed assets | 1,113 | | 2,973 | |
| Tangible fixed assets | 152,528 | | 160,020 | |
| Financial fixed assets | 34,200 | | 42,800 | |
| | | 187,841 | | 205,793 |
| **Current assets** | | | | |
| Debtors | 54,150 | | 35,936 | |
| Other debtors, prepayments and accrued income | 45,990 | | 32,183 | |
| | | 100,140 | | 68,119 |
| **Liquid assets** | | 772,238 | | 676,570 |
| **MIRT projects** | | | | |
| Projects in progress | | 6,922,264 | | 7,457,663 |
| **Total assets** | | **7,982,483** | | **8,408,145** |
| **Liabilities** | | | | |
| **Capital and reserves** | | | | |
| Government Shipping Company reserve | 32,498 | | 42,463 | |
| Operating reserve | 79,308 | | 79,994 | |
| Unallocated result | 13,182 | | 11,694 | |
| | | 124,988 | | 134,151 |
| **Provisions** | | 18,740 | | 38,975 |
| **Long-term liabilities** | | 95,736 | | 100,090 |
| **Current liabilities** | | | | |
| Creditors | 59,363 | | 79,962 | |
| Current liabilities to ministry | 0 | | 446 | |
| Other creditors, accruals and deferred income | 761,392 | | 596,858 | |
| | | 820,755 | | 677,266 |
| **MIRT projects** | | | | |
| Deliverable projects | | 6,922,264 | | 7,457,663 |
| **Total liabilities** | | **7,982,483** | | **8,408,145** |

# Notes to the summary annual accounts

The summary annual accounts and notes are taken from Rijkswaterstaat's annual accounts for 2018. The annual accounts were compiled in accordance with Ministry of Finance regulations. An unqualified audit opinion was issued on them. Rijkswaterstaat's annual accounts form part of the Ministry of Infrastructure and Water Management's annual accounts.

The 2018 financial year was closed with a surplus.

Income from other ministries mainly comprises payments received from other ministries for the use of Government Shipping Company vessels and administrative and programme costs that Rijkswaterstaat charges the Ministry of the Interior and Kingdom Relations and the Ministry of Economic Affairs and Climate Policy for activities connected with policy support and advice and the Environment and Planning Act.

Income from third parties largely consists of rents and leases paid for parcels managed by Rijkswaterstaat, compensation paid for damage caused by road or waterway users, income under the Water Act and income from services provided by the National Road Signage Agency.

Management and maintenance costs are charged by contractors and engineering firms.

Personnel costs consist of the cost of our own staff and of temporary staff hired in to carry out Rijkwaterstaat's core tasks.

Financial fixed assets comprise the debt falling due after more than one year receivable from the Ministry of Infrastructure and Water Management. The current portion is included under 'debtors'. The non-current portion will be paid off by the Ministry of Infrastructure and Water Management over 15 years as from 2009.

Projects in progress consists of direct production expenditure on current construction projects. Deliverable projects are recognised as a contra entry to the same amount.

### Operational management

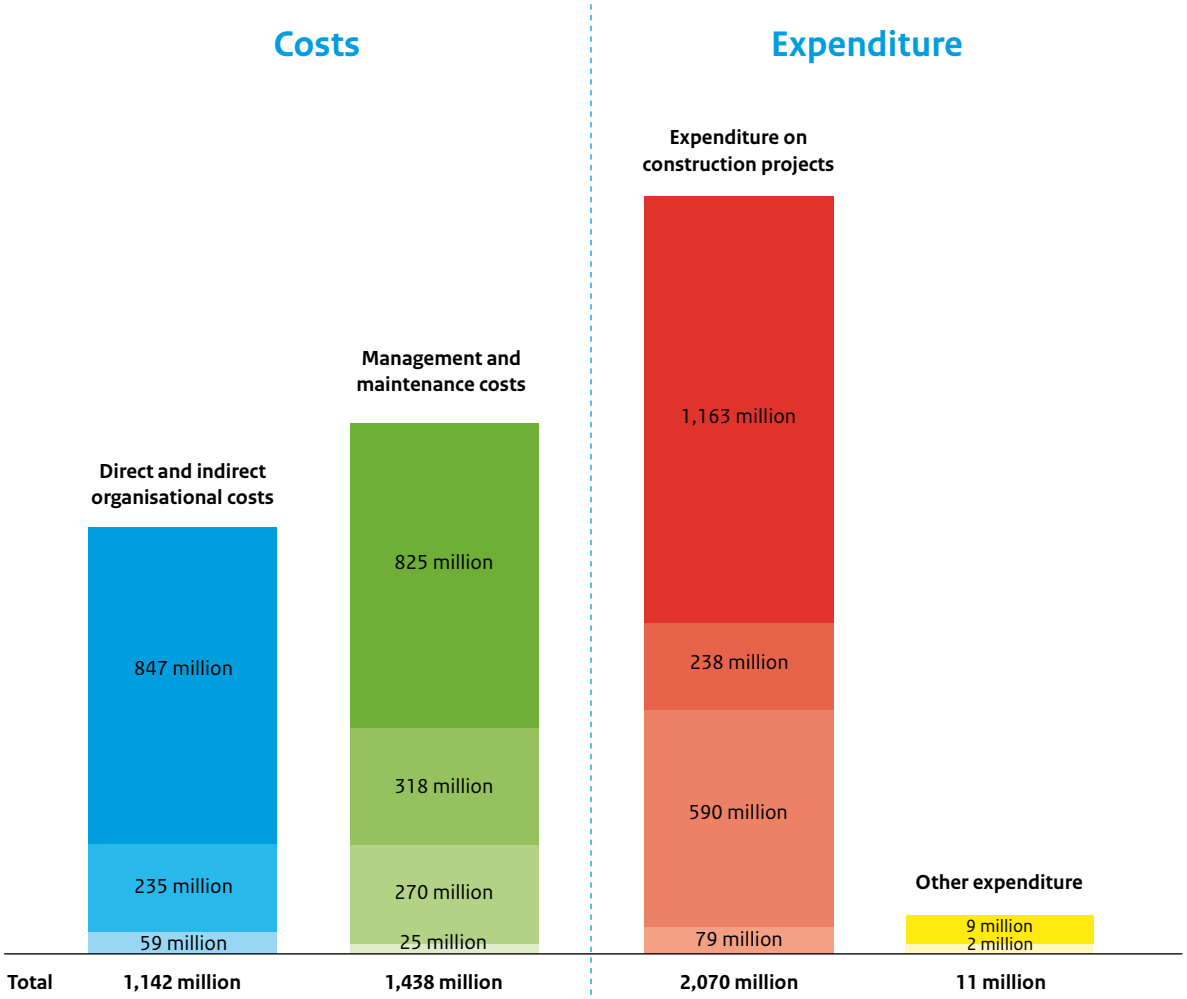
In 2018, under interministerial agreements on complying (in a demonstrable manner) with the Public Procurement Act, the market approach was assessed against the statutory requirements for the (independent) selection of suppliers. The outcome was positive. In 2019 further attention will be devoted to how the choice of procedure can be monitored in more systematic manner and what this requires in terms of ICT support and working methods.

In 2018 the contract management framework was modified; a distinction is now made between requirements for contracts with system-oriented contract management (SCB) and those without it. The HRM and training efforts required for this purpose were continued at the same level in 2018. This resulted in the ambitions set being achieved.

The Corporation Tax Liability (Public Enterprises) Modernisation Act entered into force on 1 January 2016. Agreements on related activities and responsibilities have been laid down in the Corporation Tax Framework of the Ministry of Infrastructure and Water Management. Rijkswaterstaat's activities have been charted and the results achieved have been determined as far as possible.

In 2018 Rijkswaterstaat paid 97 per cent of the 180,000 or so invoices it received on time, i.e. within 30 days, thus comfortably meeting the government-wide target of 95 per cent.

## Rijkswaterstaat costs and expenditure 2018 *(total 4.7 billion euros)*




**Direct and indirect organisational costs**

- Personnel costs
- Material costs
- Other organisational costs

**Management and maintenance costs**

*(including traffic management)*

- Main highway network
- Main waterway network
- Main water systems
- Netwerk-wide costs

**Expenditure on construction projects**

*(Infrastructure and Delta Fund)*

- Main highway network
- Main water systems
- Main waterway network
- Zuidasdok

**Other expenditure**

*(infrastructure/environment)*

- Ministry Crisis Management Coordination Centre
- Noise Reduction Schiphol project (GIS)

*All amounts in euros*

# Notes to expenditure and costs

As a departmental agency, Rijkswaterstaat concludes management and maintenance agreements with the Ministry of Infrastructure and Water Management. Rijkswaterstaat receives an agency fee for the work it performs, which also covers organisational costs. Rijkswaterstaat can make a profit or incur a loss on the agency fee. Rijkswaterstaat is also responsible for the construction and expansion of the main highways and waterways and the main water systems. The ministry funds the expenditure on these construction projects directly from the Infrastructure Fund and the Delta Fund. Rijkswaterstaat cannot make a profit or incur a loss on this expenditure.

### Management and maintenance costs

The costs of managing and maintaining the land and waters for which Rijkswaterstaat is responsible, together with its organisational costs, are accounted for in this annual report and disclosed in the statement of income and expenditure. Management and maintenance costs consist of the cost of work by contractors on the main highways and waterways and the main water system, and the cost of traffic management (main highway and waterway network) and water management (main water system). Network-wide costs are disclosed separately.

### Direct and indirect organisational costs

Organisational costs are divided into personnel costs, equipment costs and other organisational costs. Direct personnel and equipment costs relate principally to traffic and water management, management and maintenance, exploratory and planning studies, and the implementation of construction projects. Indirect equipment costs include buildings and depreciation; indirect personnel costs include central administration and management support staff.

### Expenditure on construction projects

Construction projects relate to building work on the main highways and waterways and the main water system. Like management and maintenance, this work is outsourced to third parties. Other costs incurred by Rijkswaterstaat for these projects (such as project management costs) form part of organisational costs and are accounted for in the agency's statement of income and expenditure.

### Other expenditure

Chapter XII of the central government budget is the budget of the Ministry of Infrastructure and Water Management. Rijkswaterstaat accounts for expenditure on improving the living environment (the Noise Reduction Schiphol project (GIS)). This includes expenditure on the Schadeschap Luchthaven Schiphol (which handles claims for compensation) and expenditure on crisis management, for training courses (e.g. in crisis roles), evaluations and the Crisis Expert Team on the environment and drinking water.

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# Rijkswaterstaat Annual Report 2018 on social media

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