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Tidal nature as a climate buffer

Preamble

The tidal habitats in and around the freshwater section of the Scheldt are among the most unique natural environments in Europe. Still, they are often undervalued and unjustly so, because this seemingly rugged landscape is a resilient system, rich in dynamics, biodiversity and hidden benefits for both people and wildlife.

In this brochure, you will discover why this tidal nature is so valuable. You will learn how the rhythm of the tides shapes a landscape that adapts to

the water while at the same time protecting people from it. Discover how tidal marshes and tidal mudflats store carbon, purify water, harbour a wealth of species and also provide a buffer against storms and flooding. How innovative measures, such as flood control areas and depoldering within the Sigma Plan are giving the Scheldt room again, and how Flanders is earning international recognition for this forward-looking climate adaptation policy.



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The tidal area of the Scheldt



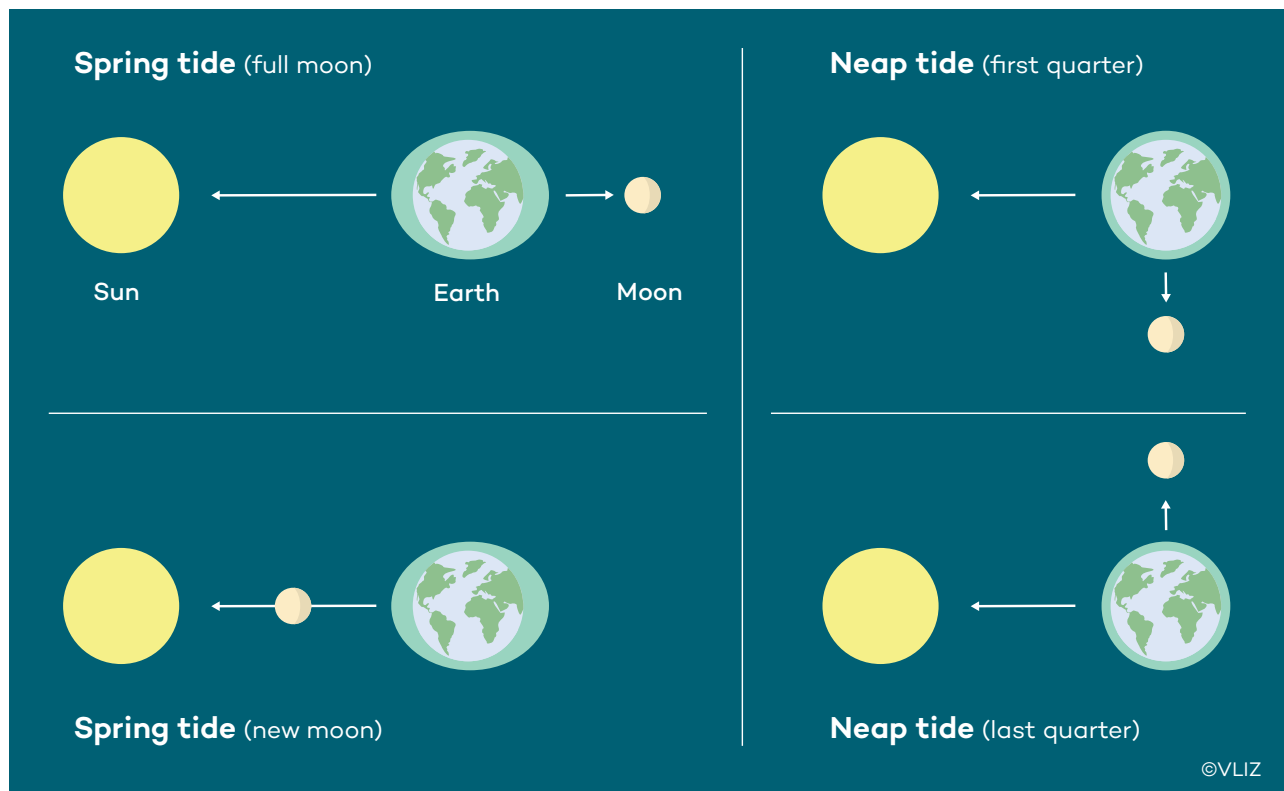
The Scheldt is sometimes referred to as the artery of Flanders. The tidal area of the Scheldt is a unique melting pot of functions. It is an internationally renowned natural phenomenon, a leading economic region and a paradise for hikers and cyclists who come to enjoy the rich blend of nature and culture. Still, the severe flooding events that have struck the valley in the past are just as characteristic of the Scheldt valley.

From source to sea

The Scheldt rises in northern France, in the municipality of Gouy, on a plateau near Saint-Quentin. From its source to Ghent, the Scheldt is known as the Upper Scheldt; beyond Ghent, its name changes to the Sea Scheldt.

After Antwerp, the Scheldt flows into the Netherlands, where it's called the Western Scheldt. At Vlissingen, the Western Scheldt flows into the North Sea.





The Scheldt and its tides

Together, the Sea Scheldt and the Western Scheldt form the Scheldt estuary, a unique tidal area where ebb and flow occur twice a day, driven by the sun and the moon. What is remarkable is that this tidal movement is felt up to 160 km inland, as far as the locks of Ghent. Even the tributaries, the Durme, the Rupel, the Kleine Nete and Grote Nete, the Dijle and the Zenne are under tidal influence; on the Dender, it is halted by a weir and lock in Dendermonde.

Every fourteen days, the nature of the tide changes. Approximately two days after a new moon and full moon, spring tide occurs, which is when the difference between high and low water is at its greatest. A week later, after

the first or last quarter of the moon, the tidal range is then at its smallest. This is known as neap tide.

The difference in water level between ebb and flood at Vlissingen (NL) is approximately four metres and increases inland due to the funnel-shaped estuary. In Antwerp, the difference grows to more than five metres, and at the Durme Estuary in Hamme to as much as six metres. Further upstream, the difference decreases due to resistance and friction in the riverbed. In Ghent, the difference in level between ebb and flood is still approximately 2.5 metres.

Fresh, brackish and salt: a mixture of 3 types of water

From the mouth in the North Sea as far as Temse, salt water from the sea and fresh water from the Scheldt and its tributaries mix. This gradual transition from salt to brackish to fresh water, the so-called salinity gradient, is one of the elements that make the Scheldt so special. In combination with the rhythm of ebb and flow, this creates a great variety of tidal habitats. Think of salt-loving herbs and grasses such as sea lavender and glasswort, across reeds and sea aster that thrive in brackish water, to reed beds and tidal willow forests that are found in the freshwater part of the Scheldt. In turn, these habitats provide a home for a wide range of birds, fish and insects.

Thanks to the straightening of the Scheldt in the past, the construction of levees and the hardening of inland areas, fresh water is discharged ever more rapidly at low tide. In addition, prolonged drought and rising sea levels are causing salt water to penetrate ever further inland. Because an unbalanced salinity level is harmful to fauna and flora, measures are being taken to slow down the discharge of fresh water. The river now has more space to flow, tidal habitats are developed and wetlands retain fresh water for longer.

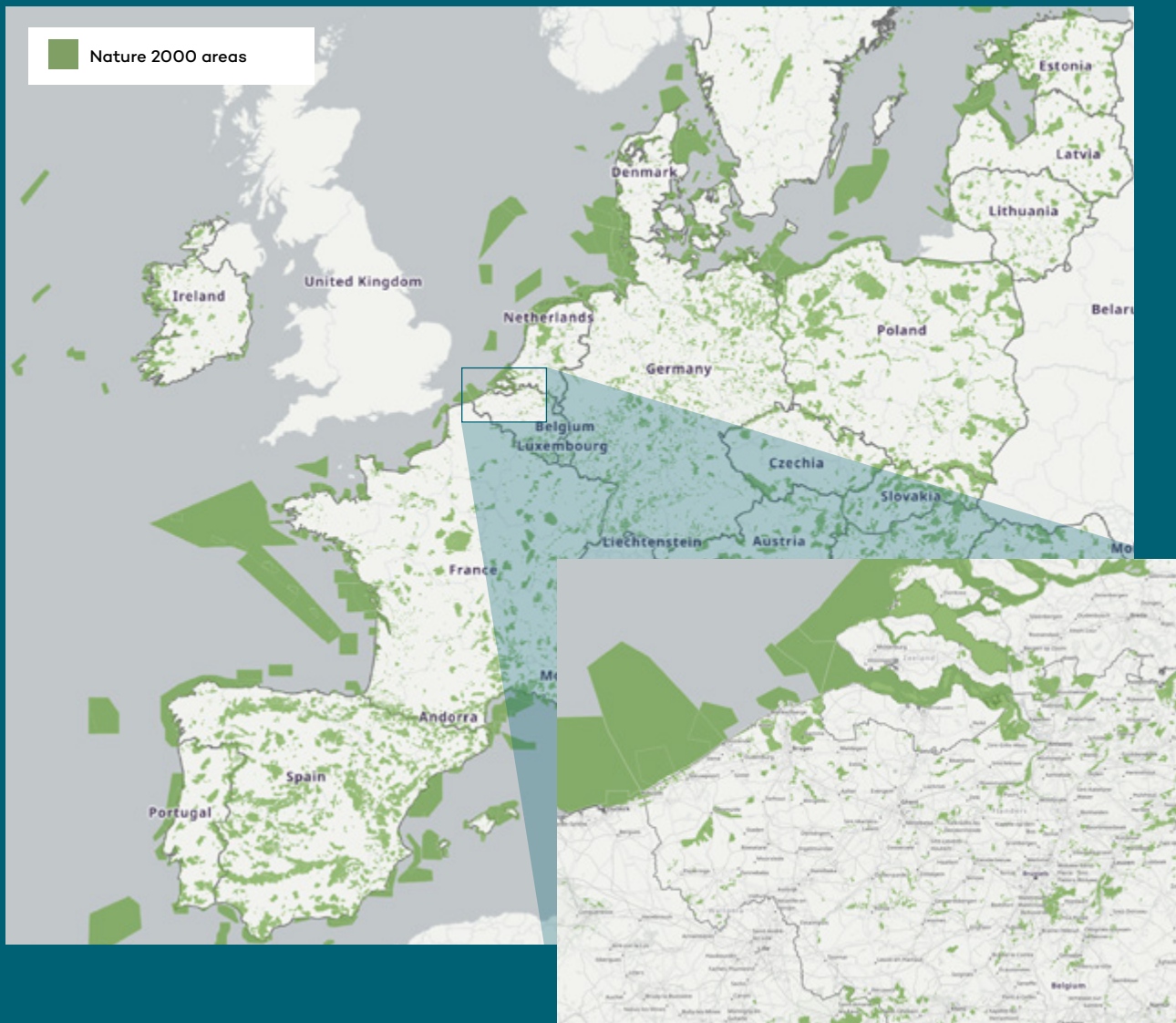


Water, sand and silt combine to sculpt the landscape

The sea and the tributaries also carry sand and silt. In some places, the riverbed is scoured out, while in other locations sedimentation takes place: sand and silt settle to the bottom and accumulate there. This creates an irregular pattern of deep and shallow water, tidal mudflats and tidal marshes, channels and creeks. In natural river landscapes, the water adapts by seeking new routes.

At low tide, the Scheldt reveals its varied bed structure. The tidal mudflats fall dry. As the water retreats, it leaves a layer of silt on the tidal mudflats. This silt gradually builds up, causing some areas to eventually rise above the waterline. This leads to the formation of tidal marshes, which are only flooded during higher high water. In contrast to tidal mudflats and shoals, plants grow on tidal marshes.





A mosaic of habitat types

The continuous interaction between tides, salt and fresh water, silt and sand forms the basis of an exceptional natural richness. This dynamic creates a varied landscape of tidal mudflats, tidal marshes, reed beds and tidal forests.

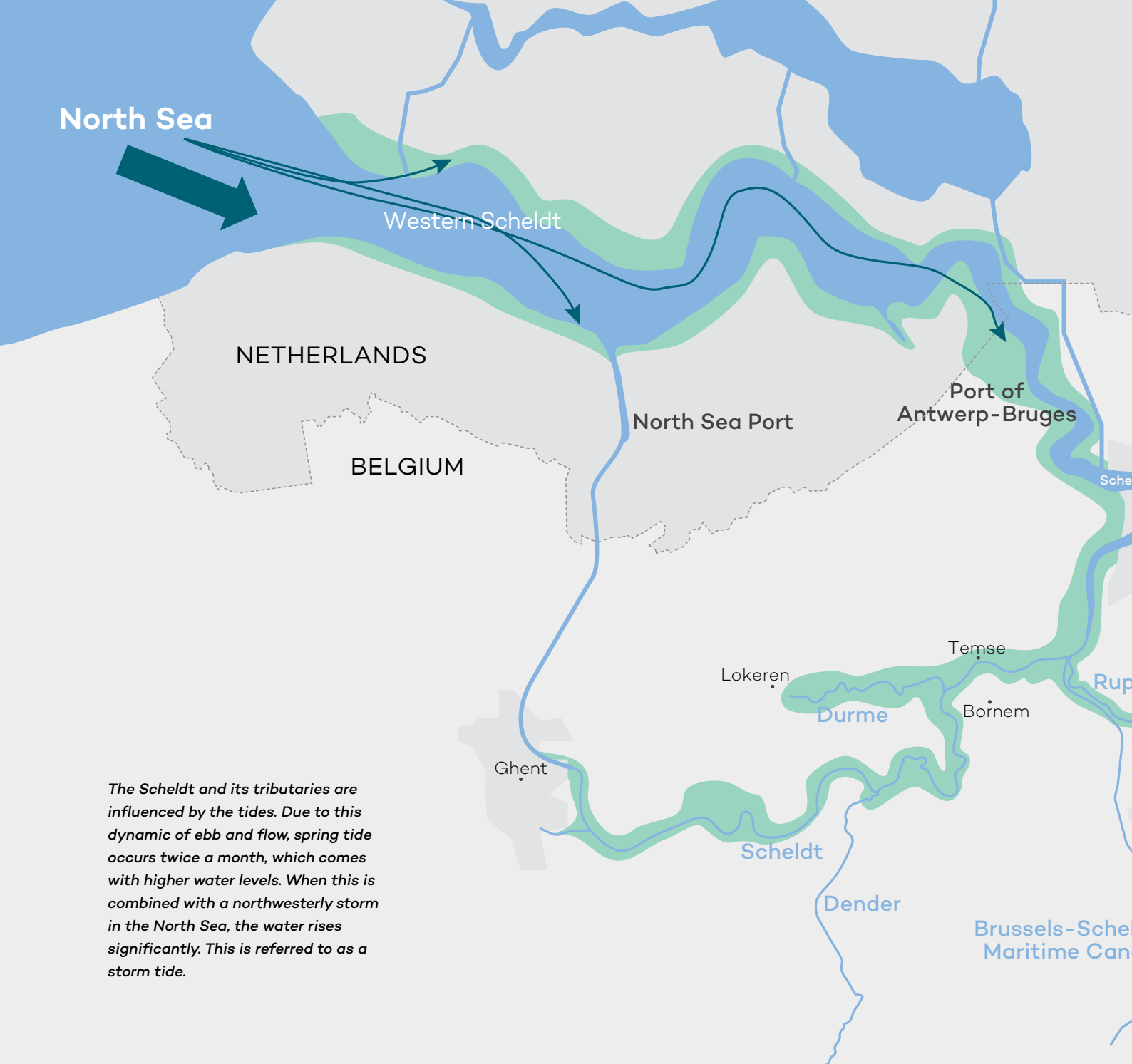
The tidal willow forests in particular are truly special: wet, dense woodlands that are inundated at high tide and strongly resemble tropical mangroves. For many migratory birds, winter visitors and breeding birds, the Scheldt is indispensable. They use these areas as feeding grounds, resting places or

breeding habitats, essential for their survival during long journeys or harsh winters.

The unique nature along the Scheldt is so valuable that Flanders protects it under international agreements. Several areas along the Scheldt are designated as European Natura 2000 sites. This European policy focuses on the conservation and restoration of biodiversity by protecting both habitats and species. For instance, the Scheldt estuary forms part of a cross-border network of protected nature.



Scheldt (tidal section at Gentbrugge) at low tide – tidal mudflats ©Vilda



The Scheldt and its tributaries are influenced by the tides. Due to this dynamic of ebb and flow, spring tide occurs twice a month, which comes with higher water levels. When this is combined with a northwesterly storm in the North Sea, the water rises significantly. This is referred to as a storm tide.





Flooding, that too is the Scheldt

Severe storm tides in the North Sea can drive enormous tidal waves into the Scheldt, with devastating consequences. In the Middle Ages, entire villages and farmlands disappeared under water. More recent floods, such as those in 1953 and 1976, also left deep scars.



Zennegat (Mechelen) in 2022 after storm Corrie ©Iris Verelst





A comprehensive plan for a versatile Scheldt

In 1977, those severe storm tides were the catalyst for the Sigma Plan: a long-term programme designed to provide better protection for Flanders. With the updated Sigma Plan in 2005, Sigma Plan 2.0, this approach evolved towards a genuine 'room for water' philosophy that combines levee reinforcement with flood control areas. These areas temporarily store water when a high flood wave caused by a storm tide enters the Scheldt, and they also reduce the force of the rising water.

However, the Sigma Plan is not solely about safety. Along the

Scheldt, much valuable nature has been lost, and therefore the plan takes targeted action in each area to restore tidal mudflats, tidal marshes, wetlands, grasslands, marshes, alluvial forests and more. In this way, the unique Scheldt nature is given a new lease on life.

In addition, the Sigma Plan also develops new cycle paths, walking routes, bird hides and observation points so everyone can experience the dynamic Scheldt landscape first-hand.



| Tidal
nature





Tidal mudflats: rich in nutrients

Tidal mudflats are parts of the riverbank that are inundated at high tide. There is no vegetation here, as few plants tolerate being submerged twice a day. In the mudflats, however, millions of worms, crabs and small crustaceans thrive, a veritable feast for geese, ducks and waders. For these birds, tidal mudflats are therefore the ideal place to rest and forage.

At high tide, the river deposits a layer of silt on the tidal mudflats. Over time, this area gradually rises through sediment accretion, causing tidal mudflats to slowly build up into tidal marshes. However, the tide can also reclaim land. Riverbanks erode, tidal marshes revert to tidal mudflats, and the cycle of marsh formation can start anew. Nature is always in motion.



Groot Schoor Hingene, ©Vilda



Sea lavender ©Nico Pieters

Tidal marshes: unique biotopes

Tidal marshes are the vegetated, higher-lying areas. They are not inundated every day, only during higher high waters. Tidal marshes are infiltrated with gullies and creeks that fill with water flows at high tide and drain again at low tide.

Young tidal marshes are flooded most frequently. Here, plants grow that easily tolerate temporary inundation. Saline tidal marshes are mainly home to herbs and grasses that can withstand significant salt levels, such as sea lavender and glasswort. On brackish tidal marshes, a mixture of salt and fresh water, reeds and sea aster can be found. Further upstream, freshwater marshes develop. Here, tidal action leads to sedimentation and erosion, creating steep and deep gullies: a changing landscape with rough vegetation, reed beds and tidal willow forests. In early spring, these tidal forests are home to blooming cuckoo flowers and marsh marigolds. Reed and marsh birds find shelter and breeding grounds here. The tidal willow forests along the Scheldt closely resemble tropical mangroves: they form dense, impenetrable forests in the water. Freshwater marshes occur upstream of Kruibeke on

the Scheldt. These habitats are rare in Europe.

The tidal range, the difference in water level between ebb and flow, on the Scheldt has increased significantly over the past century. This is mainly due to the deepening and straightening of the river, which lets tidal waves penetrate further inland. These higher water levels lead to more sediment being deposited on the tidal marshes, enabling them to keep pace with the increasing tidal range. However, tidal marshes are also affected by these changes. The edges of the highest tidal marshes have become steep and vulnerable to strong currents, resulting in a natural process of erosion.

But because there are few remaining calm zones in the river, it is increasingly difficult for new tidal mudflats and tidal marshes to form spontaneously. That is precisely why it is important to give the Scheldt more space again. Depoldering and flood control areas create new sheltered zones where young tidal marshes can develop. In this way, the Sigma Plan contributes to a process of restoration that is shaping the tidal nature of the future.

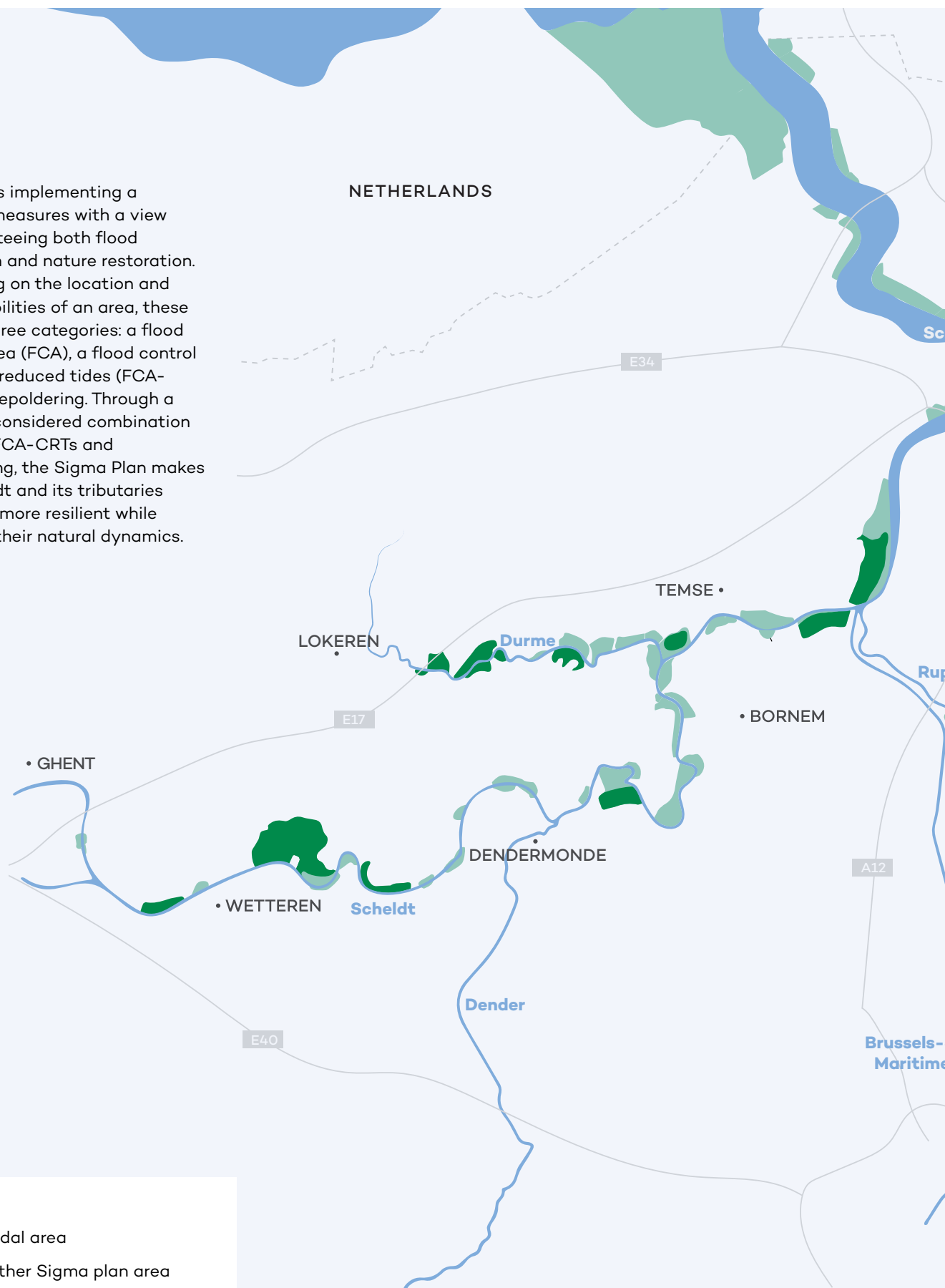
Restoration of tidal nature: the Sigma Plan in action



The tidal habitats of the Scheldt have suffered severely over the past centuries. Where the river once flowed freely, there are now residential districts, ports and agricultural land. This has led to a decline in valuable tidal mudflats and tidal marshes. The Sigma Plan is reversing this trend. Through a carefully considered combination of flood safety and nature development, a total of 9,000 hectares of additional nature is being created. For tidal mudflats and tidal marshes alone, the conservation objectives aim to add an additional 500 and 1,500 hectares respectively. A substantial area of tidal habitat now has space to develop and grow again.



Flanders is implementing a range of measures with a view to guaranteeing both flood protection and nature restoration. Depending on the location and the possibilities of an area, these fall into three categories: a flood control area (FCA), a flood control area with reduced tides (FCA-CRT), or depoldering. Through a carefully considered combination of FCAs, FCA-CRTs and depoldering, the Sigma Plan makes the Scheldt and its tributaries safer and more resilient while restoring their natural dynamics.



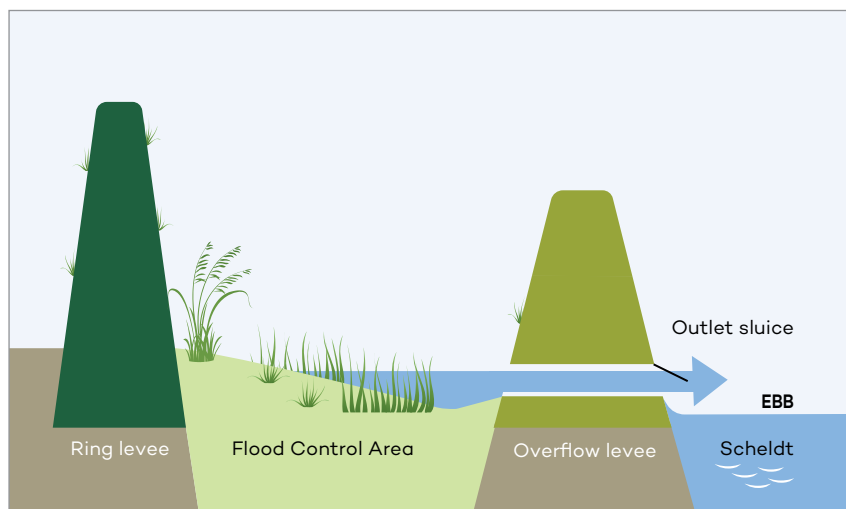
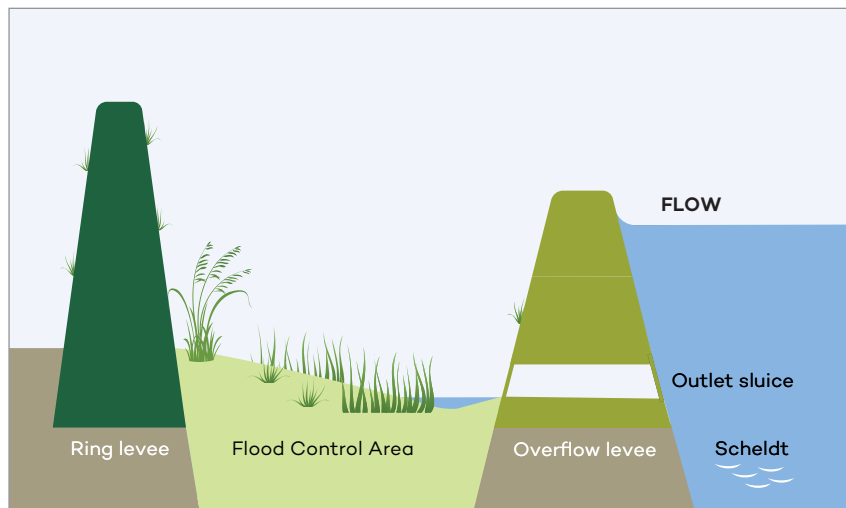
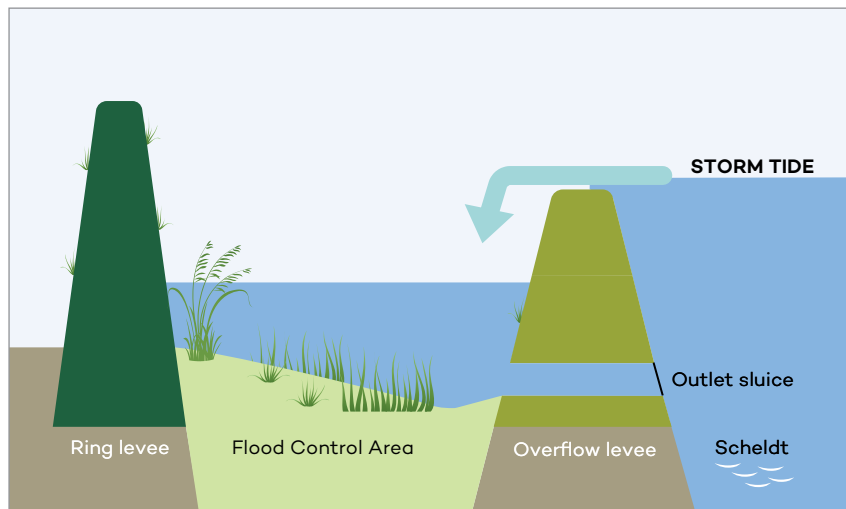


Flood control areas: flood protection and river nature

The Scheldt is a powerful tidal river, with water levels rising significantly during storm tides. As the river narrows upstream, pressure on the levees increases. To reduce flood risks, the Sigma Plan relies on flood control areas (FCAs). Many of these areas are given a nature-based layout as tidal nature reserves or wetland, meaning they not only contribute to flood protection but also to biodiversity.

How does a flood control area work?

An FCA is a flood area that can be deliberately flooded during extreme water levels. Through an overflow levee, part of the flood wave enters the area, allowing the water mass to be temporarily stored and reducing pressure on the levees. Only when the water level drops does the water flow back into the river. In such a flood control area, a ring levee protects the residential and agricultural areas behind it.





Polders of Kruibeke, ©Vilda

POLDERS OF KRUIBEKE

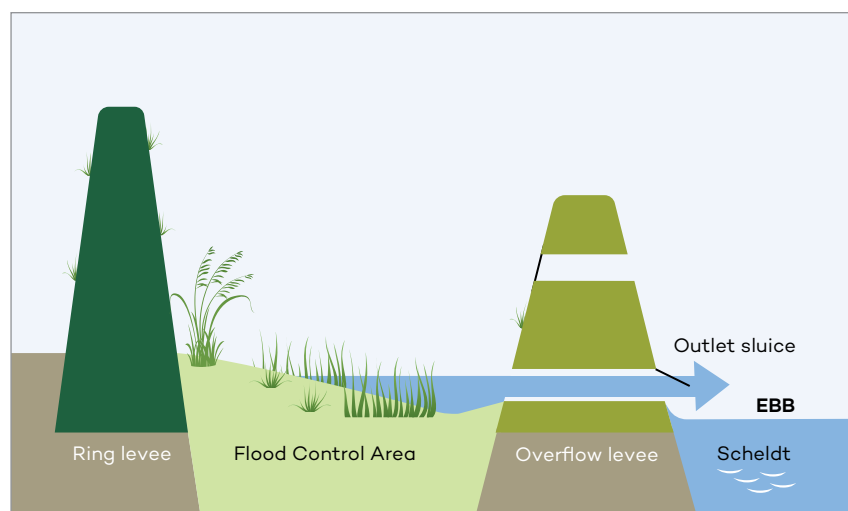
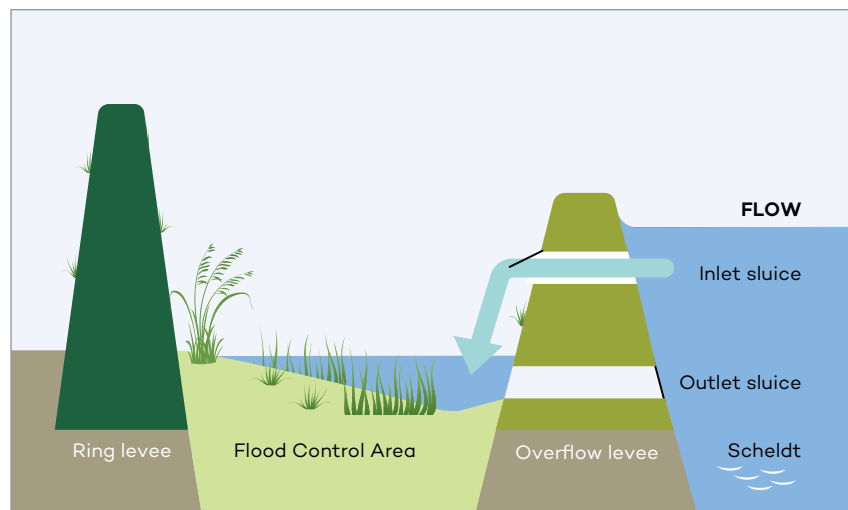
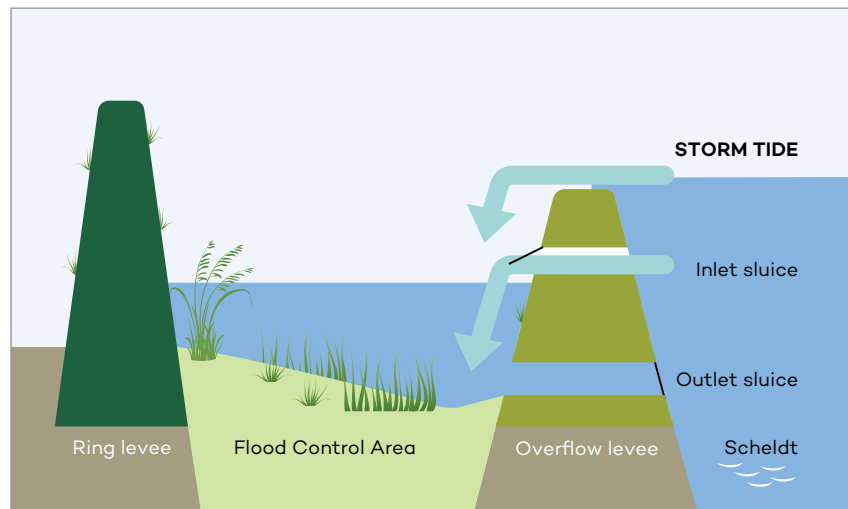
One of the largest flood control areas is the Polders of Kruibeke. One of the largest flood control areas in Flanders is the Polders of Kruibeke. This 600-hectare area combines flood protection with rich nature development: 300 hectares of tidal mudflats and tidal marshes, 150 hectares of grassland bird habitat and more than 160 hectares of wet woodland.

Flood control area with reduced tides: flood protection and tidal nature

Within the Sigma Plan, FCAs are designed in different ways. Some of them are developed as flood control areas with reduced tides (FCA-CRT). In an FCA-CRT, the area remains under tidal influence but in a weakened form. This promotes the gradual build-up of tidal mudflats and tidal marshes. With each tidal movement, the water deposits a thin layer of silt, helping the area to develop into a low-dynamic tidal area. In this way, an FCA-CRT combines flood protection with the development of tidal nature.

How does a flood control area with reduced tides work?

The basic components are the same as with a flood control area: a ring levee protects the hinterland and a lower overflow levee separates the flood area from the river. An additional element is the tidal sluice, which allows the tide to enter in a controlled and dampened way. Through this single sluice, water flows into the area at high tide, and at low tide it gradually flows back into the river. Only in exceptional cases, such as at Lippenbroek or the Polders of Kruibeke, are two separate sluices used: one inlet and one outlet sluice.



LIPPENBROEK

A major breakthrough in the development of FCA-CRTs came with a pilot project in Lippenbroek (Hamme), an erstwhile polder that was converted into a test site in 2006. This living laboratory played a crucial role in refining the technique: scientists studied how tidal nature could be combined with flood protection and demonstrated, among other things, how tidal mudflats and tidal marshes contribute to water purification.

When river water flows into the area at high tide, it is spread over a large surface area and intensively mixed. This introduces additional oxygen into the water, an important added value for fish and other aquatic animals. At the same time, fine sediment particles are deposited on the tidal marshes. Various pollutants, such as nitrogen and phosphorus, bind to this silt.

Thanks to tidal dynamics and vegetation, these nutrients are retained or biologically broken down. In addition, research in Lippenbroek shows that the returning water is richer in silicon, an essential element for the growth of diatoms. These microscopic algae form the base of the food web in estuaries. In this way, FCA-CRTs not only improve water quality, but also enhance the productivity of the ecosystem. Tidal mudflats and tidal marshes help ensure that cleaner water flows back into the river at low tide. This natural purification is not only ecologically significant but also reduces pressure on conventional water treatment plants. Thanks to the knowledge gained from Lippenbroek, the world's first FCA-CRT, scientists were able to implement improvements in other areas along the Scheldt.

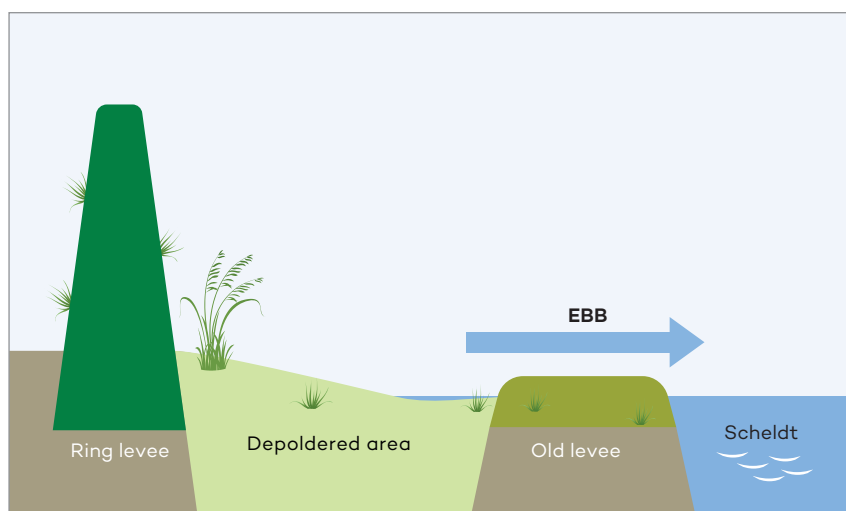
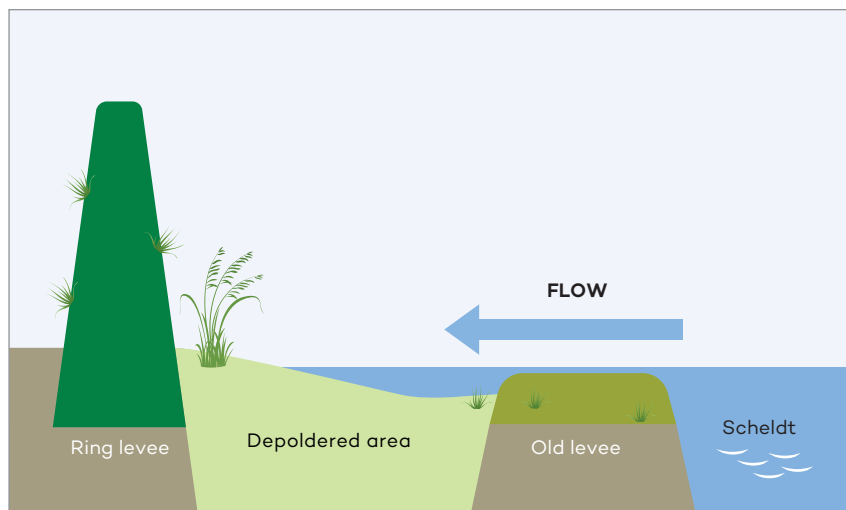
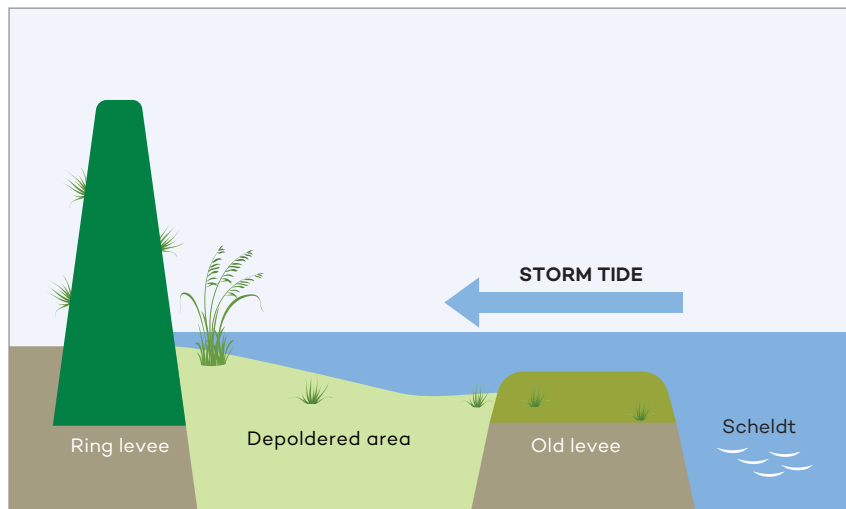
Following this successful experiment, a flood control area with reduced tides was created in Bergenmeersen (Wichelen). This 41-hectare nature area contains rare freshwater tidal nature, tidal mudflats and tidal marshes with tidal willow forests. At low tide, the tidal mudflats are exposed, allowing Eurasian teal, common shelduck and many waders to forage there. On the tidal marshes, typical wetland plants such as reeds and great reedmace spread. In the reed beds and tidal willow forests, the bluethroat and the common reed warbler feel completely at home.

Depoldering: returning land to the river

Another method through which the Sigma Plan creates additional tidal nature is depoldering, which reconnects an area enclosed by levees to the river. The return of the tides leads to the formation of tidal mudflats and tidal marshes, valuable ecosystems that strengthen biodiversity. Depoldering not only contributes to nature development but also to flood protection.

How does depoldering work?

First, a new flood defence levee is constructed further inland. Subsequently, openings are made in the old levee, or it is removed entirely. The depoldered area effectively becomes part of the river, giving the river extra space to flow and to flood. Due to the sudden widening, the depoldered area also dissipates the force of the rising water. This reduces pressure during extreme weather conditions, thereby lowering the risk of flooding upstream.



HEDWIGE-PROSPER AREA

One of the best-known examples of depoldering is the former Hedwige-Prosper area. This area on the Belgian-Dutch border was previously reclaimed for agriculture but has now been reconnected to the Scheldt. Since 2023, ebb and flow have been given free rein again, creating a dynamic landscape with valuable habitats for birds, fish and other estuarine species.



Hedwige-Prosper area ©Vilda

Unique fauna and flora in tidal nature

The tidal habitats of the Scheldt are exceptionally rich and varied. From saline tidal marshes to freshwater tidal forests, each zone hosts its own characteristic plants and animals. Discover species that have perfectly adapted to the rhythm of ebb and flow, to saline water or to the silt-rich soil. Together, they form a unique ecosystem teeming with life, from tiny worms in the silt to rare birds and charismatic mammals such as the beaver and the otter.



Saltwater tidal nature



PIED AVOCET ◀

Type: wader

Characteristic: elegant black-and-white bird with a long, upturned bill, which it sweeps from side to side to sieve small aquatic animals from shallow water

Did you know: the pied avocet often breeds in colonies on bare or sparsely vegetated mudflat edges.



OYSTERCATCHER ◀

Type: wader

Characteristic: striking black-and-white bird with a long orange bill that searches for shellfish on the mudflats

Did you know: with its powerful bill, the oystercatcher can easily prise open cockles or break them apart.



EUROPEAN SPOONBILL ◀

Type: large wader

Characteristic: uses its spoon-shaped bill to sieve small fish and shrimps from the water

Did you know: spoonbills often forage in groups, wading side by side through the water.

COMMON COCKLE ▶

Type: shellfish found in saline tidal mudflats

Characteristic: lives buried in the sand and filters plankton from the water

Did you know: an adult cockle can live for up to 25 years and is an important food source for birds such as the oystercatcher.



SHORE CRAB ◀

Type: crustacean found in saline tidal zones

Characteristic: agile crab that hides in the silt and feeds on worms and small shellfish

Did you know: the shore crab can move backwards and sideways, and regularly moults its shell as it grows

Brackish water

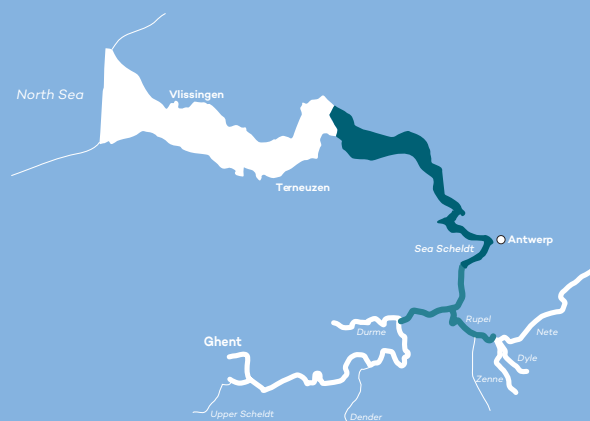


COMMON SCURVYGRASS ◀

Type: brackish-water plant

Characteristic: thrives under saline influence and grows mainly in the Drowned Land of Saeftinghe

Did you know: now that the Hedwige-Prosper area has been reconnected to the Scheldt, scurvygrass has every opportunity to flourish here again.



TWAITE SHAD ◀

Type: migratory fish that breeds in fresh water but lives mainly in the sea or in brackish water

Characteristic: a fish species that had long been absent from the Scheldt

Did you know: the twaite shad is an indicator of a healthy oxygen balance in the water. It doesn't feed during its spawning migration, making oxygen the key factor for its survival.



COMMON GOBY ◀

Type: fish found in the transition zone between fresh and salt water

Characteristic: can tolerate large fluctuations in salinity

Did you know: this fish likes to bury itself in the sand during the day to shelter from predators.



RAGWORM ◀

Type: bristle worm found in silt-rich brackish-water areas

Characteristic: Moves in a snake-like manner and preys on small invertebrates

Did you know: the ragworm has a remarkable number of legs and is in fact a predatory worm.

MYSID SCHRIMP ▶

Type: crustacean found in silt-rich brackish water

Characteristic: small, transparent shrimp that is active at low tide

Did you know: mysid shrimp are an important food source for many birds in the estuary.



BALTIC TELLIN ▶

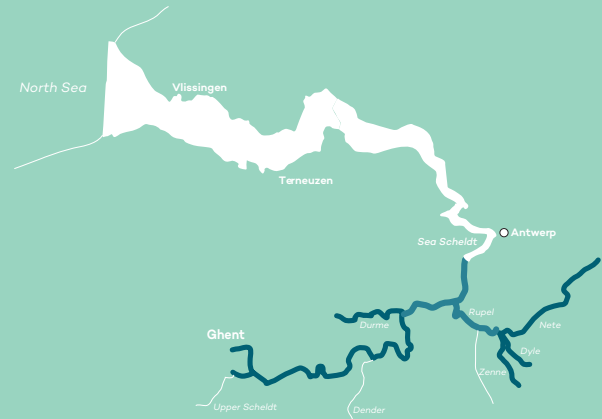
Type: shellfish found in brackish-water areas

Characteristic: lives buried in the sediment and filters food from the water

Did you know: the Baltic tellin is small but abundant, making it a crucial link in the estuarine food web.



Fresh tidal nature



©Hugo Willocx

SHELDUCK ◀

Type: bird of tidal mudflats and tidal marshes

Characteristic: feeds on tidal mudflats at low tide, searching for mysid shrimp and shellfish

Did you know: shelducks often nest in old rabbit burrows or in self-dug burrows.



TRIANGULAR CLUB-RUSH ◀

Type: pioneer plant on freshwater tidal marshes

Characteristic: forms an extensively branched network of roots and rhizomes, enabling it to trap silt

Did you know: due to pollution and eroding riverbanks, triangular club-rush all but disappeared but is now making a comeback thanks to improved water quality in the Scheldt.

WHITE WILLOW ▼

Type: characteristic tree of freshwater marshes

Characteristic: Plays an important role in trapping silt and stabilising riverbanks

Did you know: The white willow, often pollarded and then called pollarded willow, can grow up to 20 metres in tidal willow forests.



EEL ▼

Type: migratory fish that moves between salt and fresh water but spends many years in freshwater areas

Characteristic: enters the estuary as a glass eel and grows here

Did you know: thanks to improved water quality, eels are swimming further upstream in the estuary, which is a positive sign of a healthy ecosystem.



PURPLE LOOSESTRIFE ►

Type: pioneer plant in the fresh and brackish parts of the river

Characteristic: a typical species found in young tidal marshes, recognisable by its purple flowers

Did you know: In the early years, purple loosestrife dominates the tidal marshes, but over time it is replaced by willows and reeds, allowing a tidal willow forest to develop.





MARSH MARIGOLD ◀

Type: rare tidal plant

Characteristic: occurs almost exclusively in freshwater tidal areas, along reed edges and in tidal willow forests

Did you know: the marsh marigold releases small fragments of its root system, which drift on the tides and grow into new plants. What a clever way to make use of the river!

EURASIAN TEAL ▶

Type: duck of freshwater marshes

Characteristic: small, colourful duck that winters in shallow freshwater areas

Did you know: the Eurasian teal is one of the first ducks to migrate back north in spring.



FRESHWATER AMPHIPOD ▶

Type: small crustacean in freshwater silt

Characteristic: lives among plant debris and clears the water of organic waste

Did you know: despite its modest size, the freshwater amphipod plays an essential role in the food web.





FRESHWATER SNAIL
(E.G. GREAT RAMSHORN) ◀

Type: mollusc found in freshwater mudflats

Characteristic: slowly glides over mud, feeding on algae and plant debris

Did you know: many freshwater snails breathe through a kind of lung, forcing them to surface for air.



TEN-SPINED STICKLEBACK ◀

Type: fish of freshwater marshes

Characteristic: small fish that adapts to fluctuating salinity

Did you know: during breeding season, the male builds a nest and defends it fiercely, which is remarkable behaviour for such a small fish.

EUROPEAN FLOUNDER ▶

Type: flatfish found from saline to freshwater tidal areas

Characteristic: can adapt to varying salinity levels and is also present in freshwater zones

Did you know: juvenile flounders use shallow freshwater areas as nursery grounds.



©shutterstock

The ecosystem services of tidal mudflats and tidal marshes





Tidal mudflats and tidal marshes in Wijmeers, ©Wesley Poelman

Free benefits from nature

The Scheldt's natural environment provides us with a wide range of benefits, also known as ecosystem services. These are defined as 'all goods and services ecosystems deliver to society', such as natural water purification, pollination by wild insects or climate regulation.

Tidal mudflats and tidal marshes play a crucial role in this regard.

At first glance, these tidal mudflats and tidal marshes may call to mind a wet, empty and inaccessible area, yet beneath their rough surface lies a natural system that is of immense value to both people and the environment. These tidal areas provide an impressive package of ecosystem services: free benefits from nature that are of vital importance.





Flood protection

Tidal mudflats and tidal marshes form a natural buffer between the river and the hinterland. They reduce the force of the water during storm tides or high floods. The water loses speed, reducing pressure on levees and the surrounding areas. In combination with flood control areas, water levels during storm tides can be reduced by tens of centimetres, significantly lowering the risk of flooding.



Polders of Kruiabeke, ©Vilda



Climate regulation

In addition to trapping silt, tidal marshes also capture carbon. Year after year, they contribute to the formation of a soil layer and vegetation that removes CO₂ from the air and stores it, sometimes for centuries. This natural carbon storage helps mitigate climate change. At the same time, tidal mudflats and tidal marshes adapt flexibly to rising water levels, as long as they are given sufficient space to do so. Together with wetlands, tidal mudflats and tidal marshes store up to 7 tonnes of carbon per hectare annually. In total, Sigma Plan areas are estimated to remove around 73,000 tonnes of CO₂ per year from the atmosphere, comparable to the emissions of 40,000 people or a city the size of Dendermonde.



Water purification

With every tide, river water flows through the tidal mudflats and tidal marshes. Plants, bacteria and soil organisms break down pollutants and absorb nitrogen and other nutrients. Because the water flows over a large contact surface and comes into close interaction with the soil and vegetation, it is intensively mixed and oxygen can dissolve more effectively in the water. This natural purification process is surprisingly efficient: in places such as Lippenbroek, the oxygen level in the water rises to 60%. Each year, these areas remove an estimated 1,000 tonnes of nitrogen from surface water, improving water quality and the living environment for fish and other aquatic animals.



Water availability

By creating or restoring natural flood areas, tidal habitats retain water for longer, which is crucial during periods of drought. In this way, the Sigma Plan, supported by tidal nature, ensures water availability for people and wildlife.

Fish nursery and resting area

The shallow gullies in tidal mudflats and tidal marshes are an ideal nursery for juvenile fish. The water warms up more quickly, there is shelter, and food is abundant. Many fish species, such as flounder and stickleback, begin their lives here or rest during their migration between fresh and salt water.



European spoonbill



Soil fertility

With every tide, silt-rich water penetrates deep into the tidal areas. This silt acts as a natural fertiliser: rich in nutrients, it improves soil structure and supports soil life. Thanks to these fertile soils, many birds find food here, such as worms and insect larvae, further enhancing the importance of these areas for biodiversity.

Bird paradise of international importance

Tidal mudflats and tidal marshes attract vast numbers of birds. They serve simultaneously as feeding grounds, breeding sites and resting places. Countless waders and ducks, from oystercatchers to Eurasian teal, feed or rest here on their migratory routes from north to south. The Scheldt valley is an essential link in the migration route of millions of birds between Africa and the far north.



Soil stability

Tidal areas contribute to stable soils by addressing both erosion and excessive sedimentation. Tidal marsh plants and reeds help stabilise the soil and grow in step with sea level rise.



Air purification

Tidal willow forests and reed beds not only purify the water but the air as well. Trees and shrubs filter particulate matter and harmful substances such as nitrogen oxides from the air, making a valuable contribution to a healthier living environment, especially in densely populated regions such as the Flemish Scheldt valley.



©Agency for Nature and Forests



Nature experience

Tidal nature affects us in many ways. The open landscape, the play of light and water, the presence of rare birds and the changing tides: anyone who walks or cycles here benefits from a relaxing environment. In this way, tidal mudflats and tidal marshes not only strengthen our flood safety, but also our well-being, and they create opportunities for a sustainable recreation economy.



Food production

Tidal marshes with willow shrubs attract pollinating insects such as bees and butterflies. These improve crop yields of fruit and legumes in the surrounding area.

Protection of biodiversity and nature as heritage

From pioneer plants to tidal fish, from insect larvae to birds of prey: biodiversity in these areas is exceptional. That is why many tidal mudflats and tidal marshes are protected at European level, for example through the Birds Directive or the Habitats Directive. Preserving them also protects natural richness for future generations.



Raw material extraction

Tidal nature also provides raw materials such as clay, formed by the deposit of fine sediments on tidal mudflats and tidal marshes with each tide. Over time, this gradual accumulation forms a solid clay layer that has been used for centuries to produce bricks, roof tiles and other building materials. Even today, Scheldt clay remains a valuable local resource, provided that extraction is carried out carefully and the natural sedimentation cycle is preserved. While reed and willow withies are less commercially used than in the past, they remain valuable materials along the Scheldt. When properly managed, these are renewable resources.





NATIONAAL PARK
scheldevallei

SCHELDT VALLEY NATIONAL PARK

Since October 2023, the Scheldt Valley has been designated as a National Park in recognition of its exceptional tidal nature. Along the meandering Scheldt, freshwater tidal areas form a rare landscape where nature and culture come together, with historic castles acting as gateways to a valley whose mesmerising scenery is defined by the rhythm of the tides.

www.nationaalparkscheldevallei.be

Castle Marnix de Sainte Aldegonde,
©Philippe Roose

Ecosystem services in the picture

Dyle Estuary

A visit to the Dyle Estuary makes it clear how tidal nature and human ingenuity go hand in hand. In areas such as the FCA-CRT Zennegat, tidal mudflats and tidal marshes demonstrate their value as natural water purifiers. With every tidal cycle, river water is spread over a much larger surface area, allowing additional oxygen to enter the water. There is a reason why this area is referred to as the 'lungs of the Dijle'. This improved water quality also attracts life: fish such as roach, eel, sea bass and stickleback find a home here, as do bird species such as the bearded reedling, bluethroat, sedge warbler, little egret and great egret.

In addition, tidal nature plays a quiet but crucial role in flood protection. Since the Walem disaster in 1976, the region has undergone a major transformation: five flood control areas now provide robust flood protection.





Durme Valley, Tielrode, ©Dronography

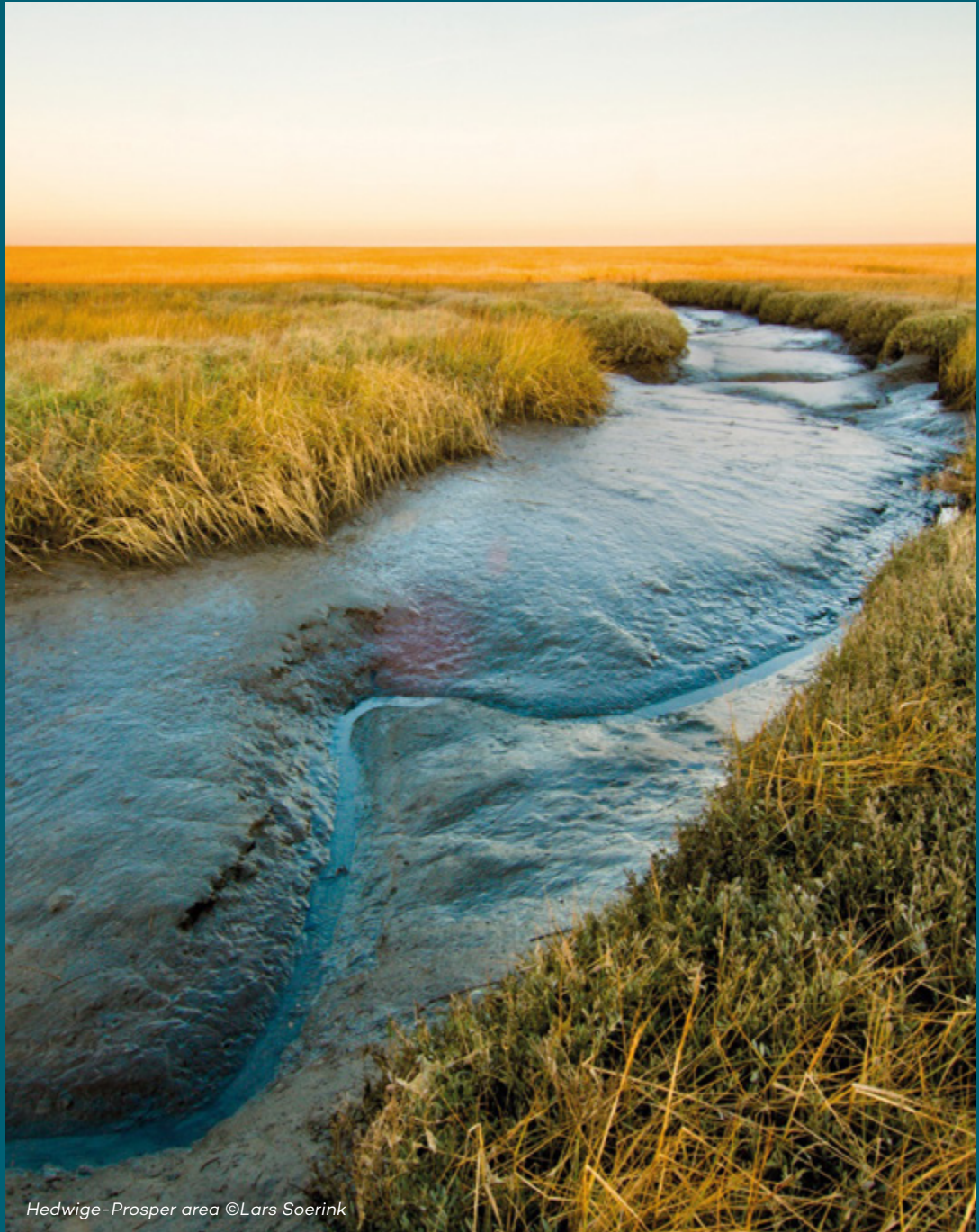
Durme



Durme Valley

In the Durme Valley, tidal nature provides smart, natural solutions. Bundles of coppice help retain dredged sediment, allowing new tidal marshes to form: natural buffers that move with the rhythm of ebb and flow while also offering protection from erosion and rising sea levels. This approach makes the soil more stable and resilient.

The Durme Valley also demonstrates how sediment can be used as a renewable resource. Deposited silt provides a local source of sand and clay, reducing the need to extract materials from quarries.



Hedwige-Prosper area

The Hedwige-Prosper area is a cross-border nature reserve where Belgium and the Netherlands are creating space for tidal nature. These natural processes filter water, store carbon in the soil and provide a rich breeding ground for plants and animals. In turn, the variety of flowering plants attracts numerous insects that ensure pollination, an essential ecosystem service. Sediment accretion fosters a dynamic landscape with wet, mineral-rich soils. The Hedwige-Prosper project demonstrates how lost biodiversity can be restored while at the same time recovering ecosystem services.



Polders of Kruibeke, ©Vilda



Polders of Kruibeke

The Polders of Kruibeke are a testament to how safety and nature can go hand in hand. During storm tides, excess Scheldt water flows into the area via a controlled overflow levee, reducing the risk of flooding by up to a factor of five. But the area offers more than protection: the tidal mudflats, tidal marshes, forests and grasslands purify water, store CO₂ and filter particulate matter from the air. Each year, the wet woodlands absorb around 5,000 tonnes of CO₂, equivalent to the annual emissions of 2,500 cars.

In addition, the extensive paths, observation points and quiet nature areas make it a popular favourite among walkers, cyclists and nature lovers. The polders are therefore a textbook example of how a carefully designed landscape delivers multiple services, including safety, clean water, clean air and recreation.

A sustainable future

Through smart nature conservation, careful assessment and scientific research, the Sigma Plan continues to strive for a dynamic balance between nature, economy and safety. These projects demonstrate that investing in nature is not only ecologically beneficial, but also economically worthwhile, helping to build a resilient and future-proof Scheldt valley with a wide range of free ecosystem services.

With major projects such as the Polders of Kruibeke, this balance was assessed in detail. Covering 600 hectares, the Polders of Kruibeke are currently the largest flood area in Flanders. As with the Hedwige-Prosper area, there was initially significant resistance to converting agricultural land and the typical polder landscape into a flood area with sections of tidal mudflats and tidal marshes,

grassland bird habitat and alluvial forest. The entire area provides substantial benefits for flood protection: this polder has reduced the risk of water damage during storm tides by a factor of five. Other ecosystem services include improved water quality in the Scheldt (tidal mudflats and tidal marshes), carbon storage in the soil and capturing particulate matter (forests). Before the redevelopment of the Polders of Kruibeke, the total annual benefit of the area was approximately €0.4 million. After redevelopment, the total economic value of the ecosystem services considered (such as food, safety and water purification) in the Polders of Kruibeke is estimated to rise to around €1.75 million per year.

Challenges in tidal nature

A close-up photograph of a crab in shallow, rippling water. The crab's legs and claws are visible, with some spines on its legs. The background is a blurred natural setting with trees and foliage.

Tidal nature provides valuable services for both people and the environment, but is also exposed to external factors that can affect the ecosystem and how it is experienced. One major challenge is invasive alien species. These do not arise from tidal dynamics themselves, but they do influence how this nature can be managed and utilised.

Invasive exotic species: Chinese mitten crab undermines bank stability

The Chinese mitten crab is a non-native species that has reached our waterways via ballast water from seagoing vessels. These crabs dig deep burrows into riverbanks, which promotes erosion and can damage infrastructure. In addition, they sometimes outcompete native species and disrupt the food chain. In the region of the Kalkense Meersen, measures such as crab passages and adapted fish ladders are being implemented to limit their impact. Such management actions are necessary to safeguard the stability and biodiversity of tidal habitats.



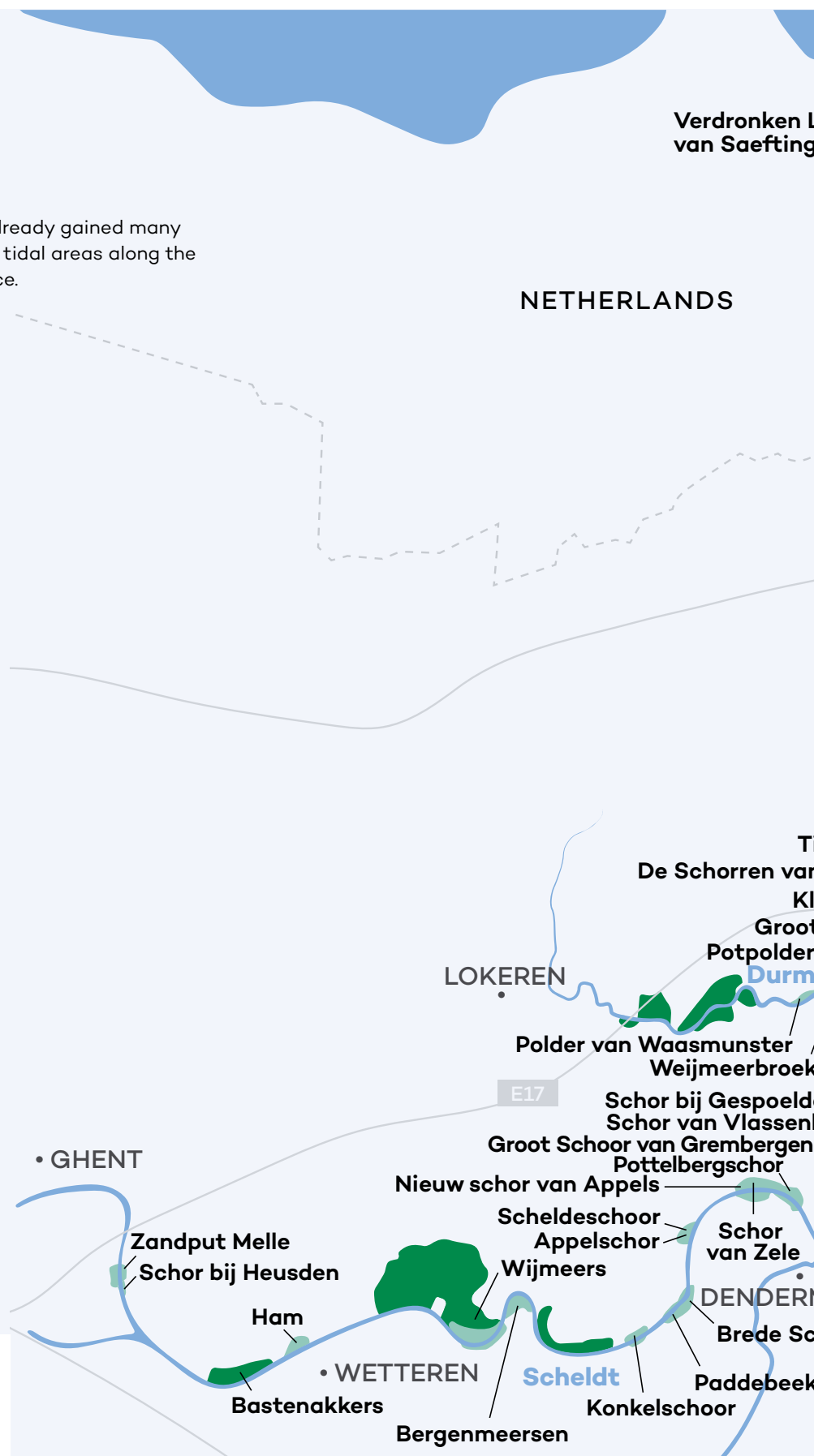
New tidal nature within the Sigma Plan





Overview

With the Sigma Plan, Flanders has already gained many hectares of tidal nature. The (future) tidal areas along the Scheldt and its tributaries at a glance.



Map key:

- tidal area
- other Sigma plan area







Lippenbroek ©Vilda

Afterword

The tidal nature of the Scheldt is a powerful and dynamic system, shaped by the continuous interaction between water, land and life. This brochure illustrates the unique and versatile nature of this landscape: from the influence of ebb and flow to its rich biodiversity, from the challenges facing the ecosystem to the solutions offered by the Sigma Plan.

The conservation and restoration of tidal nature is not a luxury, but a necessity. These areas provide essential ecosystem services: they protect us against flooding, purify water, store carbon and offer space for recreation. At the same time, they play an indispensable role as habitats for a wide range of plants and animals. Through the Sigma Plan, we are not only restoring the Scheldt's natural dynamics, but also strengthening Flanders' resilience to climate change and flooding.

Yet the story doesn't end here. In the coming years, we will continue to invest in sustainable solutions that reconcile nature, safety and the economy. The Scheldt moves and changes, and with the right efforts we can ensure that it remains a healthy and resilient river in the future.

We set our sights on a balanced future, where the power of nature is not restrained but put to best use. Because a versatile Scheldt is a valuable Scheldt, for people, wildlife and the generations to come.

COLOPHON

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