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Scheldt Estuary

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The North Sea region is home to a number of important estuaries. These include the estuaries of the Seine (France), the Oder (Germany and Poland), the Elbe (Germany), the Weser (Germany), the Humber (United Kingdom), the Ems - Dollard (Germany and Holland) and the Thames - Essex (United Kingdom) (*Debergh et al. 2009, TIDE project*). These estuaries have a great ecological value and parts of them are designated as *Natura 2000 areas* (see also theme **Nature and environment**). On the other hand, these estuaries provide space for important economic activities such as harbour developments. Furthermore, these estuaries face common challenges such as increasing flood risks, developments in shipping (e.g. upscaling), issues regarding sediment management and the preservation of ecosystem functions. Because of the common challenges of these areas, European collaboration projects concerning estuarine research and management have been conducted. Depending on the project and the project partners, these projects focus on one or several challenges (e.g. *TIDE, SEDNET, SCALDWIN, EMOVE, HARBASINS, SMARTSEDIMENT, INTERTIDE*, etc., see also *list of projects* in *ScheldeMonitor*).

The Scheldt Estuary consists of the Sea Scheldt and its tidal tributaries (Durme, Rupel, Zenne, Dijle and Netes), the Western Scheldt and the mouth of the Scheldt with the *Vlakte van de Raan*. The preservation of the tidal regime along the entire fresh - salt water gradient, with the associated tidal habitats and communities, is a unique feature in North-West Europe (*Directorate of Zeeland and AWZ 2001*). The strong interaction between the Scheldt Estuary and the North Sea results in the exchange of water masses, dissolved matter, sediments, fauna and flora, etc.

Despite the fact that the Scheldt Estuary is a Flemish-Dutch story, this theme text focuses mainly on the Flemish context. For the Dutch efforts in the Western Scheldt in the context of nature, safety and accessibility, reference is made to the website of *Rijkswaterstaat* and the *Natuurpakket Westerschelde*.

15.1 Policy context

15.1.1 Common policy and management

The policy and management of the Scheldt Estuary is a cross-border matter that involves both Flanders and the Netherlands. Between both countries, several treaties and memoranda of understanding (MoU) on the Scheldt Estuary have been concluded (see table 1 and *website VNSC*). Furthermore, ministerial declarations and treaties have been made in the context of integrated water management in the Scheldt Basin, which don't only involve Flanders and the Netherlands, but also the Walloon Region, the Brussels-Capital Region and France (see table 1 and *website International Scheldt Commission*). An overview of historical treaties and agreements is available in *van Langenhuysen and van Langenhuysen (1919)* and *Baekelandt (2002)*.

To ensure the coordination between the Flemish and Dutch authorities, a number of specific cross-border organisations for the Scheldt Estuary have been created. In 1948, on the occasion of the foundation of the Benelux Customs Union, the Technical Scheldt Commission (TSC) was established. This commission consisted of Dutch and Belgian/Flemish officials and was responsible for studies about the Scheldt (e.g. the Delta Plan, the Scheldt-Rhine connection, the Long Term Vision on the Scheldt Estuary and the Development Sketch 2010 Scheldt Estuary). In 2008, the TSC was succeeded by the Flemish-Dutch Scheldt Commission (*VNSC*) as stated in the Treaty on Common Policy and Management of the Scheldt Estuary (2005). The VNSC consists of a political college, an official college and an executive secretariat. This body aims to promote the cooperation between Flanders and the Netherlands at the policy and management level in the pursuit of a safe, accessible and natural Scheldt Estuary. In response to specific policy and management questions, the official college may set up working groups to carry out specific tasks. In 2018, six working groups were active under the umbrella of the VNSC: 'Research and Monitoring', 'Development Sketch 2010', 'New Lock at Terneuzen', 'Policy and Management', 'Long-term Perspective on Nature' and 'Long-term Perspective on Accessibility'.

The cooperation between Flanders and the Netherlands includes a joint research programme and an integrated monitoring programme focusing on the functioning of the estuary (MONEOS), which will be succeeded by the permanent VNSC working group on Research and Monitoring (R&M). In 2014, the VNSC published a first evaluation report (*Evaluation of the Treaty on Policy and Management of the Scheldt Estuary*) of the Flemish-Dutch cooperation based on the Scheldt Treaty on common policy and management. This report also identifies a number of priority themes towards a robust and sustainable *Agenda for the Future* for the Scheldt Estuary. This agenda started in 2014 with a comprehensive policy and management support research programme. In the meantime, initiatives have been started together with stakeholders in order to develop long-term perspectives for nature and accessibility (a.o. through the establishment of the Scheldt Council). Activities under the umbrella of the Agenda for the Future are coordinated by the permanent VNSC working group on Policy and Management, initially established for the first evaluation. In 2018, the second evaluation was launched (i.e. 5-yearly evaluation). It is expected that this report will be submitted to the Flemish and Dutch parliaments in the first half of 2019.

Table 1. Overview of cross-border treaties and memoranda for the Scheldt Estuary (Source: [VNSC](#)).

Flanders – The Netherlands (from 1960)	
Scheldt treaties	Memoranda of Understanding
Scheldt Council institution (2014)	MoU The Hague (2005)
Pilot Rates (2005)	Second MoU Vlissingen (2002) – mutual cooperation
Common Nautical Management (2005)	MoU Vlissingen (2002) – Safety
Common Policy and Management (2005)	MoU Kallo (2001) – Mutual cooperation
Development Sketch 2010 for the Scheldt Estuary (2005)	
Scheldt Treaty (2002)	
Widening of the Channel 48/43/38 feet (1995)	
Improvement of the Waterway at Walsoorden (1970)	
Scheldt-Rhine Connection (1963)	
Canal Ghent-Terneuzen (1960)	
Protocol Canal Ghent-Terneuzen (1985)	
Belgium – France – The Netherlands	
Treaties	Ministerial declarations
Treaty of Ghent (2002)	Ministerial declaration of Liège (2001)
Treaty of Charleville-Mézières (1994)	Ministerial conference in Middelburg (1998)

In addition to the system monitoring included in the MONEOS programme, specific monitoring programmes are being carried out with the aim of making the effects of certain interventions visible. The OMES programme (*Onderzoeksprogramma Milieu Effecten Sigmoplan*) monitors the effects of the different projects in the framework of the Sigmoplan, the *MONEOS-T implementation programme* monitors the effects of the construction and maintenance strategy of the widening of the waterway based on the *protocol for flexible dumping*, and there are numerous monitoring efforts that make it possible to map the developments of the *nature development projects in Zeeland*.

The *ScheldeMonitor* was set up in 2003 on behalf of the VNSC with the aim of acting as a central information system on research and monitoring in the Scheldt Estuary. Since 2010, in addition to providing access to information, it also focuses on data and data products related to the Scheldt Estuary, with a focus on accessing and archiving data series from the MONEOS programme.

15.1.2 Common nautical management

There is also cooperation between Flanders and the Netherlands on a sectorial level. Through the Common Nautical Management (*CNM*), both countries ensure the organisation of smooth and safe shipping traffic to and from the Scheldt ports. The *Permanent Commission for the Supervision of Scheldt Navigation*, established by article 9 of *the Convention of 19 April 1839* regulating the separation between the Netherlands and Belgium, is the highest body in the organisation of the CNM and is responsible for the safe and smooth handling of shipping traffic. The Common Nautical Authority (*CNA*) is responsible for the daily nautical control of the traffic flow. Real-time monitoring of shipping traffic on the Scheldt is carried out by the Scheldt Radar Chain (*SRK*), a shipping guidance system that is jointly managed by the Flemish and Dutch governments. The operational, functional and technical management of the systems of the SRK is carried out by the Management and Exploitation Team (*BET-SRK*).

15.1.3 International Scheldt Commission

The International Scheldt Commission (*ISC*) was initially established by the Treaty of Charleville-Mézières (1994) under the name 'International Commission for the Protection of the Scheldt' (ICBS). The commission is operating under its current name since 2002, following the coming into force of the Scheldt Convention. The aim of this entity is to strengthen cooperation between the riparian states (France, Belgium and the Netherlands) and regions (Flanders, Brussels and Wallonia) of the international Scheldt river basin, for the benefit of sustainable and integrated water management. Since 2000, the commission has been responsible for making a single management plan for the international river basin district of the Scheldt and for coordinating the national programmes of measures (first elaboration in 2009) in the implementation of the Water Framework Directive (WFD, Directive 2000/60/EC). The current management plan (*Scheldt, coast*) and *programme of measures* apply for the period 2016-2021.

15.1.4 European guidelines

The management and policy of the Scheldt Estuary are to a large extent guided by international and European legislations such as the Birds and Habitats Directives (Natura 2000), the WFD and the Floods Directive. This is done by setting specific targets for good ecological and chemical status (WFD) and conservation objectives (IHDs - N2000). The national and regional policy instruments then provide for the local implementation of these directives (see also theme **Nature and environment**). An overview of the policy framework for the Scheldt Estuary is available in [Debergh et al. \(2009\)](#) and on the following webpage: www.scheldemonitor.be/en/node/67.

15.1.5 Long Term Vision on the Scheldt Estuary

The Long Term Vision on the Scheldt Estuary (LTV, [Directorate of Zeeland and AWZ 2001](#)) was the starting point for a common integrated, cross-border policy. This vision was jointly adopted by the Netherlands and Flanders in 2001 and approved by the governments and parliaments of both countries. The objective of the LTV was to develop a healthy and multifunctional estuarine water system that is used sustainably for human needs. The vision mainly

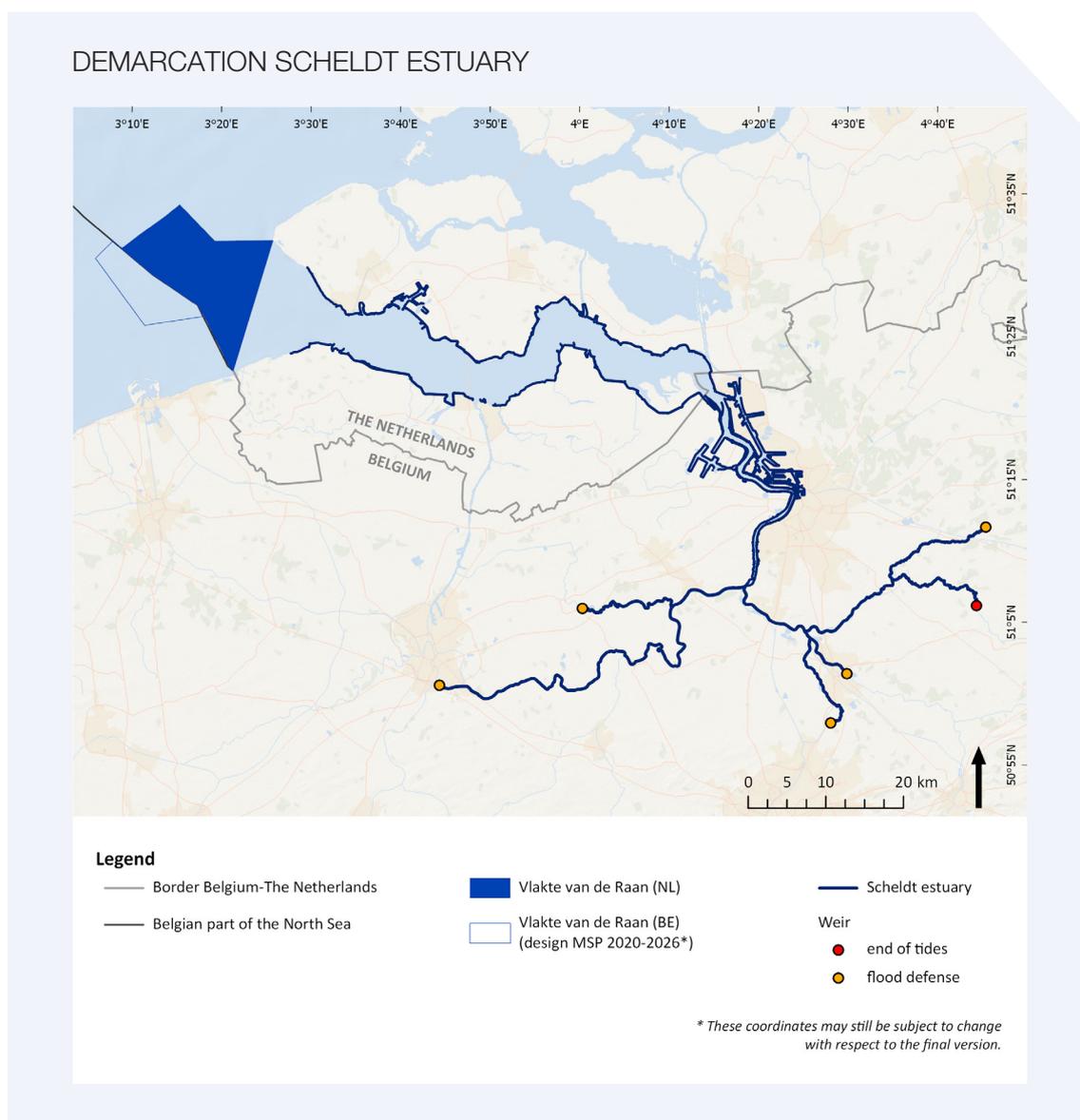


Figure 1. The area of the Scheldt Estuary, with an indication of the estuary, the Western Scheldt, the Lower Sea Scheldt and the Upper Sea Scheldt (Source: Natura 2000, [MSP 2020-2026](#), [public consultation](#), ScheldeMonitor, Flemish Hydrography) .

focused on the themes 'safety', 'accessibility' and 'nature', with the development of the morphology of the estuary being central. The LTV was made up of three components:

- Short-Term Situation Sketch: starting situation (2005) based on the expected short-term effects as a result of the already planned measures and the established policy;
- Target 2030: description of the long-term situation to be pursued (2030);
- Development Sketches 2010: description of alternative medium-term policy strategies to move from the short-term situation Sketch to the long-term target.

The Development Sketch 2010 Scheldt Estuary (*ProSes 2004*) included project proposals (measures and policy efforts) that had to be started mainly in the period 2004-2010 in order to achieve the target in 2030. Most of the projects have now been completed. A number of projects, such as the Westerscheldt Nature Conservation Package (with the depoldering of the Hedwige-Prosperpolder) and the realisation of the Sigmaphan, are still in progress.

In Flanders, the LTV themes of 'safety' and 'nature' are jointly implemented in the *updated Sigmaphan (2005)* approved by the Government of Flanders (2005). Under the motto 'Room for the river', the measures laid down therein serve both safety and nature, with a robust estuary at stake. The objectives for nature in the Sea Scheldt were refined and concretised as a result of the updated Sigmaphan (*Adriaensen et al. 2005*). A series of measures were proposed to achieve these objectives. Three types of measures can be distinguished:

- The development of mudflats and salt marshes within a flood control area (FCA) with reduced tides (CRT)
- The renewal of dikes or depoldering;
- The development of wetlands in the valley, whether or not as a FCA.

15.2 Spatial demarcation

By definition, an estuary contains the part of a river which is subject to tidal influence (*Fairbridge 1980*). In the case of the Scheldt Estuary, this is the area from the mouth of the river to the locks in Ghent (Merelbeke), including the Durme, Rupel, Zenne, Dijle and Netes up to where tidal influence can be recorded. The exact spatial boundary of the estuary is formed by the dikes (figure 1).

The LTV (*Directie Zeeland and AWZ 2001*) applies to a specific geographic area. However, a trans-border perspective is used when this is required for certain aspects. The upstream border was set at the locks in Ghent (Merelbeke) and the upstream border of the tidal influence of the tributaries. The downstream border of the estuary contains the Scheldt and its river mouth, including *Vlakte van de Raan* and other shallow water areas. The channels are taken into account up to the limit of the nautical management (indicative border: the piloting intersections west of *het Scheur*). The port of Zeebrugge and its fairway *Pas van het Zand* are not included in the area demarcated for the LTV. The LTV also covers the banks up to the main weirs.

The evaluation method (*Maris et al. 2014*) uses the most detailed classification based on the OMES (research on the environmental effects of the Sigmaphan) compartments and a classification into macro/mesocells specific to the Western Scheldt. The OMES classification is initially based on variations in salt content. In the freshwater zones, residence times are also taken into account (figure 2). This scale level is aggregated into a chain of macrocells and mesocells. The macrocells are formed by the large curved ebb channels and straight flood channels. The shortcut channels form the mesocells (*Depreiter et al. 2014*). Depending on the desired spatial detail, the zones are taken together or the focus is put on a smaller spatial scale within a zone. For example, different scale levels can be distinguished (*Maris et al. 2014*):

- Level 1: Estuary;
- Level 2: Western Scheldt – Sea Scheldt – Tributaries;
- Level 3: Strong polyhaline zone – Weak polyhaline zone – Mesohaline zone – Zone with strong salinity gradient – Oligohaline zone – Freshwater zone with long residence time – Freshwater zone with short residence time – Tributaries;
- Level 4: Scheldt-compartment (compromise between macro/mesocells in the Western Scheldt and the OMES compartments in the Sea Scheldt).

15.3 The ecosystem of the Scheldt Estuary

The Scheldt Estuary is an estuary in which the tidal regime along the entire salt - freshwater gradient is maintained (*Directorate Zeeland and AWZ 2001*). Because the tide penetrates 160 km inland, the Sea Scheldt has a vast freshwater tidal area with associated biotic communities (e.g. *Maris et al. 2014*). As a result, the Scheldt Estuary has a special natural value and a large range of ecosystem services (i.e. the benefits that society receives from

SPATIAL DIVISION OF THE SCHELDT ESTUARY

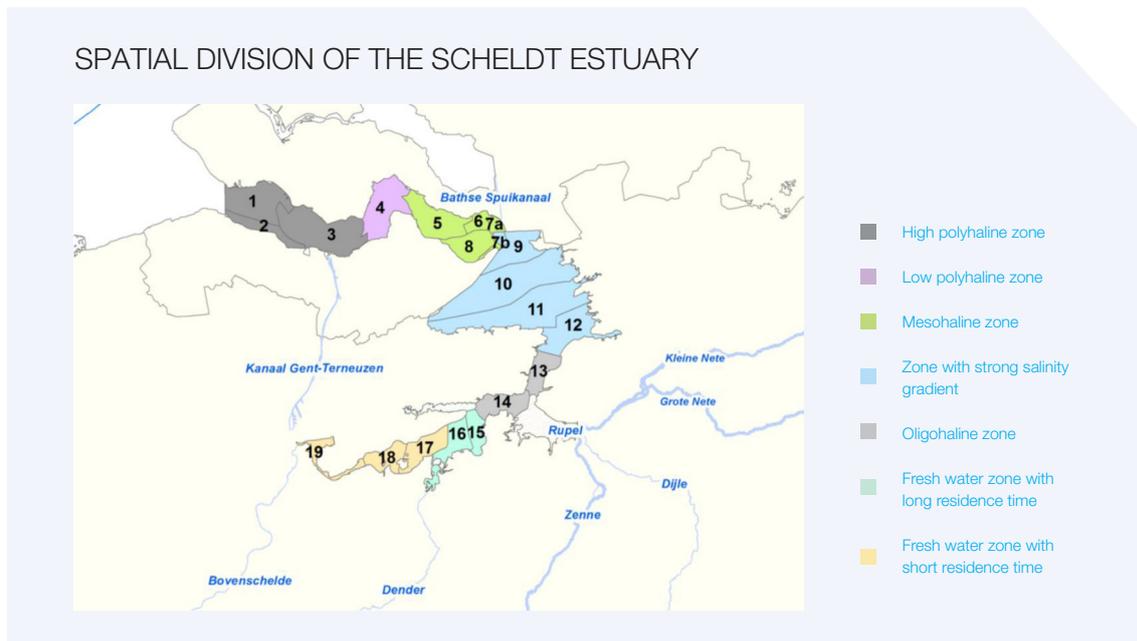


Figure 2. The spatial division of the Scheldt Estuary on level 3 and 4 according to the evaluation methodology (Source: [Maris et al. 2014](#)).

nature (ecosystems) such as food production, flood protection, recreation, etc.). Due to its geographic location in an economically important and densely populated area, the Scheldt ecosystem is under constant pressure, such as habitat loss, anthropogenic disturbance and pollution (e.g. [Maris and Meire 2017](#)). Over the years, man has strongly influenced the Scheldt by means of reclamation and embankments, straightening, channel widening, sediment extraction, agriculture and urbanisation, with an impact on tidal amplitude (e.g. [de Munter et al. 2010](#), [Depreiter et al. 2014](#), [Vandenbruwaene et al. 2016](#)) and a sharp decline in the acreage of mudflats and salt marshes as a result (e.g. [Van Braeckel et al. 2012](#), [Maris et al. 2014](#)). The quality of the remaining habitats was also under severe pressure due to changes in hydrodynamics (e.g. current velocities, waves, duration of exposure time) and poor water quality.

The Scheldt Estuary is by nature a very dynamic system. Mudflats, salt marshes, sandbanks and gullies are constantly subject to changes in tides and salinity. The ecologically valuable habitats in the Scheldt Estuary are mainly the low-dynamic (low current velocity) shallow water areas and the intertidal areas (mud flats, sandbanks and salt marshes). An overview of the different ecotopes as well as the trends in their spatial distribution is given in [Barneveld et al. \(2018\)](#). The low-dynamic shallow water areas are essential for the reproduction and growth (nursery function) of fish, crustaceans and molluscs. The intertidal areas are foraging, spawning, breeding or growing sites for many organisms and contribute to the biodiversity of the estuary. In this way, they are an essential habitat for economically important species such as sole (*Solea solea*) ([Maris et al. 2014](#)). The mudflats and sandbanks are usually rich in bottom-dwellers and provide an important source of food for waders and other birds (e.g. [Vanoverbeke and Van Ryckegem 2015](#)). Particularly the areas with a moderate exposure rate (the percentage of time that the mudflat or sandbank is above water) are most attractive from an ecological point of view ([MER Verruiming vaargeul Beneden-Zeeschelde en Westerschelde 2007](#)). Salt marshes, on the other hand, offer nesting possibilities for many bird species. Moreover, they serve as a refuge area for various species during high tide. Furthermore, the intertidal areas have an important regulating effect on water quality by removing nitrogen and acting as a source of dissolved silica, which is essential for the growth of diatoms (e.g. [Gribsholt et al. 2005](#), [Struyf et al. 2005](#), [Struyf et al. 2006](#), [Jacobs et al. 2008](#)). They also provide oxygen enrichment and form a refuge for, *inter alia*, the plankton in case of unfavourable conditions in the gully itself.

The ecosystem of the Scheldt Estuary provides a whole range of important ecosystem services in addition to its ecologically attractive function. For example, salt marshes play a role in the buffering of wave action ([Temmerman et al. 2015](#), [Temmerman et al. 2015](#)) and sea level rise ([Broekx et al. 2011](#), [Temmerman et al. 2013](#)), as a result of which they indirectly generate an economic value. The monetary valuation of (changes in) ecosystem services is already discussed in several publications (including [Liekens et al. 2013](#), [Staes et al. 2017](#)). Numerous reports on the economics of ecosystems and biodiversity have also been published at European level ([TEEB website](#)). The [SMARTSEDIMENT project](#) studies sediment management in function of the provision of ecosystem services in the entire Scheldt delta, which includes not only the Scheldt Estuary but also the Eastern Scheldt. In addition to the known threats to ecosystem services in the Scheldt Estuary (pollution, loss of habitat, etc.), the occurrence of non-

native species can also be considered as a potential threat to species diversity in recent decades, some of which exhibit invasive characteristics (e.g. [Van Damme et al. 1992](#), [Van Damme and Maes 1993](#), [Ysebaert et al. 1997](#), [Faasse and Van Moorsel 2003](#), [Azémar et al. 2007](#), [Soors et al. 2010](#), [Kerckhof 2011](#), [Vandepitte et al. 2012](#), [Soors et al. 2013](#), [Boets et al. 2016](#), [SEFINS project](#)).

International directives and agreements, such as the Ramsar Convention and the European Birds and Habitats Directives, in combination with national legislation, have ensured that mudflats, salt marshes and most parts of the Scheldt Estuary and the adjacent valley/polders are (inter)nationally protected. This is because of the unique character and rarity of the entire estuarine salt - freshwater gradient on the one hand and the importance as a wintering, migration and breeding area on the other hand. In the Western Scheldt, European fishing quotas led, among other things, to regulations for cockle fishing in order to preserve sufficient food for birds. With respect to water quality, an important step was taken with the publication of the European WFD ([Maris et al. 2014](#)).

The [ScheldeMonitor](#) collects the available information (expertise, literature, projects, etc.), data (datasets, measurements, etc.) and data products (maps, graphs, indicators, etc.) relating to the various aspects of the Scheldt ecosystem. Important information is also available in the reports produced within the framework of the R&M working group (see list of reports on the websites of the [ScheldeMonitor](#) and [VNSC](#)).

15.4 Human activities in the Scheldt Estuary

The Scheldt Estuary is not only an important ecosystem, but also hosts a number of human activities, such as shipping, dredging for nautical accessibility, recreation, flood protection (e.g. controlled flood plains), fishing, etc. The [ScheldeMonitor](#) website provides an overview of the available information (expertise, literature, projects, etc.), data (datasets, measured values, etc.) and data products (maps, graphs, indicators, etc.) related to these users. Certain human activities are also covered in the reports published in the framework of the R&M working group (see list of reports on the websites of the [ScheldeMonitor](#) and [VNSC](#)). Some of these activities are described in more detail below.

15.4.1 Shipping and ports

The Scheldt Estuary, particularly the area downstream of Antwerp, is characterised by a large number of shipping movements. In 2017, the number of seagoing vessels that entered the ports of Antwerp and Ghent (via Terneuzen) amounted to 17,316, or approximately 47 a day, of which 82% was accounted for by the port of Antwerp. These seagoing vessels represented a total gross tonnage of 444 million GT (92% for Antwerp), representing a total cargo traffic of 256 million tonnes (87% for Antwerp). In addition, inland navigation of goods in the port of Antwerp accounted for over 102 million tonnes ([Merckx 2018](#)). In 2016, the port of Antwerp also provided direct employment for 60,849 FTEs (59% of direct employment in Flemish seaports) and generated a direct added value of 10.8 billion euro (67% of Flemish seaports) ([Merckx 2018](#), [Coppens et al. 2018](#)) (see also theme **Maritime transport, shipping and ports**).

The location and operation of ports generate effects on the environment. These effects are listed, *inter alia*, in the (plan-) environmental impact assessments (EIAs) of the ports' strategic plans (see also [file database](#), [Department Environment](#)).

Vlaamse Waterweg nv is working on an [integrated plan for the Upper Sea Scheldt](#) and wants to create a sustainable balance between all the functions of the river: navigability, recreation and nature development. The EU is equipping its network of waterways for inland navigation, which is why, for example, the Seine and Scheldt will be better connected, so that large cargoes can be transported directly over water between Paris, Antwerp and Rotterdam. In order to prevent excessive traffic on the Ghent-Terneuzen Canal and the Western Scheldt, the Upper Sea Scheldt should also be easier to navigate for class Va cargo vessels (with a load capacity up to 2,250 tonnes). This new connection between the ports of Ghent and Antwerp will facilitate shipping between the Scheldt basin and the Albert Canal, and thus provide added value for the entire Flemish waterway network.

15.4.2 Dredging and dumping

In 2017, the Government of Flanders ([Maritime Access Division](#)) invested 255 million euro to ensure the accessibility of Flemish ports (including the Scheldt Estuary, [Merckx 2018](#)) (see theme **Dredging and dumping**). This investment includes maintenance dredging at sea and on the Westerscheldt, widening of the fairway, wreck salvage and sludge processing (see also the decision of the Government of Flanders of 13 July 2001).

The aim of the Convention on the Implementation of the Development Sketch 2010 Scheldt Estuary ([Verleye et al. 2018](#)) was to ensure the implementation of a number of projects and works aimed at optimising the safety, accessibility and nature of the Scheldt Estuary. In order to guarantee accessibility to the Scheldt harbours, the fairway was widened for a tidal independent navigation of up to 13.1 m draught and is continuously maintained. To this end, a new dumping strategy was developed in the Western Scheldt ([Plancke et al. 2010](#)), based on the principle of *Flexible dumping*. In addition to preserving the physical characteristics of the system, in accordance with the Scheldt treaties (2005) on the Development Sketch 2010 Scheldt Estuary and the Common Policy and Management of the Scheldt Estuary, this dumping strategy aims to create new ecologically valuable habitats near a number of sandbank edges by means of targeted dumping of dredged material. In recent years, alternative dumping sites have also been explored by means of pilot dumping sites to re-dump the dredged material into the estuary (see also [VSNc website](#)). These new insights will be used in the optimisation of the dumping strategy.

The Maritime Access Division also has disposal permits from the provinces of East Flanders and Antwerp (Sea Scheldt) for the disposal of dredged materials from the maintenance of the Sea Scheldt and Western Scheldt, as well as the necessary extraction and dumping permits from the competent Dutch authorities (Western Scheldt).

For the Sea Scheldt, sludge management is an important point of attention (e.g. increased sludge concentration in the water column, indications of an increase in the total quantity of sludge in the estuary). The *Agenda for the Future* includes research into sludge management ([Vandenbruwaene et al. 2016](#), [Vandenbruwaene et al. 2017](#)), with the aim of increasing system knowledge of the Scheldt Estuary and investigating the extent to which numerical models can reproduce these processes. On the basis of these models, research was carried out that led to an optimisation of the current permit for the dumping of dredged material from maintenance dredging in the Lower Sea-Scheldt for both the sludge-rich and the sand-rich fractions ([Plancke et al. 2016](#)).

The *sustainable management plan for the Upper Scheldt* includes dredging works that maintain the navigable profile of the river without damaging protected nature. A dredging programme has been developed for the next twenty years in order to keep the river navigable. The implementation of this sustainable management plan started in 2015.

15.4.3 Protection against flooding

The implementation of the *Sigmaplan* of the Government of Flanders provides protection against flooding from the Scheldt river and its tributaries, and runs until 2030 (see also **15.1 Policy context**; [ScheldeMonitor](#) and website [VNSC](#)). With research and monitoring programmes such as *OMES* (research on the environmental effects of the Sigmaplan; part of the *MONEOS* cross-border monitoring programme), Flemish water managers and scientists monitor the environmental impact of human activities in the Scheldt Estuary ([Maris and Meire 2017](#)). Also, since 2015, under the WFD (Directive 2000/60/EC), EU Member States are required to prepare flood risk management plans at river basin level with a special focus on protection against and prevention of floods. The flood risk management plan for the Scheldt was integrated into the *River basin management plans for Scheldt and Maas 2016-2021* and the *Programme of measures for the river basin management plans for Scheldt and Maas 2016-2021*. Within Flanders, the Coordination Committee on Integrated Water Policy (*CIW*) coordinates the procedures for drawing up all mandatory documents for the WFD and the Floods Directive. Furthermore, the *water assessment (watertoets)*, in which the government assesses the impact of a future project on the water system, also contributes to the prevention of flood damage. The water levels can also be consulted in real time at [www.waterinfo.be](#) and flood-sensitive areas can be searched for on the [Flanders Climate Portal](#) (see also theme **Safety against flooding**).

15.5 Evaluation of the functioning of the Scheldt Estuary

In addition to the mandatory assessments, Flanders and the Netherlands have decided to jointly carry out a six-yearly evaluation (under the umbrella of the VNSC working group on R&M) to assess the functioning of the Scheldt Estuary and the activities that take place in the estuary. This evaluation makes use of the monitoring results of the integrated monitoring programme for the Scheldt Estuary, which is being carried out by various institutions (e.g. [Nederhoff 2016](#), [Plancke et al. 2017](#), [Van Ryckegem et al. 2017](#)). The report focuses on the evaluation of the three main functions – ‘nature’, ‘safety’ and ‘accessibility’ – in the form of seven communication indicators for sustainable management (table 2). In 2011, an evaluation method was published that describes how each indicator should be evaluated ([Holzhauer et al. 2011](#)). This methodology is dynamic and was updated for the first time by [Maris et al. \(2014\)](#). Within the methodology, each indicator is individually substantiated according to a pyramid structure in which the relevant key parameters, calculation parameters and explanatory parameters are included. In order to be able to evaluate the starting situation, the starting point has been defined unambiguously, in which the year 2009 is considered as the

reference year ([Holzhauer et al. 2011](#), [Maris et al. 2014](#)). [Depreiter et al. \(2014\)](#) describes the starting situation (T2009) and the trend developments until 2009 of the Scheldt Estuary. [Barneveld et al. \(2018\)](#) (T2015) evaluates the situation in the Scheldt Estuary between 2010 and 2015 and tries to identify the causes for the observed trends.

Prior to the evaluation method described above, a set of indicators has already been selected in the context of the LTV objectives and aligned with the entire cross-border Scheldt Estuary, in consultation with scientists and policy makers (see [Indicators for the Scheldt Estuary 2011](#) and the [ScheldeMonitor](#)).

Table 2. Overview of the indicators which were selected within the evaluation methodology for the evaluation of the three principal functions of the Scheldt Estuary (Source: [ScheldeMonitor](#)).

Principal function	Indicator
Safety	Water movement dynamics
Accessibility	Navigability
	Water quality
	Flora and Fauna
Nature	Ecological functioning
	Habitat
	Bank-gully systems

Legislation reference list

Overview of the relevant legislation at the international, European, federal and Flemish level. For the consolidated European legislation we refer to [Eurlex](#).

International agreements, treaties, conventions, etc.		
Title	Year of conclusion	Year of entering into force
Canal Ghent-Terneuzen Protocol Canal Ghent-Terneuzen	1960 1985	
Scheldt-Rhine connection	1963	1998
Improvement of the Fairway at Walsoorden	1970	
Convention on wetlands of international importance, in particular as waterfowl habitat	1971	1975
Treaty of Charleville-Mézières	1994	
Widening Fairway 48/43/38 feet	1995	
Ministerial conference in Middelburg	1998	
Ministerial declaration of Liège	2001	
MoU Kallo		2001
MoU Vlissingen (2002) (2 MoUs)		2002 (2)
Scheldt Treaty	2002	
Treaty of Ghent	2002	
MoU The Hague	2005	2005
Pilot rates	2005	2008
Common nautical management	2005	2008
Common policy and management	2005	2008
Development Sketch 2010 for the Scheldt Estuary	2005	2008
Scheldt council Institution	2014	

European legislation		
Title	Year	Number
Council Directive on the conservation of natural habitats and of wild fauna and flora (Habitats Directive)	1992	43
Directive establishing a framework for Community action in the field of water policy (Water Framework Directive)	2000	60
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