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## Scheldt Estuary

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The Sea Scheldt and its tidal tributaries (Durme, Rupel with the Zenne, Dijle and Netes), the Western Scheldt and the mouth of the Scheldt together constitute the Scheldt Estuary. These water bodies are subject to the tides from the North Sea, whereby a strong interaction and coupling exists between the ecosystems of the Scheldt Estuary and the North Sea (exchange of water masses, dissolved substances, sediments, fauna, flora etc.). Given the relationship between the user functions of both areas (fisheries, shipping, dredging and dumping, recreation, etc.), the Compendium for Coast and Sea also covers the Scheldt Estuary. The current text is largely based on the content of the [ScheldeMonitor](#). This is a Flemish-Dutch knowledge and information system for research and monitoring in the Scheldt Estuary, which offers expertise, literature, datasets, measurements, projects, maps and a set of indicators.

A number of important estuaries are situated in the North Sea area and, just like the Scheldt Estuary, they are strongly affected by the tides. These include the estuary 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](#)<sup>138216</sup>). On the one hand, these estuaries have a great ecological value and parts of them are Natura 2000 area (see also theme [Nature and environment](#)). On the other hand, these estuaries provide space for important economic activities such as harbour developments. Besides, they face an increasing risk of flooding due to storm surges. 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. [FLOODSCAPE](#), [FRaME](#), [HARBASINS](#), [TIDE](#), etc.).

The Scheldt Estuary is unique in north-western Europe because a complete tidal regime is preserved along the entire fresh-salt water gradient in the river with the typical tidal habitats and communities ([Directie Zeeland & AWZ 2001](#)<sup>20705</sup>).

## 14.1 Policy context

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 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 not only involves Flanders and the Netherlands, but also the Walloon Region, the Brussels-Capital Region and France. (see table 1 and [website International Scheldt commission](#)).

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 was composed of Dutch and Belgian/Flemish officials and was responsible for studies about the Scheldt (e.g. the Deltaplan, the Scheldt-Rhine Connection, Long Term Vision (LTV) and the Development Sketch 2010 for the Scheldt Estuary, etc.). After 2008, the TSC was succeeded by the Flemish-Dutch Scheldt Commission ([VNSC](#)) as stated in the Scheldt treaties that were concluded on 21 December 2005 in Middelburg. The VNSC consists of a political and an official college and promotes the collaboration between Flanders and the Netherlands in the field of the policy and management of the Scheldt Estuary (the preparation of plans, programmes and projects, the establishment and guidance of a common programme for monitoring and research, etc.). Depending on the policy and management questions, the official college can establish a permanent or temporary working group to perform specific tasks. The two permanent working groups are 'Research and Monitoring' and 'Communication'. In 2013, four temporary working groups are active: 'Development sketch 2010 for the Scheldt Estuary', 'The sluice of the Canal Ghent-Terneuzen', 'Inland navigation Scheldt area', and 'Evaluation Policy and Management'.

On a sectoral level, Flanders and the Netherlands collaborate as well. Both countries ensure the organisation of easy and safe shipping from and to the Scheldt ports by means of the Common Nautical Management ([CNM](#)). The [Permanent Committee of Supervision on Scheldt Navigation](#), that was founded pursuant to article 9 of the treaty of 19 April 1839 concerning the separation between the Netherlands and Belgium, is the highest body in the organisation of the CNM and is responsible for a safe and smooth facilitation of shipping traffic. The Common Nautical Authority ([CNA](#)) ensures the daily nautical management, supervised by the Permanent Committee. The monitoring of shipping on the Scheldt is mainly performed by the Scheldt Radar Chain, a shipping guidance system that is used by the Flemish and Dutch government. The CNA provides information on radar systems and shipping guidance via the Vessel Traffic Service, legislation and procedures.

**Table 1. Overview of transborder Treaties and Memoranda for the Scheldt Estuary ([website VNSC](#), [website International Scheldt Commission](#)).**

| FLANDERS – THE NETHERLANDS (FROM 1960)   |   |
|--|---|
| Scheldt treaties   | Memoranda of Understanding (MoU)  |
| Pilot rates ( <i>Loodsgeldtarieven</i> ) (2005)  | MoU The Hague ( <i>MvO Den Haag</i> ) (2005)  |
| Common Nautical Management ( <i>Gemeenschappelijk Nautisch Beheer</i> ) (2005)                               | First MoU Vlissingen ( <i>Eerste MvO Vlissingen</i> ) (2002)<br>Second MoU Vlissingen ( <i>Tweede MvO Vlissingen</i> ) (2002) |
| Common policy and management ( <i>Gemeenschappelijk beleid en beheer</i> )(2005)                             | MoU Kallo ( <i>MvO Kallo</i> ) (2001)   |
| Development Sketch 2010 for the Scheldt Estuary ( <i>Ontwikkelingsschets 2010 Schelde-estuarium</i> ) (2005) |   |
| Scheldt treaty ( <i>Scheldeverdrag</i> ) (2002)  |   |
| Widening of the Channel 48/43/38 feet ( <i>Verruiming vaargeul 48/43/38 voet</i> ) (1995)                    |   |
| Improvement of the waterway at Walsoorden ( <i>Verbetering vaarweg te Walsoorden</i> ) (1970)                |   |
| Scheldt-Rhine connection ( <i>Schelde-Rijnverbinding</i> ) (1963)  |   |
| Canal Ghent-Terneuzen ( <i>Kanaal Gent-Terneuzen</i> ) (1960)  |   |
| • Protocol Canal Ghent-Terneuzen ( <i>Protocol Kanaal Gent-Terneuzen</i> ) (1985)                            |   |
| BELGIUM – FRANCE – THE NETHERLANDS   |   |
| Treaties   | Ministerial Declarations  |
| Treaty of Ghent (2002)   | <i>Ministerial Declaration of Liège</i> (2001)  |
| Treaty of Charleville-Mézières (1994)  | <i>Ministerial Conference in Middelburg</i> (1998)  |

The goal of the International Scheldt Commission (*ISC*) is to establish cooperation between riparian states (France, Belgium and the Netherlands) and regions of the Scheldt, in order to achieve sustainable and integrated water management of the international Scheldt river basin district. Since 2000, attention has also been paid to the common aspects of the river basin management plan for the Scheldt basin in the context of the goals of the *Water Framework Directive* (WFD).

In the current policy on the Scheldt Estuary, particular attention is being paid to the Long Term Vision for the Scheldt Estuary (LTV, *Directie Zeeland & AWZ 2001*<sup>20705</sup>). This LTV was established in 2001 by the Netherlands and Flanders and presented to the ministers concerned. The LTV constitutes the basis for the development of a trans-border and integrated policy for the estuary. The vision was conceived from the idea that the different functions of the Scheldt Estuary (within the three main themes of safety, nature, accessibility and other functions such as fisheries, tourism and recreation) have to be taken into account in the future, in a sustainable way. In the LTV a ‘Target 2030’ was formulated, listing the goals to be achieved in 2030. The *Development Sketch 2010 for the Scheldt Estuary (Ontwikkelingsschets 2010 Schelde-estuarium) (2005)*<sup>75396</sup> indicates which measures and policy efforts are needed in order to achieve the objectives of Target 2030. At present, 21 out of the 26 projects and measures have already been executed. The 5 remaining projects are being prepared and are managed by the Working group ‘Development Sketch 2010’. In the context of the LTV, the working group ‘Long Term Vision - Research and Monitoring’ (LTV- R&M) was founded in 2003. The latter working group aims to provide the necessary scientific support and the facts and figures for managers and policymakers. This requires intensive and cross-border collaboration between researchers, managers and policymakers in Flanders and in the Netherlands. As a consequence of the *Scheldt treaties* of 2005, the working group Research and Monitoring (R&M) was established in the context of the VNSC. This working group not only deals with new research questions and the project of widening the channel, but also with the objectives of the LTV-R&M. In December 2003, the *ScheldeMonitor* was launched to disclose data. The project has gained importance as an information system since 2008, as it places the results of the common monitoring programme (MONEOS, *Meire & Maris (2008)*<sup>123314</sup>) at the disposal of policy makers and researchers. To evaluate the condition and the evolution of the estuary based on the results of this monitoring programme, an evaluation methodology was created in *Holzhauser et al. (2011)*<sup>213039</sup> which is used to assess the functioning of the Scheldt Estuary.

In Flanders two of the LTV themes, safety and nature, are commonly executed in the *updated Sigmoplan (2005)*. The measures set in this plan serve both the safety as well as the nature function of the estuary. The objectives of the LTV with regard to nature in the Sea Scheldt were further refined in the context of the actualised Sigmoplan (*Adriaensen et al. 2005*)<sup>128821</sup> and a series of measures were proposed to realise these goals. Three types of measures are important in this regard: the development of mud flats and salt marshes by allowing controlled reduced tides in a controlled floodplain (CFP), renewing of dikes or depolderisation and the development of wetlands in the valley, whether or not as a controlled floodplain. The goals and measures are part of the *updated Sigmoplan (2005)* as approved by the Flemish government (22 July 2005).

The policy and management with regard to the Scheldt Estuary are largely driven by the international and European legislation such as the *Birds and Habitats Directive*, the *Water Framework Directive (WFD)*, the *Floods Directive* and the national and regional policy instruments that have to ensure the local execution of these measures (see also theme **Nature and environment**), by means of concrete goals, such as the good ecological and chemical condition (*WFD*) and the conservation status of the Natura 2000 areas in and around the estuary. An overview of the policy framework for the Scheldt Estuary is given in *Debergh et al. (2009)*<sup>138216</sup>.

## 14.2 Spatial demarcation

By definition, an estuary contains the part of the river which is subject to tidal influence (*Fairbridge 1980*<sup>113586</sup>). 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. Furthermore, the upper limit of the highest high water is regarded as a border (figure 1).

The LTV (*Directie Zeeland & AWZ 2001*<sup>20705</sup>) applies to a demarcated geographical area. However, a trans-border perspective is used when this is required for certain aspects. Upstream the border was set at the locks in Ghent (Merelbeke) and the mouths of the tributaries. Downstream the estuary contains the Scheldt and its estuaries, including the *Vlakte van de Raan* and other shallow water areas. The channels are taken into account until the limit of the nautical management (indicative border: the piloting intersections west of 'het Scheur'). The Zeebrugge Port and its waterway 'Pas van het Zand' are not included in the area concerned. Except for the river itself, the LTV also covers the banks up to the head weirs.

### THE AREA OF THE SCHELDT ESTUARY



Figure 1. The area of the Scheldt Estuary, with an indication of the estuary area, the Western Scheldt, the Lower Sea Scheldt and the Upper Sea Scheldt (Source: VNSC Communication).



In the context of the LTV goals, a series of indicators for sustainable development have been selected and applied to the entire Scheldt Estuary, in consultation with scientists and policymakers. These indicators fit in with the 3 major themes of the *Working group Research and Monitoring*: safety, nature and accessibility and are available on the *ScheldeMonitor*. For these indicators, the spatial demarcation of the LTV has been used (*Lesrauwaet et al. 2009*<sup>138217</sup>, *Indicators for the Scheldt Estuary 2011*<sup>206086</sup>).

In the context of the hydro-morphodynamics, *Meire & Maris (2008)*<sup>123314</sup> stress the importance of the mouth area: the line Zeebrugge-Westkapelle, including the *Vlakte van de Raan*. Besides the Western Scheldt and Sea Scheldt, these authors also take the Rupel into account and consider the other tributaries (Durme, Zenne, Dijle en Netes) as borderland when demarcating the Scheldt Estuary. The latter rivers are included because of their input into the system (fresh water, nutrients) and the impact of the upstream policy (e.g. water treatment, land use, etc.). According to the study about nature development measures for the Scheldt Estuary (*Van den Bergh et al. 2003*<sup>111670</sup>), the area includes the adjacent natural flooding areas, including the 'anthropogenic' development areas (controlled reduced tides area and controlled flood plains) and the valley areas related to the estuarine ecosystem (*Ramsar* areas and *Natura 2000*) in Flanders, as well as the buffer zones (2 km inland), as defined for the Western Scheldt (Zeeland).

## 14.3 The ecosystem in the Scheldt Estuary

The Scheldt Estuary is an area with unique natural values. It is one of the most important European estuaries where the tidal regime is preserved along the entire fresh-salt water gradient with the typical tidal habitats and communities (*Directie Zeeland & AWZ 2001*<sup>20705</sup>).

The Scheldt Estuary is by nature a very dynamic system that is strongly affected by the tides and variations in salinity. Mud flats, salt marshes, sandbanks and gullies are constantly subject to changes. The low-dynamic (with a low water velocity) shallow water areas, the intertidal areas (mud flats, sandbanks) and salt marshes constitute ecologically valuable habitats in the Scheldt Estuary. The mudflats and sandbanks are usually rich in benthos and constitute important feeding grounds for birds. In general, the areas with an average exposure rate (the percentage of time the mud flats are surfaced) are the most attractive areas from an ecological point of view (*MER Verruiming vaargeul Beneden-Zeeschelde en Westerschelde 2007*<sup>117580</sup>, *Wetsteijn et al. 2007*<sup>109989</sup>). Low-dynamic shallow water areas are essential for the reproduction and growth (nursery function) of fishes, crustaceans and molluscs. Salt marshes offer a suitable nesting area for several bird species and serve as a refuge during high water.

Flanders and the Netherlands collaborate on an ecotope system (i.e. a (hierarchical) classification of ecotopes) for the Scheldt Estuary. This type of system is used to track changes in different habitats throughout time, to predict the impact of certain variations in the system on the present habitats and to evaluate effects on communities (Indicator *Morphology and dynamics in the estuary, Indicators for the Scheldt Estuary 2011*<sup>206086</sup>).

Table 2 offers an overview of the available information and data in the *ScheldeMonitor* regarding the different aspects of the ecosystem. Within the topics and subtopics, a listing of the relevant information (persons, institutes, publications, projects and maps), research results and data (parameters, datasets, map layers, images and publications) is provided.

The evaluation methodology for the Scheldt Estuary (*Holzhauser et al. 2011*<sup>213039</sup>) provides instruments to evaluate the functioning of the estuarine system. This methodology is built around the major functions as defined in the LTV and offers the methodological framework for the cyclical, six-yearly evaluation of the system. In the context of the evaluation methodology, a limited set of communication-indicators has been developed. These indicators are reported in the T-2009 report (*Depreiter et al. 2013*<sup>228410</sup>) that offers a description of the contemporary condition of the estuary (including the trends before 2009) before the execution of the Development sketch 2010-projects:

- Sandbank and gully system;
- Water quality;
- Environment;
- Flora and fauna;
- Ecological functioning.

In the indicators, developed in the context of the LTV, time series and trends with regard to nature and ecosystem functioning are presented as well (*Indicatoren voor het Schelde-estuarium 2011*<sup>206086</sup>).

Table 2. Overview of the available information and data in the ScheldeMonitor about the ecosystem.

| THE ECOSYSTEM OF THE SCHELDT ESTUARY |   |
|--------------------------------------|---|
| Topic                                | Subtopic  |
| <i>Hydrodynamics</i>                 | <i>Water balance<br/>Water level and tide<br/>Waves<br/>Current</i>   |
| <i>Morphodynamics</i>                | <i>Geomorphology<br/>Ecotopes and fysiotopes</i>  |
| <i>Physico-chemistry</i>             | <i>Physical parameters<br/>Water quality<br/>Sediment quality<br/>Air quality<br/>Pollution<br/>Light climate</i> |
| <i>Habitat diversity</i>             | <i>Ecotopes and fysiotopes<br/>Nature development<br/>Habitats<br/>Nature areas</i>                               |
| <i>Species diversity</i>             | <i>Vegetation<br/>Plankton<br/>Benthos<br/>Fish<br/>Birds<br/>Mammals<br/>Amphibia<br/>Macrophytes</i>            |
| <i>Ecological functioning</i>        |   |

## 14.4 The use of the Scheldt Estuary

The Scheldt Estuary is not only an important ecosystem, but also hosts several user functions such as shipping, dredging, sand extraction, recreation, protection against floods, fishing, etc. Table 3 gives an overview of the available information and data in the *ScheldeMonitor* concerning these user functions. Within the topics and subtopics, the relevant information (persons, institutes, publications, projects, datasets and maps), and data (parameters, map layers, images, datasets and publications) is listed and linked to a set of indicators (*Indicatoren voor het Schelde-estuarium 2011* <sup>206086</sup>).

Table 3. Overview of the available information and data in the ScheldeMonitor about the different user functions of the estuary.

| THE ESTUARINE ECOSYSTEM AND USER FUNCTIONS OF THE SCHELDT |   |
|---|---|
| Topic   | Subtopic  |
| <i>Shipping</i>   | <i>Navigation channel<br/>Harbour development<br/>Nautical management<br/>Inland shipping<br/>Ocean shipping<br/>Recreation<br/>Risks</i> |
| <i>Safety</i>   | <i>History<br/>Flooding<br/>Risks<br/>Future</i>  |
| <i>Morphodynamics</i>                                     | <i>Sand extraction<br/>Dredging and dumping</i>   |

In addition, the following user functions are discussed in the ScheldeMonitor: *Fisheries, Socio-economic system, Administration and law, Recreation and tourism.*

In the methodology for the evaluation of the Scheldt Estuary (*Holzhauser et al. 2011*<sup>213039</sup>) one communication-indicator has been developed in the context of Accessibility and another one in the context of Safety. These indicators are reported in the T-2009 report (*Depreiter et al. 2013*<sup>228410</sup>) that offers a description of the contemporary condition of the estuary (including the trends before 2009) before the execution of the Development sketch 2010-projects.

## Legislation reference list

Table with international agreements, conventions, etc.

| INTERNATIONAL AGREEMENTS, CONVENTIONS, ... |  |                    |                             |
|--|--|--------------------|-----------------------------|
| Abbreviations (if available)               | Title  | Year of conclusion | Year of entering into force |
|  | Canal Ghent-Terneuzen (Kanaal Gent-Terneuzen)<br>Protocol Canal Ghent-Terneuzen (Protocol Kanaal Gent-Terneuzen) | 1960<br>1985       |                             |
|  | Scheldt-Rhine connection (Schelde-Rijnverbinding)  | 1963               |                             |
|  | Improvement of the fairway at Walsoorden (Verbetering vaarweg te Walsoorden)                                     | 1970               |                             |
| <i>RAMSAR Convention</i>                   | Convention on Wetlands of International Importance especially as Waterfowl Habitat                               | 1971               | 1975                        |
|  | Treaty of Charleville-Mézières (Verdrag van Charleville-Mézières)  | 1994               |                             |
|  | Widening of the Channel 48/43/38 feet (Verruiming vaargeul 48/43/38 voet)  | 1995               |                             |
|  | Scheldt treaty (Scheldeverdrag)  | 2002               |                             |
|  | Treaty of Ghent (Verdrag van Gent)   | 2002               |                             |
|  | Pilot rates (Loodsgeldtarieven)  | 2005               | 2008                        |
|  | Common Nautical Management (Gemeenschappelijk Nautisch Beheer)   | 2005               | 2008                        |
|  | Common Policy and Management (Gemeenschappelijk beleid en beheer)  | 2005               | 2008                        |
|  | Development Sketch 2010 for the Scheldt Estuary (Ontwikkelingsschets 2010 Schelde-estuarium)                     | 2005               | 2008                        |
| <b>Memoranda of Understanding</b>          |  |                    |                             |
|  | MoU Kallo (2001)   |                    | 2001                        |
|  | MoU Vlissingen (2002) (2 MoUs)   |                    | 2002 (2)                    |
|  | MoU Den Haag (2005)  | 2005               | 2005                        |
| <b>Ministerial Decrees</b>                 |  |                    |                             |
|  | <i>Ministerial Conference in Middelburg</i> (Ministersconferentie te Middelburg)                                 | 1998               |                             |
|  | <i>Ministerial Declaration of Liège</i> (Ministeriële Verklaring van Luik)                                       | 2001               |                             |



Table with European legislation. The consolidated version of this legislation is available on [Eurlax](#).

| EUROPEAN LEGISLATION         |   |      |        |
|------------------------------|---|------|--------|
| Abbreviations (if available) | Title   | Year | Number |
| <b>Directives</b>            |   |      |        |
| Habitats Directive           | Council Directive on the conservation of natural habitats and of wild fauna and flora           | 1992 | 43     |
| Water Framework Directive    | Directive 2000/60/EC establishing a framework for Community action in the field of water policy | 2000 | 60     |
| Floods Directive             | Directive 2007/60/EC on the assessment and management of flood risks                            | 2007 | 60     |
| Birds Directive              | Directive on the conservation of wild birds   | 2009 | 147    |

