

North Sea: Landscapes of Coexistence

Delta Interventions Graduation Studio 2017-2018



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TU Delft, Delta Interventions Graduation Studio North Sea: Landscapes of Coexistence

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All drawings and images in this booklet were made by Deniz Üstem. Exceptions and collaborations are indicated.

June 2018

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Introduction

The Delta Interventions theme for this year is landscapes of coexistence, which focuses on transitional spaces, infrastructure and power in the North Sea. Within the context of the North Sea, I depicted the Netherlands as a battleground, with the Dutch in a constant struggle against it. Thus, the project is an interpretation of the long-standing tradition of the Dutch battle against water. This led me to choosing my site, the Wadden Sea, where this battle between the land and the sea is at its most extreme. The varied research presented here gives an insight into the dynamic and extraordinary morphology of this landscape.

The project traces the myth of "making new land" by investigating four major themes adopted from a recent publication 'Sweet and Salt: The Water and The Dutch'. These four themes are perceived as a thematic backbone of the Dutch waterscapes. Therefore, the intention was to analyze the Wadden Sea and the island of Schiermonnikoog by using the themes: conflict, concord, profit and pleasure. After the investigation of these four themes, the motive here is to project them into the future by using the scenario method. This scenario envisions a future when the West Frisian island of Schiermonnikoog is left to

nature and risks slowly disappears into the currents of the North Sea. The design intervention narrates a new myth: "guarding the water" by using the typology of a fort.







The North Sea: The Dutch and the German Coast



North Sea Field Trip with Delta Intervention Studio October 2017

The group's focus is the 600km long strip of North Sea coast in Germany and the Northern part of the Netherlands. What make this part of the North Sea special and certainly interesting for us is its natural conditions of the Wadden Sea, the Frisian Islands and the related natural dynamics. This special part of the North Sea is strongly influenced by the tides and offers one of the biggest protected UNESCO habitats in the whole world with a rich flora and fauna. Water currents and the sediment streams are forming this naturally very vulnerable landscape and are creating dynamic interaction of water and 'moving' land.More extreme weather events, stronger water currents, heavier waves and especially the rising sea water level threaten this necessary sediments dynamics. The sea demands more space to expand and to refine the natural balance.This balance is difficult to maintain, because the territory is occupied with farming land, urbanization, flood protection systems and energy facilities. Static human systems, like dikes, walls and buildings, act as a buffer and protection.

These processes are determined by the loss of salty marshlands as well as by the distinction of numerous types of animals. On the one hand the static human elements are threatening the natural system, on the other hand is flooding protection essential for the hinterland of the German and Dutch North Sea coast, because the coast territory is mostly under sea level or slightly above. Different Future scenarios are stating that huge parts of the countries hinterland, including the major cities, would be flooded.

Also the human system is threatened by these conditions. The rising



North Sea Field Trip Sketches, October 2017



Island Schiermonnikoog April 2018

sea level will gradually increase the amount of salt in the farmlands ground. Farmers are loosing their traditional way of growing plants and need to reconsider new ways of farming. Also human leisure areas might be lost and flooded as well as the tourism industry might suffer from it.

Future scenarios of climate change will threaten both the natural system and the human system. They need be interrelated rather than existing next to each other. Our vision of the future coastal edge is of an adaptive and dynamic nature, which responds to the dynamics of the sea and predicted future scenarios. The key element is 'building and working with nature'; maintaining the natural conditions; its systems and the flora and fauna of the North Sea, by giving the water more *space, transform dikes and integrate more natural and dynamic flood protection. One suitable example is 'The Hondsbossche New Dunes' by West 8 in the west of the Netherlands.*

By giving space to the water certain function on land might be replaced and transformed. Algae production can be used for example as a resource for energy and food as well as the natural system is benefiting from it. An additional positive effect might be the creation of more leisure areas and attractive sites for tourists.

Another challenge might be of strategically nature. By giving more space to the water the actual Sea might become even more occupied by production facilities and infrastructure than it is today. Even if we



North Sea Field Trip Sketches, November 2017

find a way to balance human and natural demands and needs, managing different interests of the surrounding countries need to be taken in to account, for example using the idea of macro regional strategies and transnational agreements. The overall aim is that both the natural system and the human system are mutually benefiting from each other. The key idea is, that 'building with nature' means not just the increase the adaptiveness of a system but to 'delegate back to the biosphere, what she does well [...]' (Saskia Sassen, A Third Space: Neither Fully Urban nor Fully of the Biosphere').

Deniz Üstem, Jan Cyganski, Julia Holtland 04 November 2017

Preliminary Group Research

LEGAL BORDERS AND ENERGY NETWORK

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The North Sea consists of 5 Exclusive economic zones. Each country holds exclusive rights in their zone to explore and exploit resources.

Oil fieldsGas fieldsPotential oil and gas fieldsCondensateCoal power plantNuclear power plantOil pipelineGas pipelineLanding point pipelineExisting wind farmPlanned wind farmBorder Exclusive Economic Zone (EEZ) (200nm)Territorial zone (12nm)Contigous zone (12nm)



Legal Borders and Energy Network Jan Cyganski, Julia Holtland, Deniz Üstem, November 2017

40 80

200 km

NATURAL DYNAMICS AND INFRASTRUCTURE

Since North Sea is a swallow sea, where the water gets deeper the shipping routes gets denser. On the European costs there are three biggest major ports: Rotterdam, Amsterdam and Antwerp. These three majors pull the entire traffic to themselves.

- Water depth Very large harbor (t) Medium Large harbor 0 Small harbor . International airport airport * Non-terminal airport ۲ Major highways EEZ borders Current stream
- *— Shipping route*
- Protected areas



Natural Dynamics and Infrastructure Jan Cyganski, Julia Holtland, Deniz Üstem, November 2017

THE NORTHERN NETHERLANDS AND THE NORTHERN GERMANY: A SEDIMENT SHARING SYSTEM

Since North Sea is a swallow sea, where the water gets deeper the shipping routes gets denser. On the European costs there are three biggest major ports: Rotterdam, Amsterdam and Antwerp. These three majors pull the entire traffic to themselves.





EVENTS HAPPENING IN THE NORTH SEA: A SECTIONAL TIME STUDY

Wadden sea is a sediment basin due to corresponding sea and river flows. Also, it has tidal movements on the surface which forms a tidal base on the sea floor and later causes the salt marsches to grow with its movement. And there is many more events happening in different frequences. All these natural and infrastructural events happening on the grid terrain that we defined on the first image. We tried to symbolise the continuity of these simultaneous changes with a time capsule. In every piece of these capsule, a diverse event is happening. And the overlap of all of these events defined the natural and cultural landscape of the Wadden Sea



Events Map Jan Cyganski, Julia Holtland, Deniz Üstem, November 2017

CIVIL GUARDS OF THE WADDDEN SEA

The terrain which has defined in the first image is placed as a terrain which is a palimphest of diverse events. This terrain is dynamic and regulates the border conditions between dynamic north sea and static coastal line in contrast. The two civil guards in the image represents the laws and policies in terms of protecting the wadden see and respectively the north sea. But in contrast to original, because normally civil guards were protecting the land against ivasions especially against the Spanish invasions, by putting these guards on to sea, in front of the wadden sea border we tried to highlight a new position is to be taken in terms of protecting and regulating the borders in the North Sea.



Civil Guards of the Wadden Sea Jan Cyganski, Julia Holtland, Deniz Üstem, November 2017





The Wadden Sea as a Transitional Border



Wadden Sea is a transitional border between the North Sea and the North Frisian cost of the Netherlands. This waterscape is a unique example of where natural and human systems intervening each other in an exquisite way. The tides, water currents and sediment streams creating a dynamic landscape. Barrier islands are eroding, moving or sometimes disappearing in this dynamic landscape.

TIDAL RANGES

The large coherent system of Wadden Sea tidal flats is protected towards the open North Sea by a long chain of barrier islands of different geological origin. In the innermost part of the German Bight, characterized by macrotidal conditions (tidal range >3.5 m), open tidal flats and ephemeral sand bank islands occur. Dashed lines indicate mean tidal ranges. Highly dynamic islands: Rottumeroog (1), Kachelotplate (2), Mellum (3), Scharhörn / Nigehörn (4), Trischen (5), Norderoogsand (6), Kjeldsand (7).



Source: Dynamic Islands in the Wadden Sea, Waddden Sea Ecosystem No. 33 Common Wadden Sea Secretariat 2014, Ulrich Hellwig, Martin Stock

RAMSAR SITES

The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The Governments of Denmark, Germany and the Netherlands have formally requested the Secretariat of the Ramsar Convention, through a joint letter dated 1 December 2015, to list the Wadden Sea as a Transboundary Ramsar Site. With that formal request, Wadden Sea became the biggest transboundary RAMSAR site. There are 7 designated RAMSAR sites in the Neth-

erlands: North Sea Coastal Area (Ramsar Site $n^{\circ}1252$), Waddenzee (Ramsar Site $n^{\circ}289$), Duinen en Lage land Texel (Ramsar Site $n^{\circ}2213$), Duinen Vlielan (Ramsar Site $n^{\circ}2216$), Duinen Terschelling (Ramsar Site $n^{\circ}2215$), Duinen Ameland (Ramsar Site $n^{\circ}2212$) and Duinen Schiermonnikoog (Ramsar Site $n^{\circ}2214$).

Source: Dynamic Islands in the Wadden Sea, Waddden Sea Ecosystem No. 33 Common Wadden Sea Secretariat 2014, Ulrich Hellwig, Martin Stock



20 40 100 km

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UNESCO SITES

The outstanding qualities of geology, hydrology, morphology, ecology and biodiversity have led to the entire Wadden Sea being declared a UNESCO World Heritage Site. In 2009, the Dutch and German parts of the Wadden Sea were inscribed on UNESCO's World Heritage List and the Danish part was added in June 2014. The landscape is representing major stages of Earth's history: including the record of life, significant ongoing geological processes in the development of landforms, and significant geomorphic or physiographic features. More importantly, Large scale examples of continuous geological processes and morphological interactions are on public view in the Wadden Sea. Among the most spectacular are the: creation, continual shifting and changing, and ultimate disappearance of many of the region's uninhabited natural islands, along with all the biota they support.

Source: Dynamic Islands in the Wadden Sea, Waddden Sea Ecosystem No. 33 Common Wadden Sea Secretariat 2014, Ulrich Hellwig, Martin Stock



Interscalar Research

Wadden Sea is an ebb tidal delta, where the sediment sharing system causes the Wadden islands to demonstrate a highly dynamic morphological pattern. According to Hellwig and Stock "Large scale examples of continuous geological processes and morphological interactions are on public view in the Wadden Sea. Among the most spectacular are the creation, continual shifting and changing, and ultimate disappearance of many of the region's uninhabited natural islands, along with all the biota they support." They also remark that the highest mean shifting rates are reported from The Netherlands . This lead me to map the morphological transformations of the territory in three different scales, with each scale posing different problems. The first scale is the Wadden Sea Area (from The Netherlands as the westernmost extremity to Denmark as the northernmost). The second scale is the West Frisian Islands and Northern Netherlands, with the third scale being the island Schiermonnikoog.

SCALE I

WEST FRISIAN ISLANDS & NORTHERN NETHERLANDS

1. Coastal Squeeze

In the current state, the densification of urban, industrial and agricultural areas on the coast threaten this naturally very vulnerable landscape with coastal squeeze. Coastal squeeze is another threat to Wadden's unique habitat than sea level rise and gas extraction. Unlike the sea level rise and the gas extraction, the coastal squeeze is a problem developed over centuries during the Holocene development of the Northern Netherlands. Starting form 500 BC, the ebb-tidal delta of the Wadden Sea was getting smaller during centuries. And finally, with the effect of the land reclamation processes it is taken todays shape.

2. Drought & Salination Threat

Climate change, land subsidence and new water demands may lead to droughts in the Netherlands, despite it being a relatively wet country. Additionally, climate change leads to salination of the fresh water as well, which may lead shortage of fresh water for houses, agriculture and factories in the near future.



3. Moving Islands

Large amounts of the Wadden islands are moving, causing them to demonstrate a highly dynamic morphological pattern. The direction of their movements is changing in time and their moving rates are proving to vary differently. Importantly, the highest mean shifting rates are reported from the Netherlands. The current land reclamation policies of the Netherlands are against mobilisation of the islands of Texel, Vlieland, Ameland, Terschelling and Schiermonnikoog. For that purpose, sand nourishment on the beaches, dikes and sand drift dikes are implemented against the dynamic nature of the islands. But in the future, especially with the contribution of the sea level rise, these implementations may not be enough to keep the islands in their static state.



SCALE II THE WADDEN SEA

The problems posed in that scale are problems which directly relates with its legislative status of the Wadden Sea. The major problems posed by these authorities are:

1. Loss of Habitat

The Wadden Sea is a unique habitat for mammals and birds. The loss of its habitat is threatening the species living around this heavenly habitat. Sea level rise and gas extraction around the Wadden Sea is a serious threat to its unique habitat.

2. Need for a Sustainable Tourism

The area is also a favourite destination for tourists, especially for the bird watchers since it is on the flyway of numerous bird species. Some also use the islands and sandbanks to leave their eggs and to breed. Thus, tourism is an important source of income but these activities should meet sustainability criteria.



SCALE III ISLAND SCHIERMONNIKOOG

1. Most Dynamic Island

Island Schiermonnikoog is the most dynamic island among all other West Frisian Islands. This implies that the Dutch Government must allocate a higher budget for the sand nourishment than they spend for other islands. Especially with the effect of sea level rise, this situation may create a conflict between immobilisation of the island and the sand budget.

2. Highly Affected by Tidal Changes

Since the island is a part of an ebb-tidal delta, the sea level is changing twice a day. From Den Helder to Bremen, the water level difference goes from 1,4m up to 4,4m. Thus, the daily tide difference in the island is between 2 - 2,5 meters. However, during the storm surges the maximum recorded setup in the water is about 3,4 - 4 meters. These numbers are expected to get higher with the effect of climate change.

Morphological Development of The West Frisian Islands in the Holocene

ORIGINS OF TIDAL BASINS AND INGRESSION SYSTEMS (100 AD)

Geological processes and human interventions induced major changes in the Holocene coastal landscape. As a result of the global Holocene sea-level rise, northern Netherlands changed into a marine environment. Tidal channels locally eroded the subsoil and the lower parts of the Pleistocene valleys were flooded. These valley systems turned into tidal basins and where Eems debouched into the sea they became an estuary. The Wadden Islands, tidal basins and estuaries migrated landward as a result of ongoing sea-level rise. During the Late Iron Age and Roman times, at increasingly more locations in the Dutch Wadden Sea, marine sedimentation in the marginal peat lands took place. Then the border zones of peat areas started drowning. Human reclamations and continuous sea level rise caused subsidence in the border zones of the peat areas. (The average sea level rose by about 5–10 cm per century)

Source: P.C. Vos, E. Knol, Holocene Landscape Reconstruction of the Wadden Sea Area Between Marsdiep and Weser, Netherlands Journal of Geosciences, 2015



Schematic Section

EHW: extreme high water MHW: mean high water MLW: mean low water

Source: P.C. Vos, E. Knol, Holocene Landscape Reconstruction of the Wadden Sea Area Between Marsdiep and Weser, Netherlands Journal of Geosciences, 2015 - Reconstructred by Deniz Üstem



The Netherlands in 100 AD Source: P.C. Vos, E. Knol, Holocene Landscape Reconstruction of the Wadden Sea Area Between Marsdiep and Weser, Netherlands Journal of Geosciences, 2015 - Reconstructred by Deniz Üstem



MIGRATION PERIOD (800 AD)

During the Migration Period (400–500 AD) the occupation intensity in the salt-marsh area of the northwestern Wadden Sea reduced sharply and so did the reclamation activities. The occupancy of salt marshes at the seaward margin of the peat area in the northern Netherlands and northwestern Germany increased strongly again during the Early Middle Ages when the large-scale peat reclamations started, leading to full cultivation of the coastal peat bog and the adjacent peat-moor area on the Pleistocene soils. They caused a significant subsidence in the surface of the seaward margin of the peat area. Because of subsidence the seaward margin of the peat area was flooded during storms.Concomitantly, the tidal currents to the hinterland strengt ened, which in turn led to an enlargement of the tidal channels. The Lauwerszee reached its maximum extent in the Early Middle Ages. Because, the subsidence resulting from peat reclamation enabled the tidal system of the Lauwerszee to enlarge.

Source: P.C. Vos, E. Knol, Holocene Landscape Reconstruction of the Wadden Sea Area Between Marsdiep and Weser, Netherlands Journal of Geosciences, 2015



Schematic Section

EHW: extreme high water MHW: mean high water MLW: mean low water

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The Netherlands in 800 AD Source: P.C. Vos, E. Knol, Holocene Landscape Reconstruction of the Wadden Sea Area Between Marsdiep and Weser, Netherlands Journal of Geosciences, 2015 - Reconstructred by Deniz Üstem

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ARTIFICIAL SUBSIDENCE AND DIKES (1500 AD)

The Zuiderzee enlarged during the Middle Ages, erosion during major storms playing a major role. For example, during the great storm of 1170 AD a large piece of land, seaward of the current dike at Stavoren, was lost and the Marsdiep came into existence. As the inland sea increased in size, wave attack on the shorelines became stronger. The Marsdiep tidal inlet became increasingly important during the Middle Ages. The effects of anthropogenic interventions in the coastal landscape became dramatic in the Late Middle Ages, when the major part of the salt-marsh area was embanked. In the course of the 11th century the construction of dikes had become necessary in areas with strong subsidence. In the previous periods the water flowed back to the sea in a natural way after a flood. However, after the artificial subsi ence of the land, water remained present and could only be discharged to the sea during low water through a system of dikes and sluices. In this way almost the entire marsh area of the northwestern, Wadden Sea area of the Netherlands and Germany was diked between 1200 and 1300. As a result of this diking water could no longer be stored in the salt marshes during storms, leading to the impoundment of water against the dikes and an increase in maximum storm water levels in the Wadden Sea.

Source: P.C. Vos, E. Knol, Holocene Landscape Reconstruction of the Wadden Sea Area Between Marsdiep and Weser, Netherlands Journal of Geosciences, 2015



Schematic Section

EHW: extreme high water MHW: mean high water MLW: mean low water

Source: P.C. Vos, E. Knol, Holocene Landscape Reconstruction of the Wadden Sea Area Between Marsdiep and Weser, Netherlands Journal of Geosciences, 2015 - Reconstructed by Deniz Üstem



The Netherlands in 1500 AD Source: P.C. Vos, E. Knol, Holocene Landscape Reconstruction of the Wadden Sea Area Between Marsdiep and Weser, Netherlands Journal of Geosciences, 2015 - Reconstructed by Deniz Üstem

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TODAY (2000 AD)

The northern part of Noord-Holland silted up strongly and the silted-up salt marshes were diked in stages. From the 19th century onwards the intertidal coastal zone along the embanked mainland has also been reclaimed using wooden structures along the dike in which silt was trapped. When such reclamation areas had silted up to the level of the salt marsh they were diked. In the 20th century the Zuiderzee and the Lauwerszee were cut off from the Wadden Sea by large dikes. Thus the Wadden Sea area has been reduced. In particular, the saltmarsh areas are only a fraction of what they once were. After 1500 AD the peat area also decreased considerably. The coastal peat and the peat areas on the higher Pleistocene grounds have largely disappeared due to large-scale peat-cutting for fuel (turf) and salt, and by oxidation of peat due to exploitation.

Source: P.C. Vos, E. Knol, Holocene Landscape Reconstruction of the Wadden Sea Area Between Marsdiep and Weser, Netherlands Journal of Geosciences, 2015



Schematic Section

EHW: extreme high water MHW: mean high water MLW: mean low water

Source: P.C. Vos, E. Knol, Holocene Landscape Reconstruction of the Wadden Sea Area Between Marsdiep and Weser, Netherlands Journal of Geosciences, 2015 - Reconstructed by Deniz Üstem


The Netherlands in 1500 AD Source: P.C. Vos, E. Knol, Holocene Landscape Reconstruction of the Wadden Sea Area Between Marsdiep and Weser, Netherlands Journal of Geosciences, 2015 - Reconstructed by Deniz Üstem





Archetypal Struggle Against Water

| Demise of Jordsand: Creation, Continual Shifting, Changing and Ultimate Disappearance | The Last One Hundred Seventy-five Years of the Island Schiermonnikoog

Demise of Jordsand: Creation, Continual Shifting, Changing and Ultimate Disappearance



The observation hut on Jordsand on fire Photo: Svend Tougaard.



Jordsand Today Photo: Google

The island Jordstand is one of the most extreme islands of these disappeared ones. The island, which used to be an island on the Danish border of the Wadden Sea was destroyed in a series of storm tides. However, in 1971, it was as big as the island Schiermonnikoog. Since it was not protected by dikes and wasn't nourished by sand, it has disappeared in the currents of the North Sea. Today it is just a shallow sandbank and not more than a google landmark on the map. Studying the case of Jordsand carried my morphological research into reconsidering the island Schiermonnikoog which is also threatened by disappearance because of tidal changes and its dynamic morphology. By taking the Jordstand case into account, I aimed to project a future scenario by asking the question "What if the island Schiermonnikoog slowly disappears in the currents of the North Sea."



Jordsand's degradation from 1807 to 1994 The delineation shows the area's with vegetation coverage. After Jespersen and Rasmussen, 1996 Modified by Svend Tougaard, remodified by Deniz Üstem.

The Last One Hundred Seventy-five Years of the Island Schiermonnikoog



Badhotel Case Badhoter 1924, From the archieve of Eddie Bakker

In 1887, the owner of the island I.E.Banck has built a large bathhouse which has its own light house and pump installation which provides water to the hotel. In 1916 the sands underneath of the hotel slowly began eroding and eventually in 1924 the hotel was damaged by the sea water. At that time, there were 80 guests in the hotel which proved that teh resort was quite populer among Dutch community. And then in the same year that it was damaged, it was completely demolished. Migration Pattern of the Island ජං Lessons taken from the Badhotel Case

Barrier islands consist of five large-scale morpho ecological units. The island Schiermonnikoog contains each of these units within itself. And, each of these units behave differenty within the complex sedimentary system. While the island head (1) is corroding over the years, with the effect of sand nourishment supplied by the Dutch authorities, the shape of the tail remained almost same during the 175 years. The Badhotel case demostrates the effects of the corrosions on the island head (1) without implying sand nourishments.

On the other hand, the same authorities did not interfere to natural accumulation of the sand on the island tail (4), Beach and shoreface (5). Thus, the island tail (4) and the beach and the shoreface (5) got longer and longer over the years.

The sand nourishments prevents the mobilisation of the island to the North-east. As a result, the island looks like it stands on its place but getting longer on the North-east border.



Prototype Island The prototype West and East Frisian barrier island is characterized by the presence of five large-scale morpho-ecological units: (1) island head; (2) dune arc; (3) washover complex; (4) island tail; (5) Beach and shoreface Source: Löffler et al., 2011



Migration Pattern of the Island Schiermonnikoog A series of Maps were reconstructed and overlapped to understand the migration pattern of the island



Schiermonnikoog in the year of 1840





Schiermonnikoog in the year of 1930





Schiermonnikoog in the year of 1960





Schiermonnikoog in the year of 1970





Schiermonnikoog in the year of 1980





Schiermonnikoog in the year of 1990





Schiermonnikoog in the year of 2000





Schiermonnikoog in the year of 2005





Schiermonnikoog in the year of 2010





Schiermonnikoog in the year of 2015





Dynamics of the Island Schiermonnikoog

| Complex Sedimentary Systems | Tide Conditions and Shoreline Vegetation | Prevailing Winds

Complex Sedimentary Systems



Subenvironments Complex sedimentary systems with a variety of subenvironments. Source: Reinson, 1992





MICRO TIDAL TIDAL RANGE 0-2 METERS

Micro-tidal environments are those in which the tidal range is 0-2 m. These Island tend to be long and thin with few inlet channels. In micro- tidal environments that tidal surge is not large enough to top the island in many places. Without continual overtopping by tidal surges there is not the opportunity for many tidal inlets to form. Barrier islands in micro-tidal environments are considered to be wave dominated barrier islands.

MACRO TIDAL TIDAL RANGE >4 METERS

Macro-tidal environments are in areas where the tidal range is > 4m. Macro-tidal areas are considered to be barrier island free. Barrier islands exist in macro-tidal environments only very rarely when fluvial input is the dominant factor.

MESO TIDAL TIDAL RANGE 2-4 METERS

Meso-tidal barrier islands form in area in which the tidal range is from 2-4 m. The island systems which form in these environments tend to be shorter in length by slightly wider. The reason for the shorter length is continual overtopping by the tidal surge. This allows the formation of many inlet channels and hence the formation of many distinct islands. Meso-tidal barrier islands are considered to be tidally dominated barrier islands.

Source: Prothero, 1990

Tide Conditions and Shoreline Vegetation





Level (m)



Tide predictions are taken from the nearest tide station in Schiermonnikoog, Netherlands 4,97km South-east of the Schiermonnikoog Beach.







Dune



Densely Vegetated



Lowly Vegetated

Beach Plain





Dry Beach Plain



Foreshore

	Vegetated Area		E	Bare Soil / Non-Veg	etated Area	
⊷ Upland		Backshore			Foreshore	Nearshore
Dune	Densely Vegetated 158 m	Lowly Vegetated 93 m	Beach Plain	Dry Beach Plain 109 m	High Water Level & Low Water Level 180 m	
					High Water Level	
					Low	Water Level

LOW WATCH LEV

Prevailing Winds





Hysteresis curve related to changes in wind power and vegetation cover: Source: H. Tsoar

Prevailing Winds Wind Distribution in Year (%) in the island Schiermonnikoog



MODIFICATION OF DUNES

(1) Westerduinen (2) Oosterduinen (3) Kobbeduinen (4) Kooiduinen The size and morphology of coastal dunes is dependent on the complex interaction between controlling winds, sediment supply, and the geomorphology of the nearshore and beach environment. At the most basic level, dunes can be divided into those that form from the direct supply of sediment from the beach face (primary dunes), and those that form from the subsequent modification of primary dunes (secondary dunes).



ANNUAL WIND SPEED AVERAGES

With the aid of a wind map you can read what the average wind speed is at a certain place in the Netherlands. The average wind speed in the Netherlands varies from 3.5 to 4.0 m / s in the East to 7.0-7.5 m / s on the coast. Below a wind map of the Netherlands . The values relate to an axle height of 10 meters in open grassland.Source: KNMI


Struggle Against Salinisation & Droughts Island as a Source of Water

| Island as a Source of Water | Conventional Systems and Water Maps of the Netherlands

Island as a Source of Water







Water Production Facility in the Island Schiermonnikoog April, 2018

The island is a natural source of water. Nowadays, the island contains two surface water extraction facilities. One of them is located on the South-east of the Westerduinen. This production facility contains considerable amount of water wells around the duins in order to collect the fresh water which is naturally collected under the dunes.



Schematic Section of the water well in the island Schiermonnikoog Source: Th. J. Beukeboom, The Hydrology of the Frisian Islands, 1976

Conventional Systems & Water Maps of The Netherlands



Schematic Section of a conventional ground water treatment system in the Netherlands with submerged sand filters Source: W. W. J. M. de Vet, C. C. A. van Genuchten, M. C. M. van

Loosdrecht, J.C. van Dijk - Reconstructed by Deniz Üstem



Fresh Water Distribution Source: Water Atlas of the Netherlands, 2013 Reconstructed by Deniz Üstem



Northern Netherlands Salinisation along the Wadden Sea coast, drought-related problems on the islands.

Northeastern Netherlands Dry areas due to a lack of water supply infrastructure.

Centraleastern Netherlands Groundwater related drought. Supply from the IJssel and the Vecht in cases of drought.



Eastern Netherlands Presence of hilly areas where water supply is impossible.

Central Netherlands Shortage of cooling water in the Amsterdam-Rijnkanaal/ Noordzeekanaal, no other drought-related problems.

- Northwestern Netherlands Few drought-related problems, occasional deficiencies of the water supply system.
- Western Netherlands Salinisation and small-scale water supply.

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Southwestern Netherlands Salinisation

Southeastern Netherlands Presence of hilly areas where water supplyis impossible.



Southern Netherlands ater short age in hilly areas where water supply is impossible. Dependent on ater supply from Beighum, though no agreements exist to that end. In dry riods, therefore, the water supply is significantly limited. 10

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Area around the major rivers of the Netherlands Few drought-related problems, occasional deficiencies of the water supply system.



Effects of Water Shortages Source: Water Atlas of the Netherlands, 2013 Reconstructed by Deniz Üstem





Catchment Areas of Large Rivers Source: Water Atlas of the Netherlands, 2013 Reconstructed by Deniz Üstem





Effects of Heat and Drought on the Water System Source: Water Atlas of the Netherlands, 2013 Reconstructed by Deniz Üstem



Effects of Salinisation on the Water System Source: Water Atlas of the Netherlands, 2013 Reconstructed by Deniz Üstem



SURFACE WATER EXTRACTION

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★ INFILTRATION, EXTRACTION RIVERBANK GROUND WATER EXTRACTION



Water Extraction Source: Water Atlas of the Netherlands, 2013 Reconstructed by Deniz Üstem





Bathing Water Locations Source: Water Atlas of the Netherlands, 2013 Reconstructed by Deniz Üstem



Representation of the Struggle Against Water *How the Struggle Against Water is Represented in Visual Arts in the Netherlands*

| Ravenous Water Wolf | How the Struggle is Represented in Visual Arts in the Netherlands | Conflict | Concord | Profit | Pleasure | Territory as a Project

Ravenous Water Wolf





The long-standing battle between the Dutch and against water became the central tenet of my research. The heraldic motto of Zeeland, 'Luctor et Emergo' means 'I struggle and Emerge' in Latin, and is the name given to the project.

During my research, I scanned numerous maps from archives and books to investigate this battle and how it is represented. The representative image on the cover is a symbolic depiction of this battle as an animalization of the Netherlands, an orange lion, battling with a grey sea wolf. This depiction is originally comes from a map of Harlemmermeer planned by Jacob Bartelsz in which you recognize the lion and the wolf above the poem of Joost van den Vondel who calls it the 'Ravenous Water Wolf'.



Detail from the map An orange lion battling with a grey sea wolf

Map of the Harlemmermeer with its surrounding Waters and Places, 1641 Drawing on parchment, 65X97,5 cm, University Library, Leiden

How the Struggle is Represented in Visual Arts in the Netherlands

The project traces the myth of "making new land" by investigating four major themes adopted from a recent publication 'Sweet and Salt: The Water and The Dutch'. These four themes are perceived as a thematic backbone of the Dutch waterscapes. Therefore, the intention was to analyze the Wadden Sea and the island of Schiermonnikoog by using the themes: conflict, concord, profit and pleasure. After the investigation of these four themes, the motive here is to project them into the future by using the scenario method mentioned above. This scenario envisions a future when the West Frisian island of Schiermonnikoog is left to nature and risks slowly disappears into the currents of the North Sea. The design intervention narrates a new myth: "guarding the water" by using the typology of a fort. The scenario has four chapters and each of them narrates a different time period of the island's future.



Janus Like Gods

Since each of these four themes perceived as a thematic backbone of the Dutch waterscapes, they conceived as Janus like gods in the myth of "making new land". Because Janus is the god of beginnings, gates, transitions, time, duality, doorways, passages, and endings. He is usually depicted as having two faces, since he looks to the future and to the past.



Cover of the "Sweet and Salt" Tracy Metz & Maartje van den Heuvel, NAi Publishers, 2012

Conflict



De doorbraak van de Sint Anthonisdijk bij Amsterdam Willem Schellinks, 1651, Amsterdam Museum

The conflict means the conflict between the wet and dry. The disastrous floods, breaking dikes, sunken ships are representing the conflict between the solid and liquid states. Intervening the nature with heroic structures are also part of this conflict. For example, the Afsluitdijk which turned the Zuiderzee into a lake, changed the dynamics of water and split the sweet and salt.

Concord



Siege of Leiden Jan Maire, Henrick Haestens, Jan Jansz Orlers. 1614

The amphibious life of the Dutch means concord. Concord comes to life where the water management behave the enemy – the water - as an ally. When the Dutch give a room to the enemy by the canals, but also combining it with dams and locks, they somehow proved that they concord with the water. The Siege of Leiden occurred during the Eighty Years' War is a beatiful example for the theme of concord.

Profit



Departure of a Number of East Indiamen from the Marsdiep Hendrick Cornelisz Vroom, c.1600-1630, Rijksmuseum

Profit means, profiting by this amphibious life. It sometimes comes into life with ships which were like some small replicas of little Dutch towns. By this way, with a strong navy and seafaring they prosper by harvesting the seas. But in the mainland, they also prosper by the utilitarian landscape that they have designed. Windmills are the most beautiful examples of how to keep the land dry, by pumping the water out but also profit from it by using it for production and habitation. Pleasure



Winter Landscape with Skaters Hendrick Avercamp, 1608, Rijksmuseum

Pleasure means to cherish the dynamics of this landscape and the states of water. Pleasure is about the lifestyle. For instance, taking your boat at the weekend and sailing with your boat or skating on a frozen lake is pleasure of this amphibious life.





PROFIT

"Protect and Prosper"





Territory as a Project

"Territory As a Project" is a one-day symposioum and exhibion held at TU Delft, Faculty of Architecture and the Built Environment. The students of Delta Interventions Graduation Studio 2017-2018 were asked to join the exhibiton with a representative image of their proj-



ects and a representative physical model. The exhibiton convened by Dr. Arch. Taneha Kuzniecow Bacchin and Dr. Arch. Hamed Khosravi and curated by Geert van der Meulen, Elise van Herwaarden and Gerben van den Oever.





Exhibition Day The Day finished by opening of the exhibition.



Exhibition Model Territory as a Project, 2017



Exhibition Poster Territory as a Project, 2017

The Exibition poster was an opportunity to answer the research question "What would be the new myth of water defence which response and works with the accelerated dynamics of the Wadden Sea in the future?" with a drawing etude. It is also an attempt to answer the question "How these four themes: conflict, concord, profit and pleasure can be implemented in future designs and what would be the spatial consequences of interpretation of these four themes?"



Scale and Typology Etudes & The Early Proposals

| Fortifications: Walls as Rooms | Cisterns: Learning from Archetypes | Infrastructure of Dead Souls | Compositions

Fotifications: Walls as Rooms



Fort Boyard Photo Source: Anthony Penel

Fort Boyard was built on a sandbank which is also called "Boyard" on the West coast of France. The construction was begun in 1801 and the fort was finally completed in 1857. But, the original project was proposed as early as the 17th century.

After the implementation of the four themes, some typology research about the forts and fortifications around Europe became a necessity. Because the theme conflict was projecting an idea about to protect the North-west of the island with a fort and conflict with the dynamic nature of the Wadden Sea. Like fortifications, British castles as well were worth to investigate because of their similar typology to forts. Because both forts and castles were composed of "wall as rooms". Louis Kahn was known for his interest in Scottish castles. With an ode to Kahn's work and interest, Fort Boyard and Hedingham castle were studied to understand their organisational principles in plan and section.



Section of Fort Boyard Reconstructed



Hedingham Castle Photo Source: Radical Essex

Hedingham Castle, in the village of Castle Hedingham, Essex, is arguably the best preserved Norman keep in England. The castle fortifications and outbuildings were built around 1100, and the keep around 1140. (Source: Wikipedia)



Section of Hedingham Castle Reconstructed

Cisterns: Learning from Archetypes



Basilica Cistern Photo Source: Unknown

The Basilica Cistern is a Byzantinium cistern that lies beneath the city of Istanbul. This cathedral-size cistern is an underground chamber capable of holding 80,000 cubic metres of water. The ceiling is supported by a forest of 336 marble columns, each 9 metres high, arranged in 12 rows of 28 columns each spaced 5 metres apart. After the implementation of the four themes, it was decided to learn from a major archetype, cistern. Because the theme profit was projecting the idea of protecting the the North-west of the island with its natural sources of water. Yet, the island has the source and extraction facilities for it but preserving it in a type of construction had never even been thought of before. Three infrastructure selected from three different cultural backgrounds. They also date back to different times in the history. But one common typological characteristics of them are the same: a forest of columns.



Basilica Cistern Plan Reconstructed


Filtergebouw Photo Source: Unknown

Filtergebouw is a drink water storage in Rotterdam. The project designed by Peter van Zoest. The construction of the building has completed in 1965.



Dada Harir Stepwells Photo Source: Wikipedia

Dada Harir is a stepwell constructed in Ahmedabad, India in 1485. The structure is five stories deep. It is octagonal in plan at the top, built on intricately carved large number of pillars.





Dada Harir Stepwells Plan Reconstructed

Filtergebouw Plan Reconstructed

Infrastructure of Dead Souls

The theme concord was projecting an idea about to mark the landscape like the navigation marks on the sea. It means behaving the dynamic seascape of the Wadden Sea as if it is like the land. So the fortification of the island can concord the landscape and remain still, while the malleable habitat around it constantly changes. This gives a second function to the fort, the infrastructre of dead souls, rather than being an infrastructure of water.



Isola di San Michele Photo Source: Unknown



Plan of the Isola di San Michele Reconstructed



City of Angels Photo Source: Wikimedia Commons



Kumbh Mela Photo Source: The Atlantic, Photo by Manish Swarup / AP



Navigation in the Netherlands Reconstructed. Source: Spiegel van de Zuiderzee

Compositions



Section Sketch / P3 Cisterns under the sand dunes.



Section Sketch / P2 Composition of the typologies: Embedding the idea of a cistern in a fortification. Later, the aquaduct was added to composition as well.



A Cistern Under a Sand Dune / P3 Plan and a layout Plan



Axonometric Drawing of a Cistern Under a Sand Dune / P3 An aquaduct is connnecting one cistern to the other



Luctor et Emergo An Island Without an Island

\$ 370 .

Decay of the Island



Chapter 2 - The Hydraulic Machine



Chapter 3 - The Sand Machine



Chapter 4 - Inhabited Infrastruture

0 1 2 5 km

The Pontoon (Building the Hydraulic Machine) *Chapter 1*



The island has no concrete industry to build solid and durable constructions with concrete and the logistics are quite problematic due to a lack of proper roads for vehicles and the limited weight capacity of only 30 tons per day that can be carried to the island. Because of these problems, the construction was decided to be made by pontoons and the dredging of a canal on the island. After constructing the canal, pre-cast pieces of concrete are carried onto the site. After the construction of the hydraulic machine is completed, part of the dredged canal is again closed by natural forces and the sand. And the rest of the canal is used for transportation of people and goods.



Layout Plan of Chapter 1 Sscale 1:5000

The Hydraulic Machine Chapter 2



The Hydraulic Machine consists of eight major components to produce fresh water by using freshwater lenses that are formed under the dunes of Schiermonnikoog. At first, the water is collected by water wells and sent to the water towers. After being collected in the tower, the water is pumped to be filtered. After the water is purified, it is sent to the cistern with the aqueduct. The Cistern is placed at the end of the Hyrdraulic Machine which remains on the south-west of the fort. The Cistern has a massive body and an underground space where the final processed water is collected below the ground surface. As the island changes within the forces of the Wadden Sea, the dunes get lower and the water lenses below them get smaller. At that moment, the fort starts to pump the salt water inside and begins the desalination process.



Layout Plan of Chapter 2 Sscale 1:5000

Sand Machine Chapter 3



As the island becomes extremely dynamic, the Hydraulic Machine has a secondary function to resist the forces of the sea. The machine starts carrying sand from the East to the West to keep the ground safe and rigid. In other words, from where the sediments are deposited by sedimentary systems to where the sediments are eroded. Some more people are charged with filling the river barges with sand, crossing the canal and leaving it in the places exactly where the erosion is hazardous.



Layout Plan of Chapter 3 Sscale 1:5000

The Dead Souls (The Inhabited Infrastructure) *Chapter 4*



One day, during the dredging processes of the sand from the Eastern peninsula they discovered the archaeological remains of an old monastery which was built and disappeared hundreds of years ago. This creates huge enthusiasm among the public and the archaeologists. Initially, only a group of archaeologists arrive at the fort to preserve and reconstruct the remains of the old monastery. They inhabit the abandoned parts of the hydraulic machine as a workspace and a shelter. After the reconstruction of the monastery, they find some other remains around the territory of the fort. Other artefacts were also found in the remains of the buildings which were created on parts of the island that had become submerged. Then the archaeologists completely colonize the submerged territory, to find and reconstruct the remains of lost artefacts from the disappeared island.

Eventually, the fort becomes an infrastructure for the dead souls of the island Schiermonnikoog.

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Layout Plan of Chapter 4 Sscale 1:5000

Site Plan Components of the Design Working Principle of the Machine



E (*Erosion*): The direction of the where the sand is eroding. *A* (*Accumulation*: The direction of the where the sand is accumulating. *Scale* 1:2000



The Hydraulic Machine



1. Water Wells (Collection of Ground Water)

2. The Aquaduct (Transfer of the Water)

3. Purification Works (Purificaton of the water)

4. The Aquaduct (Transfer of the Water)

5. The Cistern (Storing the water)



The Sand Machine

The Aquaduct carries also the sand.

The sand is carried from where it is depositing to where the island is eroding.



1.Sand Pipe (Inlet) 2.Sand Pipe (Outlet)



Purification Works

+09 Level Plan



Main Water Channel
Rain Water Pool
Post Filter (Slow Sand Filters)
Post Filter (Rapid Sand Filters)
Post Filter (Rapid Sand Filters)
Cascades



Purification Works





B

A

- 1.Main Water Channel
- 2. Workers Lounge
- 3.Courtyard
- 4.Courtyard 5.Change Rooms
- 6. Caustic Soda Softening 7.Cascades
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Section C-C



- 1.Main Water Channel (Inlet)
- 2. Main Water Channel (Outlet)
- 3. Caustic Soda Softening
- 4.Cascades
- 5.Post Carbon Dosage
- 6.Cascades
- 7.Post Filter (Rapid Sand Filters)
- 8. Post Filter (Slow Sand filters)



Section B-B



Section A-A



The Aquaduct

Ground Level Plan





The Aquaduct

-6.00 Level Plan

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The Aquaduct

+21 Level Plan





The Aquaduct

Cross Section



The Water Well

Cross Section





Calm in the midst of wild waves. Long live the Geux.*

* Translation from Latin and French text: Saevis tranquillus in undis. Vive les Guelx. Taken from the engraving of the emblem of the Geuzen resistance movement against Philip II of Spain in The Netherlands during the Eighty Years' War.