

Dikes – cultural-historical backbones of the Wadden Sea area, an introduction

Meindert Schroor

Dikes and embankments in the Wadden Sea area to some extent form the largest, more or less coherent as well as oldest 'man-made' landscape in Europe. They protect the extremely fertile accretions of marshlands or marshes, deposited by the North Sea and its coastal Wadden Sea around the German Bight. What makes them even more special is that these marshes form only a very small north-western rim of a great North European Plain, extending from the Netherlands well into Russia. This plain is basically a Pleistocene landscape with a great similarity of podsollic soils formed in cover-sands often slightly undulating. It moreover is a coulisse-landscape of farming lands interspersed with patches of forest and heathlands, as well as tracts of more or less cultivated moors, interrupted occasionally by hilly countryside strewn with lakes. In their appearance as well as in their history the marshes alongside the Wadden Sea however differ completely from this dominant north-central European landscape. Dikes belong to the oldest large-scale technical works. Prior to the 20th century they as a rule were wholly built of clay, whereas nowadays they have a clay cover over a sandy heart, the clay being planted with grass and grazed by sheep, a familiar view of all the dikes in the Wadden Sea area.



The Waddenland: Marshlands (green) along the Wadden Sea.

It was the innate fertility of the marshes combined with their rather dense and growing population that led to the building of dikes. During the past millennium after all, man has tried to protect land, to further deposition of sediment aimed at extending the land, or to reclaim land lost to the sea. Dikes however, initially were ordained to protect existing cultivated land; starting already 2000 years ago during Roman Times through summer dikes, shielding a rather limited area of arable land, perhaps no more than a few consecutive plots during the growing season. The oldest dikes were small ones with a height between 1 and 1.25 meter, excavated by archaeologists some twenty years ago. On the marsh-bars of Westergo (Fryslân) summer dikes like these were built near the villages of Peins, Dongjum and Wijnaldum between 100 BC and 200 AD. They were merely meant to protect the harvest of grain and hay against flooding and corresponding salinization, whereas people, livestock and goods were safeguarded from flooding by living on artificial mounds: *terpen*, *wierden*, *Wurten* or *værfter*. As these initial dikes have disappeared since – through erosion, ploughing, cultivation, building and so on – we only have incomplete information about their distribution and appearance. Until now only straight dikes, parallel to the existing coastline at the time they were made, have been excavated, but there is reason to believe that they formed part of embryonic dike-rings.

Diking in the Wadden Sea area: three phases

Thus, it was not so much land reclamation, but defending and consolidating existing lands that prevailed initially. This was also true at the moment – some 1000 years ago – that the dispersed, self-contained coastal way of building mounds was gradually superseded by the more elaborate, spatially comprehensive coastal-defence practice of building dikes. Since, diking in the Wadden Sea Area can roughly be divided into three phases.



Marsh creeks in the salt marshes of Skallingen peninsula give a good impression of the landscape the first settlers encountered (from: Plan for Nationalpark Vadehavet 2013-2018. Danmarks internationale nationalpark, photo: Jan Tandrup Petersen)

The first phase was a (generally) defensive one, lasting from about 11th century until about 1500 AD and covering roughly half of the past millennium. During the second phase, from about 1500 AD till the end of the First World War, offensive diking predominated, usually – *with the exception of the so-called Top of North Holland, where even extensive sandflats like the Zijpe were embanked* – by embanking mature salt marshes, such as the Bildt-polder in 1505. In general however (especially in the Dollard-area and the East Frisian Ley-, Harle- and Jade-estuaries, as well as on the North Frisian mainland) diking in reality meant reclamation of marshlands that had been lost to the sea from the 13th up to the 16th century.

The third and last phase started in 1920 with the spectacular Zuiderzee-works in the Dutch part of the Wadden Sea area. It was preceded by a period of 70 years, in which about twelve, more or less elaborate plans were formulated, although a complete embanking of the Wadden and the Zuiderzee – suggested by Henric Stevin already in 1667 – was already abandoned at the end of the 19th century for reasons of fertility, the Wadden Sea mainly consisting of rather poor sandy soils. The idea to connect Ameland to the mainland being a short lived experiment (1872-1882). By 1920 extensive areas of water were diked at first and subsequently drained by means of large diesel- or electric-generated pumping-stations. Other, less ambitious projects – in which both dike-reduction for reasons of safety and economy and intermediate storage capacity for access inland water prevailed – were the closing of the Lauwerszee in 1969, as well as the construction of the Eidersperrwerk (1973), the Speicherkoog (1978) and the Beltringharderkoog (1987). However, a planned closing and reclaiming of the Leybucht estuary in East Friesland was limited for ecological reasons to a much smaller Speicherbecken (storage basin) in 1991. A bold Danish plan presented in 1969 to embank the whole Wadden Sea area between Esbjerg and the Rømø dam was abandoned. All the same, alongside the entire Waddensea-coast the age-old practice of active land reclamation and diking of wash lands or salt marshes (the so-called *kwelders*, *heller* or *grogen*) outside the dikes continued for some time only to end from the 1990-s onwards, likewise under pressure of environmental NGO's.

First phase: ring-dikes

The oldest dikes – apart from the ones dating from Roman Times mentioned before – were made some thousand years ago. They were meant to protect existing, inhabited clay-lands and the main impetus for building seems to have been a rather high population density or at least a continued population growth. These primal dikes, essentially ring-dikes, encircled relatively small areas, not immediately located on the coast, where the power of tidal streams was relatively weak in combination with a moderate tidal range.

From the 12th century onwards a new category of ring-dikes (e.g. the so-called *hemdijken* south of Sneek and Bolsward) came into being. They were used to protect more inland and lower

marshlands, increasingly prone to flooding by the waters coming from their hinterlands: moorlands, progressively being colonized and as such in an irreversible process of subsiding, partially even turning into lakes. Inner dikes like these were built in places where the clay of the coastal marshes gave way to the fens inland, e.g. the Graauwe Dijk in Fivelingo (northeast of Groningen), the Wolddijk (north of Groningen), the Ollendeich (dividing Stedingerland in a marshy Lechterseite and the moors of Brookseite), as well as the Kajedeich in Land Kehdingen, or the Hinterdeich in Altes Land, both in the Elbe marshes.



German topographic map-fragment (1 : 50.000) of the Elbe-marshes in Land Kehdingen showing primary (Elbdeich) and secondary dikes (Süderdeich, Hollerdeich, the adjective 'Holler' referring to the original medieval colonists from Holland) and a recent dike. Several toponyms referring to geographical conditions e.g. Balje (sandflat), Außendeich (former saltmarsh), - fleth (fleet or running water), - worth (terp or mound). The name Oederquart refers to a fourth and originally uncultivated part of the inland moors reserved for the colonists. (Landesamt für Geoinformation und Landvermessung Niedersachsen, LGLN)

As a rule the earliest embanked areas in the Wadden Sea marshlands are coincidental with clusters of the oldest inhabited artificial mounds or *terpen*. These primal dikes very neatly followed height contours, by making use of *terpen* and natural levees such as bars alongside creeks, thereby avoiding deeper gullies and broader streams as much as possible. Such early embanked areas very much resembled islands, with dikes surrounding them having a twisting course, mirroring capricious natural terrain properties. The oldest examples are to be found in the central part of Westergo in the province of Fryslân. Here, between the towns of Franeker and Bolsward, some four island-polders, so-called motherpolders (*moederpolders*), i.e. primal polders, can be discerned, probably dating from the 10th century. Though most of the dikes

have set or been levelled, a few striking remnants still are left, forming parts of the famous inner dike called *Slachte*, in which dike-segments of the four primal polders were integrated during Late Medieval times. Very soon the rising of water-levels as a result of these embankments induced the population of the marshes in building arm-dikes perpendicular to the existing ones. In doing so they cut off intermediate streams and gullies, while connecting and integrating the island polders into a more elaborate, in places even intricate system of dikes. On a time scale, the construction of arm-dikes must have followed the original dikes within a few decades. Usually the parishes (viz. their inhabitants) were responsible for making and maintaining the part of the dike adjacent to their village. The best example of an early ring-dike still visible is the so-called *Pingjumer Gulden Halsband* (literally: the Pingjum Golden Collar) protecting the village of the same name and a few surrounding hamlets, south of Harlingen, built at the end of the 11th century. Shortly afterwards the marsh-island of Humsterland and the adjacent marsh-peninsula of Middag northwest of Groningen were shut off from the tides by ring-dikes.



Endiked marshlands NW of Groningen (Schouwerzijl) famous for their fertility as well as inland shipping. The green dike at the horizon borders the Reitdiep-canal, a marshland river. (photo: Meindert Schroor)

From the 12th century onwards climatological shifts – higher temperatures, more precipitation, heavier storms – called for stronger interventions through building coherent and larger dike-rings, protecting whole districts of several hundred square kilometres instead of a handful of villages. In the 13th century a more or less coherent system of winter dikes protected the Wadden coastal areas, for a majority articulated in peninsulas, from the Alkmaar region in the southwest till Eiderstedt in the northeast. Old Frisian legal texts regularly refer to coastal defence and embankment activities from the late 12th century onwards. In the *Schoutenrecht*

for instance, clauses refer to the obligation to retain existing sea-walls (*seburch*) under ban and law as long as possible against the inroads of the sea. When it was impossible to hold a dike with the help of 'mud, wood, earth and oak-wood' any longer, responsible landholders had to swear to rebuilt the dike no further landward from the abandoned one than 'three times 63 feet' (about 50 metres). In a 1430 charter six East-Frisian districts united to protect – together with the other Frisian districts between Stavoren in the west and the Jade in the east – Frisian freedom and custom, vowing that all men shall maintain his dams and dikes according to 'dickrecht und sillrecht' (laws on dikes and drainage) either according to general Frisian law, or the law of the district.



The 16th century Burgerwielen in the Westfriese Omringdijk near the village of Eenigenburg are a proof of the numerous dike breaches that took place in the past. The dike was rebuilt around the resulting wheels. The land left belongs to the Zijpepolder, embanked in 1597. <https://www.westfrieseomringdijk.nl/>

It was in the North-Holland part of Friesland (in Dutch: West-Friesland) – since 1256 more or less effectively ruled by the counts of Holland – that a viable form of dike-management on a somewhat larger scale developed, under the authority of the counts. Villages (*bannen*) were primarily responsible for the maintenance of their part of the dike. They combined in so-called *koggen* or districts, in themselves forming part of four *ambachten* (manors). Together the landholders were responsible for the *West-Friese Omringdijk*, a still existing monumental dike-

ring of some 126 kilometres length. East of the Zuiderzee comparable dike-rings surrounding larger areas, such as the ones around the Frisian districts of Westergo, Oostergo, Middag, Humsterland and Hunsingo were indeed of an earlier date, as made clear in the previous paragraph. According to Saxo Grammaticus, writing about 1180, the whole of Friesland was already surrounded by dikes by then. However before 1500, a division between administration and water management didn't materialise east of the Zuiderzee, mainly as a result of the erosion of central power since the 12th century – such as exerted by the Counts of Holland west of this inland sea – between Vlie and Weser. *De facto* autonomous local and regional water-boards, formed by landowners and aimed at water drainage and coastal defence developed. These were usually helped by finance, expertise and administration of the large monasteries – often being the largest landowners – and their abbots, such as Klaarkamp, Aduard, Mariëngaarde, Gerkesklooster, Bloemkamp, Termunten and Wittewierum. As such they were responsible for the upkeep of the dikes (in Groningen: *dijkrechten*) and the drainage of the marshes and their hinterlands (*zijlvesten*). Though democratic by origin, the main landowners, more so after the disappearance of the monasteries between Vlie and Weser, could exert great political influence, and many of the water-boards degraded into aristocratic oligarchies.

One of the main impetuses for gradual embanking, usually by compartments, was a steady growth of an already rather dense population. As such the Dutch part of the Waddenland marshes in the tenth century had a population of about 50.000 inhabitants, a total which doubled to a possible peak about AD 1300 of circa 100.000 inhabitants; and again by 1815 (201.000). The German marshes west of the Weser river counted 98.000 inhabitants by 1821. Nowadays the whole diked salt marsh-region of the Northern Netherlands counts some 400 villages and seventeen towns, resulting in an overall density of one village for every ten square kilometres. In Westergo, between Harlingen and Leeuwarden there even is one parish per every 6.5 square kilometres! Comparable densities existed in the western East-Frisian districts of Emden and Greetsiel, where the 50 villages each have an area of 7.1 square kilometres (Arends, Ostfriesland und Jever, vol. I 1818-1820, 108). Butjadingen peninsula – somewhat greater than today's municipality and including the Blexen/Nordenham and Esenshamm areas – in 1581 counted 9,900 inhabitants on a mere 200 km². In 1300 AD, when diking in the afore named estuaries was in full swing, about 90 percent of the parishes in the marshes already existed.



Hegebeintum lies on the highest – partly excavated – artificial mound in the Dutch-German-Danish Wadden Sea area. It is one of the hundreds of mound-villages in the marshlands around the Wadden Sea.
(photo: Meindert Schroor)

Extending property claims

It was the old-Frisian right of extending property claims on the accretions, viz. on the *kwelders* or marsh-flats (*grogen* in East-Frisia, *kogen* or *køge* as they are called north of the Elbe-estuary) that very much impeded the development of new villages. The potential area for new villages seemed large enough. Some 420 square kilometres were reclaimed from the sea between 1200 and 1500. Although this gain of land loses much of its weight when compared to the circa 1,500 km² of mostly fenland that were at the same time lost to the sea, esp. south of Vlieland, around the Dollard and the Jade and even more so in North Frisia. Whereas lost moorlands at the sea-side, nor their setting and shrinking counterparts inland are the object of this survey, while the reclamation of land by means of diking is, there nevertheless is one striking similarity between them. In both cases the lay-out of the land, the parcelling was dictated by the old-Frisian right of extension (Dutch: *recht van opstrek*). This right formed the judicial base from which existing villages derived their claims on waste moorlands inland, as well as on the accretions of land seaward.

SECOND PHASE: offensive diking and centralized government

At the brink of the 16th century a more offensive form of diking developed. It was connected to a new organization of dike management (e.g. common maintenance), central rule and the introduction of the wind-mill, especially in the western parts of the Dutch Wadden area. The main impetus most probably was given by the enormous expansion of population and economy in the seaside provinces of the then Burgundian Netherlands. In the mouth of the former Frisian Middle Sea, even more so at the Top of North Holland, lay large tracts of salt flats ready for reclamation. Here, within living memory, dukes, counts or kings had usurped old titles on the salt-marshes (*kwelders*). It was also in these places that a more planned strategy of reclamation laid at the base of new villages, on a Renaissance-inspired classical plan of settlements on road-crossings at straight angles. The result was a completely new topography, hardly or not at all influenced by the lay-out of the old land, made possible because old titles on the marshy accretions were usurped by the regal claims of dukes and counts.



On the Groningen Wadden coast the broad salt marshes are perfectly visible from this mooring place for small fishing boats at Noordpolderzijl (photo: Meindert Schroor)

In Holland and Zeeland the incorporation of maritime accretions by the counts can be traced back to the 12th century. In a few cases monasteries, parishes or polder-boards were successful in maintaining their old rights. As far as drainage and the protection against inland waters was concerned, separate, autonomous, grass-root organizations like the *waterschappen* (water boards) led by dike-reeves (*dijkgraven*) had developed from the 12th century onwards, especially in the central boggy part of Holland and Utrecht and along the great rivers.

However, at least as far as future accretions concerned, the counts reserved their exclusive claims. From the moments the first reclamations started on the island of Texel (1426) and in the *Burghornpolder* near Schagen (1456) it were the Counts of Holland that issued charters (plural: *octrooien*) for embankment. Already during their short occupation of Fryslân (1397-1401) they immediately did lay claim on the Bildt salt-marsh and the Griend-hallig in 1398! Reclamation-plans soon attracted commercial investors, especially from the 1550s onwards. In Fryslân, for the time being, the legal situation remained unclear. Apart from the aforementioned Bildt (the oldest large scale reclamation on the Dutch Waddencoast, 1505), emperor Charles V, nor his successor, king Philip II or the States of Fryslân succeeded in securing full rights on the land outside the dikes. On the other hand owners had to defend and secure their titles before the High Court of Friesland, whereas the States – since 1581 self-appointed legal successors to the Kings of Spain – remained responsible for granting charters for diking initiatives or the draining of lakes. In Groningen the Ommelanden-law, in force in the rural part of this province, in 1601 specifically confirmed adjacent owners to their rights of lands outside the dike, being fully in line with old Frisian law-practice. As a consequence east of the Bildt-polders hardly any new village developed whereas in Groningen new settlements were mostly restricted to small, often rather dispersed hamlets for agricultural workers.

From legal to regal

While dike-management in the Frisian districts was severely hampered during Late Medieval Times, disrupted as it was by internal feuds; coastal defence and land-reclamation, both got a new impetus by the rise of central authority from 1500 onwards. As such the Dukes of Saxony introduced Roman law in Fryslân (1498-1515), thereby usurping traditional individual titles of land-owners inside the dikes on the accretions outside the dikes. By doing so they transformed old Frisian legal rights into new regal practice, and immediately applied it by embanking the 5,185 hectares *Oud Bildt* polder in 1505. This polder was reclaimed by four noblemen-developers from South-Holland, who made a contract with the Duke of Saxony. They took with them workers from their region of origin as well as ideas about the lay-out of the area. Their geographical outlay of the Bildt polder was dictated by classical geometrical principles: one central road running from east to west, crossed at right angles by sideways running north to south. At the main crossings some three settlements developed, initially named after villages from the South-Holland region the undertakers came from, but soon to be known by the names of the village parish saints: Sint Jacobiparochie, Sint Annaparochie and Vrouwenparochie. In fact the Old Bildtpolder - *in 1600, 1715 and 1754 extended with newly reclaimed polders, in which settlement however remained confined to ribbon-development of farmworkers-houses on the dikes* - was the first specifically planned polder in the Frisian districts of the Netherlands. This doesn't mean that its predecessors weren't planned at all. Quite the contrary, even though a deliberate plan was lacking and their spatial lay-out was – as we have seen before – in essence dictated by property-lines on existing land within the dikes.



The Old-Bildt polder was embanked in 1505 by means of the 14 km. long Oudebildtdijk, discernible by the row of houses on the dike, which by-the-way is the longest street in the Netherlands. The green dike left is the Nieuwe Bildtdijk through which the New-Bildt was endiked in 1600. The so-called Slikken or Voorgonden (literally foreground and at the foreground) were only embanked in 1971 as Jan Symen Rienkspolder as part of the dike-reinforcing Deltaplan. (photo: Meindert Schroor)

Chartered planning (by means of so-called patents or *octrooien*) came to the Frisian districts through centralized government as a more or less necessary condition for its development. Though backed by a centralized administration, it drew heavily on private initiatives. The entrepreneurs usually came from places elsewhere and took with them their own personnel. Workers who for a large part remained in the newly-won lands. Even today the Bildt area poses a striking contrast, not only physically, but also sociologically (e.g. through its dialect and political colour) to the old surrounding Frisian countryside.

Patents or octroys

After three centuries of having been a feuding society in which coastal defence was well-nigh neglected emperor Charles V, having succeeded the Saxon dukes as Lord of Friesland, rearranged coastal defence there too. At first coastal defence expertise was brought in from Zeeland – having, according to Johan van Reygersbergh famous *Cronycke van Zeelandt* (published 1551), the best and most sought-after dike-workers – to Friesland in 1525. This was through arbitration by Charles’ Brussels-appointed governor George Schenck van Toutenburg; the same official who in 1533 together with the Frisian Council and High Court of Justice arranged a large scale reorganization of coastal defence in Fryslân between the Bildt and Overijssel, by making inland areas co-responsible for repair as well as for the maintenance of the sea-walls. Elsewhere in the Wadden Sea Area similar developments took place. In 1553 Duke John of Schleswig-Holstein took

up the plan to safeguard his residential town of Tønder and surroundings by embanking the area. For that purpose a dike was built between Hoyer and Rødbøl and the river Vidå was dammed. Three years later the polders of *Hoyerkog*, *Møgeltønderkog*, *Tønderkog* and *Ubjergkog* were completed. In 1566 the adjacent, more southern *Gotteskoog* was embanked and since villages like Neuenkirchen and Aventoft are lying safe behind a dike, whereas the *Wiedingharder Alter Koog* (1436) was connected to the mainland. The Danish kings and their kin, the Holstein-Gottorp dukes, formally subordinate to the kings but actually autonomous since 1658/1660, were active in granting several charters – so-called octroys or patents – to individuals and companies intending to reclaim new polders, offering them freedom of taxes and other privileges. These patents were necessary requirements for contractors confronted with high costs and dangers. Among them were Dutchmen like Jan Claesz Rolwaghen (Rollwagen, 1563/1564 – 1623/24), who after having been responsible for the embankment of the *Schoonorth-polder* in the East Frisian Leybucht (1603), moved to Eiderstedt and signed for the embankment of *Augustenkoog* (1611) and *Dreilankoog* (1613). Likewise the surveyor Johannes Sems (Franeker 1572 – Groningen 1635) was involved in the embankment of the *Bunderneuland* in East Frisia bordering on Groningerland and was active later in the North Frisian *Bottschlott*, as well as in the embankment by means of a summer-dike of the Groningen salt-marshes along the Wadden Sea (1631-1632). Later that century (1667/1671) the Danish kings proclaimed their royal rights over the salt-marshes of Dithmarschen. In the Oldenburg region, Count Johann alias the Dike-builder, issued new dike regulations in 1573 in Stadland and Butjadingen west of the Weser river as well as in the newly (1575) acquired Lordship of Jever, which covers the easternmost third of the East-Frisian peninsula. To literally connect this part of his territory to his main possessions the Oldenburg count started the building of *Ellenserdamm* in 1596 through the westernmost corner of the Jade. The dam including the embankment of 1600 hectares of rich farmland – the so-called Schwarze Brack – was completed in 1615 by Johanns son Count Anton Günther. In 1618 the founding of Cuxhaven (literally: polder harbour) by the free imperial city of Hamburg at the Elbe mouth resulted in the embankment of the Neufeld (1400 hectares). In the Harle-estuary dividing the county of East-Friesland and the lordship of Jever at least eight consecutive 'groden' (polders) were embanked between 1598 and 1698, necessitating the sea-ward shift and repeated building of new *Siele* (drainage locks). Apart from these embankment schemes was the attachment of usually small islands immediately off the mainland coast by means of dikes, such as Ockholm (1515), Bant near Anjum (1592), Büsum (1609), Fahretoft (1633) and Dagebüll (1704); the largest island Eiderstedt by the way offering the oldest example of this practice in 1489.



Ny Frederikskog (1861, left) and Margarethe Kog (1982, right, both lying to the west (right) of the winding Vidå, are the most recent polders in the Danish Wadden Sea Area and in their rational lay-out reminiscent of the 'Renaissance' polders in the Dutch Wadden Sea area, like the Old Bildt (1505) and the Zijpe (1597). (photo: John Frederiksen)

As seen in the previous paragraphs central authorities gradually became more involved in matters of land reclamations, but they also intervened in the organizational aspects of coastal defence and matters of drainage. Governor Schenck van Toutenburg in Fryslân (1533) and Count Johann in Oldenburg (1573) were not the only ones regulating the legal and financial responsibilities for coastal defence and maintenance. In Groningen it was the city that in 1541 appointed an official, responsible for the dikes in the Oldambt-area, severely battered by previous inundations. In Fryslân, the involvement of central authorities was even immortalized in a statue, the *Stenen Man* (stone man). In 1576, this was placed as a boundary marker (terminus) between two dike-authorities on the dike south of Harlingen. It was dedicated to the then Spanish governor of Fryslân (and the adjacent northern provinces), Casper de Robles, seemingly responsible for repairing the dike after several consecutive storms. North of the Elbe river the Danish king and Duke of Schleswig-Holstein Christian III in 1557 gathered the most experienced men in matters of coastal defence from the marshes in Husum and codified many older legal practices into the so-called *Spadelandsrecht*. Based on this codification, areas like Eiderstedt (1595), Tønder (1619, 1703) and the island of Pellworm (1711, 1738) got their own diking regulations.

The practice of chartered reclamations - as far as the Northern Netherlands is concerned - reached a culmination in the Top of North Holland, in the form of the so-called 'Aangedijkte Landen'. The fierceness of the sea with its broad inlets and deep gullies, the quality of its soils, being mostly sand or sandy clay, posed far greater problems to diking entrepreneurs than they did to their silty counterparts east of the Zuiderzee. On the other hand more capital was available

or at least nearer at hand (Amsterdam!). In the fifteenth century efforts had been made to reclaim land in this area that had been lost prior to about 1300 AD. Already in 1392 a commission despatched by the count of Holland pressed the point of reclaiming the *Zijpe* (6250 hectares) between Schagen and Petten to relieve the West-Frisian dike-ring of mounting pressure by the sea. The poor quality of the sandy soil however blocked many initiatives and before 1520 turned some four patents into dead letter. After three later and failing attempts, with the help of Antwerp financiers, the entrepreneurs met their first success in 1597. The new Zijpe polder was laid out roughly according to a map drawn in 1553. Three parallel canals with two parallel roads were dug through the oblong-shaped polder. Some 87 % of the land was the property of owners from cities like Amsterdam, The Hague and Liège. Little by little the share of landowners from the nearby town of Alkmaar and villages grew. In the polder itself three villages developed at the crossings of east-west roads with the main canal. The embankment was followed by the adjacent *Wieringerwaard* (1800 hectares in 1609/1610).

Polders as investments

Sinking prices for agricultural products and economic contraction in especially Holland (from about 1660) in general were responsible for a gap in draining inland lakes and seaside embankments of almost two centuries, though not in Groningen and to a lesser degree neither in Friesland (e.g. *Bildtpollen* and *Noorderleeg* 1715, 1754, albeit private initiatives by members of the provincial administration). During the second half of the 17th century the City of Groningen through purchase obtained the rights on the accretions in the eastern arm of the Dollard. Two polders (*Kroonpolder*, 1696 and *Stadspolder*, 1740) were accomplished on these city-owned washlands, the last one by the city municipality itself. But these polders too got an exclusive agrarian destination and were both too small in area and population for the development of even one or two new villages. The disastrous Christmas flood of 1717 necessitated the building of a new sea-wall at the north coast of Groningen. By laying the new dike more seaward, some 6600 hectares of salt marshes were brought within the new dike and as such two birds killed with one stone. Because of extension-rights - and the average small size of the Waddenpolders - settlement here remained limited to dispersed farms and some ribbon development on the sleeper-dikes. The score of longitudinal, oblong-shaped Waddenpolders, as reclaimed in Fryslân (esp. between 1580 – 1760) and more so in Groningen (mainly between 1790 and 1940) and along the East-Frisian Dollard and north-coast (mainly between 1600 and 1800) therefore remained devoid of villages, except for a few farm-buildings and agricultural labourers houses on or near the dike. Nowadays their value as so-called 'silence areas' is inestimable.



How dangerous the North Sea remains and how impressive flooding could be, is proven by this map, published by the Nuremberg geographer Johann Baptist Homann, showing the land inundated by the Christmas-flood of 1717.

Elsewhere in the Wadden Sea area – especially where Dutch republican frugality gave way to enlightened rulers such as the Kings of Prussia, Danish kings and Holstein dukes and other members of the administrative elite – state or chartered embanking continued unabated, e.g. in East Friesland (*Landschaftspolder* 1752; *Heinitzpolder* 1773); Dithmarschen (*Hedwigenkoog* 1696; *Friedrichsgabe-* or *Wasmerskoog* 1714; *Sopheinkoog* 1718; *Brunsbüttelkoog* 1762 and *Kronprinzenkoog* 1787), Eiderstedt and North Frisia (*Norderfriedrichskoog* 1696; *Dagebüller Koog* 1704; *Rudbøl Kog* 1715) and the three so-called Desmescieresköge, named after the French count of the same name and counsellor of the Danish king: *Sophien-Magdalenen-Koog* 1742; *Desmerciereskoog* 1767 as well as the *Elisabeth-Sophien-Koog* 1770 on nearby Nordstrand). These dike-projects however were on a smaller scale in view of the misfortunes 17th century, mainly Dutch dike-entrepreneurs, like Johannes Sems and Jan Adriaenszoon Leeghwater (active in the Dagebüller Bucht) or Willem van Hoven (Friedrichstadt), had been confronted with.

In the western Wadden Sea area truly large embankments started again in 1824 in the *Koe-graspolder* south of the Dutch naval-town of Den Helder. This polder was the more or less casual

result of the building of the North Holland Canal, dug in order to give Amsterdam a better access to the North Sea. Initially the polder - financed by the State - was hardly a success, owing to reluctant investors and drifting sands. Smaller polders such as the *Waard- en Groetpolder* were reclaimed in 1844 and 1846. The far bigger *Anna Paulownapolder* (5030 hectares) was again financed by private capital (1847). Some 1500-2000 workers were engaged in building the dike, digging ditches and canals and building locks. Workers of this kind generally came from all corners of the Netherlands, as well as from Flanders and Germany, though usually very few of them stayed after having finished their job. The temporary inhabitants of the polder that actually did settle were impoverished agricultural workers, allured to the polder from the riverine Betuwe-district of Gelderland. The agricultural character of the polder expressed itself in a very high male percentage (58 %) of its population, even some 25 years after the reclamation work had come to an end. Relatively late (1865-1870), that is after the building of a railway station, churches and schools, a steady development of two villages could be discerned. In contrast to the older polders, though more in line with later developments, the population of the *Anna Paulownapolder* came from all corners of the Netherlands, but especially from rural provinces like Fryslân, Zeeland and Gelderland.

What strikes us most when overseeing dike-building during medieval and early modern times is their modest breadth and height. The oldest dikes measured a mere 8 to 10 metres at their base, heights varying from circa 1.5 to 2 metres, having slopes of no less than 45° or in some cases almost perpendicular (90°). Perhaps more important was the gradual experience that a fainter slope is more effective in breaking the power of the waves than near-vertical slopes. Profiles and measures like these only gradually changed, dikes becoming higher and broader. Today's the largest Wadden Sea dikes are more than 9 metres high and 40 metres wide, and some are designed to theoretically withstand a breakthrough once in 10,000 years. Prior to the 20th century dikes as a rule were wholly built of clay, whereas nowadays they have a clay cover excavated from the marshes over a sandy heart, dredged from the Wadden Sea or adjacent North Sea. The clay-cover being planted with grass and grazed by sheep – a familiar view of all the dikes in the Wadden Sea Area.



The Frisian mainland Waddensea-dike north of Harlingen during the dry summer of 2018 (photo: Meindert Schroor)

In 1730s the sea- or pile-worm (actually a clam) invasion ended the widespread practice of protecting dike-bases by means of wooden pile-work , and in the following centuries being replaced by natural stone like basalt or concrete. Another early experience – advocated by the Dutch engineer Andries Vierlingh in the 1570s in his fundamental treatise on diking *Tractaet van Dyckagie* – was the mitigating effect of broad salt marshes outside the sea-walls. Extending and protecting these forelands gradually becoming paramount along the Wadden Sea coasts if only to expand the lands of the adjacent land-owners.

Wealth and prosperity

In the eyes of visitors from elsewhere the marshes along the Wadden Sea generally have a prosperous appearance. This they owe in the first place to the many often opulent farm-houses with their large barns, especially in the areas where arable farming has dominated as is the case in the Bildt-polders, North-Groningen, around the Dollard, in the East-Frisian Krummhörn and Leybucht- and Harlepolders, some of the Elbe marshes, Dithmarschen and the coastal polders of North-Friesland between Husum and the Danish border. In between towns like Enkhuizen, Hoorn, Medemblik, Harlingen, Franeker, Leeuwarden, Dokkum, Appingedam, Emden, Stade, Glückstadt, Tönning, Husum, Tønder and Ribe bear witness of this wealth of old that between 1500 and 1870 lured many migrants from a much less prosperous and sparsely populated Pleistocene hinterland to these coastal lands. Though many small noble houses and mansion have together with the most of local nobility disappeared from the area between 1750 and 1900, the relative and sometimes absolute economic contraction in the marshes on the other hand has left many historical objects remaining, varying from picturesque harbour towns and farming

villages to monumental organs in town and villages churches, especially around the Dollard estuary.

THIRD PHASE: governmental development schemes

The unfavourable conditions under which the first generations of polder dwellers had to operate, induced the Government - after passing a Law to Enclose and Drain the Zuiderzee in 1918 - not only to finance land reclamation, but also to implement tight socio-geographical planning schemes. Schemes that hardly left any room for chance, as can be observed from the way towns and villages were planned. This law opened the third and last phase of diking. The closing of the Afsluitdijk in 1932 marked the real opening of the scheme. The more or less adjacent Wieringermeerpolder in 1930 offered the first proof of this wind blowing from another quarter, whereas the Noordoostpolder followed from 1942 onwards. Gradually even the age-old reasons for reclamation changed, from reasons of safety or agricultural motives to a range of new functions like housing, recreation and the conservation and development of natural values, being in itself a reaction to the rising pressure on land and resources exerted by a growing population on its environment. Less well known in the other parts of the Wadden Sea area is the fact that the Danish marshes were only embanked from 1916 onwards and are still mainly unpopulated.



Statue of Cornelis Lely (1854-1929) on the Afsluitdijk. As civil engineer and designer (1891) of the Zuiderzee-plan of damming of and reclamation in this former gulf. As minister for water-management he was responsible for the implementation of the plan in 1918. (photo: Meindert Schroor)

But in the end expansion of territory by reclamation of land came to a stand-still. In 1974, environmental considerations led to the cancelling of a far-reaching plan (1965) to reclaim a large part of the Waddensea by building two dams between the Frisian mainland and the island of

Ameland. It was the impetus for the founding of the Dutch Wadden Sea society that same year, without doubt the main force in putting the Wadden Sea on the map as an ecological gem. Similar ecological reasons were used in abandoning the planned reclamation of the final Zuiderzee/IJssel Lake polder, the Markerwaard. Even a scheme to reclaim a small stripe of salt marshes land on the northern coast of Fryslân was scrapped by the government in 1988. Though this occurred in a rather thinly populated area, elsewhere the Dutch government may soon be forced to leave its quarter-century old refraining from reclaiming and implement already existing plans for reclaiming parts of the North Sea between The Hague and (the) Hook of Holland or on the North Sea coast off IJmuiden (in view of the national airport Schiphol having reached its ceiling in numbers of flights and passengers). However, in the Wadden coastal areas reclamation plans for agricultural reasons nowadays are a non-issue, perhaps no better illustrated by the inundation of some excellent farming land in the Dollard polders – the so-called Blauwe Stad – near the German frontier, all aimed at attracting tourists and more so dwellers from the overcrowded western parts of the Netherlands to the area, thereby hoping in vain to create jobs in a region afflicted by high unemployment rates. On the Fryslân Wadden coast summer dikes have been opened to restore sedimentation from the sea (2001 - Noorderleeg) and the pumping station Vijfhuizen was opened there in November 2018, facilitating diadromic fish to pass from salt sea waters to fresh inland waters. Moreover, a so-called fish migration river is planned to be opened in 2022. It is intended to facilitate fish (e.g. salmon, eel) to pass from the Wadden Sea into the IJsselmeer (IJssel Lake) and vice versa through the Afsluitdijk.



Land-reclamation works as seen from the train on the Hindenburg dam between the mainland and the island of Sylt (photo: Meindert Schroor)

With a view on coastal protection and land reclamation the northern parts of the Wadden Sea area already from 1861 (Hamburger Hallig) onwards saw the construction of dams, such as the

Hindenburg Dam to Sylt, complete with railroad (1927), the dams to Oland and Langeness (1928), to Nordstrandischmoor (1933) and Nordstrand (1934). Initially dams like these were low groynes, later to be heightened above mean high tide and primarily intended to halt erosion. In the Danish Wadden Sea the island of Rømø was attached to the mainland by a dam in 1948, while nearby Mandø since 1932 (improved in 1960) can be reached at ebb-tide via the co-called Ebbevej. In Germany a plan to build an outer seaport for Hamburg at the Elbe mouth led to the return of the islands of Scharhörn and Neuwerk off Cuxhaven to this city-state in 1969. However, the new port was eventually cancelled. Elsewhere along the German Wadden Sea coast planned land reclamation schemes were narrowed to coastal safety measures in view of the flood disasters of 1962 and 1976, like the Eidersperrwerk (1973) as well as the Speicherkoog (1978) and the Beltringharderkoog (1987). A planned closing and reclaiming of the Leybucht estuary in East Friesland was abandoned in 1991. Modern diking has returned to where it all started some 2000 years ago: the protection of existing land.

Literature

- * Abrahamse, J. (ed.), *Vadehavet – et dansk-tysk-hollandsk naturområde*. BYGD/Fiskeri- og Sjøfartsmuseet, Esbjerg 1976. (also in Dutch and German)
- * Abrahamse, J. (ed.), *Wadden: verhalend landschap: cultuurhistorische reis langs de waddenkust van Denemarken, Duitsland en Nederland*. Tirion Baarn, 2005
- * Abrahamse, J. a.o. (ed.), *Waddenzee Werelderfgoed*. Uitgeverij Matrijs, Utrecht 2012
- * Egberts, Linde & Meindert Schroor (eds.), *Waddenland Outstanding. History, Landscape and Cultural Heritage of the Wadden Sea Region*, Amsterdam University Press, Amsterdam 2018.
- * Fischer, Ludwig (ed.), *Kulturlandschaft Nordseemarschen*. Bredstedt/Westerhever. 1997.
- * Fischer, Ludwig, 'Victory over the sea. Dutch diking techniques in the seventeenth and eighteenth centuries and their impact on Europe's history of mentality' in: Egberts, Linde & Meindert Schroor (eds.), *Waddenland Outstanding*. Amsterdam 2018, 109-119.
- * Fischer, Norbert, *Von Seedeichen und Sturmfluten. Zur Geschichte der Deiche in Cuxhaven*. Stade 2016.
- * Kramer, Johann, *Kein Deich, Kein Land, Kein Leben. Geschichte des Küstenschutzes an der Nordsee*, Rautenberg, Leer 1989
- * Kühn, Hans Joachim: Früher Deichbau. I: *Das große Nordfriesland-Buch*. Nordfriisk Instituut, Bredstedt, 2000.
- * Kunz, Harry & Albert Panten: *Die Köge Nordfrieslands*. Nordfriisk Instituut, Bredstedt 1997.
- * Lambooy, Herman, *Getekend land. Nieuwe beelden van Hollands Noorderkwartier*. Alkmaar 1987.
- * Schoorl, Henk, *De convexe kustboog I-IV*. Uitgeverij Pirola. Schoorl 1999-2000* Schroor, Meindert, *De wereld van het Friese landschap*. Wolters-Noordhoff. Groningen 1993.

- * Schroor, Meindert, *Van Middelzee tot Bildt – Landaanwinning in Fryslân in de Middeleeuwen en de vroegmoderne tijd*, Uniepers. Abcoude 2000.
- * Schroor, Meindert & Jan Meijering (2007). *Golden Raand. Landschappen van Groningen*. In Boekvorm, Assen 2007.
- *Schroor, Meindert, *Waddenzee-Waddenland*. Leeuwarden 2008 (with english summary)
- *Schroor, Meindert, 'Flutkatastrophen und Küstenschutz in der niederländischen Marschlandschaft: Zwischen Wirtschaftlichkeit und Sicherheit' in: Fischer, Ludwig & Karsten Reise (Hrsg.), *Küstenmentalität und Klimawandel* oekom, München 2011, 153-166.
- * Schroor, Meindert (2018), *Landschapsbiografie van het Waddengebied. Historisch-landschappelijke karakteristieken en hun ontstaan*. Rijksdienst voor het Culturele Erfgoed, Amersfoort. (<https://www.overland.nl/Landschapsbiografie%20Wadden%20DEF%20print.pdf>)
- * Steensen, Th. (ed.), *Das große Nordfriesland-Buch*. Hamburg. 2000.
- * Ven, G.P. van der (ed.), *Man-made lowlands. History of water management and land reclamation in the Netherlands*. Matrijs. Utrecht 2004.
- * Vollmer, M. a.o. (ed.), *Lancewad. Landscape and Cultural Heritage in the Wadden Sea Region*. Common Wadden Sea Secretariat. Wilhelmshaven 2001.