IGU - WORKING GROUP ON

GEOMORPHOLOGY OF RIVER AND COASTAL PLAINS

Friday, September 11th
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by

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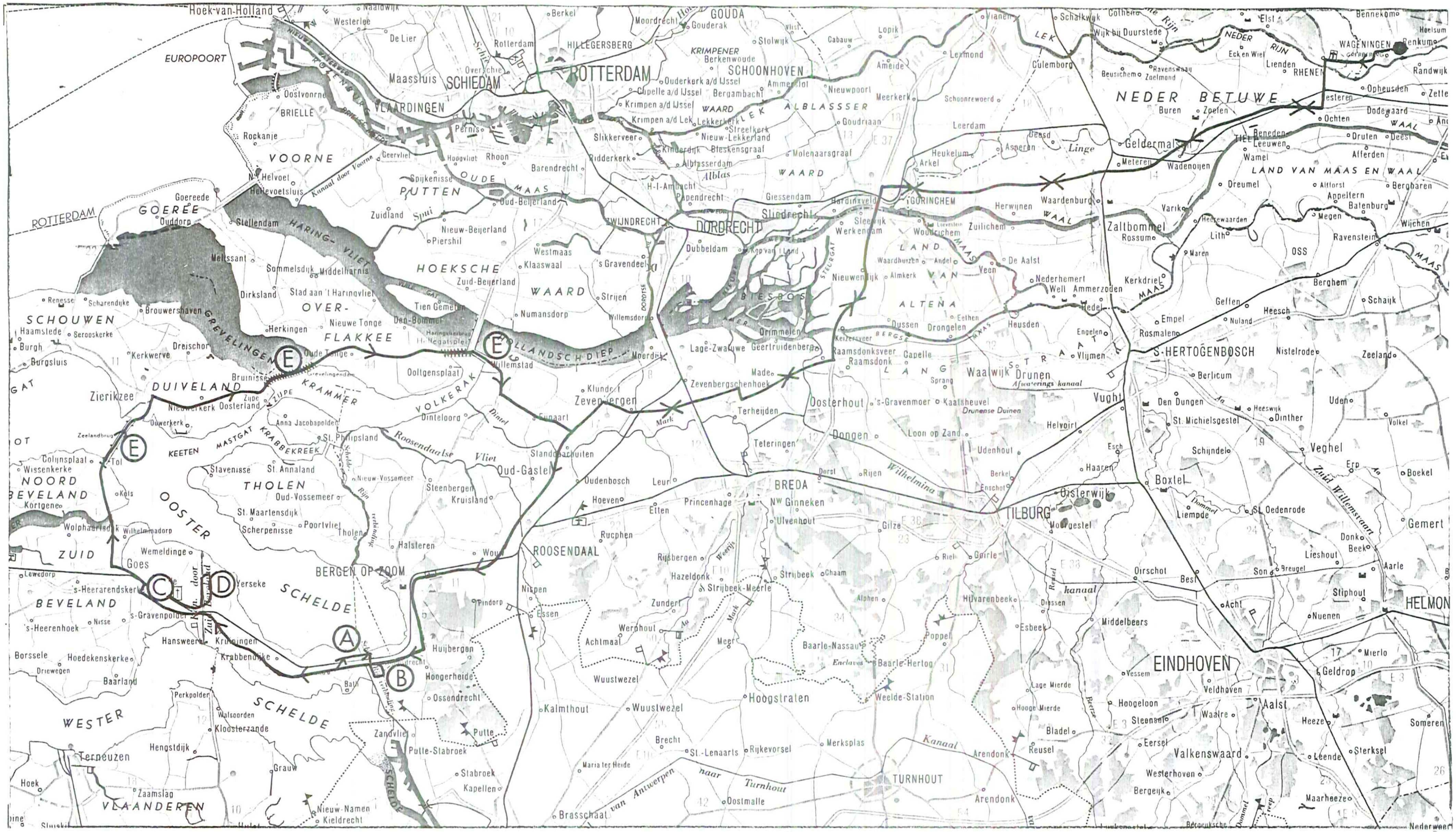
Wageningen, August 1981.



A route and point

0 5 10 20 km

Fig. 1 Excursion route IGU 11th September 1981

EXCURSION TO THE SOUTHWESTERN COASTAL AREA OF THE NETHERLANDS

Friday, September 11th 1981

Start: 7.45 hrs. from ITC, Wageningen
Boots (provided by IAC)

Trip by coach to excursion area (Fig. 1): Wageningen - Rhenen (Rhine-bridge) - Kesteren - Motorway A15 (West) - Gorinchem - Motorway A27 (South) (Merwede-bridge) - Raamsdonksveer - Secondary road, West - Zevenbergen - Motorway A17 (South) - Bergen op Zoom - Scheldt-Rhine canal bridge - Krabbendijke - Rattekaai (Oosterschelde).
Arrival: 9.30 hrs.

A. SALT MARSH AND INTERTIDAL FLAT AT THE RATTEKAAI (OOSTERSCHELDE)

In the Oosterschelde large areas occur where sediments are found, deposited above mean Low Tide level during the rise and fall of tides (intertidal zone).
As altitude increases the sediments at higher levels become finer textured. This process of particle sorting as one moves from sea to land also operates from the source of sediment supply (gullies and creeks) to their backlands. Two main subzones can be distinguished in the intertidal zone: intertidal flats and salt marshes. Intertidal flats constitute the lowest part of the intertidal zone. They are bare, slightly undulating flats dissected by a few gullies. Salt marshes form the highest part of marine intertidal zones and are covered with a dense vegetation. Three landscape elements can be distinguished: creeks, natural levees and basins. In figure 2 the major shore types on sheltered coasts in the Netherlands are given (see end of this guide).

The Rattekaai is situated at the southern edge of the Oosterschelde. Behind the seadike at the Rattekaai salt marshes and intertidal flats are present with a natural development. A traverse will be made through the salt marshes, into the high intertidal flat and back to the seadike. This intertidal zone belongs to the shore type with a gradual transition from intertidal flat to salt marsh, represented in figure 2A.

During the traverse attention will be paid to

- geomorphological aspects as: creek and gully patterns, development of natural levees, stability of creek and gully patterns;
- sedimentary aspects as: granular composition and lamination;
- flora and fauna;
- some changes in the sediment due to processes occurring shortly after deposition, e.g.: changes in initial water content, aeration phenomena and carbonate deficiencies.

Detailed information on these subjects can be found in Soil Survey Paper No. 14 (added to this excursion program) esp. Appendix 3, upper part.
Duration of this part of the excursion: about 2 hrs.
Departure: 11.30 hrs.

B. SUCCESSIVELY EMBANKED YOUNG POLDERS

Roundtrip by bus through a series of young polders, embanked successively with an interval of about 20 years (Fig. 3). Route, see figure 3 (right lower corner).
Accretions silt up to older land (in the Netherlands mostly a dike). The marsh is most elevated and finest textured (clay loam) near the old dike and becomes lower and lighter textured (sandy loam) near the former waterline.
Each successive embankment has a higher level than the previous embankment. In this case the differences in elevation of the three polders, embanked in 1923, 1904 and 1885, amount to 0.75 m à 1 m, the youngest one (Krekerak polder, 1923) being the highest (see cross section, fig. 3).
Departure: 12.30 hrs.

C. LUNCH: Motel De Caisson

Smokkelhoekweg 10
Biezelinge, tel. 01102-1649

Departure: 13.45 hrs.

EPOCH	AGE	TIME SCALE B.P.	MARINE TRANSGRESSIVE INTERVALS	DATES B.P.
HOLOCENE	SUB-ATLANTIC	0	DUNKERQUE III B	0
				700
		1000	DUNKERQUE III A	800
				1100
			DUNKERQUE II	1400
				1750
	SUB-BOREAL	2000		
			DUNKERQUE I	2200
				2500
		3000	DUNKERQUE 0	3000
				3500
		4000	CALAIS IV	4000
				4700
	ATLANTIC	5000	CALAIS III	
			CALAIS II	5300
		6000		
			CALAIS I	6300
		7000		
	BOREAL	8000		8000
	PRE-BOREAL	9000		
		10 000		

(mainly after Rijks Geologische Dienst)

Table 1 The chronology of the Holocene

D. EMBANKED MARINE "OLD LAND" NEAR THE VILLAGE OF KAPELLE AND IN THE YERSEKE MOER

Roundtrip by bus, 1 stop with demonstrations.

During early Holocene marine sediments (Calais Deposits, Table 1) were deposited on pleistocene eolian sands. After Mid-Atlantic the rate of the eustatic sea level rise decreased and a series of coastal barriers developed. Behind these,conditions were favourable for peat formation. Since Late-Subboreal local transgressions occurred via breaches in the coastal barrier and in the estuaries of the Rhine-Meuse and of the Scheldt. The peat and even the underlying Calais deposits were partly eroded and new sedimentations originated: the Dunkerque Deposits. The first Dunkerque transgression to reach the visited area was the Dunkerque II (250-600 A.D.). It eroded creeks in the peat and deposited non-calcareous clay over uneroded peat islands (Fig. 4A). At the end of the transgression creeks were filled with light textured material (sand and sandy loam) (Fig. 4B-C). As a result of natural drainage and top-weight of the clay, subsidence of the clay-over-peat land started. This process intensified after embankment and artificial drainage since the 10th century A.D. (Fig. 4D). The landscape of the Dunkerque-II Deposits consists of low lying clay-over-peat basins, intersected by elevated creek-ridges (filled up former creeks) (Figs. 5 and 5A). They form the nuclei of the present-day (pen)insulas, known now as "Old Land".

A new transgression (Dunkerque-IIIA) between 900 and 1200 A.D. caused superficial erosion locally together with a shallow rejuvenation with calcareous material of the old creek-ridges.

A third transgression (Dunkerque-IIIB) started after 1300 A.D. Much of the then existing "Old Land" was eroded, but also new sedimentation took place. Along the coasts of the Old Land tidal flats and marshes were formed (as now at excursion point A) and successively embanked and reclaimed as New Land (e.g. the polders of excursion point B).

In the "Polder Breede Watering Bewesten Yerseke" in a fresh ditch wall will be demonstrated a cross section as in figure 5A from a creek-ridge towards the basin:

1. Creek-ridge, i.e. a silted up creek of the Dunkerque-II period. The loamy topsoil, overlying sand is slightly calcareous. The soil is brown as a result of continued deep natural drainage. Of old, land use is therefore arable land and orchards.

2. Basin soil, non-calcareous silty clay loam (Dunkerque-II) overlying peat.

3. Results of peat digging in the basin. During the Middle ages the peat underneath the clay (loam) has been dug out for salt making, the peat being soaked with salt water during the inundations. The dug out peat was burned to reclaim salt from the ash, extracted in boiling sea water. The almost saturated salt solution was then evaporated (Fig. 6). The industry came to an end in the 15th century by salt import from Portugal and France.
The result of the peat digging is a very irregular surface of the land, that is only fit for grassland of a poor quality.

Departure: 15.45 hrs.

E. DELTA WORKS

In 1953 a storm surge caused heavy dammage in the Southwestern district. Over 160,000 ha land were flooded with salt water, 1800 people drowned. To increase safety the Delta-plan was carried out.
From the works indicated on figure 7 with numbers 1-15 (see also the pamphlet: The south-west Netherlands, p. 21-26), the following are passed during the trip back to Wageningen:

No. 7 Dam in the Zandkreek (1960), one of the secondary dams, mainly built to create a fresh water compartiment and for infrastructural reasons.
Overall-length 1 km. It comprises a lock.

No. 15 Zeeland-bridge (Fig. 8), nearly 5 km long; 16 m above mean sea level; 52 spans on pears, each comprising 3 hollow concrete cylinders up to 50 m long. The last span (on the north side) is movable. It crosses the navigation channel with locks. The invested money is recovered through charging of toll. Foto stop.

No. 8 Grevelingen Dam (1965), 5 km long, built of concrete blocks, transported by a cable-way.

No. 9 Volkerak Dam (1970), 4+2 km long with locks of the Scheldt-Rhine connection (Fig. 9), constructed in an artificial "island". The traffic intersection is built on a sand bank. On the intersection a bridge (14), 2,5 km long, forms the connection with Rotterdam.

F. RETURN TRIP TO WAGENINGEN IAC.

Estimated time of arrival 18.00 hrs.

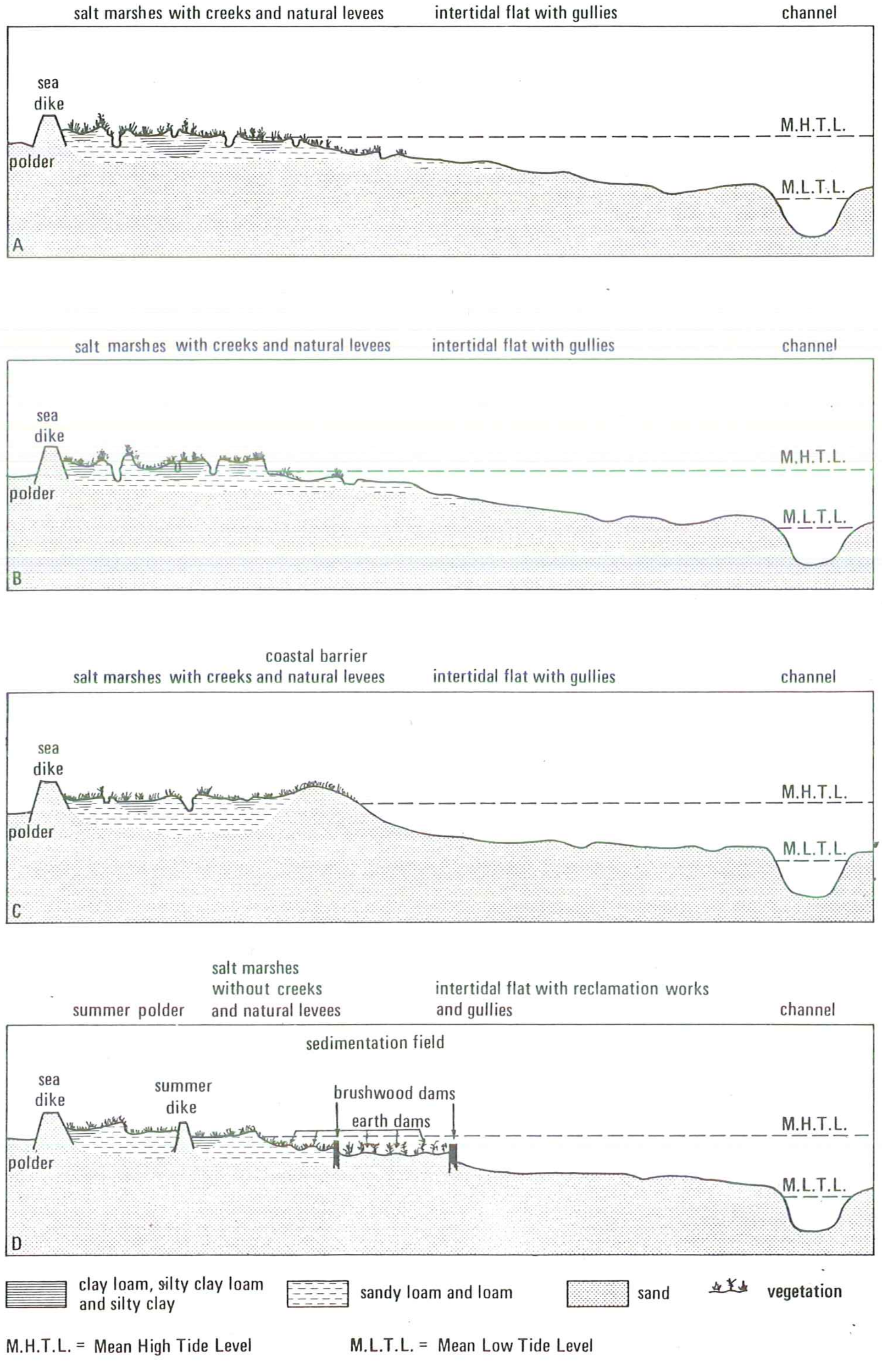


Fig. 2 Major shore types on sheltered coasts in the Netherlands

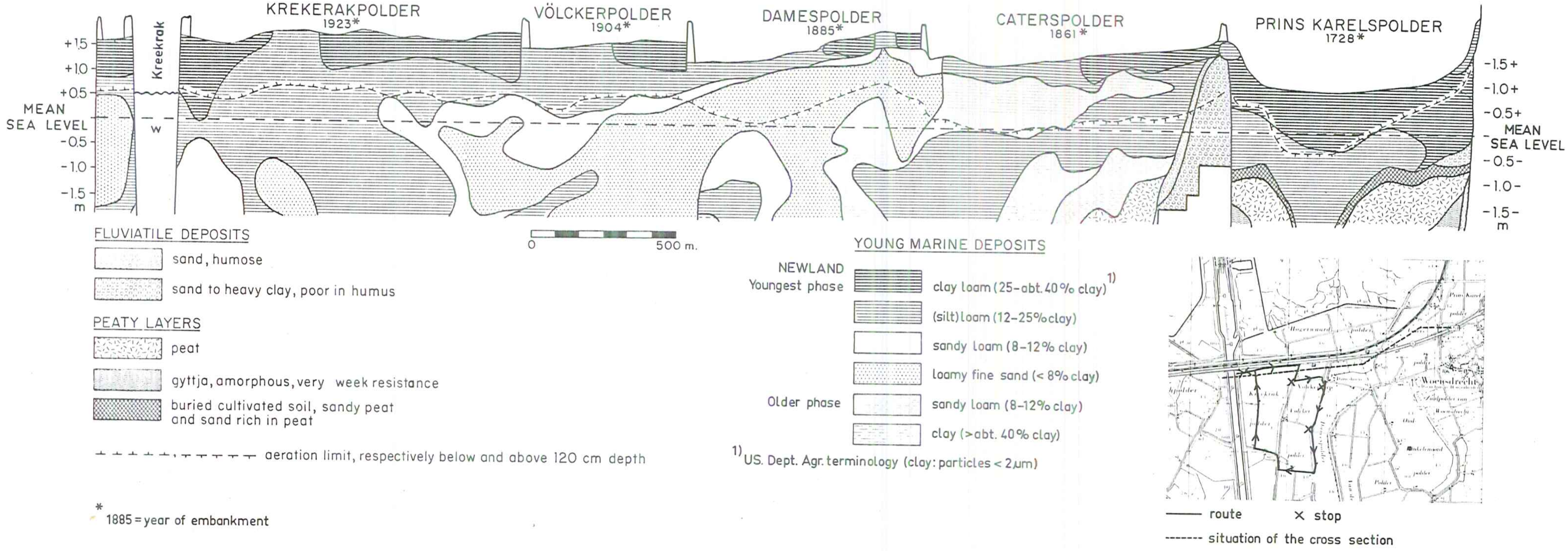


Fig. 3 Cross section newland polders " SCHELDEZOOM "

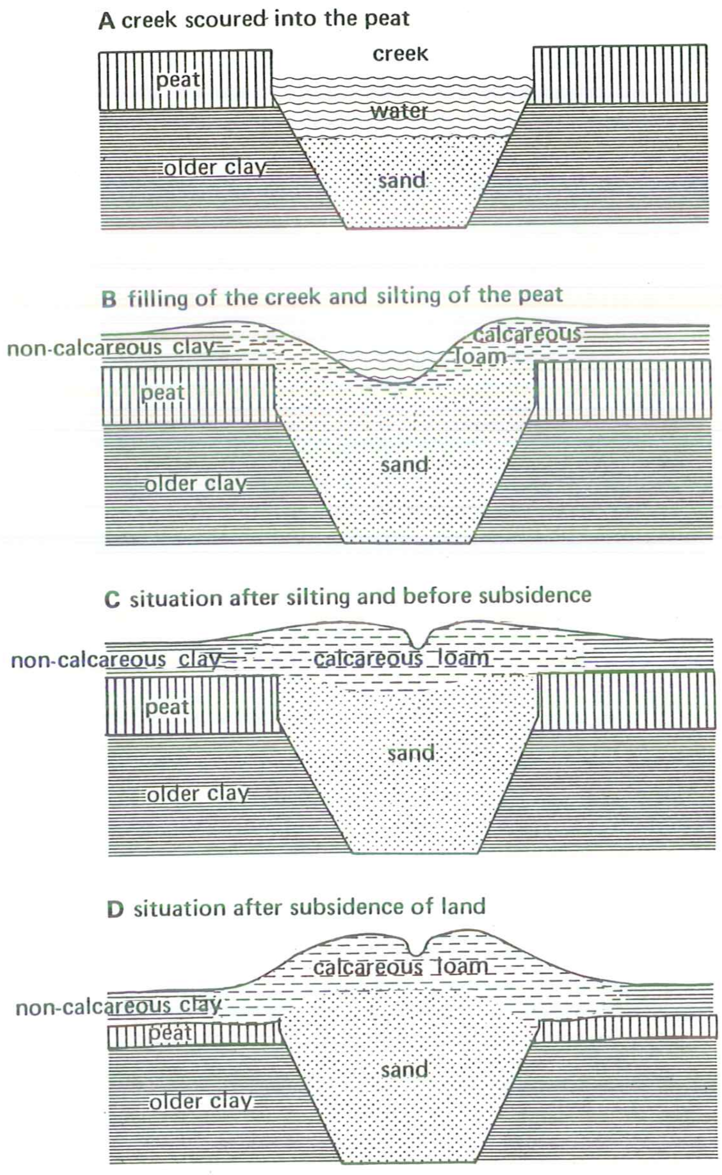


Fig. 4 Development of a "creekridge"

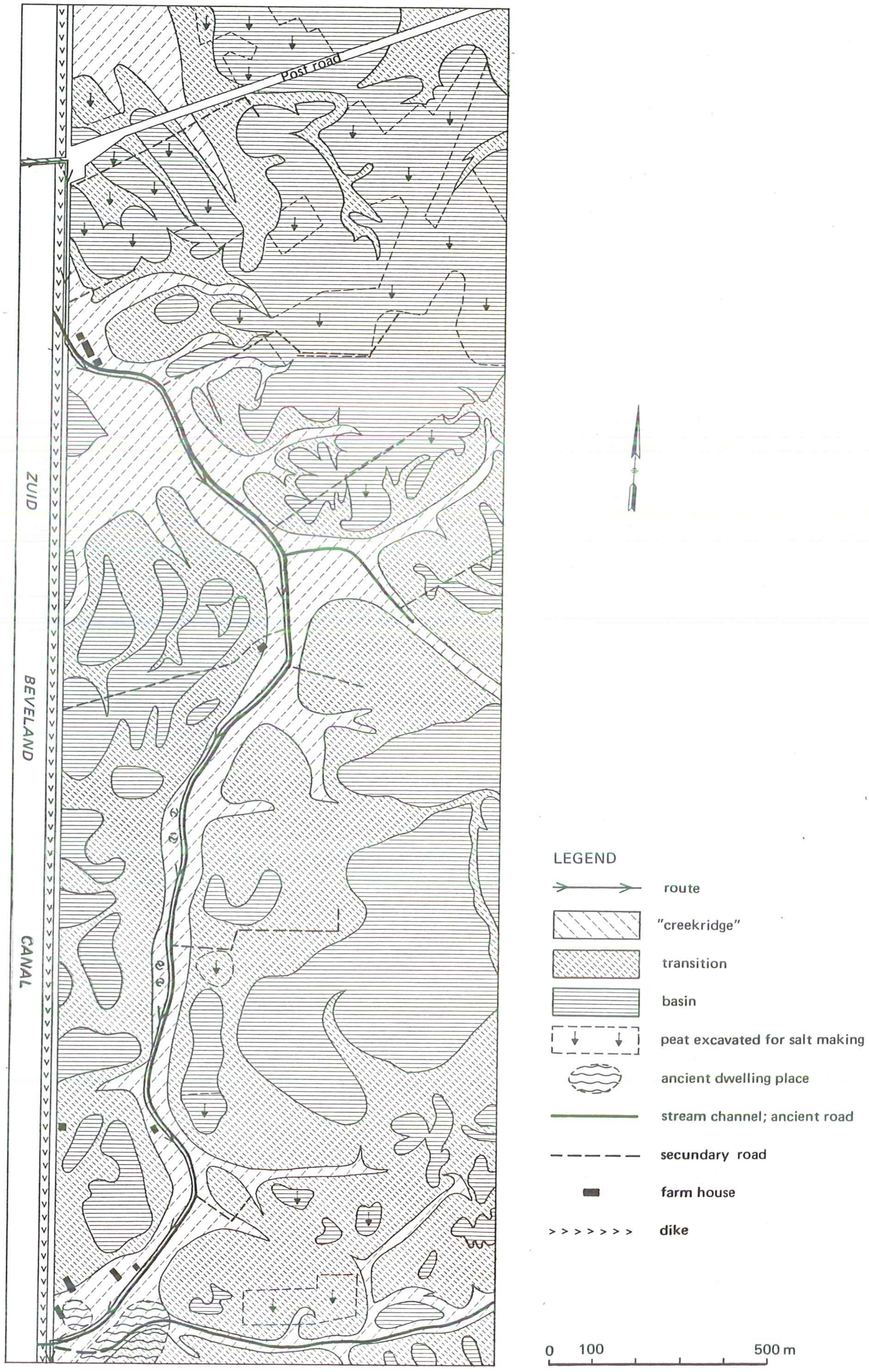


Fig. 5 Morpho-genetic map of Yerseke Moer (generalized after soil map, G. de Bakker, 1949)

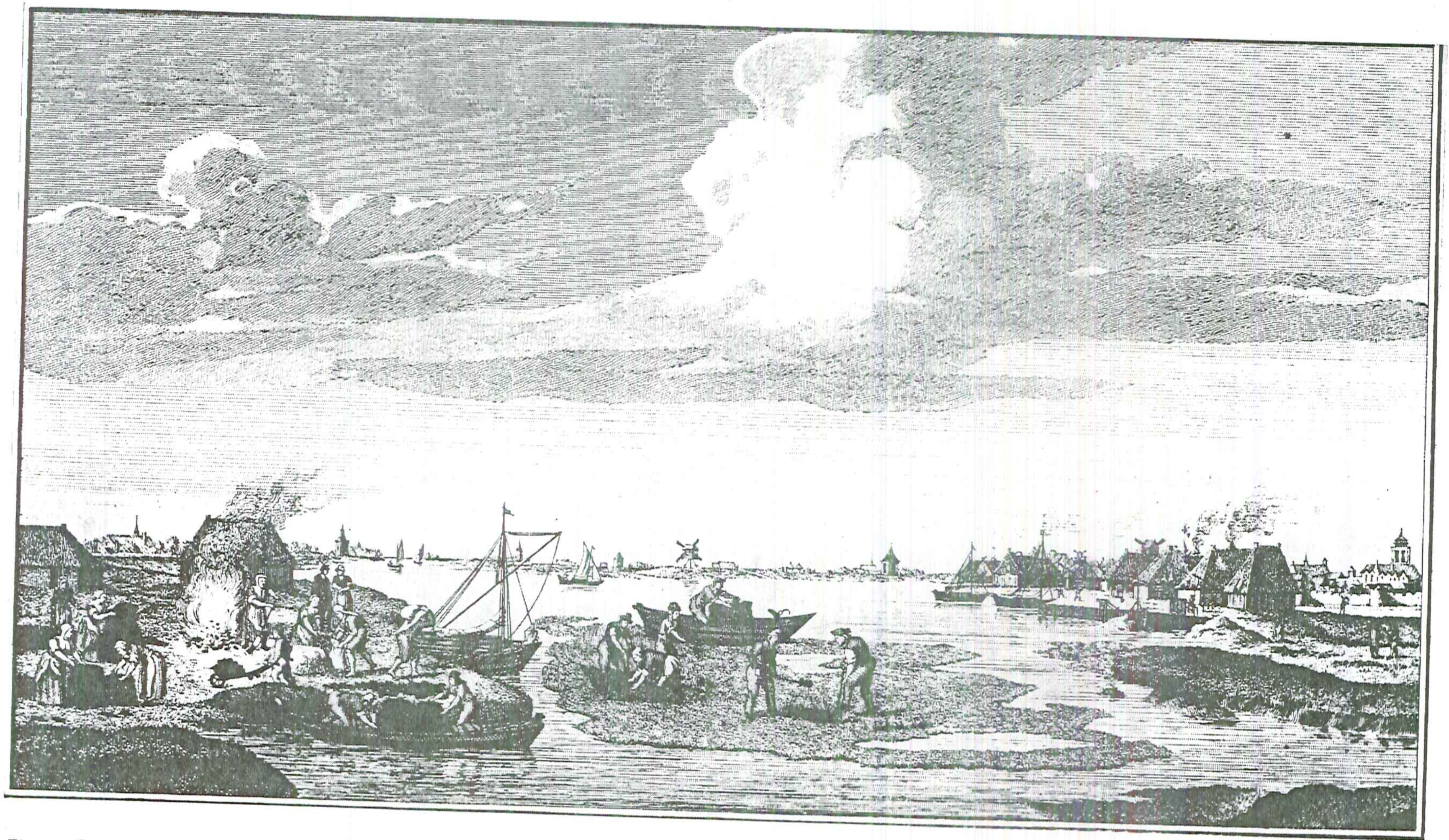


Fig. 6 Salt making from peat. Dry point etching by C. Pronk, 1745. The etching is made after an old painting. In the centre peat is dug out of the soil, dried, shipped and burned (left). The ashes were transported to salt factories (right with smoking chimneys) and there dissolved in sea water; the brine being evaporated to white salt. (Collection G. Steur).

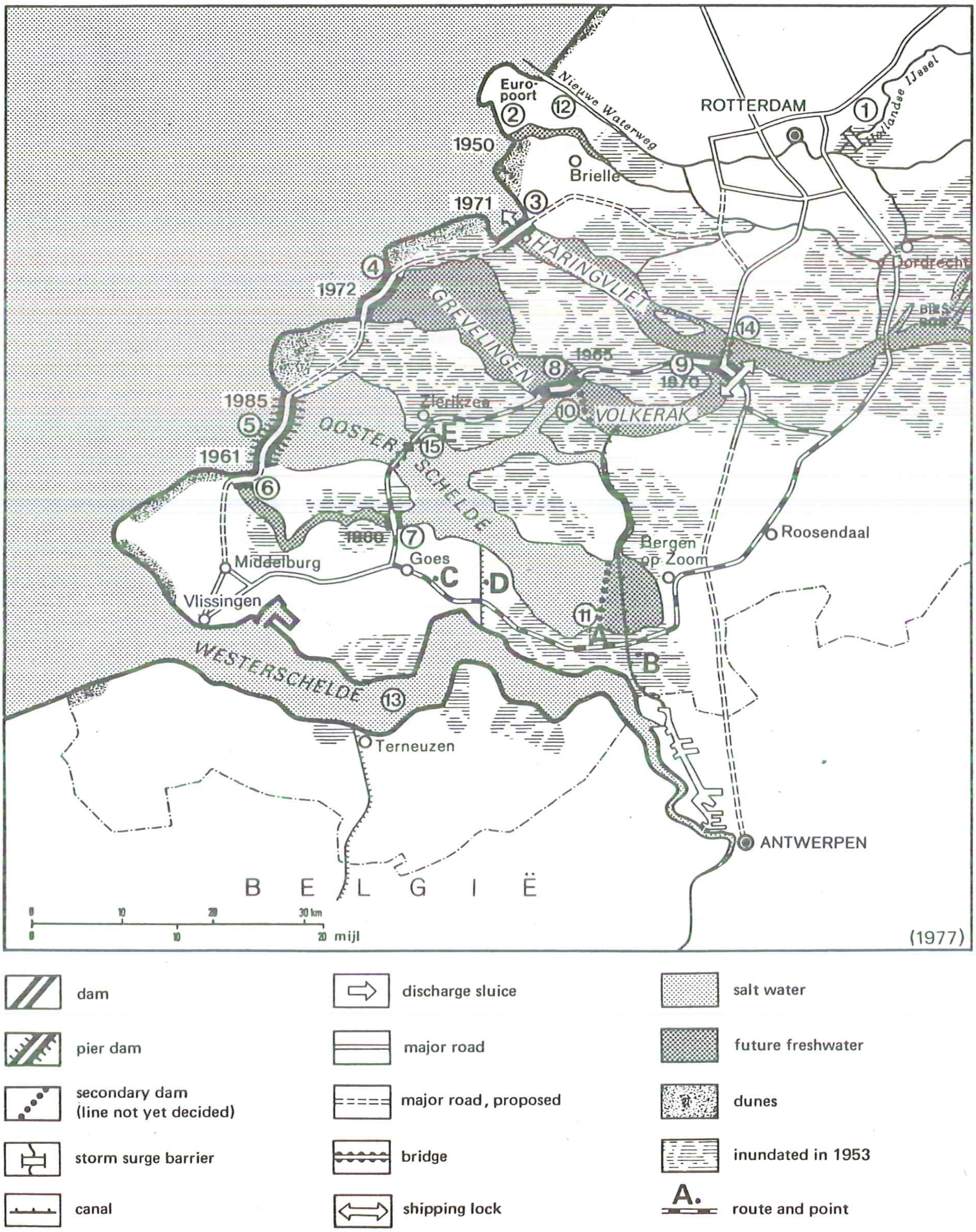
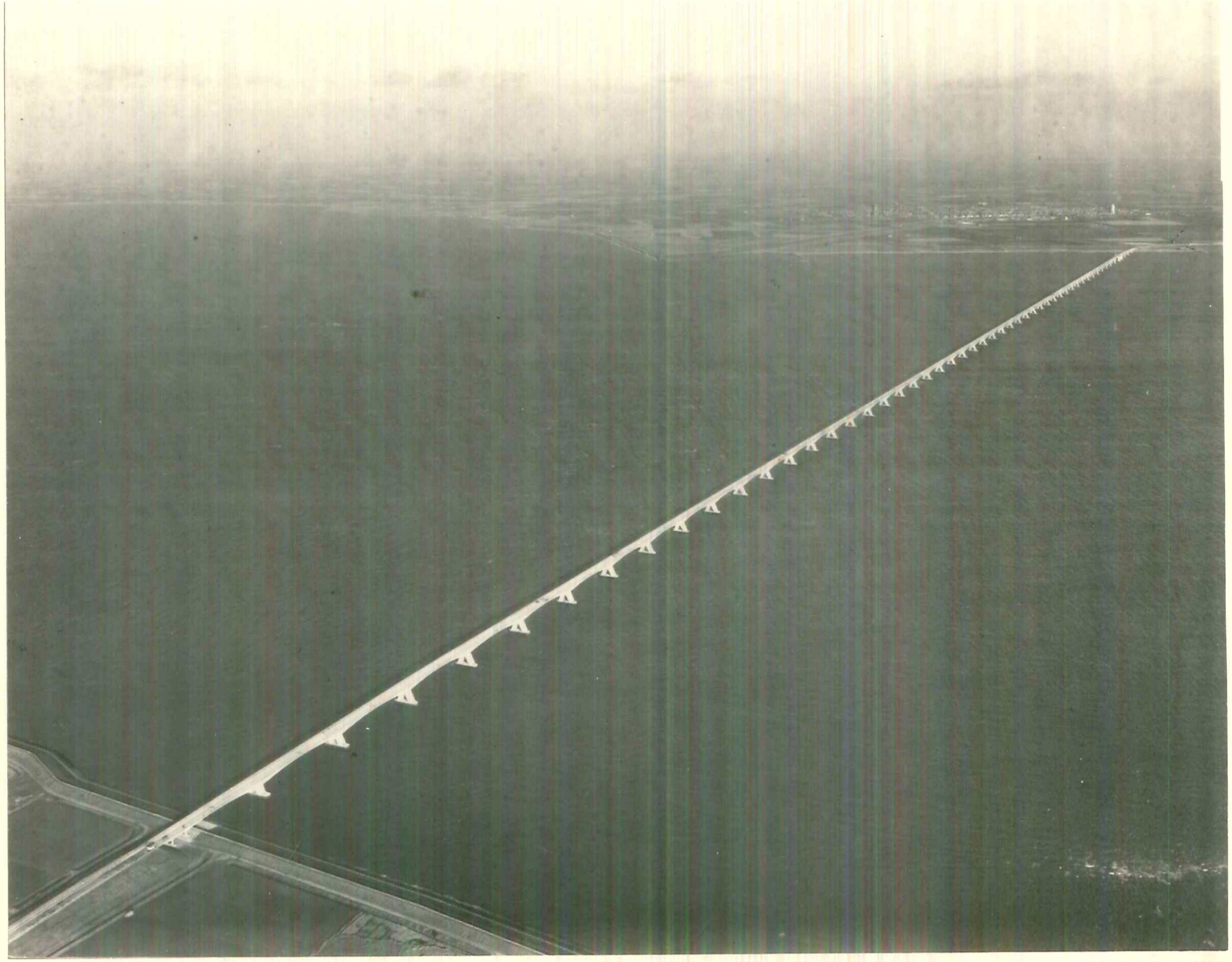
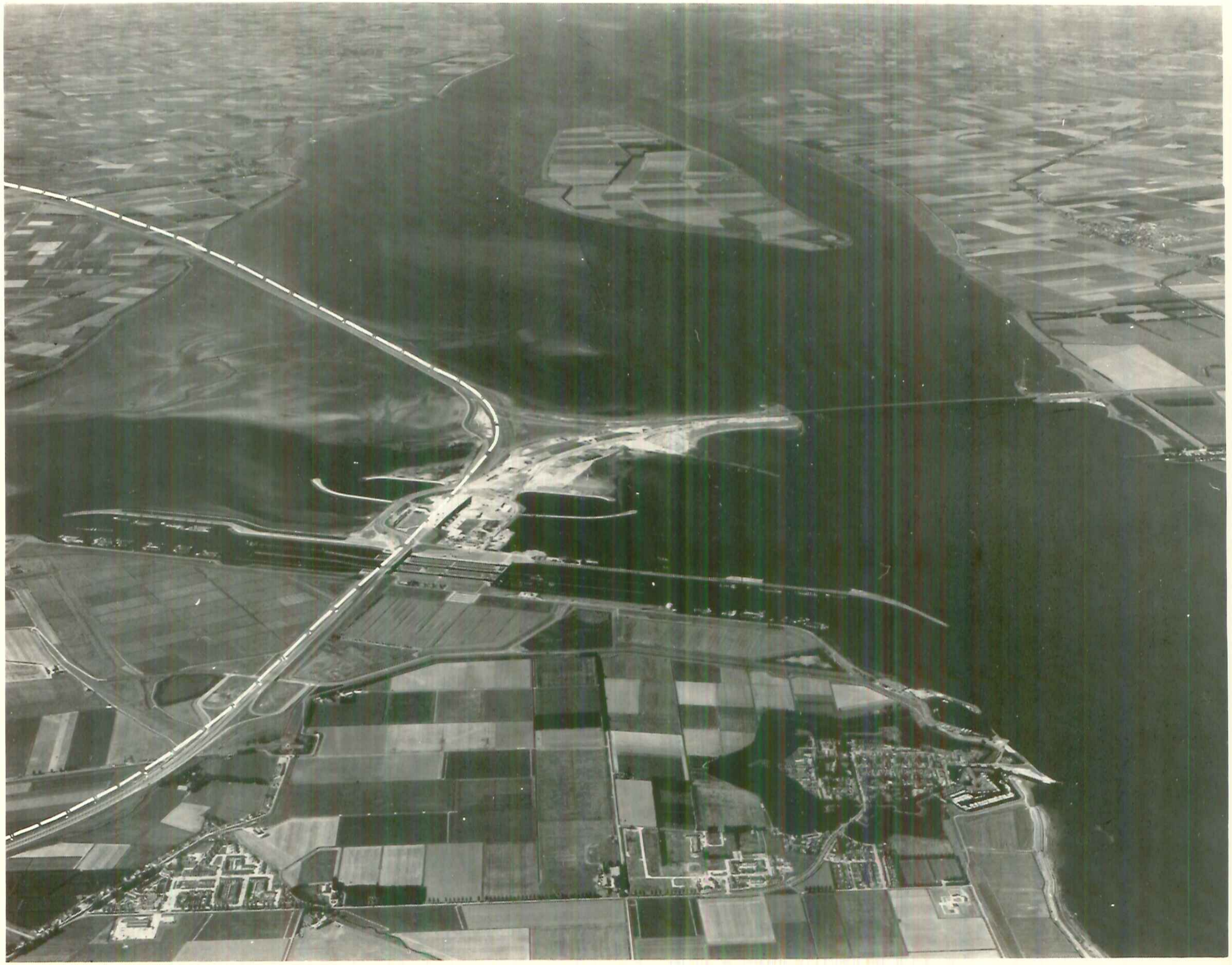


Fig. 7 Delta plan. After IDG 1978. The South - West Netherlands 2nd ed. The Hague, Min. Foreign Aff.



LUCHTFOTO BART HOFMEESTER RIJKSVOORLICHTINGSDIENST

Fig. 8 The Zeeland Bridge over the Eastern Scheldt, looking N; it links North Beveland (bottom left) and Schouwen-Duiveland with Zierikzee (top right)



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——— ——— ——— route

Fig. 9 Volkerak Dam and Haringvliet Bridge, looking W. In the right foreground the old fortified town of Willemstad in North Brabant, on the Holland Diep. Behind it the Volkerak Locks – still partly under construction in the photograph, but since completed – an important section of the Scheldt-Rine Canal. To the rear left of the locks the Volkerak Dam, connecting with the island of Goeree-Overflakkee and, to the right of the locks, the Haringvliet Bridge, connecting with the Hoekse Waard. In the distance the island Tiengemeten in the Haringvliet

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