13. Sea Defence and Land Drainage of Romney Marsh

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with contributions by Frank Midmer and George Roberts

All three authors of this paper are long-serving officers of Southern Water. The substance of most of the paper originally appeared in a paper published in the Gazette of the Association of Drainage Authorities in Summer 1984. It is reprinted by kind permission of the author and the editor of the Gazette. The substance of the final section, Land Drainage in the valleys of the Rother, Tillingham and Brede, was published in the Yearbook of the Association of River Authorities, and is reproduced by kind permission of the author, Frank Midmer. George Roberts kindly contributed the coastal sections in Fig. 13.2.

Introduction

The primary force which created the 27,000 ha of fertile farmland in the embayment between Pett and Hythe has been wave action, dominating from the south-west, induced by the prevailing south-westerly wind, bringing flint pebbles from the Sussex shoreline to form spits and ridges across the bay. The secondary land-building factor has been sedimentation in the relatively calm water between the shingle spits and the old cliffs.

Sea Defence

Sea Walls

Dymchurch Wall

Approximately half of the present coastline of the Romney Marsh area (Fig. 13.1) is defended by sea walls, the oldest of which is the Dymchurch Wall. Some of the massive shingle bank which previously formed the eastern seaboard of Romney Marsh moved southward, but most of it moved away north-eastward, filling Hythe Haven (now Hythe Ranges) and travelling on towards Folkestone. As the shingle bank diminished so the construction of one of the world's great sea walls began – using clay dug from the land close behind it, armed on its seaward face with wood piles and faggots, and with rock groynes (knockes, relayes, slattes, groynes and fothegges) projecting into the sea to hold the shingle. The starting date of construction of Dymchurch Wall is not known – it was probably late in the 13th century – and the wall was certainly of great importance by the mid-16th century (see also Tatton-Brown 1988).

By 1803 the condition of the wall, nearly 6.5 km in length, was so bad that an outside engineer was called in to advise and he caused the front slope, previously almost vertical, to be set back to about 6 to 1 by throwing the crest inland. Whether or not he advised the use of rock to protect the front face is uncertain, but the first purchase of Kentish Ragstone for this purpose, quarried from the hills behind Hythe, is recorded in 1825. During the next 14 years considerable quantities of rock went on to the wall in a haphazard way. By 1837 the wall was again causing great concern and the engineers Elliott, father and son, and James Walker were called in to survey, report and advise. After a good deal of acrimony James Elliott junior started work in 1839 on a systematic construction of the ragstone apron, much of which is still extant. Starting with timber toe piling at foreshore level he carried the apron up to high water level at a slope of 1 in 7, then rising towards the crest to finish with a curve of 2.13 m radius.

By the 1890s the wall was again in a dangerous condition, particularly between Grand Redoubt and Willop Outfall, the north-eastern section of the wall. The last remnants of the shingle bank had gone and the lower part of the rock apron was in ruins due to the erosion of the foreshore. In 1892 and 1893 the apron towards the Grand Redoubt was foreshortened to a slope of 1 in 4, and a mass concrete toe was constructed by the expenditor, Edward Case. Crisis followed the stormy winter of 1893–4 and outside civil engineering consultants, including Sir John Wolfe Barry, were again called in. Their advice, to restore the apron to the 'Elliott' profile was rejected on grounds of cost, and Edward Case was authorised to begin his celebrated system of lightweight groynes. Some 150 of these groynes, consisting of pairs of 22.86 cm × 7.62 cm timber uprights dug into the foreshore about 2.44 m apart with horizontal planking fixed between the uprights, were constructed along the Dymchurch Wall. For some years these means were successful in building up the foreshore with shingle coming from the south.

By the late 1930s the wall between Grand Redoubt and Willop was again causing concern and plans were made to reface the apron with Welsh granite. One shipment was received before war caused postponement of the work until 1961. Model tests were carried out then which indicated that by raising the lower part of the apron and forming a 'berm' road at high tide level, waves could be made to break there and temper their

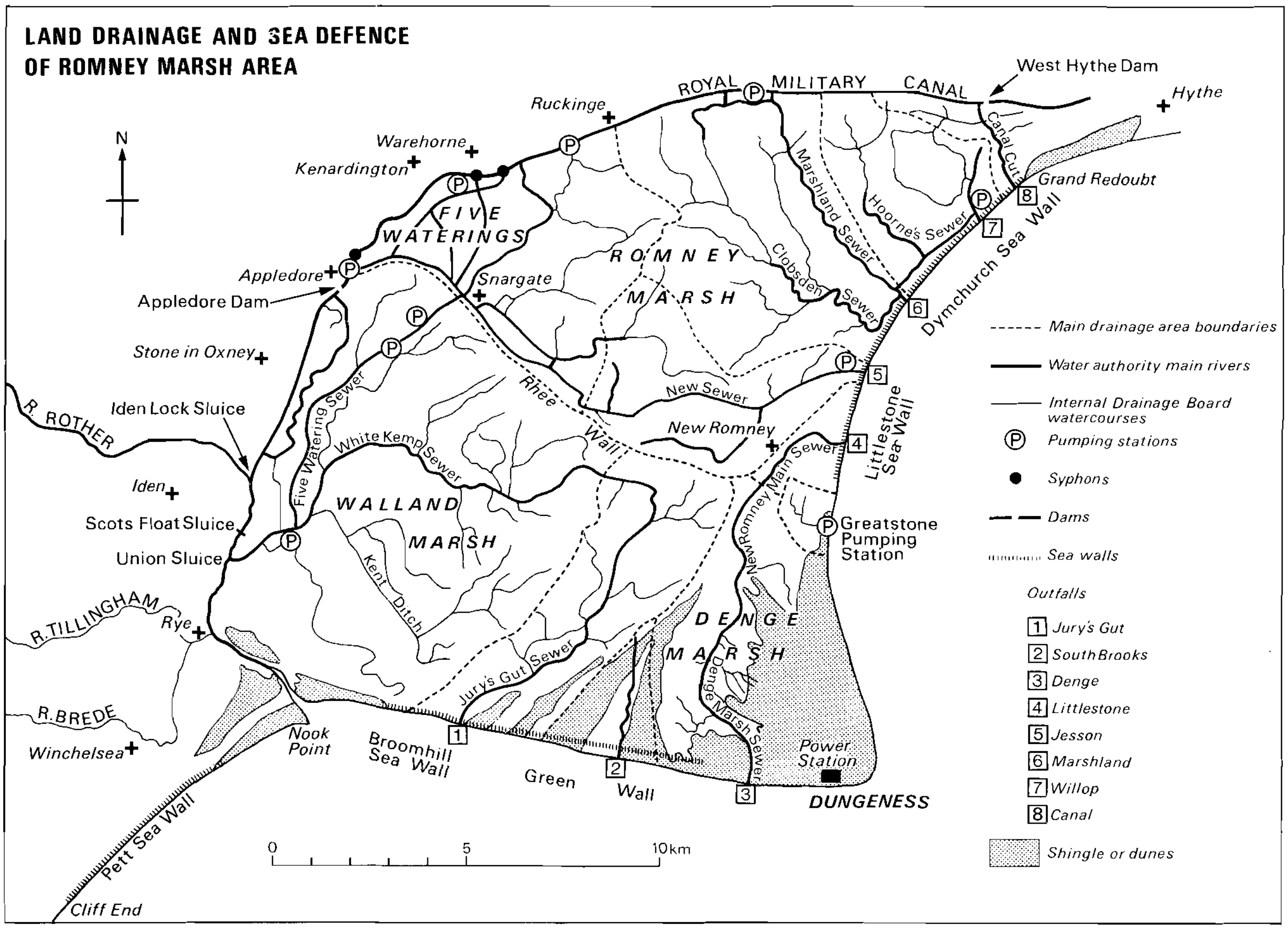

Fig. 13.1 Land drainage and sea defences of the Romney Marsh area.

attack on the upper apron and reduce the amount of over-topping. Although some four times as durable as concrete, by the time the work was carried out the considerably greater cost of granite was not acceptable. The whole of the existing apron was grouted to fill cavities and the part below high water level was thickened with concrete and extended some 6.00 m seaward of the existing toe to newly-driven oak sheet piles. The thickened apron was then faced with pre-cast 38.1 cm cube gap graded concrete blocks. A reinforced concrete road incorporating a wave wall 0.75 m high at the landward edge was constructed along just over a kilometre of the wall crest, the total cost of the work being £440,000. After some 25 years of life this apron was again showing signs of movement and further deep grouting has been carried out and reinforced concrete bulkhead beams installed.

The wave wall is now 7.90 m above Ordnance Datum Newlyn. Spring tide level at Dymchurch is about 3.35 m AODN with a range of 6.71 m, and the highest recorded tide (in October 1967) is 4.95 m OD in Rye Bay. Near Grand Redoubt the wave wall is 9.15 m above foreshore level and the wall is 57.91 m wide between the road behind it and the toe piling (Fig. 13.2.10).

Pett Wall

Until about 1930 the shingle beach between Cliff End and Nook Point at the present mouth of the Rother was of adequate height and bulk to form a natural sea defence but then, probably as a result of successful efforts to stop erosion further west, the supply of shingle gradually died away.

Between 1933 and 1936 a timber breastwork some 6.5 km long was built to form a solid crest to the beach with groynes to retard the littoral drift. A timber pile wave screen was built in front of the groynes to reduce the impact of waves on the beach. Between 1947 and 1952 a massive steel pile, concrete block and asphalt wall was constructed along some five kilometres of this foreshore with a crest level of 7.31 m OD (Fig. 13.2.1) and at a cost of £700,000, but still the erosion of the foreshore continued and within a few years the toe of the wall was in danger of being undermined. Rather than trying to keep pace with the natural process by extending the rigid wall seaward, a system of beach recharge was carried out and regular shingle feeding continues (see below).

Broomhill, Jury's Gap and Littlestone Sea Walls (Figs. 13.2.5, 13.2.6 and 13.2.9) with similar histories are also currently maintained by shingle feeding.

Shingle and sand beaches

The shingle promontory of Dungeness (Figs. 13.2.7 and 13.2.8) is above high tide level, though for a distance of 6.5 km south of Lydd the natural sea bank is backed up by the Green Wall, a man-made embankment of shingle and clay which helps to prevent sea water seeping up the 'lows' to Lydd. The sand dunes at Camber (Fig. 13.2.4) and Greatstone rise to a level of about 12.20 m OD so that sea walls as flood defences are unneccessary. These dunes have been restored during the past 25 years by erection of fencing to arrest wind-blown sand and to confine traffic to defined paths to limit damage to sand-anchoring vegetation.

Beach recharge

Where shingle beaches form an important element of sea defences, as with much of the Romney Marsh coastline, the recently developed method of beach recharge is a most effective system of maintenance and improvement. The process is well illustrated in the Pett Level coastline. 153,000 cu m of shingle was dug from the accumulation at Nook Point (Fig. 13.2.2), transported by lorry and deposited on the seaward side of the Pett Level wall to establish a beach profile with top level above normal tides and a thickness adequate to absorb the energy of the attacking waves. An annual recharge of about 19,000 cu m of shingle excavated from the foreshore west of the Rother outfall keeps pace with the erosion and has the additional advantage that it keeps the Rye harbour entrance free from blockage.

Similar problems at Broomhill, Littlestone and in front of the Dungeness Power Station are being dealt with effectively and economically by the same process. Modern bulk material handling techniques make possible the movement of large quantities of shingle which might have daunted our predecessors.

Land Drainage

Although the sea, through the agency of plentiful supplies of shingle and alluvium, gifted the land of the marshes, man's own efforts drained the land and contributed to making it habitable and agriculturally profitable. Most high tides rise to levels significantly higher than the marsh level so that it is only during the low tide period that drainage can take place through the outfalls through the sea walls. To prevent sea water flowing back on to the land during high tide the outfalls are fitted with tide flaps, timber doors hung by links or hinges along their top edge, or doors hinged at their sides like lock gates 'pointing' into the sea. The doors or flaps are usually hung at the inland end of embanked tidal basins just inside the sea walls to avoid the damage by wave action which would occur if they were fixed on the seaward face of the sea wall.

Romney and Walland Marshes

The earliest outfalls were probably built through the Appledore walls in the western corner of Romney Marsh to carry the run-off from the Five Waterings of Speringbrook, Abbatridge, Sedbrook, Brenzett and Yoakes into the Appledore Channel.

As the sealing of the Rother's outlet at New Romney (Tatton Brown 1988; Green 1988) altered the pattern of sea defence, so it altered the drainage problems. Outfalls, or gutts, were built through the ever-growing Dymchurch Wall at Clobsden, Marshland and Willop, the last two close to the sites of present-day outfalls. Rillways (natural meandering channels) in the marsh were deepened and in some places straightened to lead water from the marsh and from the high ground beyond it to the outfalls. Problems increased in the western part of the marsh due both to the silting up of the Appledore Channel and to shrinkage of the peat in the Dowels.

At a stroke and by the fortunes of war the drainage pattern was again radically altered when in 1804–6 the Royal Military Canal was dug around the north-western perimeter between Iden and Hythe. Primarily a military defence the canal also served for a short time as a route for heavy supplies from Rye Harbour to the garrisons at Shorncliffe – but its importance to land drainage was quickly appreciated. Upland water from hills inland which previously had to pass through the marsh sewers was now directed to the sea at the Seabrook outfall east of Hythe or to the Rother at Iden. Windmills lifted water from the Dowels into the embanked canal and in 1852 the first steam pump was built at Appledore. This was replaced in 1876 by an improved steam engine and at the same time the Canal Cut was constructed to take canal water to the sea by a shorter route than by way of the Seabrook Outfall, through the Dymchurch Wall near Grand Redoubt. An earth dam was constructed across the canal near the head of this cut at West Hythe to reduce the amount of water passing through Hythe to the Seabrook Outfall.

In 1938 diesel pumps of 1.37 cumec capacity were constructed at Kenardington to lift water into the canal from low-lying marshland on both sides of the canal, that from the north being syphoned under the canal. In 1949 the steam engine at Appledore was replaced with diesel-powered pumps similar to those at Kenardington. Electrically powered automatically controlled sets have recently been installed at Warehorne, Ruckinge and Bilsington, all discharging into the canal which then gravitates to the sea. The pumps at Bilsington and Warehorne are Archimedean screws, probably one of the most ancient forms of water-lifting equipment, looking rather like the inside part of a meat mincer, revolving in a concrete trough, semi-circular in section and tilted at 30° to the horizontal, 'screwing' water uphill.

The Royal Military Canal, military defence work, highway, land drain, fishery and a thing of great beauty, has yet one further facility not immediately obvious – namely as a reservoir during the dry summer months

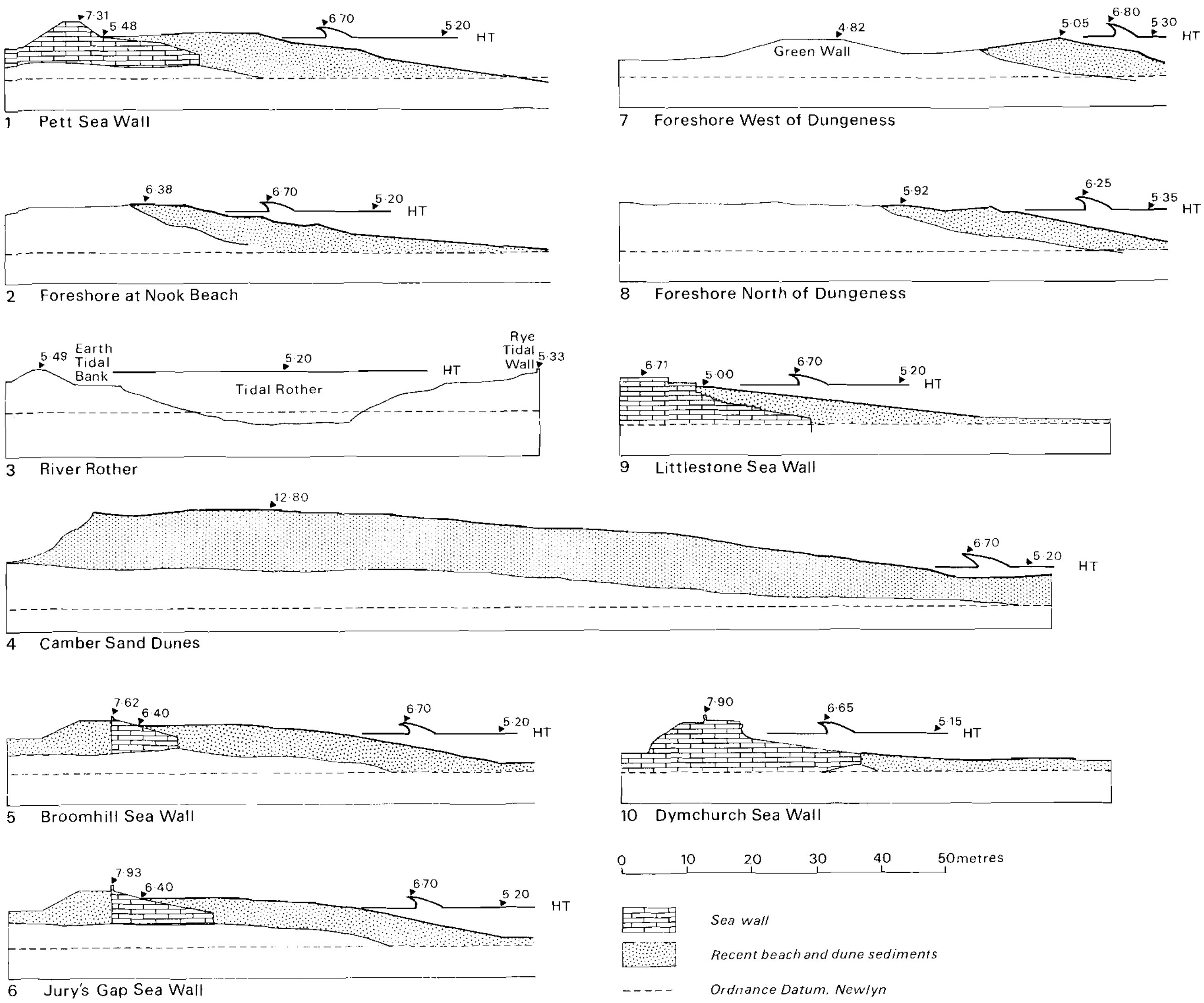

Fig. 13.2 Sea defences between Pett Level and Dymchurch. Sections show natural beach and dune profiles and sea walls. HT levels represent highest predicted astronomical tide for 300-year return period; associated maximum wave crest heights are also shown.

when its water, impounded by sluices at Appledore and West Hythe, can be fed through penstocks (pipes fitted with screw-down valves) into the thirsty marsh sewers.

Time has gone full circle with the construction in 1969 of a 7.14 cumec pumping station near Union Sluice, primarily to drain Walland Marsh into the tidal Rother. This pump has some capacity to spare for some Romney Marsh water which now passes under the Rhee Wall at Vinal Bridge, Snargate and across Walland Marsh via the Five Waterings Sewer. Very recently electrically powered automatic pumping stations have been constructed at the outfalls of the Greatstone Sewer, the New Sewer at St. Mary's Bay and the Hoornes Sewer at Dymchurch, augmenting gravity outfalls which are tide-locked for about half the tidal cycle.

The valleys of the Rother, Tillingham and Brede

Between Bodiam and the sea, a distance of 27 km, the Rother valley lies below MHWST (+3.66 m OD). The Wet Level, which was reclaimed early on, is the lowest ground, lying on average at +0.92 m OD. Land reclaimed later is higher because it continued to be raised by the silt deposited by the tides. The Rother is tidal up to Scots Float Sluice. The valleys of the Brede and Tillingham are similar but shorter and their water enters the Rother estuary through tidal sluices at Rye.

The uplands of the Rother catchment are steep and relatively impermeable; consequently in wet weather there is a high rate of run-off. The lowland valley between Bodiam and Scots Float Sluice then becomes a flood storage lake which can discharge only intermittently between each high tide. Not only is the river incapable of storing this water within its banks when it is tide-locked, but when tide-free its discharge is restricted by the small cross-section of the upper reaches of the estuary (Fig. 13.2.3). These two factors result in frequent and extensive flooding of the valley.

The exceptional floods in November 1960, when the peak run-off came at the end of an extremely wet period of five days, exceeded in level anything previously recorded, and most of the valley was inundated.

Between 1966 and 1980 the Rother Area Drainage Improvement Scheme was installed. The banks of the river were raised so that they would not be overtopped, except through the Wet Level, and the lowlands were pumped into the high level river. Watercourses carrying a large amount of upland water were similarly embanked. Twenty Archimedean screw pumping stations were installed to drain the marsh areas and also deal with the upland water. Reorganization of the marshland drainage was necessary behind some of the pumping stations. The Wet Level, an area of about 280 ha, continued to be used as storage for periods when the flow of the river is stopped by the tide, but the banks along the Wet Level were raised so as to delay its flooding to periods of highest possible flows, thereby increasing the discharge though the estuary as much as possible.

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