WAVENEY DISTRICT COUNCIL

TECHNICAL AND LEISURE SERVICES DEPARTMENT

ENGINEERS DIVISION

A BACKGROUND NOTE TO

COASTLINE MANAGEMENT IN WAVENEY

ADMINISTRATION

There are three principal groups of agencies who are responsible for the maintenance of the coastline of England and Wales.

The National Rivers Authority look after those lengths of the coast where the natural or built defences provide protection to low-lying areas against flooding. These are referred to as sea defences. The principal legislation which provides them with the powers to carry out this function is contained in the Land Drainage Act 1991 and the Water Resources Act 1991 .

The Maritime District Councils (Such as Waveney) are the Coast Protection Authorities for England. Coast protection is the protection of land from erosion by the sea. There is no obligation on the District Councils to protect all eroding shorelines and, for a number of reasons, this would be an unwise policy. The equivalent empowering legislation is the Coast Protection Act 1949.

The Ministry of Agriculture Fisheries and Food have the Central Government coordinating role for England and Wales. It is they who ultimately give consent under the various Acts for works to proceed. In recognition of the national importance of coastal management they also allocate Government-funded grant aid to the N.R.A. and District Councils for providing new capital works. MAFF are also instrumental in sponsoring research into coastal processes and in developing new engineering techniques.

Other bodies may have responsibility for individual lengths of coastline which protect their particular interests. These bodies include Associated British Ports, British Rail and the Ministry of Defence.

The allocation of coastal responsibility within Waveney District is shown on the map in Appendix A.

Criticism is often raised about the number of agencies involved in management of the coast, - the argument usually includes the fact that the sea itself does not recognise these largely administrative boundaries. Apart from the position of MAFF as the principal coordinating body there now exist a number of Coastal Groups which cover virtually the entire coastline of England and Wales. These groups bring together the various authorities for a region to ensure compatibility in dealing with the prevailing conditions and, where it is appropriate, develop a regional strategy within which its constituent members can manage their own interests. The chairs of these groups also meet together under the aegis of the MAFF run Coastal Defence Forum.

The funding of coast protection maintenance works is borne by the District Councils and forms part of their Standard Spending Assessment for each financial year. The proportion of the cost of capital works, net of grant aid, which falls to the Councils is covered by Supplementary Credit Approval entitling them to finance their share of the cost through borrowing. Under the terms of the Coast Protection Act the County Councils are required to pay a contribution towards the cost of schemes, again, net of any grant.

ENGINEERING TECHNIQUES

A variety of methods have been used throughout the years to try and secure the position of the coastline and prevent coastal flooding. Generally speaking there is no difference between the techniques used in sea defences and coast protection - the same coastal processes are being dealt with in both cases.

In the past heavy reliance has been made on "bulwark" defences which have been designed to reflect the destructive energy of waves. This is typified by the traditional sea wall, many examples of which can be found at Lowestoft, Kessingland and Southwold. In some cases this would still be the chosen method of protecting a given length of coast, particularly where the amenity benefit of the resulting promenade is particularly valued. The design of the face of such walls has developed over the years and will usually be found to incorporate some form of shaping designed to reflect the wave back in the direction from which it has come. The walls will normally have a concrete "apron" in front which will be provided to try and resist undermining of the toe of the wall. Unless the levels of these aprons have been very carefully designed, taking into account all possible levels of the beach in front of them, there is the chance that they will contribute to instability of the beach because of the concentrations of energy occuring when a reflected wave meets an incoming wave clear of the apron toe. The downward component of the resultant wave can cause significant scour to the beach.

Appendices B,C,D,E and F show the typical form of some of the sea walls which have been built within the District over the years.

The costs of building such walls will vary considerably depending on the form of construction and their location but a figure of £3-5million per kilometre is typical.

At Corton and Kessingland timber breastwork defences have been constructed. A cross section of this form of defence is shown in Appendix G. This system costs less to build than a concrete sea wall but the maintenance costs can be quite significant. Because of the porous nature of the structure a certain amount of erosion may continue, particularly during storms, and for this reason it would be an inappropriate means of protecting high value property.

Another early form of defence which is still in wide use today is the groyne. A number of these are usually found together forming a groyne field in front of a sea wall or natural cliff or dune system. The basic principle behind the groyne is to intercept beach material which is being driven along the shoreline by waves and tidal currents so that it can be stabilised in one place where a beach is required for amenity or coast protection purposes.

Groynes can be seen working to good effect on the South Beach in lowestoft and in front of Southwold. In some other places the structures have been allowed to fall derelict. This is particularly the case where experience has shown that they have not been effective, perhaps because the dominant movement of beach material is on-off shore rather than alongshore.

The typical "Waveney" groyne consists of a double row of timber king piles connected by horizontal crossheads and walings. The timber used is greenheart or balau, both of which have been chosen for their strength and resistance to worm attack. If timber is required for new construction or repair we ensure that it is derived from a sustainable resource in accordance with the Council's Environmental Charter.

To this framework is fastened a line of steel sheet piles. One of the main maintenance problems is the abrasion which exists where the sand and shingle is moved along the groyne at beach level. You will note that several groynes have

more than one line of sheet piling indicating that a second, replacement, line has been required because of this. Appendix H shows a typical cross-section through a timber and steel groyne.

Again the cost of building an individual groyne will vary because of its plan length and the length of the required piles. A new groyne, of the type described above would cost £250-300,000 to build.

In more recent years the Council has been using rock armour, both to build new structures (such as the breakwater at Childrens Corner, Lowestoft) or to improve the hydraulic performance of existing defences, (an example being the works at Ness Point Lowestoft).

Rock armour has many advantages when used in marine structures. It is obviously very durable being, in most cases, some form of granite. When placed, it allows for the absorption of much of the wave energy. This leads to more calm conditions which are more conducive to the deposition of sediments. The structures require minimal maintenance and when they do sustain damage repairs should only consist of replacing dislodged rocks. Construction in rock is very flexible, allowing for the final shape of any structure to be "fine tuned" until its desired performance is achieved. Appendices I,J and K show the use of rock at three sites within Waveney.

These techniques cover the main forms of construction used by the Council over the years. The plan in Appendix L shows the disposition of defence strucures within the District.

In the future we will be considering more "soft" engineering solutions to our coastal problems. These include beach nourishment, where sand and shingle is dredged from offshore and placed on the beaches. Where natural dune systems exist they can be strengthened and protected and, particularly where there is low-

lying land a policy of managed retreat of the defence line can be considered if the land use is suitable.

COASTAL PROCESSES

The shape of the Waveney coastline has evolved throughout geological history largely through the action of the sea on its soft geology. This is a continuing process and it is considered by some that coast protection works are only "buying time" until the cumulative effect of incremental changes is sufficient to make them ineffective.

Waves have the most noticeable effect on the coastline. They are produced as the result of the frictional effect of the wind on the surface of the sea. The longer the wind has to exert this effect, the higher the waves that are produced. This means that, for the Waveney frontage, winds from the north-east are generally most significant as the "fetch", or length of open water over which the wind can have an effect, is greatest from this direction.

The northern part of the District coastline is largely protected by a complex system of off-shore banks lying off Lowestoft and Great Yarmouth. These banks vary in size and position but always remain a feature of this part of the North Sea. Their effect is to restrict the height of waves which can pass over them, thereby limiting the amount of destructive wave energy which can reach the beaches. They also act to refract waves or change their direction.

Storm waves breaking on a beach will disturb the particles of beach material. Heavier sediments such as shingle will be tumbled along the sea bed and will tend to be moved along the beach in the dominant direction of the waves. Lighter sediments such as sands and silt may be put into suspension in the water when it is more likely that they will be moved by tidal currents. This can mean that the destructive effect of a particular storm may be governed by the state of the tide when it occurred.

The mean spring tidal range at Lowestoft is 1.9metres, from +0.9m to -1.0m Ordnance Datum (OD). At Southwold the equivalent range is +1.2m to -0.9m. High water at Southwold is approximately 35 minutes after Lowestoft. The strength of the current is very variable but spring flood tides can run at approximately 2.5 knots.

The southern North Sea is prone to tidal surges when atmospheric and climatic conditions can combine to add significantly to the predicted tidal level. It is such events which cause large scale flooding as occurred in 1953 and the damage to defences in February 1993. Levels of 3.4m O.D. and 2.7m O.D. were reached on these respective occasions. Predictions on the effect on sea level of global warming vary amongst the various researchers in the field. This Council is assuming a rise in level of 6mm/year in carrying out the design of new works.

EROSION HISTORY

The Waveney coastline experiences some of the worst coastal erosion in the country. This is because of its exposure to the hostile North Sea environment and its particularly soft geology.

At Corton, before the construction of the present sea wall in the late 1960s erosion had lead to the loss of property. The remains of the former "Colmans" sea wall can still be seen and the amount of erosion which took place after its collapse is indicated by the position of the new wall. The remains of the cellars of a house can still be seen in the upper part of the cliff behind the wall.

Pakefield has suffered considerable losses throughout the centuries with much of the original settlement having now vanished. This continued until the 1930s since when the provision of sea defences have stabilised the beach.

The village of Kessingland has been vulnerable to erosion in the past necessitating the construction of the present sea wall. However the continuing northward movement of the former Benacre Ness is now providing an increasingly wide beach in front of the village.

Between Benacre and Easton Bavents the coastline has no built defences and this frontage experiences the most severe erosion in the region. At Covehithe an annual average rate of retreat of the cliff edge has been estimated at 5 metres per year. This reduces as one moves south but it is still of the order of 2-3 metres per year at Southwold.

Appendices M and N show how the coastline has eroded at Pakefield, Covehithe and Easton Bavents.

COUNCIL POLICY

The Council has recently commissioned consultants to help it to prepare a shoreline management strategy to take it into the next century. This strategy is still being prepared but some important features can already be declared.

Before any scheme of protection works can be approved it must meet three main criteria.

Firstly the scheme must show a positive cost-benefit. This means that the cost of carrying out the work must be matched or exceeded by the calculated present-day value of the benefits which will result. The methods of calculating the benefit are somewhat complicated but may include the value of property lost to the sea, restoration oor diversion of public utilities, loss of amenity beaches etc..

Secondly the scheme must satisfy environmental criteria. Major schemes will require that a full Environmental Assessment is carried out to look into the full impact which the proposed works will have on the surroundings both during construction and in service. The coastline to the south of Kessingland has many statutory designations including being an Area of Outstanding Natural Beauty and a Site of Special Scientific Interest. It is unlikely that any known techniques for coast protection could be used on this frontage without seriously jeopardising these important features.

Thirdly it is important that the coastline is looked at in an integrated way. The material forming a particular beach has been derived from the erosion of a cliff updrift of that beach. Clearly preventing that erosion taking place will be to the detriment of the dependent beach. A particular example of this is the relationship between the erosion at Covehithe and the maintenance of the Southwold beach.

As a result the situation has arisen whereby the main coastal settlements of Corton, Lowestoft, Pakefield, Kessingland and Southwold have the benefit of some form of built protection. It is unlikely that the lengths of protected coastline will be extended in the foreseeable future because any such proposal would not meet at least one of the criteria listed above.

OTHER REFERENCES

National Rivers Authority - Ipswich Area	0473 727712
Suffolk County Council (Heritage Coast)	0473 230000
English Nature (SSSI and National Nature Reserves)	0284 762218

Local libraries will have books of local interest including descriptions of coastal erosion and activities on the coast.

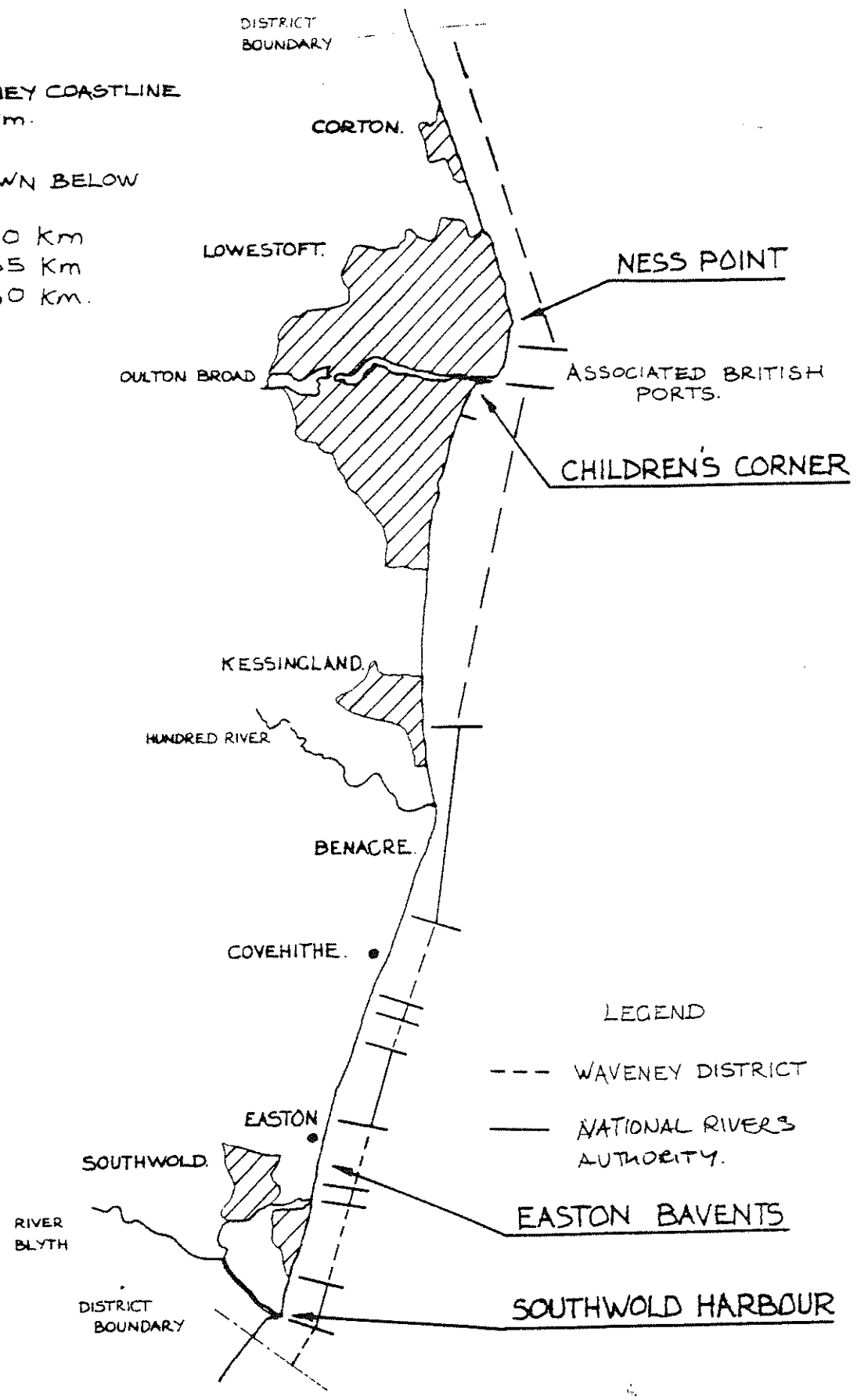
Local papers will have archive records giving details of flooding and coastal erosion events.

Suffolk County Council Records Office may be able to help with old maps and documents	0473 231710

LENGTH OF WAVENEY COASTLINE
26·05 Km.

DIVIDED AS SHOWN BELOW

W.D.C.	18·90 Km
A.B.P.	0·55 Km
N.R.A.	6·60 Km.

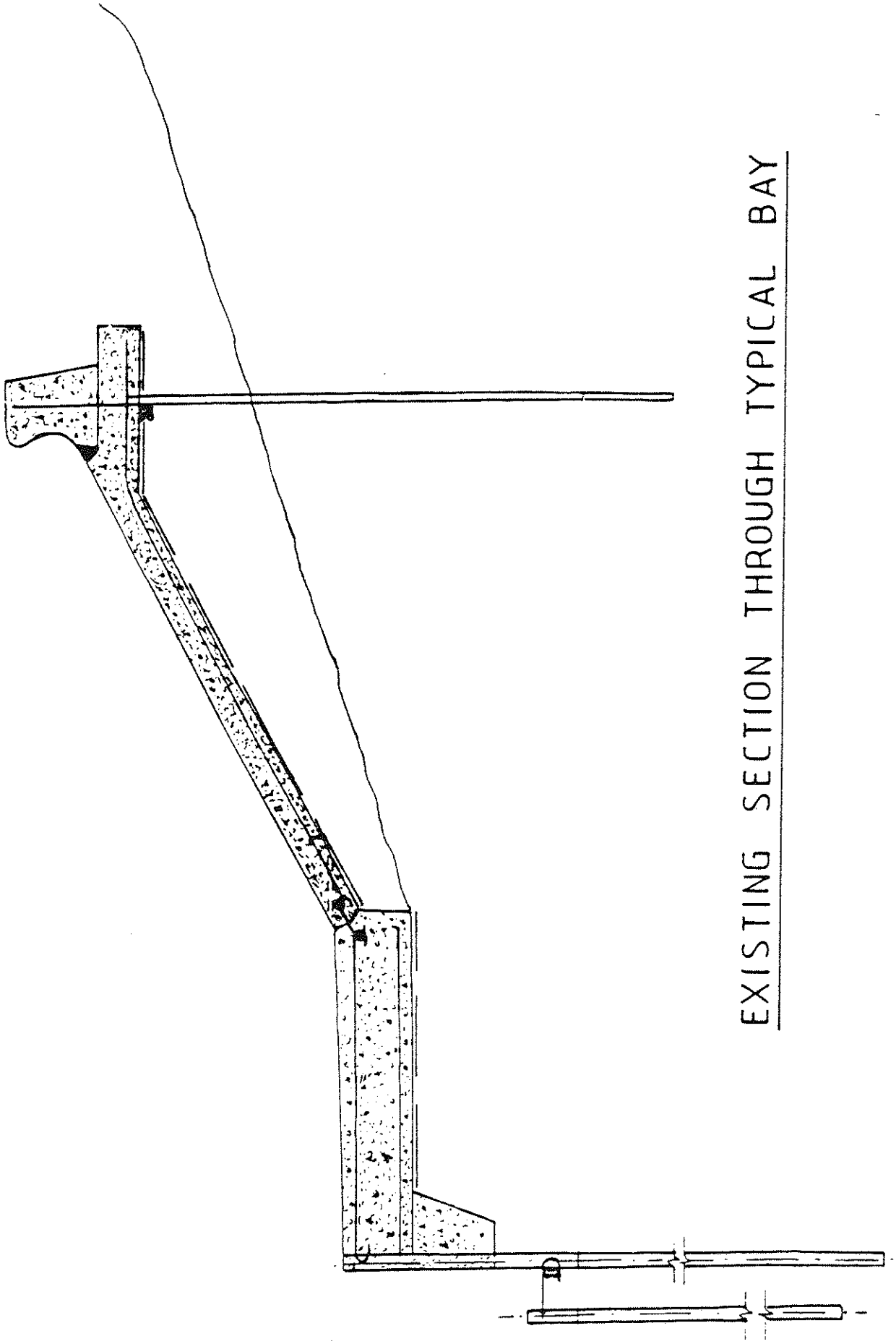


TECHNICAL DEPARTMENT Engineers Division

DISTRICT TECHNICAL OFFICER
TA Oakes C Eng
Mariners Street Lowestoft NR32 1JT
telephone: 0502-562111

WAVENEY COASTLINE
DIVISIONS OF
RESPONSIBILITY.
Scale: N/A Drawn: P.F.P.

Drawing Number
APPENDIX A
Date: 18-8-93



EXISTING SECTION THROUGH TYPICAL BAY

TECHNICAL DEPARTMENT Engineers Division

DISTRICT TECHNICAL & LEISURE SERVICES OFFICER
TA Oakes CEng
Mariners Street Lowestoft NR32 1JT
telephone: 0502-562111

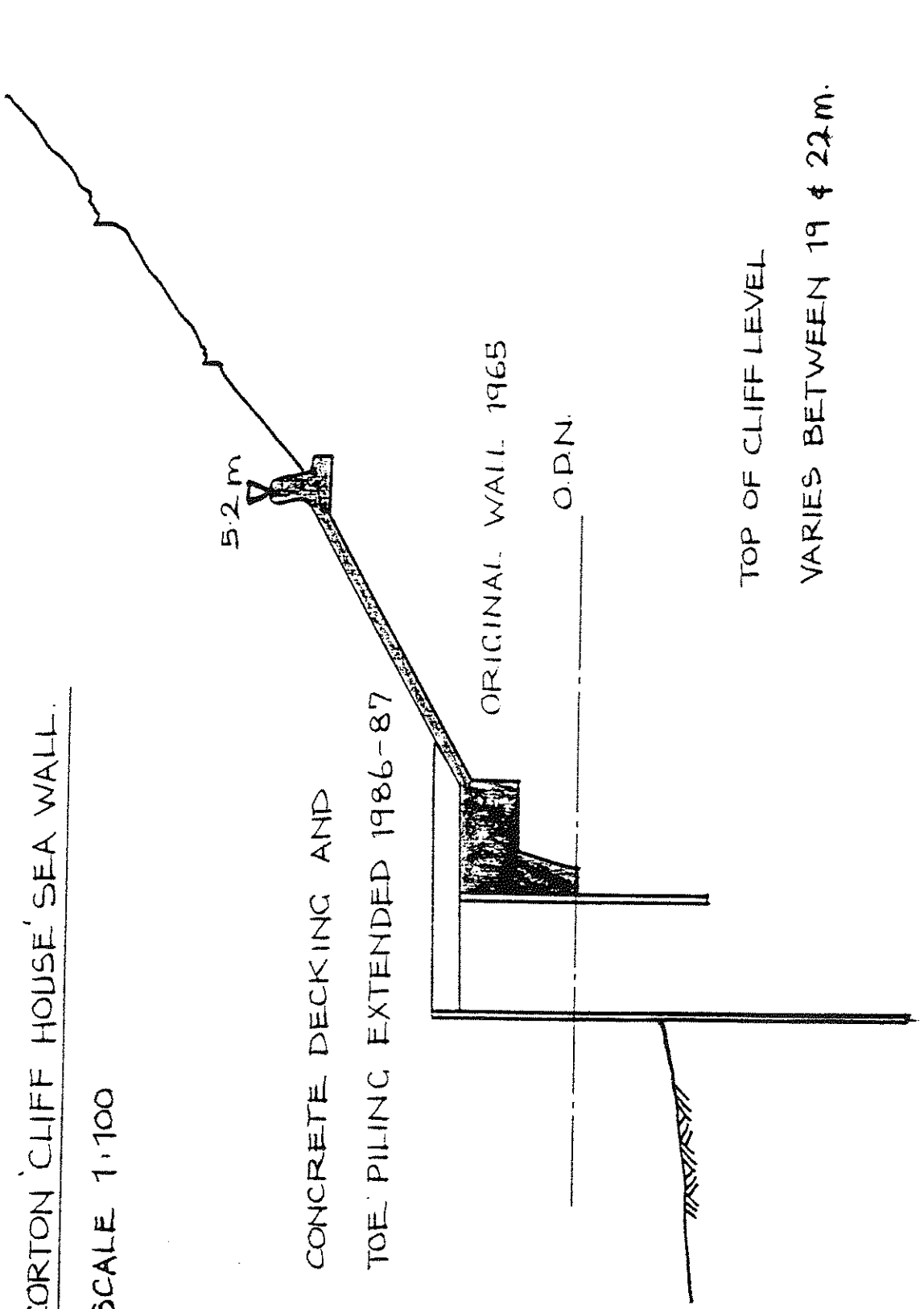
HOPTON SEA WALL.
TYPICAL SECTION THRO'

Scale

Drawn

Drawing Number
APPENDIX B

Date SEPT. 91



CORTON 'CLIFF HOUSE' SEA WALL.

SCALE 1:100

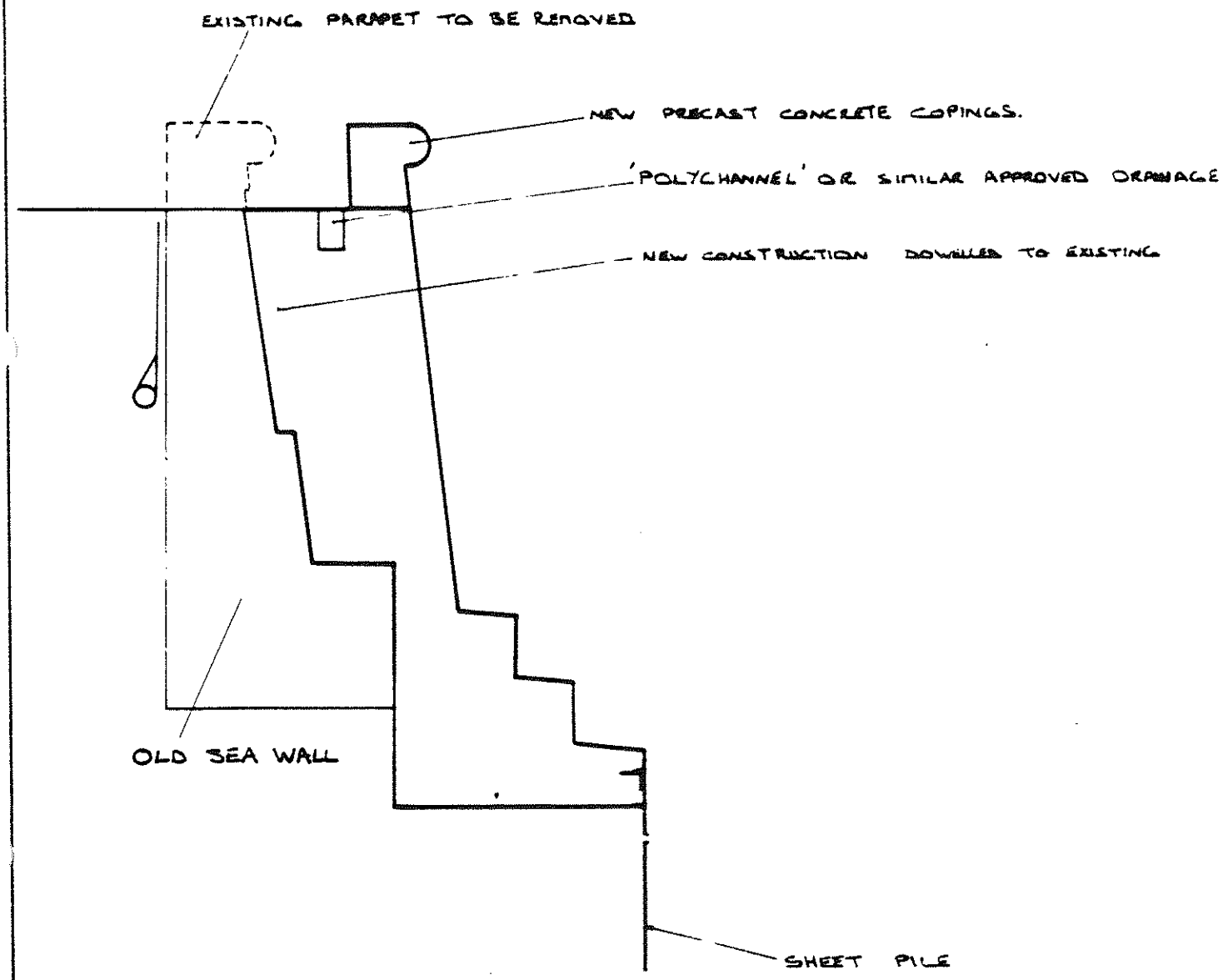
TECHNICAL DEPARTMENT Engineers Division

DISTRICT TECHNICAL OFFICER
T.A. Oakes C Eng.
Mariners Street Lowestoft NR32 1SN
telephone: 0502-62111

CORTON 'CLIFF HOUSE' SEA WALL. SECTION THRO'

Scale: 1:100 Drawn: P.F.P

Drawing Number
APPENDIX C.
Date: 11-4-88

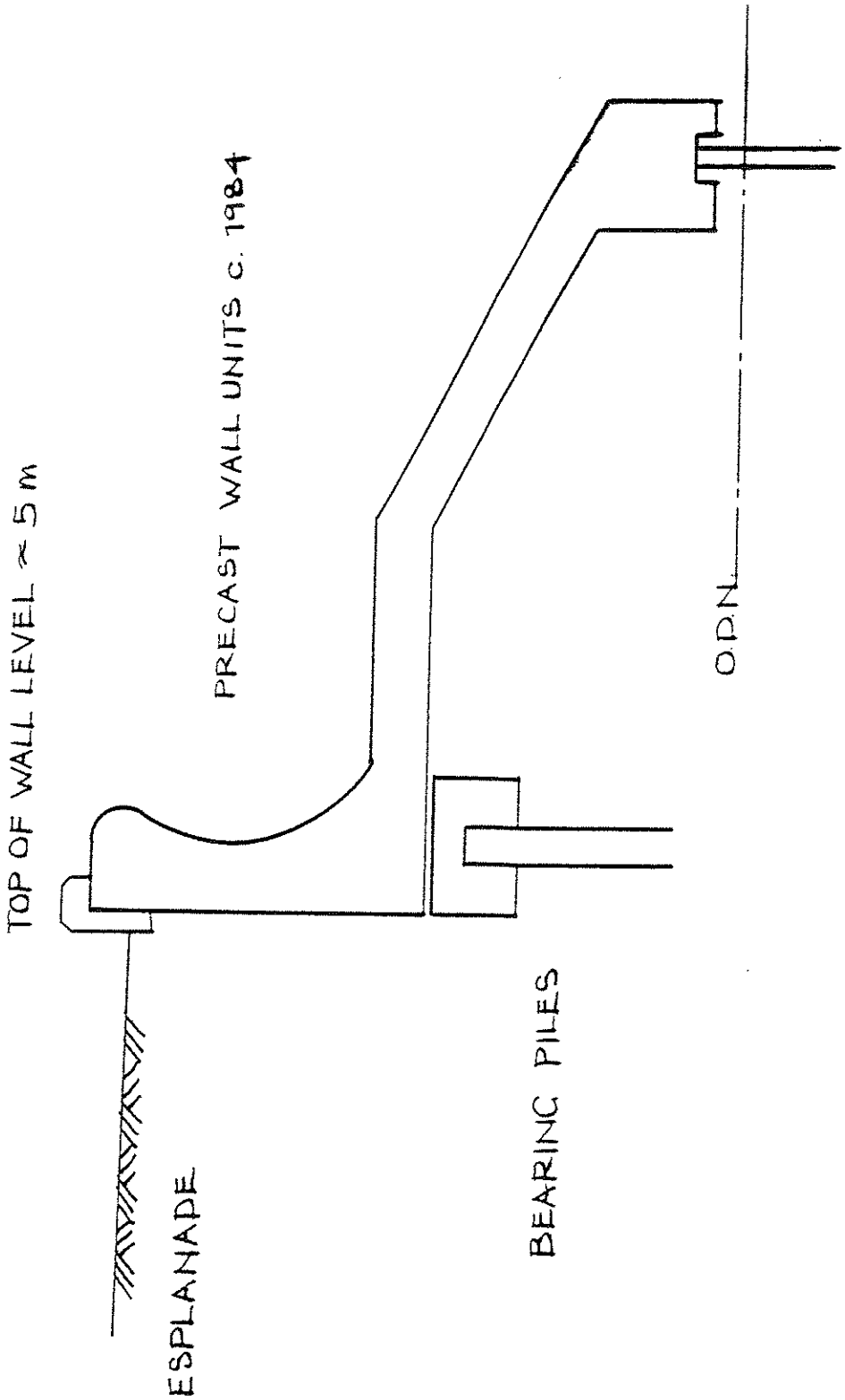


TECHNICAL DEPARTMENT Engineers Division

DISTRICT TECHNICAL & LEISURE SERVICES OFFICER
TA Oakes C Eng
Mariners Street Lowestoft NR32 1JT
telephone: 0502-562111

CHILDRENS CORNER
SEA WALL.
LOWESTOFT.
Scale 1:50 Drawn

Drawing Number
APPENDIX.D
Date MAR. '88



NEPTUNE SEA WALL RECONSTRUCTION

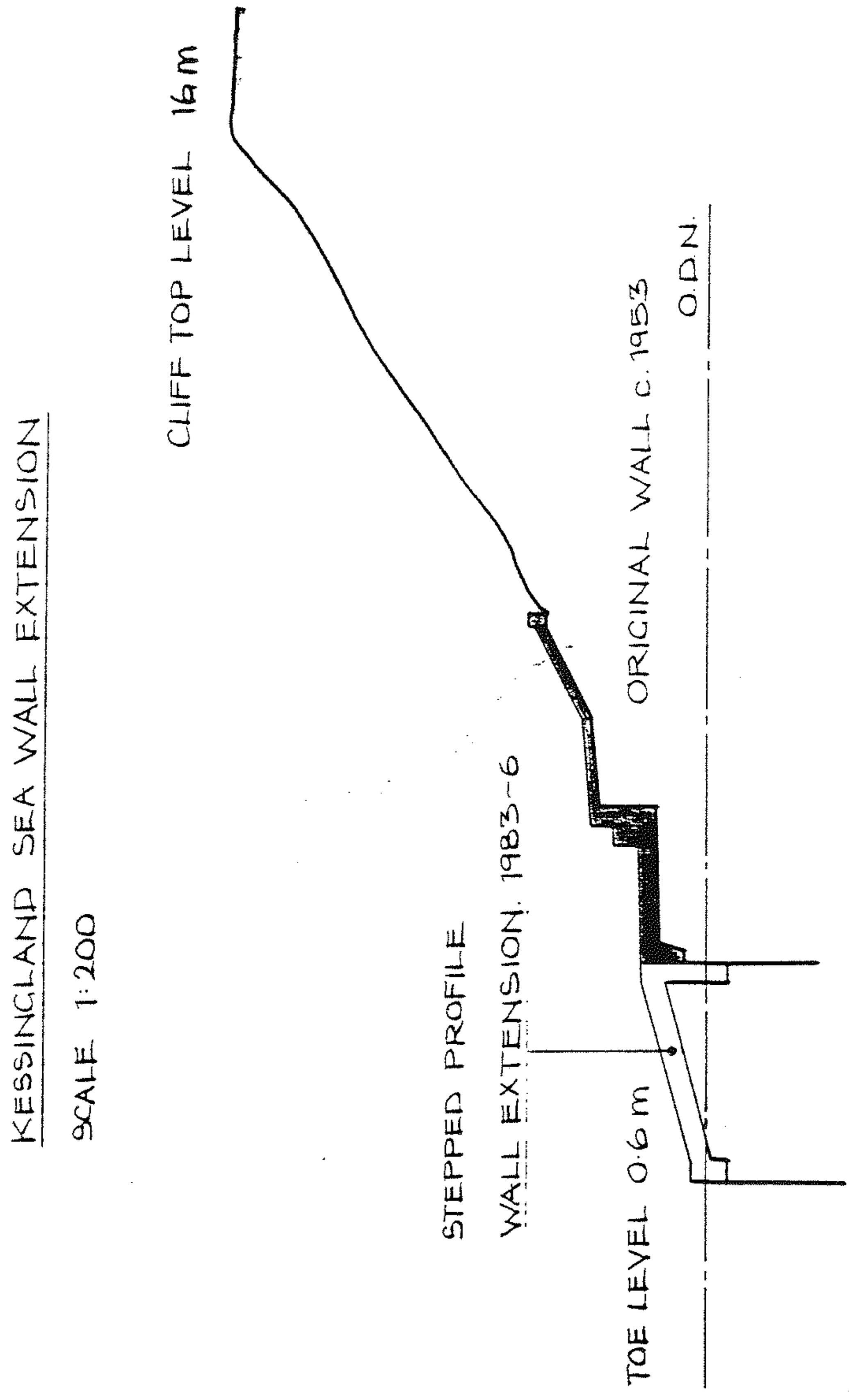
SCALE 1:50

TECHNICAL DEPARTMENT Engineers Division

DISTRICT TECHNICAL OFFICER
T.A. Oakes C Eng.
Mariners Street Lowestoft NR32 1SN
telephone: 0502-62111

NEPTUNE SEA WALL
SECTION THRO'
Scale: 1:50 Drawn: P.F.P.

Drawing Number
APPENDIX E.
Date: 11.4.88



TECHNICAL DEPARTMENT **Engineers Division**

DISTRICT TECHNICAL OFFICER
J. A. Oakes C. Eng.
Mariners Street Lowestoft NR32 1SN
telephone: 0502-62111

KESSINGLAND SEA WALL
SECTION THRO'
Scale: 1:200 Drawn: P.F.P.

Drawing Number
APPENDIX F.
Date: 11-4-88

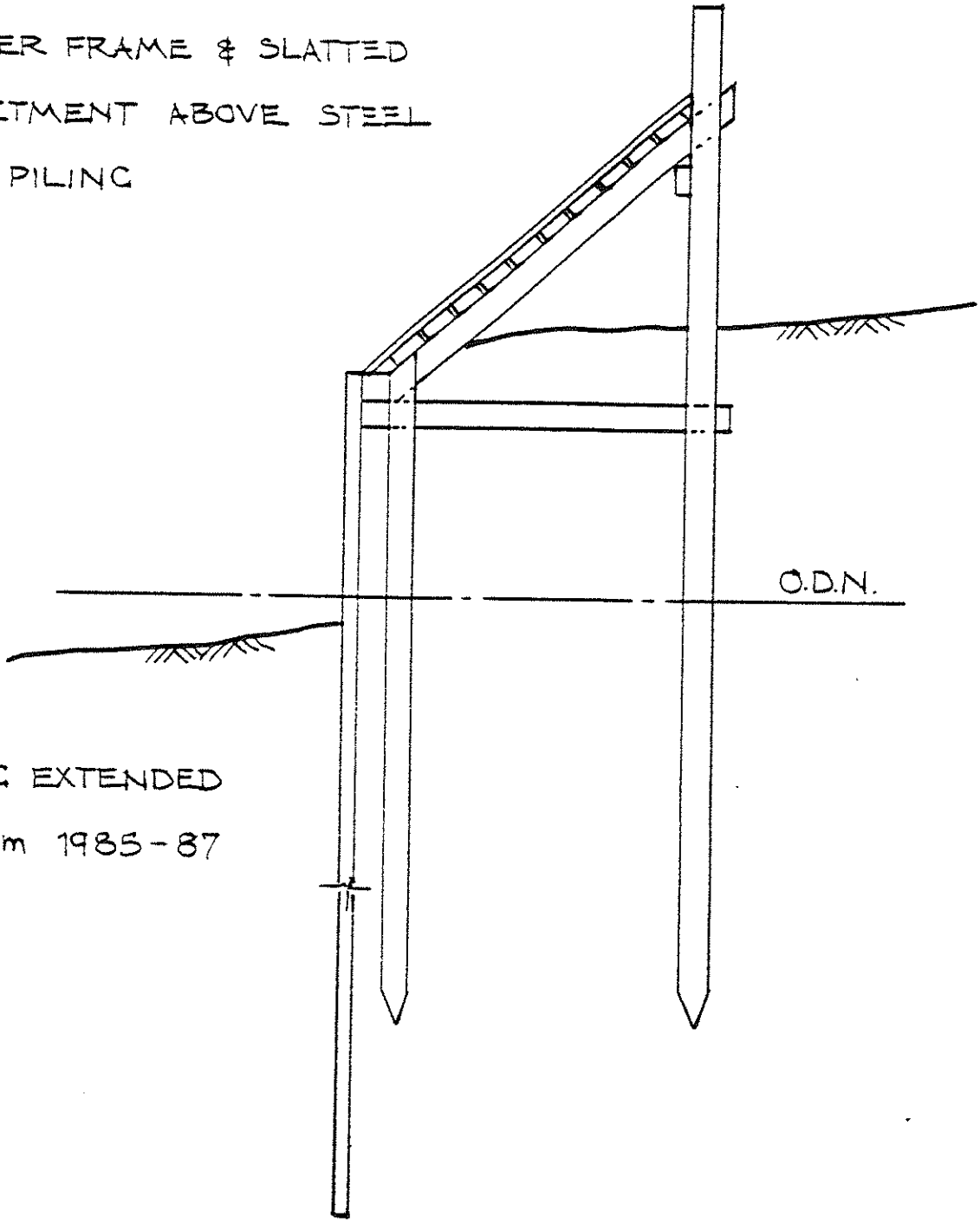
CORTON REVETMENT

SCALE 1:50

ORIGINAL STRUCTURE

1973–74.

TIMBER FRAME & SLATTED REVETMENT ABOVE STEEL TOE PILING



PILING EXTENDED TO 7m 1985–87

TECHNICAL DEPARTMENT Engineers Division

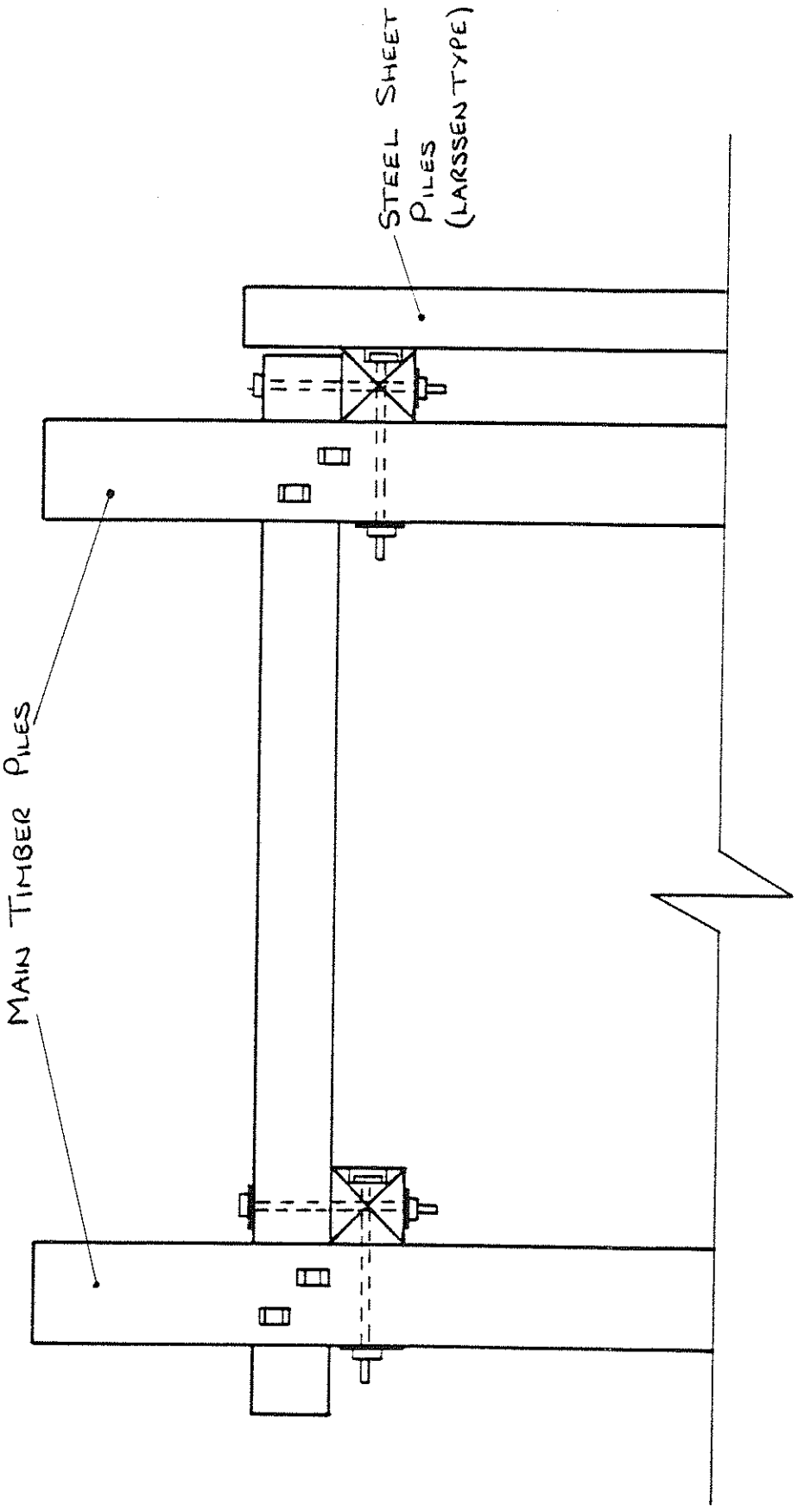
DISTRICT TECHNICAL OFFICER
J.A. Oakes C Eng.
Mariners Street Lowestoft NR32 1SN
telephone: 0502-62111

CORTON TIMBER REVETMENT. SECTION THRO'

Scale: 1:50 Drawn: P.F.P.

Drawing Number APPENDIX 9.

Date: 11-4-88



TECHNICAL DEPARTMENT Engineers Division

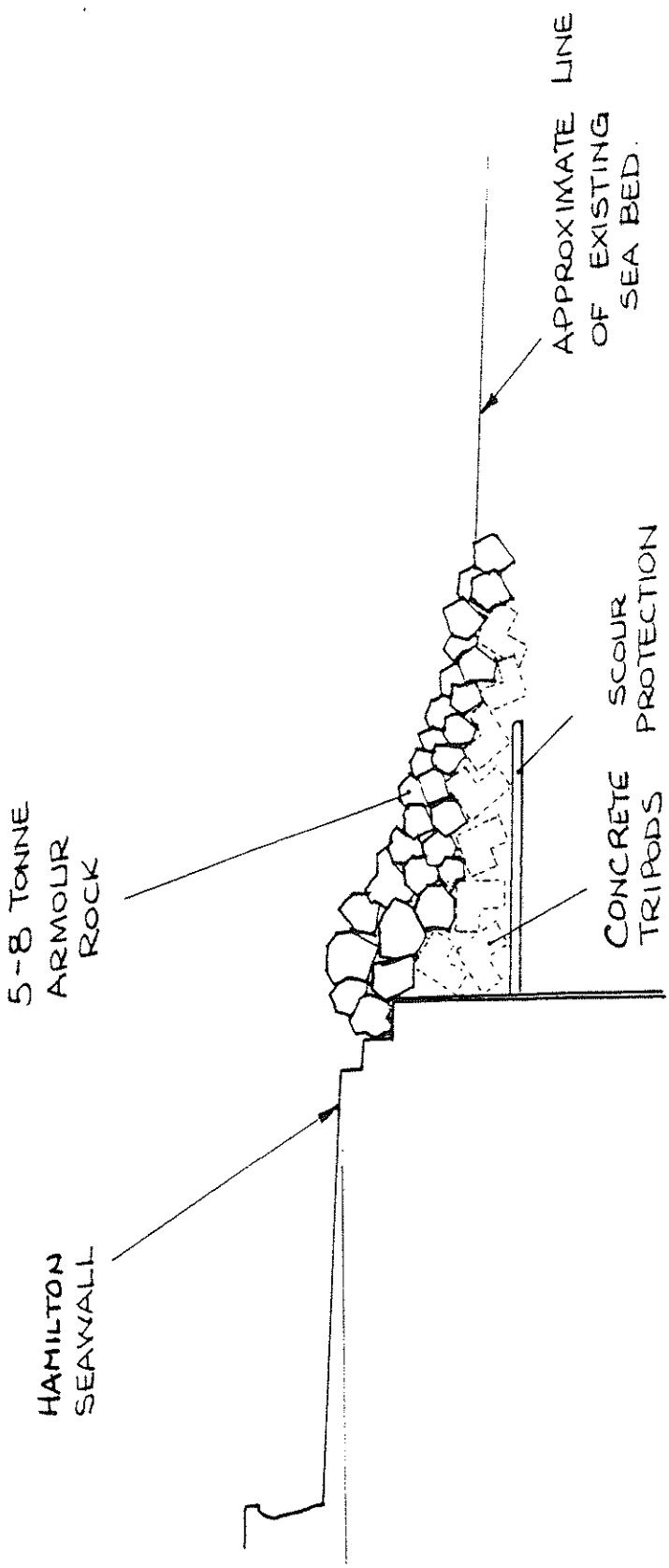
DISTRICT TECHNICAL & LEISURE SERVICES OFFICER
TA Oakes CEng
Mariners Street Lowestoft NR32 1JT
telephone: 0502-562111

SECTION THRO' TYPICAL TIMBER GROYNE

Scale 1:20 Drawn

Drawing Number APPENDIX H.

Date AUG. '88



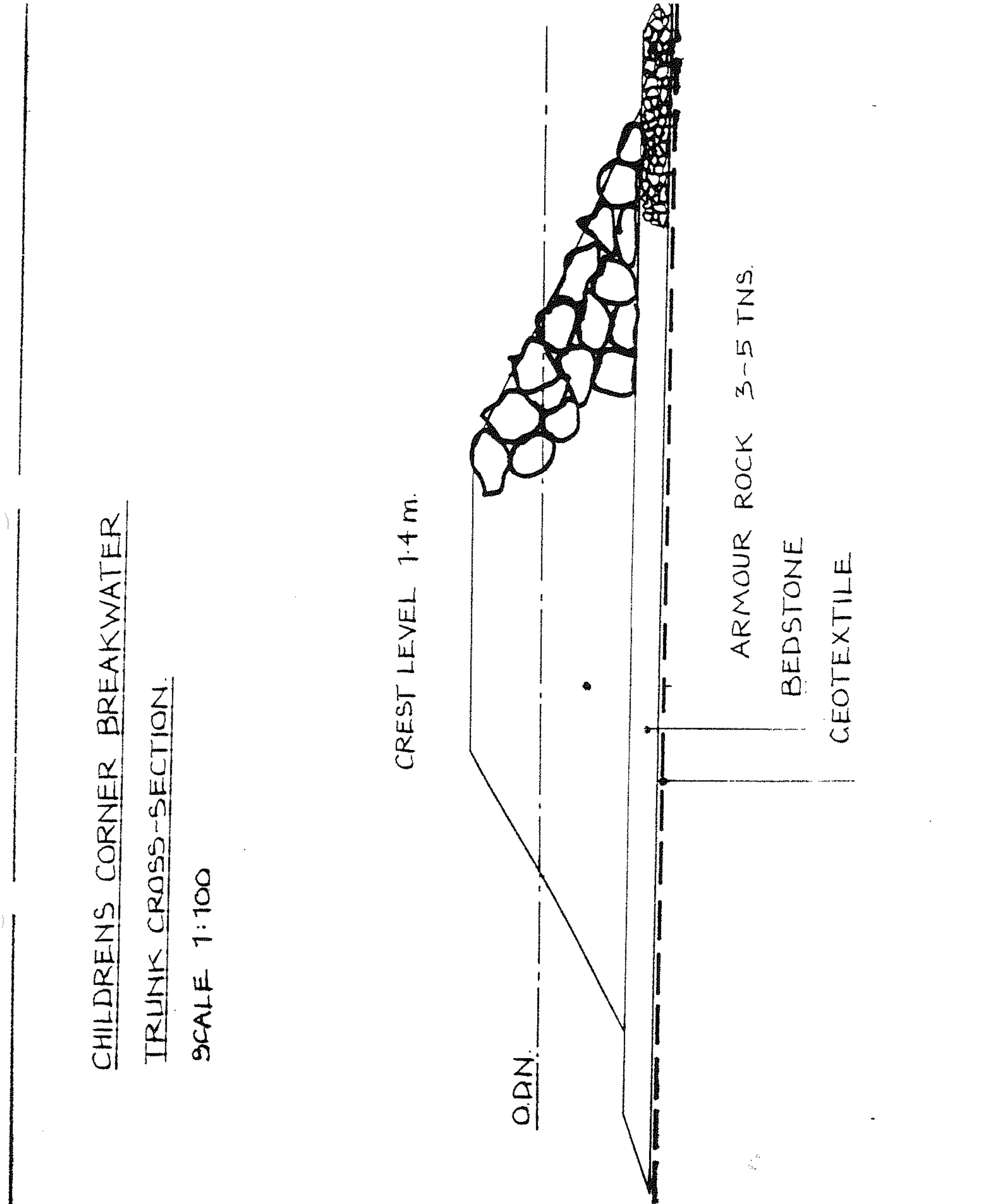
Scale 1:200

TECHNICAL DEPARTMENT Engineers Division

DISTRICT TECHNICAL & LEISURE SERVICES OFFICER
TA Oakes CEng
Mariners Street Lowestoft NR32 1JT
telephone: 0502-562111

HAMILTON SEA WALL AND ROCK REVETMENT.
SECTION THRO'
Scale 1:200 Drawn

Drawing Number
APPENDIX I.
Date FEB. '92



TECHNICAL DEPARTMENT Engineers Division

DISTRICT TECHNICAL OFFICER
T.A. Oakes C Eng.
Mariners Street Lowestoft NR32 1SN
telephone: 0502-62111

CHILDRENS CORNER BREAKWATER.		Drawing Number APPENDIX J.
Scale: 1:100	Drawn: P.F.P.	Date: 11-4-88