REPORT

Southwold Harbour Study

Site Inspection Report

Client: Coastal Partnership East for East Suffolk Council

Reference: PB9485-RHD-ZZ-XX-RP-Z-0001

Status: Final/02

Date: August 2020

Royal HaskoningDHV

Enhancing Society Together

HASKONINGDHV UK LTD.

Rightwell House
Rightwell East
Bretton
Peterborough
PE3 8DW
United Kingdom
Water
VAT registration number: 792428892

+44 1733 334455 **T**
+44 1733 262243 **F**
info@uk.rhdhv.com **E**
royalhaskoningdhv.com **W**

Document title:	Southwold Harbour Study
Document short title:	Southwold Site Inspection
Reference:	PB9485-RHD-ZZ-XX-RP-Z-0001
Status:	03/Final
Date:	August 2020
Project name:	Southwold Harbour
Project number:	PB9485
Author(s):	Euan Hobson
Drafted by:	Euan Hobson
Checked by:	David Cramp
Date / initials:	25/02/20 DC
Approved by:	Amy Savage / Tim Burgess
Date / initials:	04/06/20

Classification
Project related

Disclaimer

Royal HaskoningDHV

Table of Contents

Table of Figures

1 Introduction

This report describes the condition of the existing coastal defences in Southwold Harbour. The report is based on the findings of a defence condition inspection that was undertaken as part of the Southwold Harbour Study for Coastal Partnership east on behalf of East Suffolk Council.

Southwold Harbour is located on the Suffolk coast at the mouth of the River Blyth estuary, with the layout of the harbour shown in Figure 1 below.

Figure 1 - Southwold Harbour Location Plan

The Condition Assessment split the site into 7 locations. These are as follows, and labelled on Figure 1:

- North Wall
- North Pier
- Knuckle
- South Training Wall
- South Pier

The harbour previously supported a major local fishing industry, but this commercial activity has declined and made way for an increase in recreational use of the harbour. Southwold Harbour now attracts many yachting visitors to Southwold and is a focal point for day yachtsmen. Walberswick Beach attracts summer visitors and is a 'walkers' beach throughout the year.

Despite the decline in commercial fishing the area does still support a small but active fishing industry with associated shore-based activities. The harbour is also a base for a RNLI Lifeboat.

2 Site visit details

2.1 General details of inspection

An inspection of the coastal defences at Southwold Harbour was undertaken on 12th February 2020, during both High and Low tide. Weather and tidal conditions during the inspection were as follows:

- Westerly winds, bearing 270°, speed 15knots)
- Sunny conditions
- Minor swell
- Low tide of 0.53m CD at 7.30am (MLWS at Southwold is 0.5m AOD)
- High tide of 2.64m CD at 1pm (MHWS at Southwold is 2.4 mAOD)

Royal HaskoningDHV engineers Tim Burgess, David Cramp and Euan Hobson attended the inspection, which was conducted both from the land and from the water via a RIB. The extreme high and low tides allowed for boat access to view the South side of the South Pier at a much closer distance than is normally possible due to the rock armour in this area.

The inspection was undertaken as follows:

- The South Pier and South Training Wall were viewed from the land at 7:45am and from the water at 12:00pm and 3:00pm
- The North Pier, Knuckle and North Wall were viewed from the land at 11:00am and 4:30pm, and from the water at 12:00pm and 3:00pm
- The Blackshore area was viewed from the water at 12:30pm
- Walberswick Quay was viewed from the land at 8:30am

2.2 Observed Coastal Processes

In the mouth of the harbour the wave direction is confused where the larger sea waves meet reflected waves in the harbour. During the site visit the westerly winds tended to force vessels leaving and entering the harbour towards the fendering and rocks at the North Pier.

Strong tidal flow was observed around the gaps in the corroded sheet piles, which pulled or pushed vessels to the sides of the channel as they approached this area.

Wave height was higher than desired around the North Wall and Coastal Voyager dock.

3 Site inspection – condition assessment

3.1 South Pier

3.1.1 Form of Defence

The South Pier is comprised of three or four different types of structure having undergone a number of repairs over the last 90 years. Fundamentally however, the South Pier consists of a 417m long continuous reinforced concrete structure with a face (on the north side of the Pier) of either reinforced concrete planks or steel sheet piling making up the harbour wall, supported by pairs of raking piles connected with concrete longitudinal and cross members. The nature and condition of this face varies depending on location. In places, the raking piles are surrounded by rock armour, intended to reduce scouring according to the 1990s design drawings. An example cross-section drawing of one part of the South pier is included in Figure 2.

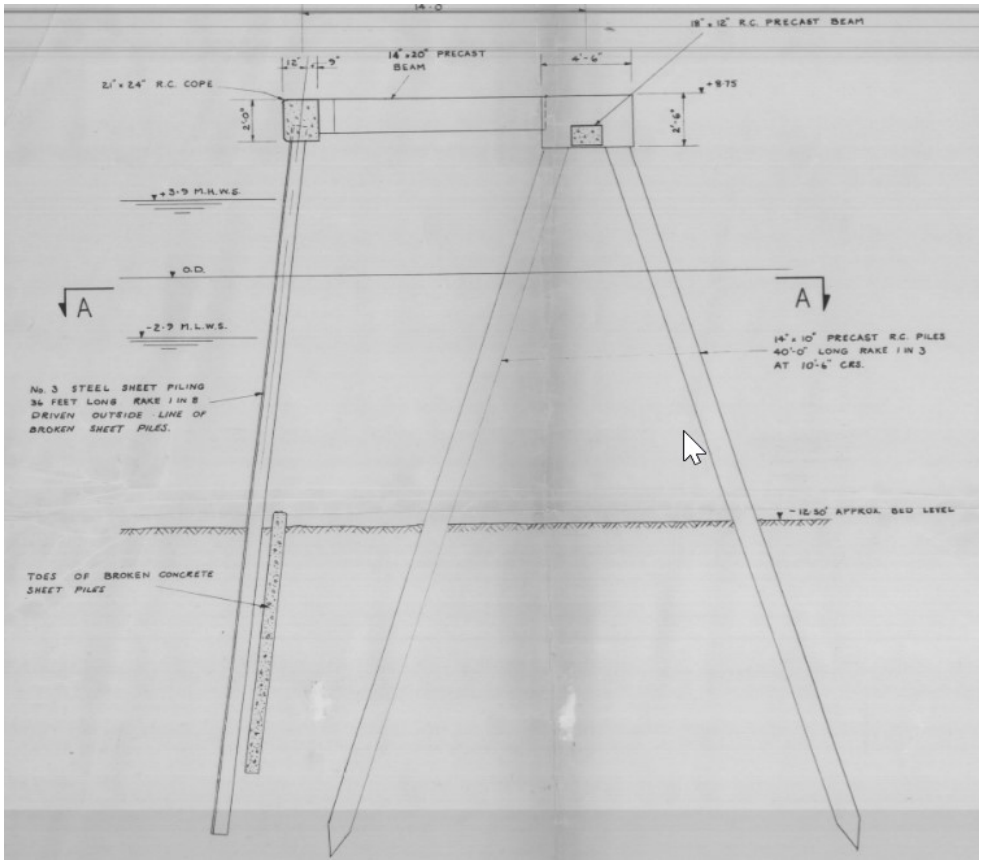

Figure 2 – Example cross-section of South Pier (Length C)

The easternmost section of the pier, Length A (Figure 3), is made up of box piles at each crossmember interlocked with sheet piles driven in front of the concrete planks. The box piles are shown on historic drawings to be filled with concrete above the seabed level. The planks have been cut off at -1.0m AOD (Figure 4). The rear concrete beams to Length A have also been replaced at some point. The joints between these box piles and the crossmembers have been repaired in the past.

An original length of the pier remains inland of these box piles (Length B), which is still in relatively good condition.

Length C, immediately inland of Length B1, is made up of steel sheet piles driven in front of the concrete planks which had been cut off at -1.0m OD (Figure 2). Newer raking piles, beams and crossmembers have been added here too. This structure differs slightly from the original design in that the rear beams are below the cross members rather than in line with the cross beams.

Length B2 is the remainder of the structure inshore of Length C up to the entrance to Dunwich Creek, and is similar in construction to Length B1.

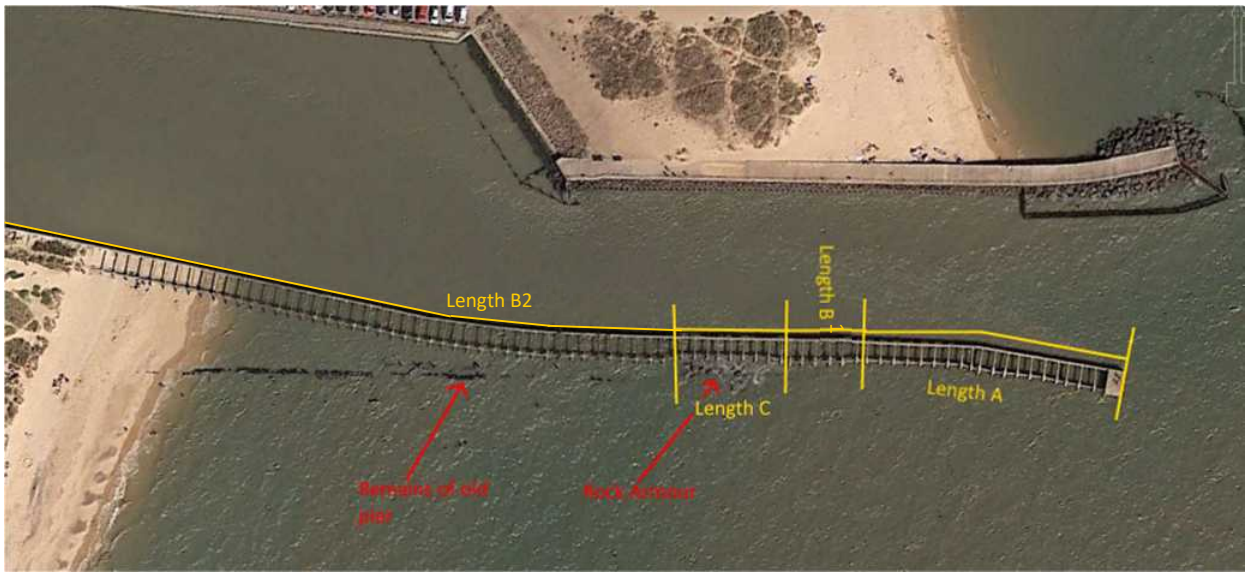

Figure 3 - Map of South Pier with marked Lengths A-C

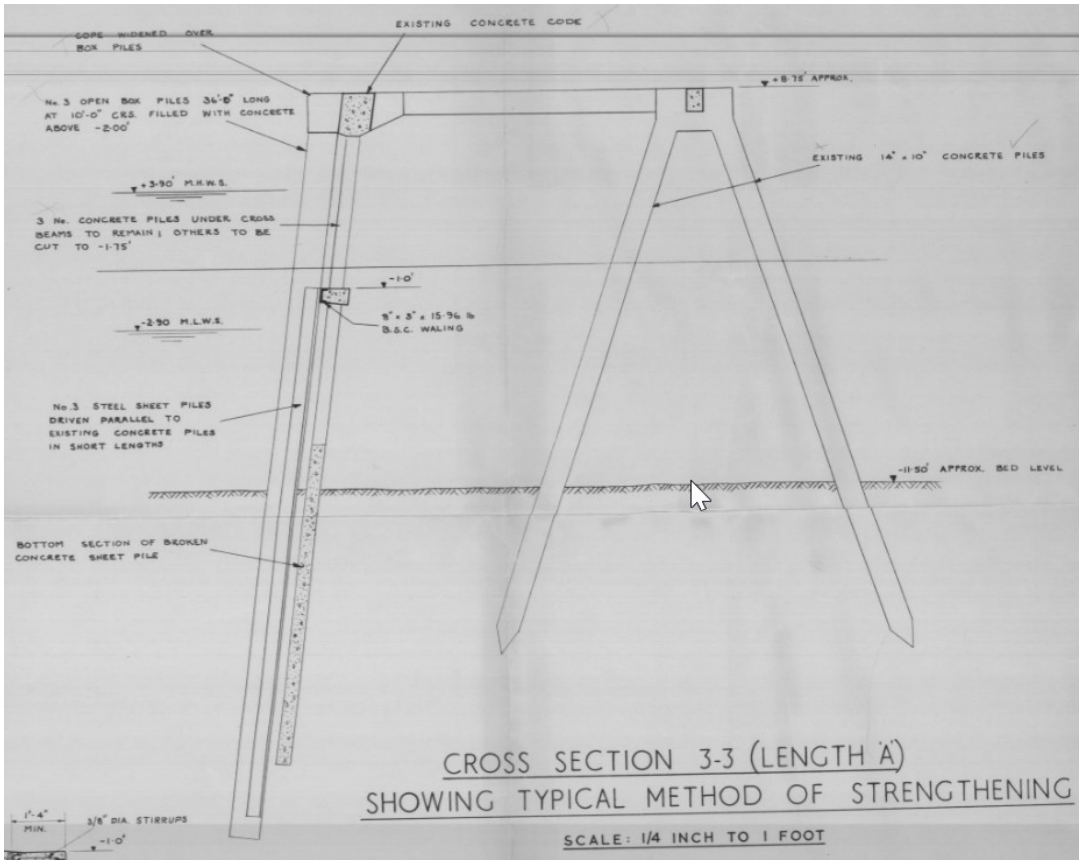

Figure 4 – South Pier Length A, Section 3-3

3.1.2 Historical Data Summary

The original South Pier was constructed in 1936 as above with concrete planks making up the front face. This was built to replace an old 1840's timber pier, with the aim of improving the wave climate within the harbour. However, by 1938 it had become apparent that the new South pier was unsuccessful in achieving this aim and the harbour suffered from increased wave activity all the way up the river to the Blackshore area. This forced many of the vessels to be moored further upstream. There were also reports of large amounts of sediment deposition around the mouth of the Harbour.

In 1940 the Navy sank 2 steel barges in the mouth of the harbour as block ships. The presence of the block ships had a negative impact on siltation around the harbour mouth. In 1942 the East Suffolk Rivers Catchment Board sought help from the army and a gap was blown in the pier head in an attempt to ease these problems. This gap was further widened by natural forces until it extended for approximately 30 meters (Figure 5) (this ties in with Length C identified above).

Figure 5 - 1945 aerial photo of damage to South Pier

A 1946 report to the Catchment Board identifies that this gap had led to increased scouring at the foot of the piles around the mouth of the harbour (found during the removal of a number of mines and bombs from the harbour mouth). This caused concerns that these denuded piles would be unstable, and it was recommended that this gap be repaired once the block ships were removed.

During the 1960's work began on repairing the pier and plans were made to replace damaged concrete planks with steel piles on the front face of the pier.

The pier was demolished from the gap eastwards (Figure 5) and a replacement structure was constructed similar to the original design but with box piles interlocked with steel sheet piles on the front face. Later these sheet piles were cut away to help with mitigating wave impact at this part of the harbour mouth as past issues had returned.

An original length of the pier was left (Length B1) as it was still in relatively good condition.

Length C was completely rebuilt with steel sheet piles driven in front of the damaged concrete planks, with new raking piles, beams and crossmembers. This structure differs slightly from the original design in that the rear beams are below the cross members rather than in line with them.

This structure was inspected again in the 1990s and it was identified that several openings were beginning to form in the sections of steel sheet piling. These were filled with rock to dissipate wave energy and to try to minimise the damage to the remaining piling caused by wave impact on the rear face.

A study of the South Pier structure by Robert West and Partners in 1984 stated that the pier would 'collapse' in 5 to 10 years. A more recent study of the pier carried out by Waveney District Council in 1996, concluded that the pier had a minimum life of 5 to 10 years.

3.1.3 Summary of Condition Assessment

The majority of the structure was in a moderately good condition overall considering previous estimates of life expectancy.

The concrete part of the structure does not appear to be at the end of its life. Whilst a few areas have failed, and rebar is exposed in small, localised areas, generally there aren't any signs of imminent failure that might have been expected given the structure had a predicted life of 5-10 years 24 years ago.

Most raking piles look to be in good condition. The narrow crossmembers are typically the part of the structure in worst condition, with exposed rebar and signs of corrosion to approximately 20% of these. Much of the cracking in the concrete appears to be due to failure of previous poor-quality patch repairs.

The sheet steel piles in Length C extend above low water into the splash zone. Consequently they have suffered from significant corrosion, and are supporting little to none of the front beam. This beam is cantilevered off the piles behind and would appear to be the most 'at risk' part of the structure. In the event of a storm surge event this beam is liable to be driven upwards, which could lead to the crossmembers or rear piles failing and a length of this front beam collapsing into the harbour.

Length A of the South Pier is generally considered be less vulnerable than Length C. The more substantial box piles have been installed around the original concrete structure, with the additional lower level steel sheet piles typically located below low water level and according to the original drawings supported by a waling at the top and the old concrete planks lower down. As such the sheet piles do not appear to have corroded in the same way as the sheet piles to Length C. Whilst visibility of these piles was limited during the inspection, the section continues to be well aligned and the upper edge of the sheet piles did not appear to be corroded to the extent of the Length C sheet piles (Figure 7).

One of the box piles around the harbour mouth (number 8 counting the seaward end inland) is not supporting the beam above it. Closer inspection suggests that this pile is likely to have been struck by a vessel resulting in a dent at the low tide waterline. This damage is also causing the top beam to be cantilevered off the rear piles and may be subject to failure in a storm surge as above.

3.1.4 Areas of Interest

Box pile number 8 **(Figure A01)** has been damaged, possibly hit by a vessel at some point, and is no longer supporting the beam above which is simply cantilevered off the raking piles behind and the adjacent box piles. (Figure 6).

A section of planks has been replaced with steel sheet piles (Length C) however these have corroded severely (Figure 7). This front beam section is no longer supported properly and is cantilevered off the rear raking piles. The damage to this structure in the past appears to have been slowed with mounds of rock that have been used to block openings in the pier face from the rear **(Figure A02).**

A rear longitudinal beam at piles 35-36 **(Figure A02)** has failed completely (Figure 8).

There is a minor issue with scouring around the planks at piles 66-67 **(Figure A03)** where a scour hole has formed on the beach side of the structure (Figure 9).

The west end of the pier, level with Walberswick dunes and inside Walberswick Quay, has also developed some holes between the planks leading to scour in these regions (Figure 11) **(Figure A04).** This is before the section where the main planks have been cut down to allow water exchange.

Approximately 20% of the rear piles, beams and connecting cross members have exposed rebar (**Figure A01 to A06**).

Potential failure has occurred in the front beam at piles 115-116 (Figure 10, See location in **Figure A05**)

A joint has begun to fail / a crack has formed on the front beam between piles 121 and 122 **(Figure A05)**.

Figure 6 - Box Pile 8 failure

Figure 7 - Length C corroded steel sheet piles and unsupported front beam.

Figure 8 - 35-36 rear longitudinal beam failure

Figure 9 - Scour Hole in South beach at piles 66-67

Figure 10 - Exposed rebar and failure of front beam at piles 115-116

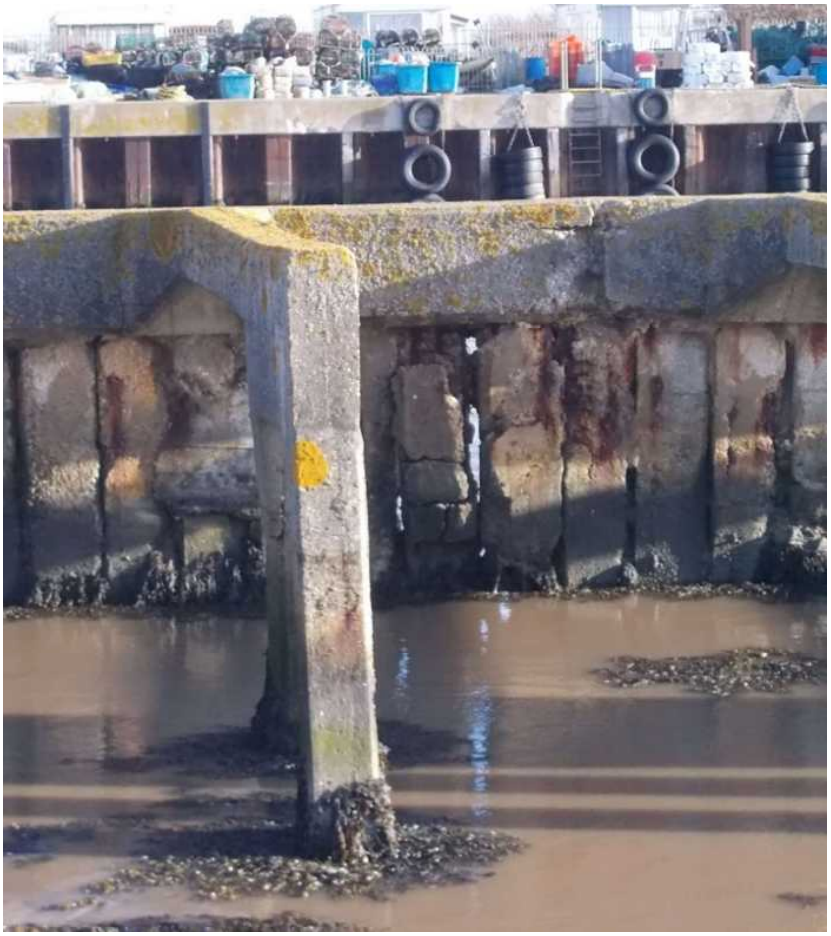

Figure 11 - Scour holes from failed front planks

3.1.5 Life Expectancy and Recommendations

The condition of the structure and the predicted sources of failure are essentially unchanged from the reports from the 1990s. The condition of most of the existing concrete structure is unlikely to have changed much since that time. It is therefore considered likely to last another 15-20 years if the unsupported and cantilevered sections are repaired.

Length C has essentially failed and could collapse within the next 5 years. Failure could risk damage to adjacent parts of the structure. This section should be repaired as soon as possible.

The steel sheet piles to Length A of the South Pier are not considered to be at high risk of failure at present based on the above water inspection, and therefore the residual life of 15-20 years for the overall structure is applicable in this area. It is recommended that the condition of this part of the structure continues to be monitored, with a diving inspection undertaken of the below water section if any change is observed. It may be cost-effective to plan such an inspection at the same time as the repairs to Length C.

Reinforced concrete can be patched or replaced at those locations where the rebar is exposed. However, this may not be cost effective as it would not improve structural stability.

If necessary considering the aims of the scheme, scour holes could be filled after the gaps in the planks and piles have been repaired.

This assessment is based only on the inspection of the present condition of the structure, and does not consider additional risks due to scour of the bed of the entrance channel.

3.2 South Training Wall

3.2.1 Form of Defence

This is the same structure as the original South Pier, with most of the concrete planks cut down to -1.0m AOD.

This wall is separated from the South Pier by a narrow entrance that allows access to Walberswick Quay from the Harbour.

3.2.2 Historic Data Summary

Constructed at the same time as the South Pier in 1936, this structure was identified as a potential cause of increased wave height in the harbour as it prevented waves from spreading out in to the Walberswick Quay area and reflected them towards the North shore. Sections of concrete planks on the front face were cut away down to a level of -1.0m AOD to allow wave energy to be dissipated, leaving 3-4 planks per crossmember to ensure the front beam of the pier remains supported.

3.2.3 Summary of Condition Assessment

As with the South Pier this structure is not at the end of its life. Most of the concrete is still intact with only a few localised patches of exposed rebar.

The cut concrete planks appear to still have a toe in place, serving to support the bed material on Walberswick Quay side of the planks and to prevent it from collapsing into the harbour. It was observed that the depth of water fluctuates along the length of the wall in the harbour channel, which suggests that some of these planks have dropped out allowing some previously retained material to spread out.

3.2.4 Areas of Interest

The wall has had windows cut in the North face that would otherwise enclose Walberwick Quay (Figure 13). The toes of the planks remain in situ serving to retain built up sediment in the quay (Figure 14).

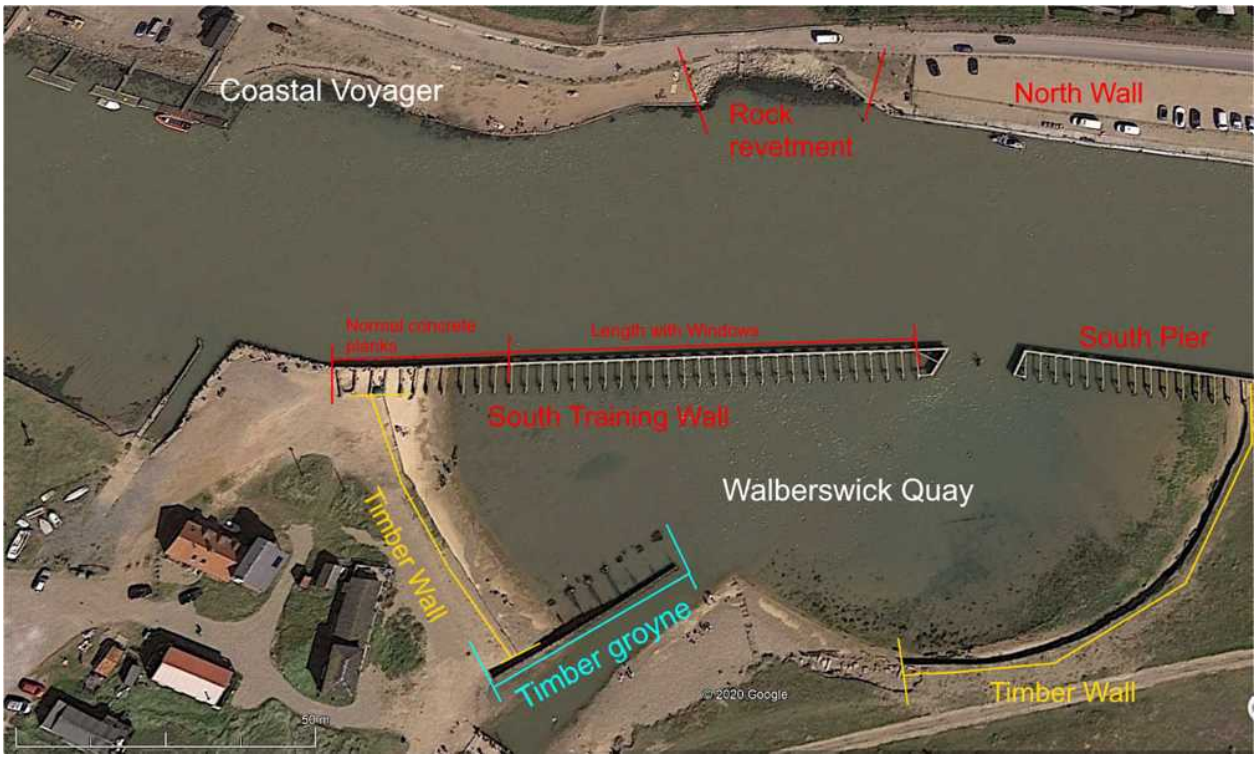

Figure 12 - Map of South Training Wall, Walberswick Quay with marked lengths where windows have been cut in concrete planks

Figure 13 - Length of wall with windows cut in planks

Figure 14 - Planks with cut out panels along South Training Wall

3.2.5 Life Expectancy and Recommendations

The condition of the South Training Wall has not changed significantly since the 1996 study that predicted minimum life expectancy of 15 years. Therefore it seems reasonable that this structure will have at least another 15-20 years of life.

Exposed rebar and areas of damage to the reinforced concrete can be patched and replaced if necessary but these will not serve to increase structural stability.

The windows cut in the concrete planks should not be filled as the reflected wave energy would cause problems for harbour users. It is recommended that the lower sections of the cut planks are left in situ to support the build-up of sediment inside Walberswick Quay and prevent it from collapsing out into the harbour channel.

3.3 Walberswick Quay

3.3.1 Form of Defence

The North beach is protected by a timber groyne at the mouth of Dunwich Creek (Figure 15). The quay is surrounded by a timber wall at the top of the beach.

3.3.2 Historical Data Summary

The timber groyne was added during the harbour improvements in 1962, when the windows were cut in the South Training wall. The aim of the timber groyne was to help maintain the beach as a means of dissipating wave energy inside the harbour.

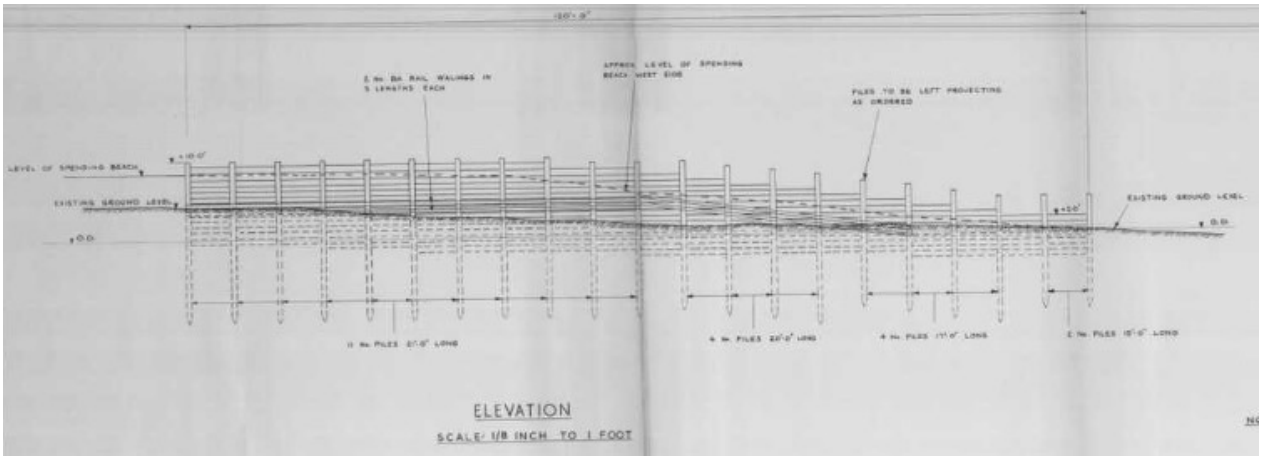

Figure 15 - 1962 Harbour Improvement works - Drawing of timber groyne

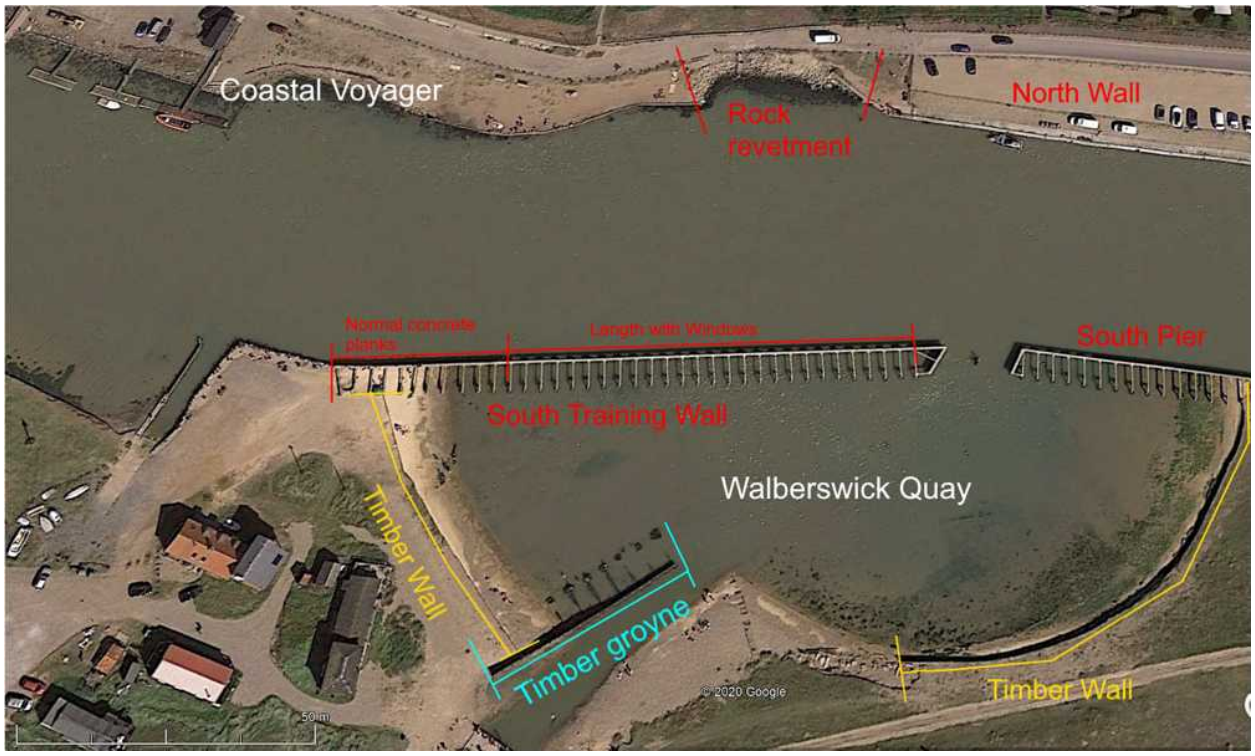

Figure 16 - Walberswick Quay with marked timber groyne and timber walls

3.3.3 Summary of Condition Assessment

The groyne is still in a relatively good condition.

There are a few lengths of cut concrete planks piled up on the West beach. These are most likely the remains of the cut panels from the South Training Wall. They may have been placed here to provide additional protection, or simply pushed up here during a storm event.

3.3.4 Areas of Interest

A timber groyne runs along the mouth of Dunwich Creek where it enters the quay serving to maintain the West beach here (Figure 17).

The remains of the cut out concrete planks were found on the West beach (Figure 18).

A timber wall runs around the top of the beach serving as a perimeter to Walberswick Quay and as a retaining wall for the upper level of the shore here (Figure 19).

3.3.5 Life Expectancy and Recommendations

The relatively good condition of the timber groyne means that it is expected to have at least another 20 years of life.

It is recommended that the wave modelling considers potential changes to the timber wall and beach to assess whether wave reflection could be reduced.

Figure 17 – Timber groyne at Dunwich Creek

Figure 18 – Remains of upper lengths of cut planks from South Training Wall

Figure 19 - Timber wall around Walberswick Quay

3.4 North Wall

3.4.1 Form of Defence

The Northern side of the harbour, to the west of the North Pier and Knuckle, is defended by an anchored piled wall consisting of sheet piling with a concrete capping beam. Type 1 stone has been used to infill between the sheet piles and the original concrete harbour wall. The anchors are constructed from 2.4m high PU8 sheet piles, buried 1m below the surface, tied to the piled wall by 16m long, 70mm diameter rods. The structure is approximately 14.5m high, with the tops of piles at +3.1m AOD (Figure 20).

Mooring posts are spaced at regular intervals, cast into the capping beams. A setback safety barrier has been installed along the length of the wall with access ladders at regular intervals. The sheet piles have been fitted with sacrificial anodes to protect against corrosion.

At the west end of the new piled wall there is a short length of old sheet piled wall (Figure 20). To the west of this, extending up to the Blackshore area, lies a stretch of rock revetment approximately 20m in length. This has been topped with loose concrete and masonry rubble.

3.4.2 Historical Data Summary

The current wall was constructed in 2012-13 enclosing the existing harbour wall.

3.4.3 Summary of Condition Assessment

This structure was built less than 10 years ago and is still in a good condition. It is noted that the pile capping beam / coping is shown to be +3.1m AOD in Figure 20, but this has recently been measured as +2.8m AOD.

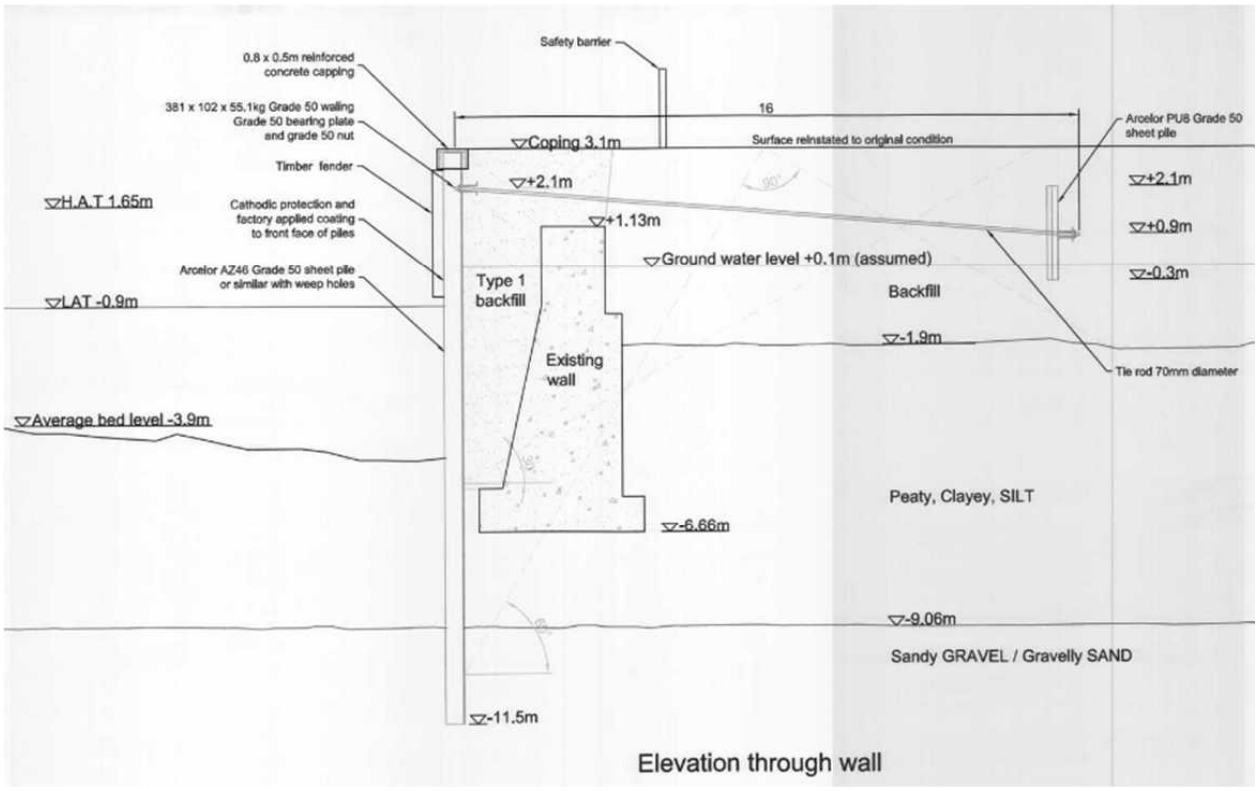

Figure 20 - North wall work drawings - 2012-13

Figure 21 - Map of North Wall and rock revetment with old sheet piles marked

3.4.4 Areas of Interest

Figure 22 - Current condition of North Wall

Figure 23 - Old Steel Sheet Piles at western end of North Wall

Figure 24 - Rock revetment West of North Wall

3.4.5 Life Expectancy and Recommendations

This new wall is still in very good condition, and would be expected to have another 50 years of life or more. In structural terms, no further actions currently need to be taken.

It is noted that wave action at the North Wall restricts the mooring of vessels. This issue should be considered by the wave modelling to assess whether changes could be made to improve the conditions at the North Wall.

3.5 Knuckle

3.5.1 Form of Defence

The Knuckle is located on the Northern shore of the Harbour, between the North Wall and the North Pier. This structure currently consists of an area of rock revetment (60-300kg) with gabion walls and edgings, and a concrete toe beam (Figures 25 and 26).

This length of defence was previously a vertical wall of similar height and form of construction as the original North Wall. In the 1980s, a concrete tripod revetment (units of approx. 4 tonnes) was placed in front of the wall to reduce rotational movement and risk of failure. A timber fender was also added at the toe of the tripod revetment. During the harbour works in the 1990s, the concrete wall was cut down to further reduce the risk of failure. The rock revetment was added on the landward side of the cut-down wall and some of the concrete tripods were repositioned at low water (Figure 26, Section A-A and Plan).

The structure is surrounded on the landward sides by a guard rail. Two mooring posts are cast into the toe.

A grassy strip of land provides some additional protection against flooding of the car park and properties beyond.

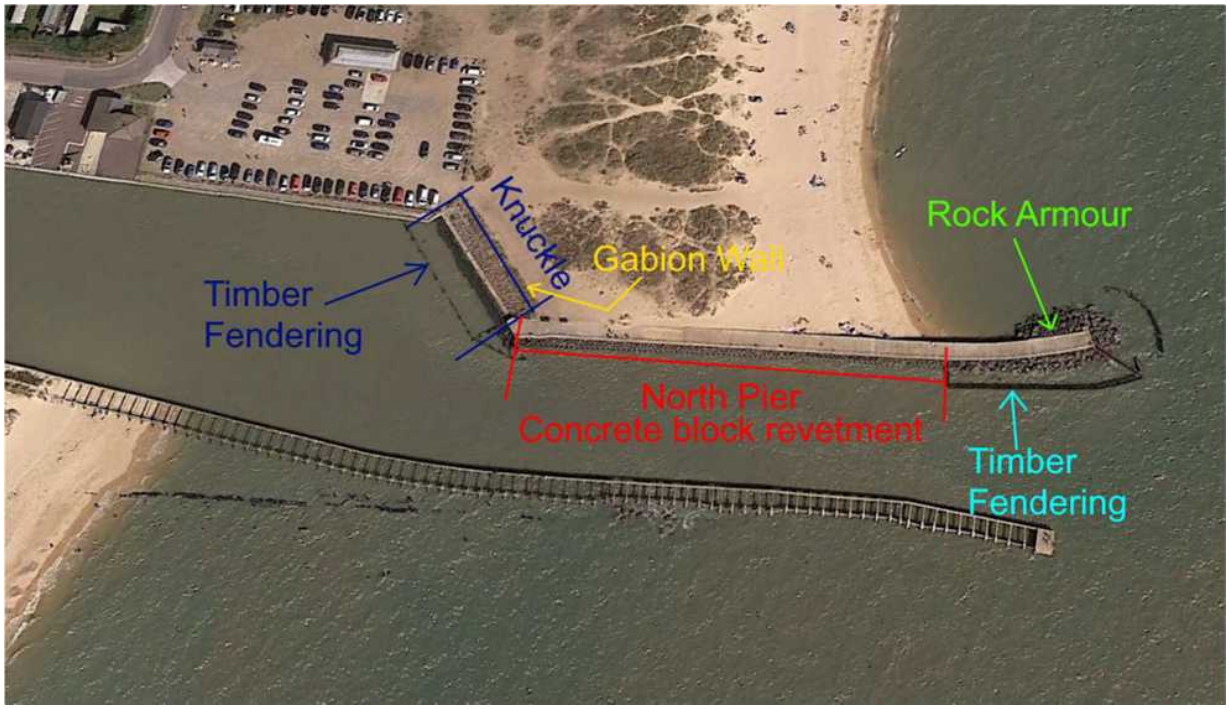

Figure 25 – Plan of Knuckle and North Pier

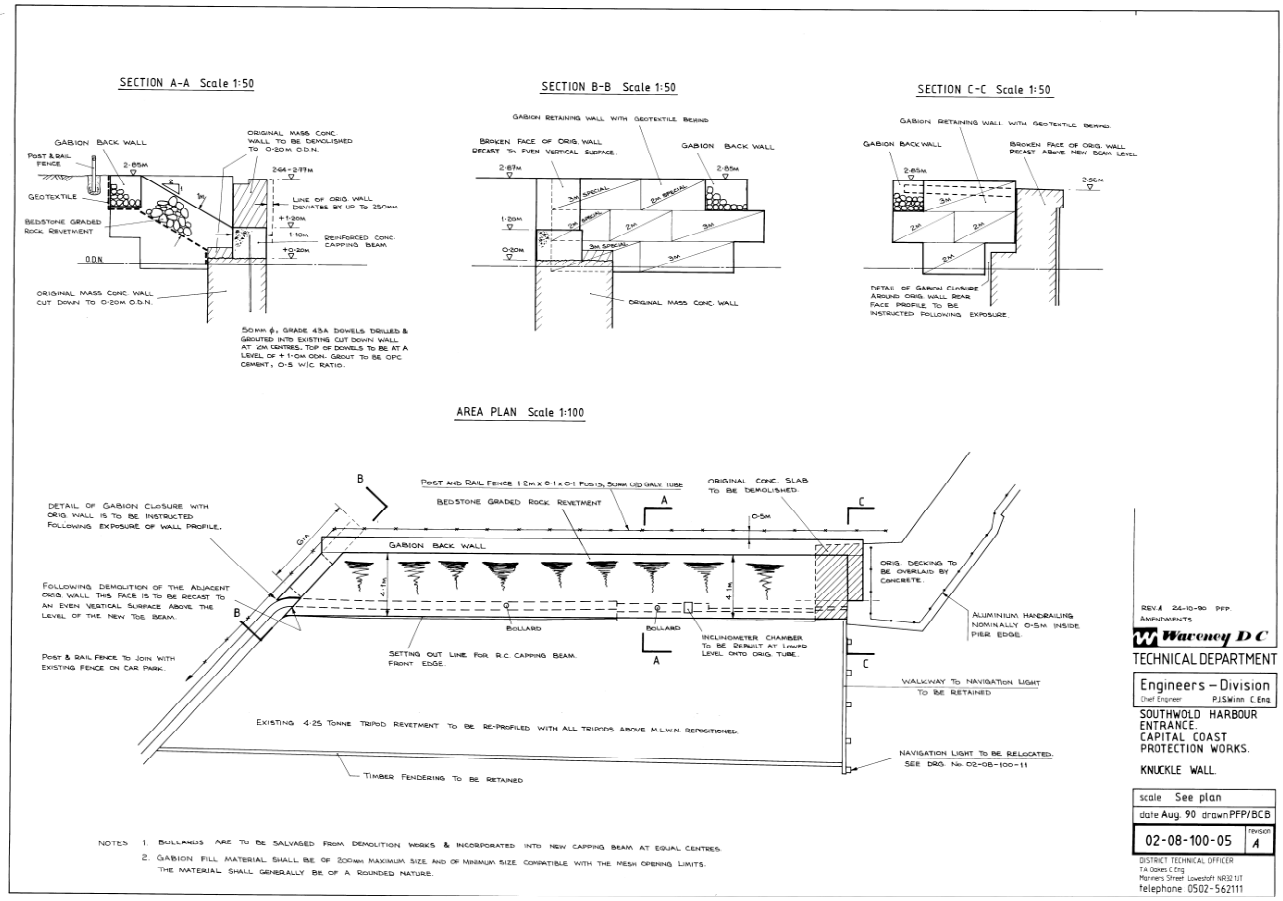

Figure 26 - 1990 Knuckle Wall works

3.5.2 Condition Assessment Summary

The revetment is in a good condition. The concrete toe beam is also in good condition and is continuing to support the revetment. Although the gabion cages are failing the wall has bedded into the surrounding ground and seems to be very solid.

3.5.3 Areas of Interest

Figure 28 shows the Knuckle with the rock revetment, concrete toe beam and timber fendering visible.

3.5.4 Life Expectancy and Recommendations

Although the gabion cages are failing this is not considered to be a significant issue as their purpose has been served. The Knuckle is expected to have at least another 20 years of life. No actions currently need to be taken.

Figure 27 - Current condition of Knuckle

3.6 North Pier

3.6.1 Form of Defence

To the east of the harbour at the Northern Shore runs the North Pier. This is comprised of a long continuous concrete structure protected by a combination of Shed concrete block revetment (Figure 28) along most of the length and rock armour that wraps around the east end of the pier at the harbour mouth.

The pier structure itself is comprised of steel sheet or concrete piles supporting a concrete deck. The area beneath the deck is typically infilled with concrete and beach materials, although there is a hollow section (Figure 30). This has all been surrounded in a layer of concrete during more recent works.

The size of the rock armour at the harbour mouth varies, with 3 to 6 tonne rock on the southern side of the roundhead and 1 to 3 tonne armour on the north side. Smaller 0.3 to 1.0 tonne rock is used inshore of the roundhead.

At the seaward end of the North Pier a stretch of timber fendering (Figure 29) has been installed to protect boats from colliding with the rock armour. This was last repaired in 2007. This fendering is damaged and sections are missing in some places. The timber fendering and rock armour transitions into a SHED concrete block revetment that spans most of the length of the North Pier.

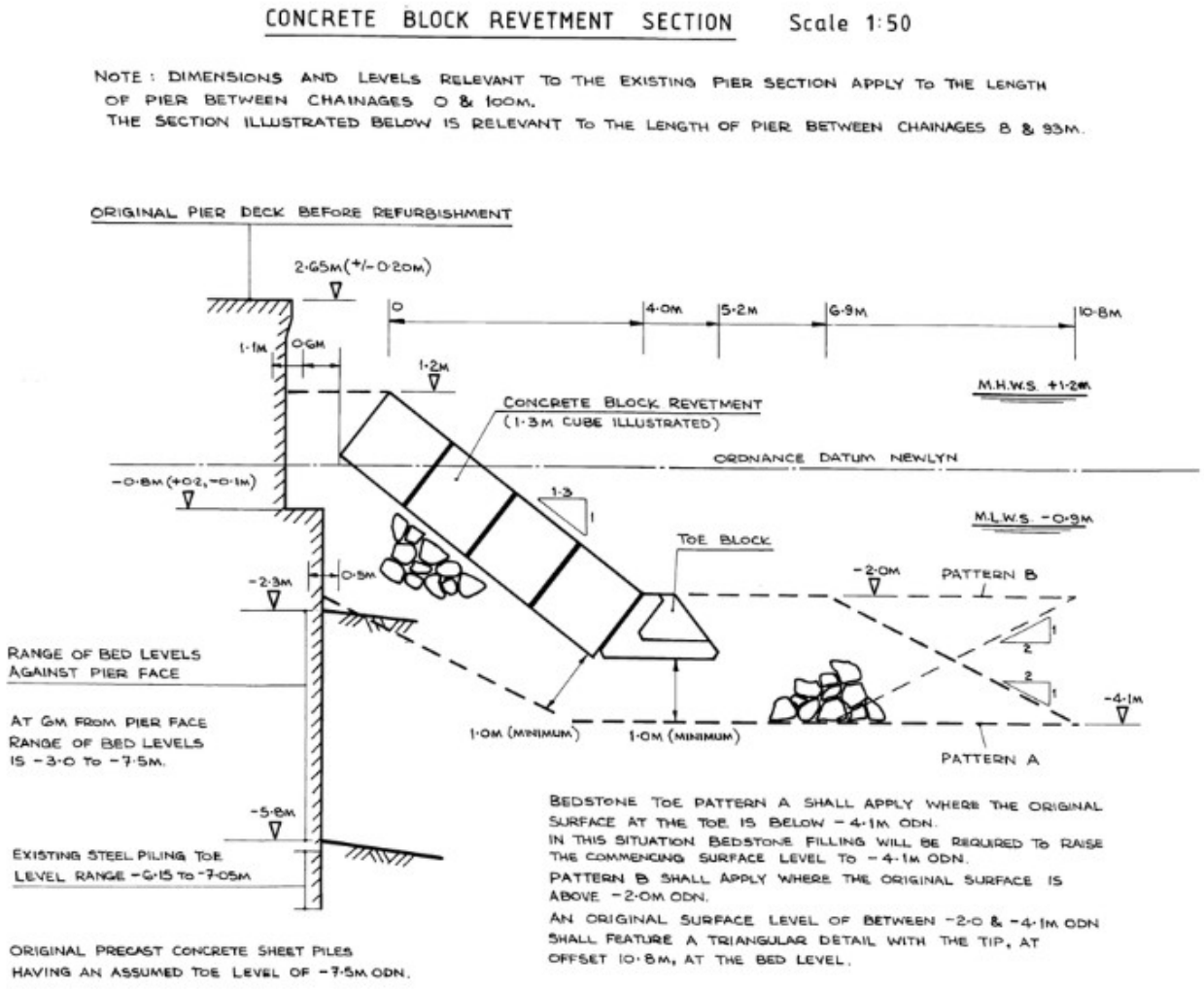

Figure 28 - 1992 SHED concrete block revetment section

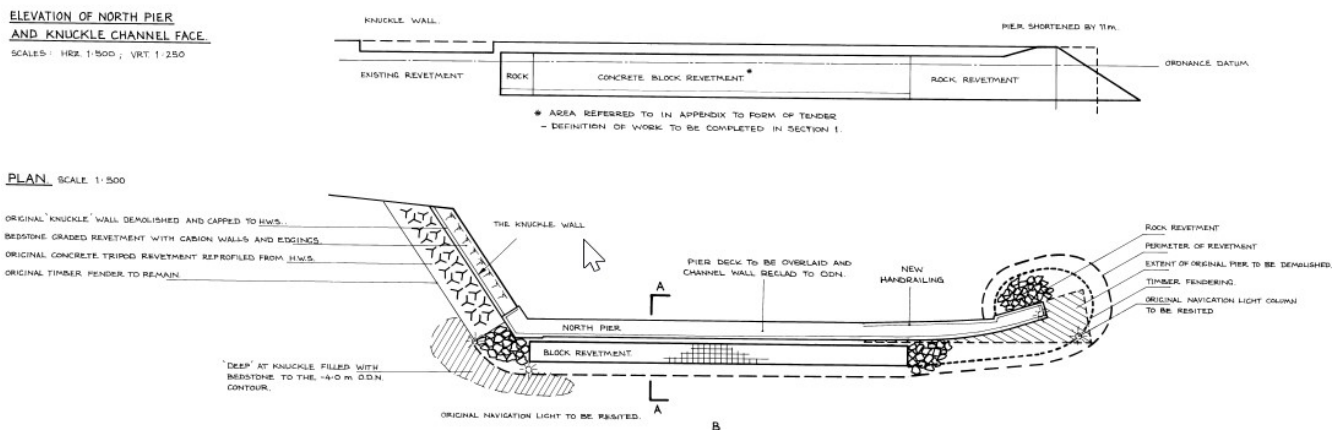

Figure 29 - 1992 North Pier works plan

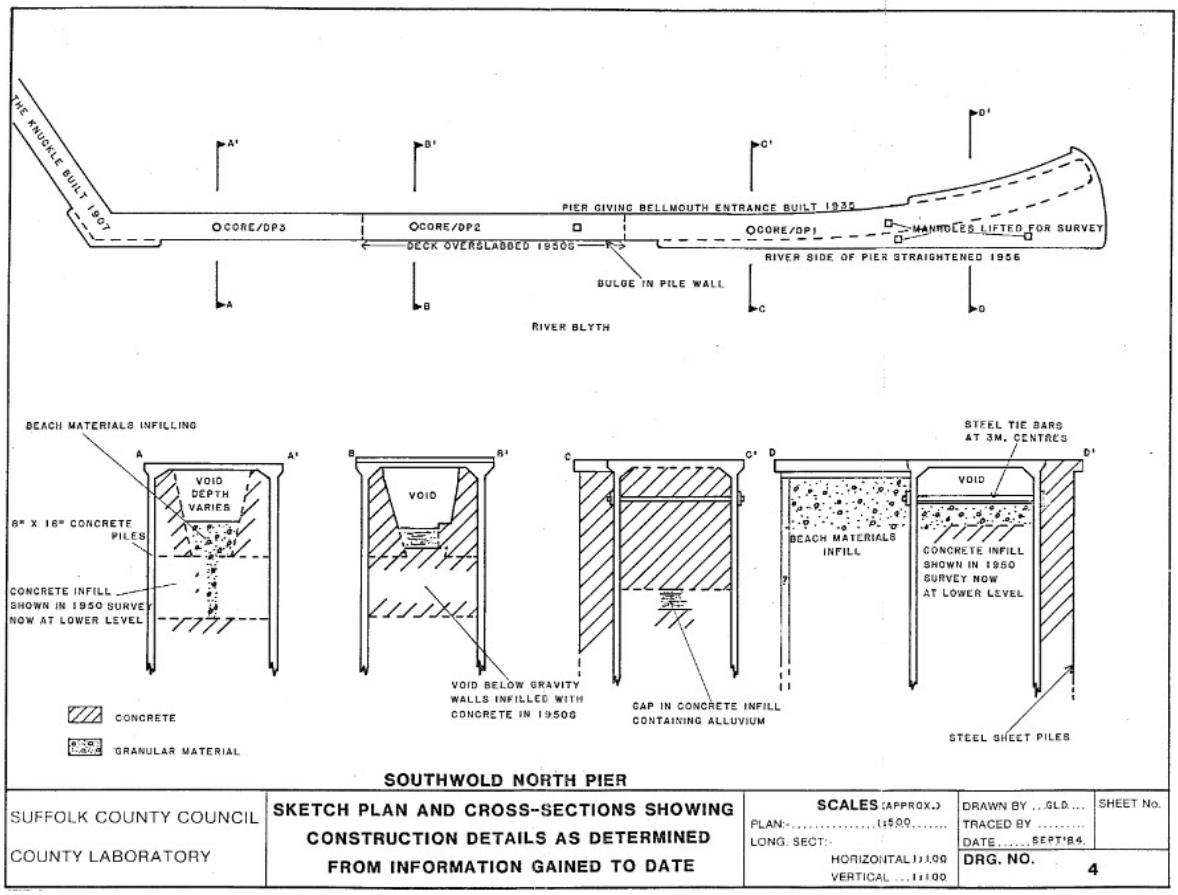

Figure 30 - 1984 North Pier study: Plan and Cross-sections

Figure 31 - Map of North Wall and Knuckle

3.6.2 Historical Data Summary

A North Pier to Southwold Harbour has been in place in some form since 1750. In the 1930s, the harbour entrance was reconstructed to create a funnel-shaped mouth, with subsequent strengthening and straightening between 1935 and in 1955 (Figure 30) in an attempt to reduce the size of the waves travelling into the harbour.

Works were undertaken to the North Pier in 1992 (Figure 29) with the aim of increasing flow through the entrance channel to prevent sedimentation restricting navigation, and to reduce wave energy in the harbour to improve mooring conditions.

These works reduced the length of the structure by 11m and constructed a rock armour revetment and timber fendering around the pier head (approx. 50m length). A SHED concrete block revetment was constructed along 100m of the North Pier to provide support to the concrete structure from the rock revetment to the Knuckle (Figure 28). The integral concrete pier structure was also repaired and refurbished.

3.6.3 Condition Assessment Summary

Some of the blocks have cracked and failed completely at the eastern end of the SHED concrete block revetment.

The pier itself shows no obvious signs of being at end of life.

The timber fendering is damaged and a length of it is missing (Figure 34). The eastern-most length is missing the lower crossbeam and the vertical timber columns are only restrained at the top allowing them to move with the waves.

The rock armour is still in good condition.

3.6.4 Areas of Interest

The SHED concrete block revetment runs most of the length of the North Pier (Figure 31). This has sustained some damage since construction in 1990 (Figure 32).

3.6.5 Life Expectancy and Recommendations

Overall the North Pier is considered to have a remaining life of at least 20 years.

The failed concrete blocks at the eastern end of the SHED concrete block revetment could be replaced.

The loose timber fendering should be replaced but might be wise to keep an access gap in this to allow access if needed in case someone becomes trapped behind it (Figure 34).

This assessment is based only on the inspection of the present condition of the structure, and does not consider additional risks due to scour of the bed of the entrance channel.

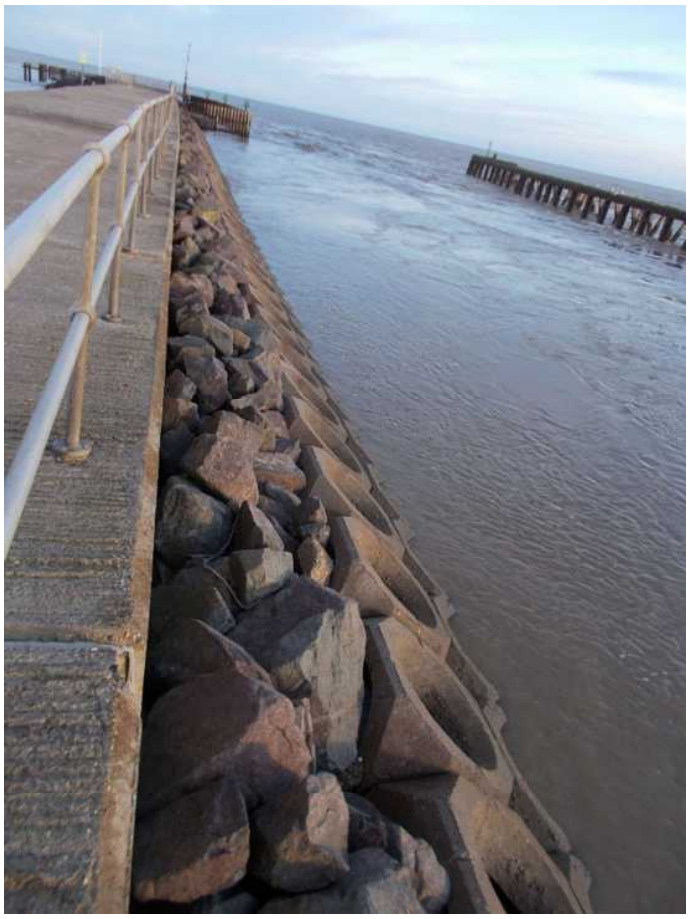

Figure 32 - SHED concrete blocks with rock fill

Figure 33 - Failed blocks near east end of concrete block revetment

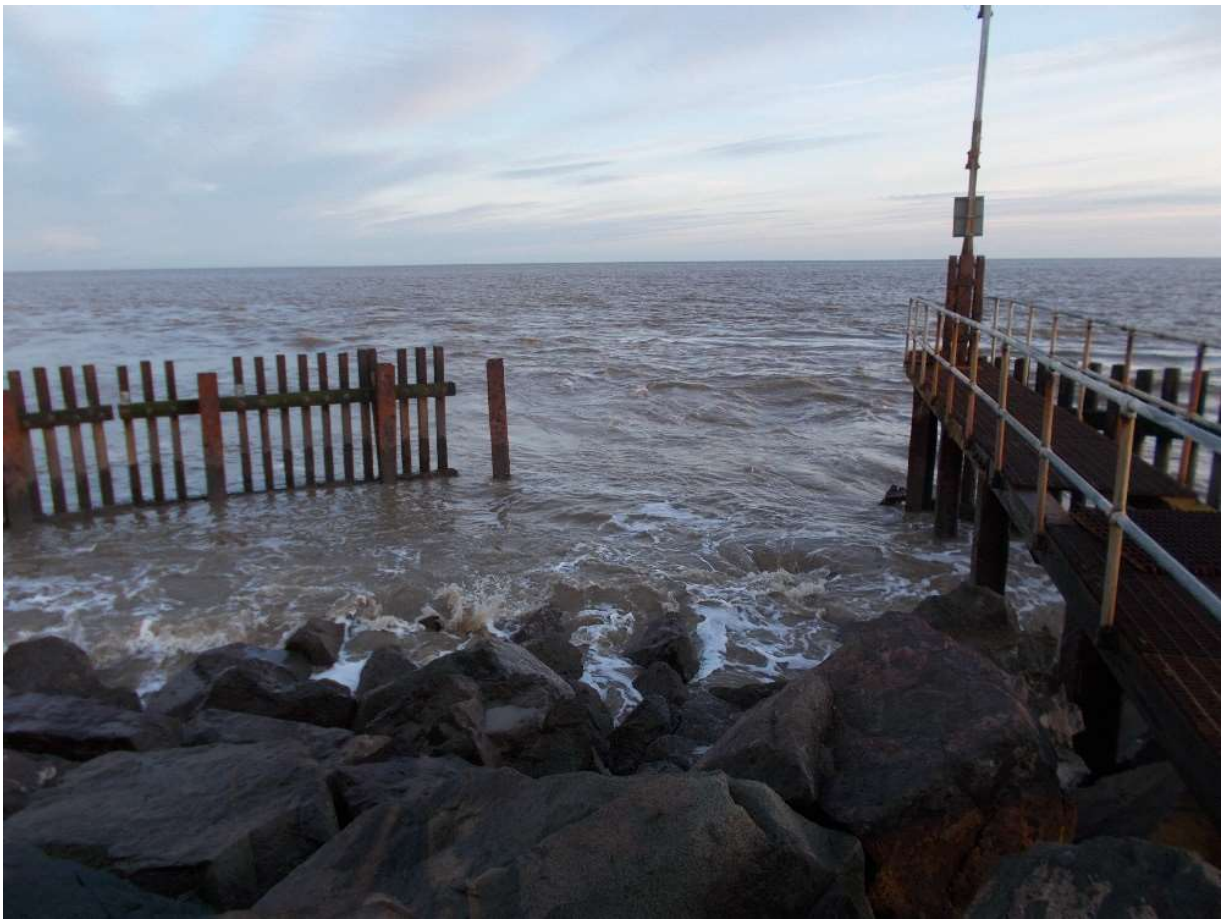

Figure 34 - Rock armour, navigational light and damaged timber fendering

4 Views of local harbour users

When on site and during the time spent on the Coastal Voyager RIB, RHDHV spoke to Marcus Gladwell, the skipper of the vessel and a lifelong user of the harbour, who previously worked at the RNLI station in the harbour. His views are summarised as follows:

- Generally, few changes need to be made to the structures as those who use the harbour understand the few problem areas and know how to navigate them.
- The gaps around the South Pier box piles at the harbour mouth help provide a transition zone where the wave direction is confused. This makes it easier to smooth out changes in speed in an area where it is all to easy to overcommit to fighting wave forces, which can result in less experienced navigators sailing onto the fendering to the North.
- The gap created by damage to the timber fendering is potentially helpful when rescuing people who have fallen from the pier into the water as this has proven to be difficult in the past.
- The rock used to protect the rear of the corroded sheet piles seems to be doing a good job and more of it to the south of the South Pier might be helpful, however there was recently a boat wrecked against the remains of the Old South Pier and these rocks so the location of any additional rock protection would need careful consideration.
- The timber wall around Walberswick Quay is reflecting wave energy back into the harbour resulting in waves breaking near to the Coastal Voyager berth. These waves are higher than desired and causes regular damage to mooring lines and floating docks along this part of the northern shore.
- Reflection from the South Pier is causing increased wave height at the North Wall which makes mooring here difficult for anything other than the larger fishing boats. Mooring lines are often broken because of the large amount of resultant movement.

Appendix A

Annotated Maps from Site Inspection

Royal HaskoningDHV

Appendix A

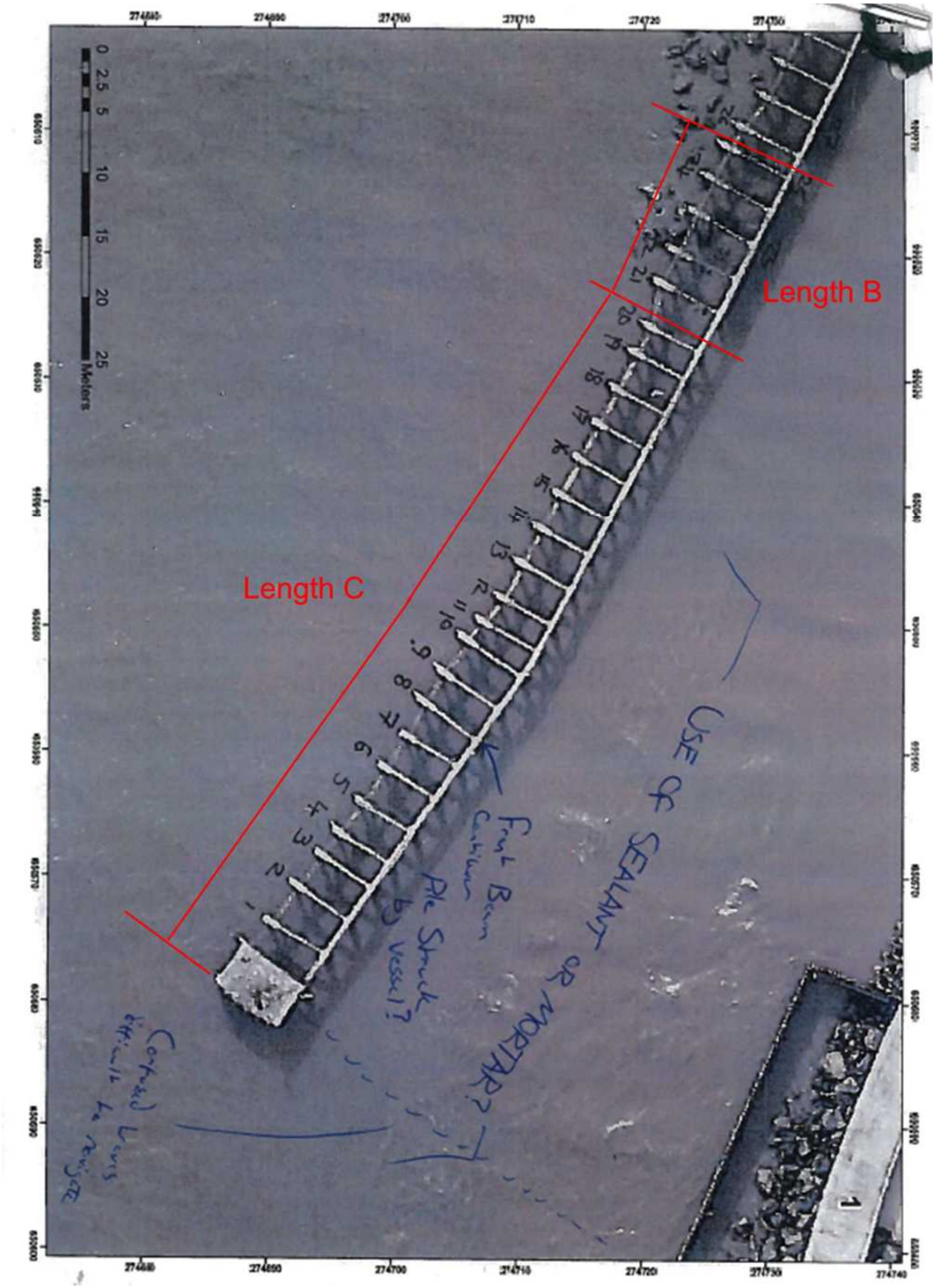

Figure A01 East end of South Pier

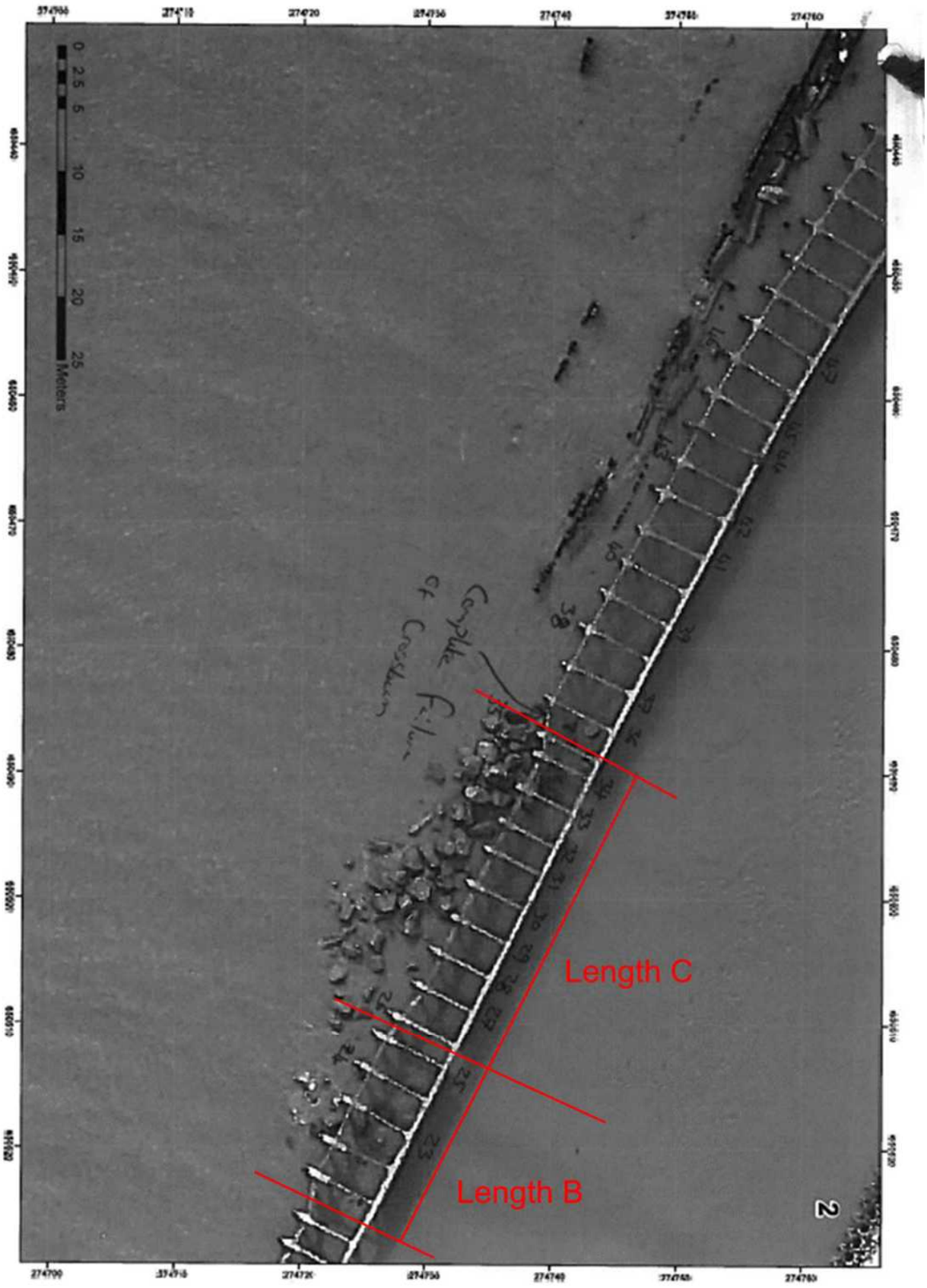

Figure A02 Rock armour and Length C at South Pier

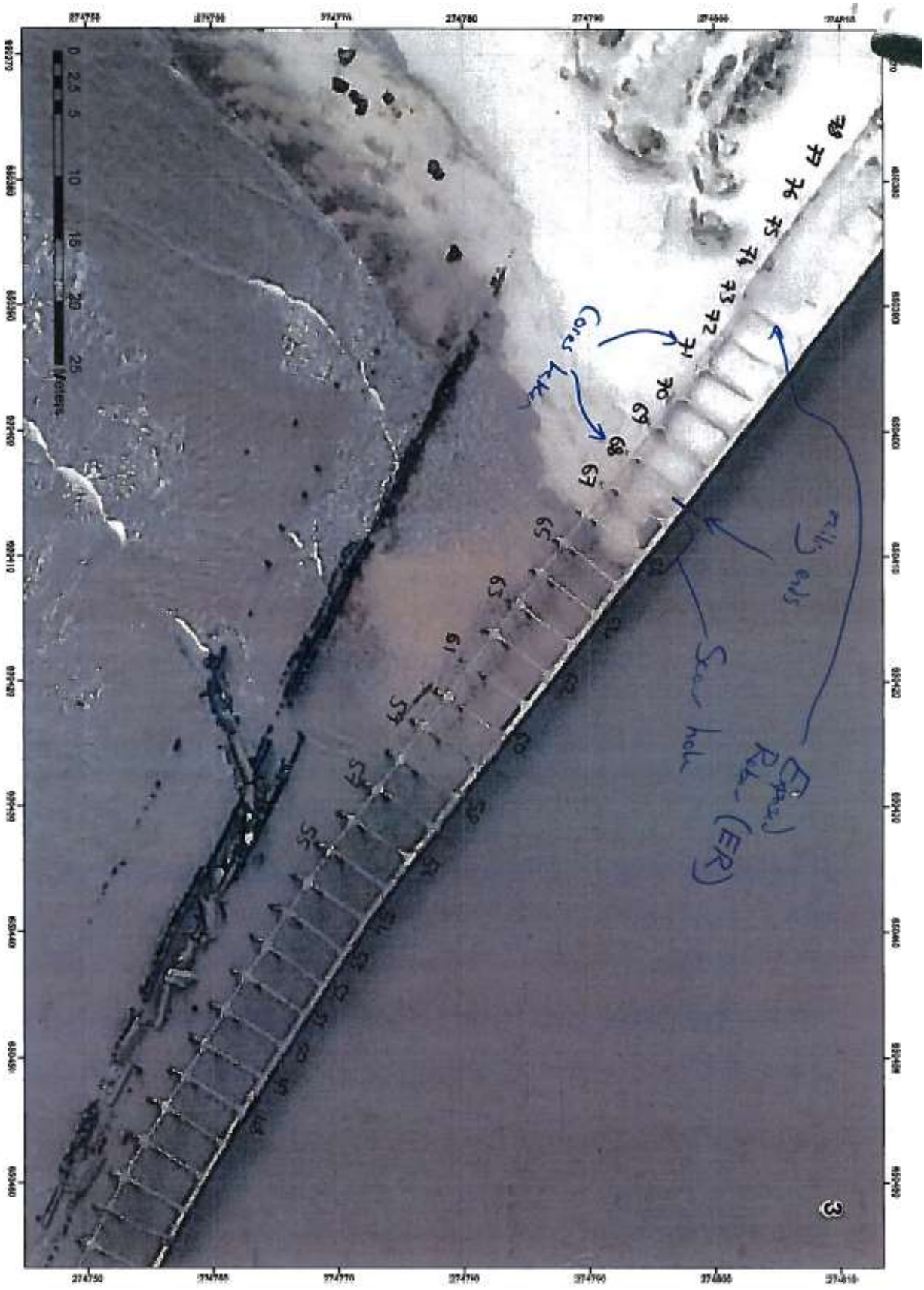

Figure A03 Beach and remains of old pier at South Pier

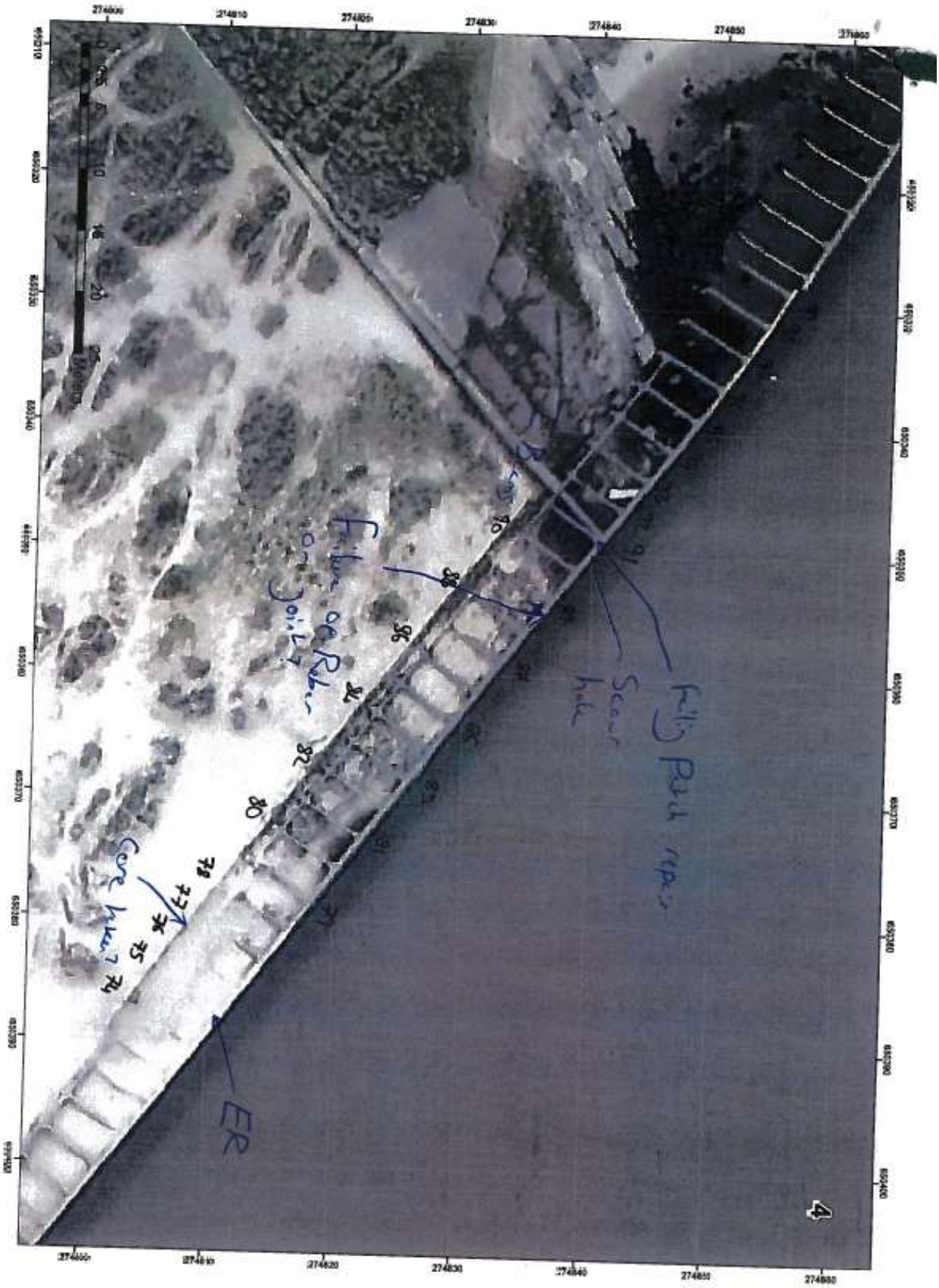

Figure A04 Walberswick Dunes at South Pier

Figure A05 South Pier

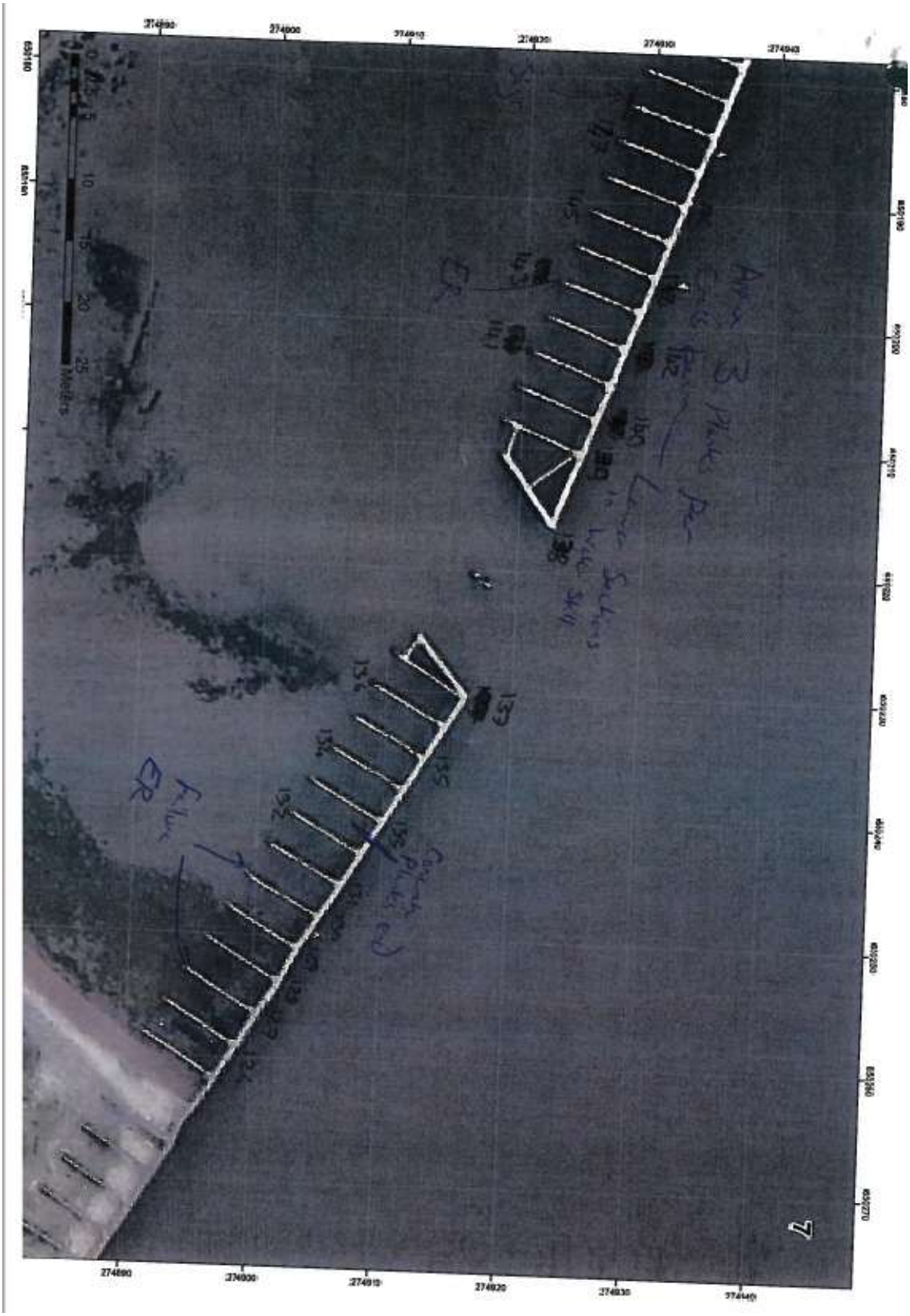

Figure A06 Walberswick Quay South Pier – South Training Wall opening

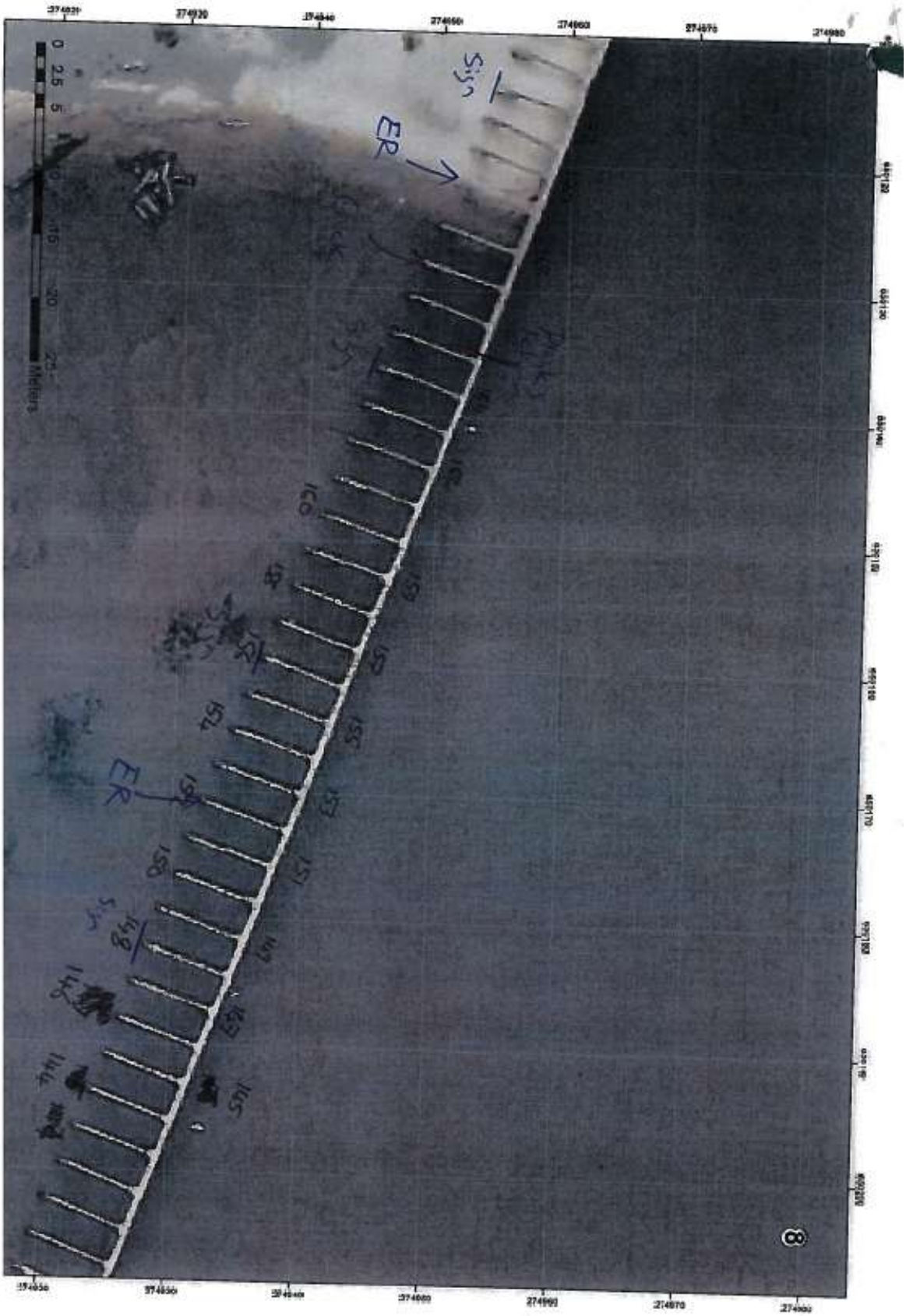

Figure A07 South Training Wall at Walberswick Quay

Figure A08 South Training wall and Slipway

Figure A09 East end of North Pier

Figure A10 North Pier Shed concrete block revetment

Figure A11 Knuckle

Figure A12 East end of North Wall

Figure A13 North Wall at RNLI Station

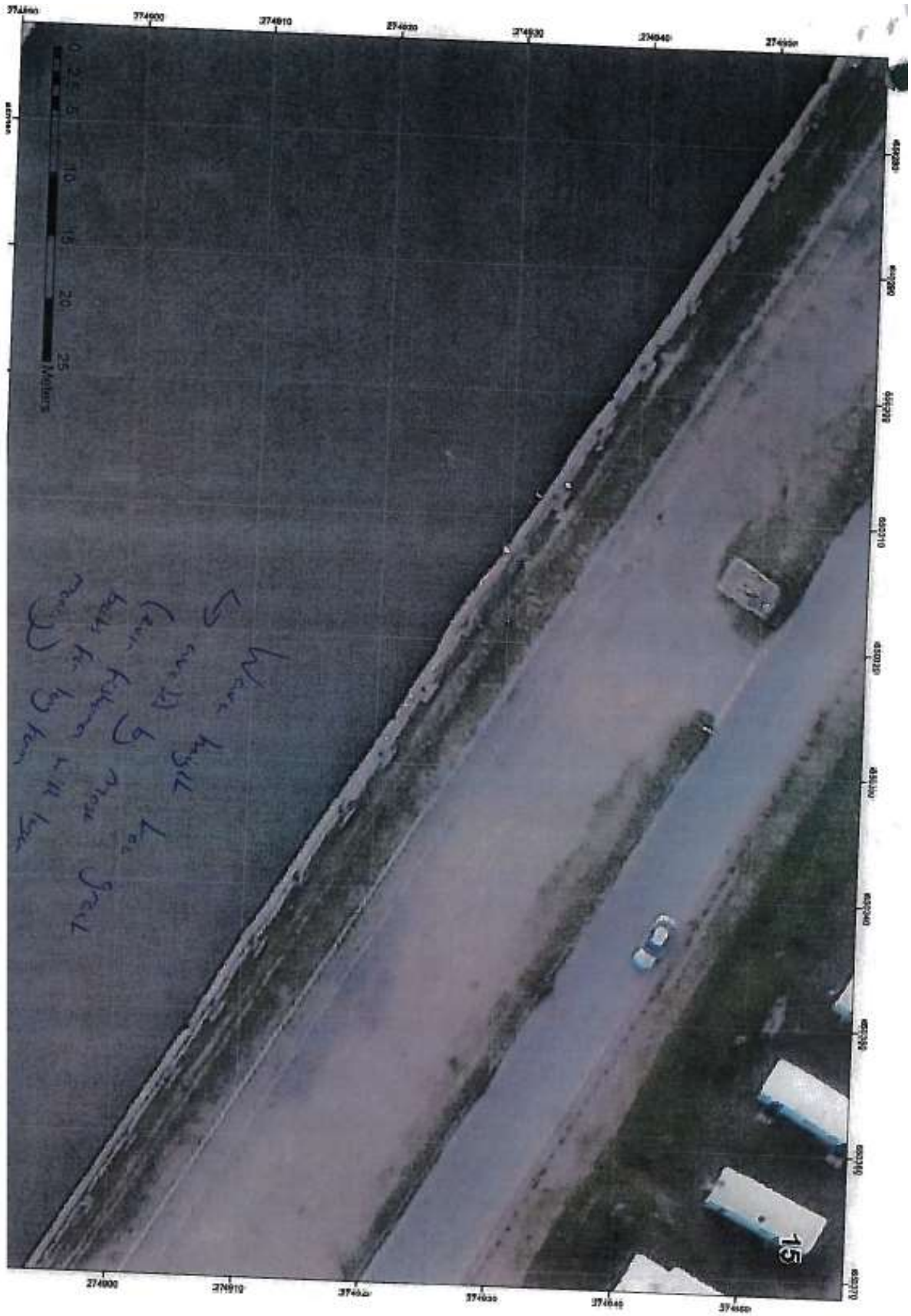

Figure A14 North Wall west of RNLI Station

Figure A15 West end of North Wall

Figure A16 Rock revetment West of North Wall

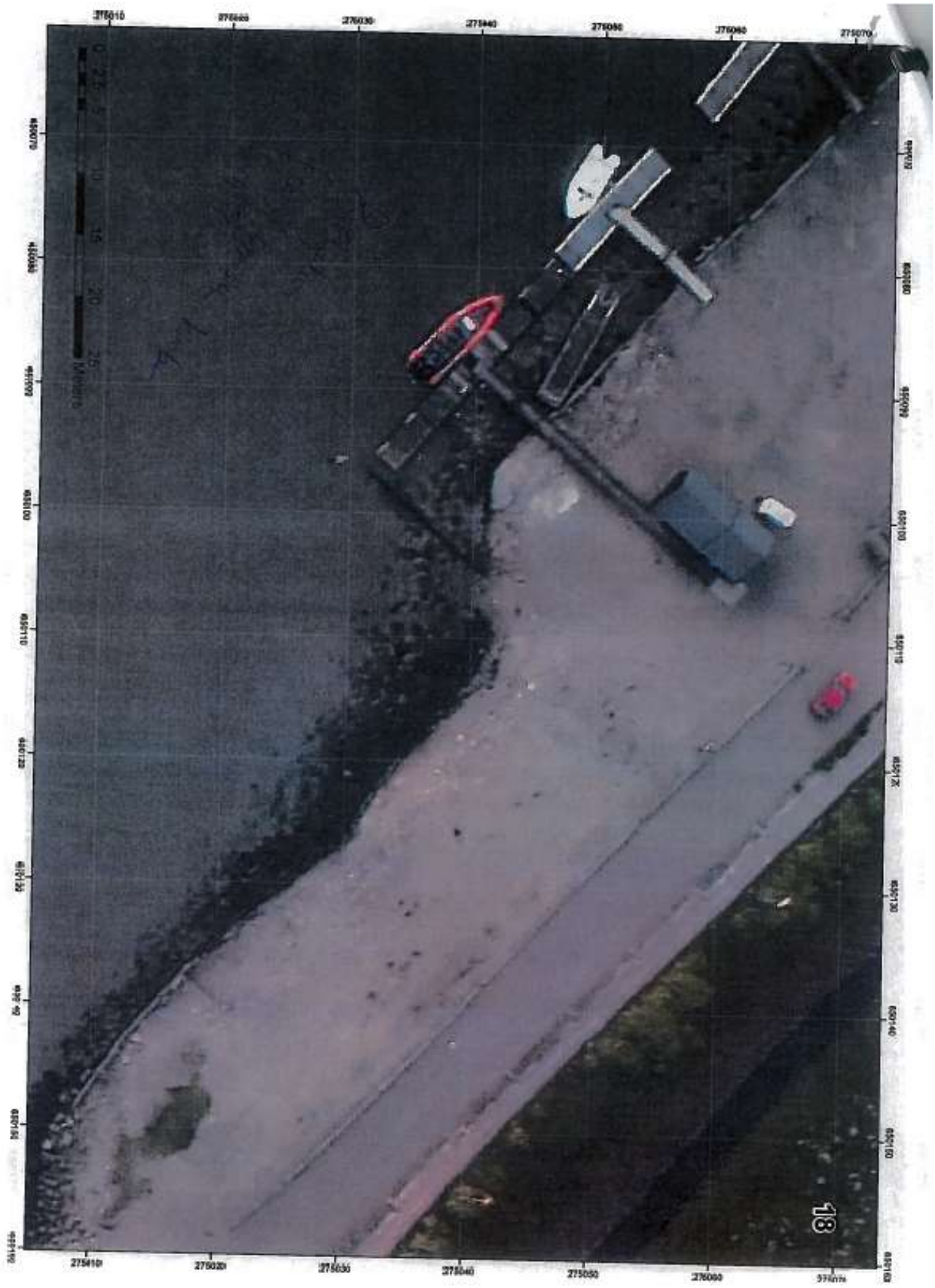

Figure A17 Harbour at Costal Voyager west of North Wall and rock revetment

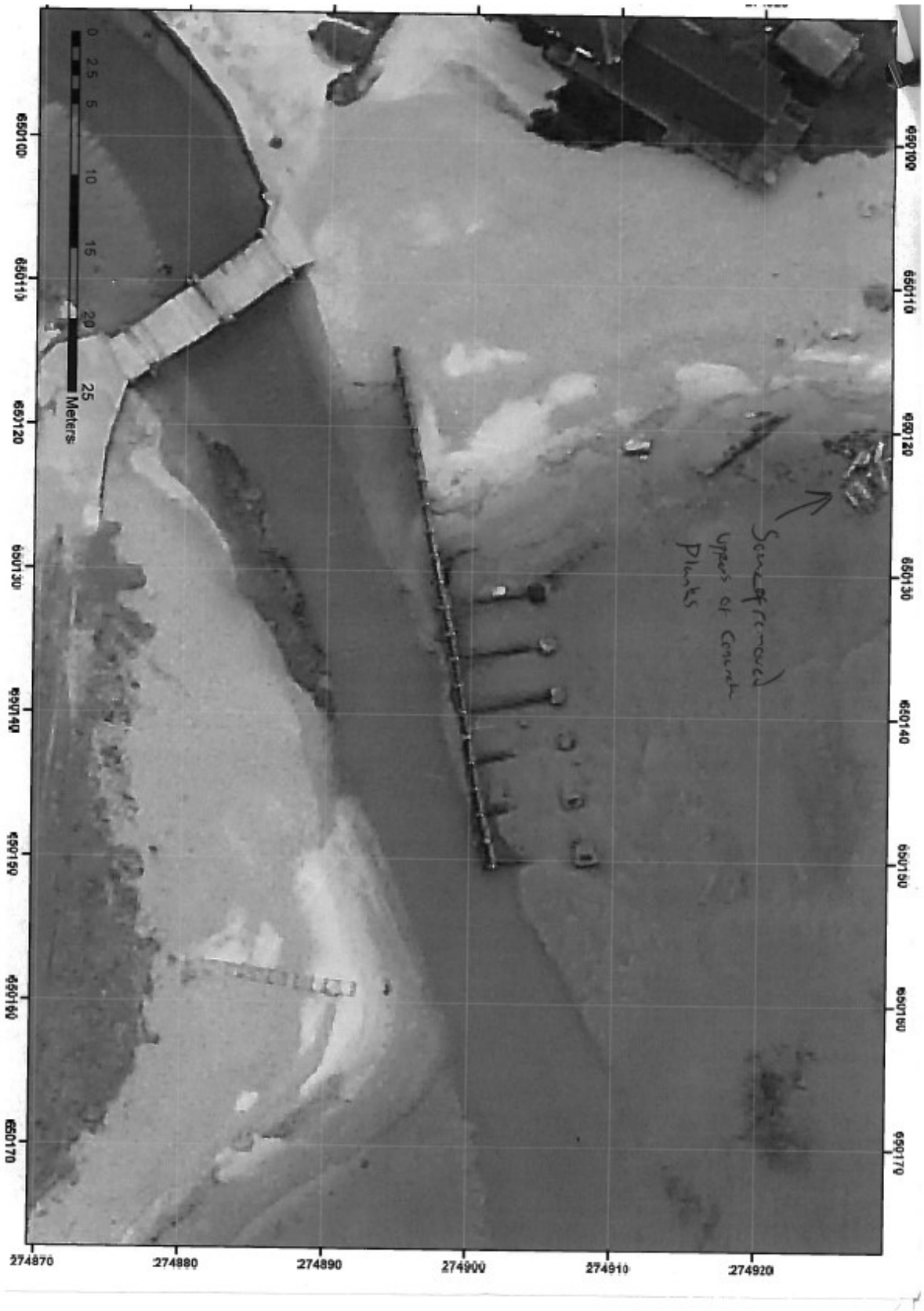

Figure A18 Walberswick Quay timber groyne and remains of cut planks