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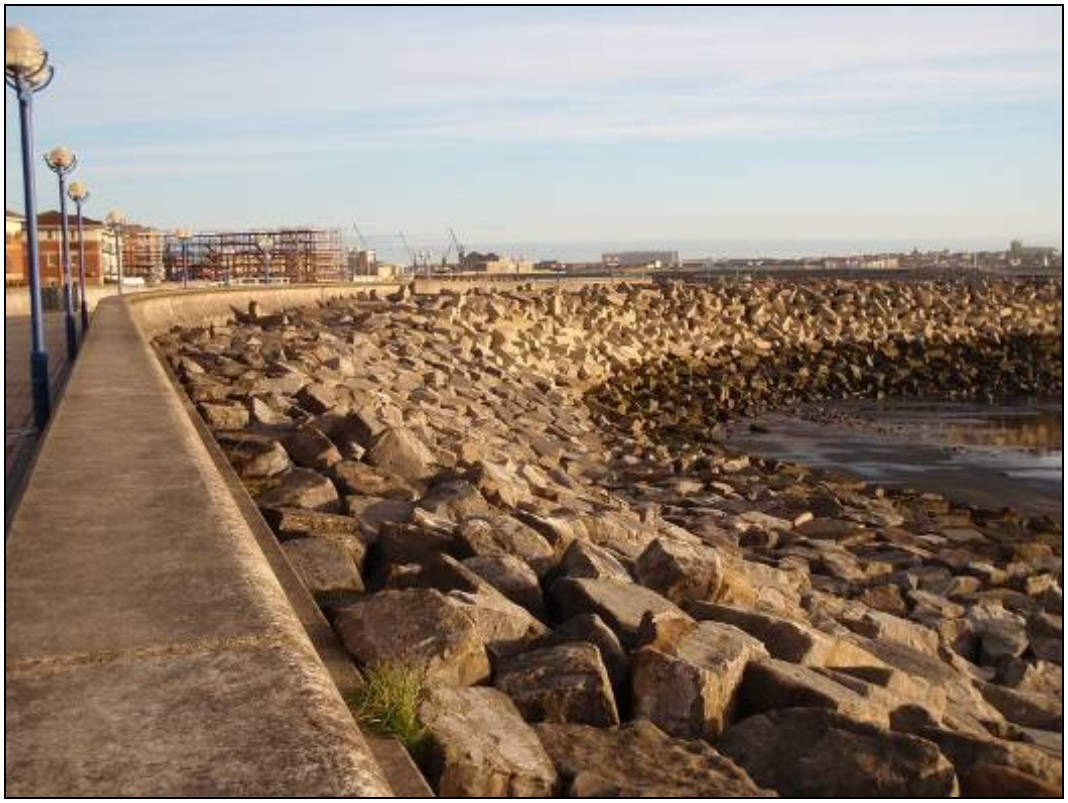


NECAG Coast Protection Assets and Coastal Slope Condition Analysis

HARTLEPOOL BOROUGH COUNCIL

Hartlepool Borough Council
Final Report

April 2009

Preamble

The North East Coastal Authorities Group (NECAG) comprises the following organisations, each of whom has certain responsibilities for managing the coastline between the River Tyne and Flamborough Head:

- South Tyneside Council;
- Sunderland City Council;
- Easington District Council;
- Hartlepool Borough Council;
- Redcar and Cleveland Borough Council;
- Scarborough Borough Council;
- East Riding of Yorkshire Council;
- Environment Agency;
- North York Moors National Park;
- Natural England;
- The National Trust.

Collectively, NECAG produced a 'second generation' Shoreline Management Plan (or 'SMP2') for its coastal frontage in 2007. In this SMP2, recommendations were made for condition assessments of the coastal protection assets and coastal cliffs and slopes along this frontage, as part of a broader coastal monitoring programme.

To this end, Scarborough Borough Council, acting as the 'lead authority' for NECAG, commissioned a team from Royal Haskoning and Halcrow to undertake the '*NECAG Coastal Protection Assets and Coastal Slope Condition Analysis*' between August 2008 and January 2009. Fieldwork was undertaken in the summer to autumn of 2008.

The joint team approach between Royal Haskoning and Halcrow has enable skilled staff with previous expertise of the specific stretches of frontage to work together and offer best value to NECAG. The asset and slope inspectors have included Chartered Engineers (focusing mainly on the built coastal protection structures) and Engineering Geomorphologists (focusing mainly on the natural cliffs and coastal slopes) ensuring suitable skills are applied to each length of frontage.

To ensure a consistency of approach in reporting, a standard template has been used for each of the seven Local Authorities within NECAG. In addition, the findings from the inspections have been entered into the Environment Agency's National Flood and Coastal Defence Database (NFCDD) for each identified length of 'defence', be it an engineered structure or a natural cliff/slope. This ensures that each Local Authority is complying with its High Level Target to ensure that the NFCDD is regularly updated.

Following these initial 2008/09 inspections, it is intended that future inspections are undertaken within the recently commissioned Cell One Coastal Monitoring Programme, which again is being undertaken jointly by Royal Haskoning and Halcrow under Scarborough Borough Council's leadership. This ensures that future work will be undertaken by the same teams and that the 2008/09 inspections will provide a baseline against which future changes, such as deterioration of defences or erosion of cliffs, can be compared.

1. Introduction

Methodology

The assessment of coastal protection assets and slopes along the Hartlepool Borough Council frontage was carried out by a team of asset inspectors and structural engineers during September and October 2008. All assets were graded based on their condition, residual life and urgency of repair work. Observations were photographed and all data were stored in the National Flood and Coastal Defence Database (NFCDD).

The asset descriptions provide an overview of findings, summarising each locality and identifying individual assets of poor condition, failing structures and assets that have the potential to fail. It is anticipated that this will help identify areas for investment, including repair work, replacement or the installation of a different asset type. This report will also highlight assets with a certain level of importance or interest.

Study Area

Hartlepool Borough Council's frontage extends from Crimdon Beck in the north to the North Gare Breakwater in the south. It comprises natural dunes, towns defended by sea walls and revetments, and key maritime structures such as port or harbour breakwaters.

The quay walls within Victoria Harbour and Hartlepool Marina were not inspected because they are not classified as coastal defence assets and they are located within privately owned areas.

2. Overview

The coastal defence assets of Hartlepool Borough Council are generally regularly inspected and well maintained. This maintenance regime is retaining some of the older sea wall structures in a fair condition and preventing deterioration.

Since the last data entries in NFCDD in 1998, several new schemes have been completed, mainly involving the construction of rock armour or concrete accropode revetments. These presently remain in a good condition since construction.

The principal areas of concern relate to:

- Dune erosion at the southern side of the mouth of Crimdon Beck.
- Slumping of the slag bank fronting the disused industrial areas along North Sands.
- The almost obsolete condition of the brick-filled gabions just south of the Old Cemetery, and the associated safety risk presented to beach users due to its instability.
- Deterioration of the sea wall along Hartlepool headland, including abrasion and capping beam spalling.
- Cavities and collapse at the seaward end of The Heugh Breakwater.
- Loss in functionality of the existing groynes fronting Town Wall, causing lowering of beach levels and exposure of the timber toe piles protecting the foundation of the wall in places.
- Deterioration in the condition of the North Pier, including abrasion of blocks, voids/holes in the structure, settlement/moving of the sloping blockwork revetment at the base of the structure, and loss of mortar from joints between the blocks.
- The condition of the sea wall along Seaton Sands.
- The poor condition of the North Gare Breakwater.

3. Condition Assessment

North Sands

The dunes immediately at the mouth of Crimdon Beck (south side) are high, steep and bare of vegetation. Cliffing is occurring at the toe of these dunes, caused by the proximity of the channel of the Beck.

Further south the dunes are somewhat more stable, with slumping confined to local points. Also, in places, new vegetation growth is occurring on the seaward face of the dunes and beach levels generally are healthy.

Further south still, the beach is crossed by industrial pipelines and other structures. The first outfall structure has a concrete deck and steel sheet pile sides. The piles are severely corroded but the concrete is in good condition. Healthy dunes with new vegetation growth back the beach between here and the second major outfall structure. This is similar in condition to the first outfall, although it also suffers minor damage to the concrete capping beam on its southern side. Just to the south, there is an obsolete timber pipeline-support structure which has been partially excavated.

The industrial land behind is presently disused and ruinous.

The main issue here is that the slag bank, located at the rear of the dunes, is actively slumping in places, although this is not due to marine erosion. Around here a second obsolete outfall is present.

Despite these problems, the area is fronted by stable (but low and narrow) dunes and healthy beach levels.

The third and fourth main outfall structures, close to the pier, are largely buried by high beach levels but the exposed sections were in good structural condition.

The pier itself is in fair but deteriorating condition. This timber structure carries a large pipeline but is also used by local anglers. The metal brackets at the timber joints are badly corroded and there are small scour holes in the beach around the legs of the structure.

The first outfall south of the pier is in a ruinous condition. There appears to have been excavation of the upper beach to locate the head of this structure, with the hole being left open. Here the backing dunes are in a relatively stable condition, although they occupy only a narrow width before the industrial wasteland is reached. The slag bank backing the dunes is in a poor

condition due to slumping (again, not marine-induced). Towards the southern end of this frontage rubble has been tipped down the slag bank.

Just to the south of the Old Cemetery, fronting an area of disused industrial works, is a brick-filled gabion wall fronting a slope of made ground.

This gabion wall is in a very poor, almost obsolete, condition. Bricks are spilling out from the wire-mesh gabions and the wall is very unstable in form. It presents a safety hazard to beach users and should be stabilised / removed. Since this wall helps stabilise the backing rubble slope, that too would require improved stabilisation.

Between here and the Marine Drive sea wall and promenade is an area of slag waste embankment, with in places a poured slag apron at the toe. In the main, this is presently relatively stable due to the protection provided by the toe apron, but there are several places where this is now starting to be undercut. Rock armour has been placed at the southern-most end, where outflanking was starting to occur to the Marine Drive sea wall. This seems to have arrested this problem.

Marine Drive and Hartlepool Headland

The Marine Drive sea wall is faced with masonry blockwork. Beach levels were reasonably healthy at the time of the inspection.

No major gaps or voids were observed in the mortar between blocks, although spalling of the capping beam was quite extensive. Previous repairs are evident, and these seem to be holding well. Very occasional minor vertical cracks were observed and some of the blocks suffer from minor abrasion.

Beach levels dropped locally in the vicinity of the large outfall, which appears to interrupt general north-west to south-east drift of sediment, but recover again further south. Spalling of the capping beam and blockwork abrasion worsens with progression south, but no significant structural issues were noted. The spalling and abrasion is worst on the Vane Street access steps.

Further south, the wall is faced with larger concrete blockwork. There is continued spalling of the capping beam with progression south-east along the headland and at the southern-most end the wall is in places locally very badly abraded. Here, hand railing was heavily rusted, although some had been repainted or replaced. Structurally, there are few cracks or voids and no evidence of undermining. Previous repairs seem to be holding well. At the very southern end, around the vicinity of the pipeline, the wall is cosmetically poor in appearance with very heavy abrasion of the blockwork and concrete apron. Locally, reinforcement bars are exposed in the concrete apron. Several areas have been subject to extensive concrete and blockwork repairs, but numerous areas remain abraded. Overall, the fair condition of the wall is retained through a very good programme of inspection and maintenance by the Council.

Moving around the headland towards The Heugh Breakwater, the wall is split into four asset lengths within the National Flood and Coastal Defence Database. The first, fronting the Coastguard Station, is in fair structural condition although there is extensive spalling of the capping beam and blockwork and apron abrasion. The adjacent length (left) is relatively poor, with numerous missing (smaller) blocks which need to be filled. Previous repairs have been made here indicating that it is a particularly vulnerable section of wall.

The adjacent length (below, left) is heavily abraded, but shows no voids. The final section (below, right), abutting the landward end of The Heugh Breakwater is in a good condition with only local and minor abrasion.

The Heugh Breakwater appears to have been reasonably well maintained by PD Teesport, with previous repairs holding well along the landward half where the blockwork is showing no signs of displacement. Along the seaward half, however, there are some cavities from which water can be seen issuing when the tide drops and the seaward end has collapsed, although this was partially covered by the tide at the time of the inspection and may require a further visit to more adequately assess condition.

Immediately in the lee of the breakwater is Block Sands. The seawall fronting the paddling pool is in fair condition, with some abrasion at the toe. To the west of here, the wall backing the rocky foreshore is being locally undermined in one area and is spalling at the crest. At the southern end, leading towards the Old Pier, beach levels are very high and stable, with vegetation growth.

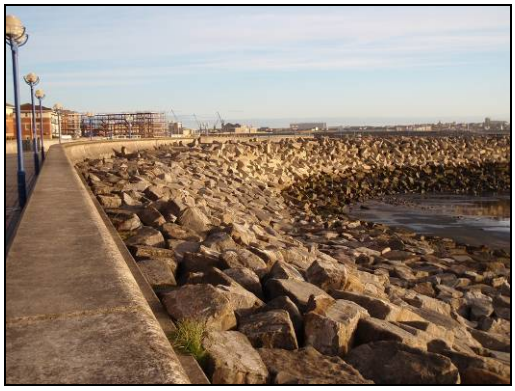
Old Pier is a concrete quay with accropode protection to its distal end. The quay wall is in fair condition, although some settlement is evident on the inward face. The accropode armouring is in good condition. Extending from the landward root of Old Pier along Fish Sands is Town Wall, a masonry blockwork wall which is a Scheduled Ancient Monument, built in the 1300s. Due to the sheltering effect of Old Pier, the wall itself remains in good condition despite its age. There have been some local repairs, which are holding well and one section of the wall is bolted. Here the bolts are corroded and the concrete rust-stained. The main concern, however, relates to the dilapidated condition of three of the four groynes along the fronting beach. This is leading to lowering beach levels and exposure of the timber toe piles protecting the foundation of the wall in places.

Victoria Harbour and Hartlepool Marina quay walls were not inspected as part of this commission since they are under private ownership and not classed as coastal defence assets.

Middleton Jetty is very heavily protected by concrete accropodes. Rock armour has been placed in front of certain sections of frontage between this jetty and North Pier. The North Pier itself extends into deeper water and appears in need of repointing and repair, including possible filling of voids. North of the lock entrance to the marina, the wall is in need of repointing. Between the lock entrance and the Middle Pier the concrete block revetment has experienced settlement/displacement in one area and this should be repaired before the blocks start to unravel further. The masonry quay wall between Middle Pier and South Pier has lost mortar from some joints and routine repointing is recommended.

Carr House Sands

To the south of the South Pier the concrete accropodes are replaced by dolerite rock armour units forming a revetment in front of a concrete recurved splash wall. This forms part of a coastal protection scheme, completed in 2003 which extends along approximately 2.5 km of the coastline, to the north of Seaton Carew.



The asset was in very good condition with no significant visible defects in the concrete of the splash wall or the seawall below. The density of the rock armour revetment appeared consistent with crest and bank profiles intact. There was minor displacement of some of the armour stones towards the toe of the revetment.

To the north of the concrete outfall, seaward of Newburn Bridge, there appears to be some thinning of the armour layer with an area of beach material visible.

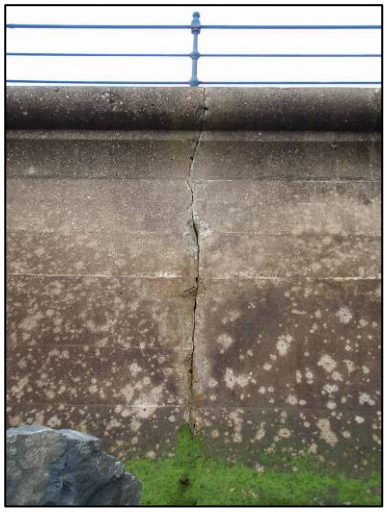
Shingle had accreted in the spaces between some armour units so the performance of the revetment in dissipating wave energy may be slightly reduced.

Seaton Carew

Inland of the Little Scar outcrop, a concrete ramp provides access to the foreshore through a reduced rock revetment. The seawall and ramp structure is in good condition. Some minor cracks were visible around construction joints with evidence of previous repairs. The concrete surface is stained beneath the drainage outlets and minor deterioration of the surface is beginning to occur. The reduced rock armour revetment is in good condition.

Seaton Sands

South of the access ramp the rock armour revetment is reduced to toe protection in front of a concrete seawall. The seawall has construction joints at approximately 20m centres, many of which have expanded and caused cracking of the surrounding concrete. The vertical cracks typically extend from the crest of the wall to the visible base. Localised spalling was occurring around some of the cracks, notably near the crest of the wall and close to drainage outlets.



Spalling and scour damage to the seawall was evident behind the rock armour. Vegetation was present on sections of the seawall sheltered by the rock armour. The rock armour units were well placed with no significant displacement evident.

The seawall above the access steps appeared to have settled, causing large vertical cracks which have previously been in-filled. The concrete wall fronting the access steps was eroded significantly at its base.

To the south, the crest level of the seawall is reduced. The rock armour thins, eventually leaving the concrete seawall exposed down to beach level. The beach level increased moving southwards. The widening of construction joints and the associated cracking was also present along the lower seawall.

The seawall extends to a gated access to the beach opposite Station Lane. South of the access, the defence consists of a concrete crest wall above a grouted stone revetment.

The upper concrete wall was spalled in some locations with exposed reinforcement. Minor cracking was present in some joints towards the crest of the wall with several more significant cracks extending through the full height of the wall.

The grouted stone revetment was in fair condition. Cracks were developing in the revetment face, with missing grout and occasional missing blocks. There was no evidence of undercutting although the beach level was sufficiently high to cover the toe of the revetment. To the south, the masonry becomes regular and coursed and here the structure was in better condition.

The defence ends at another access point to the foreshore. The access is flanked by masonry walls which were in fair condition with missing mortar and concrete render in places. To the south of the access, a grouted stone revetment with a concrete surface layer was in good condition, although missing concrete render to the northern end of the revetment (at the tie in with the masonry wall) was beginning to expose the infill material.

The car park to the south of Seaton Carew is fronted by a concrete wall. Localised lowering of the beach level had exposed a concrete apron which was being undercut. Access to the beach is to the north of the wall. Here a section of the wall has been displaced although this will not affect the performance of the asset significantly. Rock armour units provide some protection to the access, although this appears predominantly to prevent vehicular access to the foreshore.

To the south of the sewage pumping station the frontage is undefended, consisting of a relatively stable dune system.

The dunes had a good coverage of established vegetation, with localized areas of non-vegetated dune. The most significant erosion of the dunes appears to be that caused by members of the public creating makeshift footpaths.

Towards the southern extent of undefended frontage there is a stone/rubble embankment which ties in with the North Gare Breakwater. There are several large concrete blocks and smaller pre-cast concrete blocks acting to limit the erosion of the dunes landward of the structure and outflanking. There is slight displacement of some of the concrete blocks, although the embankment is generally in good condition.

North Gare Breakwater

The North Gare Breakwater protects the entrance to the Tees Mouth and retains the beach material of Seaton Sands. The structure was inaccessible to the public due to instability and holes in the surface. Fencing was present to prevent public access in addition to signs warning of the dangers.

The breakwater is a masonry and concrete structure with evidence of a variety of previous repairs including bagwork, mass concrete and pre-cast concrete blocks. There

was evidence of undercutting, missing pre-cast concrete sea wall units, void formation and failure of previous repairs. There appeared to be significant settlement close to the seaward extent of the structure although this could not be confirmed by closer inspection.

The landward end of the breakwater on the northern side was in very poor condition.

Large voids have opened up beneath the upper concrete layer which was largely damaged or missing.

This section of the structure requires urgent attention to prevent further deterioration.

Sand dunes are accreting to the south of the breakwater. The dunes appear to be stable with reasonable coverage of well established vegetation.

The southern side of the breakwater appeared in better condition than the northern side. There was some missing material, notably at the toe of the concrete screed at the landward end of the structure.

4. Comparison with Previous Assessment

The previous assessment documented within the National Flood and Coastal Defence Database (NFCDD) was reportedly carried out by Hartlepool Council in March 1998. The most significant change is the construction of new defences since that time, such as the rock armour between Middleton Jetty and North Pier, the rock revetment along Carr House Sands to the south of the Marina, and the rock armour at the toe of the seawall at Seaton Sands.

The previous assessment suggested urgent action be taken to several defence assets to the south of South Pier. The assets have since been replaced by the new coastal defence and the present assessment found the defence assets to be in very good condition with no further repairs necessary.

5. Problems Encountered and Uncertainty in Analysis

All assets were inspected at suitable stages of the tide, although a boat-based visual inspection of some of the deeper water structures, such as the North Pier, is recommended to complement this inspection.

Quay walls within Victoria Harbour and Hartlepool Marina were not inspected since they are located within private estates and are not classified as coastal defence assets.

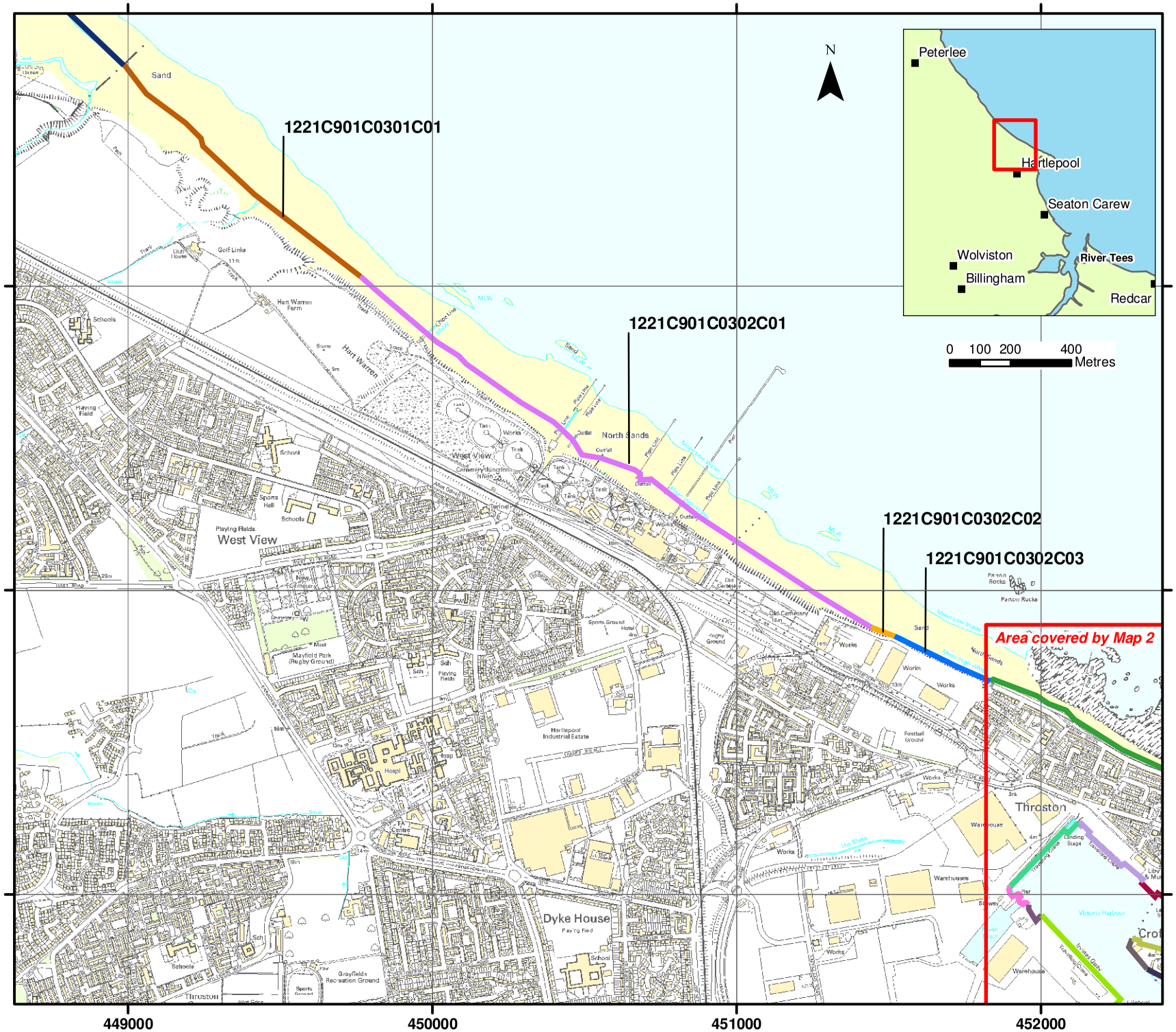
Access to the North Gare Breakwater was not possible because the structure was closed to members of public due to instability and holes in the surface. The landward end of the breakwater was inspected, with observation of the seaward extent made from the foreshore either side of the structure. More detailed investigations into the problems here is recommended to advise on suitable remedial responses.

6. Conclusions and Recommended Actions

Defence	Location	Priority	Date	Recommended Action
1221C901C0301C01	North Sands	Medium	02/09/2008	Monitoring of erosion to dunes at the mouth of Crimdon Beck heading south.
1221C901C0302C02	North Sands	High	02/09/2008	Remove/stabilise wall and slag bank.
1221C901C0303C01	Marine Drive	Medium	02/09/2008	Monitoring effectiveness of rock armour in preventing outflanking at northern end of seawall. Remedial work to beach access steps and ramp.
1221C901C0303C02	Hartlepool headland	Medium	02/09/2008	Continue inspection and maintenance regime.
1221C901C0303C03	Hartlepool headland	Medium	02/09/2008	Continue inspection and maintenance regime.
1221C901C0303C04	Hartlepool headland	Medium	02/09/2008	Continue inspection and maintenance regime.
1221C901C0401C02	Hartlepool headland	Medium	02/09/2008	Continue inspection and maintenance regime.
1221C901C0401C03	Hartlepool headland	Medium	02/09/2008	Continue inspection and maintenance regime.
1221C901C0401C01	Heugh Breakwater	Medium	02/09/2008	Continue inspection and maintenance regime. Address issue of cavities and collapse at seaward end.
1221C901C0401C05	Inscar Point	Low	02/09/2008	Monitor wall undermining.
1221C901C0401C35	Town Wall	High	02/09/2008	Continue inspection and maintenance regime. Produce long term solution for loss of groynes and reduction in beach levels.
1221C901C0401C22	North Pier	High	02/09/2008	Repointing of joints and repair of holes in blockwork structure, including possible grouting of infilled materials to fill voids within the structure.
1221C901C0401C24	North of Lock	Medium	02/09/2008	Repointing.
1221C901C0401C26	Between Lock and Middle Pier	Low	02/09/2008	Repair settled blockwork.
1221C901C0401C28	Middle Pier to South Pier	Low	02/09/2008	Repointing.
1221C901C0401C29	Middle Pier to South Pier	Low	02/09/2008	Repointing.

Defence	Location	Priority	Date	Recommended Action
1221C901C0402C02	Carr House Sands	Low	14/10/2008	Monitor extent of rock armour thinning.
1221C901C0501C01	Carr House Sands	Low	14/10/2008	Infill cracks in concrete.
1221C901C0501C05	Seaton Sands	Medium	14/10/2008	Infill cracks in concrete. Remedial work to access steps.
1221C901C0501C04	Seaton Sands	Medium	14/10/2008	Infill cracks in concrete. Replace missing masonry. Replace missing grout.
1221C901C0501C03	Seaton Sands	Medium	14/10/2008	Repoint masonry wall. Replace concrete render to north of revetment.
1221C901C0501C02	Seaton Sands	Low	14/10/2008	Relocate displaced wall section. Infill cracks in concrete wall.
1221C901C0503C01	North Gare Breakwater	High	14/10/2008	Structural survey. Significant remedial works.*

* viewed from landward end only – structure inaccessible



Asset location

NFCDD Asset Number

Client: North East Coastal Authorities Group

Project: Coastal slope and asset condition inspection, summer 2008

Map 1 - Hartlepool Council Frontage

Asset Condition 2008

Drawing Scale 1:17,000 at A4

Drawn by:	TC	Date: 02/04/2009
Checked by:	NC	Date: 02/04/2009
Approved by:	NC	Date: 02/04/2009

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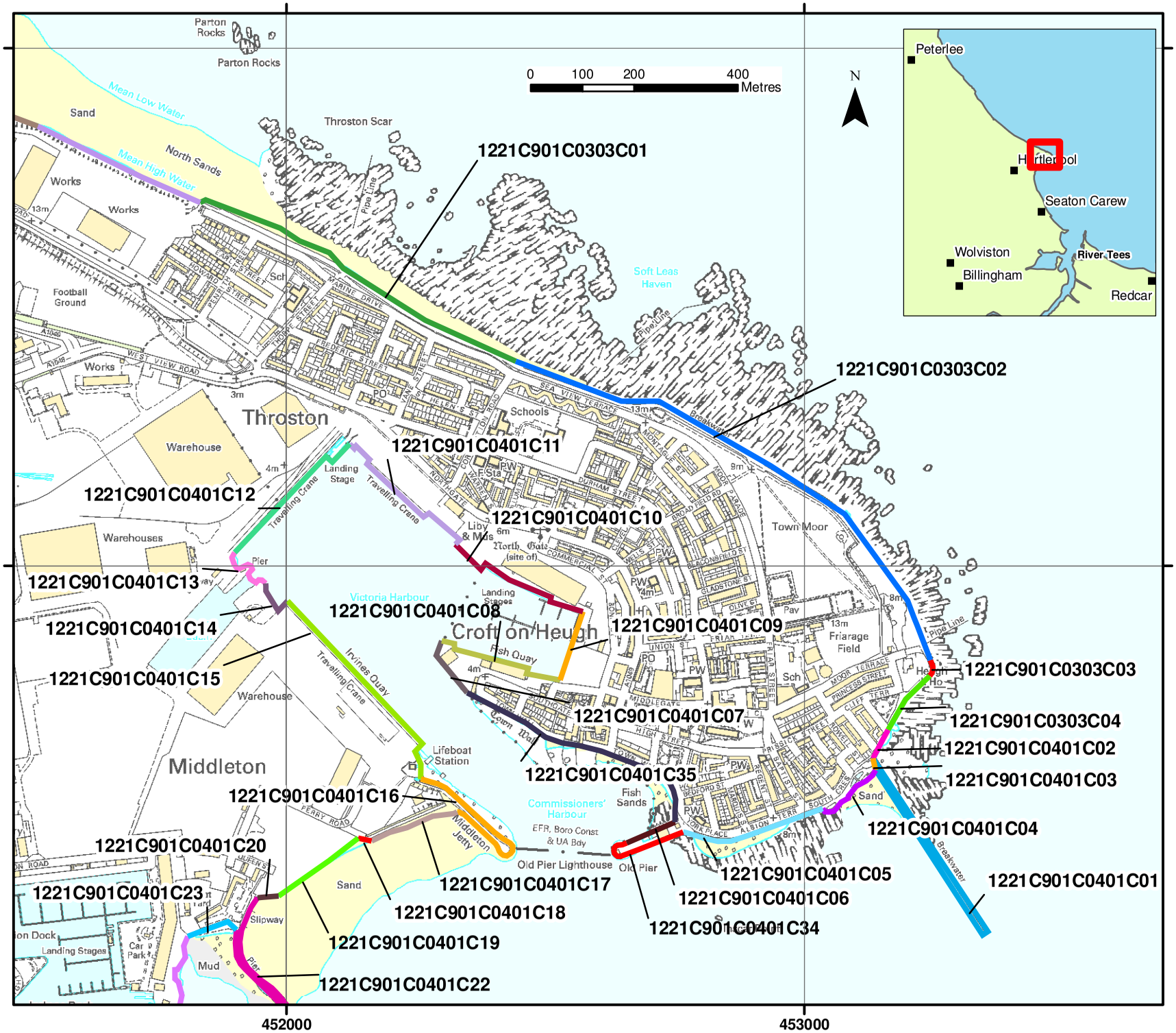

Asset location

NFCDD Asset Number

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Project: Coastal slope and asset condition inspection, summer 2008

Map 2 - Hartlepool Council Frontage

Asset Condition 2008

Drawing Scale 1:10,000 at A4

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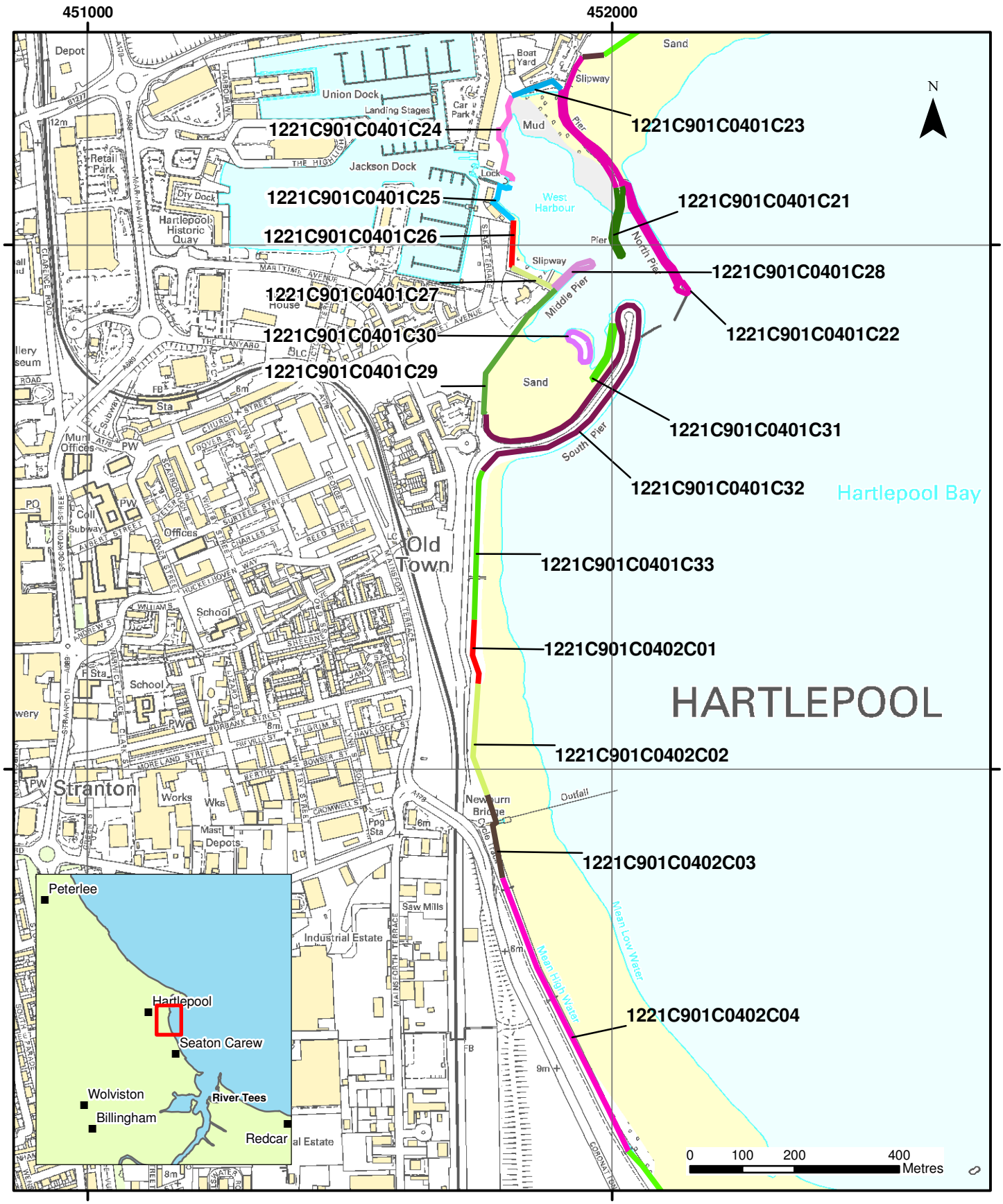

Asset location

NFCDD Asset Number

Client: North East Coastal Authorities Group

Project: Coastal slope and asset condition inspection, summer 2008

Map 3 - Hartlepool Council Frontage

Asset Condition 2008

Drawing Scale 1:10,000 at A4

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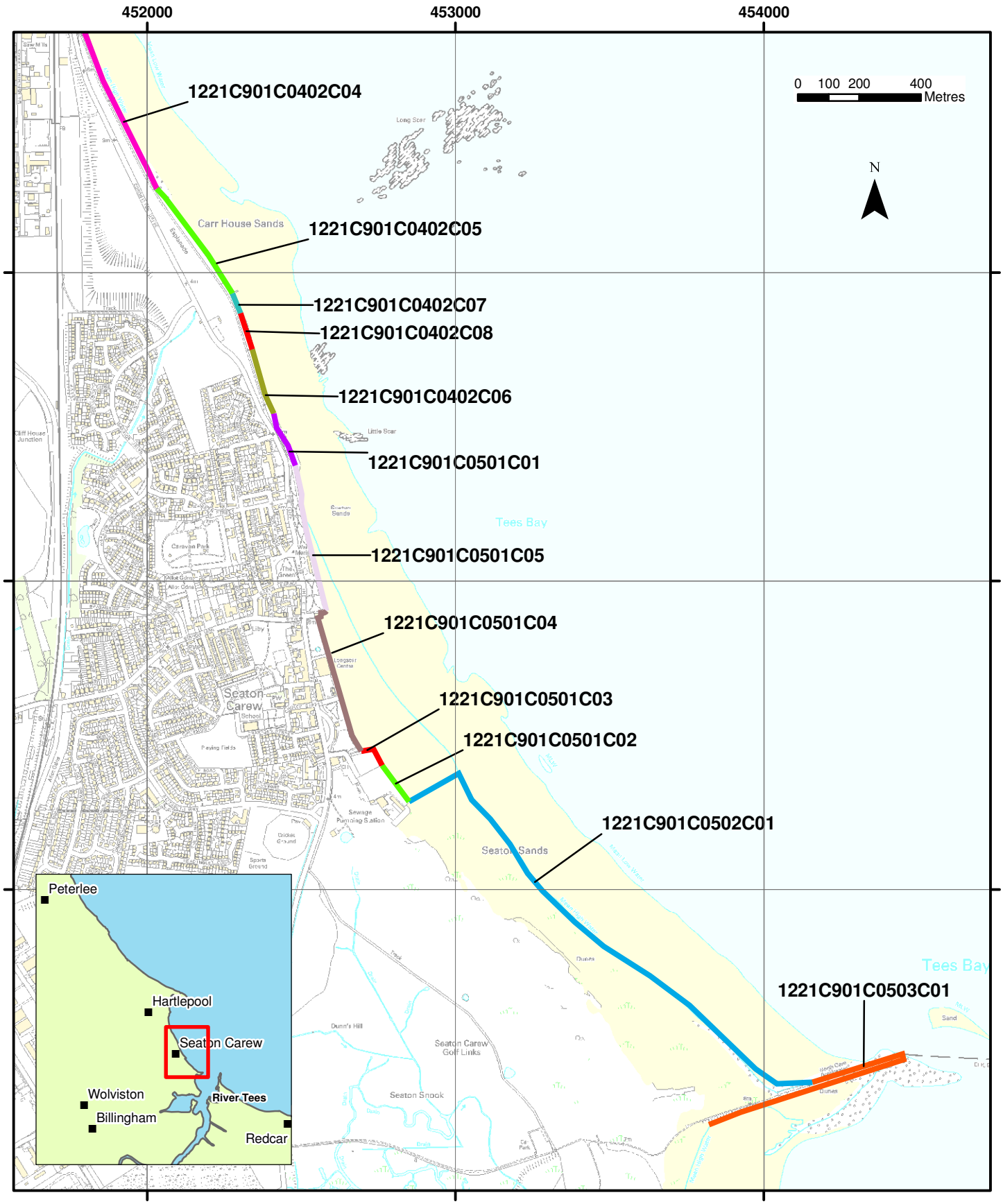

Asset location

NFCDD Asset Number

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Project: Coastal slope and asset condition inspection, summer 2008

Map 4 - Hartlepool Council Frontage

Asset Condition 2008

Drawing Scale 1:17,000 at A4

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