



**NECAG Coast Protection Assets
and Coastal Slope Condition Analysis**



**Durham County 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;
- Durham County Council ⁽¹⁾;
- 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 The former Durham County Council became part of a unitary Durham County Council on 1st April 2009.

1. Introduction

Methodology

The assessment of coastal protection assets and slopes along the Durham County Council frontage was carried out by a team of asset inspectors and structural engineers during September 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

Durham County Council's frontage extends from Ryhope Dene to Crimdon Beck and is largely comprised of sea cliffs and fronting beaches and shore platforms.

A large proportion of the frontage is undefended, with much of this owned by The National Trust, and is rural in nature. Seaham Harbour is a major feature along the frontage and, together with the town of Seaham, is protected by structures.

2. Overview

Large lengths of frontage comprise undefended sea cliff subject to modest ongoing erosion. The principal mechanisms of recession are:

- Localised slumping in softer materials, such as glacial tills;
- Cave and arch excavation in the base of harder materials, such as magnesian limestone;
- Occasional localised rock falls in the harder rock, and in one case a larger rock slide; and
- Chemical weathering of the rock around Chourdon Point.

This cliff erosion generally does not have major implications in terms of risk due to the largely natural character of the coastline, but just to the north of Seaham Harbour's North Pier it is of more relevance and here a section of cliff top has been fenced-off to ensure public safety.

Just to the north of Featherbed Rocks, a different problem is being experienced; one of accretion. Beach levels have increased so much through the deposition of shingle that they now almost reach the crest of the sea wall in this section of frontage. Whilst this has the positive effect of providing direct shelter to the sea wall itself, the beach levels are providing a 'ramping' effect for wave run-up, resulting in wave splash overtopping the wave wall and starting to erode the backing sea cliffs, set back from the wall crest by the width of the promenade.

Over many lengths of frontage, the shoreline behaviour is still affected by the legacy of colliery waste tipping on the foreshore. The resulting 'beaches' provide protection against marine erosion to the backing cliffs. Whilst there are places where healthy widths still remain affording good protection, such as the northern section of Blast Beach, there are also sections where the waste has eroded landwards leaving only a very narrow strip.

Most notably this is the case to the north of Nose's Point and in the northern section of Hawthorne Hive.

Since the last recorded entries in the National Flood and Coastal Defence Database (NFCDD) in 1998, two schemes have been completed and the NFCDD has been updated accordingly. The first is rock armour protection around the Featherbed Rock headland, and the second is a wide rock revetment running south from Seaham Harbour South Pier to around Seaham Fleet Rock.

The southern-most section of frontage comprises sand dunes extending towards Crimdon Beck. There is some modest erosion of these dunes, particularly around and south of the car park access steps.

3. Condition Assessment

The northern section of Durham County Council's frontage, extending immediately south from Ryhope Dene, is undefended sea cliff (right). The cliffs comprise a magnesian limestone base with overlying glacial till. There is ongoing active slumping in the till, but this is relatively small-scale. Due to heavy rainfall on the previous day, the cliffs were experiencing a lot of water seepage through their face in the softer overlying material at the time of the inspection.



In places, the cliffs have stacks and arches forming at their base, caused by differential erosion of the harder rock by waves at their toe. An example of this is presented on the front cover of this report. Along the length of cliff is a small pebble beach at the toe.



The heavy rainfall of the previous day also had the effect of causing spate in the watercourse flowing down the side of the access steps to the beach from the car park (left).

This caused a minor and temporary increase in the width of channel that is formed across the foreshore enabling drainage of the watercourse out to sea.

Immediately south of the car park access steps is a short undefended length of cliff which is experiencing ongoing slumping in the softer till material. Further south still is a short (about 10m) section of wall which is in poor condition and is being a little outflanked at its northern end (below left) and its crest is moderately abraded. This wall immediately grades into a larger seawall and promenade, with occasional access steps or ramps from the promenade to the beach. The grassed slope above the northern-most access ramp is covered by a blockwork revetment which is in fair condition (below right).



The cliffs and slopes behind the main length of seawall were mostly stable at the time of inspection, but one area had small rock placed to stabilise the slope (right).

Beach levels at the toe of the wall were healthy at the time of the inspection, with a small pebble berm sitting on top of a sand foreshore. Across the frontage three timber groynes and one concrete groyne were buried by beach sediment, with only their very tips exposed.



The beach condition could generally be described as 'good'. At the southern end of the frontage, beach levels almost reached the seawall crest (left).

Whilst this provides a good degree of protection to the sea wall, such extensive accretion in itself presents a problem to the Council since waves run up the 'ramp' formed by the coarser beach material, overtop the sea wall and effect the face of the backing sea cliffs.

The seawall itself is, where not buried by beach material, generally in a fair condition, but some cracks are evident where access ramps extend off the promenade. Towards its southern end the wall becomes notably more abraded. Since beach levels are so high along the southern-most section of wall, it was not possible to inspect the structure here and should beach levels drop it is recommended that this section is visually inspected, along with the groynes and toe piling along the remainder of the frontage.

Due to the heavy rainfall of the previous day, a notable channel had formed across the foreshore by a moderately-sized flap-valve outfall within the wall.

Around Featherbed Rocks a rock revetment has been constructed, extending around the headland and further south.

At the northern section of the headland, this is in the form of a berm located seaward of the actual toe of the cliff (right). The structure is fairly substantial in armour size and in good condition.





On the southern side of the headland, there is a concreted platform under which an outfall discharges to sea (left). The revetment extends around this outfall and head wall.

Whilst the concrete is in a badly abraded condition, the structure is now well stabilised by the rock armour forming the revetment.

Further south of the headland, rock armour continues south.

In places this is as a berm seaward of the cliff toe and in other places it more directly abuts the cliff toe.

This structure gradually grades out to undefended cliffs further south and tapers back into abut the cliff toe at its southern end.



The southern-most section of protected cliff and the undefended stretch extending between the rock armouring and Seaham Harbour is subject to ongoing recession, with an area of cliff top close to a car park being fenced off to ensure public safety. Despite being well vegetated, these cliffs are at a relatively steep angle of repose and are in places slumping. A drainage pipe through the cliffs has been exposed in one area, probably due to settlement.

Further south, beach levels become higher, with a wide pebble berm perched on top of the sand beach. This seems to be protecting the cliff face since no active signs of slumping were observed.

Seaham Harbour itself was only inspected from a distance due to public access restrictions, making assessments of condition difficult (see Section 5 for further information).



From the root of the structure protecting South Dock southwards to around Seaham Fleet Rock, a wide rock revetment has been placed (left) since the last recorded entry in NFCDD.

In the northern section, this armouring is stabilising the wall to South Dock, but further south it is protecting cliffs that previously were undefended and rapidly eroding.

South of the now defended frontage, is a section of undefended sea cliff leading towards Nose's Point. Here erosion of cliffs seems active and ongoing since the face is near vertical and largely bare of vegetation.

Just to the north of a rock stack on the foreshore, a recent rock fall was observed (right).



Along Blast Beach there remains a good degree of protection to the backing sea cliffs provided by the colliery waste beach in most places (left), although towards the south the width decreases notably. In local areas the soft cliff material has experienced slumping and the harder rock some vertical cracking, possibly indicative of settlement due to subsidence.

Also along Blast Beach some sections of the cliff base are being eroded by chemical attack from mine water leaching from the hard rock and glacial till interface.

There is more active slumping in the softer material capping the harder rock at Chourdon Point, with cave excavation at the base of the cliffs. The fronting rock platform and upper beach boulders are showing signs of extensive chemical weathering.

At the northern section of the Hawthorne Hive beach the colliery spoil has eroded back to leave only a very narrow width fronting the cliffs. With ongoing erosion of the spoil recession of the backing sea cliffs will soon be re-activated. Within the centre of this frontage there is a quite wide berm beach composed of pebbles and fine shingle. Here the backing cliffs are more stable, occupying a gentler slope angle and being well vegetated. Hawthorne Beck discharges to sea through this beach.

Further south from here to Gin Cave at Blackhall Rocks, behaviour is dominated by cliff geology and the presence (or absence) of a protective beach formed from colliery waste. Generally, where the form of the cliff comprises softer material overlying a harder rock base, there can be slumping in the overlying material and cracks and arches formed at the cliff base.



There are occasional stack formations resident on the foreshore and in one location a rock slide was observed. Elsewhere rock falls become more prevalent. Where colliery waste beaches are observed, even where they are only of moderate width, the backing sea cliffs are generally more stable. As the waste beaches become wider and higher with progression south, so the stability of the backing cliffs improves further. Two reedbed lagoons are protected by the colliery spoil towards the southern section of this frontage.



From Gin Cave southwards to Crimdon Park Caravan Site the cliff type has a different character and there are protective scars across the foreshore. Whilst these cliffs are eroding, the processes are very localised and the rates are not as high as along the cliffs further north. Where the rock scars stop, however, rock falls and slumps are immediately observed in the cliffs once again.

Between Crimdon Park Caravan Site and the southern boundary of Durham County Council's jurisdiction at Crimdon Beck, the frontage is composed of dunes. Immediately at the end of the rock scars in the north, the dunes are very stable and well vegetated. Here they are high in crest level and of a relatively shallow slope angle. Further south, around the car park access steps, there is minor erosion and some fencing has been placed to control pedestrian access. South of the access steps, the dunes are more exposed. Here a cobble berm partially protects the toe but occasional slumping has still occurred. The dune field behind the 'front-line' dune crest is locally bare of vegetation where trampling has occurred. Just north of Crimdon Beck, some fencing was placed to prevent disruption of nesting Little Tern.

4. Comparison with Previous Assessments

The last documented inspections within NFCDD were undertaken in 1998, presumably as part of the national Sea Defence Survey update.

At that time, the frontage around Featherbed Rocks was subdivided into four whole 'asset lengths'. There was a concrete wall to the base of the eroding cliffs which, at the time of the last survey in NFCDD was classified as being in a 'very poor' condition. In places concrete slabs had collapsed and some emergency rock armour had been placed, with investigations under way supporting a rock armour coast protection scheme. As this scheme has now been implemented, a decision has been made to merge the previous asset lengths into one single asset length covering the extent of the rock armour berm/revetment.

At the southern end of Seaham Harbour (seaward side) rock armour protection has been placed against the landward root of the wall and extends further south against the formerly eroding sea cliffs since the last recorded inspection in NFCDD in 1998.

To the north of Nose's Point, the 1998 NFCDD entry records colliery waste on the foreshore that was "eroding fast". At present, there is only a narrow width of waste remaining in this section.

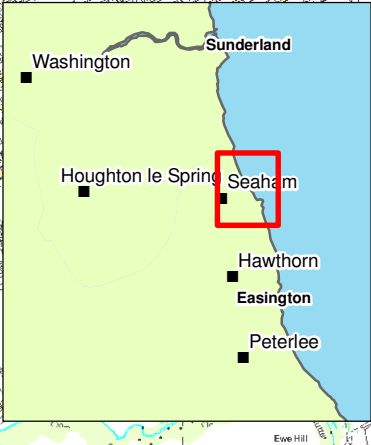
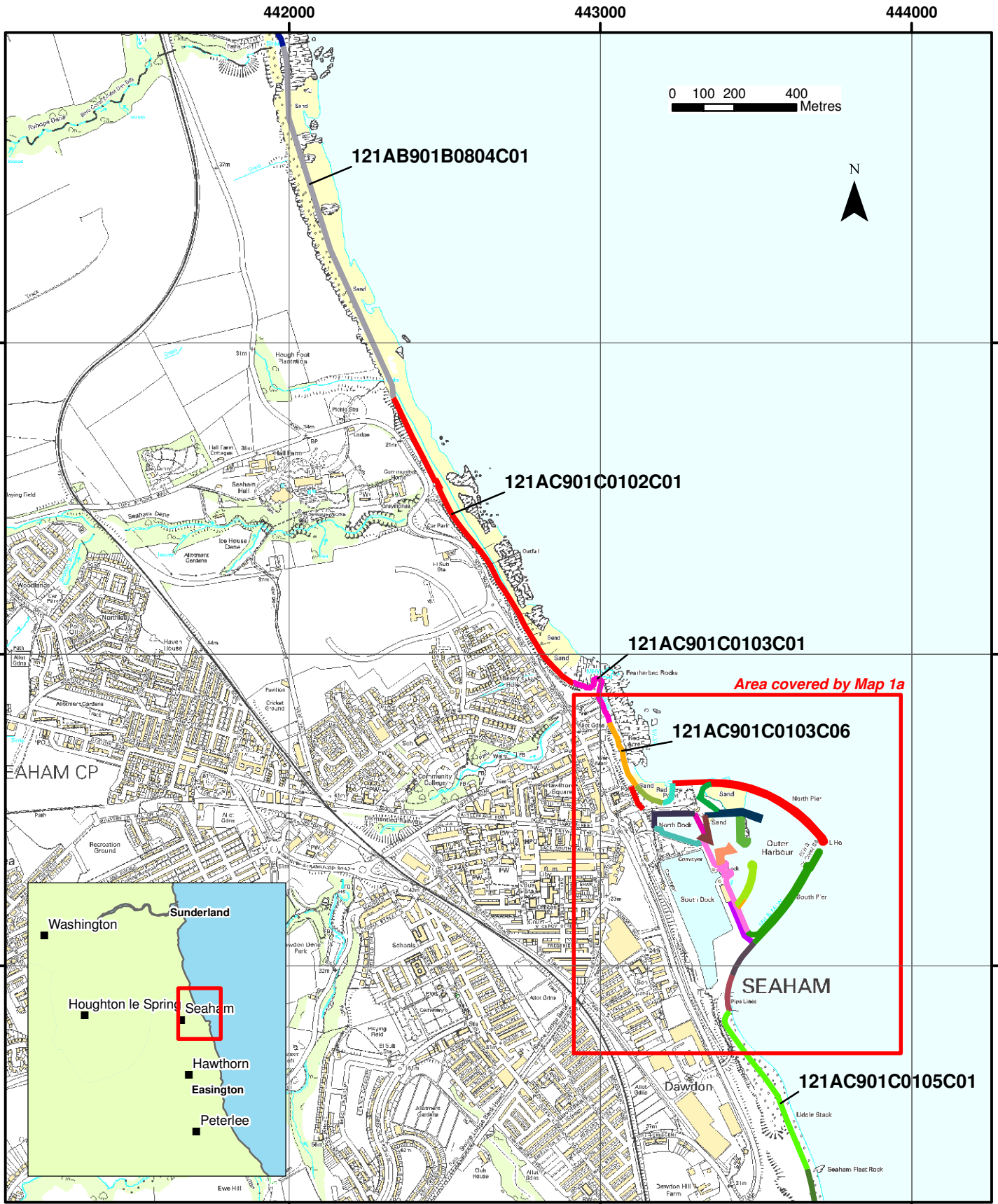
5. Problems Encountered and Uncertainty in Analysis

Seaham Harbour was only inspected from a distance due to public access restrictions and because other than the North Pier and the South Pier, other structures are not coastal defence assets. Despite this an evaluation of the harbour walls and slopes around North Dock was previously undertaken as part of the Seaham Harbour Regeneration Plans by Cundall in July 2008 and reported to the then Easington District Council at that time.


Further, vessel-based, inspections of the North Pier and the South Pier are recommended.

6. Conclusions and Recommended Actions

Defence	Location	Priority	Date	Recommended Action
121AC901C0102C01	Featherbed Rocks (north of)	Low	01/09/2008	Inspect groynes, sheet piling and sea wall if beach levels drop
121AC901C0103C06	North Pier (north of)	Medium	01/09/2008	Public safety needs to be monitored and access to cliff top controlled when necessary
121AC901C0103C07	North Pier (north of)	Low	01/09/2008	Minor repairs to cracks
121AC901C0104C03	North Pier	Medium	01/09/2008	Vessel-based inspection
121AC901C0104C17	South Pier	Medium	01/09/2008	Vessel-based inspection
121AC901C0107C01	Blast Beach	Low	01/09/2008	Monitor rate of erosion of colliery spoil
121AC901C0201C01	Outfall pipe	Low	01/09/2008	Repair broken outfall pipe



Asset location
NFCCD Asset Number



Client: North East Coastal Authorities Group

Project: Coastal slope and asset condition inspection, summer 2008

Map 1 - Easington Council Frontage

Asset Condition 2008

Drawing Scale 1:17,000 at A4


 ROYAL HASKONING
 Royal Haskoning
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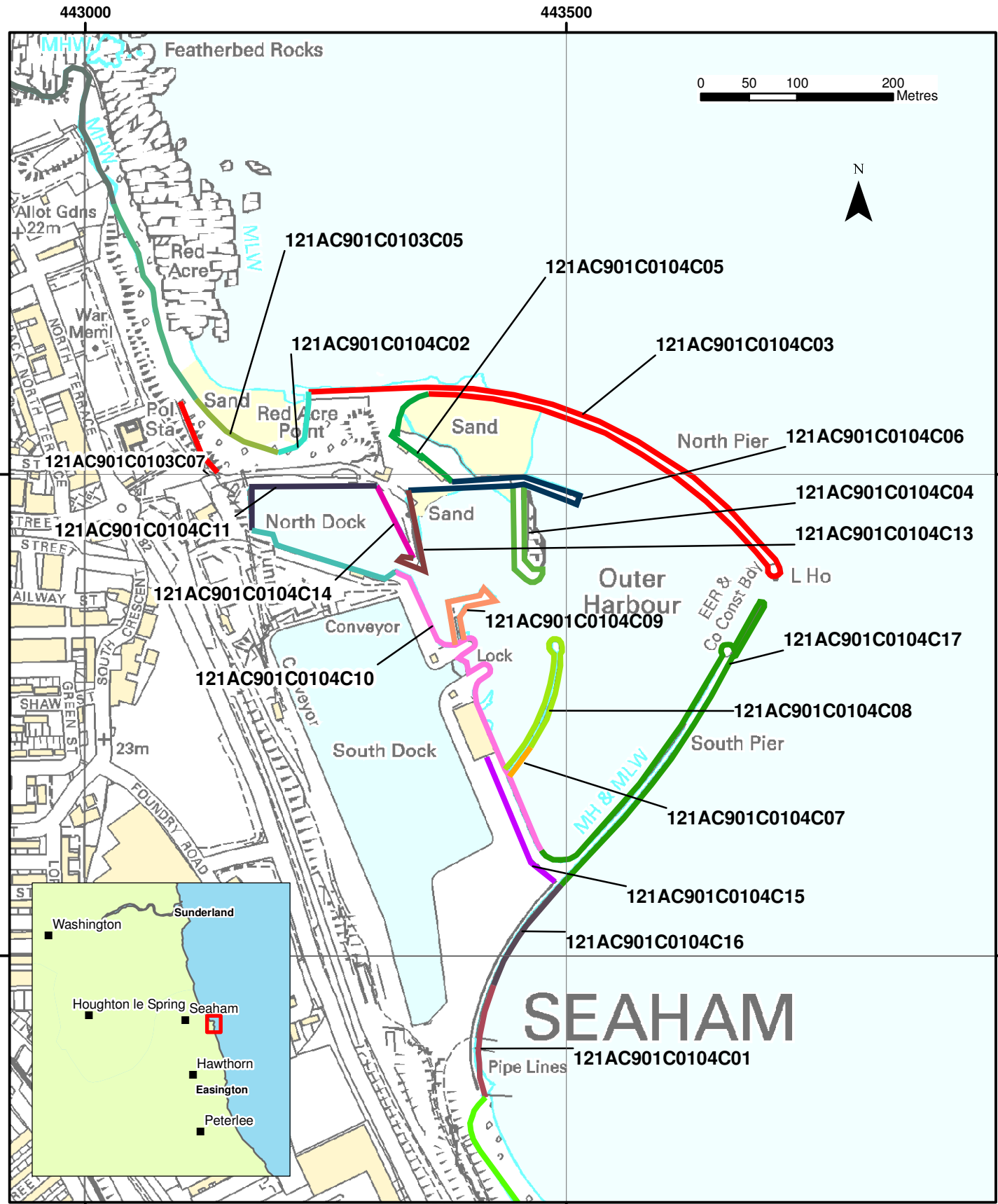

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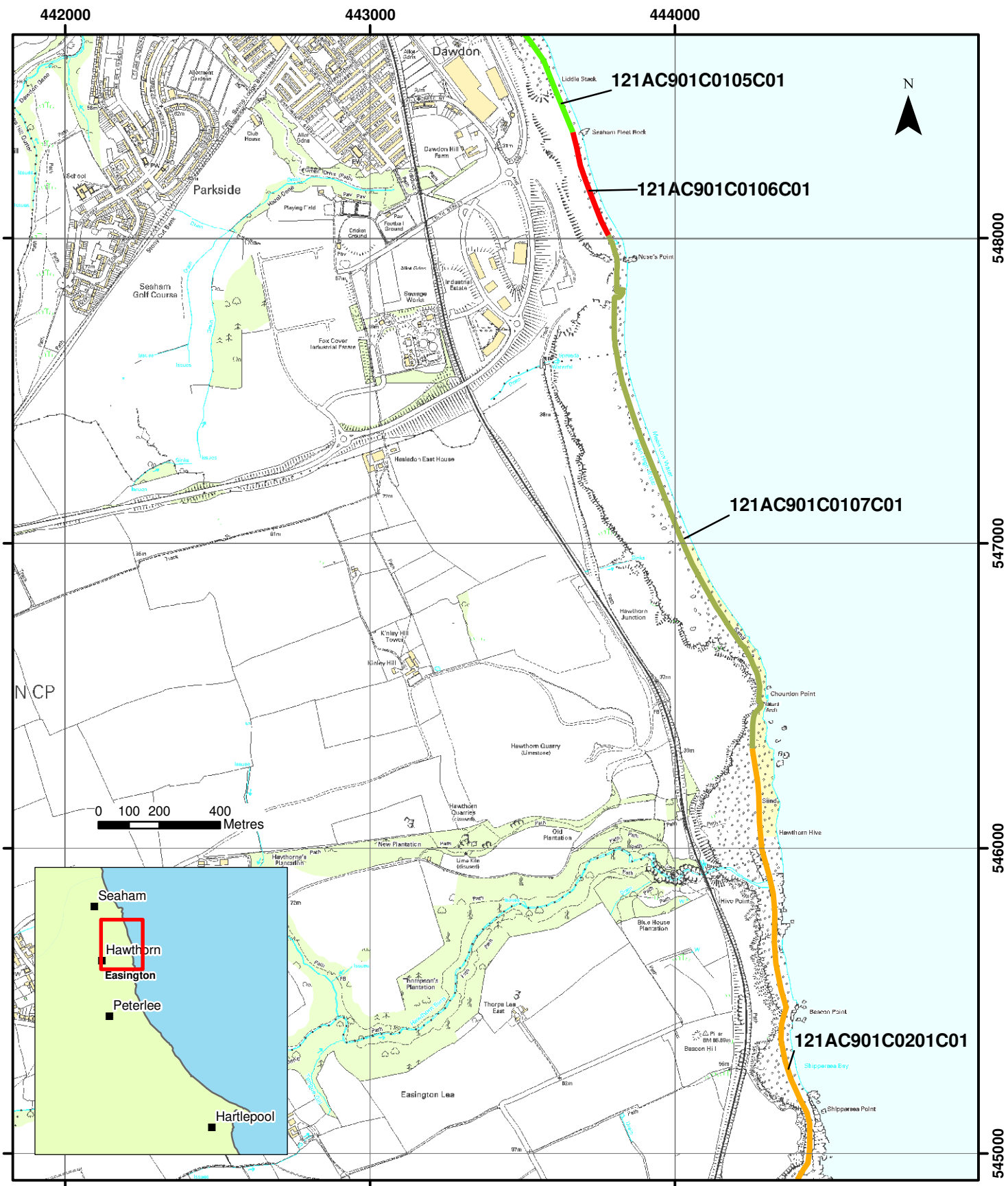
Map 1a - Easington Council Frontage
 Asset Condition 2008
 Drawing Scale 1:5,500 at A4



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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 2 - Easington Council Frontage
 Asset Condition 2008

Drawing Scale 1:17,000 at A4

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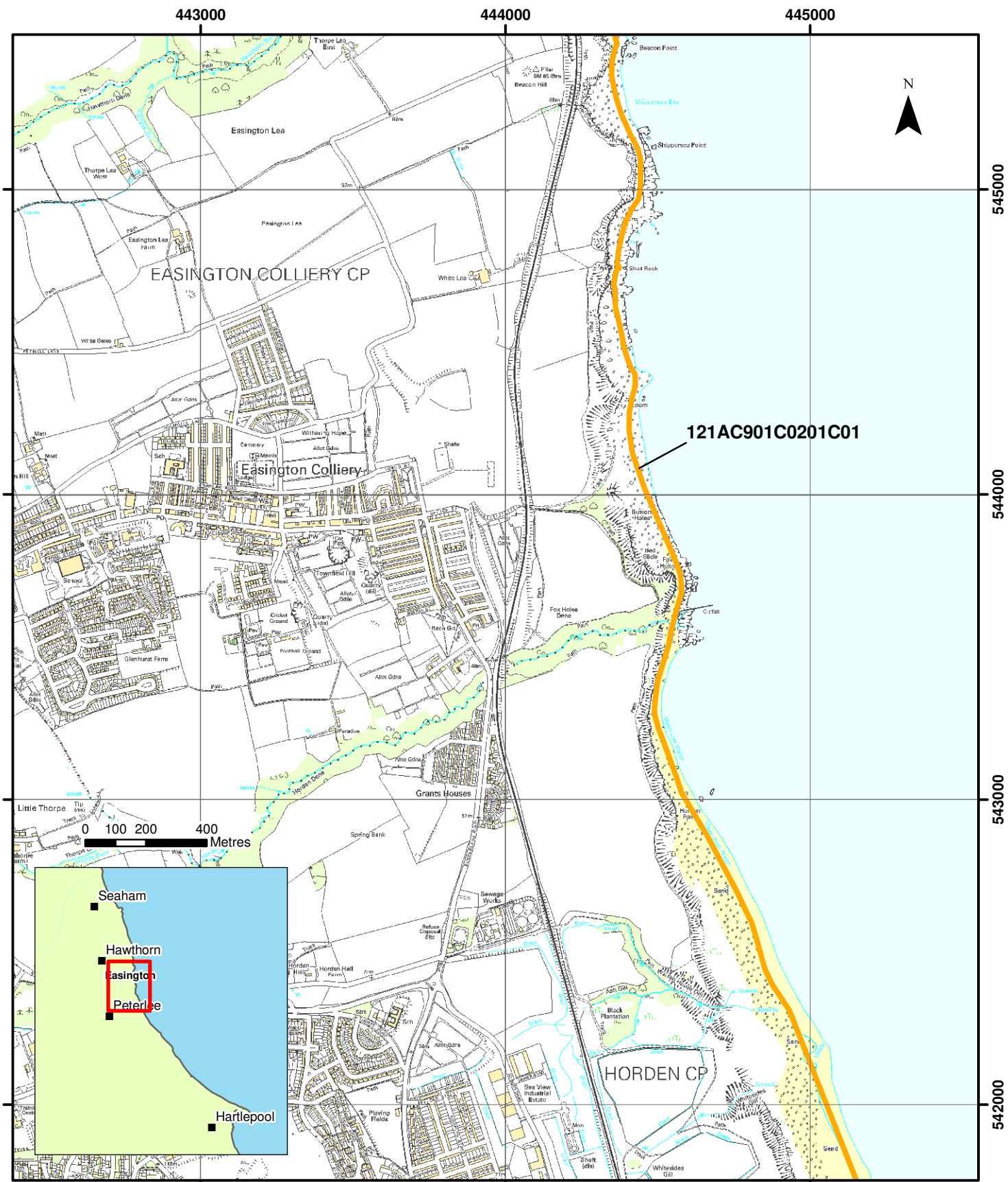
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EASINGTON COLLIERY CP

HORDEN CP

Legend
 Asset location
 NFCDD Asset Number



Client: North East Coastal Authorities Group
 Project: Coastal slope and asset condition inspection, summer 2008

Map 3 - Easington Council Frontage
 Asset Condition 2008

Drawing Scale 1:17,000 at A4



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Legend

 Asset location
 NFCDD Asset Number



Client: North East Coastal Authorities Group

Project: Coastal slope and asset condition inspection, summer 2008

Map 4 - Easington Council Frontage

Asset Condition 2008

Drawing Scale 1:17,000 at A4



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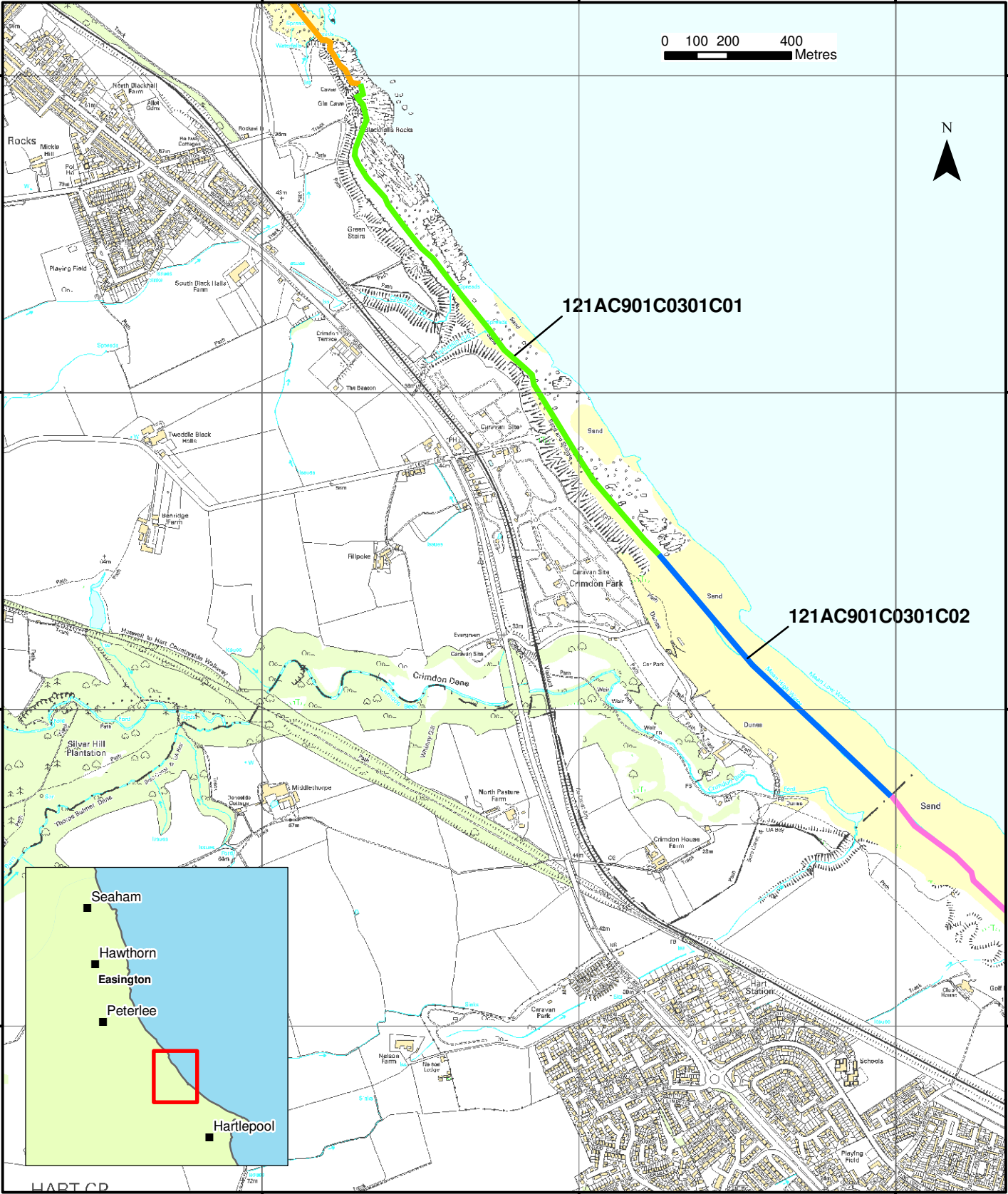


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Legend

-  Asset location
-  NFCDD Asset Number



Client: North East Coastal Authorities Group

Project: Coastal slope and asset condition inspection, summer 2008

Map 5 - Easington Council Frontage

Asset Condition 2008

Drawing Scale 1:17,000 at A4

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