



NECAG Coast Protection Assets and Coastal Slope Condition Analysis



**Redcar and Cleveland
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 enabled 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

This section presents the approach taken by the slope and asset inspectors respectively for the Redcar and Cleveland Borough Council coastal frontage.

Coastal Slope Condition Assessment

The cliff condition assessment was undertaken by systematic walk-over inspection of the whole coastline by a team of geomorphologists in August 2008. The inspection involved visual assessment of cliff activity and noting specific areas of activity (e.g. landslides and tension cracks). All observations were documented with photographs and annotated field maps. Each unit was identified, photographed and classified according to the five point activity scale as defined in Table 1.1. Brief descriptions of the condition of the cliffs were also entered into the National Flood and Coastal Defence Database (NFCDD) for all areas of undefended coastline.

Activity Class	Description
Totally Active	Retreating cliffline almost entirely affected by large-scale landsliding or intense erosion
Partly Active	Retreating cliffline with very common smaller-scale landslides or areas of intense erosion
Locally Active	Retreating cliffline with localised small landslides or areas of erosion
Inactive	Relict cliffs or landslides with vegetated slopes and localised erosion of the toe or failure of the headscarp
Dormant	Protected cliffline or landslide complex with no visible evidence of landslide activity

Table 1.1 Cliff activity classes used in the August 2008 assessment.

The inspection was primarily conducted from the cliff-top, due to access restrictions and health and safety concerns associated with the cliff toe and beaches along this stretch of coast. In the Redcar and Cleveland Borough Council region, the coastline is followed for the most part by the Cleveland Way cliff top footpath. Where the footpath moved inland the inspection kept to the cliff edge to ensure the whole coastline was observed and activity recorded. The beach and foreshore were only inspected where access could be safely achieved from the cliff top, as at the coastal towns of Saltburn-by-the-Sea and Skinningrove.

The cliff condition assessment walkover survey for the Redcar and Cleveland Borough Council frontage was conducted between 20th and 21st August 2008 in a north to south direction. Weather conditions during this time were generally warm and fair.

Coast Protection Asset Condition Assessment

The structural assessment of assets within the Redcar and Cleveland Borough Council region was carried out by a team of asset inspectors and structural engineers in October 2008. Assets were graded based on their condition, residual life and urgency of repair work. Observations were photographed and all data were stored 'live' in the NFCDD using onsite laptops.

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.

The asset condition assessment for the Redcar and Cleveland Borough Council frontage was conducted on 7th, 8th and 15th October 2008 by the structural engineer and a rivers and

coastal asset inspector working from South to North. The weather experienced during this period was fair with no visibility problems.

Study Area

This report documents the condition of the coastal cliffs and assets from the South Gare Breakwater, in the north, to Cowbar Nab, Staithes in the south. The majority of the frontage between the River Tees and Saltburn is characterised by undefended coastal slopes of varying profile and level, with extensive concrete and masonry sea defences at Redcar and local defences at Marske-by-the-Sea and Saltburn. South of Saltburn the area is characterised by slope-over-wall cliffs comprising Lower Jurassic Lias clays and limestones overlain by glacial sediments. Between Skinningrove and Boulby the natural cliffs are largely replaced by extensive abandoned quarries cut back into the coastline. In places, the quarries are steep and extend down to sea level. East of Boulby the cliffs are lower, with the clear stratigraphy of the Lower Jurassic Lias rock and glacial sediment evident again.

No cliff behaviour units (CBUs) had previously been mapped along this stretch of coast, and therefore, for the purposes of the cliff condition assessment, CBUs were defined using boundaries identified in FutureCoast (Halcrow 2002) with refinements based on assessment of aerial imagery and the site inspection. The naming convention for CBUs in this region is as follows: For CBU E59/6 the prefix relates to FutureCoast unit E59 and the suffix 6 relates to the specific area as defined in this case by the headland at Redhouse Nab (between Boulby and Cowbar).

2. Overview

Condition Assessment

Coastal Slope Condition Assessment

The northern extent of the frontage consists of a 4.3km long dune system to the rear of Coatham Sands. Between Redcar and Saltburn the frontage is characterised by undefended mudstone slopes which are steep, often shear in the north with the crest level increasing and the slope gradient becoming less steep with more vegetation cover towards the south. South of Saltburn, the frontage is characterised by Lower Jurassic Lias cliffs with a glacial till cap and disused alum quarries between Skinningrove and Boulby. In total 58 CBUs were observed, of which 5 were classed as Totally Active, 22 as Partly Active and 31 as Locally or less active (Figure 1). Assets along this stretch of coastline include intermittent property, the Warsett Hill railway line, the lane at Cowbar and the cliff top footpath.

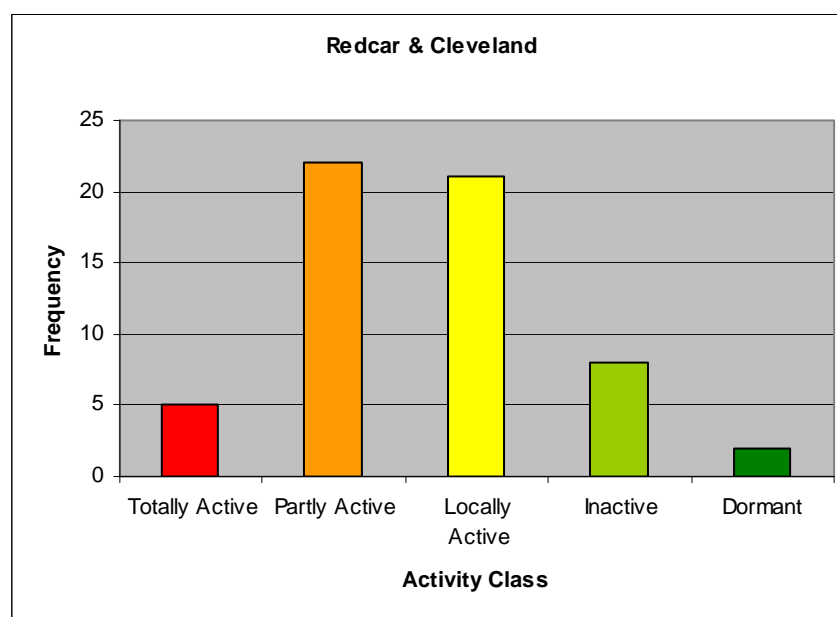


Figure 1. Frequency of cliff activity along the Redcar & Cleveland frontage

Of particular concern is the activity observed at Hunt Cliff and Warsett Hill where the railway line runs close to the cliff edge. Intense erosion was also observed between Boulby and Cowbar where parts of Cowbar Lane have been lost and redirection of the road has been necessary. This poses a significant risk to local traffic as it is the only access road to Cowbar. Frequent monitoring of both these sites is recommended.

Coast Protection Asset Condition Assessment

The South Gare Breakwater at the northern end of Coatham Sands (Asset Ref No 1221C901C0506C01) is in poor condition and requires urgent remedial works. A detailed survey of the structure is recommended as this will identify if local, isolated repairs are sufficient or whether a broader strategy/scheme which considers the condition and performance of the whole structure is more appropriate.

A concrete revetment protecting the Redcar frontage (Asset Ref No 1221C901C0602C01) is beginning to be undercut, with voids opening up at the toe. These voids should be infilled to prevent washout of fill material and further damage which may compromise the integrity of the structure. The timber groyne along Redcar Sands to the east of Redcar (Asset Ref No 1221C901C0603C01) are in poor condition with large numbers of planks missing and piles beginning to split.

A masonry seawall protecting much of the frontage at Saltburn (Asset Ref No's 1221C901C0703C02 to 1221C901C0704C06) requires repointing and refilling of expansion joints in places. East of Skelton Beck there are heavily eroded sections of sea defences, displaying extensive excavation, undercutting, cracking and in parts, total collapse (Asset Ref No 1221C901C0704C05). Urgent remedial work is required to prevent damage to adjacent property.

At Skinningrove, the jetty shows evidence of significant cracking, deformation and corrosion in places (Asset Ref No. 1221D901D0201C02). It is disused as a jetty, however, access is still possible and so consideration should be given to public health and safety.

Comparison with Previous Assessments and Recommendations

No previous cliff condition assessment data were available. It is anticipated that this survey will form the baseline to which future assessments may be compared.

Previous asset condition information compiled by Redcar and Cleveland Borough Council in 1998 was available from NFCDD. Many assets were found to be in a very similar state as previously and therefore their residual life classification was upgraded.

Much of this coastline is undergoing minor erosion, but areas of greater activity have been identified at Warsett Hill, where the railway line runs close to the cliff edge, and at Cowbar, where parts of Cowbar Lane have already been lost. Frequent monitoring of these sites is recommended in order to inform mitigation or future losses of assets.

3. Condition Assessment

The coastline between the Tees entrance and Staithes is described from north to south with reference to groups of CBUs of similar activity. Location and activity status of all CBUs in the study area are shown on Maps 1 to 5.

Coatham Sands

(Map 1 – Coatham Sands to Redcar, Coastal Slope Condition 2008)





Coastal Slope Condition Assessment

The sand dunes to the rear of Coatham Sands (E52/11) are stable with a good coverage of established vegetation. A clear strand line is visible on the upper beach, with no evidence of recent erosion of the seaward toe of the embankment. Erosion has been caused by people walking through the dunes to access the beach and creating makeshift footpaths.



Coast Protection Asset Condition Assessment

The northern extent of the frontage is marked by the South Gare Breakwater. The structure is generally in poor condition with significant cracking, spalling, loss of mortar and sealant to many of the concrete and masonry elements. Several pre-cast concrete seawall units are missing towards the seaward extent of the structure exposing cracked and rust stained concrete walls beneath. Wave action has removed several concrete slabs from the eastern side of the revetment, the broken remains of which are now visible on the foreshore below. Voids are opening up, allowing water/waves to penetrate and potentially weaken the structure. A large section of concrete render is missing from the western side of the breakwater, which has exposed the earth/rubble core of the structure and is beginning to undercut the crest road. Failure of a concrete toe and apron has exacerbated the damage, with evidence of washing out of infill material. This area requires urgent attention to limit further damage. A structural survey of the breakwater is recommended in order to establish the full extent of the damage and identify appropriate remedial works.

 <p>Damaged render exposing fill material on west side (Asset Ref No 12221C901C0506C01)</p>	 <p>Failure of concrete wall at embankment toe on west side (Asset Ref No 12221C901C0506C01)</p>
 <p>Missing pre-cast concrete units at seaward extent (Asset Ref No 12221C901C0506C01)</p>	 <p>Missing concrete slab on east side (Asset Ref No 12221C901C0506C01)</p>

Redcar

Coastal Slope Condition Assessment

There are no coastal slopes along the defended length of frontage at Redcar.

Coast Protection Asset Condition Assessment

The sea defences at Redcar are in good to fair condition. The western defences consist of a grouted stone revetment with a concrete crest wall which extends along 1km of the frontage.

The revetment extends to the cinema, the mass concrete wall to the rear of which forms part of the defences (Asset Ref No 1221C901C0602C05). A former promenade shelter has been bricked up to form a seawall (Asset Ref No 1221C901C0602C04) which is in good condition, although there is evidence of settlement at the eastern extent which should be monitored. East of this seawall, the defence consists of concrete steps and a slipway which provide access between the beach and the Esplanade.

The east of the Redcar frontage consists of concrete revetment in front of a concrete crest wall (Asset Ref No 1221C901C0602C02 and 1221C901C0602C01). Many of the construction joints in the concrete wall appear to have widened, some of which have then caused cracking and spalling of the surrounding concrete. There are significant cracks in the concrete forming the slipways. Damage at the revetment toe has led to opening up of voids with the loss of infill material allowing undercutting of the structure. The condition of the revetment generally worsens towards the east. Some patchwork concrete repairs are evident, several of which have failed. Further repairs are recommended to prevent undercutting of the toe.



Settlement/movement of seawall (Asset Ref No 1221C901C0602C04)



Crack propagating from construction joint (Asset Ref No 1221C901C0602C02)



Failure of previous repair exposing reinforcement and infill material (Asset Ref No 1221C901C0602C01)



Erosion at toe exposing masonry and forming voids (Asset Ref No 1221C901C0602C01)

At the time of writing, Redcar and Cleveland Borough Council were preparing a Project Appraisal Report (PAR) for extensive coastal defence works as part of the Redcar Flood Alleviation Scheme. The scheme will involve the reconstruction and refurbishment of the sea defences along the frontage from Coatham through to the eastern extent of The Stray. The PAR was to be submitted in May 2009.

East Redcar to Saltburn-by-the-Sea

(Map 2 – Redcar to Saltburn, Coastal Slope Condition 2008)

Coastal Slope Condition Assessment

The CBUs between Redcar and Saltburn show evidence of recent instability. The units E52/10 to E52/8 are classified as Locally Active. Most of the movement of the slopes appears to be localized minor headscarp failure. Signs are present warning members of the public of landslips. To the north of Marske, E52/7 is classified as Dormant as it is defended by masonry and concrete walls. From Marske to Saltburn the crest level of the coastal slopes increases and the slopes become vegetated with localised erosion at the toe. CBUs E52/6 to E52/4 are classified as Inactive.



E52/10 Looking south from Mill Howle
(Locally Active)



E52/10 Recent slope slip
(Locally Active)



E52/6 Looking south from Scanbeck Howle
(Locally Active)



E52/4 Looking north from Stone Gap
(Inactive)

Coast Protection Asset Condition Assessment

The coastal defences along this frontage are concentrated around Marske-by-the-Sea. Coastal defences at Marske are in fair to poor condition. The masonry wall to the northwest is in fair condition, with missing mortar and masonry blocks. The concrete wall above the masonry wall has two significant vertical cracks extending through the full height of the structure and there appears to be some lateral movement of the upper section of the wall, possibly caused by heave from the coastal slope to the rear.



Missing masonry blocks and mortar with vegetation growth in gaps (Asset Ref No 12221C901C0702C02)



Crack in concrete wall below coastal slope (Asset Ref No 12221C901C0702C02)

The masonry revetment (Asset Ref No 12221C901C0702C02) is in poor condition with extensive loss of blocks and erosion of the material below. The low beach level exposes the masonry wall below. This structure is missing several blocks which should be replaced and also needs repointing to replace missing mortar. To the southeast of the access at Marske, a coursed masonry wall (Asset Ref No 12221C901C0702C01) has a large settlement crack and missing bricks to the seaward end.



Missing masonry blocks with erosion and vegetation growth below (Asset Ref No 12221C901C0702C02)



Settlement crack in masonry wall (Asset Ref No 12221C901C0702C01)

Saltburn-by-the-Sea

(Map 3 – Saltburn to Cattersy Cliffs, Coastal Slope Condition 2008)

Coastal Slope Condition Assessment

The CBUs in and around Saltburn-by-the-Sea show little evidence of recent instability. The units above Saltburn Sands are all classified as Inactive as they are defended by a sea wall and are well vegetated (E52/3b, E52/3a, E52/2). CBU E52/1 shows more activity with some erosion at the head and foot of the large mound situated just east of Saltburn Beck. To the east, CBU E53/5 is classified as Dormant as it is defended and heavily vegetated.



E52/3b looking up at well vegetated cliffs from Saltburn Sands (Inactive)



E52/1 looking eastwards at the mound like feature above the café (Locally Active)

Coast Protection Asset Condition Assessment

A 1km long masonry seawall protects much of the frontage at Saltburn (Asset Ref No's 1221C901C0703C02 to 1221C901C0704C06). The Saltburn Pier (timber and steel construction) also fixes to this seawall. Beach gravel deposits are located at the toe of the wall throughout its length. Recommended action includes repointing of masonry blockwork and re-filling the expanding joints between poured concrete promenade slabs.



The sea wall at Saltburn (Asset Ref No's 1221C901C0703C02 to 1221C901C0704C06)



Saltburn Pier

East of the Skelton Beck outfall is the southerly limit of the Saltburn defences. Here the coastal protection consists of heavily eroded sections of concrete defence, displaying large amounts of excavation, undercutting, major cracking and in some parts, total collapse (Asset Ref No. 1221C901C0704C05). A disused concrete sewer pipe is exposed due to erosion of the covering concrete. Urgent remedial work is required to prevent damage to adjacent property. The properties to the rear of this defence including the public house, museum and derelict property are privately owned and the defences are not maintained by Redcar and Cleveland Borough Council.



Undercutting and excavation of concrete defences (Asset Ref No. 1221C901C0704C05)



Total collapse of part of concrete defences and failure of unprotected cliffs (Asset Ref No. 1221C901C0704C05)



Property at risk behind eroded concrete defences (Asset Ref No. 1221C901C0704C05)



Cracking and erosion of concrete defences (Asset Ref No. 1221C901C0704C05)

Cliffs northeast of Saltburn

(Map 3 – Saltburn to Cattersy Cliffs, Coastal Slope Condition 2008)

Coastal Slope Condition Assessment

The cliffs to the northeast of Saltburn are characterised by an upper till layer and a steep, lower hard rock layer. The till unit is undergoing erosion in the form of slumping and sliding. This has resulted in staining of the lower cliffs and the formation of large debris cones at the toe. These cliffs are classified as Locally (E53/4, E53/3, E53/1) and Partly Active (E53/2). The latter are defined by the lesser vegetation cover on the upper till layer and lower debris cones. Within the Partly Active unit E52/2 there is a backward tilted section of the upper till layer which may represent a small rotational landslide.



Coast Protection Asset Condition Assessment
 There are no coastal assets within this area.

Hunt Cliff and Warsett Hill*

(Map 3 – Saltburn to Cattersy Cliffs, Coastal Slope Condition 2008)

Coastal Slope Condition Assessment

These cliffs are highly active, all being classified as Partly (E54/3a, E54/2a) or Totally Active (E54/4, E54/3b, E54/2b). The upper till layer is thin, supports some vegetation, and is undergoing localised failures. The lower cliff layer is steep and exposed with erosion occurring down the entire length. There is evidence of localised and relatively recent rock fall activity. The railway line runs very close to the cliff edge as it curves around Warsett Hill.



* Please note this refers to the Warsett Hill located west of Skinningrove, not the Hill of the same name located east of Skinningrove.



E54/3a vegetated debris flow lobe at cliff base, strewn with rock fall deposits (Partly Active)



E54/2b erosion of lower cliff slopes (Totally Active)

Coast Protection Asset Condition Assessment

There are no coastal assets within this area.

Cattersy Cliff and Skinningrove

(Map 3 – Saltburn to Cattersy Cliffs, Coastal Slope Condition 2008 and Map 2 – Cattersy Cliffs to Loftus Alum Quarries, Coastal Slope Condition 2008)

Coastal Slope Condition Assessment

These cliffs are less active than those around Warsett Hill and are generally classified as Locally (E54/1, E55/3, E56/2b) or Partly Active (E55/2, E55/1). The CBUs in the north of this area are characterised by a vegetated thin upper layer of till, below which sit the Lower Jurassic rocks. The lower half of the cliff is largely obscured by large relict debris lobes which are being subjected to toe erosion (E54/1, E55/3).

Further south, the relict debris lobes are replaced by sparsely vegetated, steeper debris cones which extend up the majority of the cliff face. These cones show evidence of recent activity and are being eroded at the toe by marine action. The bedrock surface dips down to beach level at this location, meaning the till layer becomes thicker and the cliffs are increasingly susceptible to localised slumping (Partly Active- E55/2, E55/1).

Above Cattersy Sands (immediately west of the jetty) the cliffs are largely Inactive with development of embryo dunes at their base (E56/2a). It is likely that the lack of activity and development of dunes here results, in part, from the protective influence exerted by the adjacent jetty.

East of the jetty, the cliff unit adjacent to Skinningrove is Locally Active (E56/1). The well vegetated slopes have a stepped appearance with evidence of slumping and sliding mid-slope, despite the presence of rock armour at the toe.



E54/1 looking northwest (Locally Active)



E55/2 looking southeast towards Skinningrove, steep, vegetated debris cones at cliff base (Partly Active)



E56/2a looking southeast towards Skinningrove, showing shallow, vegetated debris mantled slopes and dunes at the slope toe. (Inactive- cliffs in mid-distance)



E56/2a looking up at dunes from Cattersy Sands (Inactive)



E56/1 east of the jetty at Skinningrove (Locally Active)

Coast Protection Asset Condition Assessment

Within this area coastal defences are present around Skinningrove but there are none west of the jetty. Coastal defences at Skinningrove are generally in a sound condition. The majority of defences are rock armour revetments (Asset Ref No's 1221D901D0202C01 and 1221D901D0202C02) including a fishtail breakwater (Asset Ref No. 1221D901D0202C05).

The rock armour is generally tightly packed and has suffered minimal deformation or rock displacement. The original mining breakwater (or 'jetty') is located 400m northwest of the town and may still be actively serving a defensive purpose, although is no longer in use as a jetty. It is constructed of concrete and sheet piles and shows evidence of significant cracking, deformation and corrosion in places (Asset Ref No. 1221D901D0201C02). It is recommended that this asset be confirmed as redundant. If this is the case then little further action is required.

	
<p>Fishtail breakwater defence (jetty in background) at Skinningrove (Asset Ref No. 1221D901D0202C05)</p>	<p>Tightly packed rock armour in good condition (looking southeast towards Skinningrove) (Asset Ref No's 1221D901D0202C01 and 1221D901D0202C02)</p>
	
<p>Looking seaward along the jetty, northwest of Skinningrove (Asset Ref No. 1221D901D0201C02)</p>	<p>Significant cracking of the jetty near Skinningrove (Asset Ref No. 1221D901D0201C02)</p>

Skinningrove to Boulby

(Map 4 – Cattersy Cliffs to Loftus Alum Quarries, Coastal Slope Condition 2008 and Map 3 – Loftus Alum Quarries to Staithes, Coastal Slope Condition 2008)

Coastal Slope Condition Assessment

The cliffs within this section are predominantly classified as Locally (E57/6, E57/4-2, E58/6, E58/5, E58/4upper, E58/2upper) or Partly Active (E57/7, E57/5, E57/1, E58/4lower, E58/3upper and lower, E58/2lower, E58/1b, E58/1a). West of The Warren, the cliffs are steep and high. There is an upper till layer which supports some vegetation cover with localised patches of erosion. The lower rock layer is largely devoid of vegetation cover, and has evidence of activity. East of The Warren, the complex cliff system owes its character to the large abandoned quarries which were operational in this area during the 19th century. The undulating terrain of the upper part of the disused quarries is heavily vegetated and CBUs are

generally Locally Active. There is localised erosion of the shale-like material and evidence of past rock fall from the quarried cliff face above. The lower part of the quarries is much steeper, very sparsely vegetated and with loose material visible at the surface (Partly Active).

Below Rockhole Hill there is a single unit classified as Totally Active (E58/1c). Here the lower cliff face is undergoing mass failure. Active sliding was observed during the walkover survey and a large crack and associated displacement slump are present behind the active zone.



E57/7 looking southeast across the bay at Skinningrove (Partly Active)



E57/1 looking east towards The Warren (Partly Active)



E58/5 looking west across the upper part of the disused alum quarries (Locally Active)



E58/4 (lower) looking east across the steep lower part of the disused alum quarries (Partly Active)



E58/1c looking across to the northwest (Totally Active)



Behind unit E58/1c crack and displaced slump (Totally Active)

Coast Protection Asset Condition Assessment

There are no coastal protection assets within this area.

Boulby to Cowbar Nab

(Map 5 – Loftus Alum Quarries to Staithes, Coastal Slope Condition 2008)

Coastal Slope Condition Assessment

The majority of CBUs within this area are classified as Partly Active. The cliffs are characterised by a soft upper till unit which supports a variable amount of vegetation cover. The head scarp is receding and frequent slumping, sliding and rilling is occurring within the till layer. The lower hard rock unit is almost entirely exposed except where covered by cones of debris deposited from the till unit above. In places there is evidence of recent rock fall from the rock layer.

Along Cowbar Lane, there is one CBU where the upper till unit is undergoing particularly severe erosion and slumping onto the shoreline below (Totally Active- E59/3). This has led to the loss and redirection of parts of the lane. Near Cowbar attempts have been made to stabilise the till using a flexible mesh facing which to the date of the inspection appears to have been successful (Partly Active- E59/1).



E59/8 looking towards Staithes from Boulby (Partly Active)



E59/4 looking towards Staithes from Redhouse Nab (Partly Active)



E59/3 looking west from Cowbar (Totally Active)



E59/3 loss of Cowbar Lane (Totally Active)



E60/1b Overview of cliffs at Cowbar looking east (Partly Active)



E59/1 flexible mesh facing near Cowbar (Partly Active)

Coast Protection Asset Condition Assessment
There are no coastal assets within this area.

4. Comparison with Previous Assessments

Coastal Slope Condition Assessment

No previous cliff condition assessment data were available for this region. It is anticipated that this survey will form the baseline to which future assessments may be compared.

Coast Protection Asset Condition Assessment

Previous asset condition data was available in the form of data stored within NFCDD. However this data was frequently incomplete, spatially incorrect or missing entirely. Most asset inspections required the re-digitisation of assets within NFCDD to correct spatial positioning. As a result it was possible to make only very few comparisons.

In general, the findings of the 2008 inspections were similar to those of previous inspection data recorded in NFCDD. Surveyors inspecting the assets in 2008 found the assets in a similar condition to previous surveys and therefore assigned similar condition gradings. Many assets, however, were given a shorter residual life classification due to general degradation of the asset over time, most frequently from >20 years to 11-20 years. Previous assessments also suggested that a policy of 'no repairs' was applicable for many assets, whereas the current survey suggests that a routine monitoring and maintenance programme is more appropriate.

Condition grading discrepancies between the existing data and the 2008 inspection data were found in only a small number of cases. These generally included improved or repaired assets or assets which have experienced degradation. It is these assets which are highlighted below.

Coatham Sands

The South Gare Breakwater (Asset Ref No 1221C901C0506C01) was classified as grade 3 (fair) in 1998 and has been reclassified as a grade 4 (poor) following the 2008 inspection. The damage identified could lead to a significant reduction in the performance of the breakwater and further investigation and remedial work is required urgently.

Redcar

The condition of the assets along the Esplanade (Asset Ref No's 1221C901C0602C02 and 1221C901C0602C01) was generally the same as in the 1998 inspection. Extensive repair work was evident although this appeared to be simply slowing the continued degradation of the assets as opposed to significantly improving their condition. The condition of the assets remained as grade 4 (poor) and grade 3(fair) respectively, with the residual life reduced to 6-10 years.

Marske-by-the-Sea

The masonry revetment to the south east of the access at Marske (Asset Ref No 1221C901C0702C02) has been downgraded from grade 2 (good) to grade 4 (poor). This is due to the loss of masonry and erosion of the material below. The masonry wall beneath the revetment is also missing blocks and is displaced in places.

Saltburn-by-the-Sea

This section of the coast was not reviewed as part of the 2005 Staithes to Speeton report and therefore the only comparisons possible use data taken from the NFCDD.

Most assets in this area show little change in condition since 1998 when they were last inspected and recorded in the NFCDD. However, assets 1221C901C0703C02 (the low concrete wall) and 1221C901C0704C05 (the mixed concrete and masonry defence) show degradation from a condition grade 2 (good) to 3 (fair) and from 3 (fair) to 4 (poor) respectively. The rating drop for the low concrete defence appears to be due to the natural

degradation of the condition of the asset with increased evidence of minor cracking and spalling, although this process may have been accelerated by changes in beach level and exposure of the toe of the defences. The rating drop for the mixed concrete and masonry defence shows more extensive defects including significant cracking, undercutting and joint failure. Large holes have appeared and the southern end has collapsed.



The mixed concrete and masonry defence (Asset Ref No. 1221C901C0704C05)



The mixed concrete and masonry defence (Asset Ref No. 1221C901C0704C05)

Skinninggrove

This section of the coast was not reviewed as part of the 2005 Staithees to Speeton report and therefore the only comparisons possible use data taken from the NFCDD.

Most assets in this area show little change in condition since 1998 when they were last inspected and recorded in the NFCDD. However, the condition of asset 1221D901D0201C02 has slipped from a fair to poor grading. This asset is the old jetty to the west of Skinninggrove which is disused, has large cracks in several places and shows signs of deformation.



The jetty west of Skinninggrove (Asset Ref No. 1221D901D0201C02)



The jetty west of Skinninggrove (Asset Ref No. 1221D901D0201C02)

5. Problems Encountered and Uncertainty in Analysis

Coastal Slope Condition Assessment

In three locations E53/1, E57/6 and E58/2 to E58/6 views of the cliff were limited due to the steep, linear nature of the cliffs, the complicated terrain of the disused quarries and access restrictions to the beach. In these situations, judgements were made based on the clearly visible cliff sections.

Coast Protection Asset Condition Assessment

Very few problems were encountered on site during the asset condition assessment. Access issues posed the largest problem although most assets were located in public spaces and were easily accessible. Access to sections of the South Gare Breakwater at the northern extent of the frontage was restricted by the presence of the Coastguard Station although these areas were generally visible from distance. Local tides tables provided key information for the appropriate planning of each day's inspections. These issues are not considered to have affected the quality of the assessment.

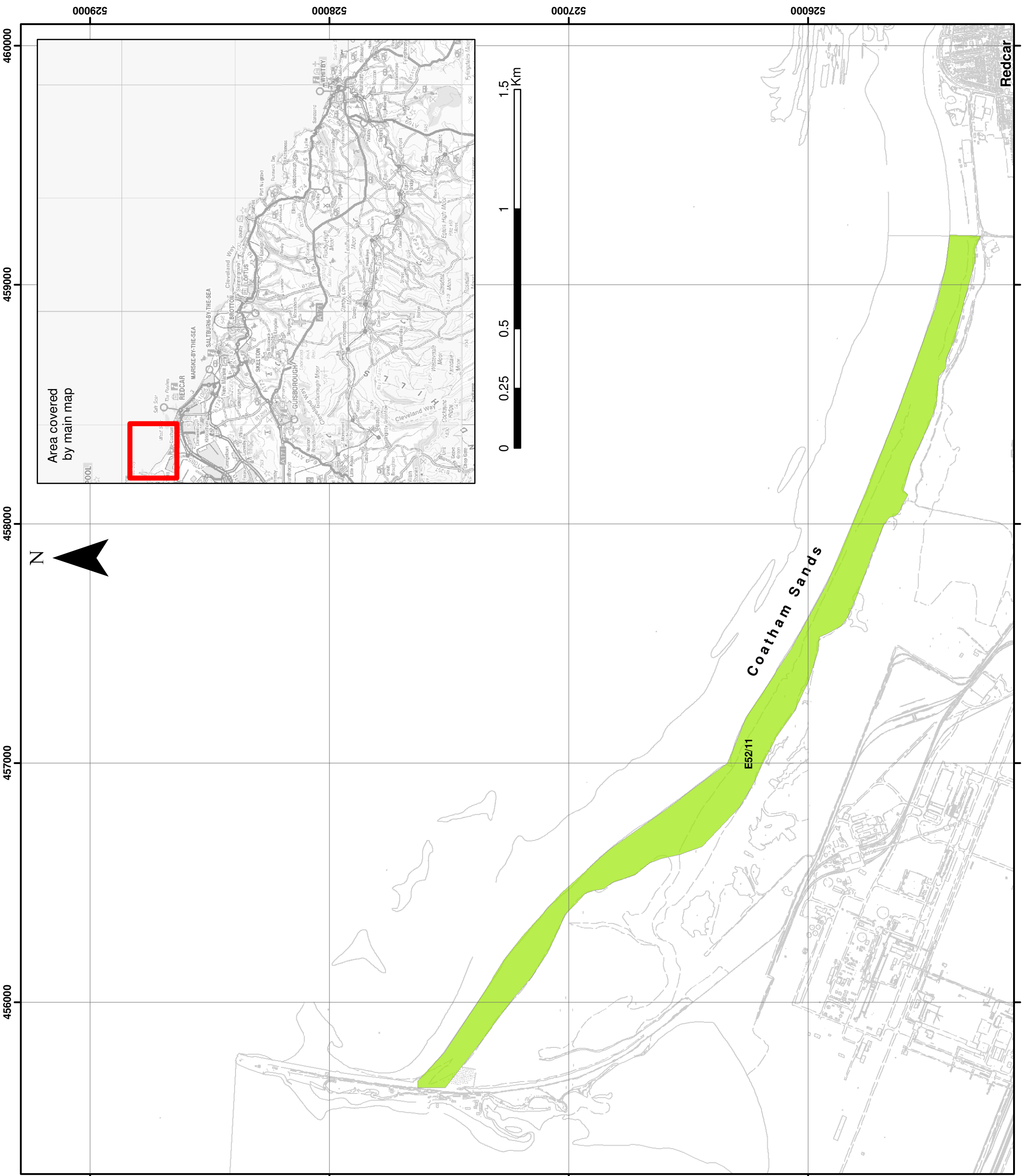
6. Conclusions and Recommended Actions

Much of this coastline is undergoing minor erosion and it is recommended that monitoring of the entire frontage is continued. Specific and more regular assessments should be conducted for those cliff units classified as Totally Active. These include CBU E54/3b at Warsett Hill (and surrounding area) where the railway line runs very close to the cliff edge, and in the vicinity of E59/3 where parts of Cowbar Lane have been lost.

It is highly recommended that continued monitoring is undertaken for all assets, with specific recommendations for individual assets given in the table below:

Defence	Location	Priority	Date	Recommended Action
1221C901C0506C01	South Gare Breakwater	High	Oct 2008	Structural survey. Large scale repairs. Urgent remedial work.
1221C901C0601C01	Coatham	Low	Oct 2008	Replace missing render. Replace missing section of wall.
1221C901C0602C06	Coatham	Low	Oct 2008	Infill voids below drainage outlets. Infill cracks to viewing platform.
1221C901C0602C05	Redcar	Low	Oct 2008	Infill cracks.
1221C901C0602C04	Redcar	Low	Oct 2008	Infill cracks. Monitor southern extent for movement.
1221C901C0602C03	Redcar	Low	Oct 2008	Monitor lower steps for movement/undercutting.
1221C901C0602C02	Redcar	Medium	Oct 2008	Infill voids at toe. Infill cracks. Replace missing sealant.
1221C901C0606C01	Redcar	High	Oct 2008	Infill cracks. Replace failed patch repair. Infill voids at toe.
1221C901C0603C01	Redcar	Medium	Oct 2008	Replace missing render. Repair timber groynes.
1221C901C0702C03	Marske	Medium	Oct 2008	Infill cracks. Monitor wall for lateral movement. Replace missing masonry blocks. Repoint masonry wall.
1221C901C0702C02	Marske	High	Oct 2008	Reconstruct masonry revetment. Repoint lower masonry wall. Remove vegetation.
1221C901C0702C01	Marske	Medium	Oct 2008	Repoint masonry wall. Infill crack. Reconstruct/tidy seaward extent.
1221C901C0703C02	Saltburn	Medium	Oct 2008	Continue active monitoring, repair cracks if they worsen.
1221C901C0704C01	Saltburn	Low	Oct 2008	Repoint masonry blockwork
1221C901C0704C06	Saltburn	Medium	Oct 2008	Repair cracking, repoint
1221C901C0704C03	Saltburn	Medium	Oct 2008	Prevent undercutting of the slipway, repair cracking in slipway surface
1221C901C0704C04	Saltburn	Low	Oct 2008	Repoint masonry blockwork
1221C901C0704C05	Saltburn	High	Oct 2008	Infill holes/gaps, repair cracking. Urgent

Defence	Location	Priority	Date	Recommended Action
				remedial work is required to prevent damage to adjacent property.
1221D901D0201C02	Skinningrove	Medium	Oct 2008	Large repair work scheme required
1221D901D0202C03	Skinningrove	Medium	Oct 2008	Repair cracking in concrete surface



Legend

Cliff Activity Status 2008

- Dormant
- Inactive
- Locally Active
- Partly Active
- Totally Active



Client: North East Coastal Authorities Group

Project: Coastal slope and asset condition inspection, summer 2008

Map 1 - Coatham Sands to Redcar

Coastal Slope Condition 2008

Drawing Scale 1:15,000 at A3

Drawn by: TC Date: Jan 2009
 Checked by: MD Date: 28 Jan 2009
 Approved by: NC Date: 29 Jan 2009



ROYAL HASKONING
 Royal Haskoning
 Marlborough House
 Marlborough Crescent
 Newcastle upon Tyne
 NE1 4EE

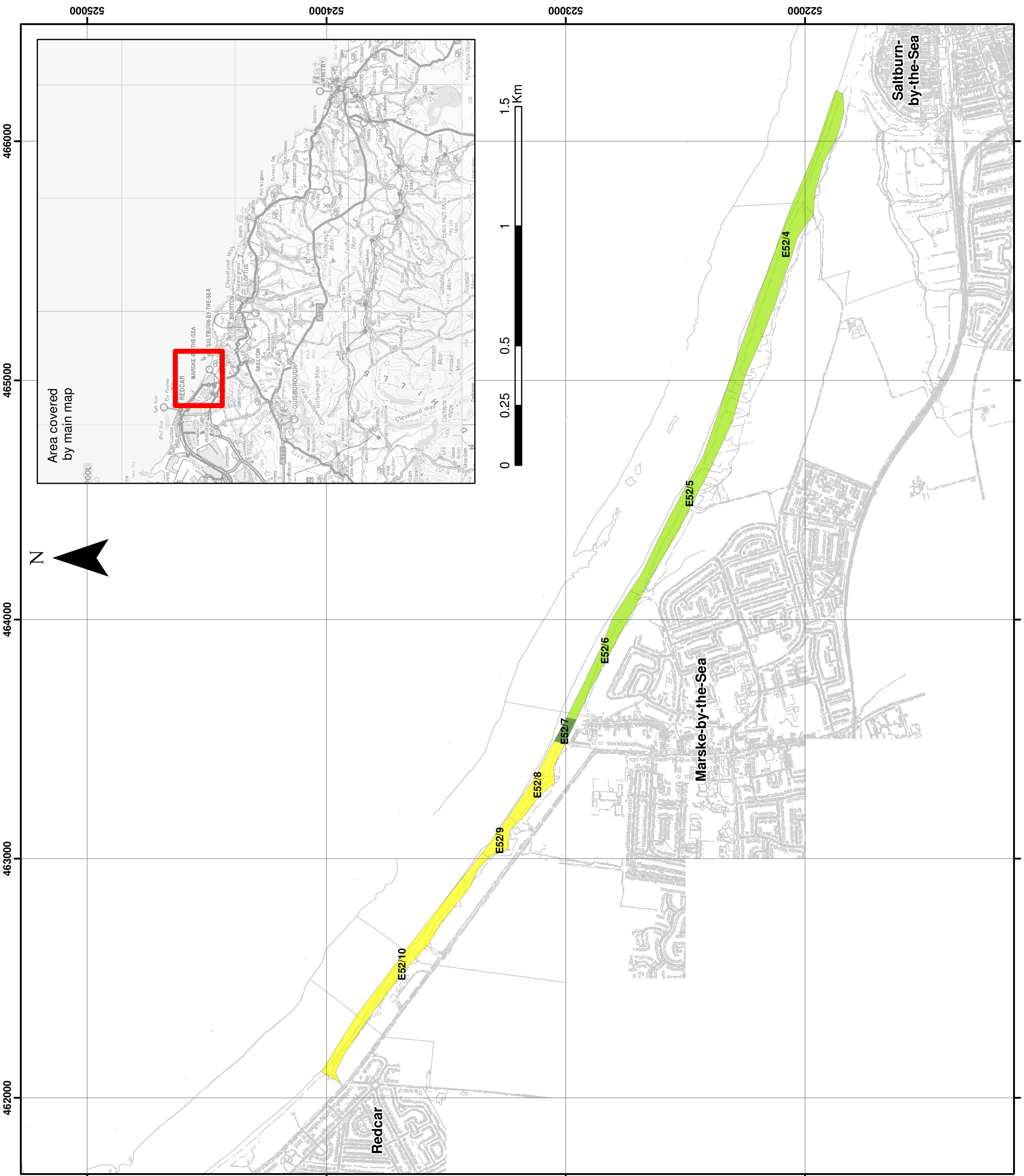


Halcrow
 Halcrow Group Ltd
 Lyndon House
 62 Hagley Road
 Edgbaston
 Birmingham
 B16 8PE

Tel: +44 (0)191 211 1300
 Fax: +44 (0)191 211 1313
 www.royalhaskoning.com

Tel: +44 (0)121 456 2345
 Fax: +44(0)121 456 1569
 www.halcrow.com

Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office © Crown Copyright.
 Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings.
 Scarborough Borough Council.
 Licence No. LA 079251



Legend

Cliff Activity Status 2008

- Dormant
- Inactive
- Locally Active
- Partly Active
- Totally Active



Client: North East Coastal Authorities Group

Project: Coastal slope and asset condition inspection, summer 2008

Map 2 - Redcar to Saltburn

Coastal Slope Condition 2008

Drawing Scale 1:15,000 at A3

Drawn by: TC Date: Jan 2009
 Checked by: MD Date: 28 Jan 2009
 Approved by: NC Date: 29 Jan 2009



Royal Haskoning
 Marlborough House
 Marlborough Crescent
 Newcastle upon Tyne
 NE1 4EE



Halcrow Group Ltd
 Lyndon House
 62 Hagley Road
 Edgbaston
 Birmingham
 B16 8PE

Tel: +44 (0)191 211 1300
 Fax: +44 (0)191 211 1313
 www.royalhaskoning.com

Tel: +44 (0)121 456 2345
 Fax: +44(0)121 456 1569
 www.halcrow.com

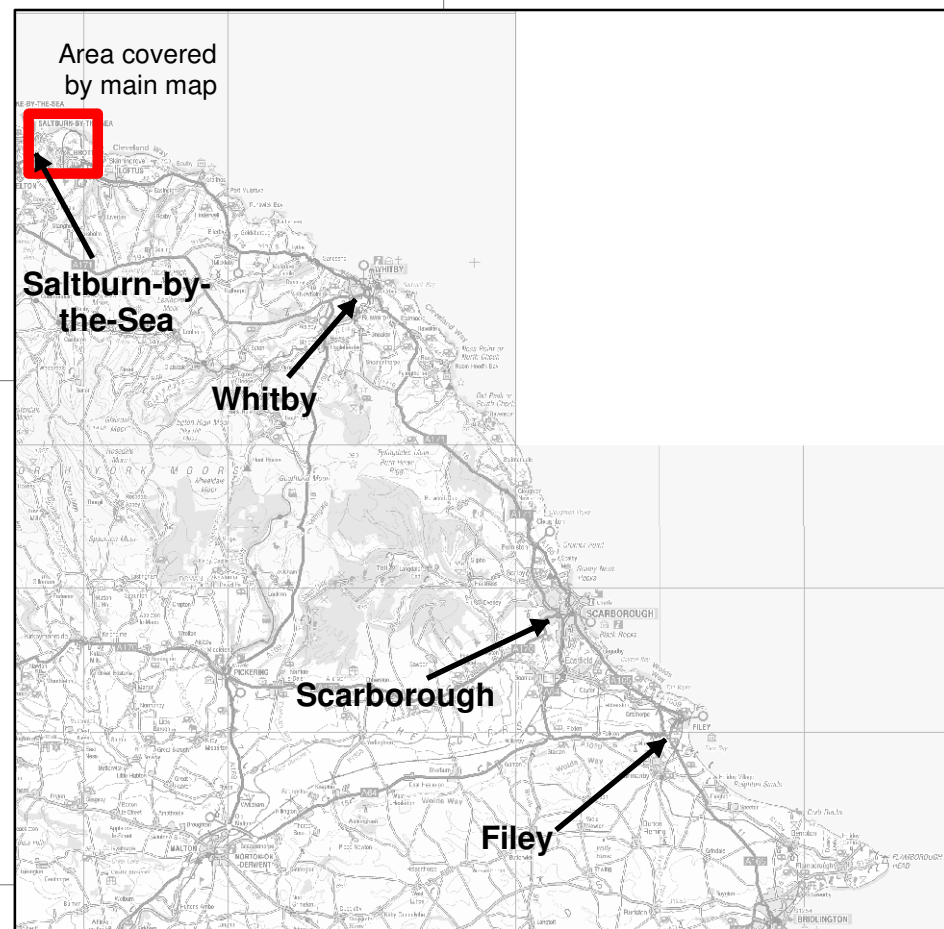
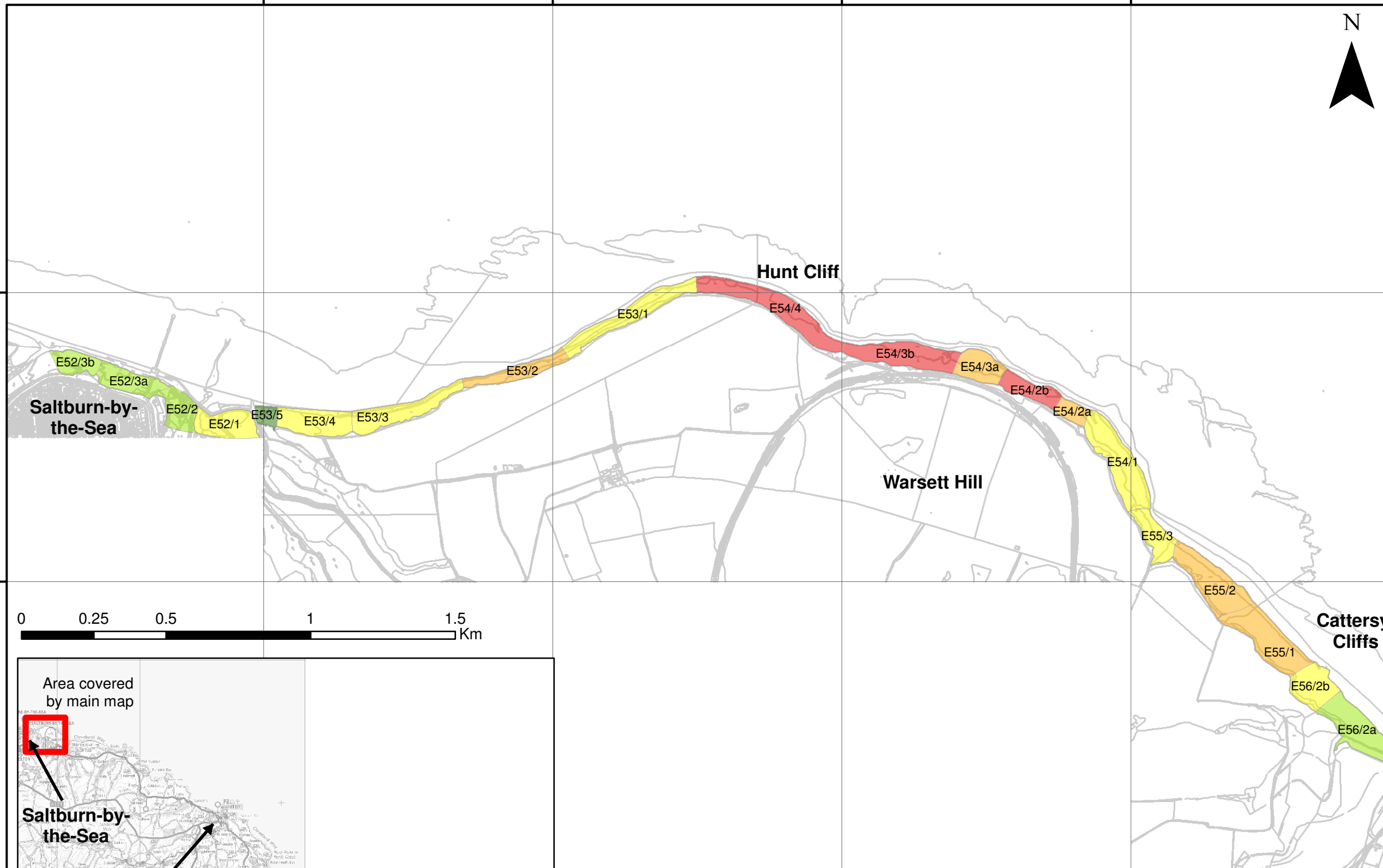
Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office © Crown Copyright.
 Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings.
 Scarborough Borough Council.
 Licence No. LA 079251

467000

468000






469000

470000



Legend

Cliff Activity Status 2008

-  Dormant
-  Inactive
-  Locally Active
-  Partly Active
-  Totally Active



Client: North East Coastal Authorities Group

Project: Coastal slope and asset condition inspection, summer 2008

Map 3 - Saltburn to Cattersy Cliffs

Coastal Slope Condition 2008

Drawing Scale 1:15,000 at A3

Drawn by: AW	Date: Nov 2008
Checked by: PRF	Date: 19 Jan 2009
Approved by: PRF	Date: 19 Jan 2009



Royal Haskoning
Marlborough House
Marlborough Crescent
Newcastle upon Tyne
NE1 4EE

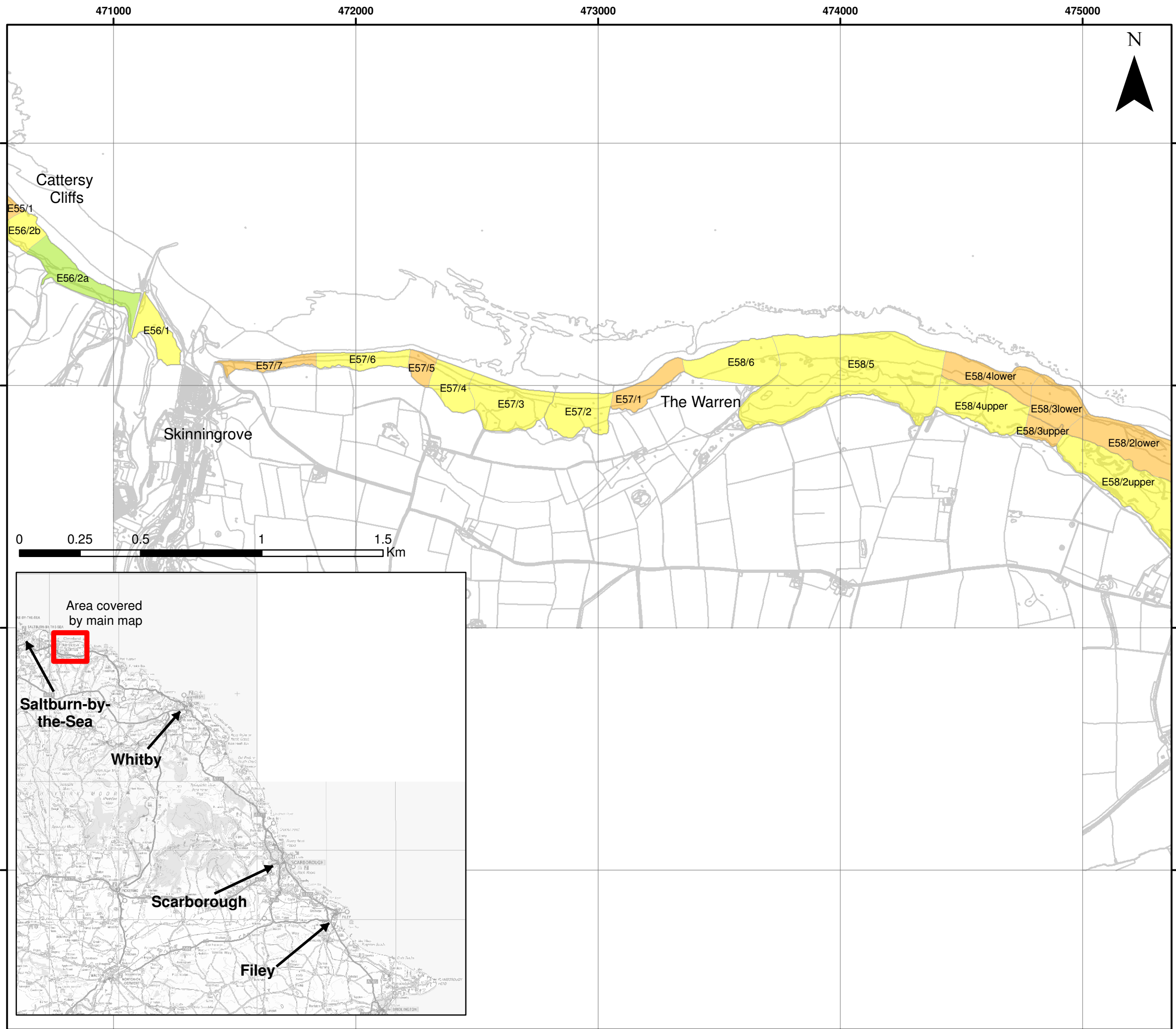


Halcrow Group Ltd
Lyndon House
62 Hagley Road
Edgbaston
Birmingham
B16 8PE

Tel: +44 (0)191 211 1300
Fax: +44 (0)191 211 1313
www.royalhaskoning.com

Tel: +44 (0)121 456 2345
Fax: +44(0)121 456 1569
www.halcrow.com

Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office © Crown Copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Scarborough Borough Council. Licence No. LA 079251



Legend

Cliff Activity Status 2008

- Dormant
- Inactive
- Locally Active
- Partly Active
- Totally Active



Client: North East Coastal Authorities Group

Project: Coastal slope and asset condition inspection, summer 2008

Map 4 - Cattersy Cliffs to Loftus Alum Quarries

Coastal Slope Condition 2008

Drawing Scale 1:15,000 at A3

Drawn by: AW	Date: Nov 2008
Checked by: PRF	Date: 19 Jan 2009
Approved by: PRF	Date: 19 Jan 2009

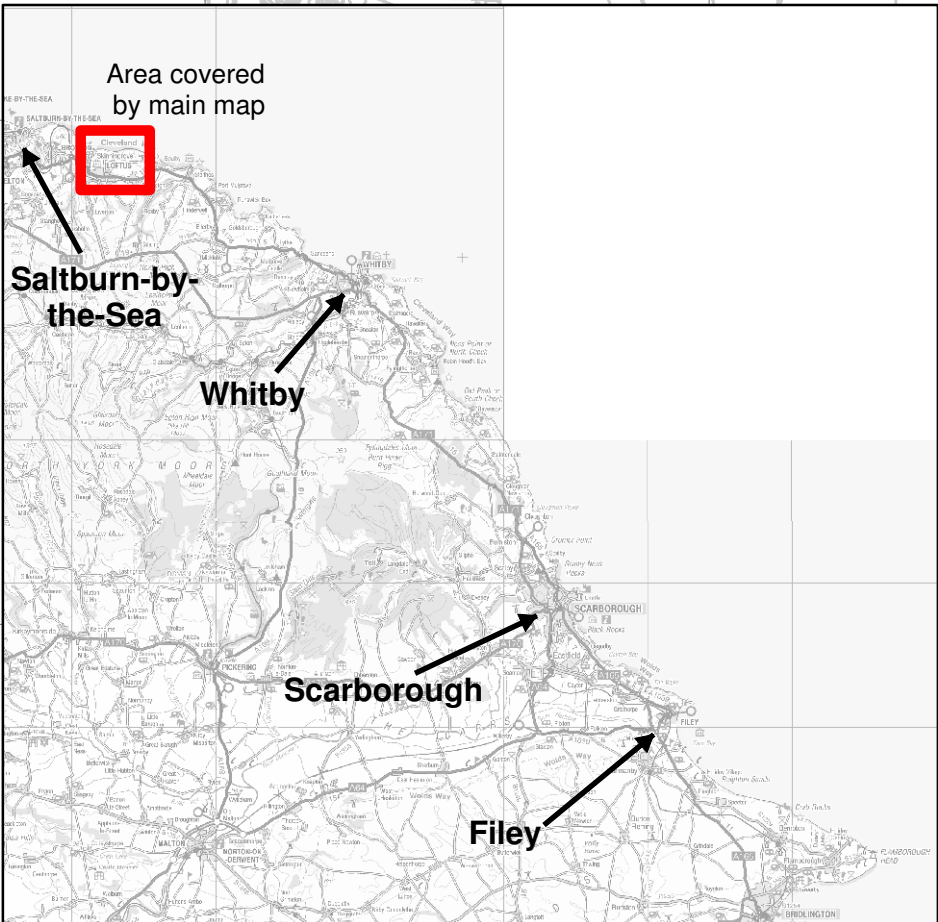


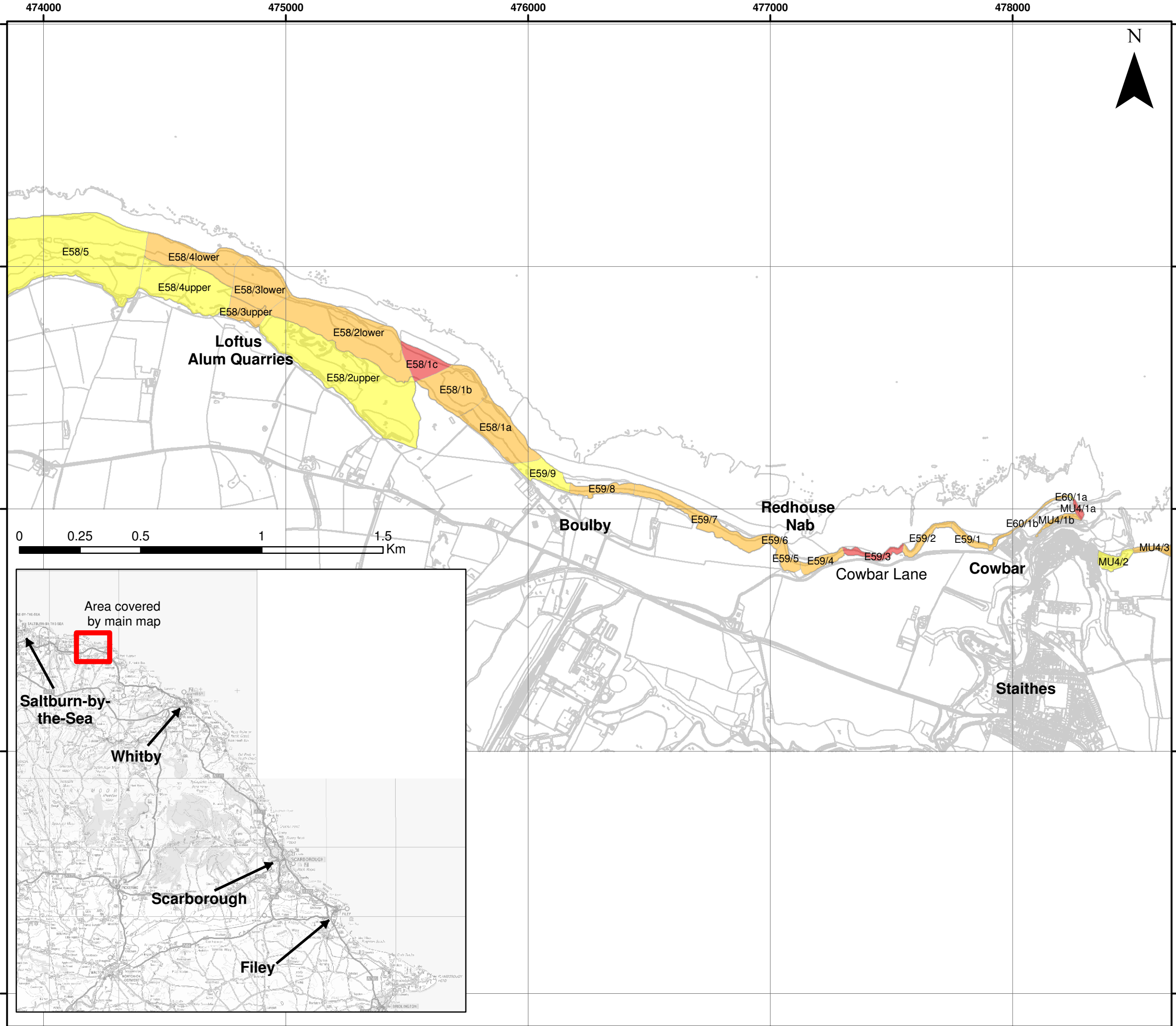
Royal Haskoning
Marlborough House
Marlborough Crescent
Newcastle upon Tyne
NE1 4EE

Halcrow Group Ltd
Lyndon House
62 Hagley Road
Edgbaston
Birmingham
B16 8PE

Tel: +44 (0)191 211 1300	Tel: +44 (0)121 456 2345
Fax: +44 (0)191 211 1313	Fax: +44(0)121 456 1569
www.royalhaskoning.com	www.halcrow.com

Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office © Crown Copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Scarborough Borough Council. Licence No. LA 079251





Legend

Cliff Activity Status 2008

- Dormant
- Inactive
- Locally Active
- Partly Active
- Totally Active



Client: North East Coastal Authorities Group

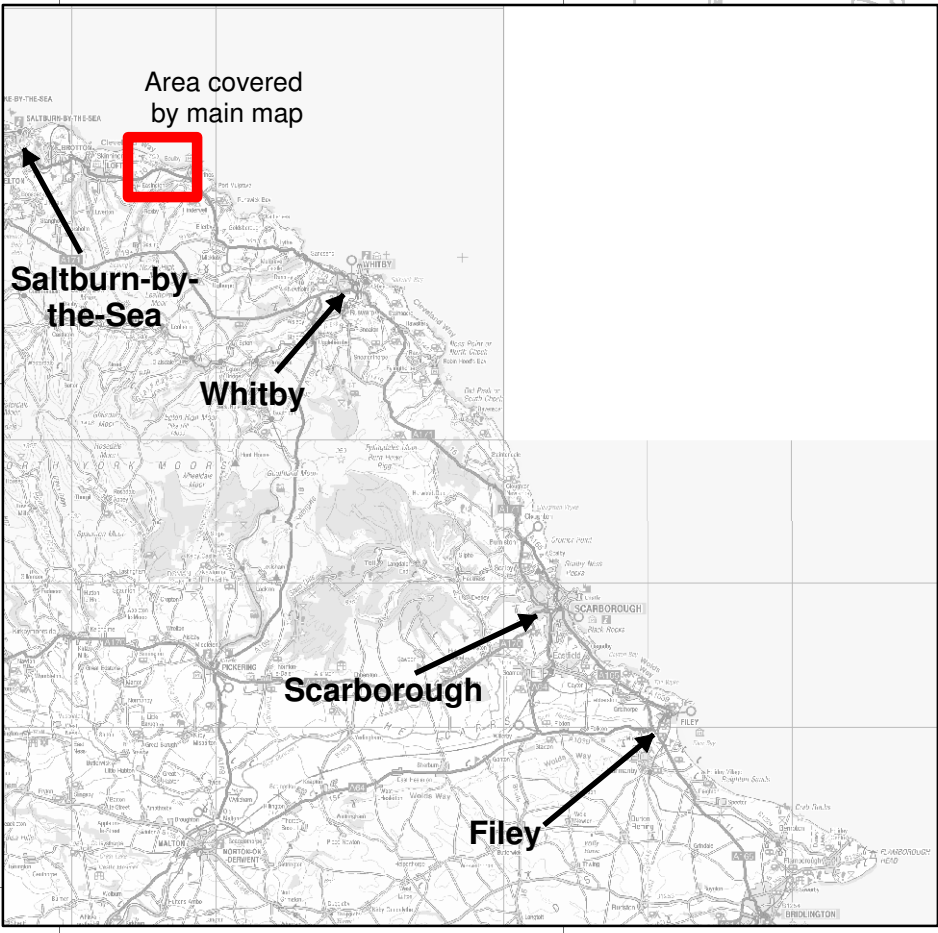
Project: Coastal slope and asset condition inspection, summer 2008

Map 5 - Loftus Alum Quarries to Staithes

Coastal Slope Condition 2008

Drawing Scale 1:15,000 at A3

Drawn by: AW	Date: Nov 2008
Checked by: PRF	Date: 19 Jan 2009
Approved by: PRF	Date: 19 Jan 2009



 ROYAL HASKONING	 Halcrow
Royal Haskoning Marlborough House Marlborough Crescent Newcastle upon Tyne NE1 4EE	Halcrow Group Ltd Lyndon House 62 Hagley Road Edgbaston Birmingham B16 8PE
Tel: +44 (0)191 211 1300 Fax: +44 (0)191 211 1313 www.royalhaskoning.com	Tel: +44 (0)121 456 2345 Fax: +44(0)121 456 1569 www.halcrow.com

Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office © Crown Copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Scarborough Borough Council. Licence No. LA 079251

Asset location
NFCDD Asset Number



Client: North East Coastal
Authorities Group

Project: Coastal slope and asset
condition inspection,
summer 2008

Map 1 - Redcar & Cleveland Council Frontage Asset Condition 2008

Drawing Scale 1:20,000 at A4

Drawn by: TC Date: 06/04/2009
Checked by: NC Date: 06/04/2009
Approved by: NC Date: 06/04/2009



Royal Haskoning
Marlborough House
Marlborough Crescent
Newcastle upon Tyne
NE1 4EE

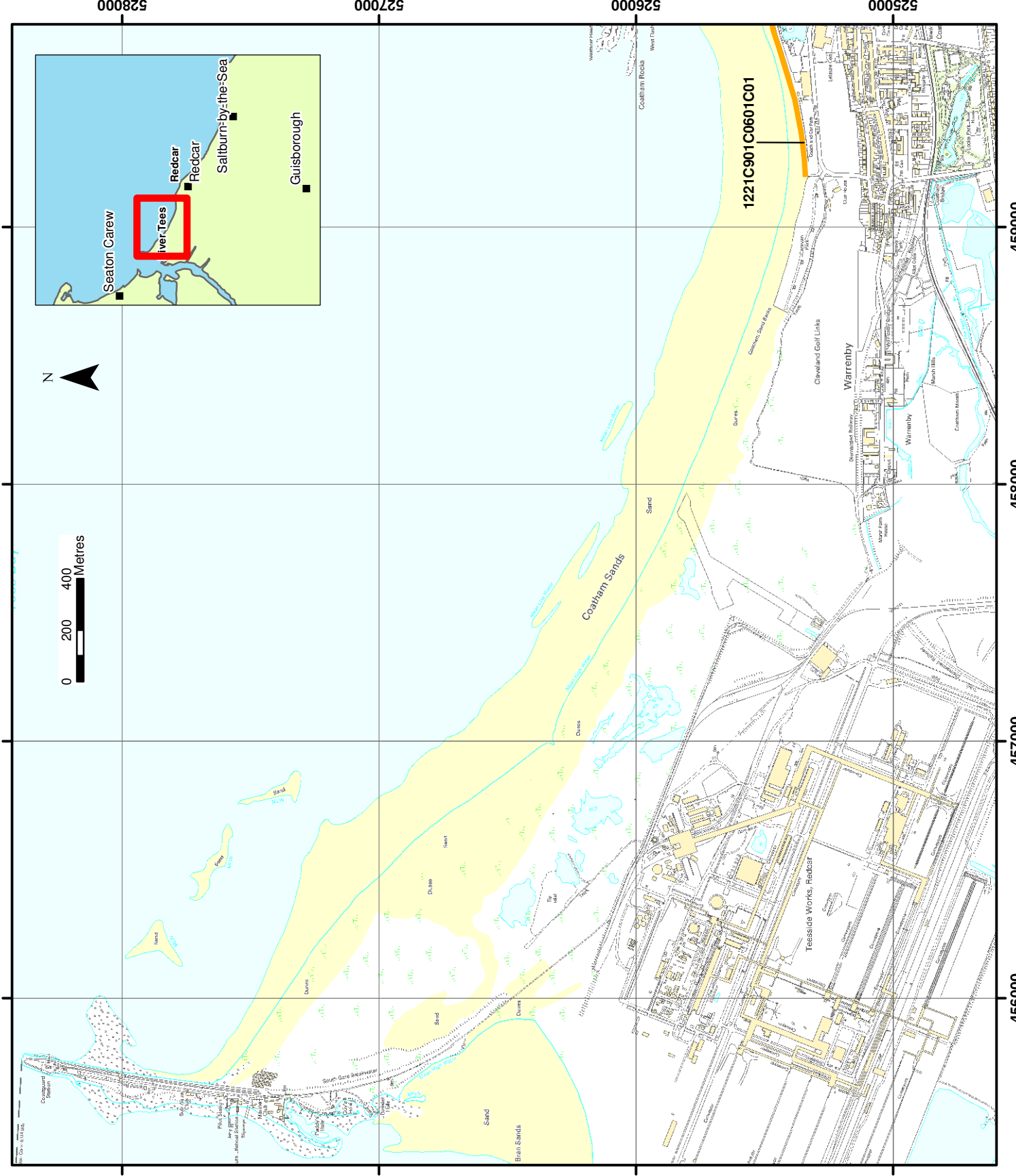
Tel: +44 (0)191 211 1300
Fax: +44 (0)191 211 1313
www.royalhaskoning.com



Halcrow Group Ltd
Lyndon House
62 Hagley Road
Edgbaston
Birmingham
B15 8PE

Tel: +44 (0)121 456 2345
Fax: +44 (0)121 456 1569
www.halcrow.com

Reproduced from Ordnance Survey mapping with the
permission of the Controller of Her Majesty's Stationery
Office © Crown Copyright.
Unauthorised reproduction infringes Crown Copyright
and may lead to prosecution or civil proceedings.
Scarborough Borough Council.
Licence No. LA 079251



Asset location
NFCDD Asset Number



Client: North East Coastal Authorities Group

Project: Coastal slope and asset condition inspection, summer 2008

Map 2 - Redcar & Cleveland Council Frontage

Asset Condition 2008

Drawing Scale 1:20,000 at A4

Drawn by: TC Date: 06/04/2009
Checked by: NC Date: 06/04/2009
Approved by: NC Date: 06/04/2009



Royal Haskoning
Lyndon House
Marlborough Crescent
Newcastle upon Tyne
NE1 4EE

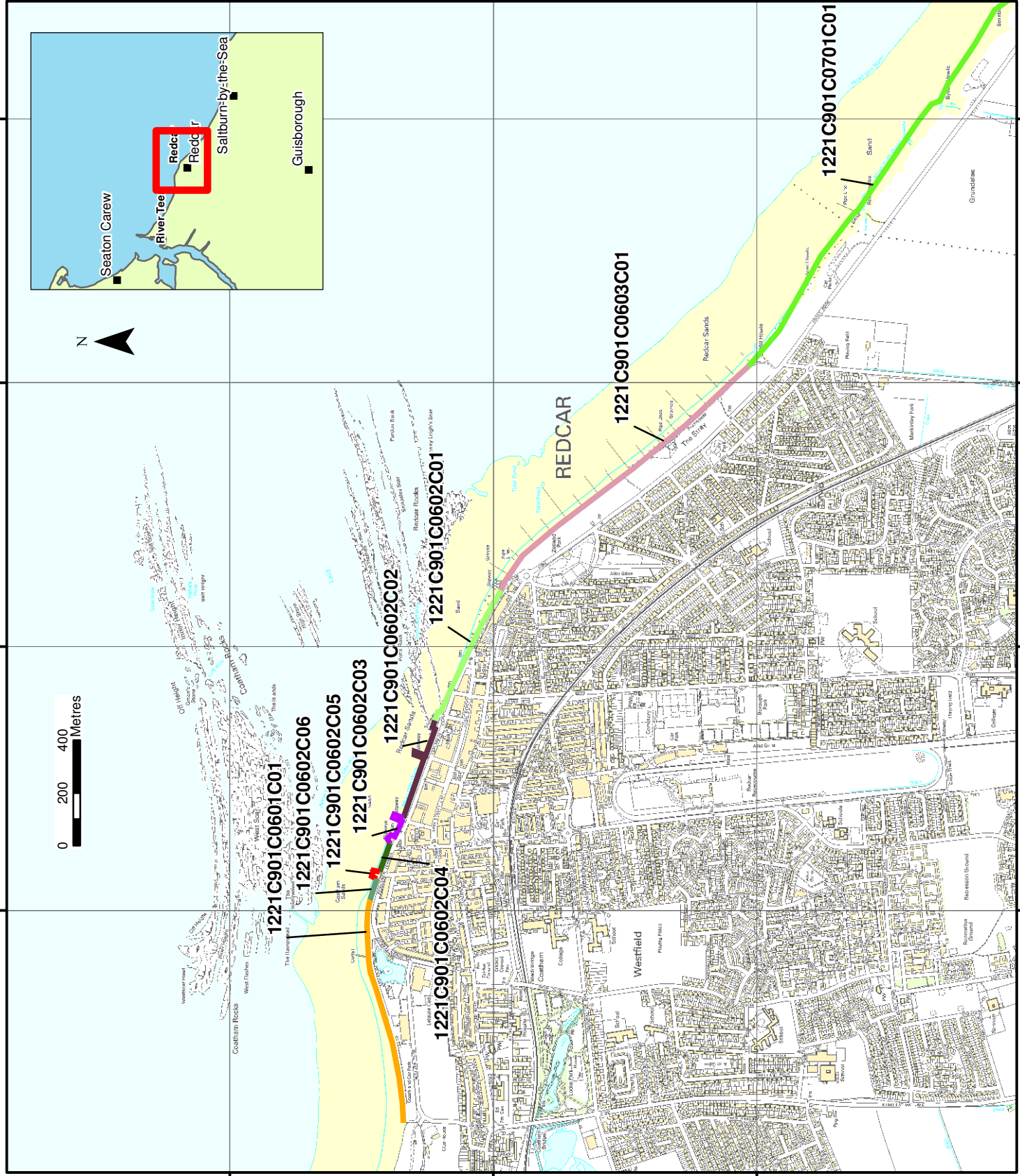


Halcrow Group Ltd
Lyndon House
62 Hagley Road
Edgbaston
Birmingham
B16 8PE

Tel: +44 (0)191 211 1300
Fax: +44 (0)191 211 1313
www.royalhaskoning.com

Tel: +44 (0)121 456 2345
Fax: +44(0)121 456 1569
www.halcrow.com

Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office © Crown Copyright.
Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings.
Scarborough Borough Council.
Licence No. LA 079251



Asset location
NFCDD Asset Number



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

Map 3 - Redcar & Cleveland Council Frontage
Asset Condition 2008

Drawing Scale 1:20,000 at A4
Drawn by: TC Date: 06/04/2009
Checked by: NC Date: 06/04/2009
Approved by: NC Date: 06/04/2009



Royal Haskoning
Lyndon House
Marlborough Crescent
Newcastle upon Tyne
NE1 4EE

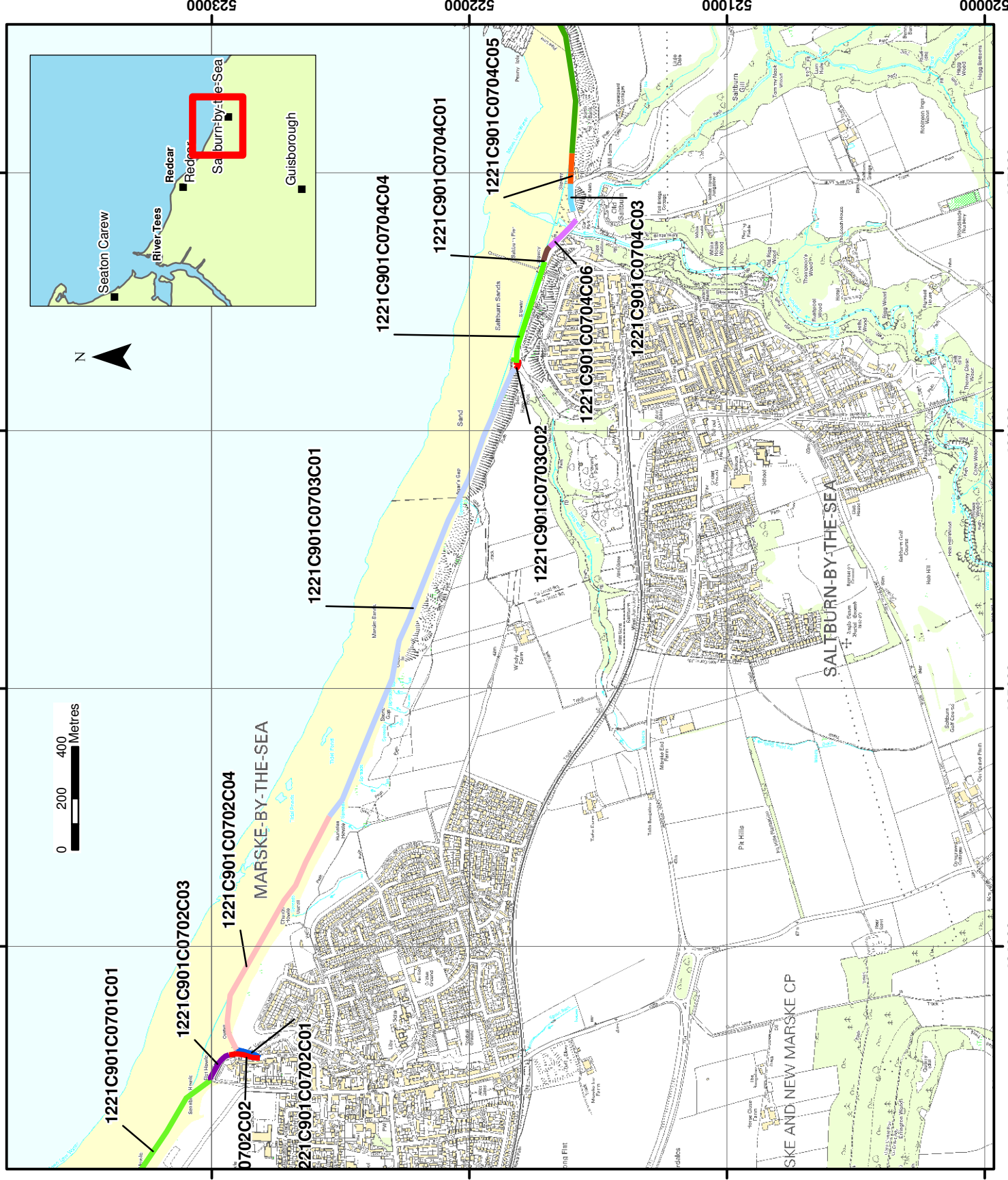


Halcrow Group Ltd
Lyndon House
62 Hagley Road
Edgbaston
Birmingham
B16 8PE

Tel: +44 (0)191 211 1300
Fax: +44 (0)191 211 1313
www.royalhaskoning.com

Tel: +44 (0)121 456 2345
Fax: +44(0)121 456 1569
www.halcrow.com

Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office © Crown Copyright.
Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings.
Scarborough Borough Council
Licence No. LA 079251



Asset location
NFCDD Asset Number



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

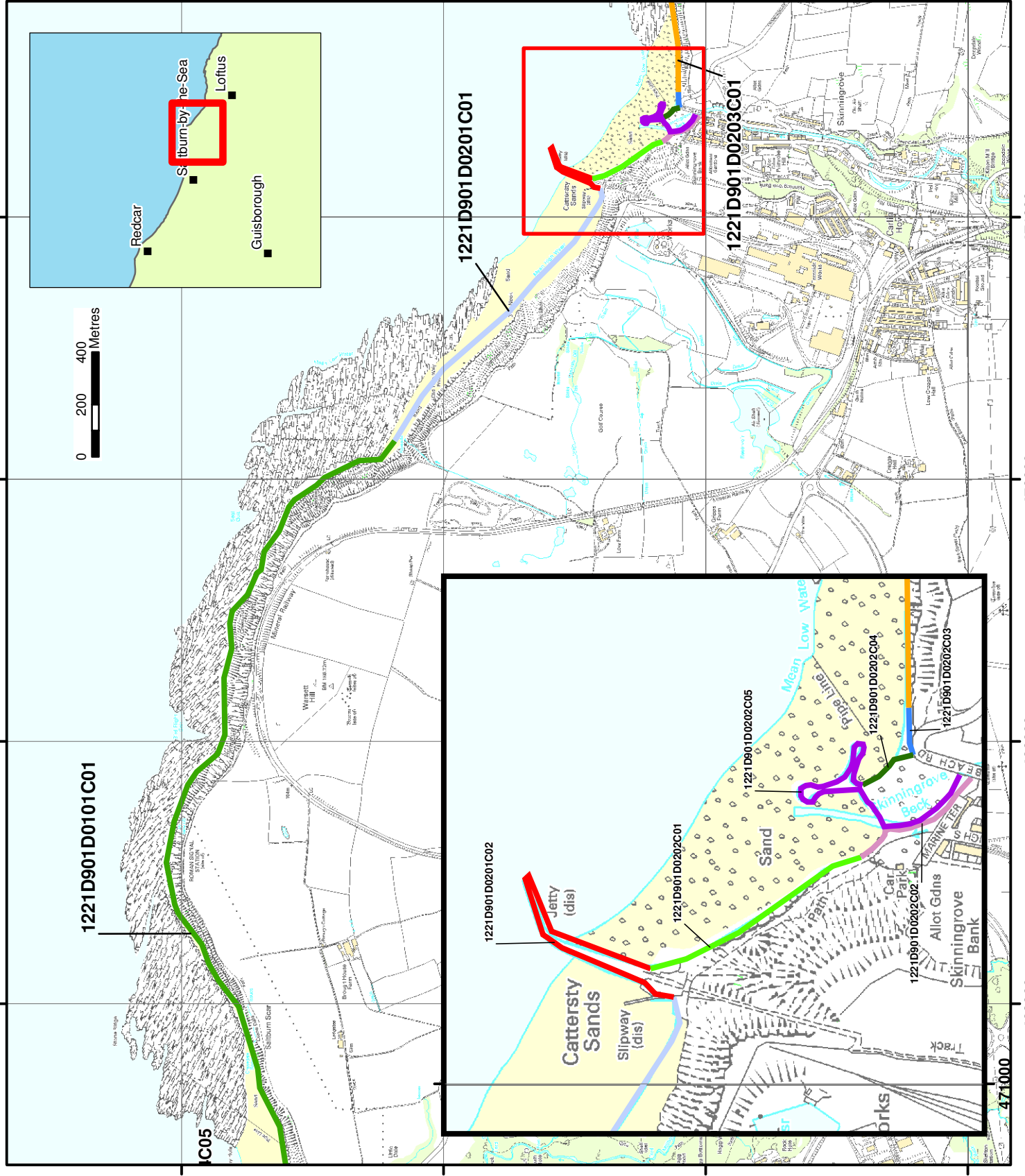
Map 4 - Redcar & Cleveland Council Frontage
Asset Condition 2008

Drawing Scale 1:20,000 at A4
Drawn by: TC Date: 06/04/2009
Checked by: NC Date: 06/04/2009
Approved by: NC Date: 06/04/2009

HALCROW
Halcrow Group Ltd
Lyndon House
62 Hagley Road
Edgbaston
Birmingham
B16 8PE
Tel: +44 (0)121 456 2345
Fax: +44 (0)121 456 1569
www.halcrow.com

ROYAL HASKINING
Royal Haskoning
Marlborough Crescent
Newcastle upon Tyne
NE1 4EE
Tel: +44 (0)191 211 1300
Fax: +44 (0)191 211 1313
www.royalhaskoning.com

Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office © Crown Copyright. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. Scarborough Borough Council. Licence No. LA 079251



Asset location
NFCDD Asset Number



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

Map 5 - Redcar & Cleveland Council Frontage Asset Condition 2008

Drawing Scale 1:20,000 at A4
Drawn by: TC Date: 06/04/2009
Checked by: NC Date: 06/04/2009
Approved by: NC Date: 06/04/2009



Royal Haskoning
Marlborough House
Newcastle upon Tyne
NE1 4EE

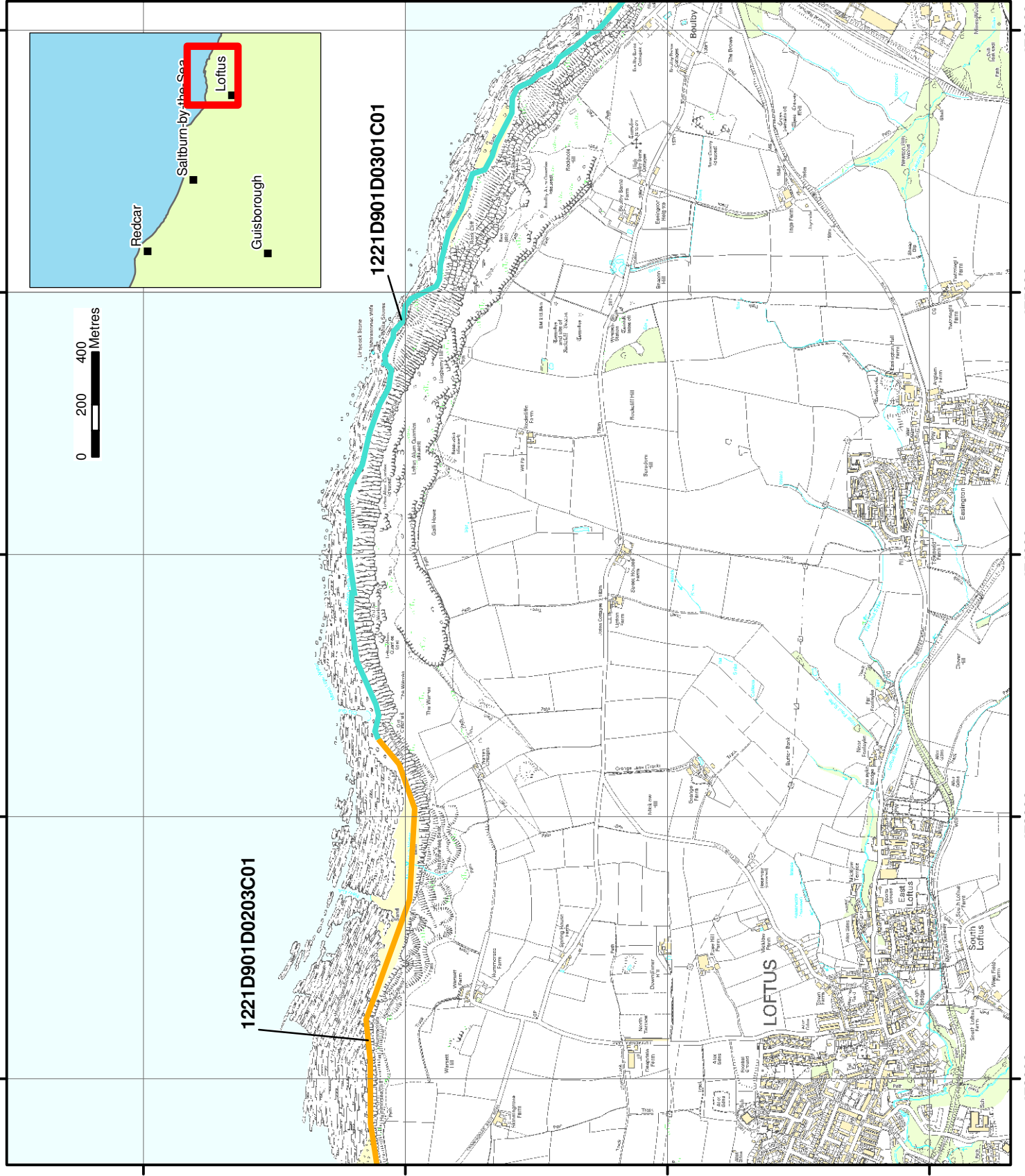


Halcrow Group Ltd
Lyndon House
62 Hagley Road
Edgbaston
Birmingham
B16 8PE

Tel: +44 (0)191 211 1300
Fax: +44 (0)191 211 1313
www.royalhaskoning.com

Tel: +44 (0)121 456 2345
Fax: +44 (0)121 456 1569
www.halcrow.com

Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office © Crown Copyright.
Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings.
Scarborough Borough Council.
Licence No. LA 079251



0 200 400 Metres

521000

520000

519000

518000

476000

475000

474000

473000

472000

Asset location
NFCDD Asset Number



Client: North East Coastal Authorities Group

Project: Coastal slope and asset condition inspection, summer 2008

Map 6 - Redcar & Cleveland Council Frontage Asset Condition 2008

Drawing Scale 1:20,000 at A4

Drawn by: TC Date: 06/04/2009
Checked by: NC Date: 06/04/2009
Approved by: NC Date: 06/04/2009



Royal Haskoning
Lyndon House
Marlborough Crescent
Newcastle upon Tyne
NE1 4EE

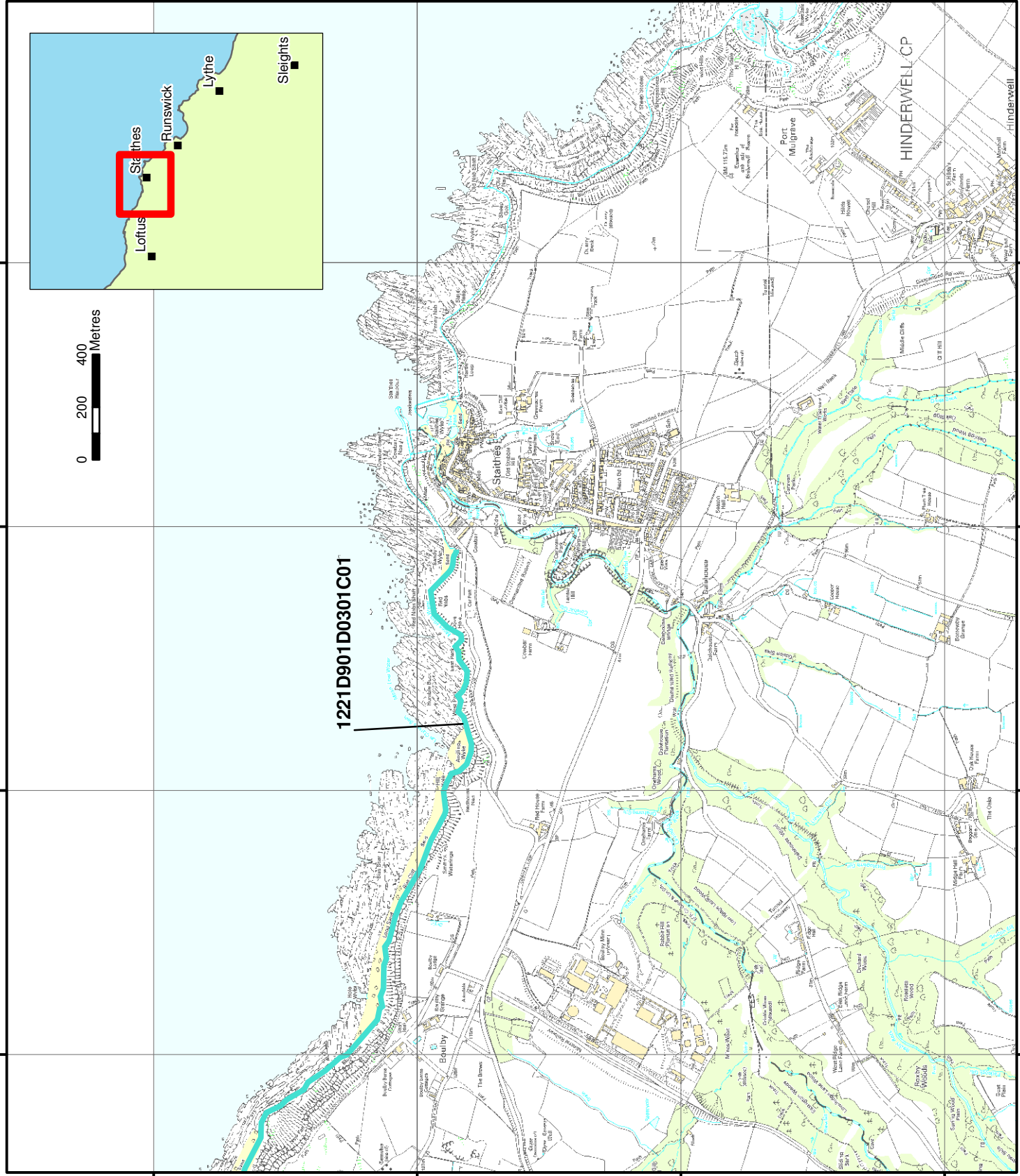


Halcrow Group Ltd
Lyndon House
62 Hagley Road
Edgobaston
Birmingham
B16 8PE

Tel: +44 (0)191 211 1300
Fax: +44 (0)121 456 2345
www.royalhaskoning.com

Reproduced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office © Crown Copyright.
Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings.
Scarborough Borough Council.
Licence No. LA 079251

GIS Filename: Recar_map6.mxd



0 200 400 Metres

1221 D901 D0301 C01

520000

519000

518000

517000

479000

478000

477000

476000