Cell 1 Regional Coastal Monitoring Programme Walkover Inspection Surveys 2018

Redcar & Cleveland Borough Council

September 2018

Redcar & Cleveland Borough Council

Walkover Inspection Surveys 2018

Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Authorised
1	0	First issue	13/09/2018	N. J. Cooper

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Appendices

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Preamble

The Cell 1 Regional Coastal Monitoring Programme covers approximately 300km of the north-east coastline, from the Scottish Border (just south of St. Abb's Head) to Flamborough Head in East Yorkshire. This coastline is often referred to as 'Coastal Sediment Cell 1' in England and Wales (Figure 0-1). Within this frontage the coastal landforms vary considerably, comprising low-lying tidal flats with fringing salt marshes, hard rock cliffs that are mantled with glacial till to varying thicknesses, softer rock cliffs, and extensive landslide complexes.

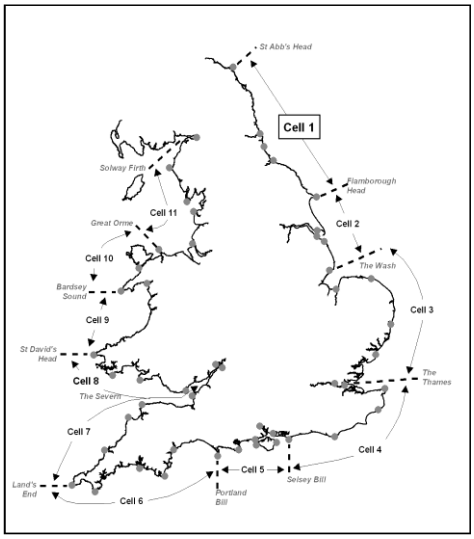


Figure 0-1 - Sediment Cells in England and Wales

The work commenced with a three-year monitoring programme in 2008 that was managed by Scarborough Borough Council on behalf of the North East Coastal Group. This initial phase was followed by a five-year programme which started in 2011 and the current five-year programme which started in 2016. The programme funded by the Environment Agency, working in partnership with the following organisations.

The main elements of the Cell 1 Regional Coastal Monitoring Programme involve:

- beach profile surveys
- topographic surveys
- cliff top recession surveys
- real-time wave data collection
- bathymetric and sea bed characterisation surveys
- aerial photography
- walkover inspection surveys

Royal HaskoningDHV has been appointed to provide Analytical Services in relation to the Cell 1 Regional Coastal Monitoring Programme 2016 - 2021.

The present report is **Walkover Inspection Surveys 2018** and provides a summary of the main findings from the walkover inspections of Redcar & Cleveland Borough Council's frontage that are undertaken once every 2 years.

In addition, separate reports are produced for other elements of the programme as and when specific components are undertaken, such as beach profile, topographic and cliff top surveys, wave data collection, bathymetric and sea bed sediment data collection, and aerial photography.

1. Introduction

1.1 Study Area

Redcar & Cleveland Borough Council's coastal frontage extends from South Gare at the mouth of the River Tees in the north, to Cowbar Nab in the south, and is shown in **Figure 1-1**. Detailed maps showing the location of each of the coastal defence assets considered in this report are presented in **Appendix A**. In addition, the cliffs within the frontage have been classified according to their characteristic behaviour condition and a series of Cliff Behaviour Units (CBUs) have been defined and mapped. The location of the CBUs is presented in **Appendix B**.

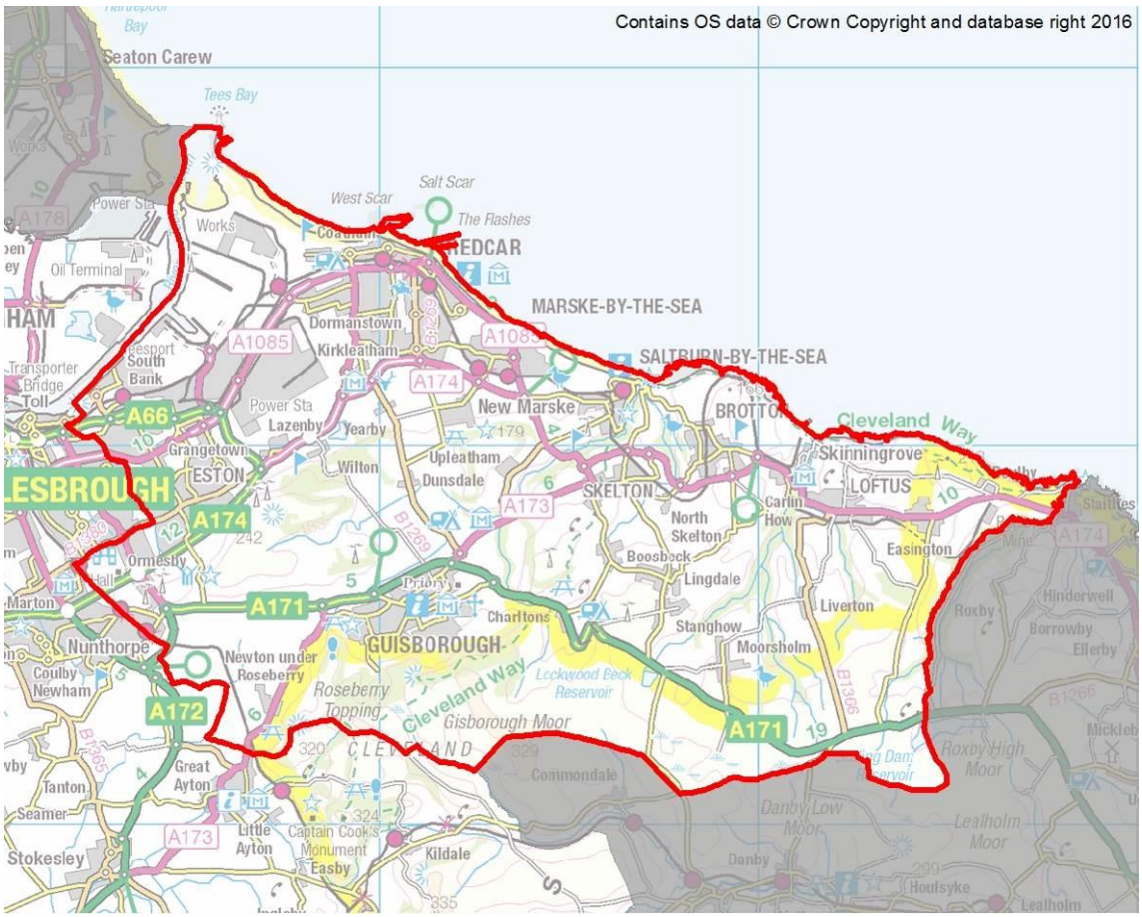


Figure 1-1: Redcar & Cleveland Borough Council study area

1.2 Methodology

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

The walkover inspection surveys for the Redcar & Cleveland Borough Council frontage were undertaken on 21st June and 30th July 2018. The weather experienced during the inspections was warm and fine with no access or visibility problems caused by adverse weather despite some sea fret on occasions.

The frontage has been split into a number of 'asset lengths' (Appendix A), as defined in the National Flood and Coastal Defence Database (NFCDD) that was established by the Environment Agency.

The walkover inspections cover both built defence assets and natural defence assets such as cliffs, slopes and dunes. All assets were visually inspected, photographed and graded based on their condition and an estimate made of their residual life.

For built assets the grading classification was undertaken in accordance with the Condition Assessment Manual (EA, 2012), with estimates made of the urgency of any necessary repairs. An extract of the grading classification for built assets is presented in ***Table 1-1***. For ease of reference the built asset photographs presented in this report have also been bordered with the colours key indicated below.

Grade	Rating	Description
1	Very Good	'As built' condition or cosmetic defects that have no effect on performance.
2	Good	Minor defects that will not reduce overall performance of the asset.
3	Fair	Defects that could reduce overall performance of the asset.
4	Poor	Defects that would significantly reduce overall performance of the asset.
5	Very Poor	Severe defects resulting in overall performance failure of the asset.

Table 1-1: Condition assessment grading for man-made assets.

In addition to the above grading classification, for natural assets such as cliffs and slopes the same five point activity scale used in previous walkover inspections within Cell 1 was used. This grading classification is presented in ***Table 1-2***. For ease of reference the natural asset photographs presented in this report have also been bordered with the colours key indicated below.

Grade	Class	Description
1	Dormant	Features with no interaction with marine processes.
2	Inactive	Features with no visible evidence of erosion or landsliding activity.
3	Locally active	Features with localised evidence of small erosion or landsliding activity.
4	Partly active	Features with widespread evidence of small erosion or landsliding activity or areas of intense erosion or landsliding.
5	Totally active	Features with large-scale or intense erosion or landsliding.

Table 1-2: Condition assessment grading used for natural assets (cliffs/ slopes).

This report provides an overview of the findings from the walkover inspections, summarising each locality in general but also specifically identifying individual assets in ‘poor’ or ‘very poor’ condition. It is anticipated that this summary will help identify areas for maintenance or capital investment. Full details of the inspection of each asset are provided in **Appendix B**.

In addition to this report, full details of the inspection and a selection of appropriate photographs have been entered into the SANDS (Shoreline And Nearshore Database System) database and provided along with this report with SANDS viewer software.

2. Overview

The following significant findings were observed during the 2018 walkover inspection surveys:

- **South Gare Breakwater** – The breakwater remains in poor condition and is comprised of numerous ad hoc repairs particularly along its northern flank. A large number of defects were noted including extensive cracking and spalling, exposure of reinforcing steel, missing mortar, open joints, damaged render and missing masonry blocks. At the root of the structure the slag embankments are being undercut and in places void formation is evident. The historic western pier arm structure remains in a failed / decrepit state. Damaged concrete Accropode and rock armour units show signs of displacement with a poor interlock. Some repairs to the deckslab were noted. An area of particular concern was a small section of cracked and lifted deckslab on the south facing root of the structure.

- **Coatham Sands** – The dunes remain stable and well vegetated particularly in the north, however there is extensive ongoing erosion of the dune crest fronting the caravan site at the southern end of the asset.

- **Redcar** – The new sea defences, completed in 2013, generally remained good to very good condition. Several minor defects were noted along the frontage. These included minor cracking in larger *in situ* concrete panels at access ramps and staining of the concrete beneath drainage outfalls. Generally, there was little change of the defence assets from the 2016 survey. The seawall fronting the Redcar Beacon remained an area of concern and still appeared to be missing flexible sealant in many of the joints, with filler board visible indicating that sealant was never present. Low beach levels have exposed undercutting of the north-east corner of the massive seawall to the rear of the derelict cinema.

- **The Stray** – The groynes appear to be in fair condition and performing satisfactorily. Beach levels are being maintained and there is a reasonable accumulation of pebble and cobble size material to the rear of the beach. Several timber elements are missing from the groynes, particularly towards their seaward ends.

- **Saltburn-by-the-Sea** - Missing coping stones and local damage (cracking and spalling) to the concrete wall and access ramp surface were noted, as in previous inspections. At the eastern end of the frontage, the masonry and concrete seawalls and concrete aprons protecting the public house and land to the east of the slipway are in poor condition, suspected vehicle impacts have destabilised the wall and a significant section has now collapsed. Low beach levels have exposed voids and undercutting beneath the concrete apron/revetment poured to east of the defence. A series of masonry walls higher up the slope were also noted as being undercut. Following the exceedingly dry summer period, a significant rockfall occurred along the cliff units to the south of Saltburn.

- **Skinningrove** – A recent coastal defence scheme (completed in 2015) has repaired and improved the previously poor condition of the Skinningrove Jetty. As noted in 2016 a number of small defects remain, including heavily corroded steel sheet piling, cracked and abraded concrete and some of the new works have poorly inserted sealant in construction joints and exposed reinforcement bars, which could lead to future maintenance problems. The rock armour revetment and path leading from the jetty to the village remain in good condition.

- **Cowbar** - An area of particular and long standing concern is adjacent to Cowbar Lane. Here an upper till unit is undergoing severe erosion and there is evidence of recent rockfall from the lower part of the cliff. This is resulting in the loss of the now abandoned parts of Cowbar Lane. Following rockfall in 2016 the National Trust access to the Nab was closed due to further slippage of the till cliffs. Ongoing minor slippage and activity was visible by approaching the base of the cliffs from the foreshore.

3. Condition Assessment

3.1 Coatham Sands

Coastal Slope Condition Assessment
As reported in previous inspections from 2008 onwards, the sand dunes along Coatham Sands were generally stable with a good coverage of established vegetation. Erosion, loss of vegetation and lowering of dune crest was evident locally at more frequently used beach access points (the northern and southern extents of the dunes). This was particularly significant alongside the caravan park to the south where the continuing roll-back of the dunes is now encroaching significantly into the caravan park and former site compound areas. This was evidenced by the loss of at least one more pitch along the seaward facing row of caravans. A healthy beach level was maintained throughout Coatham Sands.

View looking north west from caravan site (/C0507C01)

View looking south east from South Gare Breakwater (/C0507C01)

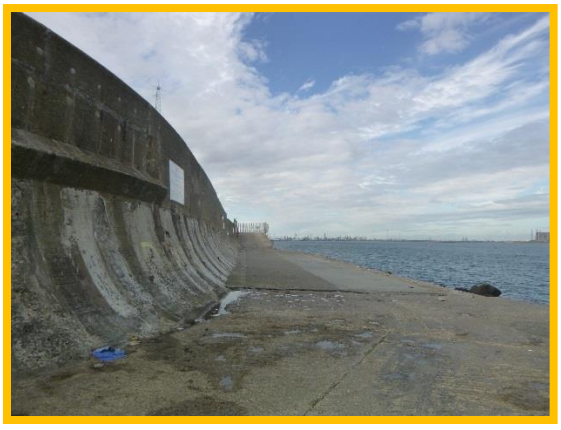
Dunes fronting caravan site (/C0507C01)

Loss of dune crest at access point (/C0507C01)

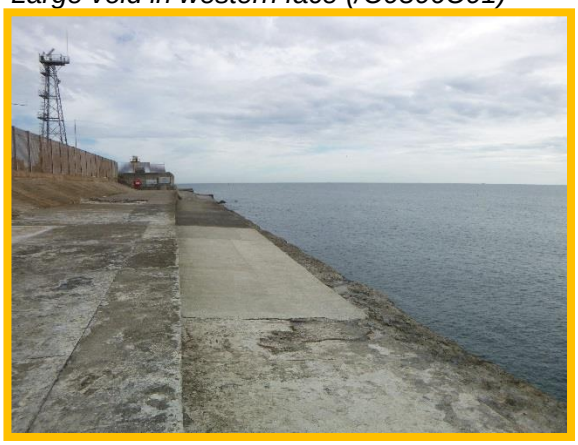
Coastal Protection Asset Condition Assessment
The northern extent of Redcar & Cleveland Borough Council's coastal frontage is marked by the South Gare Breakwater. The structure has been graded in poor condition from the 2008 survey and this remains the case in 2018. Despite the poor condition of the asset, it still continues to provide protection to the navigation channel to the west and control of Coatham Sands to the east.

The structure is privately owned by PD Teesport and signage was present to instruct members of public not to progress onto the structure beyond the boundary fencing for the existing navigation infrastructure. No physical barriers prevented access and it is understood that members of the public, in particular anglers, frequently venture onto the structure.

Large void in western face (/C0506C01)



Western face (/C0506C01)



Historic repairs to deckslab along eastern face (/C0506C01)

Damage to deckslab along eastern face (/C0506C01)

Warning signage (/C0506C01)

Northern extent of upper structure (/C0506C01)

Numerous significant defects were observed along the structure. These included extensive cracking and spalling, exposure of reinforcing steel, missing mortar and masonry, open joints and damaged render. Additionally, it was noted that voiding and undercutting of the slag embankments at the root of the structure have worsened and the historic western pier structure is now totally collapsed. Along the seaward face of the structure, damaged rock armour and Accropode units were noted, with generally poor profile, coverage and interlock. In several locations, the concrete deck slab beneath the wave return wall was lifted above the coping stones and in one location was missing entirely.

Multiple patchwork and ad-hoc repairs to both the deck slab, and face of the pier walls were evident throughout. The effectiveness of repairs differed greatly, with the more recent concrete encasements appearing to work as intended. Historic repairs such as the grouted rubble revetment showed signs

of voiding and general collapse. As noted in previous surveys, a detailed survey of the structure is beyond the scope of the present inspections and a full structural survey of the breakwater is recommended in order to establish the full extent of the damage and identify any remedial works.

To the west of Redcar, defences comprise a concrete crest wall with grouted stone revetment fronting the promenade and car park. These remained in fair condition at the time of the inspections. Beach levels were lower than in 2016 and as such, exposure/undermining of the north-eastern extent of the wall and promenade was noted as identified in previous reports. Other defects, such as local damage and missing blocks were also visible along the defence. The concrete wall remains in fair condition, with the approximately two metre gap towards the north-eastern extent still present. However, due to the event which had taken place over the preceding weekend (28th and 29th July) it was not possible to inspect this defect in detail. The beach remains in good condition, and is actively managed using a tractor and rotavator. There was no evidence of overtopping of the defence, however it was noted that surface water on the promenade generally pooled on the landward side of the path and as such did not drain through the crest wall surface water outlets as intended.

View looking east (/C0601C01)

Undercutting of western corner of the asset (/C0601C01)

Grouted stone revetment (/C0601C01)

Gap in concrete wall partially visible despite being obscured by fair (/C0601C01)

3.2 Redcar

Coastal Slope Condition Assessment
CBU **E52/11** which runs along the rear of the promenade along The Stray retains a Dormant grading as it has done since 2012. The vegetated slopes along this frontage are afforded ample protection from the upgraded blockwork revetment and the beach material retained by the refurbishment of the groynes.

Coastal Protection Asset Condition Assessment
The Environment Agency funded extensive capital works to upgrade the 2.7km of coastal defence assets from Coatham to the eastern extent of The Stray. These works were completed in 2013 and as such were inspected 'as built' during the 2014 walkover survey. The new defences follow similar alignments to the previous assets and, for the purposes of this report, the original NFCDD references have been retained, as they were done in 2016. The GIS linework was amended as part of the 2016 survey to the assets generally remained in very good to good condition, although several minor defects were noted. Minor cracking was observed in larger *in situ* concrete panels particularly at access ramps and staining of the concrete was evident beneath drainage outfalls. Particularly concerning was the lack of flexible sealant between numerous joints in the seawall fronting the Redcar Beacon. It was noted in the 2016 report that filler board was visible in certain joints indicating that joint sealant was never present.

Concrete sea wall at Redcar Beacon (/C0602C03)

Loose and missing flexible joint sealant (/C0506C01)

Missing flexible joint sealant in vertical joint. No sealant in horizontal joint – black filler board visible (/C0602C03)

Exposed concrete apron – no sealant in joints – black filler board visible (/C0602C03)

The seawall at the cinema was not upgraded as part of the Redcar scheme. Beach levels were lower than in 2016 and 2014, this exposed the undermining of the toe apron at the north-west corner noted in some previous reports. The wall has been downgraded to poor condition following the 2018 survey due to the extensive undercutting visible along the toe of the wall and further localised cracking to its face. There was some evidence of historic repairs which generally remain in fair condition. The interfaces with the more recently constructed defences adjacent on both sides remained in good condition.

Cinema seawall (/C0602C05)

Undercut toe of Cinema seawall (/C0602C05)

Cracking and local damage to surface of RNLI slipway (/C0602C02)

South eastern access ramp. Loss of concrete render exposing grouted stone fill beneath concrete deck slab (/C0602C01)

Accretion of sand and formation of embryo dunes at south eastern extent of defence in 2016 (/C0602C01)

Loss of sand build up in 2018 (/C0602C01)

Cracking of precast slabs around access ramps (/C0602C01)

Corrosion staining in precast slabs sections around access ramps (/C0602C01)

3.3 East Redcar to Saltburn-by-the-Sea

Coastal Slope Condition Assessment
The CBUs between Redcar and Saltburn show evidence of recent instability.

Unit **E52/10** remains classified as Partly Active during the 2018 inspection as it has been since 2013. The whole unit was showing signs of erosion, particularly around the subtle headland approximately mid-length of the unit. This continues to be the case and the status of Partly Active has been retained. A concrete outfall structure is present within this unit and instability/scour was evident adjacent to the same. The gabion baskets fronting the outfall were failing and the concrete blockwork revetment showed significant signs of settlement and could be classed as having failed with numerous misplaced and damaged blocks. An informal access ramp was present at the interface with the hard defences at the south eastern extent of The Stray and the crest level is lower in this location. This should be monitored to ensure the condition does not deteriorate with consideration given to fencing/signage to marshal pedestrian access towards the formal access points.

View looking south east (/C0701C01) CBU E52/10

Concrete outfall structure (/C0701C01) CBU E52/10

Informal access at interface with hard defences (/C0701C01) CBU E52/10

The cliffs in Units **E52/9** and **E52/8** are afforded some protection by the wide beach at the toe, particularly at **E52/9** where there is a substantial coarse (cobble-size) fraction in the beach material, despite this the unit showed evidence of dune degradation and roll back and as such both units are now classed as Locally Active. The principal cause of this is likely pedestrian access from the adjacent carpark. As with elsewhere along the frontage it is recommended that signage and fencing is installed to deter the public from further damaged this section of lower lying dune.

View looking south east (CBU E52/8)

View looking north (/C0701C01) CBU E52/9

Immediately to the north of Marske, **E52/7** remains classified as Dormant as it has done since 2008. The asset is defended at its toe by low level sand dunes and a series of masonry and concrete walls, is well vegetated and shows no evidence of recent activity.

Vegetated slope above masonry wall CBU E52/7

At the headland at Marske, **E52/6** the low accreting dunes noted in the 2016 report appear to have subsided slightly, likely due to low beach levels present along the frontage. This has led to some minor localised activity and as such the unit has been classified as Locally Active. This is particularly apparent at the access showing in the image below, where low beach levels have further exposed the timber piles at the foot of the concrete path.

Exposure of timber piles at foot of concrete footpath (CBU E52/6)

Further exposure of timber piles at foot of concrete footpath (CBU E52/6)

From Marske to Saltburn the crest level of the coastal slopes increases and the slopes become increasingly active. **E52/5** shows evidence of toe erosion and localised activity in the upper slopes and remains classified as Locally Active, as does **E52/4** where erosion of the toe and mudsliding appears to have slowed and is now more localised and as such has rescinded its Partly Active status and is now classified as Locally Active.

North western extent of CBU (CBU E52/5)

View looking south east (CBU E52/5)

Southern extent of CBU (CBU E52/4)

View looking south east (CBU E52/4)

Coastal Protection Asset Condition Assessment

The frontage to the east of Redcar along The Stray to Mill Howle consists of concrete block revetment and concrete promenade constructed as part of the Redcar Coastal Defence Scheme which remained in very good condition.

As observed in 2014 and 2016, several timber elements were missing from the groynes, particularly towards the seaward ends. This was particularly evident as beach levels were lower than in 2016, further exposing damage to the groynes.

View on The Stray frontage looking south east (/C0603C01)

View on The Stray frontage looking north west (/C0603C01)

The coastal defences at Marske are protected by a wide beach and so only exposed to marine action during storm events. The low masonry wall and revetment around the headland to the north west of the beach access at Marske was largely covered by beach levels despite being lower than in 2016 where exposed the wall and revetment remained in fair condition. As identified in previous inspections there were some missing coping blocks and there was evidence of lateral movement / settlement of the wall which remained stable.

The concrete wall at the toe of the vegetated slope was reported as cracked through its full height in all inspections from 2008 onwards, however the defect appeared to be of the same width and extent in the present inspections. The slope above showed no evidence of recent movement or any placement of excessive loading on the structure. An area of potential concern was the lower section of masonry wall towards the west of the asset, where there appears to have been some lateral movement. It is recommended that this is monitored as failure of the wall would have a significant impact on the slope to its rear.

Crack in wall – no apparent change (/C0702C03)

Masonry wall showing signs of lateral movement (/C0702C03)

High beach levels and vegetation cover obscuring masonry wall and revetment north west of beach entrance (/C0702C01)

Little change was noted to the masonry wall to the southeast of the beach access at Marske. Settlement cracks were evident throughout the full height and missing bricks at the seaward end, with scour evident to the rear of the structure. The landward, concrete wall was generally in fair condition, although as reported in previous surveys, displayed vertical cracks locally.

Masonry wall south east of beach entrance (/C0702C01)

3.4 Saltburn-by-the-Sea

Coastal Slope Condition Assessment
The CBUs in and directly around Saltburn-by-the-Sea do not show much evidence of recent instability.

Units **E52/3b and E52/3a** above Saltburn Sands are again classified as Inactive in 2018, these units are defended at the toe by a sea wall and are well vegetated. Several unvegetated areas where shallow failures had exposed underlying material were noted in December 2013, but these do not appear to have developed since and vegetation appears to be re-establishing.

E52/2 remains grade as Dormant as per 2016 survey due to a lack of evidence for failures in this section of cliff.

CBU **E52/1** shows a little more activity, with loose materials and localised erosion at the head of the large mound situated just east of Saltburn Gill. However, the activity is minimal and this unit was downgraded from Locally Active to Inactive in 2014 and retained this status to 2016 In 2018 there was no evidence of failures or erosion and as such the unit is now classified as dormant. CBU **E53/5** was classified as Locally Active in 2012 due to shallow slumping which occurred on the cliff face and the unit was reclassified as Locally Active. The slumping has occurred despite the presence of toe protection and probably occurred in response to the wet weather experienced in the latter half of 2012. Evidence of activity still remains, so a status of Locally Active has been retained for this unit in 2018.

View looking east (E52/3b)

View east towards pier (/E52/3a)

(E52/1)

(E53/5)

Coast Protection Asset Condition Assessment

Hazel Grove Foot marks the north western extent of the hard defences which run along the Saltburn frontage. Missing coping stones and local damage (cracking and spalling) to the concrete wall and access ramp surface were present, as noted in 2014 and 2016, and do not appear to have worsened resulting in a fair condition grading.

During the 2016 survey it was noted that the security grille was open, presenting a health and safety risk. In 2018 this had been remedied and the grille was found to be sufficiently secured in place, however some of the bars were obviously damaged and the resulting opening was noted as being of a sufficient size to allow access to small children and animals. Due to the nature of this beach and the high footfall it receives it is highly recommended that the trash grille be replaced to ensure access is restricted.

Missing coping stone exposing fill beneath promenade surface (/C0703C02)

Security grille damaged (/C0703C02)

South of Hazel Grove Foot, the frontage is defended by a masonry seawall. Shingle/cobble beach levels were higher than observed in 2014. Generally, beach levels were found to be lower than in 2016, this enabled a more thorough examination of the masonry wall along this frontage. The masonry and historic repointing works remained in good condition. Most mortar joints were in good condition as in 2016 with the exception of some localised areas of missing mortar and coping stones around the slipway at the RLNI station and seawall beneath the historic pier. Further localised damage was present along the low concrete wall to the rear of the promenade, comprising local cracking and abrasion.

View looking northwest. Lower beach levels than 2016. (/C0702C04)

Exposed masonry at slipway (/C0702C04)

Local damage to pedestrian guardrail and coping stone (/C0702C04)

Local damage to concrete wall (/C0702C04)

To the south east of the pier, the defences comprise a masonry blockwork revetment which is generally in good condition with some missing mortar observed locally. Cobble beach levels were lower than in 2016, particularly evident across the 'apex' of the curve of the structure, with more of the blockwork exposed.

The concrete blockwork wall to the west of Skelton Beck remains in fair condition although a section was missing coping stones, leaving the footway fill material exposed. Grouted masonry apron and masonry abutments to pedestrian bridge appeared to be in fair condition as reported in 2016.

View looking north west (/C0704C01)

Missing coping blocks (/C0704C06)

View looking southeast from pier. Beach levels lower at 'apex' of headland (/C0704C01)

Vegetation establishment fronting car park (/C0704C02)

Exposure of corner of car park (/C0704C02)

To the east of Skelton Beck, the frontage is undefended past the boat/car park. Further erosion/lowering of the cobble beach was evident at the eastern extent. Vegetation had begun to establish toward the crest of the shingle although local erosion was apparent, potentially as a result of members of public accessing the beach from the car park. Possibly a general lowering of beach levels on the east bank of Skelton Beck indicated by the exposure of the crest of the grouted rock revetment (although no significant change from 2014).

Exposed crest of grouted rock revetment (/C0704C06)

Undercutting of rock revetment apron (/C0704C06)

To the south of the boat park is a set back wall protected by a high cobble beach. The wall remains in a good condition, and shows signs of recent repairs and paintwork. There remain some local defects such as minor cracking and loss of render as noted in 2016. The recently refurbished concrete slipway remains in good condition, however flexible joint sealant was observed to be loose and missing locally, particularly at the seaward end between deckslab and eastern facing side slope. The vertical face of the slipway was visible on the western side of the structure and minor abrasion was evident (the southern face of the structure remains obscured by the high cobble beach.

View looking west (/C0704C03)

Western face of concrete slipway (/C0704C03)

The most southerly section of coastal defences at Saltburn comprises the masonry and concrete seawalls and concrete aprons protecting the public house and land to the east of the slipway. The condition of the assets remains in poor condition as it did in 2016. The masonry and concrete seawalls show extensive signs of cracking and abrasion, particularly towards the eastern end. It was noted during the 2018 survey that the boundary wall fronting the public house car park has collapsed. This is most likely due to vehicle impact.

The concrete apron/revetment poured to east of the defence is severely undercut with numerous voids forming, and in parts has shown signs of collapse. The masonry walls higher up the slope were also undercut, as noted in 2016.

Low beach levels exposing undercutting of toe (/C0704C05)

Damage to boundary wall fronting Public House (/C0704C05)

View looking west (/C0704C05)

Undercutting/voiding in in situ concrete apron (/C0704C05)

3.5 Cliffs northeast of Saltburn

Coastal Slope Condition Assessment
Northeast of Saltburn the cliffs have a slope-over-wall form, with a weak till overlying a steep hard rock cliff. The till is subject to periodic mudslides, which result in material falling over and staining the cliffs and deposition of a debris apron along the cliff toe. The debris apron is partly-vegetated, indicating periodic activity in the form of wave erosion and debris falls.

During July and August 2018 several high-profile incidents of cliff activity occurred along the coastline between Saltburn and Scarborough, including the collapse of a section of cliff to the east of Staithes on 8th August, where tragically a young child was killed. The Teesside Gazette reported that a rockfall had occurred on the same day to the northeast of Saltburn, although fortunately the tide was in at the time the incident occurred meaning that no one was injured. It is unclear from news reports exactly where this rockfall occurred, however it is suspected that it was somewhere within CBU E53/2. This unit which has been classified as Partly Active since 2008 and the headscarp can be seen in images below.

Following the 2014 inspection, cliff units E53/5 to E53/1 were classed as Locally Active except E53/2 which remained as Partly Active. The condition in 2018 appeared similar to that observed in 2016. The more westerly slopes (E53/5 – E53/3) are Locally Active and remain vegetated with some minor slips evident along the head scarp. In several locations, the Cleveland Way path is significantly exposed and at risk of being undercut particularly in the E53/2 locality and as such is observed as remaining Partly Active. Towards Hunt Cliff (E53/1) the cliff becomes steeper and less vegetated and appears to be only Locally Active.

E53/3 to E53/1 Generally small-scale slumping in the till layer of the cliff northeast of Saltburn (Locally Active except E53/2, right).

E53/2 slumping in the till layer of the cliff northeast of Saltburn (Partly Active)

Image of rockfall occuring on 08/08/18 taken from Teesside Gazette website

Suspected approximate location of rockfall **E53/2** (Partly Active).

Coast Protection Asset Condition Assessment

There are no coastal assets within this area.

3.6 Hunt Cliff and Warsett Hill

Coastal Slope Condition Assessment
The cliffs are characterised a slope-over-wall form, comprising vertical rock cliffs capped by weaker till. There is evidence of localised and recent rock fall activity in the cliff and mudsliding. These high, steep cliffs were all classed as Partly Active during the 2018 walkover survey, apart from E54/4 and E54/1 which were observed to be Locally Active.

During the 2018 inspection it was noted that the Cleveland Way path is at significant risk of being undercut, particularly at the apex of the corner on the railway line. There appears to be recent rockfalls and the fencing in parts is at risk of collapse due to the retreat of the escarpment.

E54/4 looking northwest along Hunt Cliff showing active cliff face and debris apron (Partly Active)

E54/3a proximity of footpath and railway line to actively eroding cliff top (Partly Active)

Coast Protection Asset Condition Assessment

There are no coastal assets within this area.

3.7 Cattersty Cliff and Skinningrove

Coastal Slope Condition Assessment

The cliffs in this area reduce in height towards Skinningrove and are generally less active than those around Warsett Hill. They have a characteristic slope-over-wall form, comprising a thin layer of till overlying the hard rock cliff.

E54/1, is characterised by a vegetated layer of till, which sits above the Lower Jurassic bedrock. Lower down the cliff, the cliff face is largely obscured by periodically active debris lobes that are undergoing marine erosion at the toe. This unit was observed to remain as Locally Active in 2018.

Units **E55/3, E55/2 and E55/1** have a small, steep debris apron that is sparsely vegetated. Most of the debris apron shows evidence of recent activity and is subject to ongoing toe erosion. The till in the upper cliff is subject to localised mudslide development and headscarp recession. These units are Partly Active in 2018. E55/1 particularly had evidence of recent mudslide activity, see bottom image.

E55/2 – E54/1 Vegetated layer of till, which sits above the Lower Jurassic bedrock. Partly Active in foreground, Locally Active in background.

E56/2a and 56/2b Cliffs above Cattersty Sands, looking towards Skinningrove (Locally Active)

Characteristic mudslide along the toe of **E55/1.**

Unit **E56/2a and 56/2b** are above Cattersty Sands (immediately west of the jetty). The cliffs here have a shallower gradient with extensive vegetation cover. They are also provided protection at their base by a set of embryo dunes. The development of these dunes and lack of erosional activity within this unit is due to the protection afforded by the adjacent jetty. The overall unit remains classed as Locally Active, however it could be argued that the more southerly of the two sections (**E56/2a**) be downgraded to Inactive, due to the low level of activity observed.

Unit **E56/1** is located to the east of the jetty and adjacent to the mouth of the beck. The slopes within this unit are well-vegetated. There is no evidence of recent sliding activity and since modification of the rock revetment, the unit has been downgraded to inactive at the present time.

Coast Protection Asset Condition Assessment

Although Skinningrove Jetty (Asset Ref No. 1221D901D0201C02) is redundant for its original purpose, the export of pig iron, and until recently has been in a failing state, the massive structure provides some coastal stabilisation, fixing the orientation of the adjacent bay to the east and giving some protection to Skinningrove village to the south east. It also helps hold the beach in front of the undefended cliffs to the west. Refurbishments works were undertaken in 2015 to repair a failed section of crest wall and damaged jetty decking, whilst placing additional rock armour protection on the collapsing seaward side. These works are improved the condition of the jetty from poor to good. A number of small defects remain however, including corroded steel sheet piling, cracked and abraded concrete and some of the new works have poorly inserted sealant in construction joints and exposed reinforcement bars, which could lead to future maintenance problems. The condition of the asset has not changed since 2016, other than staining of the seaward face of the repaired wall due to corrosion of reinforcement as highlighted in the 2016 report.

View of crest from access gate showing missing section of crest wall and damaged deck in 2014 (Asset Ref No. 1221D901D0201C02)

Voiding and collapse of west side of jetty structure in 2014 (Asset Ref No. 1221D901D0201C02)

Repaired and improved structure in 2018 (Asset Ref No. 1221D901D0201C02)

Repaired and improved rock armour (Asset Ref No. 1221D901D0201C02)

Seaward face of repair. Note exposed reinforcement.
(Asset Ref No. 1221D901D0201C02)

Heavily corroded sheet piles and rock armour around nose of orignal jetty structure.

The nose of the original structure remains in poor condition with heavily corroded sheet piles visible on the landward face, and some rock armour placed around the seaward face. The poor condition does not seem to affect the structures performance however and it only recommended that ongoing monitoring of this is undertaken.

During the 2018 walkover survey it was also noted that lighting has been provided along the jetty and revetment leading to the village of Skinningrove which provides an obvious health and safety benefit.

The rock armour defence between Cattersty Jetty and Skinningrove village, (Asset Ref No 1221D901D0202C01) was re-profiled as part of the recent Skinningrove coastal defence works, with an extension of the armour around the inner face of the jetty. This appears to offer good protection against overtopping as there was no evidence of slippage in the backing slopes. The crest of the berm has also been surfaced as part of those works.

It was noted in 2018 that there had been some loss of surface material from the path, particularly at the southern end of the revetment. This is likely caused by surface water runoff from the slope behind the path. It is recommended that footpath levels are monitored, particularly following heavy rainfall as they may present a health and safety risk if they increase significantly in size and depth.

General view of modified revetment and surfaced path looking from Jetty towards village in 2018 (Asset Ref No. 1221D901D0202C01)

Evidence of washout of surfaced path. (Asset Ref No. 1221D901D0202C01)

Modified rock revetment protecting inner face of jetty (Asset Ref No. 1221D901D0202C01)

Defences to the east of Kilton Beck were also modified during the 2015 works, with the fishtail groyne being reduced in size and a small detached breakwater being constructed. Future monitoring and inspections should be used to determine the location and scale of beach changes that may result as a consequence of these modifications.

Original defences to the east of Kilton Beck, 2014

Modified defences to the east of Kilton Beck, 2018. **Note:** *detached breakwater and repaired navigation light visible on right hand side of image*.

3.8 Skinningrove to Boulby

Coastal Slope Condition Assessment
Many of the cliffs in this area have been subject to alum quarrying of their uppermost sections, resulting in a characteristic excavated upper part and a natural lower part. In some parts, the whole cliff face has been subject to quarrying and the coastline is formed in quarry waste.

Directly to the east of Skinningrove the Cleveland Way path rises sharply towards Hummersea Cliff. The path appears to have been recently repaired and in parts the head scarp of the cliff is almost encroaching upon its route. **E57/7** was observed to be Partly Active, with extensive slumping along the upper slopes and crest of the cliff. **E57/6** is a high rock cliff with a thin cap of till above which is deemed to be Locally Active.

E57/7 Slumping cliffs (Partly Active)

E57/6 High rock cliff with till cap (Locally Active)

To the east of Hummersea Point the cliffs generally become less steep and area known as Hummersea Bank is heavily vegetated. The cliff units **E57/5** through **E57/3** remain locally active. It was noted during the 2018 inspection that a set of access steps leading down onto Hummersea Scar from Hummersea Farm have been closed as of 16th January 2017 due to damage caused by stormy weather and are now dangerous to use.

REDCAR AND CLEVELAND BOROUGH COUNCIL

LOFTUS PUBLIC FOOTPATH NO.105 AT HUMMERSEA STEPS

NOTICE IS HEREBY GIVEN that on Monday 16th January 2017 the Council for the Borough of Redcar and Cleveland issued a Notice under Section 14(1)(b) of the Road Traffic Regulation Act 1984 (as amended by the Road Traffic (Temporary Restrictions) Act 1991) because of the likelihood of danger to the public.

The effect of this notice is to prohibit the public from the flight of metal steps that go down to the beach at Hummersea (at grid reference NZ 7263 1998). Closure of the steps is necessary because they have been damaged by stormy weather and are dangerous to use.

Dated this: Monday 16th January 2017

For further information or advice please contact:

Public Rights of Way Advisor
Redcar & Cleveland Borough Council
Redcar & Cleveland House
Kirkleatham Street
Redcar
TS10 1RT

Tel: 01287 612397

E57/3 Notice prohibiting Public Access to the beach at Hummersea.

E57/3 Hummersea Bank with the approximate location of the access steps circled.

To the west of The Warren, the cliffs are characterised by an upper till layer with some vegetation cover and localised mudsliding and consequent recession at the headscarp. The lower rocky cliff is free of vegetation and has evidence for on-going erosion. **E57/2** and **E57/1** remain classed as Locally Active, however due to access restrictions and the footpath leading down into The Warren being heavily overgrown it was not possible to observe any potential activity on the lower slopes.

Unit **E58/6** cover a section of cliff known as 'The Warren' and represents a change in behaviour between the naturally formed cliffs to the west and the cliffs formed, at least in part, by quarrying and tipping of waste. This unit is classified as Locally Active in 2018, unchanged since 2012.

To the east of The Warren, the cliffs rise to become some of the highest in Britain. Here the cliff form owes its character to the large abandoned alum quarries which were operational in this area during the 19th Century. Units **E58/5 to E58/2** each has an upper and lower unit. The upper parts of the quarry units are backed by steep sandstone cliffs and feature heavily vegetated, undulating terrain, possibly the product of past rockfalls as a result it is classified as Locally Active in 2018, unchanged since 2012. The lower part of the cliff is exposed to marine attack, is steep and comprises exposed shales that are heavily weathered and prone to ongoing and intense erosion. Consequently, these lower units all remain classified as Partly Active in 2018, unchanged since 2012. Below Rockhole Hill there is a unit (**E58/1c**) classified as Partly Active, **E58/1a** and **E58/1b** remain classified as Partly Active.

It is worth noting that observations of activity along **E58** were generally made from afar due to the limited access and exposure within the abandoned quarries along Rock Cliff.

E58/5 to E58/2 – Cliffs of the Loftus Alum Quarries
(Locally Active upper sections and Partly Active lower sections)

Coast Protection Asset Condition Assessment

There are no coastal protection assets within this area.

3.9 Boulby to Cowbar Nab

Coastal Slope Condition Assessment

In the coastal section between Boulby and Cowbar Nab the cliffs are much lower than those adjacent to the west. The majority of CBUs within this area are classified as Partly Active. They are characterised by a soft upper till unit which supports a variable vegetation cover and is subject to landsliding and consequent headscarp recession. Lower down the cliff the harder rock unit is largely bare except where covered by debris cones, reflecting localised rockfall activity.

E58/1 to E/59/6 Soft, slumping, upper till resting upon harder rock (Partly Active)

E58/1 to E/59/6 Soft upper till resting upon harder rock subject to rock fall (Partly Active)

An area of particular and long-standing concern along this stretch is adjacent to Cowbar Lane. Here units **E59/5** to **E59/1** are all classified as Partly Active in 2018, unchanged from 2012. They are characterised by an upper till unit which is undergoing severe erosion and there is evidence of recent rockfall from the lower part of the cliff. This is resulting in the loss of the now abandoned parts of Cowbar Lane. Rock armour is also locally present along the toe of unit **E60/1b**, which is acting to locally protect the base of the cliffs, but is not able to prevent failures in the till materials above. However, a fresh rockfall occurred in 2016 immediately adjacent to the rock armour, leading to further slippage in the till cliffs above and closure by The National Trust of public access to Cowbar Nab. In 2018, it was noted that the nearly the abandoned section of Cowbar Lane is now affected along almost its entire seaward facing side.

E59/3 and E59/4 Loss of road due to ongoing erosion at Cowbar Lane

E59/3 and E59/4 Loss of road due to ongoing erosion at Cowbar Lane

E59/4 work ongoing to further abandon a section of the old Cowbar Lane road, now access is restricted to users of the Cleveland Way path.

Previously abandoned section with alternative path route.

E60/1 Closure of access to Cowbar Nab in 2016.

E60/1 Closure of access to Cowbar Nab in 2018.

During the 2018 walkover survey it was noted that the access onto Cowbar Nab remained in very similar condition to 2016. Given that erosion to the cliff face (**E60/1b**) is ongoing, it is recommended that a more permanent solution is found to restrict access onto the Nab.

Coast Protection Asset Condition Assessment

Although the NFCDD records show no specific coastal defence assets within this area there are two sections of rock armour that give some protection to the cliff toe adjacent to local 'pinch points' next to the cottages on Cowbar Lane, constructed as part of the 2002 scheme at Staithes harbour. The rock armour was in fair condition, similar to that observed in 2012, and appears to comprise a mixture of imported granite and smaller locally sourced rock. The crest level is relatively low and the length of cliff protected short, so appears to be designed as an adaptive measure to slow the rate of erosion locally. In addition, netting has been used to help stabilise the till slopes in local sections along Cowbar Lane.

E59/1 Rock armour located at toe of cliff to the west of Cowbar Cottages

E60/1b Rock armour located at toe of cliff to the north of Cowbar Cottages

4. Comparison with Previous Assessment

The previous formal assessment across the whole study frontage was undertaken in summer 2016.

Between 2014 and 2016, Skinningrove in particular benefited from a capital investment in repairs and improved defences. The repairs and improved defences appear to be in good condition to the present date and are having a positive impact on beach conditions and use of the shoreline features such as the surfaced path between Cattersty Jetty and Skinningrove itself.

Of the remaining areas, the most major changes since 2016 exist along undefended cliffs, especially near Cowbar Nab. Prior to the 2016 walkover survey The National Trust had been forced to close public access to the Nab due to extensive erosion to its northern face. Generally, however, the cliff behaviour categories remain largely unaltered from the 2016 inspections, except for a few areas where the classification has been downgraded.

There are several built assets which retain a poor condition grading, most notably the South Gare Breakwater the condition of which has continued to deteriorate.

5. Problems Encountered and Uncertainty in Analysis

During the 2018 inspections very few issues were encountered across the frontage. Access issues posted the largest risk, however most assets are located within public spaces and therefore were freely accessible.

All assets were inspected at an appropriate stage in the tidal cycle and due care was taken when accessing the more remote assets. Beach levels were generally lower throughout the 2018 inspections meaning that undercutting and voiding not visible in 2012 and 2014 inspections was generally visible.

The South Gare Breakwater was not accessible to members of the public and therefore inspection of this structure was limited.

Views of the lower part of the cliffs were sometimes limited, especially between units **E58/5** to **E58/1c** due to the steep, complex terrain of the former quarries. At locations where observations were difficult, judgements about cliff behaviour activity status were made based on the visible cliff sections and informed by previous assessments and additional data derived from aerial survey data collected as part of Cell 1 Regional Coastal Monitoring programme.

6. Conclusions and Recommended Actions

Further to the visual inspection of all assets, specific conclusions and recommendations for individual assets are given in **Appendix C**. The main urgent recommendations are:

- South Gare Breakwater – survey required to ascertain nature and extent of defects. Repairs are required to maintain the integrity of the structure. Potential health and safety issues due to the ease of access to the seaward elements of the structure.

- Potential health and safety issues were presented by the damaged security grille at the culvert outfall to the north-western extent of the promenade at Saltburn. Despite having been reattached following the 2016 inspection the damage may allow public access into the confined space.

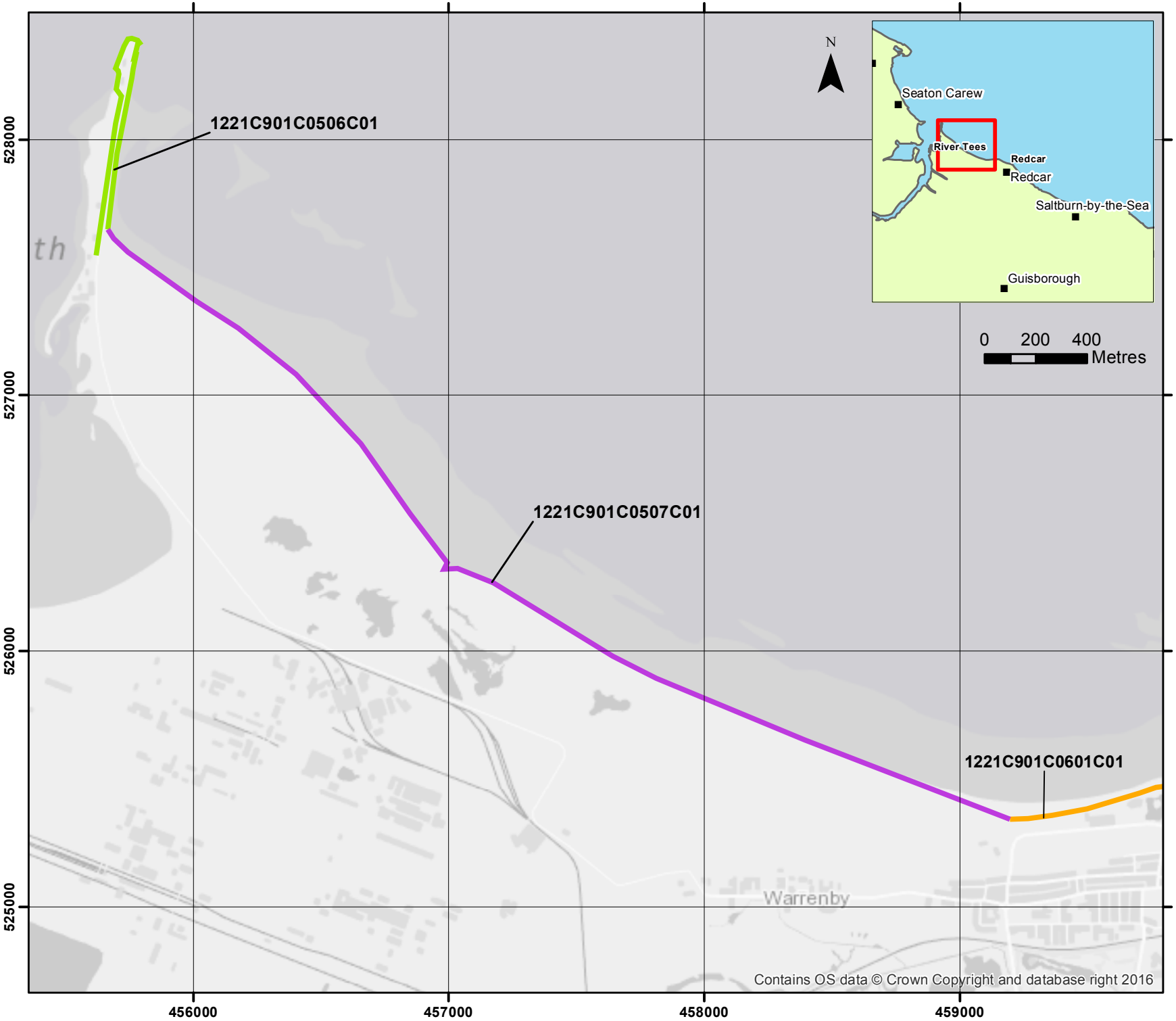
- The collapsed masonry wall fronting the Ship Inn should be repaired to prevent damage to the premises and vehicles using the car park.

In addition, the cliffs have been characterised according to their present activity status and details are given in **Appendix D**.

All condition assessment data and selected photographs have been uploaded to SANDS (Shoreline And Nearshore Database System).

Appendices

Appendix A
Asset Location Maps



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Asset location

NFCDD Asset Number

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 1

Redcar & Cleveland Borough Council Frontage

Asset Inspection Report

Drawing Scale at A4 1:20,000

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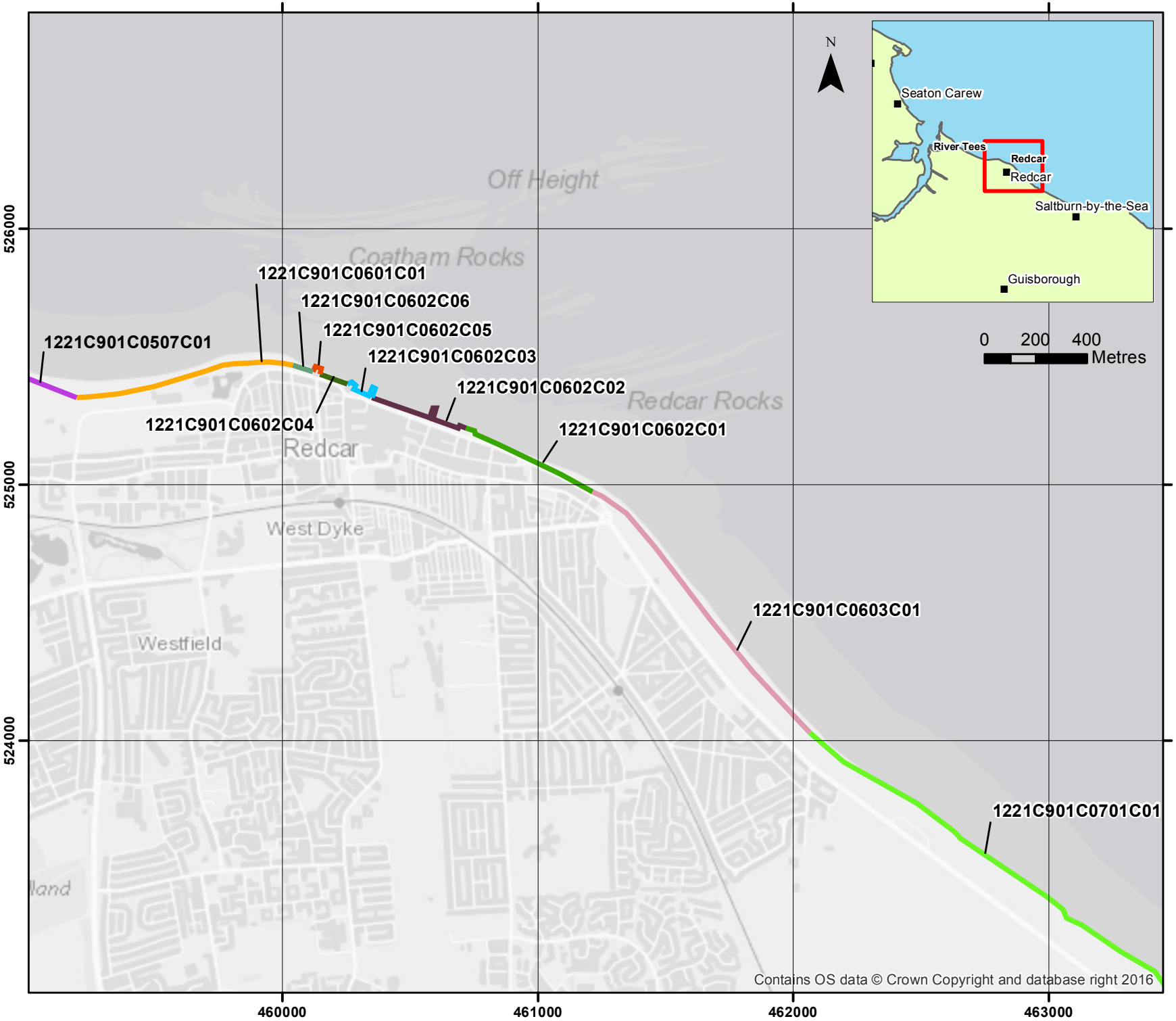

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Asset location

NFCDD Asset Number

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 2

Redcar & Cleveland Borough Council Frontage

Asset Inspection Report

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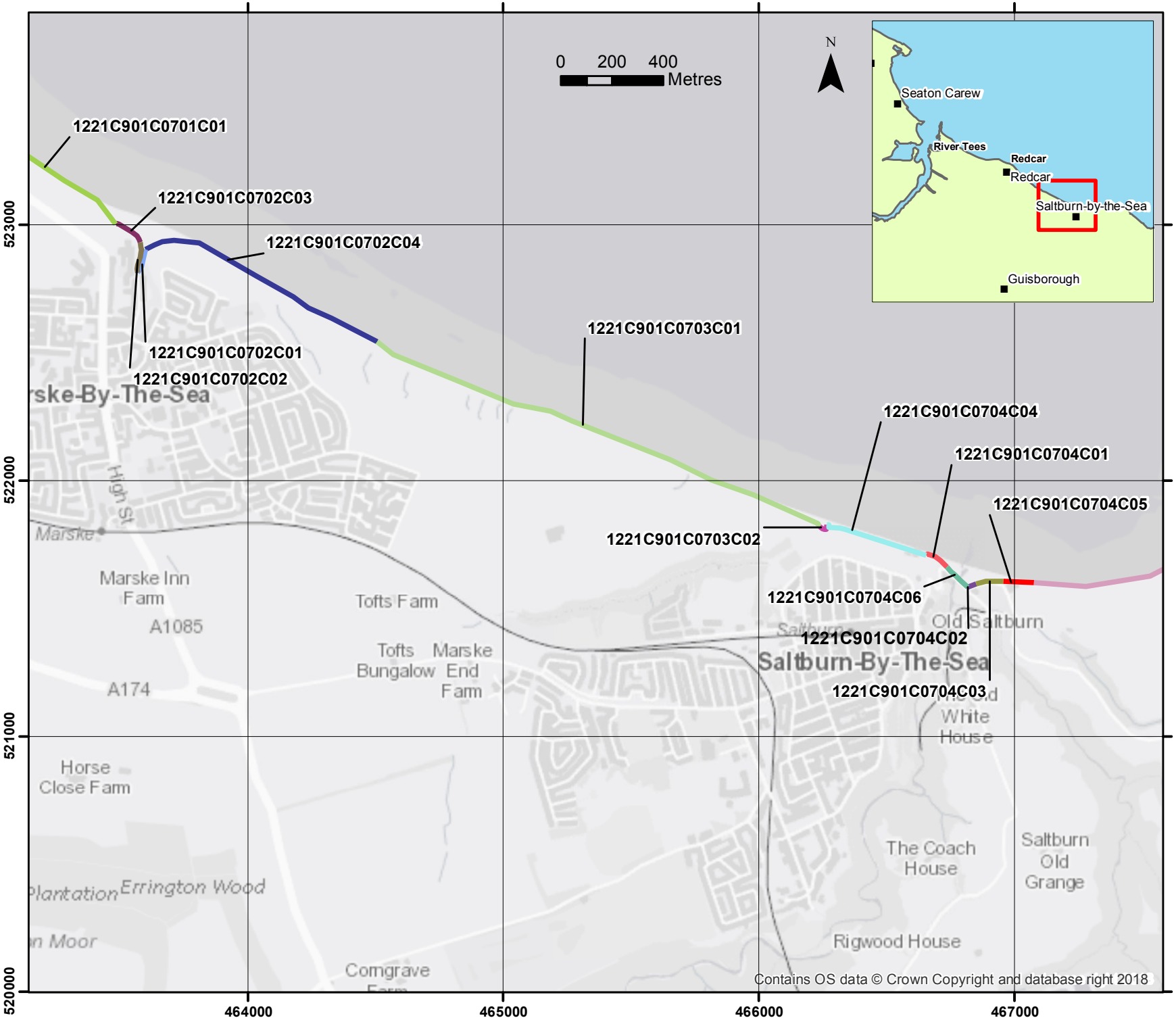

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Asset location

NFCDD Asset Number

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 3

Redcar & Cleveland Borough Council Frontage

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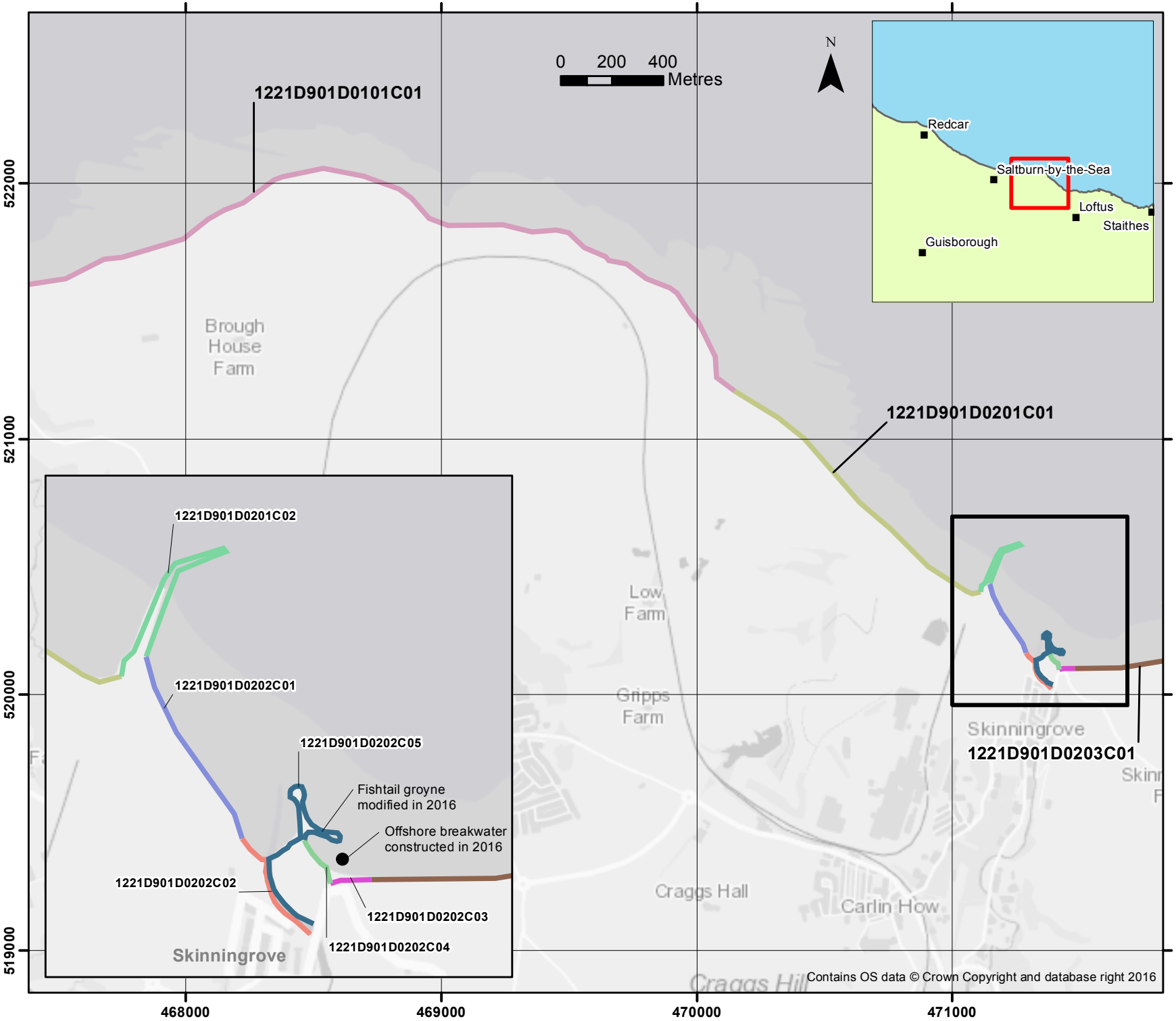

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Asset location

NFCDD Asset Number

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 4

Redcar & Cleveland Borough Council Frontage

Asset Inspection Report

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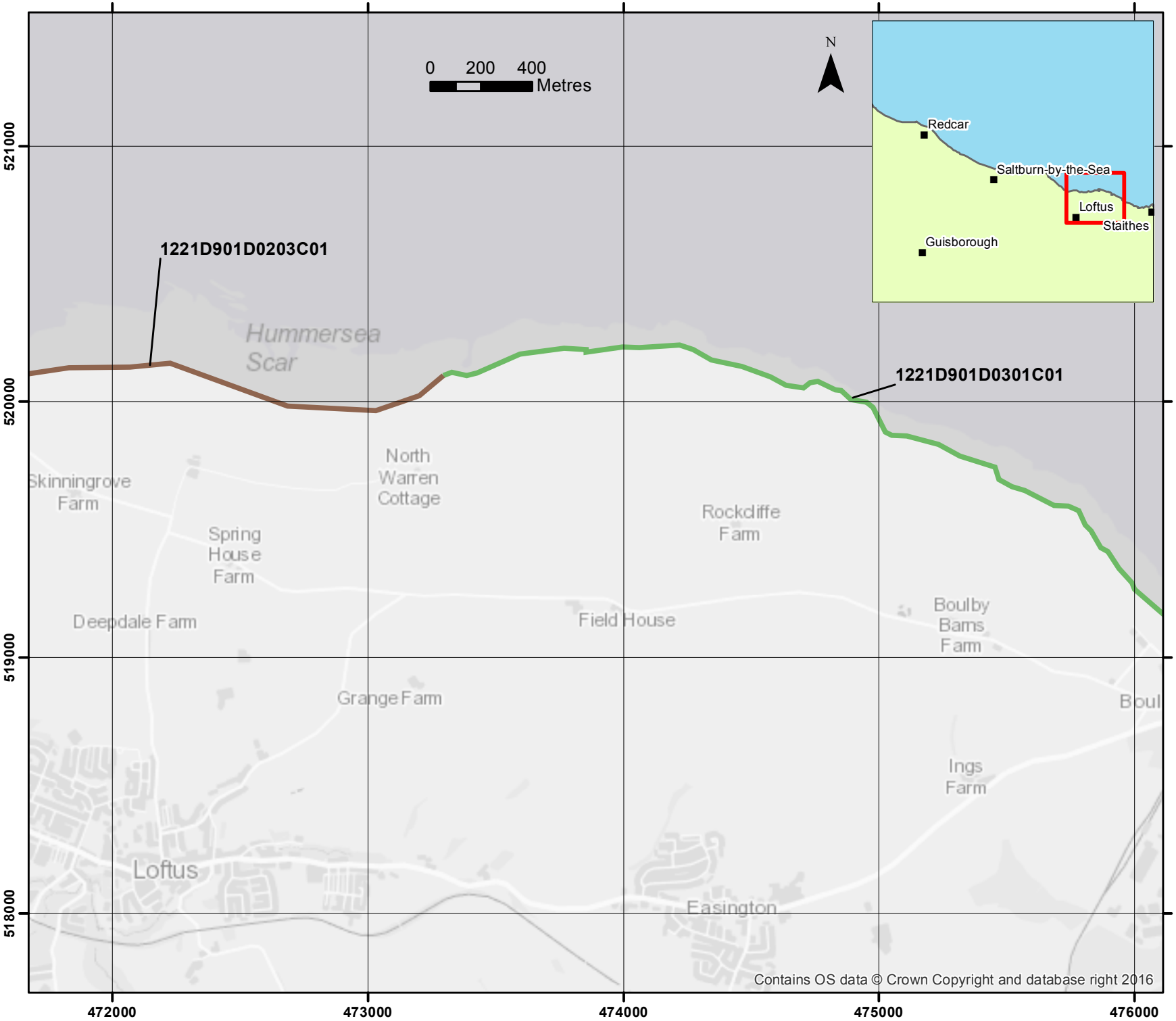

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Asset location

NFCDD Asset Number

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 5

Redcar & Cleveland Borough Council Frontage

Asset Inspection Report

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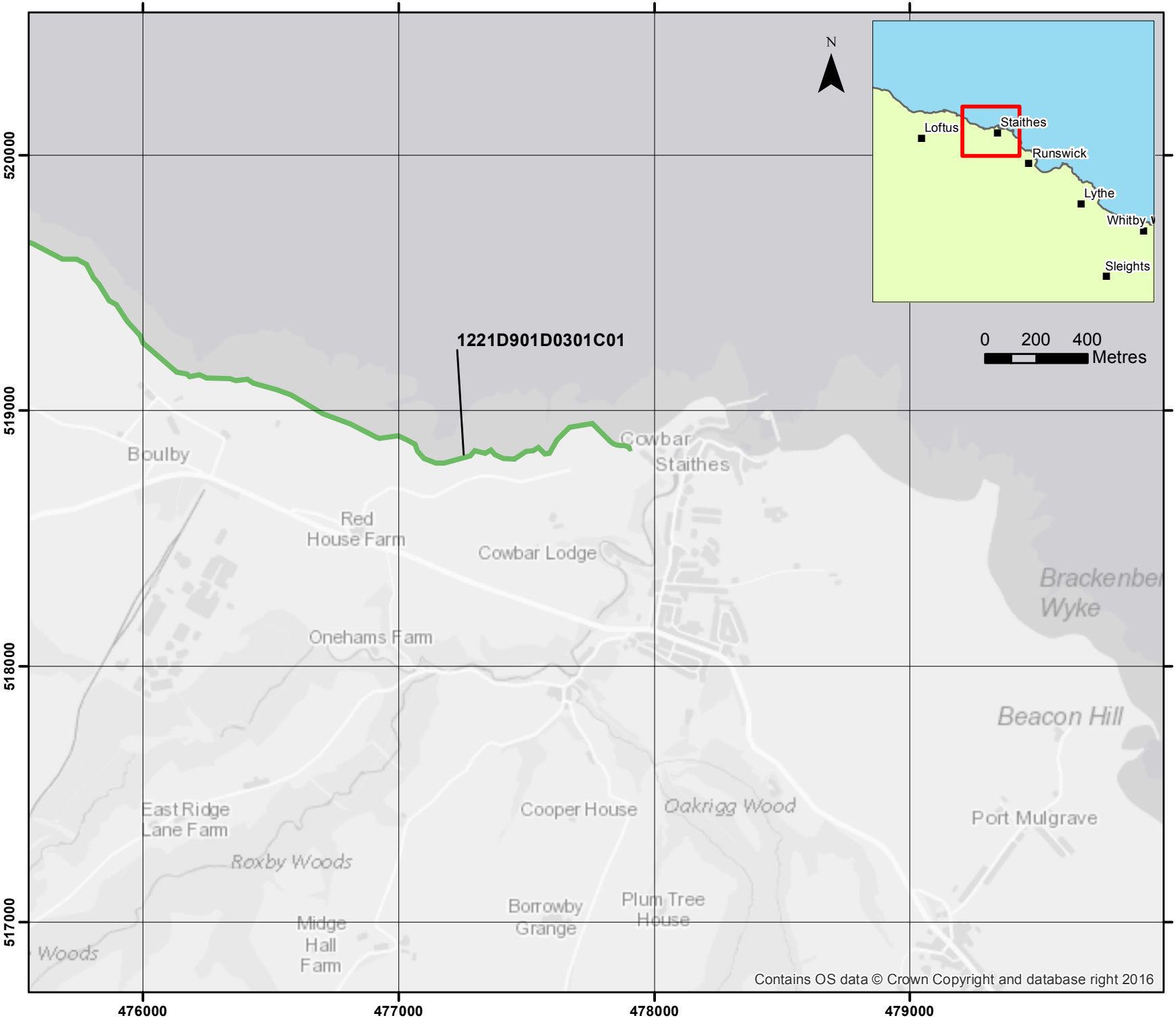

Legend

Asset location

NFCDD Asset Number

Note: The area of Cowbar is covered by Cliff Behaviour Units

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 1 - Map 6

Redcar & Cleveland Borough Council Frontage

Asset Inspection Report

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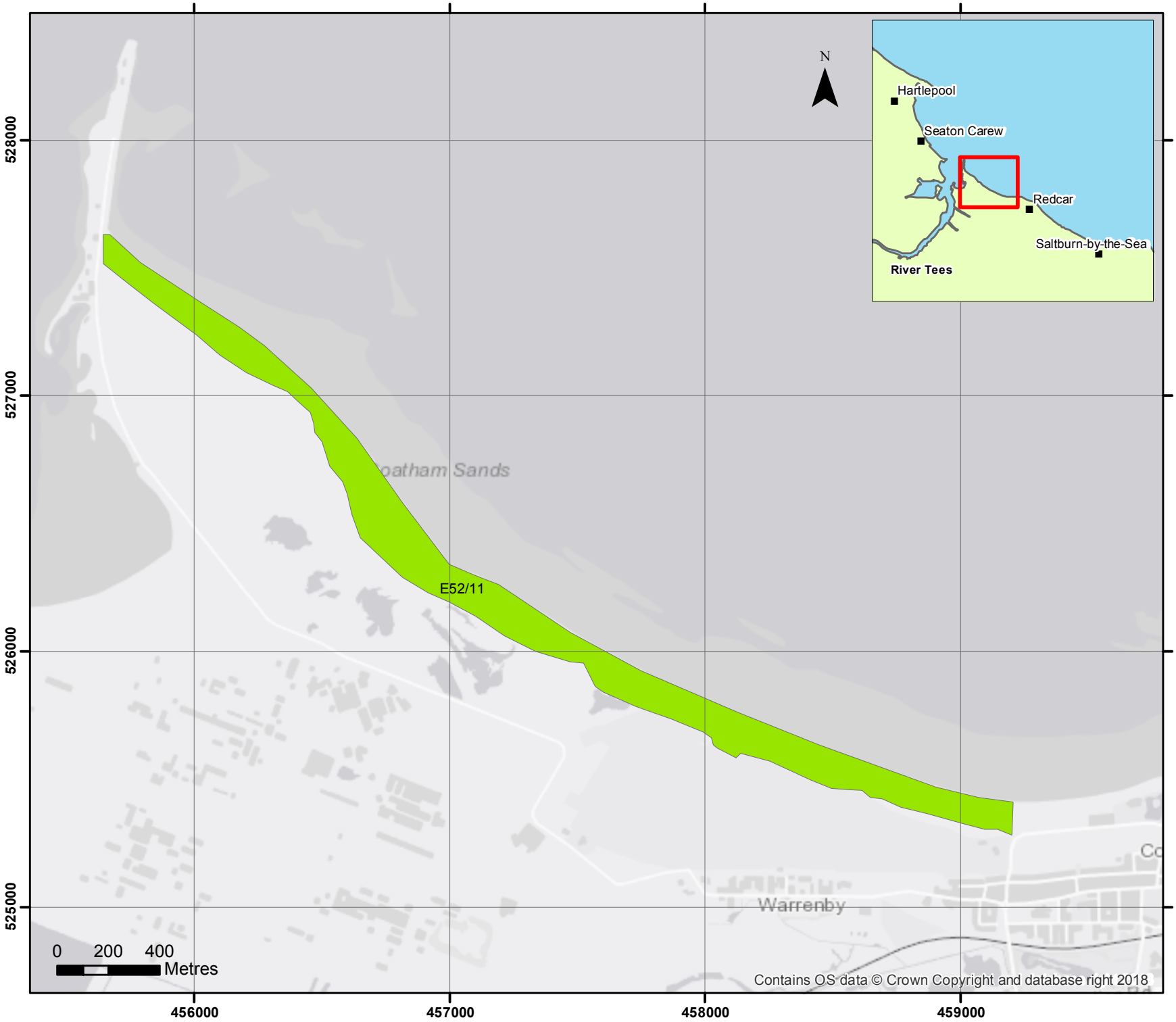
Appendix B
Cliff Behaviour Units



Legend

Cliff Activity Status 2018

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

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2- Map 1

Redcar & Cleveland Borough Council Frontage

Coastal Slope Condition 2018

Drawing Scale at A4 1:20,000

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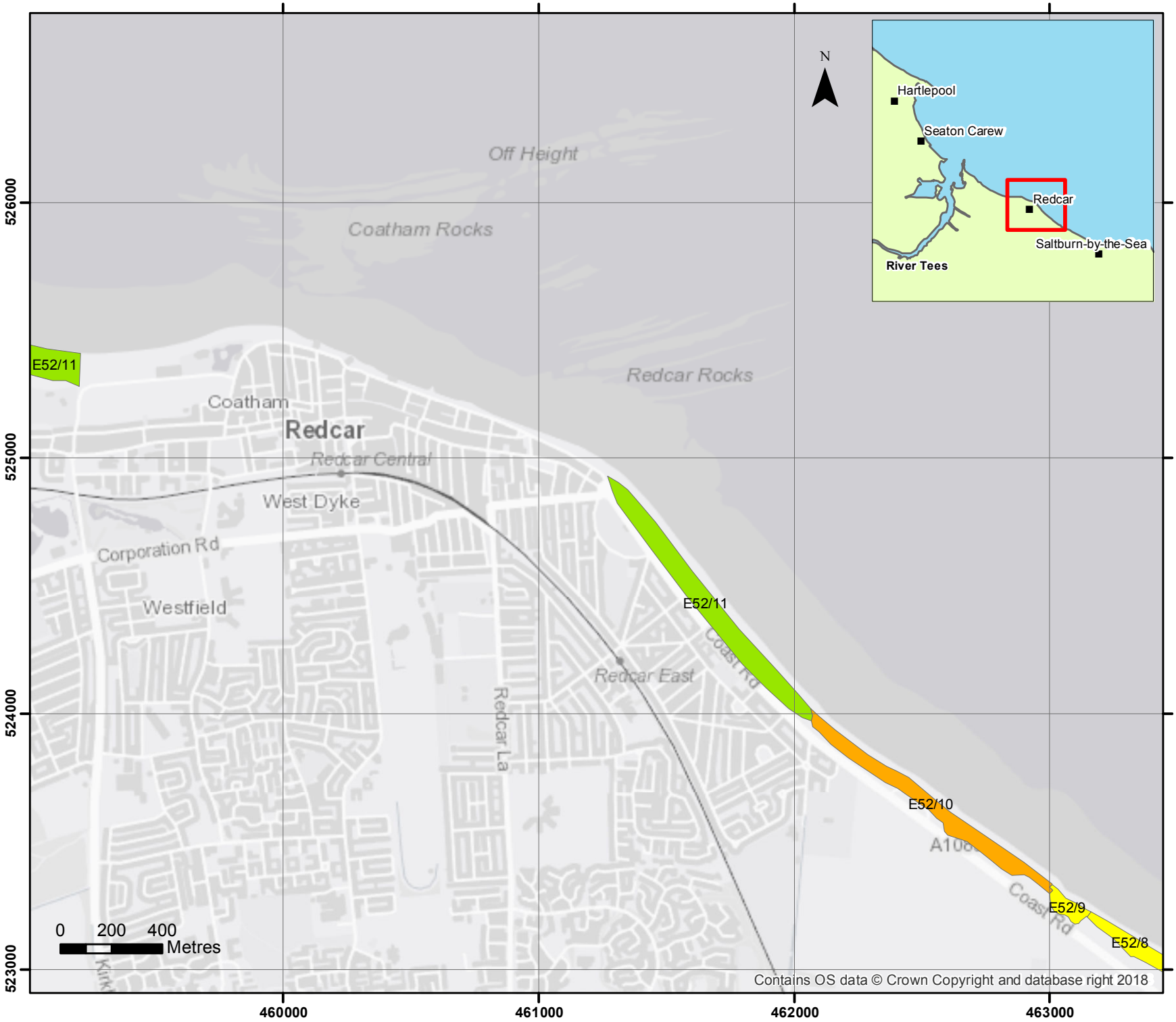

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Cliff Activity Status 2018

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

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2- Map 2

Redcar & Cleveland Borough Council Frontage

Coastal Slope Condition 2018

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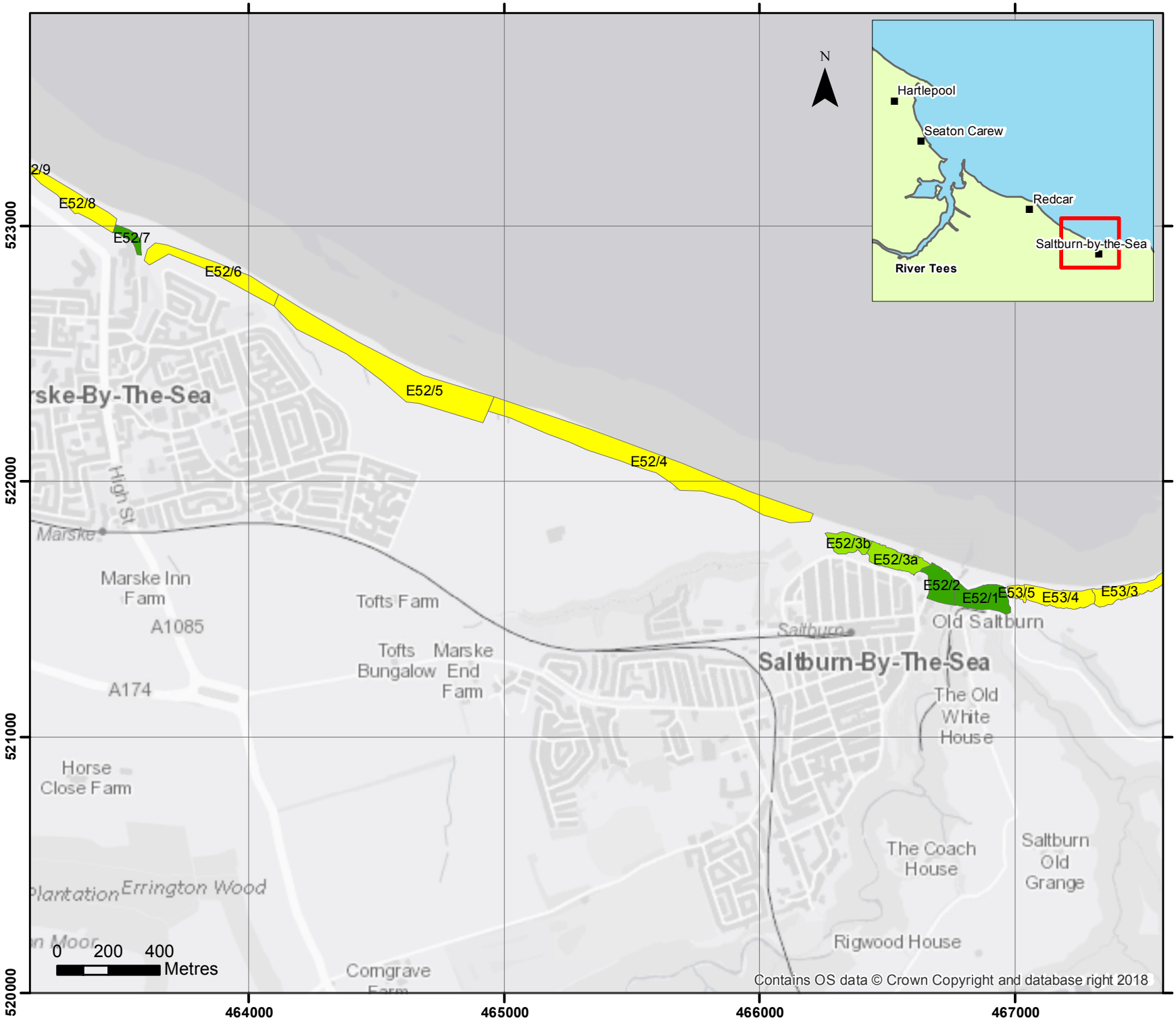

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Cliff Activity Status 2018

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

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2- Map 3

Redcar & Cleveland Borough Council Frontage

Coastal Slope Condition 2018

Drawing Scale at A4 1:20,000

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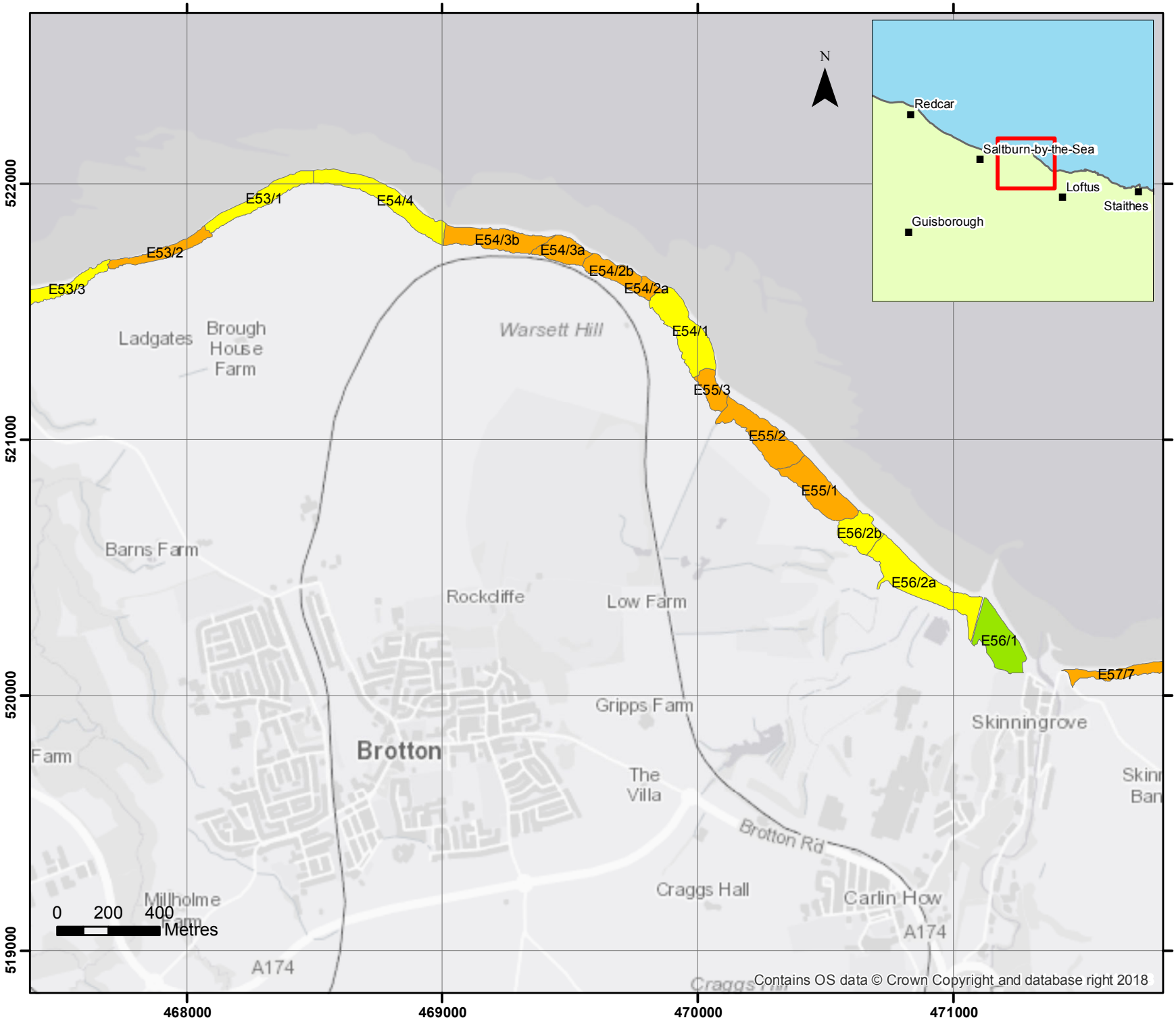

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Cliff Activity Status 2018

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

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2- Map 4

Redcar & Cleveland Borough Council Frontage

Coastal Slope Condition 2018

Drawing Scale at A4 1:20,000

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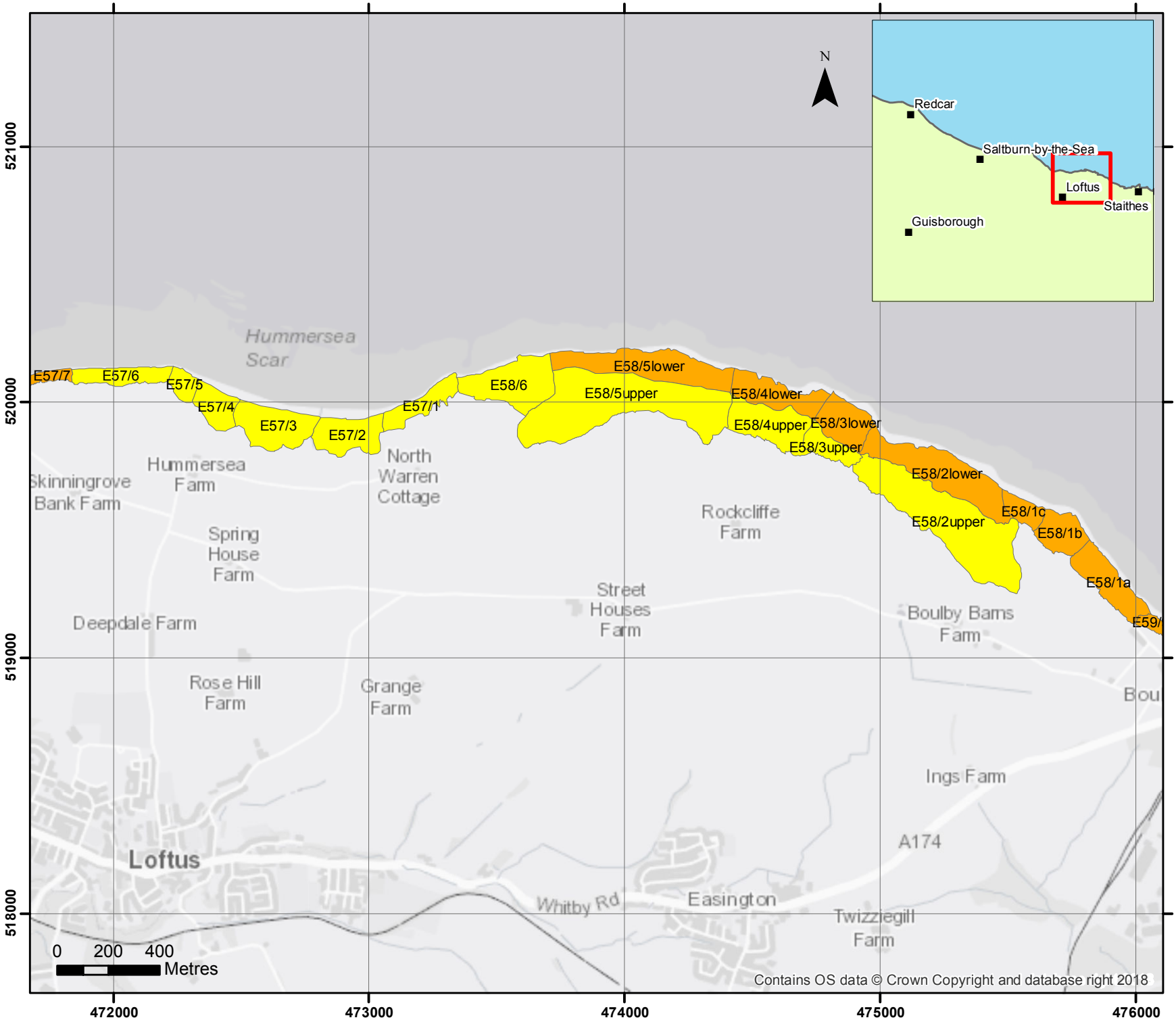

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Cliff Activity Status 2018

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

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2- Map 5

Redcar & Cleveland Borough Council Frontage

Coastal Slope Condition 2018

Drawing Scale at A4 1:20,000

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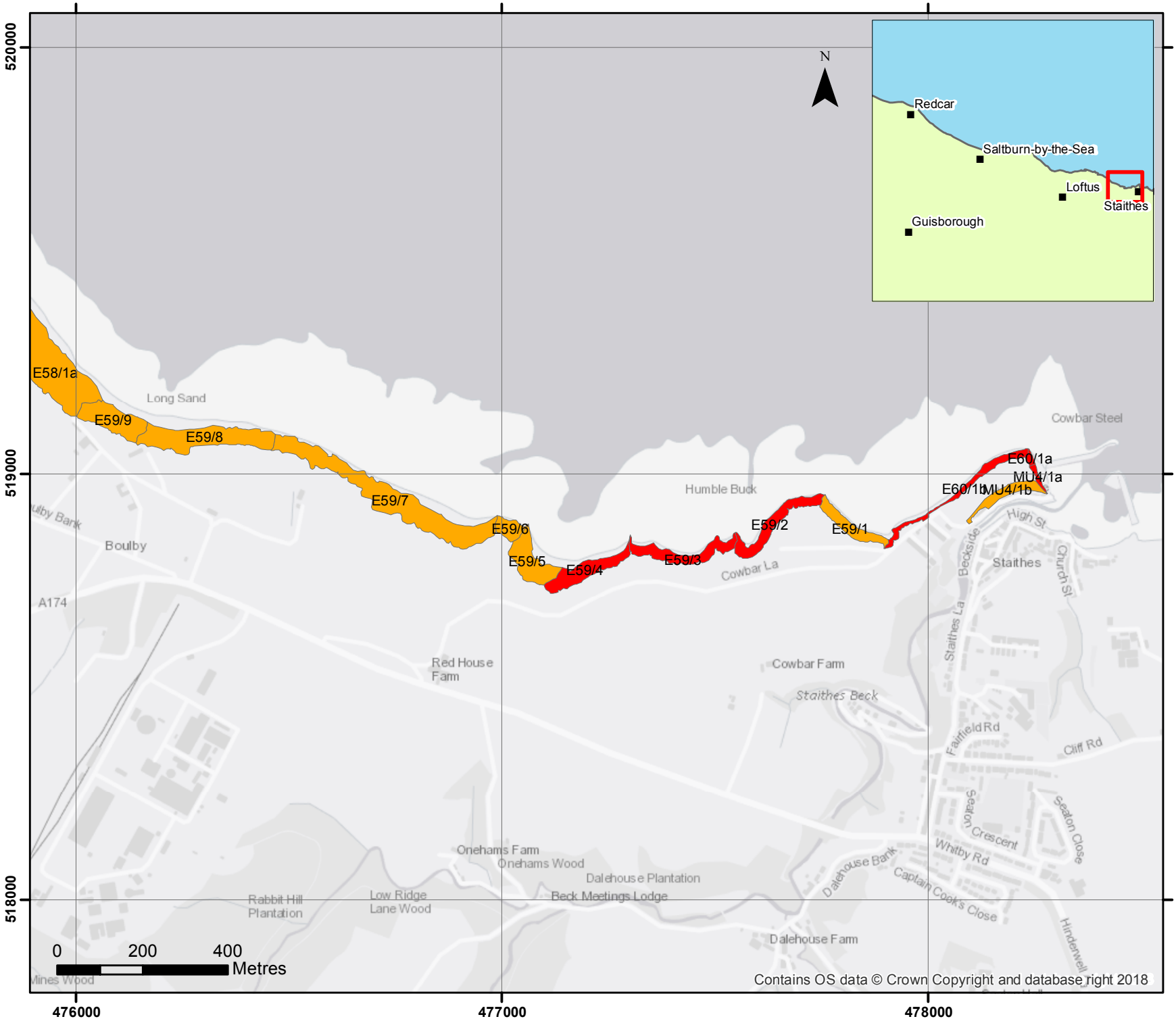

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Cliff Activity Status 2018

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

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2- Map 6

Redcar & Cleveland Borough Council Frontage

Coastal Slope Condition 2018

Drawing Scale at A4 1:12,000

WATER
Royal HaskoningDHV
Marlborough House
Marlborough Crescent
Newcastle upon Tyne
NE1 4EE

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

Royal HaskoningDHV
Enhancing Society Together

Appendix C
Asset Condition & Recommendations

Asset Name	Description	Type	Length	Inspection Date	Inspector	Comments	Overall Condition	Residual Life	Recommendations	Urgency
1221C901C0506C01	South Gare Breakwater. Protects Coatham Sands to south and Tees entrance to north.	Breakwater	1672.5		Royal HaskoningDHV	Generally the structure remains in poor condition with further degradation noted from the 2016 survey. Recent repairs to the deckslab on the south facing wave return platform appeared in good condition however a number of significant defects remain. These include missing, cracked and lifted deckslabs, missing coping stones, extensive cracking and spalling around the structure. Missing blockwork from the wall faces. Exposure of reinforcement steel, missing mortar, open joints, damaged render and void formation particularly on the northern face of the structure. The ongoing failure of the western pier arm structure, damaged and displaced rock armour and Accropode units with a poor interlock were also noted. It is worth noting, that on the day following the inspection of the asset, RHDHV staff recorded the presence of a small crane on the nose of the structure whilst undertaking asset inspections on the north side of the Tees Estuary.	4	11 - 20	Structural inspection incl, boat/dive survey. Continue to monitor.	routine
1221C901C0507C01	Undefended	Undefended	4330.2		Royal HaskoningDHV	Good coverage of established vegetation and dunes. Localised erosion due to public access was particularly apparent directly adjacent the South Gare breakwater and fisherman's huts. Continued degradation of the dune crest adjacent to the caravan park. Seaward facing row of caravans now has only 4 occupied pitches, a decrease of at least 1 from 2016. The beach remains wide and healthy.	3	>20	Continue to monitor. Routine inspection & maintenance	routine
1221C901C0601C01	Concrete crest wall above part length of grouted stone revetment.	Revetment	861.5		Royal HaskoningDHV	Gap in crest wall not inspected in detail, though clearly visible, due to the presence of funfair on northern end of promenade. Wall and grouted stone slope remain in fair condition. Local damage including missing render and blocks along toe. Further undercutting and damage to the north end of the asset.	3	11 - 20	Local repairs. Infill gap in crest wall.	routine
1221C901C0602C06	Rough concrete revetment over old 1890's slag revetment.	Revetment	82.1		Royal HaskoningDHV	Stepped precast concrete revetment and precast concrete recurve wave return wall remain in as new condition. Occasional vegetation growth through open joints.	1	>20	Remove any vegetation from open construction joints. Routine inspection and maintanence.	routine

Asset Name	Description	Type	Length	Inspection Date	Inspector	Comments	Overall Condition	Residual Life	Recommendations	Urgency
1221C901C0602C05	Massive concrete wall to rear of cinema. Crest level reduces towards shore.	Wall	68.7		Royal HaskoningDHV	Cinema building. Fair to poor condition, multiple cracks Cinema building and massive seaward facing rear wall in poor condiition. Low beach levels have exposed the north eastern corner of the building. The concrete toe is significantly undercut. Undercutting noted in 2014 obscured by high beach levels.	4	6-10	Continue to monitor. Place rock armour around toe of structure to prevent further undercutting.	no repairs
1221C901C0602C04	Former concrete promenade shelter, now has voids infilled with brick work (internal structure unknown).	Wall	113.9		Royal HaskoningDHV	Stepped precast concrete revetment and precast concrete recurve wave return wall remain in as new condition. Occasional vegetation growth through open joints.	1	>20	Remove any vegetation from open construction joints. Routine inspection and maintanence.	routine
1221C901C0602C03	Stepped seawall to main sea frontage.	Wall	206.4		Royal HaskoningDHV	Concrete seawall around Beacon. Missing flexible sealant in places. Loose in others. Horizontal joints and joints in apron had no sealant and filler-board could be seen suggesting never sealant present.	1	>20	Replace/install flexible joint sealant. Routine inspection & maintenance.	routine
1221C901C0602C02	Concrete revetment below concrete seawall.	Revetment	480.7		Royal HaskoningDHV	Stepped seawall and recurve wave wall, generally in as new condition. Some damage to the in-situ concrete slope around slipway fronting King Street / The Esplanade. Cracking, spalling and staining of the slope was noted, in addition to a 'cluster' of grouted boreholes through the slab. The other slipways, in particular the RNLI slipway, showed signs of localised damage to the deckslabs and low beach levels exposed minor undercutting.	1	>20	Local repairs to slipway. Routine inspection & maintenance	routine
1221C901C0602C01	Concrete toe to revetment.	Apron	559.2		Royal HaskoningDHV	Stepped seawall and recurve wave wall - as new condition. Further accretion of material and formation of embryo dunes/ vegetation toward SE end of asset.	1	>20	Routine inspection & maintenance.	routine
1221C901C0603C01	Grouted masonry revetment in front of promenade & The Stray. Concrete splash wall landward of promenade. Accretion of sand & dunes behind.	Splash Wall	1273		Royal HaskoningDHV	Concrete block revetment tied into concrete promenade. As new condition. Some vegetation growth where sand has accumulated in joints. Timber groynes in good condition – some missing timbers, notably towards seaward ends.	1	11 - 20	Continue to monitor. Routine inspection & maintenance. Local repairs to groynes.	routine

Asset Name	Description	Type	Length	Inspection Date	Inspector	Comments	Overall Condition	Residual Life	Recommendations	Urgency
1221C901C0701C01	Undefended Frontage	Undefended Frontage	1765.3		Royal HaskoningDHV	Informal access ramp at interface with hard defence and the embankment crest show further signs of erosion and lowering - caused by public access. Headwall structure in fair condition, flexible tied concrete block mattress in very poor condition, several blocks missing with many misplaced and lifted. Localised scour to embankment across entire frontage. Generally more active in the NW and at 'headland', with more stable slopes in SE.	3	11 - 20	Continue to monitor. Replace or repair flexible tied concrete block mattress to ensure headwall and surrounding bank remain effectively defended.	routine
1221C901C0702C03	Lower masonry wall to path. Upper wall varies (concrete/masonry), coastal slope to rear.	Wall	125.9		Royal HaskoningDHV	High beach levels. Accretion in front of wall with formation of dunes. Local defects to masonry wall – missing coping stones. Full height vertical cracks in rear concrete wall appear to be stable (noted in 2008,2010,2012,2014).	3	11 - 20	Infill cracks. Replace missing blocks. Continue to monitor wall for movement.	routine
1221C901C0702C02	Masonry revetment to path and coastal slope above masonry wall. Coastal slope with access to properties above.	Revetment	122.2		Royal HaskoningDHV	Extensive vegetation growth and high beach level largely obscuring blockwork revetment and wall. Visible sections in fair condition.	3	11 - 20	Repoint masonry, clear vegetation. Replace missing blocks.	routine
1221C901C0702C01	Brick wall enclosure of boat park and access. Short length of concrete wall with lower crest level.	Wall	97.2		Royal HaskoningDHV	Damage to seaward end of masonry wall does not appear to have worsened significantly. Further scour and outflanking to rear. Landward concrete wall in fair condition with vertical cracks locally.	3	11 - 20	Repoint masonry, replace missing masonry/tidy seaward end of wall. Fill cracks.	routine
1221C901C0702C04	Undefended Frontage	Undefended Frontage	1011.6		Royal HaskoningDHV	Low, accreting dunes fronting mostly vegetated slopes. Local erision through pedestrian access. At SE extent, timber piles at toe of concrete ramp are further exposed. Ramp is now significantly undercut and as such presents a health and safety hazard to the public and may be at risk of collapse in the near future.	3	11-20	Continue to monitor. Repair toe of concrete ramp, extend ramp to prevent further undercutting in this location.	routine
1221C901C0703C01	Undefended Frontage	Undefended Frontage	1883.2		Royal HaskoningDHV	Partly active. Erosion of the toe and land sliding is more widespread. NW extent and SE extent are most active (least vegetation). Good vegetation cover elsewhere.	4	>20	Continue to monitor.	routine

Asset Name	Description	Type	Length	Inspection Date	Inspector	Comments	Overall Condition	Residual Life	Recommendations	Urgency
1221C901C0703C02	Concrete wall including outfall and two concrete slipways to coastal slope.	Wall	46.8		Royal HaskoningDHV	Generally fair condition. Minor cracking and spalling remains but appears not to have worsened. Missing coping at top of south access ramp. Security grille open. Security grille noted as being open in 2016 inspection was now securely closed. However, some of the bars appeared damaged, meaning a small child or animal may be able to obtain access into the outfall.	3	>20	Routine: Infill cracks. Replace missing copes. Urgent: Secure security grille.	urgent
1221C901C0704C04	Masonry wall in good condition, generally high sand with shingle to east end. Concrete splash wall to rear of promenade below coastal slope.	Sea Wall	415		Royal HaskoningDHV	High cobble beach covering much of wall. Masonry in good condition along with previous repointing/repairs where visible. Slipway/RNLI station frontage more visible. Minor mortar loss locally underneath pier structure and no mortar in lower visible section of masonry slipway. Local defects to concrete wall at rear of promenade (cracking and abrasion). Improve/soften interface with undefended frontage to east e.g. rock armour revetment.	2	>20	Local repairs masonry/concrete walls. consider new rock revetm to east	routine
1221C901C0704C01	661501 Large masonry block revetment protecting carpark, road and coastal slope. Masonry slipway is also present.	Revetment	65.8		Royal HaskoningDHV	Minor mortar loss locally. High cobble beach levels. Minor local damage to concrete wall at foot of slope. Masonry access ramp at RNLI station open-jointed in lower section (assume covered in beach material when re-pointing undertaken.	2	>20	Local repairs to concrete wall. Local repairs to pedestrian guardrail. Monitor.	routine
1221C901C0704C06	Concrete blockwork seawall protecting pavement, handrail and tarmac road. This section also includes bridging point over river, continuation of sea wall on the southern side.	Sea Wall	147.1		Royal HaskoningDHV	Towards the north western end of the asset high beach levels protect the toe of wall. Beach levels lower around apex of bend and at south eastern end, particularly to the south east of Skelton Beck. Undercutting of wall visible adjacent crest of rock armour. Generally the wall remains in good to fair condition with minor local abrasion, cracking and vegetation growth throughout. Additionally a localised area of missing coping blocks has exposed the backing footway material, though there does not appear to have been any significant change here since 2016.	3	>20	Replace missing coping blocks. Repoint locally. Monitor beach levels at Skelton. Consider grouting voids beneath wall to the south east of Skelton Beck.	routine

Asset Name	Description	Type	Length	Inspection Date	Inspector	Comments	Overall Condition	Residual Life	Recommendations	Urgency
1221C901C0704C02		Carpark.	35.7		Royal HaskoningDHV	Erosion/ lowering of the beach on the SE flank of watercourse. Further exposure of the crest of the rock armour revetment. Low beach levels expose undercutting at the tie in with wall to left of revetment. Local erosion around corners of car park. Vegetation established in front of car park, however accumulated material was 'cliffing' indicating recent erosion.	3		Continue to monitor. Consider reprofiling shingle.	
1221C901C0704C03	661701 White rendered sea wall set back from the beach, cobbles have collected on the seaward side protecting the toe. Boat handling area, carpark and PH located behind. Slipway is also present giving access to the beach.	Wall	106.8		Royal HaskoningDHV	Wall appears in fair condition and has recently been repainted. Some cracking and loss of render remains. Paving/ promenade remains in good condition. Concrete slipway in good condition, vertical concrete face remains visible on western side. Joint sealant missing towards seaward end of ramp.	2	11 - 20	Replace flexible joint sealant to access ramp. Local repairs to wall.	routine
1221C901C0704C05	661801 Various concrete and masonry walls to private property with various degrees of concrete apron with typical level of 4.7 mODN.	Wall	118.7		Royal HaskoningDHV	Beach levels fronting the Ship Inn appeared lower than in 2016 and the undercutting / voiding along the toe of the wall was partly visible, as noted in previous reports. The poured concrete apron / revetment at E end is further undercut and extensive voids have been exposed by lower beach levels. There is localised cracking to concrete elements. Concrete blockwork is abraded, and several full height vertical cracks were visible. Masonry wall has sustained significant damage, likely caused by vehicle impact, and is now totally collapsed at its western end. The section of wall still standing has numberous open joints and extensive areas of missing mortar.	4	1 - 5	Repointing ramp, repair masonry wall fronting Ship Inn car park. Monitor undercutting of toe and voiding beneath grout revetment at eastern end.	urgent
1221D901D0101C01	High cliffs are locally active above beach east of Saltburn. Cliffs much more active (partly active) along Hunt Cliff above shore platform, specifically where railway nears cliff edge. Further east, cliffs are less high and locally active.	Undefended high cliffs.	3551.2	21/06/2018	Royal HaskoningDHV	Generally, similar to 2016. High cliffs are locally active, around Hunt Cliff the activity increases, particularly where railway nears cliff edge. The footpath on the seaward side of the railway is now at significant risk of collapse.	3	>20	Continue to monitor. Localised stabilisation works recommended in areas where erosion threatens footpath and railway.	
1221D901D0201C01	Cliffs to NW partly active, slumping of soft upper slopes, erosion of harder lower cliff, some veg. Cliffs to SE support more veg, small dune system at toe, less active (locally active/inactive).	Undefended high cliffs.	1262.3	21/06/2018	Royal HaskoningDHV	Generally similar to 2016. Some evidence of recent mudslips and activity at the toe of cliffs. Mud lomes protruding onto foreshore are being eroded and undercut. Embryo dunes visible, but appear smaller than in 2016.	4	>20	Continue to monitor.	

Asset Name	Description	Type	Length	Inspection Date	Inspector	Comments	Overall Condition	Residual Life	Recommendations	Urgency
1221D901D0201C02	Skinningrove Jetty	Breakwater	477	21/06/2018	Royal HaskoningDHV	Repairs to crest wall, jetty deck and rock armour placed along seaward face appear to be working effectively. Some defects visible on original structure (deck slab lifted, poor joint sealant, longitudinal cracks visible in landward face of structure, heavily corroded sheet pile at snout). The new structure is in generally good condition however small defects remain (exposed reinforcement on seaward face). Rock armour appears in good condition with generally a good size and interlock. Noted that at the jetty root the rock armour appeared to be of a smaller size and perhaps more vulnerable to movement.	2	>20	Repair remaining defects and continue to monitor the effectiveness of existing repairs particularly rock armour.	routine
1221D901D0202C01	Rock armour defence from jetty to village protects coastal slope and footpath	Armour	305.1	21/06/2018	Royal HaskoningDHV	Re-profiled rock armour is in good condition. Backing slopes remain stable. Footpath appears to be at a lower level to 2016. There is evidence of washout from the path surface between the rock armour. Geotextile mattress is visible in parts. This may be due to wave overtopping or more likely, surface water runoff from slope to rear of path (E56/1).	3	>20	Monitor effectiveness of re-profiled rock armour and stability of slope. Consider filling holes in revetment with concrete.	routine
1221D901D0202C02	662103 Masonry wall behind rock revetment, severly overtopped prior to breakwater and beck control works.	Wall	182.4	21/06/2018	Royal HaskoningDHV	Similar to 2016, rock armour in fair to good condition. Relatively good interlock, some gaps in coverage.	3	>20	Continue active monitoring.	routine
1221D901D0202C05	662201 Offshore fishtail breakwater protecting fontage and stabilizing beach levels. Concrete slipway also included in defence providing access for fishermen. Highground is natural main land.	Breakwater	450.4	21/06/2018	Royal HaskoningDHV	Repairs and reprofiling of fishtail breakwater appear in good condition. Beach levels appear similar to 2016.	3	>20	Continue to monitor rock armour and beach levels.	routine
1221D901D0202C04	Beach frontage with shingle, cobbles and boulders giving protection to soil embankment and fishing area. Small detached rock berm constructed in 2016 (using rock armour from former fishtail groyne 1221D901D0202C05)	Beach frontage.	77.2	21/06/2018	Royal HaskoningDHV	Similar to 2016, beach levels appear similar to 2016 if not slightly lower. Appears to be loss of larger rocks, beach is generally comprised of finer material in 2018.	2	>20	Continue to monitor.	routine
1221D901D0202C03	662301 Concrete wall in moderate condition to end of protection offered by breakwater. Protects road.	Wall	60.5	21/06/2018	Royal HaskoningDHV	Fair condition, some evidence of undercutting to the southern seaward face of strucutre.	3	>20	Continue to monitor. Consider placing rock armour around southern face of structure.	routine

Appendix D
Cliff Condition Assessments

UNIT	2008	2010	2012	2013 (post-surge)	2014	2016	2018	2020
E52/1	Locally active	Locally Active	Locally Active	Inactive	Inactive	Inactive	Dormant	
E52/2	Inactive	Inactive	Inactive	Inactive	Dormant	Dormant	Dormant	
E52/3a	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	
E52/3b	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	
E52/4	Not Inspected	Not Inspected	Partly Active	Partly Active	Partly Active	Partly Active	Locally Active	
E52/5	Not Inspected	Not Inspected	Inactive	Locally Active	Locally Active	Locally Active	Locally Active	
E52/6	Not Inspected	Not Inspected	Inactive	Inactive	Inactive	Inactive	Locally Active	
E52/7	Not Inspected	Not Inspected	Dormant	Dormant	Dormant	Dormant	Dormant	
E52/8	Not Inspected	Not Inspected	Locally Active	Locally Active	Locally Active	Locally Active	Locally Active	
E52/9	Not Inspected	Not Inspected	Locally Active	Inactive	Inactive	Inactive	Locally Active	
E52/10	Not Inspected	Not Inspected	Locally Active	Partly Active	Partly Active	Partly Active	Partly Active	
E52/11	Not Inspected	Not Inspected	Inactive	Dormant	Dormant	Dormant	Inactive	
E53/1	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	
E53/2	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E53/3	Locally active	Locally Active	Locally Active	Locally Active	Locally Active	Locally Active	Locally Active	
E53/4	Locally active	Locally Active	Locally Active	Partly Active	Partly Active	Locally Active	Locally Active	
E53/5	Dormant	Dormant	Locally Active	Locally Active	Locally Active	Locally Active	Locally Active	
E54/1	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	
E54/2a	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E54/2b	Totally Active	Totally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E54/3a	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E54/3b	Totally Active	Totally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E54/4	Totally Active	Totally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Locally Active	
E55/1	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E55/2	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E55/3	Locally active	Locally Active	Locally Active	Not Inspected	Partly Active	Partly Active	Partly Active	

UNIT	2008	2010	2012	2013 (post-surge)	2014	2016	2018	2020
E56/1	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Inactive	Inactive	
E56/2a	Inactive	Inactive	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	
E56/2b	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	
E57/1	Partly Active	Partly Active	Locally Active	Not Inspected	Partly Active	Locally Active	Locally Active	
E57/2	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	
E57/3	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	
E57/4	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	
E57/5	Partly Active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	
E57/6	Locally active	Locally Active	Locally Active	Not Inspected	Partly Active	Partly Active	Locally Active	
E57/7	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E58/1a	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E58/1b	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E58/1c	Totally Active	Totally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E58/6	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	
E58/2 Lower	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E58/2 Upper	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	
E58/3 Lower	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E58/3 Upper	Partly Active	Partly Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	
E58/4 Lower	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E58/4 Upper	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	
E58/5 Lower	Locally active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E58/5 Upper	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Locally Active	
E59/1	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E59/2	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Totally Active	
E59/3	Totally Active	Totally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Totally Active	
E59/4	Partly Active	Totally Active	Partly Active	Not Inspected	Partly Active	Partly Active	Totally Active	

UNIT	2008	2010	2012	2013 (post-surge)	2014	2016	2018	2020
E59/5	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E59/6	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E59/7	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E59/8	Partly Active	Partly Active	Partly Active	Not Inspected	Partly Active	Partly Active	Partly Active	
E59/9	Locally active	Locally Active	Locally Active	Not Inspected	Locally Active	Locally Active	Partly Active	
E60/1a	Locally active	Totally Active	Totally Active	Totally Active	Totally Active	Totally Active	Totally Active	
E60/1b	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active	Totally Active	Totally Active	
MU4/1a	Totally Active	Totally Active	Totally Active	Totally Active	Totally Active	Totally Active	Totally Active	
MU4/1b	Dormant	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active	Partly Active	