North East Coastal Observatory

Royal HaskoningDHV
Enhancing Society Together

Cell 1 Regional Coastal Monitoring Programme Update Report 12: 'Partial Measures' Survey 2020

Redcar & Cleveland Borough Council

Redcar and Cleveland Council

August 2020

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Abbreviations and Acronyms

Acronym / Abbreviation	Definition
AONB	Area of Outstanding Natural Beauty
DGM	Digital Ground Model
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWS	Mean Low Water Neap
MLWS	Mean Low Water Spring
m	metres
ODN	Ordnance Datum Newlyn

Water Levels Used in Interpretation of Changes

Water Level Parameter	Water Level (m AOD) Hartlepool Headland to Saltburn Scar	Skinningrove	Hummersea Scar to Sandsend Ness	Sandsend Ness to Saltwick Nab
HAT	3.25	3.18	3.15	3.10
MHWS	2.65	2.68	2.65	2.60
MLWS	-1.95	-2.13	-2.15	-2.20

Water Level Parameter	Water Level (m AOD) Saltwick Nab to Hundale Point	Hundale Point to White Nab	White Nab to Filey Brigg	Filey Brigg to Flamborough Head
HAT	3.10	3.05	3.05	3.10
MHWS	2.60	2.45	2.45	2.50
MLWS	-2.20	-2.35	-2.35	-2.30

Source: *River Tyne to Flamborough Head Shoreline Management Plan 2*. Royal Haskoning, February 2007.

Glossary of Terms

Term	Definition
Beach nourishment	Artificial process of replenishing a beach with material from another source.
Berm crest	Ridge of sand or gravel deposited by wave action on the shore just above the normal high water mark.
Breaker zone	Area in the sea where the waves break.
Coastal squeeze	The reduction in habitat area which can arise if the natural landward migration of a habitat under sea level rise is prevented by the fixing of the high water mark, e.g. a sea wall.
Downdrift	Direction of alongshore movement of beach materials.
Ebb-tide	The falling tide, part of the tidal cycle between high water and the next low water.
Fetch	Length of water over which a given wind has blown that determines the size of the waves produced.
Flood-tide	Rising tide, part of the tidal cycle between low water and the next high water.
Foreshore	Zone between the high water and low water marks, also known as the intertidal zone.
Geomorphology	The branch of physical geography/geology which deals with the form of the Earth, the general configuration of its surface, the distribution of the land, water, etc.
Groyne	Shore protection structure built perpendicular to the shore; designed to trap sediment.
Mean High Water (MHW)	The average of all high waters observed over a sufficiently long period.
Mean Low Water (MLW)	The average of all low waters observed over a sufficiently long period.
Mean Sea Level (MSL)	Average height of the sea surface over a 19-year period.
Offshore zone	Extends from the low water mark to a water depth of about 15 m and is permanently covered with water.
Storm surge	A rise in the sea surface on an open coast, resulting from a storm.
Swell	Waves that have travelled out of the area in which they were generated.
Tidal prism	The volume of water within the estuary between the level of high and low tide, typically taken for mean spring tides.
Tide	Periodic rising and falling of large bodies of water resulting from the gravitational attraction of the moon and sun acting on the rotating earth.
Topography	Configuration of a surface including its relief and the position of its natural and man-made features.
Transgression	The landward movement of the shoreline in response to a rise in relative sea level.
Updrift	Direction opposite to the predominant movement of longshore transport.
Wave direction	Direction from which a wave approaches.
Wave refraction	Process by which the direction of approach of a wave changes as it moves into shallow water.

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 1).

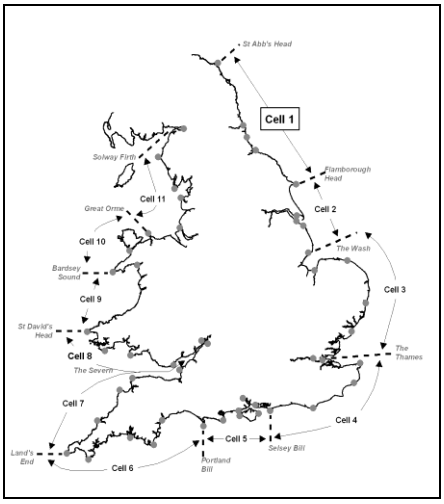


Figure 1 Sediment Cells in England and Wales

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 seabed characterisation surveys
- aerial photography
- LiDAR surveys
- walk-over cliff and coastal defence asset surveys

The beach profile surveys, topographic surveys and cliff top recession surveys are undertaken as a 'Full Measures' survey in autumn/early winter every year. Some of these surveys are then repeated the following spring as part of a 'Partial Measures' survey.

To date the following reports have been produced:

Table 1 Analytical, Update and Overview Reports Produced to Date

Year		Full Measures		Partial Measures		Cell 1 Overview Report
		Survey	Analytical Report	Survey	Update Report	
1	2008/09	Sep-Dec 08	May 09	Mar-May 09		
2	2009/10	Sep-Dec 09	Mar 10	Feb-Mar 10	Jul 10	
3	2010/11	Aug-Nov 10	Feb 11	Feb-Apr 11	Aug 11	Sep 11
4	2011/12	Sep-Oct 11	Oct 12	Mar-May 12	Feb 13	
5	2012/13	Sep 2012	Mar 13	Feb- Mar 13	May 13	
6	2013/14	Oct-Nov 13	Feb 14	Mar-Apr 14	Jul 14	
7	2014/15	Sep-Oct 14	Feb 15	Mar-Apr	Jul 15	
8	2015/16	Sep-Oct 15	Feb 16	Mar 16	Jul 16	Jun 16
9	2016/17	Sep-Nov 16	Feb 17	Mar 17	Jul 17	
10	2017/18	Oct 17	Mar 18	Mar-May 18	Jun 18	
11	2018/19	Sep 18	Mar 19	Mar-Apr 19	May 19	
12	2019/20	Sep-Nov 19	Jan 20	Mar–May 20	Aug 20 (*)	

(*) The present report is **Update Report 12** and provides an analysis of the 2020 Partial Measures survey for Redcar and Cleveland Council's frontage.

1. Introduction

1.1 Study Area

South Gare Breakwater at the mouth of the River Tees estuary to Cowbar Nab at Staithes. For the purposes of this report, it has been sub-divided into six areas, namely:

- Coatham Sands
- Redcar Sands
- Marske Sands
- Saltburn Sands
- Cattersty Sands (Skinningrove)
- Staithes [1]

1.2 Methodology

Along Redcar & Cleveland Borough Council's frontage, the following surveying is undertaken:

- Full Measures survey annually each autumn/early winter comprising:
    - Beach profile surveys along nine transect lines
    - Topographic survey along Coatham Sands
    - Topographic survey along Redcar Sands
    - Topographic survey along Marske Sands
    - Topographic survey along Saltburn Sands
    - Topographic survey at Skinningrove along Cattersty Sands

- Partial Measures survey annually each spring comprising:
    - Beach profile surveys along nine transect lines
    - Topographic survey along Redcar Sands
    - Topographic survey along Saltburn Sands
    - Topographic survey at Skinningrove along Cattersty Sands

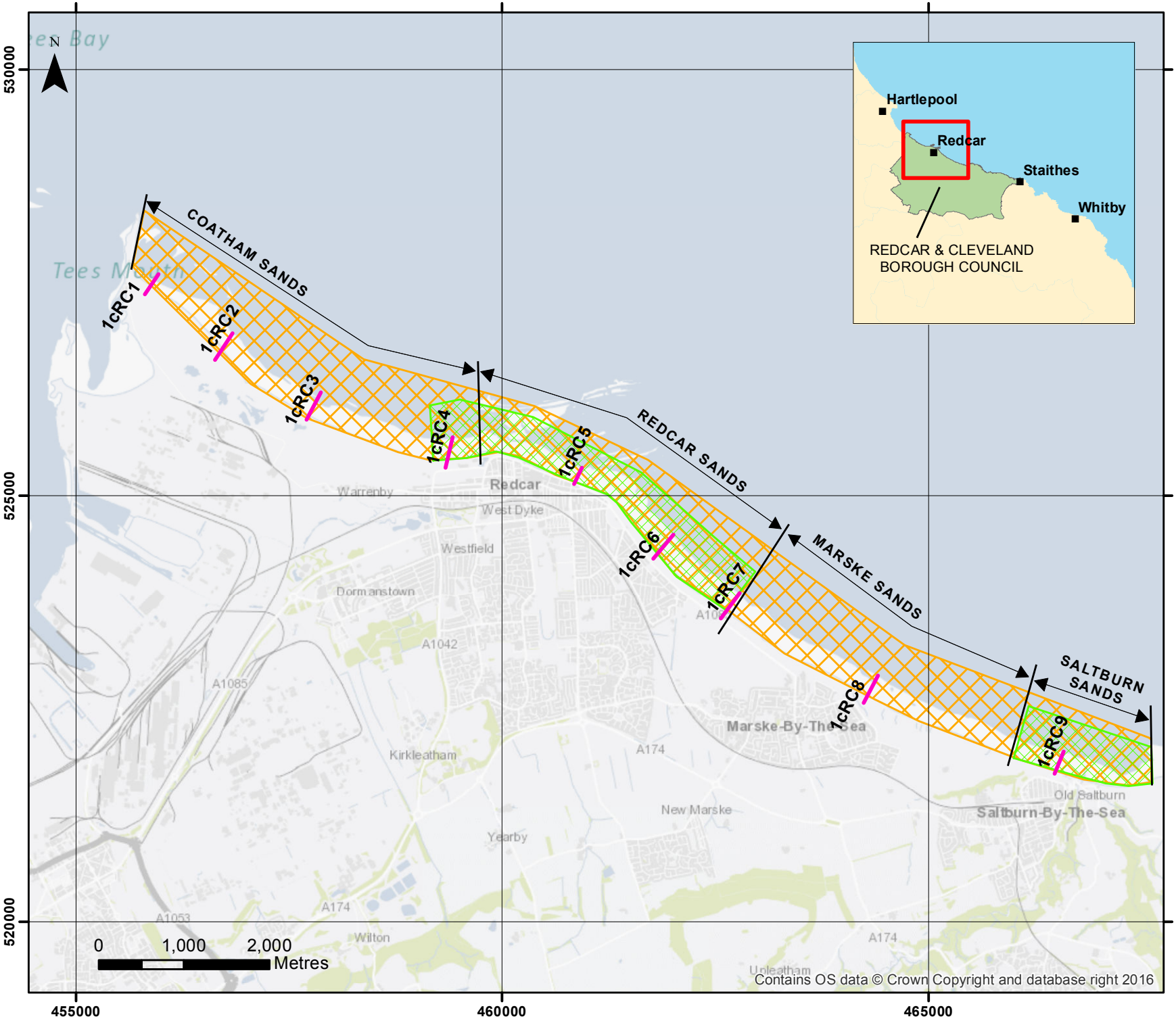
- Cliff top survey (biannually) at:
    - Staithes

The location of these surveys is shown in Figure 2 and 3. The Partial Measures survey was undertaken along this frontage between 26th and 29th May at Redcar (Coatham Sands, Redcar Sands, Markse Sands and Saltburn Sands), 23rd March at Skinningrove and 16th March at Staithes. During the surveys the weather was varied with varying sea states. Specific weather conditions are detailed in the survey reports.

Processed data from the present survey are presented in the Appendices.

Due to the Covid19 pandemic, all surveys were put on hold, effective from late March 2020. Only the cliff top survey at Staithes was completed prior to this point. The remaining surveys were undertaken in May 2020 under government social distancing guidelines.

[1] The Staithes frontage straddles the boundary of jurisdiction of Redcar & Cleveland Borough Council and Scarborough Borough Council



Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 1

Redcar & Cleveland Borough Council Frontage

Analytical Report
Topo Surveys

Drawing Scale at A4 1:60,000

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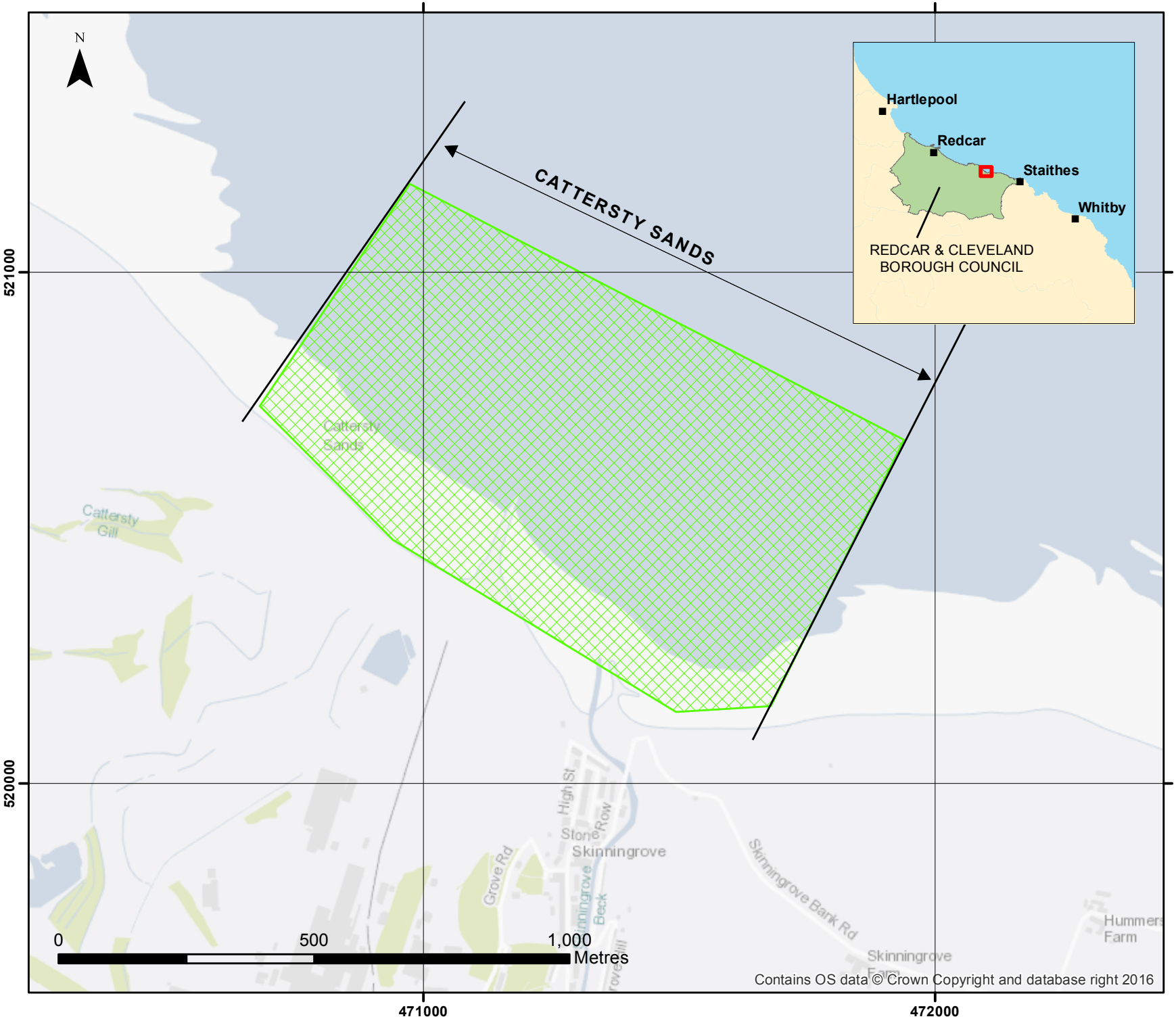

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 2

Redcar & Cleveland Borough Council Frontage

Analytical Report
Topo Surveys

Drawing Scale at A4 1:10,000

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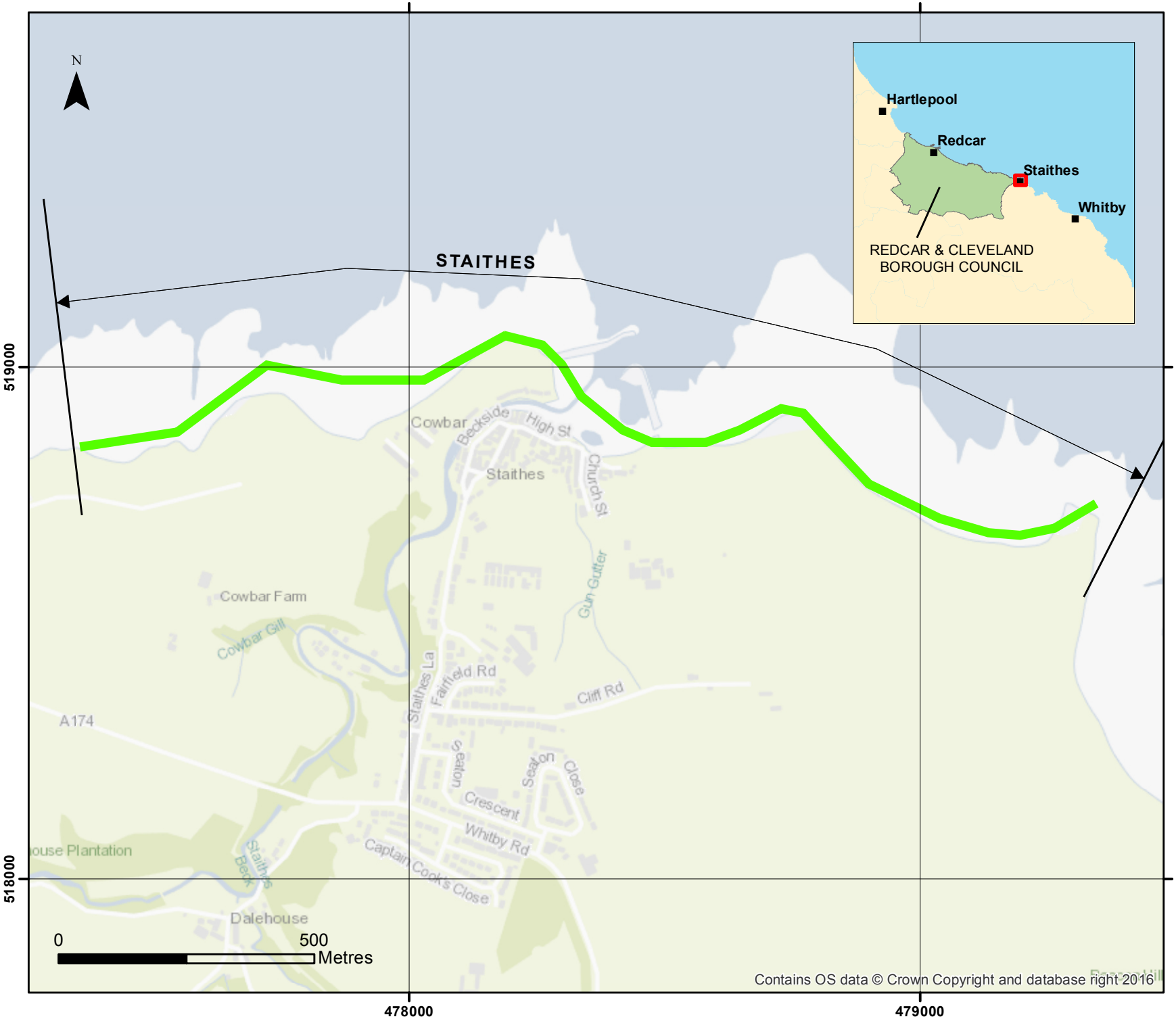

Key

SURVEY LOCATIONS

Frequency

@ 50

@ 100

@ 300

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 3

Redcar & Cleveland Borough Council Frontage

Analytical Report
Topo Surveys

Drawing Scale at A4 1:10,000

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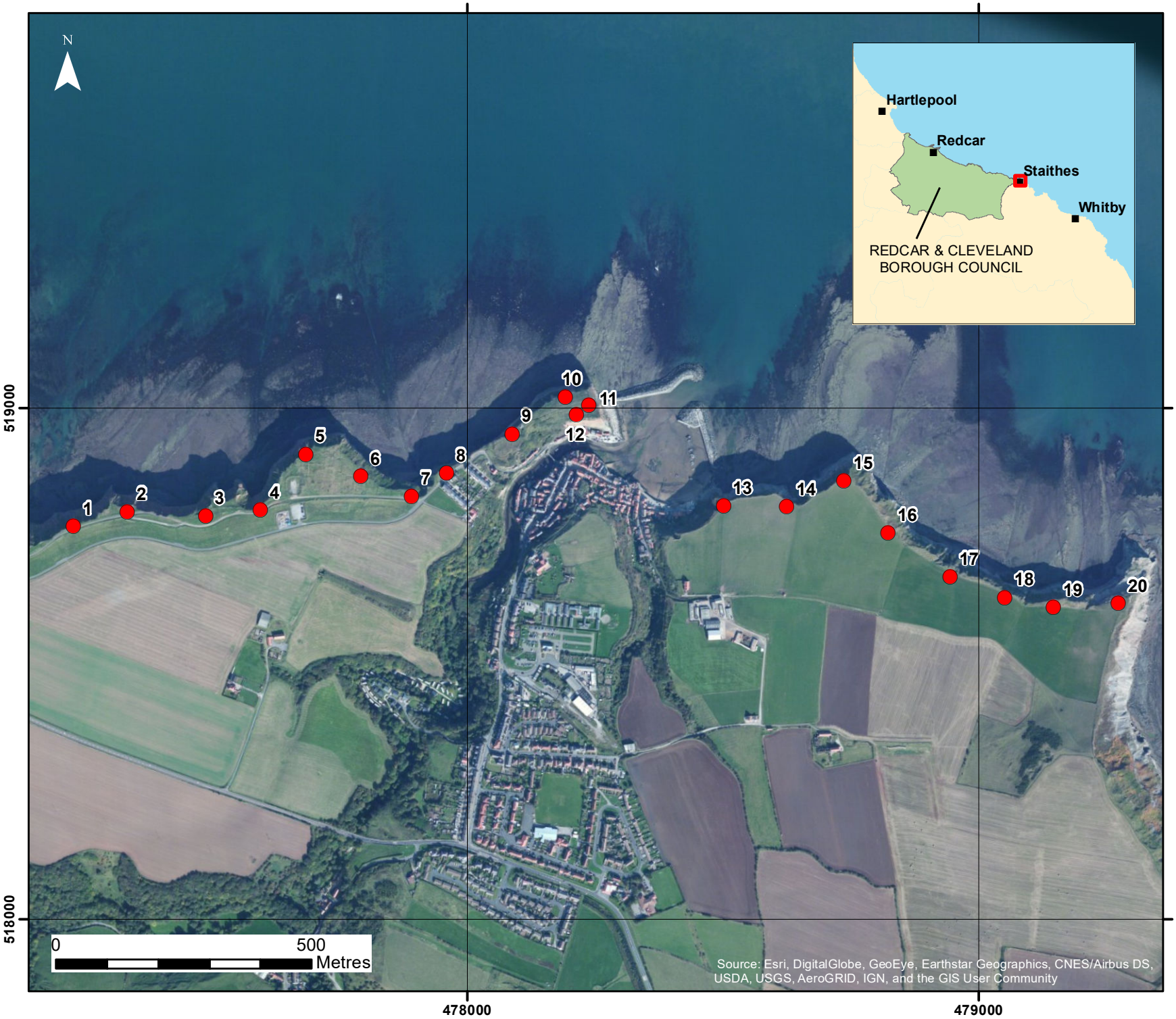

Key

- Cliff Top Survey Locations

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 3 - Map 1

STAITHES

Redcar and Cleveland Borough Council Council Frontage

Cliff Top Survey Locations

Drawing Scale at A4 1:10,000

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2. Analysis of Survey Data

2.1 Coatham Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
29th May 2020	**Beach Profiles:** Coatham Sands is covered by four beach profiles during the Partial Measures survey (1cRC1 to 1cRC4; Appendix A) that were last surveyed in October 2019. **Profile 1cRC1** is located 300m southeast of the South Gare Breakwater, in the lee of the German Charlies slag banks. The upper profile to 105m chainage is dominated by dunes that have remained stable since 2009.The highest dune (chainage 60m), is unchanged since October 2013. Since the previous survey, the foredune between 70m and 105m chainage has remained stable with some accretion of up to 0.4m on its seaward face, and is at its highest recorded level. Between 107m and 170m chainage the upper beach has eroded by up to 0.5m since October 2019. Over the same time period the beach between chainage 170m and 210m has accreted by approximately 0.5m, forming two shallow mid-beach berms. The profile remains largely unchanged between chainage 230m and 260m, with a small amount of accretion of up to 0.1m between chainage 260m and 275m. At the toe of the beach, from 275m to the end of the profile at 285m, there has been erosion of up to 0.5m. The profile is at its highest recorded level between chainage 97m to 107m and 173m and 225m. Overall, the profile is at a high level compared to the range of previously recorded results. At **profile 1cRC2** the dunes have remained largely stable with accretion of up to 0.4m on the foredunes between chainage 79m and m and 100m since the previous survey. The upper beach between chainage 100m and 130m has experienced erosion of up to 0.2m, with this material moving down the beach to create a small berm between 135m and 145m. The upper mid beach between chainage 145m and 180m has experienced no change. The remainder of the mid-beach has experienced a low level of accretion of up to 0.2m between chainage 180m and 330m. The lower beach from chainage 325m to the end of the survey at chainage 390m has experienced a low level of erosion of up to 0.2m. Between chainages 79m to 98m, 132m to 152m and 297m to 303m, the profile is at its highest recorded level. Overall the beach is at a high level compared to the range recorded from previous surveys, whilst the dunes remain at their highest recorded levels, particularly the foredune.	Overall the beaches are healthy. The dune areas all show stability or some minor accretion on the foredunes over the winter of 2019/20, which conforms to a wider trend of stability. The dunes are at their highest recorded levels for all profiles. Generally, the profiles show a varied trend of accretion and erosion with most changes limited to the range recorded from previous surveys. There does tend to be more accretion on the lower beach in the eastern profiles RC2, 3 and 4. Although the most western profile is a slight anomaly due to erosion at the beach toe, much of the lower beach has experienced accretion. All of the profiles remain at healthy levels and demonstrate a long term trend of stability. **Longer term trends:** All of the Redcar profiles show the dunes are stable or accreting on their seaward extent. The beaches to the west show a typical longer-term trend of progressive accretion. The beaches in the centre and to the east have a more fluctuating long-term pattern.

Survey Date	Description of Changes Since Last Survey	Interpretation
	Profile 1cRC3 showed the main dune has remained stable since April 2014The seaward face of the foredune has experienced some minor accretion of up to 0.2m against its too. The upper beach between chainage 50m and 100m has experienced accretion of up to 0.3m, raising the level of the toe of the embankment. From chainage 100m to 200m change has been limited to less than 0.1m of accretion. The lower beach is dominated with accretion. Two berms have formed from chainage 200m to 290m and 290m to the end of the survey at chainage 348m. The former has experienced up to 0.4m of accretion whilst the latter has experienced up to 0.7m of accretion. Overall the profile remains at a medium level, whilst the lower beach is at a high level when compared with the range recorded from previous surveys. The dunes which have remained stable over the winter of 2019/20 remain at a high level compared to the range recorded from previous surveys. The lower beach berm from chainage 318m to the end of the survey at 348m is the highest recorded level in this location. **Profile 1cRC4** is located at the beginning of the defended section at Coatham and Redcar. There has been accretion of up to 0.6m at the base of the seawall throughout the winter of 2019/20. On the upper beach between chainage 25m and 65m here has been erosion of up to 0.4m. The upper-mid beach, from chainage 65m to 120m has experienced a low level of accretion up to 0.2m. Whilst the lower-mid beach, from chainage 120m to 220m has experienced a low level of erosion equalling less than ±0.1m. Across the lower beach from chainage 220m to the end of the survey at chainage 340m there has been a low level of accretion with changes limited to +0.2m Overall the profile is at a medium level across the upper and mid beach and a medium to low level on the lower beach when compared to the range recorded from previous surveys.	

2.2 Redcar Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
29th May 2020	**Beach Profiles:** Redcar Sands is covered by three beach profiles (RC5 to RC7; Appendix A), with RC7 being approximately on the boundary with the Marske Sands area. They were last surveyed in October 2019. At **profile 1cRC5** the sea defences constructed in 2012 remain unchanged as far as 20m chainage. There has been accretion at the toe of the sea defence of 0.9m.From chainage 25m to 45m there has been erosion the upper beach berm by 0.4m, whilst from chainage 45m to 65m there has been accretion of up to 0.3m, with this forming the crest of the present upper beach berm. The mid beach has experienced further erosion of up to 0.5m, which means the upper beach berm is now more prominent due to the more significant erosion on the upper and mid beach. The rock exposure at chainage 155m remains exposed and the low levels reported seawards of this point in October 2019 remain. Overall the upper beach is at a medium level whilst the remainder of the beach is at a low level compared to the range recorded from previous surveys. In particular the section of profile from chainage 81m-90m is the lowest on record. The **profile at 1cRC6** has not changed landward of 55m chainage since the last survey due to the presence of the sea defence. There has been some minor erosion of up to 0.2m between chainage 57m and 63mwhilst from chainage 63m to 90m a similar level of accretion has been experienced. The mid beach has experienced a low level of erosion of between 0.1m and 0.2m from chainage 90m to 200m. The lower beach from chainage 200m to the end of the survey at chainage 319m has experience minor change within the survey tolerance of ±0.1m. The profile remains at a high level compared with the range of previously recorded results. The profile is generally very evenly graded, with the sections from chainage 230m – 240m and chainage 280m – 290m being the highest on record. **Profile 1cRC7** is undefended. The dune face at 60m chainage remained stable since October 2014. Between chainage 70m and 95m the toe of the dune has slipped, with 0.4m of erosion around chainage 75m and 0.2m of accretion around chainage 85m. The remainder of the profile, from chainage 95m to the end of the survey at chainage 340m there has been accretion of up to 1.0m, with some shallower sections of accretion fully covering the lower beach berm previously recorded here. Overall the beach profile is at a high level across most of its length, with the exception of the toe of the dunes where it is at its lowest recorded level at chainage 70m, when compared to the range recorded from previous	Profiles 1cRC5shows erosion to be the dominant process but remains largely within the bounds of the previous results. Profiles RC6 and RC7 show accretion to be dominant process with beach levels remaining medium, with RC7 experiencing a significant level of accretion over much of its extent. Each of the profiles shows some evidence of movement of berms, **Longer term trends:** Profiles RC5 and RC7 show movement of beach berms, across the profile with some evidence for gradual accretion.

Survey Date	Description of Changes Since Last Survey	Interpretation
	surveys.	
May 2020	**Topographic Survey:** Redcar Sands is covered by a 6-monthly topographic survey. Data have been used to create a DGM (Appendix B – Map 1a) using a GIS. The DGM shows that the beach topography is broadly parallel to the shore, although there is a slight embayment with a slightly steeper beach between the two headlands at Coatham Rocks and Redcar Rocks. The GIS has also been used to calculate the differences between the current topographic survey (Autumn 2019) and the most recent (Spring 2020) topographic survey, as shown in Appendix B – Map2a, to identify areas of erosion and accretion. The difference plot shows that accretion is dominant in the north west of the frontage, with the exception of an area of erosion between Coatham Rocks and Redcar Rocks and Ayton Hole. The area of beach known as Redcar Sands in the east of the frontage, has remained relatively stable with some accretion of up to around 1m. The area of greatest change is around the Redcar Rocks and at Ayton Hole with erosion of up to 1.5m	The topographic difference plots show that the beach has remained relatively stable with accretion being the dominant process with some localised areas of erosion. This broadly confirms the pattern shown by beach profiles.

2.3 Marske Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
29th May 2020	**Beach Profiles:** Marske Sands is covered by two beach profiles during the Partial Measures survey (RC7 to RC8; Appendix A). RC7 is on the boundary with the Redcar Sands area. **Profile 1cRC7** is located along The Stray and has been discussed in Section 2.2. **Profile 1cRC8** is largely unchanged as far as 50m chainage. Since April 2014 the dune face (chainage 50m) has remained stable, which contrasts with the winter of 2013/14 when 10m of recession was recorded. From chainage 50m at the base of the cliff to 80m on the upper beach, there has been minor accretion of up to 0.2m of material. The upper beach between chainage 80m and 90m has experienced no change. From chainage 190m to 130m an upper beach berm formed around chainage 100m has been eroded by up to 0.4m, meaning the upper beach profile is now at a consistent shallow gradient. Much of the remainder of the beach from chainage 130m to 270m has experienced a healthy level of accretion up to 0.6m. From chainage 270m to the end of the survey at 280m there has been erosion of up to 0.3m at the toe of the beach. The profile is at a medium level when compared to the range recorded from previous surveys.	The cliffed face of the dune remained stable at both RC7 and RC8 following the recession over the winter of 2013/14. RC8 shows limited change, with the beach having a smooth, shallow profile, **Longer term trends:** The April 2014 profiles were amongst the lowest seen at 1cRC8, due to the December 2013 storm surge. The beach has recovered with medium beach levels in 2020. .

2.4 Saltburn Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
29th May 2020	**Beach Profiles:** Saltburn Sands is covered by one beach profile (RC9; Appendix A). Overall **Profile 1cRC9** has experienced no change over the section covered by the sea defence as far as 20m chainage. There has been accretion of up to 0.8m at the toe of the seawall to chainage 52m. Seawards of chainage 52m there has been erosion of up to 0.2m across the upper beach. The mid-beach from chainage 110m to 210m has experienced a similarly low level of accretion. Whilst a shallow beach berm previously recorded at the profile toe has been eroded from chainage 210m to the end of the survey at 265m. The beach lies at a medium level when compared to the previous surveys.	The profile has remained stable over the winter of 2019/ 20 with a relatively even balance of erosion and accretion. The effects of the seasonal drawdown noted in this location previously may be masked in this spring's survey results due to the delay caused by the Covid19 lockdown restrictions meaning the surveys were undertaken in late May. Overall, the beach is at a medium level and despite some erosion, appears relatively stable when compared with the previous survey **Longer term trends:** The profile plots show net erosion, although there are periods of recovery. The May 2020 results may be slightly misleading due to them being undertaken in late spring / early summer.
May 2020	**Topographic Survey:** Saltburn Sands is covered by a 6-monthly topographic survey. Data have been used to create a DGM (Appendix B – Map 2a). The beach topography consists of shore parallel contours, with a small change at the mouth of the channel. This DGM has been compared against the previous (Autumn 2019) survey in Appendix B – Map 2b. The difference plot comparing the DGMs shows that since Autumn 2019 beach levels have experienced shore parallel changes. In the west of the profile the change is pronounced with a narrow band of erosion of up to 1.0m on the upper beach, whilst the mid and lower beach have experience accretion of up to 1.0m. Moving eastwards across the survey extent the changes become less pronounced but follow a similar general trend. There are some exceptional areas; for example, at the mouth of Skelton Beck which there has been some accretion on the upper beach, and some patchy localised pockets of erosion across the mid and lower beach. The far east of the profile has experienced little change.	The difference plot indicates that there has been a relatively balanced level of erosion and accretion with limited net change. This confirms the pattern shown in the profile.

2.5 Cattersty Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
March 2020	**Topographic Survey:** Cattersty Sands is covered by a 6-monthly topographic survey. Data have been used to create a DGM (Appendix B – Map 3a). For the most part the beach contours are shore-parallel, and steeper east of the breakwater than west of it. Two deviations from the shore parallel pattern occur where the channel outflow crosses the beach and in the furthest east part of the survey where the contours indicate an embayment. The Spring 2020 DGM has been compared against the previous (Autumn 2019) survey in Appendix B – Map 3b. In the far west of the survey extent there has been accretion on the upper and mid beach separated by a narrow band of erosion. On the lower beach there has been some erosion. Further east towards the breakwater the changes are less distinct with most of the beach having experienced negligible change. There has been some accretion against the western face of the breakwater. Generally, the changes on the western side of the breakwater are less distinct, with erosion limited to -0.75m and accretion limited to +1.0m. To the east of the breakwater the changes at Cattersy are more complex. Accretion has been the dominant process between the breakwater and the groyne, with erosion being limited to directly adjacent (to the east) of the breakwater, around the tip of the groyne and directly downstream of the road bridge at Skinningrove Beck. To the east of the groyne, a narrow band of erosion has been experienced on the upper beach fronting the car park and further east and the toe of the cliffs. The mid beach is dominated by accretion, whilst the lower beach has experienced a similar magnitude of erosion. At the far eastern end of the survey extent there has been little change. The changes to the east of the breakwater are in the order ±1.25m.	The data shows that there has been a mixture of accretion and erosion throughout the frontage. Generally, beach levels have remained reasonably stable. The most notable area of erosion has occurred on the lower beach to the east of the groyne. There has also been some erosion in the riverbed, although the river mouth appears to have experienced little change. 0 **Longer term trends:** The long-term trend shows that on the north-west side of the breakwater there is erosion in the upper beach and accretion in the lower beach. On the south-east side of the breakwater there is a long-term pattern of accretion in the mid beach with erosion in the channel mouth. The winter erosion dominates the overall behaviour of the beach but the calmer weather in the summer months should lead to some accretion. If the erosion of the upper beach continues it is likely to drive cliff failures which would add material to the upper beach for redistribution.

2.6 Staithes

16th March 2020	**Cliff-top Survey:** Twenty ground control points have been established at Staithes for the purposes of cliff top monitoring. The separation between any two points is a nominal 100m. The cliff top surveys at Staithes are undertaken bi-annually. Data collection involves a distance offset measurement from the ground control point to the cliff edge along a fixed bearing. Appendix C provides results from the March 2020 survey, showing the distance from the ground control point to the edge of the cliff top along the defined bearing and changes in position since the November 2008 baseline survey and the previous November 2019 survey. The results provided in Appendix C show that the majority of the profiles show little or no erosion, <0.1m. Five points show erosion in excess of 0.1m; at the eastern end of the survey extent Point 2 shows erosion of 0.12m, whilst Points 4 and 5 show erosion of 0.58m and 0.24m respectively. At the western end of the survey extent at Old Nab Points 19 and 20, have experienced 0.32m and 0.2m of erosion respectively. Several points noted negative erosion, (Points 7, 14, 15, 17 and 18), this is likely to be due to difficulties in accurately identifying the cliff edge through vegetation. Point 8 which has experienced some apparent activity in recent years appears to be stable with less than 0.1m of change from the previous (November 2019) survey result. Notably, Points 9 to 12, at Cowbar Nab were accessible on this occasion. These points have not been surveyed since before September 2016 meaning that there is no calculation of change over the winter of 2019/20 specifically. However, a comparison with the baseline survey (of November 2008) is possible. Point 9 and 10 have both experienced negative movement when compared with the November 2008 survey. While Point 11 has experienced 0.3m of erosion over the same period. Point 12 has experienced less than 0.1m of erosion since 2008 and is considered stable. The long term recession rates show that none of the points at Cowbar Nab show recession of greater than 0.1m/year. Although these results do appear to suggest that the cliffs at Cowbar Nab have remained relatively inactive over this period, survey photographs show there is still recent activity on the upper slopes and headscarp in this location. Most notably this is seen in the photograph of VMP9, which is taken looking south west toward VMP8.	The recorded changes to the cliff top between November 2019 and March 2020 are generally small. There has been one point which shows retreat greater than 0.5m, and three which show retreat greater than or equal to 0.2m.One point shows minor retreat less than 0.2m. **Longer term trends:** Table C1 in Appendix C presents the erosion rates calculated from the data collected since 2008. Points 1, 4, and 13 are the only locations with a significant recession rate, which ranges from 0.18 to 0.57m/yr.

3. Problems Encountered and Uncertainty in Analysis

Topographic Survey

No significant problems were reported with the topographic surveys.

Cliff Top Surveys

The cliff top surveys at Staithes are assumed to have a limit of accuracy of ± 0.1 m due to the methodology. Erosion can reliably be measured at only one location but as monitoring progresses, underlying patterns in erosion will become more evident. The following points were highlighted in the survey reports:

- Survey points 9 to 12 at Staithes have been cordoned off by the National Trust due to a landslip on the headland, however in Spring 2020 survey points 9 to 12 have been surveyed for the first time since before September 2016.

4. Recommendations for 'Fine-tuning' the Monitoring Programme

No further recommendations are made at this stage for the fine-tuning of the monitoring programme.

5. Conclusions and Areas of Concern

- Beach levels across the Redcar and Cleveland frontage show a varied trend of erosion and accretion with most of the changes limited to the range recorded from previous surveys.
- Due to the Covid19 lockdown restrictions the surveys were undertaken in late May which is 1-2 months later than they typically would be undertaken. The delay in undertaking the surveys may provide a misleading picture with the beaches having recovered somewhat from the effects of winter drawdown.
- At Coatham Sands the profiles have remained relatively stable with some erosion noted on the lower beach in the west.
- Across Redcar Sands, erosion has tended to be the dominant process in the west, however the levels here remain within the bounds of previously recoded results. The remainder of the profiles have been dominated with accretion, most notably in the east of the survey extent. At Marske Sands the cliffed face of the dune generally remained stable, despite some slight slumping of material at the toe of the dune. There has been very limited accretion and erosion across the profile with the beach at a medium level
- At Saltburn Sands the profile has remained relatively stable with a balance of erosion and accretion. Previously reported winter drawdown in this area may be somewhat masked by the effects of a later survey window.
- Across Cattersty Sands there has been a mixture of erosion and accretion. The most notable area of erosion is to the east of the groyne on the lower beach. There has been some erosion to the riverbed, with limited change at the river mouth. There has been minor changes to the west of the pier.
- At Staithes, the recorded changes to the cliff top between November 2019 and March 2020 are generally small. There has been on point which shows major retreat greater than or equal to 0.5m. Three points show retreat of between 0.2m and 0.5m and one point which shows retreat of between 0.1m and 0.2m. Points 1, 4 and 13 show long term average erosion rates of between 0.2m/year and 0.6m/year since 2008. Notably Points 9 to 12 (at Cowbar Nab) were surveyed in the Partial Measures 2020 survey. When compared with the baseline survey none of the 4 points show recession of greater than 0.1m.

Appendices

Appendix A

Beach Profiles

The following sediment feature codes are used on some profile plots:

Code	Description
S	Sand
M	Mud
G	Gravel
GS	Gravel & Sand
MS	Mud & Sand
B	Boulders
R	Rock
SD	Sea Defence
SM	Saltmarsh
W	Water Body
GM	Gravel & Mud
GR	Grass
D	Dune (non-vegetated)
DV	Dune (vegetated)
F	Forested
X	Mixture
FB	Obstruction
CT	Cliff Top
CE	Cliff Edge
CF	Cliff Face
SH	Shell
ZZ	Unknown

Beach Profile

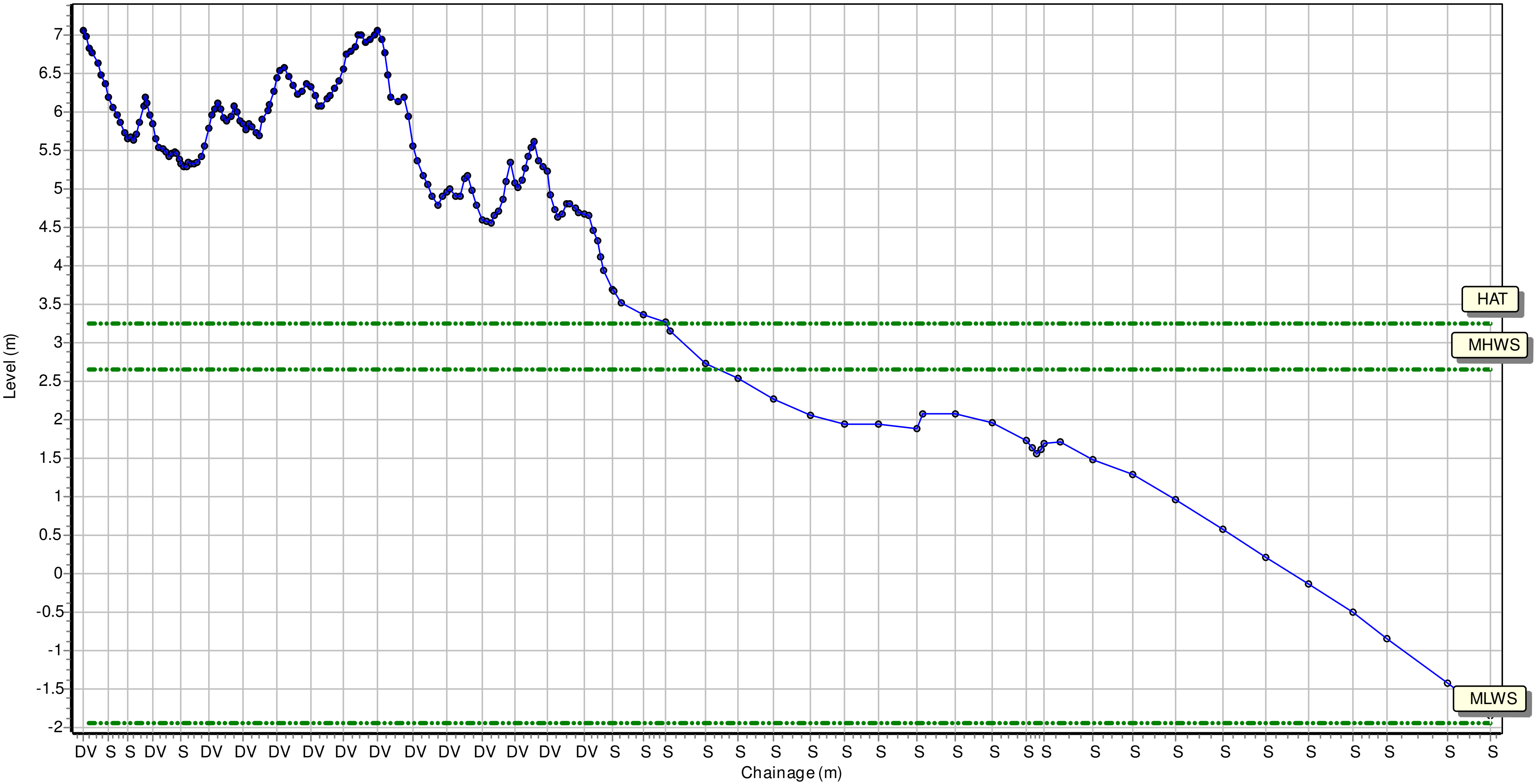
Location: **1cRC1**

Date: 29/05/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2020 Partial Measures Topo Survey

Easting: 455811.436 **Northing:** 527373.402 **Profile Bearing:** 34 ° from North



Beach Profile

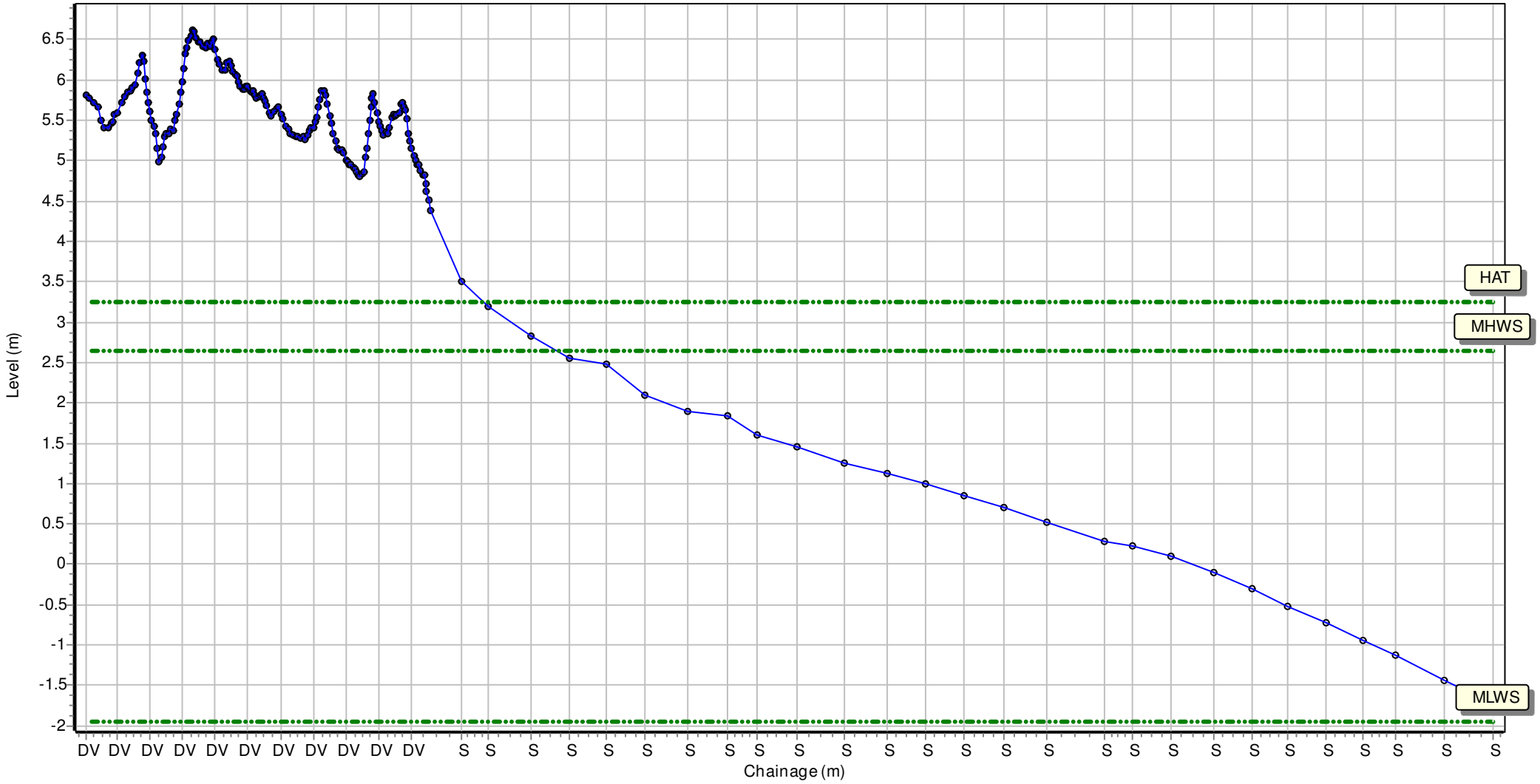
Location: 1cRC2

Date: 29/05/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2020 Partial Measures Topo Survey

Easting: 456633.253 **Northing:** 526599.577 **Profile Bearing:** 34 ° from North



Beach Profile

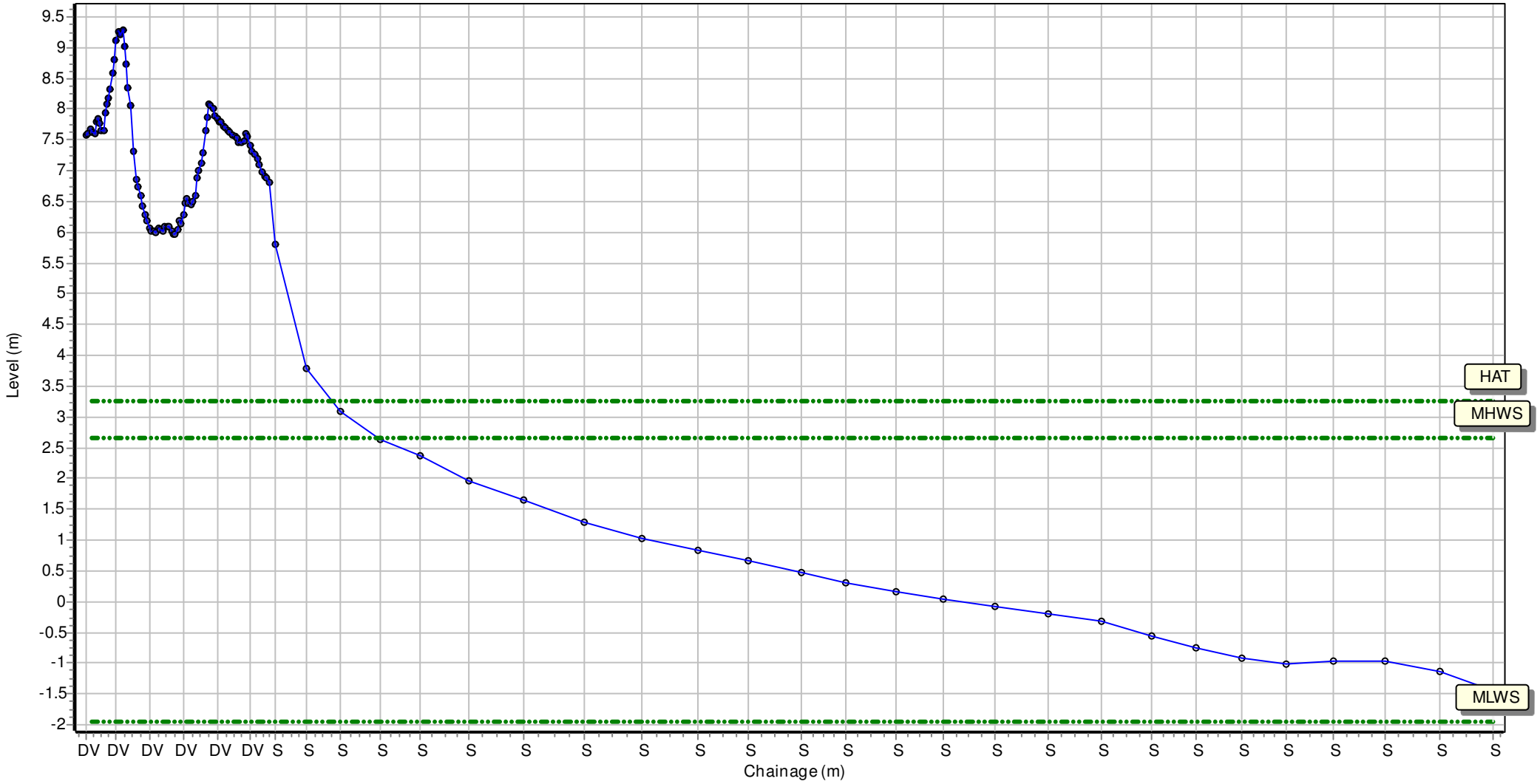
Location: 1cRC3

Date: 29/05/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2020 Partial Measures Topo Survey

Easting: 457706.365 **Northing:** 525898.597 **Profile Bearing:** 28 ° from North



Beach Profile

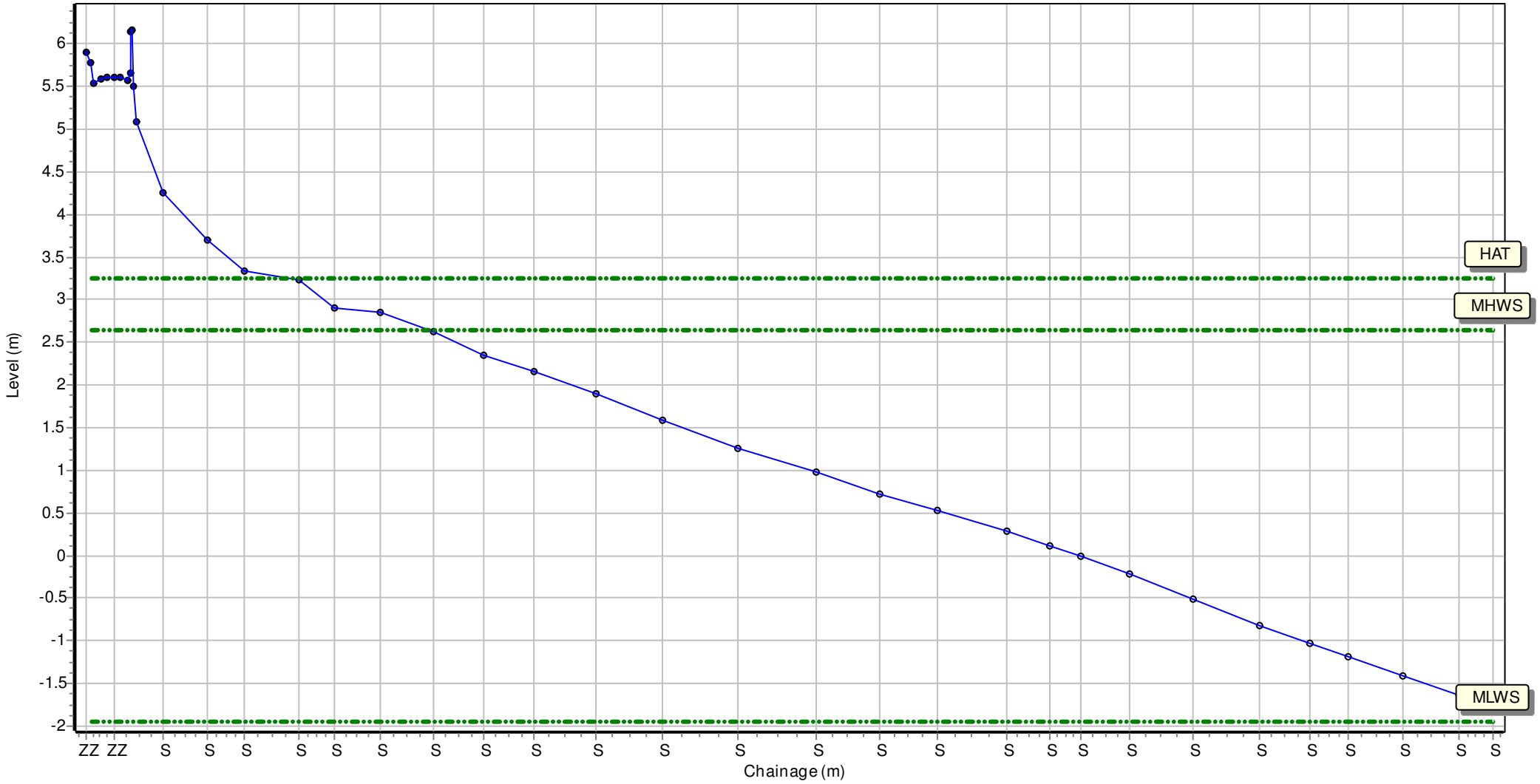
Location: **1cRC4**

Date: 29/05/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2020 Partial Measures Topo Survey

Easting: 459337.597 **Northing:** 525336.99 **Profile Bearing:** 13 ° from North



Beach Profile

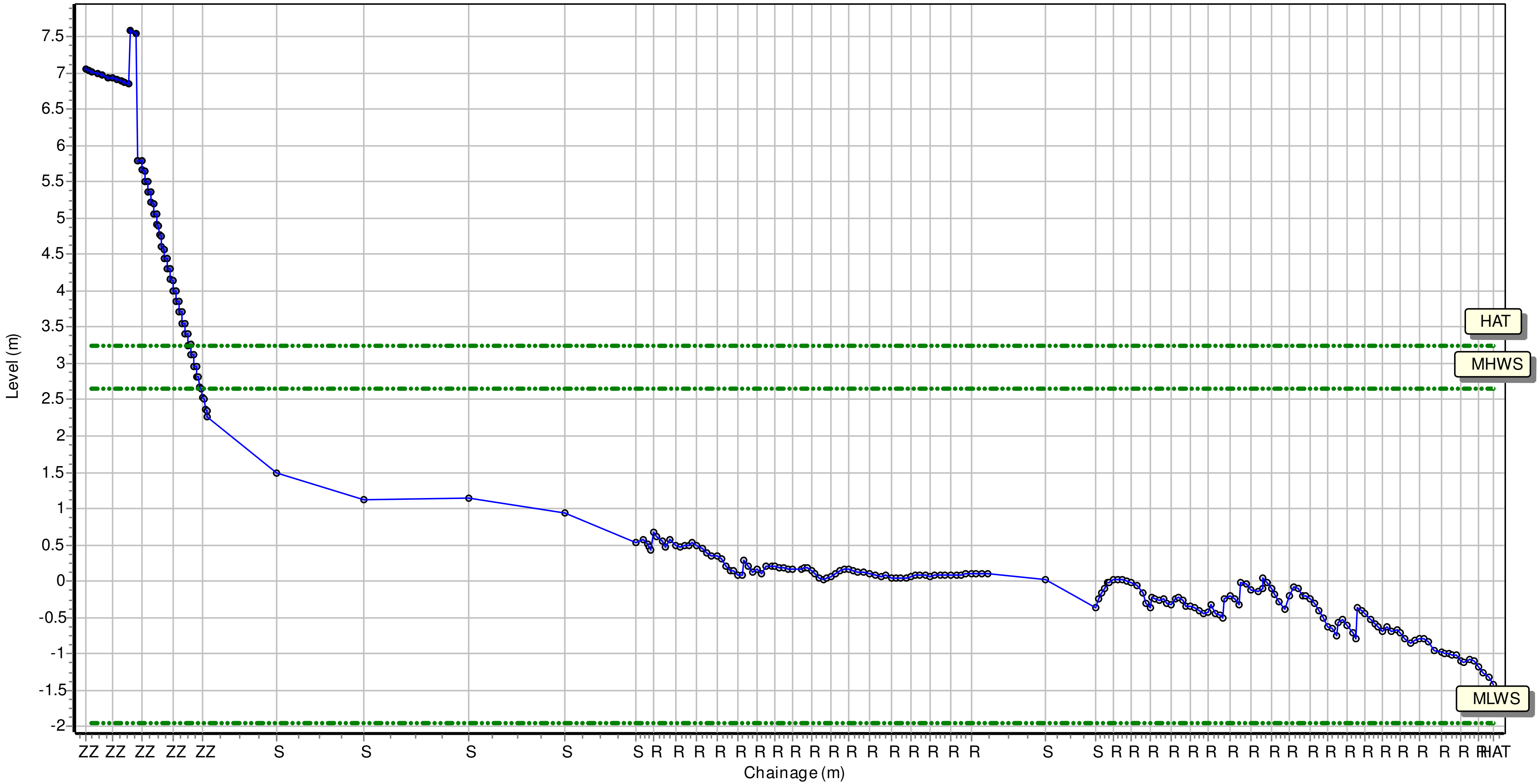
Location: 1cRC5

Date: 29/05/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2020 Partial Measures Topo Survey

Easting: 460845.21 **Northing:** 525146.997 **Profile Bearing:** 26 ° from North



http://www.sandsuser.com

SANDS

Beach Profile

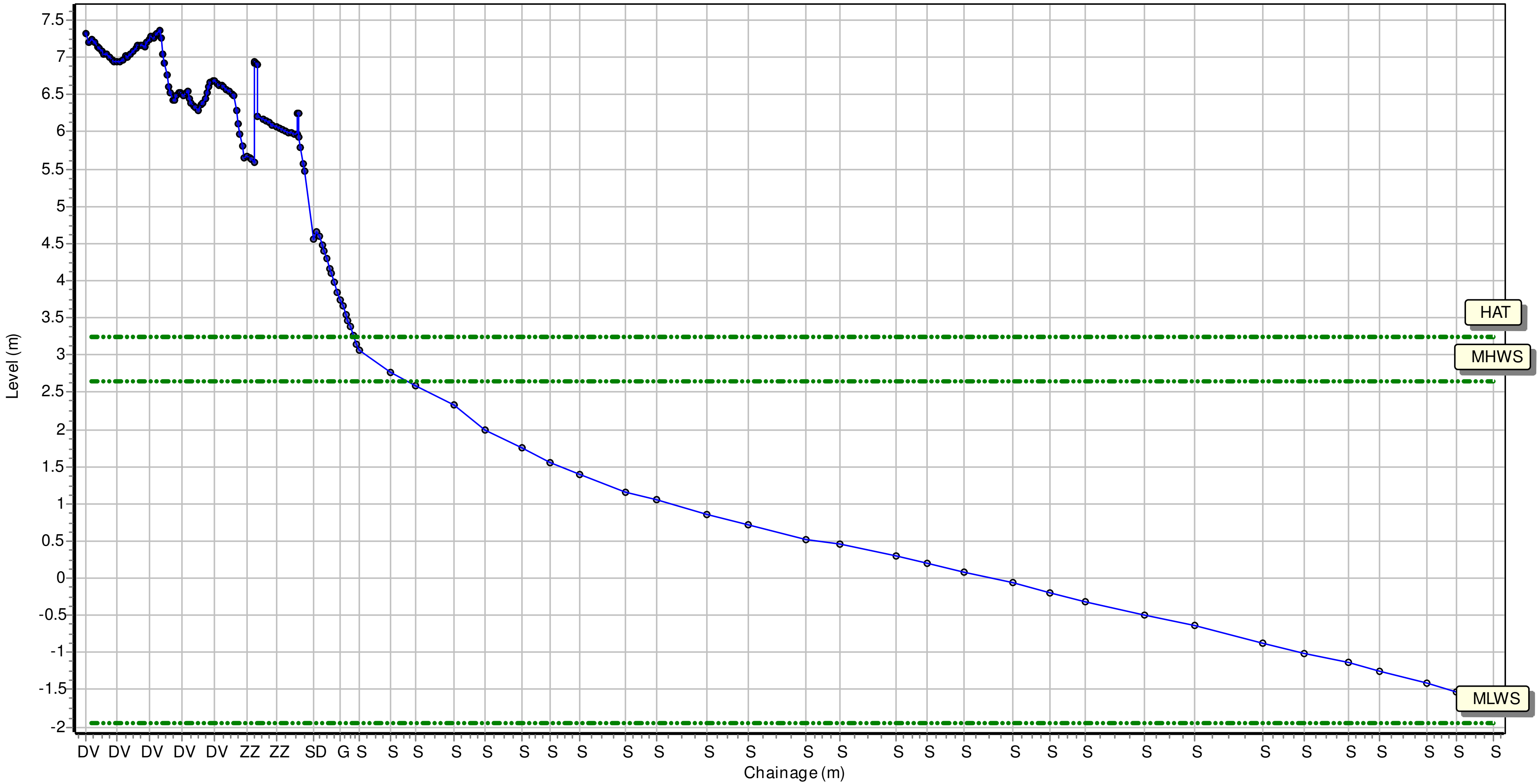
Location: **1cRC6**

Date: 29/05/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2020 Partial Measures Topo Survey

Easting: 461776.835 **Northing:** 524269.592 **Profile Bearing:** 39 ° from North



http://www.sandsuser.com

SANDS

Beach Profile

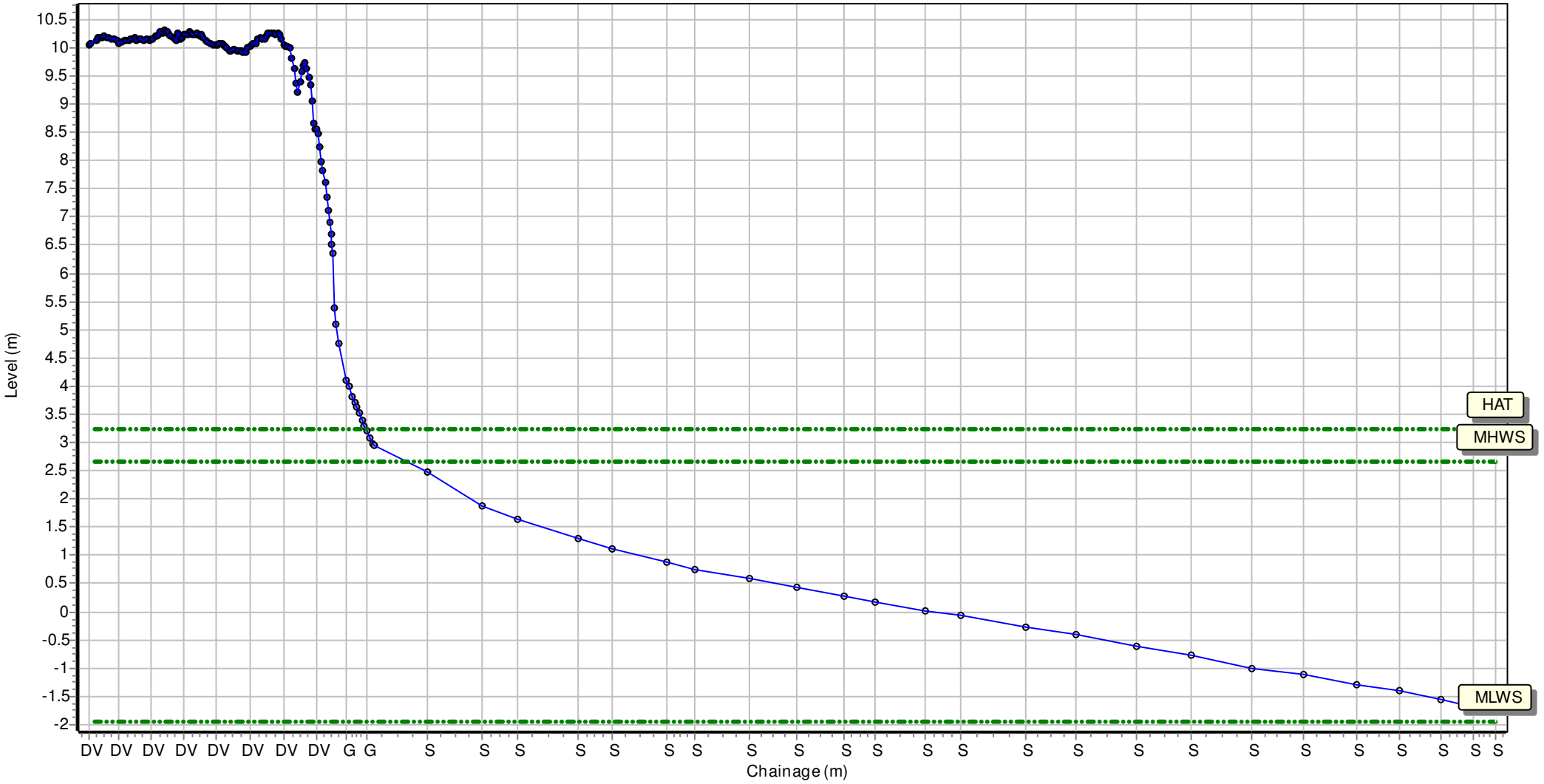
Location: 1cRC7

Date: 29/05/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2020 Partial Measures Topo Survey

Easting: 462568.453 **Northing:** 523568.436 **Profile Bearing:** 37 ° from North



Beach Profile

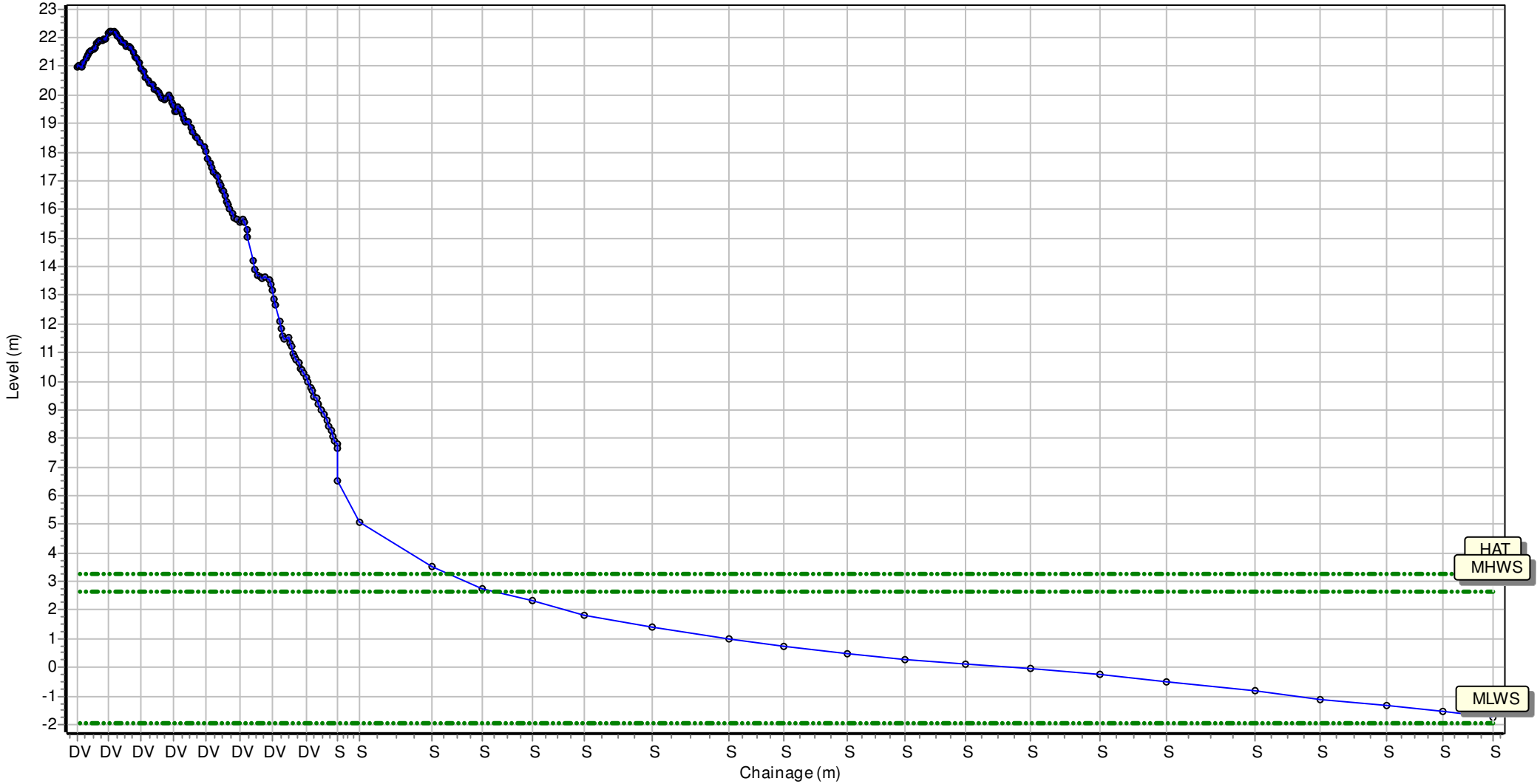
Location: 1cRC8

Date: 29/05/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2020 Partial Measures Topo Survey

Easting: 464245.579 **Northing:** 522578.097 **Profile Bearing:** 28 ° from North



Beach Profile

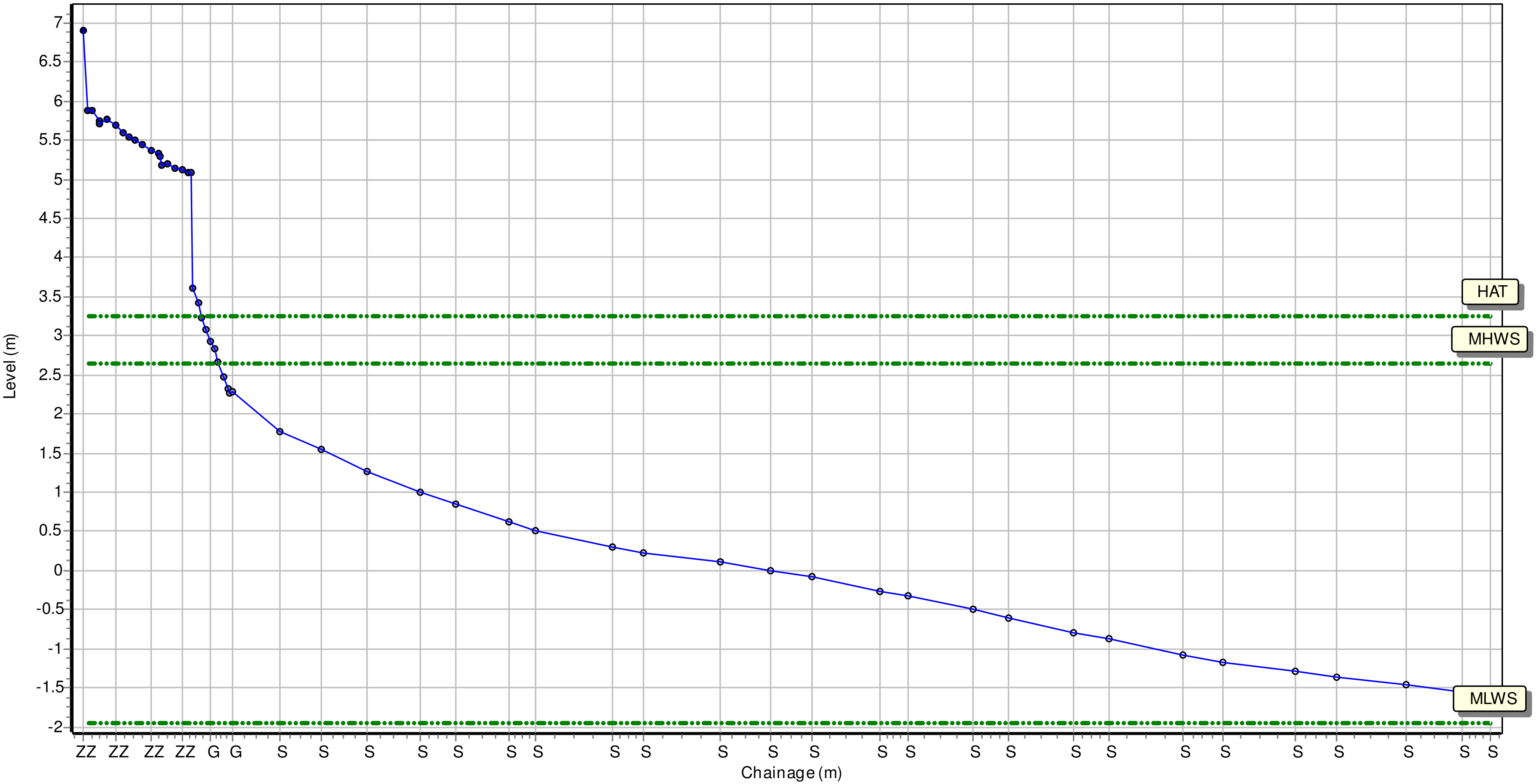
Location: 1cRC9

Date: 29/05/2020 **Inspector:** AG **Low Tide:** **Low Tide Time:**

Wind **Sea State:** **Visibility:** **Rain:**

Summary: 2020 Partial Measures Topo Survey

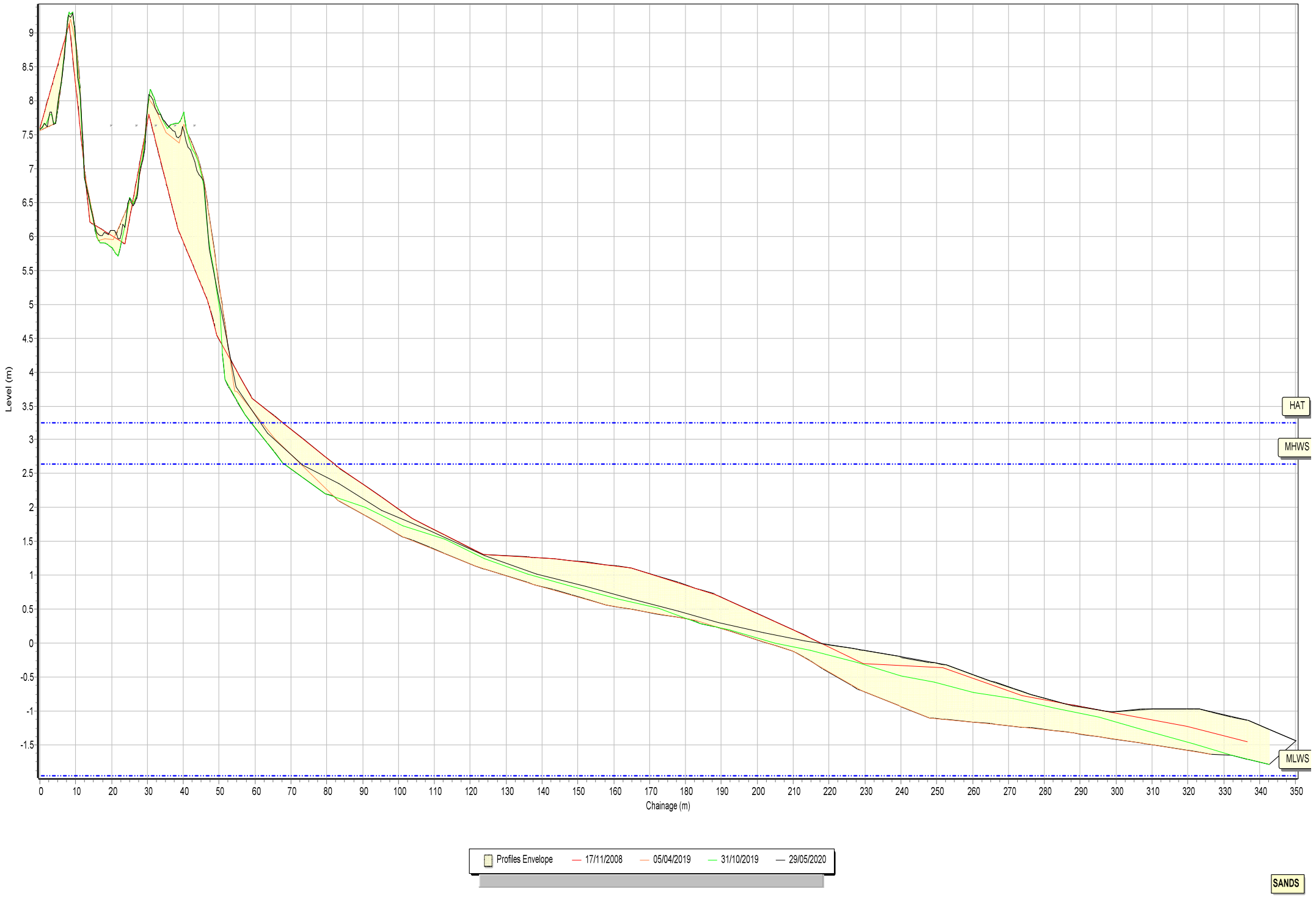
Easting: 466477.532 **Northing:** 521748.87 **Profile Bearing:** 22 ° from North

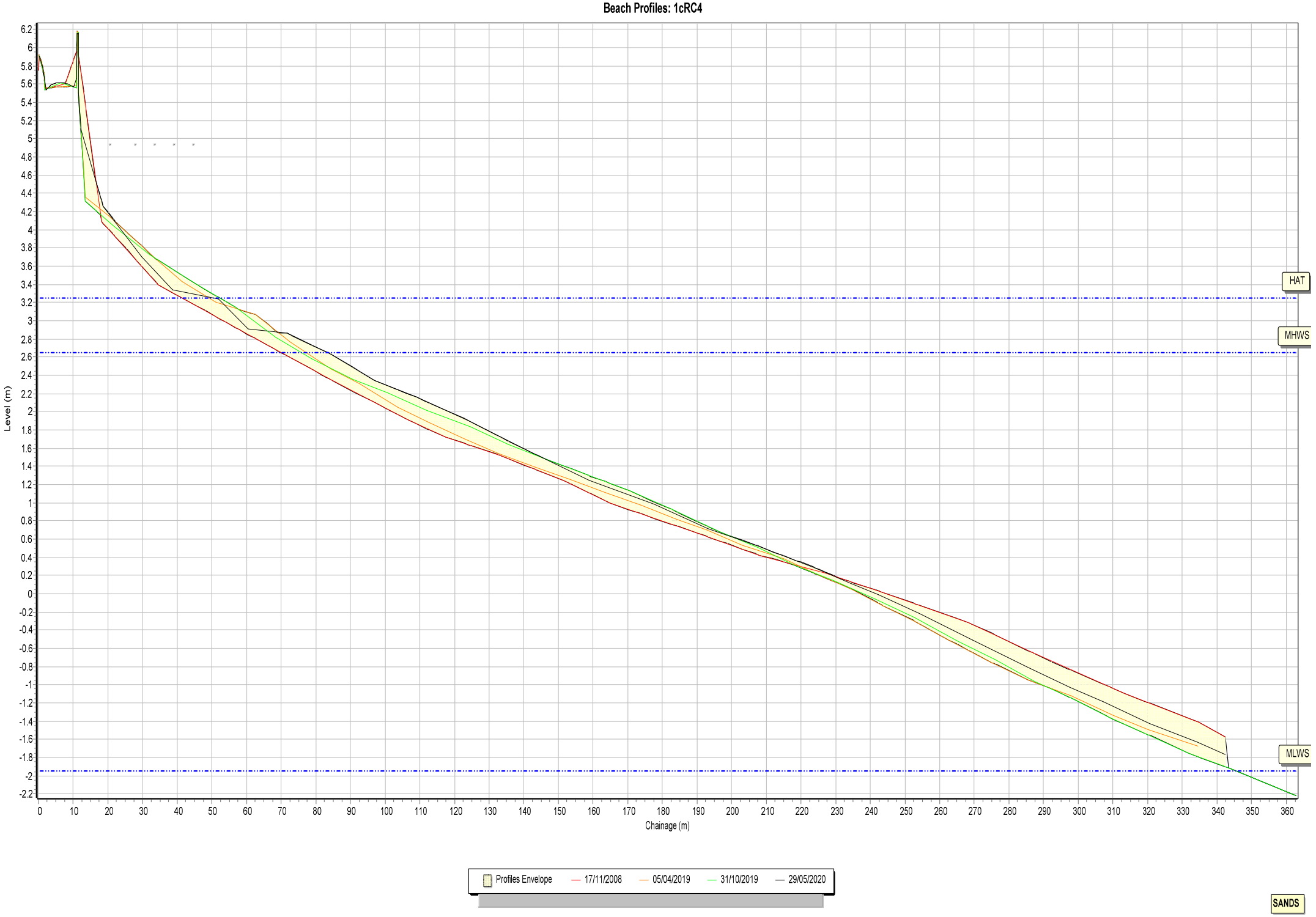



Beach Profiles: 1cRC1
Level (m)
Chainage (m)
HAT
MHWS
MLWS
Profiles Envelope
17/11/2008
05/04/2019
31/10/2019
29/05/2020
SANDS

Beach Profiles: 1cRC2

Beach Profiles: 1cRC3




Beach Profiles: 1cRC4
Level (m)
Chainage (m)
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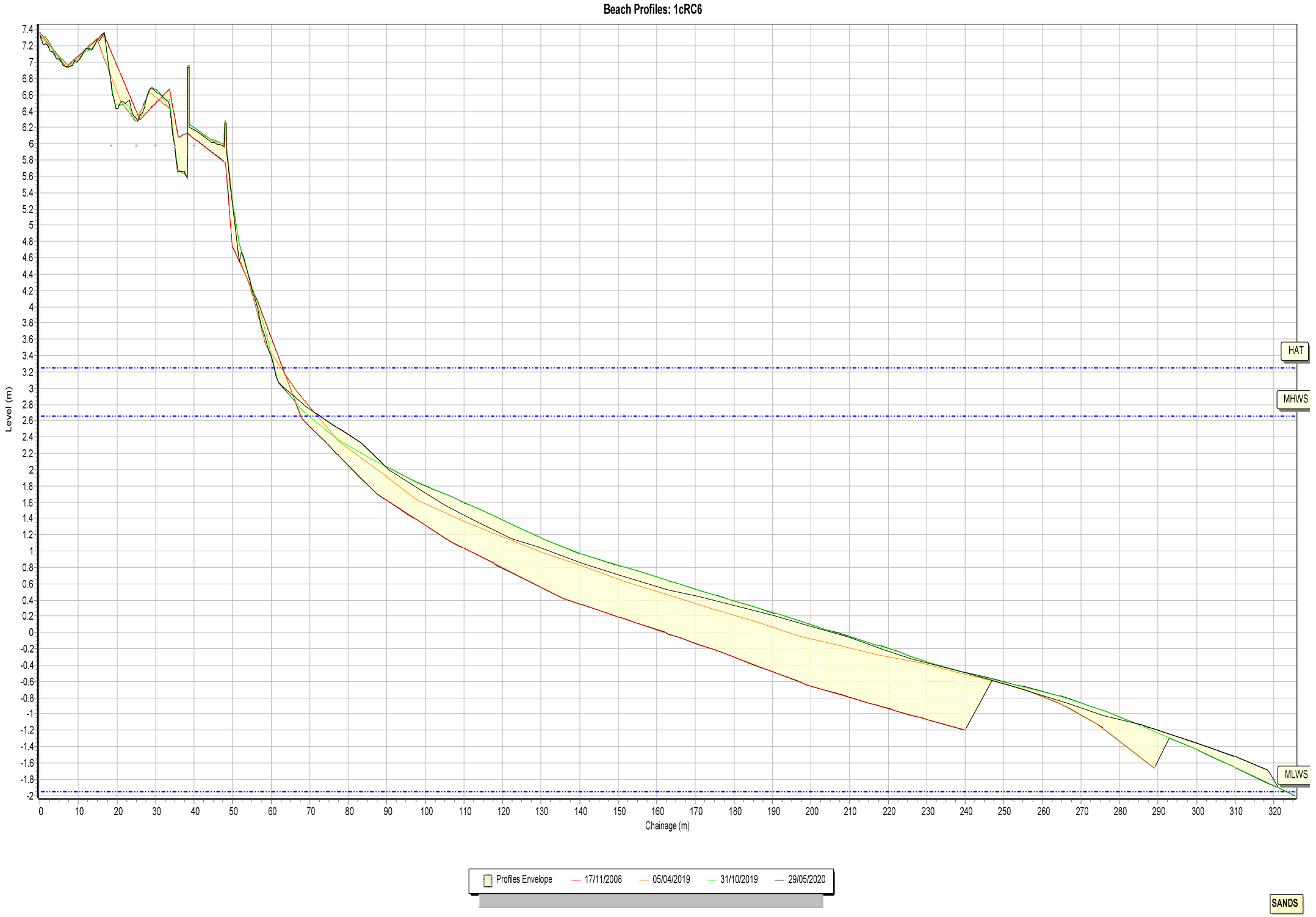
MHWS
MLWS
Profiles Envelope
17/11/2008
05/04/2019
31/10/2019
29/05/2020
SANDS


Beach Profiles: 1cRC5
Level (m)
Chainage (m)
HAT
MHWS
MLWS
Profiles Envelope
14/03/2012
05/04/2019
31/10/2019
29/05/2020
SANDS


Beach Profiles: 1cRC6
Level (m)
Chainage (m)
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MHWS
MLWS
Profiles Envelope
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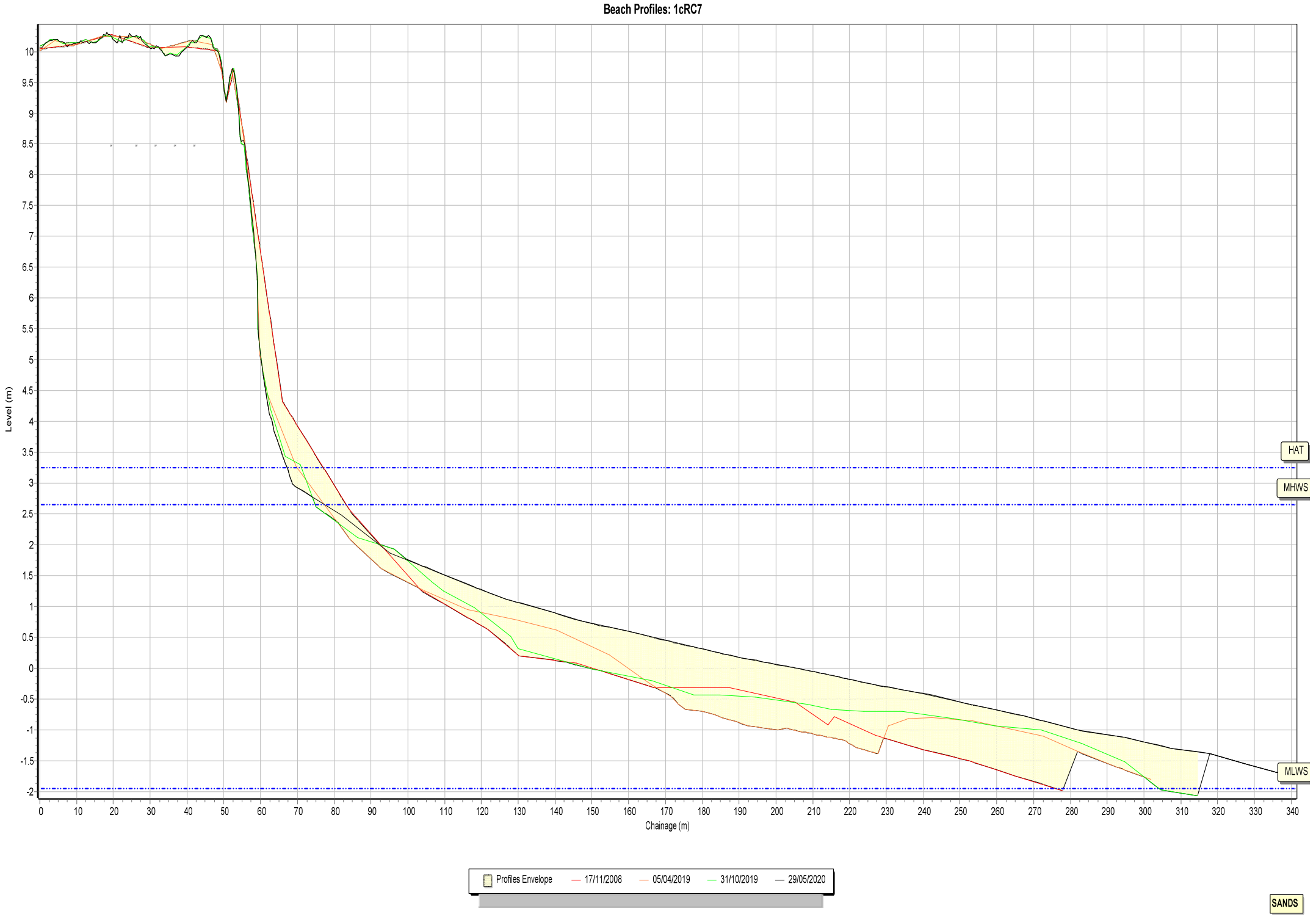
05/04/2019
31/10/2019
29/05/2020
SANDS


Beach Profiles: 1cRC7
Level (m)
Chainage (m)
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MHWS
MLWS
Profiles Envelope
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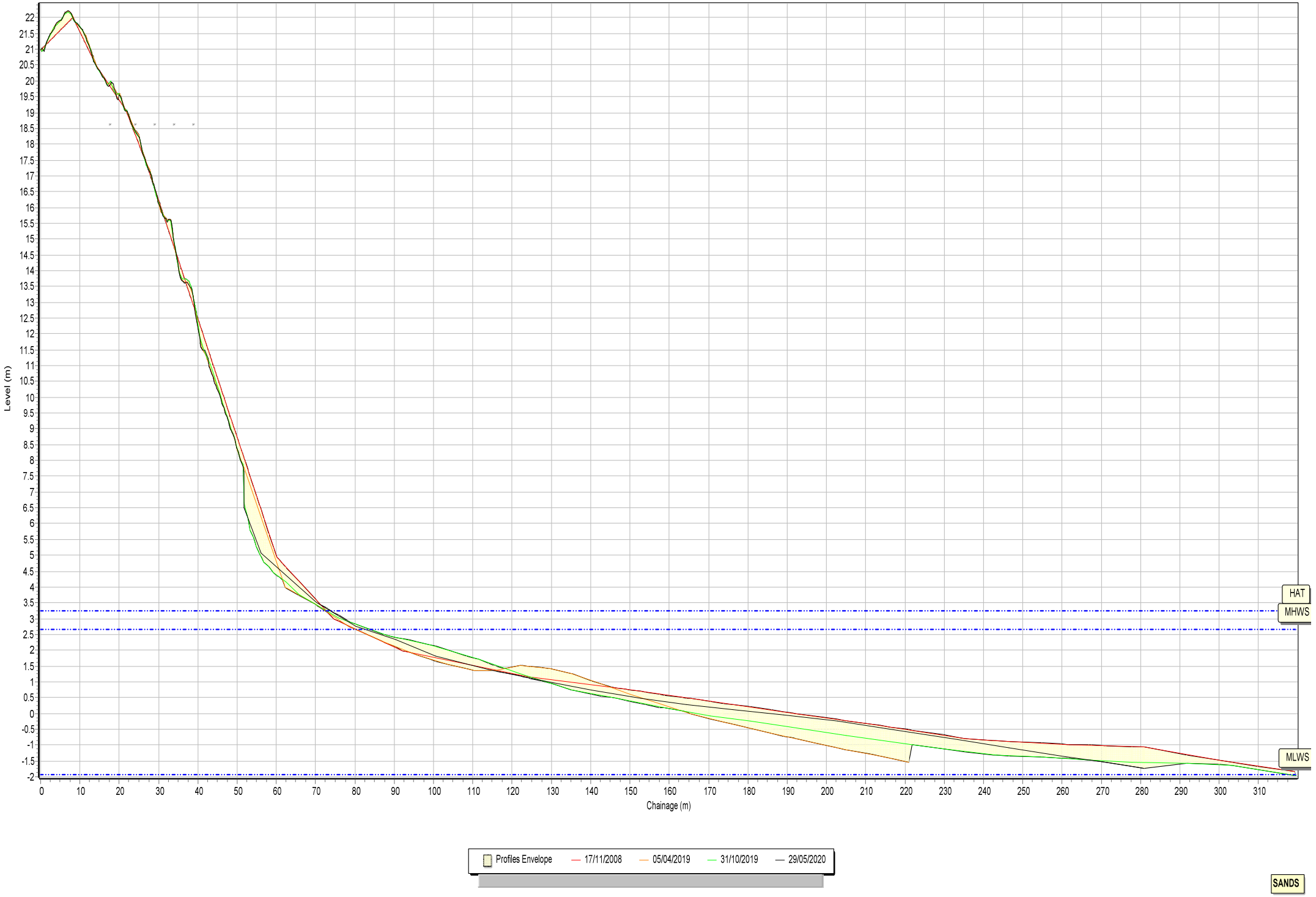
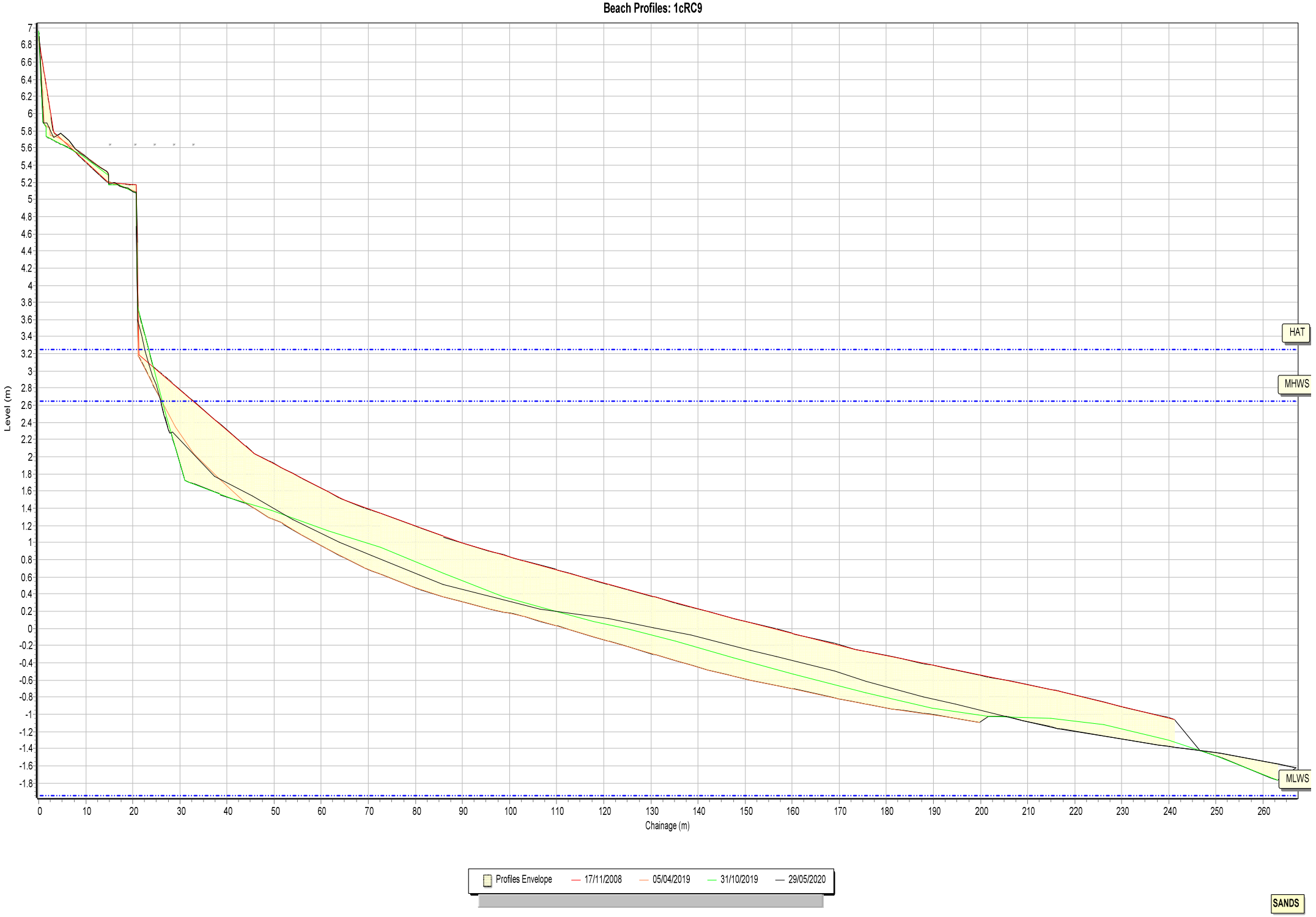
05/04/2019
31/10/2019
29/05/2020
SANDS

Beach Profiles: 1cRC8




Beach Profiles: 1cRC9
Level (m)
Chainage (m)
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MHWS
MLWS
Profiles Envelope
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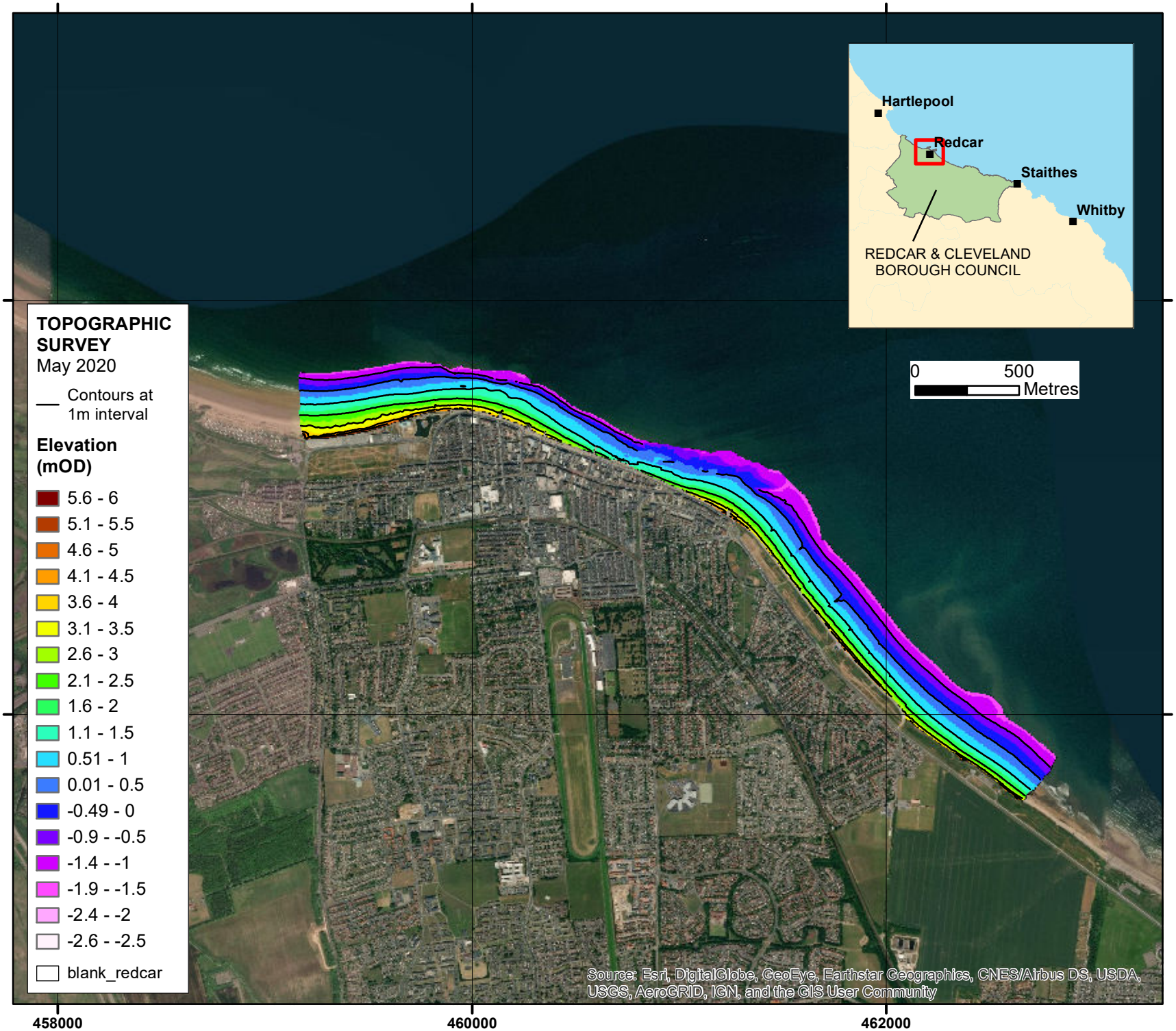
05/04/2019
31/10/2019
29/05/2020
SANDS

Appendix B

Topographic Survey



Key

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 1

REDCAR SANDS

Redcar and Cleveland Borough Council Frontage

Update Report
'Partial Measures' Survey 2020

Drawing Scale at A4 1:25,000

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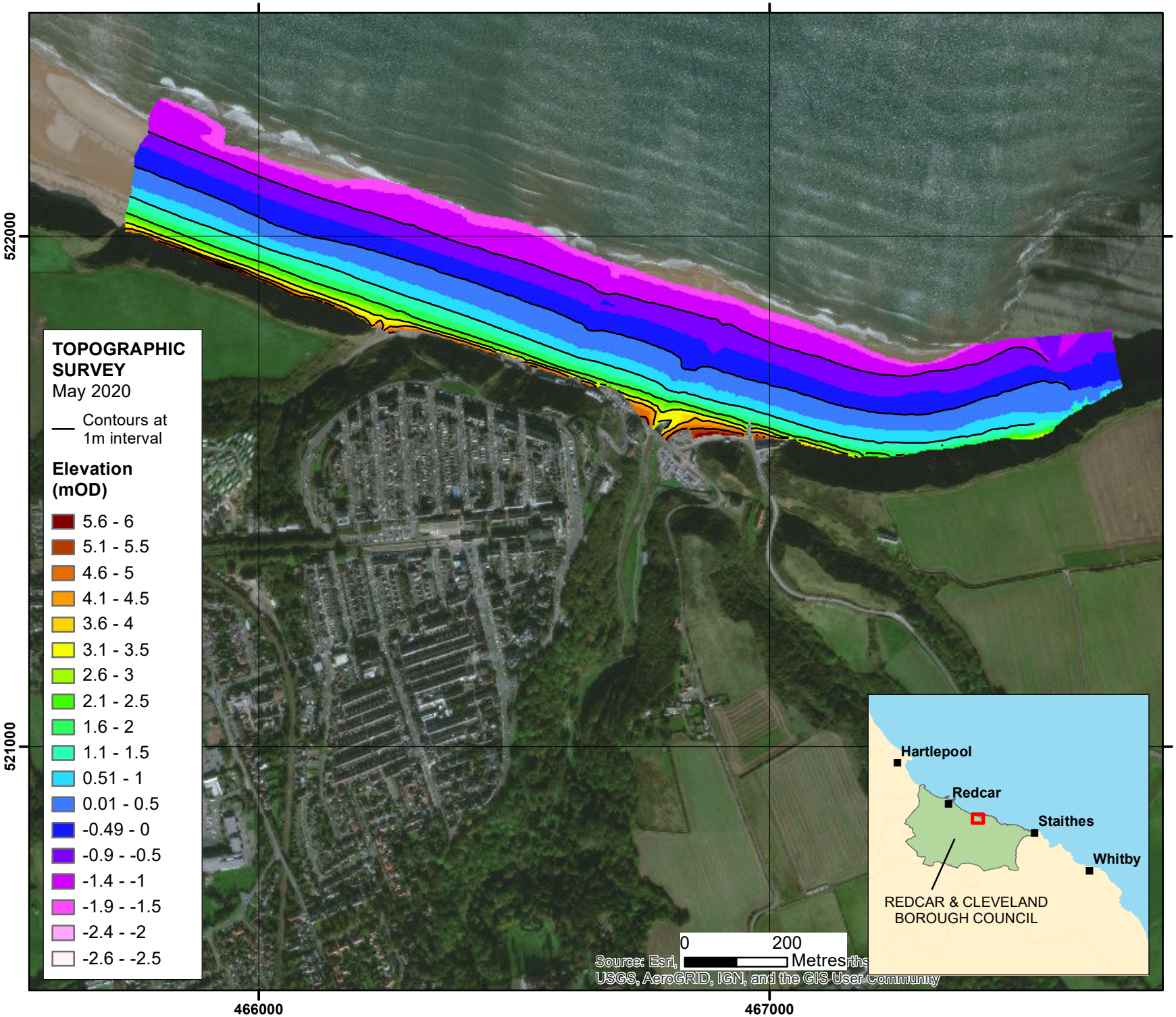

Key

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 2

SALTBURN SANDS

Redcar and Cleveland Borough Council Frontage

Update Report
'Partial Measures' Survey 2020

Drawing Scale at A4 1:10,000

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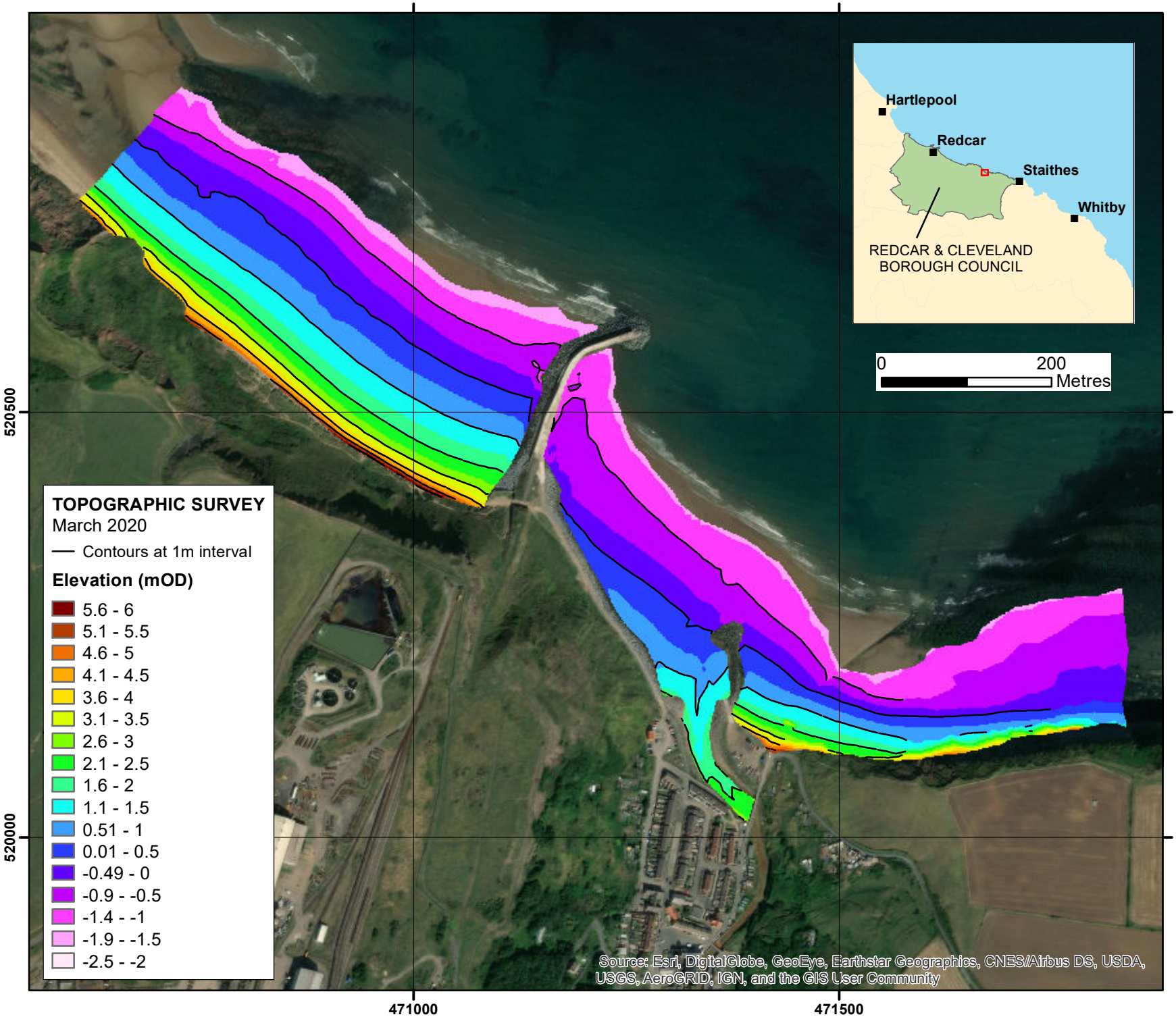

Key

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 3

CATTERSTY SANDS

Redcar and Cleveland Borough Council Frontage

Update Report
'Partial Measures' Survey 2020

Drawing Scale at A4 1:6,000

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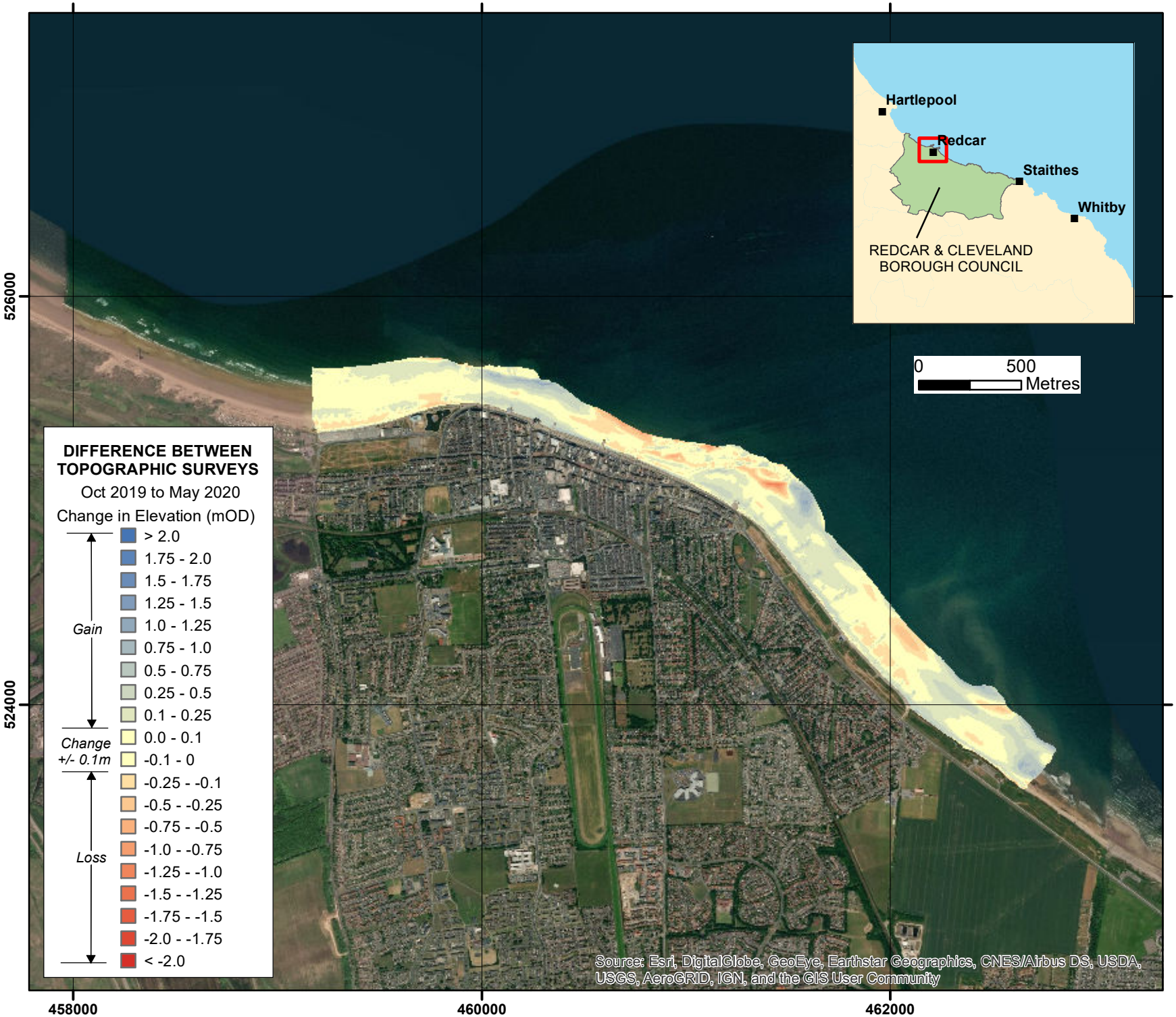

Key

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 4

REDCAR SANDS

Redcar and Cleveland Borough Council Frontage

Update Report
'Partial Measures' Survey 2020

Drawing Scale at A4 1:25,000

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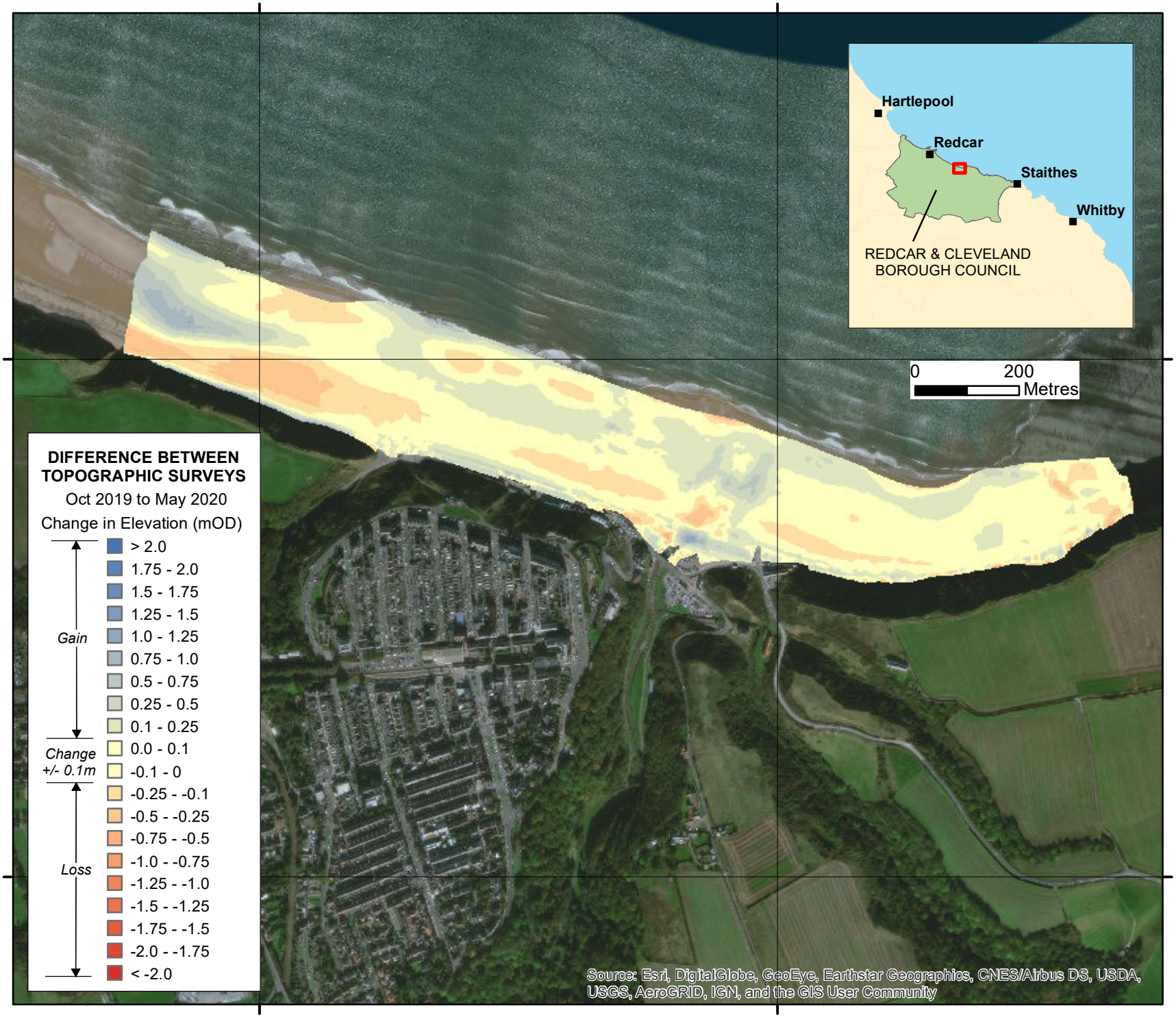

Key

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 5

SALTBURN SANDS

Redcar and Cleveland Borough Council Frontage

Update Report
'Partial Measures' Survey 2020

Drawing Scale at A4 1:10,000

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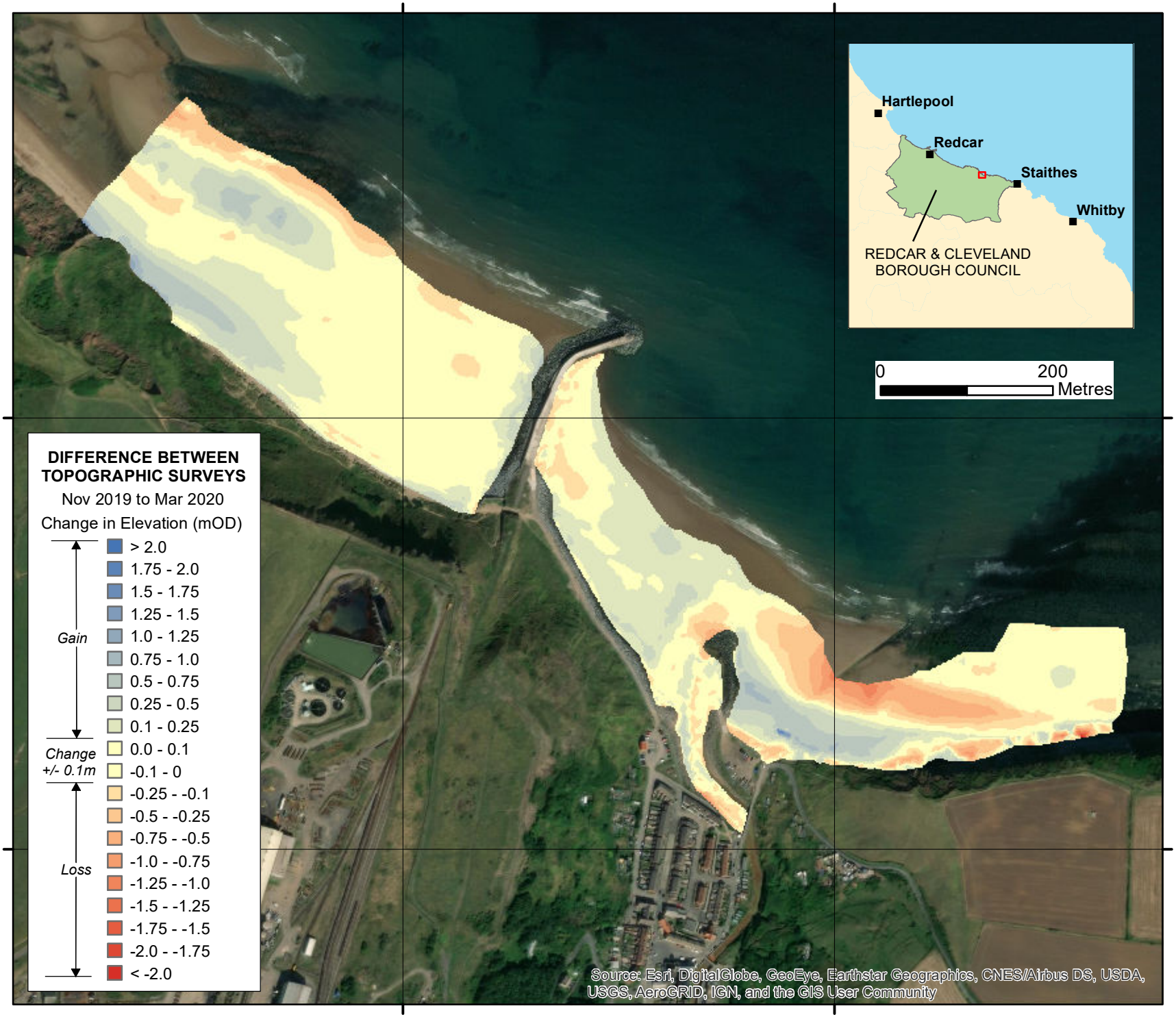

Key

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 6

CATTERSTY SANDS

Redcar and Cleveland Borough Council Frontage

Update Report
'Partial Measures' Survey 2020

Drawing Scale at A4 1:6,000

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Appendix C

Cliff Top Survey

Cliff Top Survey

Staithes

Twenty ground control points have been established at Staithes (Figure C1). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion.

The cliff top surveys at Staithes are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table C1 provides baseline information about these ground control points and results from the November 2008 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

Table C1 – Cliff Top Surveys at Staithes

Ground Control Points				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing (°)	Baseline Survey	Previous Survey	Present Survey	Baseline to Present	Previous to Present	Baseline to Present
STAITHES				Nov 2008	Oct 2019	March 2020	Nov 2008 - 2020	Oct 2019 - 2020	Nov 2008 - 2020
1	477228	518769	320	1.90	-4.87	-4.90	6.80	0.03	0.57
2	477334	518798	0	10.90	10.78	10.66	0.24	0.12	0.02
3	477487	518789	350	7.10	8.09	8.00	-0.90	0.09	0.00
4	477594	518801	340	5.90	4.37	3.79	2.11	0.58	0.18
5	477683	518911	350	8.40	8.35	8.11	0.29	0.24	0.02
6	477792	518867	30	8.60	8.55	8.50	0.10	0.05	0.01
7	477891	518828	60	7.70	7.20	7.29	0.41	-0.09	0.03
8	477959	518873	350	8.70	9.56	9.50	-0.80	0.06	0.00
9	478088	518950	350	7.60	UTS	8.07	-0.47	UTS	0.00
10	478191	519023	340	8.40	UTS	9.59	-1.19	UTS	0.00
11	478237	519007	60	6.90	UTS	6.60	0.30	UTS	0.03
12	478213	518988	150	6.10	UTS	6.07	0.03	UTS	0.00
13	478501	518809	15	11.40	8.73	8.65	2.75	0.08	0.23
14	478624	518807	20	7.50	7.46	7.47	0.03	-0.01	0.00
15	478737	518858	60	6.10	6.26	6.32	-0.22	-0.06	0.00
16	478823	518757	60	8.00	8.50	8.46	-0.46	0.04	0.00
17	478944	518671	30	9.30	9.08	9.13	0.17	-0.05	0.01
18	479052	518630	20	9.20	9.18	9.25	-0.05	-0.07	0.00
19	479147	518610	0	14.20	14.36	14.04	0.16	0.32	0.01
20	479274	518618	20	11.40	11.34	11.14	0.26	0.20	0.02