



Cell 1 Regional Coastal Monitoring Programme Analytical Report 9: 'Full Measures' Survey 2016

North Tyneside Council



March 2017

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1.

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)
	River Tyne
1 in 200 year	3.7
HAT	3.1
MHWS	2.4
MLWS	-1.9

Source: *Scottish Border to River Tyne Shoreline Management Plan 2.*
Royal Haskoning, May 2009.

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). 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 sediment to varying thicknesses, softer rock cliffs and extensive landslide complexes.

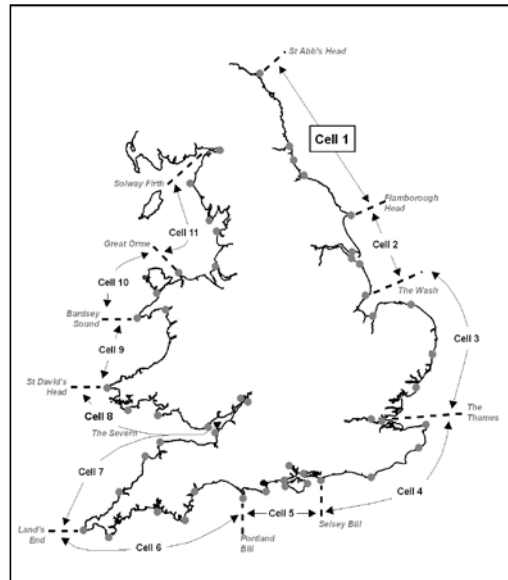


Figure 1 Sediment Cells in England and Wales

The work commenced with a three-year monitoring programme in September 2008 that was managed by Scarborough Borough Council on behalf of the North East Coastal Group. This initial phase has been followed by a five-year programme of work, which started in October 2011. The work is 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
- walk-over 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.

Each year, an Analytical Report is produced for each individual authority, providing a detailed analysis and interpretation of the 'Full Measures' surveys. This is followed by a brief Update Report for each individual authority, providing ongoing findings from the 'Partial Measures' surveys.

Annually, a Cell 1 Overview Report is also produced. This provides a region-wide summary of the main findings relating to trends and interactions along the entire Cell 1 frontage.

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	Sept-Dec 08	May 09	Mar-May 09	June 09	
2	2009/10	Sept-Dec 09	Mar 10	Feb-Mar 10	July 10	
3	2010/11	Aug-Nov 10	Feb 11	Feb-Apr 11	Aug 11	Sept 11
4	2011/12	Oct-Nov 11	Oct 12	Mar-May 12	Feb 13	
5	2012/13	Sept-Oct 12	Mar 13	Mar-Apr 13	June 13	
6	2013/14	Sept-Oct 13	Feb 14	Mar-Apr 14	July 14	
7	2014/15	Oct-Nov 14	Feb 15	Mar 15	July 15	
8	2015/16	Oct-Nov 15	Feb 16	Mar 16	July 16	
9	2016/17	Sept 16	Feb 17 (*)			

(*) The present report is **Analytical Report 9** and provides an analysis of the 2016 Full Measures survey for North Tyneside Council's frontage.

In addition, separate reports are produced for other elements of the programme as and when specific components are undertaken, such as wave data collection, bathymetric and sea bed sediment data collection, aerial photography, and walk-over visual inspections.

For purposes of analysis, the Cell 1 frontage has been split into the sub-sections listed in the Table 2.

Table 2 Sub-divisions of the Cell 1 Coastline

Authority	Zone
Northumberland County Council	Spittal A
	Spittal B
	Goswick Sands
	Holy Island
	Bamburgh
	Beadnell Village
	Beadnell Bay
	Embelton Bay
	Boulmer
	Alnmouth Bay
	High Hauxley and Druridge Bay
	Lynemouth Bay
	Newbiggin Bay
	Cambois Bay
Blyth South Beach	
North Tyneside Council	Whitley Sands
	Cullercoats Bay
	Tynemouth Long Sands
	King Edward's Bay
South Tyneside Council	Littehaven Beach
	Herd Sands
	Trow Quarry (incl. Frenchman's Bay)
	Marsden Bay
Sunderland Council	Whitburn Bay
	Harbour and Docks
	Hendon to Ryhope (incl. Halliwell Banks)
Durham County Council	Featherbed Rocks
	Seaham
	Blast Beach
	Hawthorn Hive
	Blackhall Colliery
Hartlepool Borough Council	North Sands
	Headland
	Middleton
	Hartlepool Bay
Redcar & Cleveland Borough Council	Coatham Sands
	Redcar Sands
	Marske Sands
	Saltburn Sands
	Cattersty Sands (Skinningrove)
	Staithes
Scarborough Borough Council	Staithes
	Runswick Bay
	Sandsend Beach, Uppgang Beach and Whitby Sands
	Robin Hood's Bay
	Scarborough North Bay
	Scarborough South Bay
	Cayton Bay
	Filey Bay

1. Introduction

1.1 Study Area

North Tyneside Council's frontage extends from Hartley (just south of Blyth) in the north, to the River Tyne in the south. For the purposes of this report and for consistency with previous reporting, it has been sub-divided into four areas, namely:

- Whitley Sands
- Cullercoats Bay
- Tynemouth Long Sands
- King Edward's Bay

1.2 Methodology

Along North Tyneside Council's frontage, the following surveying is undertaken:

- Full Measures survey annually each autumn/early winter comprising:
 - Beach profile surveys along eight transect lines (commenced 2002)
 - Beach profile surveys along an additional two transects (commenced 2010)
 - Topographic survey along Whitley Sands (commenced 2010)
 - Topographic survey along Tynemouth Long Sands (commenced 2011)
- Partial Measures survey annually each spring comprising:
 - Beach profile surveys along all ten transect lines (commenced 2010)

The location of these surveys is shown in Figure 1. The beach profiles and topographic surveys were undertaken between the 14th and 20th September 2016. The weather conditions varied throughout the survey, details can be found in the surveyors reports.

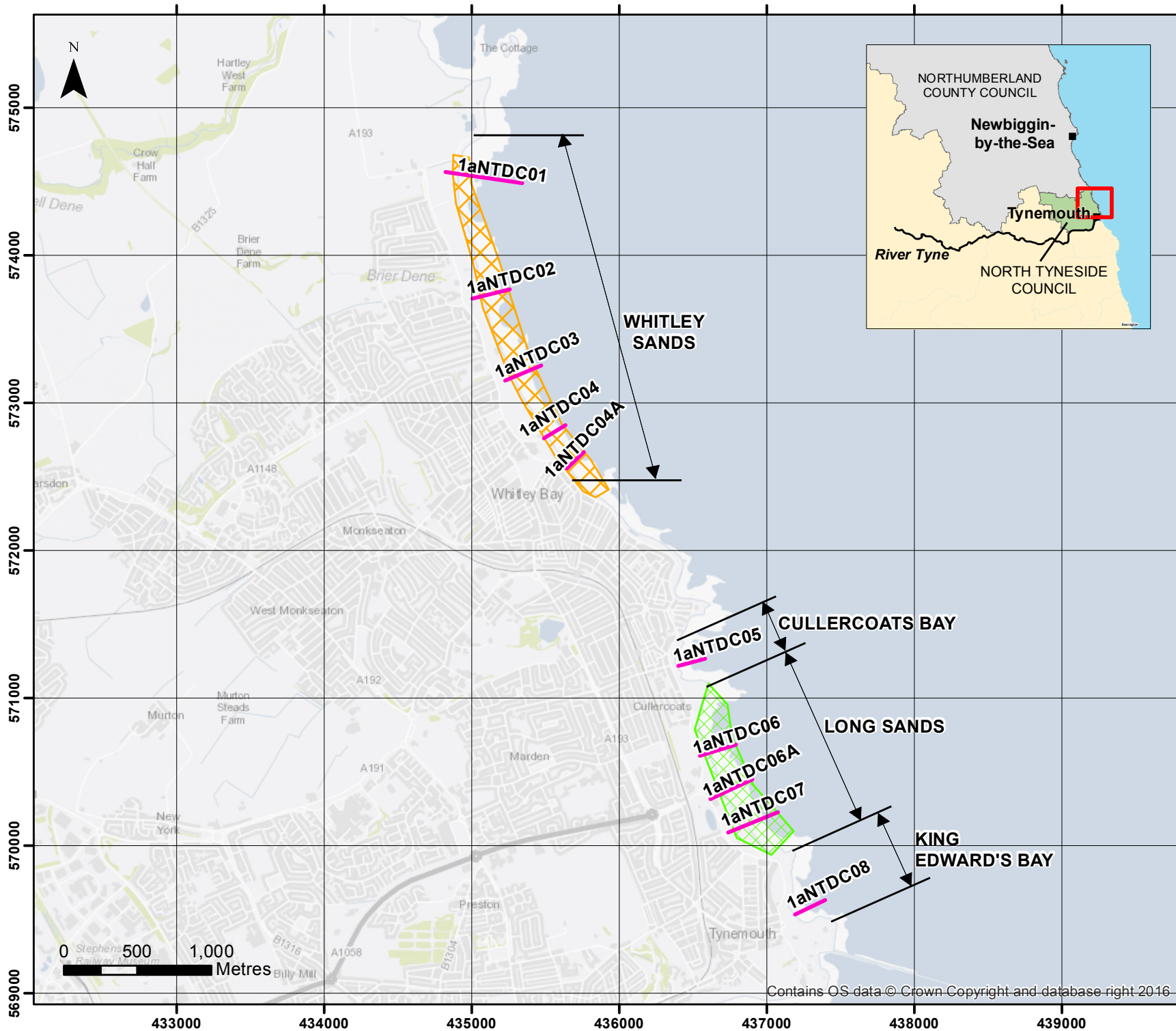
All data have been captured in a manner commensurate with the principles of the Environment Agency's *National Standard Contract and Specification for Surveying Services* and stored in a file format compatible with the software systems being used for the data analysis, namely SANDS and ArcGIS. This data collection approach and file format is comparable to that being used on other regional coastal monitoring programmes, such as in the South East and South West of England.

Upon receipt of the data from the survey team, they are quality assured and then uploaded onto the programme's website for storage and availability to others and also input to SANDS and GIS for subsequent analysis.

The Analytical Report is then produced following a standard structure for each authority. This involves:

- description of the changes observed since the previous survey and an interpretation of the drivers of these changes (Section 2);
- documentation of any problems encountered during surveying or uncertainties inherent in the analysis (Section 3);
- recommendations for 'fine-tuning' the programme to enhance its outputs (Section 4); and
- providing key conclusions and highlighting any areas of concern (Section 5).

Data from the present survey are presented in a processed form in the Appendices.



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

North Tyneside Council Frontage

Analytical Report
Topo Surveys

Drawing Scale at A4 1:35,000

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2. Analysis of Survey Data

2.1 Whitley Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
September 2016	<p>Beach Profiles:</p> <p>Whitley Sands is covered by five beach profile lines for the Full Measures survey (Appendix A). Four of these (1aNTDC01 to 1aNTDC04) were initially surveyed in April 2002 and were surveyed annually to 2009 (Full Measures, autumn 2009) and bi-annually thereafter. From March 2010 (Partial Measures, spring 2010) onwards, an additional beach profile line (NTDC04A) has been surveyed at the southern end of the frontage. All profiles were last surveyed in March 2016 for the Partial Measures survey.</p> <p>1aNTDC01 is located in the north of Whitley Sands, along the undefended cliffs immediately south of Trinity Road car park. There has been little change in the position of the cliff or beach levels at the toe of cliff to chainage 65m since the March 2016 survey. Between chainage 65m and 135m there has been erosion of up to 0.9m. Seawards of 135m chainage there has been little change. Overall, the profile is relatively high on the upper and lower beach compared to the range recorded from previous surveys but medium-low through the middle beach.</p> <p>Profile 1aNTDC02 is located in the northern part of Whitley Sands. A seawall is present at the back of the beach. There has been significant accretion at the base of the seawall, forming a large berm up to 1.5m higher than the March 2016 beach levels. Accretion has occurred between the seawall (chainage 50m) and chainage 105m. There has been erosion of 0.4m between chainage 105m and 145m, and the rock is exposed from 145m seawards. The profile is relatively high on the upper beach and low on the lower beach compared with the range recorded from previous surveys, resulting in a relatively steep profile.</p> <p>Profile 1aNTDC03 is located at the centre of Whitley Sands. There has been accretion of up to 0.4m across the whole beach profile since the March 2016 survey, though the gains in the middle beach are <0.2m. A berm up to 0.8m high has formed at the base of the seawall (chainage 15m to 25m). Overall, the October 2016 profile is in the middle of the range recorded from previous surveys.</p> <p>Profile 1aNDC04 is located in the southern part of Whitley Sands. There has been a small amount of accretion on the upper beach between the seawall (15m) and chainage 45m of up to 0.2m. The middle</p>	<p>Since the last survey, there has been accretion across the beach in the southern part of the bay. In the northern part of the bay there has been erosion in the middle beach.</p> <p>Longer term trends: Beach levels are within the range seen in earlier surveys.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>beach shows more significant accretion of up to 0.5m between chainage 45m and 90m, covering the rock platform which was previously exposed in the March 2016 and November 2015 surveys. Seaward of 90m chainage there has been very little change since March 2016. Overall, the profile is in the middle of the range recorded from previous surveys.</p> <p>Profile 1aNTDC04a is located towards the southern end of Whitley Sands. There has been accretion across the whole of the beach profile since March 2016 of up to 0.6m. The rock platform at chainage 80m remains exposed. Overall, the profile is a medium level compared to the range recorded from previous surveys, though it is relatively low towards the toe of the beach and at the base of the seawall.</p>	
September 2016	<p>Topographic Survey:</p> <p>Whitley Sands is covered by an annual topographic survey, which commenced in October 2010.</p> <p>Data from the most recent topographic survey (Full Measures, autumn 2016) have been used to create a digital ground model (DGM) (Appendix B – Map 1) using a GIS. A difference plot has also been produced using the DGM (Appendix B – Map 3) produced from the last produced topographic survey (Full Measures, autumn 2015) and the present survey.</p> <p>The difference plot shows generally shore parallel changes. Accretion has occurred on the upper beach around the whole bay, with the accretion spreading across the middle and lower beach at the southern end of the bay. The middle beach is dominated by erosion in the centre and north of the bay, with some areas of erosion on the upper and lower beach in the centre of the bay. The lower beach at the northern end of the bay shows very little change. Overall accretion dominates the southern end of the bay, with erosion being slightly more predominant in the centre of the bay.</p> <p>Whilst this is a comparison of annual surveys, rather than a biannual comparison like the beach profiles, the changes observed in the detailed profiles support this pattern of change in the bay as whole, indicating that much of this change is likely to have happened in the last six months.</p>	<p>The topographic survey indicates there to have been a movement of sediment towards the southern end of the bay. This is similar to the pattern recorded in the Autumn 2015 survey. In the autumn 2014 Full Measures survey there was a northerly movement of sediment recorded, suggesting the beach responds to storm directions that dominate over the monitoring period.</p>

2.2 Cullercoats Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
September 2016	<p>Beach Profiles:</p> <p>Cullercoats Bay is covered by one beach profile line for the Full Measures survey (Appendix A). This was surveyed annually each autumn between 2002 and 2009. From spring 2010 onwards, it has been surveyed bi-annually.</p> <p>At profile 1aNTDC05, the survey report notes '<i>cliff not measured at section 5 due to dangerous access</i>' as it has done in previous surveys. There has been little change in the profile since March 2016, with accretion of up to 0.2m between the toe of the cliff and chainage 75m, and erosion of up to 0.1m seawards of 75m. The September 2016 profile is the highest on record for the upper beach (up to chainage 70m) and the lowest on record for the lower beach from 90m chainage.</p>	<p>As in previous surveys, access to the cliff has not been possible.</p> <p>The data shows only limited change, related to short-term patterns of sediment movement.</p> <p>Longer term trends: The amount of change is low and the profile is within the past range. The upper beach is currently high, whereas the lower beach is at its lowest level and a bar seen in earlier surveys is absent.</p>

2.3 Tynemouth Long Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
September 2016	<p>Beach Profiles:</p> <p>Tynemouth Long Sands is covered by three beach profile lines for the Full Measures survey (Appendix A). Profiles 1aNTDC06 and 1aNTDC07 were initially surveyed annually each autumn between 2002 and 2009. A third profile, 1aNTDC06A, was then added in the centre of the frontage. From spring 2010 (Partial Measures) onwards, all profiles have been surveyed bi-annually.</p> <p>1aNTDC06 is located approximately 150m south of the access ramp towards the north of the bay. The top of the cliff has not changed since the last survey, however, the remainder of the cliff profile cannot be reviewed due to lack of data points in the profile plot as the survey report notes '<i>no access to middle of section 6 due to seed protection fences</i>'. The beach profile starts at c.35m chainage and shows accretion over the upper beach of up to 0.7m. From chainage 125m to 195m, this changes to erosion of up to 0.6m. The end of the profile from 195m to 215m shows minor accretion of <0.2m. Overall, the profile is at a relatively high level in the upper beach but a relatively low level on the lower beach compared to the range recorded from previous surveys.</p> <p>At profile 1aNTDC06A, the dune-cliff face has not significantly changed in form or position. As with section 6, the survey report notes '<i>no access to middle of section 6a due to seed protection fences</i>'. There has been accretion from the toe of the dunes at chainage 80m to chainage 115m of up to 0.5m. Between chainage 115m to 195m, the middle beach has been eroded by up to 0.3m. The lower beach seawards of chainage 195m has accreted by up to 0.4m. Overall, the September 2016 profile is relatively high-medium on the upper and lower beach, but relatively low in the middle beach compared to the range recorded from the previous surveys.</p> <p>Profile 1aNTDC07 is located approximately 50m south of the access route through the dunes towards the southern end of the bay. The dune-cliff has not significantly changed in form or position since the last survey. As with section 6 and 6a, the survey report notes '<i>no access to middle of section 7 due to seed protection fences</i>'. There has been a small amount of accretion across the whole beach profile with most of the change being up to 0.2m with some areas of accretion up to 0.4m in the upper and lower beach. Overall, the September 2016 profile is medium-high compared to the range recorded from previous surveys.</p>	<p>Since the last survey the dunes have retained the same form and position. The upper and lower beach has generally shown accretion with erosion in the middle beach, with the exception of profile 1aNTDC07 at the southern end which showed accretion across the whole beach profile.</p> <p>Longer term trends: Overall, the beaches have retained a similar form but are towards the upper bound of the range of previous surveys, particularly in the foreshore.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>September 2016</p>	<p>Topographic Survey:</p> <p>The first survey was undertaken for the Full Measures survey in October 2010.</p> <p>Data from the current topographic survey have been used to create a digital ground model (DGM) (Appendix B – Map 2) using a Geographical Information System (GIS). A difference plot has also been produced by comparing the current DGM (Appendix B – Map 4) with that produced from the last topographic survey in March 2016.</p> <p>The difference plot shows that change since the last survey (Partial Measures, spring 2016) is patchy. The northern half of the bay shows the greatest magnitude of change of $\pm 2\text{m}$, and has a clear pattern of accretion in the upper beach and erosion in the lower beach. The southern part of the bay shows more accretion than erosion, with accretion dominating the upper and lower beach, and the middle beach generally showing little change. The exceptions are a patch of erosion in the middle beach opposite Beach Road, and a patch of erosion in the lower beach at the very southern limit of the bay.</p>	<p>The pattern shown in the difference plot does not entirely corroborate the patterns identified in the profiles, but this is likely due to the patchiness of the accretion and erosion and the positions of the profiles. The northern part of the bay appears to show movement of material up the beach from the middle/lower foreshore.</p>

2.4 King Edward's Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
September 2016	<p>Beach Profiles:</p> <p>King Edward's Bay is monitored by one beach profile line for the Full Measures survey (Appendix A). This was surveyed annually between 2002 and 2009. From spring 2010 onwards, it has been surveyed bi-annually.</p> <p>At profile 1aNTDC08 there has been alternating sections of accretion and erosion. The upper beach up to chainage 55m has accreted with the formation of a small berm 0.8m high at chainage 35m. Between chainage 55m and 80m erosion of 0.2m has occurred. Between chainage 80m and 140m the middle beach has accreted by up to 0.3m, whilst the lower beach seawards of 140m has eroded by up to 0.4m. The profile varies greatly along its length when compared to the range recorded from previous surveys, being generally medium in the upper beach, high in the middle beach, and low in the lower beach.</p>	<p>Since the last survey, the beach at King Edward's Bay has steepened further since the March 2016 survey with material appearing to be moved up the beach.</p> <p>Longer term trends: The profile is within the range of previously observed profiles at this location.</p>

3. Problems Encountered and Uncertainty in Analysis

Individual Profiles

- The surveyor noted that there was construction ongoing on the promenade between profiles 1aNTDC04 and 1aNTDC04A.
- At profile 1aNTDC05 the cliff was not measured due to access problems. Access to this profile is noted to have been dangerous in the previous Partial Measures and Full Measures reports, and is recommended that the beach profile should start at the cliff toe and that the cliff be monitored using the aerial survey data.
- At Tynemouth Long Sands (profiles 1aNTDC06, 1aNTDC06A and 1aNTDC07), there was no access to the dunes in the middle of the profile due to seed protection fences. This means it has not yet been possible to monitor the effectiveness of the dune stabilisation scheme

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

It is recommended that access to the stabilised dunes at Tynemouth Long Sands be attempted in future surveys in order to monitor the effectiveness of the stabilisation fences.

5. Conclusions and Areas of Concern

- At Whitley Sands, beach levels have experienced variable change with increases and decreases throughout individual profiles. For the most part, the beach is at a medium level in the range recorded from previous surveys. There are no causes for concern.
- The topographic survey indicates that sediment movements in Whitley Bay have, in general terms, 'reverted to type' with apparent sediment movement being towards the southern end of the bay.
- At Cullercoats Bay, at profile 1aNTDC05, there has been little change and there are no causes for concern.
- At Tynemouth Long Sands, the recorded profiles are within the previously recorded range and present no cause for concern. The topographic survey shows significant change in the northern bay with material moving up the beach, but little change in the southern part of the bay which is mainly showing accretion.
- At King Edward's Bay, there appears to have been movement of sediment up the beach in berms.

Appendices

Appendix A

Beach Profiles

Beach Profile

Location: 1aNTDC02

Date: 14/09/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

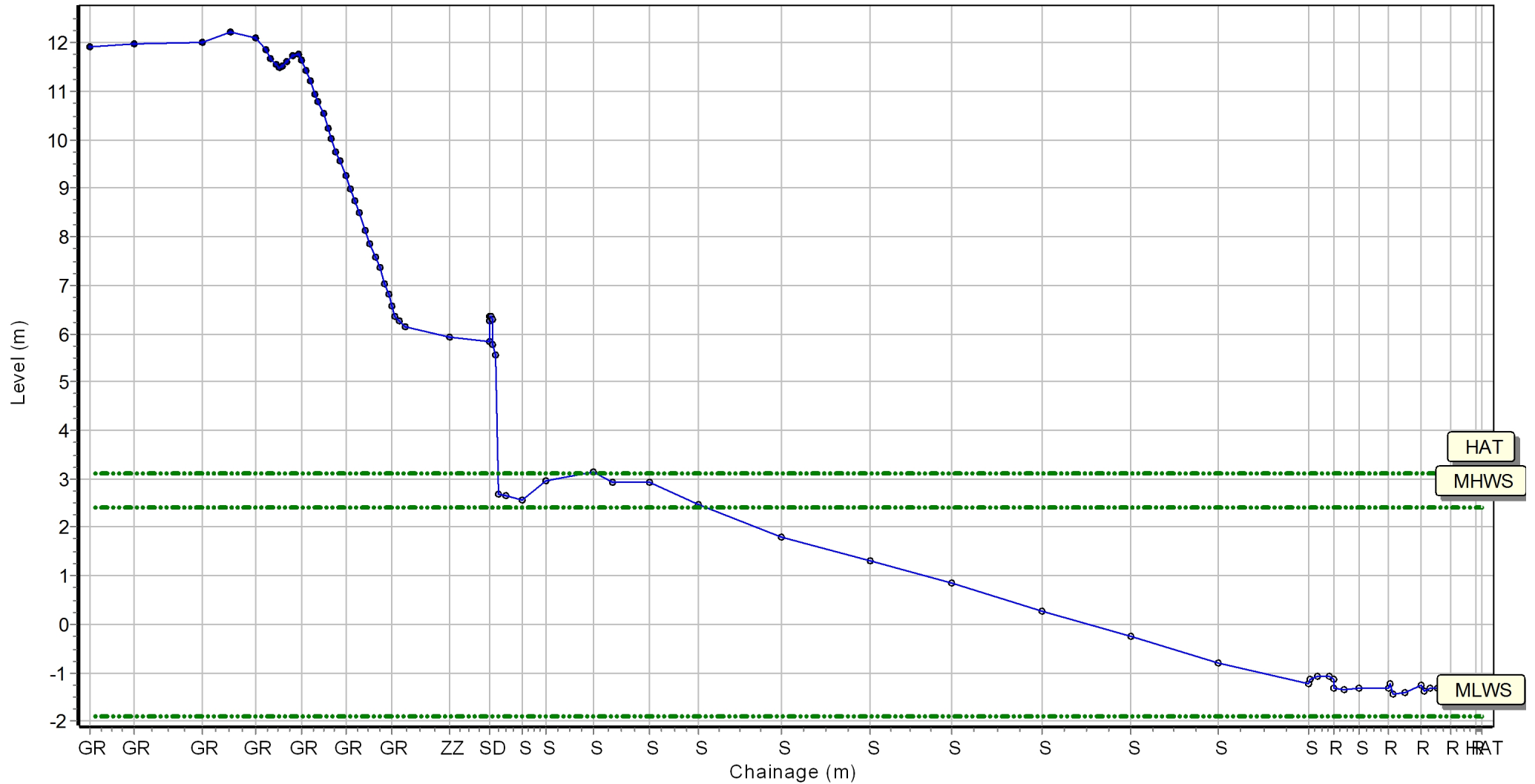
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

Easting: 435030.395 Northing: 573704.317 Profile Bearing: 76 ° from North



Beach Profile

Location: 1aNTDC03

Date: 14/09/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

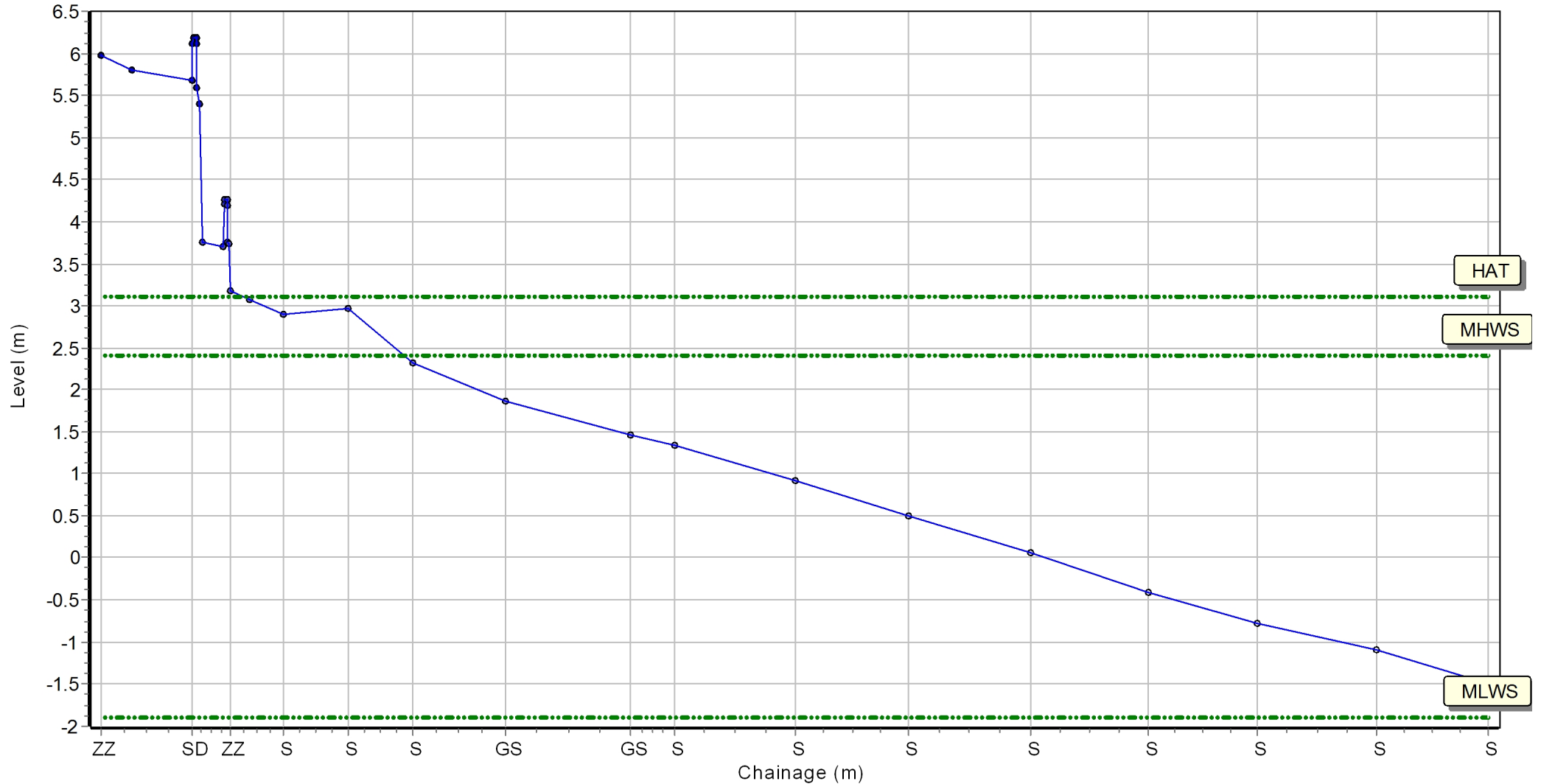
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

Easting: 435270.865 Northing: 573151.795 Profile Bearing: 70 ° from North



Beach Profile

Location: 1aNTDC04

Date: 14/09/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

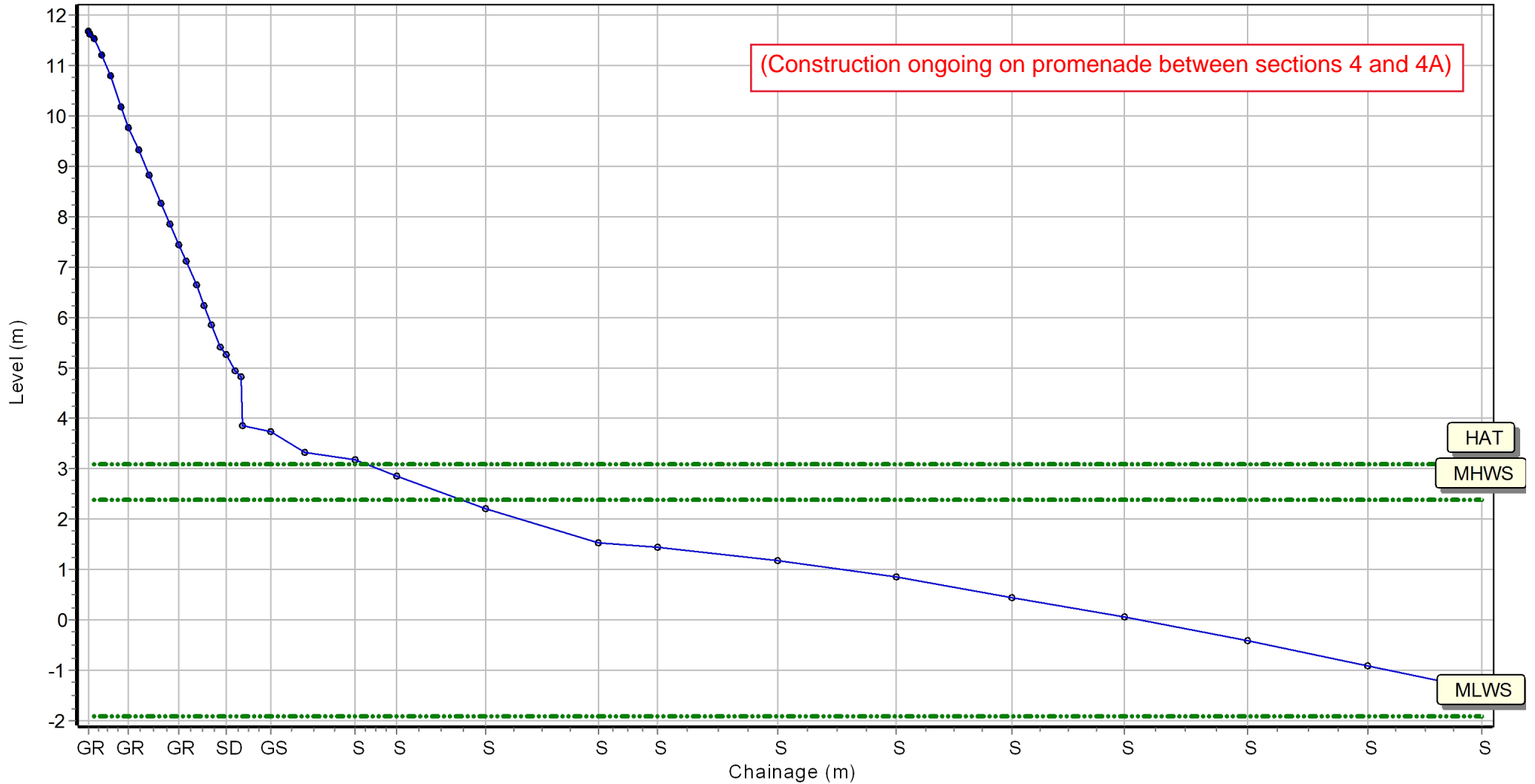
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

Easting: 435490.594 Northing: 572746.234 Profile Bearing: 60 ° from North



Beach Profile

Location: 1aNTDC04A

Date: 14/09/2016 Inspector: AG

Low Tide:

Low Tide Time:

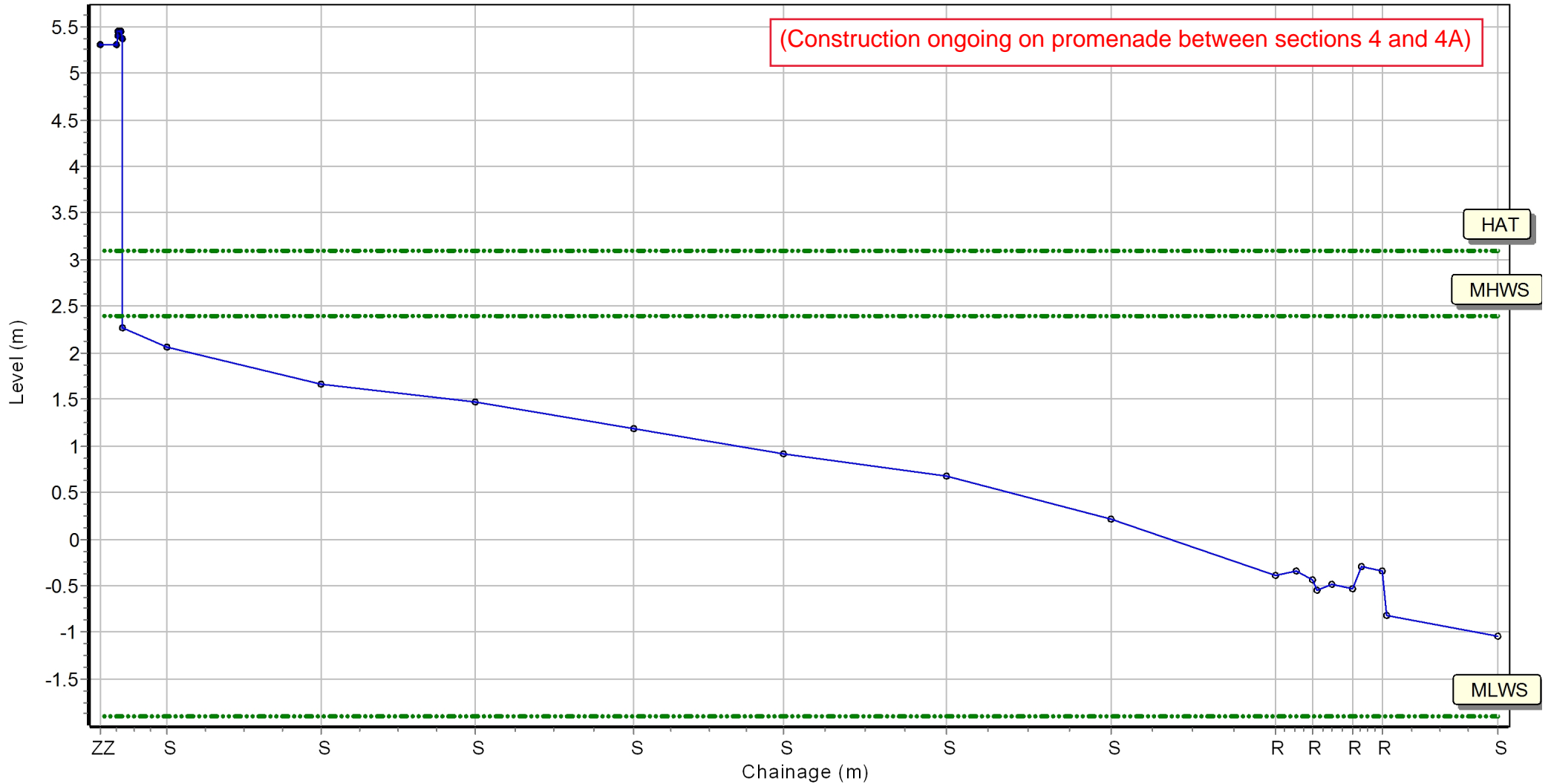
Wind Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

Easting: 435645.554 Northing: 572557.615 Profile Bearing: 46 ° from North



Beach Profile

Location: 1aNTDC05

Date: 20/09/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

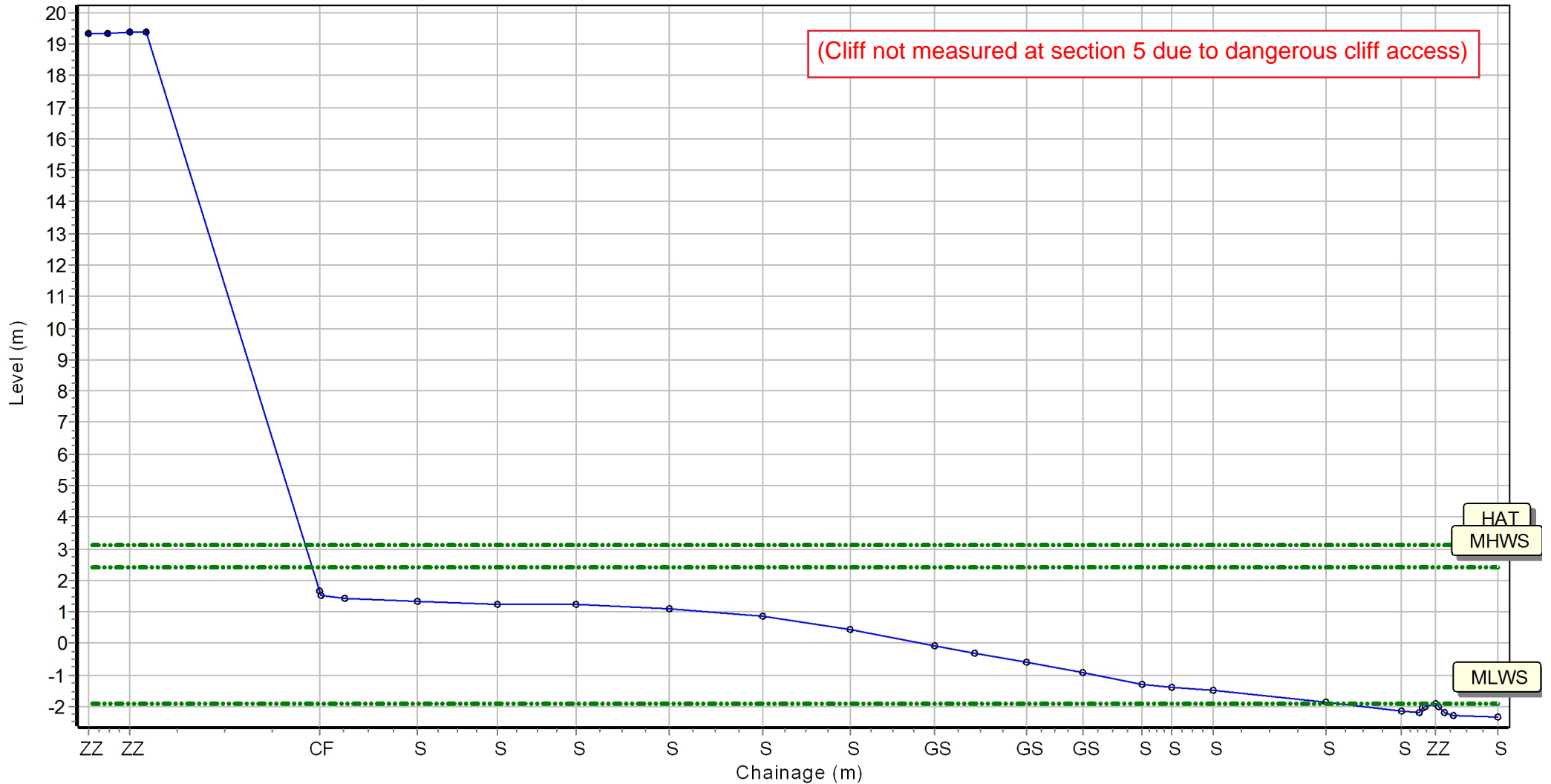
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

Easting: 436365.005 Northing: 571217.518 Profile Bearing: 77 ° from North



Beach Profile

Location: 1aNTDC06

Date: 20/09/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

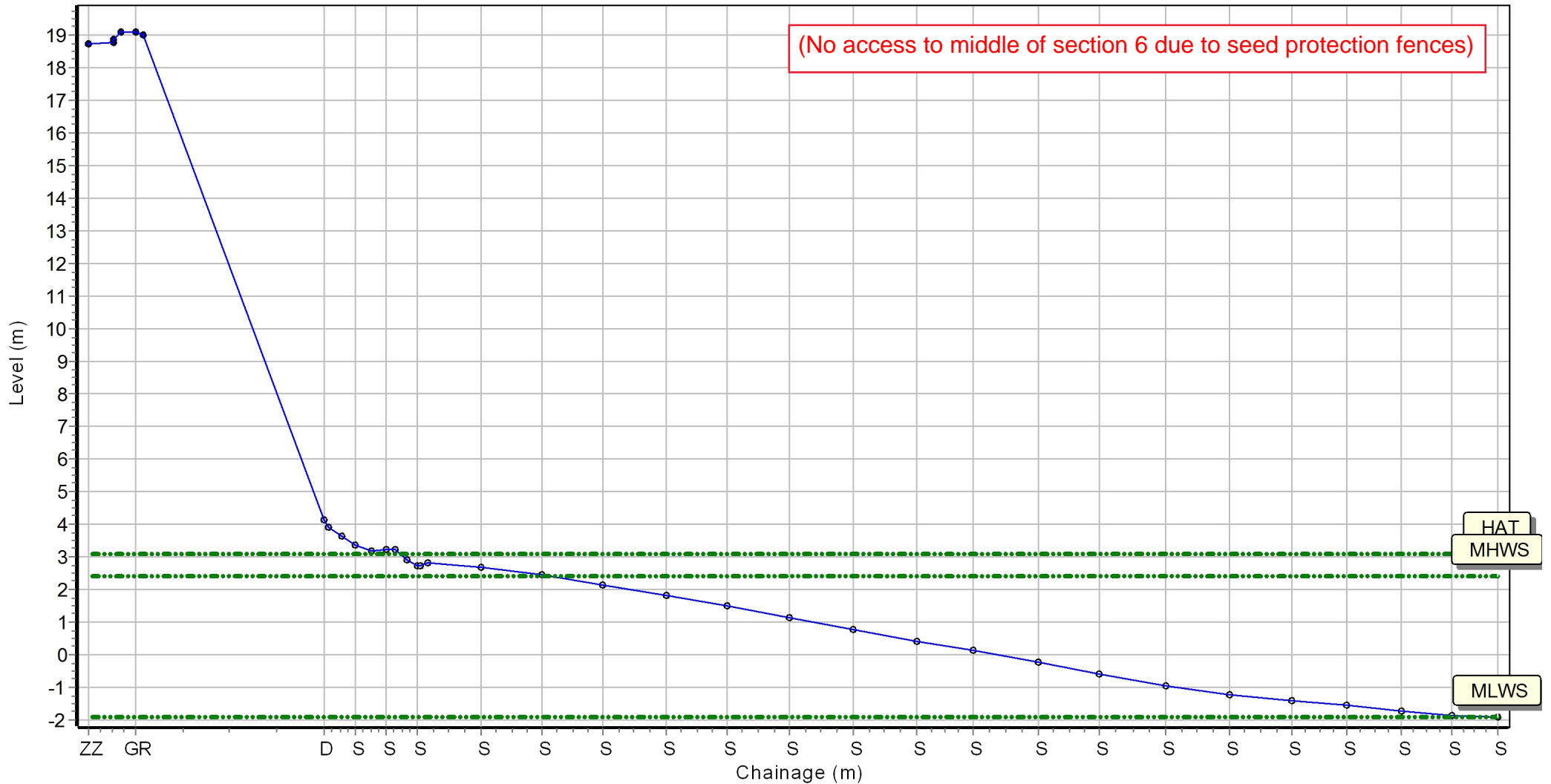
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

Easting: 436550.6 Northing: 570613.529 Profile Bearing: 77 ° from North



Beach Profile

Location: 1aNTDC06A

Date: 20/09/2016 Inspector: AG

Low Tide:

Low Tide Time:

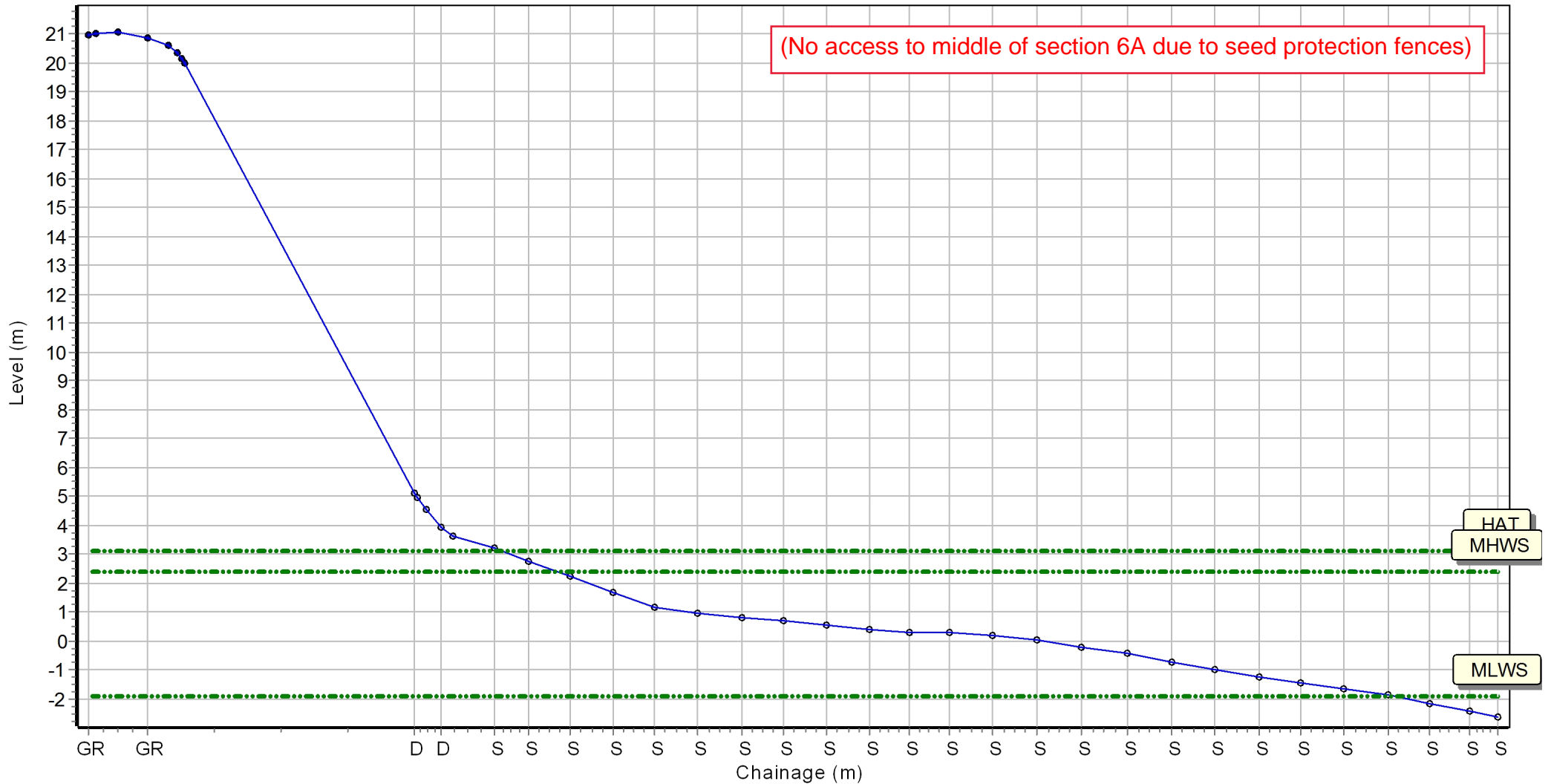
Wind Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

Easting: 436620.512 Northing: 570317.533 Profile Bearing: 65 ° from North



Beach Profile

Location: 1aNTDC07

Date: 20/09/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

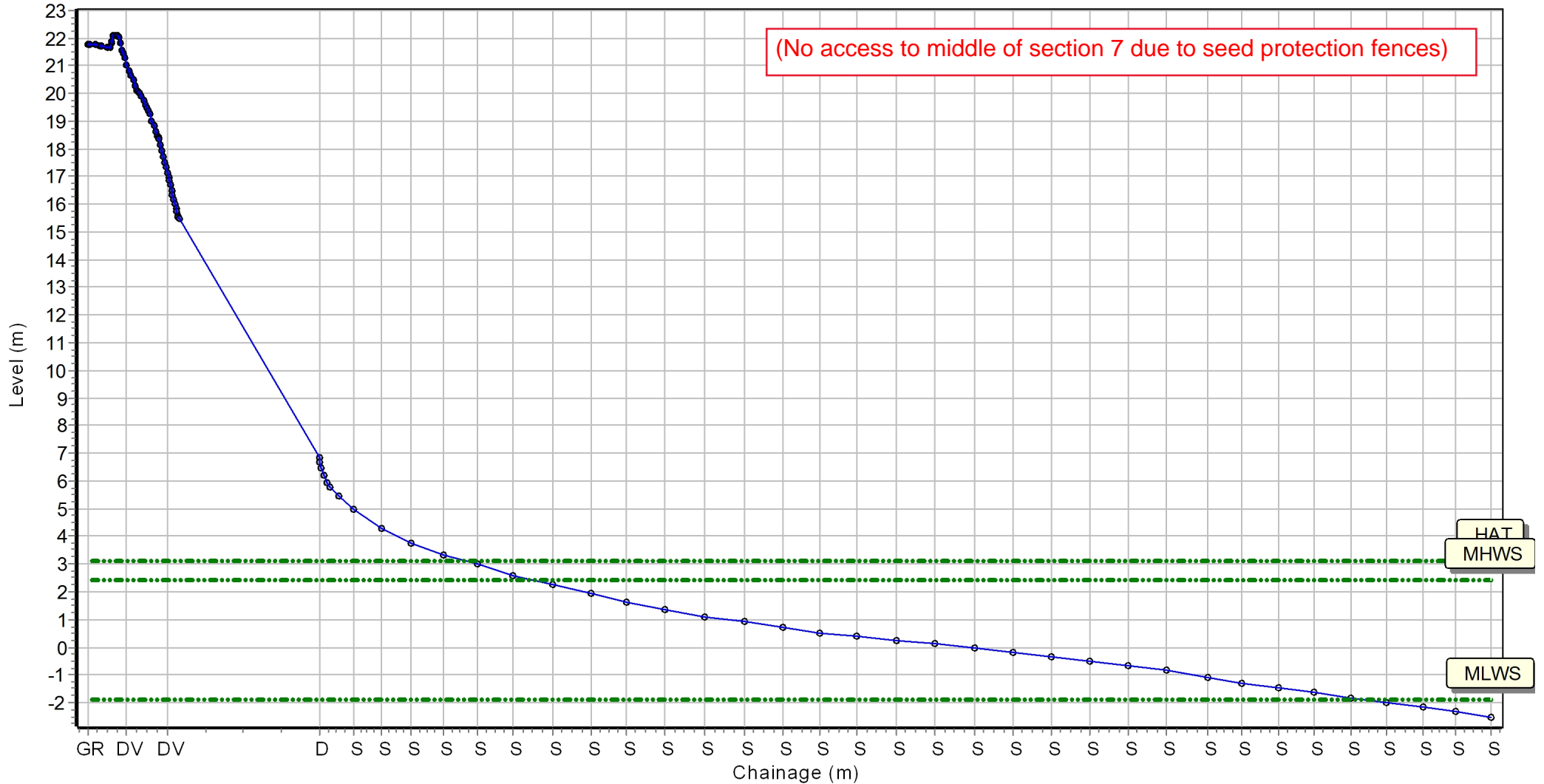
Sea State:

Visibility:

Rain:

Summary: 2016 Full Measures Topo Survey

Easting: 436742.221 Northing: 570082.97 Profile Bearing: 74 ° from North



Beach Profile

Location: 1aNTDC08

Date: 20/09/2016

Inspector: AG

Low Tide:

Low Tide Time:

Wind

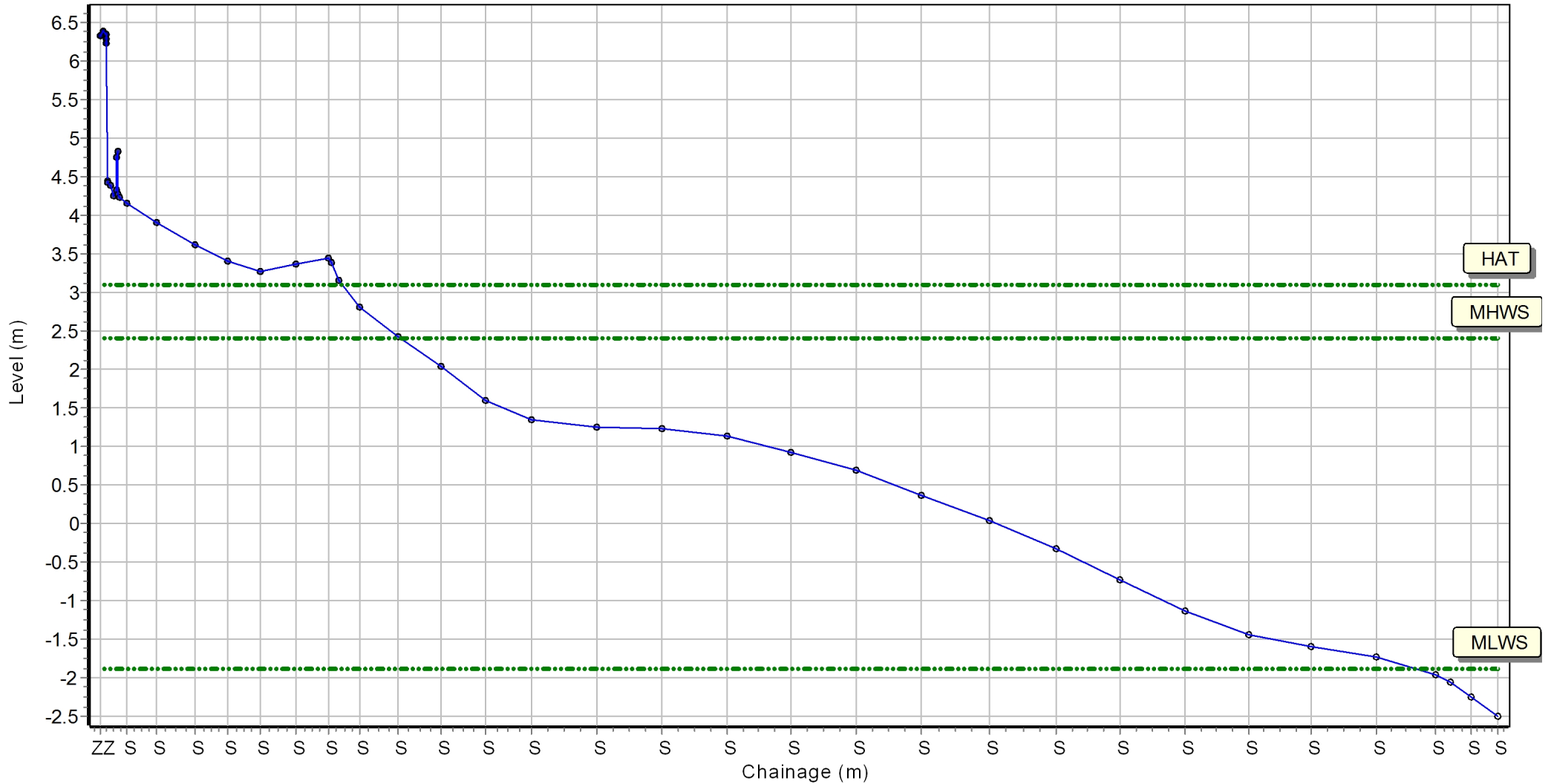
Sea State:

Visibility:

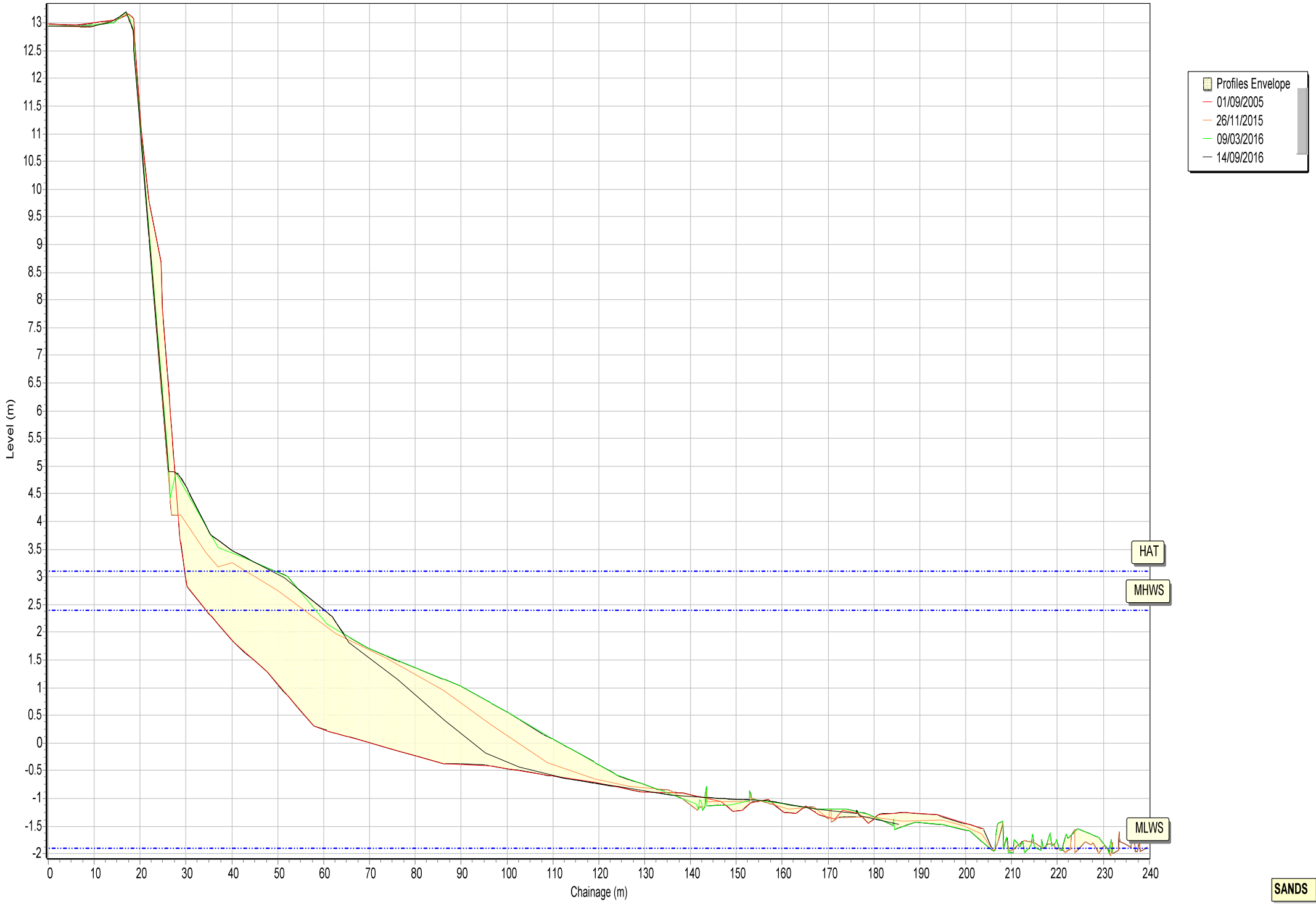
Rain:

Summary: 2016 Full Measures Topo Survey

Easting: 437142.187 Northing: 569510.828 Profile Bearing: 67 ° from North



Beach Profiles: 1aNTDC01



Profiles Envelope
01/09/2005
26/11/2015
09/03/2016
14/09/2016

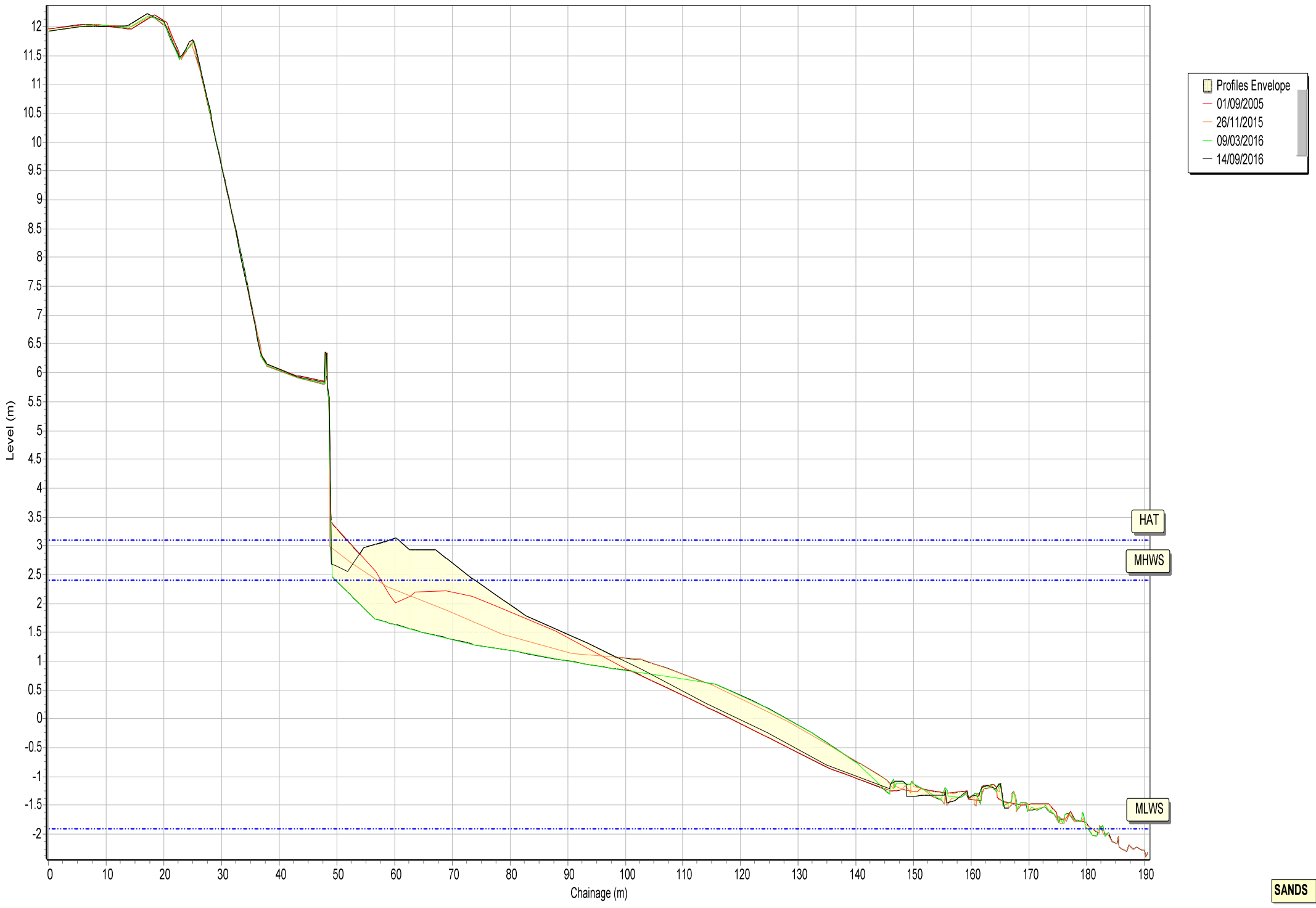
HAT

MHWS

MLWS

SANDS

Beach Profiles: 1aNTDC02



Profiles Envelope
01/09/2005
26/11/2015
09/03/2016
14/09/2016

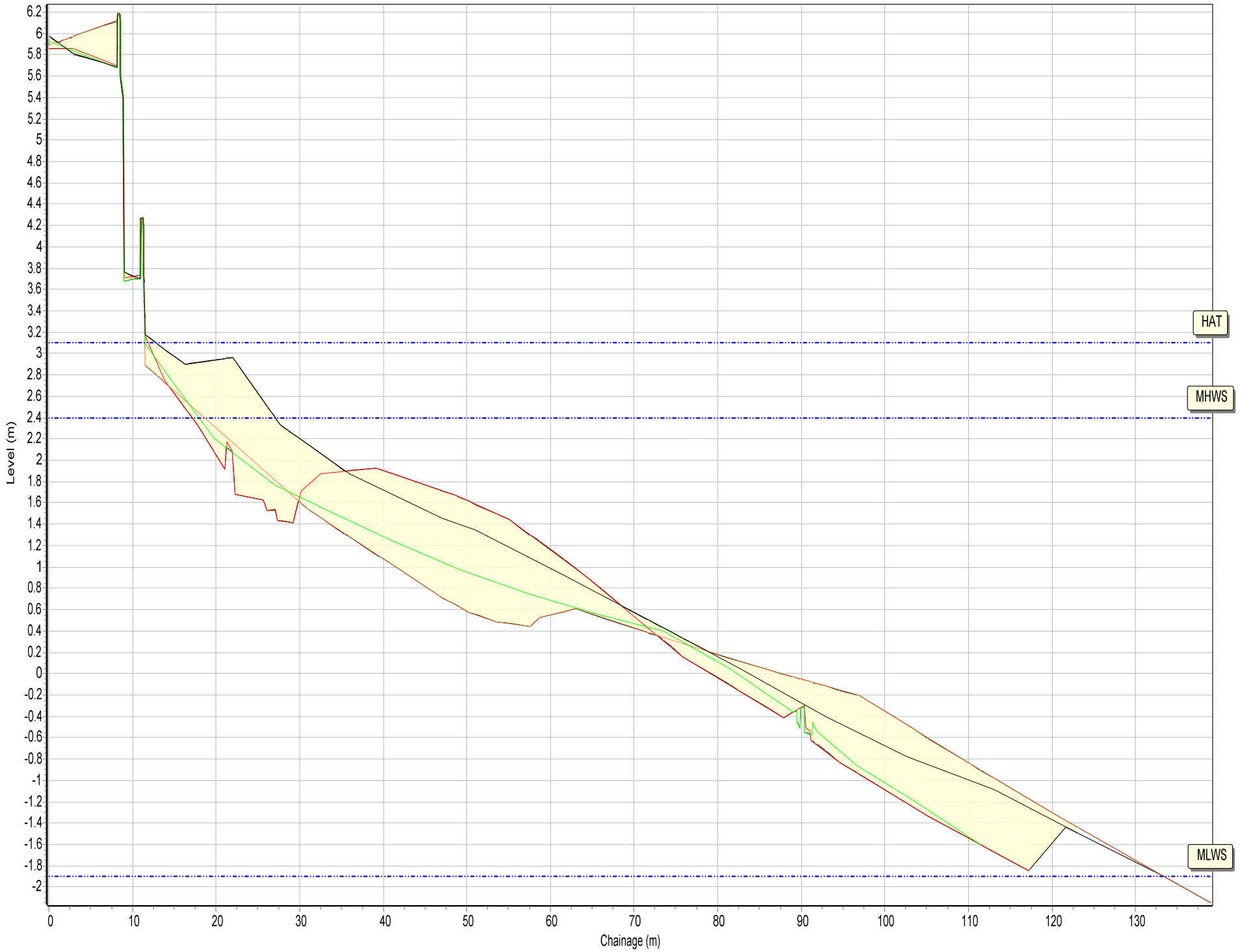
HAT

MHWS

MLWS

SANDS

Beach Profiles: 1aNTDC03



Profiles Envelope
01/09/2005
26/11/2015
09/03/2016
14/09/2016

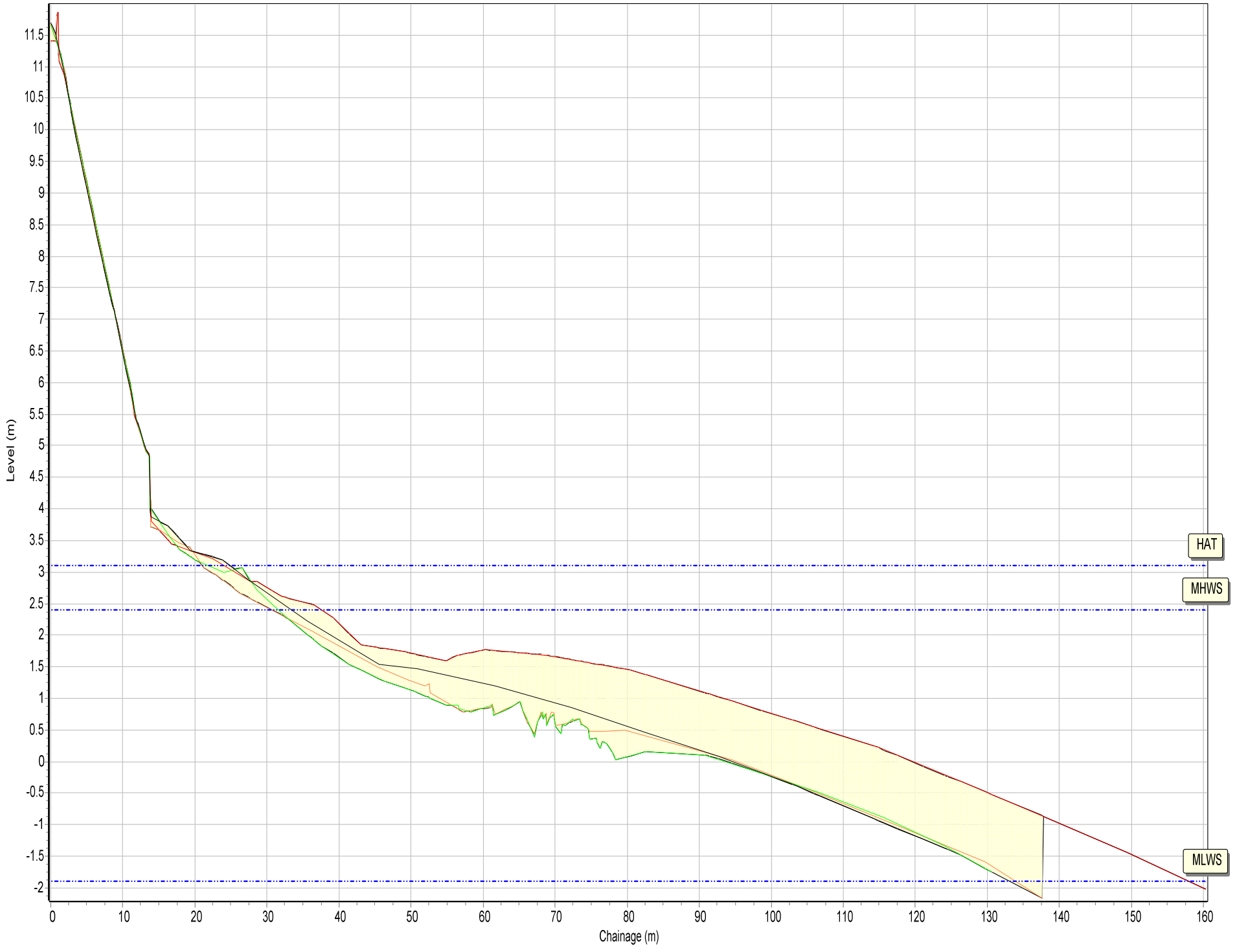
HAT

MHWS

MLWS

SANDS

Beach Profiles: 1aNTDC04



Profiles Envelope
01/09/2005
26/11/2015
09/03/2016
14/09/2016

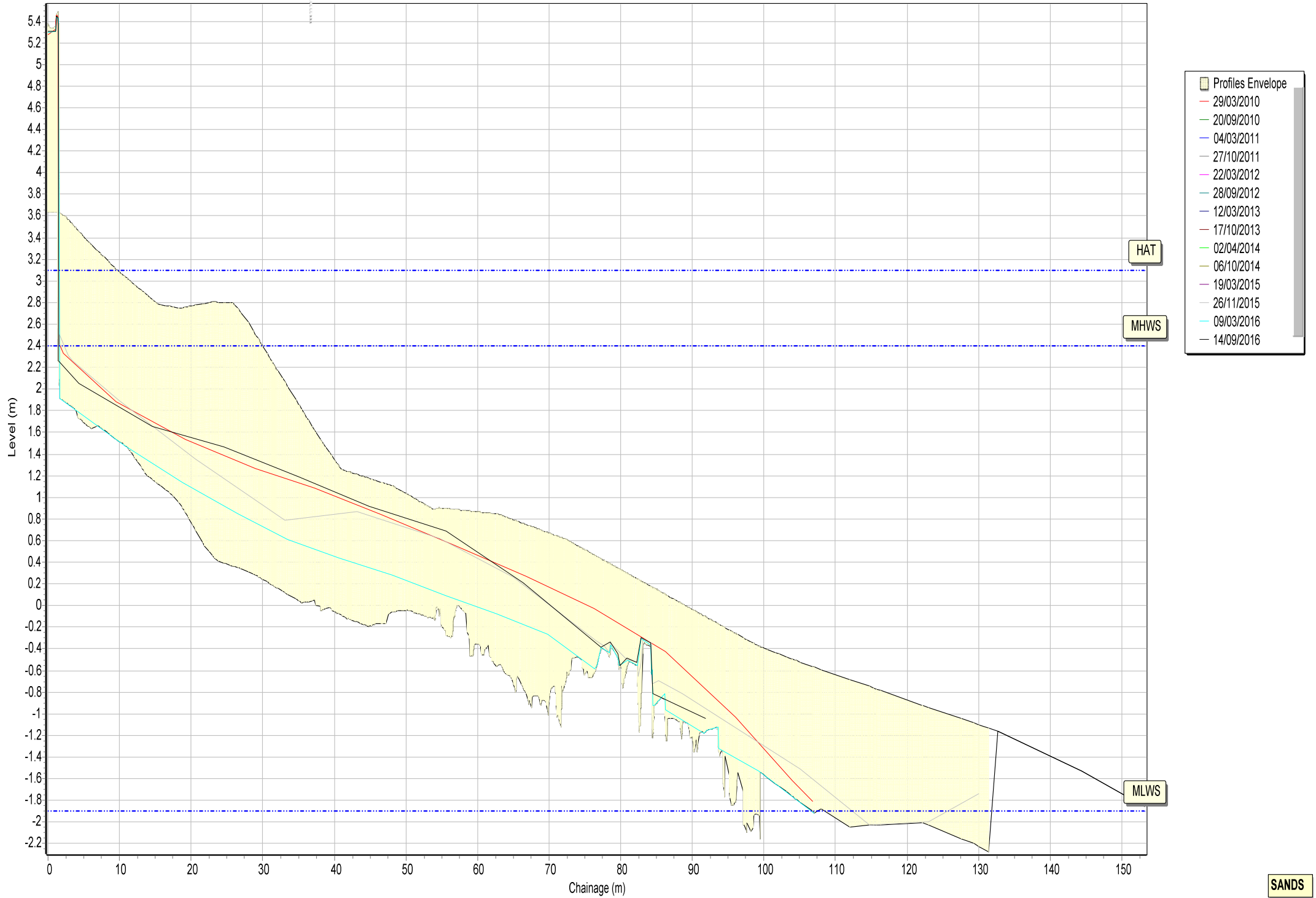
HAT

MHWS

MLWS

SANDS

Beach Profiles: 1aNTDC04A



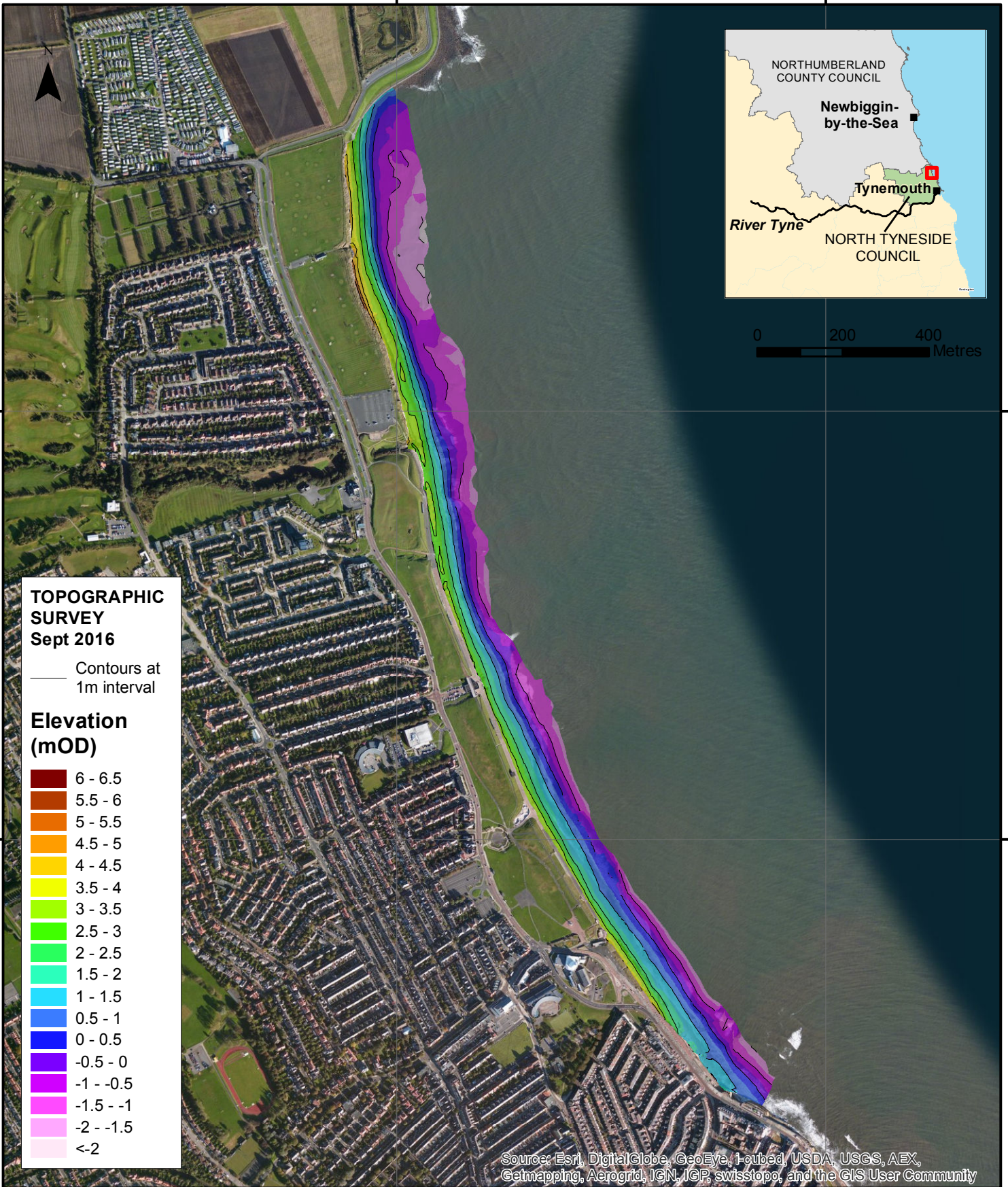
The following sediment feature codes are used on some profile plots:

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

Appendix B
Topographic Survey

435000

436000



Appendix B - Map 1

WHITLEY SANDS

North Tyneside Council Frontage

Analytical Report
'Full Measures' Survey 2016

Drawing Scale at A4 1:12,000

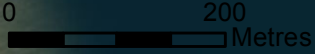
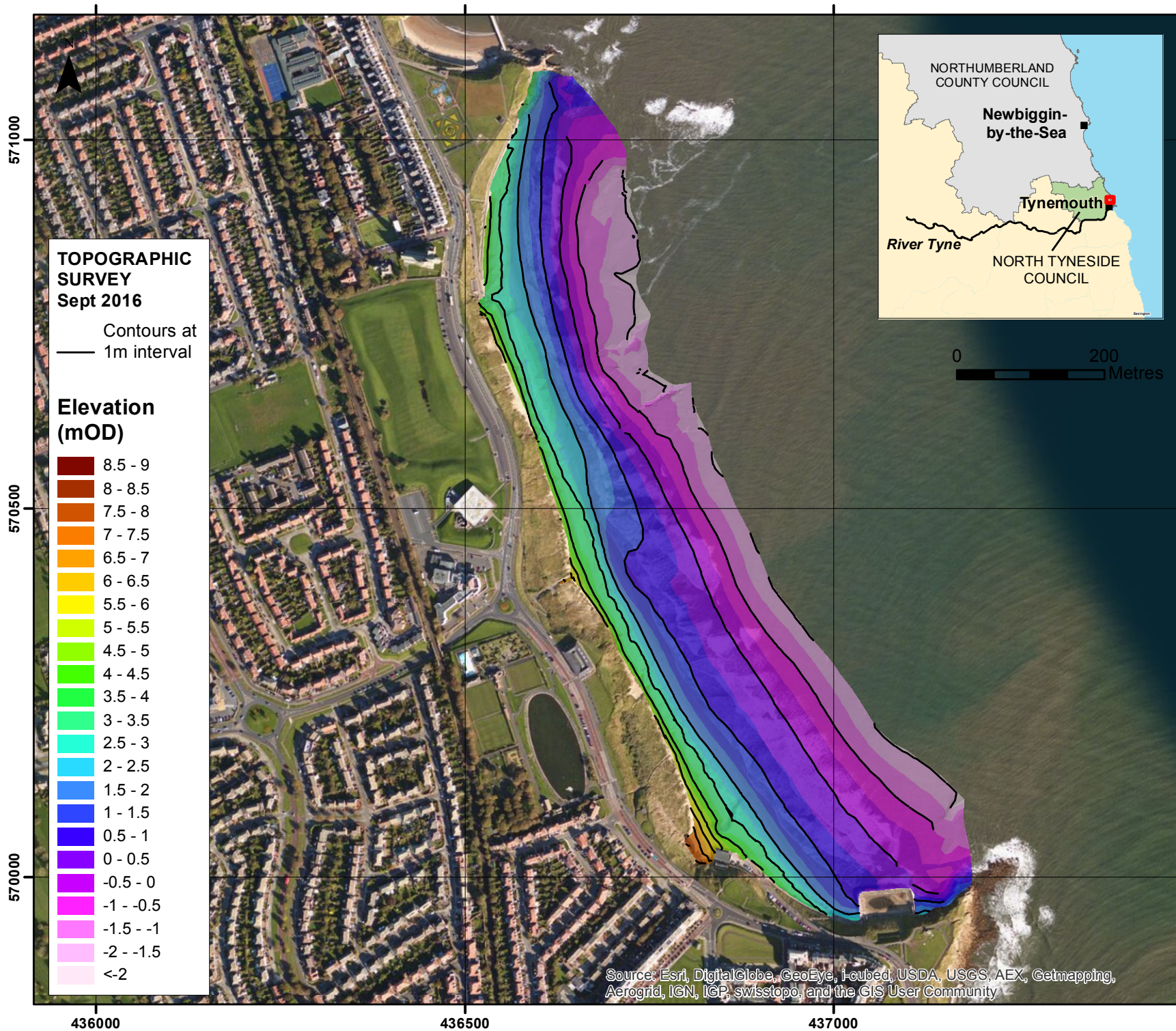
Client:
North East Coastal Group

Project:
Cell 1 Regional Coastal Monitoring Programme

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Client: North East Coastal Group
 Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 2
LONGSANDS

North Tyneside Council Frontage

Analytical Report
 'Full Measures' Survey 2016

Drawing Scale at A4 1:7,000

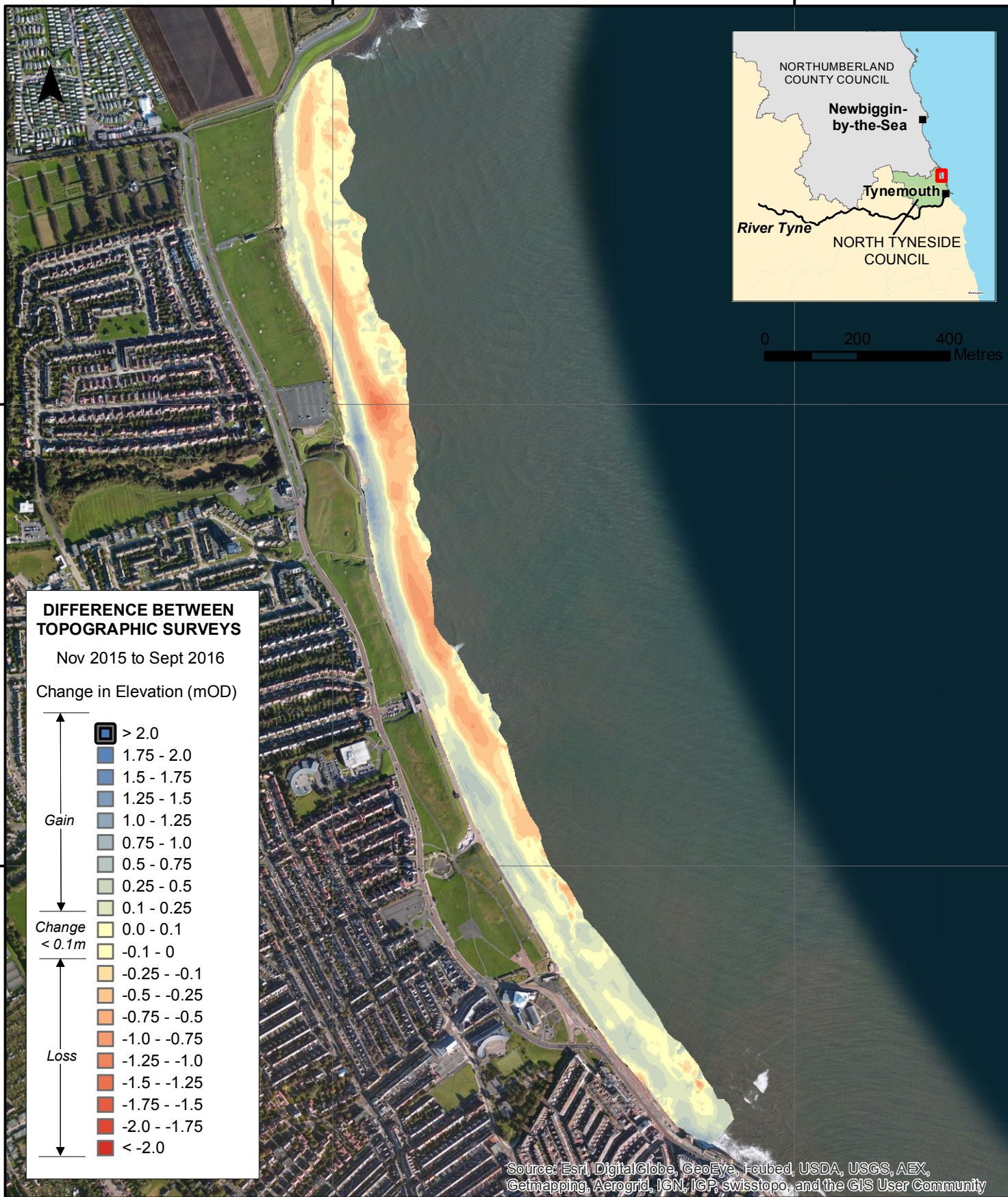
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435000

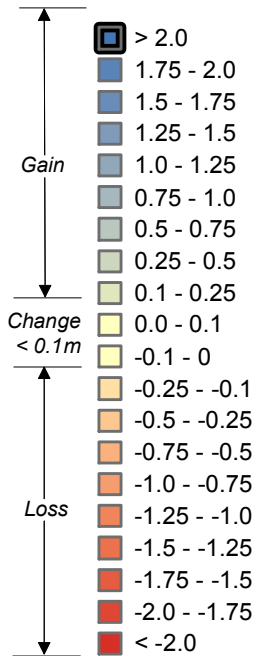
436000



DIFFERENCE BETWEEN TOPOGRAPHIC SURVEYS

Nov 2015 to Sept 2016

Change in Elevation (mOD)



Source: Esri, DigitalGlobe, GeoEye, I-ubed, USDA, USGS, AEX, Getmapping, AeroGrid, IGN, IGP, swisstopo, and the GIS User Community

Appendix B - Map 3

WHITLEY SANDS

North Tyneside Council Frontage

Analytical Report
 'Full Measures' Survey 2016

Drawing Scale at A4 1:11,209

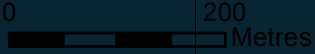
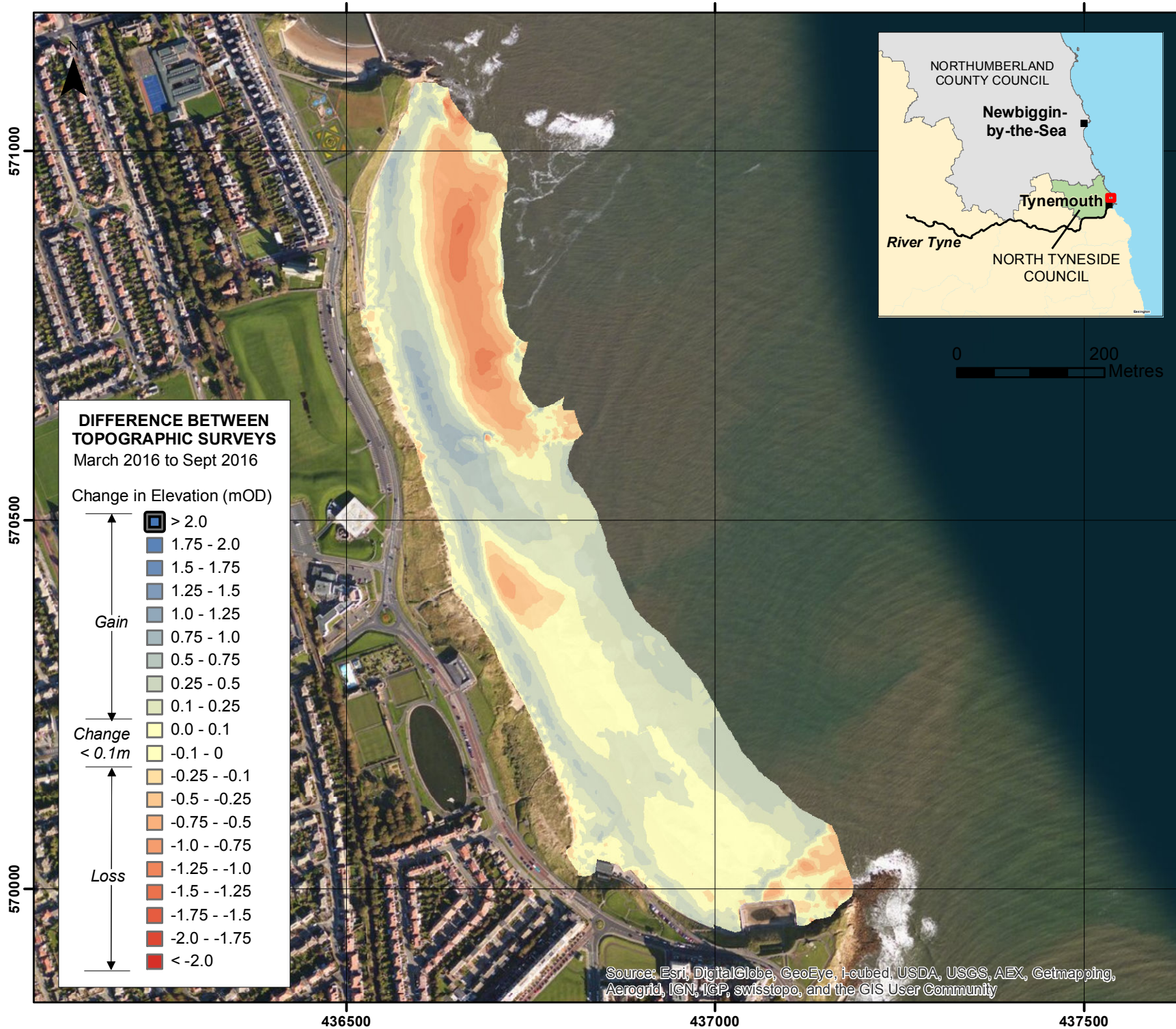
Client:
 North East Coastal Group

Project:
 Cell 1 Regional Coastal Monitoring Programme

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Client: North East Coastal Group
Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 4

LONGSANDS

North Tyneside Council Frontage

Analytical Report
'Full Measures' Survey 2016

Drawing Scale at A4 1:7,000

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