Cell 1 Regional Coastal Monitoring Programme Update Report 9: 'Partial Measures' Survey 2017

Northumberland County Council

July 2017

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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)		
	Berwick upon Tweed	Holy Island	North Sunderland
1 in 200 year	3.4	3.4	3.5
HAT	2.8	2.8	2.8
MHWS	2.2	2.4	2.4
MLWS	-1.9	-1.8	-1.7
Water Level Parameter	**Water Level (m AOD)**		
	Amble	**Blyth**	**River Tyne**
1 in 200 year	3.5	3.6	3.7
HAT	3.1	3.1	3.1
MHWS	2.4	2.4	2.4
MLWS	-1.9	-1.8	-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).

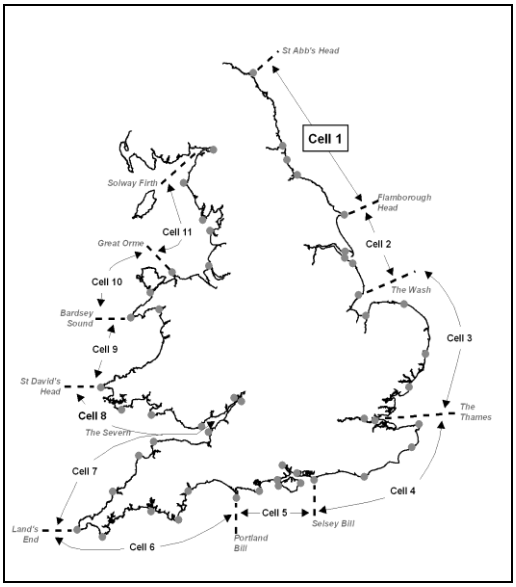


Figure 1 Sediment Cells in England and Wales

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 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 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	Sept-Dec 08	May 09	Mar-May 09		-
2	2009/10	Sept-Dec 09	Mar 10	Feb-Mar 10	Jul 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	Feb13	-
5	2012/13	Sept-Nov 12	Mar 13	Mar-Apr 13	Jun 13	-
6	2013/14	Sept-Oct 13	Feb 14	Mar-Apr 14	Jul 14	-
7	2014/15	Sept-Nov 14	Feb 15	Mar-Apr 15	Jul 15	-
8	2015/16	Sept-Dec 15	Feb 16	Mar-May 16	Jul 16	Jun 16
9	2016/17	Aug-Nov 16	Mar 17	Feb-Apr 17	Jul 17 (*)	

(*) The present report is **Update Report 9** and provides an analysis of the 2017 Partial Measures survey for Northumberland County Council's frontage.

1. Introduction

1.1 Study Area

Northumberland County Council's frontage extends from the Scottish border in the north to Hartley, just south of Blyth, in the south. For the purposes of this report and for consistency with previous reporting, it has been sub-divided into 15 areas, namely:

- Sandstell Point (Spittal A)
- Spittal (Spittal B)
- Goswick Sands
- Holy Island
- Bamburgh
- Beadnell Village
- Beadnell Bay
- Embleton Bay
- Boulmer
- Alnmouth Bay
- High Hauxley and Druridge Bay
- Lynemouth Bay
- Newbiggin-by-the-Sea
- Cambois
- Blyth South Beach

1.2 Methodology

Along the Northumberland frontage, the following surveying is undertaken:

Full Measures survey annually each autumn comprising:

- Beach profile surveys along 78 transect lines (commenced 2002)
- Beach profile surveys along an additional ten transect lines (commenced 2007)
- Beach profile surveys along an additional 26 transect lines (commenced 2010)
- Topographic survey along Holy Island (commenced 2004)
- Topographic survey along Alnmouth Bay (commenced 2005)
- Topographic survey along Sandstell Point (commenced 2009)
- Topographic survey along Newbiggin Bay (commenced 2010)

Partial Measures survey annually each spring comprising:

- Beach profile surveys along 29 transect lines (commenced 2002)
- Beach profile surveys along an additional ten transect lines (commenced 2007)
- Beach profile surveys along an additional one transect line (commenced 2010)
- Beach profile surveys along an additional two transect lines (commenced 2011)
- Topographic survey along Alnmouth Bay (commenced 2005)
- Topographic survey along Sandstell Point (commenced 2009)
- Topographic survey along Newbiggin Bay (commenced 2010)

Cliff top survey (bi-annually) at:

- Cliff top survey at Lynemouth Bay (commenced 2008)
- Cliff top survey at Cambois Bay (Sandy Bay) (commenced 2008)
- Cliff top survey at Cambois Bay (Cambois) (commenced 2009)

Sand extent survey (bi-annually) at:

- Edge of sand survey at Newbiggin Bay, Spital Carrs, (commenced 2011 to determine potential adverse impact on foreshore SSSI of the Newbiggin beach recharge scheme)

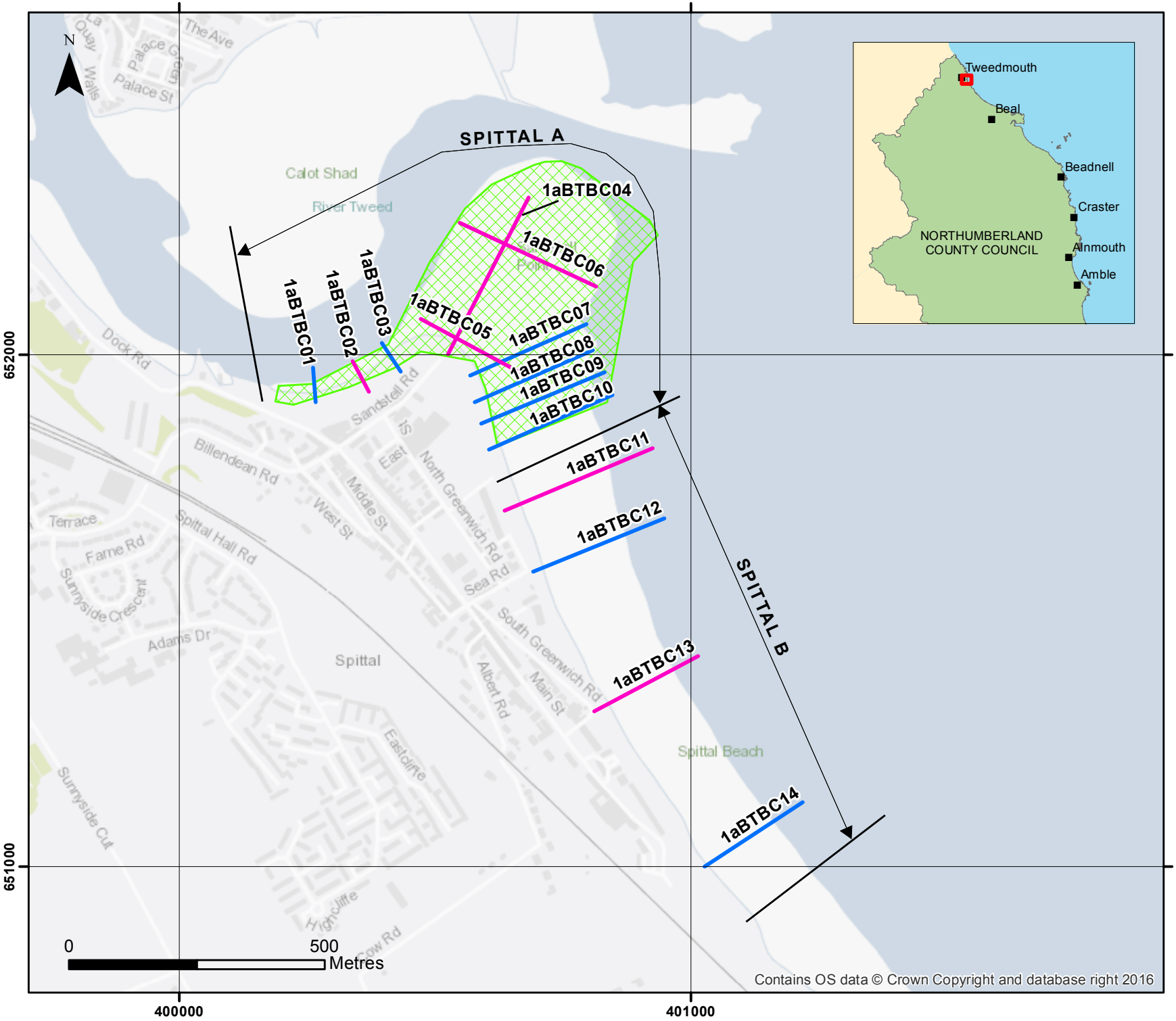
For all cliff-top surveys prior to Full Measures 2011, the data was previously saved in '.kmz' format for plotting and visual comparison in GoogleEarth. This data has been visualised in GIS, which revealed the quality was variable and reliable interpretations of short-term cliff change could not be made. For the present and future surveys, the data will be plotted in GIS and change will qualified along a series of pre-defined transect lines. The resulting data on amount and rate of change is presented in tables and the survey results are compared.

The location of these surveys is shown in Figure 2. The Partial Measures survey was undertaken along this frontage between 27th February to 28th April 2017. During this time weather conditions varied considerably; refer to the survey reports for details of the weather conditions over this survey period.

The Update Report presents the following:

- 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
- key conclusions and highlighting of 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

Northumberland County Council Frontage

Analytical Report
Topo Surveys

Drawing Scale at A4 1:10,000

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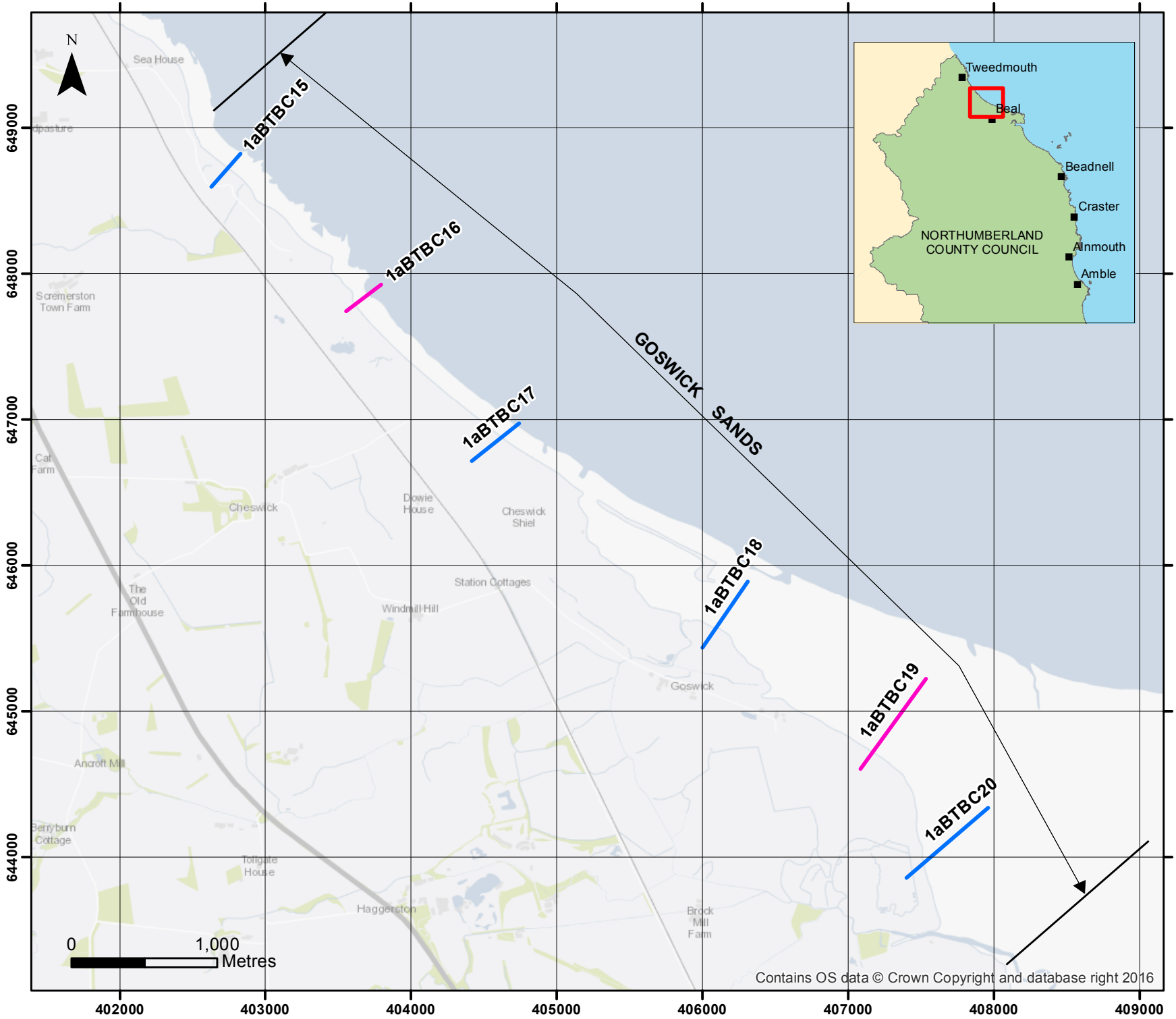

Key

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

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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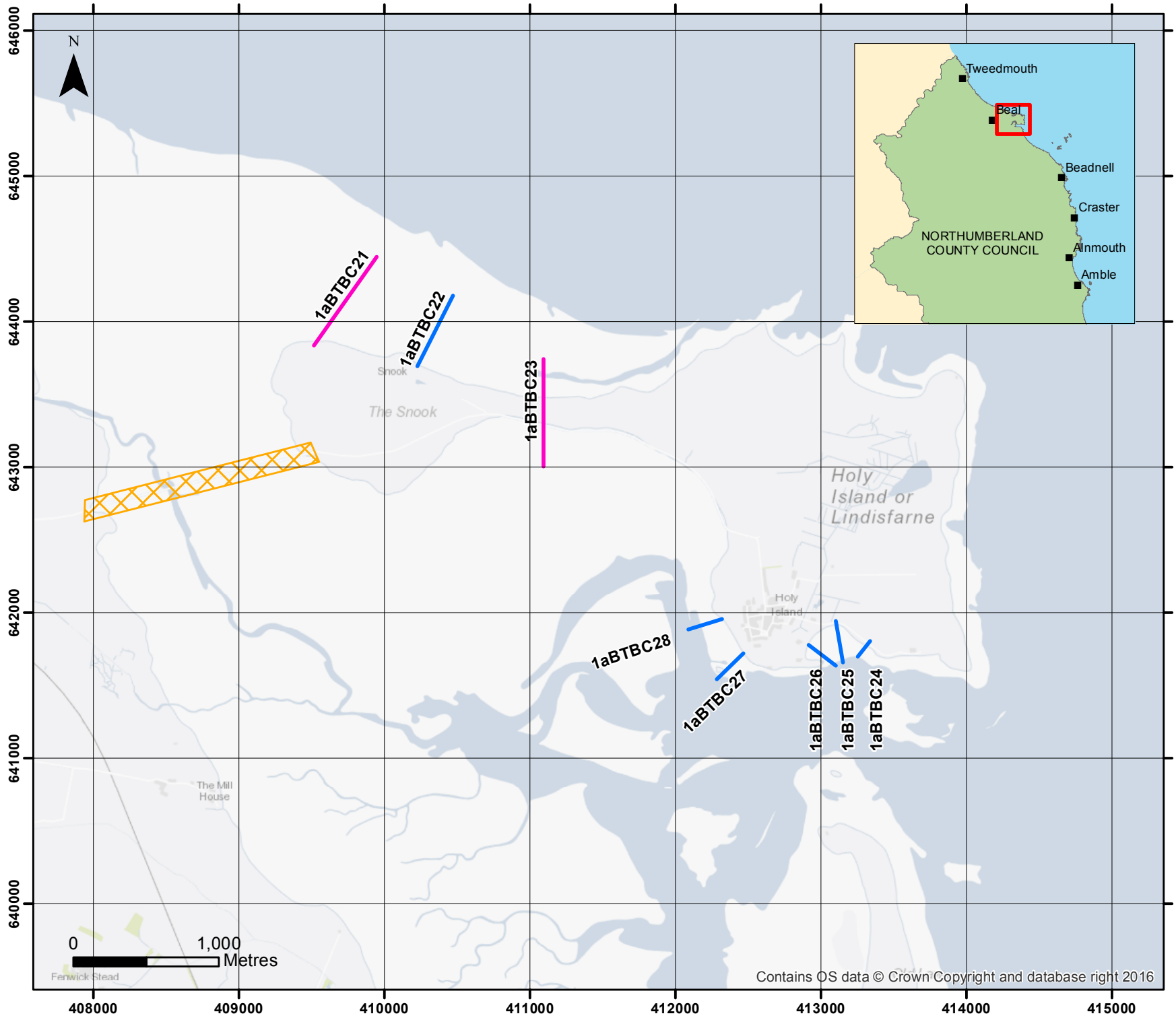

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly

(Indicative Survey Extents shown)

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Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 3

Northumberland County Council Frontage

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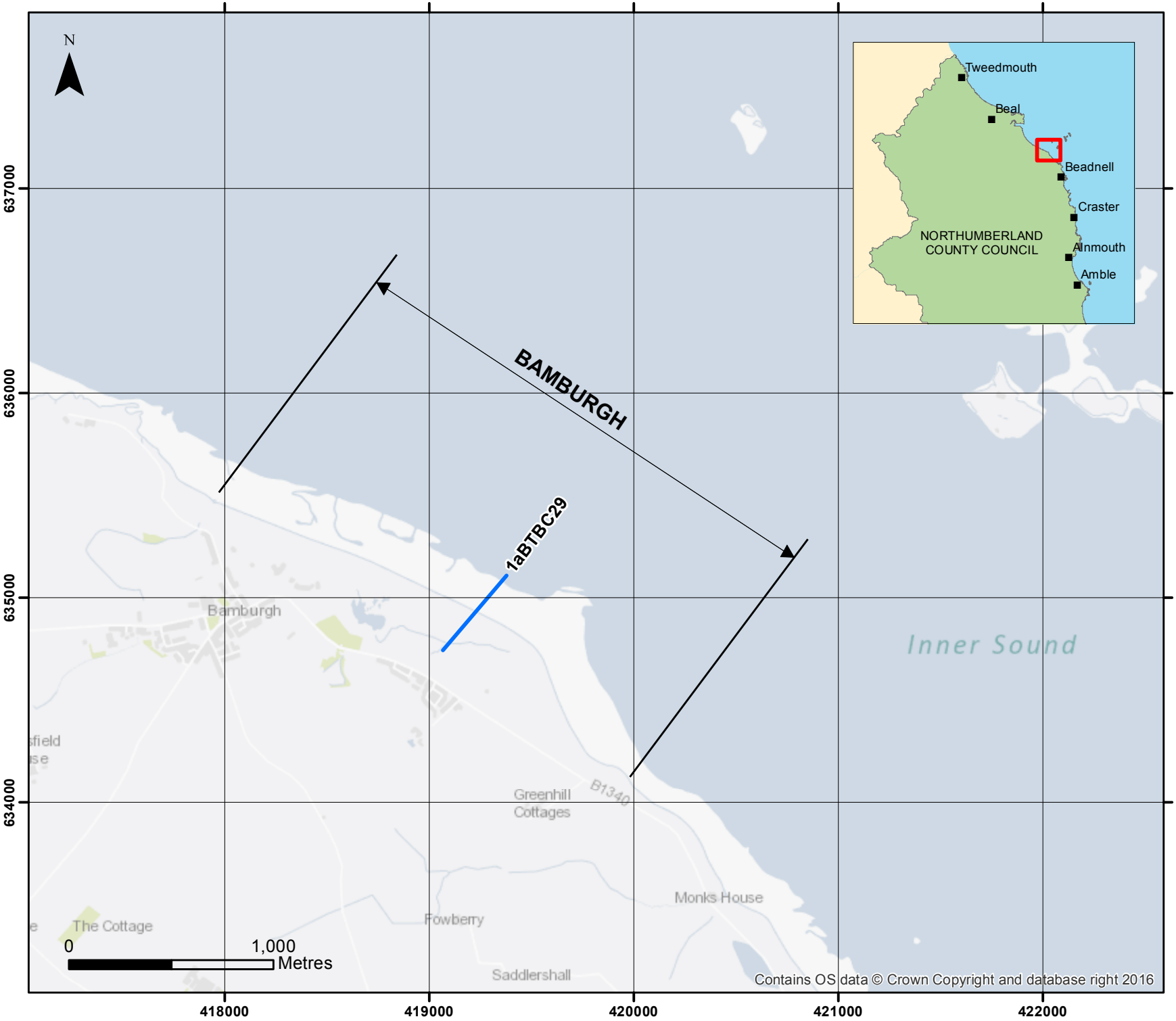

Key

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 4

Northumberland County Council Frontage

Analytical Report
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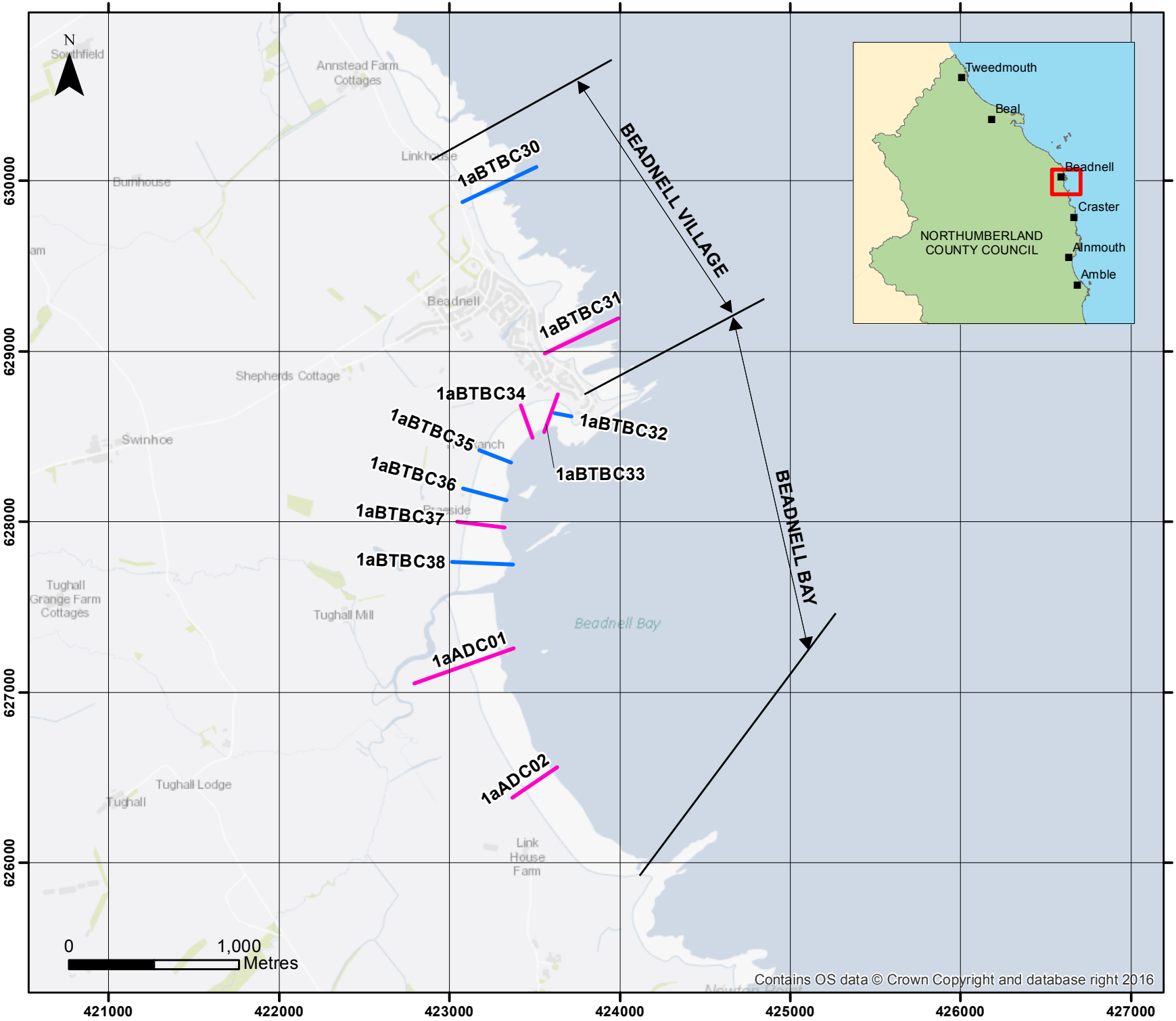

Key

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 5

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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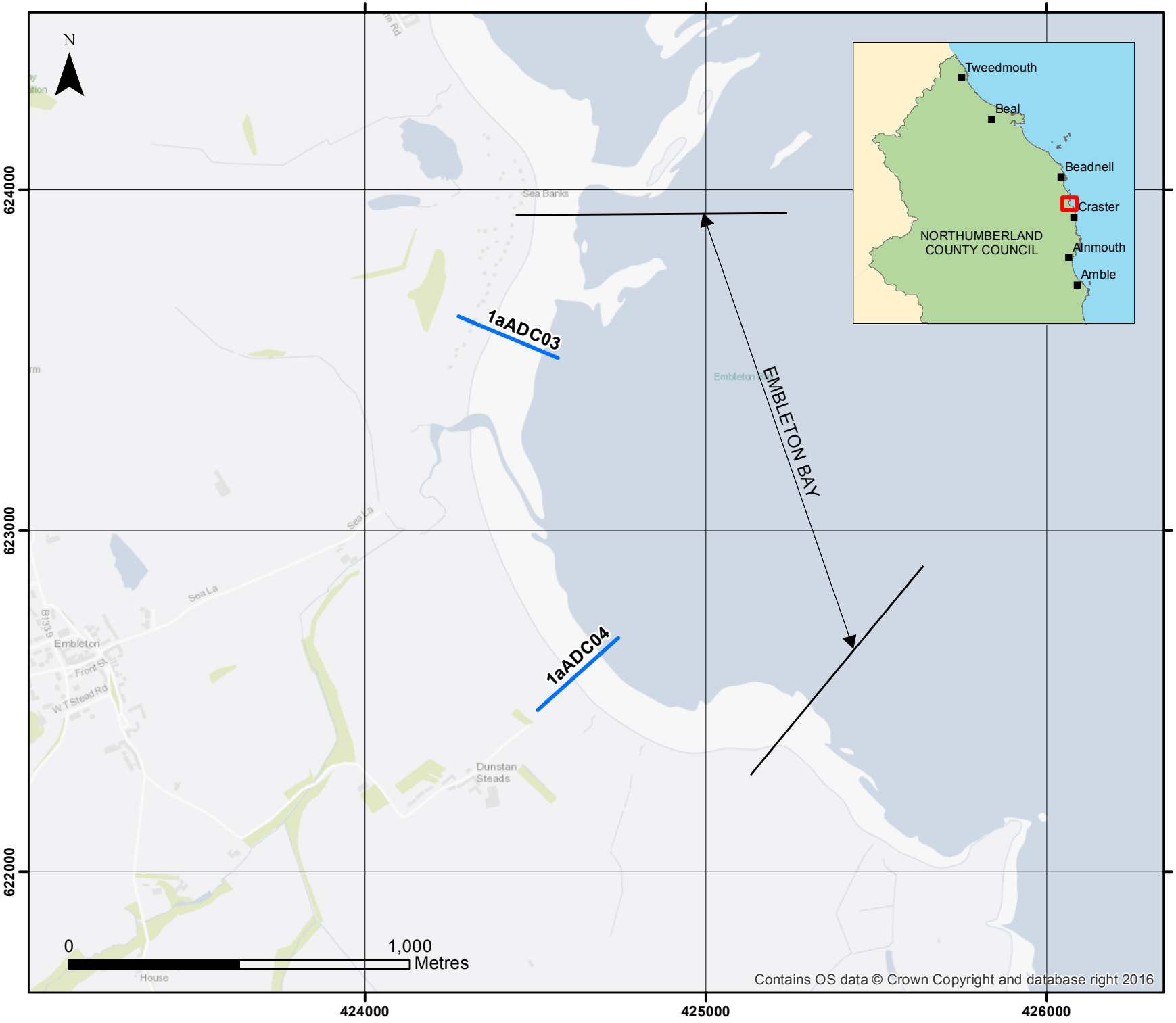

Key

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 6

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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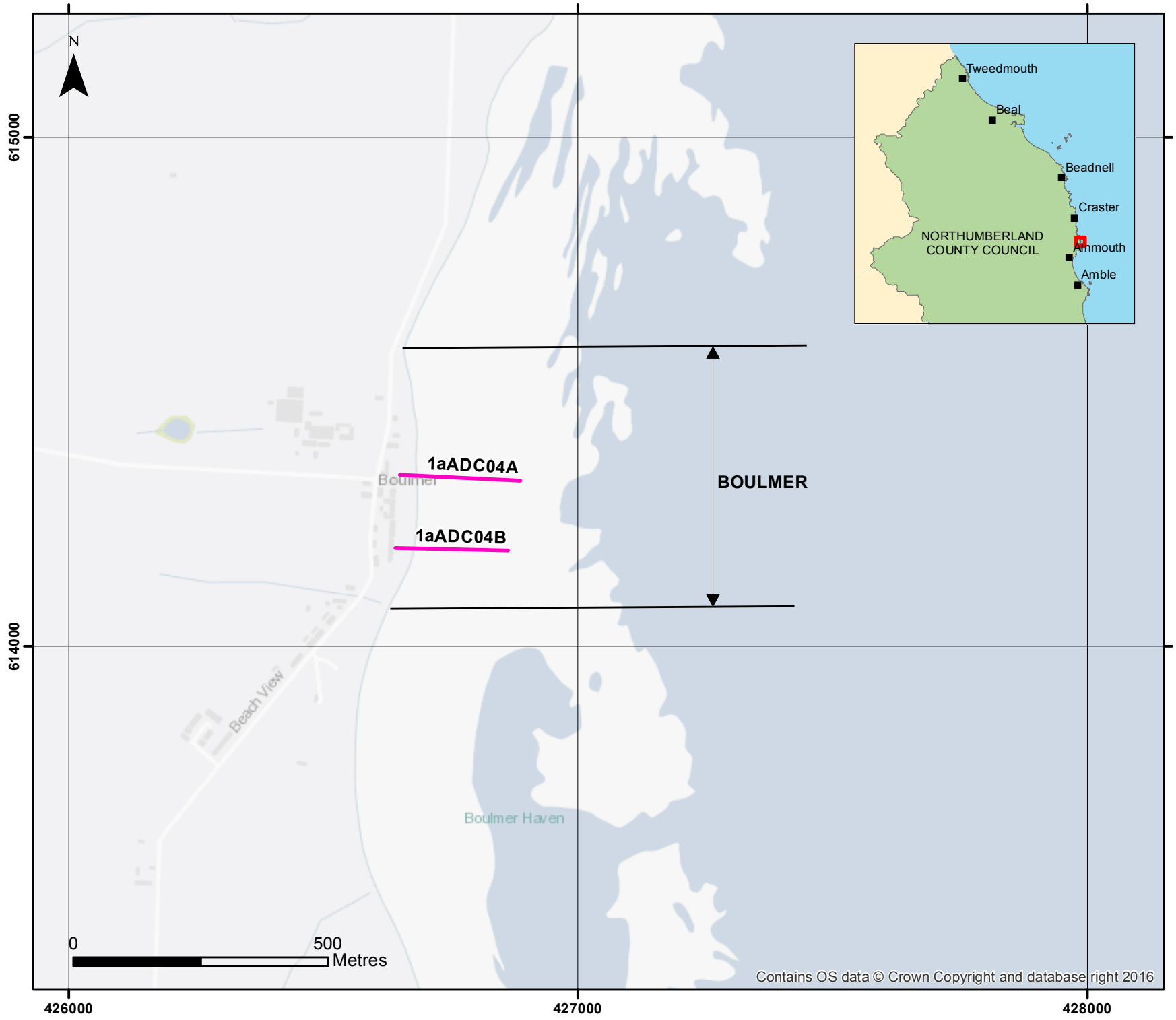

Key

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 7

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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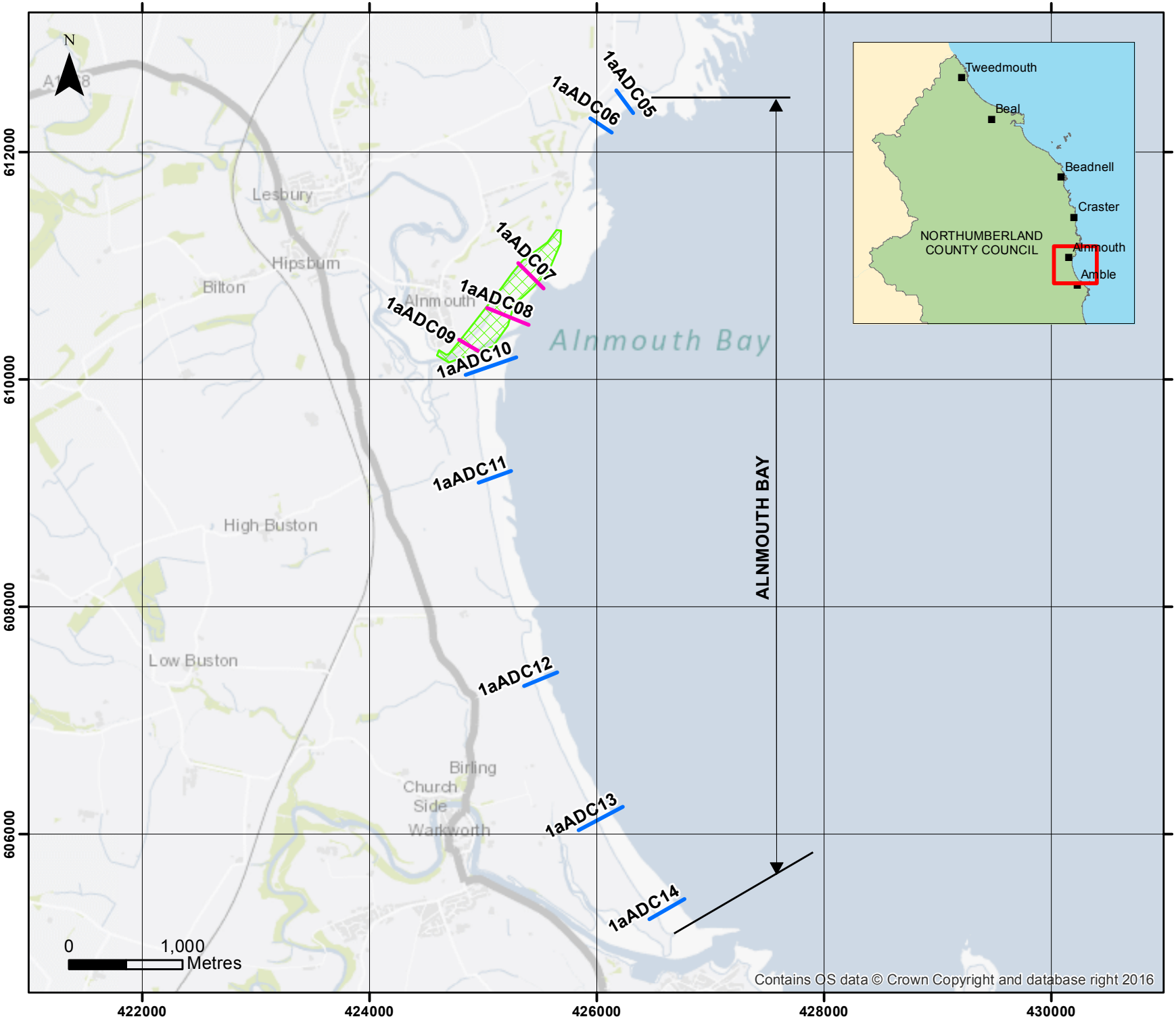

Key

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 8

Northumberland County Council Frontage

Analytical Report
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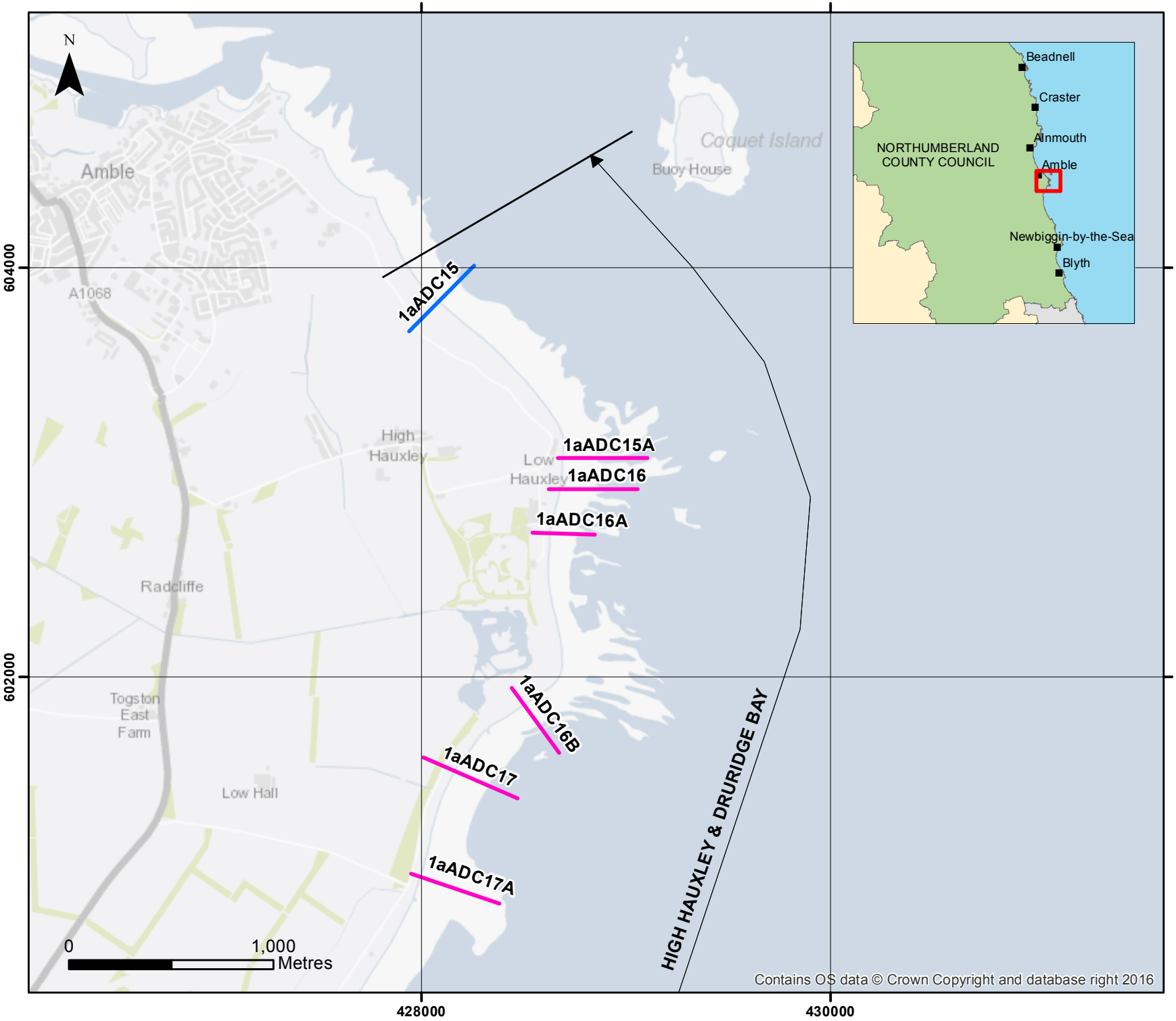

Key

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 9

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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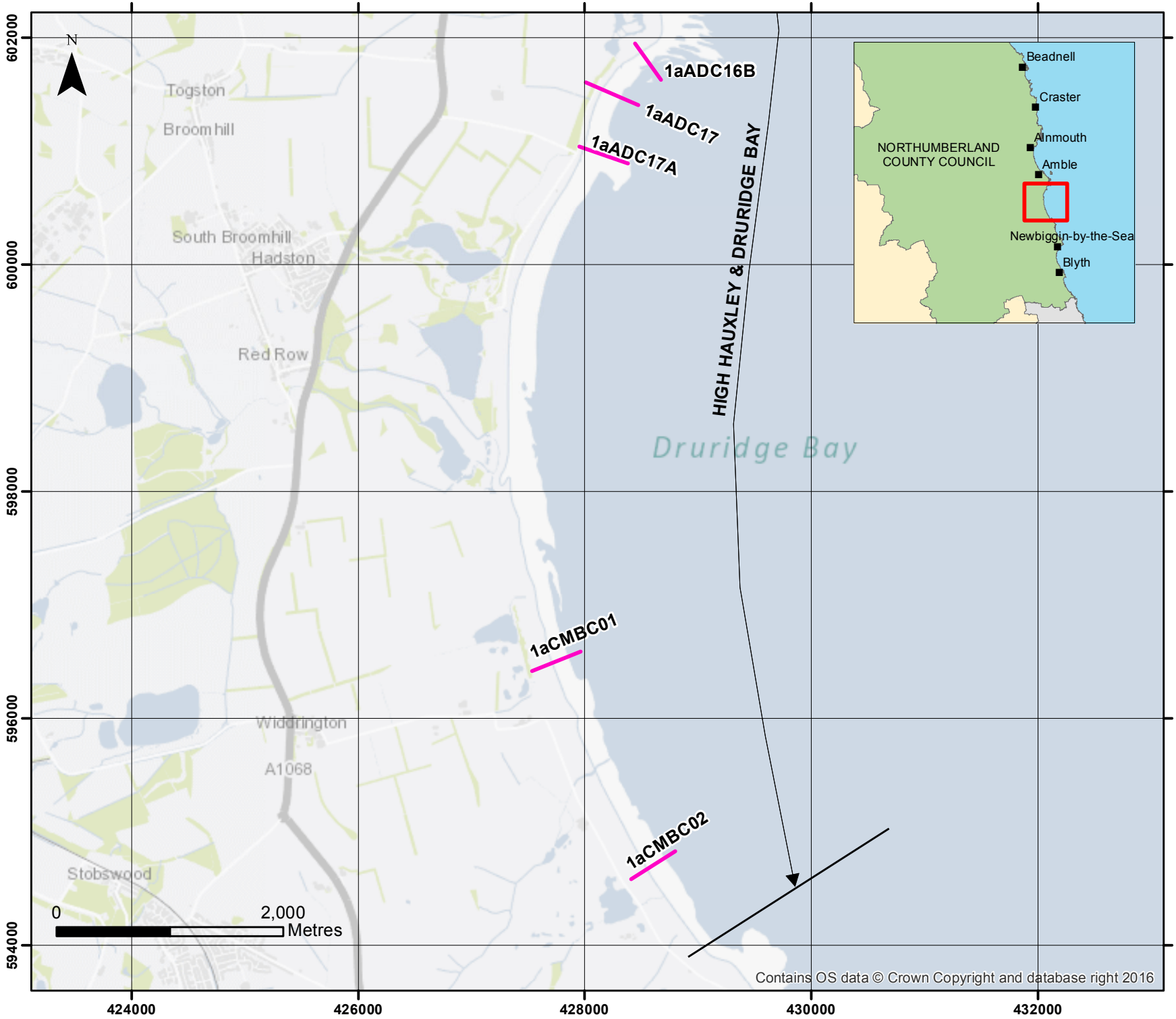

Key

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 10

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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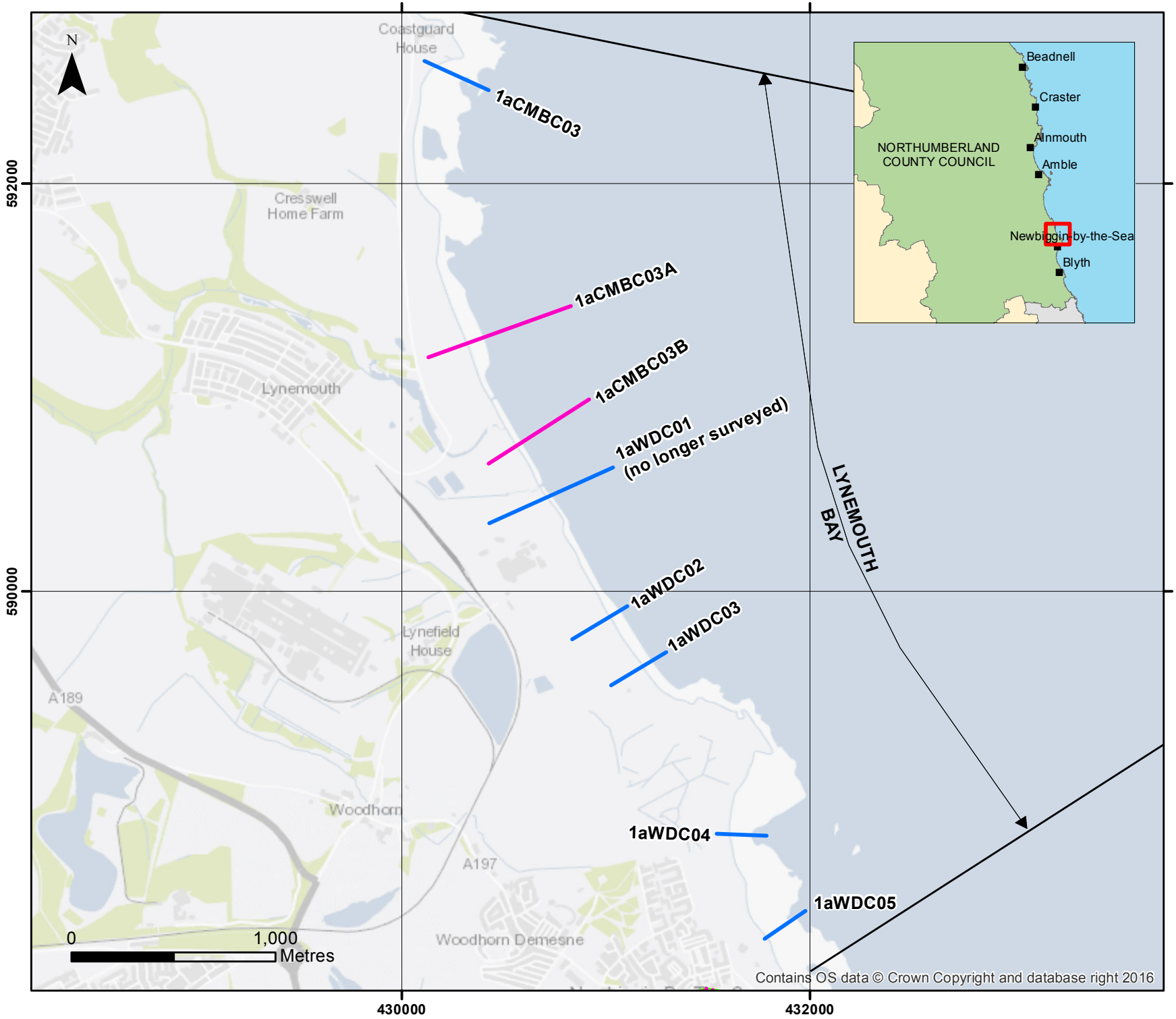

Key

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 11

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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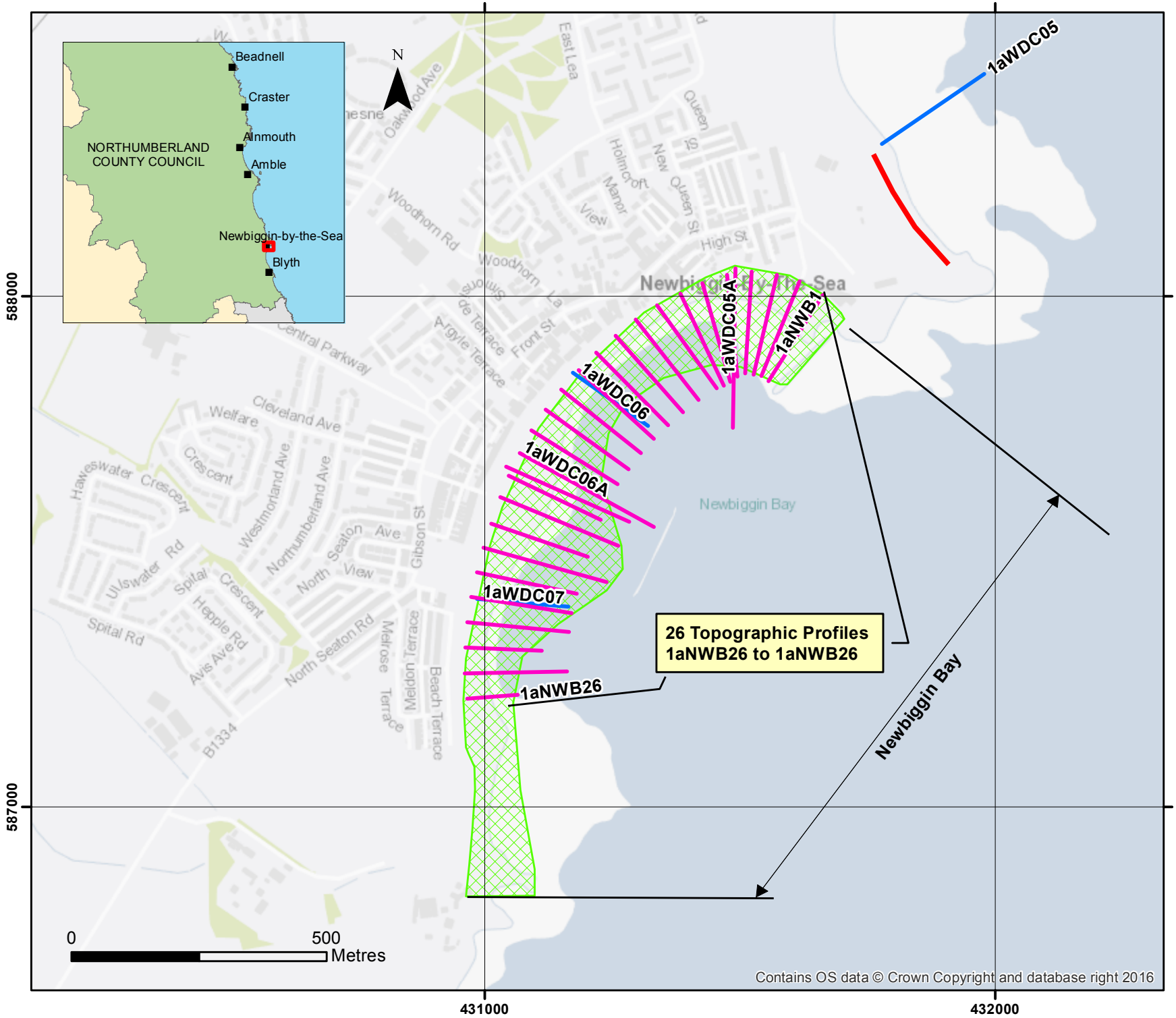

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual

Topographic Surveys

- 6 monthly
- yearly
- 5 yearly
- Cliff Top Edge Survey

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Figure 2 - Map 12

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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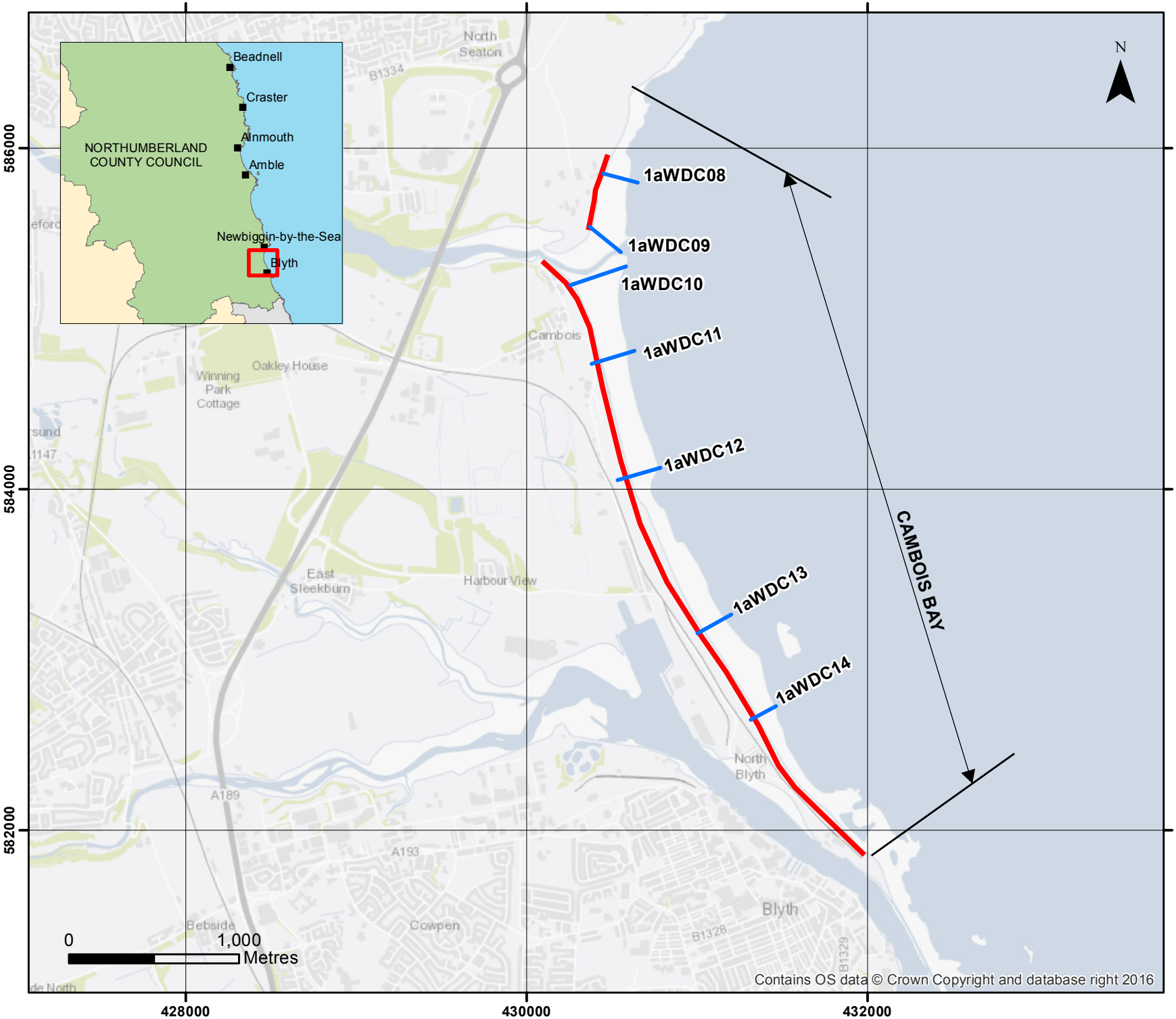

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual
- Cliff Top Edge Survey

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 13

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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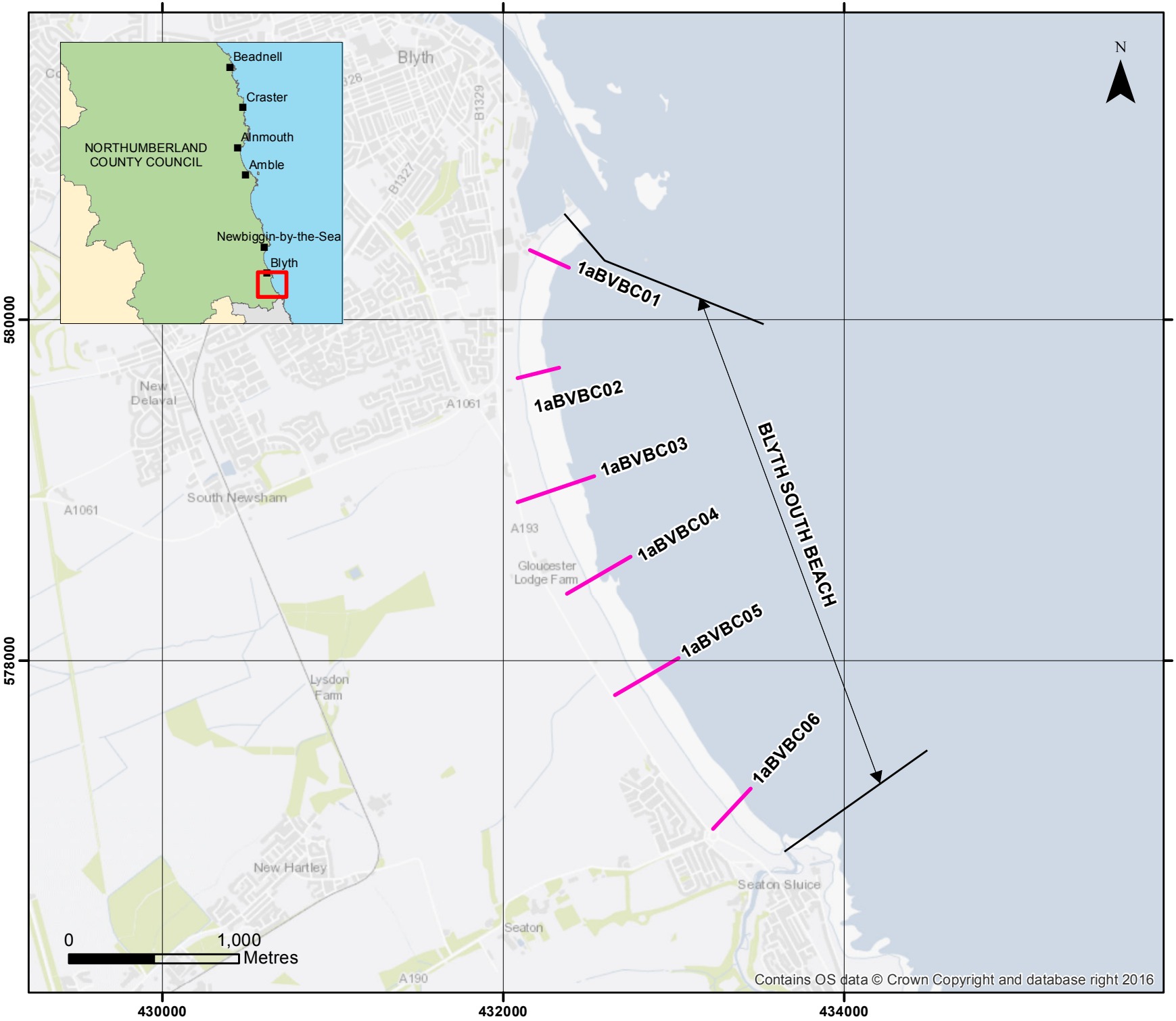

Key

SURVEY LOCATIONS

Topographic Profiles

- Annual
- Bi-Annual
- Cliff Top Edge Survey

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 14

Northumberland County Council Frontage

Analytical Report
Topo Surveys

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2. Analysis of Survey Data

2.1 Sandstell Point (Spittal A)

Survey Date	Description of Changes Since Last Survey	Interpretation
3rd March 2017	**Beach Profiles:** Sandstell Point is covered by four beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2016. Profile **1aBTBC02** is located on the southern bank of the inner Tweed estuary. The dunes have remained stable with no changes in height or position. The beach levels between the dune front at chainage 41m and chainage 58m have increased by up to 0.7m. Seawards of chainage 58m there has been varying erosion and accretion but limited to <0.2m (the majority being <0.1m). Overall the profile is at a medium level compared to the range recorded from previous surveys. Profiles **1aBTBC04** (longitudinal section) and **1aBTBC05** and **1aBTBC06** (both cross-sections) cover the spit at Sandstell Point. Profile **1aBTBC04** shows that the spit has generally accreted along its length, with the exception of up to 0.7m of erosion towards the landward end between chainage 10m and 35m. Between chainage 35m and 150m there has been minor accretion of up to 0.6m but more typically <0.2m. Between chainage 150m and the end of the profile at chainage 365m there has been significant accretion of the berm recorded in the previous survey (at chainage 230m) by up to 2.7m, and of the end of the spit by up to 1.5m, which has resulted in the toe extending seawards by c.60m. The profile is at a relatively medium-low level from the landward end to chainage 140m, and from chainage 260m to its seaward end, and at its highest recorded level across the berm (chainage 160m to 250m). Profiles **1aBTBC05** and **1aBTBC06** are transects across the spit, with the open sea on the left-hand side of the plot and the river channel to the right. At **1aBTBC05**, there has been accretion on the sea-side as far as chainage 155m of up to 1.8m, and erosion on the river-side of up to 1.7m, suggesting material has been moved seawards. The river-side face of the spit has moved seawards by c.10m. Overall the profile is generally within the range recorded from previous surveys, however the sea-side berm is at its most seawards recorded position. At **1aBTBC06** the sea-side face has moved river-wards by c.150m, losing the berm (chainage -60m) at	Since the last survey, the dunes along the south bank of the River Tweed have remained stable. There have been considerable changes to the profiles around the mouth of the River Tweed on Sandstell Point. The spit has been particularly dynamic, rotating around the headland in an anti-clockwise direction. **Longer term trends:** The small change in dune profile is within the bounds of previous surveys that indicate they have remained stable over the past 11 years. The beach profiles show that the form of the spit is generally within the range of past observations, although levels are relatively low in the longitudinal section (1a BTBC04). The wide variation in profile forms over time is indicative of this being one of the most dynamic systems on the north east coast.

Survey Date	Description of Changes Since Last Survey	Interpretation
	its toe previously recorded in the September 2016 survey. The sea-side berm previously recorded at chainage 120m has decreased in height by 0.5m and moved river-wards by c.20m. The river-side berm previously recorded at chainage 170m has increased in height by 1.8m and moved river-wards by c.40m. The river-side toe has extended its position by c.20m. Overall the profile is generally withint eh range recorded from previous surveys, however the river-side berm shows the highest recorded levels for that chainage (180m to 240m), however the berm has recorded higher levels in other locations. The combination of movement observed at 1aBTBC05 and 1aBTBC06 suggests the river channel has migrated , pushing the base of the spit seawards and rotating the head of spit in an anti-clockwise direction.	
April 2017	**Topographic Survey:** Due to the significant changes that have been observed from the beach profiles along the spit at Sandstell Point and the three dimensional nature of these changes, a topographic survey was introduced to the monitoring programme in 2011. The previous survey was undertaken for the Full Measures survey in autumn 2016. Data from the most recent topographic survey (Partial Measures, spring 2017) have been used to create a digital ground model (DGM) (Appendix B – Map 1a) using a Geographical Information System (GIS). A difference plot has also been produced using the DGM (Appendix B – Map 1b) produced from the last produced topographic survey and the present survey. In particular, the difference plot shows: (i) little change in the dunes on the south bank of the River Tweed; (ii) decrease in the beach elevation along the northwest edge of the survey area just off the edge of the land; (iii) on the seaward side of the spit a band of elevation decreases running parallel to the shore in a NNW-SSE orientation, before turning NE-SW at the head of the spit (iv) beach elevation increase in the centre of the survey area running broadly N-S; (v) a patch of elevation increase in the north east of the survey area.	The findings of the topographic survey show similar trends to the profile survey. This appears to show erosion in the upper beach and migration of both the river channel and the spit in an anti-clockwise direction around the headland.

2.2 Spittal (Spittal B)

Survey Date	Description of Changes Since Last Survey	Interpretation
3RD March 2017	**Beach Profiles:** Spittal B is covered by two beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2016. Profile **1aBTBC11** is located to the north of Spittal Beach. The dunes have increased in height by 0.2m. From the edge of the dunes at chainage 10m to chainage 40m there has been erosion of up to 1.2m. Between chainage 40m and 90m there has been accretion of up to 0.7m. Between chainage 90m and 140m there has been very little change, ±0.2m. Seawards of chainage 140m there has been accretion on the lower beach of up to 0.6m, pushing the toe of the beach seawards by c.30m. Overall the profile is generally at a relatively high level compared to the range recorded from previous surveys with the lower beach between chainage 180m and 210m having its highest recorded levels, however the upper beach is relatively low. Profile **1aBTBC13** is located towards the centre of Spittal Beach. Beach levels here generally show a decrease in levels. The upper beach to chainage 45m shows erosion of up to 1.7m. Between chainage 45m and 95m there has been very little change, ±0.1m. From chainage 95m seawards there has been erosion of up to 0.4m. Overall the profile is at a medium-low level compared to the range recorded from previous surveys.	Since the last survey, the changes in beach level have been variable indicating a redistribution of sediment throughout the profiles, with erosion particularly dominant on the upper beach. **Longer term trends:** At both profile locations along Spittal Beach, the changes observed from the present survey are generally within the bounds of previous surveys.

2.3 Goswick Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
13th April 2017	**Beach Profiles:** Goswick Sands are covered by two beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2016. Profile **1aBTBC16** is located to the north of Goswick Sands, between Far Skerr and Cheswick Black Rocks. The dune has remained stable since the last survey. The beach at the toe of the dune has dropped by up to 0.5m. Seawards of chainage 70m there has been accretion across the rest of the beach of up to 0.4m, with the lower beach berm at chainage 175m becoming more pronounced. Overall the profile is at a very high level compared to the range recorded from previous surveys, particularly the lower beach berm which is highest level on record. Profile **1aBTBC19** is located to the south of Goswick Sands. The dunes have remained largely stable since the last survey, with changes restricted to ±0.1m. Beach levels have changed by no more than 0.1m as far as the end of the previous survey. However the present survey extends c.200m further than the previous survey, indicating that sediment has accumulated in the lower beach, similar to previous spring surveys. Beach levels are at a relatively medium level compared to the range recorded from previous surveys.	Beach levels have fallen at the toe of the dunes but risen over the rest of the profile in the north at Goswick Sands, whilst there has been little change in the south. **Longer term trends:** Both profiles are within the range recorded from previous surveys. However, the range of variation on record is limited compared to beaches elsewhere along the north east coast.

2.4 Holy Island

Survey Date	Description of Changes Since Last Survey	Interpretation

Survey Date	Description of Changes Since Last Survey	Interpretation
13th April 2017	**Beach Profiles:** Holy Island is covered by two beach profile lines for the Partial Measures surveys (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2016. **1aBTBC21** and **1aBTBC23** are located on the north-west side of the island, along The Snook. At profile **1aBTBC21** the dunes have remained stable since the last survey. Beach levels have experienced negligible change as far as 675m chainage. The toe of the beach seawards of chainage 675m shows erosion of up to 0.4m. The beach is near its lowest level relative to earlier surveys, particularly at the toe which is at its lowest recorded level from chainage 600m seawards. Profile **1aBTBC23** shows that the dunes and beach have remained stable since the last survey. Overall the beach levels seaward of The Snook are at a medium level compared to the range recorded from earlier surveys.	The dunes, sandy foreshore and sand flats around The Snook have remained stable in both form and position since the last survey. **Longer term trends:** The minor changes observed since the last survey are within the bounds of previous surveys although the beaches at both locations are low-medium relative to the overall survey record.

2.5 Beadnell Village

Survey Date	Description of Changes Since Last Survey	Interpretation
12th April 2017	**Beach Profiles:** Beadnell Village is covered by one beach profile line for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2016. **1aBTBC31** is in Nacker Hole and extends across the promenade and seawall. Since the last survey, the beach profile has remained relatively stable, with only changes of ±0.1m recorded. However the profile is generally at a relatively low level compared to the range recorded from the previous surveys (with exception of the upper beach which is at a more medium level), particularly between chainage 33m and 45m where the lowest levels on record occur. .	The beach to the south of Beadnell Village has generally remained stable. **Longer term trends:** The changes observed since the last survey are within the bounds of previous surveys.

2.6 Beadnell Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
12th April 2017	**Beach Profiles:** Beadnell Bay is covered by five beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2016. Profiles **1aBTBC33** and **1aBTBC34** are located in Beadnell Harbour to the north of Beadnell Bay. Profile **1aBTBC37** is located further south towards the outfall of Brunton Burn/Long Nanny. At **1aBTBC33**, the beach profile shows no change to the dunes. However, the survey report notes that the middle of the dunes were not surveyed due to access difficulties created by vegetation. Beach level changes are restricted to <0.2m, and tend to show erosion, with the exception of a small area of accretion between chainage 70m and 90m. The profile is at a relatively lwo level compared to the range recorded from previous surveys. At profile **1aBTBC34**, the dunes have remained mostly stable; however the toe has retreated by c.0.5m. Between the dune toe and the exposed boulders at chainage 95m, there has generally been erosion of up to 0.3m, with the exception of a small area of accretion between chainage 30m and 45m. Seaward of the exposed boulders there has been very little change, ±0.1m. Overall the profile is at a medium level compared to the range recorded from previous surveys. At **1aBTBC37**, the dunes have remained mostly stable since the last survey; however the toe has retreated by c.1.0m. Between the dune toe and chainage 200m there has generally been erosion of up to 0.4m, except for a small area of accretion between chainage 40m and 70m. Seawards of chainage 200m there has been very little change, ±0.1m. Overall the profile is at a medium-high level compared to the range recorded from previous surveys, with the upper beach between chainage 40m and 60m being the highest on record. Profiles **1aADC01** and **1aADC02** are located along the frontage to the south of the outfall of Brunton Burn/Long Nanny. The dunes at 1aADC01 and 1aADC02 have not changed form or position. At **1aADC01** beach levels from the dune toe as far as 520m chainage have undergone erosion of up to 0.4m, with the exception of a small area of accretion between chainage 280m and 310m. The toe of the beach from chainage 520m to 540m also shows accretion of 0.2m. Overall the profile is at a medium	Along the length of Beadnell Bay, the dunes have remained largely stable since the last survey. The lower dune face/dune toe and upper beach have experienced variable, limited erosion and accretion. The rest of the beach profile has experienced more limited change. **Longer term trends:** Along the length of Beadnell Bay, the dunes are of a similar form to those observed in the past. The changes in beach profile form and position observed since the last survey are generally within the bounds of previous surveys.

Survey Date	Description of Changes Since Last Survey	Interpretation
	level compared to the range recorded from previous surveys. At profile **1aADC02** beach levels at the dune toe has receded landward by c.3m Changes in the rest of the profile are negligible, showing erosion of <0.2m, except at the toe of the beach where there is accretion of 0.2m. Overall the profile is at a relatively low level compared to the range recorded from previous surveys with the exception of the toe which is high.	

2.7 Boulmer

Survey Date	Description of Changes Since Last Survey	Interpretation
13th March 2017	**Beach Profiles:** Boulmer is covered by two beach profile lines for the Partial Measures survey (Appendix A). These were added to the programme in October 2007. The previous survey was undertaken for the Full Measures survey in autumn 2016. At profile **1aADC04A** there has been a small accumulation of material at the base of the sea defence of 0.2m. From chainage 20m to 60m there has been erosion of up to 0.4m, with the creation of a berm at chainage 35m. The rock platform is exposed from chainage 60m to the end of profile as in the previous survey. Overall the profile is at a medium level compared to the range recorded from previous surveys. At profile **1aADC04B** the backshore (now rock armour) has remained stable since the last survey. Material has accumulated by 0.2m at the toe of the rock armour. Between chainage 20m and the exposed rock platform at chainage 70m there has been erosion of up to 0.4m. Seawards of chainage 70m the rock platform is exposed over the rest of the profile, as it was in the previous survey. The profile is at a relatively high level at the toe of the rock armour, and at a more medium level over the rest of the profile compared to the range recorded from previous surveys.	The dune cliff backshore at Boulmer is now fixed in position by the rock armour at both profiles. Beach levels at both locations in Boulmer have experienced quite limited change since the last survey, with small accumulations at the toe of the rock armour and erosion across the rest of the profile to the exposed rock platform. **Longer term trends:** The changes in beach profile form and position observed since the last survey are within the bounds of previous surveys. The sandy part of the upper beach remains near its highest level on record, and the rocky shore platform continues to be exposed in the lower foreshore.

2.8 Alnmouth Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
13th March 2017	**Beach Profiles:** Alnmouth Bay is covered by three beach profile lines during the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2016. The three profiles are located to the north of Alnmouth Bay between Marden Rocks and the mouth of the River Aln Estuary. At profile **1aADC07** the overall position of the dunes has remained stable since the last survey. The profile has been smoothed out since the last survey, with erosion of up to 0.6m on the upper and lower beach, removing the lower beach berm at chainage 180m, and accretion in the middle beach of up to 0.9m. The toe of the beach also shows accretion of 0.4m with the end of the survey recorded c.80m further seaward than the previous survey. Most of the profile is at a relatively medium level compared to the range recorded from previous surveys, except at the toe which is the highest recorded level from chainage 250m seawards. At profile **1aADC08** the dunes have remained largely stable since the last survey, however the dune toe has retreated by c.2m. Beach levels from the dune toe to chainage 44m have dropped by up to 0.6m. Beach levels seawards of chainage 44m have increased by up to 0.3m, extending the toe of the beach seawards by c.15m. Overall the profile is at a relatively medium level compared to the range recorded from previous surveys. At profile **1aADC09** the dunes have remained stable since the last survey. From chainage 25m to 45m there has been accretion of up to 0.3m. Between chainage 45m and 105m the beach levels have dropped by up to 0.4m, removing the small berm previously recorded at chainage 75m. The toe of the beach seawards of chainage 105m shows accretion of up to 0.5m, steepening the toe. Overall the profile is at a relatively medium level compared to the range recorded from previous surveys, however the toe is at a relatively landward position (reflecting the movement of the river channel).	The dunes in the northern part of Alnmouth Bay have remained stable since the last survey, although some recession of the dune toe has occurred in the north of the bay. Beach level change has been variable and the continued migration of the river channel is the most notable change. **Longer term trends:** The dunes show long-term stability. The changes in beach profile form and position observed since the last survey are within the bounds of previous surveys, although change in the position of the river channel has substantially curtailed profile 1aADC09 and therefore no information is available about beach elevations on the opposite bank of this channel along this profile alignment (this been the case since 2015).

Survey Date	Description of Changes Since Last Survey	Interpretation
March 2017	**Topographic Survey:** The northern part of Alnmouth Bay (to the north of the River Aln estuary) is covered by bi-annual topographic survey, which commenced in April 2005. Data from the most recent topographic survey (Partial Measures, spring 2017) have been used to create a DGM (Appendix B – Map 2a) using a Geographical Information System (GIS). A difference plot has also been produced using the DGM (Appendix B – Map 2b) produced from the last produced topographic survey (Full Measures, autumn 2016) and the present survey. The difference plot shows a mixed pattern of erosion and accretion. The extent and magnitude of erosion and accretion is well balanced. In the south of the survey area there are alternating patches of accretion and erosion progressing northwards along the length of the beach. These changes will in part be due to migration of the river channel across the beach. Starting in the centre of the survey area there is a shore parallel band of erosion on the upper beach which stretches to the northern limit of the survey area. The middle and lower beach is a patchwork of erosion and accretion, with large areas (particularly in the north) of little change. The toe of the beach in the centre of the study area shows a consistent patch of accretion. There is also a large patch of accretion in the middle patch to the north of centre.	The findings of the topographic survey show a balanced mixture of erosion and accretion, some resulting from winter erosion of the upper beach and consequent accretion in the lower beach (draw down), whereas other changes result from migration of the mouth of the River Aln across the beach.

2.9 High Hauxley & Druridge Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
11th April 2017	**Beach Profiles:** High Hauxley to Druridge Bay is covered by eight beach profile lines during the Partial Measures survey (Appendix A). Four of these (with A or B suffixes) were added to the programme in October 2007. The previous survey was undertaken for the Full Measures survey in autumn 2016. **1aADC15A**, **1aADC16** and **1aADC16A** are located around Hauxley Haven. Dunes at these three profiles have remained stable since the last survey. At profile **1aADC15A**, there has been 0.8m of erosion at the toe of the dunes. Beach levels have dropped across the whole profile by up to 0.6m, with the toe of the beach steepening. Overall the profile	At Hauxley Haven, the dunes have remained stable since the last survey. Beach levels have varied and are generally at low levels but largely remain within the bounds of previous surveys. In most of Druridge Bay the dunes and low cliff at their toe, where present, have experienced little change. However the beaches have varied with erosion tending to dominate, however all profiles are largely at a medium level compared to the range recorded from

Survey Date	Description of Changes Since Last Survey	Interpretation
	is at a low level relative to the range recorded from previous surveys, particularly between chainage 35m and 70m which has the lowest recorded levels for that section. At profile **1aADC16** beach levels have fallen across the profile by up to 0.5m, removing the two upper beach berms previously recorded at chainages 85m and 120m, creating a smoother profile. The upper beach is at a medium level relative to the range recorded from previous surveys, whilst the lower beach is at a very low level particularly between chainage 175m and 230m.The survey report notes '*gaps in section due to bushes'* which appear to be in the dune part of the section. Profile **1aADC16A** shows erosion of up to 0.5m between the sea defences at chainage 80m and chainage 135m, removing the upper beach berm previously recorded at chainage 100m. Between chainage 135m and 195m there has been an increase in beach levels of up to 0.3m. Seawards of chainage 195m there has been erosion of <0.2m, with the rock platform exposed from chainage 215m as in previous surveys. Overall the profile is at a medium level relative to the range recorded from previous surveys, except for the lower beach where the rock platform is exposed. **1aADC16B**, **1aADC17** and **1aADC17A** are located to the north of Druridge Bay, between Bondi Carrs and Hadston Carrs and extend seawards from Togston Links. At profile **1aADC16B** beach levels have changed very little, ±0.1m, with much of the rocky shore platform and bedrock steps exposed. Overall the beach is at a medium level relative to the range recorded from previous surveys. At profile **1aADC17** there has been a small drop in beach levels at the toe of the dunes of 0.2m. From chainage 50m the profile is dominated by erosion of 0.2-0.4m, except for a small section of accretion between chainage 175m to 220m. The overall effect has been to smooth out the profile, removing the berm at chainage 60m and depression at chainage 190m. The profile is generally at a medium level compared to the range recorded from previous surveys, with the lower beach between chainage 190m and 220m being very high. At profile **1aADC17A** the dunes have remained stable. The upper beach has changed very little, ±0.1m. Between chainage 50m and 90m there has been accretion of up to 0.3m. Seawards of chainage 90m there has been erosion of up to 0.4m to the exposed rock platform at chainage 220m. Overall the profile is at a medium level relative to the range recorded from previous surveys.	previous surveys. **Longer term trends:** At Hauxley Haven and Druridge Bay, the dunes have demonstrated a long-term trend of stability. The changes in beach profile form and position observed since the last survey are generally within the bounds of previous surveys.

Survey Date	Description of Changes Since Last Survey	Interpretation
	1aCMBC01 and **1aCMBC02** are located in the southern section of Druridge Bay. At profile **1aCMBC01**, the dunes appear to have remained stable. There has been erosion on the upper beach of up to 0.6m forming a berm at chainage 205m. Between chainage 220m and 295m there has been significant accretion of up to 2.4m forming a large mid-beach berm. Seawards of chainage 295m there has been erosion of up to 1.2m, moving the toe of the beach landwards by c.50m. The overall effect is a much steeper undulating profile. The profile is generally at a medium level compared to the range recorded form previous surveys, except for the mid-beach berm at chainage 260m which has the highest recorded beach level. At profile **1aCMBC02**, the dune face has eroded by c.2m. The upper beach face and berm previously recorded at chainage 205m have moved c.5m landwards. There has been a small amount of accretion between chainage 235m and 250m of up to 0.2m. Seawards of chainage 250m beach levels have dropped by 0.2-0.4m. The mid-lower beach has formed a series of undulations with berms at chainage 235m, 270m, and 305m. Compared to the range recorded from previous surveys the upper beach is at a medium level, the mid beach is at a low level, and the lower beach is at a medium-high level.	

2.10 Lynemouth Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
10th April 2017	**Beach Profiles:** Lynemouth is covered by three beach profile lines during the Partial Measures survey (Appendix A). Profile 1aWDC01 was added to the programme in May 2002. Profiles 1aCMBC03A and 1aCMBC03B were added to the programme in October 2007. The previous survey was undertaken for the Full Measures survey in autumn 2016. **1aCMBC03A** is located c.450m north of the mouth of the River Lyne and extends across the extensive slag banks before reaching the foreshore. The profile of the slag bank has not experienced any change since the last survey. The beach levels show erosion across the profile of up to 0.8m. The beach levels are at their lowest recorded level for most of the profile.	North of the mouth of the River Lyne, the slag bank has remained stable. The beach has experienced erosion and is at its lowest recorded level. To the north of the power station, the slag bank has continued to erode, retreating by approximately 2.5m since the last survey. The beach has accreted across its profile. **Longer term trends:** North of the mouth of the River Lyne, the slag bank has demonstrated a long term

Survey Date	Description of Changes Since Last Survey	Interpretation
	1aCMBC03B is located to the north of Lynemouth Power Station and extends across the extensive slag banks before reaching the foreshore. The process of slag bank erosion has been progressing for some years. Since the last survey, the slag bank has retreated by approximately 2.5m, the same amount as recorded in the previous spring survey. The beach shows an increase in levels of up to 0.8m. Overall the beach is low compared to earlier surveys, reflecting the ongoing landward recession of the artificial shoreline at this point in the bay.	trend of stability.To the north of the power station, the slag bank has continued to retreat, demonstrating parallel retreat of the artificial shoreline.
March 2017	**Cliff-top Survey:** Cliff top survey data collected for baseline survey (autumn, 2008), the previous Full Measures survey (autumn 2017) and the present Partial Measures survey (spring 2017) is presented in this report. The cliff top survey is carried out as a continuous cliff edge line survey at the Newbiggin Caravan Park at Newbiggin Point. The results from the cliff top monitoring are anticipated to have an accuracy of ±0.2m due to the technique used. Furthermore, problems in precisely locating the cliff top, due to vegetation growth or the indistinct form of the cliff top, have also affected the data quality. There has been numerous small areas of 0.3-0.7m of erosion along the survey length, particularly in the northern third of the survey area, but no long consistent lengths of erosion.	Since the last survey, there have been some small areas of erosion of up to 0.7m mainly focused in the northern part of the survey area. **Longer term trends:** Since surveys began in October 2008, cliff movement has been greatest in the north of the survey area with up to 3.4m of cliff top retreat, whilst the central and southern parts of the survey area have shown less movement with retreat of up to 1.4m.

2.11 Newbiggin-by-the-Sea

Survey Date	Description of Changes Since Last Survey	Interpretation
27th February 2017	**Beach Profiles:** Newbiggin-by-the-Sea is covered by four beach profile lines during the Partial Measures survey (Appendix A). Two of these (with an 'A' suffix) were added to the programme in October 2007 specifically to help assess the performance of the capital scheme involving beach replenishment and construction of an offshore breakwater. It should be noted that an extended series of profiles and a	Since the last survey, the beach at Newbiggin-by-the-Sea has generally accreted, with all profiles at a medium-high level compared to the range recorded from previous surveys.. **Longer term trends:** Data collected since the start of

Survey Date	Description of Changes Since Last Survey	Interpretation
	topographic survey are also recorded via the Cell 1 Regional Coastal Monitoring Programme for purposes of post-project evaluation of this capital scheme. These profiles are not analysed here, however, the findings of the topographic survey are presented below. The previous survey was the Full Measures assessment undertaken in autumn 2016. **1aWDC05A** is in the north of Newbiggin Bay. The upper beach levels have increased by 0.2m, whilst the upper beach face between chainage 40m and 55m has eroded by up to 0.6m becoming more concave. The lower beach from chainage 65m has also increased in level by 0.3m, before the rock platform is exposed at chainage 105m. The upper beach is high relative to the range recorded from previous surveys, with the mid and lower beach being at a more medium level. **1aWDC06** is located in the centre of the northern part of Newbiggin Bay, between the two breakwaters. There has been accretion of 0.4m of material at the base of the seawall. Between chainage 20m and 60m there has been limited change of ±0.2m. Seawards of chainage 60m there has been accretion of 0.3m. The upper and lower beaches are relatively high compared to the range recorded from previous surveys, whilst the middle beach is at a medium level. **1aWDC06A** is located in the centre of Newbiggin Bay, behind the offshore breakwater. The upper beach berm has increased in height by 0.2m and moved landwards by c.10m. There has been very little change through the mid-beach, ±0.1m, with accretion of 0.3m at the toe of the beach forming a berm at chainage 245m. Overall the profile is at a high level relative to the range recorded from previous surveys, with the exception of the face of the upper beach berm being in a relatively landward position. **1aWDC07** is located towards the south of Newbiggin Bay. The upper beach between chainage 10m and 25m has eroded by up to 0.3m. Seawards of chainage 25m the beach levels have increased by up to 0.6m, but more typically up to 0.2m. Overall the profile is at a medium level compared to the range recorded from previous surveys.	monitoring in May 2002 reflects the change in beach width resulting from the beach nourishment scheme implemented at Newbiggin-by-the-Sea. This change is also reflected in the beach profile plot in Appendix A. The changes in beach profile form and position observed since the last survey are within the bounds of previous surveys.

Survey Date	Description of Changes Since Last Survey	Interpretation
March 2017	**Topographic Survey:** Newbiggin-by-the-Sea is covered by bi-annual topographic survey, which commenced in September 2010 to assess the performance of the capital scheme constructed in 2007. Prior to incorporation in the programme, these surveys were undertaken on occasions between 2007 and 2010 as part of the scheme development. The previous survey was the Full Measures assessment undertaken in autumn 2016. Data from the most recent topographic survey (Partial Measures, spring 2017) have been used to create a digital ground model (DGM) (Appendix B – Map 3a) using a Geographical Information System (GIS). A difference plot has also been produced using the DGM (Appendix B – Map 3b) produced from the previous and present surveys. The topographic survey shows patchy accretion and erosion on the upper and lower beach north of the central breakwater, with a consistent band of erosion running from the upper beach at Bridge Street to the mid beach at the northern end of the bay. The tombolo behind the central breakwater shows accretion on both of its sides but erosion in the centre spreading into a shore parallel band of erosion in the mid beach (which almost joins up with the erosion band in the north), with a band of accretion in the upper beach. South of the breakwater the pattern is patchy again, particularly on the lower beach. The survey report notes that sand was covering most of the revetment rocks at the back of the beach.	The topographic survey shows variable change across the bay, with most change occurring in the tombolo behind the central breakwater. The northern and southern ends of the bay show a much more patchy distribution. This suggests there may have been movement away from the centre of the bay.
March 2017	**Sand Extent Survey**: Spital Carrs is located to the south of Newbiggin Bay and is covered by a bi-annual sand extent survey, which commenced in 2011. The survey was designed to address concerns that the beach recharge scheme undertaken in Newbiggin Bay may impact on the Spital Carrs SSSI and SPA. The sand extent survey therefore identifies the boundary of the sand beach on the rock platform. Data from the most recent sand extent survey (Partial Measures, spring 2017) has been plotted onto aerial imagery (refer to Appendix D – Map 1). The plot shows some variation of the extent of sand between the autumn 2016 and the spring 2017 survey. There has been up to 25m of landward retreat of sand from the shore platform in the southern part of the survey area, but this is within the range of changes seen in previous surveys. Otherwise, change in the position of the edge of the sand has been	Since the last survey, there has been some retreat of the edge of the sand in the south of bay, but limited movement elsewhere. **Longer term trends:** sand extent surveys for the past 11 surveys shows oscillation of the edge of the beach with no net trend. Recent changes are within the range of changes seen previously.

Survey Date	Description of Changes Since Last Survey	Interpretation
	limited.	

12.12 Cambois Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
March 2017	**Cliff-top Survey:** Cliff top survey data collected for baseline survey (spring, 2009), the previous Full Measures survey (autumn 2016) and the present Partial Measures survey (spring 2017) is presented in this report. The cliff top survey is carried out as a continuous cliff edge line survey in two locations within Cambois Bay; at Sandy Bay Caravan Park to the north of the River Wansbeck estuary, and Cambois Bay from south of the River Wansbeck to the breakwater at the southern end of the bay . The results from the cliff top monitoring are anticipated to have an accuracy of ±0.2m due to the technique used. Furthermore, problems in precisely locating the cliff top, due to vegetation growth or the indistinct form of the cliff top, have also affected the data quality. There has been very little change in the position of the cliff top at Sandy Bay Caravan Park since the previous survey in autumn 2017 along the majority of the survey length. The exceptions are two short sections towards the southern end of the survey limits where the cliff top has appeared to have retreated by 2m over a 5m length and 1m over a 7m length. The dunes on the southern bank of the River Wansbeck show very little change. There has been variable amounts of erosion along the survey length in Cambois Bay, typically less than 0.2m, but with numerous short sections of erosion up to 0.5m, and a few areas of more severe erosion; the most notable areas include: • The Paddocks area at the northern end of survey – 1.5m of erosion over a couple of short lengths c.15m; and • Consistent erosion of 1m to 4.5m over 1.1km length from north of the roundabout at the top of the tidal basin, along the West Bridge Street frontage (industrialised Battleship Wharf area), to the start of the defended section at North Blyth.	Since the last survey in November 2015, the cliffs do not show erosion greater than the anticipated error at any of the survey locations. **Longer term trends:** At Sandy Bay Caravan Park the cliff top retreat has been more significant in the southern part of the survey area with up to 8m of erosion since 2007, whilst the northern part has eroded by c.1-2m. In Cambois Bay, the area of greatest cliff top retreat since the surveys began in 2009 is in the centre of the bay opposite Ridley Terrace, Cambois, where up to 12m of erosion has occurred. The north and south of the bay have more typical retreats of c.3-6m. .

2.13 Blyth South Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
28th February 2017	**Beach Profiles:** Blyth South Beach is covered by six beach profile lines for the Partial Measures survey (Appendix A). The previous survey was the Full Measures assessment undertaken in autumn 2016. **1aBVBC01** is located towards the north of South Beach, in front of the land owned by the Port of Blyth. The dune crest and dune face appear to have accreted up to 0.2m. The upper beach has increased in level by up to 0.4m. The middle beach between chainage 42m and 74m shows erosion of up to 1.0m, removing the two berms and small runnel from the previous survey. Between chainage 75m and 115m there has been accretion of up to 0.7m, infilling the large depression from the previous survey. Between chainage 115m and 140m there has been very little change. Seawards of chainage 140m there has been accretion of 0.2m. The overall effect has been to smooth out the profile. Overall the profile is at a medium-high level compared to the range recorded from previous surveys. At profile **1aBVBC02**, there has been varying levels of erosion and accretion across the profile. At the base of the seawall there has been erosion of up to 0.4m. Erosion of up to 0.4m has also occurred between chainage 45m and 85m and at the toe of the beach seawards of chainage 155m. Accretion of 0.2-0.4m has occurred between chainage 30m and 45m, and 85m and 155m. Overall the profile is at a medium level compared to the range recorded from previous surveys. At profile **1aBVBC03**, there have been no significant changes to the position and form of the dune crests or the upper part of the dune front since the last survey. The profile has been smoothed out compared to the previous survey, with accretion of 0.4m at the dune toe, 1.0m of erosion at the berm previously recorded at chainage 110m, and limited changes across the rest of the profile of ±0.2m. The lower beach berm previously recorded at chainage 300m has also been removed. Overall the profile is at a medium level compared to the range recorded from previous surveys. At profile **1aBVBC04**, around 0.1m of accretion has taken place on the dune crest and 0.2m on the sloping dune face, pushing the dunes c.0.5m forward. The upper beach has accreted by 0.4m up to chainage 40m. Between chainage 40m and 85m there has been erosion of the berm, reducing the height by 0.9m. Between chainage 85m and 125m there was accretion of 0.6m. Seawards of chainage	Since the last survey, the dune crests at Blyth South Beach have remained stable, generally retaining the same form and position with some minor advances. There have been variable amounts of erosion and accretion across the profiles, with a general trend of flattening and smoothing out of the profiles. All the profiles with the exception of BVBC06 are at a medium level compared to the range recorded from previous surveys. The middle beach at profile BVBC06 however is at its lowest recorded level. **Longer term trends:** At Blyth South Beach, the dunes have generally demonstrated a long-term trend of stability. The profiles are mostly at a medium level.

Survey Date	Description of Changes Since Last Survey	Interpretation
	125m there has been erosion of up to 0.7m. The overall effect is a smoothing and flattening of the profile. Overall the profile is at a medium level compared to the range recorded from previous surveys. At profile **1aBVBC05**, the dunes have remained stable, with minor accretion of <0.1m, and the sloping dune face advancing by c.1m. Between chainage 70m and 100m there has been erosion of up to 1.8m, removing the berm previously recorded at chainage 85m. Between chainage 100m and 170m there has been accretion of up to 1.2m. Seawards of chainage 170m the lower ebach berm has been removed with up to 1.0m of erosion. The effect has been to create a smoother flatter profile. Overall the profile is at a medium level compared to the range recorded from previous surveys. **1aBVBC06** is located at the southern end of the beach, towards Seaton Sluice. The dunes have remained stable, with minor accretion of <0.1m, and the sloping dune face advancing by c.1m. There has been erosion of up to 0.4m between chainage 95m and 120m. Between chainage 120m and 160m there has been accretion of 0.2-0.4m, with a berm forming at chainage 125m. Between chainage 160m and the end of the profile at 255m the beach level has dropped by 1.0m. Whilst the upper and lower beach are at a relatively medium level compared to the range recorded from previous surveys, the middle beach between chainage 170m and 210m is the lowest on record.	

3. Problems Encountered and Uncertainty in Analysis

Individual Profiles

- Profiles 1aBTBC19, 1aBTBC21, and 1aBTBC23 all end at drains.
- At profile 1aBTBC33, the middle of the dunes were not measured due to the presence of dense vegetation. Care is therefore needed when interpreting the interpolated data.
- At profiles 1aADC08 and 1aADC09, the profiles end at the River Aln channel due to quicksand.
- At Profile 1aADC16A the first part of the section as far as c.40m chainage were not surveyed due to the presence of trees.
- At profile ADC16B a 'new' fence has been installed at the start of the profile (around the time of the Partial Measures survey, spring 2014). This fence is now the new profile start point.
- At profile CMBC02 the first part of the section was not surveyable due to the presence of cattle with calves.

Topographic Surveys

- At Newbiggin-by-the Sea, the topographic survey report notes that sand was covering most of the revetment rocks at the back of the beach
- At Berwick the surveyors noted that quicksand near the water's edge was noticeable

Cliff Top Surveys

Surveying any cliff top is difficult due to the need for a consistent interpretation of the cliff edge in successive surveys, which can be challenging, especially when vegetation is thick. For these reasons, it has been assumed that any changes of ±0.2m may be considered as being within the margins of error of the surveying technique, and that any indication of an advancing cliff line is error.

Surveying the cliff top along Cambois Bay is more difficult than the similar surveys at Newbiggin Caravan Park and Sandy Bay Caravan Park because the cliff edge is less distinct and hard to precisely define due to vegetation coverage and its smooth, degraded form.

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

No changes to the monitoring programme are recommended at this time.

5. Conclusions and Areas of Concern

- At Sandstell Point (Spittal A), the recorded profiles and topographic survey present no causes for concern.
- At Spittal (Spittal B), the recorded profiles present no causes for concern.
- At Goswick Sands, the recorded profiles present no causes for concern.
- At Holy Island, the recorded profiles present no causes for concern.
- At Beadnell Village, the beach is at a relatively low level compared to the range recorded from previous surveys.
- At Beadnell Bay, the recorded profiles present no causes for concern.
- At Boulmer the recorded profiles present no causes for concern.
- At Alnmouth Bay, the recorded profiles and topographic surveys present no causes for concern.
- At High Hauxley & Druridge Bay, the beach levels are at a low to medium level but remain within the range recorded from previous surveys.
- At Lynemouth Bay, to the north of the Power Station (profile 1aCMBC03B), the slag bank has continued to recede as part of an ongoing trend. To the north of the River Lyne (profile 1aCMBC03A) the beach levels are at their lowest recorded levels.

- Elsewhere along Lynemouth Bay, the beach profiles and cliff top survey present no causes for concern.
- At Newbiggin Bay, the recorded profiles, topographic survey and the sand extent survey present no causes for concern.
- At Cambois Bay, the cliff top survey shows no causes for concern at Sandy Bay Caravan Park. Along the Cambois Bay survey length there has been little change in the north, but consistent erosion of 1-4.5m along 1.1km of the central section from north of the roundabout at the top of the tidal basin, along the West Bridge Street frontage (industrialised Battleship Wharf area), to the start of the defended section at North Blyth. .
- At Blyth South Beach, the profiles have generally flattened and been smoothed out, and beach levels are generally at medium levels compared to the range recorded from previous surveys.

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

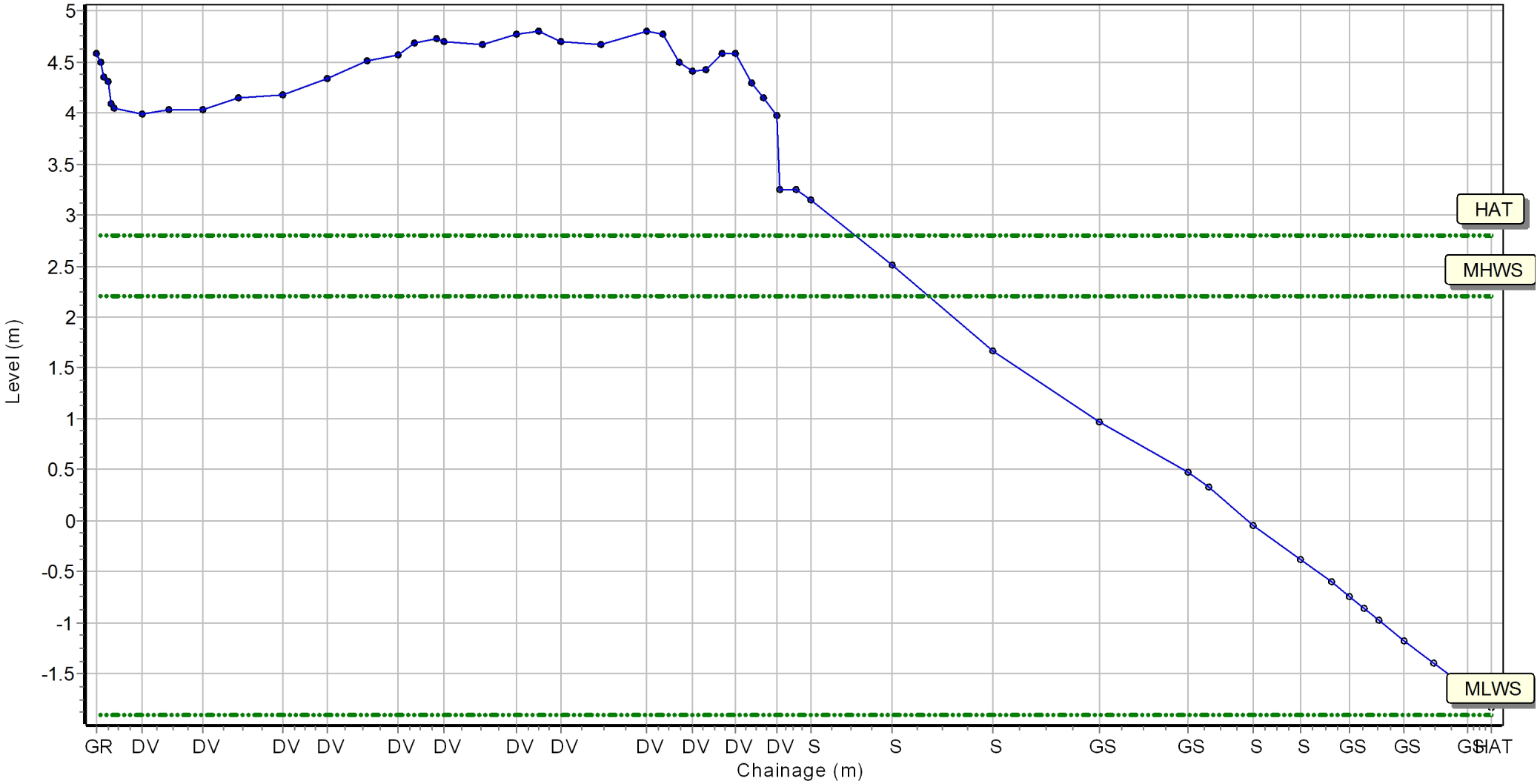
Location: **1aBTBC02**

Date: 03/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 400388.132 **Northing:** 651916.302 **Profile Bearing:** 334 ° from North



Beach Profile

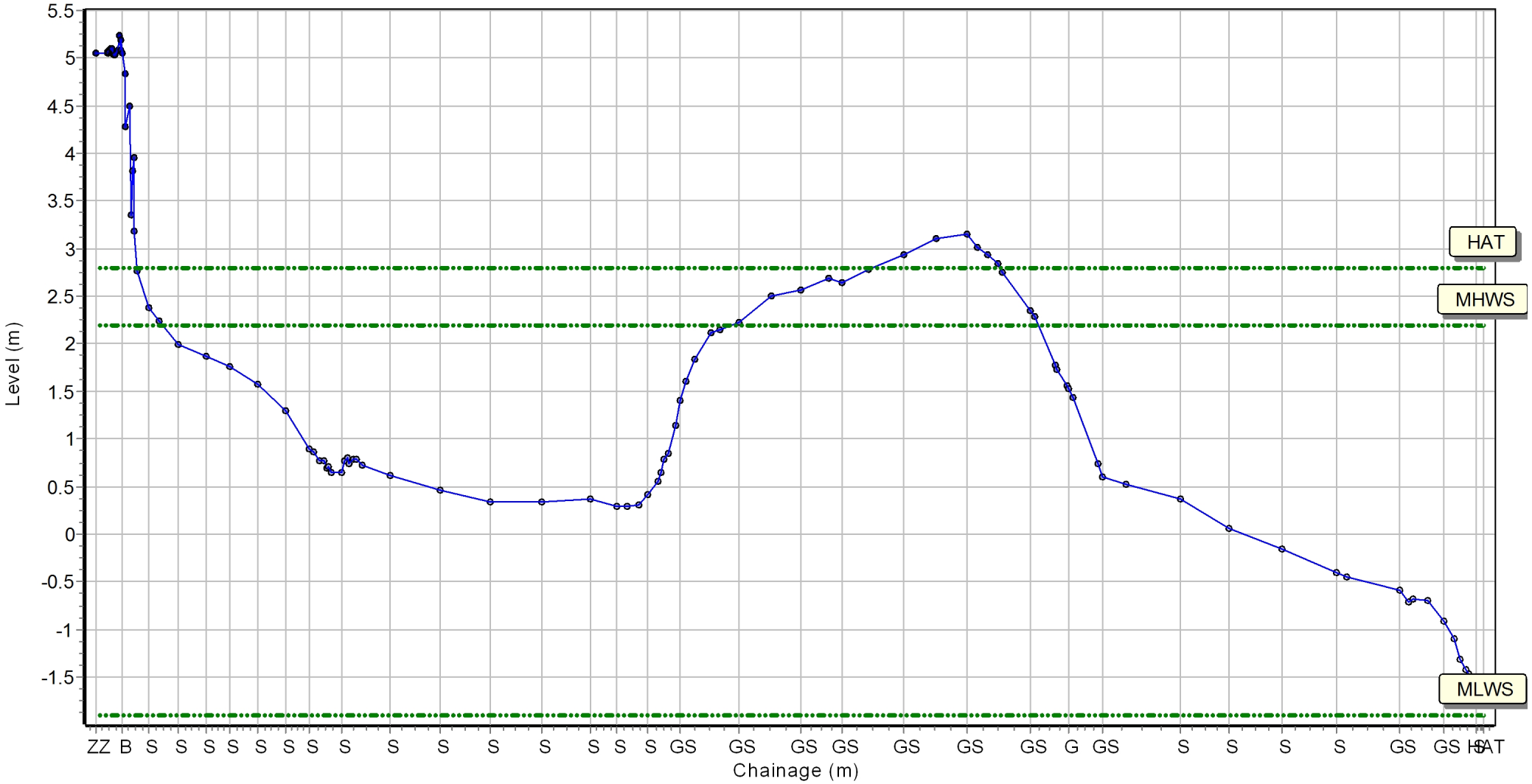
Location: **1aBTBC04**

Date: 03/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 400531.615 **Northing:** 652001.966 **Profile Bearing:** 27 ° from North



Beach Profile

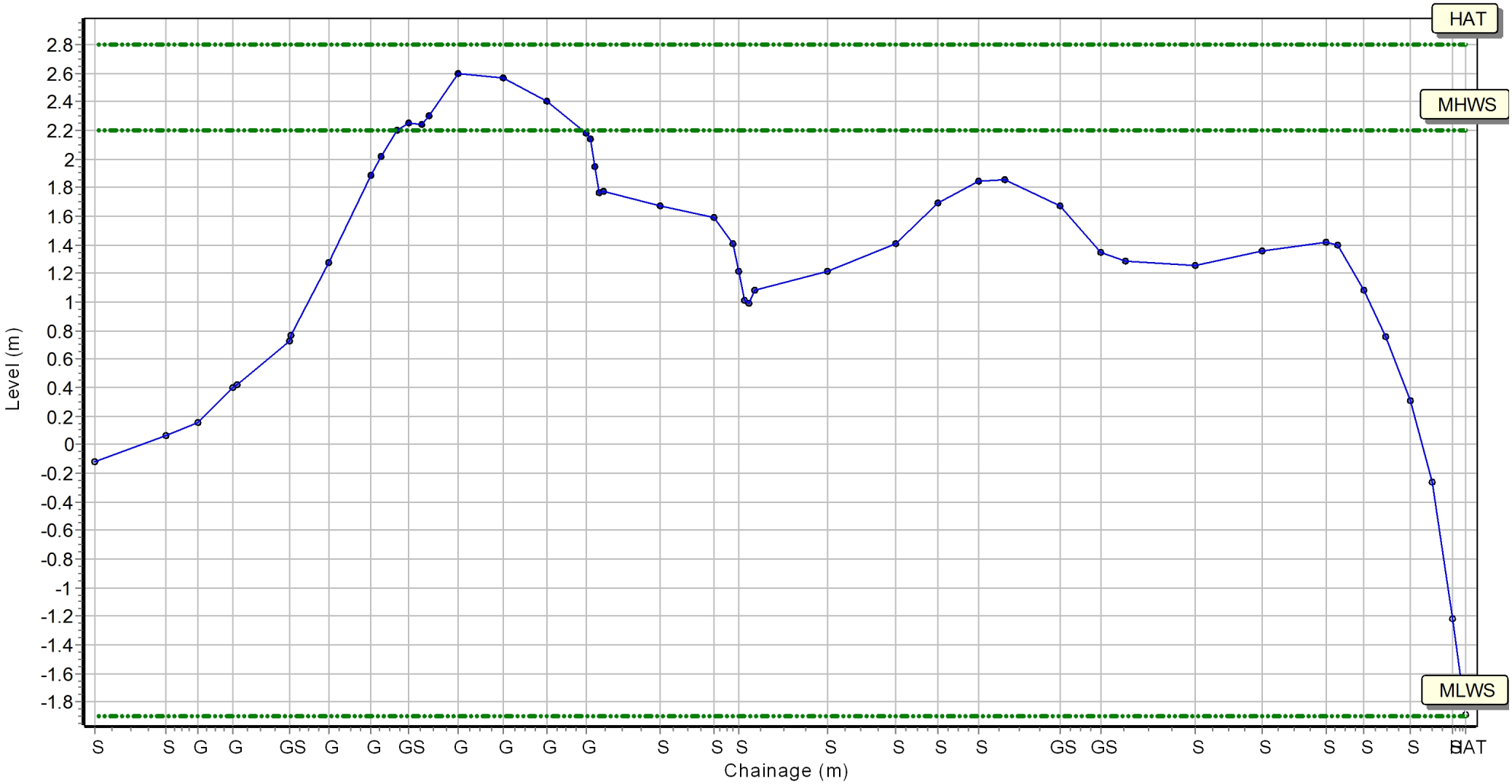
Location: **1aBTBC05**

Date: 03/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 400678.665 **Northing:** 651969.27 **Profile Bearing:** 298 ° from North



Beach Profile

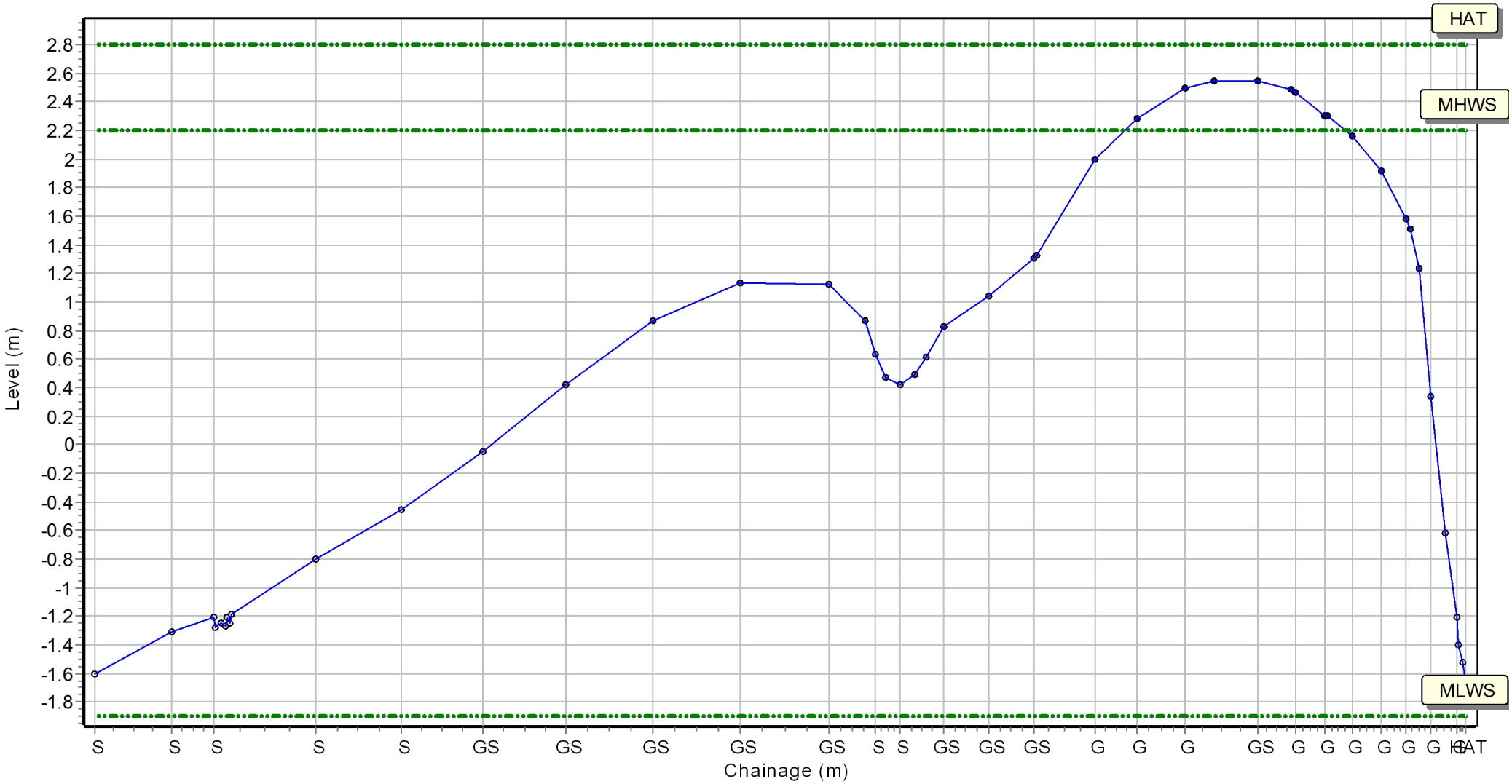
Location: **1aBTBC06**

Date: 03/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 400825.582 **Northing:** 652135.224 **Profile Bearing:** 295 ° from North



Beach Profile

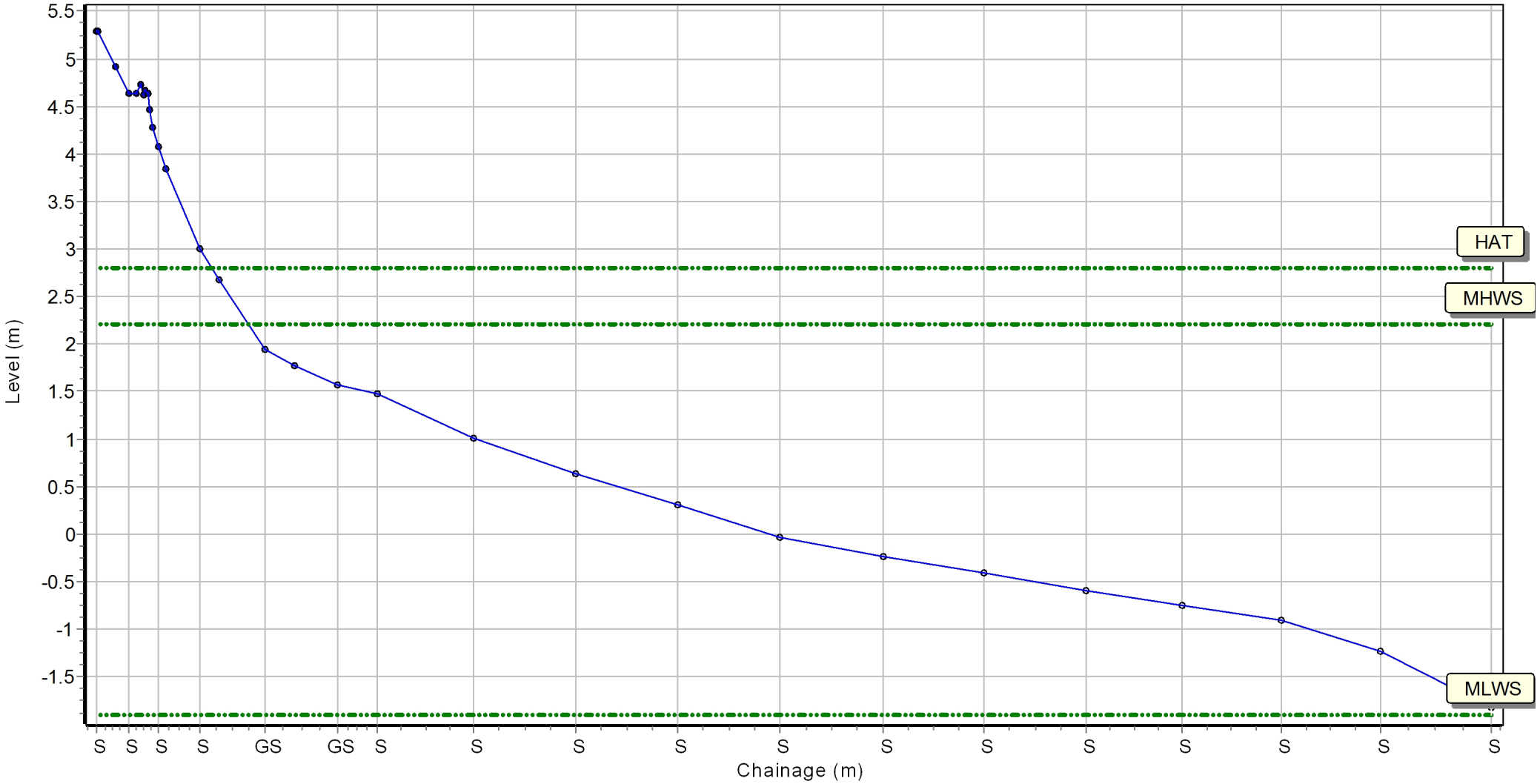
Location: **1aBTBC11**

Date: 03/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 400638.037 **Northing:** 651699.812 **Profile Bearing:** 66 ° from North



Beach Profile

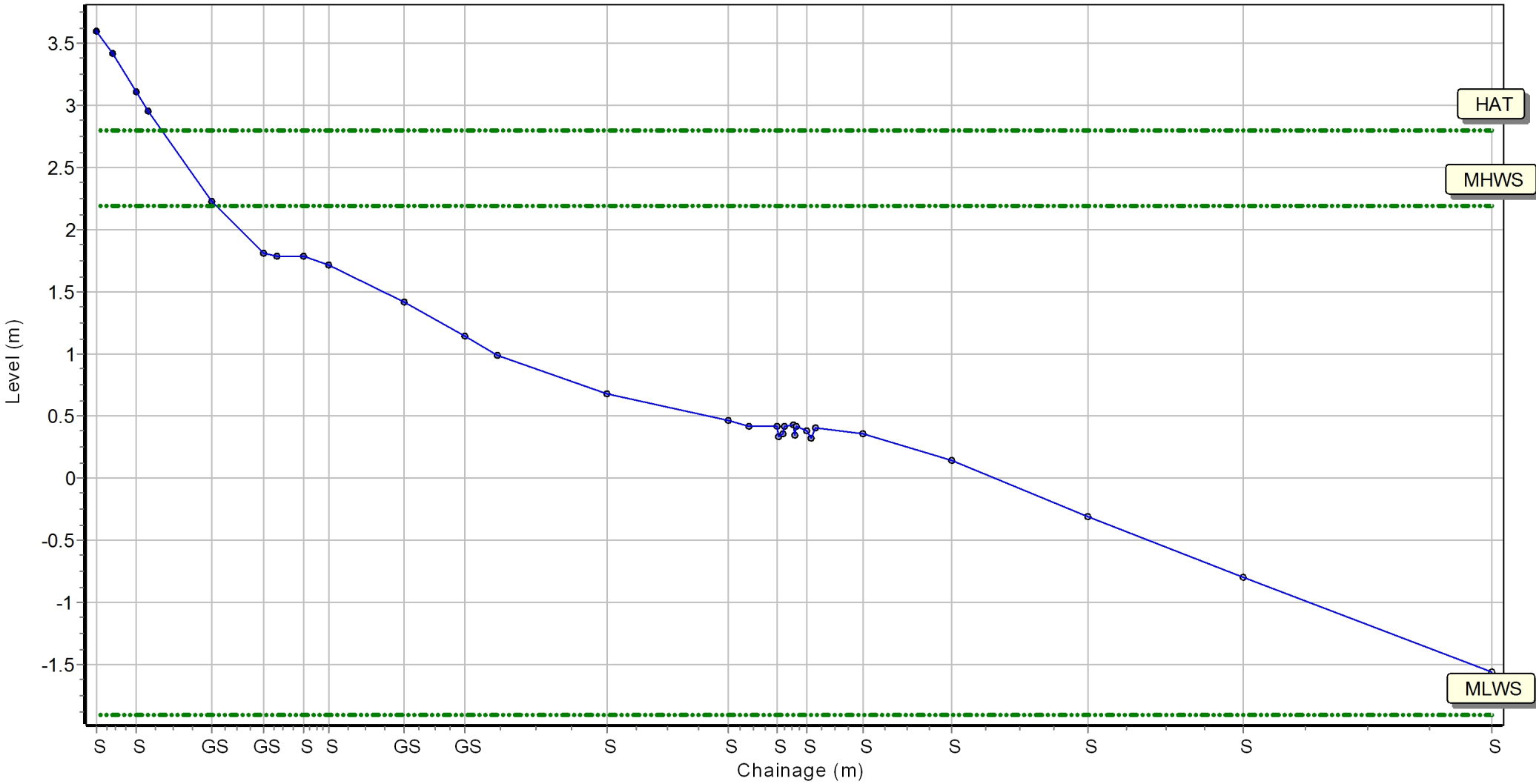
Location: **1aBTBC13**

Date: 03/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 400820.787 **Northing:** 651312.459 **Profile Bearing:** 65 ° from North



Beach Profile

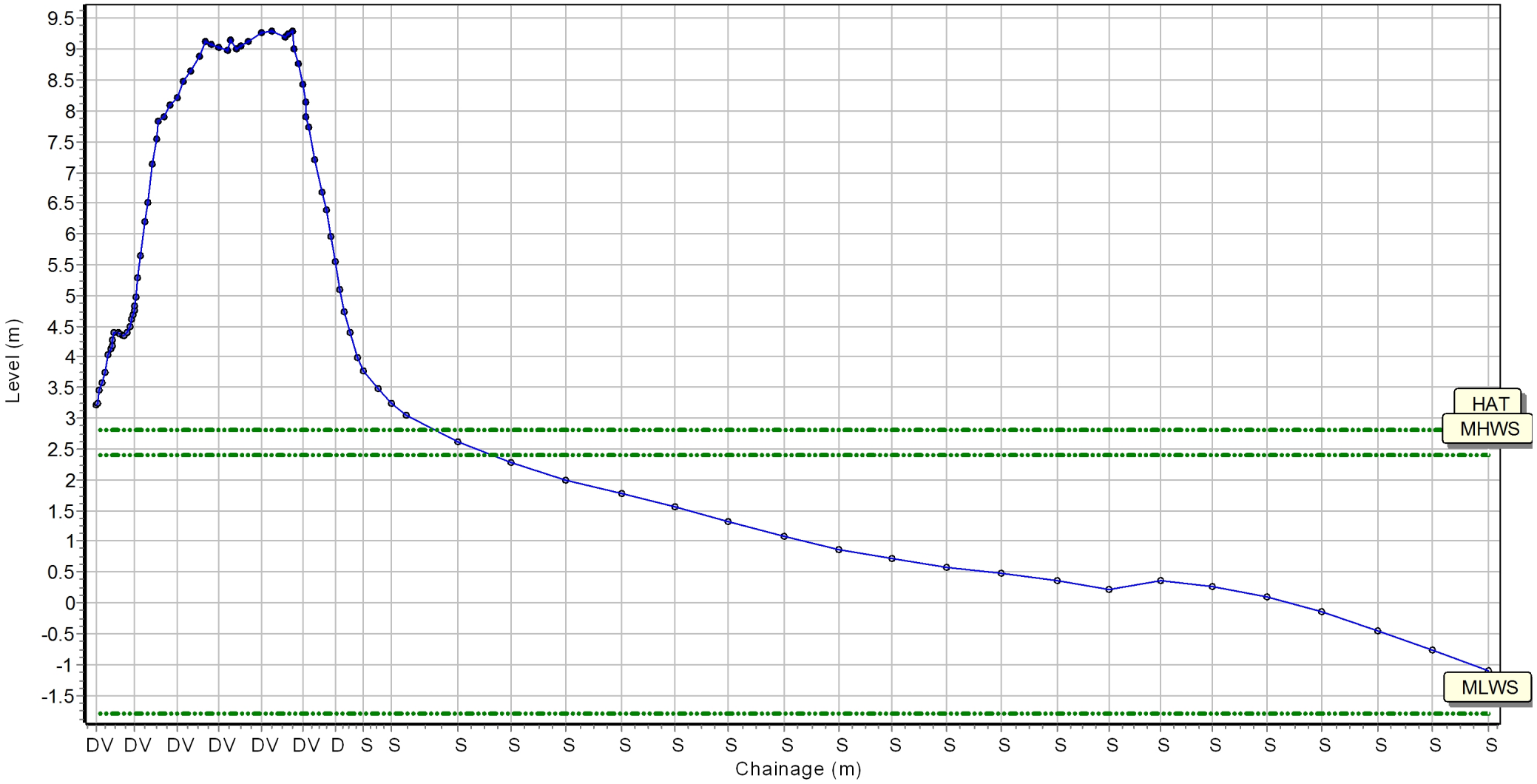
Location: **1aBTBC16**

Date: 13/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 403565.671 **Northing:** 647735.833 **Profile Bearing:** 53 ° from North



Beach Profile

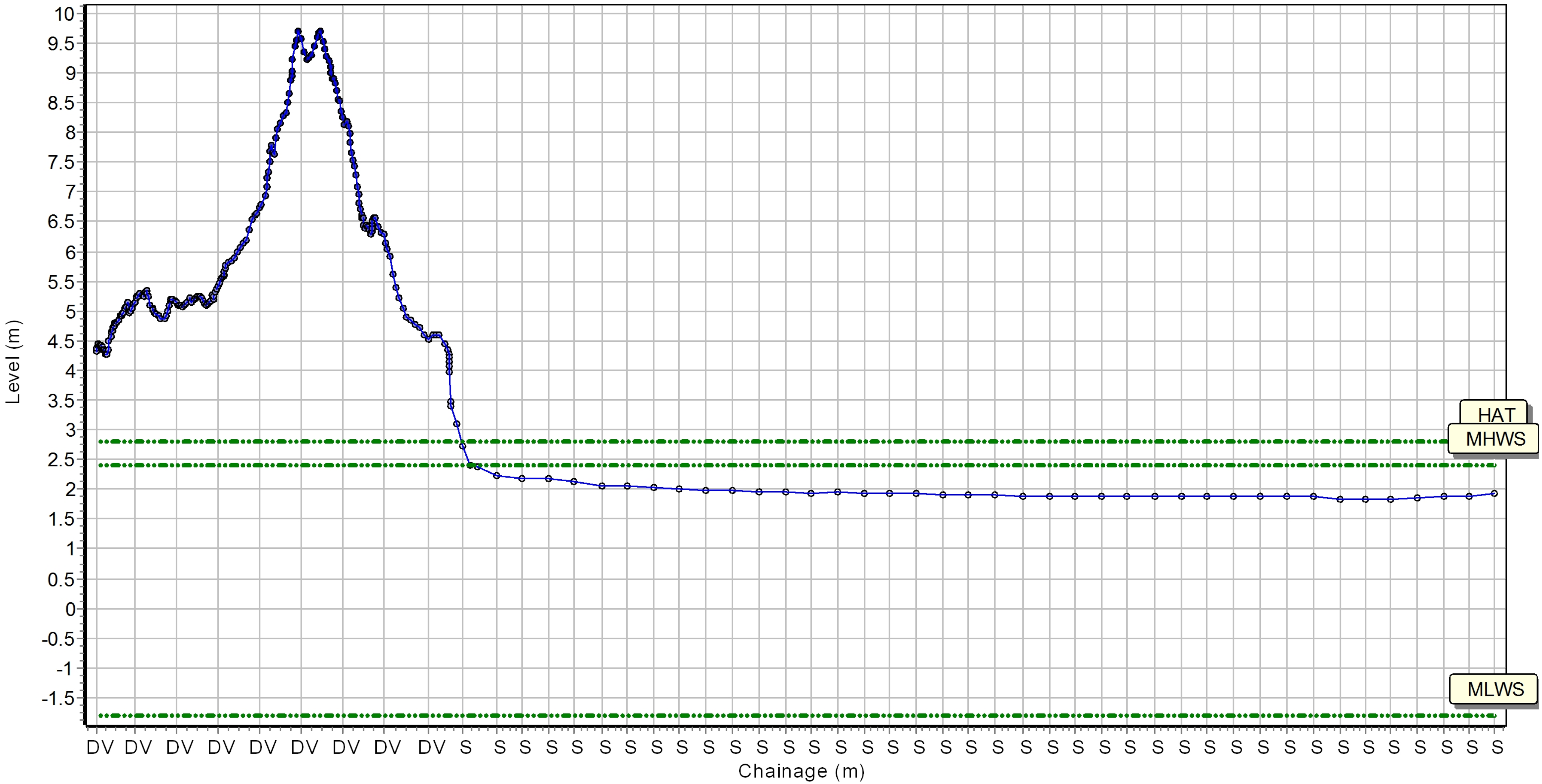
Location: 1aBTBC19

Date: 13/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 407091.566 **Northing:** 644616.133 **Profile Bearing:** 34 ° from North



Beach Profile

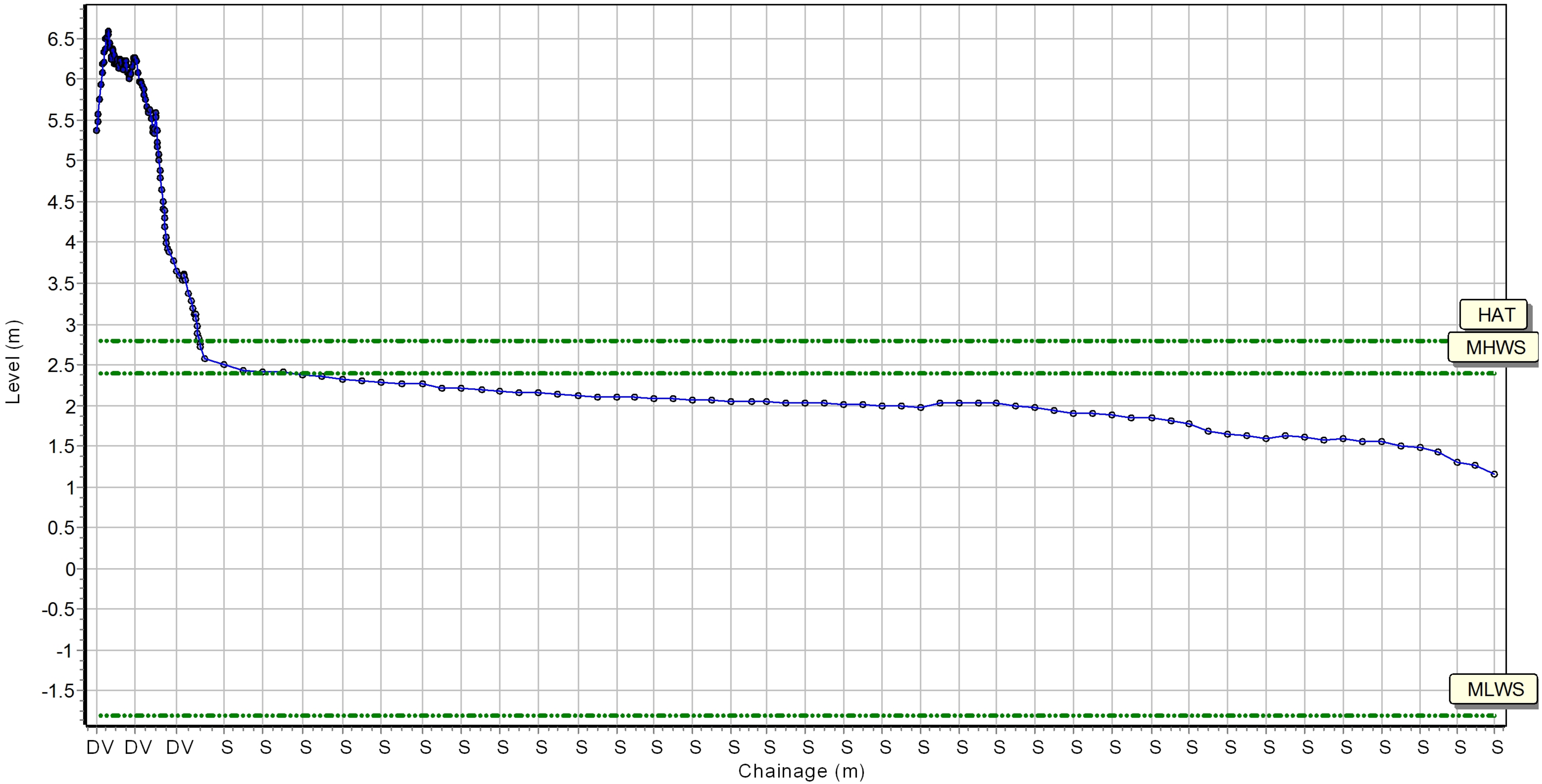
Location: 1aBTBC21

Date: 13/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 409501.341 **Northing:** 643847.61 **Profile Bearing:** 33 ° from North



http://www.sandsuser.com

SANDS

Beach Profile

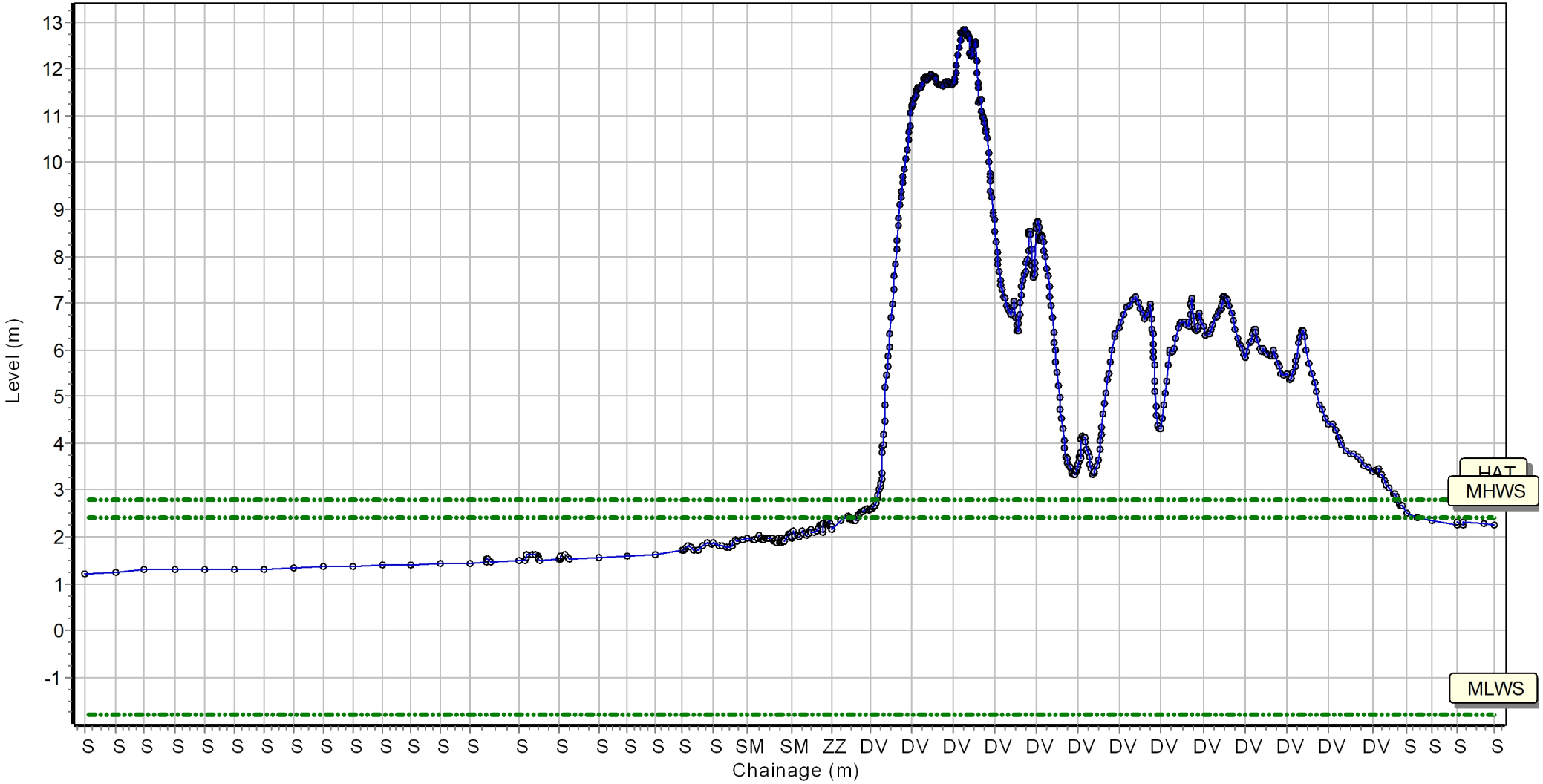
Location: **1aBTBC23**

Date: 13/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 411084.123 **Northing:** 643008.731 **Profile Bearing:** 0 ° from North



Beach Profile

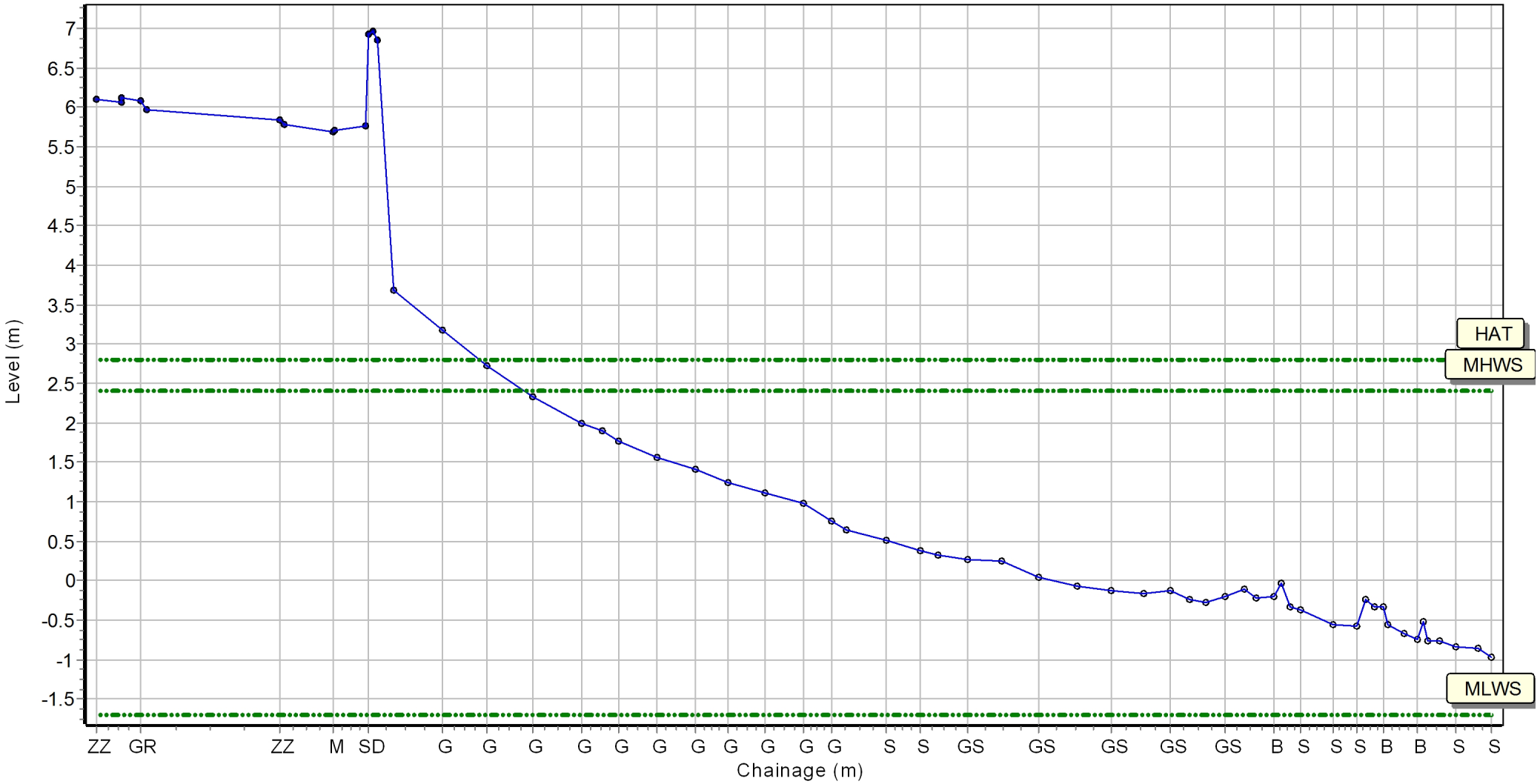
Location: **1aBTBC31**

Date: 12/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 423579.204 **Northing:** 628973.295 **Profile Bearing:** 56 ° from North



Beach Profile

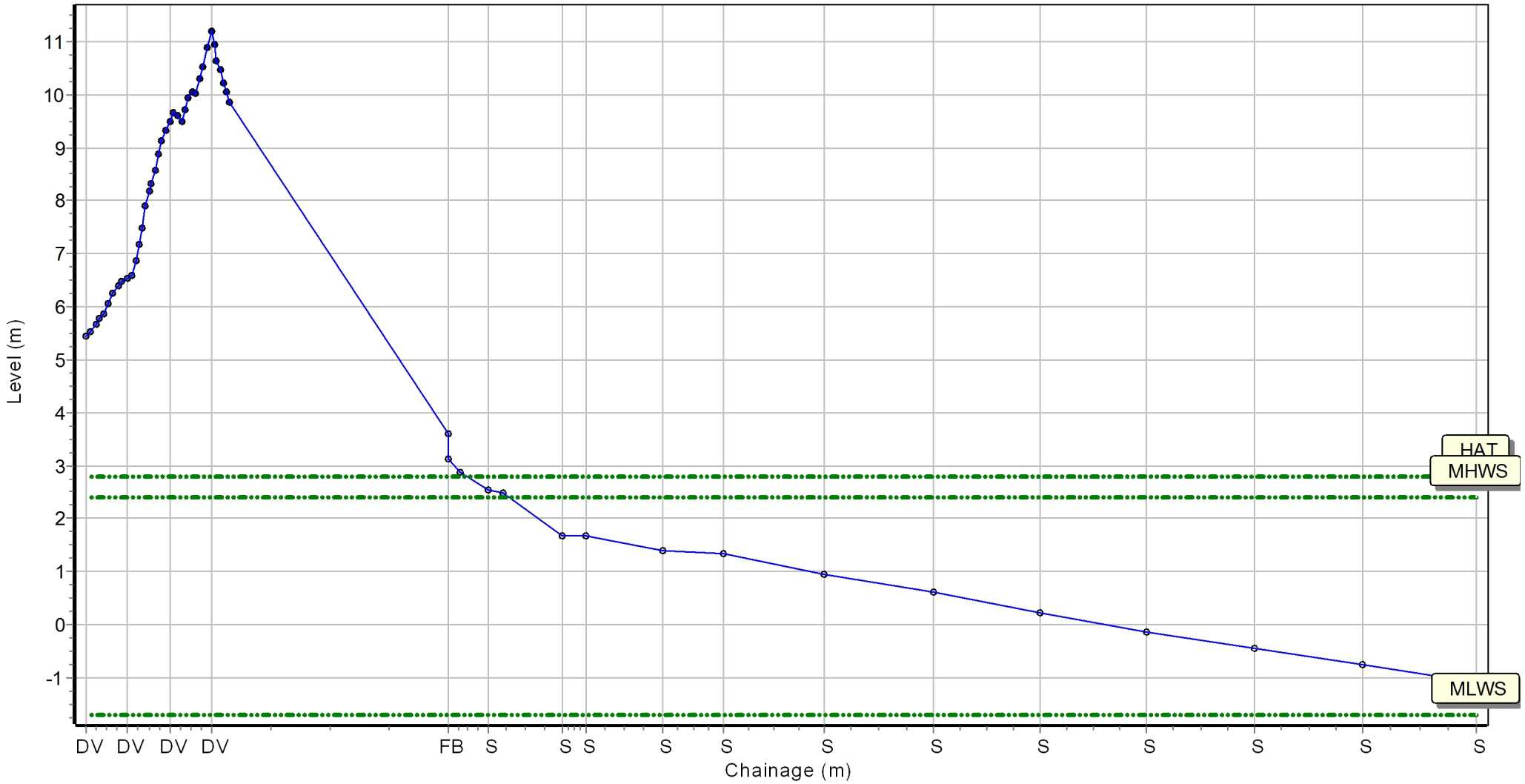
Location: **1aBTBC33**

Date: 12/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 423672.571 **Northing:** 628761.646 **Profile Bearing:** 204 ° from North



Beach Profile

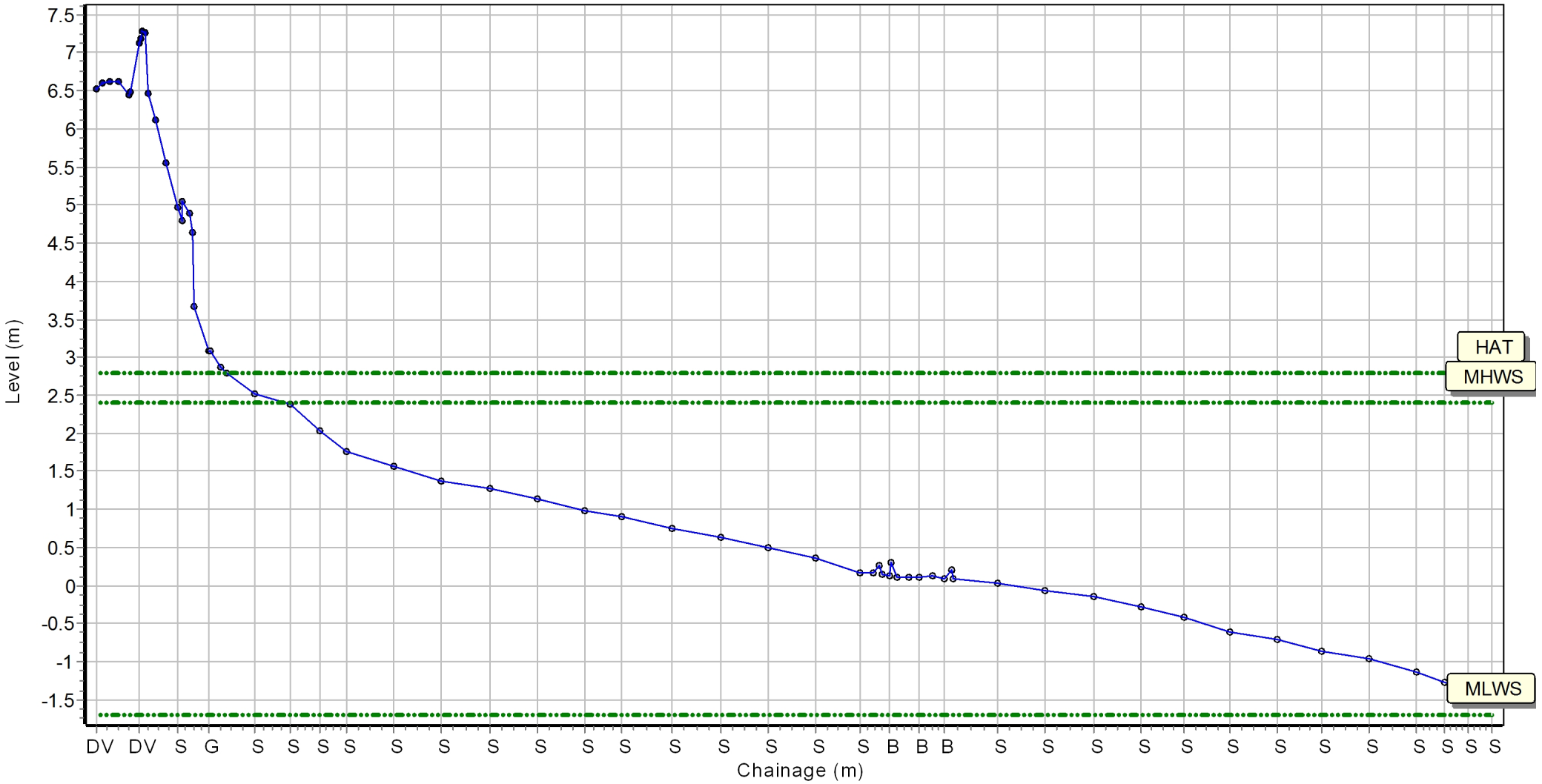
Location: **1aBTBC34**

Date: 12/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 423434.960 **Northing:** 628693.15 **Profile Bearing:** 160 ° from North



Beach Profile

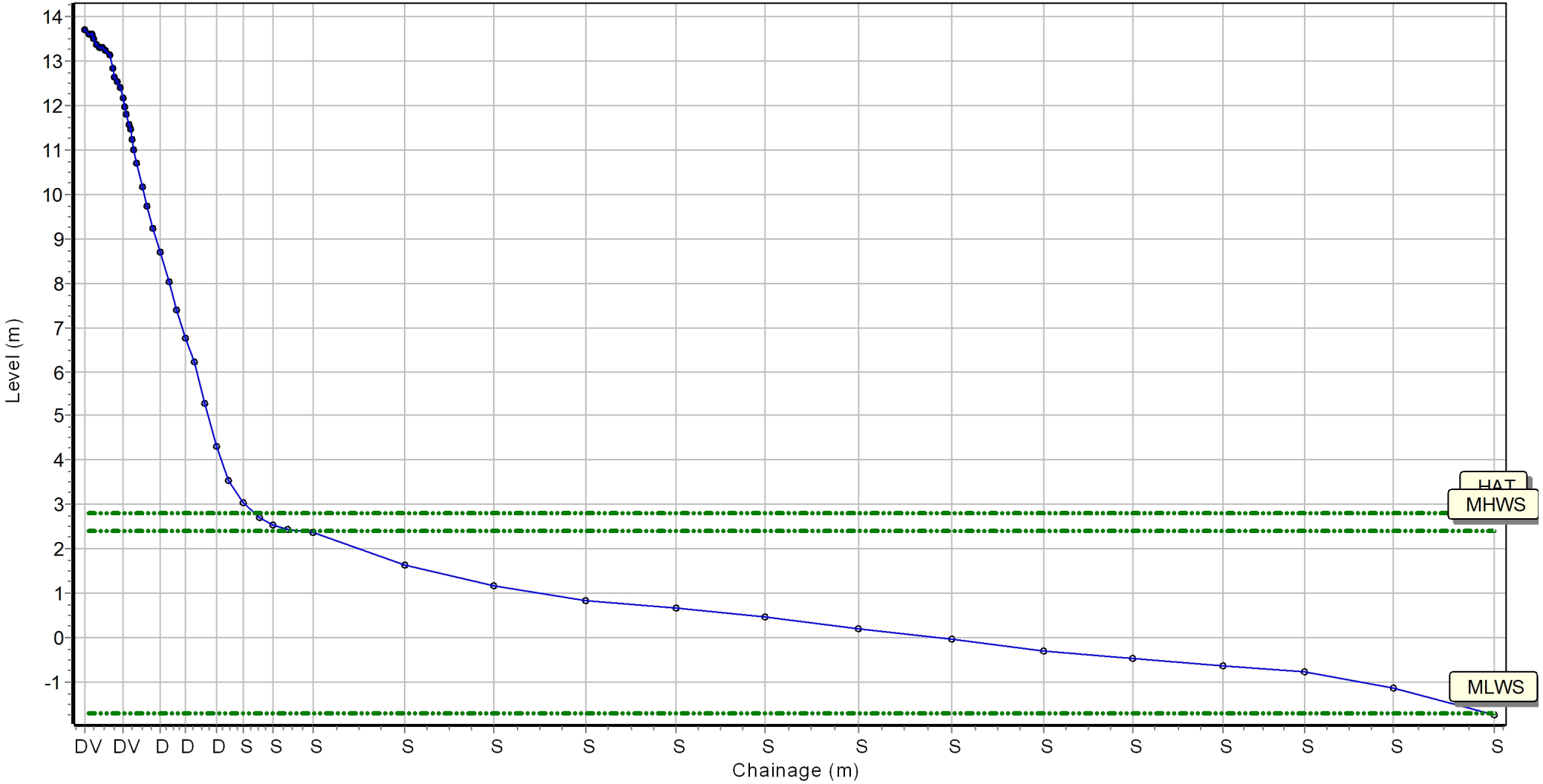
Location: **1aBTBC37**

Date: 12/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 423060.156 **Northing:** 628006.169 **Profile Bearing:** 96 ° from North



Beach Profile

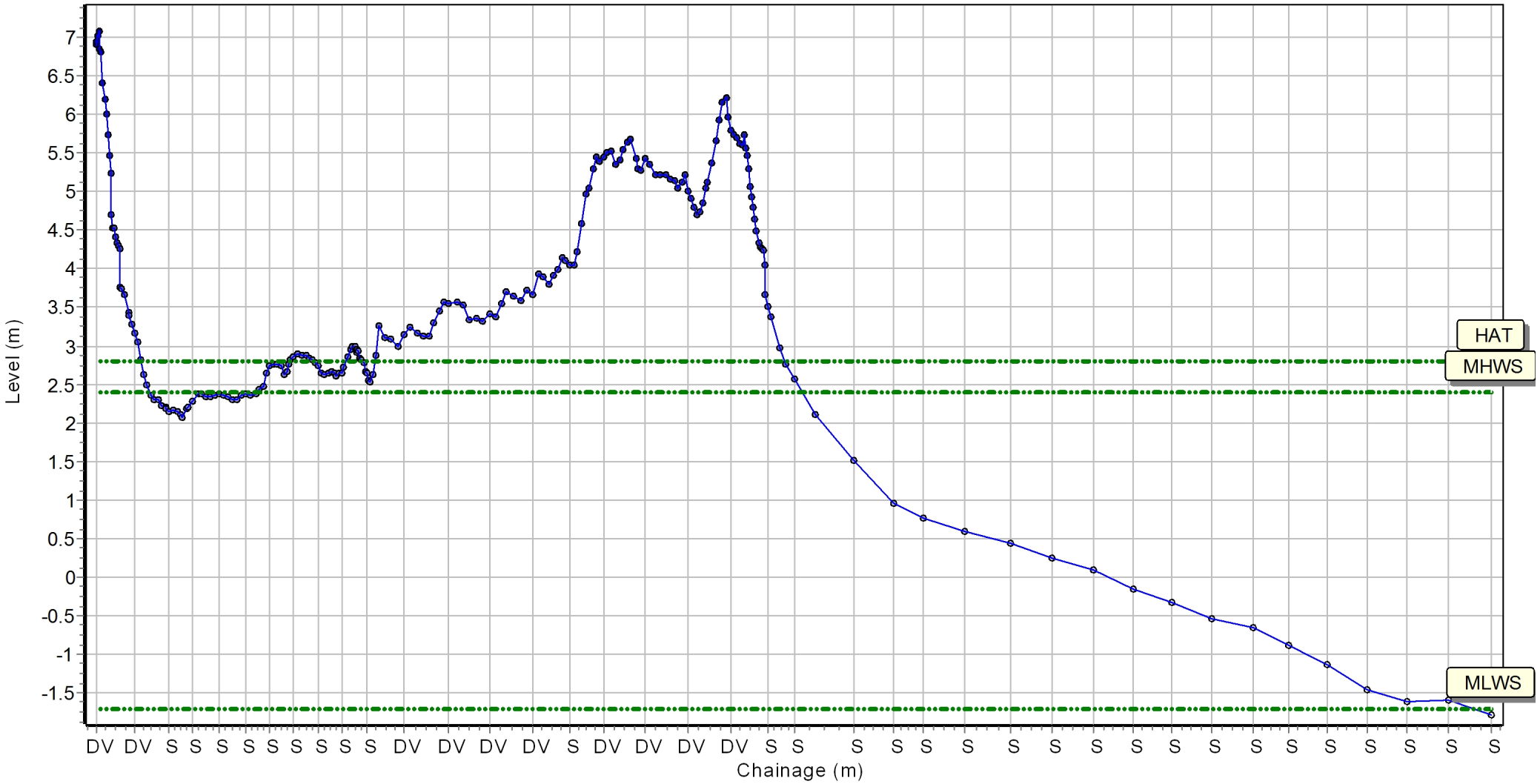
Location: **1aADC01**

Date: 12/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 422824.294 **Northing:** 627077.805 **Profile Bearing:** 77 ° from North



Beach Profile

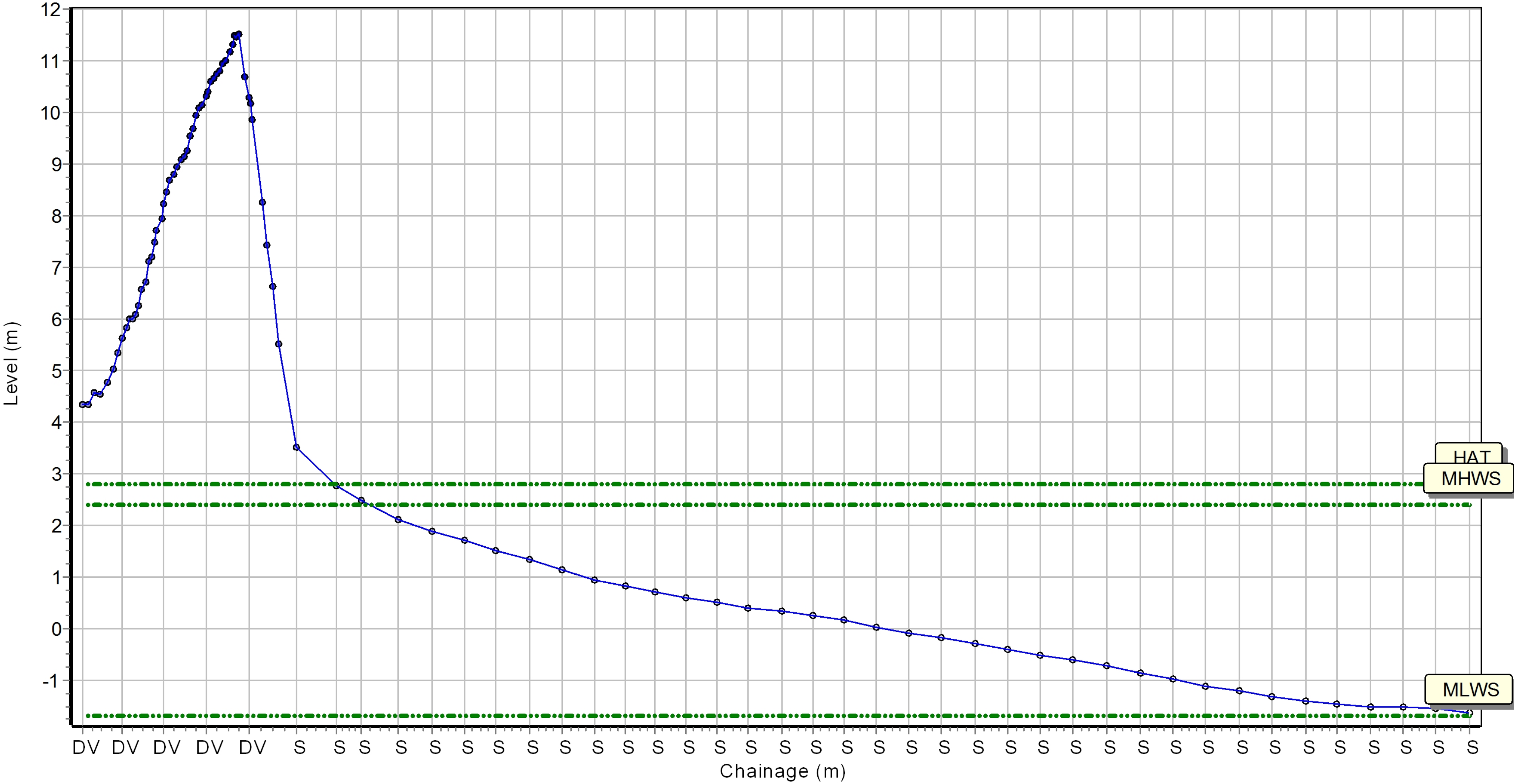
Location: **1aADC02**

Date: 12/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 423387.925 **Northing:** 626385.049 **Profile Bearing:** 56 ° from North



Beach Profile

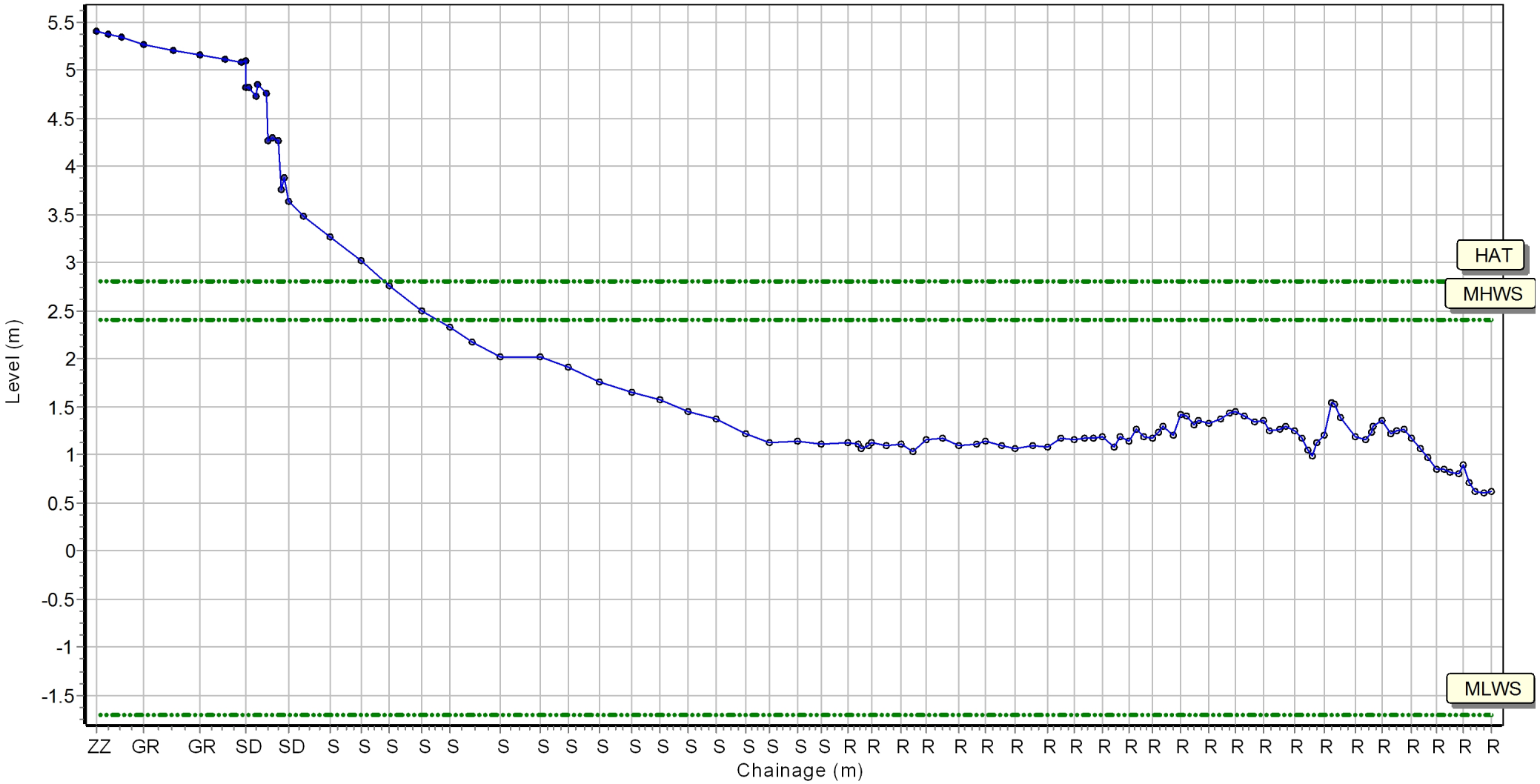
Location: **1aADC04A**

Date: 13/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 426649.592 **Northing:** 614336.9 **Profile Bearing:** 93 ° from North



Beach Profile

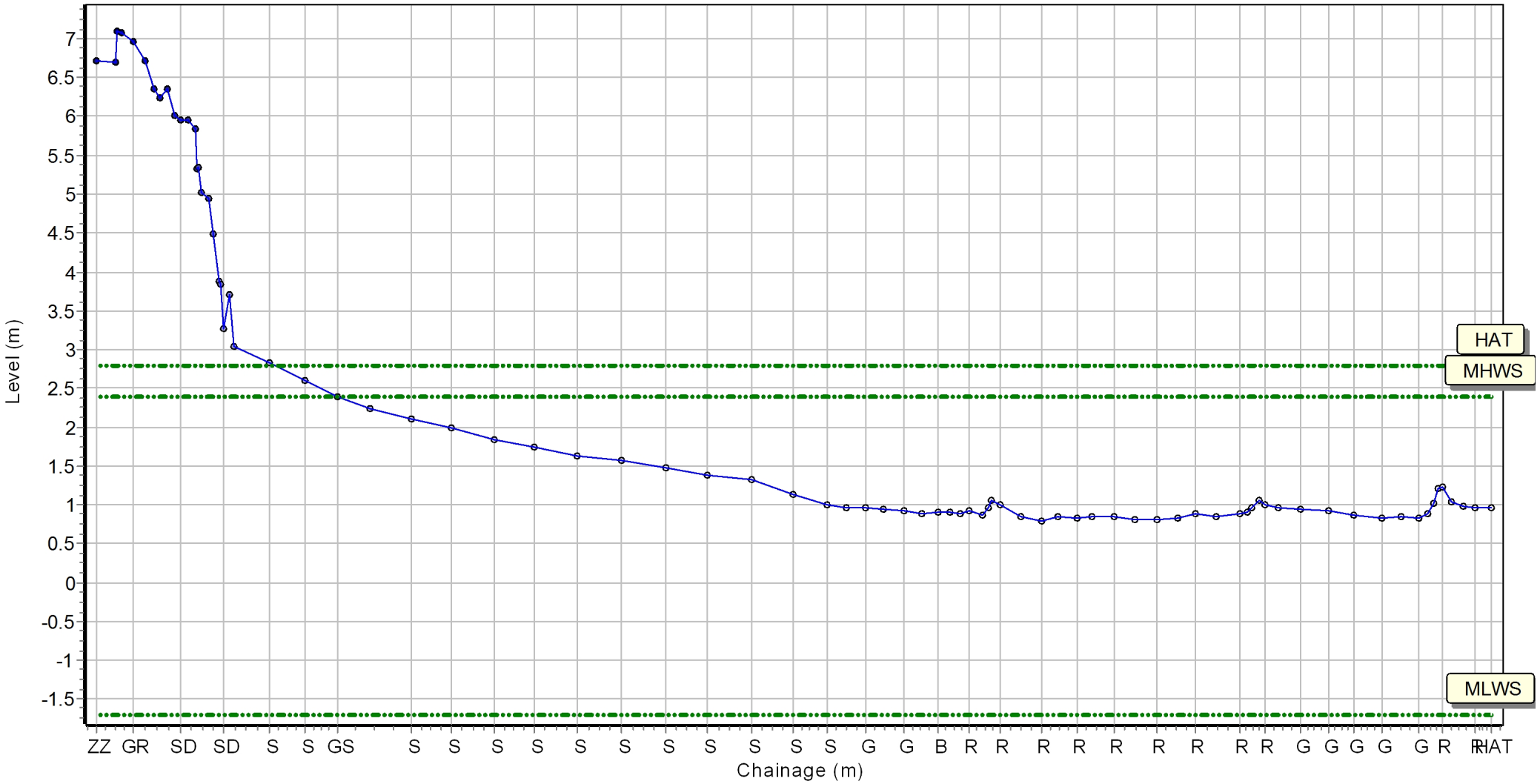
Location: **1aADC04B**

Date: 13/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 426641.642 **Northing:** 614193.793 **Profile Bearing:** 91 ° from North



Beach Profile

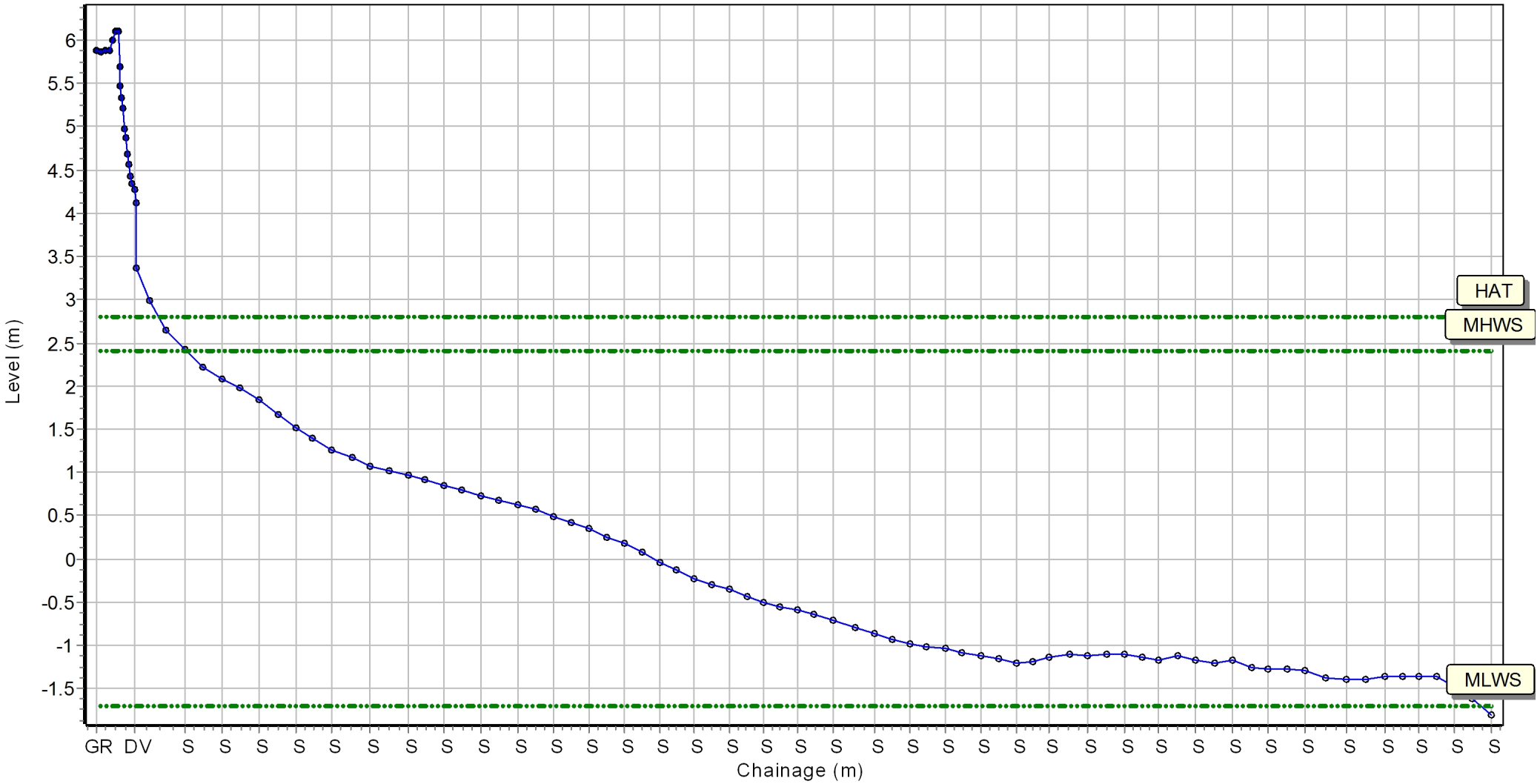
Location: **1aADC07**

Date: 13/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 425324.445 **Northing:** 611018.794 **Profile Bearing:** 134 ° from North



Beach Profile

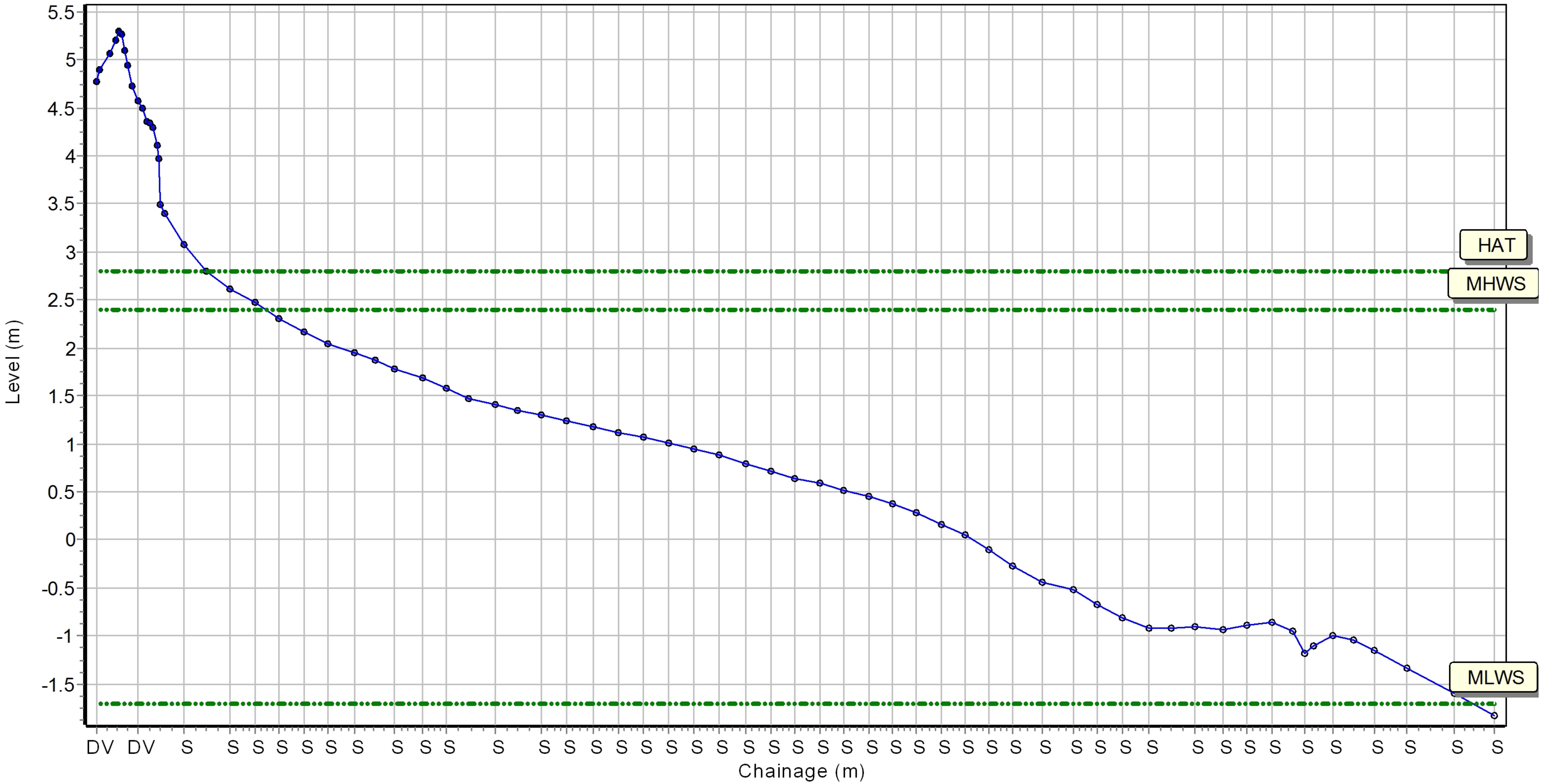
Location: 1aADC08

Date: 13/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 425031.727 **Northing:** 610632.355 **Profile Bearing:** 112 ° from North



Beach Profile

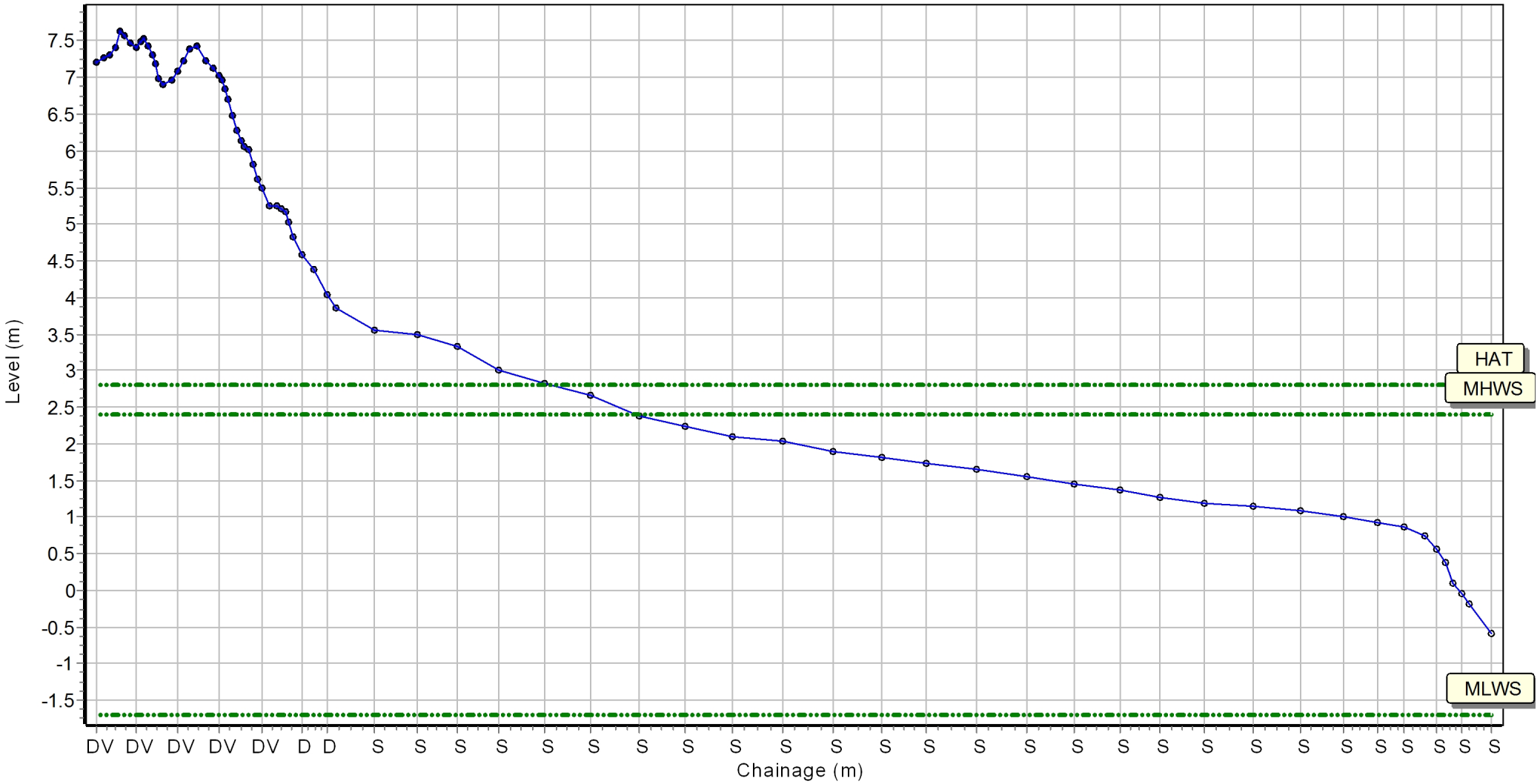
Location: **1aADC09**

Date: 13/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 424802.33 **Northing:** 610353.259 **Profile Bearing:** 120 ° from North



Beach Profile

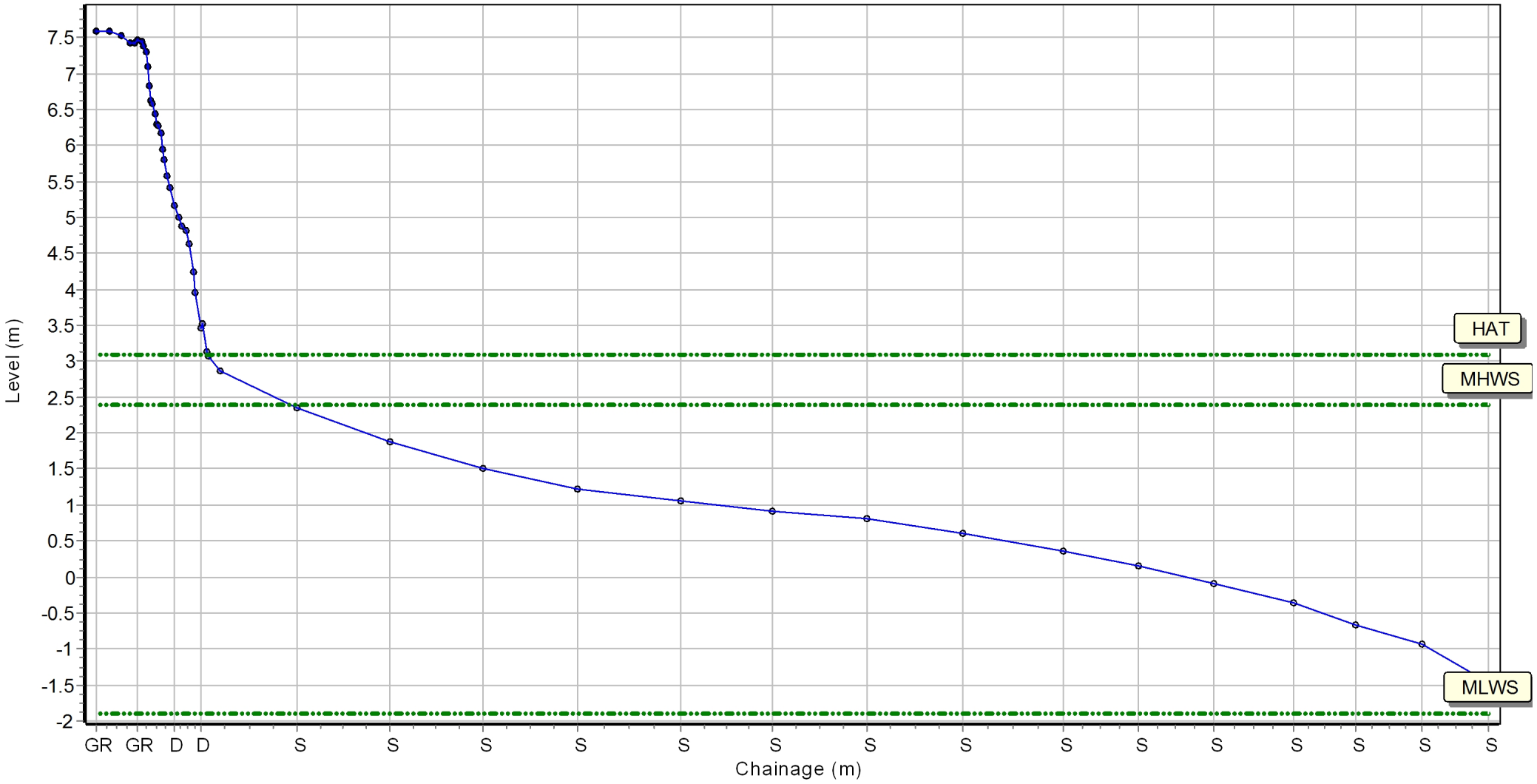
Location: **1aADC15A**

Date: 11/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 428642.365 **Northing:** 603069.145 **Profile Bearing:** 90 ° from North



Beach Profile

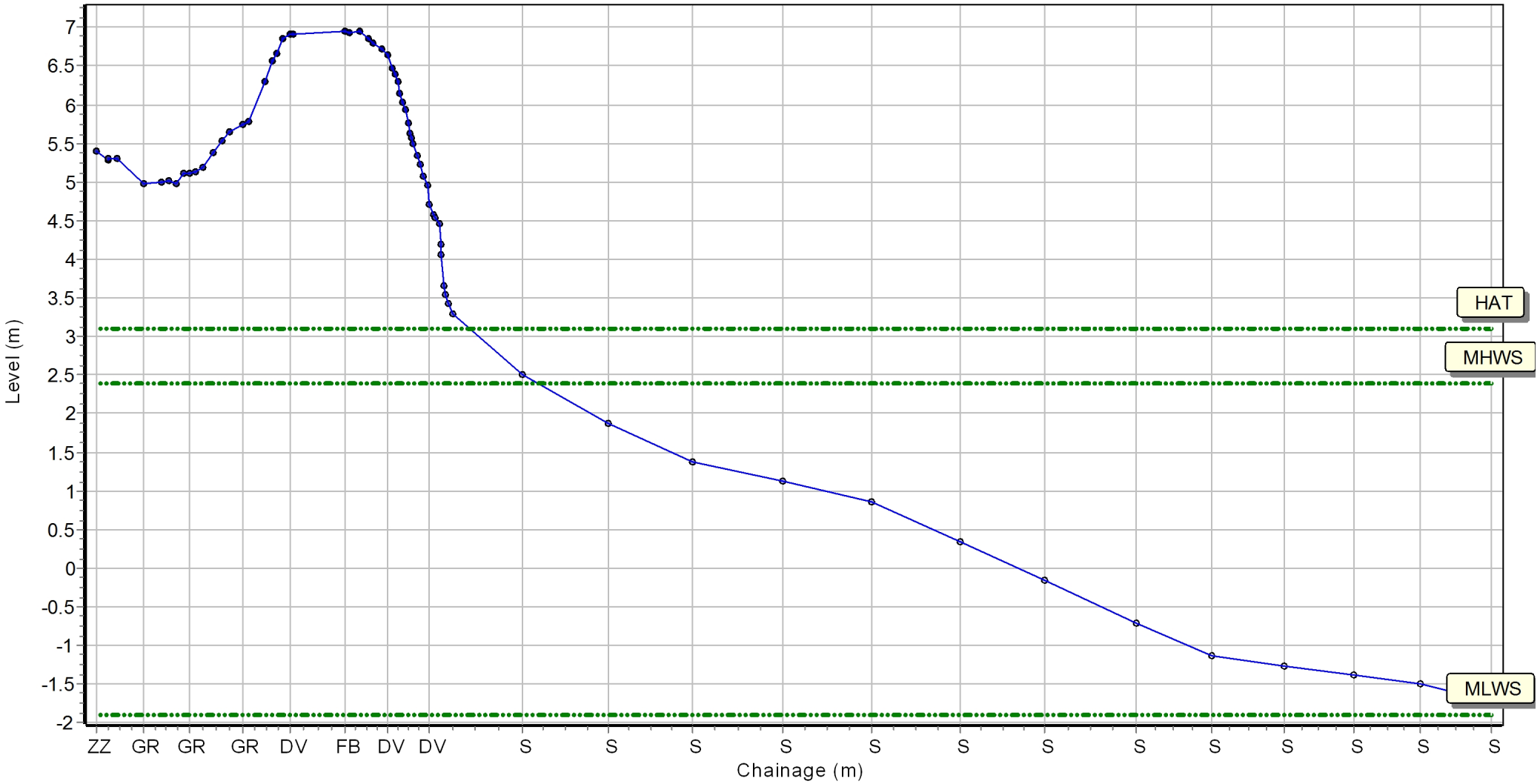
Location: **1aADC16**

Date: 11/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 428575.092 **Northing:** 602921.577 **Profile Bearing:** 93 ° from North



Beach Profile

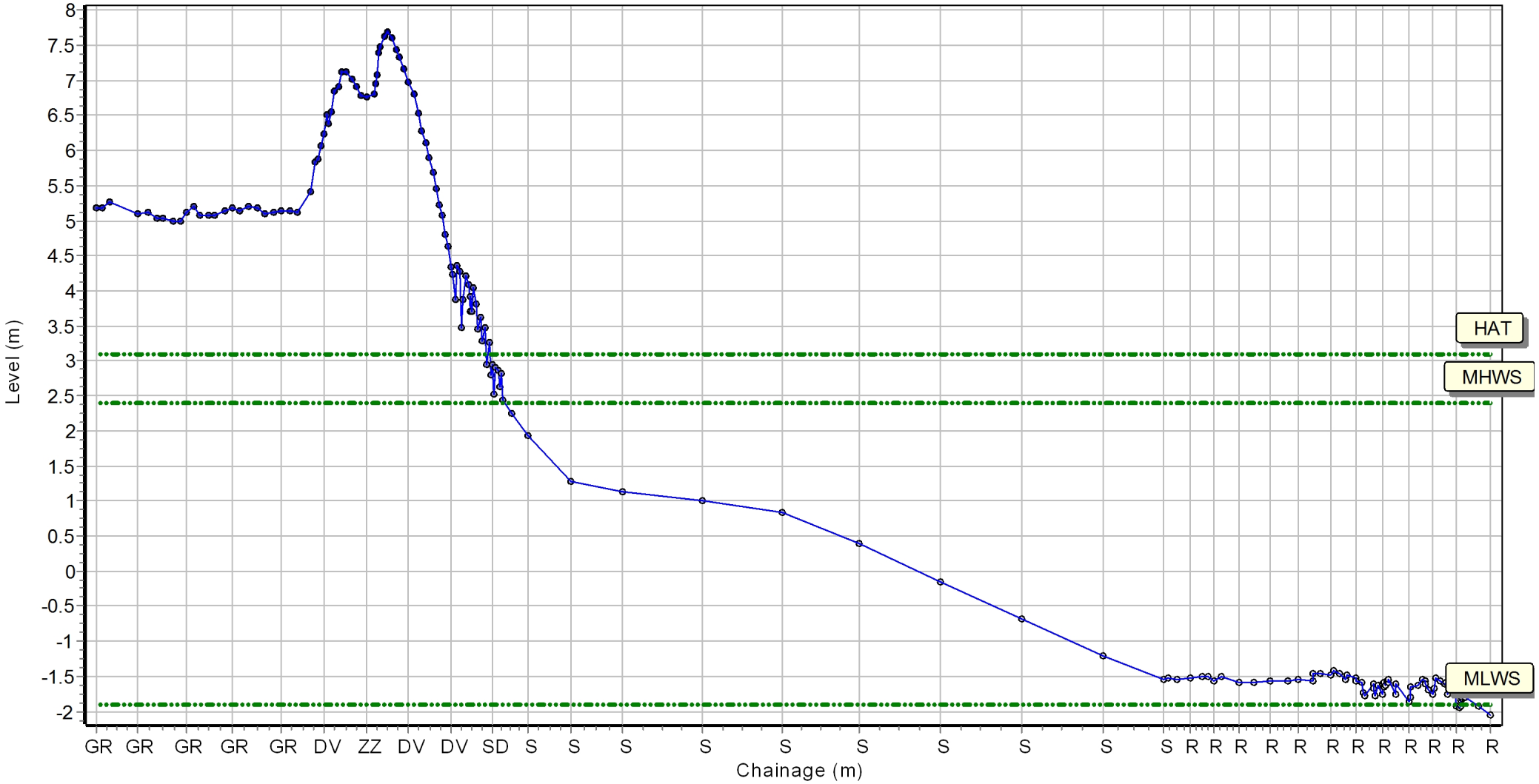
Location: **1aADC16A**

Date: 11/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 428543.525 **Northing:** 602704.175 **Profile Bearing:** 92 ° from North



Beach Profile

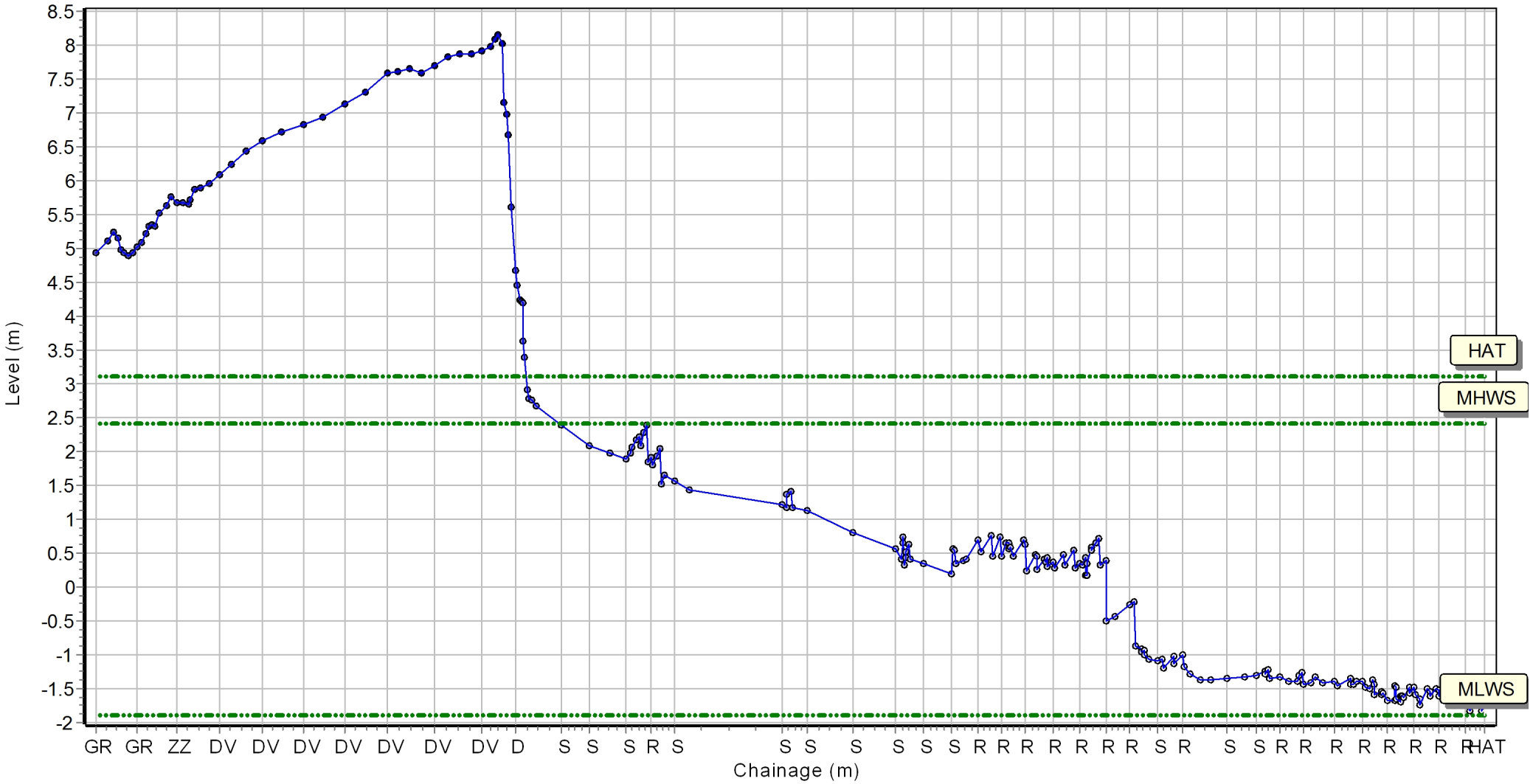
Location: **1aADC16B**

Date: 11/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 428440.457 **Northing:** 601948.341 **Profile Bearing:** 144 ° from North



Beach Profile

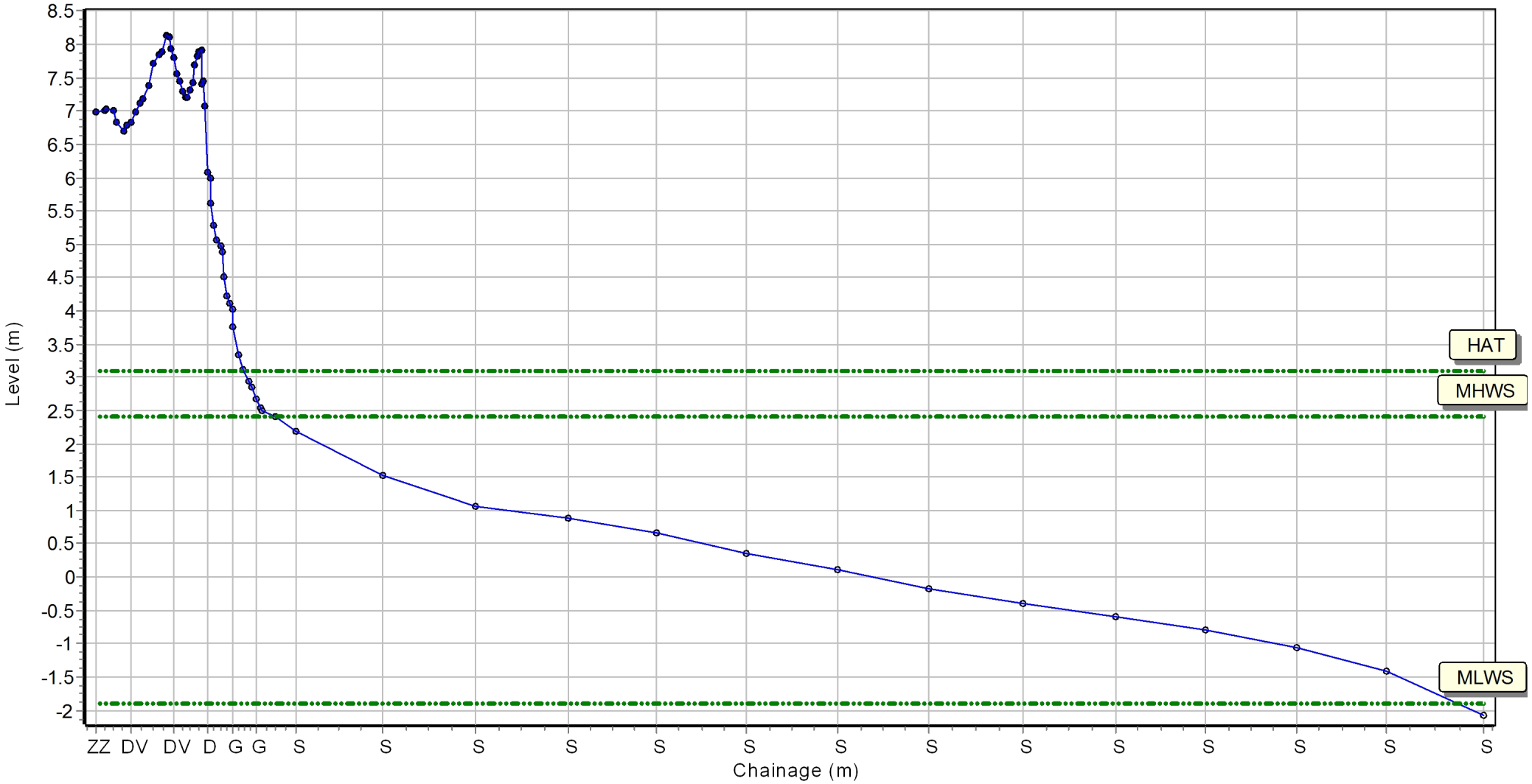
Location: **1aADC17**

Date: 11/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 428116.847 **Northing:** 601565.465 **Profile Bearing:** 114 ° from North



Beach Profile

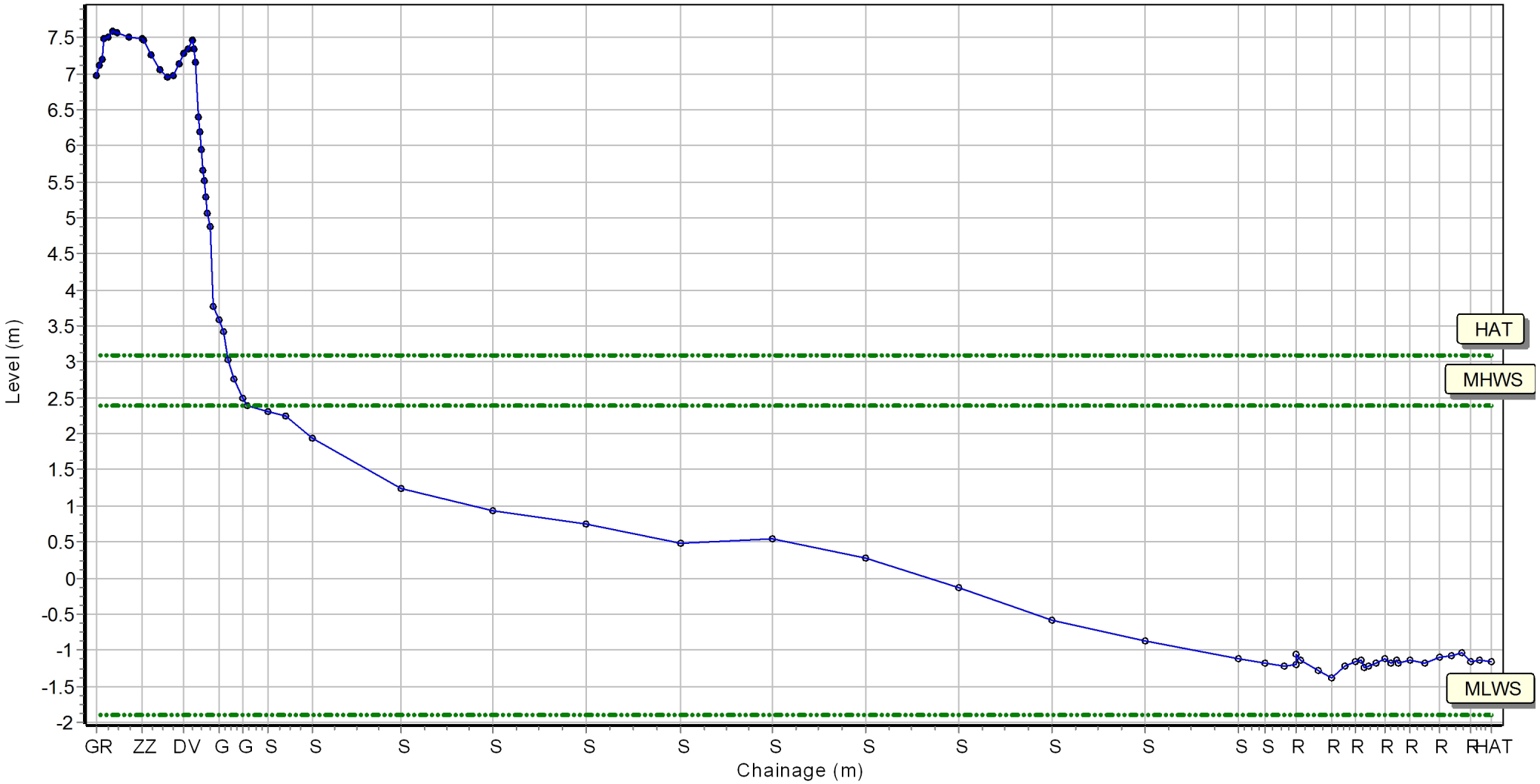
Location: **1aADC17A**

Date: 11/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 427947.662 **Northing:** 601040.259 **Profile Bearing:** 109 ° from North



Beach Profile

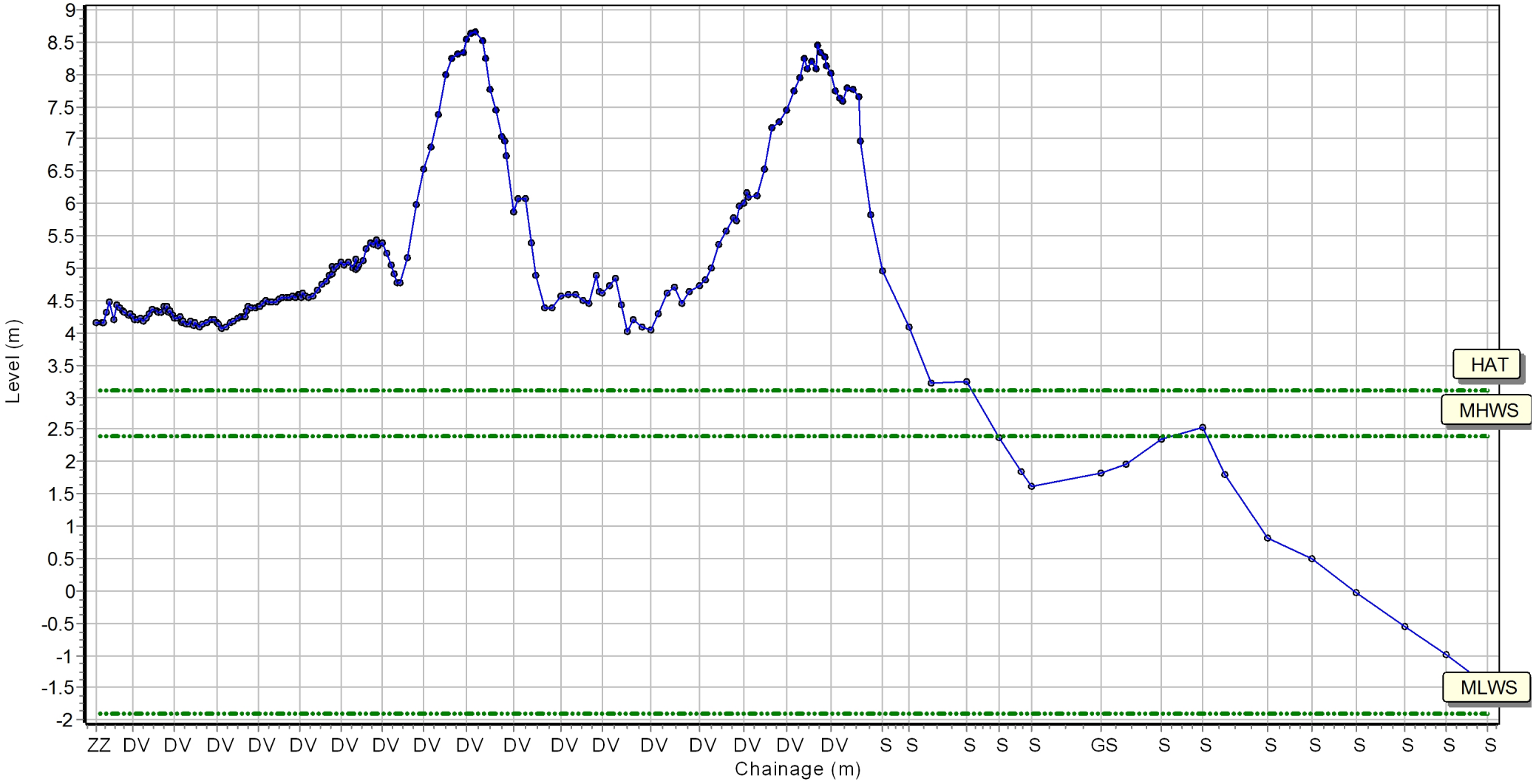
Location: **1aCMBC01**

Date: 11/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 427552.578 **Northing:** 596402.769 **Profile Bearing:** 59 ° from North



Beach Profile

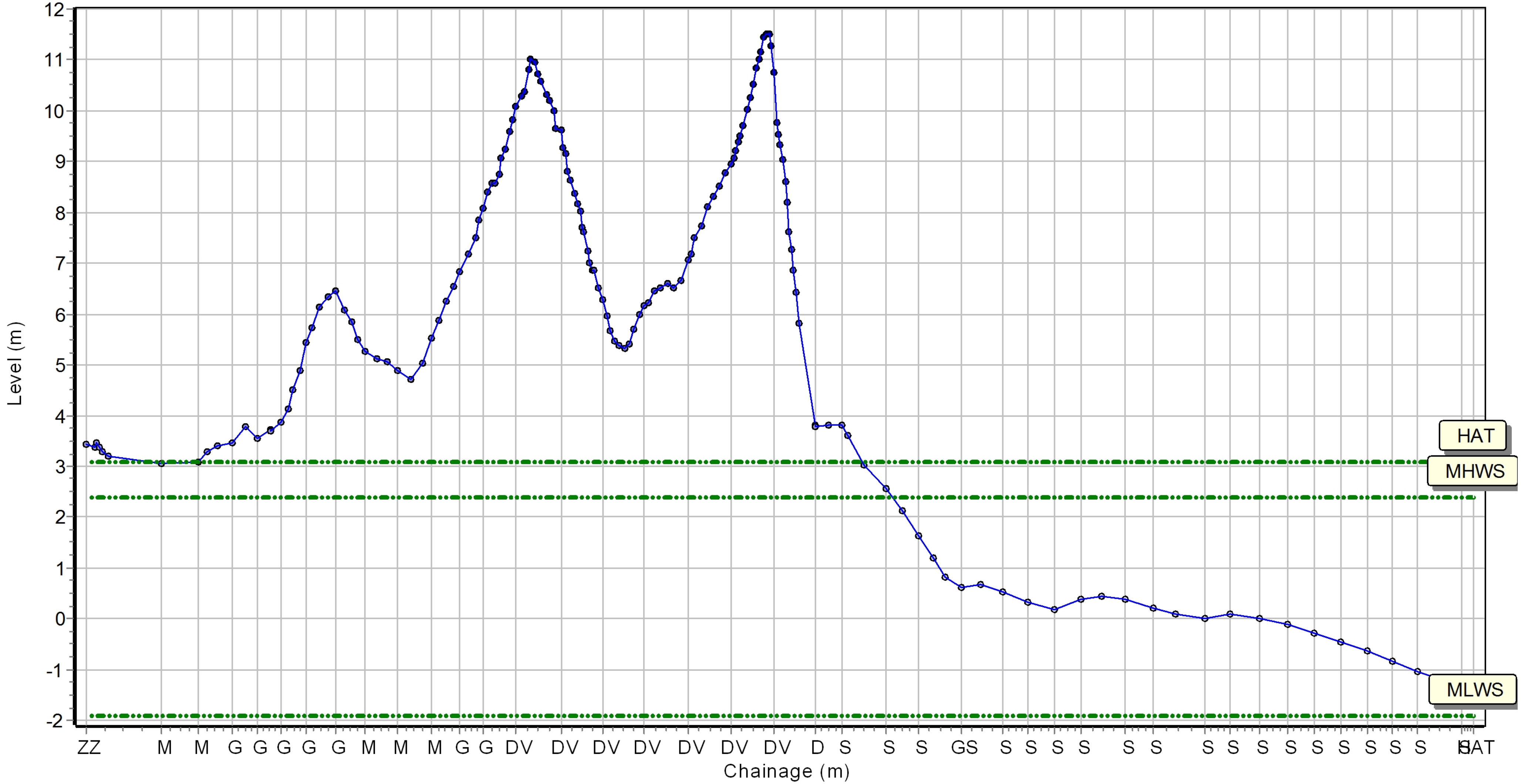
Location: **1aCMBC02**

Date: 11/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 428355.916 **Northing:** 594532.141 **Profile Bearing:** 56 ° from North



http://www.sandsuser.com **SANDS**

Beach Profile

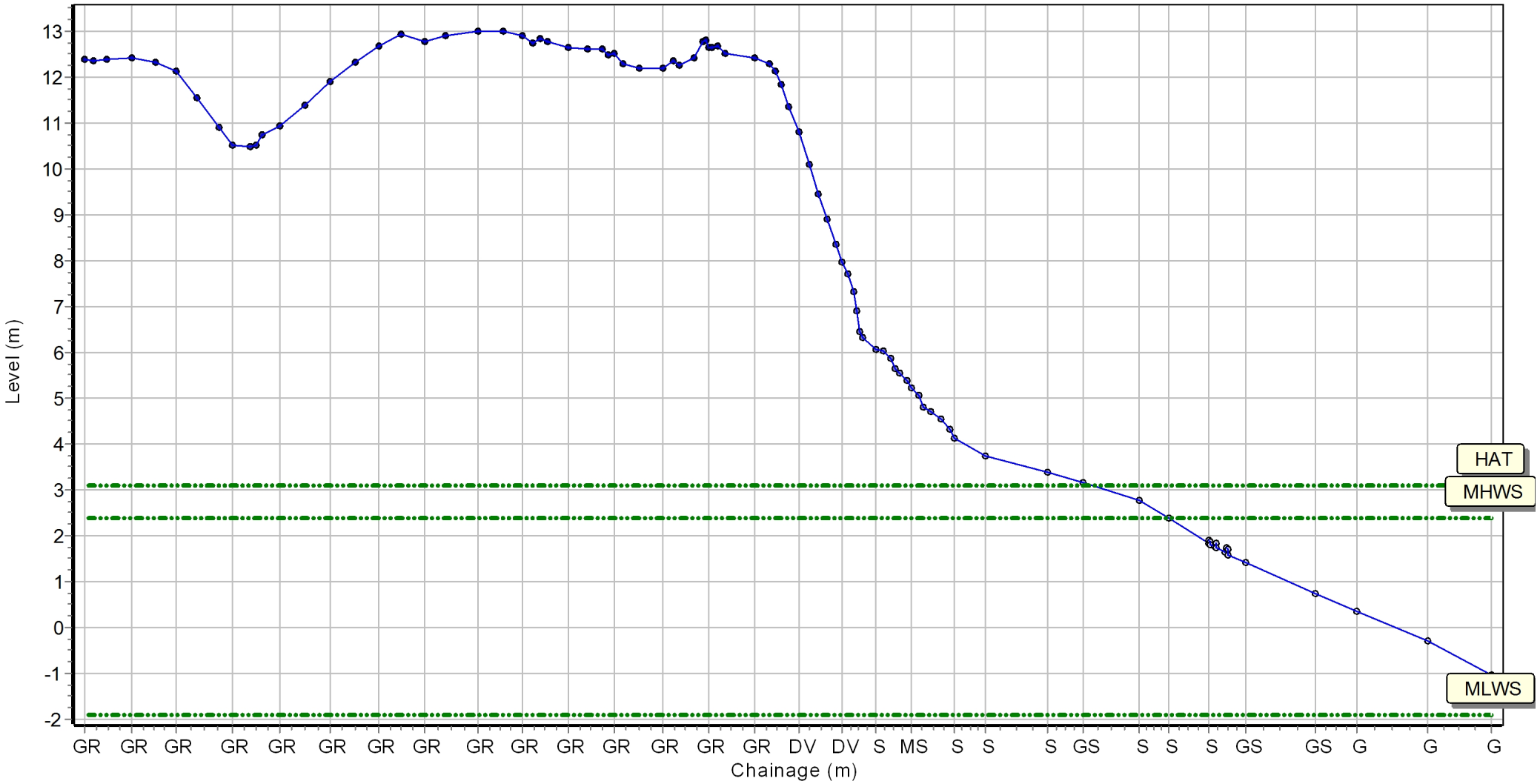
Location: **1aCMBC03A**

Date: 10/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 430128.317 **Northing:** 591148.463 **Profile Bearing:** 70 ° from North



Beach Profile

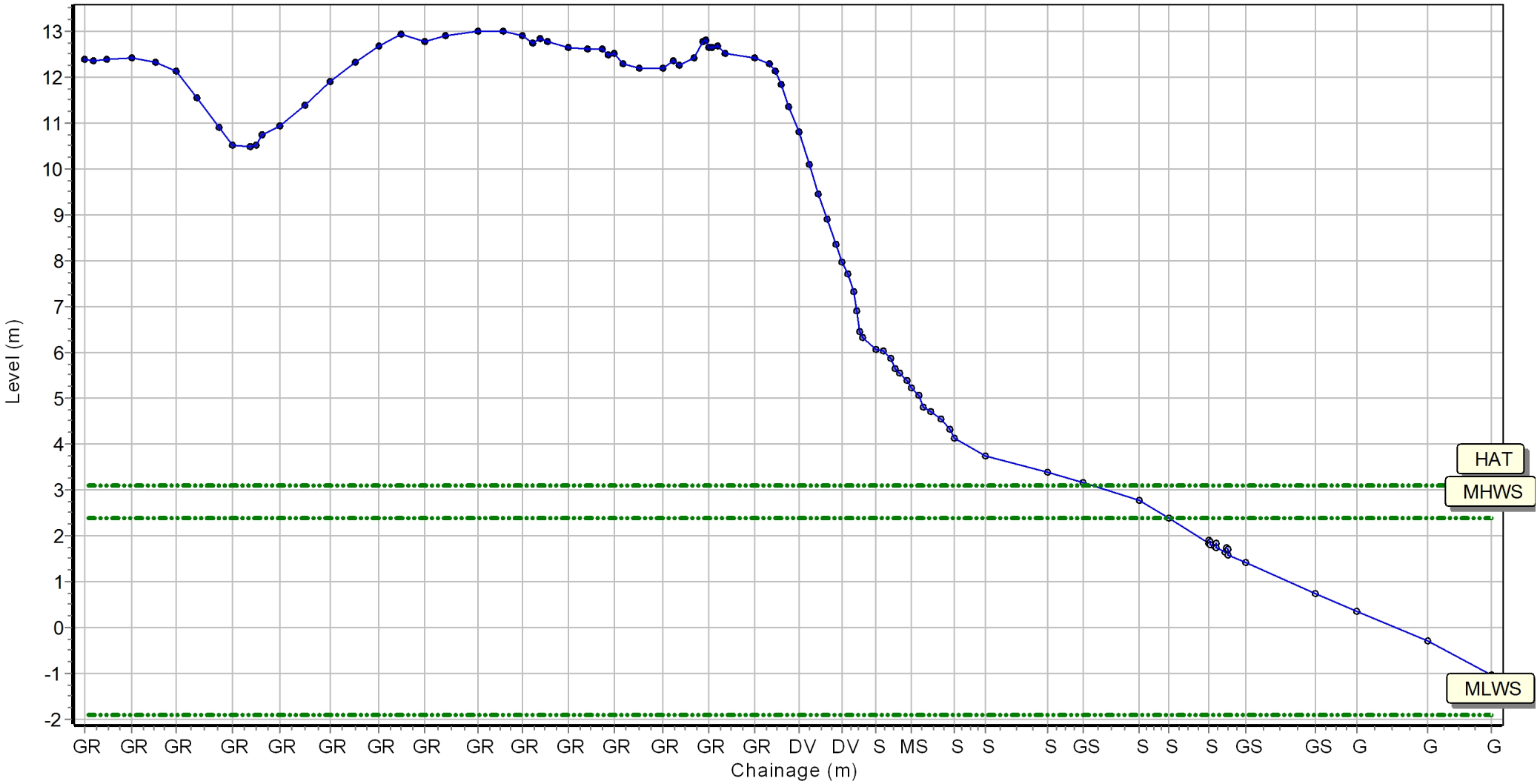
Location: **1aCMBC03A**

Date: 10/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 430128.317 **Northing:** 591148.463 **Profile Bearing:** 70 ° from North



Beach Profile

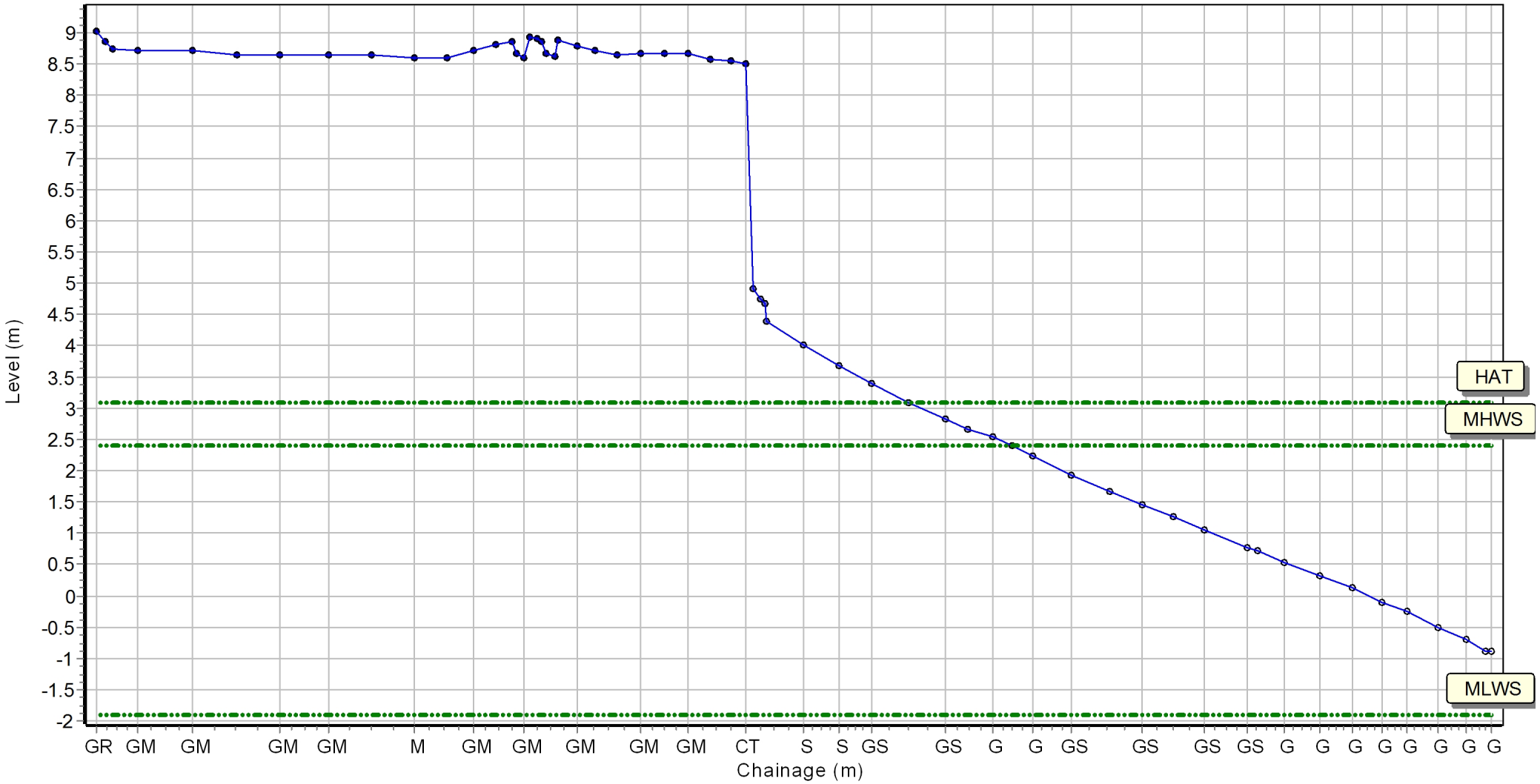
Location: **1aCMBC03B**

Date: 10/04/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 430478.518 **Northing:** 590661.474 **Profile Bearing:** 58 ° from North



Beach Profile

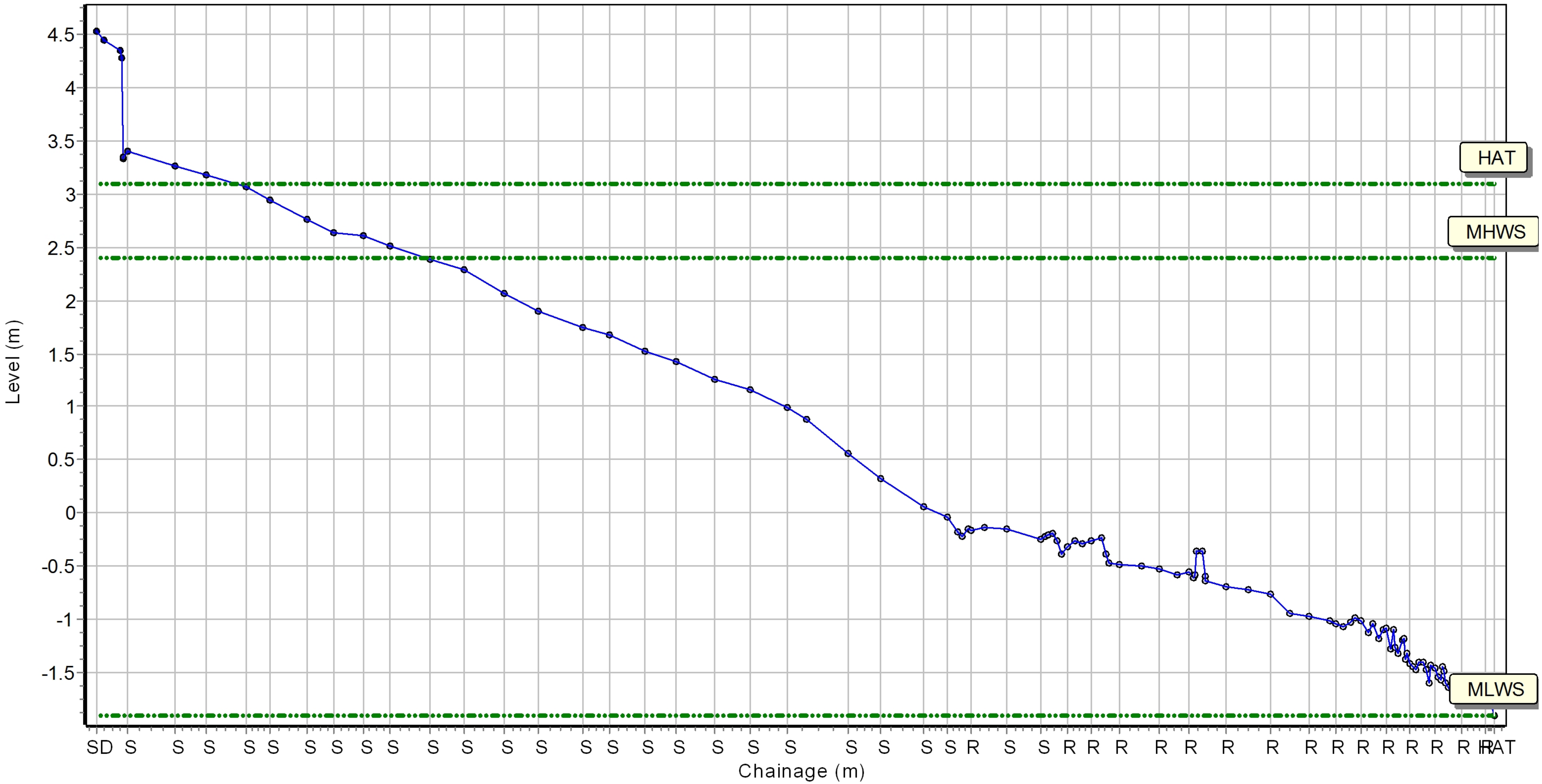
Location: 1aNWB1

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431665.429 **Northing:** 588007.636 **Profile Bearing:** 212 ° from North



Beach Profile

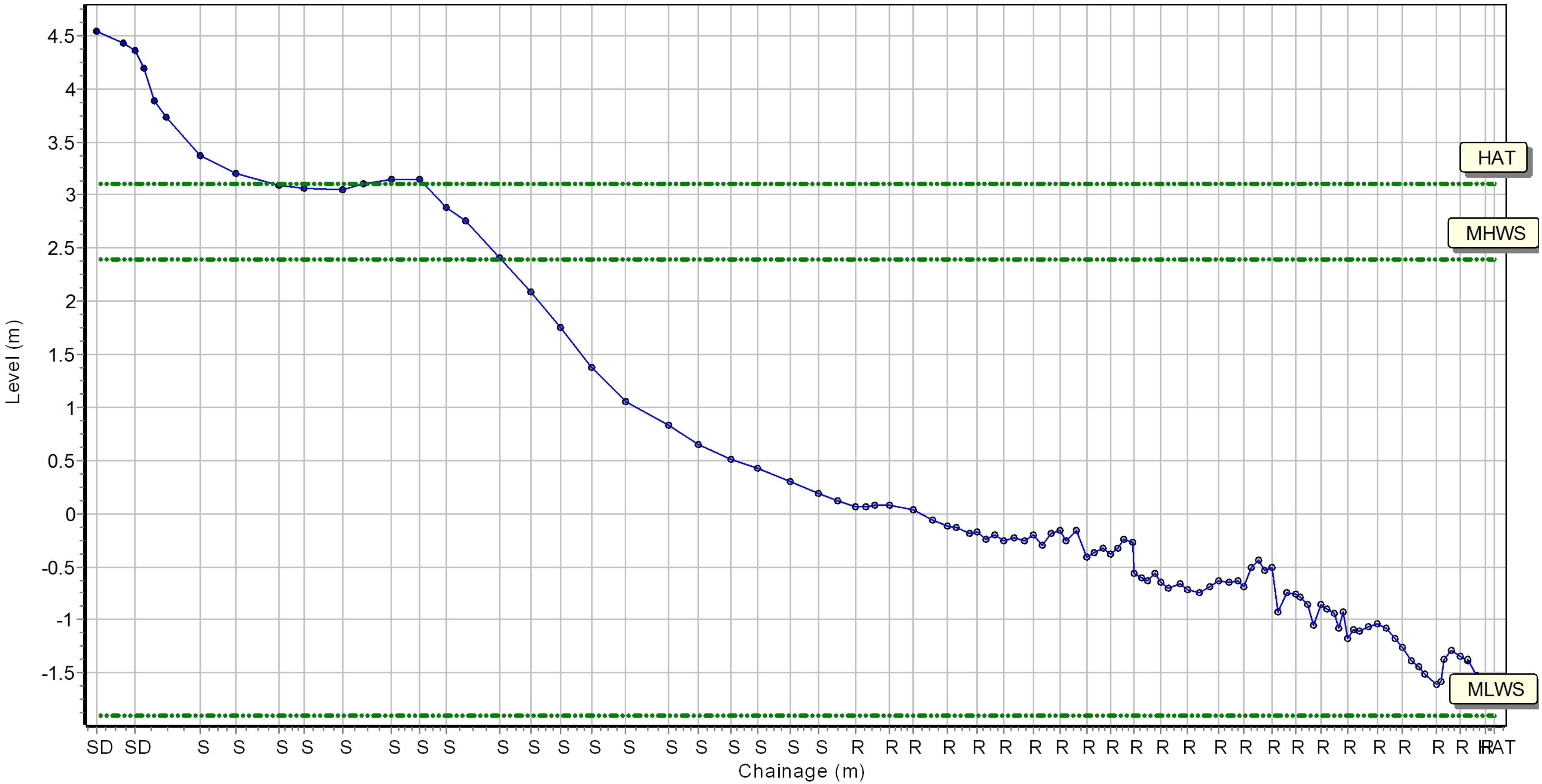
Location: **1aNWB2**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431618.236 **Northing:** 588035.356 **Profile Bearing:** 202 ° from North



http://www.sandsuser.com

SANDS

Beach Profile

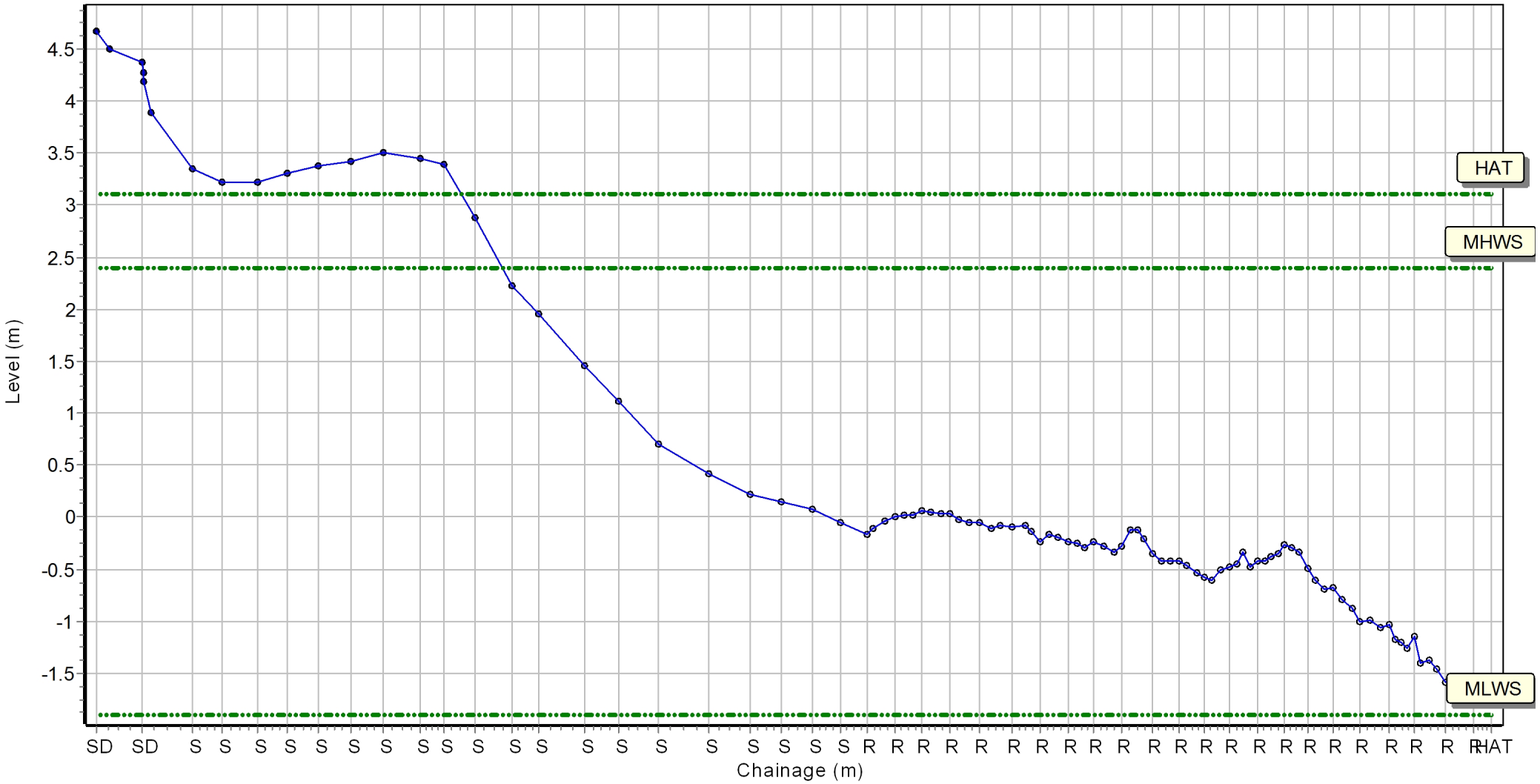
Location: **1aNWB3**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431573.455 **Northing:** 588049.149 **Profile Bearing:** 193 ° from North



Beach Profile

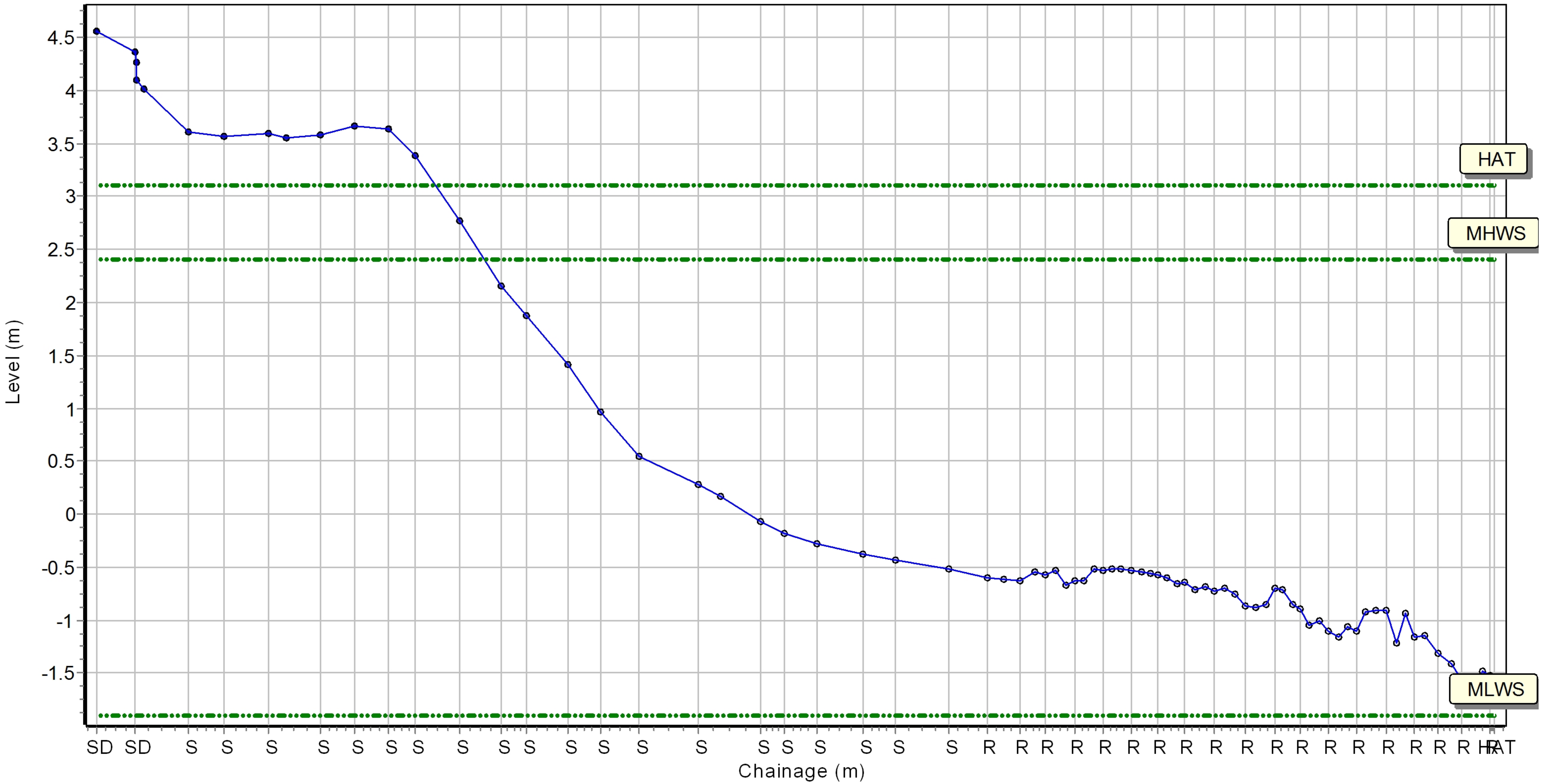
Location: **1aNWB4**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431523.116 **Northing:** 588054.727 **Profile Bearing:** 184 ° from North



Beach Profile

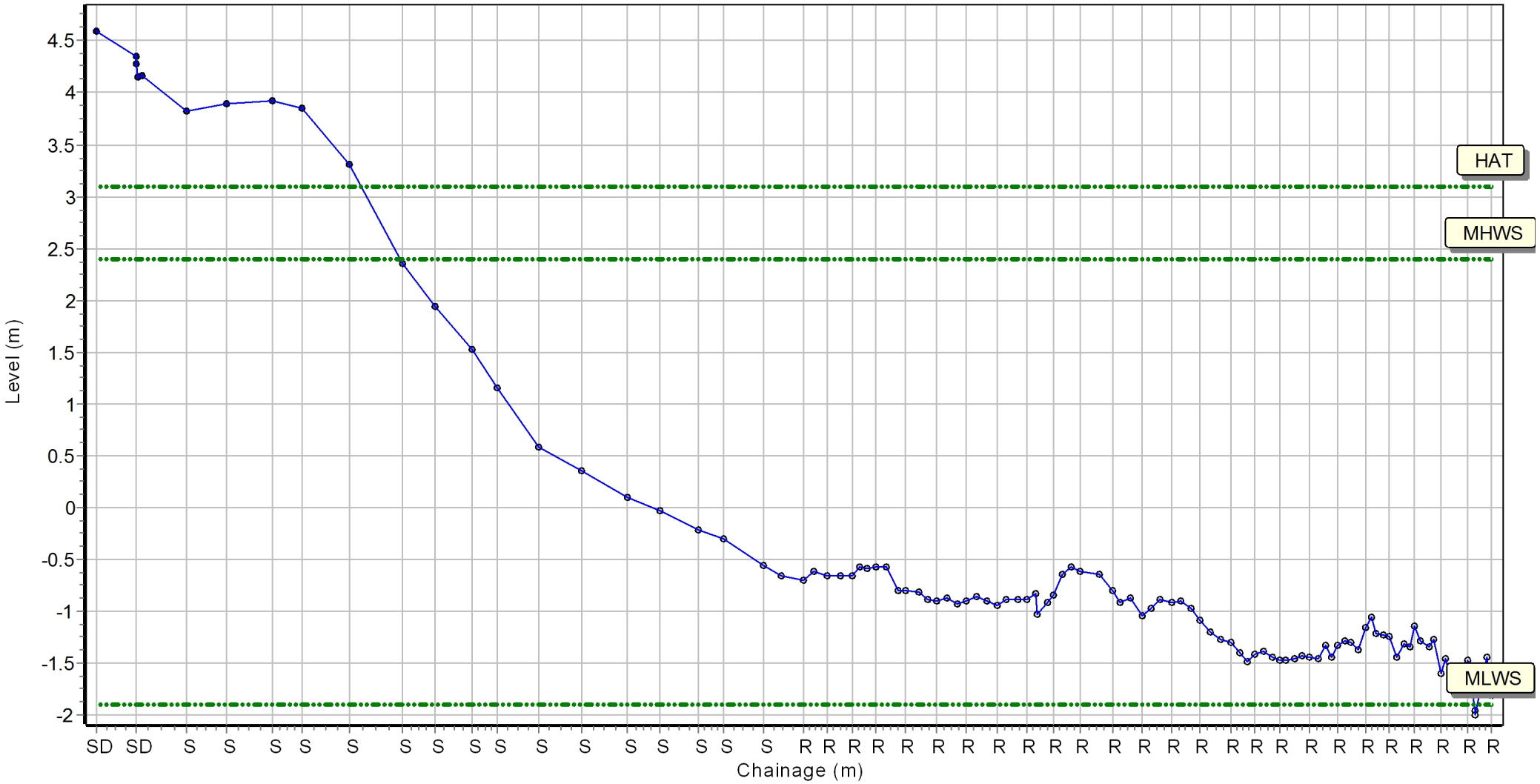
Location: **1aNWB5**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431473.586 **Northing:** 588048.504 **Profile Bearing:** 174 ° from North



Beach Profile

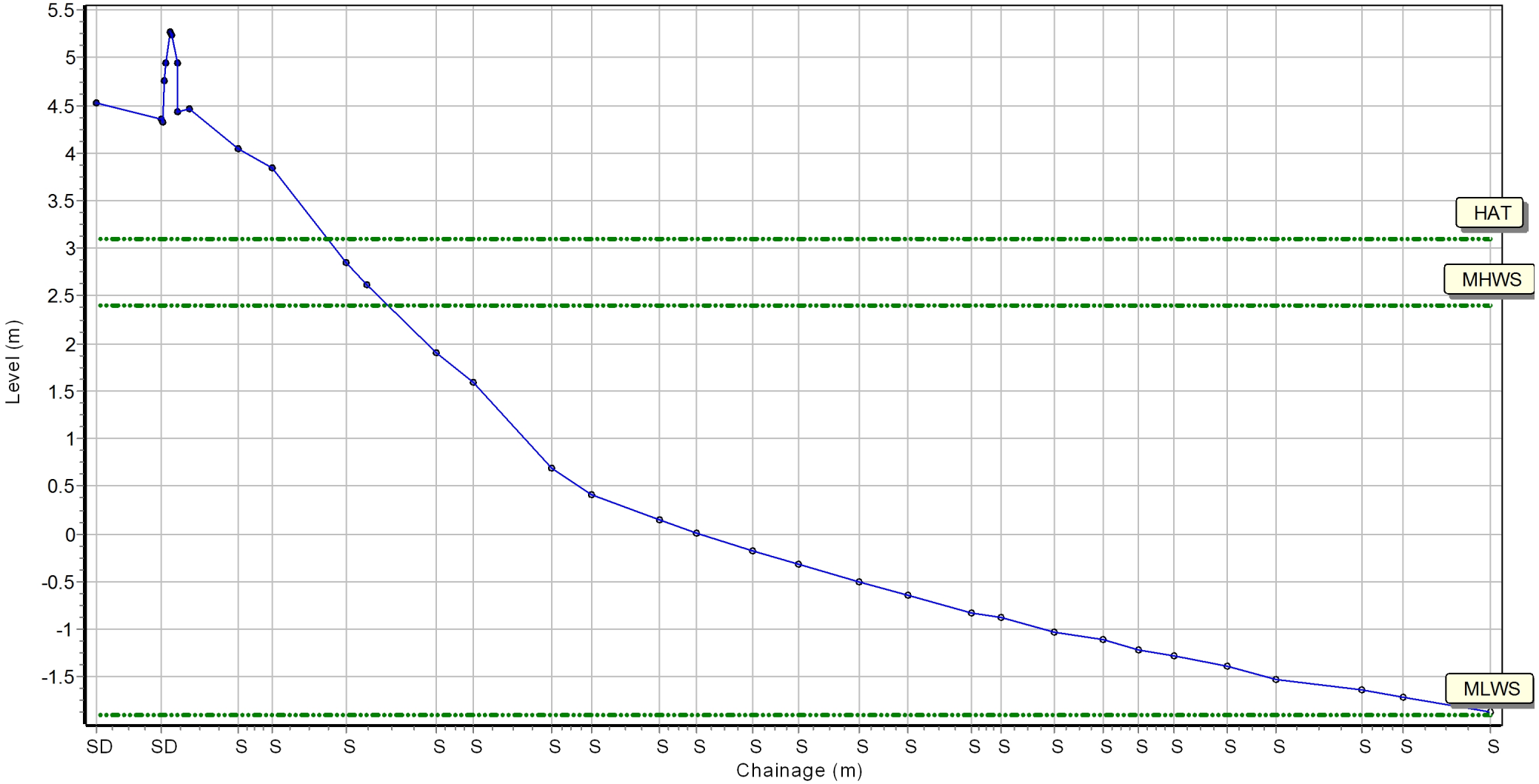
Location: **1aNWB6**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431424.56 **Northing:** 588032.268 **Profile Bearing:** 164 ° from North



Beach Profile

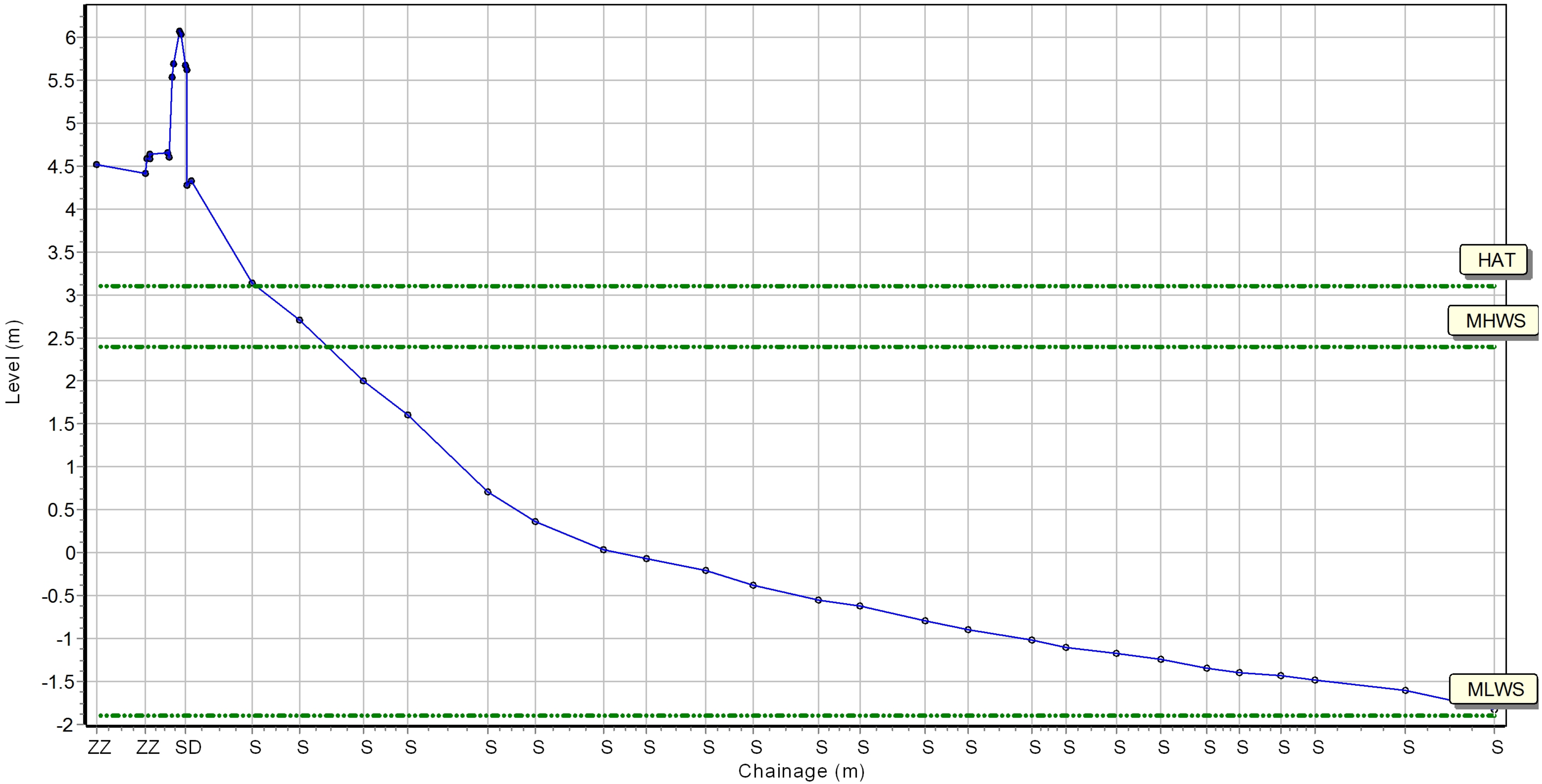
Location: 1aNWB7

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431379.622 **Northing:** 588011.712 **Profile Bearing:** 165 ° from North



Beach Profile

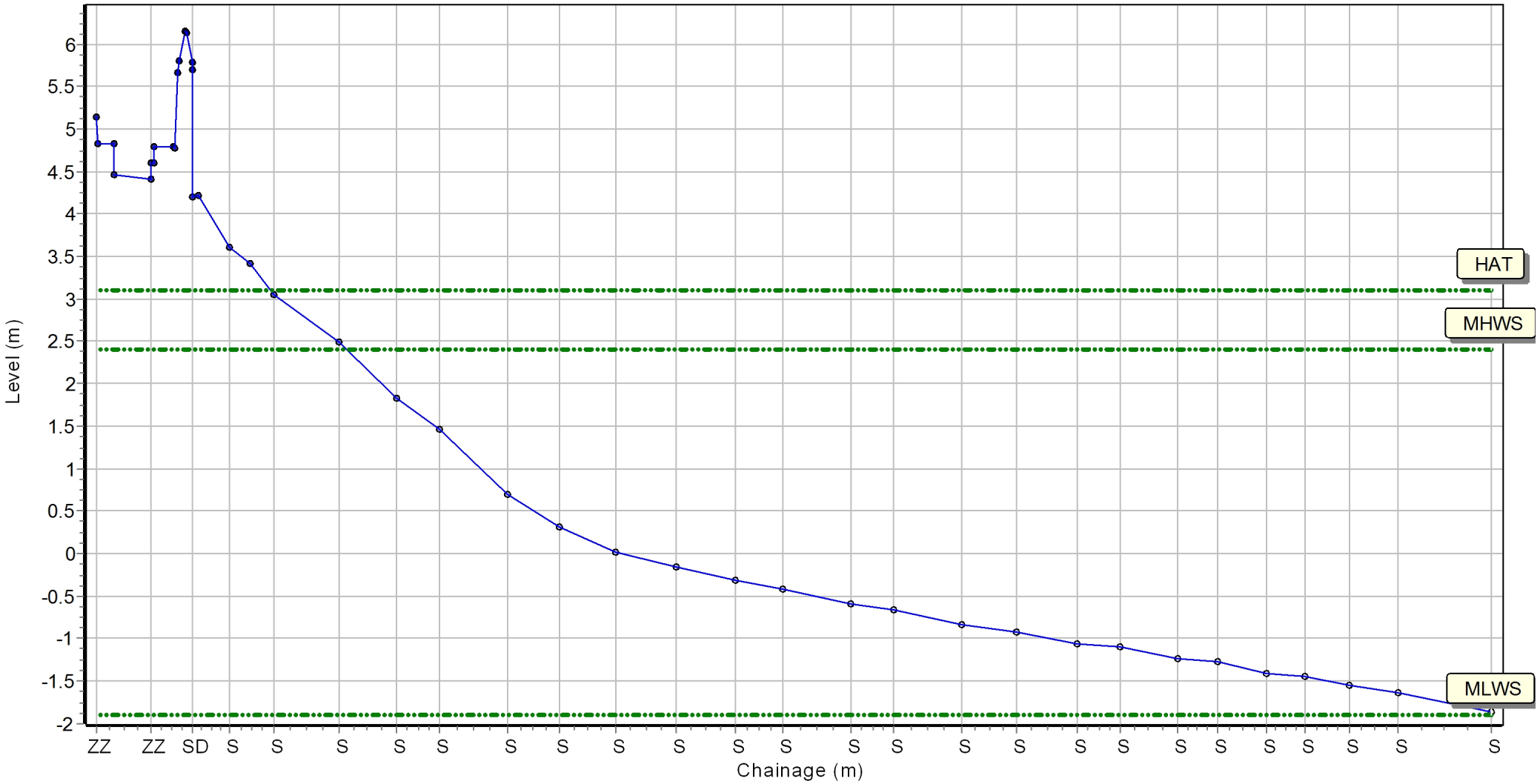
Location: **1aNWB8**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431332.62 **Northing:** 587988.039 **Profile Bearing:** 144 ° from North



Beach Profile

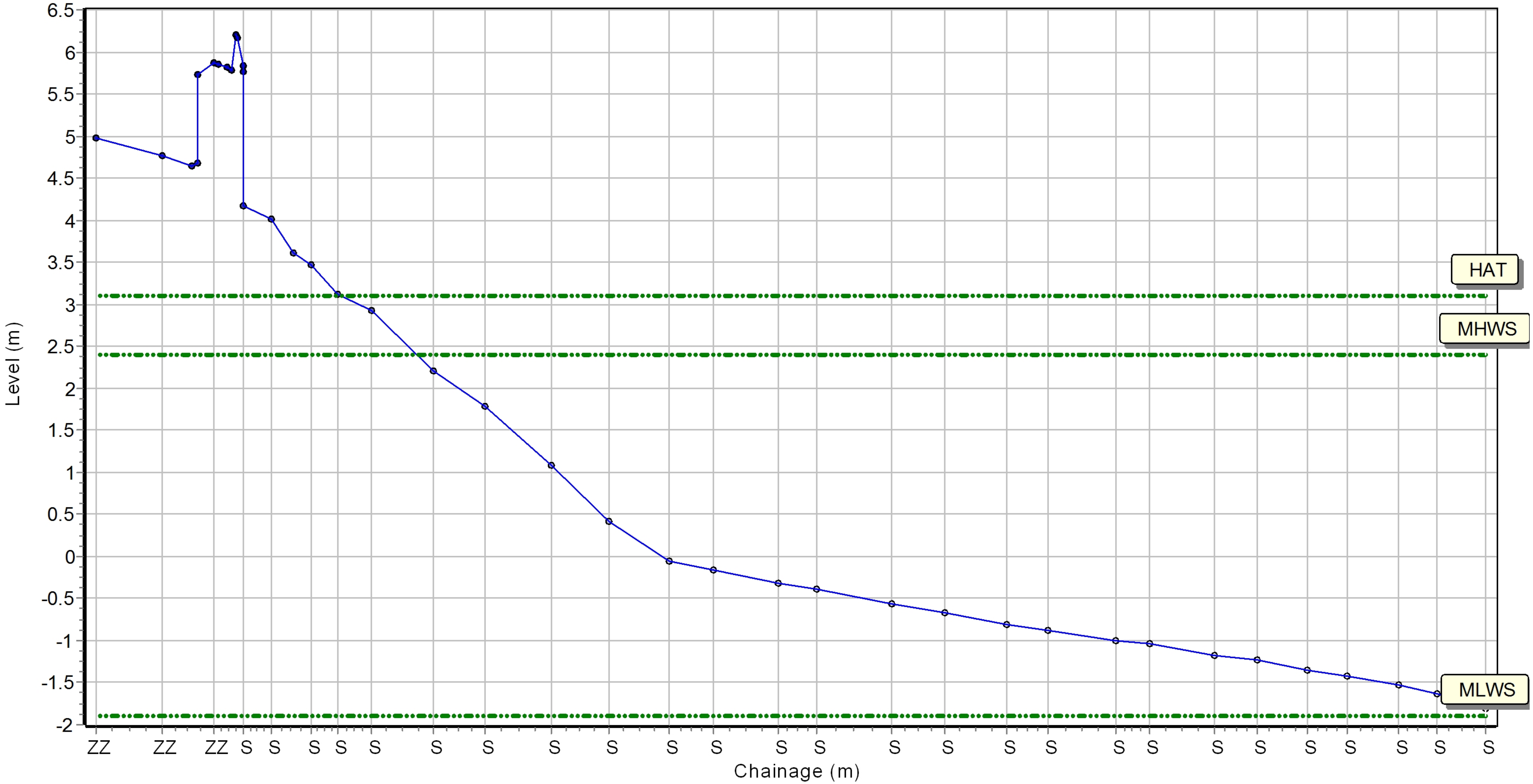
Location: 1aNWB9

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431288.421 **Northing:** 587963.979 **Profile Bearing:** 142 ° from North



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Beach Profile

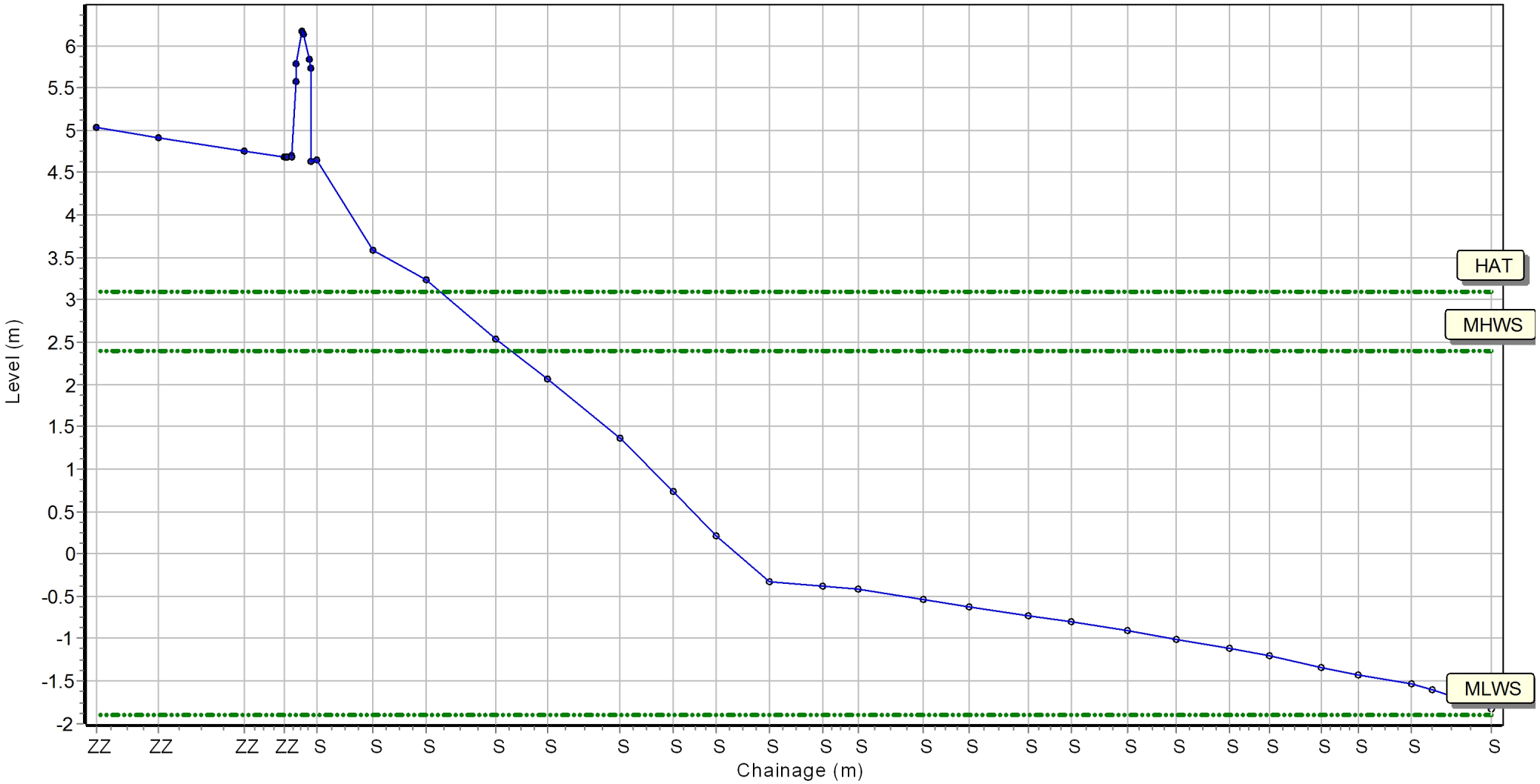
Location: **1aNWB10**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431244.074 **Northing:** 587936.575 **Profile Bearing:** 139 ° from North



Beach Profile

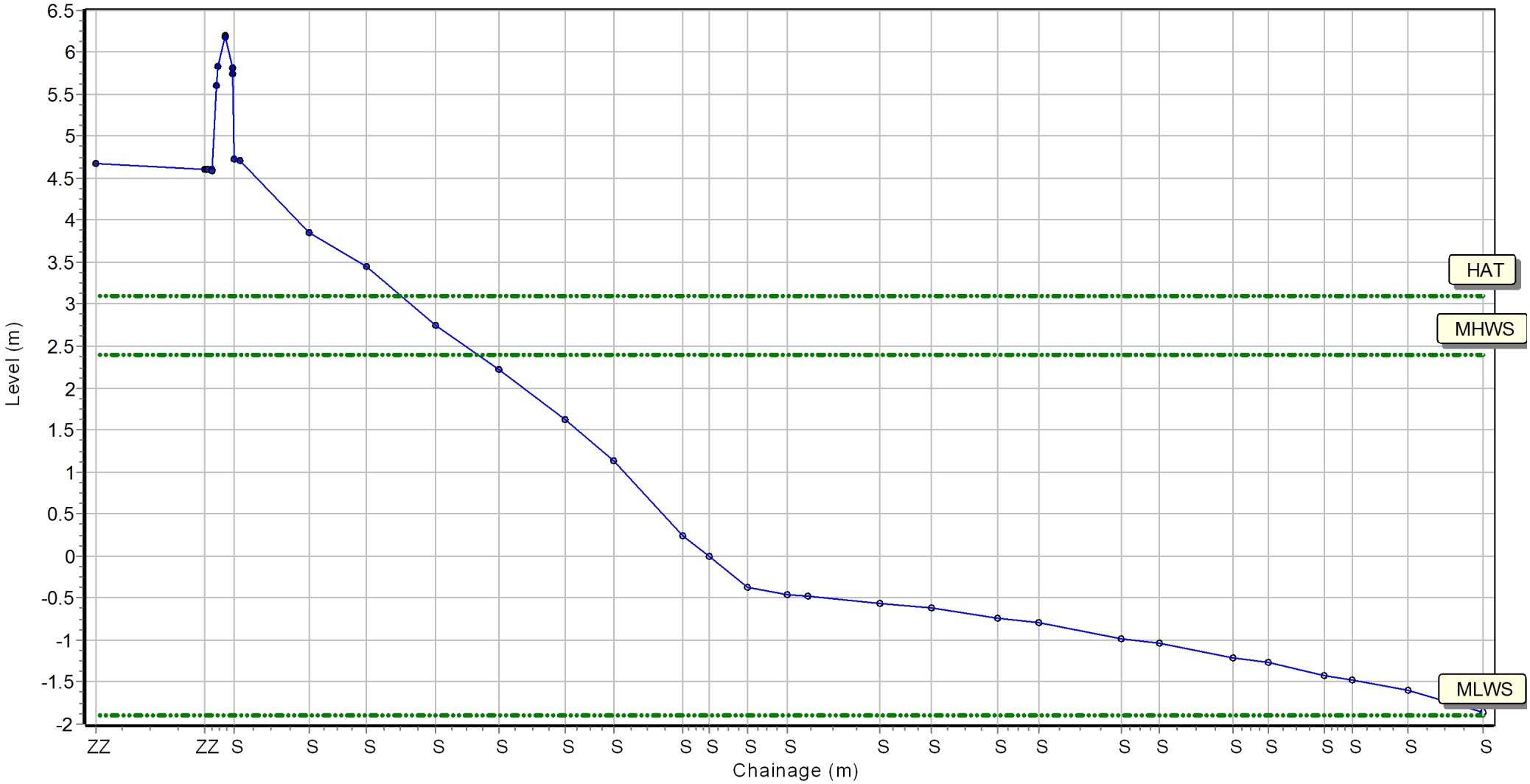
Location: **1aNWB11**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431211.343 **Northing:** 587896.891 **Profile Bearing:** 135 ° from North



Beach Profile

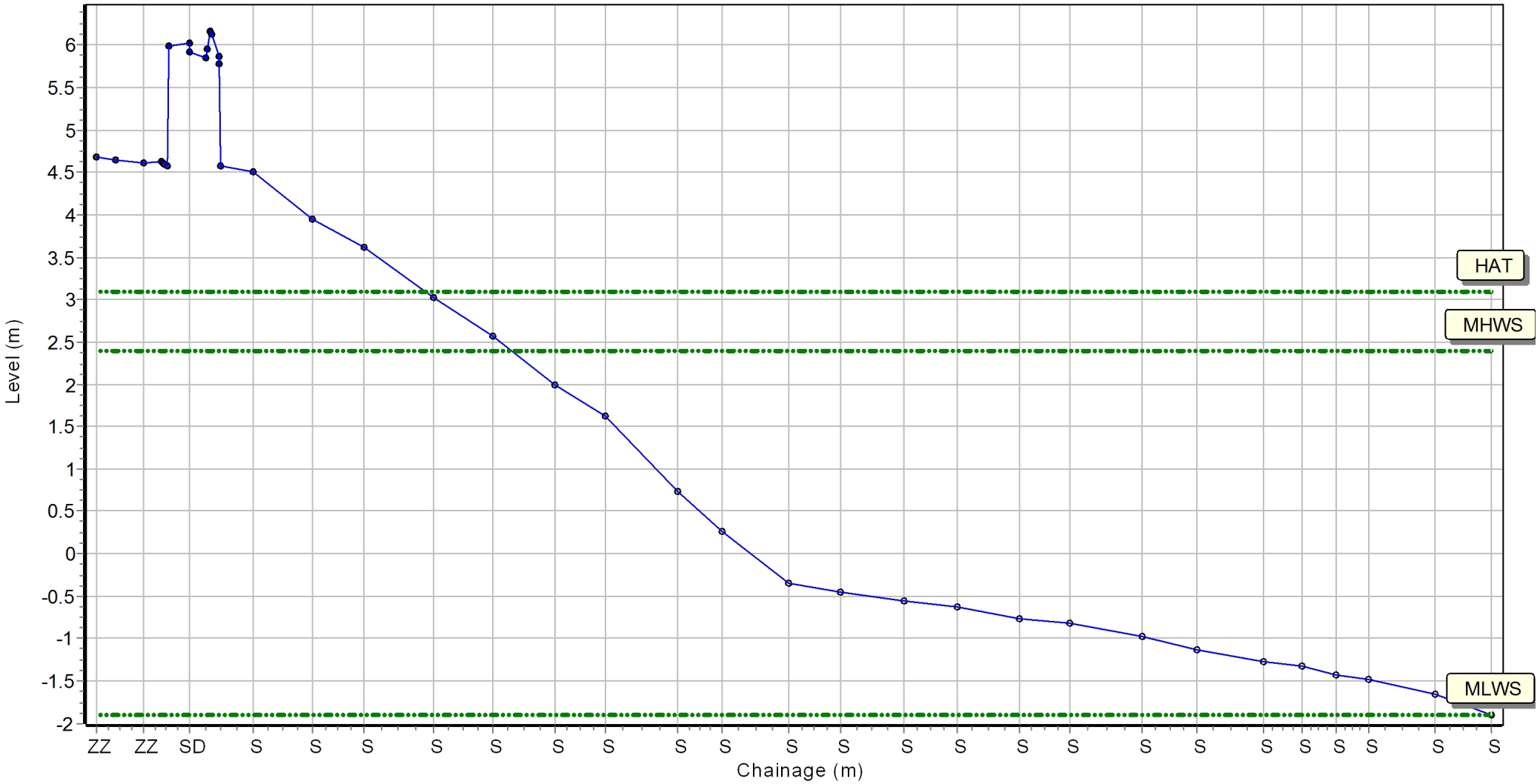
Location: **1aNWB12**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431176.844 **Northing:** 587860.651 **Profile Bearing:** 132 ° from North



Beach Profile

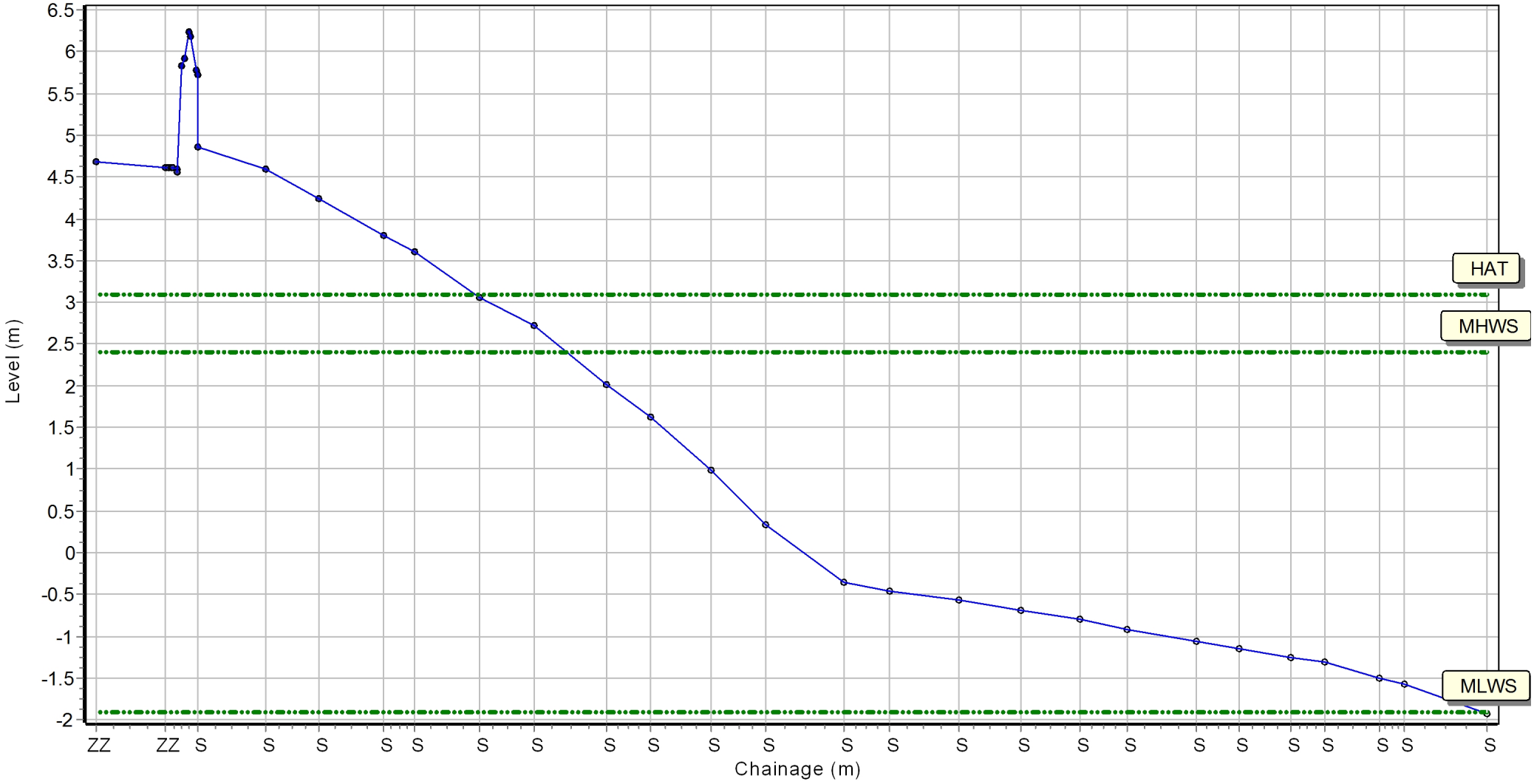
Location: **1aNWB13**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431143.784 **Northing:** 587821.594 **Profile Bearing:** 129 ° from North



Beach Profile

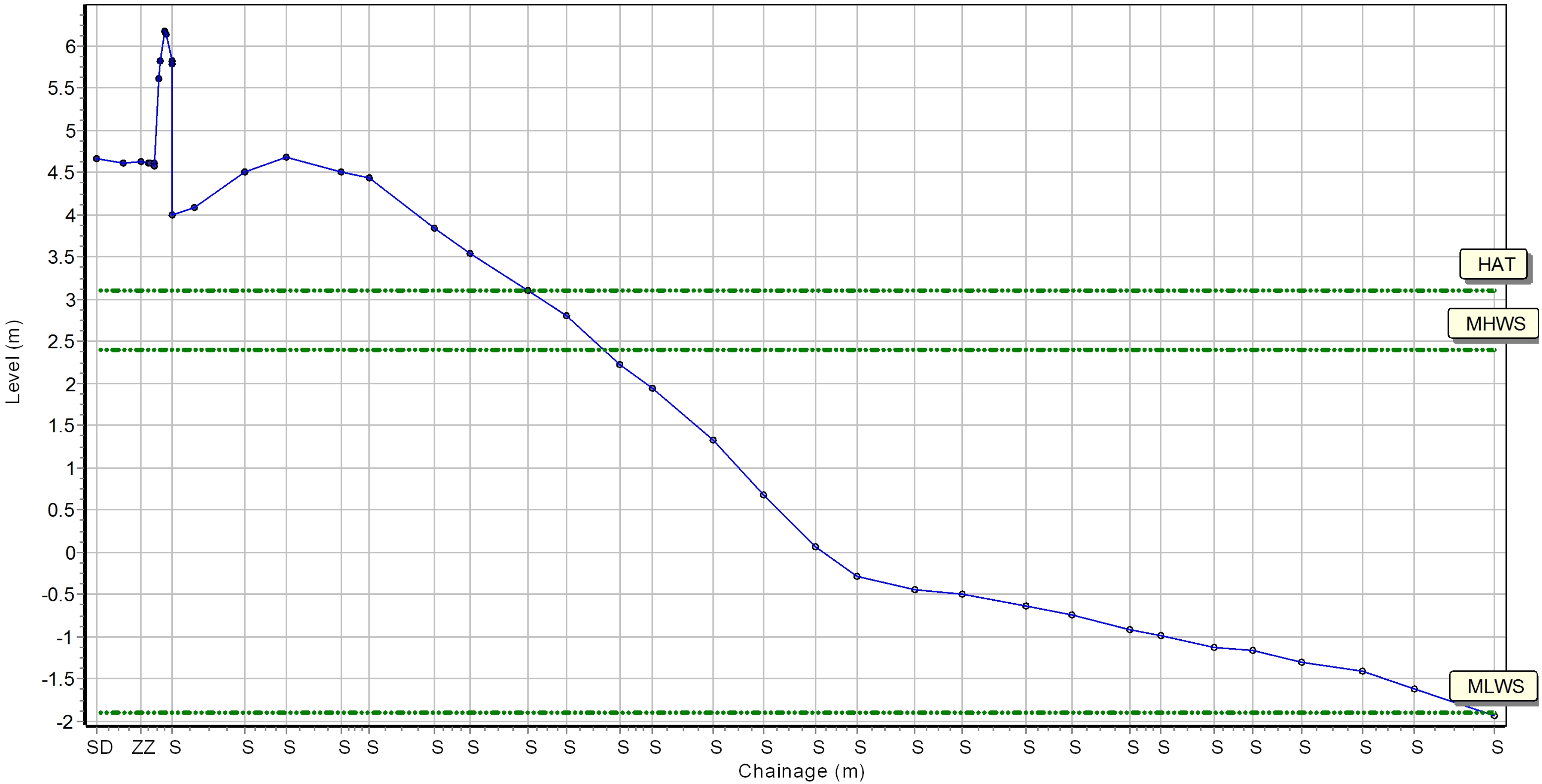
Location: **1aNWB14**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431113.86 **Northing:** 587780.727 **Profile Bearing:** 115 ° from North



Beach Profile

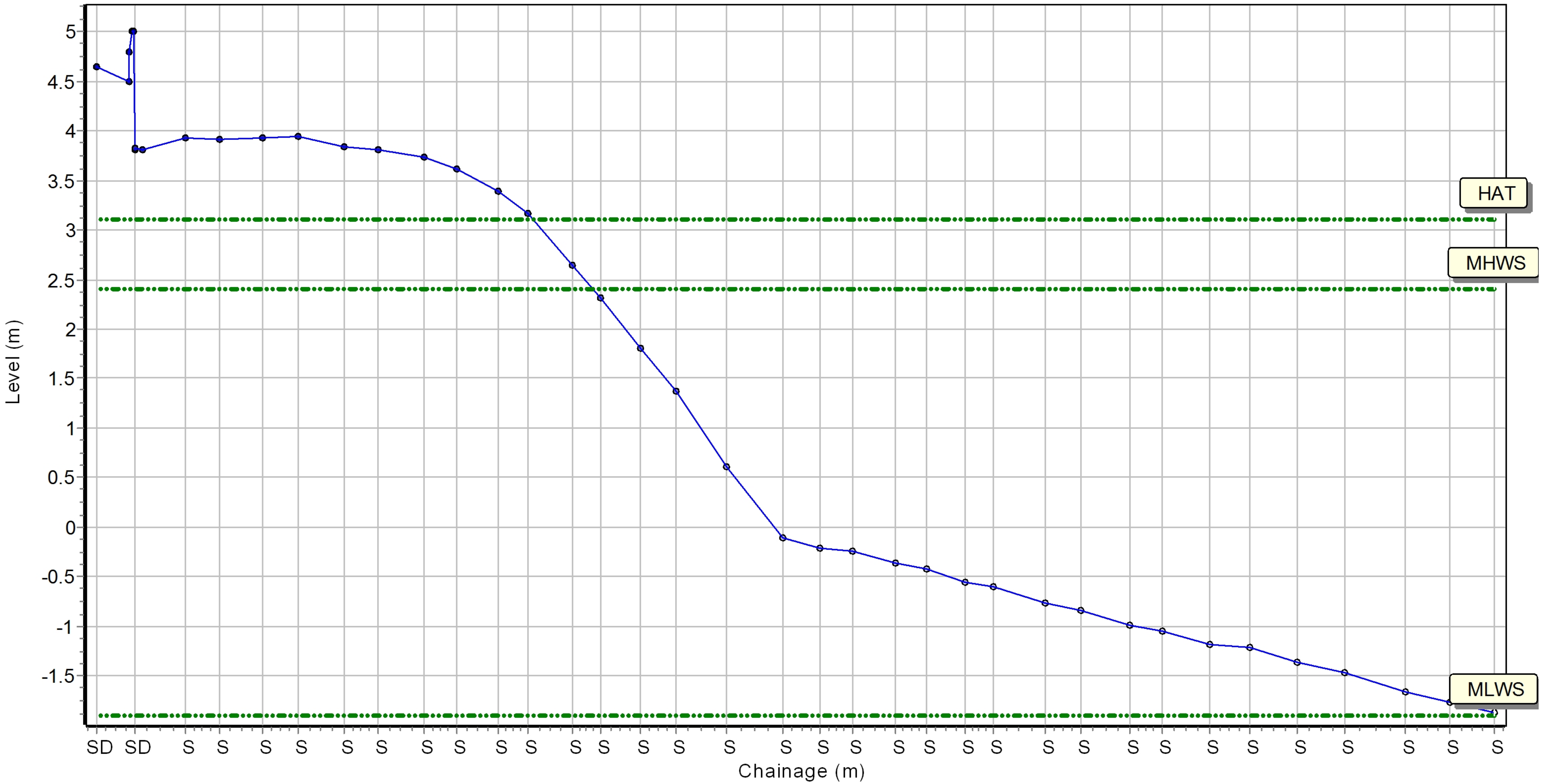
Location: 1aNWB15

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431088.458 **Northing:** 587739.577 **Profile Bearing:** 125 ° from North



Beach Profile

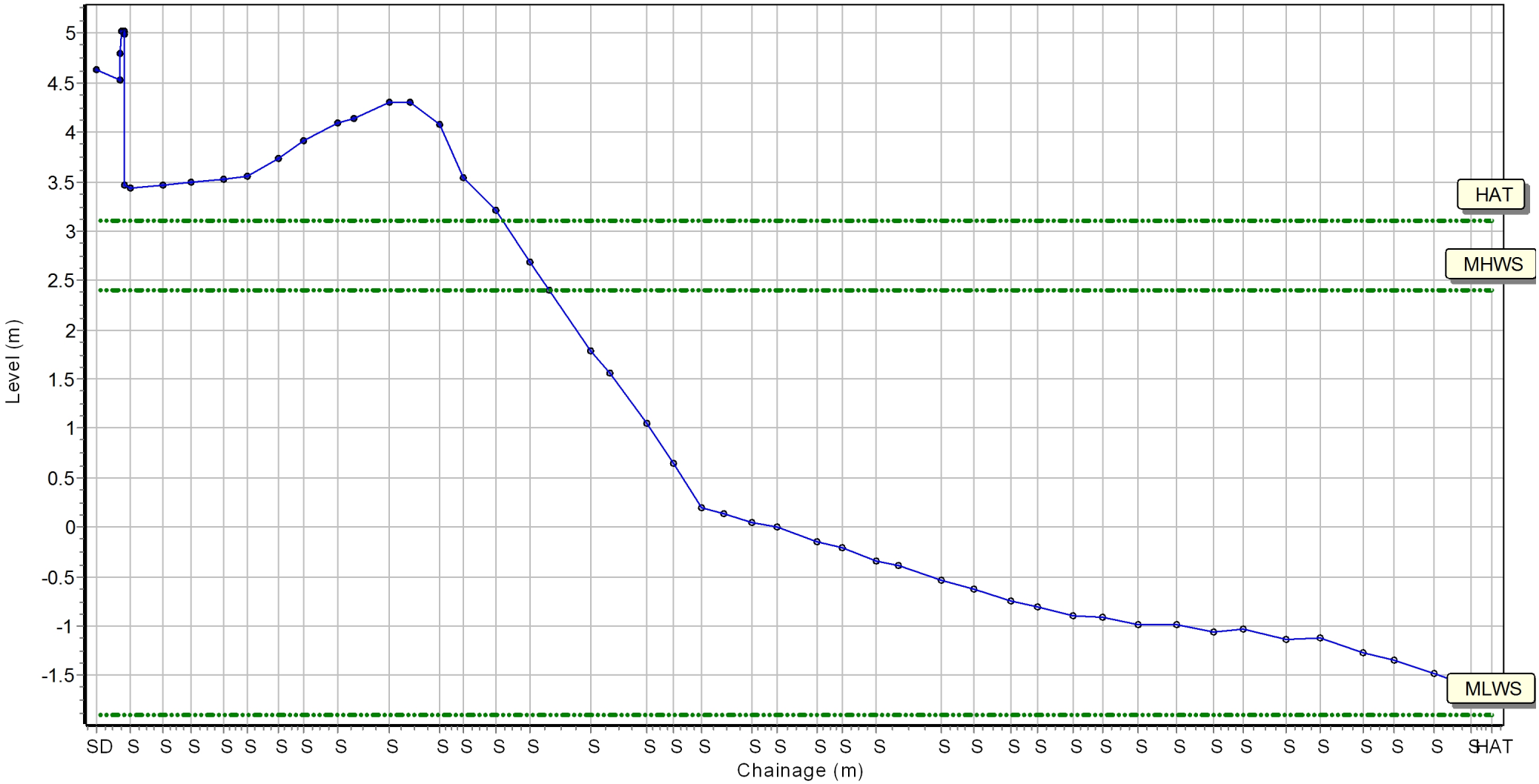
Location: **1aNWB16**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431063.789 **Northing:** 587695.893 **Profile Bearing:** 119 ° from North



Beach Profile

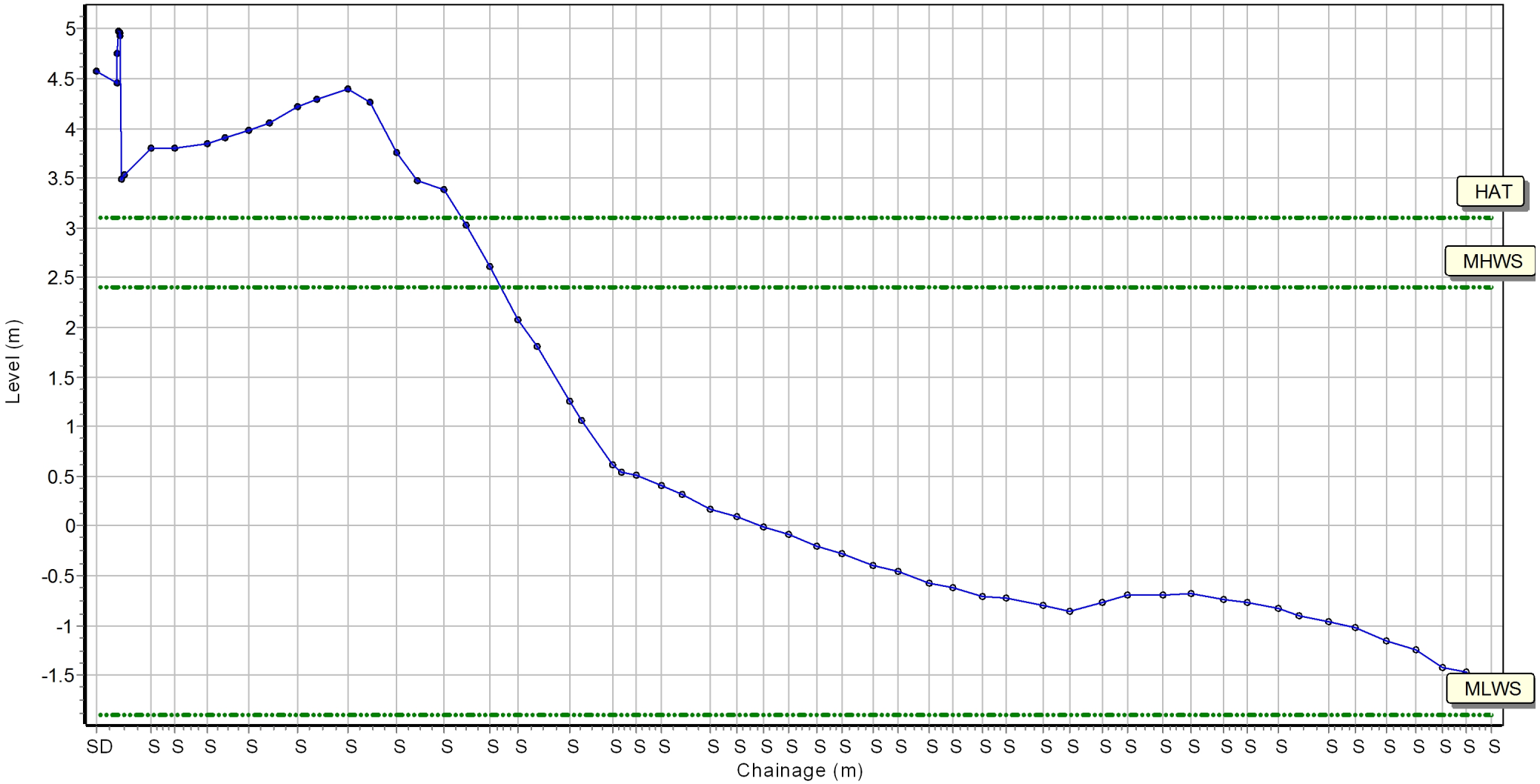
Location: **1aNWB17**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431042.191 **Northing:** 587650.627 **Profile Bearing:** 116 ° from North



Beach Profile

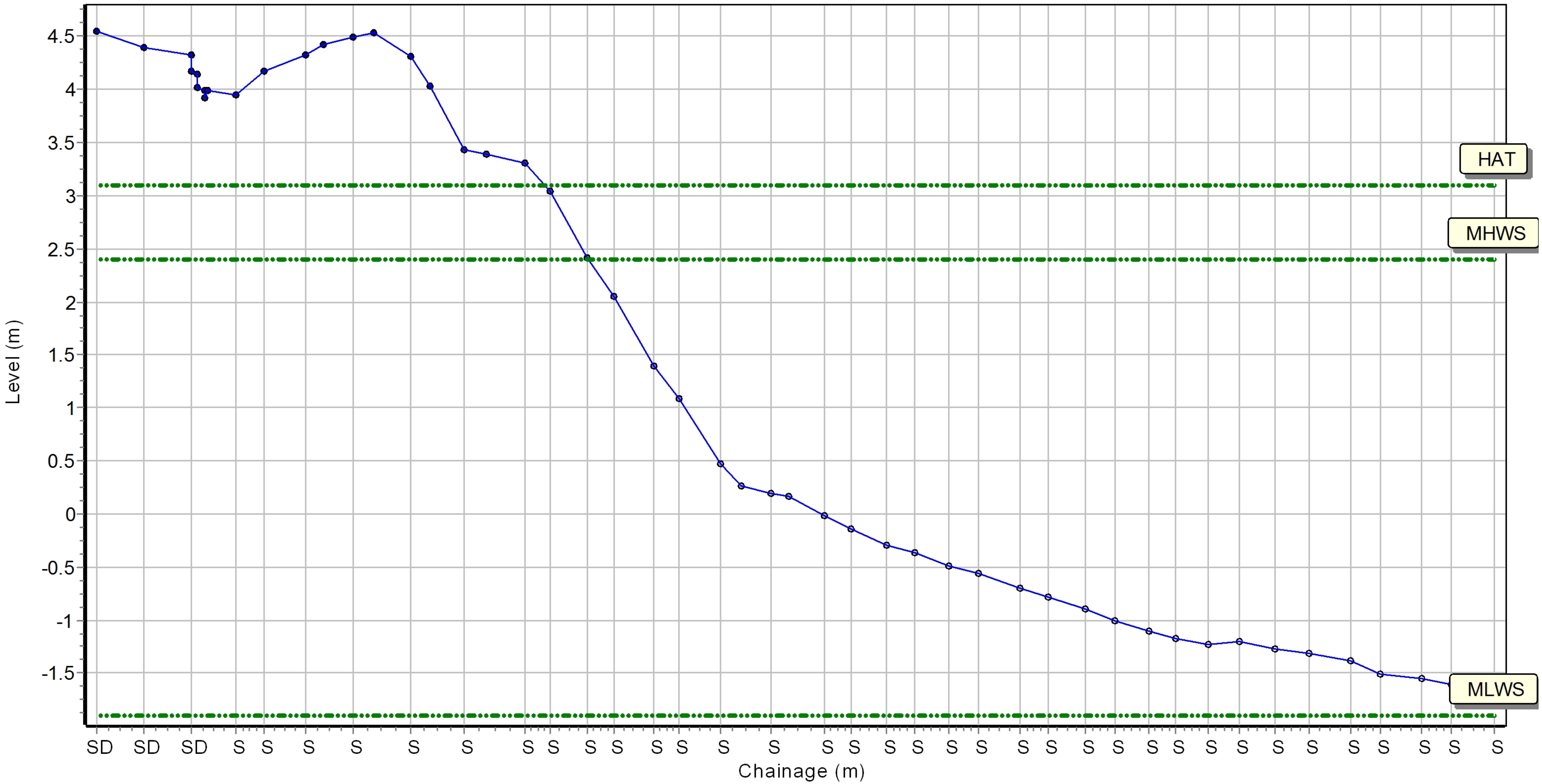
Location: **1aNWB18**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431024.999 **Northing:** 587608.929 **Profile Bearing:** 113 ° from North



Beach Profile

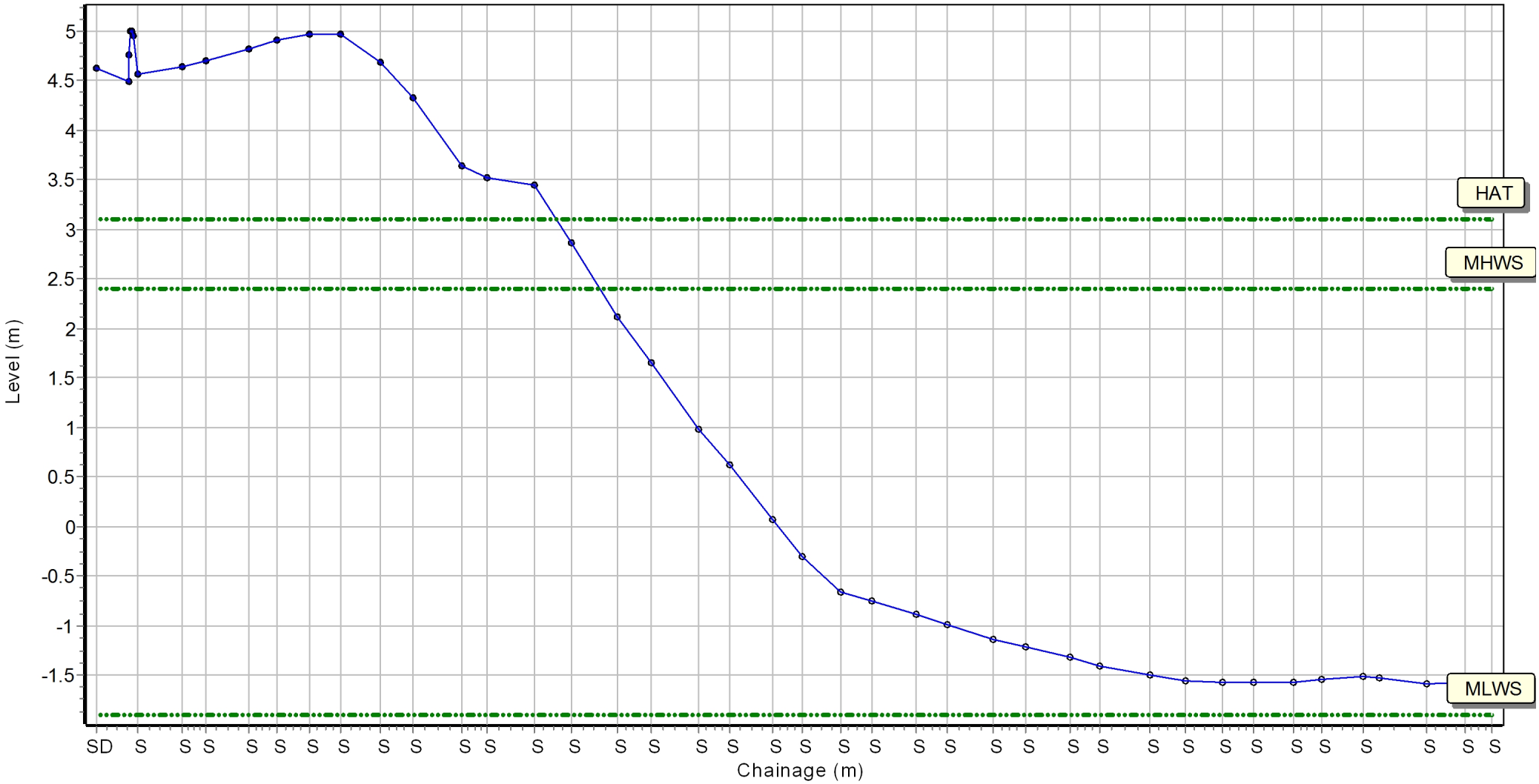
Location: **1aNWB19**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 431007.485 **Northing:** 587556.656 **Profile Bearing:** 109 ° from North



Beach Profile

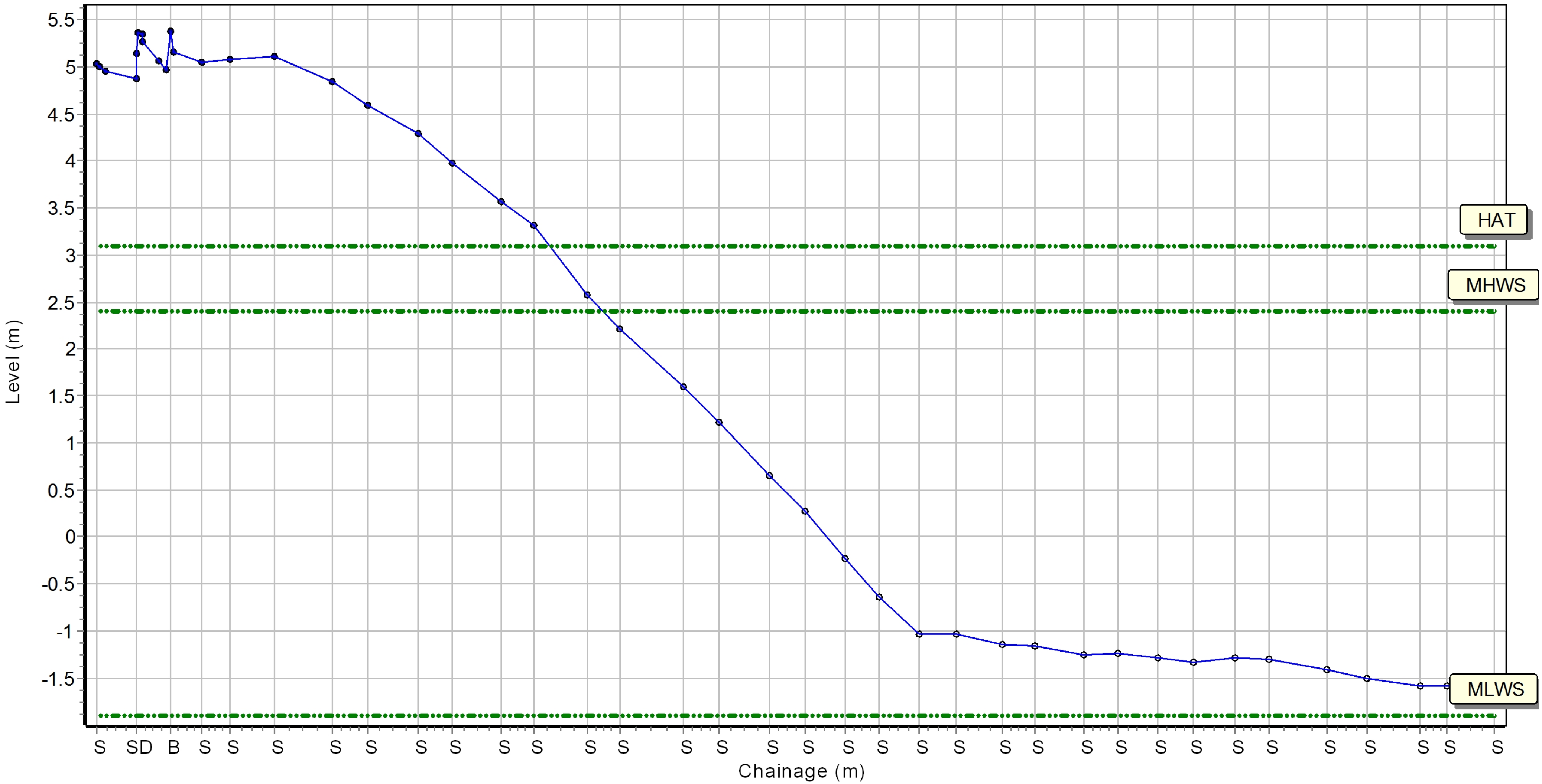
Location: **1aNWB20**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 430992.437 **Northing:** 587508.87 **Profile Bearing:** 102 ° from North



Beach Profile

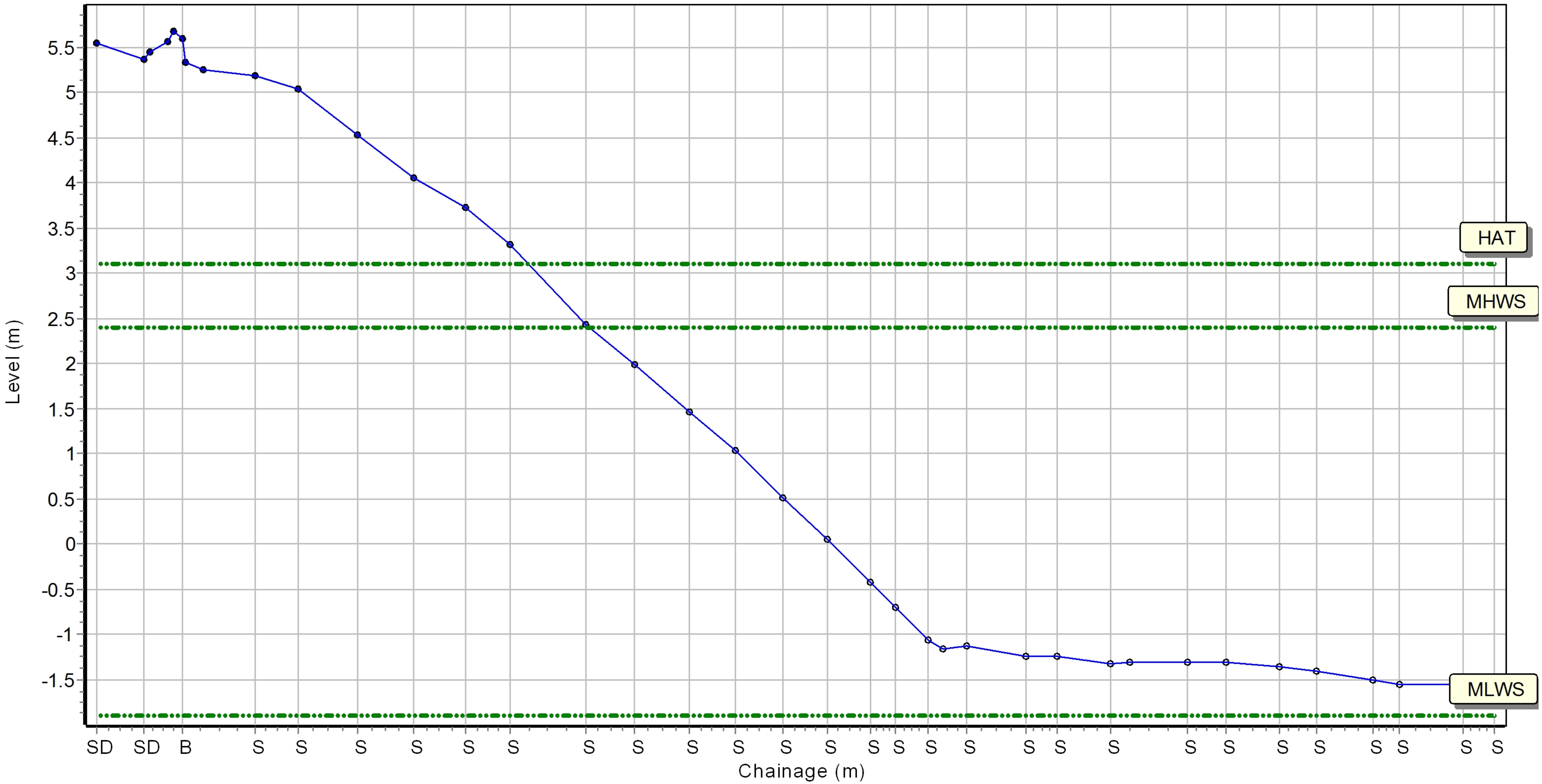
Location: 1aNWB21

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 430978.85 **Northing:** 587460.577 **Profile Bearing:** 102 ° from North



Beach Profile

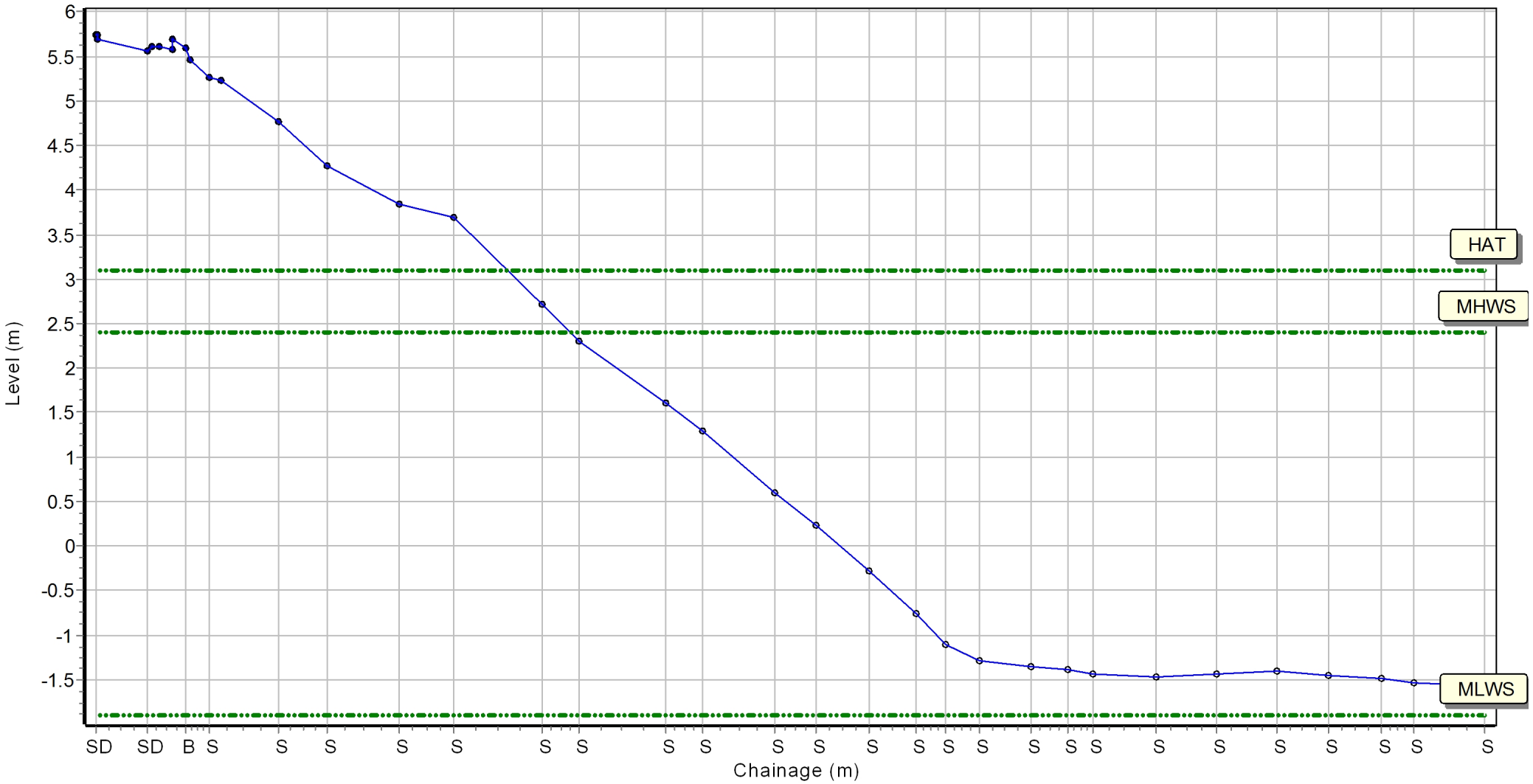
Location: **1aNWB22**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 430967.686 **Northing:** 587411.684 **Profile Bearing:** 99 ° from North



Beach Profile

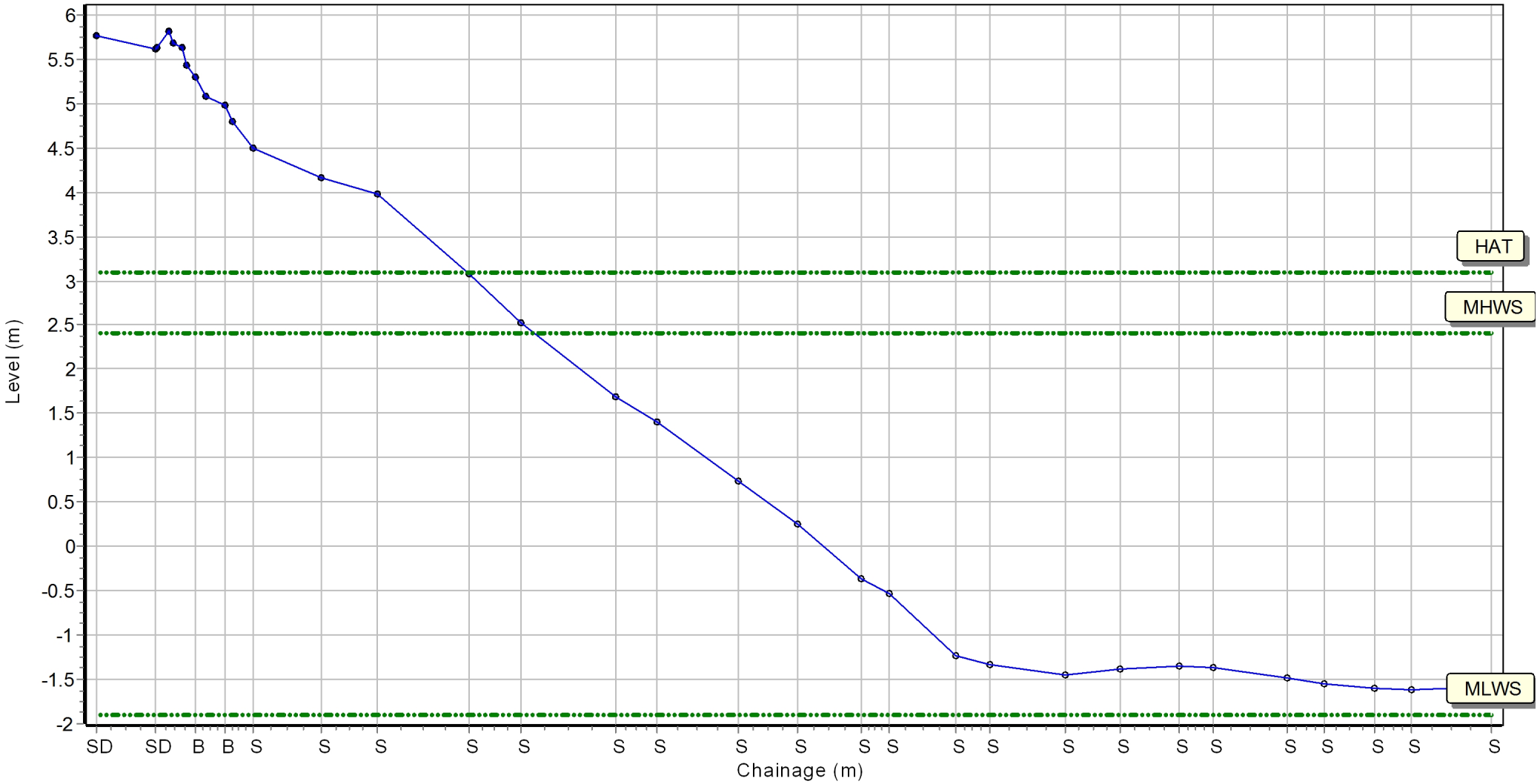
Location: **1aNWB23**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 430959.877 **Northing:** 587362.168 **Profile Bearing:** 96 ° from North



Beach Profile

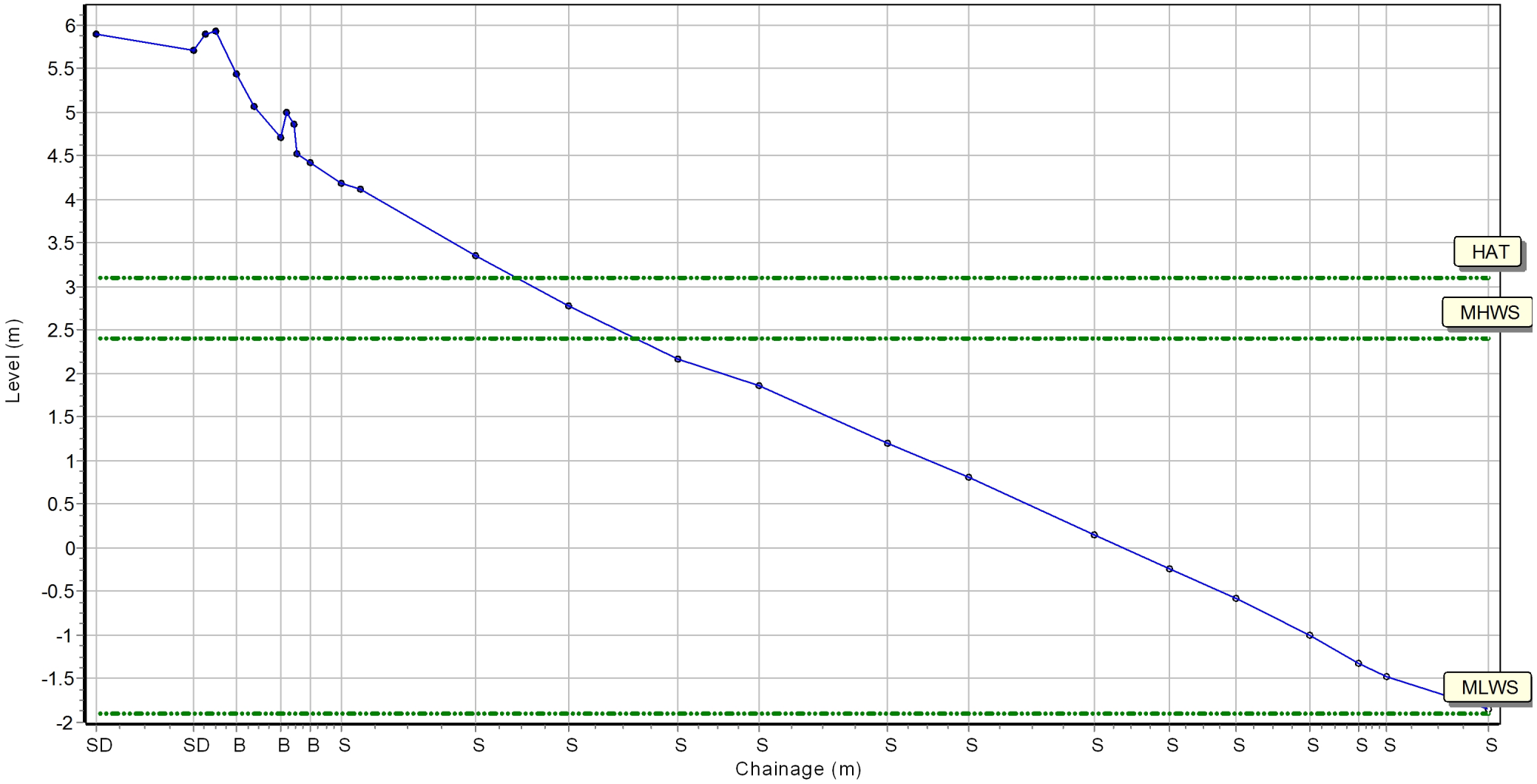
Location: **1aNWB24**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 430956.511 **Northing:** 587312.153 **Profile Bearing:** 92 ° from North



Beach Profile

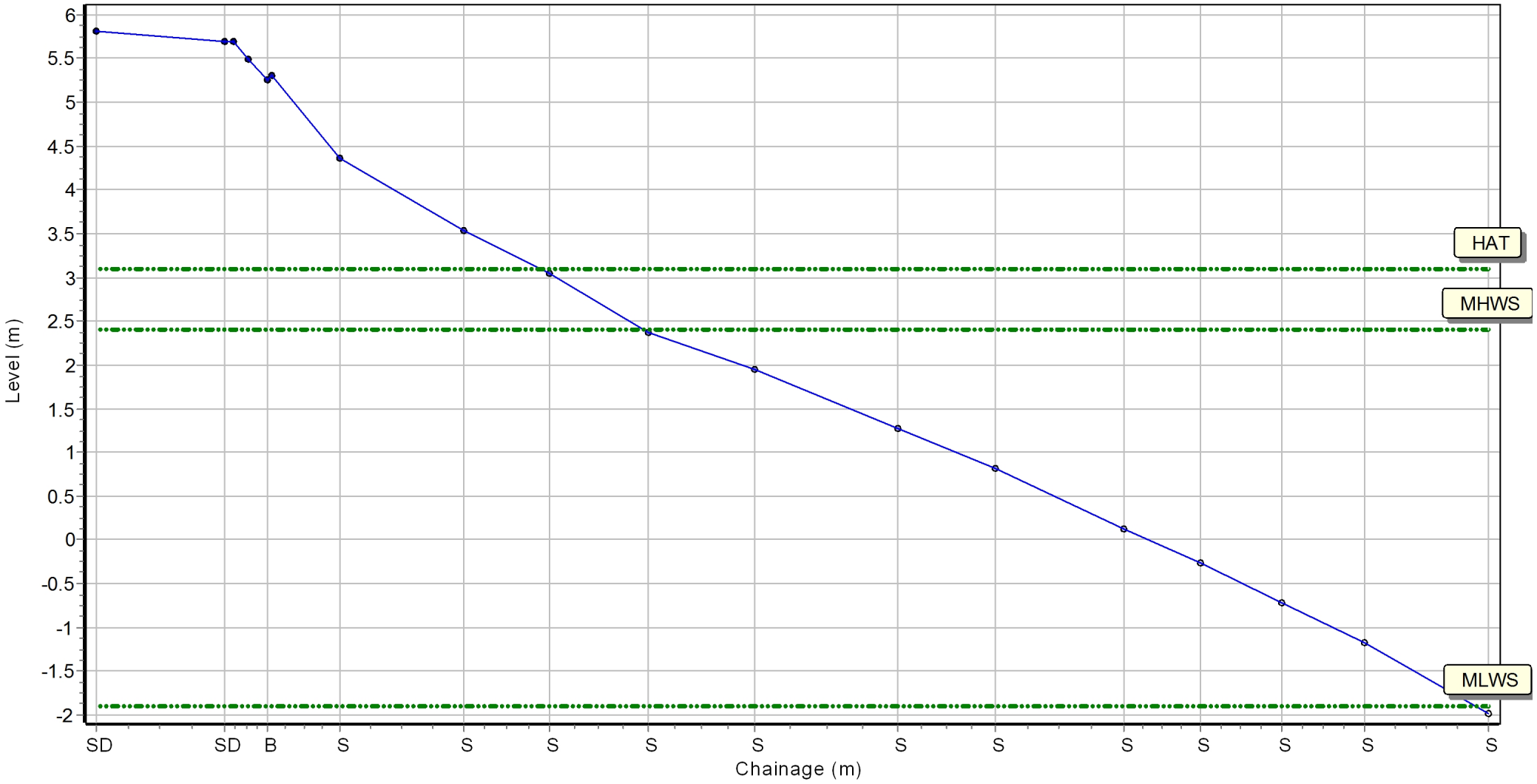
Location: **1aNWB25**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 430953.984 **Northing:** 587261.982 **Profile Bearing:** 89 ° from North



Beach Profile

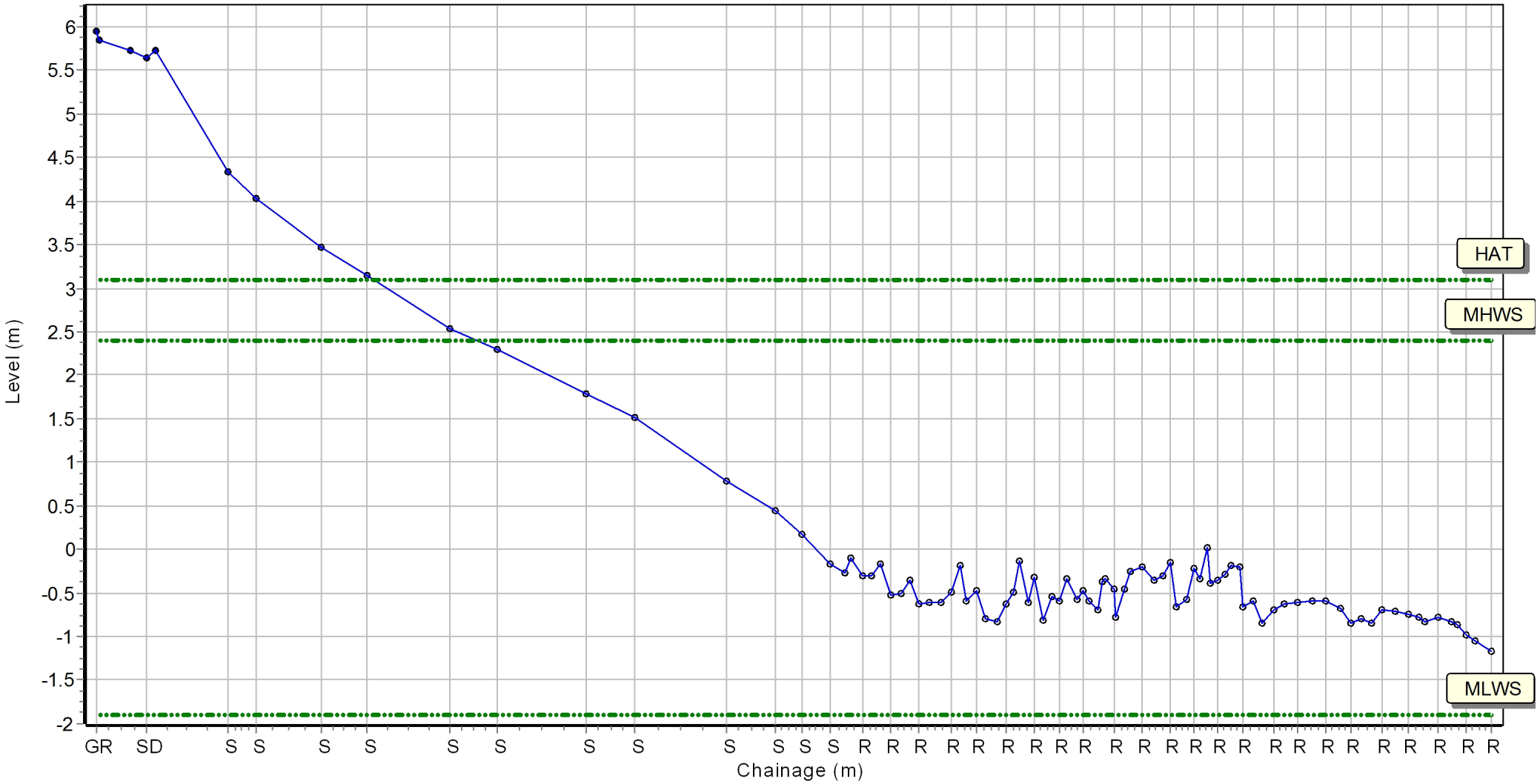
Location: **1aNWB26**

Date: 16/03/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 430960.828 **Northing:** 587212.152 **Profile Bearing:** 86 ° from North



Beach Profile

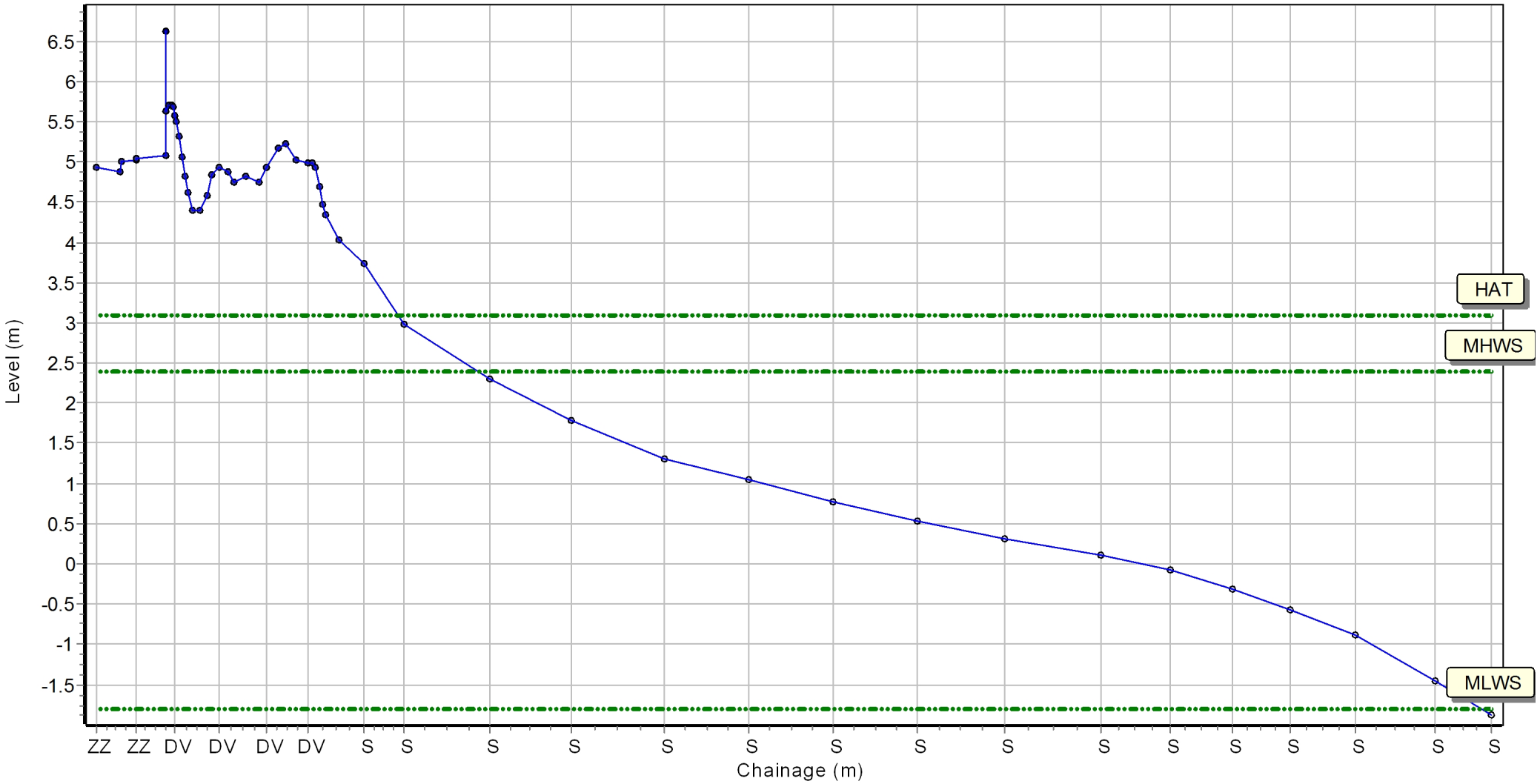
Location: **1aBVBC01**

Date: 28/02/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 432171.107 **Northing:** 580411.515 **Profile Bearing:** 113 ° from North



Beach Profile

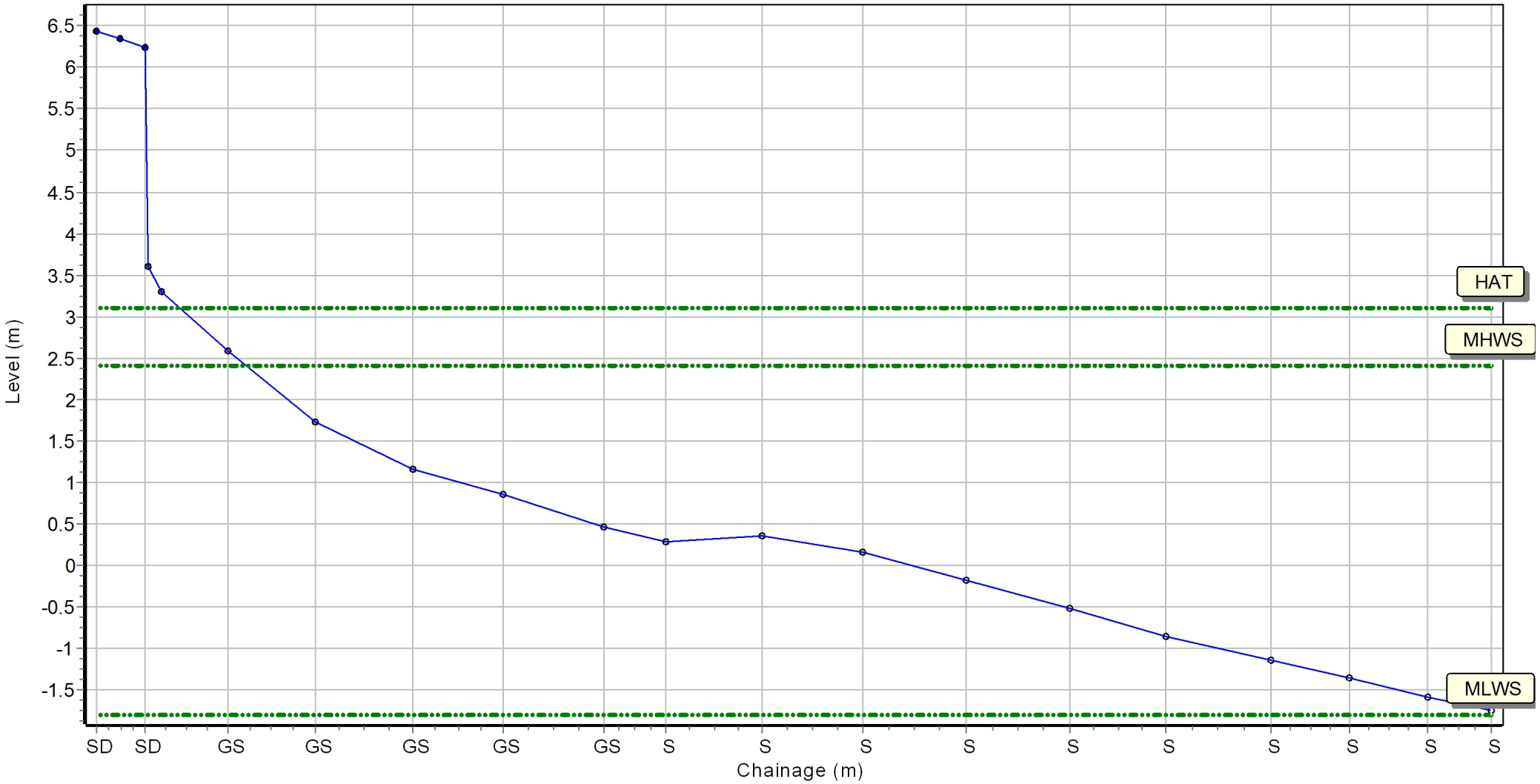
Location: **1aBVBC02**

Date: 28/02/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 432072.788 **Northing:** 579668.162 **Profile Bearing:** 77 ° from North



Beach Profile

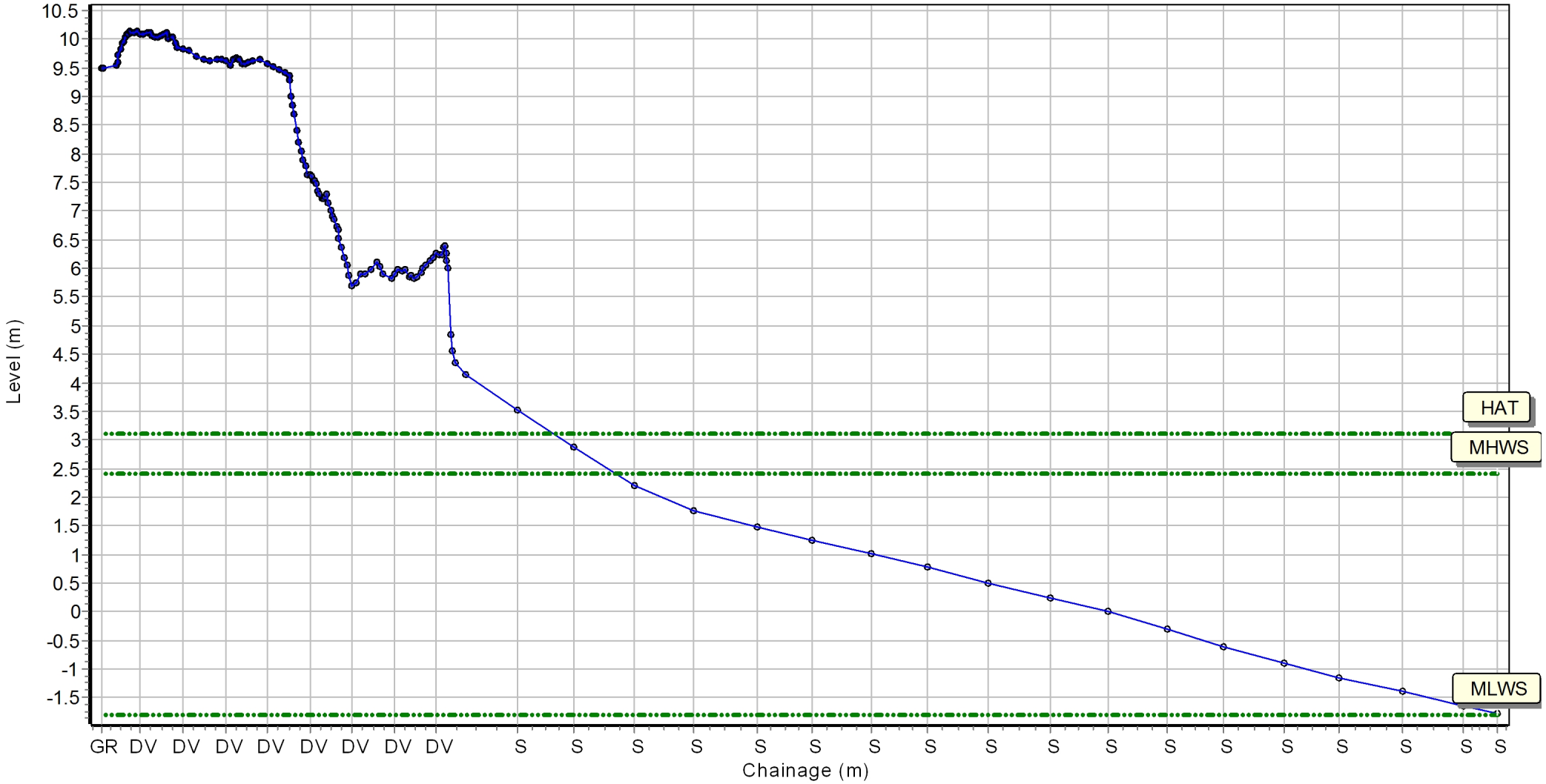
Location: **1aBVBC03**

Date: 28/02/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 432120.659 **Northing:** 578982.375 **Profile Bearing:** 71 ° from North



Beach Profile

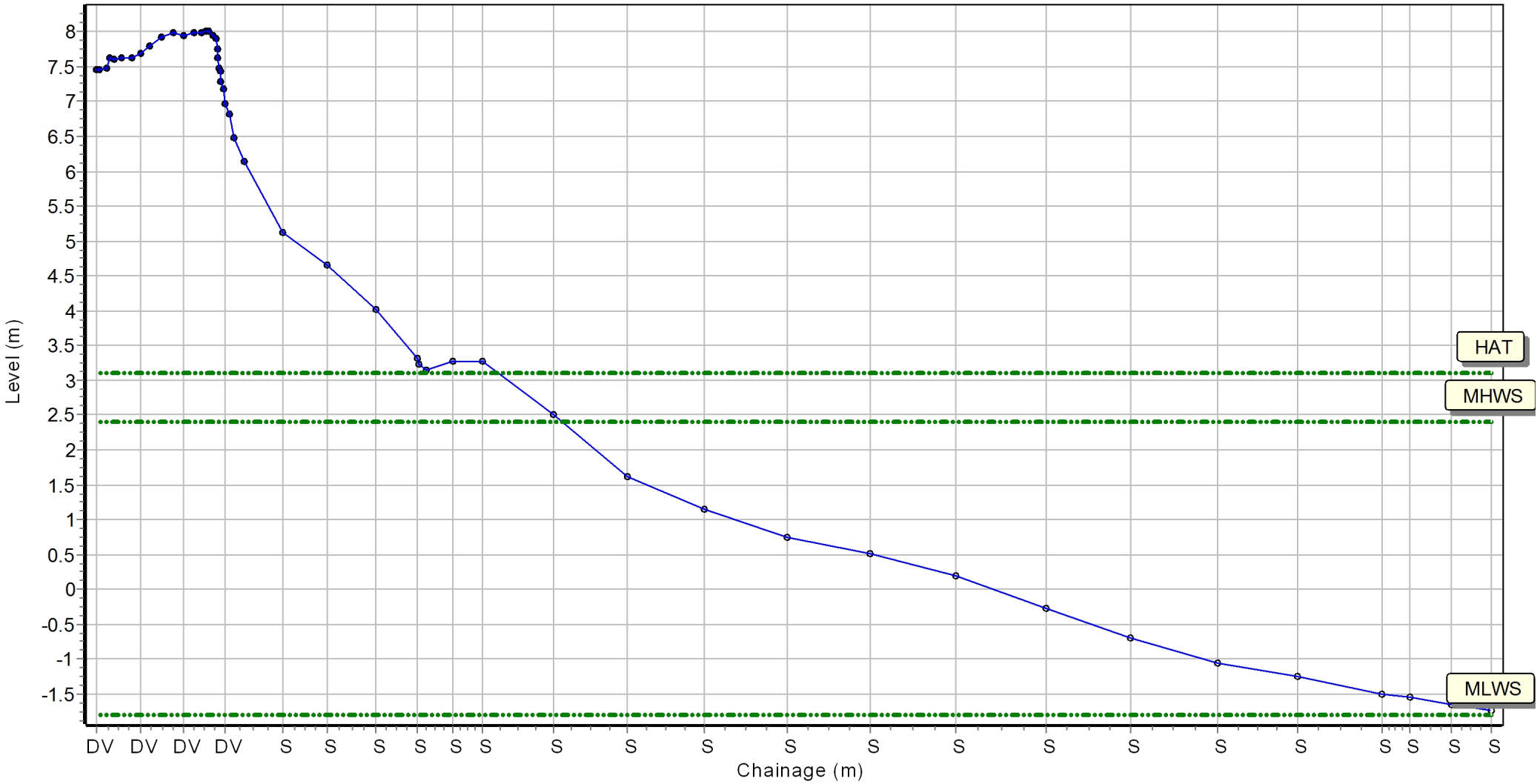
Location: **1aBVBC04**

Date: 28/02/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 432398.19 **Northing:** 578463.878 **Profile Bearing:** 60 ° from North



Beach Profile

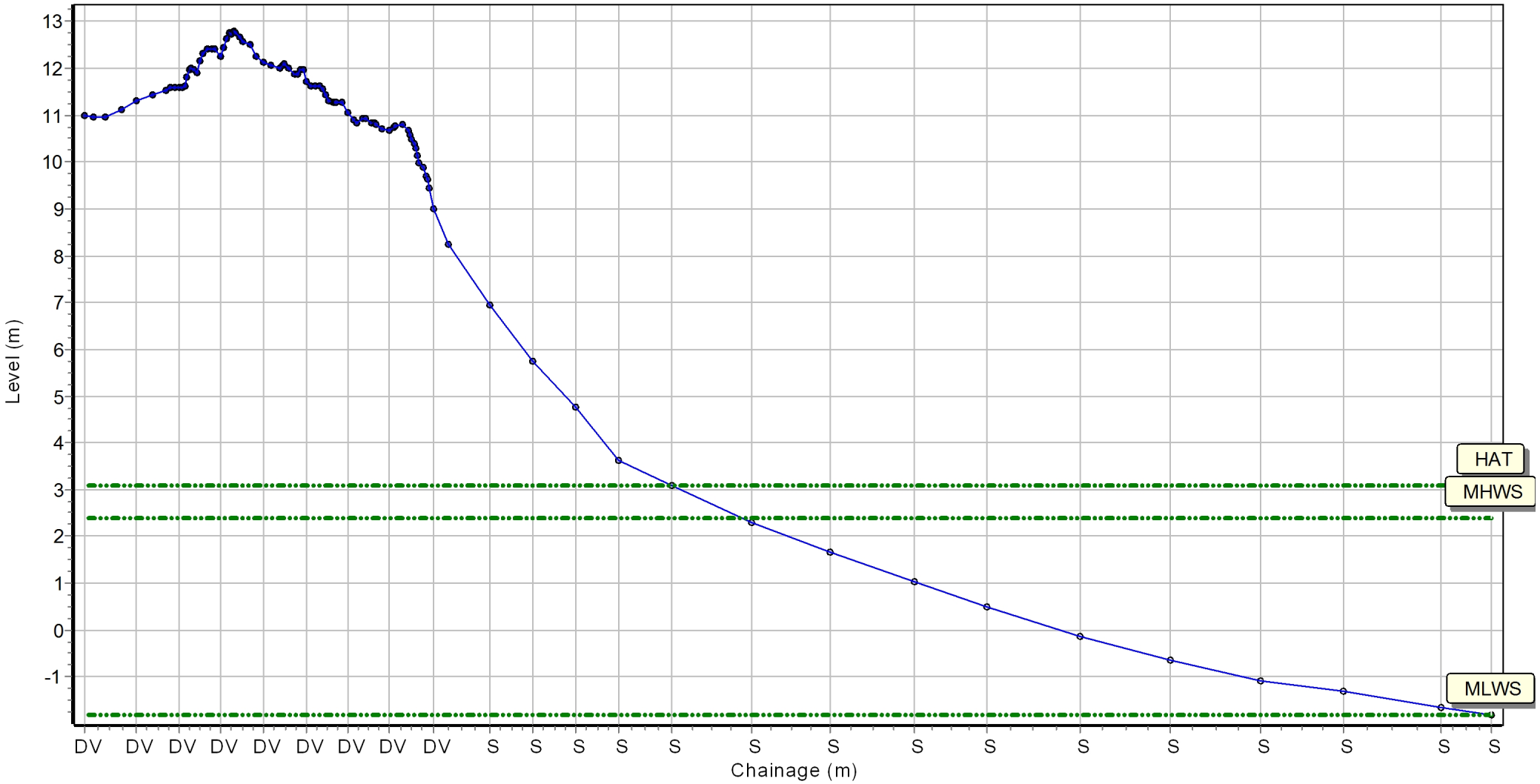
Location: **1aBVBC05**

Date: 28/02/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 432667.046 **Northing:** 577891.873 **Profile Bearing:** 60 ° from North



Beach Profile

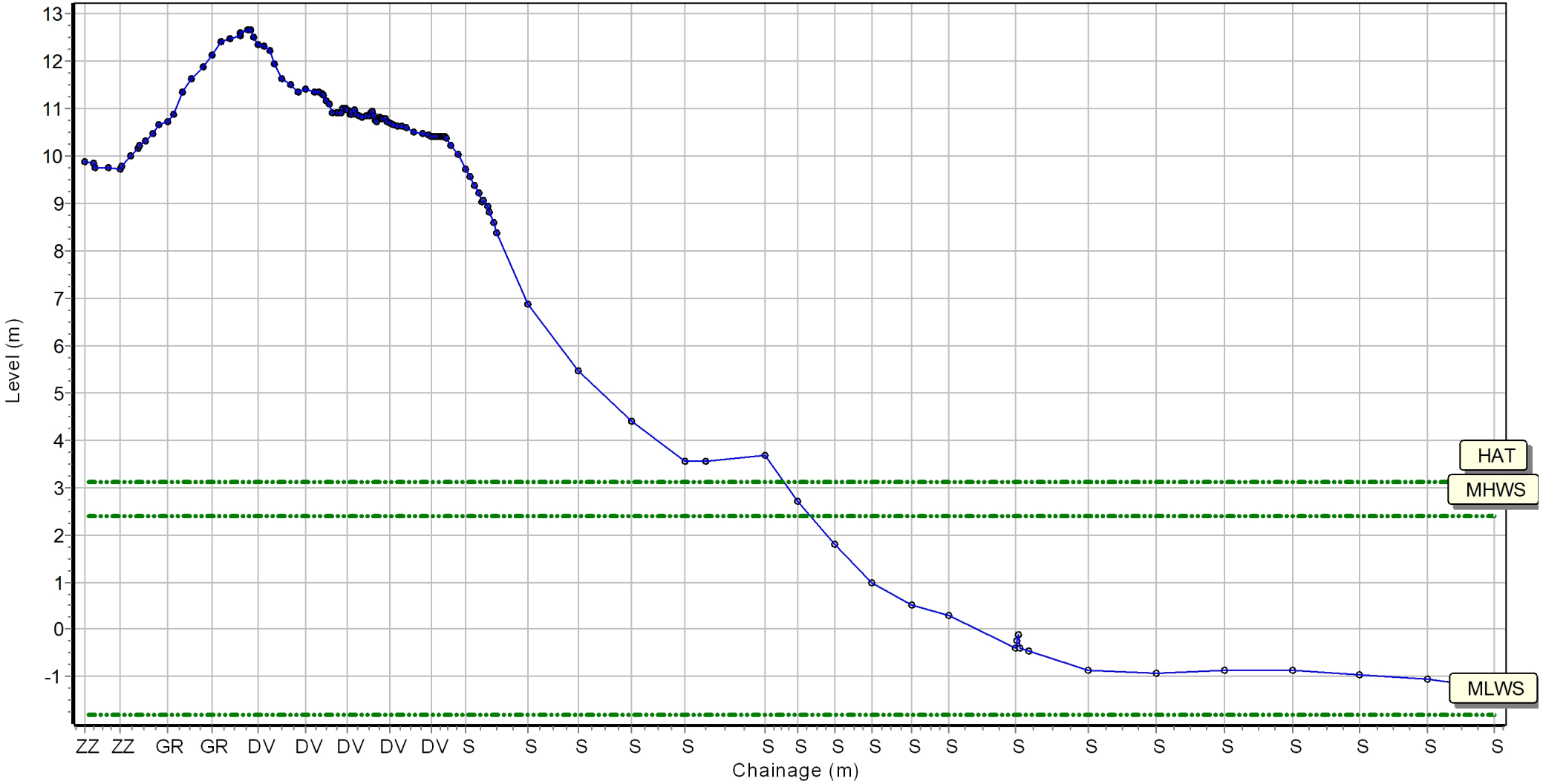
Location: **1aBVBC06**

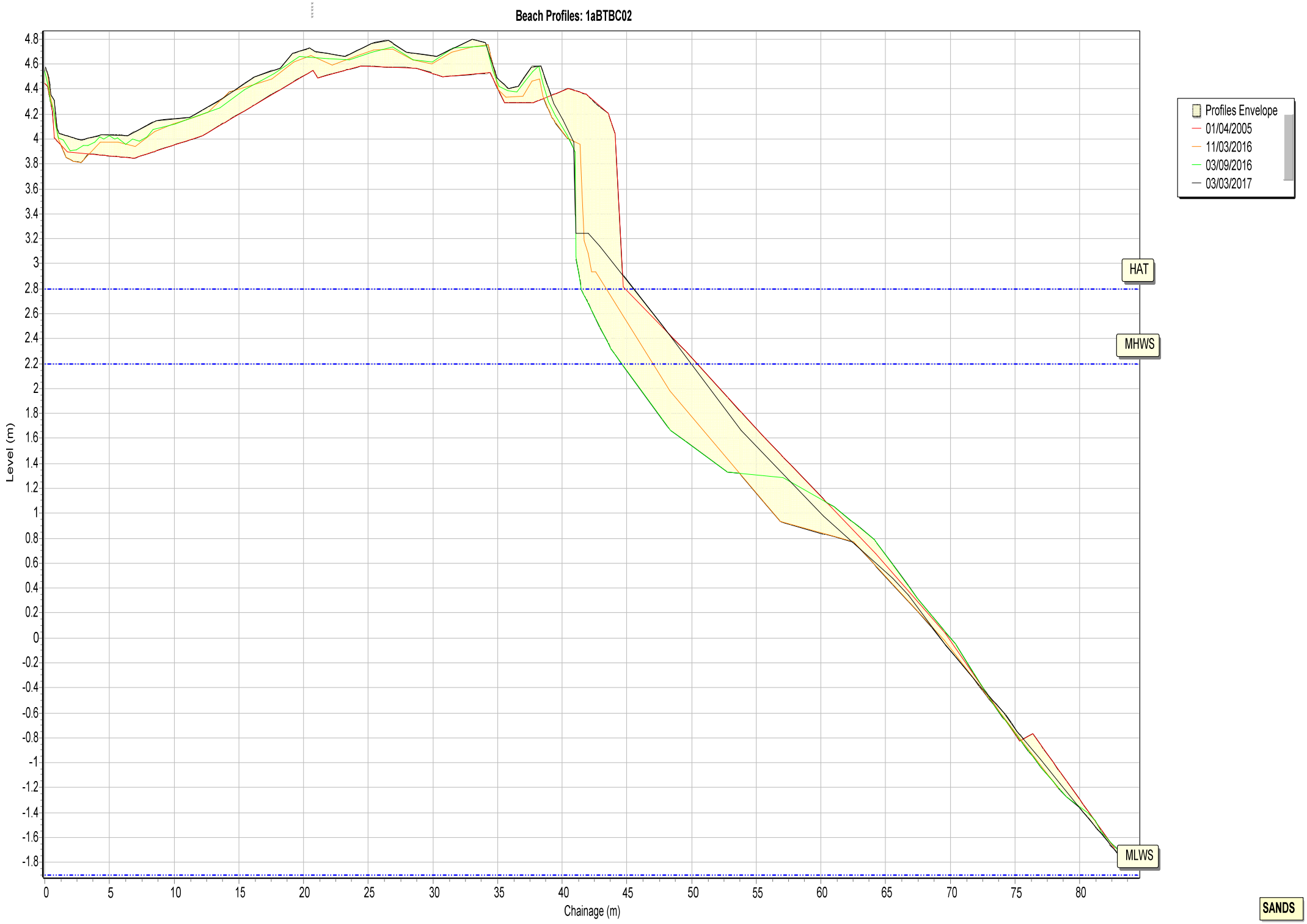
Date: 28/02/2017 **Inspector:** AG **Low Tide:** **Low Tide Time:**

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

Summary: 2017 Partial Measures Topo Survey

Easting: 433247.516 **Northing:** 577032.054 **Profile Bearing:** 53 ° from North




Beach Profiles: 1aBTBC02
Profiles Envelope
01/04/2005
11/03/2016
03/09/2016
03/03/2017
HAT
MHWS
MLWS
SANDS
Level (m)
Chainage (m)
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
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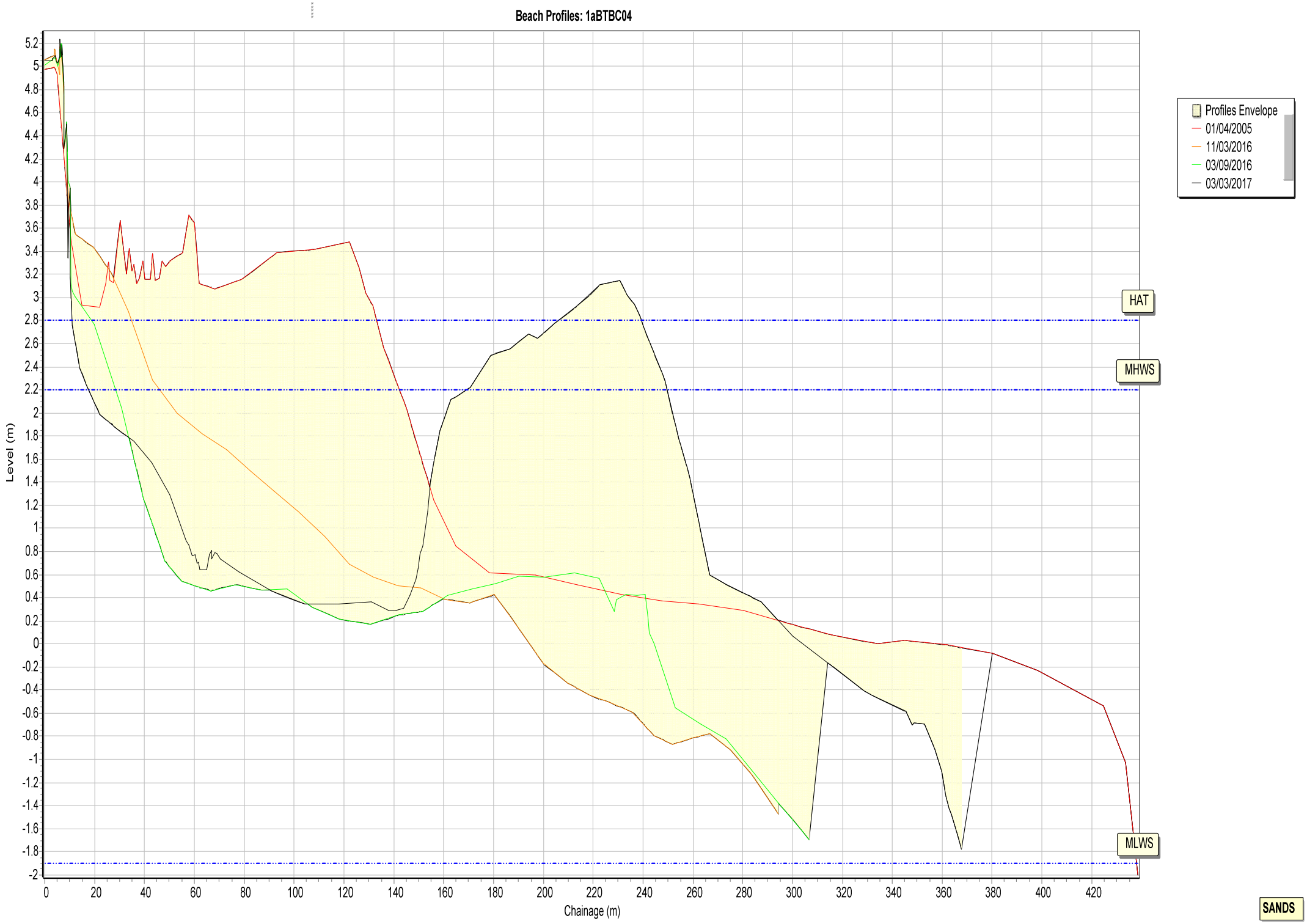
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80


Beach Profiles: 1aBTBC04
Profiles Envelope
01/04/2005
11/03/2016
03/09/2016
03/03/2017
HAT
MHWS
MLWS
SANDS
Level (m)
Chainage (m)
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
-2
0
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400
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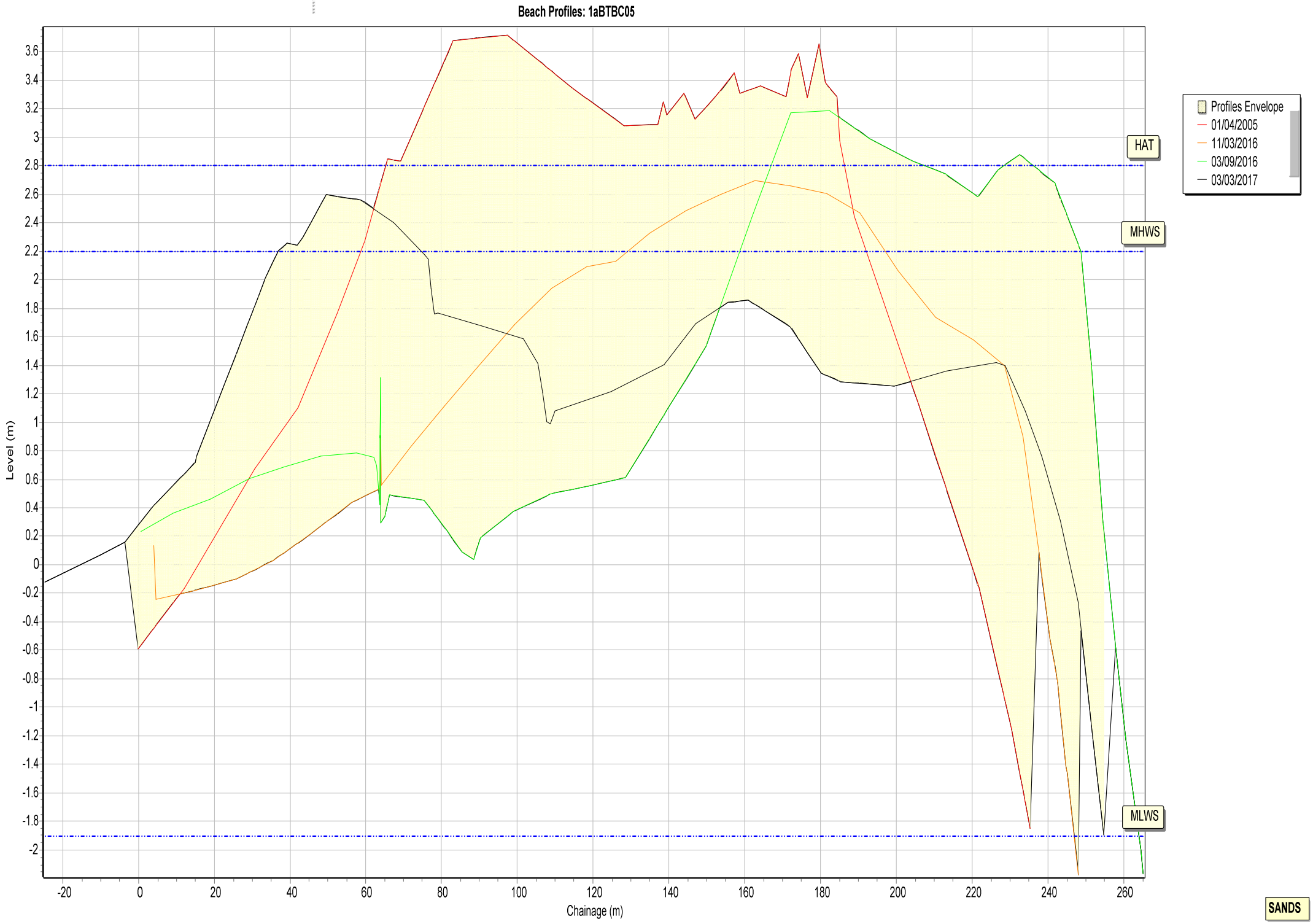
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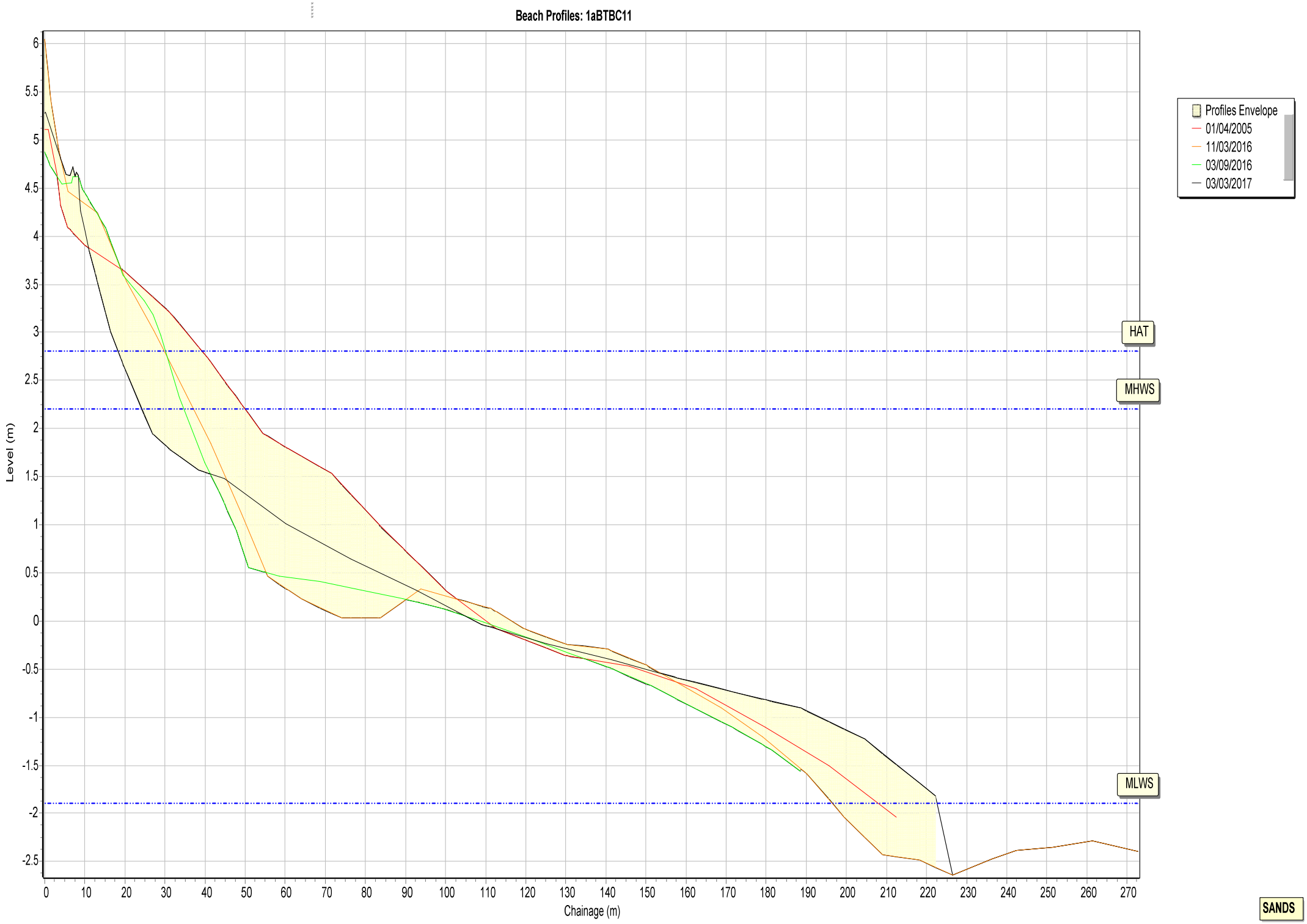
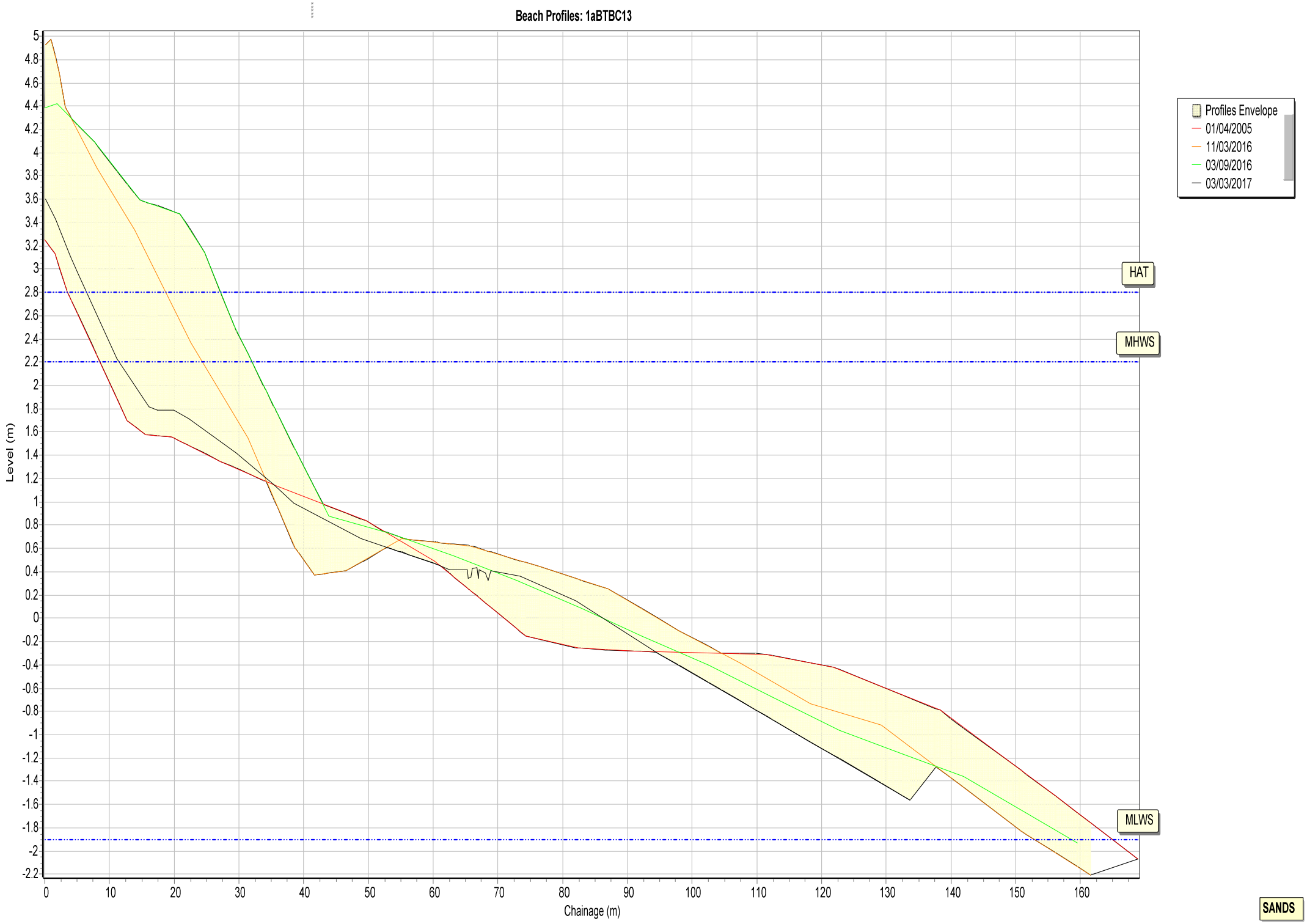
Profiles Envelope
01/04/2005
11/03/2016
03/09/2016
03/03/2017
HAT
MHWS
MLWS
Level (m)
Chainage (m)
SANDS


Beach Profiles: 1aBTBC06
HAT
MHWS
MLWS
Profiles Envelope
01/04/2005
11/03/2016
03/09/2016
03/03/2017
Level (m)
Chainage (m)
SANDS


Beach Profiles: 1aBTBC11
Profiles Envelope
01/04/2005
11/03/2016
03/09/2016
03/03/2017
HAT
MHWS
MLWS
Level (m)
Chainage (m)
SANDS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Profiles Envelope
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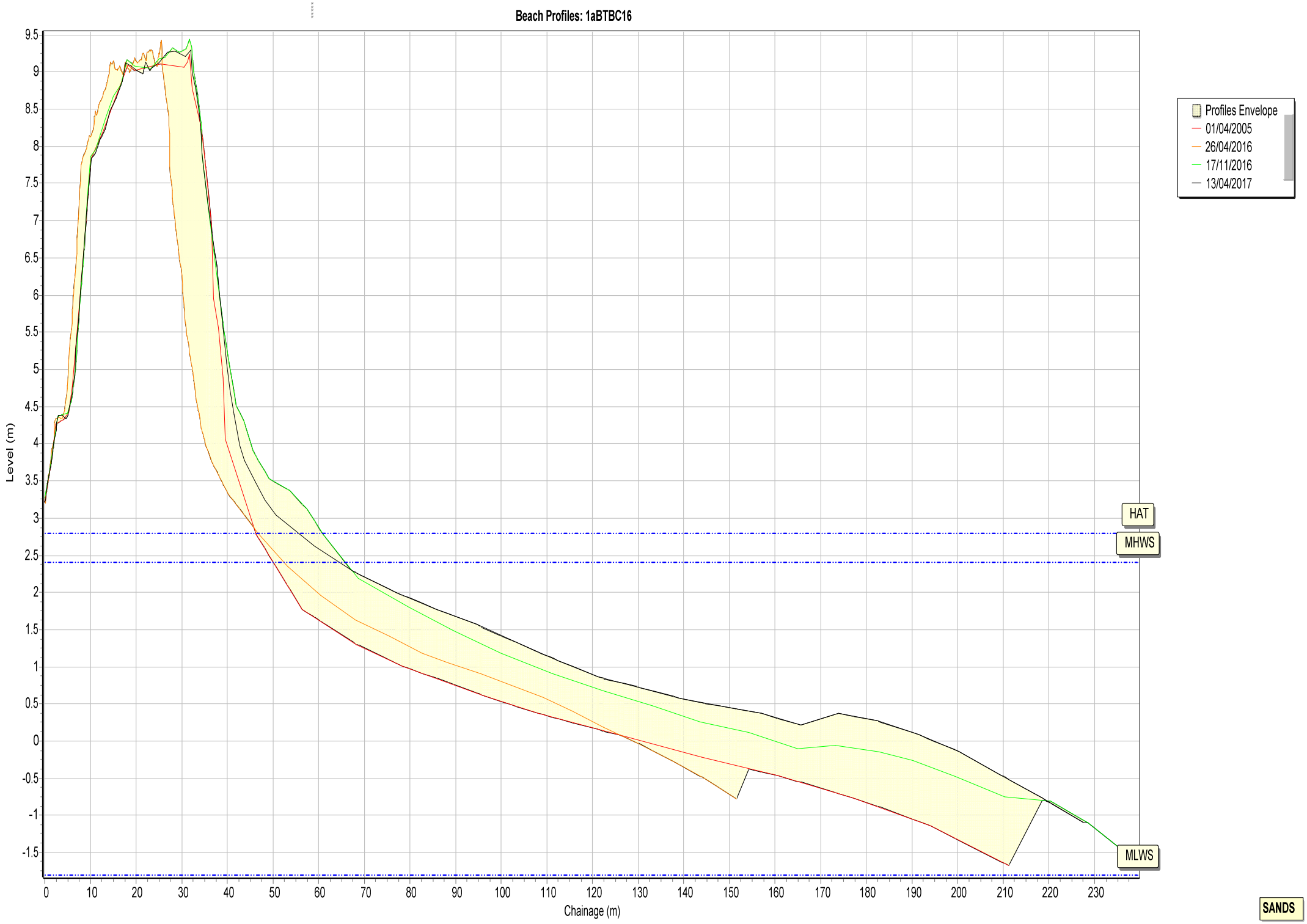
11/03/2016
03/09/2016
03/03/2017
HAT
MHWS
MLWS
Level (m)
Chainage (m)
SANDS


Beach Profiles: 1aBTBC16
Profiles Envelope
01/04/2005
26/04/2016
17/11/2016
13/04/2017
HAT
MHWS
MLWS
Level (m)
Chainage (m)
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
0
10
20
30
40
50
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70
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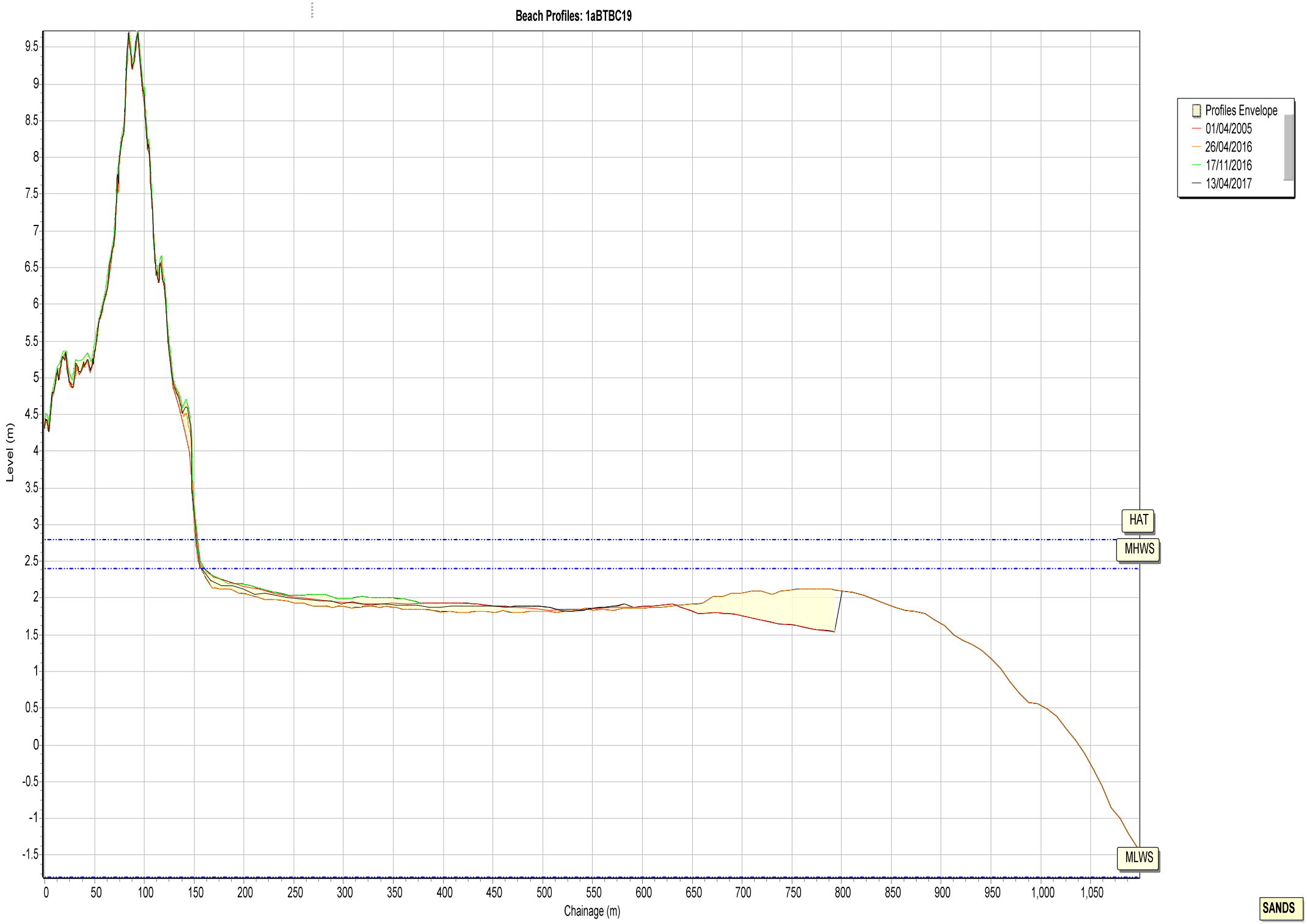
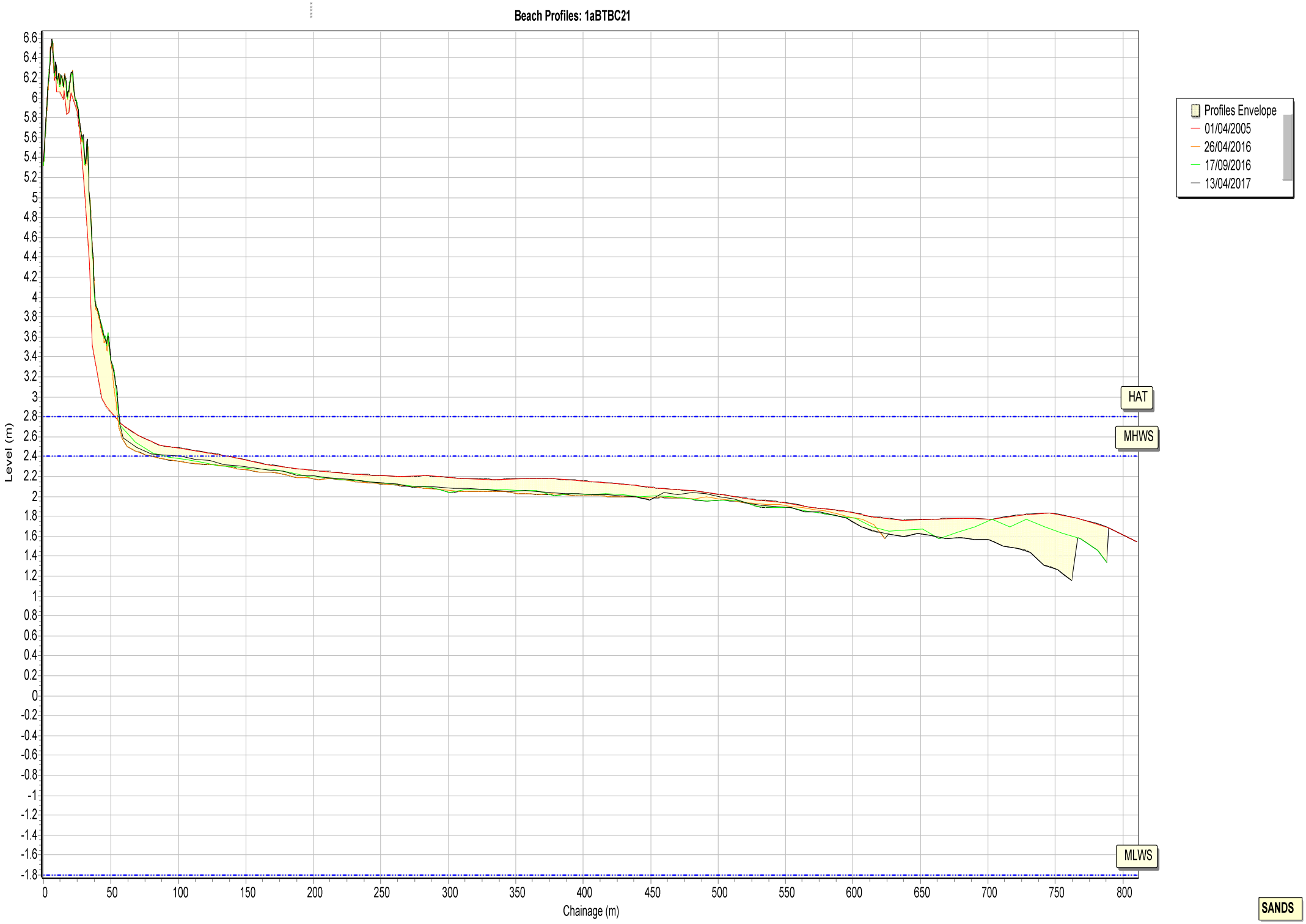
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
SANDS


Beach Profiles: 1aBTBC19
Profiles Envelope
01/04/2005
26/04/2016
17/11/2016
13/04/2017
HAT
MHWS
MLWS
Level (m)
Chainage (m)
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1,000
1,050
SANDS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Profiles Envelope
01/04/2005
26/04/2016
17/09/2016
13/04/2017
HAT
MHWS
MLWS
SANDS
Level (m)
Chainage (m)
6.6
6.4
6.2
6
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
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250
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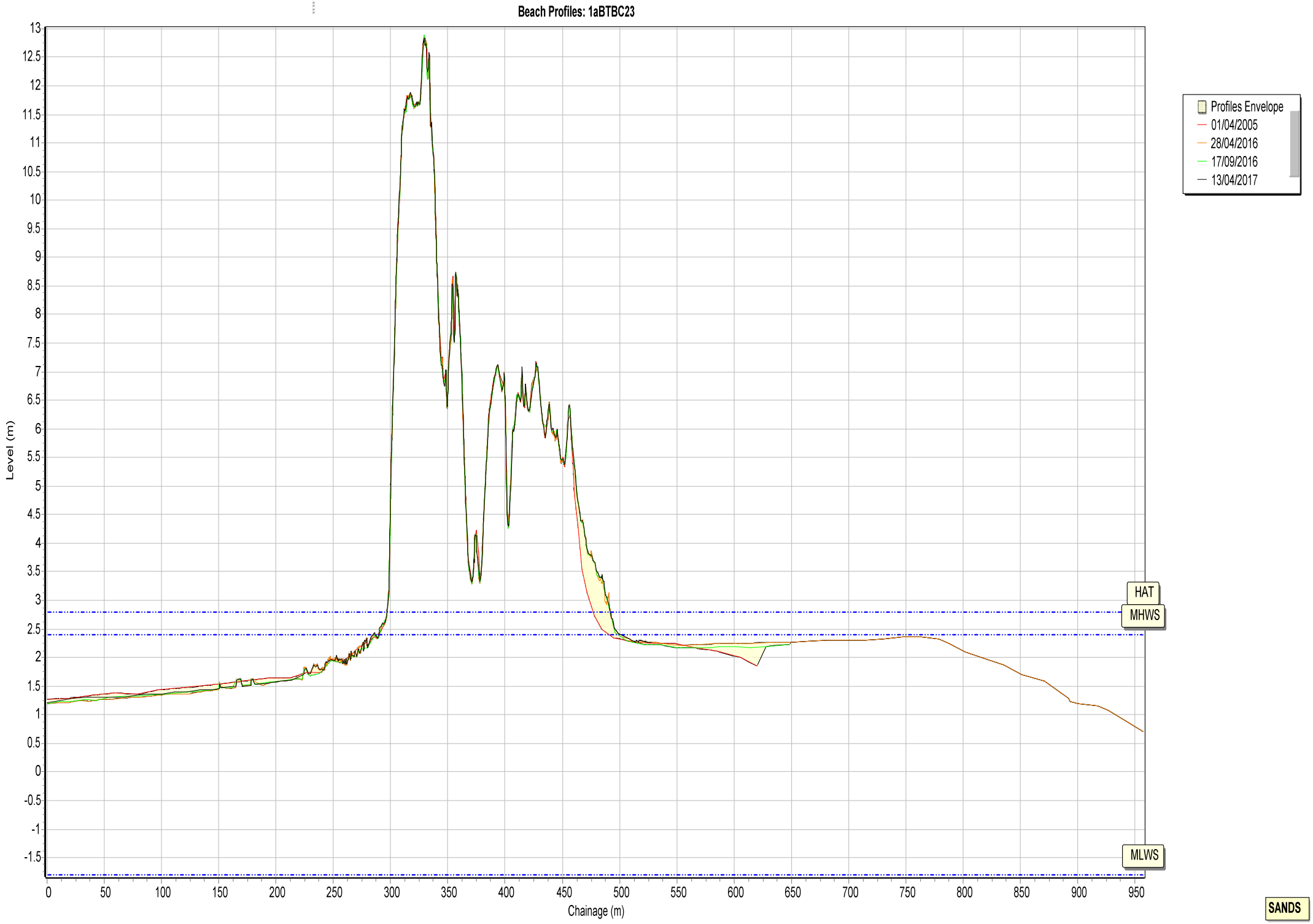
350
400
450
500
550
600
650
700
750
800


Beach Profiles: 1aBTBC23
Profiles Envelope
01/04/2005
28/04/2016
17/09/2016
13/04/2017
HAT
MHWS
MLWS
SANDS
Level (m)
Chainage (m)
13
12.5
12
11.5
11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
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-1
-1.5
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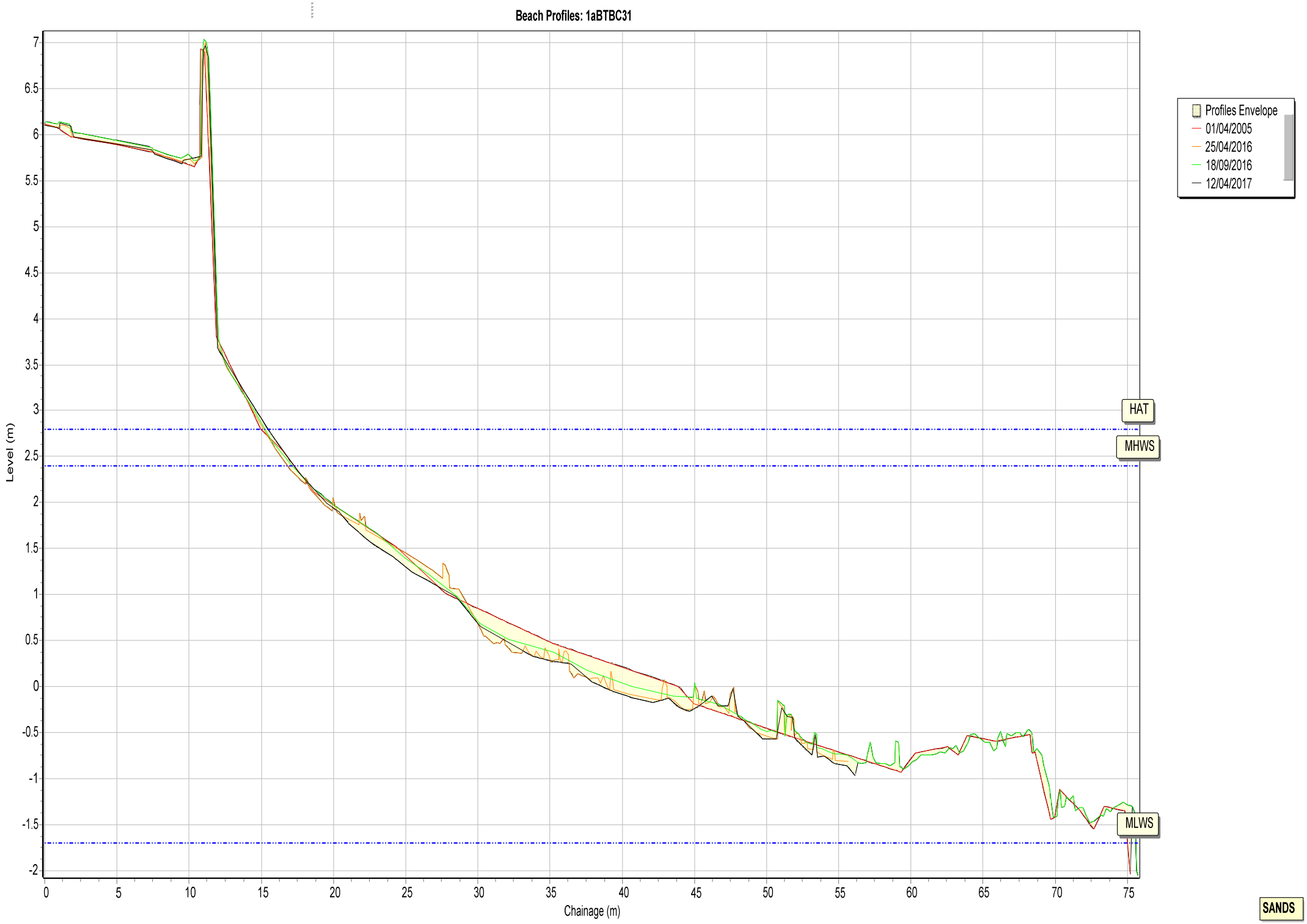
800
850
900
950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01/04/2005
25/04/2016
18/09/2016
12/04/2017
HAT
MHWS
MLWS
SANDS
Level (m)
Chainage (m)
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0
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10
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20
25
30
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40
45
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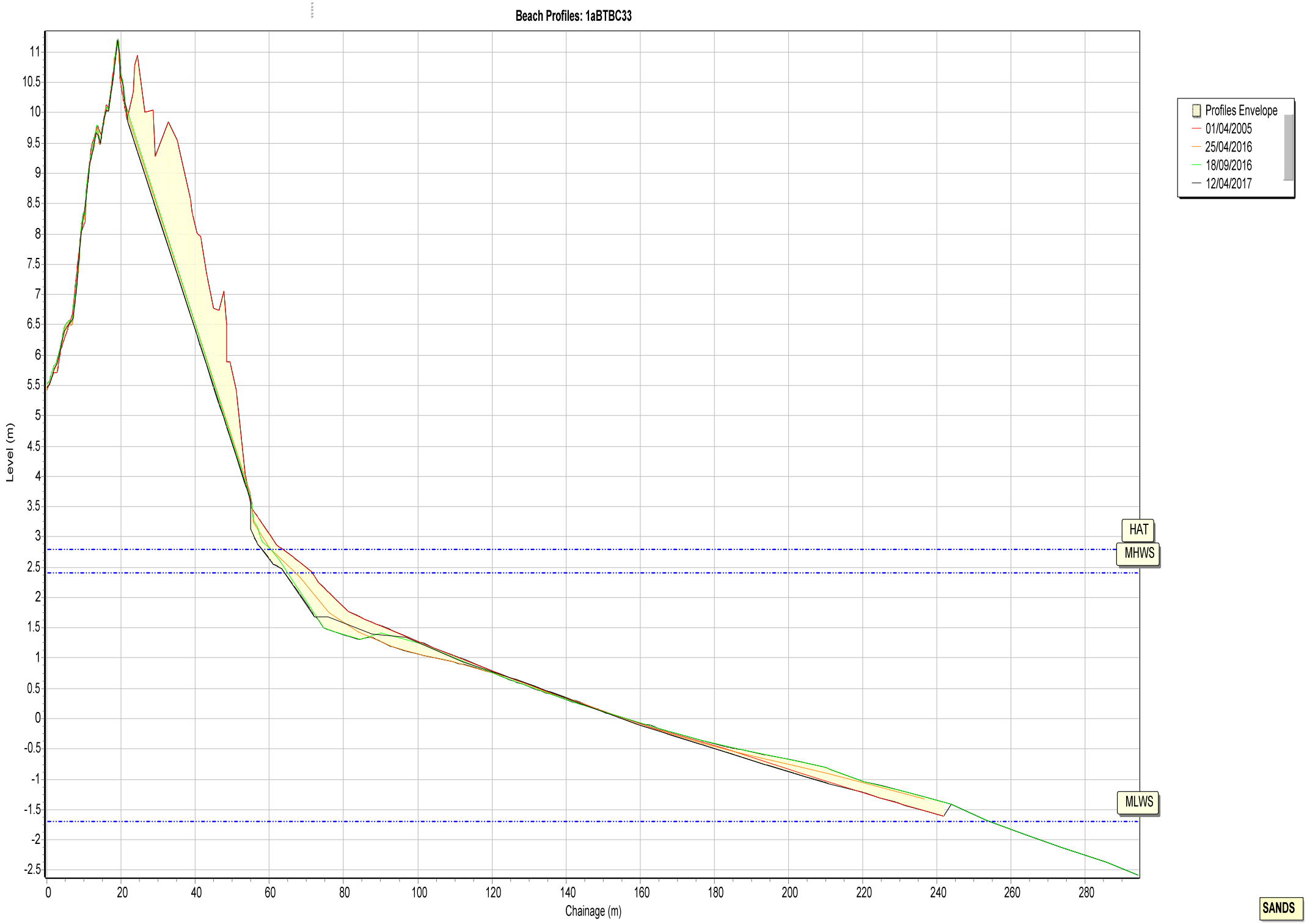
55
60
65
70
75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01/04/2005
25/04/2016
18/09/2016
12/04/2017
HAT
MHWS
MLWS
SANDS
Level (m)
Chainage (m)
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10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
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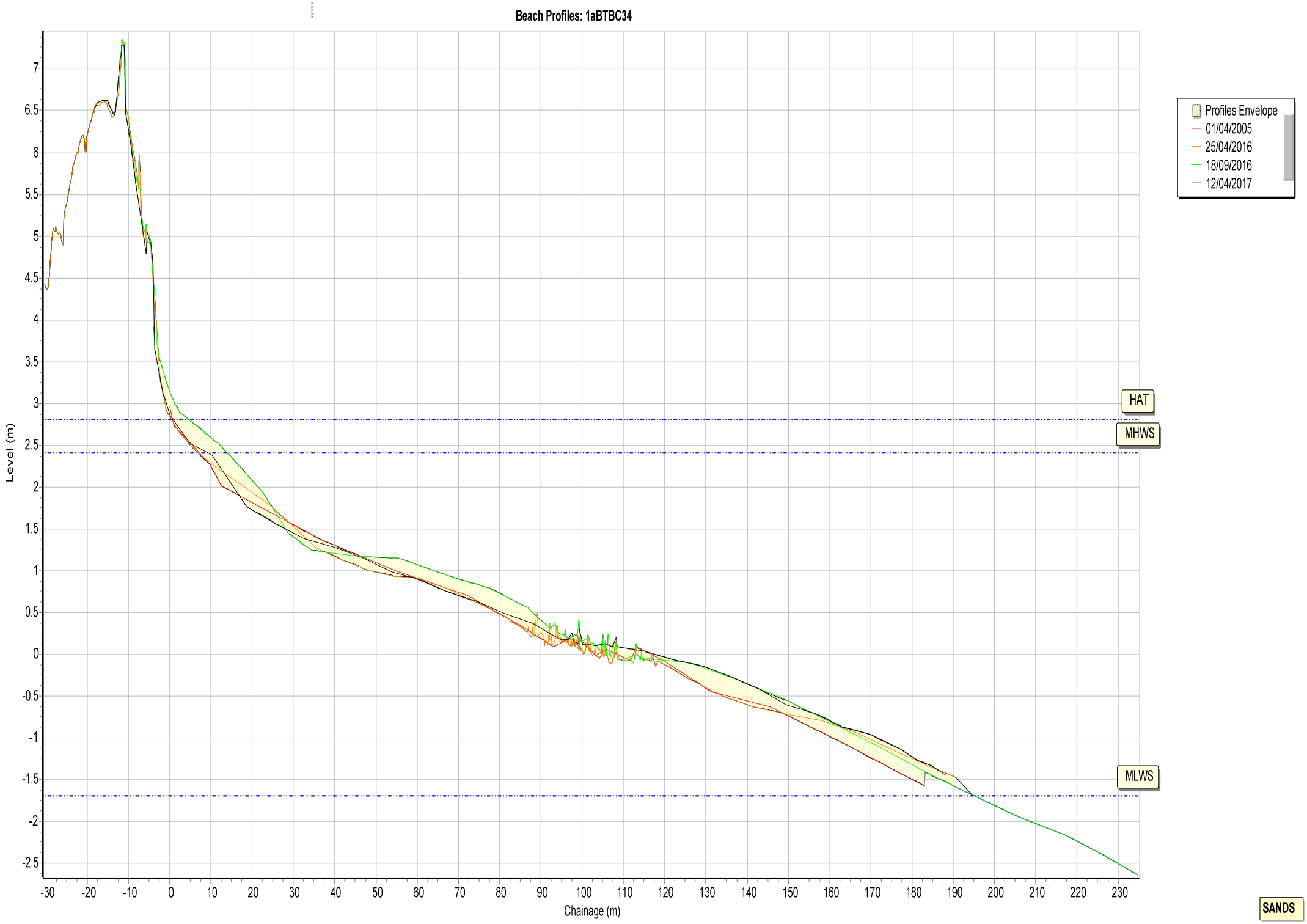
100
120
140
160
180
200
220
240
260
280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Profiles Envelope
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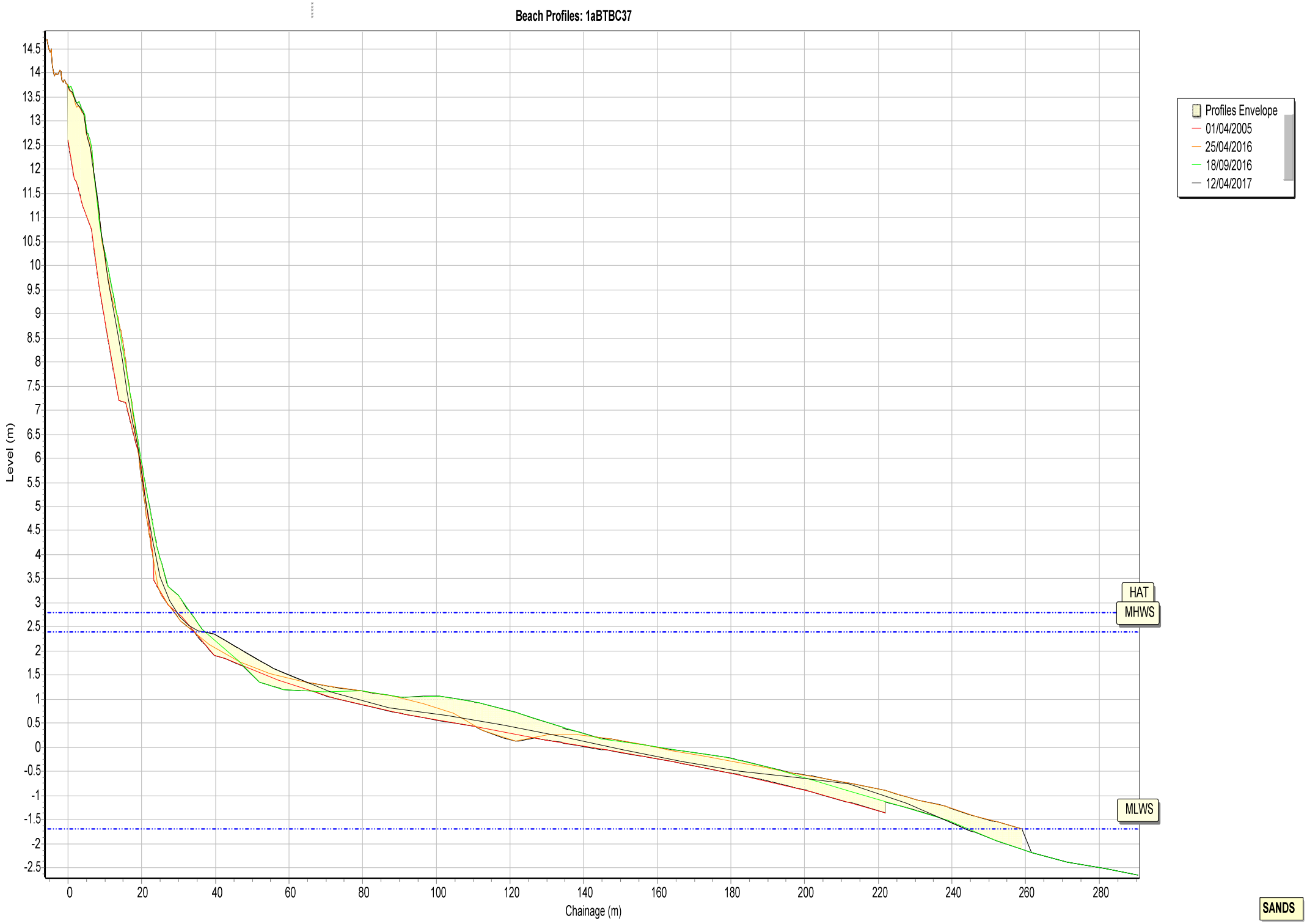
25/04/2016
18/09/2016
12/04/2017
HAT
MHWS
MLWS
Level (m)
Chainage (m)
SANDS


Beach Profiles: 1aBTBC37
Profiles Envelope
01/04/2005
25/04/2016
18/09/2016
12/04/2017
HAT
MHWS
MLWS
SANDS
Level (m)
Chainage (m)
14.5
14
13.5
13
12.5
12
11.5
11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
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-1
-1.5
-2
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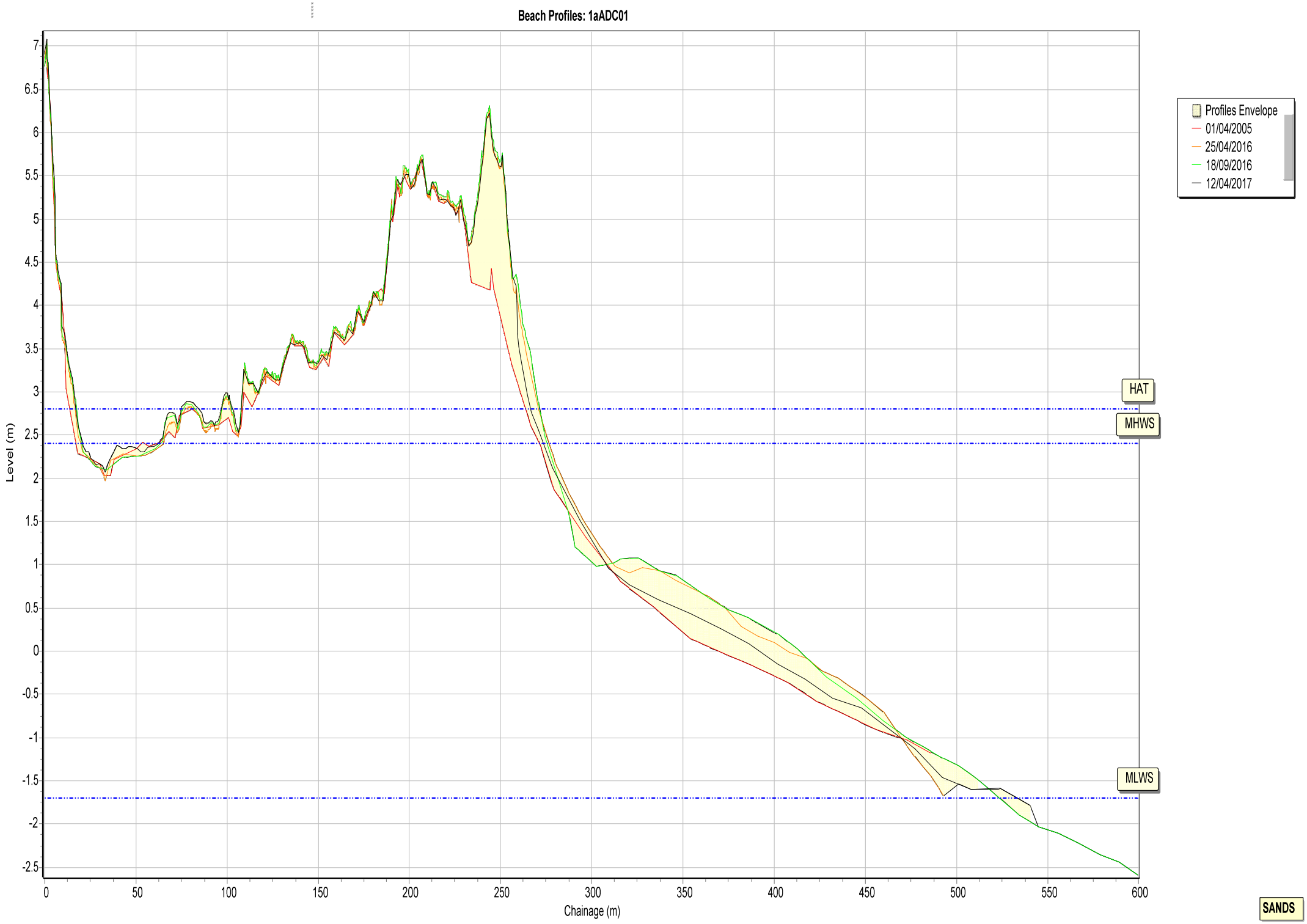
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Profiles Envelope
01/04/2005
25/04/2016
18/09/2016
12/04/2017
HAT
MHWS
MLWS
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Level (m)
Chainage (m)
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
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-1.5
-2
-2.5
0
50
100
150
200
250
300
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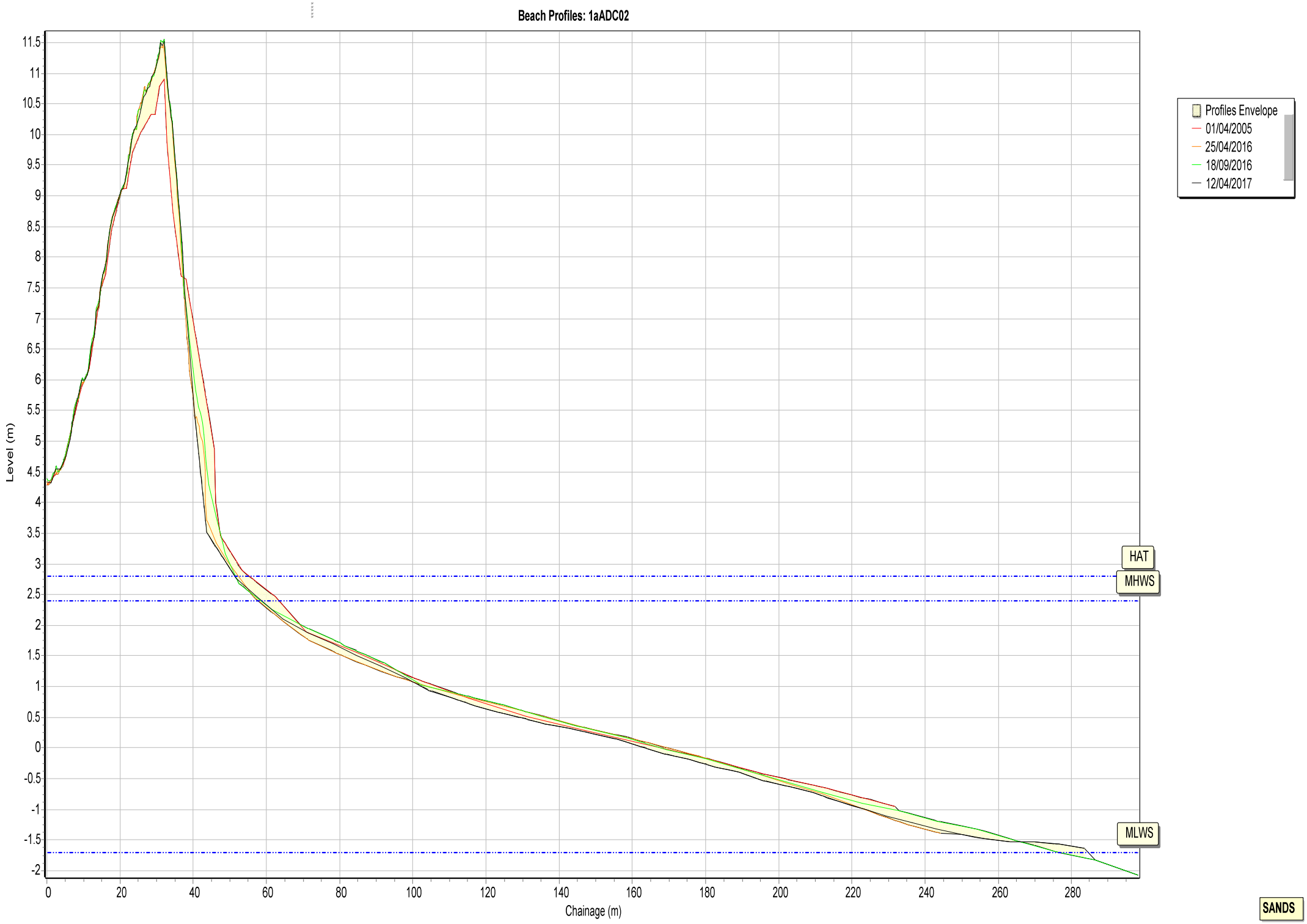
450
500
550
600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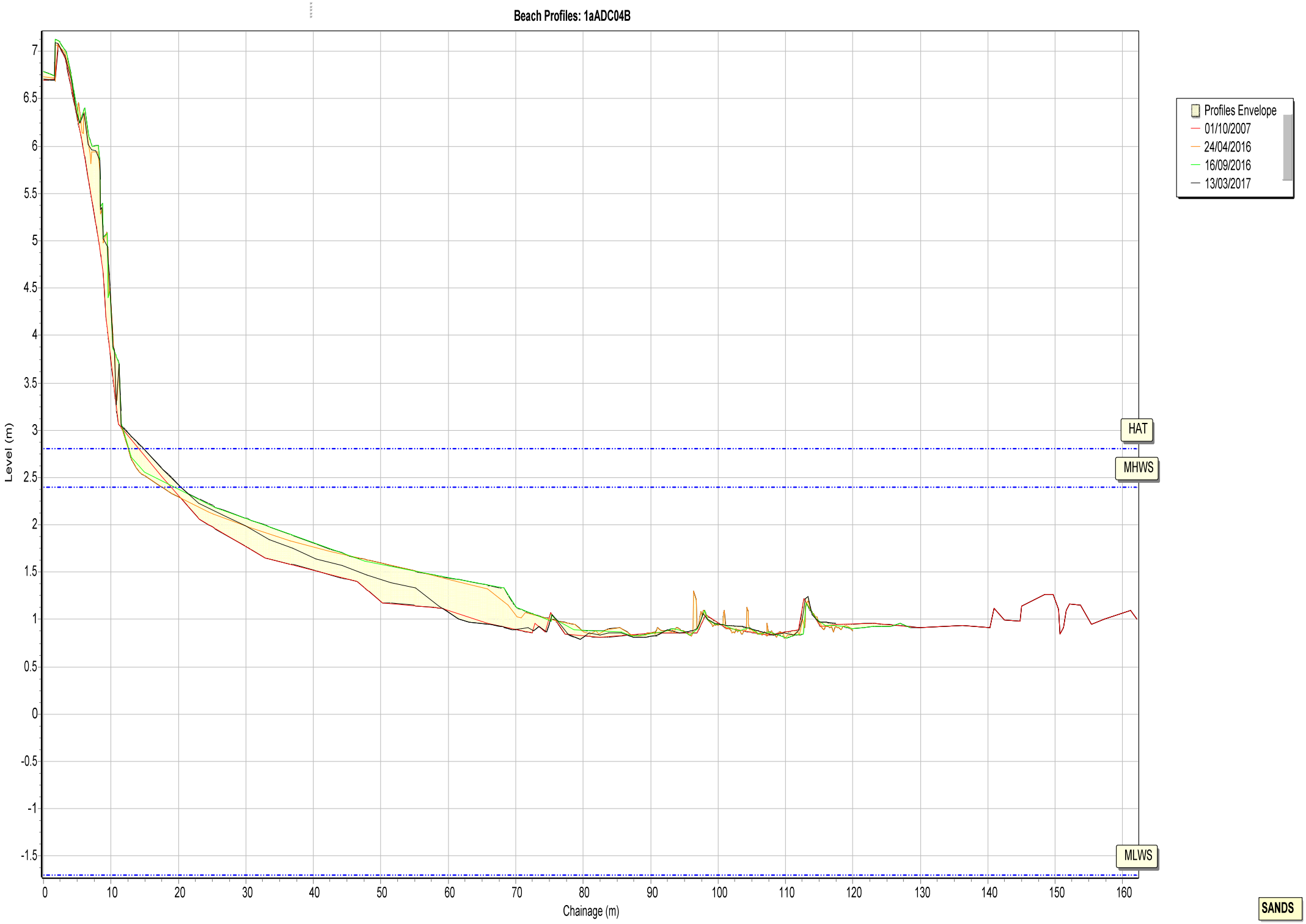
25/04/2016
18/09/2016
12/04/2017
HAT
MHWS
MLWS
SANDS
Level (m)
Chainage (m)
11.5
11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280


Beach Profiles: 1aADC04A
Profiles Envelope
01/10/2007
24/04/2016
16/09/2016
13/03/2017
HAT
MHWS
MLWS
Level (m)
Chainage (m)
SANDS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24/04/2016
16/09/2016
13/03/2017
HAT
MHWS
MLWS
SANDS
Level (m)
Chainage (m)
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
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30
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70
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90
100
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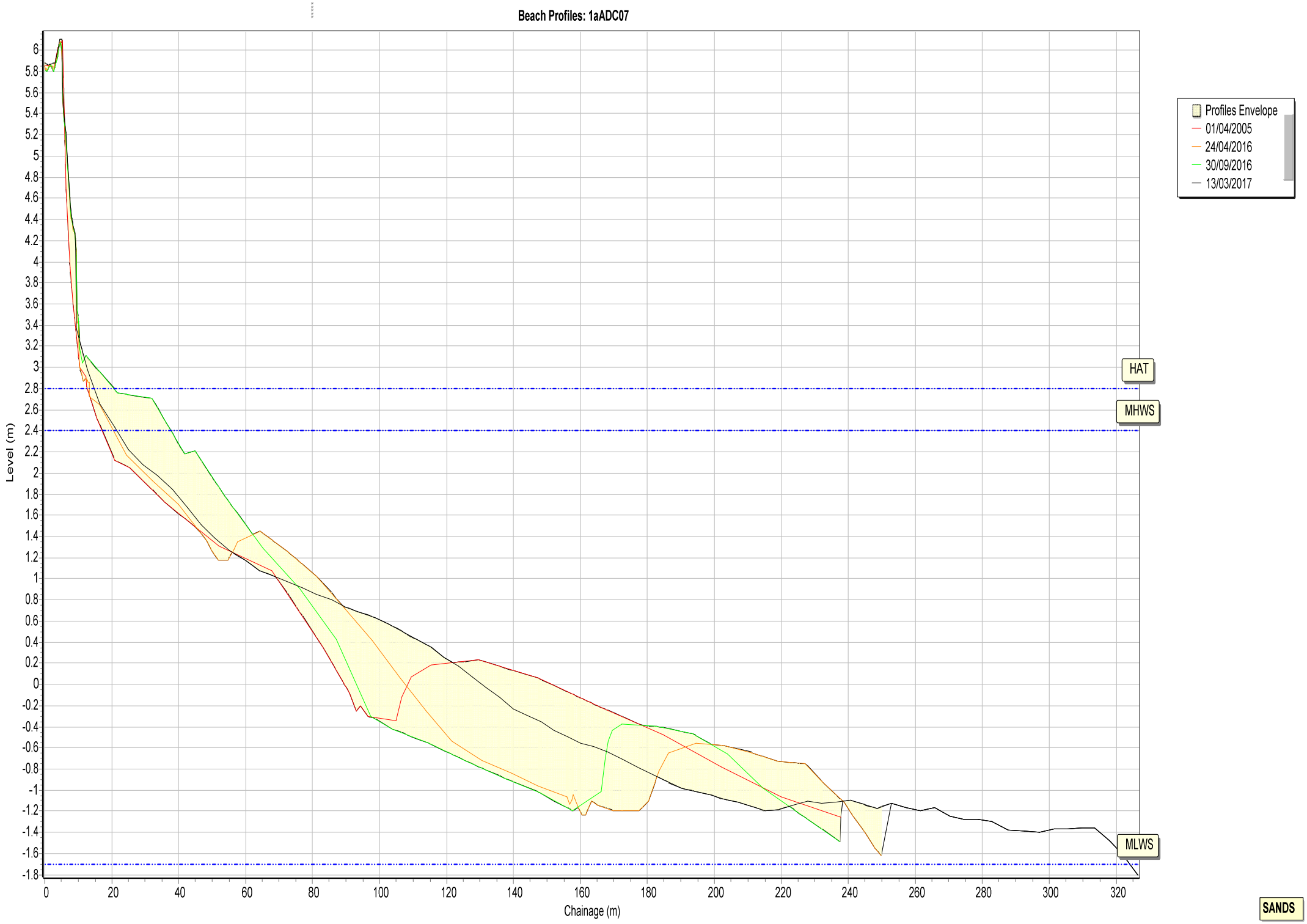
130
140
150
160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Profiles Envelope
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24/04/2016
30/09/2016
13/03/2017
HAT
MHWS
MLWS
SANDS
Level (m)
Chainage (m)
6
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
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2.8
2.6
2.4
2.2
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1.8
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1.4
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200
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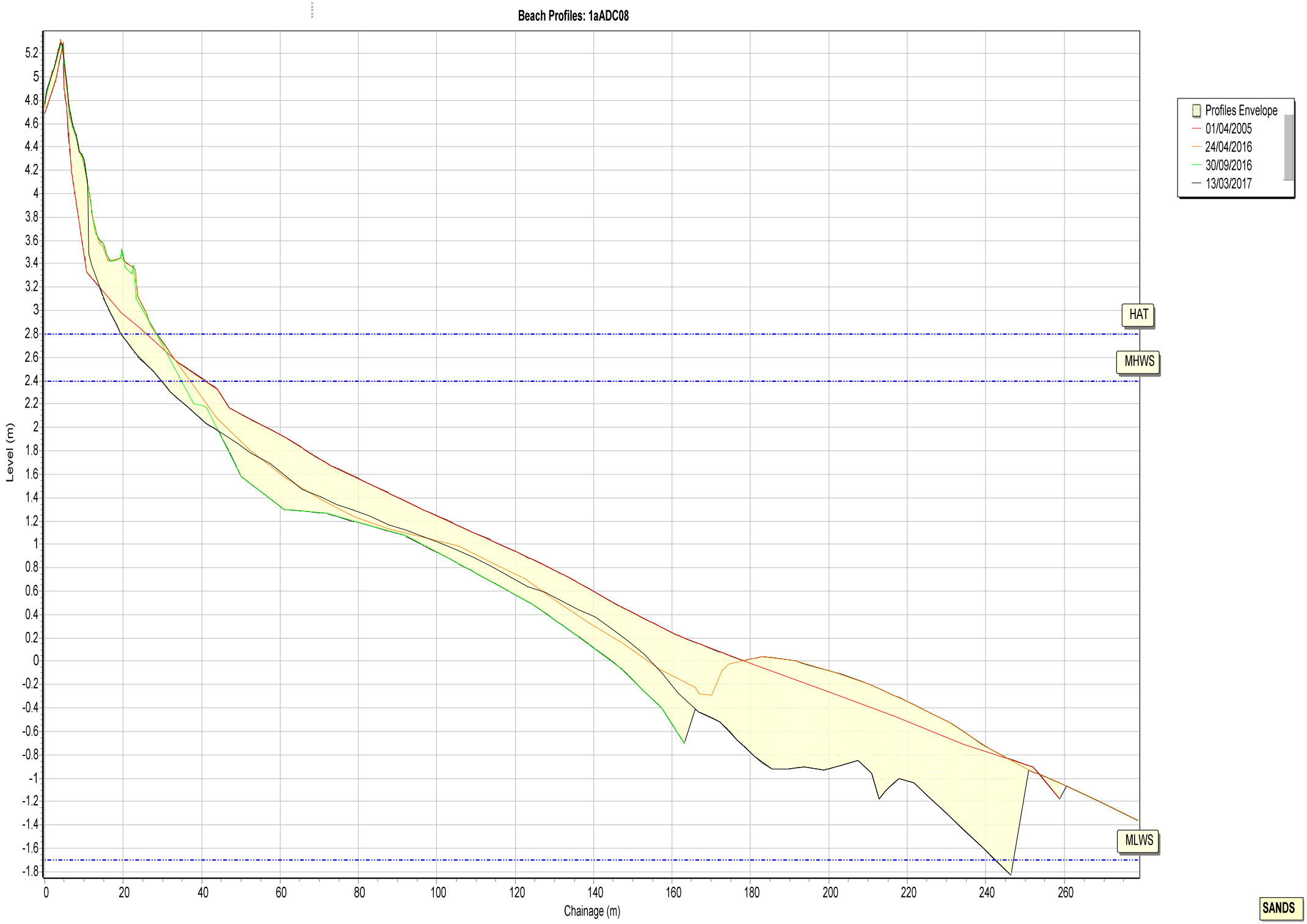
320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Profiles Envelope
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24/04/2016
30/09/2016
13/03/2017
HAT
MHWS
MLWS
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Chainage (m)
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4.8
4.6
4.4
4.2
4
3.8
3.6
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3.2
3
2.8
2.6
2.4
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1.8
1.6
1.4
1.2
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0.6
0.4
0.2
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-0.2
-0.4
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-0.8
-1
-1.2
-1.4
-1.6
-1.8
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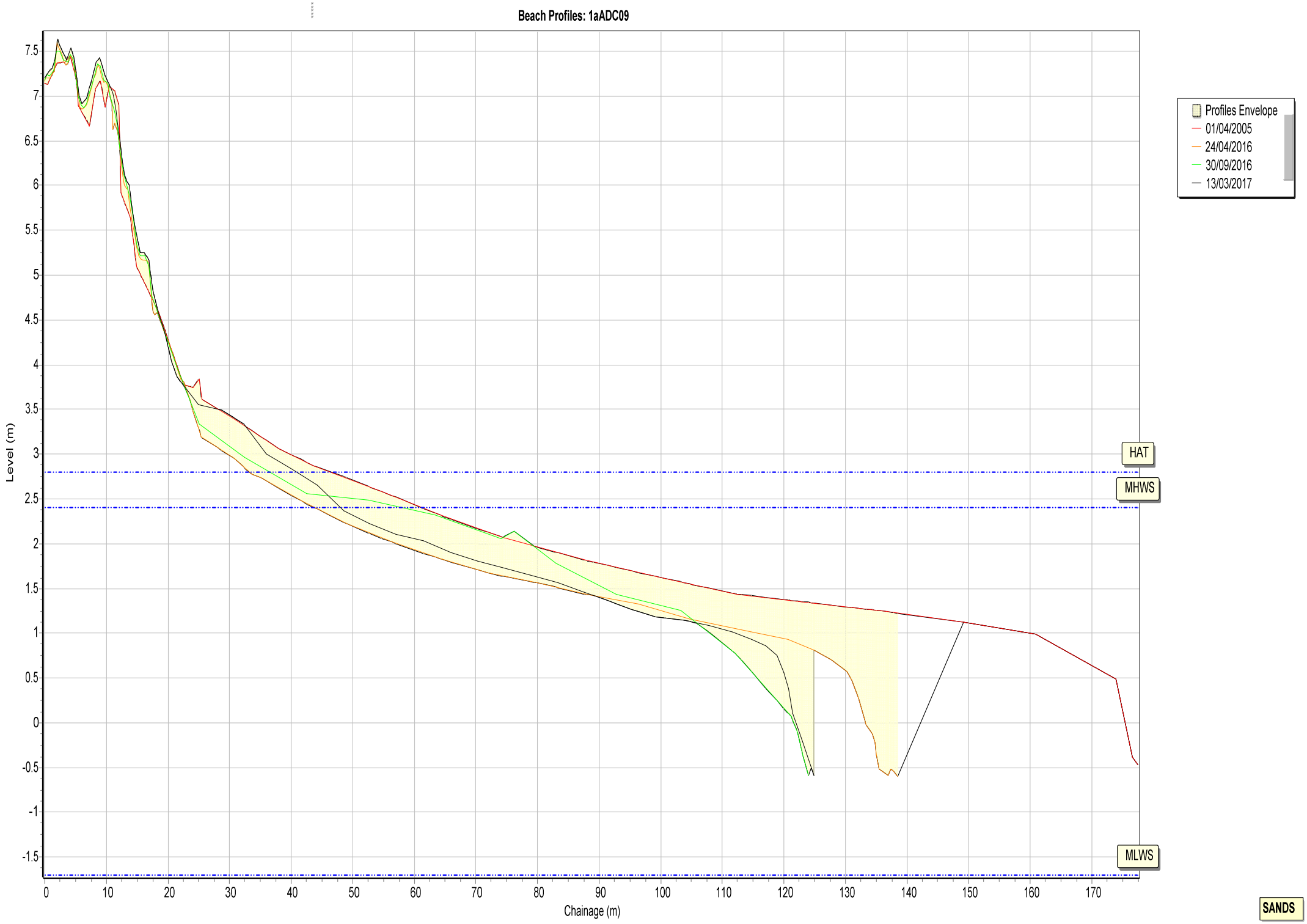
140
160
180
200
220
240
260
SANDS


Beach Profiles: 1aADC09
Profiles Envelope
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24/04/2016
30/09/2016
13/03/2017
HAT
MHWS
MLWS
SANDS
Level (m)
Chainage (m)
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
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40
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70
80
90
100
110
120
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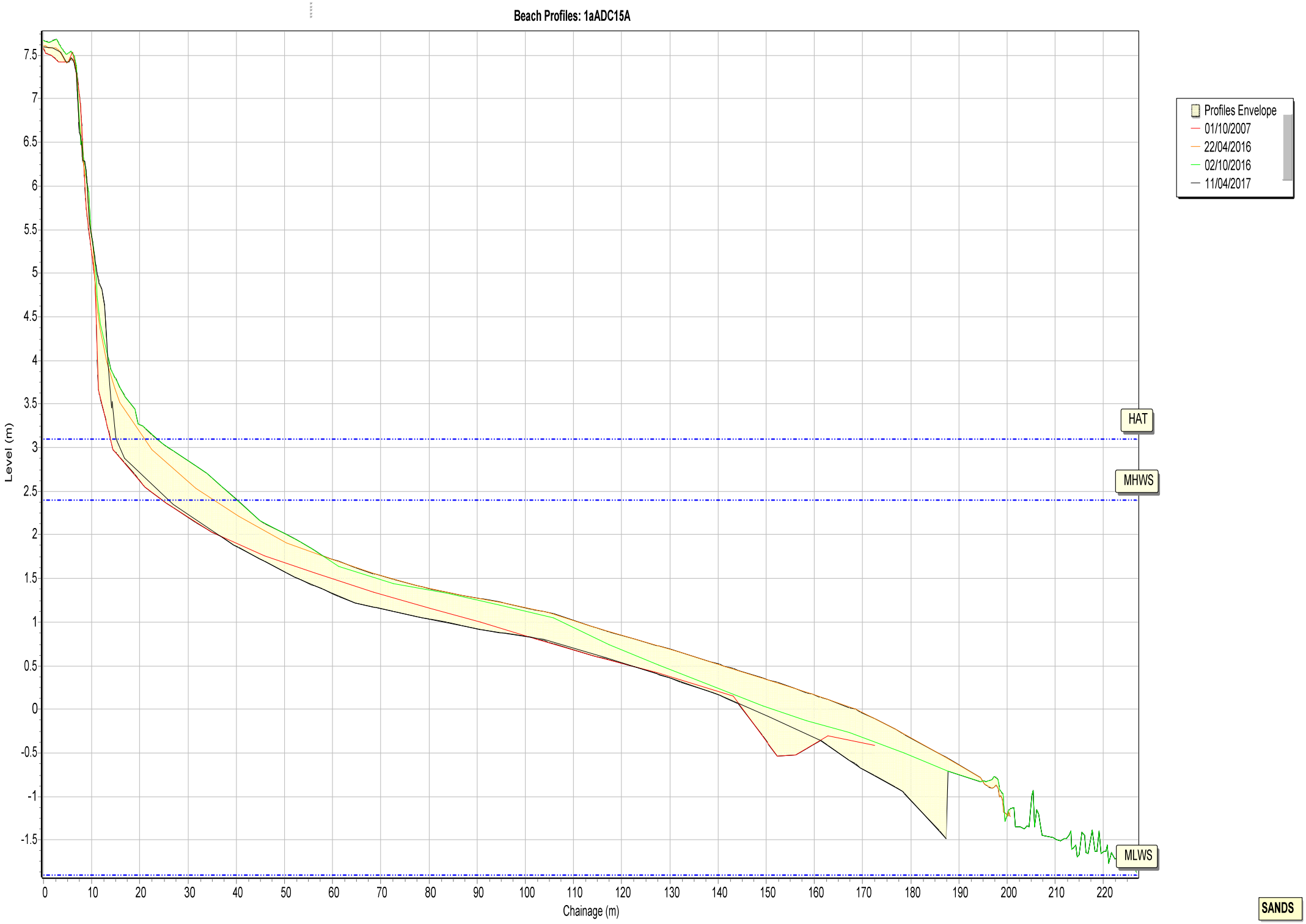
140
150
160
170


Beach Profiles: 1aADC15A
Profiles Envelope
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22/04/2016
02/10/2016
11/04/2017
HAT
MHWS
MLWS
Level (m)
Chainage (m)
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7
6.5
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4.5
4
3.5
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2.5
2
1.5
1
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90
100
110
120
130
140
150
160
170
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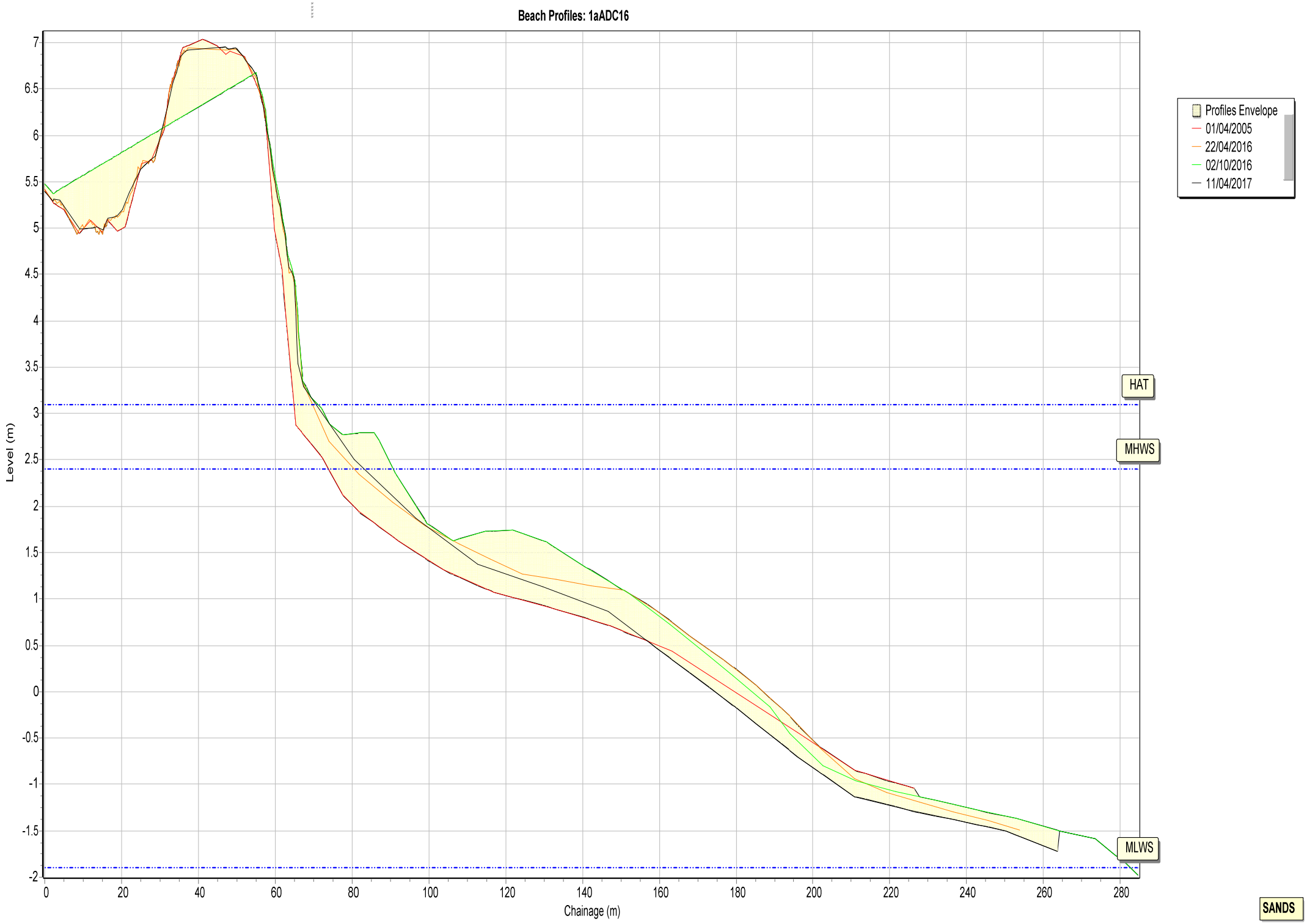
190
200
210
220
SANDS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22/04/2016
02/10/2016
11/04/2017
HAT
MHWS
MLWS
SANDS
Level (m)
Chainage (m)
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
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0.5
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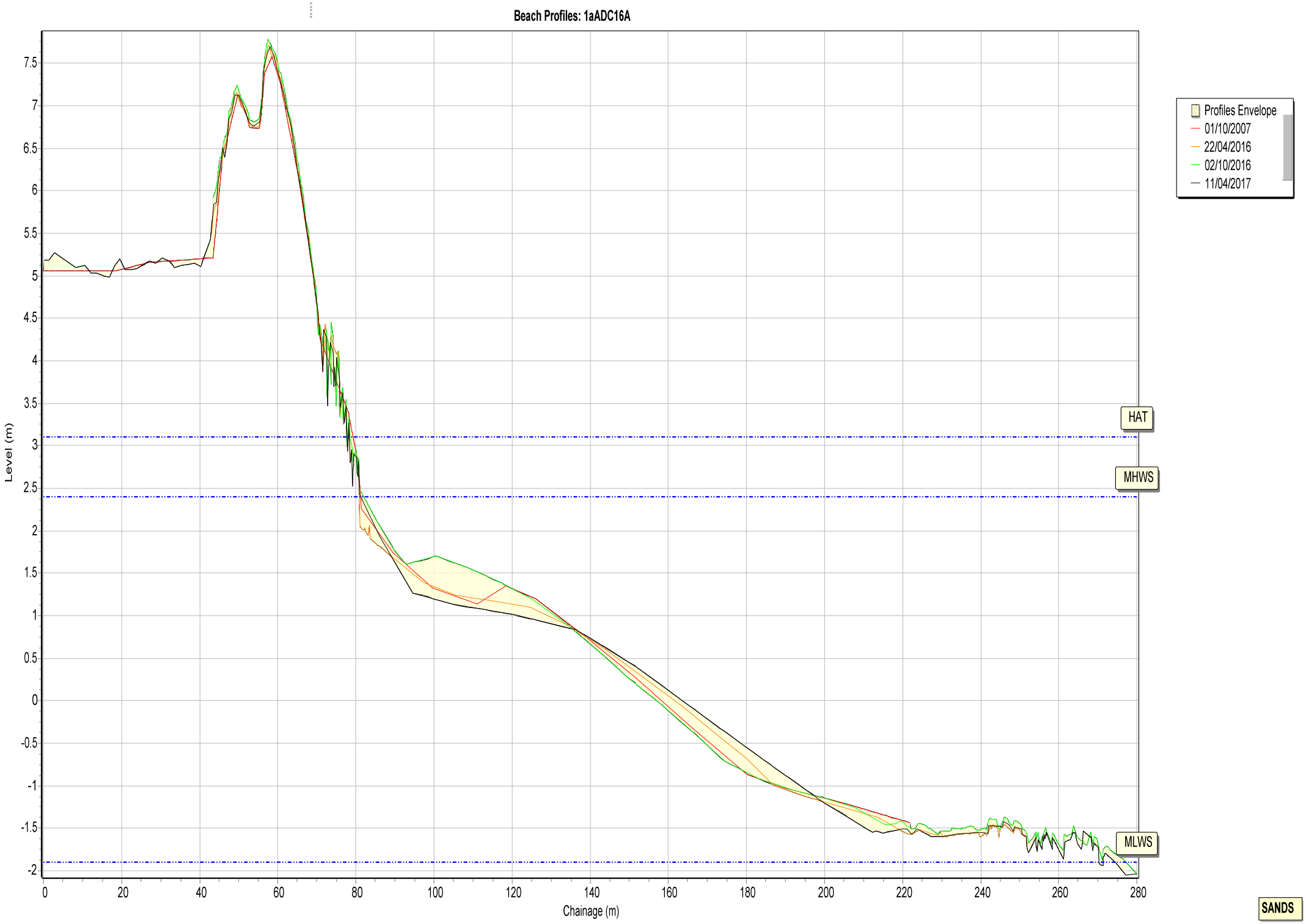
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02/10/2016
11/04/2017
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MLWS
SANDS
Level (m)
Chainage (m)
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
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0.5
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40
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80
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140
160
180
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240
260
280


Beach Profiles: 1aADC16B
Profiles Envelope
01/10/2007
22/04/2016
02/10/2016
11/04/2017
HAT
MHWS
MLWS
SANDS
Level (m)
Chainage (m)
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
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0.5
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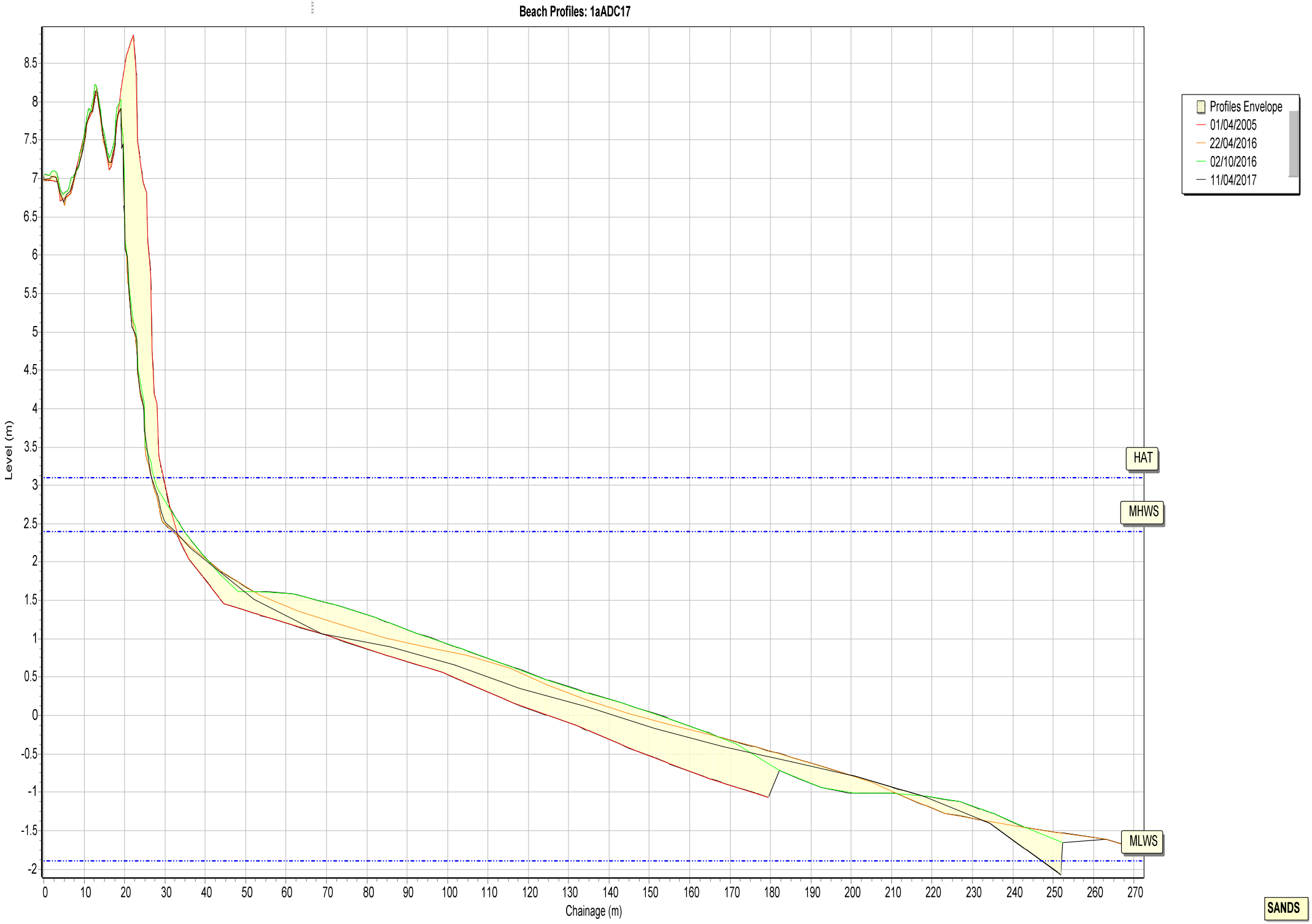
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Chainage (m)
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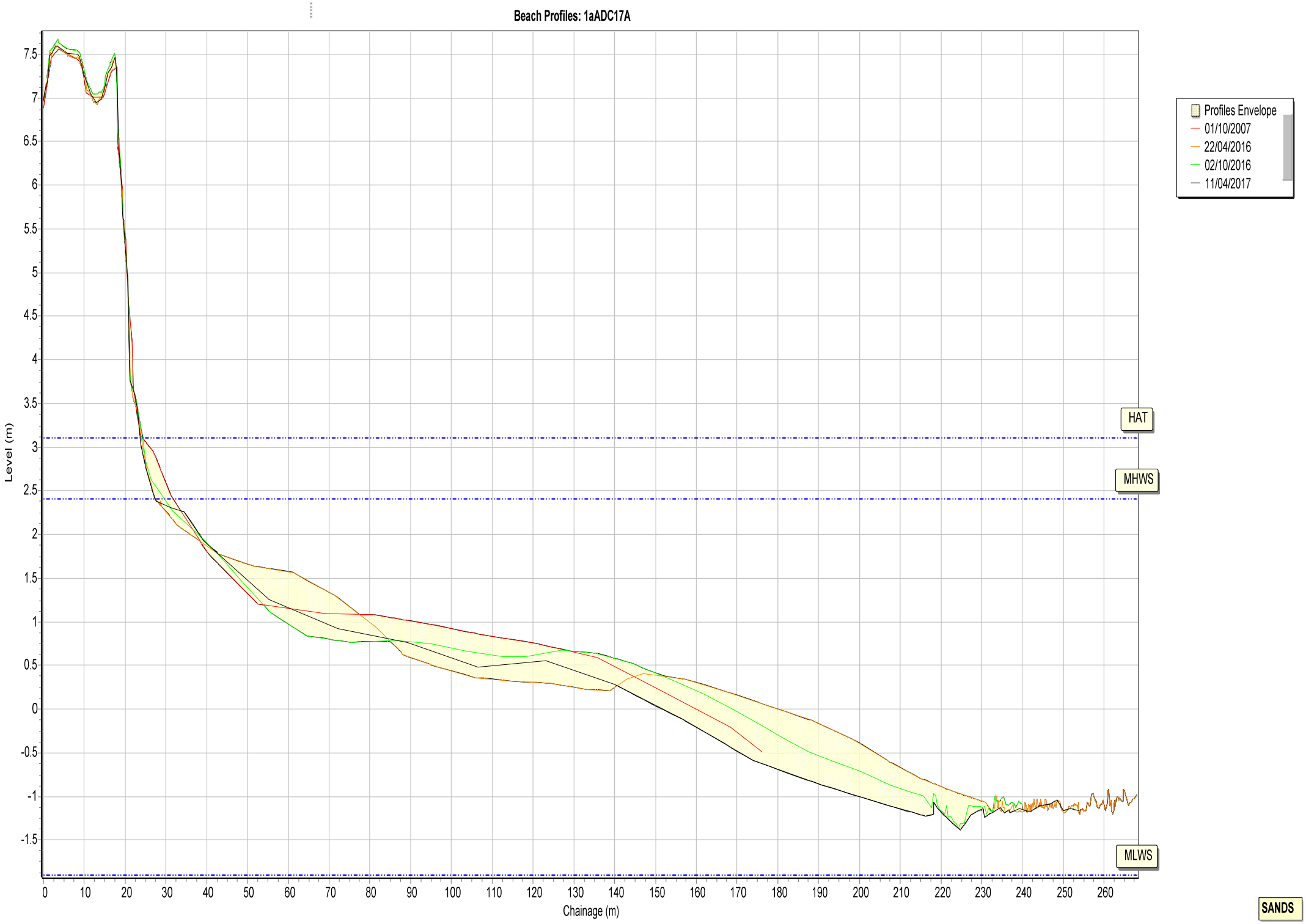
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11/04/2017
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Chainage (m)
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
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-1
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10
20
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30/09/2016
11/04/2017
HAT
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Level (m)
Chainage (m)
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8.5
8
7.5
7
6.5
6
5.5
5
4.5
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2
1.5
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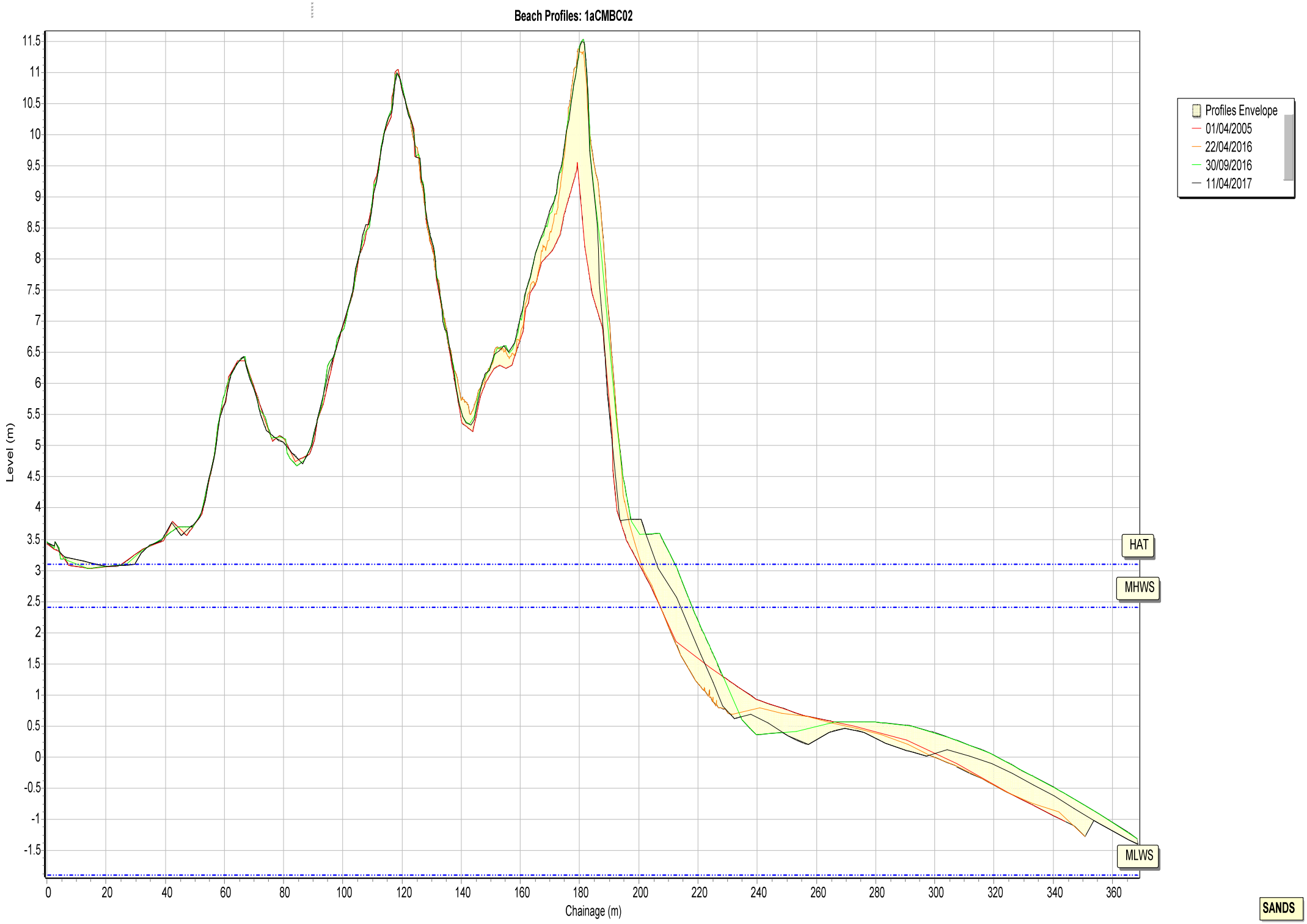
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11/04/2017
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MLWS
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Level (m)
Chainage (m)
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11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
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-1
-1.5
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220
240
260
280
300
320
340
360


Beach Profiles: 1aCMBC03A
Profiles Envelope
01/10/2007
22/04/2016
28/09/2016
10/04/2017
Level (m)
Chainage (m)
HAT
MHWS
MLWS
SANDS


Beach Profiles: 1aCMBC03A
Profiles Envelope
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28/09/2016
10/04/2017
Level (m)
Chainage (m)
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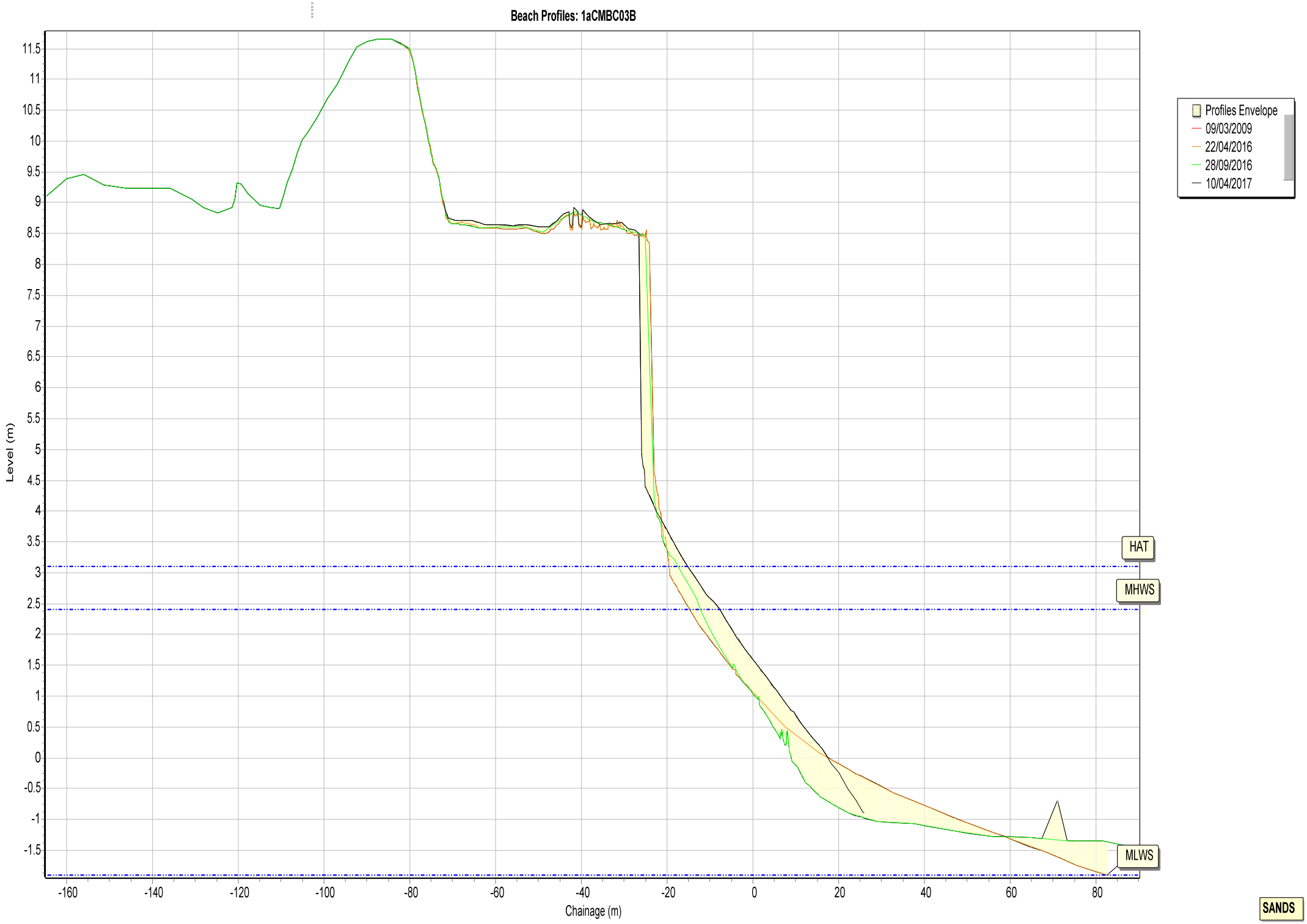
MLWS
SANDS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22/04/2016
28/09/2016
10/04/2017
HAT
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MLWS
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Level (m)
Chainage (m)
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11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
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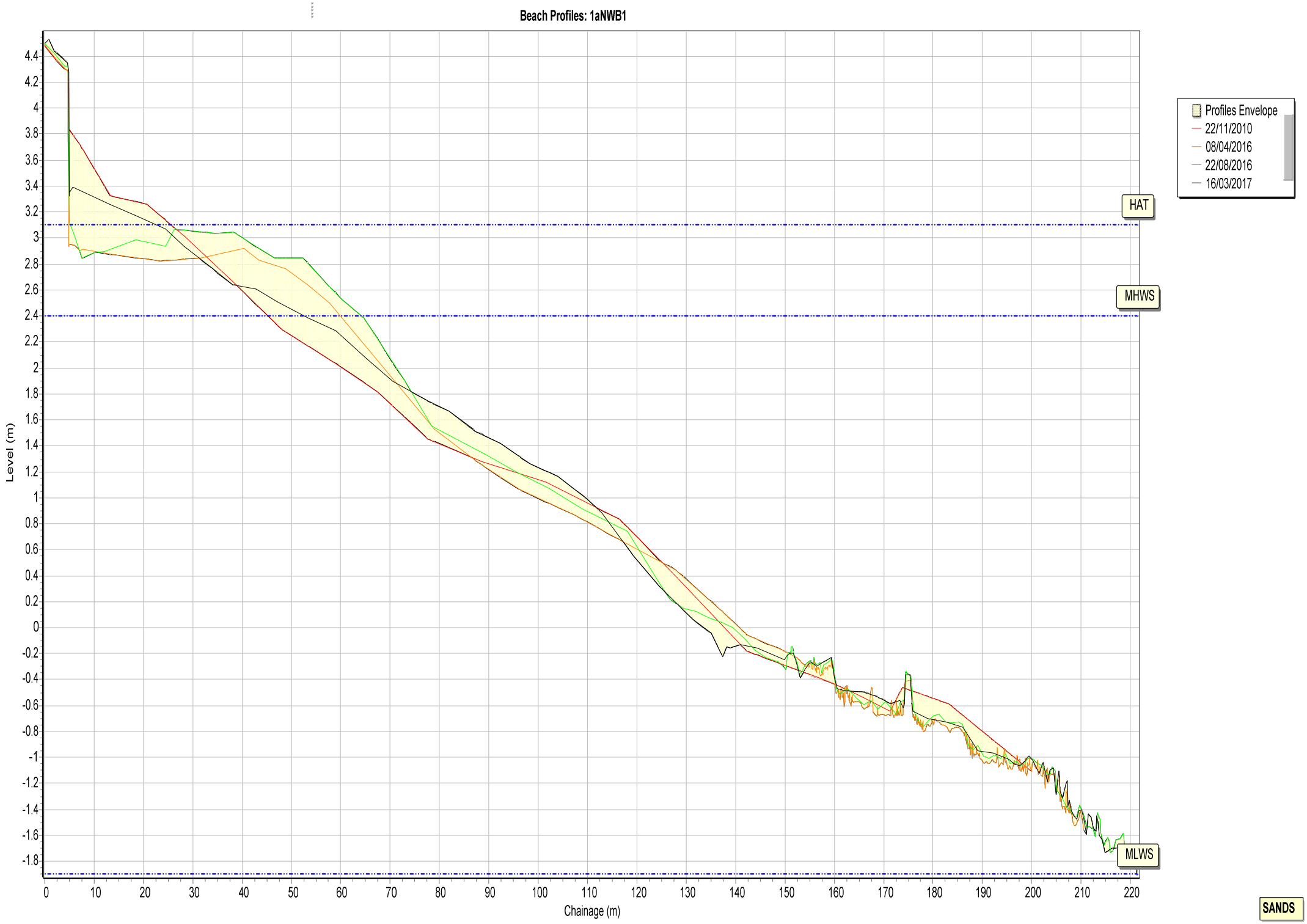
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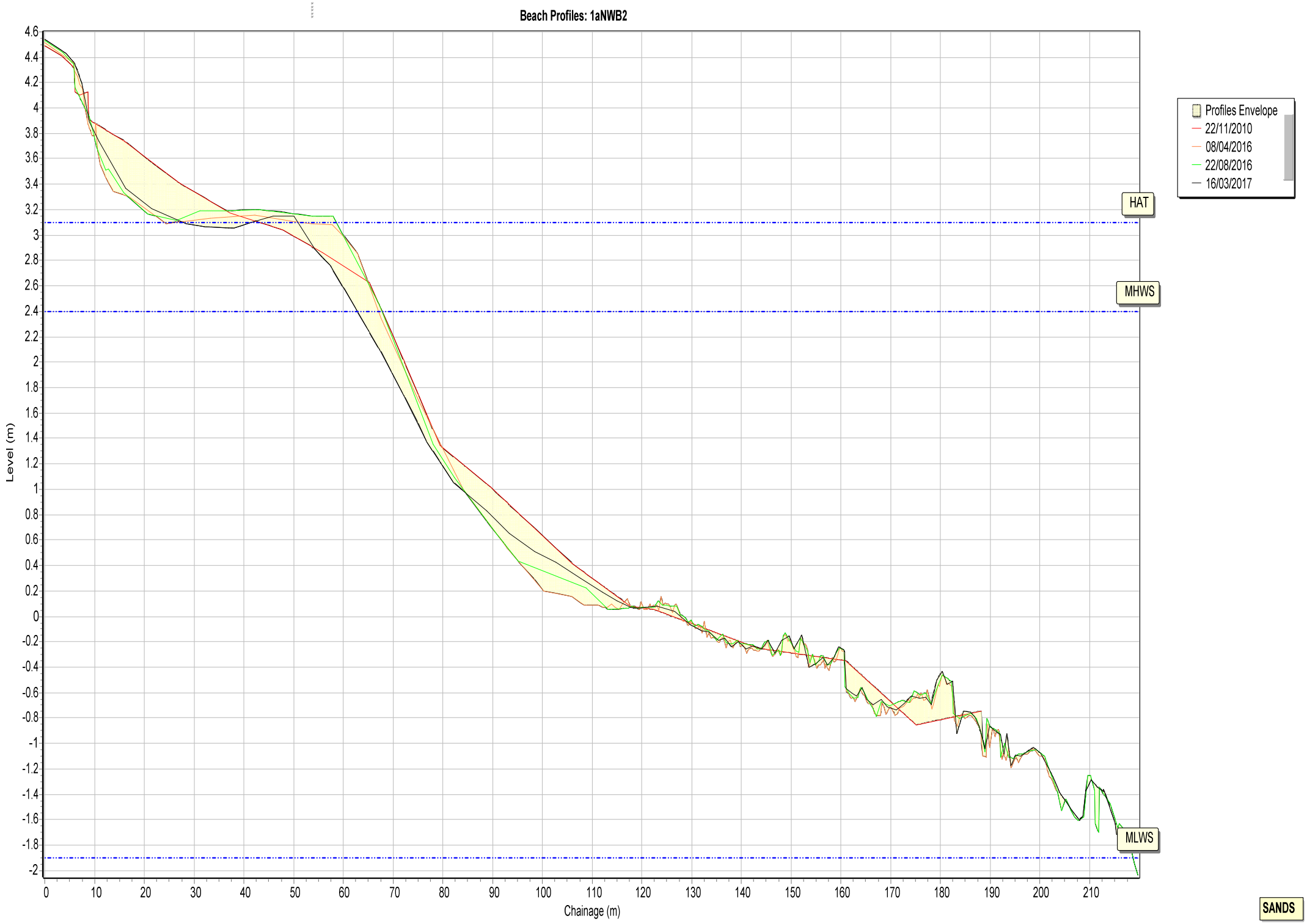
22/08/2016
16/03/2017
HAT
MHWS
MLWS
Level (m)
Chainage (m)
SANDS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22/08/2016
16/03/2017
HAT
MHWS
MLWS
Level (m)
Chainage (m)
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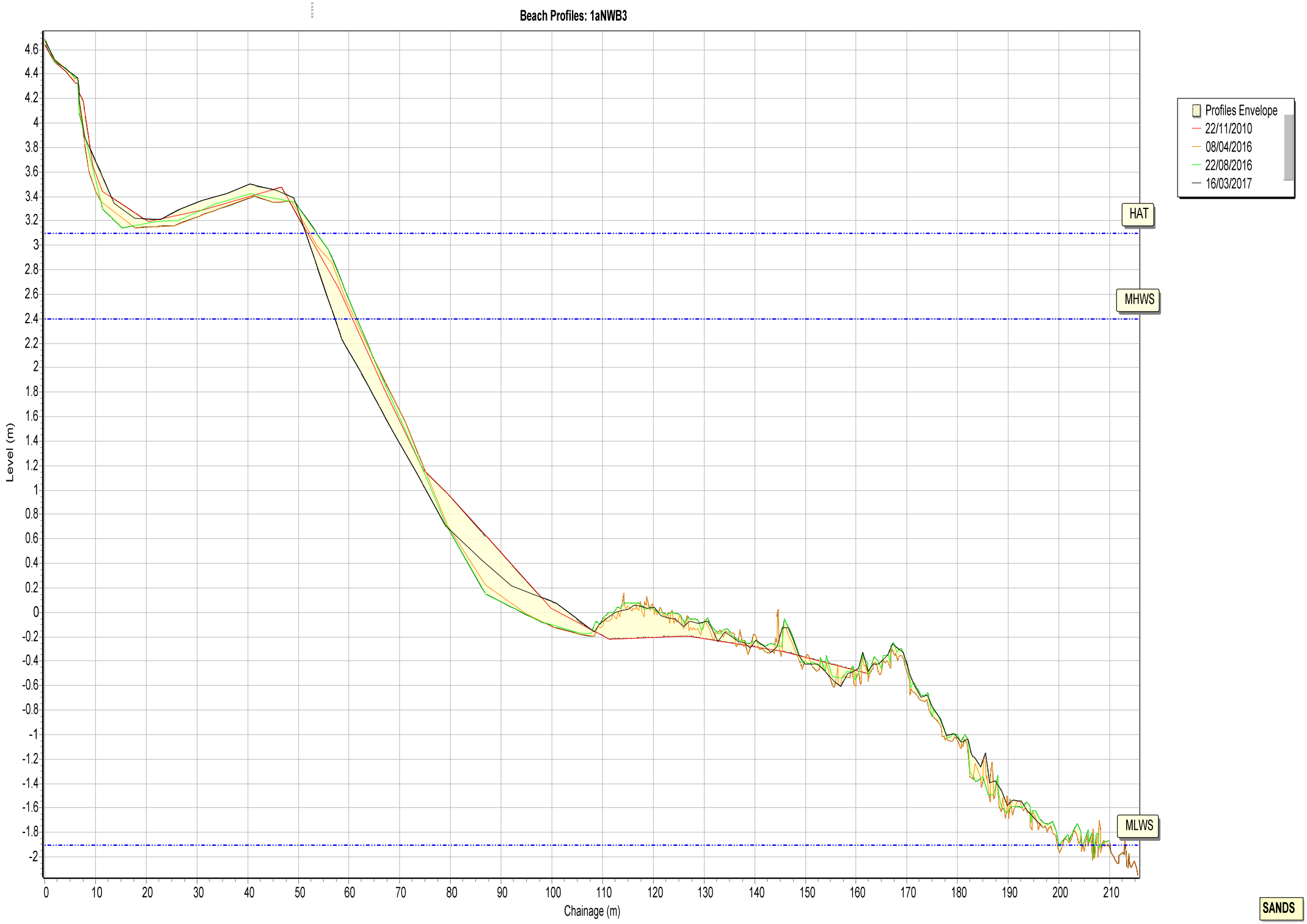
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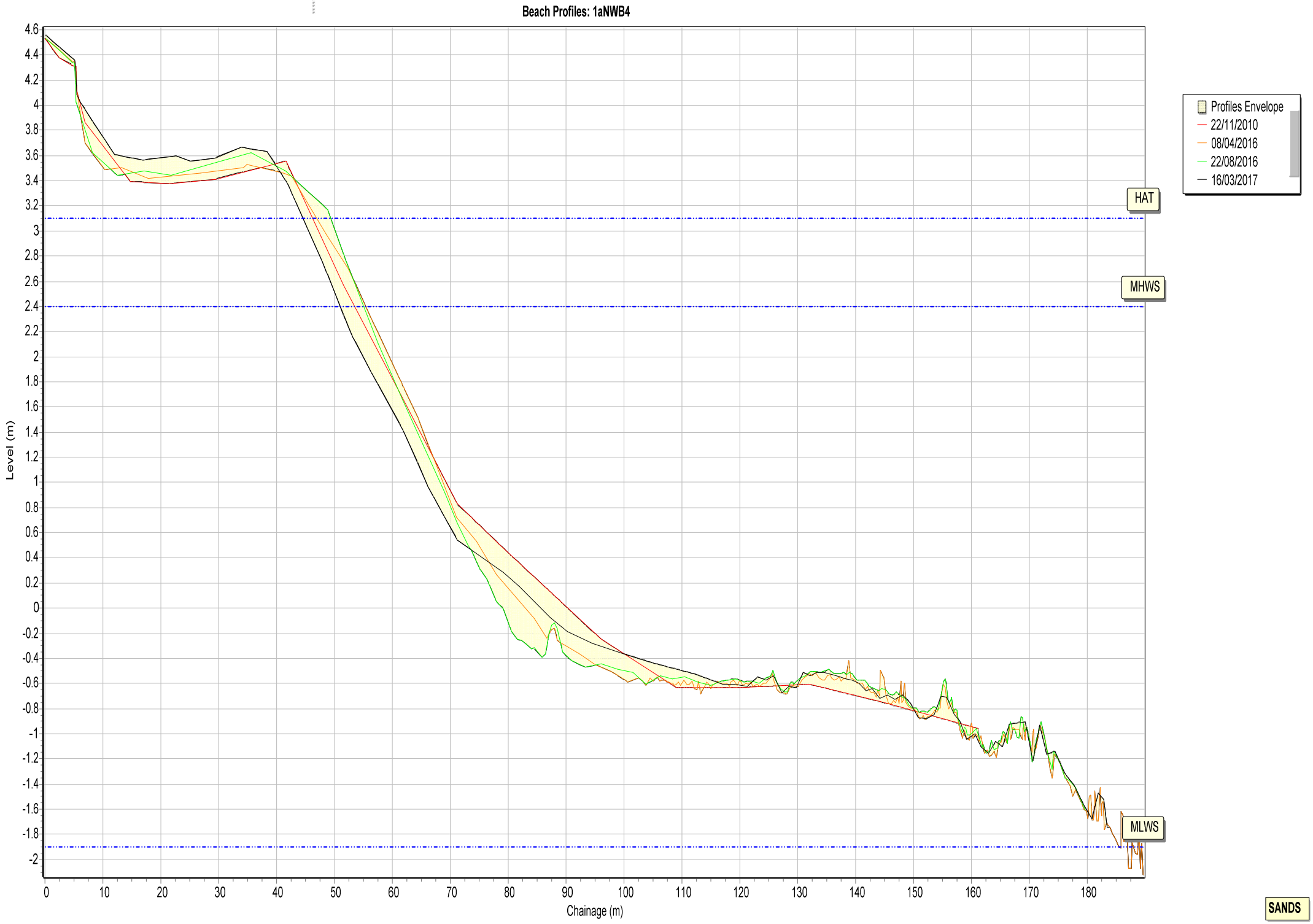
22/08/2016
16/03/2017
HAT
MHWS
MLWS
Level (m)
Chainage (m)
SANDS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22/08/2016
16/03/2017
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MLWS
Level (m)
Chainage (m)
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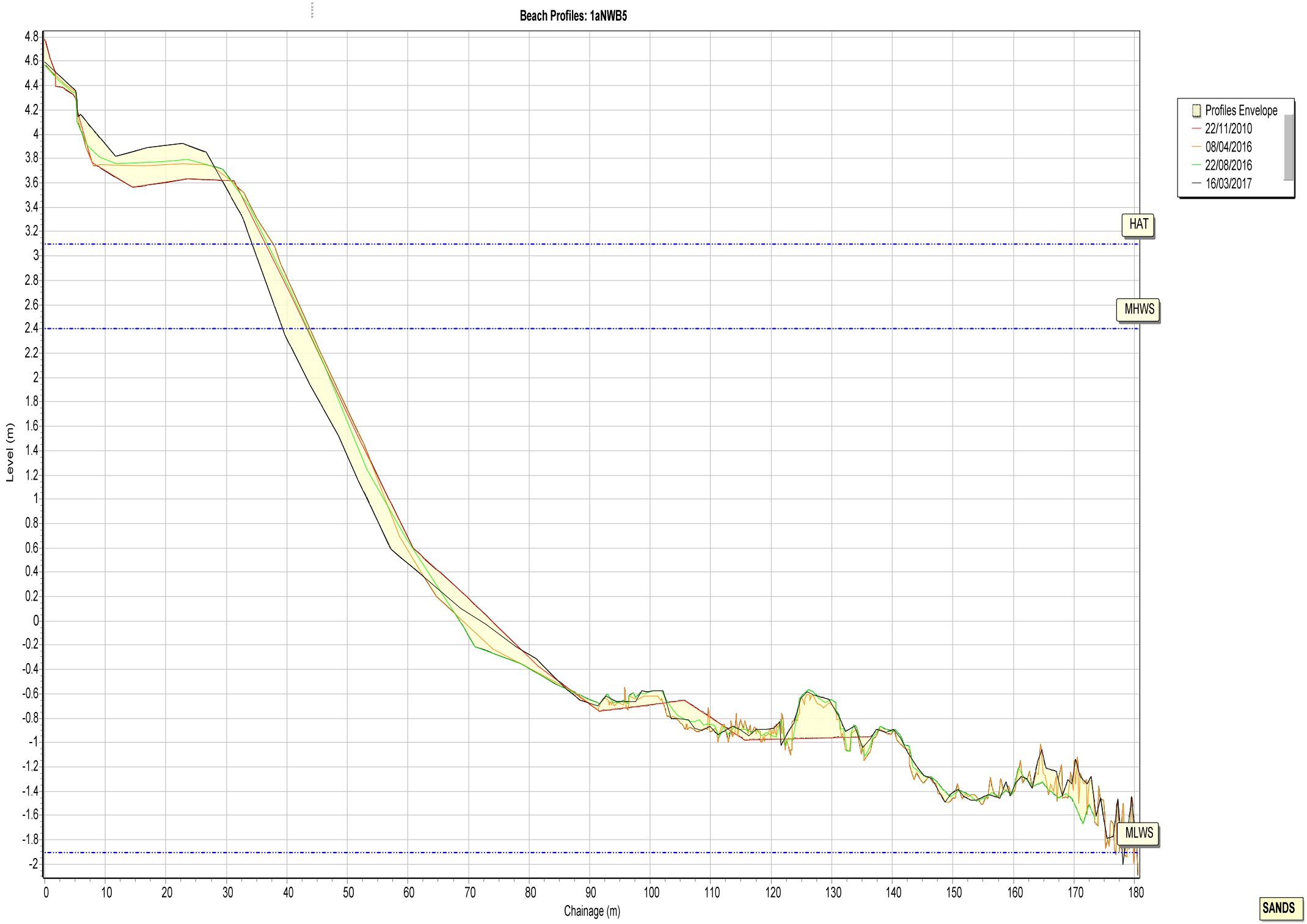
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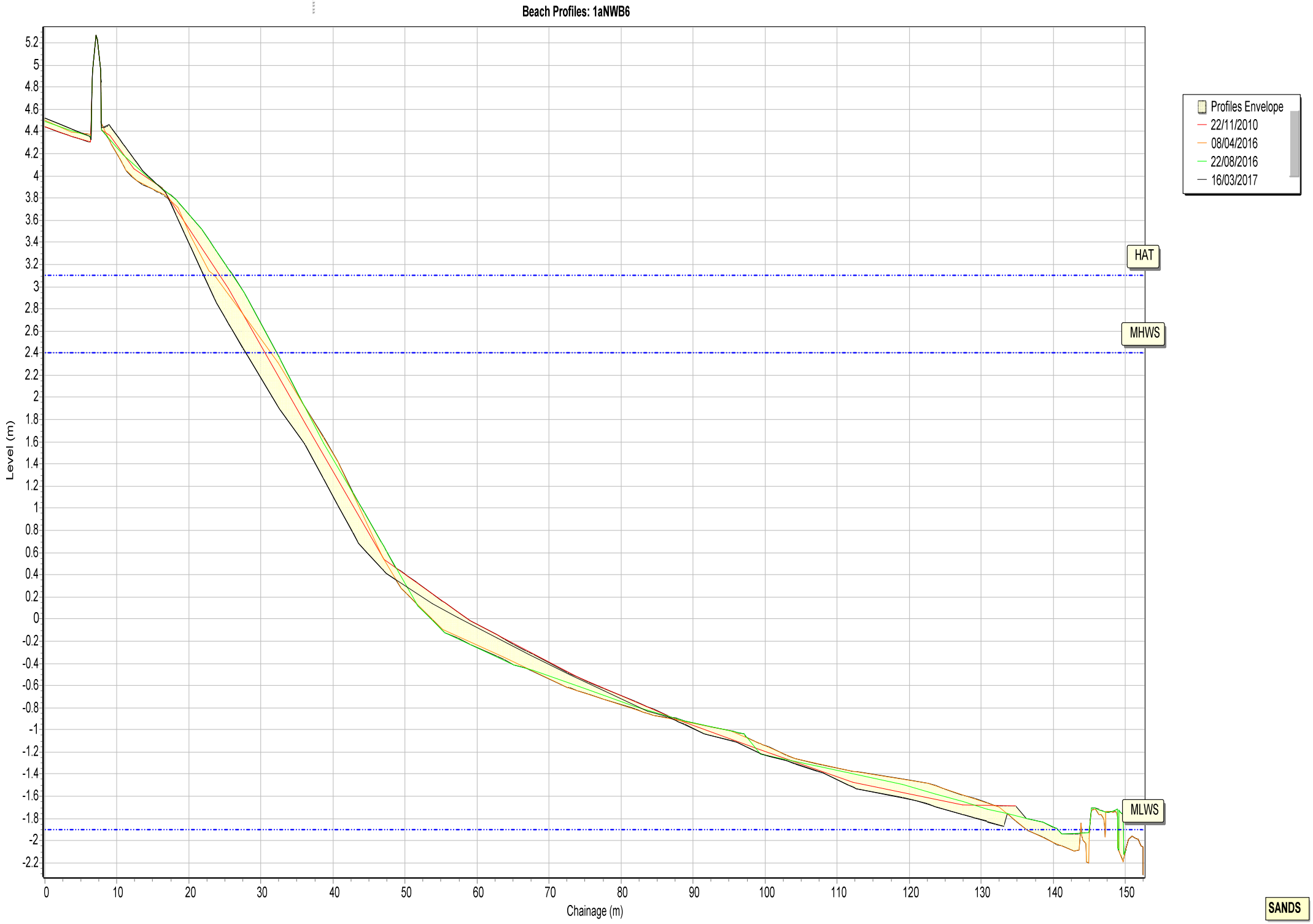
22/08/2016
16/03/2017
HAT
MHWS
MLWS
Level (m)
Chainage (m)
SANDS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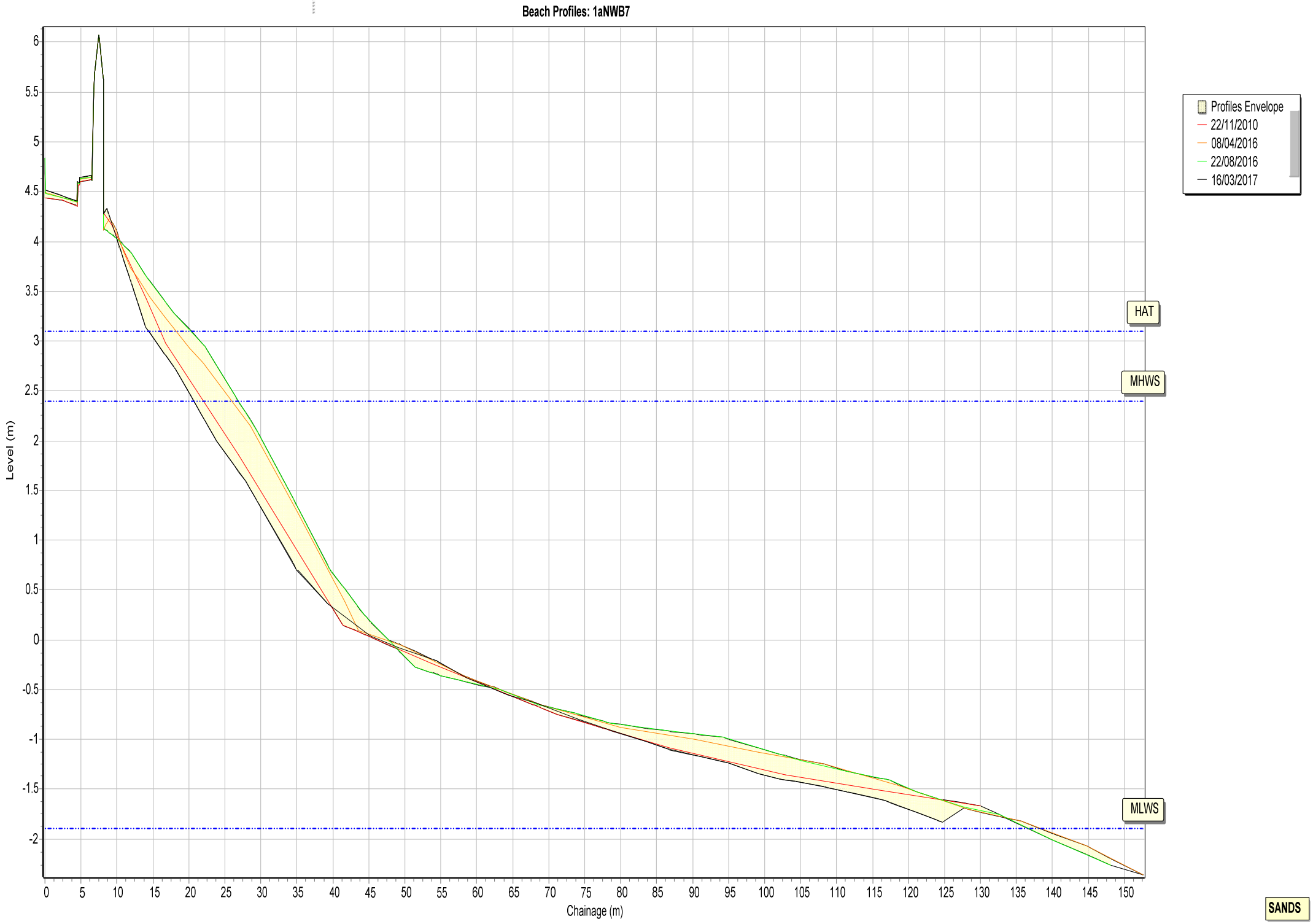
22/08/2016
16/03/2017
HAT
MHWS
MLWS
Level (m)
Chainage (m)
SANDS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16/03/2017
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MLWS
Level (m)
Chainage (m)
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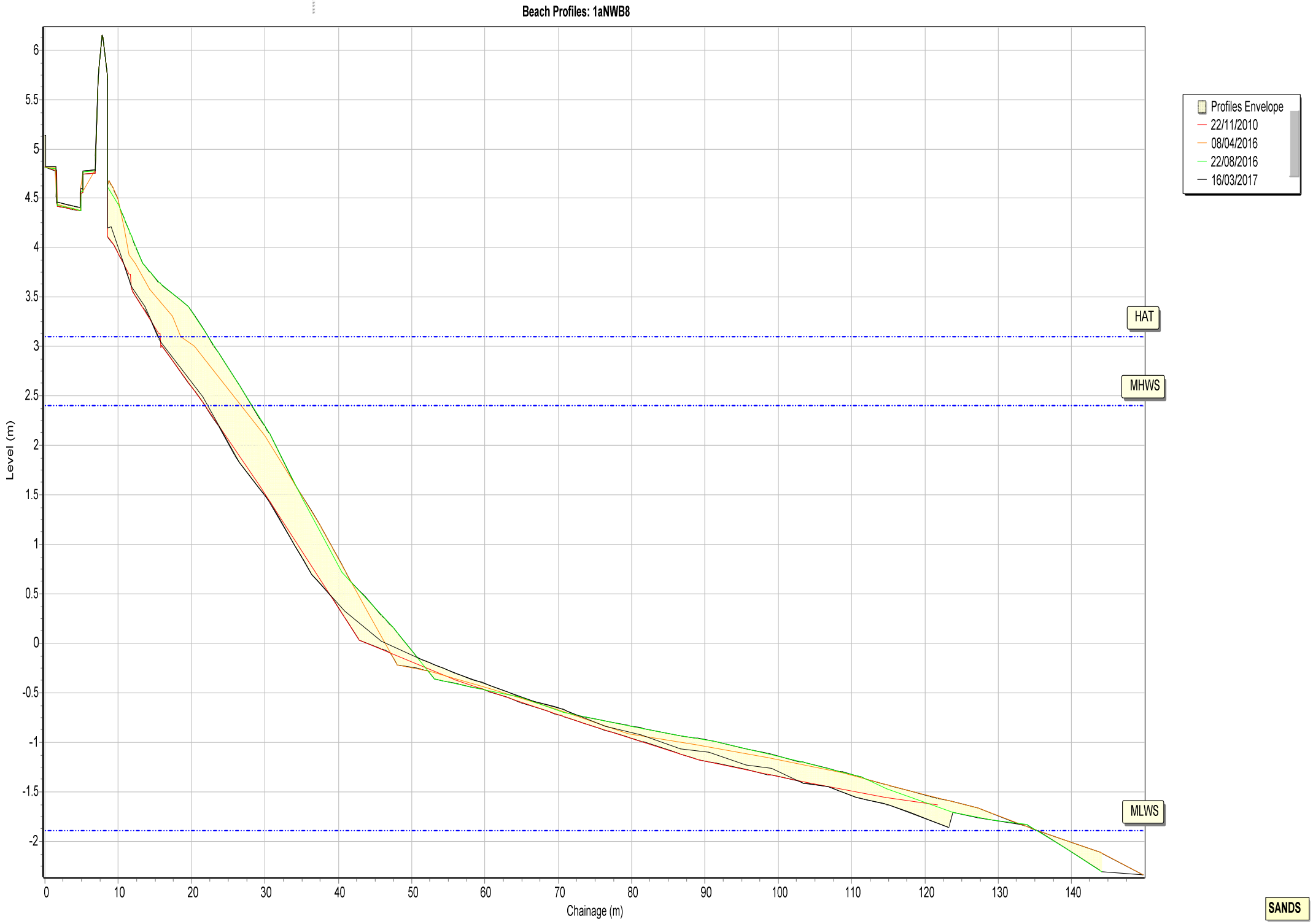
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16/03/2017
HAT
MHWS
MLWS
SANDS
Level (m)
Chainage (m)
6
5.5
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4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
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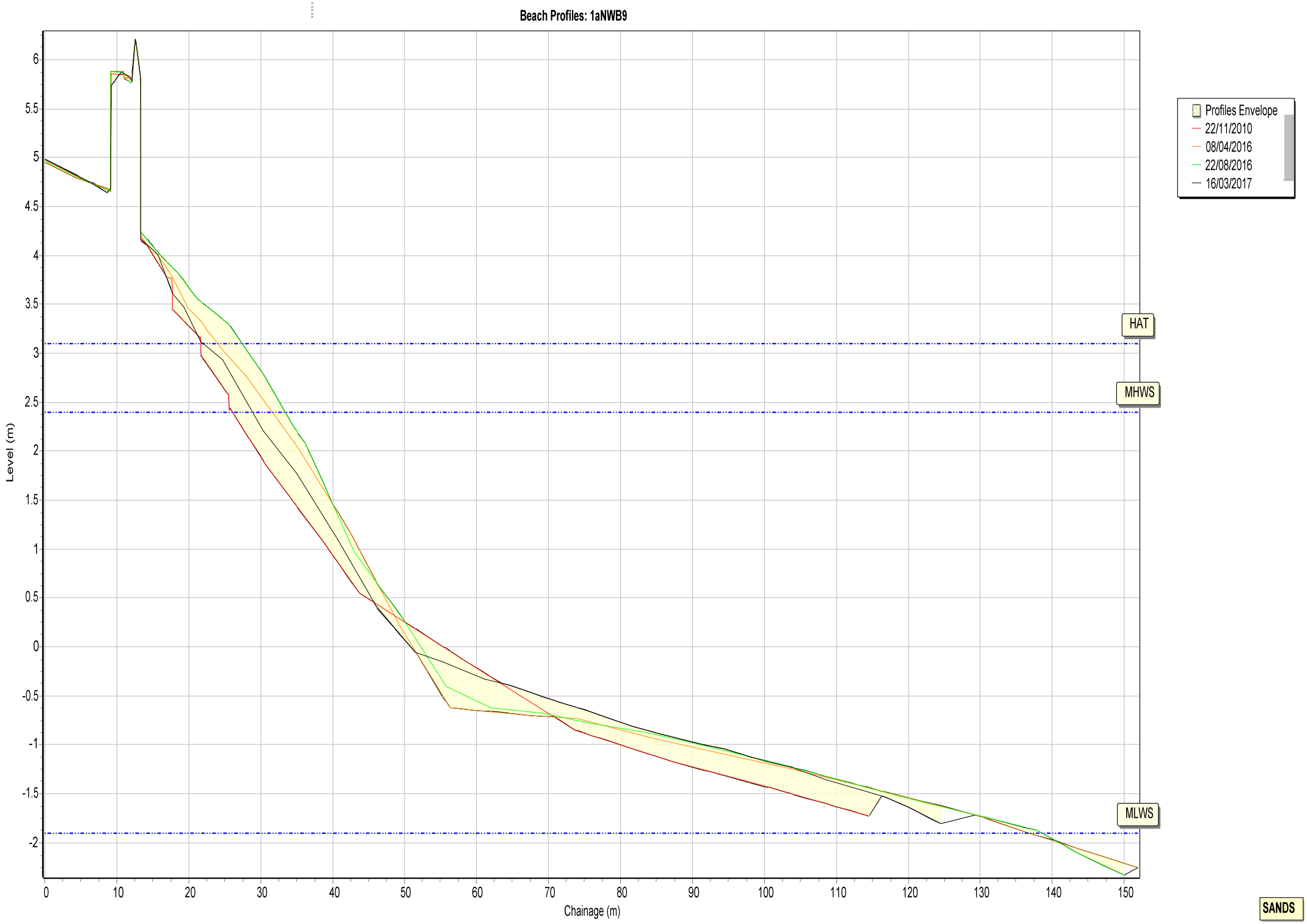
70
80
90
100
110
120
130
140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Profiles Envelope
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08/04/2016
22/08/2016
16/03/2017
HAT
MHWS
MLWS
SANDS
Level (m)
Chainage (m)
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
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-0.5
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120
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140
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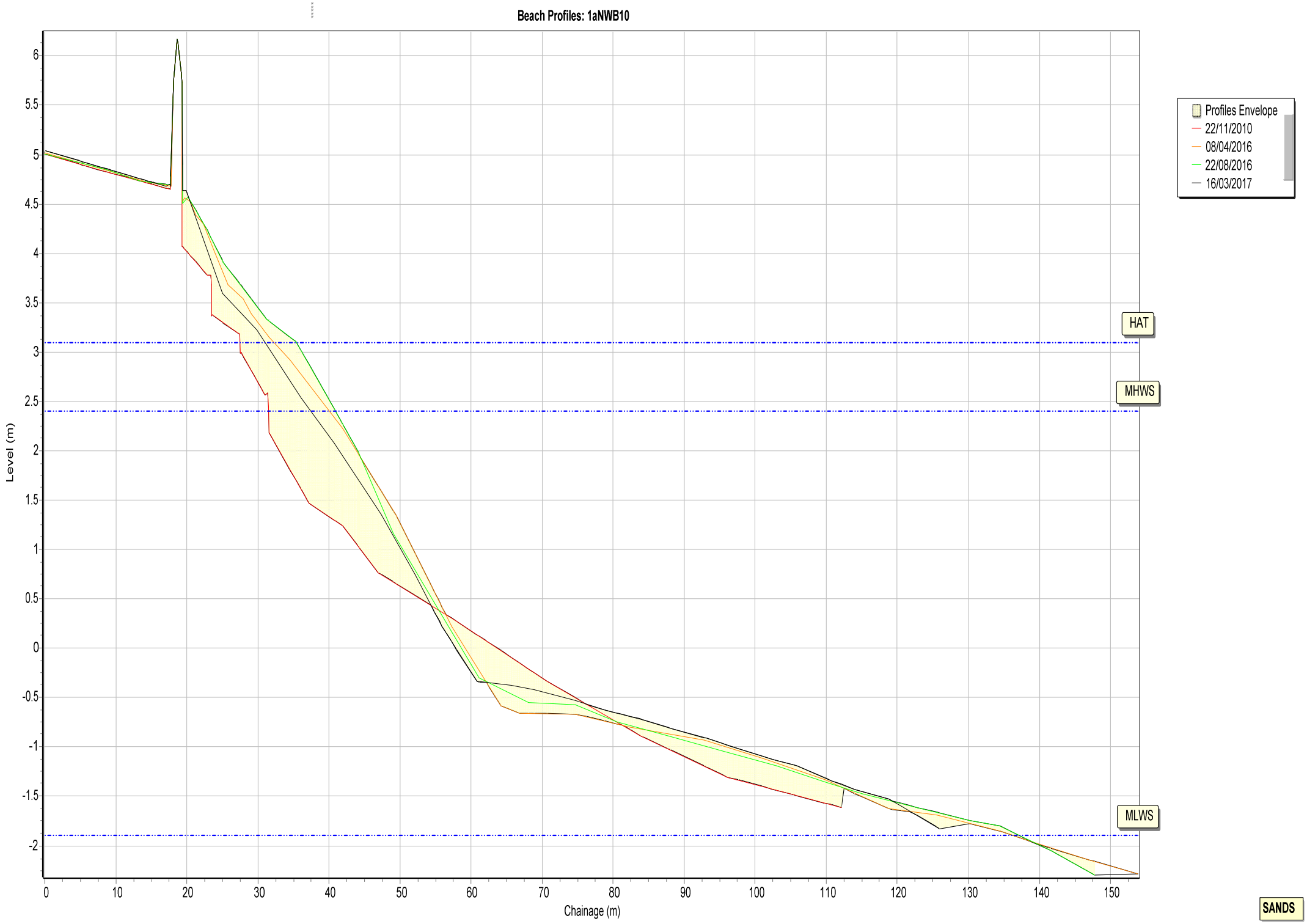
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16/03/2017
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MLWS
SANDS
Level (m)
Chainage (m)
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
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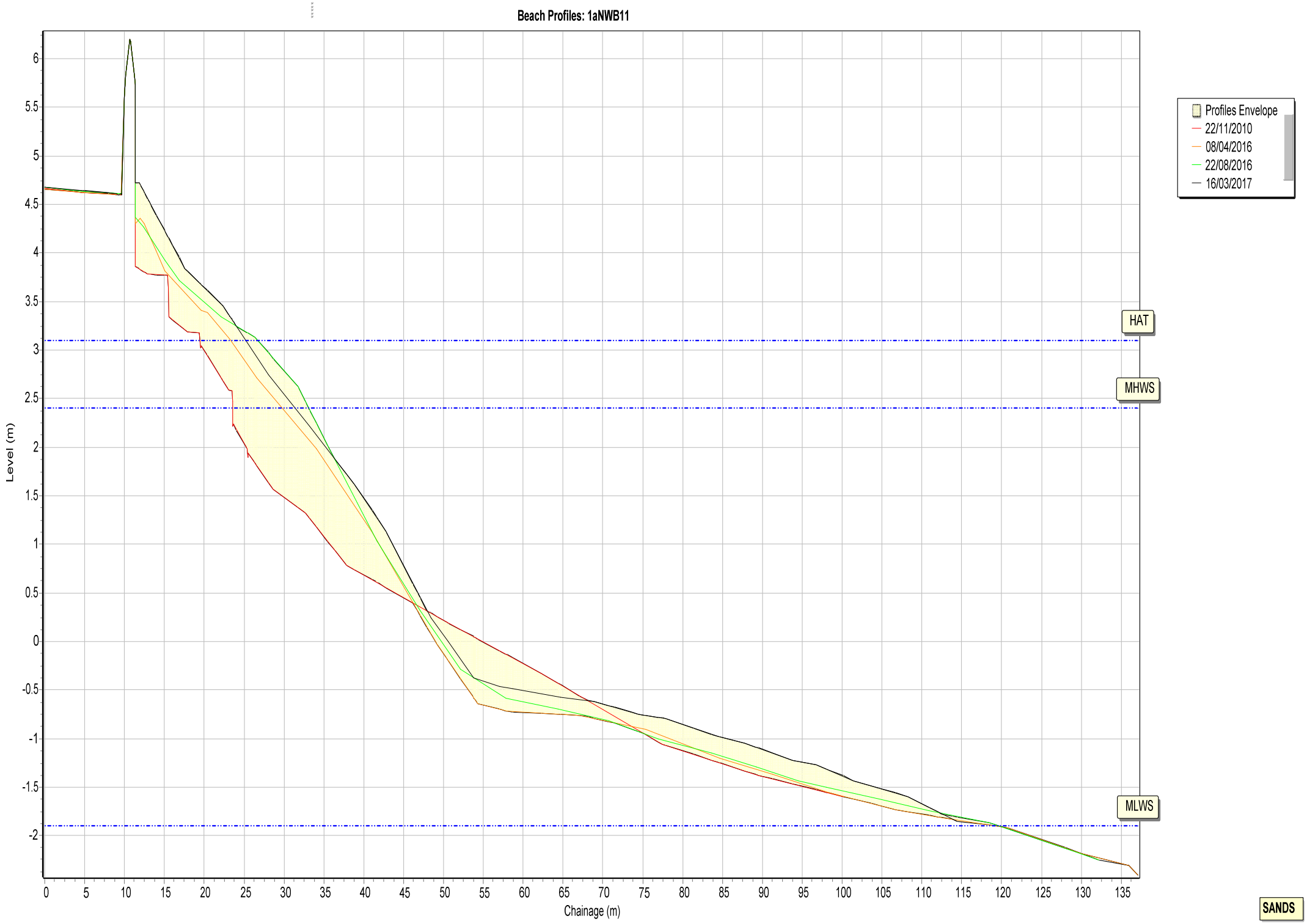
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16/03/2017
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MLWS
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Chainage (m)
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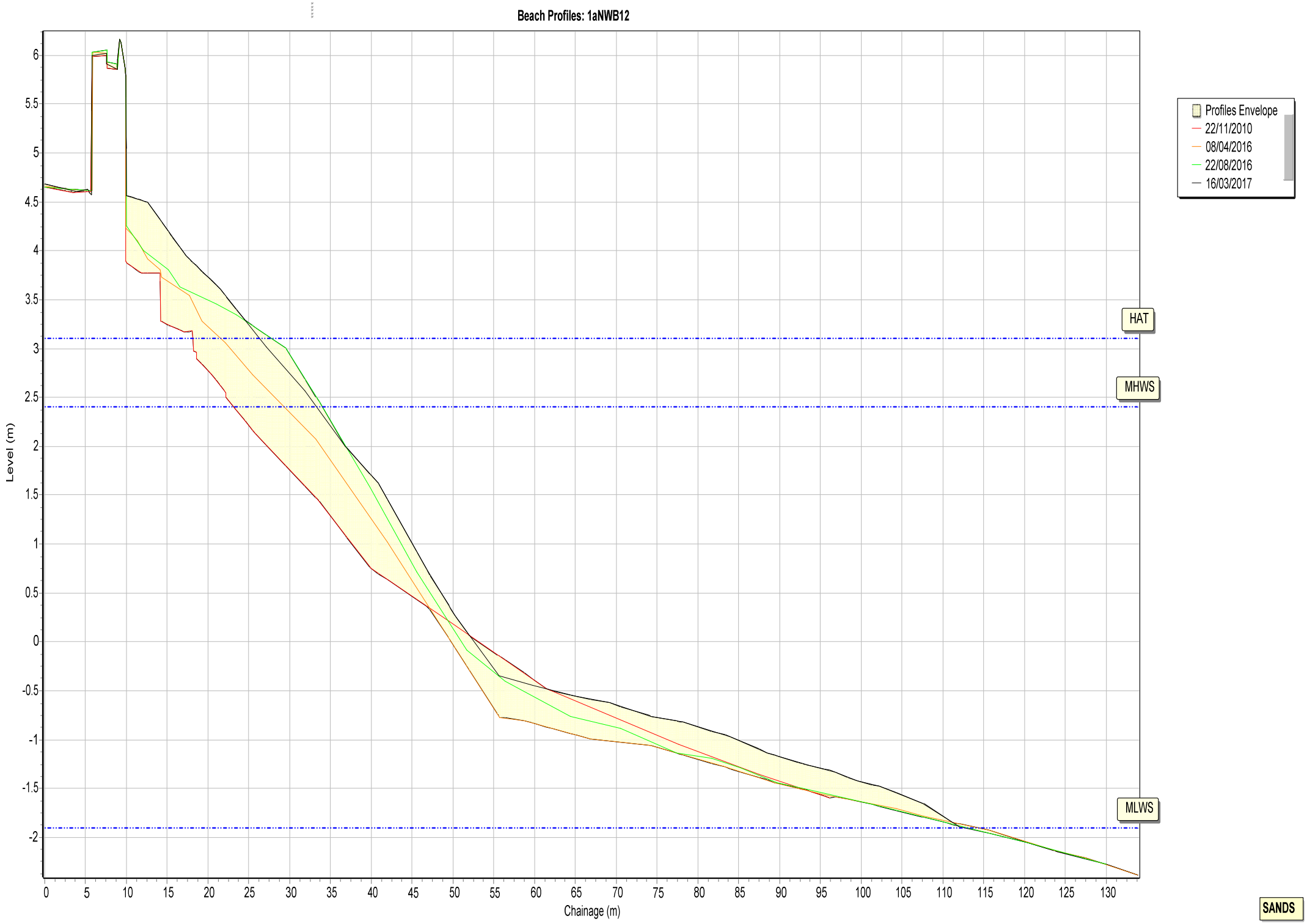
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16/03/2017
HAT
MHWS
MLWS
SANDS
Level (m)
Chainage (m)
6
5.5
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4.5
4
3.5
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2.5
2
1.5
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0.5
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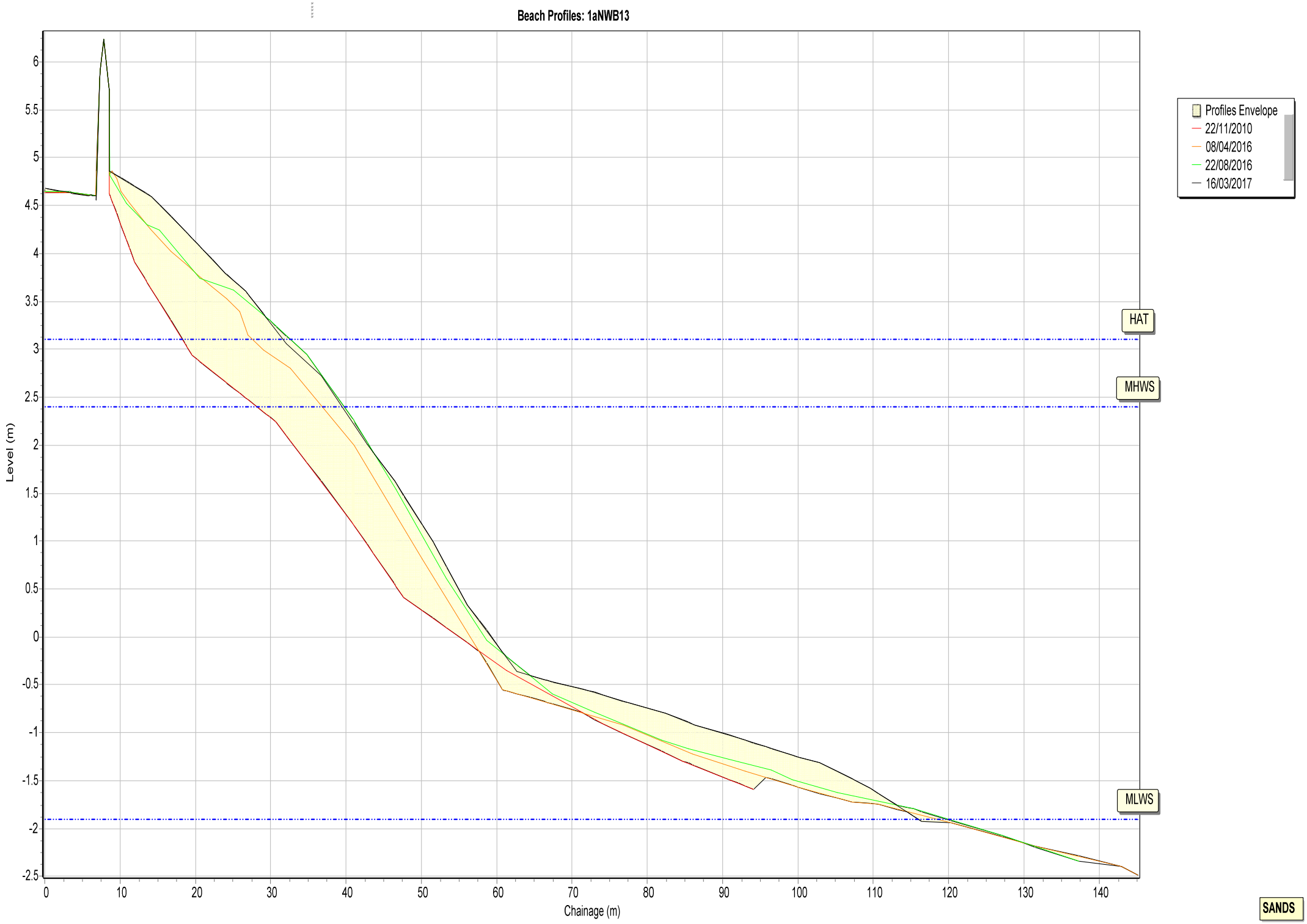
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HAT
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MLWS
SANDS
Level (m)
Chainage (m)
6
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5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
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-1
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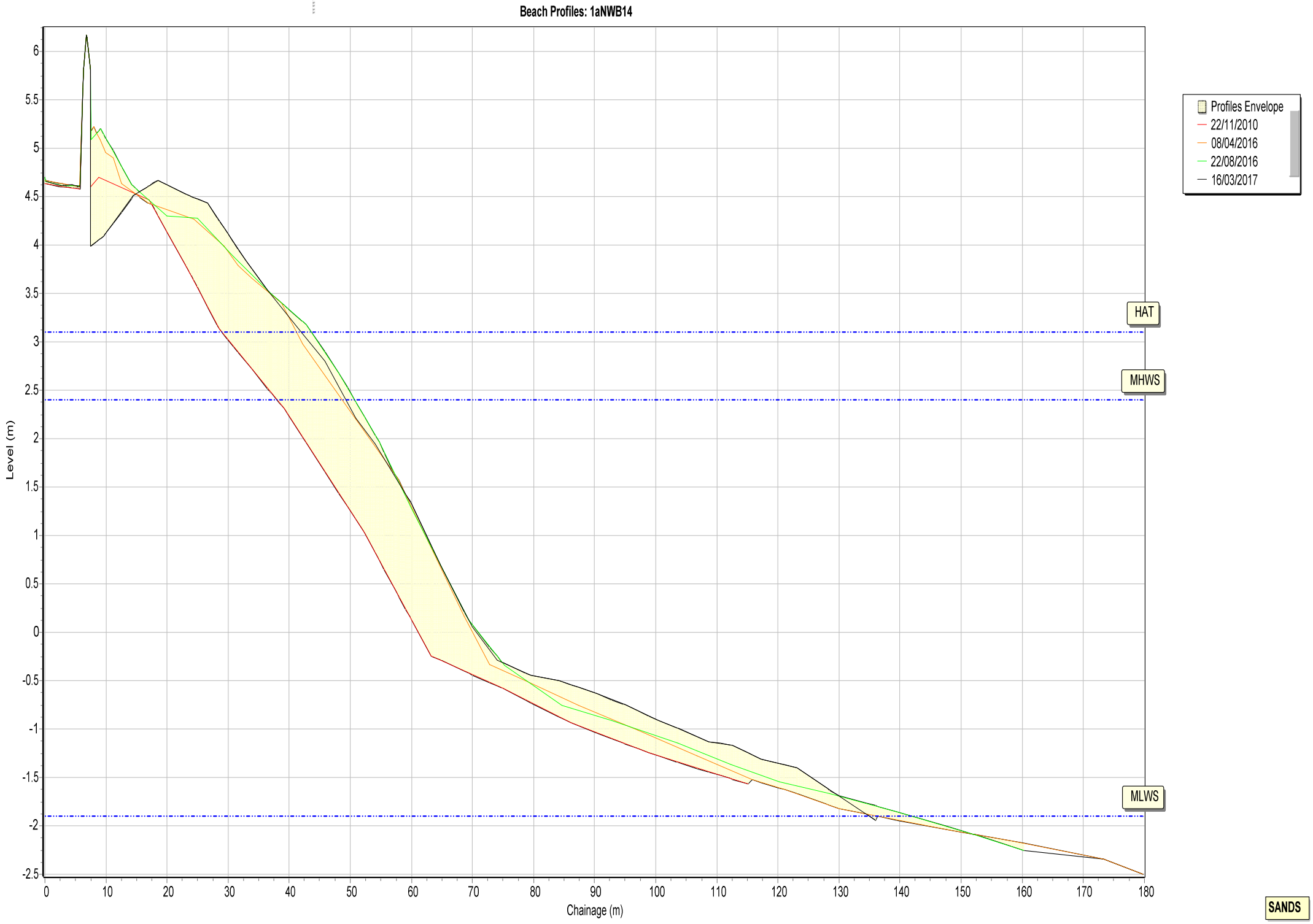
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Chainage (m)
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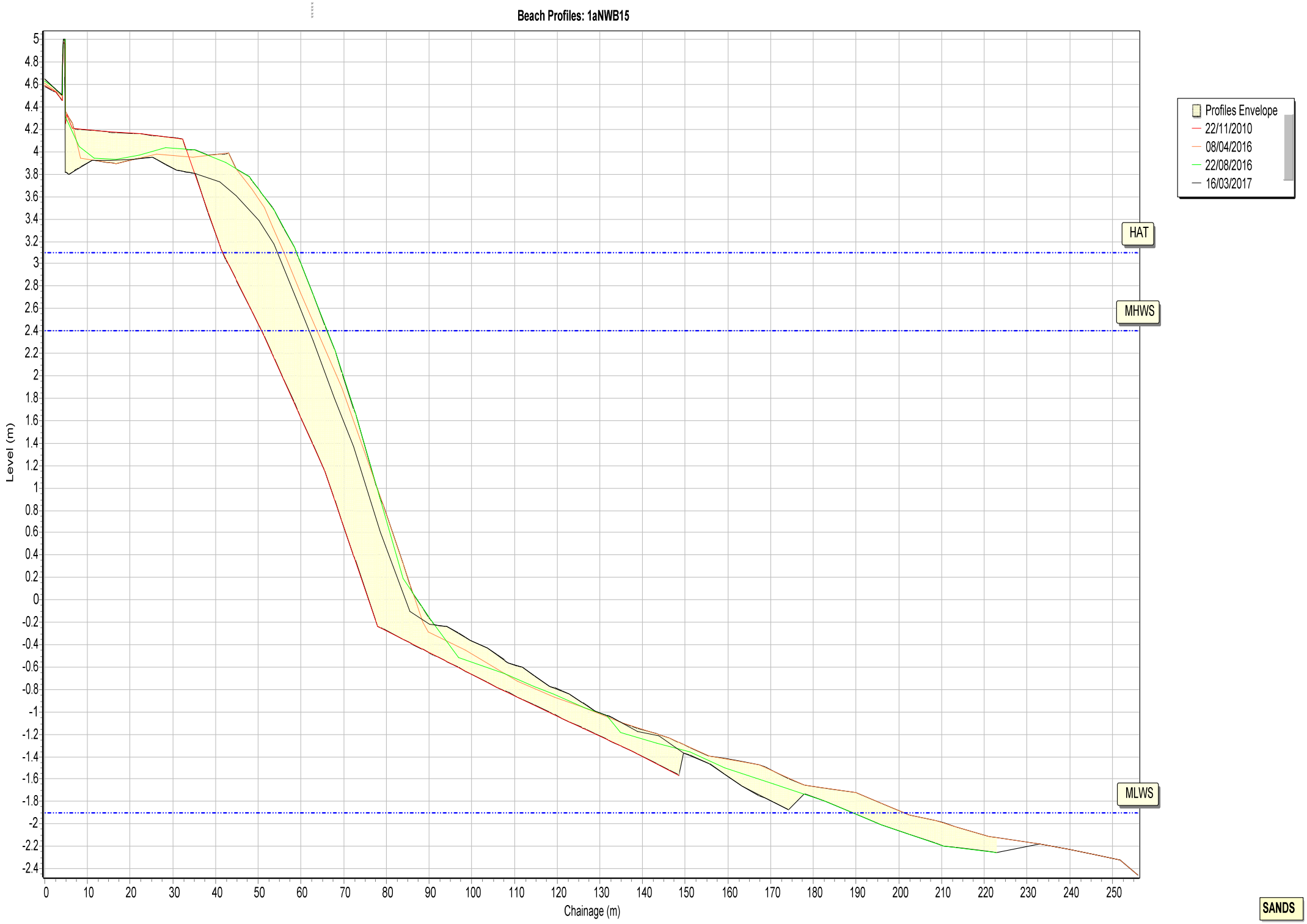
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Chainage (m)
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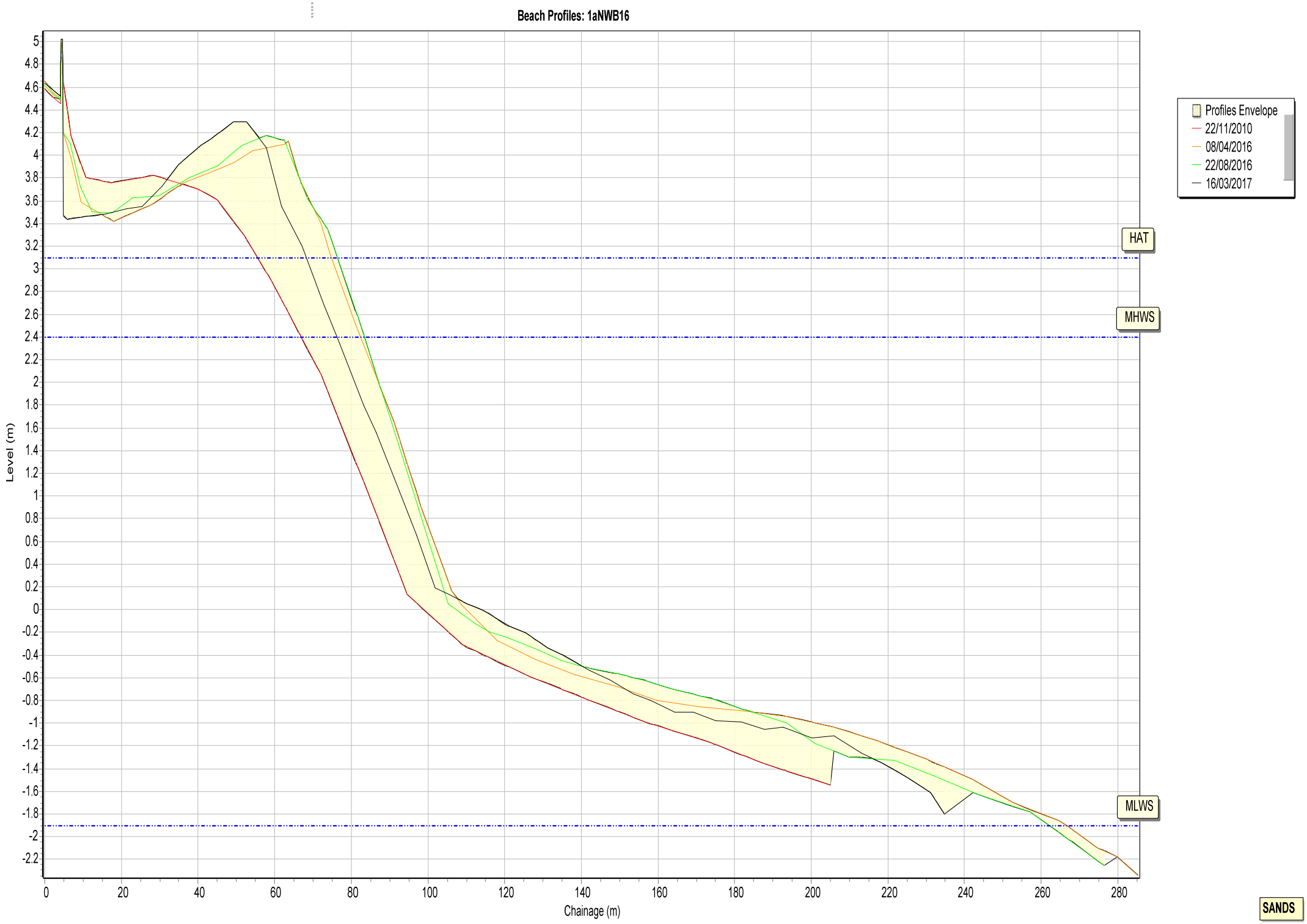
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MLWS
Level (m)
Chainage (m)
SANDS


Beach Profiles: 1aNWB17
Profiles Envelope
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16/03/2017
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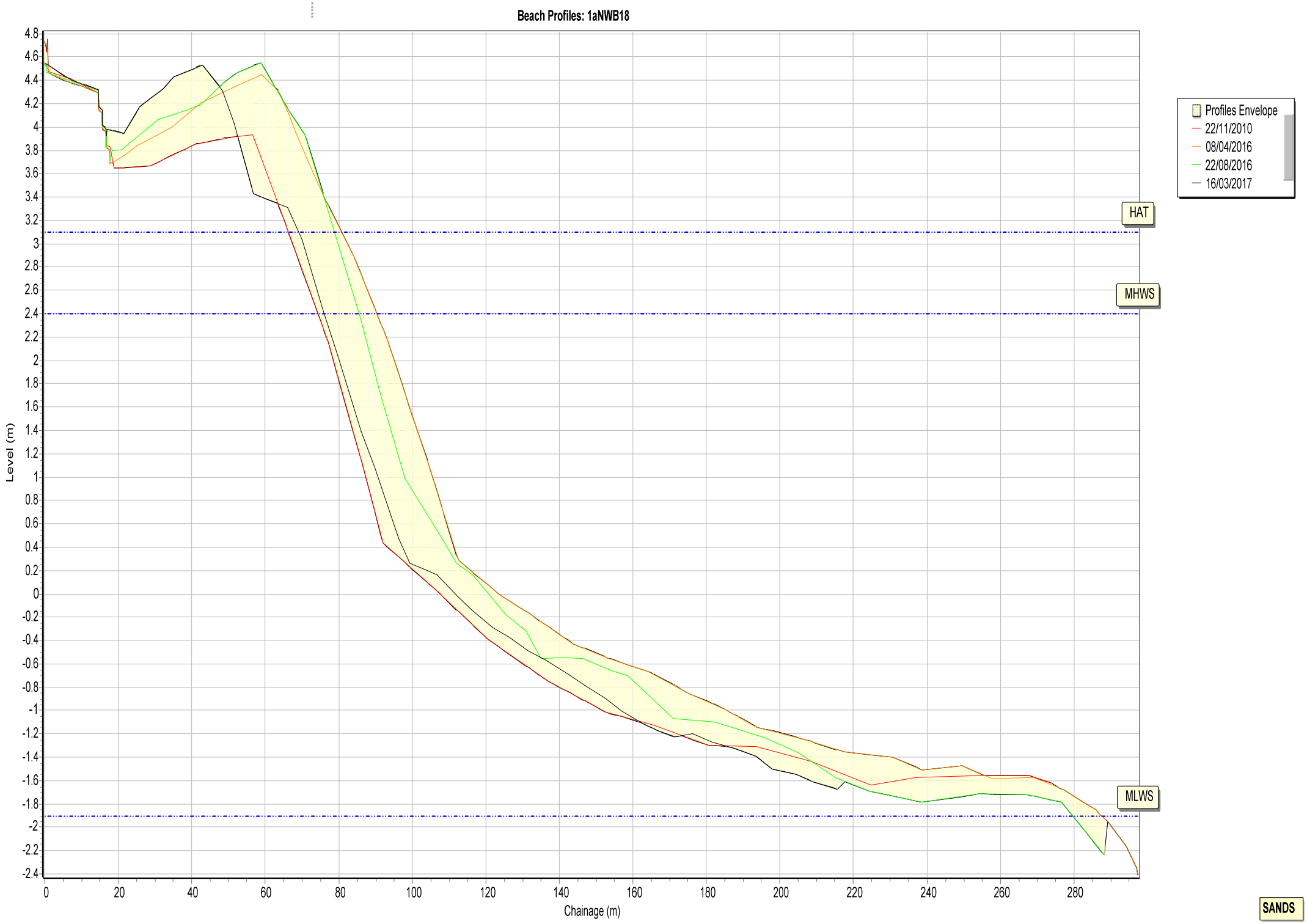
MLWS
Level (m)
Chainage (m)
SANDS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16/03/2017
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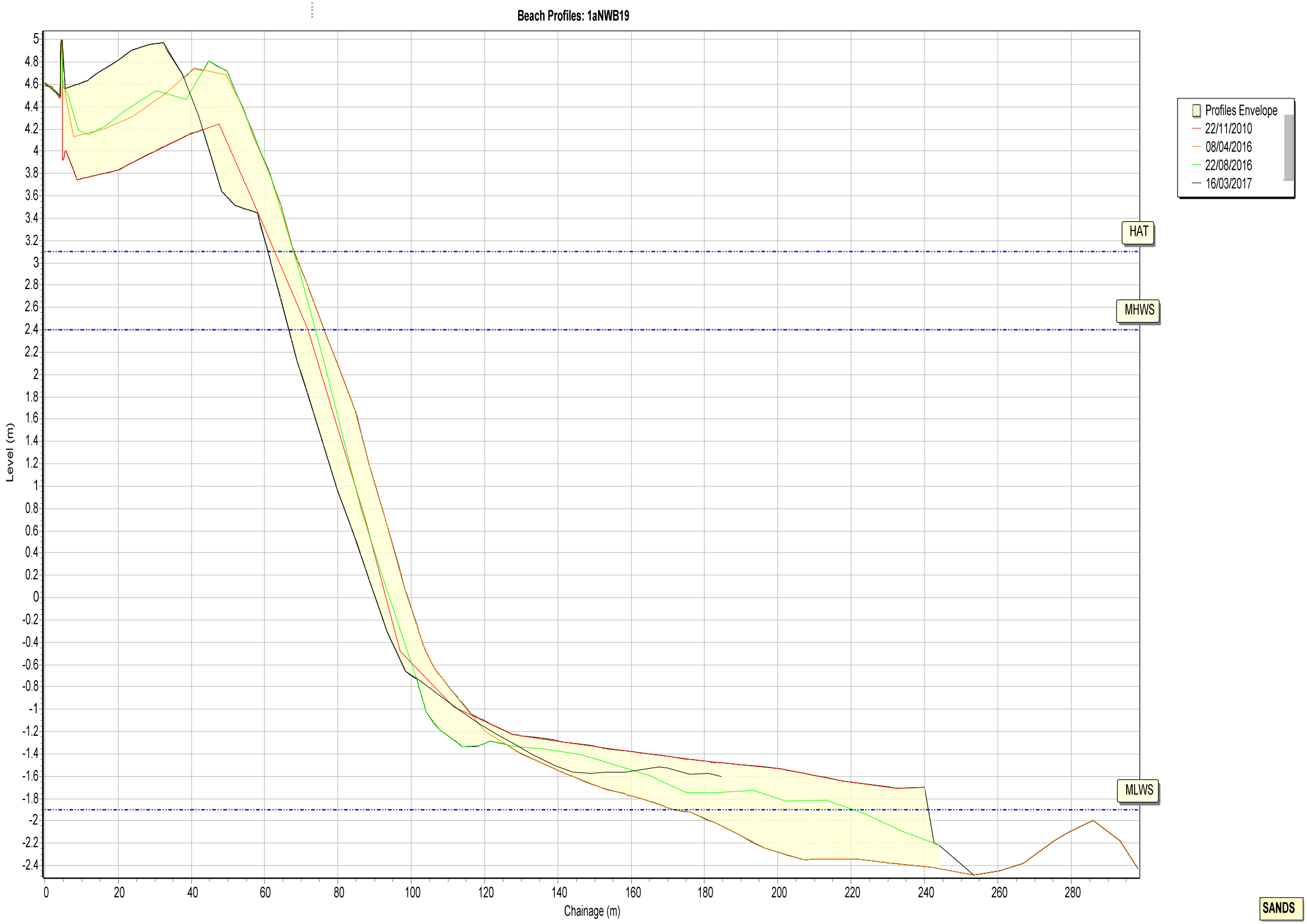
Level (m)
Chainage (m)
SANDS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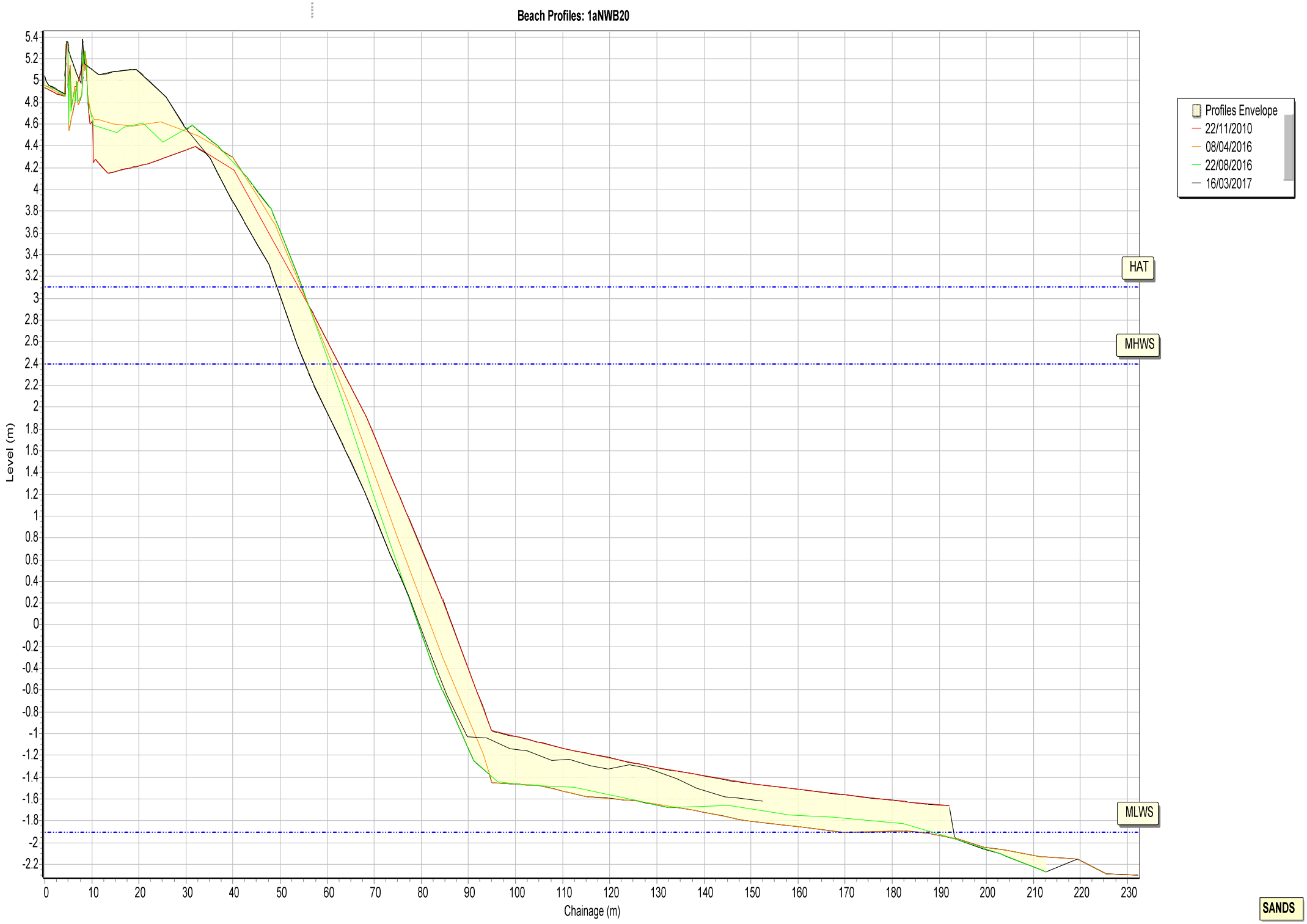
Level (m)
Chainage (m)
SANDS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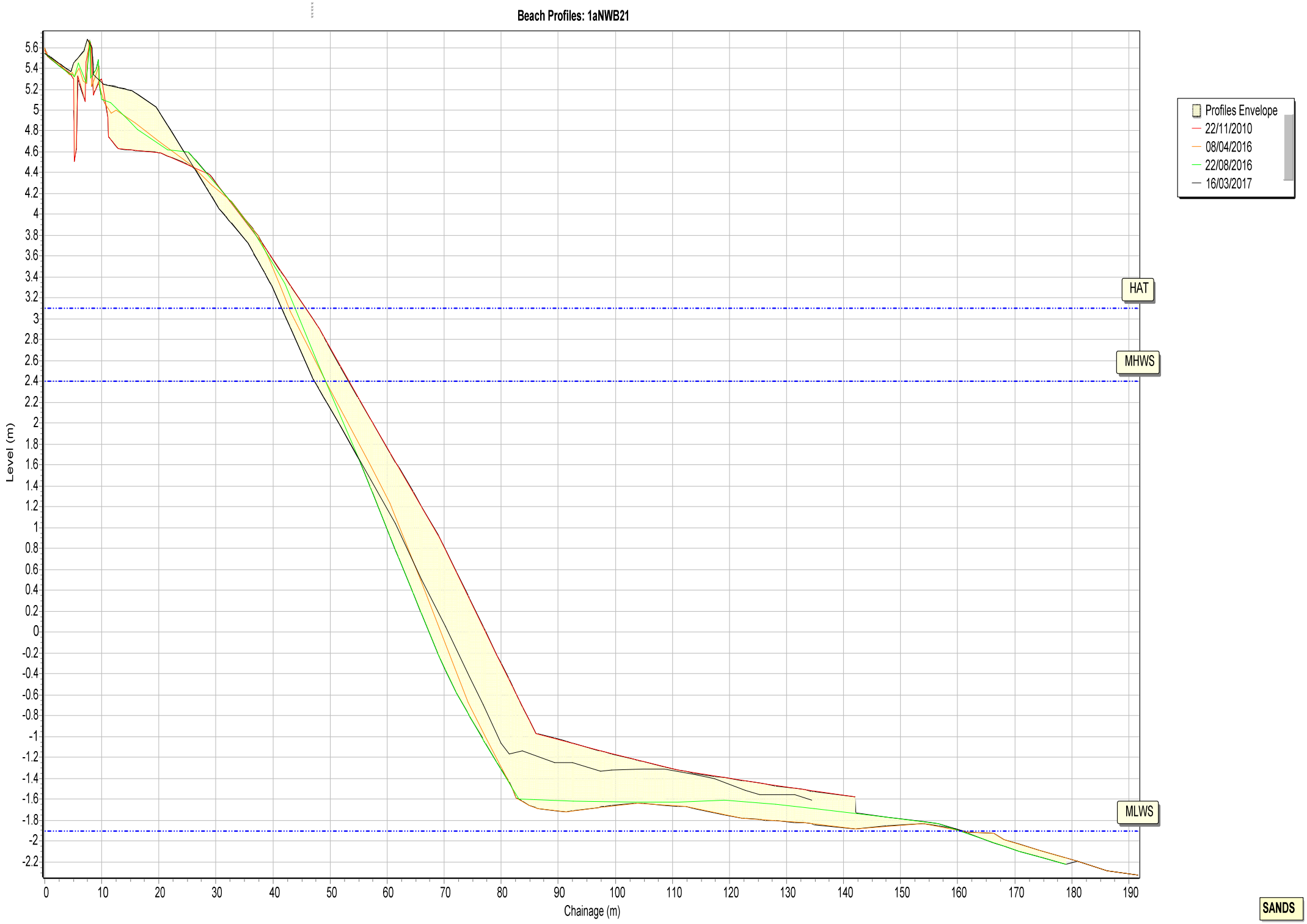
Chainage (m)
SANDS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16/03/2017
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Chainage (m)
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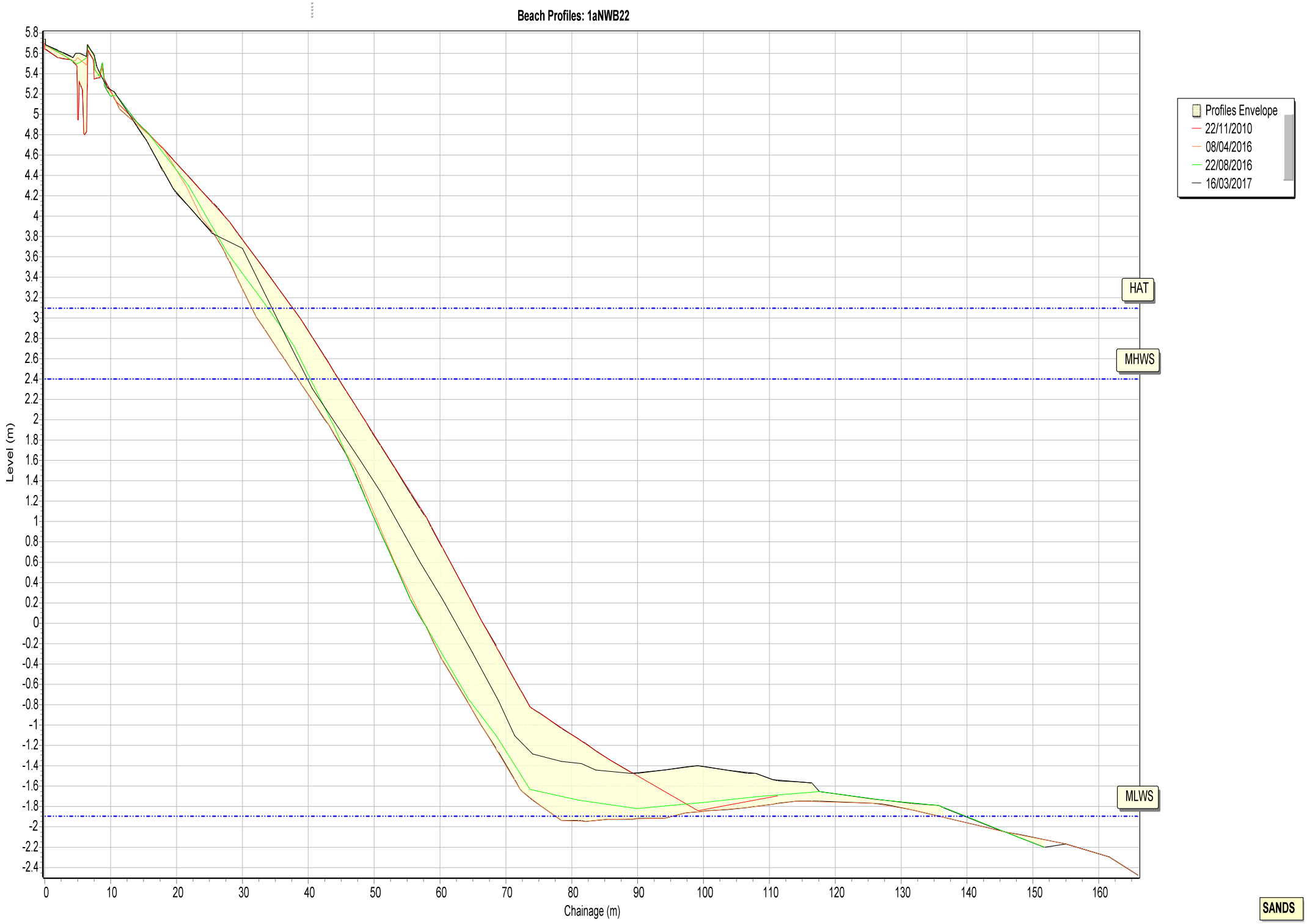
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Chainage (m)
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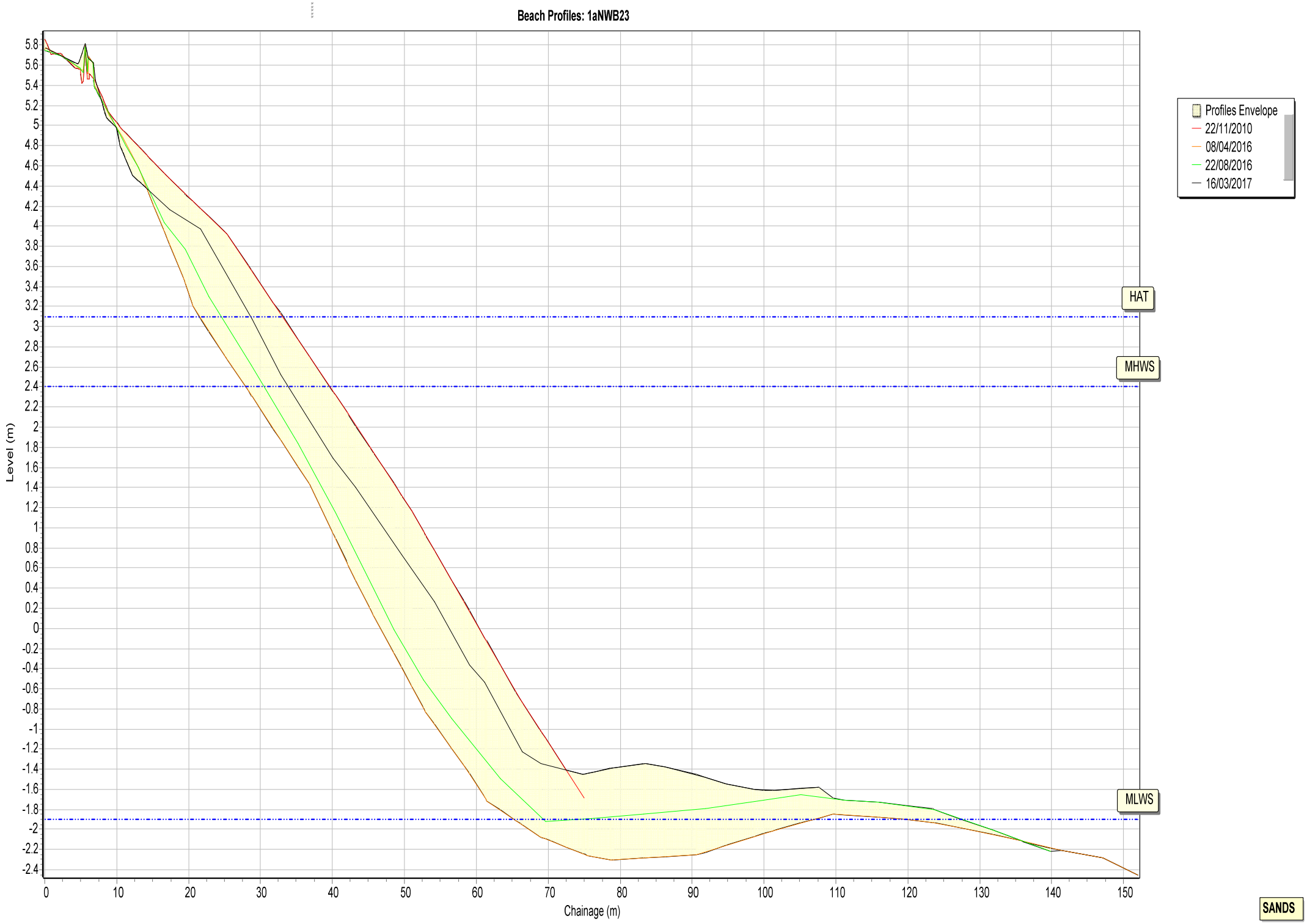
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16/03/2017
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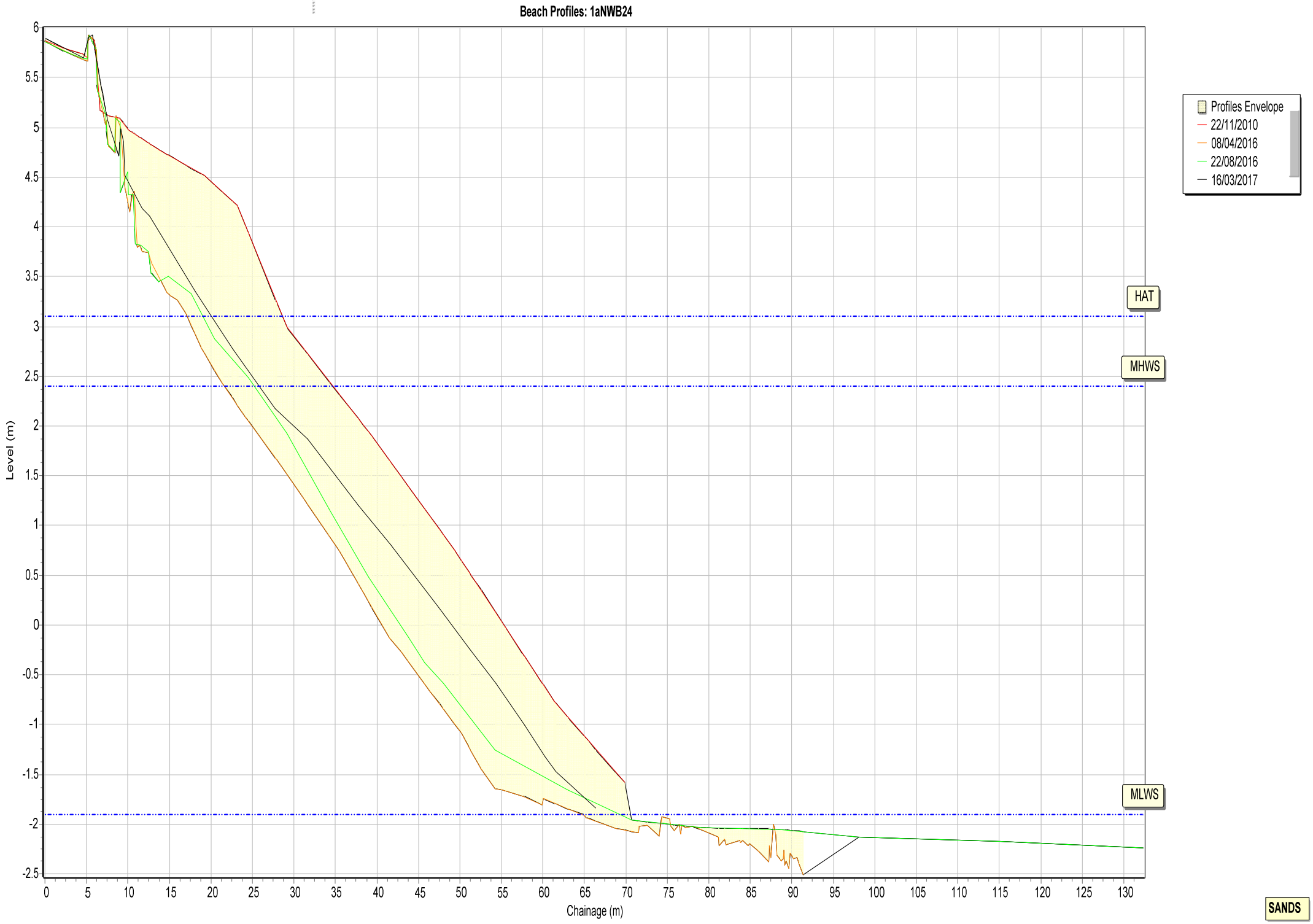
Level (m)
Chainage (m)
SANDS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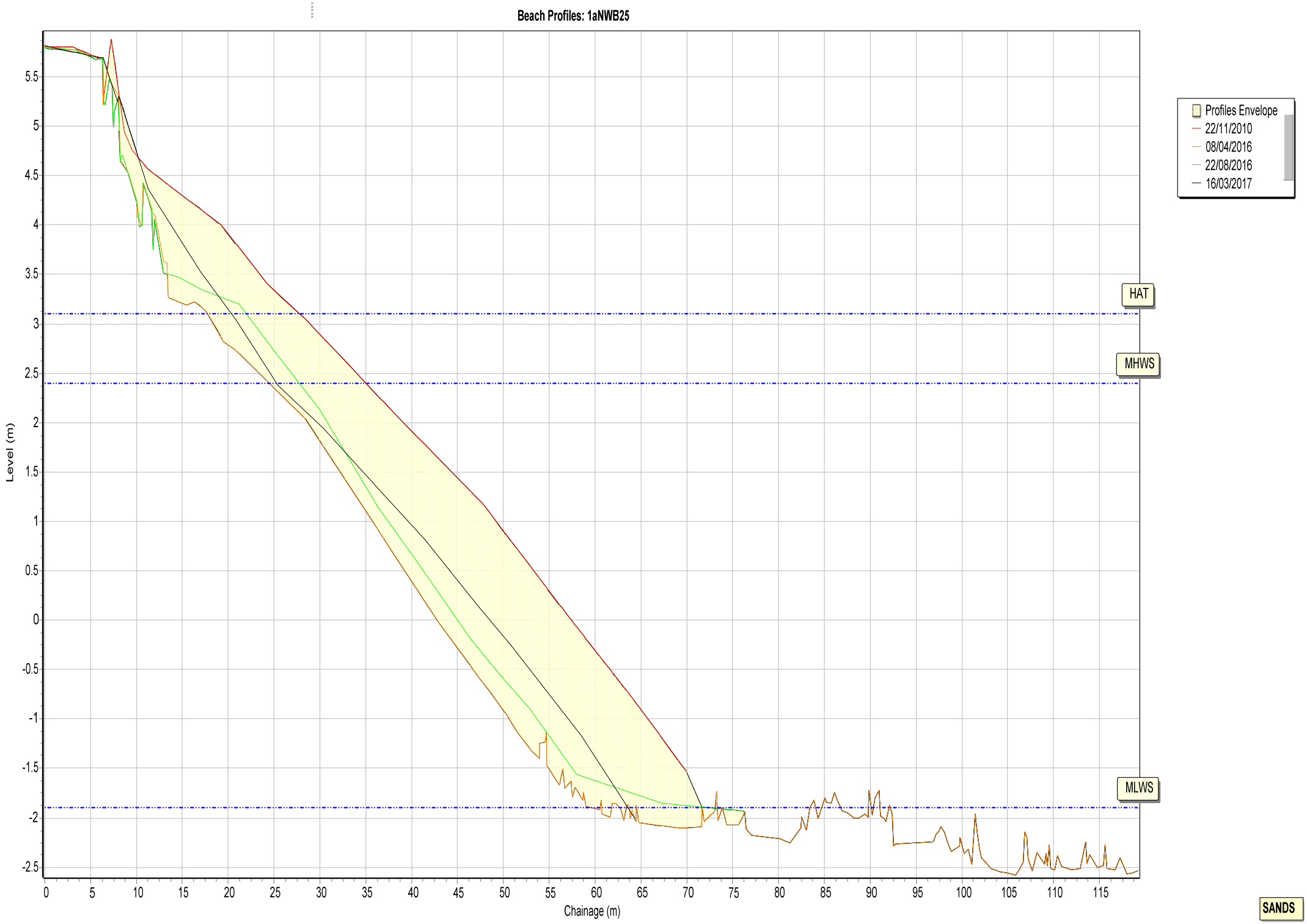
Chainage (m)
SANDS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22/08/2016
16/03/2017
HAT
MHWS
MLWS
Level (m)
Chainage (m)
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
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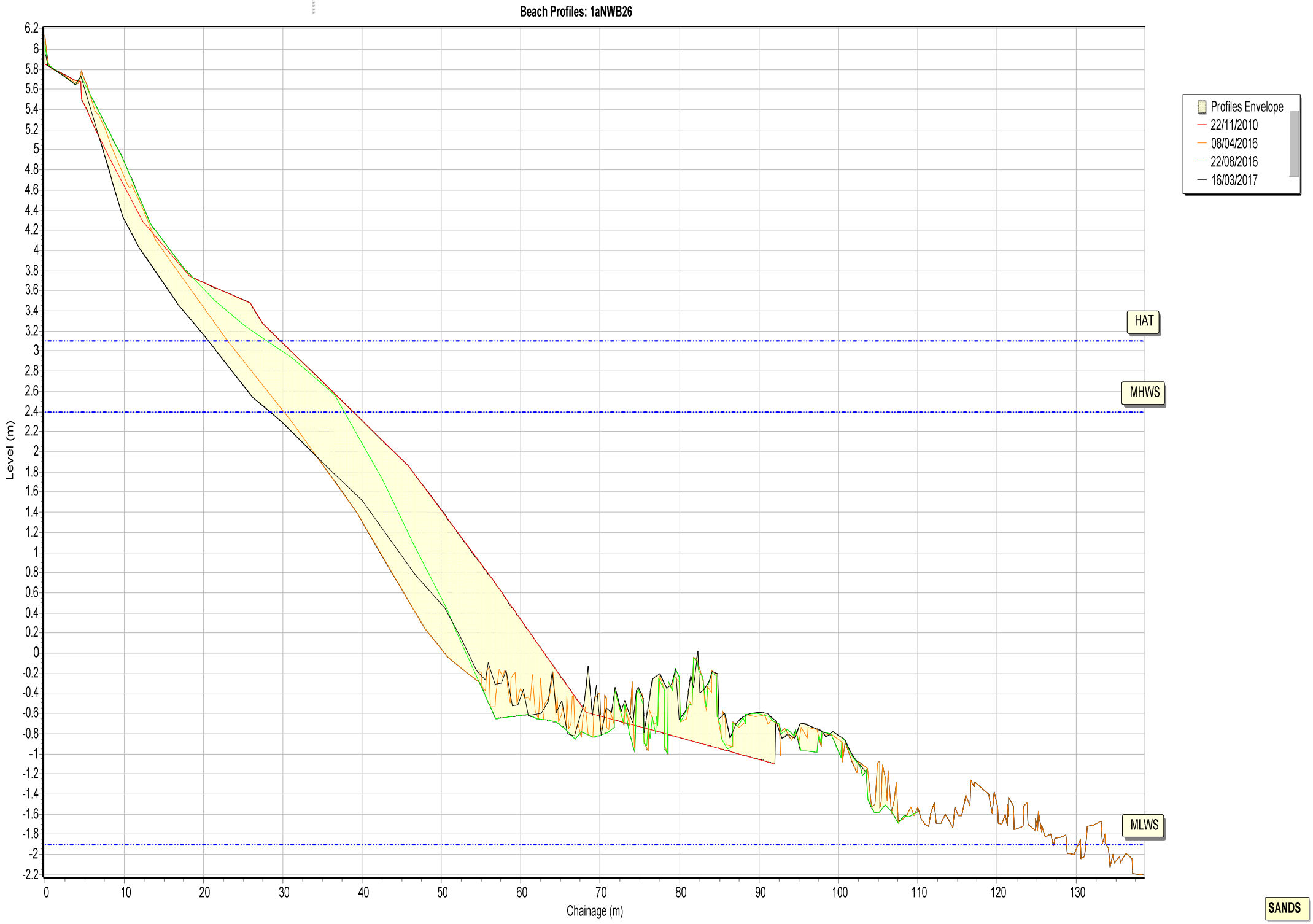
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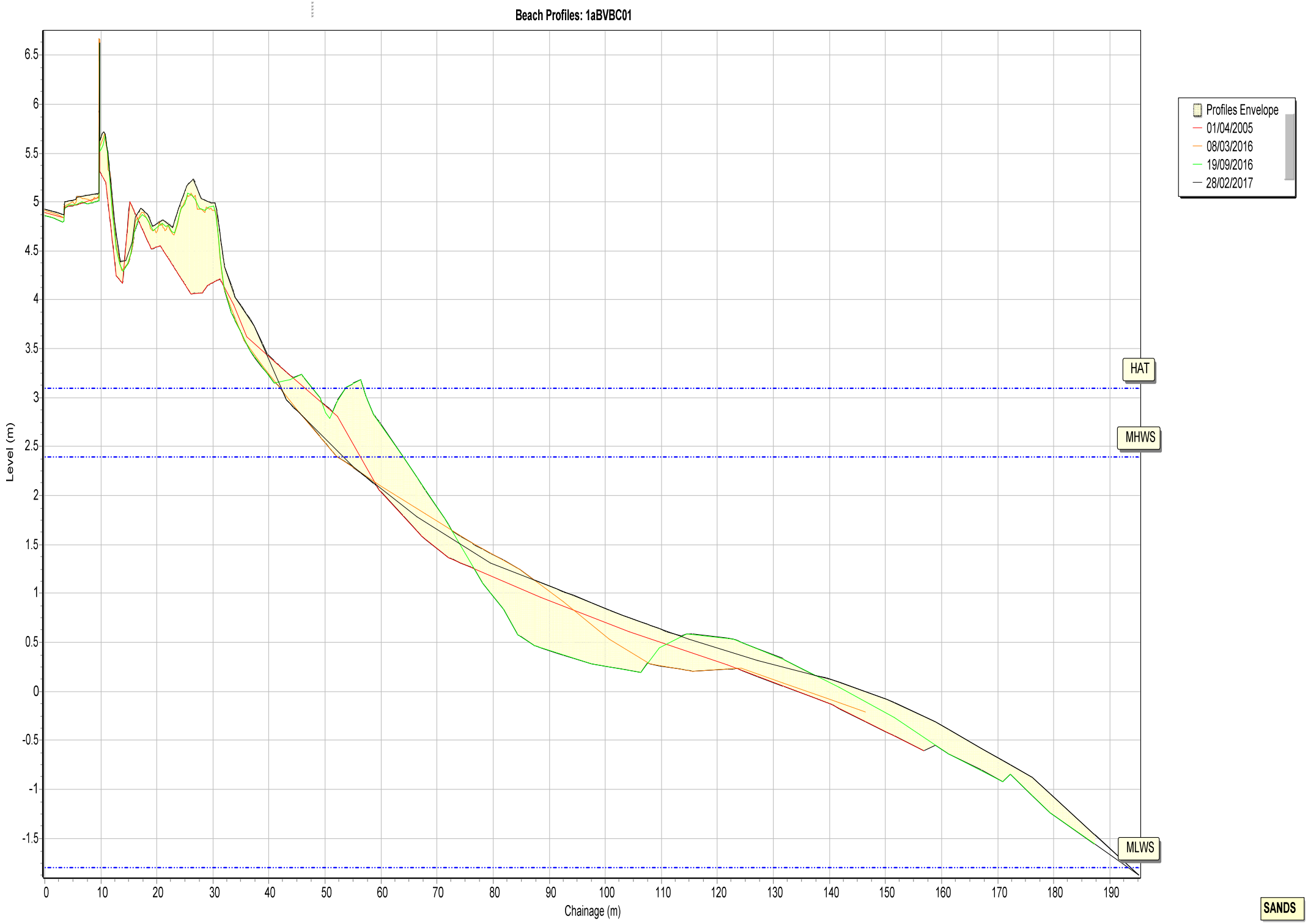
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Chainage (m)
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6
5.5
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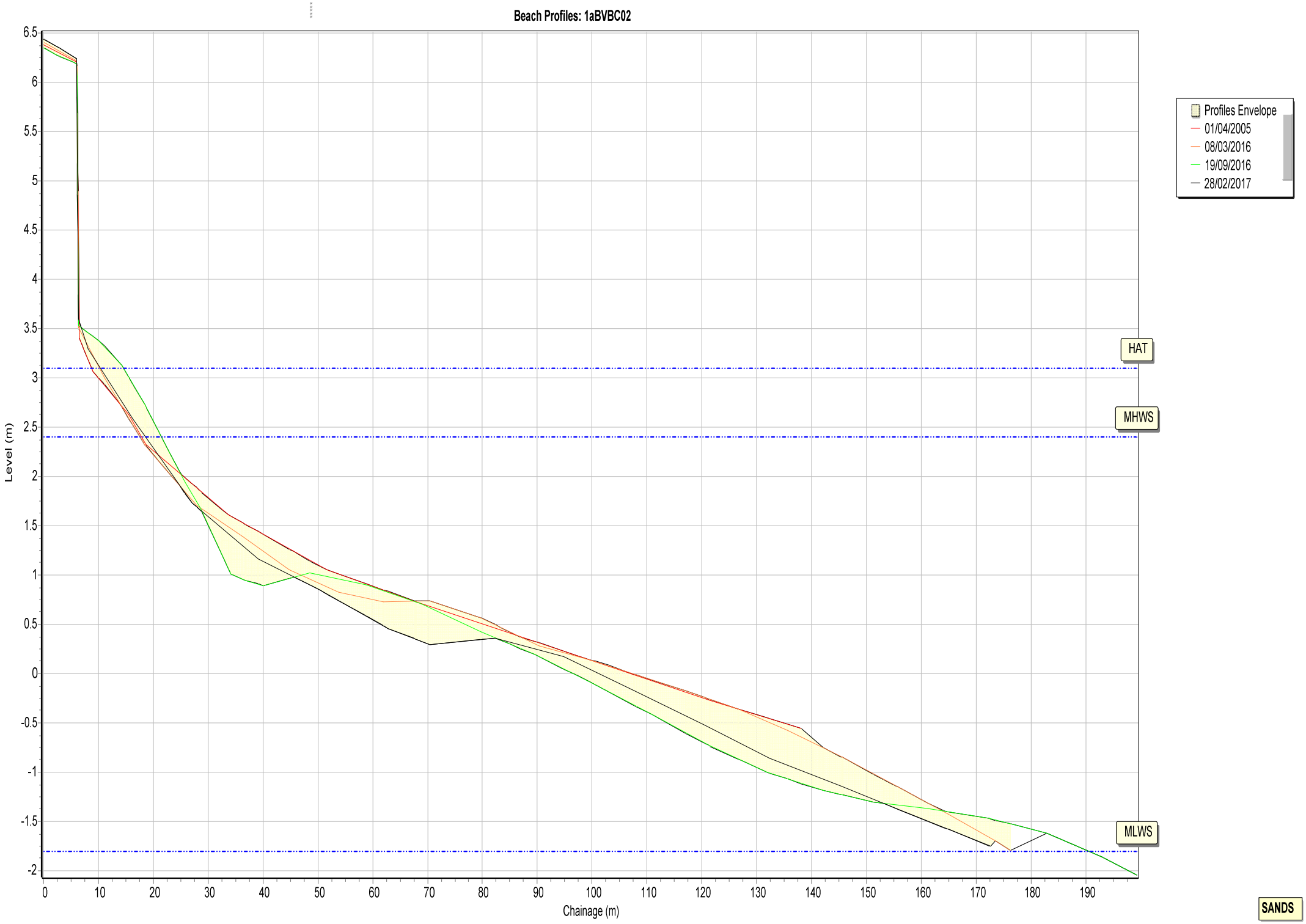
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4.5
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3.5
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2.5
2
1.5
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-1
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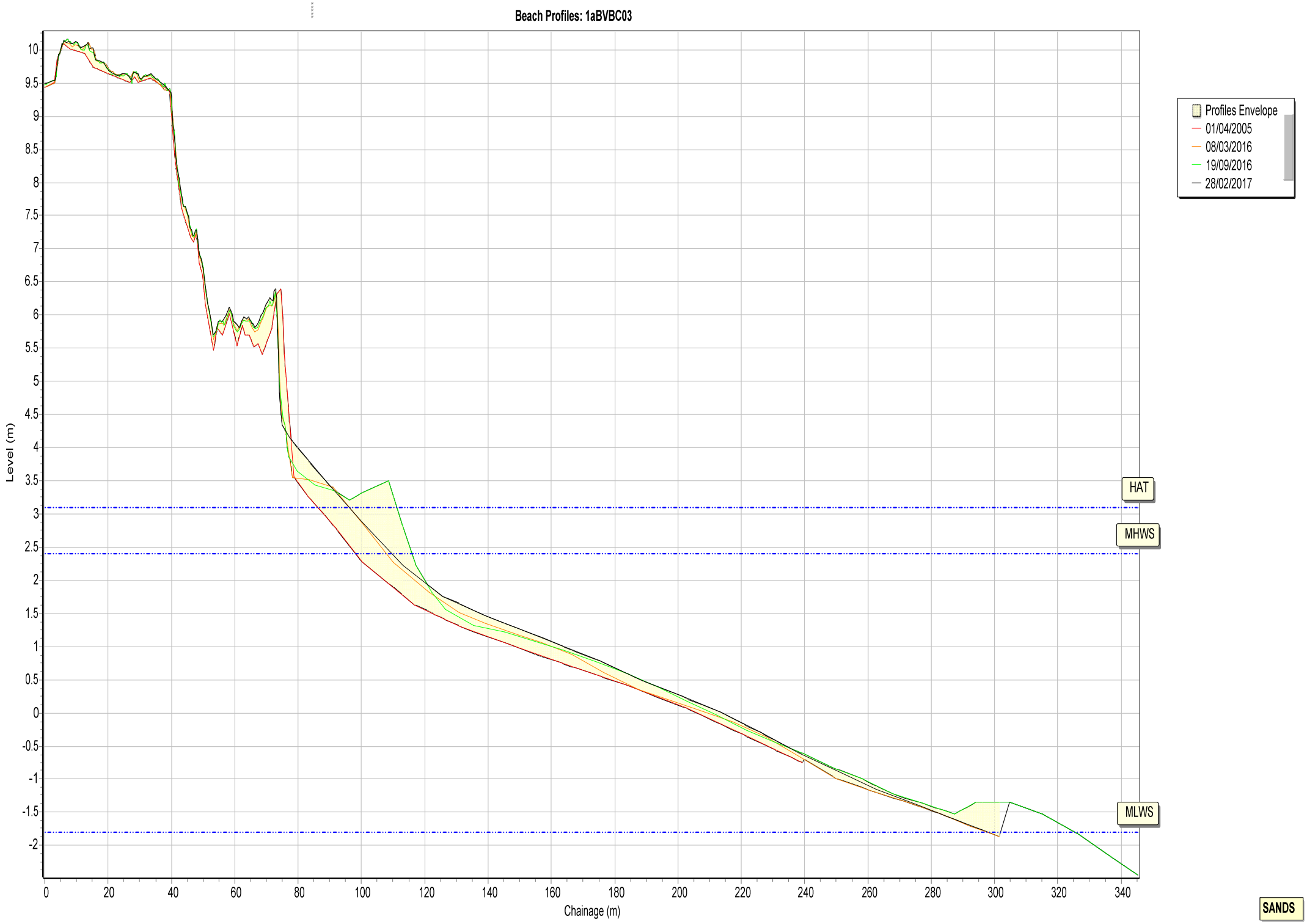
SANDS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MLWS
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Chainage (m)
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9
8.5
8
7.5
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6.5
6
5.5
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4.5
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3.5
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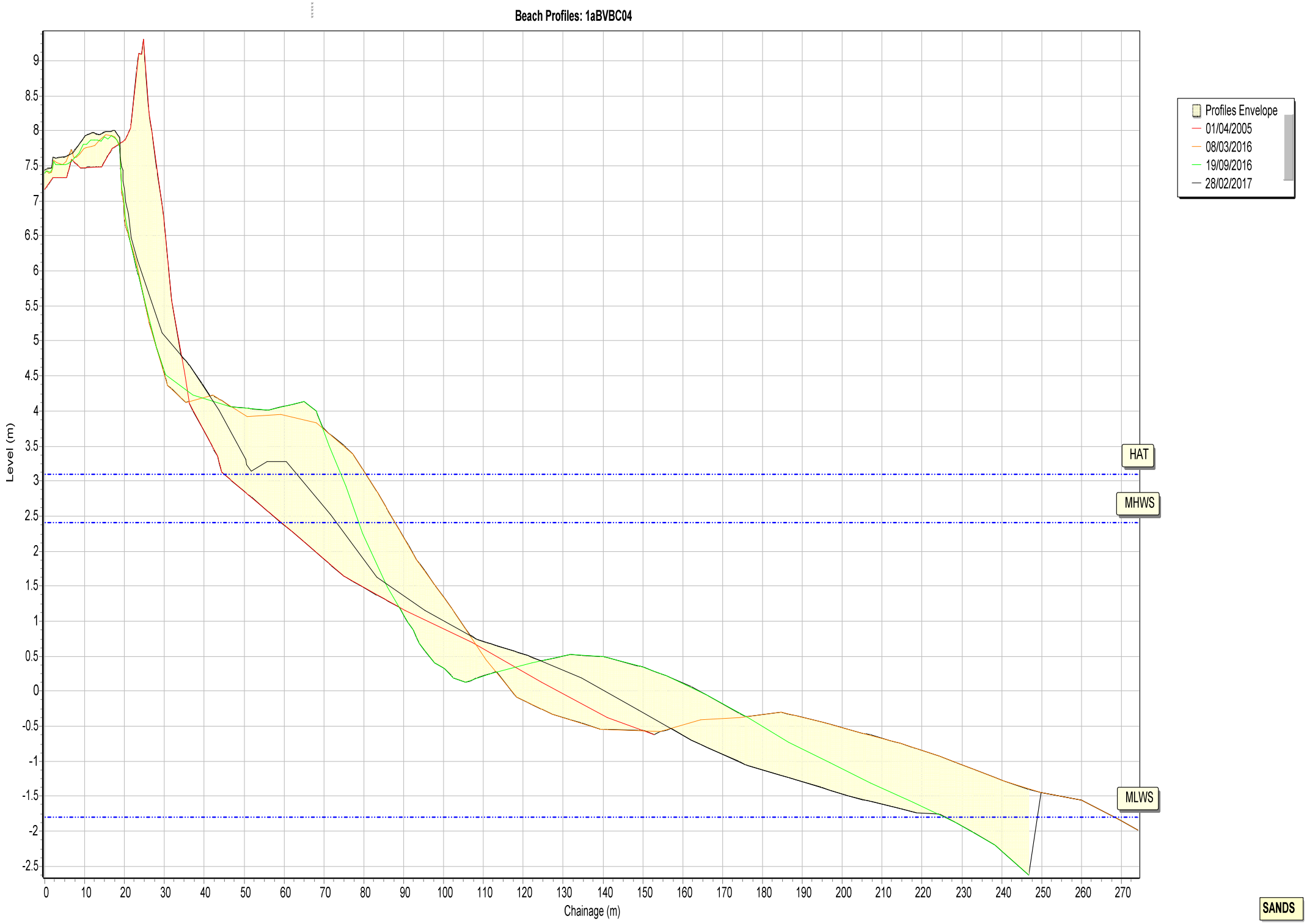
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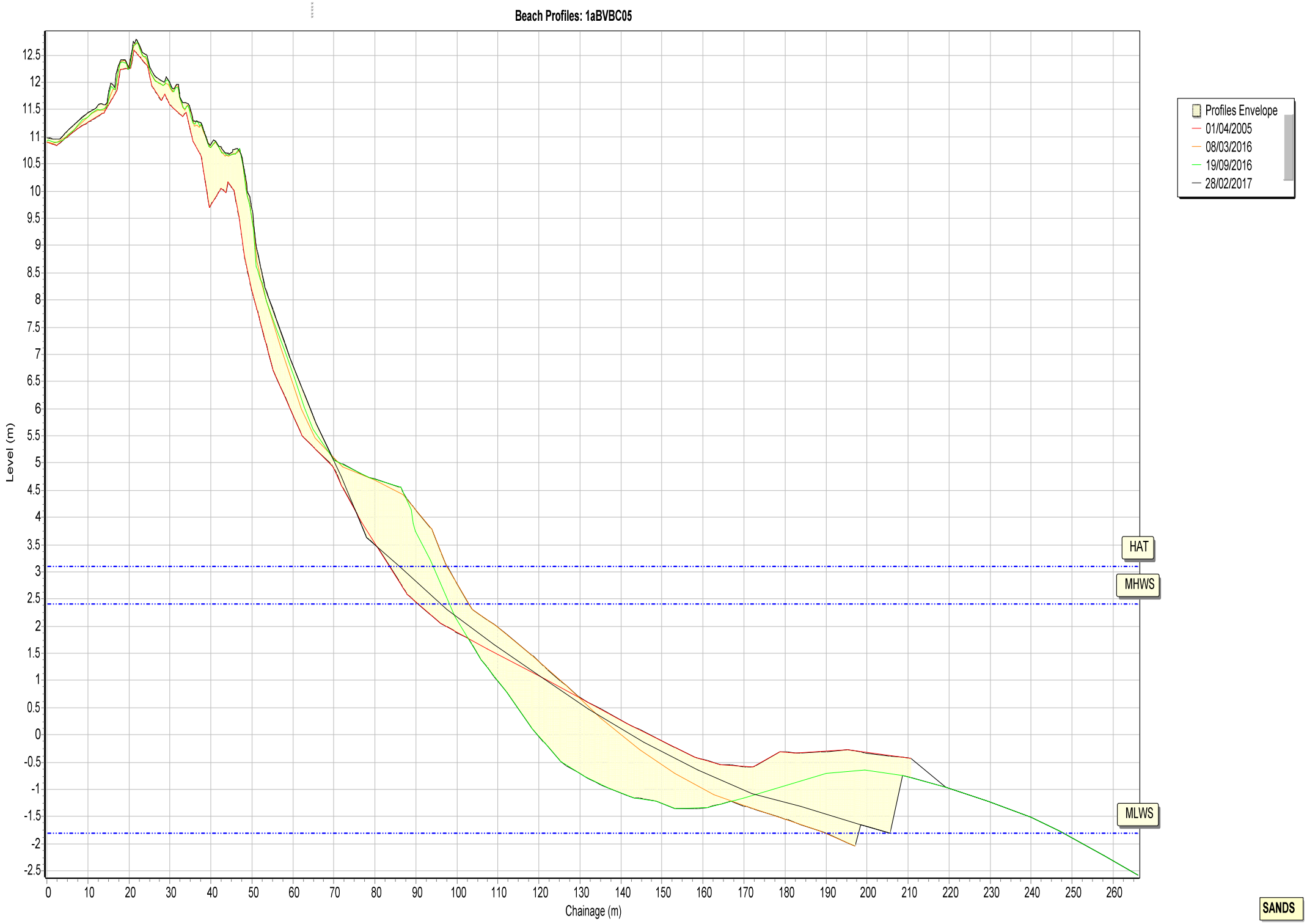
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Chainage (m)
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12
11.5
11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
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4.5
4
3.5
3
2.5
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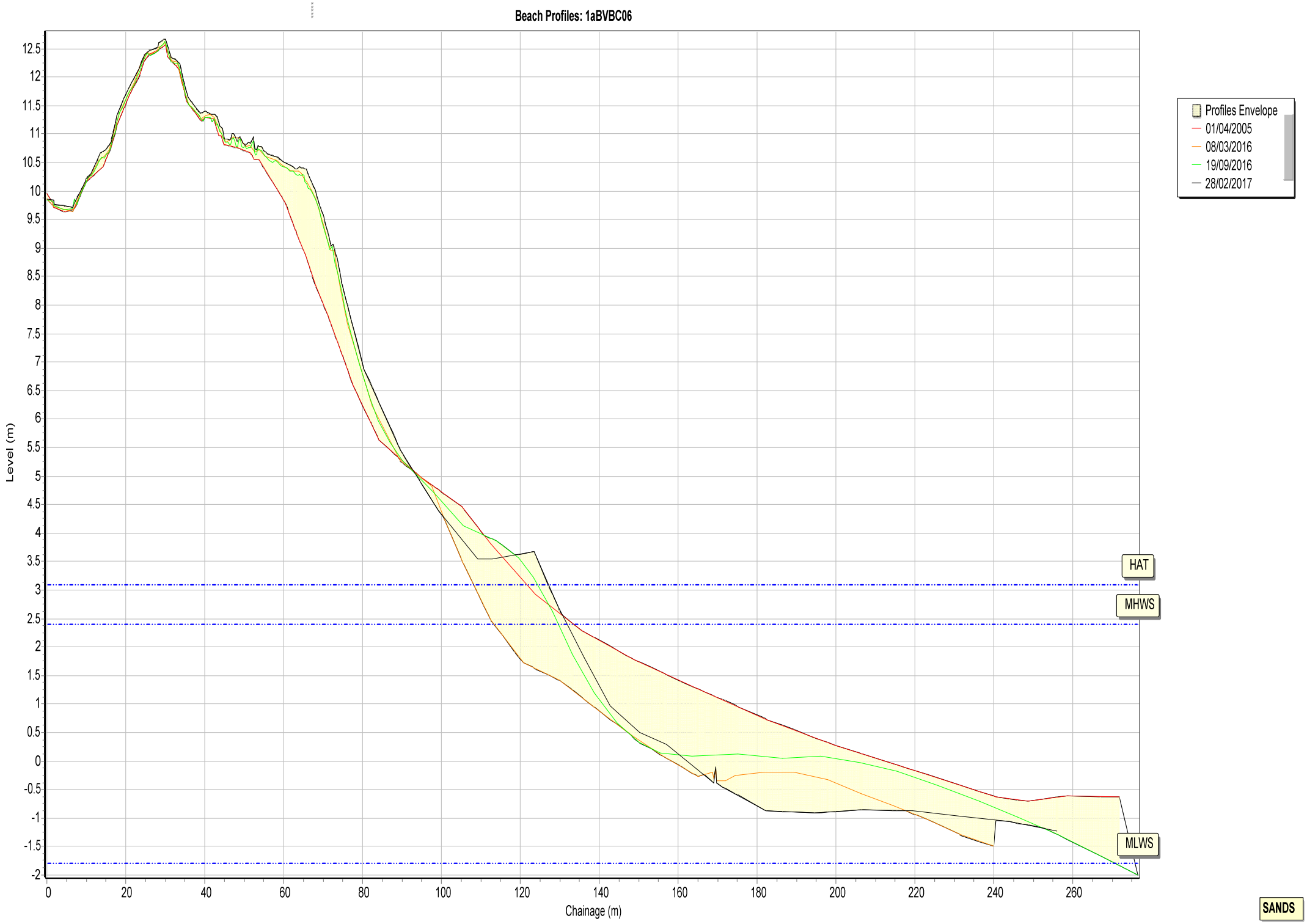
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Chainage (m)
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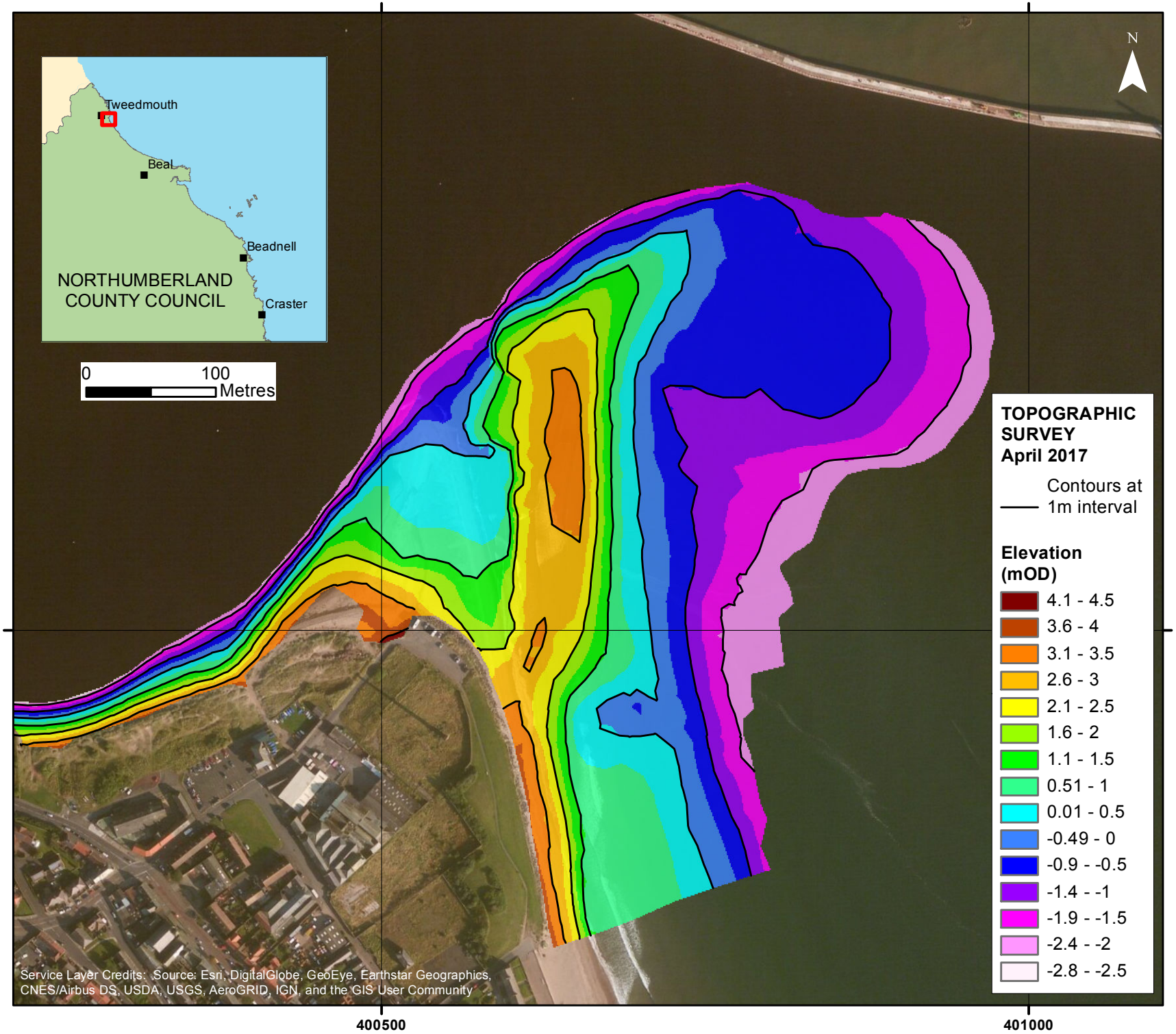
260

Appendix B

Topographic Survey



Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 1

BERWICK

Northumberland County Council Frontage

Update Report
'Partial Measures' Survey 2017

Drawing Scale at A4 1:4,000

WATER
Royal HaskoningDHV
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Fax: +44 (0)191 211 1313
www.royalhaskoningdhv.com

Royal HaskoningDHV
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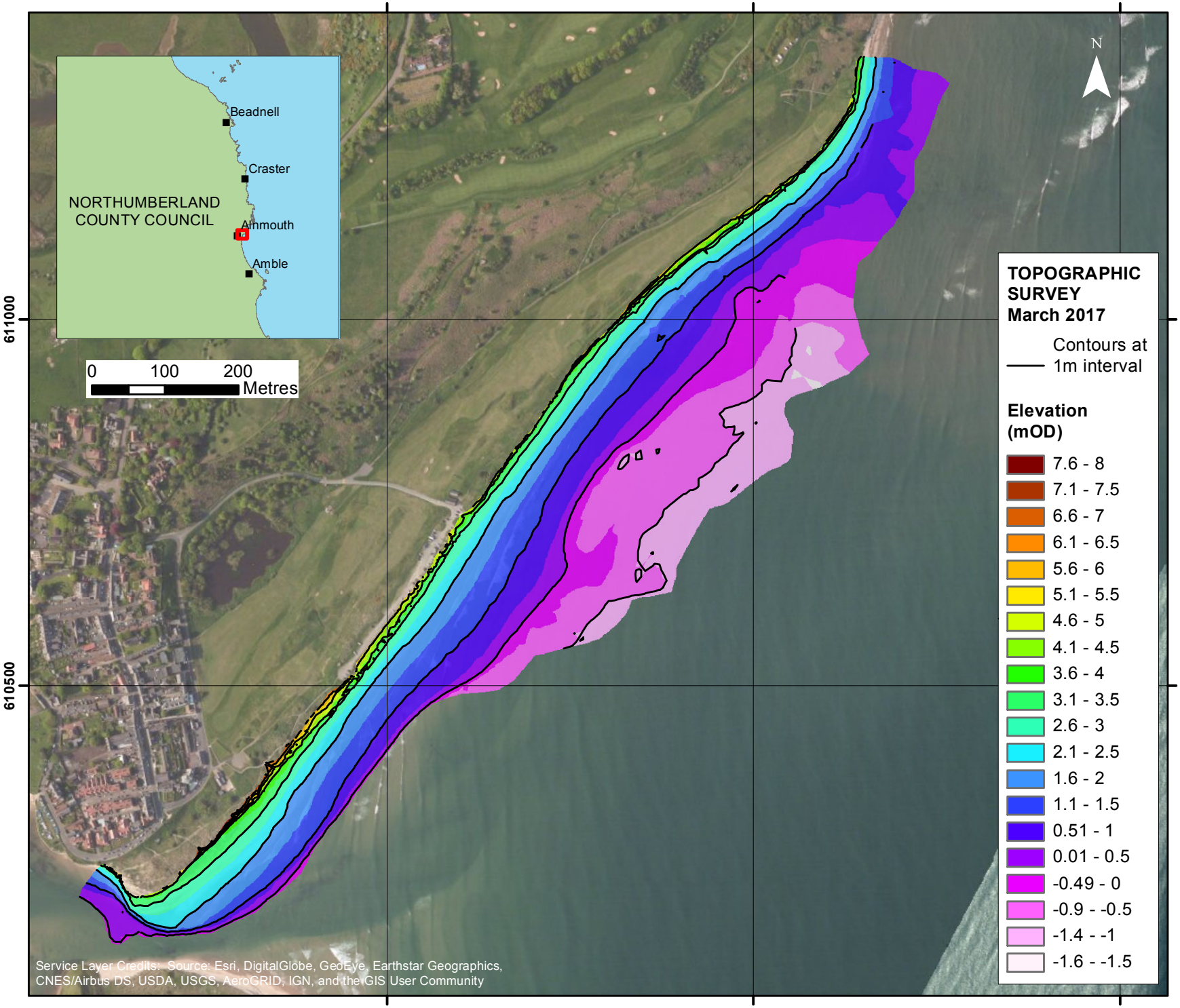

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 2

ALNMOUTH

Northumberland County Council Frontage

Update Report
'Partial Measures' Survey 2017

Drawing Scale at A4 1:7,000

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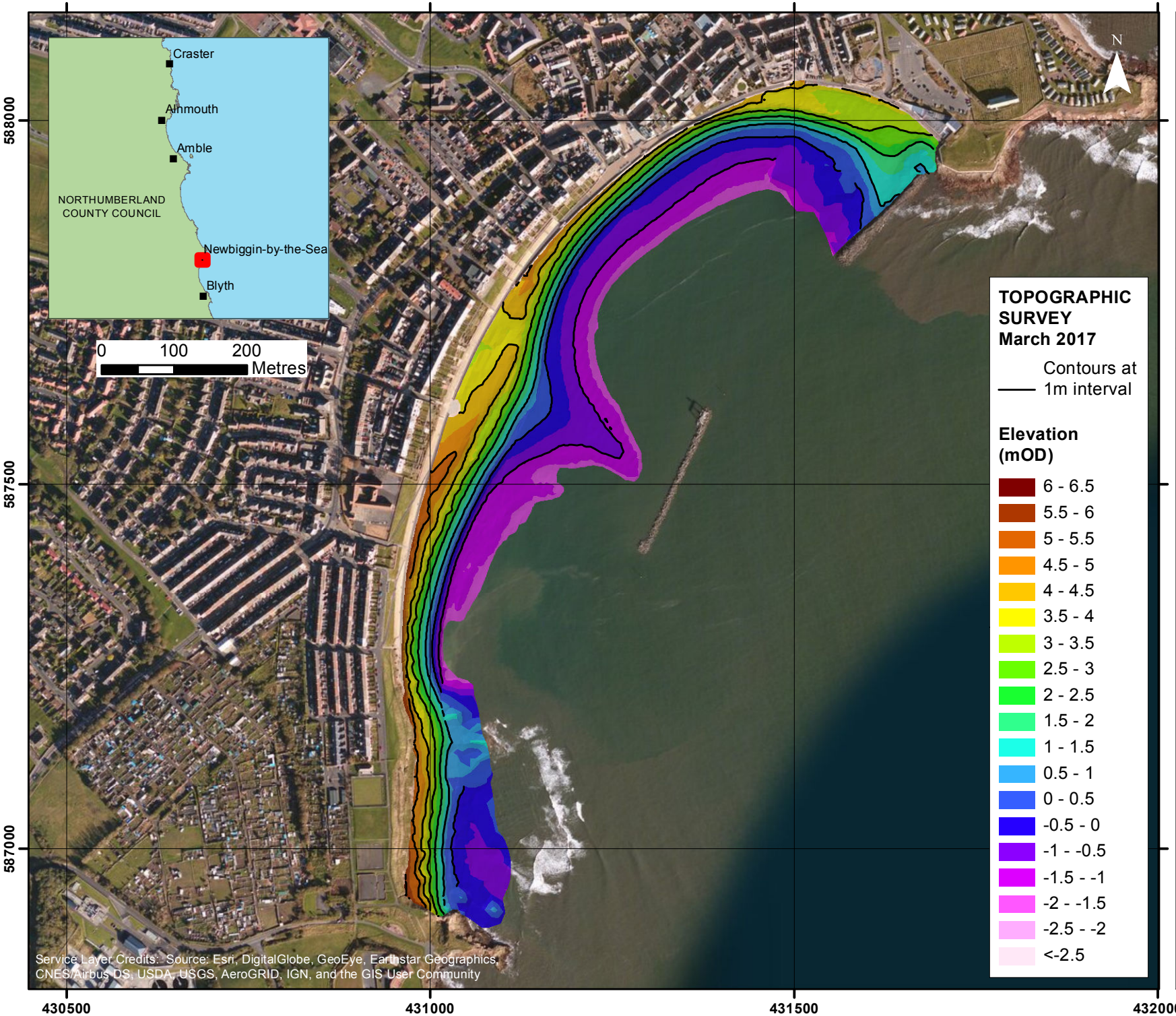

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 3

NEWBIGGIN-BY-THE-SEA

Northumberland County Council Frontage

Update Report
'Partial Measures' Survey 2017

Drawing Scale at A4 1:7,000

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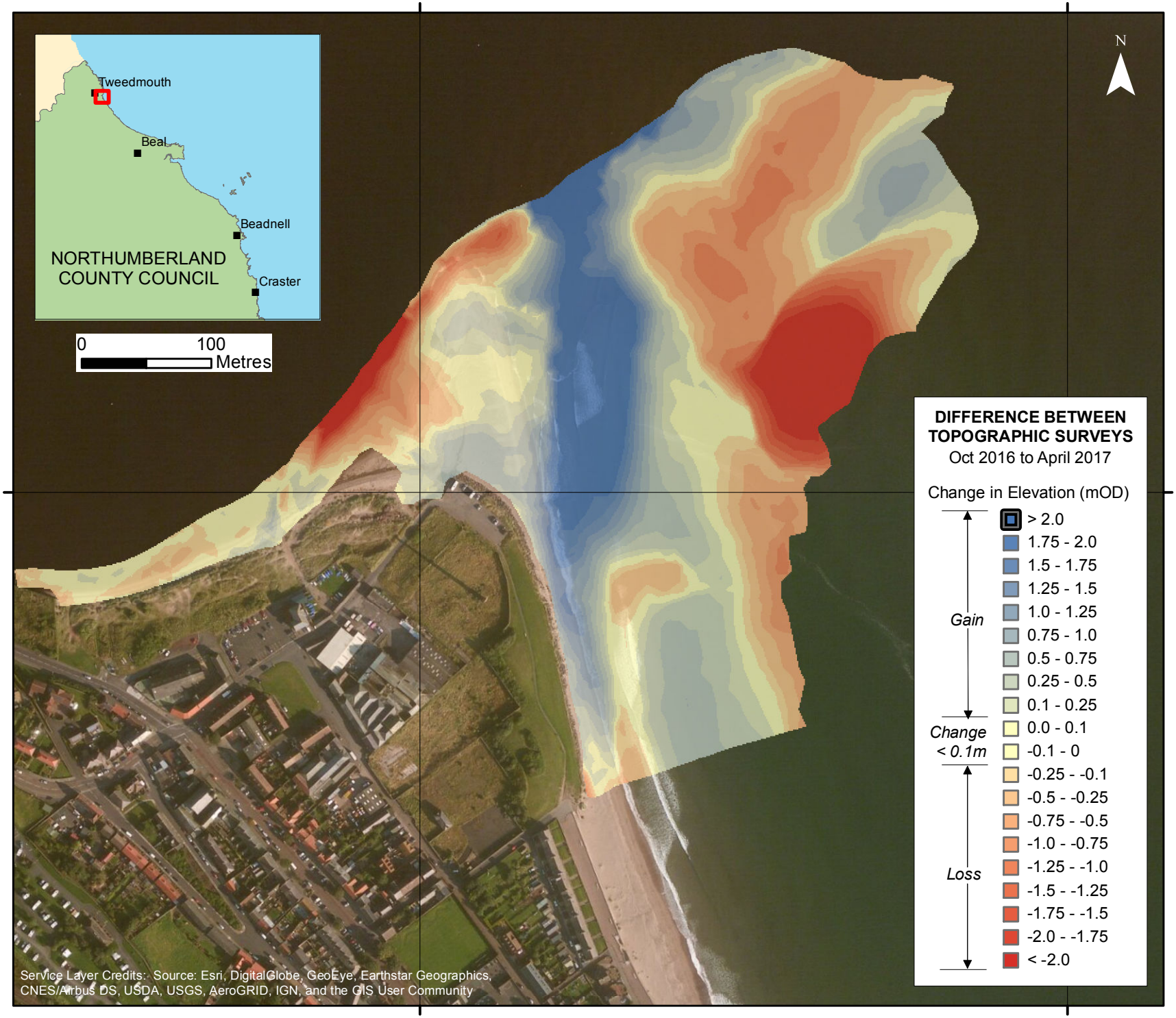

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 4

BERWICK

Northumberland County Council Frontage

Update Report
'Partial Measures' Survey 2017

Drawing Scale at A4 1:4,000

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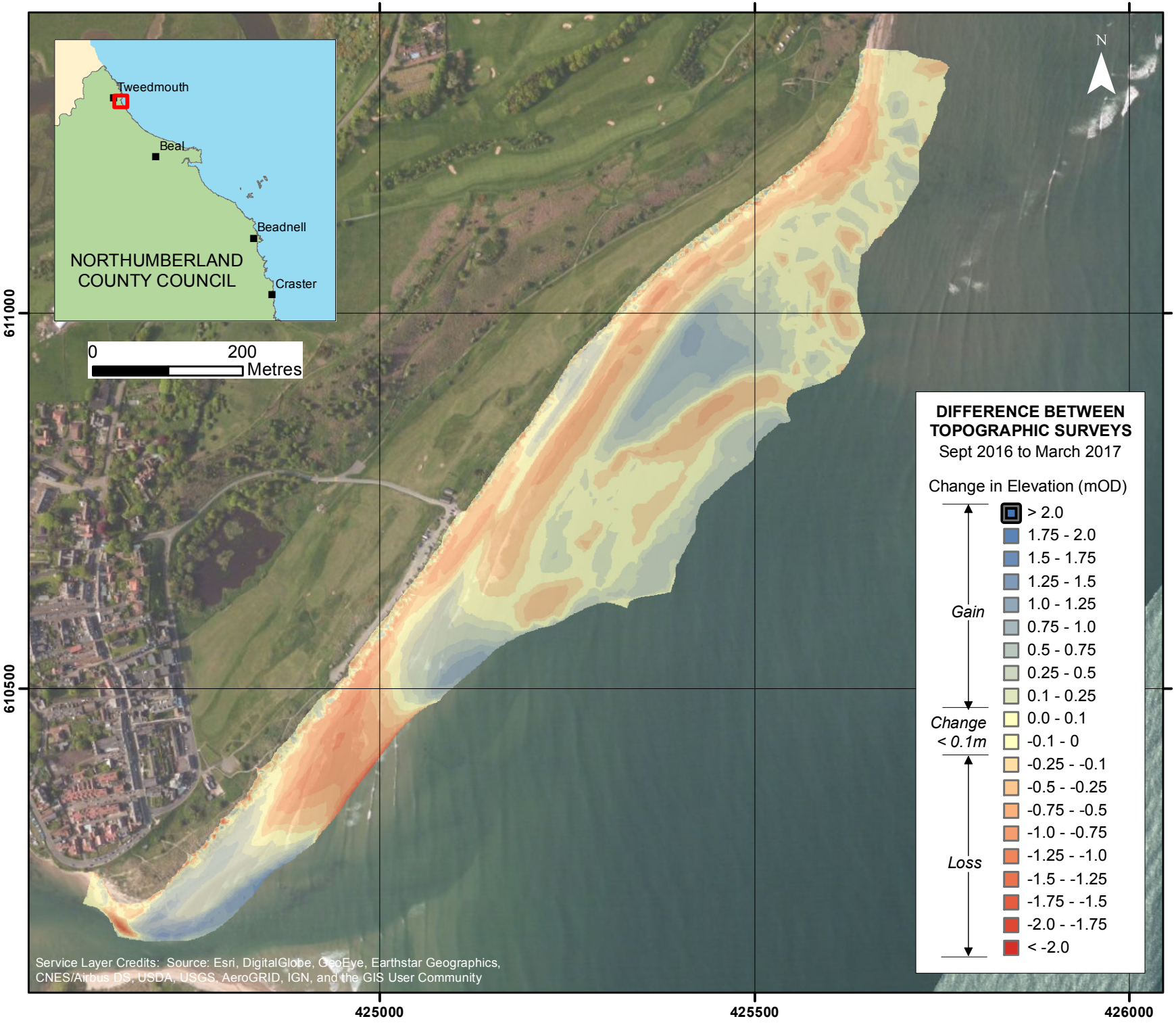

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 5

ALNMOUTH

Northumberland County Council Frontage

Update Report
'Partial Measures' Survey 2017

Drawing Scale at A4 1:6,821

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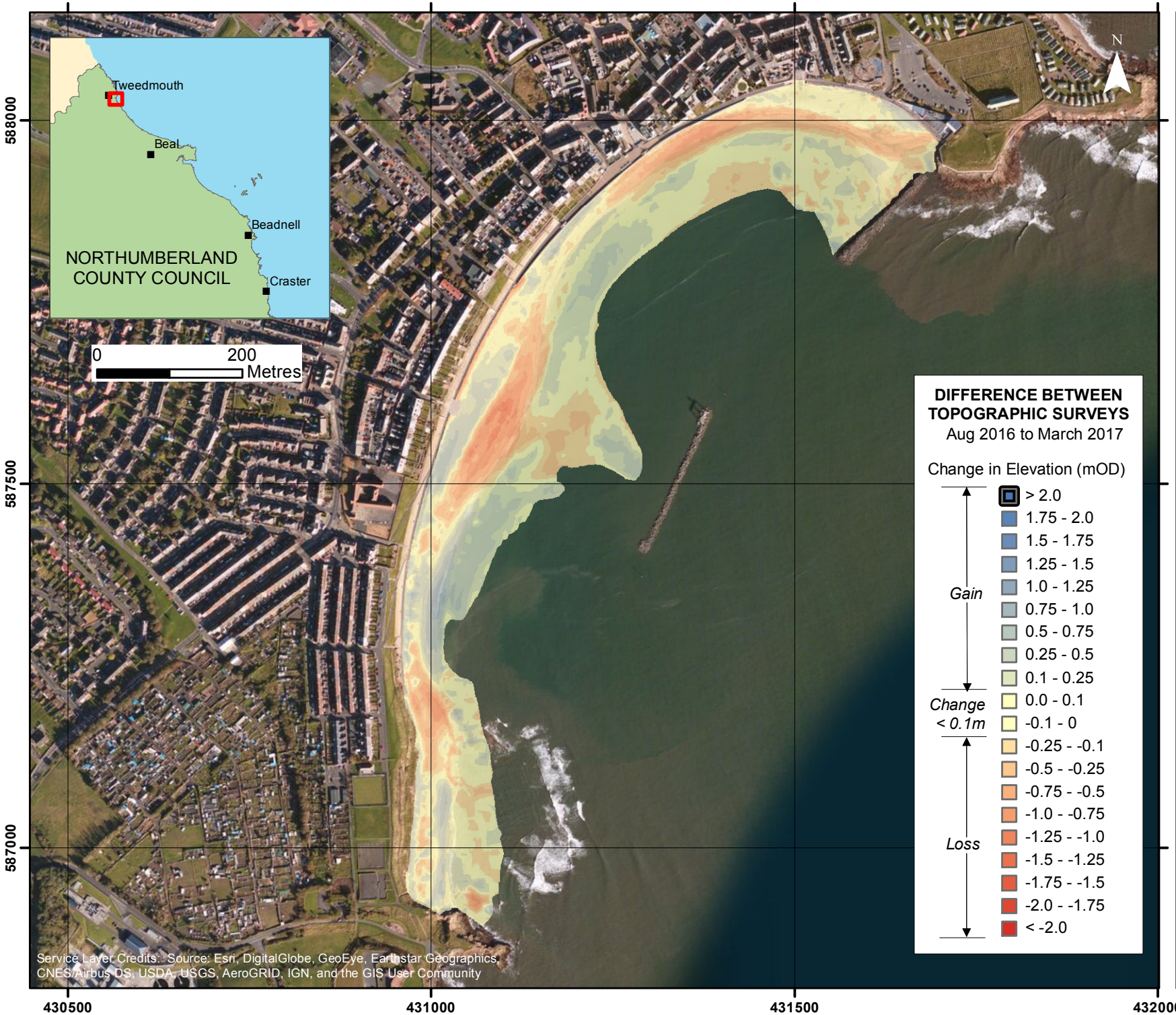

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Appendix B - Map 6

NEWBIGGIN-BY-THE-SEA

Northumberland County Council Frontage

Update Report
'Partial Measures' Survey 2017

Drawing Scale at A4 1:7,000

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Appendix D

Sand Extent Survey

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

NEWBIGGIN-BY-THE-SEA SAND EXTENT

Northumberland County Council Frontage

Update Report
'Partial Measures' Survey 2017

Drawing Scale at A4 1:2,000

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