

**Cell 1 Regional Coastal Monitoring Programme  
Update Report 7: 'Partial Measures' Survey 2015**



**Durham Council  
Final Report  
July 2015**

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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)			
	River Tyne to Frenchman's Bay	Frenchman's Bay to Souter Point	Souter Point to Chourdon Point	Chourdon Point to Hartlepool Headland
1 in 200 year	3.41	3.44	3.66	3.91
HAT	2.85	2.88	3.18	3.30
MHWS	2.15	2.18	2.48	2.70
MLWS	-2.15	-2.12	-1.92	-1.90

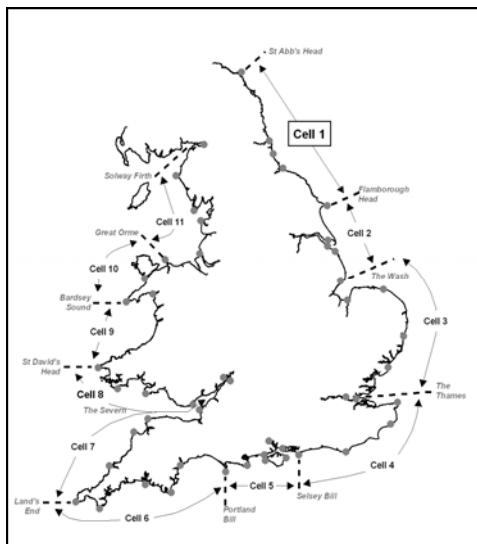
**Source:** *River Tyne to Flamborough Head Shoreline Management Plan 2.*  
Royal Haskoning, February 2007.

## Glossary of Terms

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

## Preamble

The Cell 1 Regional Coastal Monitoring Programme covers approximately 300km of the north east coastline, from the Scottish Border (just south of St. Abb's Head) to Flamborough Head in East Yorkshire. This coastline is often referred to as 'Coastal Sediment Cell 1' in England and Wales (Figure 1).



**Figure 1 Sediment Cells in England and Wales**

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

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

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

**Table 1 Analytical, Update and Overview Reports Produced to Date**

Year		Full Measures		Partial Measures		Cell 1 Overview Report
		Survey	Analytical Report	Survey	Update Report	
1	2008/09	Sep-Dec 08	May 09	Mar-May 09		-
2	2009/10	Sep-Dec 09	Mar 10	Feb-Mar 10	July 10	-
3	2010/11	Aug-Nov 10	Feb 11	Feb-Apr 11	Aug 1	Sep 11
4	2011/12	Sep 2011	Aug 12	Mar-May 12	Feb 13	
5	2012/13	Sept 2012	Feb 13	Mar-Apr 13	May 13	
6	2013/14	Oct 2013	Feb 14	Mar-Apr 14	July 14	
7	2014/15	Nov 2014	Feb 15	March 15	June 15(*)	

(\*) The present report is **Update Report 7** and provides an analysis of the 2015 Partial Measures survey for Durham Council's frontage.

## **1. Introduction**

### **1.1 Study Area**

Durham Council's frontage extends from Ryhope Dene to Crimdon Beck. For the purposes of this report, it has been sub-divided into four areas, namely:

- Featherbed Rocks
- Seaham (Dawdon)
- Blast Beach
- Hawthorn Hive
- Blackhall Colliery

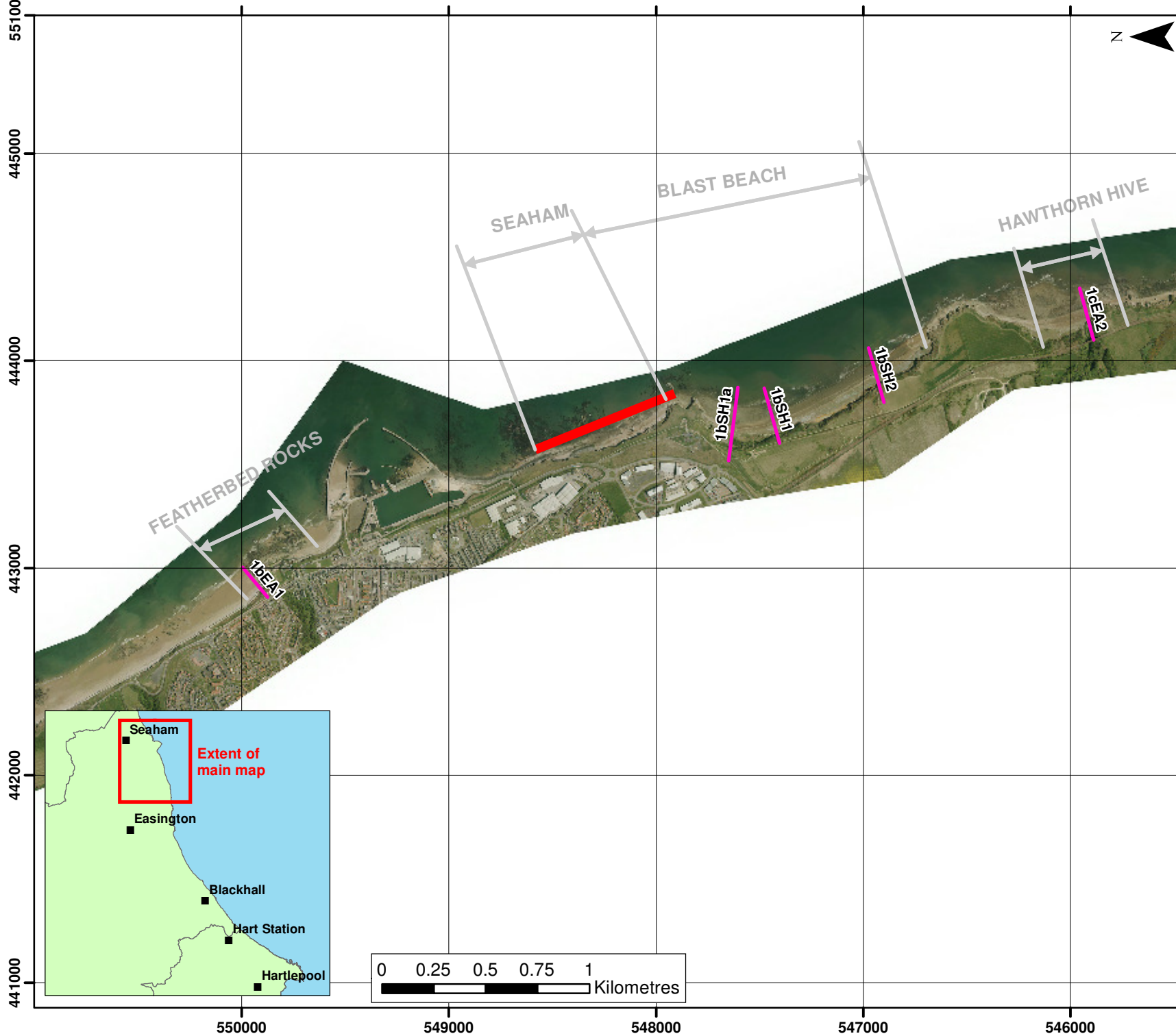
### **1.2 Methodology**

Along Durham County Council's frontage, the following surveying is undertaken:

- Full Measures survey annually each autumn/early winter comprising:
  - Beach profile surveys along eight transect lines
- Partial Measures survey annually each spring comprising:
  - Beach profile surveys along five transect lines
- Cliff top survey bi-annually at:
  - Seaham (Dawdon)

The location of these surveys is shown in Figure 2. The Partial Measures survey was undertaken along this frontage on 7<sup>th</sup> March 2015. During the survey the weather was overcast, cloudy and windy. The wind was force 6 from the south west. The sea state was calm.

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



**KEY**

**Topographic Profiles**

- Annual
- 6 monthly

**Topographic Surveys**

- 6 monthly
- yearly
- 5 yearly

**Cliff Top Monitoring Pegs**

- 50m centres
- 100m centres
- 300m centres

*(Indicative survey extents shown)*

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Figure 2 - Map 1  
Survey Locations  
Featherbed Rocks to  
Hawthorne Hive  
Durham County Council**

Update Report 7  
Partial Measures Survey  
Spring 2015

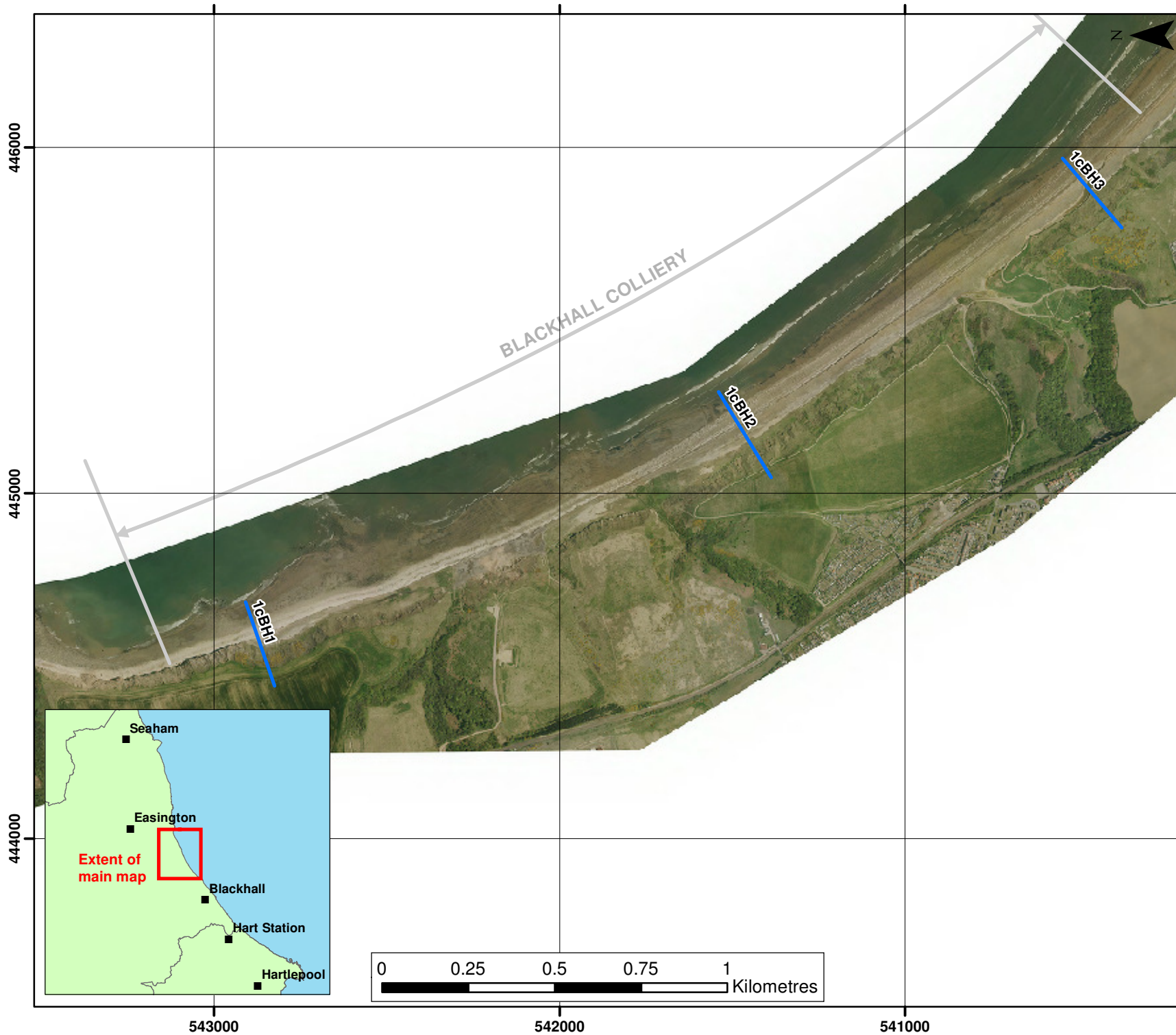


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**Cliff Top Monitoring Pegs**

- 50m centres
- 100m centres
- 300m centres

*(Indicative survey extents shown)*

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Figure 2 - Map 2  
Survey Locations  
Blackhall Colliery  
Durham County Council**

Update Report 7  
Partial Measures Survey  
Spring 2015



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## 2. Analysis of Survey Data

### 2.1 Featherbed Rocks

Survey Date	Description of Changes Since Last Survey	Interpretation
7 <sup>th</sup> March 2015	<p><b>Beach Profiles:</b></p> <p>Featherbed Rocks is monitored by one beach profile line (EA1) during the Partial Measures survey (Appendix A). The previous survey was October 2014.</p> <p>Profile 1bEA1 has changed very little to 55m chainage, which covers the cliff and promenade. The uneven profile at the base of the sea wall than earlier surveys between 55m and 80m is due to the rock armour. From 80m chainage to 85m chainage there is little change since November 2014 due to the rocks being exposed in both surveys. Beyond 85m chainage the beach has not been surveyed.</p>	<p>The rocky nature of the foreshore means it is unlikely to undergo significant changes in morphology unless sediment is deposited. Previous monitoring indicates that a veneer beach tends to accumulate over the summer and is stripped off by winter storms, giving rise to small and localised changes in profile. The upper part of the profile, which covers the cliff promenade and rock armour remains unchanged. The lower part of the profile covering the beach was not measured in November 2014 or March 2015.</p> <p><b>Longer term trends:</b></p> <p>The level of the beach at the last survey which covered the beach in April 2014 was comparable with the lowest beach levels recorded in March 2010, April 2013 and October 2013.</p>

## 2.2 Seaham (Dawdon)

Survey Date	Description of Changes Since Last Survey	Interpretation
7 <sup>th</sup> March 2015	<p><b>Cliff-top Survey:</b></p> <p>Three ground control points have been established along the cliff top at Dawdon (Figure B1). The separation between any two points is nominally 300m. These cliff top surveys are intended to inform on erosion rates of the undefended sea cliffs extending south of the rock armour revetment to the south of Seaham Harbour. The cliff top surveys at Dawdon are undertaken bi-annually.</p> <p>Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top. Appendix B provides results from the March 2015 survey showing the position from the ground control point to the edge of the cliff top along the defined bearing and changes since the November 2008 baseline survey.</p> <p>The cliff monitoring data show very little change in the last 6 months. Survey point 2 shows recession of 0.1m since November 2014, which is within the margin of error for the measurement.</p>	<p>Ground control point number 2 showed slight recession of 0.1m since November 2014. However, the longer term trend for this point shows no change.</p> <p><b>Longer term trends:</b></p> <p>There is more confidence in the long-term pattern of change, where the cumulative measured erosion is greater than the error inherent in the technique.</p> <p>Ground control points 1 and 3 have both shown an average recession rate of 0.1m/yr and 0.2m/yr respectively, since monitoring began in 2008. Point 2 shows no significant erosion in the longer term.</p>

## 2.3 Blast Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
7 <sup>th</sup> March 2015	<p><b>Beach Profiles:</b></p> <p>Blast Beach is covered by three beach profile lines during the Partial Measures survey (Appendix A). Two of these commenced in November 2008, with 1bSH1a being added in October 2009.</p> <p>At <b>1bSH1a</b> the crest of the eroding face of spoil at around 141m chainage and shows little change since October 2013. Between 150m and 160m chainage there is a mound of beach material above HAT, which was present in the November 2014 survey. From 160 to 200m chainage the beach level has dropped by up to 1m over the winter. From 200m chainage to the extent of the survey and MLWS the rocks are exposed. There has been little change at the bottom of the survey over the winter of 2014/15. Overall the gradient of the beach has remained stable.</p> <p>At <b>1bSH1</b> the profile is similar to the previous surveys as far as the beach crest at 75m. From 75m to 90m chainage the beach level has changed by less than 0.1m. At 90m chainage, just above the HAT level there is a mound of beach material which was also present in the November 2014 profile. From 100m chainage (HAT) to 150m chainage (MLWS) the beach level has dropped by up to 1m since November 2014. Overall the beach has flattened.</p> <p>At <b>1bSH2</b> the beach below the berm's previous crest at around 125m chainage has remained stable for the first time since April 2013. The crest usually erodes by up to 2m over a six month period but it was stable over the winter of 2014/15. From the crest at 125m chainage the mid beach at 150m chainage there has been little change since November 2014. From 150m chainage to the extent of the survey at 175m the beach level has increased by around 0.5m Overall the beach has flattened.</p>	<p>Through the winter there has been erosion in the SH1 and SH1a profiles in the northern part of the bay. On both profiles there is a mound of material above HAT before and after winter. The two profiles show a drop in beach level of around 1m between HAT and MLWS. The beach levels at SH1 and SH1a are in the middle of the range of profiles. The November 2014 profile was near the historical highest and therefore the lowering to March 2015 represents movement towards more typical beach levels rather than long0term beach erosion.</p> <p>Further south at SH2 there has been little change apart from flattening of the beach. The photographs show that the stack at this location has continued to erode over the winter of 2014/15.</p> <p><b>Longer term trends:</b></p> <p>The beach at SH2 shows an overall pattern of erosion since October 2008. However, SH1 and SH1a show much more fluctuation in beach level.</p>

## 2.4 Hawthorne Hive

Survey Date	Description of Changes Since Last Survey	Interpretation
7 <sup>th</sup> March 2015	<p><b>Beach Profiles:</b></p> <p>Hawthorne Hive is covered by one beach profile line <b>1cEA2</b> during the Partial Measures survey (Appendix A). The survey report notes “<i>unable to measure start of Section EA2 as the vegetation has choked out the section line and route over cliff faces</i>” and therefore all surveys following October 2012 start at 95m chainage.</p> <p>Until the partial measures survey in April 2013, a channel was present between 95m and 105m chainage, but it has infilled. The November 2014 and March 2015 beach profiles show a depression at 100m chainage. The March 2015 photographs suggest the feature is a depression between berms. From 105m to 110m chainage there has been little change in beach level. Between 110m and 145m chainage the beach level has increased by 0.6m since November 2014. At the seaward end of the profile between 145m and 220m chainage the beach profile shows the rocky foreshore has not changed.</p>	<p>The beach was at a low level in April and November 2014. Since then the beach level has recovered and it is now in the middle of the range of surveys since 2008.</p> <p><b>Longer term trends:</b></p> <p>Overall it appears that the profiles show that the beach is undergoing progressive erosion. The most recent profile shows a recovery of beach levels but it is not possible to know if this is a change in the trend or a one-off measurement.</p> <p>The infilling and incision of the channel seems to be an episodic process and is likely to reflect a combination of annual and seasonal variations in the flow of Hawthorn Burn and storm events which move sediment onshore to block the outflow of the burn.</p>

### **3. Problems Encountered and Uncertainty in Analysis**

#### **Individual Profiles**

At Blast Beach, the surveyor was unable to measure the bottom and top of section 1a and the top of section 2 due to vegetation. Dense vegetation was also present at the top of section 1. The beach at profile EA1 has not been surveyed in November 2014 and March 2015. The surveyor said that at this section the bottom can be difficult to measure, because it is generally rock. Even at low tide a fair bit of water can be washing over the rocks, hindering the survey

At Hawthorne Hive the surveyor was unable to measure start of Section EA2 due to vegetation cover.

#### **Cliff Top Surveys**

While there is low confidence in the short term erosion rates due to the error in the method, longer-term data are more reliable and suggest erosion rates of up to 0.2m/yr.

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

No changes are recommended at the present time.

### **5. Conclusions and Areas of Concern**

- At Featherbed Rocks the upper part of the profile looks stable. The lower part of the profile, including the beach, has not been surveyed and as a result it is difficult to give an overview of the condition of the shore.
- At Seaham Cliffs, the survey data indicates that the average recession rate since monitoring began in 2008 is 0.1 to 0.2m/yr.
- At Blast Beach colliery spoil still prevents the sea from actively eroding the cliffs. However, there have been significant changes in the beach profile. The erosion of the beach at the northern end of the bay and its accretion at the southern end of the bay may indicate a south to north transfer of material within the bay. It is the opposite of the trend observed over the winter of 2013/14.
- At Hawthorn Hive the beach level was low in April and November 2014. The beach has now recovered slightly and is close to the middle of the previous range of results. However, it is likely that the long term trend of progressive erosion will continue on this profile.

## **Appendices**

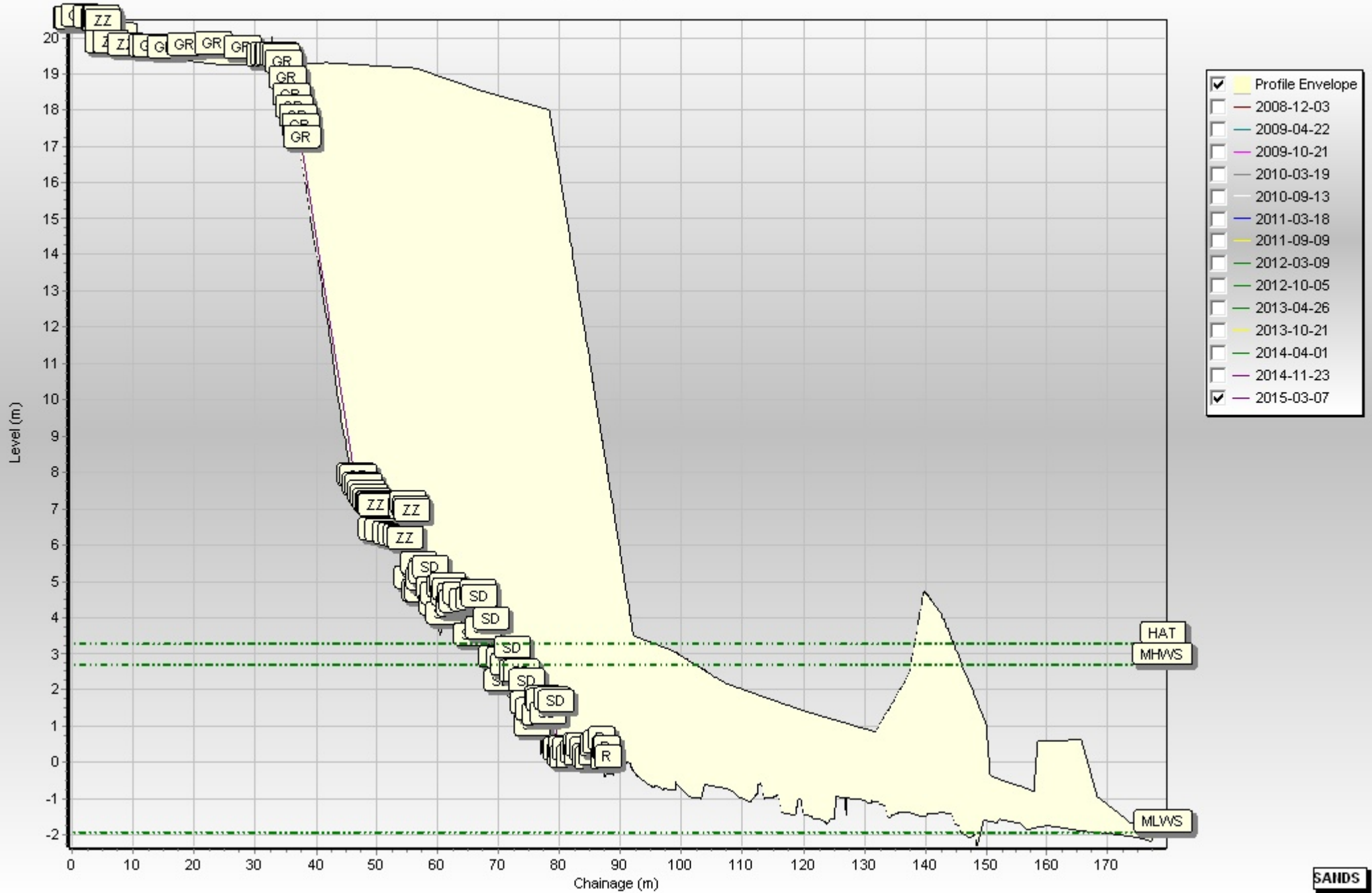
**Appendix A**  
**Beach Profiles**



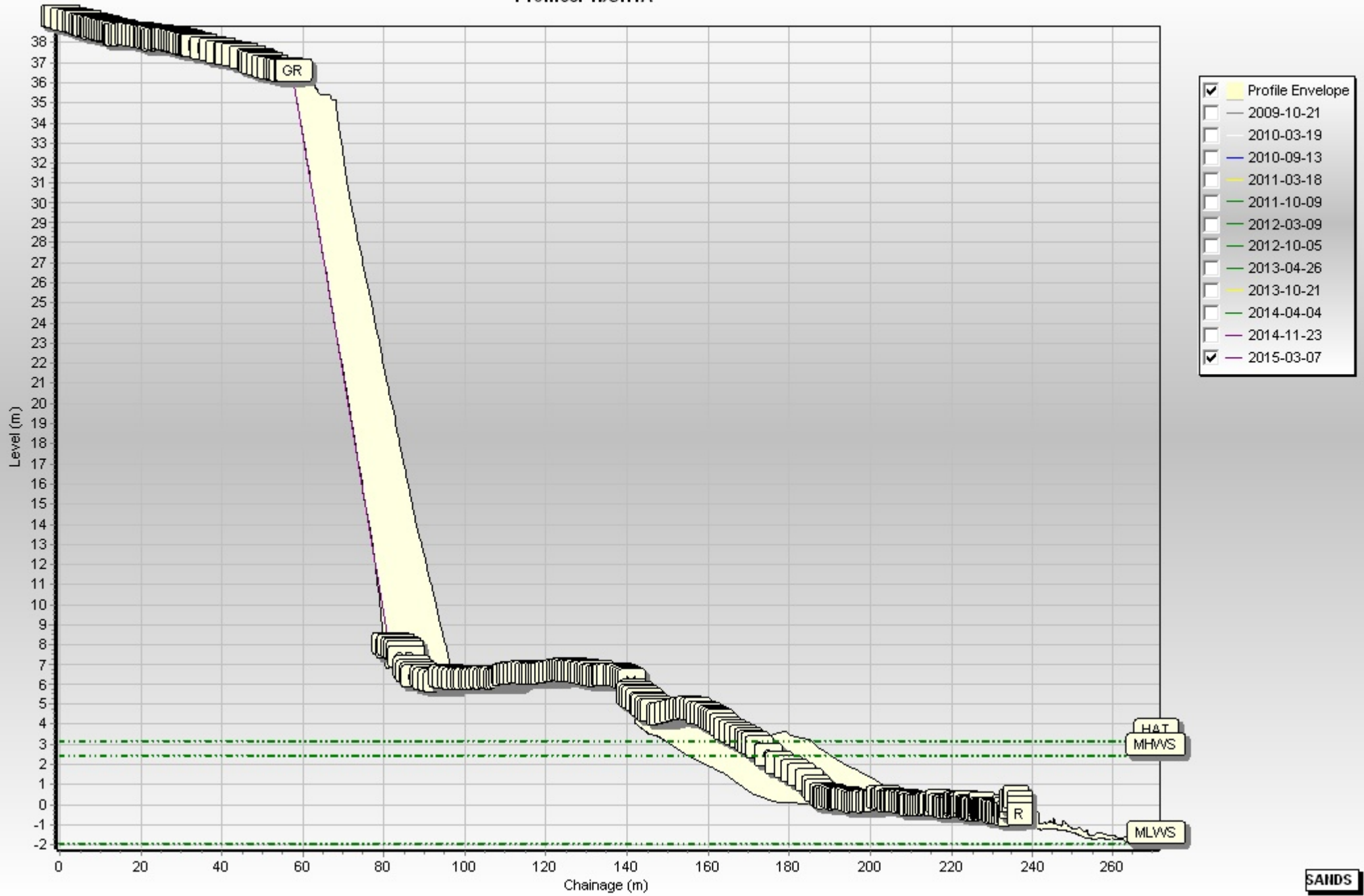
The following sediment feature codes are used on some profile plots:

<b>Code</b>	<b>Description</b>
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

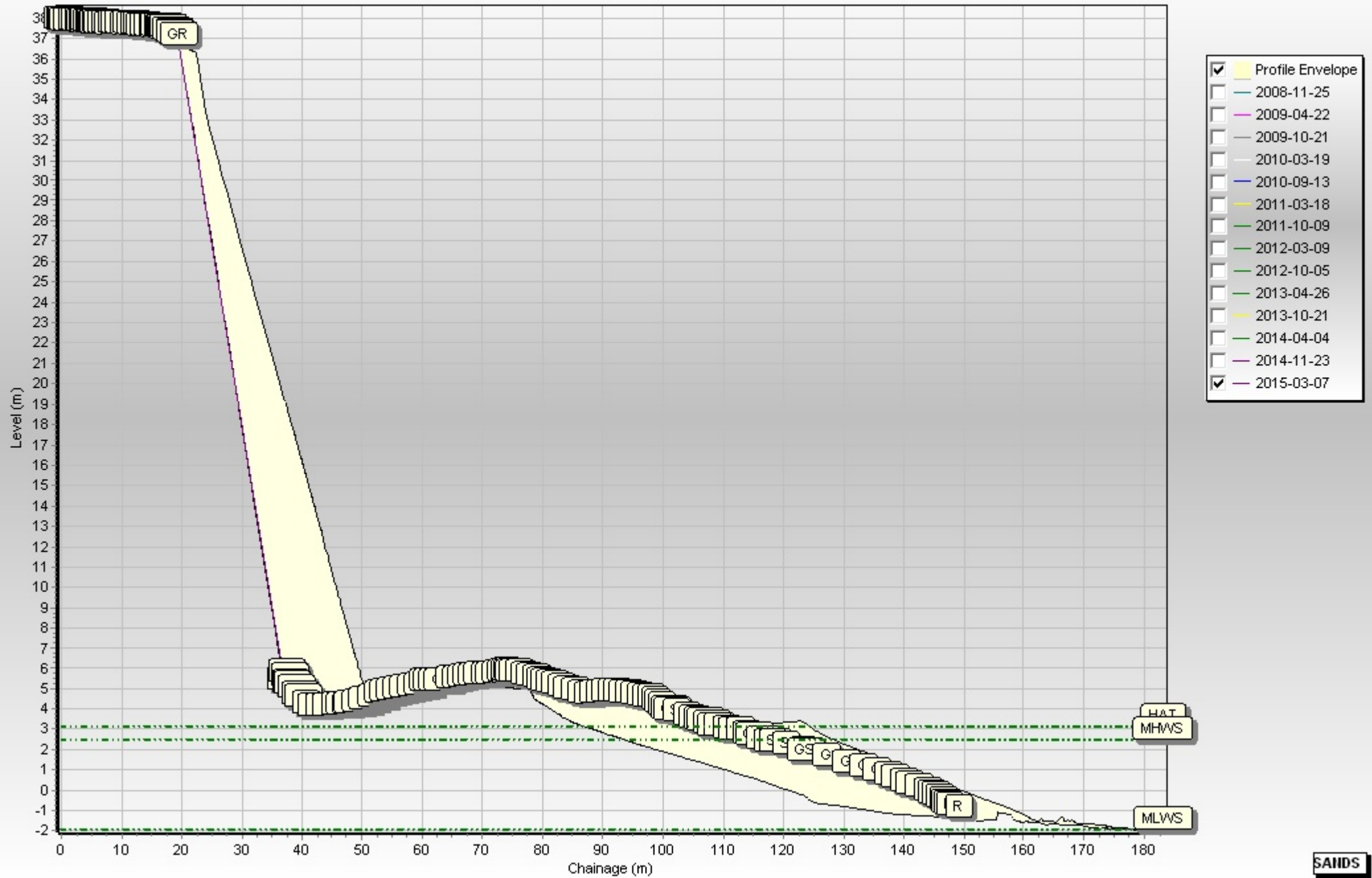
### Profiles: 1bEA1



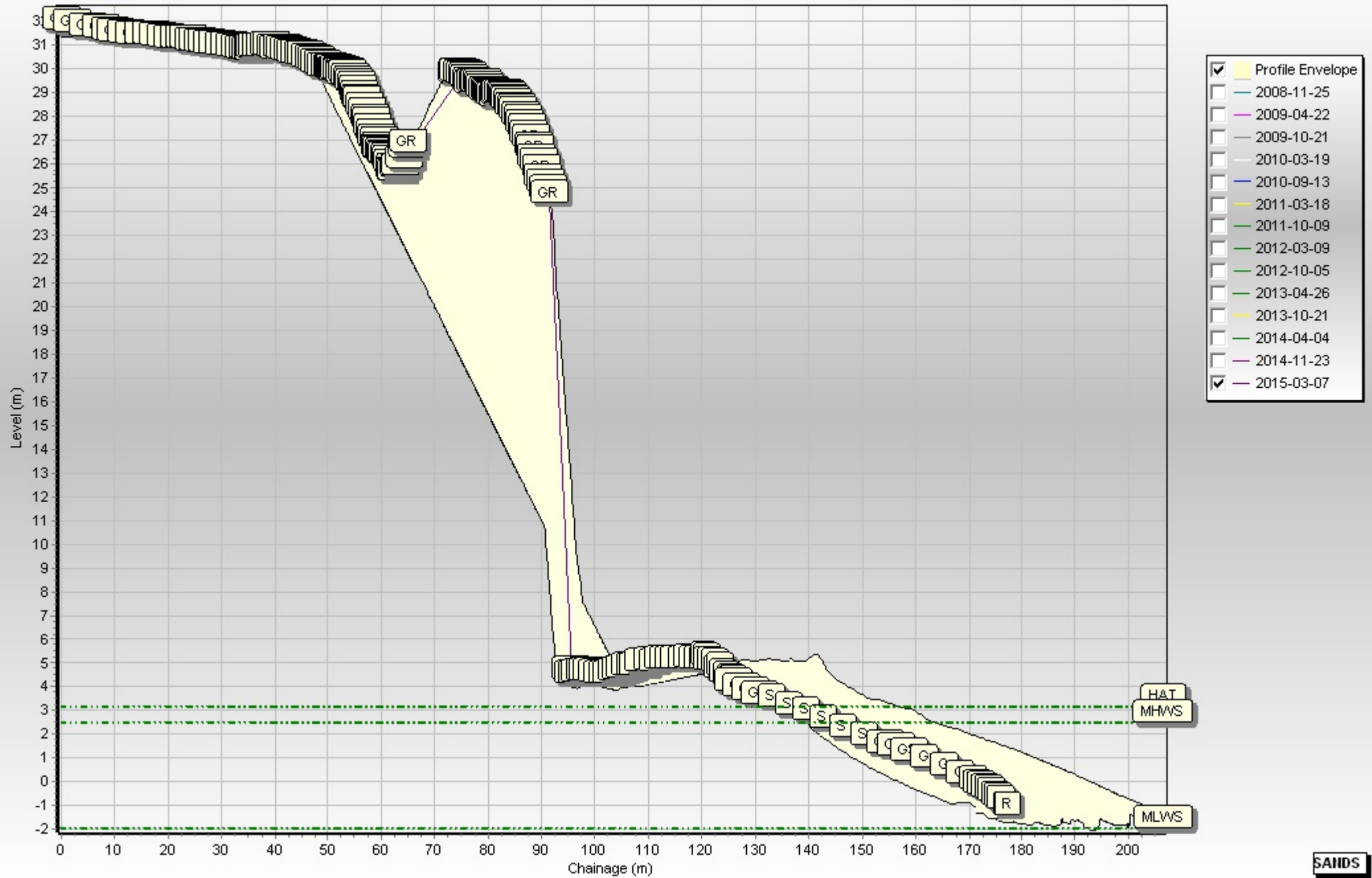
### Profiles: 1bSH1A



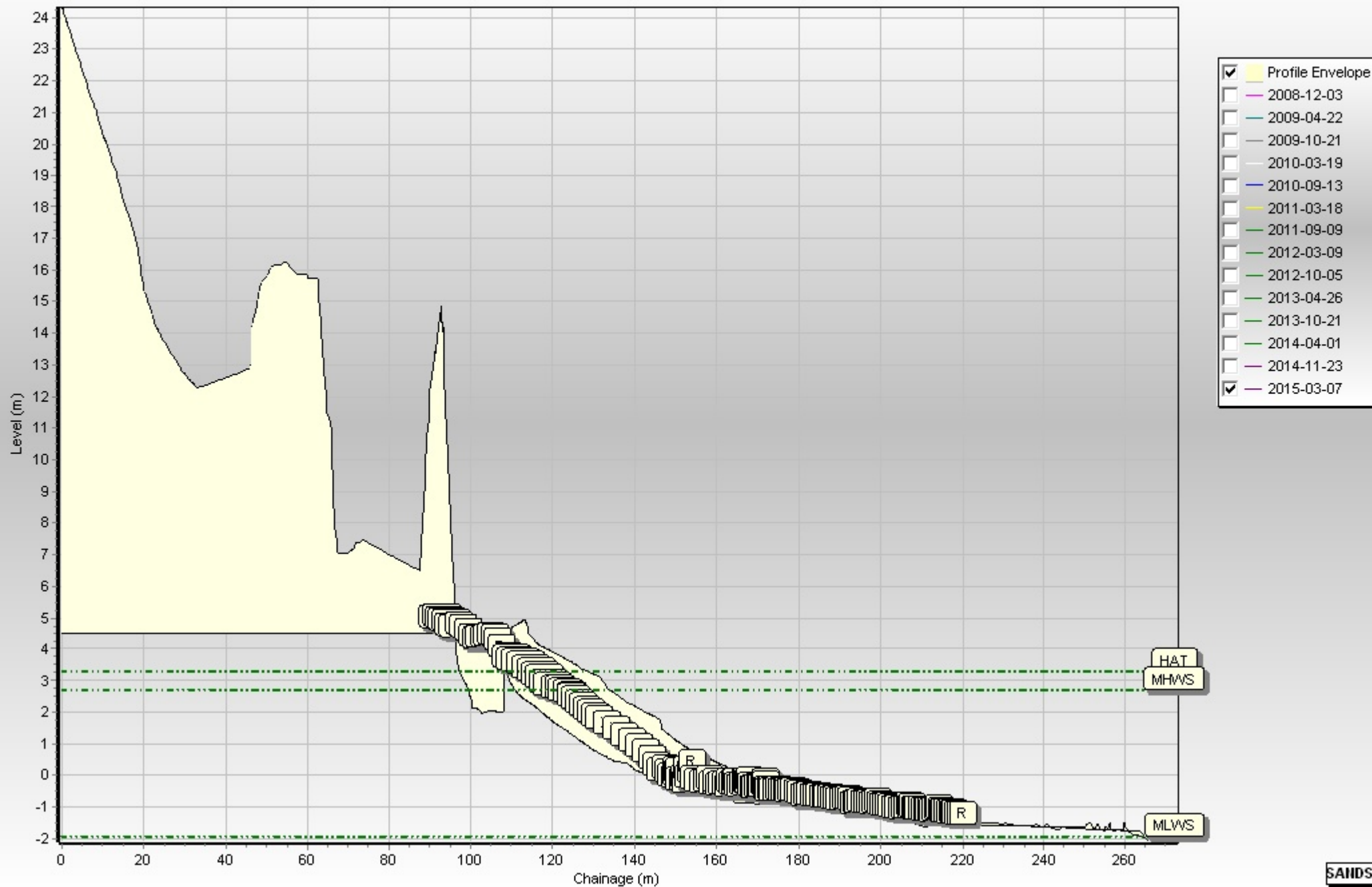
### Profiles: 1bSH1



### Profiles: 1bSH2



### Profiles: 1cEA2



**Appendix B**  
**Cliff Top Survey**

## Cliff Top Survey

### Seaham (Dawdon)

Three ground control points have been established at Dawdon (Figure B1). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion.

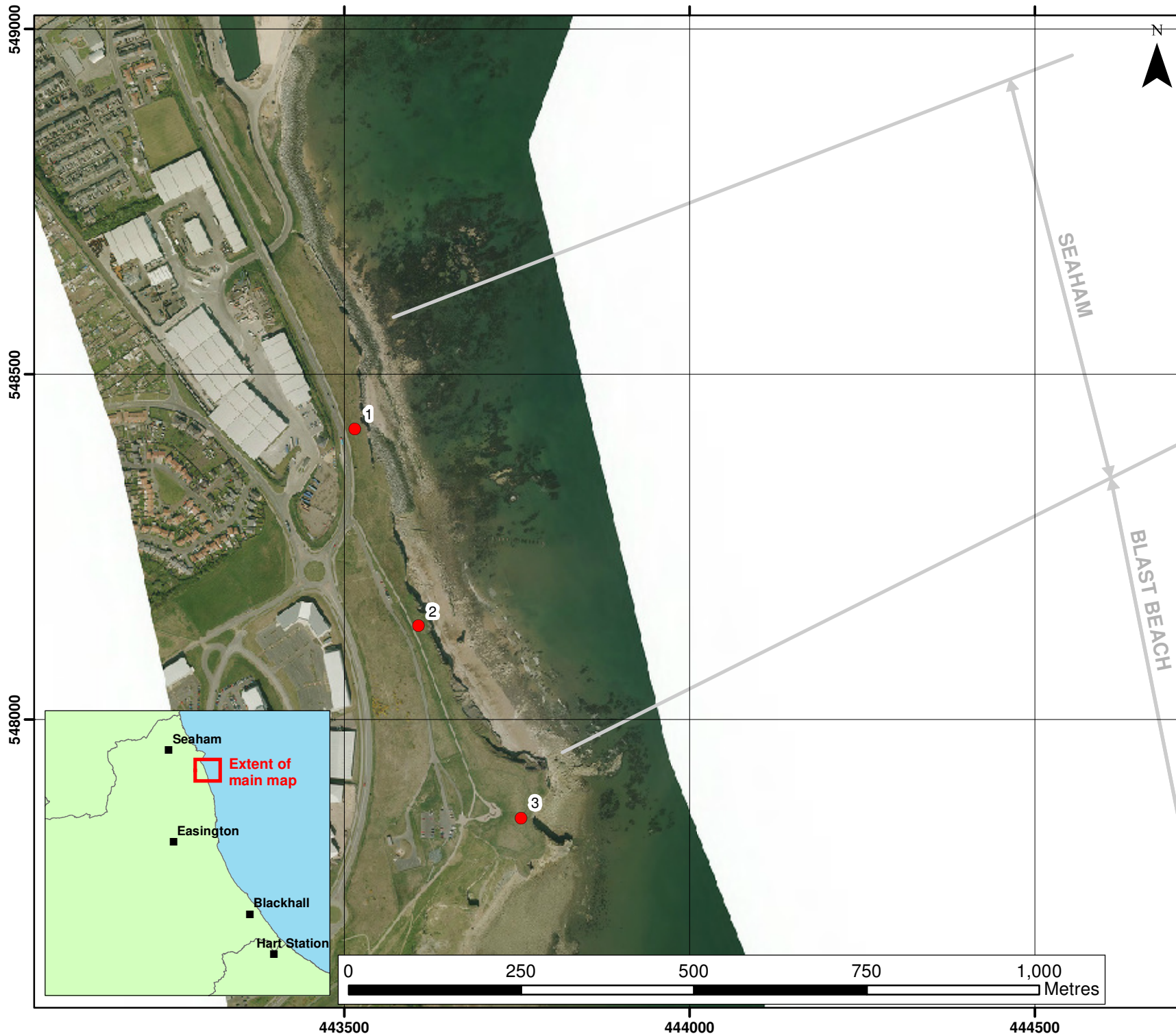
The cliff top surveys at Dawdon are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table B1 provides baseline information about these ground control points and results from the 2008 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

**Table B1 – Cliff Top Surveys at Dawdon**

Ground Control Point Details				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing (°)	Baseline Survey (Nov 2008)	Previous Survey (Nov 2014)	Present Survey (Mar 2015)	Baseline (Nov 2008) to Present (Mar 2015)	Previous (Nov 14) to Present (Mar 2015)	Baseline (Nov 2008) to Present (Mar 2015)
1	443515.4	548421.7	70	16.1	15.0	15.2	-0.9	0.2	-0.1
2	443607.8	548136.3	90	13.3	13.4	13.3	0.0	-0.1	0.0
3	443756.1	547858.5	95	14.8	13.5	13.5	-1.3	0.0	-0.2





**KEY**

- Ground Control Points

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Appendix B - Map 1  
Ground Control Points  
Seaham  
Durham County Council**

Update Report 7  
Partial Measures Survey  
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