

**Cell 1 Regional Coastal Monitoring Programme
Update Report 4: 'Partial Measures' Survey 2012**

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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

Water Level Parameter	Water Level (m AOD)			
	Hartlepool Headland to Saltburn Scar	Skinningrove	Hummersea Scar to Sandsend Ness	Sandsend Ness to Saltwick Nab
1 in 200 year	3.87	3.86	4.1	3.88
HAT	3.25	3.18	3.15	3.10
MHWS	2.65	2.68	2.65	2.60
MLWS	-1.95	-2.13	-2.15	-2.20

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).

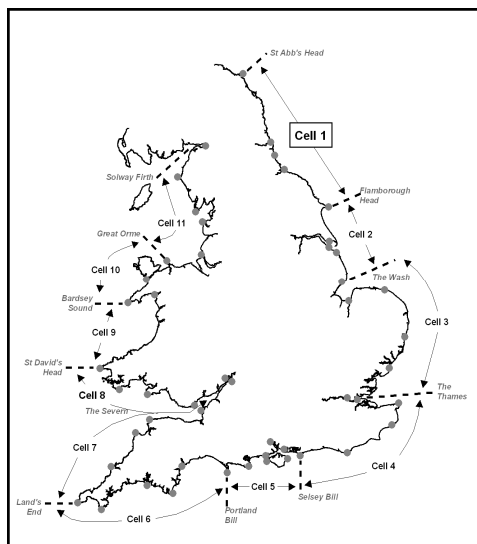


Figure 1 Sediment Cells in England and Wales

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	Sept-Dec 08	May 09	Mar-May 09	June 2009	-
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	Feb 13 (*)	

(*) The present report is **Update Report 4** and provides an analysis of the 2012 Partial Measures survey for Hartlepool Council's frontage.

1. Introduction

1.1 Study Area

Hartlepool Council's frontage extends from Crimdon Beck in the north to the North Gare Breakwater in the south. For the purposes of this report, it has been sub-divided into four areas, namely:

- North Sands
- Hartlepool Headland
- Middleton
- Hartlepool Bay

1.2 Methodology

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

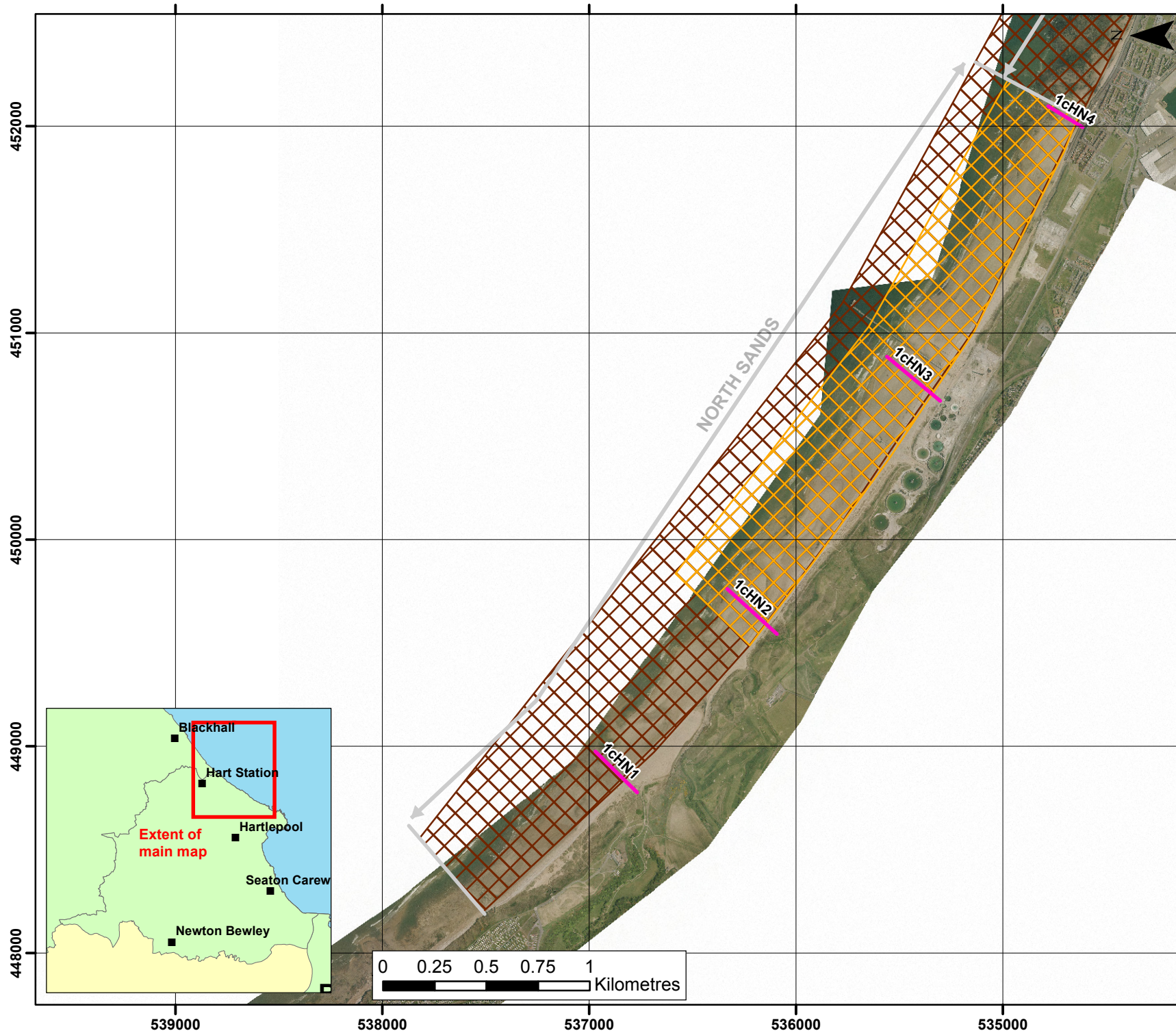
- Full Measures survey annually each autumn/early winter comprising:
 - Beach profile surveys along nine transect lines
 - Topographic survey along part of North Sands (referred to as Hartlepool North)
 - Topographic survey along Middleton (referred to as Hartlepool Central)
 - Topographic survey along Hartlepool Bay (referred to as Hartlepool South)
- Partial Measures survey annually each spring comprising:
 - Beach profile surveys along nine transect lines
- Additionally, every five years (starting with 2008 as the baseline year), the Full Measures survey at Hartlepool North is extended to fully cover the whole of North Sands and Hartlepool Headland with a topographic survey. This extends across the boundary of jurisdiction between Hartlepool Borough Council and Durham County Council.

The location of these surveys is shown in Figure 2. The Partial Measures survey was undertaken along this frontage between 26th and 27th March 2012. During this time weather conditions were warm and sunny, with a calm sea state and a gentle easterly wind.

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
- providing key conclusions and highlighting any areas of concern (Section 5).

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



KEY

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)

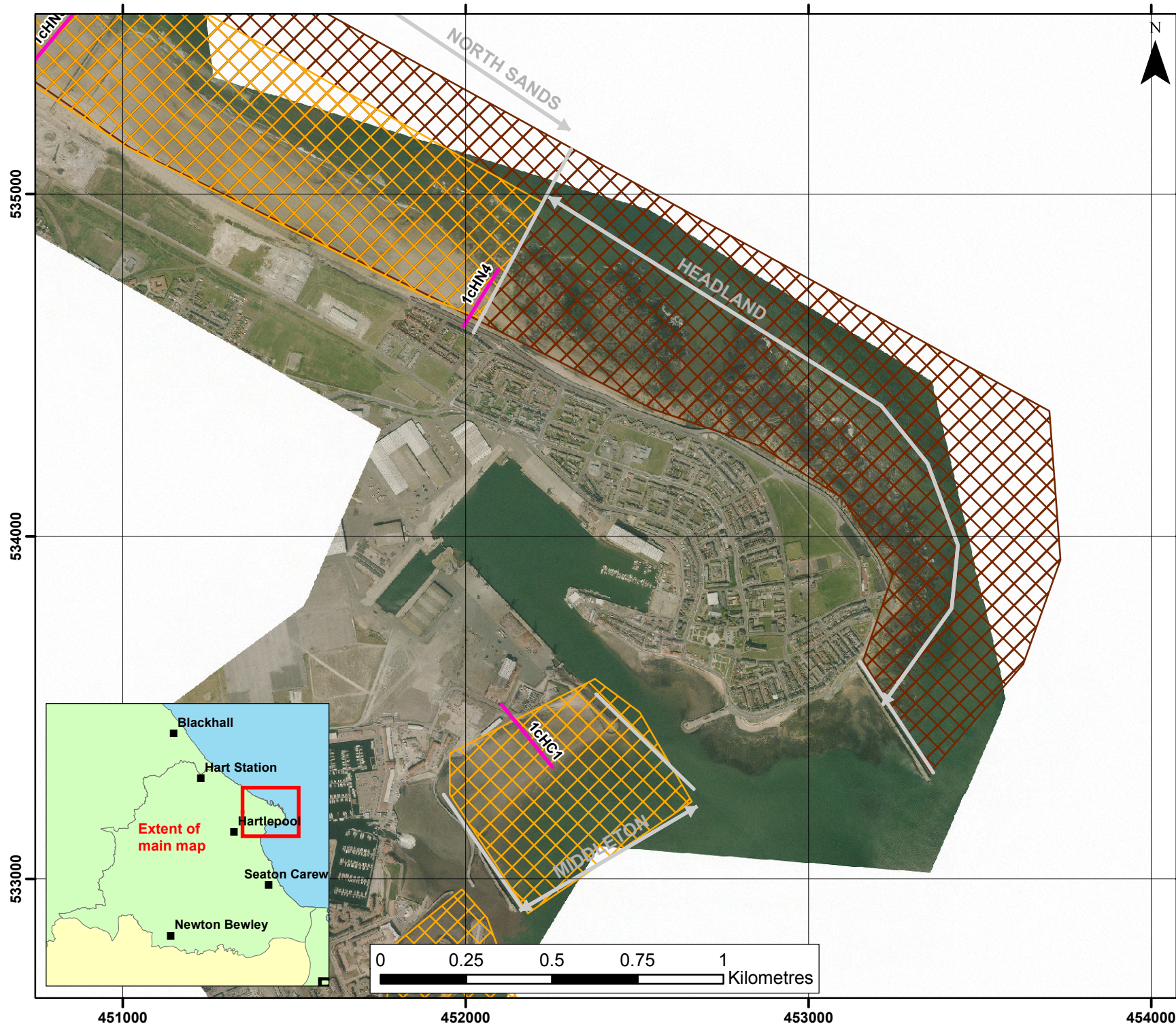
Client: North East Coastal Group
 Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

Figure 2 - Map 1
Survey Locations
North Sands
Hartlepool Borough Council

Update Report 4
 Partial Measures Survey
 Spring 2012

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- Annual
- 6 monthly

Topographic Surveys

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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
Headland and Middleton
Hartlepool Borough
Council**

Update Report 4
Partial Measures Survey
Spring 2012



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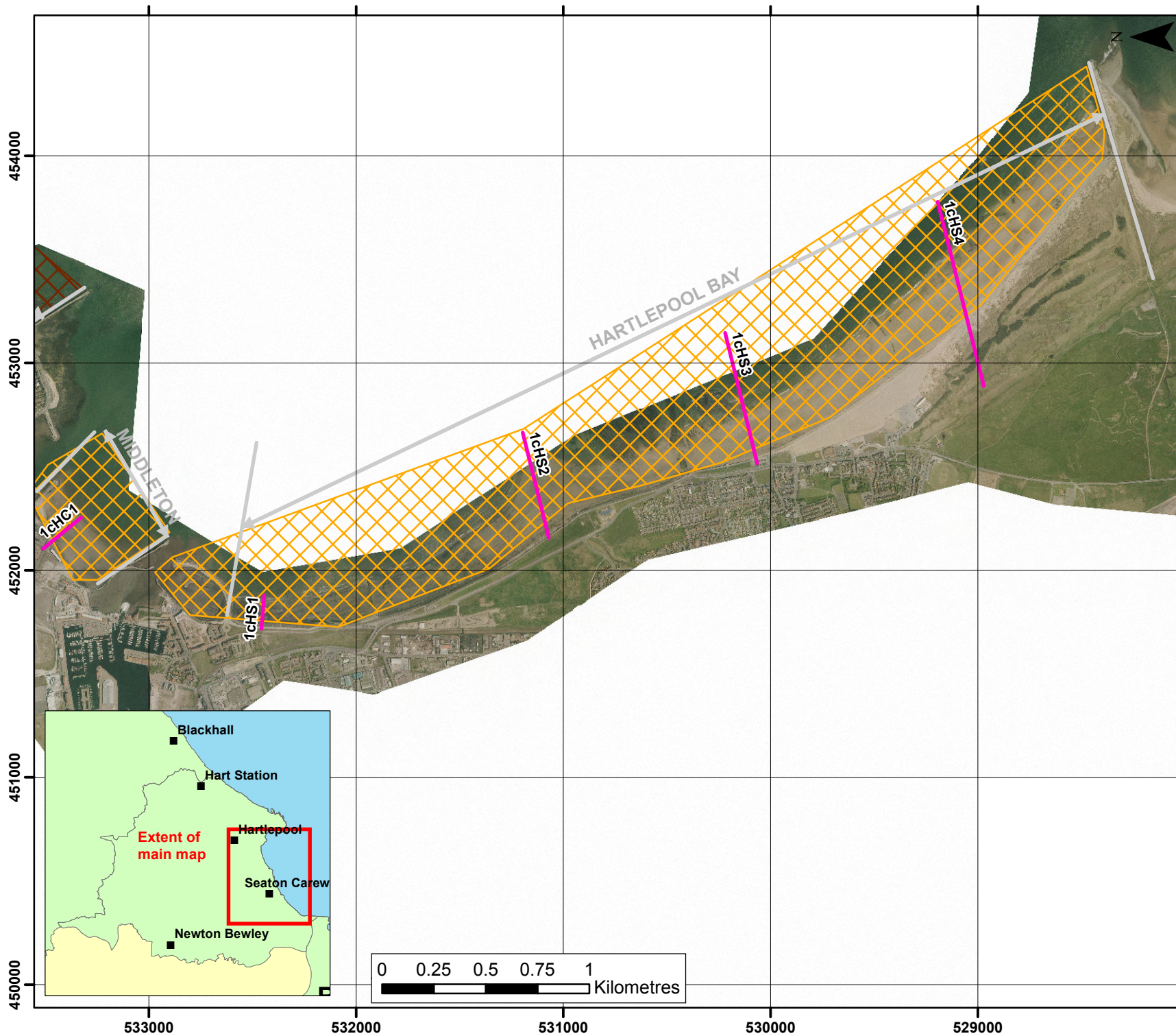
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KEY

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 3
Survey Locations
Hartlepool Bay
Hartlepool Borough
Council**

Update Report 4
Partial Measures Survey
Spring 2012



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2. Analysis of Survey Data

2.1 North Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
26/03/12	<p>Beach Profiles:</p> <p>North Sands is covered by four beach profile lines during the Partial Measures survey (Appendix A) that were last surveyed in October 2011.</p> <p>Profile HN1 is located within Durham County Council's jurisdiction, about 400m north of the outfall of Crimdon Beck, but has been reported here so changes can be interpreted in association with those observed elsewhere along North Sands at HN2, HN3 and HN4. The form of both the beach and the dune sections of the profile in March 2012 were very similar to that recorded in October 2011. The upper beach is similar to the previous survey. Between MLWS and MHWS a second berm has appeared on the beach. It is considered likely that the single berm recorded in October 2011 was re-worked to form two features. The growth of the berms represents a gain of up to 0.6m in some places and erosion of around 0.5 in other places. Overall the volume of the beach appears to have remained stable.</p> <p>Profile HN2 shows stability from 0m chainage to 50m chainage. At 50m chainage a berm has appeared since October 2011 what indicates localised accretion of c. 0.5m over the summer months. The rest of the beach has accreted by 0.4m since October 2011 and the small berm that was present in October had been removed by March 2012.</p> <p>Profile HN3 exhibited very little change above HAT. The 0.7m high beach berm that was present between 80m and 100m chainage in October 2011 has been flattened. Below the level of the berm a depression that had form during the October 2011 survey had been filled in. The beach overall has flatten and reached a gradient comparable with the other surveys which have been carried out at this location.</p> <p>Profile HN4 showed that the beach had eroded by 0.4m overall, which is to be expected during the winter. A berm had developed in the middle of the beach over the winter months that indicated accretion of around 0.25m since the last survey.</p>	<p>Profiles HN1 and HN2 are showing widespread accretion over the winter, which is likely to be due to the erosion of material from above the beach or from alongshore areas. Since the last survey, profiles HN3 and 4 have lost material, which is a typical beach response to winter storm events.</p> <p>Longer term trends: All the profiles appear to be stable above the HAT line with variation of the beach below. At HN1 and 2 the beach levels were among the highest recorded since October 2008.</p> <p>At HN3 beach gradient recorded was similar to the previous spring profiles recorded at this location although the level was lower.</p> <p>At HN4 the beach shows a reasonably high level of variability. The March 2012 beach level was comparatively low, with the rocks at the lowest extent of the survey being exposed.</p>

2.2 Middleton

Survey Date	Description of Changes Since Last Survey	Interpretation
27/03/12	<p>Beach Profiles:</p> <p>Middleton is covered by one beach profile line during the Partial Measures survey (Appendix A). The profile was last surveyed in September 2011.</p> <p>Profile HC1 has reasonably high compared to the last survey. At the toe of the defence and between 140 to 185m chainage the beach has accreted over the 2011/12 Winter. Between 70m and 140m the beach has eroded by a maximum of only 0.2m,.</p>	<p>The beach was at a high level compared to the previous surveys.</p> <p>Longer term trends: The beach level at this location tends to fluctuate through time, with the most variable area being adjacent to the sea wall. There is no clear pattern in the beach variability, with no obvious signal of long term change. The March 2012 surveys are the most similar to the March and September 2009 surveys.</p>

2.3 Hartlepool Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
26/03/12	<p>Beach Profiles:</p> <p>Hartlepool Bay is covered by four beach profile lines during the Partial Measures survey (Appendix A). The profiles were last surveyed in October 2011.</p> <p>Profile HS1 is located approximately 150m south of the root of the South Pier. The profile starts at the wall to the rear of the promenade and extends across the promenade, over the fronting concrete splash wall and down the sloping face of the rock armour revetment before reaching the beach. The majority of changes in the profile occur beyond 40m chainage. The beach level is comparable overall to the last survey. Close to the sea wall the beach has accreted by 0.4m since the last survey. Beyond 70m chainage the beach appears to have eroded by around 0.25m, which shows that overall the beach is steepening, with a net transfer of sediment towards the back of the beach. HS2 has a similar pattern of change and is also steepening, with the upper beach accreting by around 0.1m in most places and the lower beach eroding by up to 0.2m</p> <p>At profile HS3 during the March 2012 survey there were sea defence construction works taking place on the beach. As a result there is a new sea wall apparent. The October 2011 full measures survey for HS3 was not carried at this location out due to the construction works and therefore the last survey at this location is March 2011. When the current survey is compared to the March 2011 survey the beach profiles are very similar, although accretion of around 0.3m is visible along the whole profile. The March 2012 profile should be taken as the new baseline for future changes because the effect of the new defence on the beach.</p> <p>Profile HS4 is located around 1km north of the North Gare Breakwater, within the area of undefended dunes at Seaton Carew. The main dune ridge has remained very stable over time, but a foredune developing on the seaward face in October 2010 was reduced in crest height by March 2012. A lobe of material was seen between HAT and MHWS in the current survey, which is a similar size to the foredune seen in the last survey. This could be evidence of collapse of the foredune and reworking of sediment into the beach system. The level of the beach was reasonably high and changed in elevation by $\pm 0.25\text{m}$ along the foreshore since October 2011. The overall morphology and elevation of the profile has not changed since October 2011.</p>	<p>The beach profiles at HS1 and HS2 have become steeper over the winter of 2011/12, as sediment has been transferred towards the back of the beach. This transfer of sediment is typical of winter conditions. Profile HS3 has been the location of a new sea defence and consequently the current survey cannot be directly compared to past surveys. However, since construction of the defence, the beach level does appear to have risen compared to surveys since March 2009.</p> <p>At HS4 the level of the upper beach is high compared to previous surveys, which could be due to the collapse of the fore dune on to the beach and reworking of sediment. The lower half of the beach, beyond 400m chainage, is lower than the previous surveys. The profile is steeper than the previous profiles, showing the same pattern of transfer of sediment to the back of the beach during winter.</p> <p>Longer term trends: The beach levels are high and healthy. It is noteworthy that the profiles have all steepened over the last six months or more. However, there are no obvious trends of behaviour over the long term apart from the natural fluctuation of the beach level.</p>

3. Problems Encountered and Uncertainty in Analysis

Individual Profiles

Profile 1c HS3 has been significantly affected by the construction of new sea defences in winter 2011. This means comparison of new data from this profile with previous survey needs careful interpretation. It is recommended that the current profile is taken as a new baseline.

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

No changes are recommended at the present time.

5. Conclusions and Areas of Concern

- At North Sands profiles HN1 and HN2 are showing accretion since October 2011, whereas profiles HN3 and 4 have lost material, which is to be expected over the winter. There are no causes for concern at North Sands.
- At Middleton the beach was at a high level compared to the previous surveys, so there is no cause for concern.
- The beach levels at Hartlepool Bay are high and healthy. It is noteworthy that the profiles have all steepened over the last six months or more. However, there is no cause for concern.

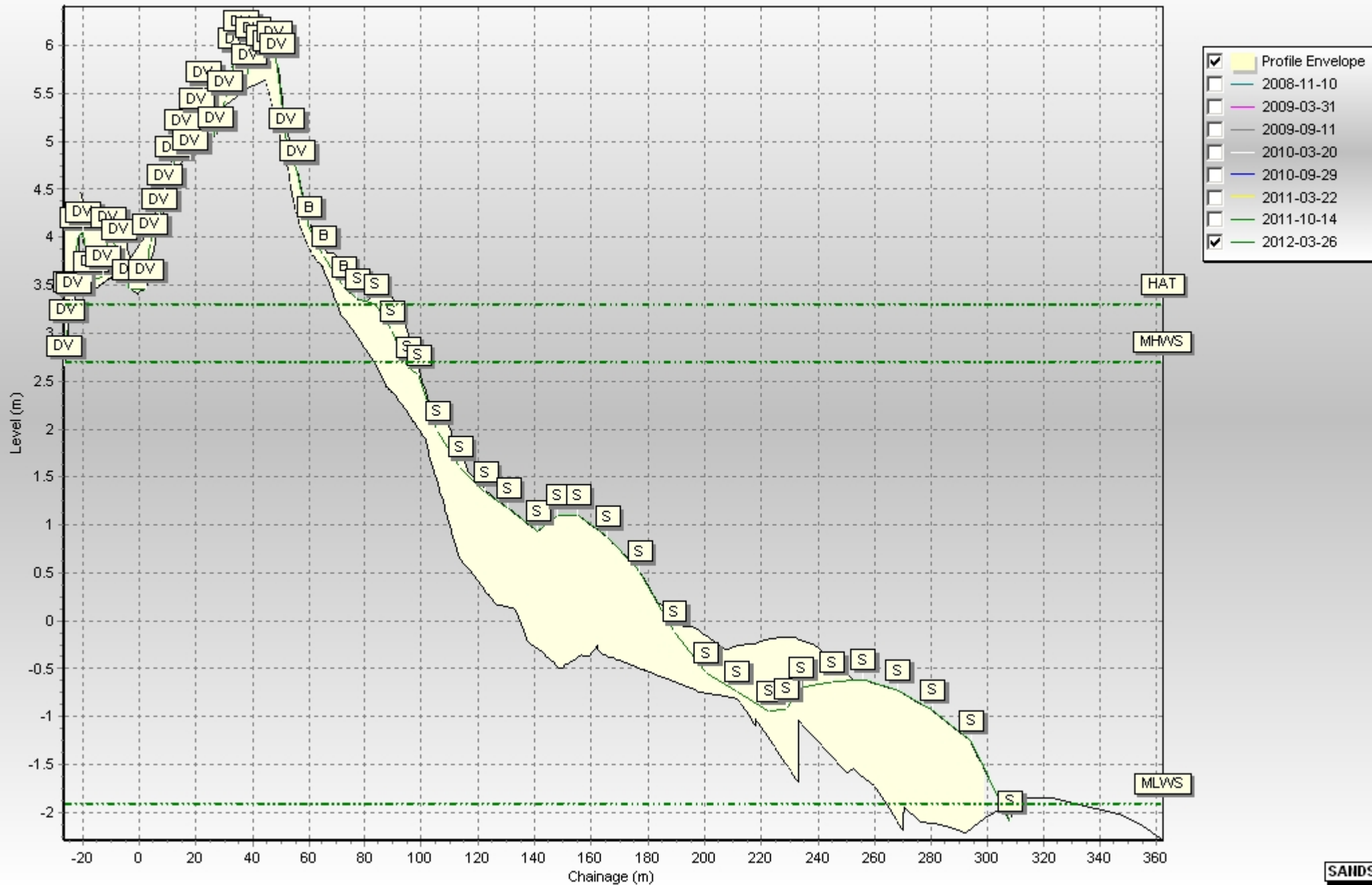
Appendices

Appendix A
Beach Profiles

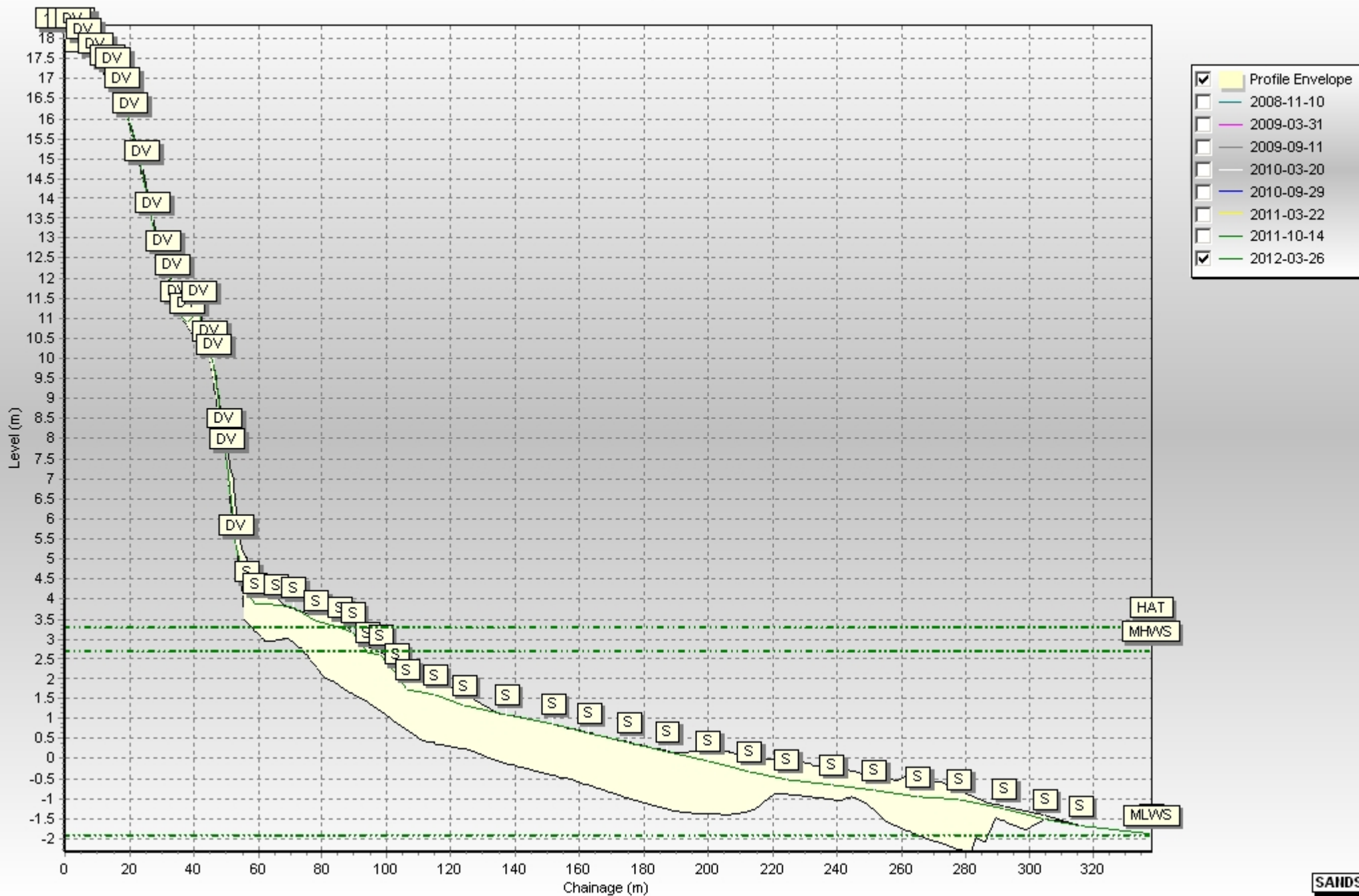
The following sediment feature codes are used on some profile plots:

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

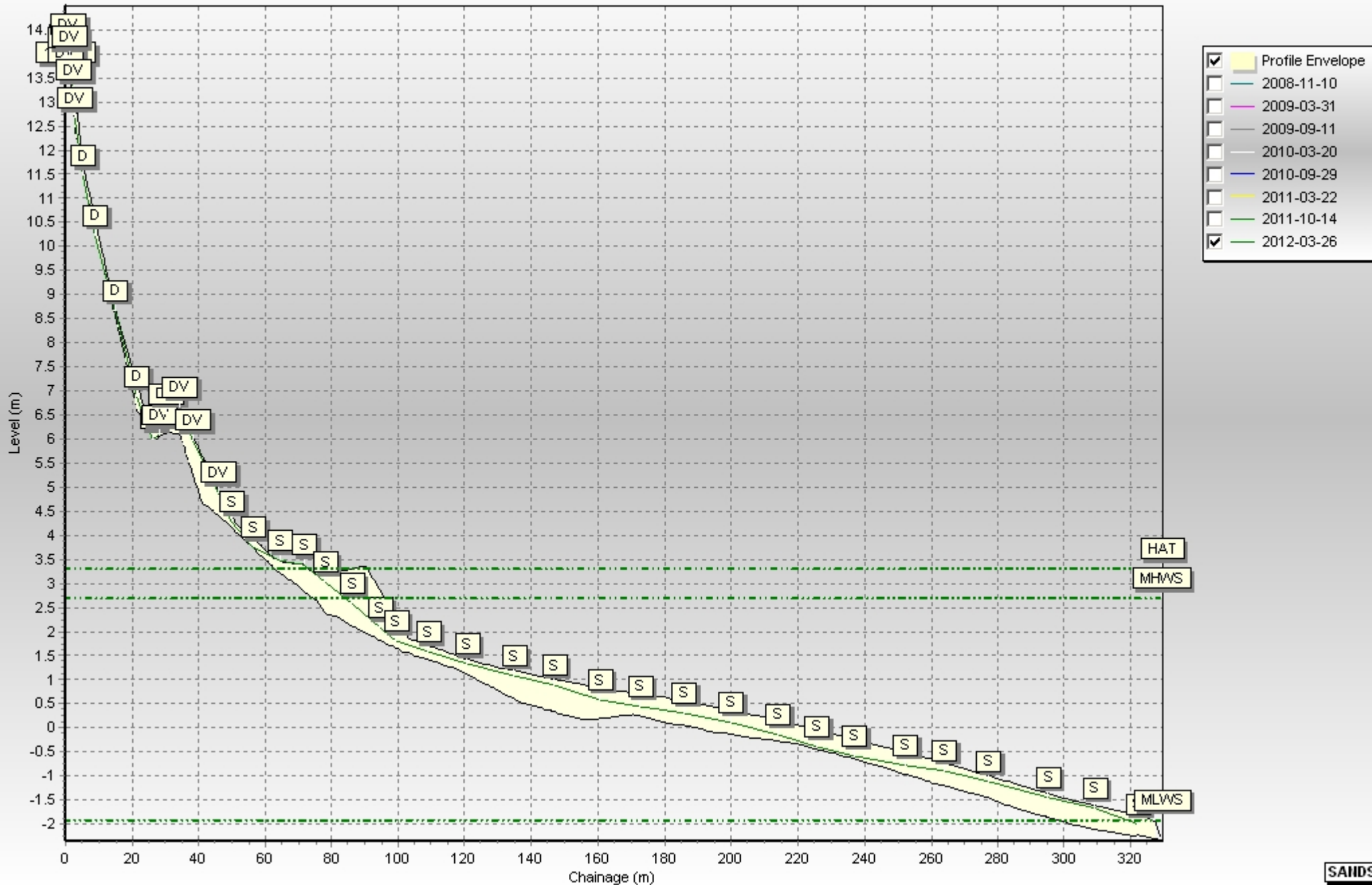
Beach Profiles: 1cHN1



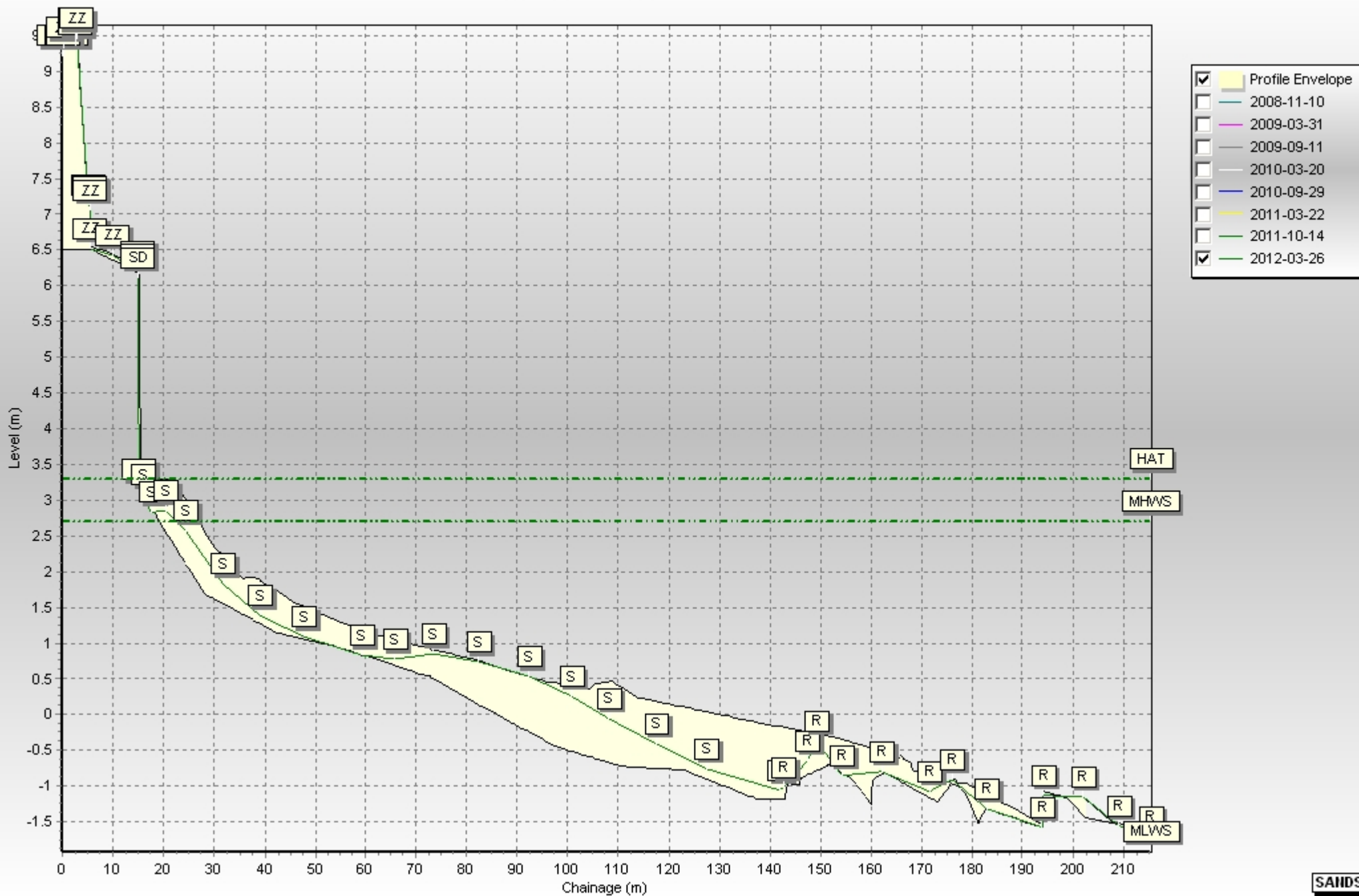
Beach Profiles: 1cHN2



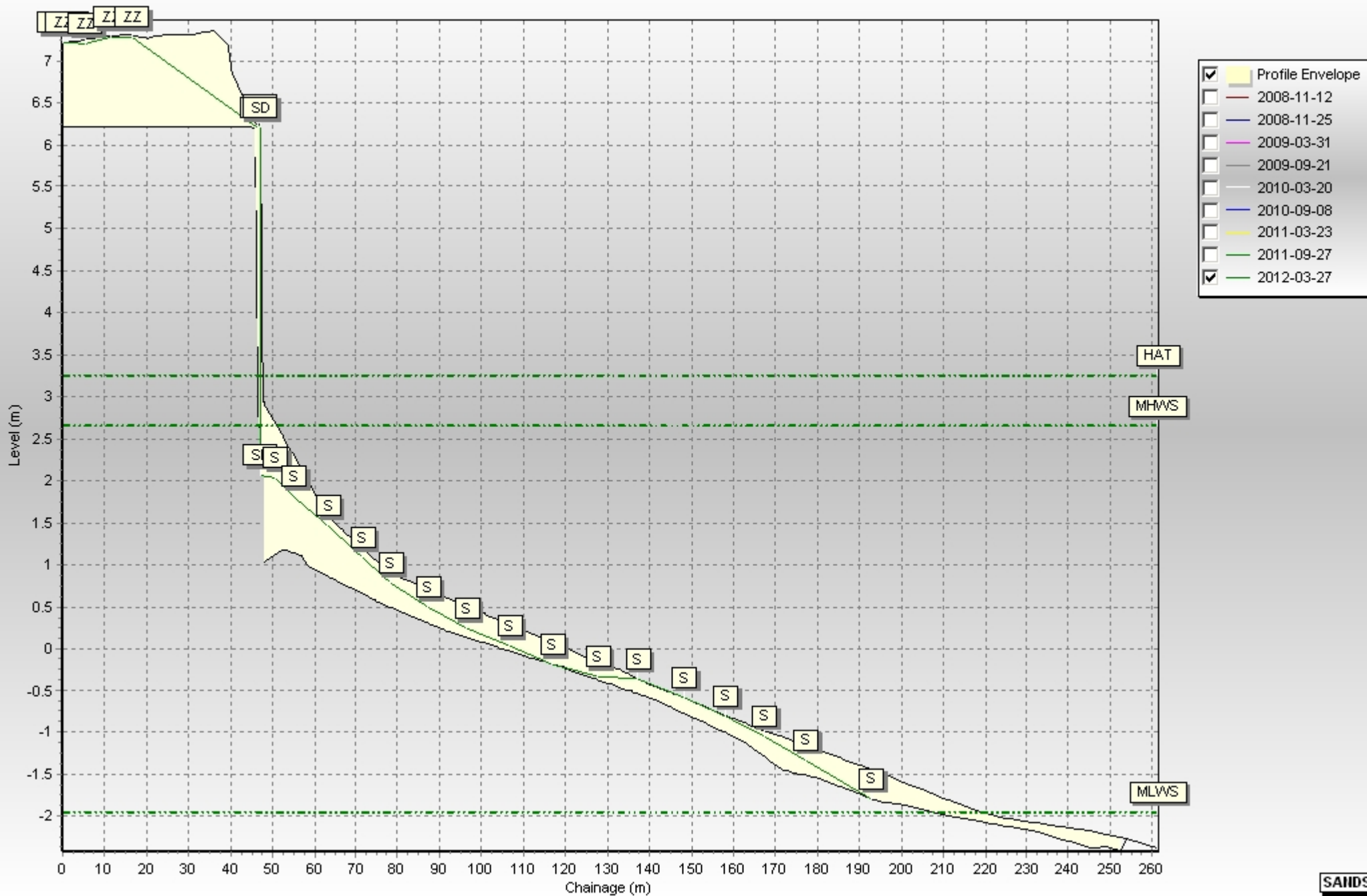
Beach Profiles: 1cHN3



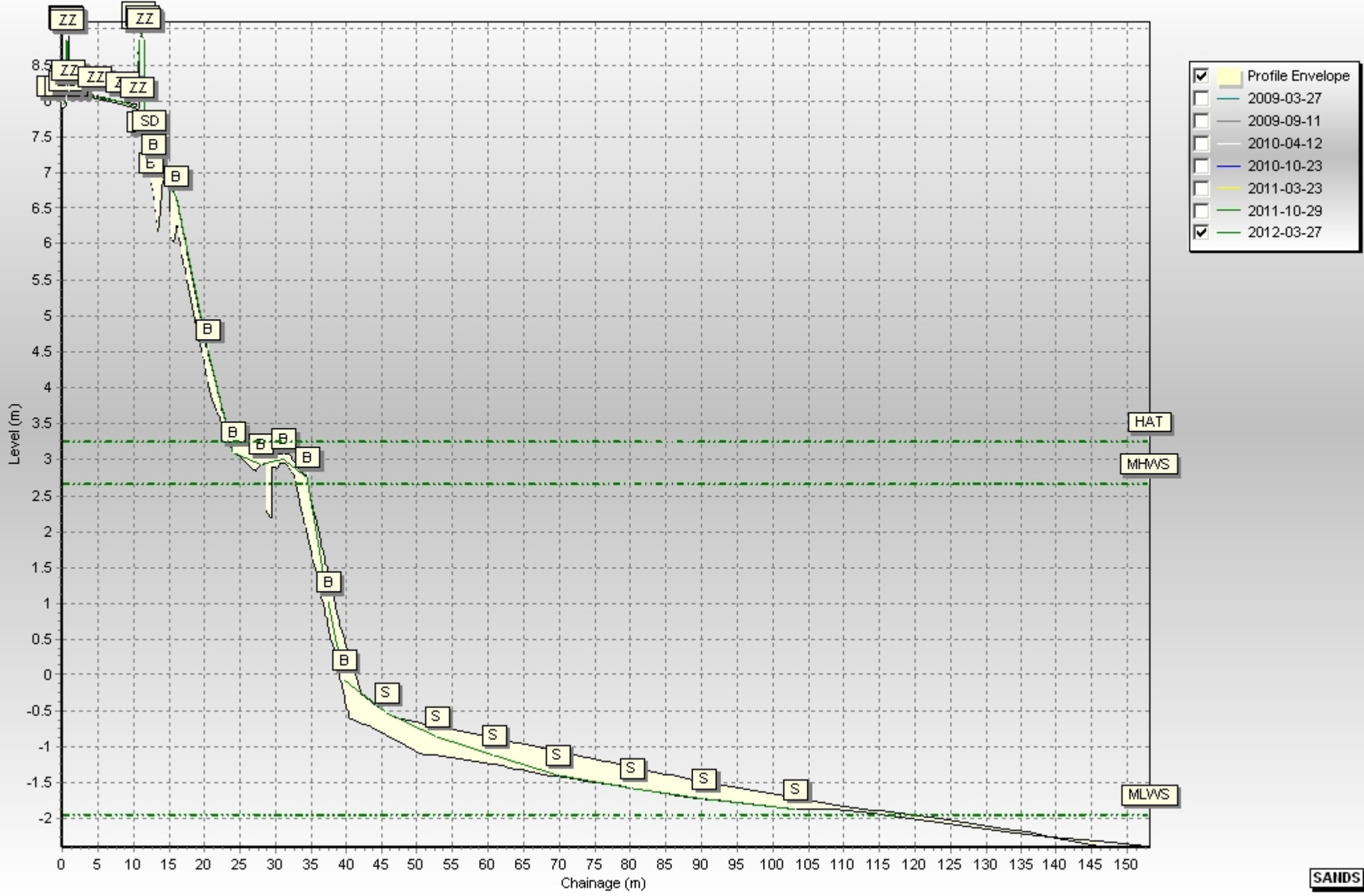
Beach Profiles: 1cHN4



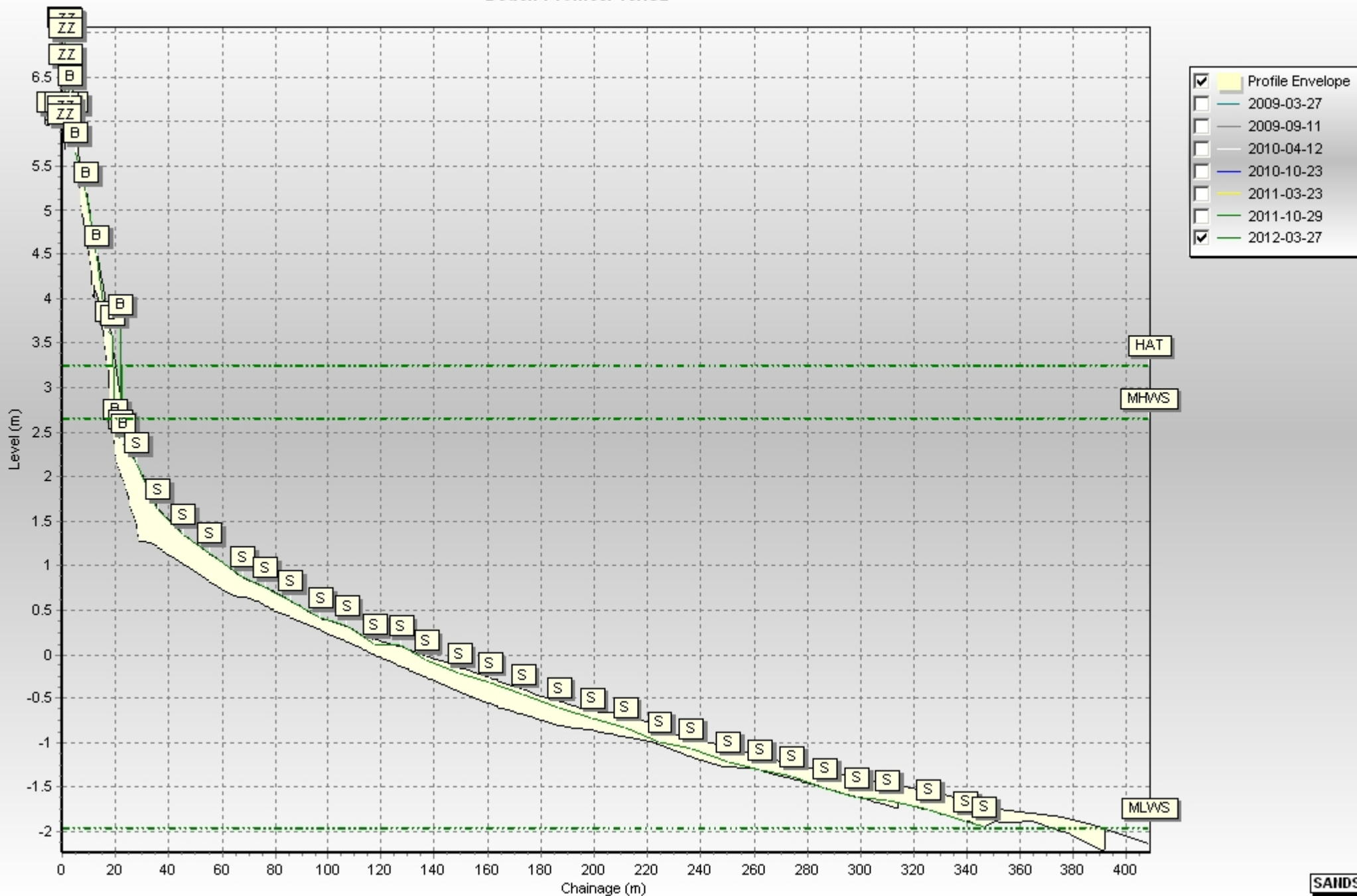
Beach Profiles: 1cHC1



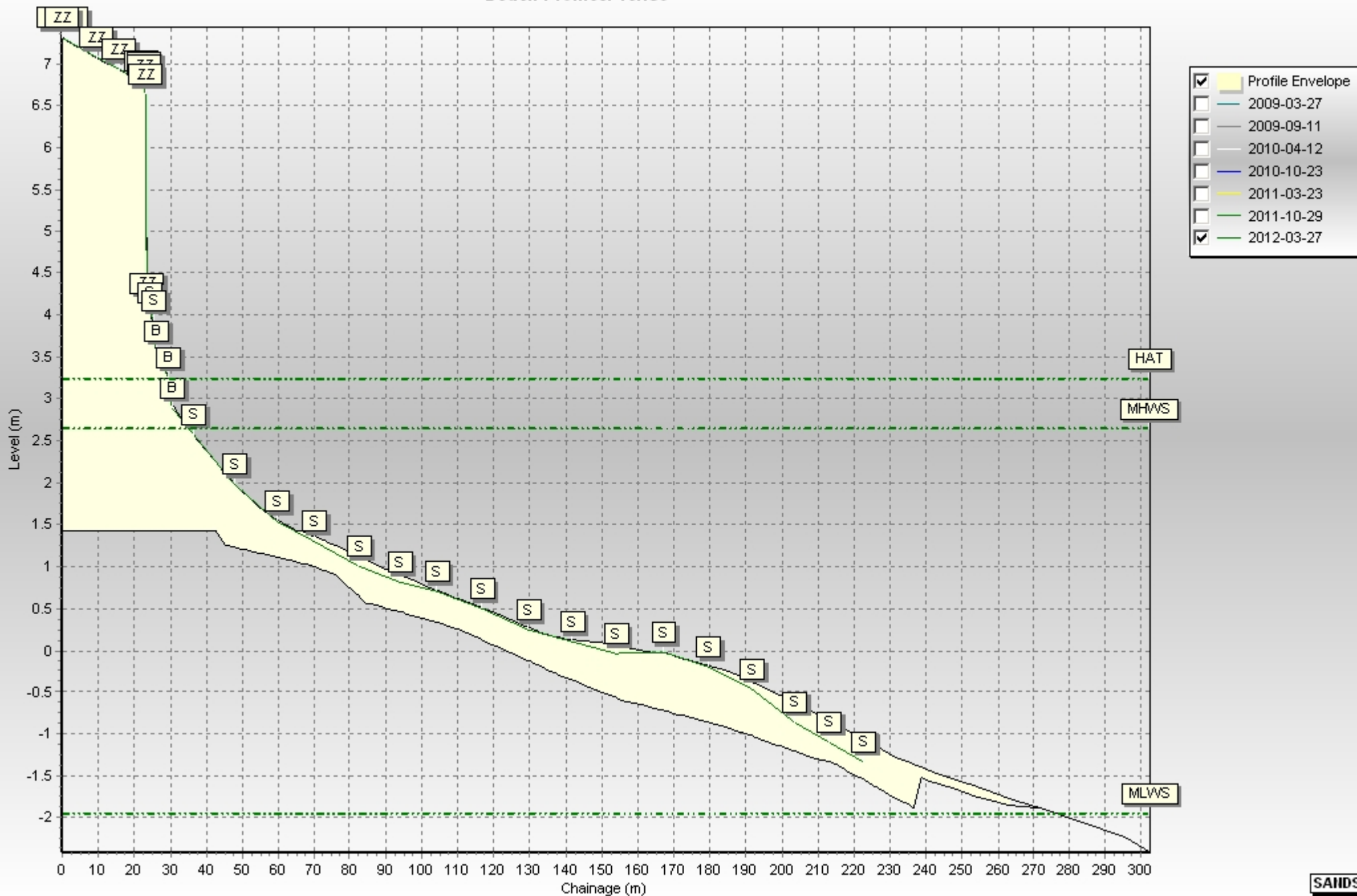
Beach Profiles: 1cHS1



Beach Profiles: 1cHS2



Beach Profiles: 1cHS3



Beach Profiles: 1cHS4

