

**Cell 1 Regional Coastal Monitoring Programme  
Update Report 2: 'Partial Measures' Survey 2010**



**Durham County Council  
Final Report**

**May 2010**

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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
m	metres
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWS	Mean Low Water Neap
MLWS	Mean Low Water Spring
MSL	Mean Sea Level
ODN	Ordnance Datum Newlyn

## Water Levels Used in Interpretation of Changes

Water Level Parameter	Water Level (mODN)			
	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 (mODN)			
	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
Water Level Parameter	Water Level (mODN)			
	Saltwick Nab to Hundale Point	Hundale Point to White Nab	White Nab to Filey Brigg	Filey Brigg to Flamborough Head
1 in 200 year	3.88	3.93	3.93	4.04
HAT	3.10	3.05	3.05	3.10
MHWS	2.60	2.45	2.45	2.50
MLWS	-2.20	-2.35	-2.35	-2.30

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

## Glossary of Terms

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

## Preamble

The Cell 1 Regional Coastal Monitoring Programme covers approximately 300km of the north east coastline, from the Scottish Border (just south of St. Abb's Head) to Flamborough Head in East Yorkshire.

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	June 09	-
2	2009/10	Sep-Dec 09	Mar 10	Mar-April 10	May 10 <sup>(*)</sup>	-

<sup>(\*)</sup> The present report is **Update Report 2** and provides an analysis of the 2010 Partial Measures survey for Durham County Council's frontage. It is intended as a brief update of the key findings from this survey to maintain an understanding of ongoing changes.

# **1. Introduction**

## **1.1 Study Area**

Durham County Council's frontage extends from Ryhope Dene to Crimdon Beck. For the purposes of this report, it has been sub-divided into five 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 8 no. transect lines
- Partial Measures survey annually each spring comprising:
  - Beach profile surveys along 5 no. transect lines
- Cliff top survey bi-annually at:
  - Seaham (Dawdon)

The location of these surveys is shown in Figure 1. They have also previously been provided on a digital file which can be opened in Google Earth showing the locations of the surveys.

The Partial Measures survey was undertaken along this frontage in March 2010, when weather conditions were fine, bright but occasionally breezy and the sea state was calm.

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.

442000

443000

444000

0 200 400 Metres

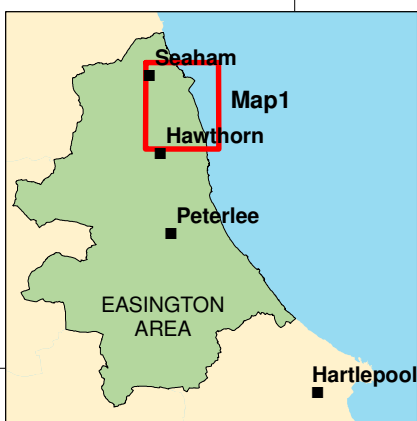
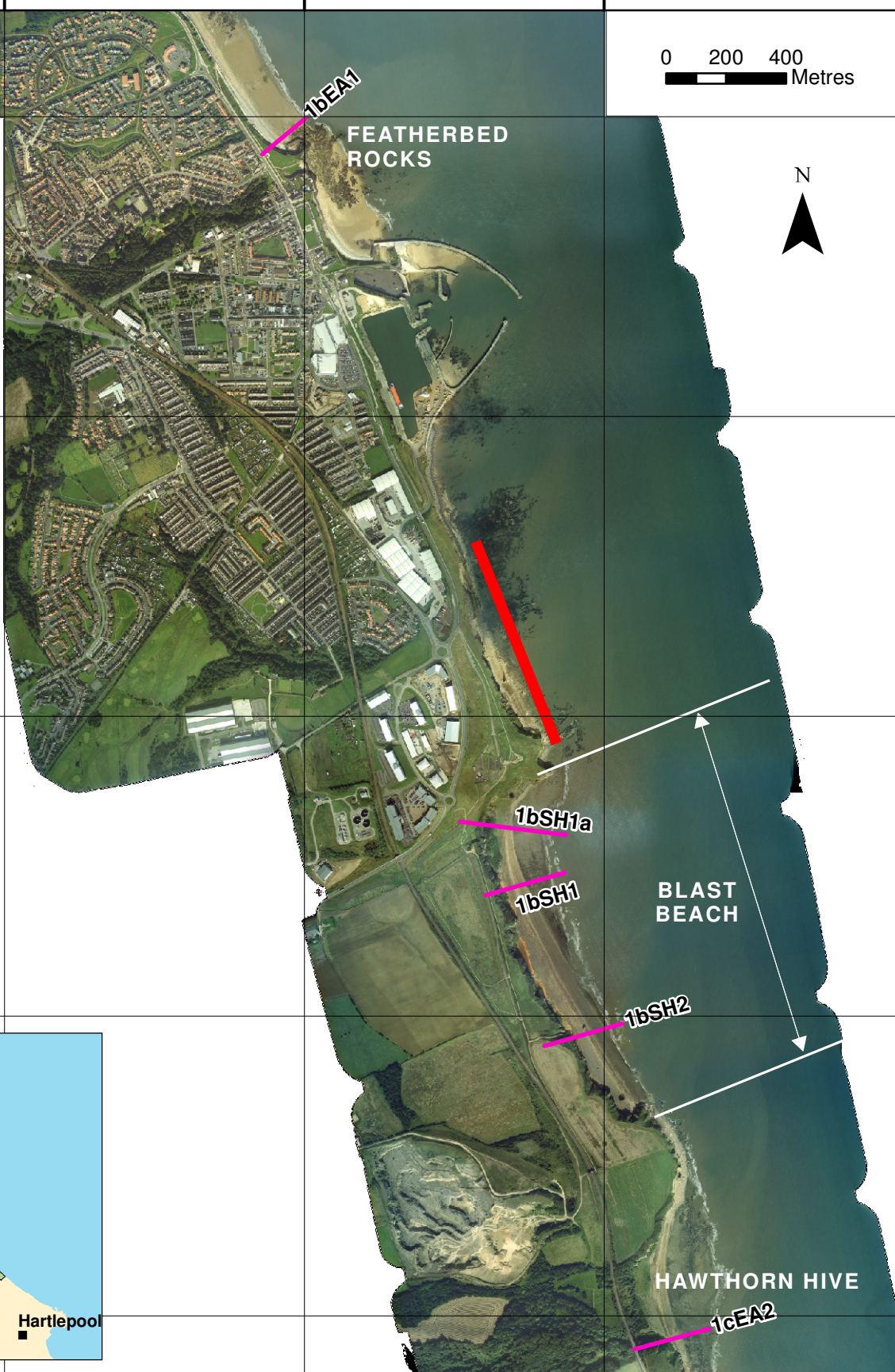
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**TOPOGRAPHIC SURVEY LOCATIONS**

-  Annual Profile
  -  Bi-Annual Profile
  -  6 monthly Survey
  -  Yearly Survey
  -  5 yearly Survey
  -  Cliff Top Survey @ 50 centres
  -  Cliff Top Survey @ 100 centres
  -  Cliff Top Survey @ 300 centres
- (Indicative Survey Extents shown)*

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

**Figure 1 - Map 1  
Durham County  
Council Frontage**

Update Report 2  
'Partial Measures' Survey 2010

Drawing Scale 1:20,000 at A4



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Approved by: NC Date: 24/05/2010

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## 2. Analysis of Survey Data

### 2.1 Featherbed Rocks

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2010	<p><b>Beach Profiles:</b></p> <p>Featherbed Rocks is covered by one beach profile line (EA1) during the Partial Measures survey (Appendix A).</p> <p>The shingle berm, which previously had a quite distinct near-vertical seaward-facing edge around HAT and a 'ramped' profile between there and the toe of the sea wall, has been flattened, reducing beach levels just seaward of the toe of the wall by around 1m. Further seaward along the profile, the lowest beach levels since surveys began in April 2009 were recorded, exposing rock outcrops along the lower foreshore.</p>	<p>Whilst there has been a longer-term net tendency for accretion of shingle at this location, the March 2010 survey shows that erosion has occurred over the winter of 2009/2010. There appears to have been a net export of shingle from this profile, suggesting some drawdown and movement (temporarily) offshore. It is expected that over the summer of 2010 much of this material will return to shore and re-form the ramped profile characteristics of this site.</p>

### 2.2 Seaham (Dawdon)

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2010	<p><b>Cliff Top Survey:</b></p> <p>Three ground control points have been established along the cliff top at Dawdon (Figure B1).</p> <p>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. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.</p> <p>Appendix B provides results from the March 2010 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 ground control points at the northern and southern locations previously recorded substantial erosion between November 2008 and March 2009. Between October 2009 and March 2009 there is an apparent growth in cliff top position at these two locations. This could be due to the onset of a toppling failure, but is more likely to be associated with the limits of accuracy of the surveying techniques, indicating why a long-term record is important. The central ground control point remained stable.</p>



### 2.3 Blast Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2010	<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 SH1a being added in October 2009.</p> <p>SH1a shows stability in the form, height and position of the vertical cliff-edge at the seaward face of the spoil beach. The backing wide spoil beach and cliffs remain stable, with minor changes in the foreshore causing only a modest reduction locally in beach levels.</p> <p>SH1 shows yet further accretion of sediment on the foreshore fronting the beach comprised of colliery spoil. This has raised beach levels here by up to a further 0.5m. The edge of the colliery spoil has not eroded.</p> <p>SH2 shows measurable erosion at the seaward face of the spoil beach, with the cliffed front edge cutting landwards by around 6.5m. There is now a reduce width of around 38m of spoil beach in front of the relic cliff. In addition to this, the foreshore has also lowered by up to 1m.</p>	<p>The previous trend identifying a small amount of redistribution of beach sediment from the southern frontage to the northern frontage appears to have continued, but now there has been measurable erosion of the colliery spoil beach along SH2.</p>

### 2.4 Hawthorne Hive

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2010	<p><b>Beach Profiles:</b></p> <p>Hawthorne Hive is covered by one beach profile line (EA2) during the Partial Measures survey (Appendix A).</p> <p>The foreshore has shown some modest accretion since October 2009, and levels are now generally mid-way between the envelope of previous surveys. The outlet channel of Hawthorne Hive remained in a relatively constant position (at this profile line).</p>	<p>The stability in the channel position resulted in modest accretion along the foreshore.</p>

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

Beach profiles SH1, SH2 and EA2 extend across cliff tops, each with difficult access to the cliff edge. This has led to slightly different levels of detail being picked up in these difficult areas between successive surveys. This gives rise to minor 'apparent' changes in the cliff face or cliff top which are not true. However, once crossing the foreshore there are no such problems and the survey accuracy is restored.

The cliff top position surveys at Dawdon are assumed to have a limit of accuracy of  $\pm 0.1\text{m}$  due to the techniques used. Whilst an annual erosion rate has been calculated from these cliff top survey data, it is really too early in the monitoring for this to be a meaningful rate at present. This will improve with longevity of the data record, however, to yield a more meaningful longer-term mean rate.

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

No changes are recommended at the present time.

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

- Despite the longer-term trend of accretion, the shingle along the foreshore at profile EA1 has been redistributed from the 'ramp' that built up at the toe of the sea wall and promenade. It is likely that this material has been (temporarily) washed offshore during the winter storms of 2009/2010.
- The previous substantial cliff top recession observed at both the northern and southern ground control points along Dawdon cliff does not appear to be continuing at the same rate month by month. Instead the recession is likely to be episodic.
- There has been no erosion of the colliery spoil along northern sections of Blast Beach, but along SH3 the edge of the spoil has cut back by 6.5m. Whilst there remains a substantial width of spoil in front of the relic cliffs, this is the first record of cut-back since the monitoring began in November 2008.
- The outlet channel of Hawthorne Hive remained in a relatively constant position, enabling a modest amount of beach accretion.

## **Appendices**

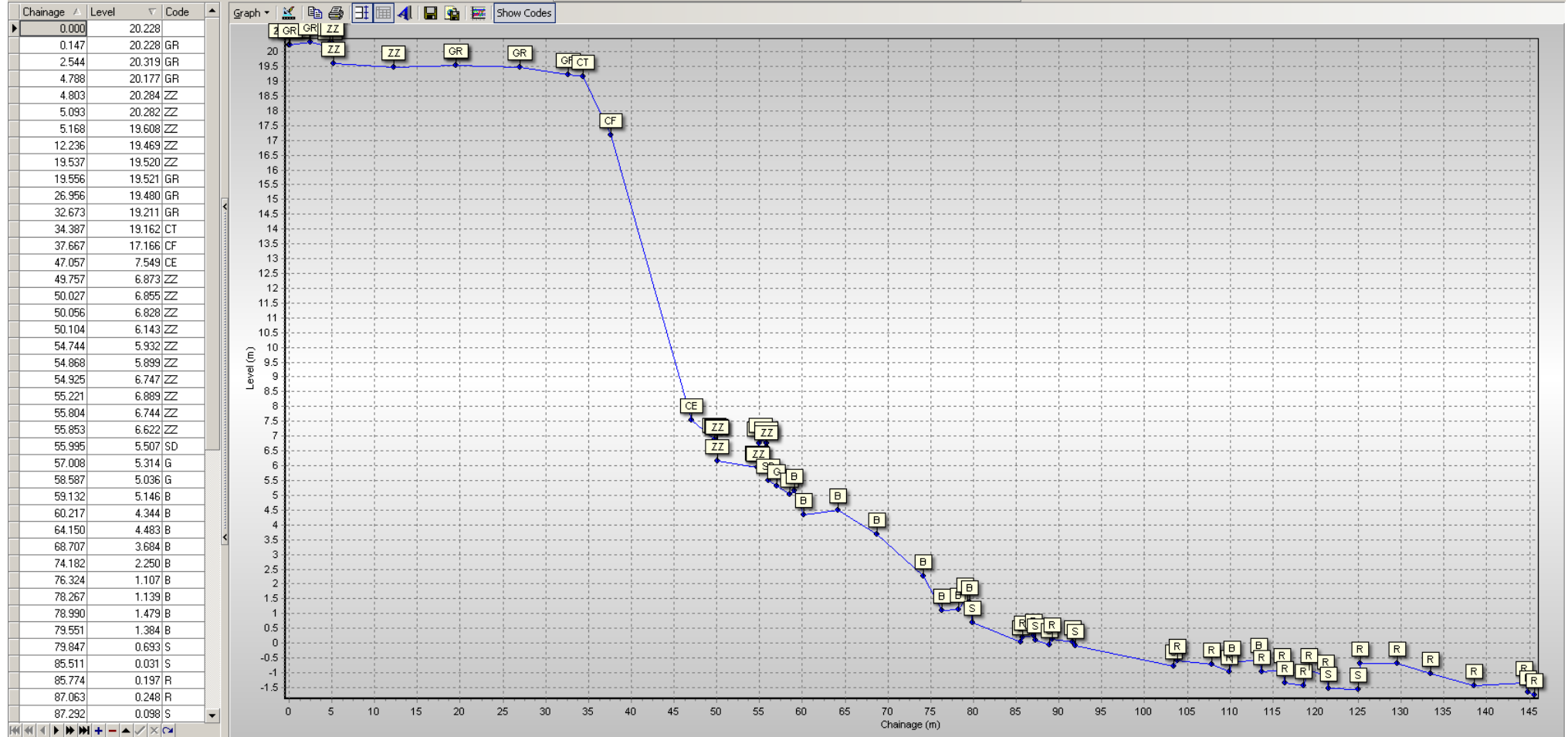
**Appendix A**  
**Beach Profiles**

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

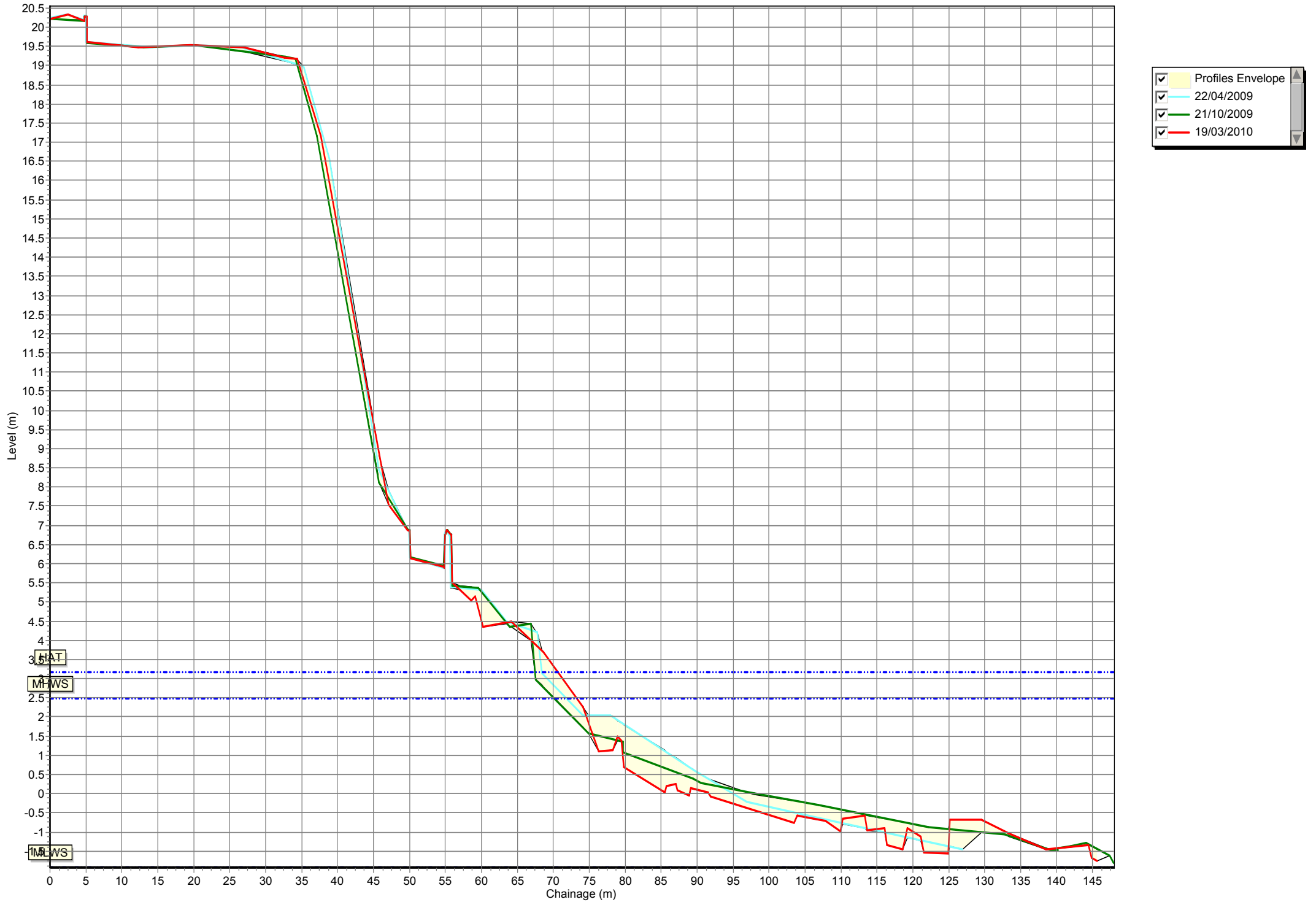
<b>Code</b>	<b>Description</b>
M	Mud
S	Sand
G	Gravel
GS	Gravel & Sand
GM	Gravel & Mud
MS	Mud & Sand
B	Boulders
R	Rock
SD	Sea Defence
SM	Salt Marsh
GR	Grass
D	Dune (non-vegetated)
DV	Dune (vegetated)
F	Forested
X	Mixture
FB	Obstruction
CT	Cliff Top
CE	Cliff Edge
CF	Cliff Face
SH	Shell
W	Water Body
ZZ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

# Durham

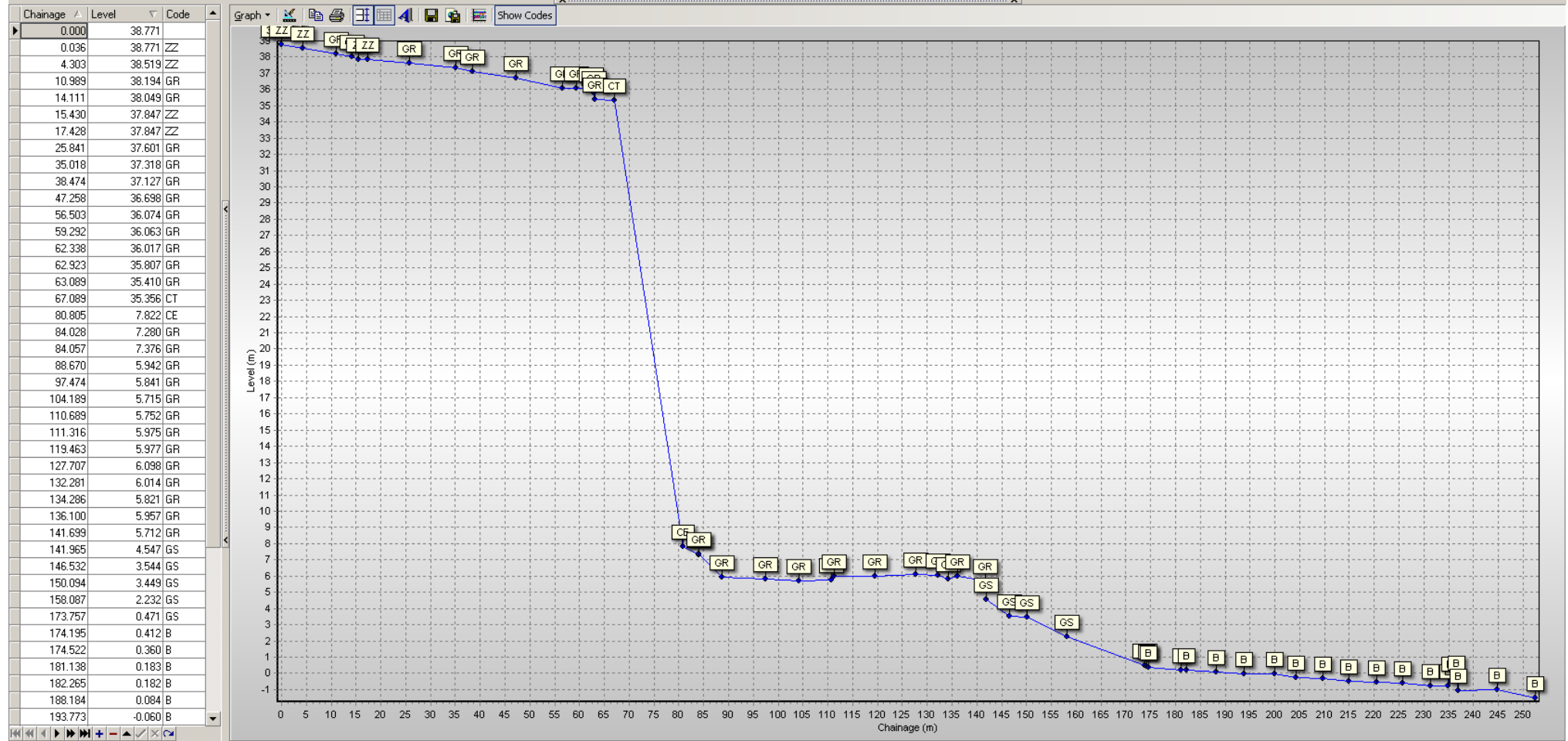
## 1bEA1 – 19/03/2010



# Beach Profiles: 1bEA1

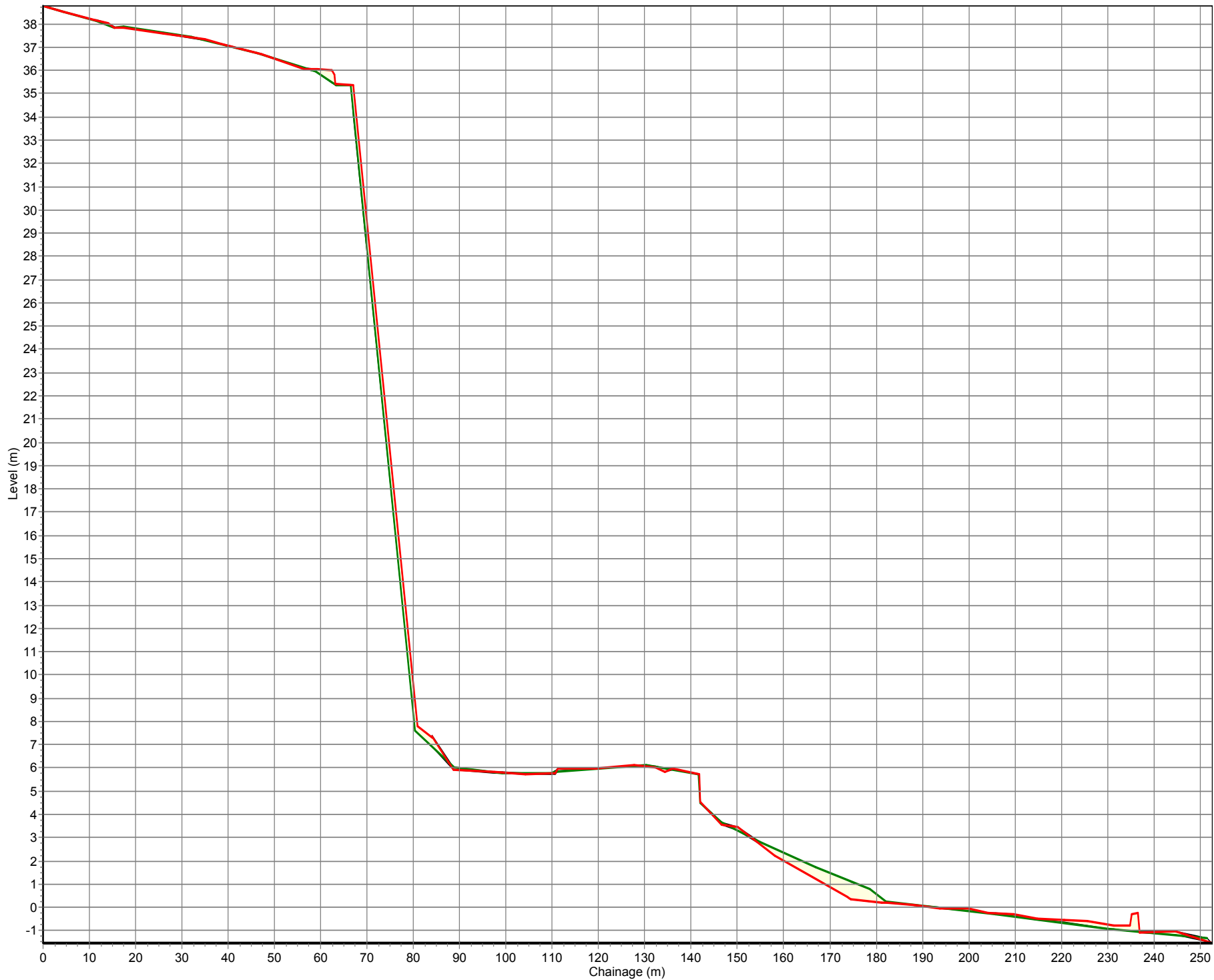


# 1bSH1a – 19/03/2010





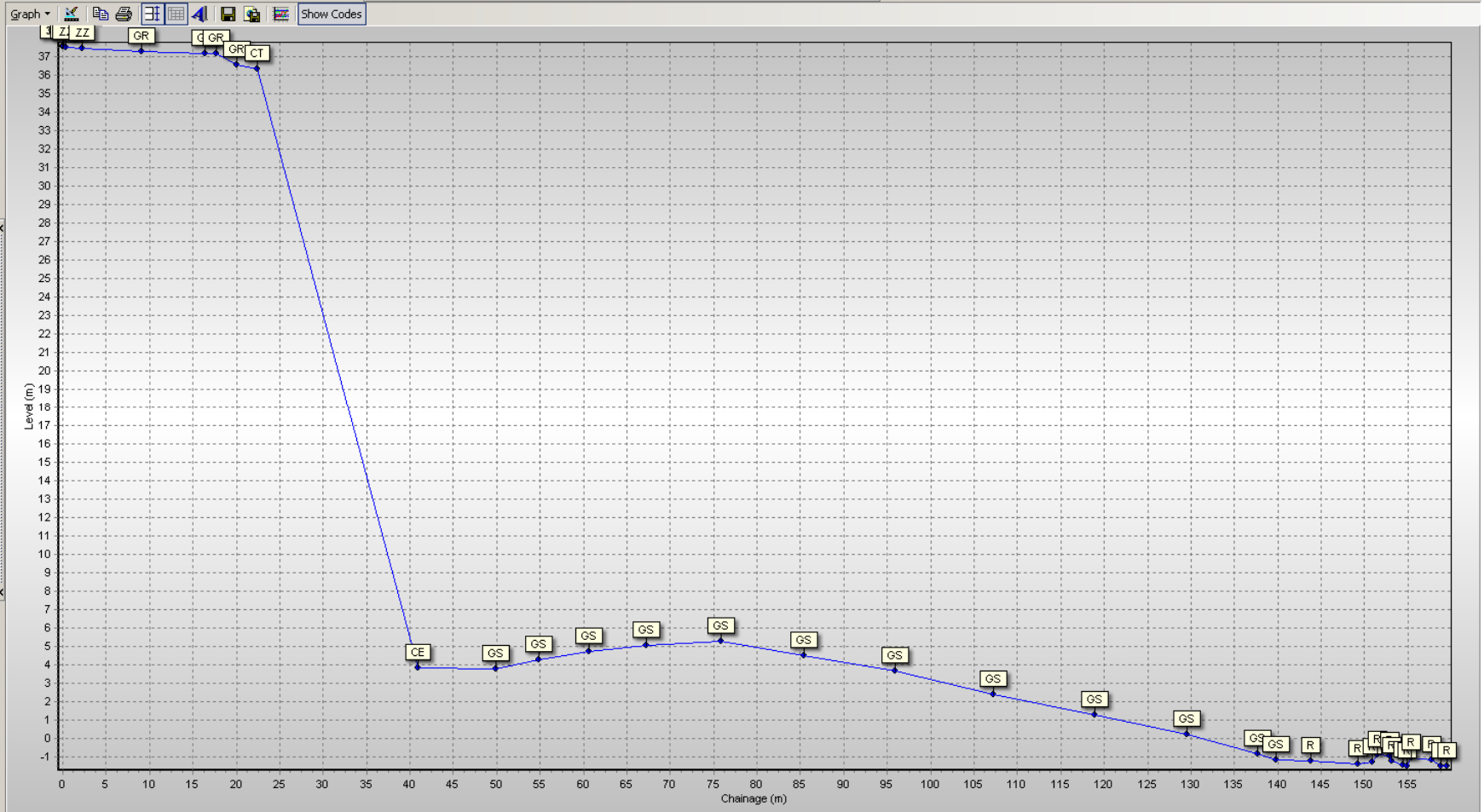
Beach Profiles: 1bSH1a



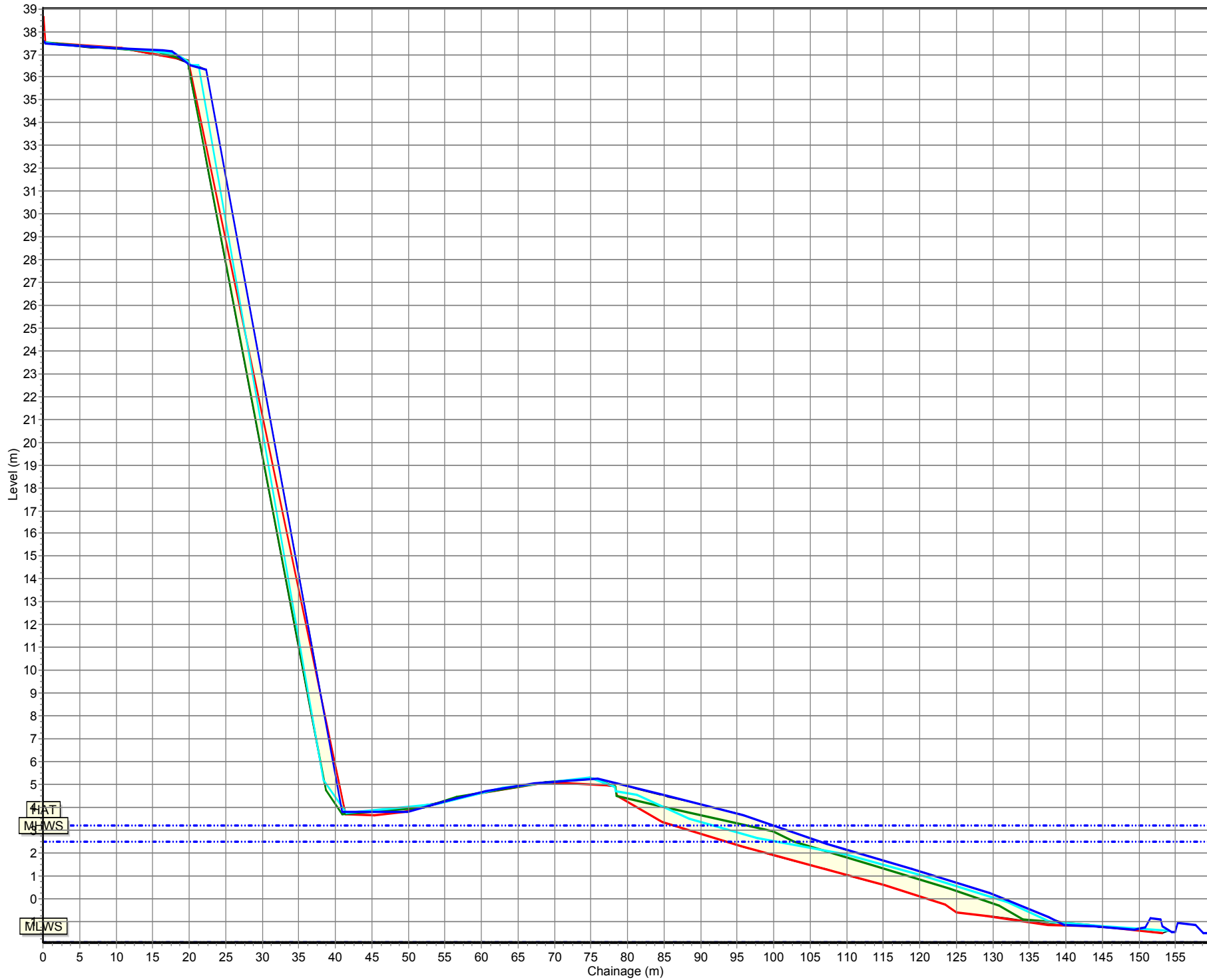
- Profiles Envelope
- 21/10/2009
- 19/03/2010

# 1bSH1 – 19/03/2010

Chainage	Level	Code
0.000	37.555	
0.068	37.555	ZZ
0.403	37.476	ZZ
2.198	37.444	ZZ
9.122	37.298	GR
16.347	37.165	GR
17.665	37.144	GR
20.071	36.531	GR
22.371	36.323	CT
40.900	3.803	CE
49.897	3.785	GS
54.881	4.268	GS
60.591	4.692	GS
67.298	5.034	GS
75.851	5.267	GS
85.460	4.472	GS
95.880	3.636	GS
107.184	2.405	GS
118.974	1.280	GS
129.538	0.230	GS
137.647	-0.834	GS
139.756	-1.187	GS
143.858	-1.234	R
149.294	-1.389	R
150.879	-1.289	R
151.527	-0.891	R
152.950	-0.928	R
153.170	-1.219	R
154.442	-1.471	R
154.956	-1.481	R
155.333	-1.081	R
157.768	-1.182	R
158.781	-1.505	R
159.506	-1.503	R



# Beach Profiles: 1bSH1

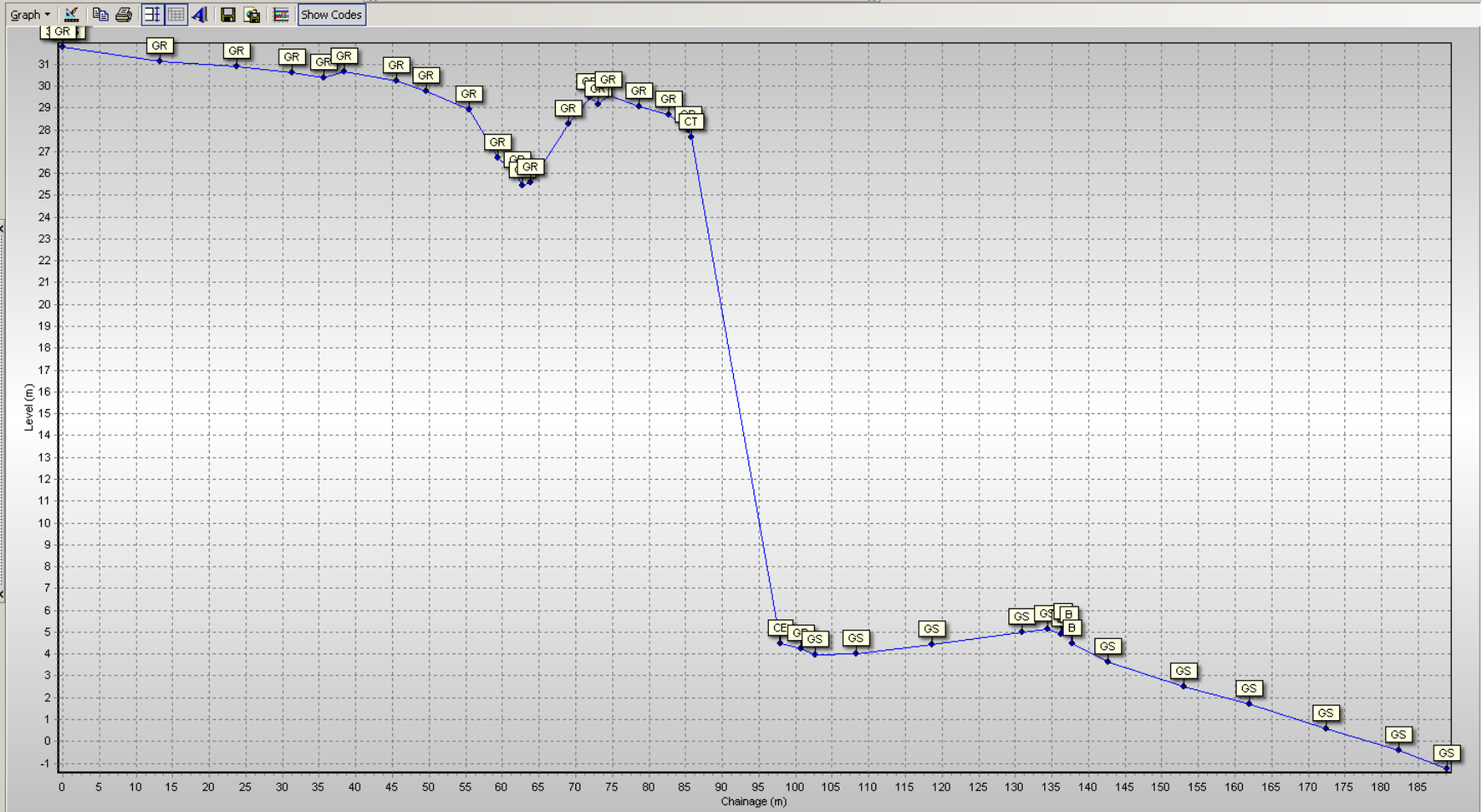


- Profiles Envelope
- 25/11/2008
- 22/04/2009
- 21/10/2009
- 19/03/2010

HAT  
MHW  
MLWS

# 1bSH2 – 19/03/2010

Chainage	Level	Code
0.000	31.786	
0.015	31.786	GR
13.246	31.125	GR
23.743	30.906	GR
31.250	30.617	GR
35.603	30.368	GR
38.403	30.647	GR
45.545	30.224	GR
49.657	29.772	GR
55.540	28.914	GR
59.381	26.708	GR
61.990	25.897	GR
62.676	25.422	GR
63.823	25.597	GR
68.969	28.261	GR
71.972	29.460	GR
73.015	29.170	GR
74.507	29.578	GR
78.677	29.070	GR
82.692	28.670	GR
85.329	27.984	GR
85.849	27.649	CT
97.996	4.489	CE
100.739	4.238	GR
102.768	3.964	GS
108.276	3.996	GS
118.689	4.451	GS
130.875	5.004	GS
134.442	5.121	GS
136.255	4.889	B
136.501	5.211	B
137.293	5.103	B
137.795	4.487	B
142.666	3.652	GS
153.070	2.516	GS
161.948	1.709	GS
172.367	0.577	GS
182.313	-0.388	GS
188.923	-1.257	GS



# Beach Profiles: 1bSH2



- Profiles Envelope
- 22/04/2009
- 21/10/2009
- 19/03/2010

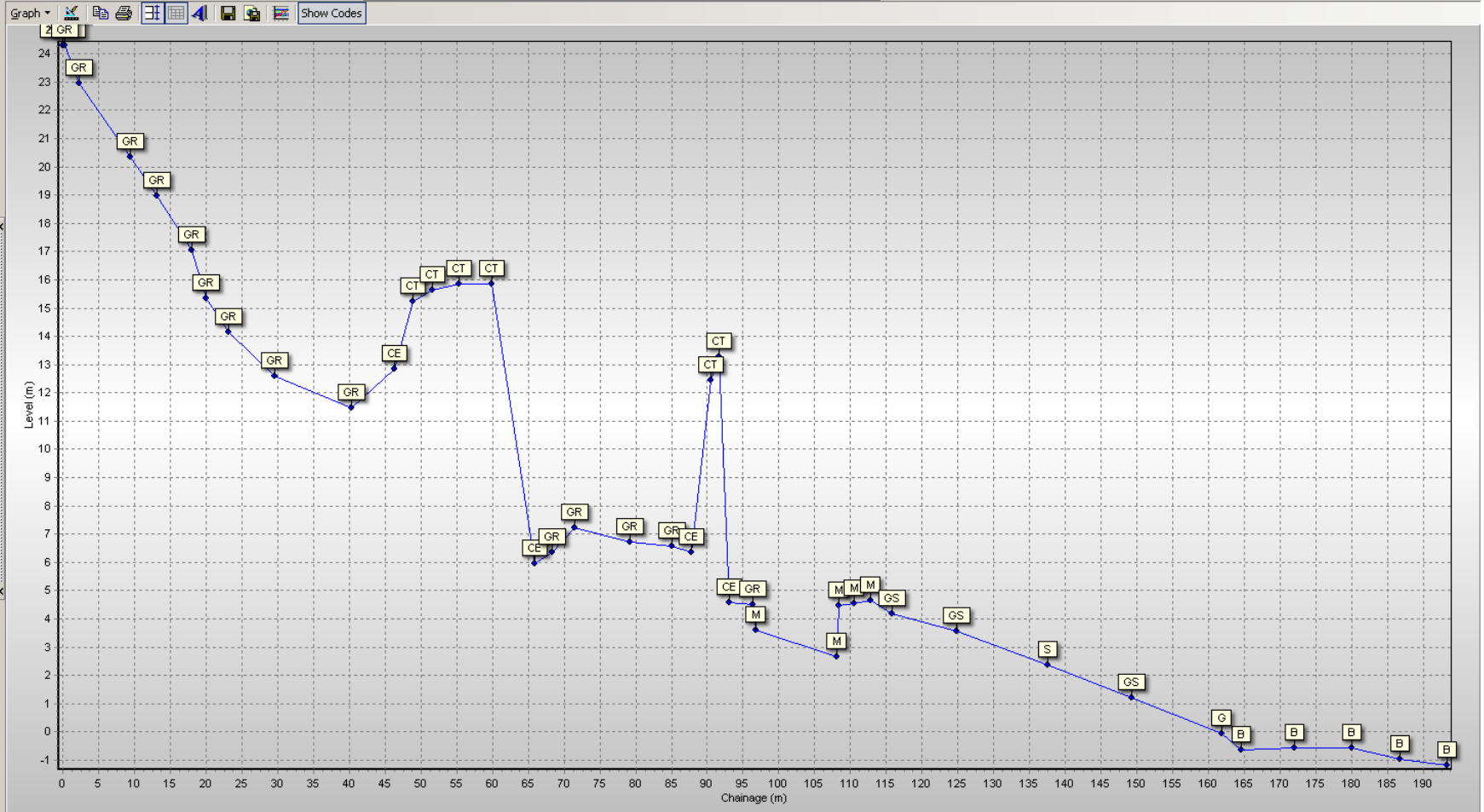
FHT

M+WS

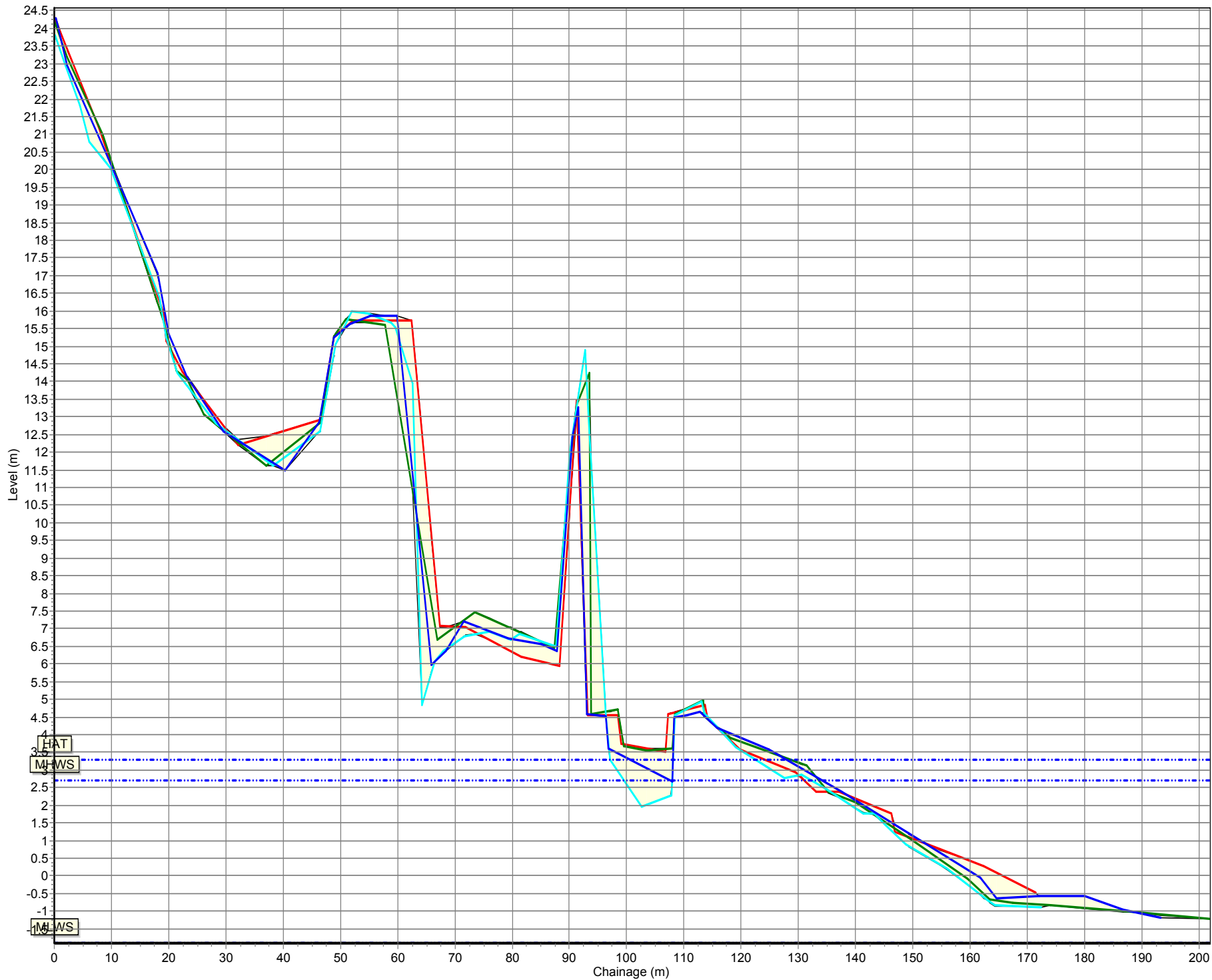
MLWS

1cEA2 – 19/03/2010

Chainage	Level	Code
0.000	24.295	
0.335	24.295	GR
2.306	22.952	GR
9.417	20.337	GR
13.122	18.951	GR
18.003	17.049	GR
20.021	15.353	GR
23.187	14.153	GR
29.555	12.585	GR
40.314	11.473	GR
46.287	12.853	CE
48.891	15.235	CT
51.641	15.623	CT
55.265	15.854	CT
59.879	15.862	CT
65.936	5.968	CE
68.408	6.374	GR
71.486	7.213	GR
79.265	6.735	GR
85.119	6.575	GR
87.846	6.357	CE
90.498	12.434	CT
91.638	13.264	CT
93.045	4.566	CE
96.396	4.521	GR
96.809	3.607	M
108.036	2.674	M
108.357	4.471	M
110.526	4.563	M
112.768	4.655	M
115.747	4.179	GS
124.842	3.570	GS
137.564	2.366	S
149.201	1.200	GS
161.852	-0.053	G
164.604	-0.633	B
172.027	-0.564	B
180.071	-0.568	B
186.759	-0.974	B
193.300	-1.180	B



Beach Profiles: 1cEA2



- Profiles Envelope
- 03/12/2008
- 22/04/2009
- 21/10/2009
- 19/03/2010

HAT  
MHW  
MLW

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



## Cliff Top Survey

### Seaham (Dawdon)

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. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table B1 provides information about these ground control points and results from the 2008 (baseline), previous and present cliff top surveys 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	Level (mODN)	Bearing (°)	Baseline Survey (Nov 2008)	Previous Survey (Oct 2009)	Present Survey (Mar 2010)	Baseline (Nov 2008) to Present (Mar 2010)	Previous (Oct 2009) to Present (Mar 2010)	Baseline (Nov 2008) to Present (Mar 2010)
1	443515	548422	25.1	70	16.1	15.1	15.5	0.6	-	0.45
2	443608	548136	28.0	90	13.3	13.2	13.2	0.1	0.0	0.08
3	443756	547859	27.6	95	14.8	13.7	13.9	0.9	-	0.68

**Note:** It is assumed that the accuracy of cliff top monitoring using this technique is  $\pm 0.1$ m. Therefore observed changes have been altered by this amount, where necessary, prior to calculation of annual erosion rates.

443000

444000



SEAHAM

BLAST BEACH

1

2

3



Cliff Top Monitoring Points

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

### Appendix B - Map 1 Durham County Council Frontage

Update Report 2  
'Partial Measures' Survey 2010

Drawing Scale 1:10,000 at A4



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