



**Cell 1 Regional Coastal Monitoring Programme  
Analytical Report 3: 'Full Measures' Survey 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
MLWN	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. This coastline is often referred to as 'Coastal Sediment Cell 1' in England and Wales (Figure 1). Within this frontage the coastal landforms vary considerably, comprising low-lying tidal flats with fringing salt marshes, hard rock cliffs that are mantled with glacial till to varying thicknesses, softer rock cliffs, and extensive landslide complexes.

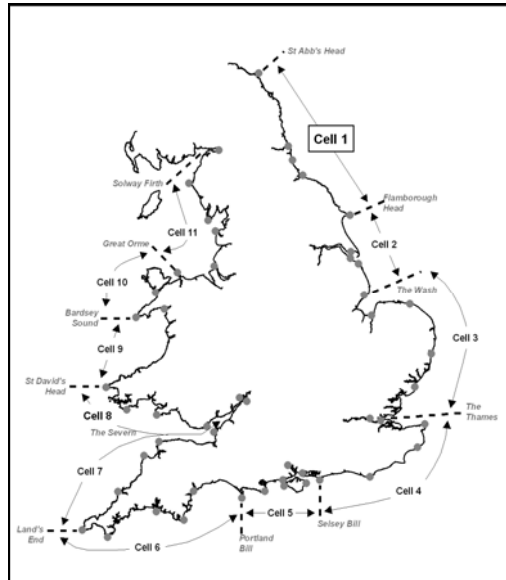


Figure 1 Sediment Cells in England and Wales

The programme commenced in its present guise in September 2008 and is managed by Scarborough Borough Council on behalf of the North East Coastal Group. It is funded by the Environment Agency, working in partnership with the following organisations.



The data collection, analysis and reporting is being undertaken as a partnership between the following organisations:



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

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

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

Each year, an Analytical Report is produced for each individual authority, providing a detailed analysis and interpretation of the 'Full Measures' surveys.

This is followed by a brief Update Report for each individual authority, providing ongoing findings from the 'Partial Measures' surveys.

A Cell 1 Overview Report will also be produced periodically. This will provide a region-wide summary of the main findings relating to trends and interactions along the entire Cell 1 frontage within distinct time phases of the programme, defined by specific funding allocations. The first such report is expected to be produced in spring 2011 (covering 2008 – 2011) when the initial three year funding allocation comes towards an end.

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	Nov 08	May 09	Mar 09	June 09	-
2	2009/10	Oct 09	Mar 10	Mar 10	May 10	-
3	2010/11	Sep 10	Nov 10 <sup>(*)</sup>			

<sup>(\*)</sup> The present report is **Analytical Report 3** and provides an analysis of the 2010 Full Measures survey for Durham County Council's frontage.

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

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

**Table 2 Sub-divisions of the Cell 1 Coastline**

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



## 1. Introduction

### 1.1 Study Area

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 2.

The Full Measures survey was undertaken along this frontage in September 2010. During the Featherbed Rocks, Seaham (Dawdon), Blast Beach and Hawthorn Hive surveys the weather conditions were wet and windy and the sea state was flat but with a heavy swell. For the surveys Blackhall Colliery surveys the weather improved to fine and dry and the sea state was medium calm.

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

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

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

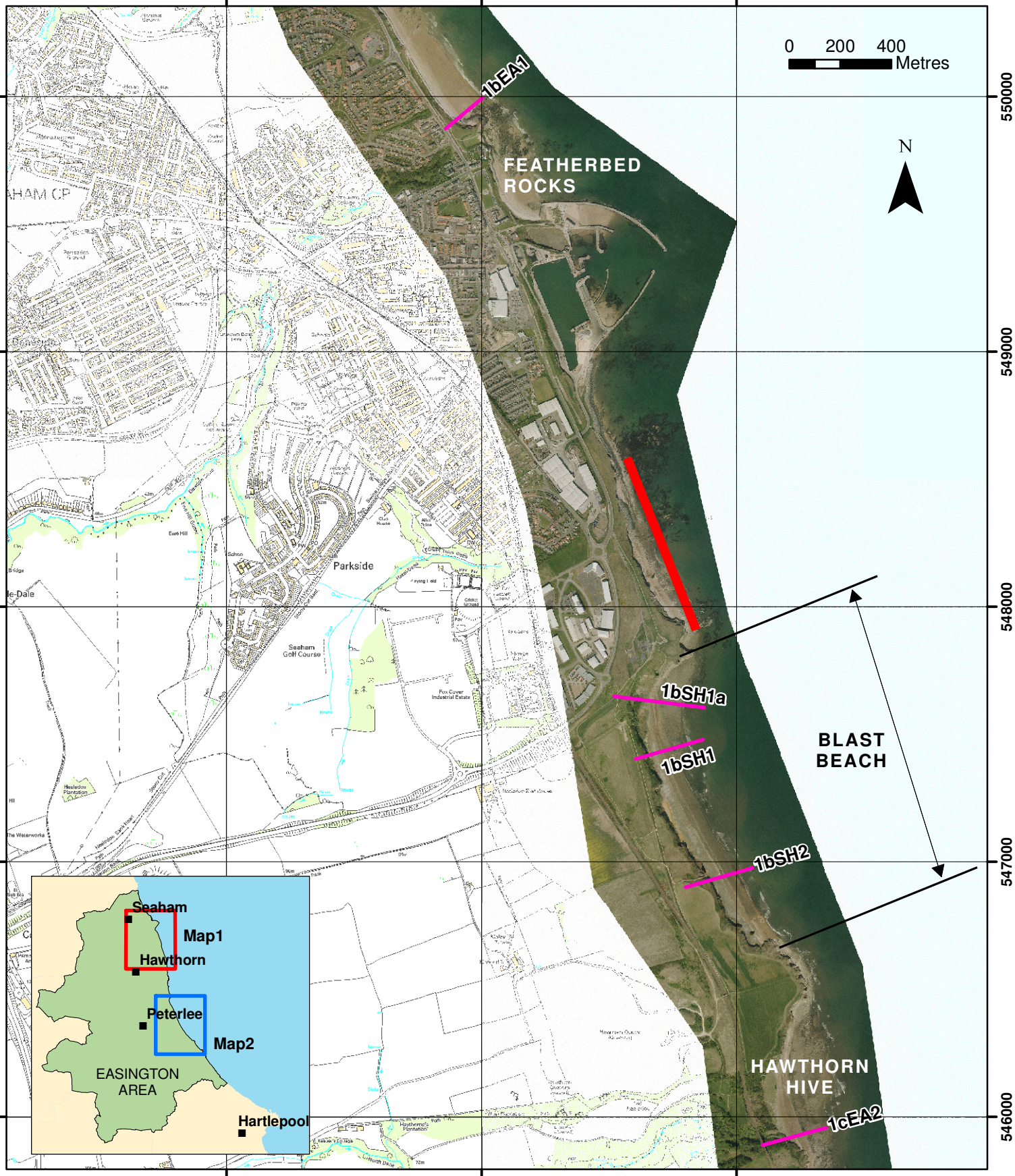
- description of the changes observed since the previous survey and an interpretation of the drivers of these changes (Section 2);
- documentation of any problems encountered during surveying or uncertainties inherent in the analysis (Section 3);
- recommendations for 'fine-tuning' the programme to enhance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

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

442000

443000

444000



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

Analytical Report 3  
 'Full Measures' Survey 2010

Drawing Scale 1:20,000 at A4



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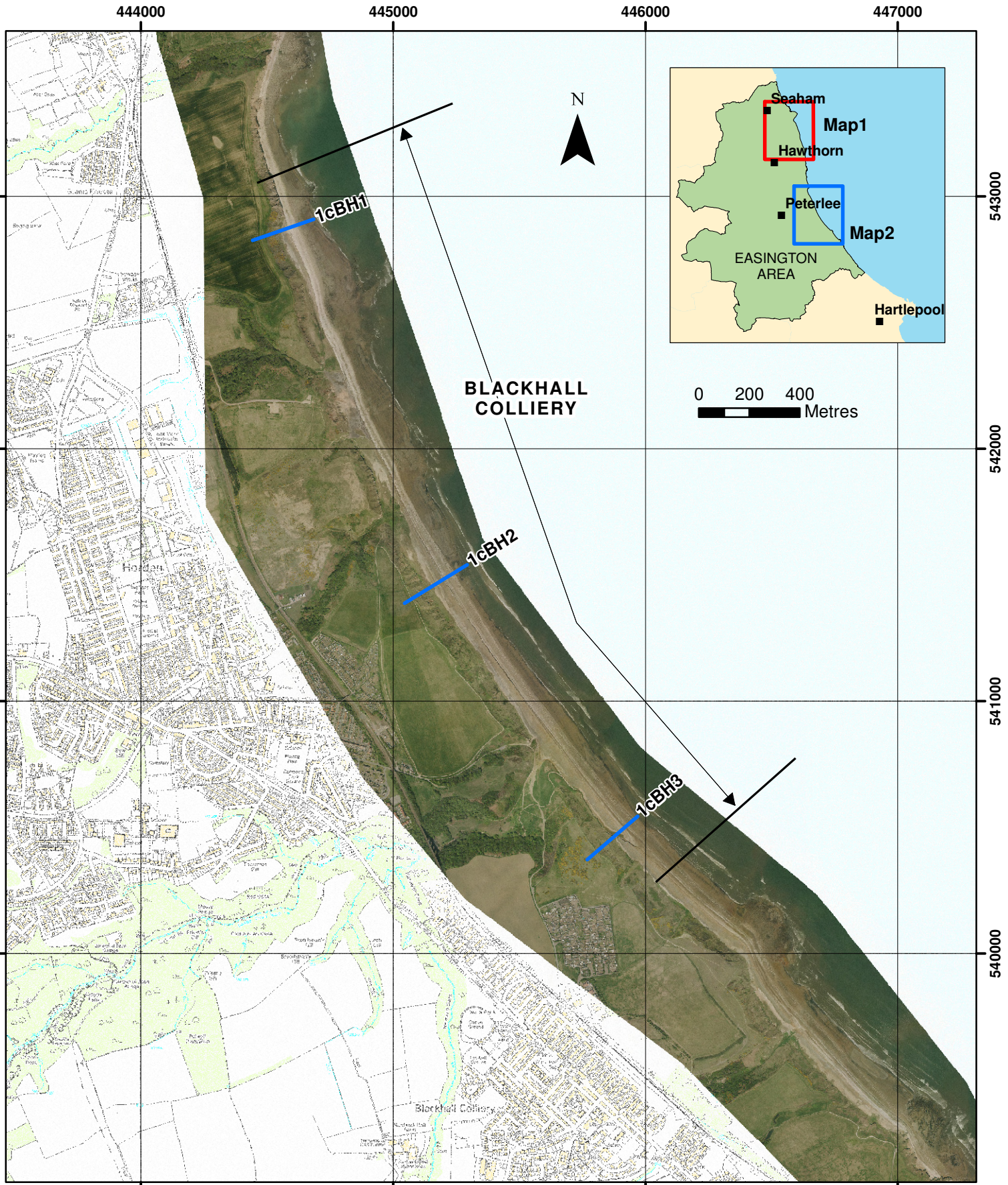


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 Checked by: MD      Date: 05/11/2010  
 Approved by: NC      Date: 05/11/2010

Photography courtesy of  
 North East Coastal Observatory  
 www.northeastcoastalobservatory.org.uk



- TOPOGRAPHIC SURVEY LOCATIONS**
- Annual Profile
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Client: North East Coastal Group  
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**Figure 2 - Map 2  
 Durham County Council Frontage**

Analytical Report 3  
 'Full Measures' Survey 2010

Drawing Scale 1:20,000 at A4



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## 2. Analysis of Survey Data

### 2.1 Featherbed Rocks

Survey Date	Description of Changes Since Last Survey	Interpretation
09-2010	<p><b>Beach Profiles:</b></p> <p>One beach profile line (EA1) is located at Featherbed Rocks (Appendix A). The profile line was relocated to its present position in March 2009. The profile extends across the cliff top, dipping slightly at the cliff edge to around 19mODN. It then drops down the cliff face to the toe of the cliff and then extends seawards across the promenade. The sea wall is then crossed, before the survey drops to beach level where a significant quantity of shingle has accumulated at the toe of the wall. The upper beach levels were similar in September 2010 to the previous survey of March 2010, but these are low than recorded on the two previous surveys where a wide berm of shingle was present at the toe of the wall. It is know from the summer 2010 walk-over inspections that shingle has again extended to the wall crest in places, so the slight reduction in levels to September 2010 must have occurred post-summer. Along the lower foreshore the levels have increased, with a veneer of sand now covering much of the previously exposed rock platform.</p>	<p>There is some degree of variability in the width of shingle present at the southern end of Seaham promenade, and a smaller degree of variability in level directly at the toe.</p> <p>There is also a tendency of a sand veneer to temporarily cover the rock foreshore, and then become stripped during high wave energy events.</p>

### 2.2 Seaham (Dawdon)

Survey Date	Description of Changes Since Last Survey	Interpretation
09-2010	<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. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top. Appendix B provides information about the ground control points and results from between the 2008 (baseline) cliff top survey and the current (September 2010) survey.</p>	<p>Overall, there has been recession along ground control points 1 and 3 by the order of 0.6m and 0.9m, respectively, since surveys began in November 2008. Cliffs at these ground control points appear to have experienced a large erosion event over the winter of 2008/09 and a small event between March and September 2010. No significant change has occurred along ground control point 2.</p>

## 2.3 Blast Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
09-2010	<p><b>Beach Profiles:</b></p> <p>Blast Beach is covered by three beach profile lines (Appendix A).</p> <p>Profile SH1a was added to the programme during the Full Measures survey in September 2010. It is located to the north of the previously-established SH1. All three profiles along Blast Beach exhibit similar forms, with a backing cliff, wide spoil beach with a distinct cliff at the seaward margin of the spoil and a gravel and sand foreshore extending down to the low water mark. The width of the spoil beach along SH1a is around 60m, reducing to around 35m along SH1 and SH2.</p> <p>Profile SH1a shows that the position of the edge of the colliery spoil has remained unchanged since surveys began along this transect in October 2009. Along SH1 the foreshore accretion previously observed has started to become eroded, moving back towards the near vertical edge of the colliery spoil. Along SH2, the measurable erosion of the near-vertical seaward face of the colliery spoil beach has continued, with a further 2m recession between March 2010 and September 2010. Furthermore, the face of the spoil has angled back to a sloped upper section, resulting in the 'cliff top' being some 5m landward of the position recorded previously.</p>	<p>Measurable changes along parts of Blast Beach were noted between October 2009 and March 2010 and these have continued to the present survey.</p> <p>The width of protective spoil beach fronting the cliffs along profiles SH1 and SH2 has now reduced from around 40m to around 35m. Profile SS1a to date remains unaffected.</p>

## 2.4 Hawthorne Hive

Survey Date	Description of Changes Since Last Survey	Interpretation
09-2010	<p><b>Beach Profiles:</b></p> <p>One beach profile line (EA2) is located at Hawthorne Hive (Appendix A).</p> <p>The outlet channel of Hawthorne Burn was slightly shallower than in the previous survey and the foreshore levels seaward of the channel had dropped slightly to new record low values in some places.</p>	<p>Although record low levels have been set along some parts of the foreshore, this is considered to be natural variation and is likely to recover.</p>

## 2.5 Blackhall Colliery

Survey Date	Description of Changes Since Last Survey	Interpretation
09-2010	<p><b>Beach Profiles:</b></p> <p>Blackhall Colliery is covered by three beach profile lines (Appendix A).</p> <p>BH1 is located near Horden Point and shows no significant change since the previous survey.</p> <p>BH2 exhibits no change in the cliff profile, but the cliffed-edge of the spoil beach has eroded landwards by a further 10m since October 2009, leaving only around 48m to the cliff toe.</p> <p>BH3 shows some apparent deepening of the outlet channel of Castle Eden Burn, which crosses the profile, and some landward cut-back, typically by around 6m, of the seaward slope of the profile.</p>	<p>The surveys show that the spoil beach along much of the Blackhall Colliery shore continues to provide effective protection to the backing cliffs, but in places is eroding landwards at high rates of retreat.</p>

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

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**

It is worthwhile considering increasing the surveys along Seaham Beach in view of the anticipated study to investigate and better manage accretion at the southern end of the frontage.

It is also worth considering adding an additional cliff top survey point to the north of Nose's Point where the spoil beach has only a narrow width fronting the cliff. This could suitably be located mid-way between points 2 and 3.

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

- There is notable variability in the foreshore sediments at the southern end of Seaham promenade. Whilst shingle has accumulated to great depths in previous surveys, there was a slightly lesser volume present in September 2010. This does, however, still reach a notable distance up the seawall. Lower down the profile temporary veneers of sand tend to intermittently cover the rock platform.
- Cliff top recession along some sections of the undefended Dawdon cliffs has continued. Calculation of longer-term recession rates has improved with the increased length of the dataset.
- Measurable changes continue to occur along parts of Blast Beach in the width of protective spoil beach fronting the cliffs. This has now reduced from around 40m to around 35m along profiles SH1 and SH2.
- The outlet channels of Hawthorne Burn and Castle Eden Burn exhibited signs of shallowing and deepening, respectively.
- The spoil beach at Blackhall Colliery provides protection to the backing cliffs, but along one profile (BH2) the cliffed edge of the spoil has cut back landwards by around 10m since March 2010.





## **Appendices**



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

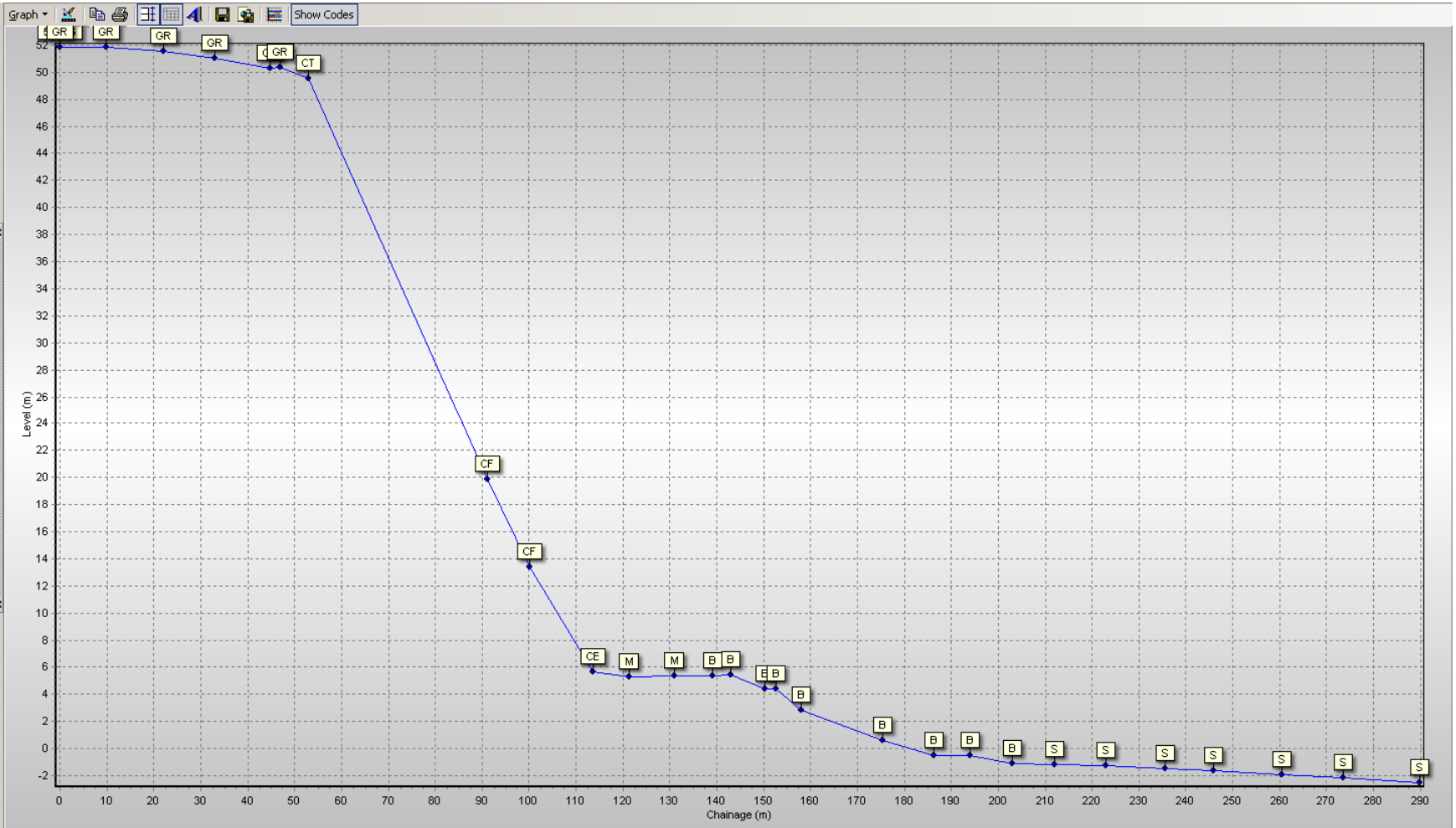
The following sediment feature codes are used on some profile plots:

<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 CC

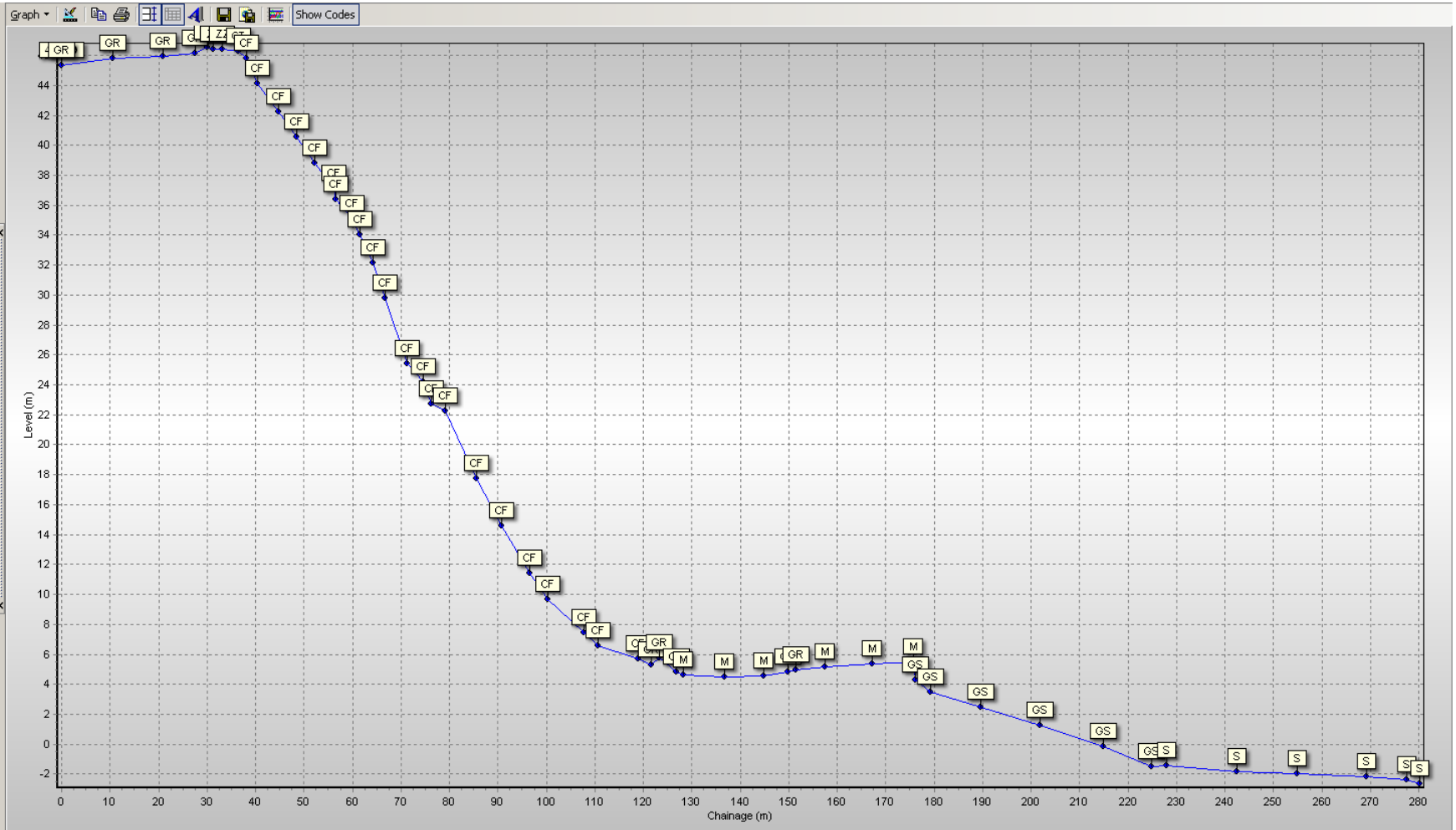
1bBH1 - 09/09/2010

Chainage	Level	Code
0.000	51.846	
0.074	51.846	GR
9.909	51.827	GR
22.069	51.574	GR
32.969	50.995	GR
44.747	50.247	GR
46.904	50.345	GR
53.024	49.570	CT
91.163	19.896	CF
100.117	13.391	CF
113.723	5.656	CE
121.436	5.321	M
130.967	5.342	M
139.209	5.370	B
142.959	5.446	B
150.239	4.388	B
152.725	4.392	B
157.895	2.829	B
175.306	0.599	B
186.311	-0.527	B
194.019	-0.518	B
203.049	-1.115	B
212.042	-1.178	S
223.059	-1.254	S
235.613	-1.475	S
246.000	-1.649	S
260.394	-1.895	S
273.574	-2.154	S
289.848	-2.520	S

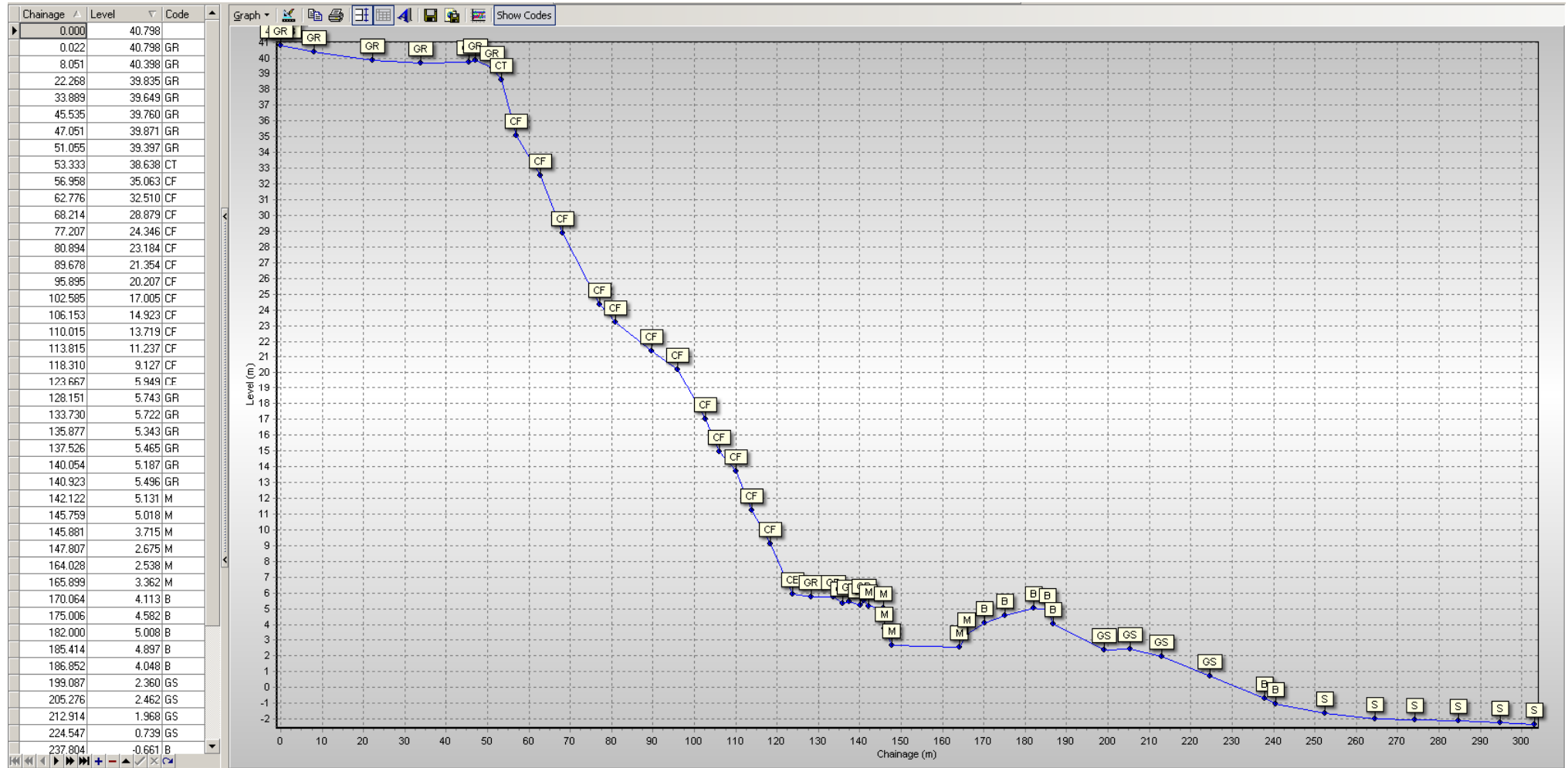


1bBH2 - 09/09/2010

Chainage	Level	Code
0.000	45.369	
0.005	45.369	GR
10.517	45.785	GR
20.960	45.975	GR
27.565	46.151	GR
30.123	46.548	GR
31.287	46.389	ZZ
33.188	46.407	ZZ
36.463	46.283	CT
38.158	45.832	CF
40.345	44.110	CF
44.659	42.228	CF
48.426	40.537	CF
52.133	38.838	CF
56.069	37.124	CF
56.551	36.362	CF
59.811	35.118	CF
61.559	34.004	CF
64.213	32.115	CF
66.816	29.787	CF
71.239	25.403	CF
74.582	24.229	CF
76.260	22.729	CF
79.128	22.234	CF
85.536	17.747	CF
90.666	14.610	CF
96.644	11.451	CF
100.398	9.699	CF
107.754	7.466	CF
110.658	6.549	CF
119.032	5.709	CE
121.710	5.287	GR
123.336	5.782	GR
126.901	4.801	GR
128.240	4.607	M
136.722	4.471	M
144.831	4.550	M
149.834	4.800	GR
151.556	4.991	GR
157.588	5.144	M
167.225	5.372	M
175.750	5.499	M
176.124	4.314	GS
179.221	3.483	GS

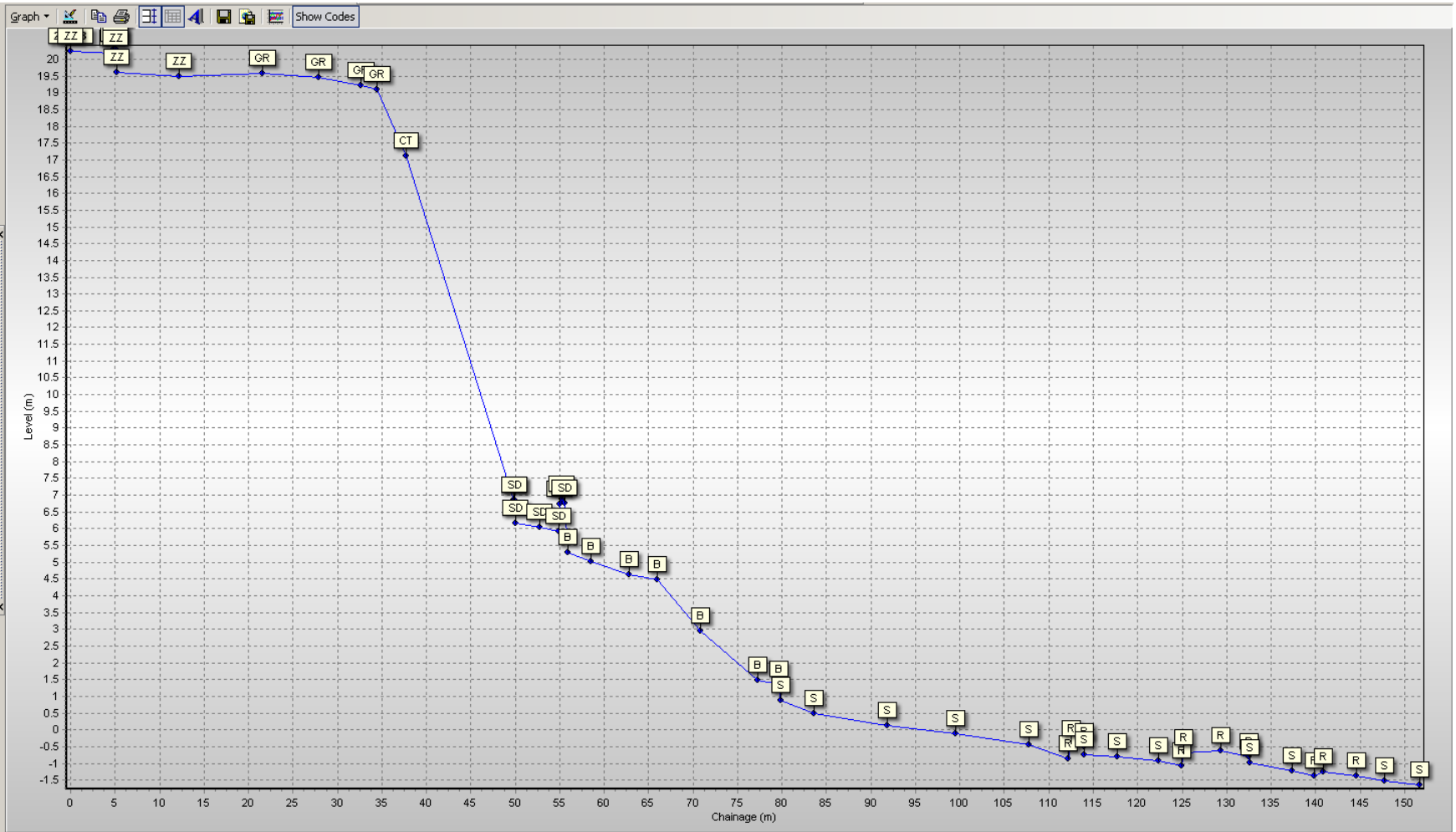


1bBH3 - 09/09/2010



# 1bEA1

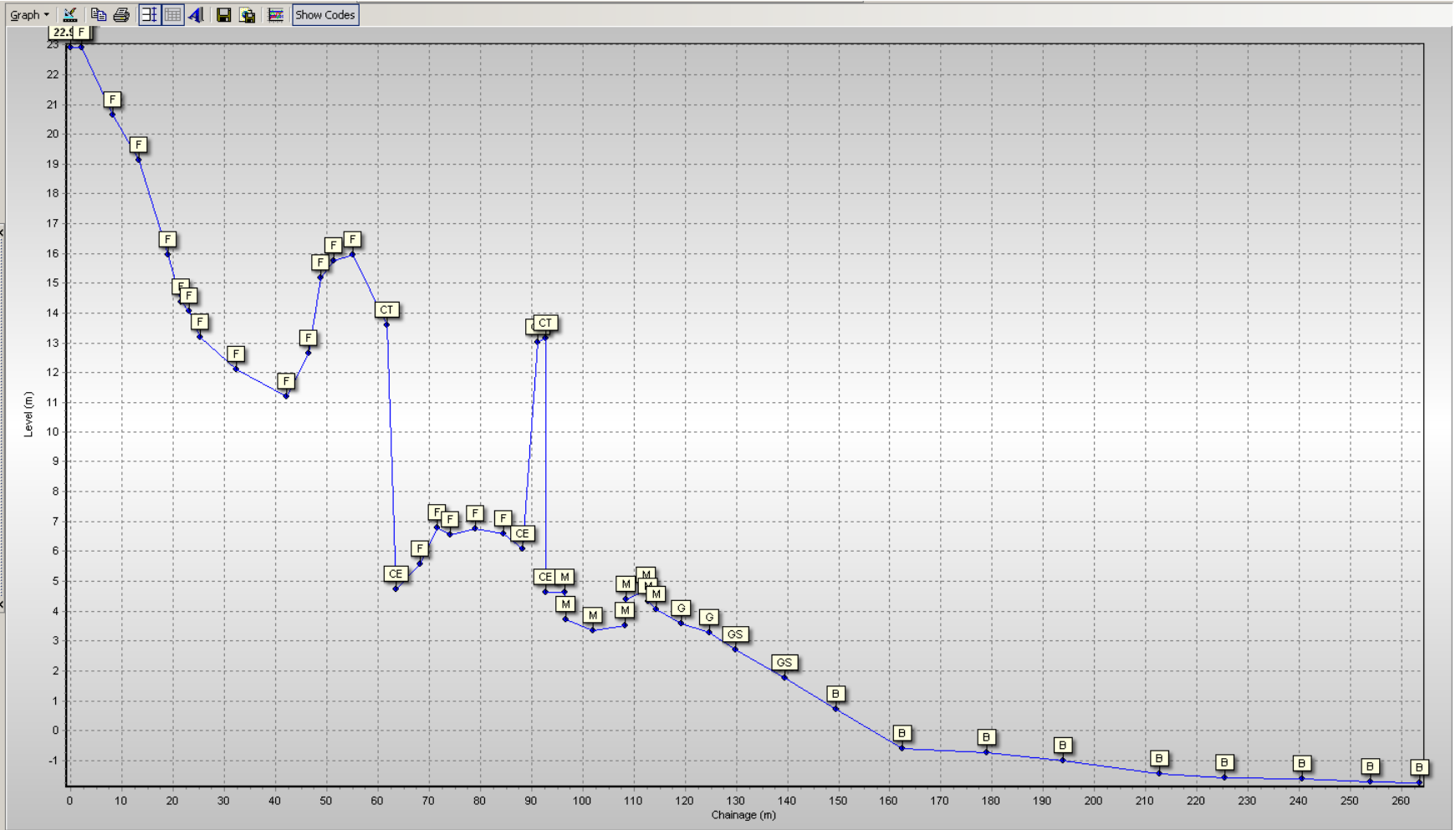
Chainage	Level	Code
0.000	20.238	
0.027	20.238	ZZ
4.798	20.193	ZZ
4.844	20.301	ZZ
5.092	20.292	ZZ
5.116	20.195	ZZ
5.155	19.623	ZZ
12.256	19.482	ZZ
21.573	19.571	GR
27.898	19.448	GR
32.593	19.207	GR
34.469	19.108	GR
37.689	17.118	CT
49.814	6.858	EB
49.954	6.856	SD
50.058	6.155	SD
52.784	6.029	SD
54.853	5.912	SD
55.021	6.728	SD
55.200	6.871	SD
55.619	6.756	SD
55.873	5.302	B
58.536	5.014	B
62.817	4.623	B
65.962	4.494	B
70.876	2.956	B
77.227	1.487	B
79.618	1.370	B
79.905	0.871	S
83.586	0.498	S
91.829	0.141	S
99.535	-0.105	S
107.753	-0.432	S
112.187	-0.857	R
112.528	-0.429	R
113.950	-0.493	R
114.026	-0.742	S
117.691	-0.810	S
122.340	-0.922	S
124.919	-1.080	R
125.209	-0.683	R
129.304	-0.634	R
132.477	-0.804	R
132.676	-0.979	S





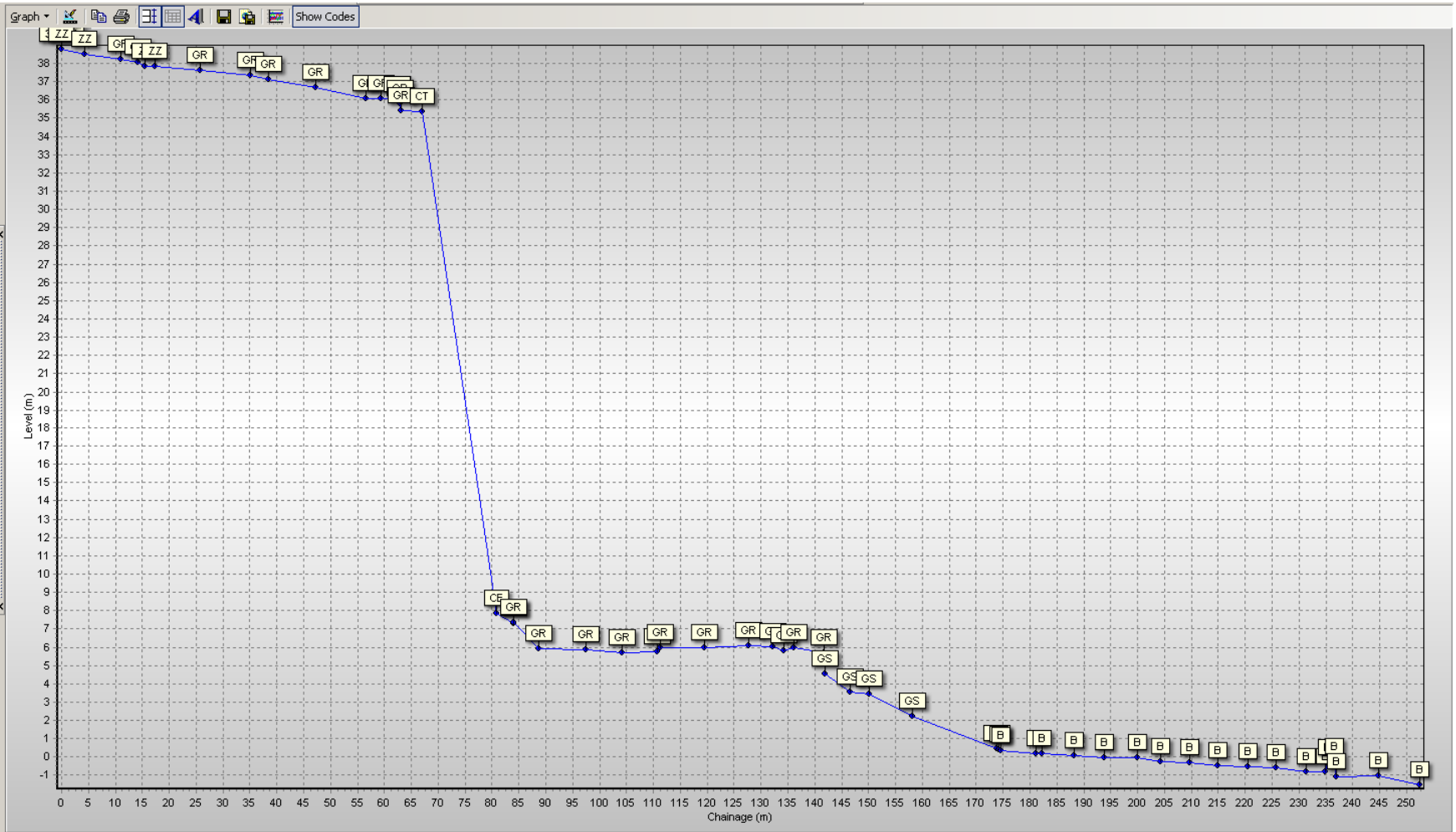
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Chainage	Level	Code
0.000	22.906	
2.201	22.906	F
8.329	20.636	F
13.249	19.128	F
18.953	15.960	F
21.524	14.378	F
23.196	14.070	F
25.369	13.209	F
32.306	12.108	F
42.243	11.197	F
46.410	12.646	F
48.812	15.170	F
51.397	15.750	F
55.127	15.954	F
61.720	13.606	CT
63.589	4.723	CE
68.337	5.559	F
71.690	6.778	F
74.248	6.551	F
79.118	6.764	F
84.602	6.583	F
88.195	6.093	CE
91.236	13.019	CT
92.773	13.166	CT
92.799	4.632	CE
96.440	4.638	M
96.814	3.708	M
102.033	3.336	M
108.270	3.501	M
108.513	4.392	M
112.484	4.710	M
112.902	4.321	M
114.441	4.049	M
119.323	3.578	G
124.718	3.283	G
129.926	2.723	GS
139.568	1.755	GS
149.475	0.708	B
162.505	-0.607	B
178.942	-0.730	B
193.795	-1.013	B
212.717	-1.439	B
225.364	-1.590	B
240.496	-1.606	B



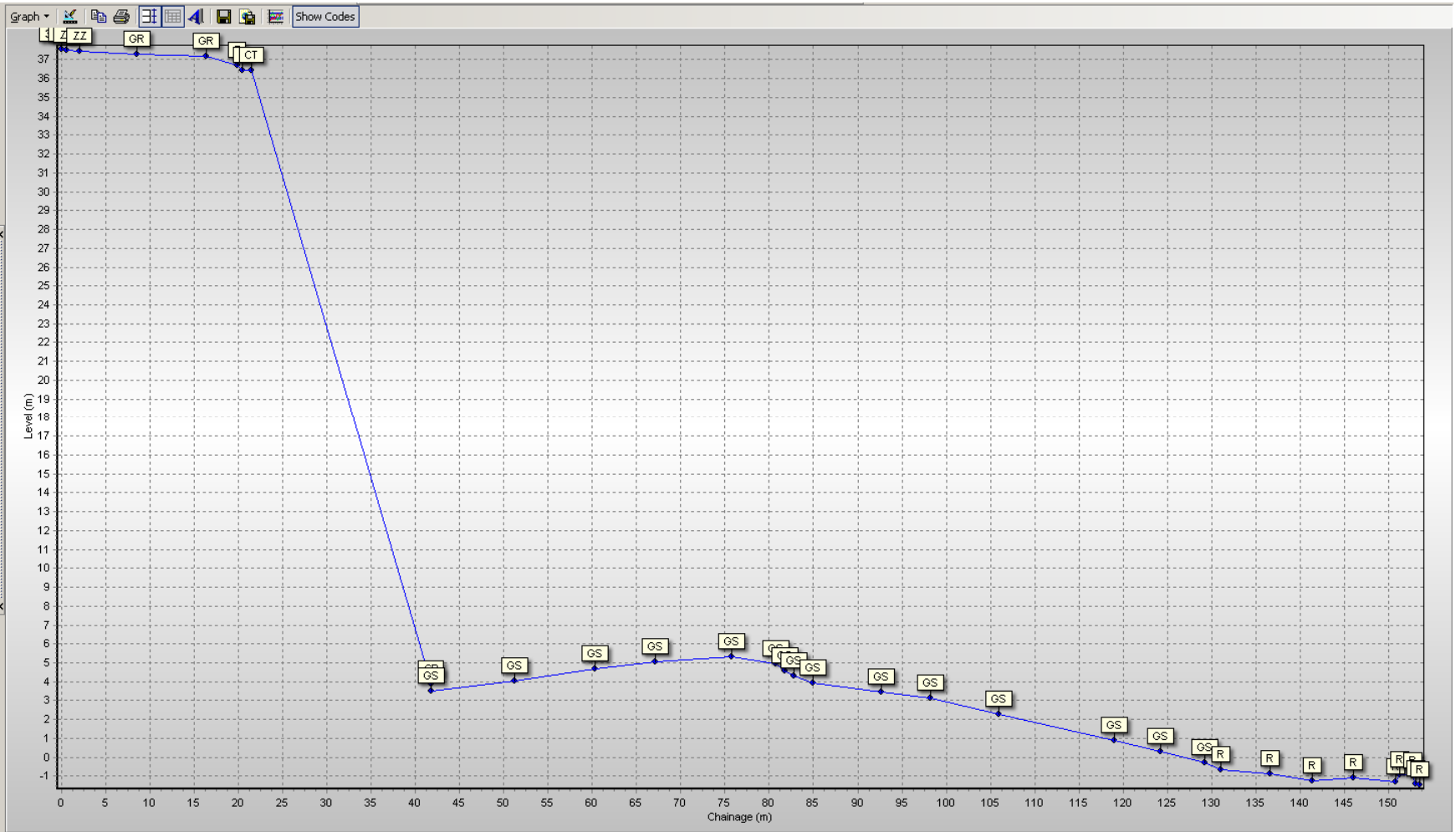
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Chainage	Level	Code
0.000	38.771	
0.036	38.771	ZZ
4.303	38.519	ZZ
10.989	38.194	GR
14.111	38.049	GR
15.430	37.847	ZZ
17.428	37.847	ZZ
25.841	37.601	GR
35.018	37.318	GR
38.474	37.127	GR
47.258	36.698	GR
56.503	36.074	GR
59.292	36.063	GR
62.338	36.017	GR
62.923	35.807	GR
63.089	35.410	GR
67.089	35.356	CT
80.805	7.822	CE
84.028	7.280	GR
84.057	7.376	GR
88.670	5.942	GR
97.474	5.841	GR
104.189	5.715	GR
110.689	5.752	GR
111.316	5.975	GR
119.463	5.977	GR
127.707	6.098	GR
132.281	6.014	GR
134.286	5.821	GR
136.100	5.957	GR
141.699	5.712	GR
141.965	4.547	GS
146.532	3.544	GS
150.094	3.449	GS
158.087	2.232	GS
173.757	0.471	GS
174.195	0.412	B
174.522	0.360	B
181.138	0.183	B
182.265	0.182	B
188.184	0.084	B
193.773	-0.060	B
199.936	-0.020	B
204.236	-0.245	B



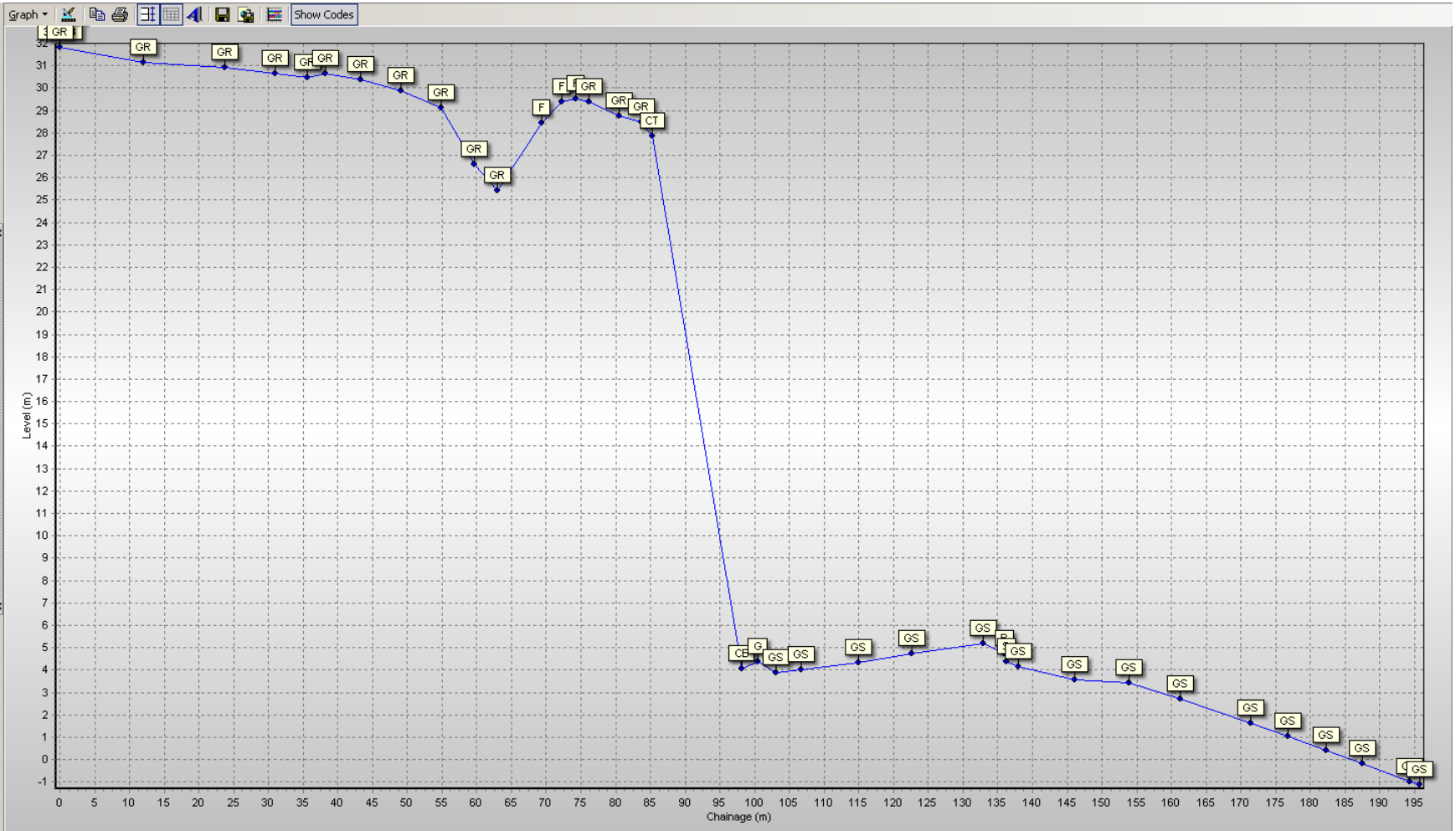
# 1bSH1

Chainage	Level	Code
0.000	37.554	
0.030	37.554	GR
0.595	37.487	ZZ
2.074	37.421	ZZ
8.477	37.286	GR
16.396	37.173	GR
19.899	36.702	F
20.447	36.457	F
21.447	36.457	CT
41.735	3.883	CB
41.764	3.509	GS
51.197	4.025	GS
60.336	4.691	GS
67.066	5.080	GS
75.719	5.306	GS
80.702	4.929	GS
81.808	4.584	GS
82.802	4.302	GS
84.972	3.939	GS
92.636	3.438	GS
98.288	3.160	GS
106.003	2.293	GS
119.020	0.912	GS
124.252	0.328	GS
129.248	-0.286	GS
131.020	-0.654	R
136.567	-0.866	R
141.351	-1.225	R
146.017	-1.082	R
150.785	-1.272	R
151.230	-0.942	R
152.784	-0.976	R
153.084	-1.381	R
153.538	-1.456	R



# 1bSH2

Chainage	Level	Code
0.000	31.823	
0.035	31.823	GR
11.974	31.161	GR
23.726	30.923	GR
30.941	30.629	GR
35.685	30.475	GR
38.197	30.649	GR
43.273	30.394	GR
49.092	29.870	GR
54.903	29.135	GR
59.602	26.581	GR
62.932	25.425	GR
69.289	28.434	F
72.288	29.401	F
74.273	29.533	F
76.169	29.377	GR
80.482	28.777	GR
83.689	28.508	GR
85.314	27.878	CT
98.095	4.082	CB
100.493	4.371	G
103.023	3.878	GS
106.753	4.001	GS
114.893	4.321	GS
122.611	4.757	GS
132.949	5.171	GS
135.949	4.738	R
136.223	4.397	S
137.911	4.132	GS
146.082	3.543	GS
153.880	3.419	GS
161.232	2.727	GS
171.405	1.632	GS
176.712	1.055	GS
182.234	0.392	GS
187.430	-0.194	GS
194.320	-0.968	GS
195.741	-1.122	GS



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- 04/11/2008
- 06/10/2009
- 09/09/2010

Beach Profiles: 1cBH2



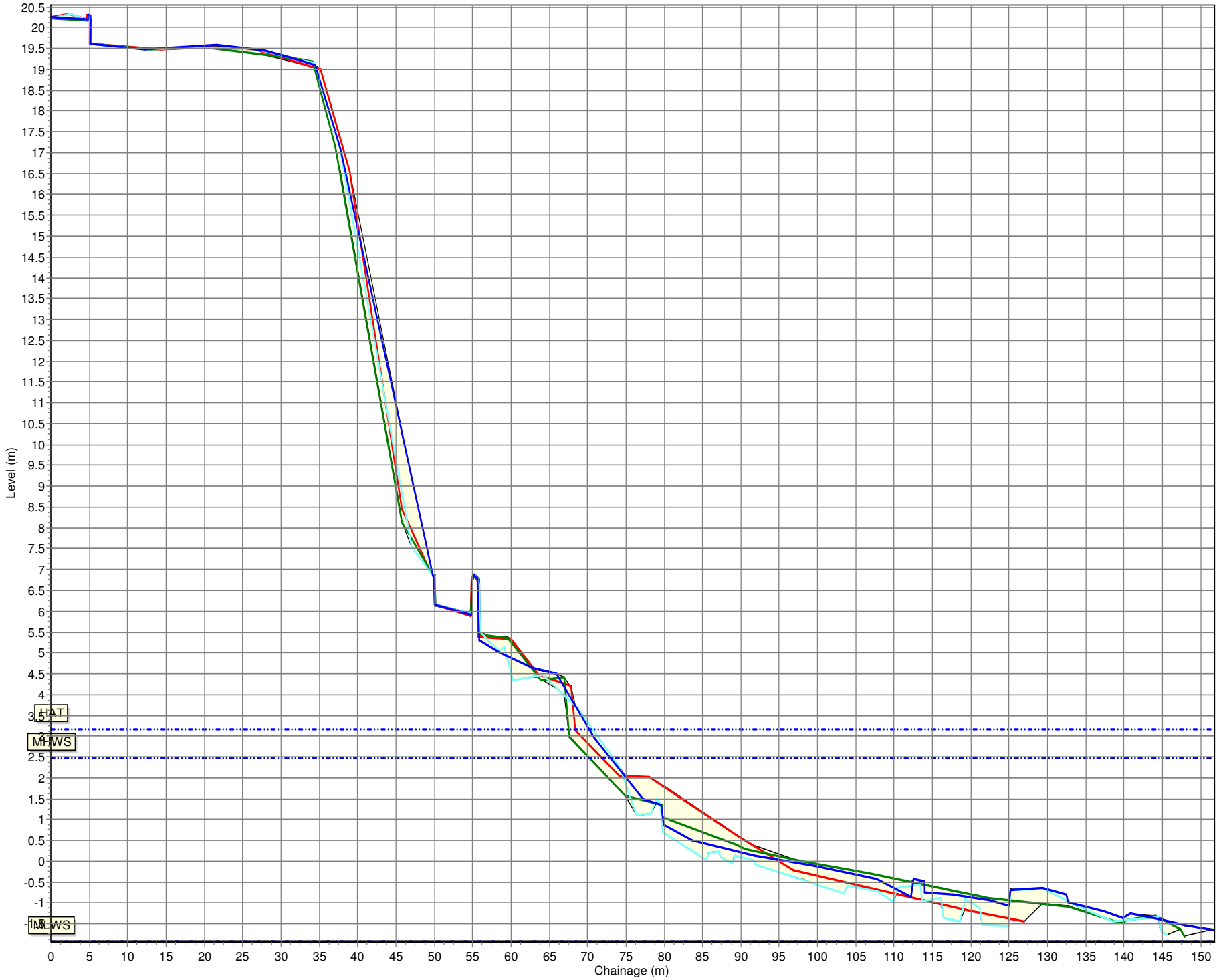
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### Beach Profiles: 1cBH3



- Profiles Envelope
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# Beach Profiles: 1bEA1

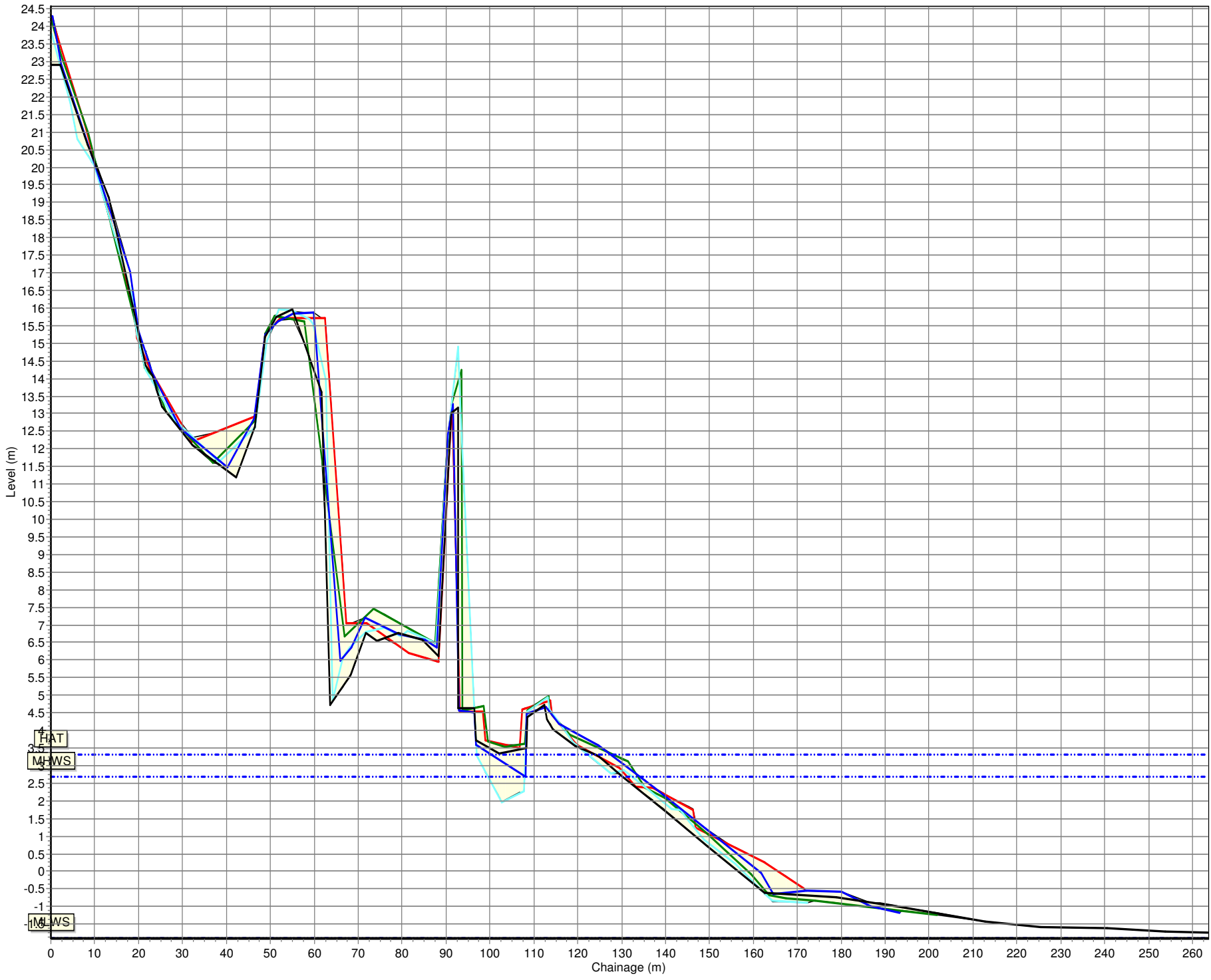


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HAT  
MWS  
LWS



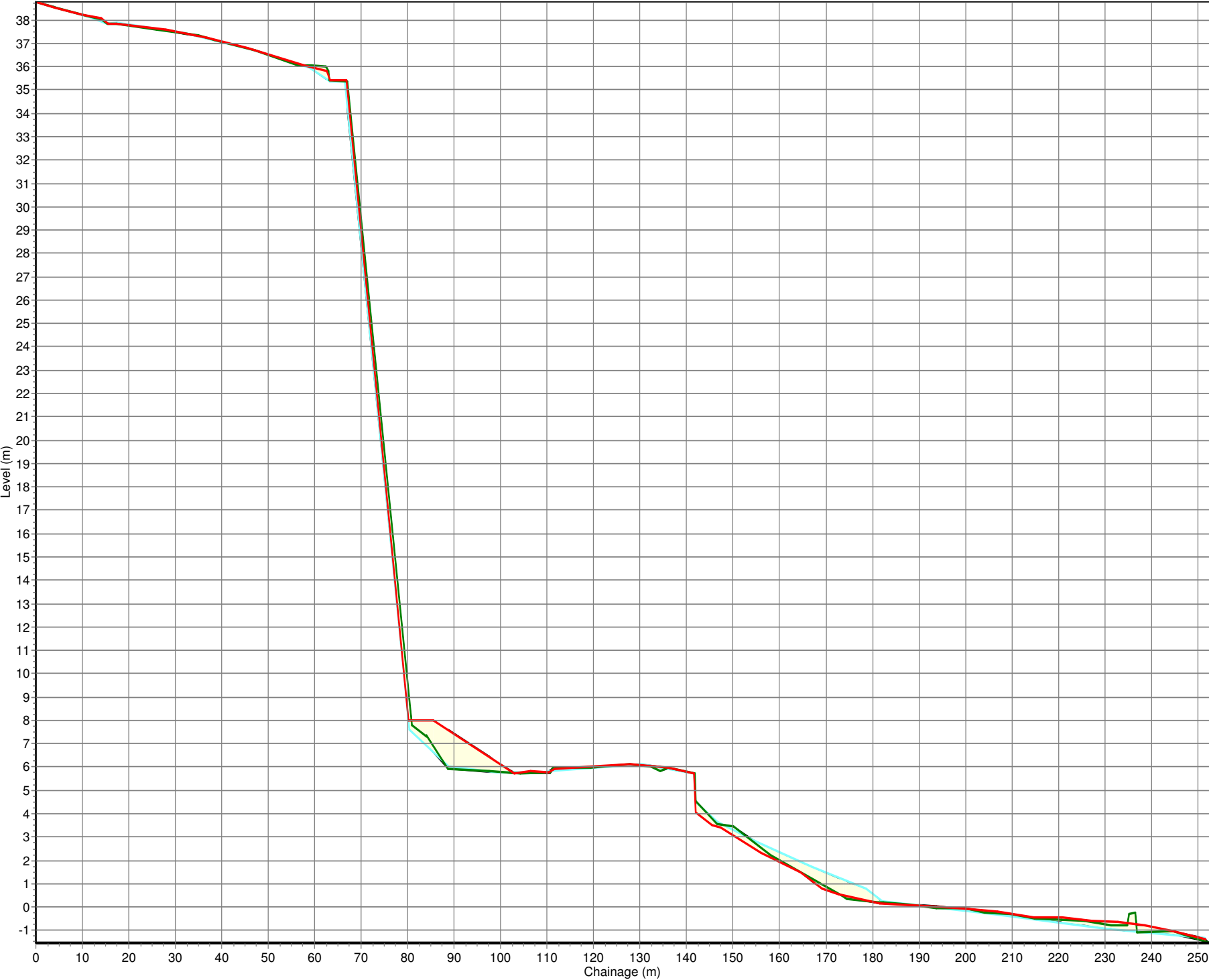
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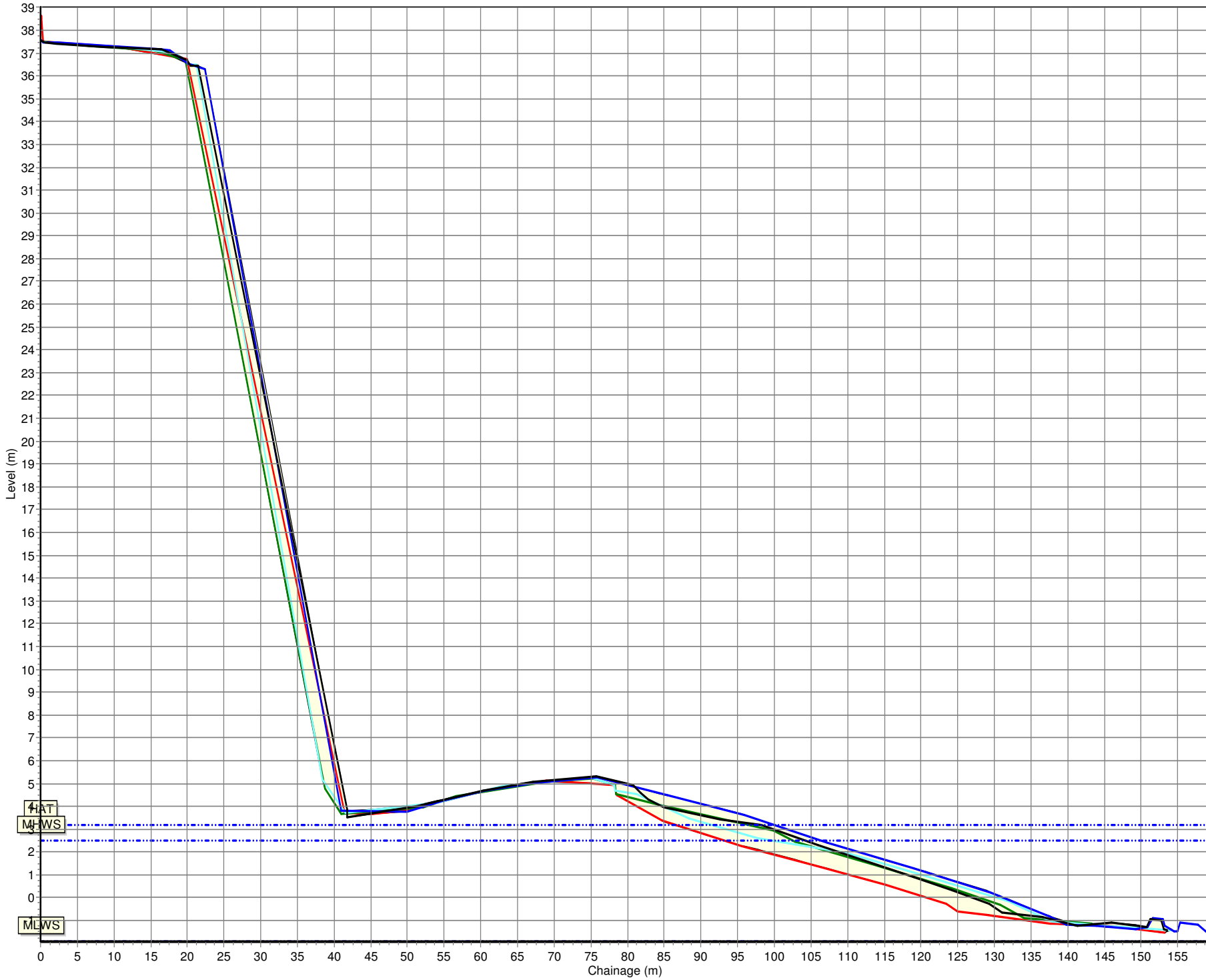
HAT  
MWS  
LWS

Beach Profiles: 1bSH1A



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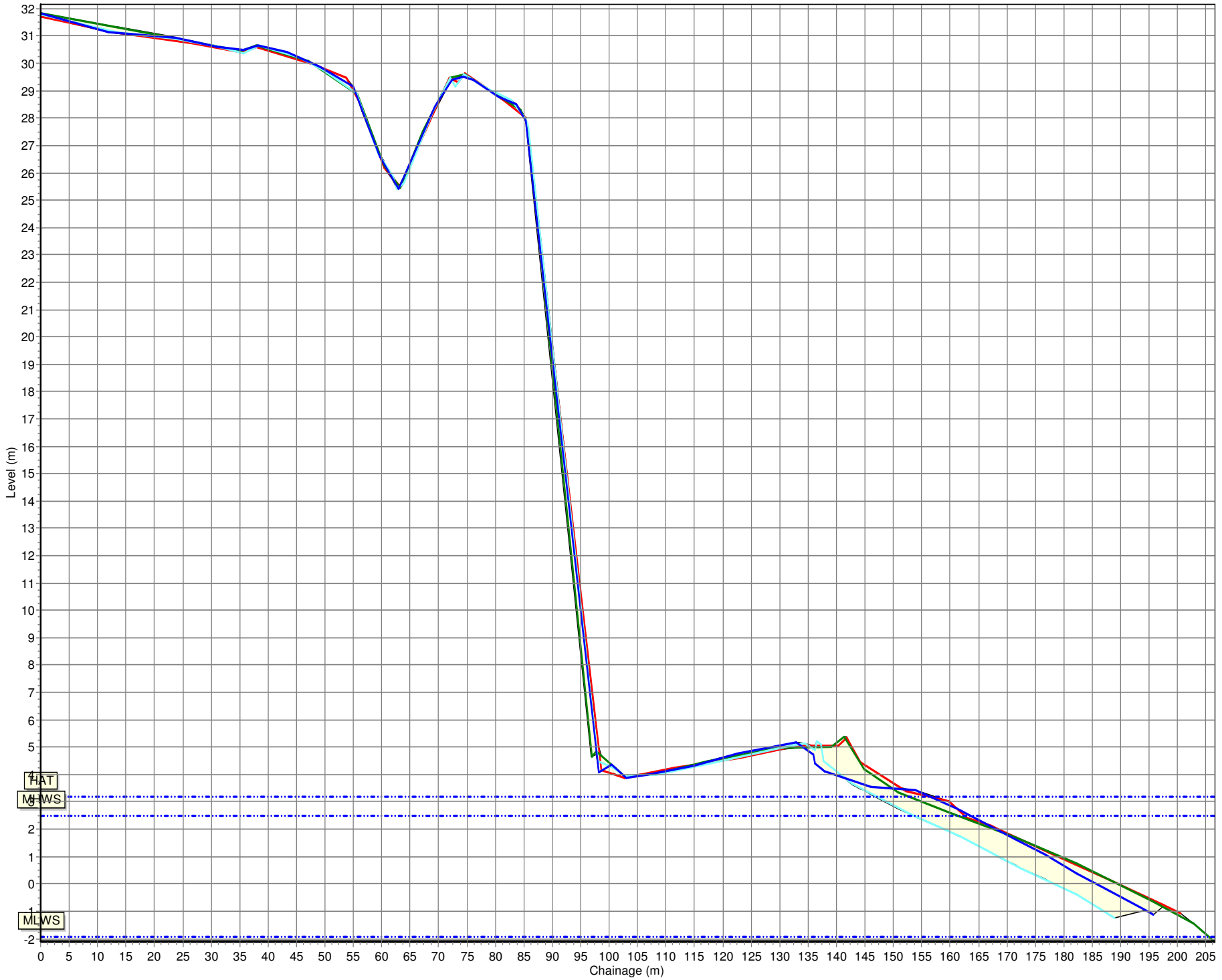
# Beach Profiles: 1bSH1



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- 22/04/2009
- 21/10/2009
- 19/03/2010
- 13/09/2010

HAT  
MHW  
MLWS

Beach Profiles: 1bSH2



- Profiles Envelope
- 22/04/2009
- 21/10/2009
- 19/03/2010
- 13/09/2010

**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.

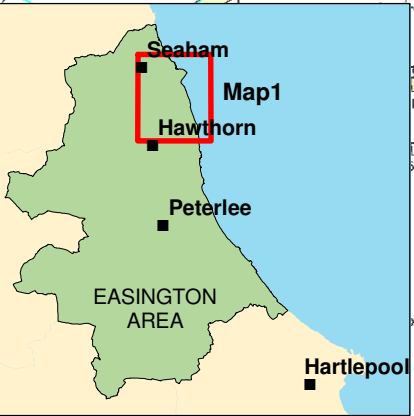
**Table B1 – Cliff Top Surveys at Dawdon**

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 (Mar 2010)	Present Survey (Sept 2010)	Baseline (Nov 2008) to Present (Sept 2010)	Previous (Mar 2010) to Present (Sept 2010)	Baseline (Nov 2008) to Present (Sept 2010)
1	443515	548422	25.1	70	16.1	15.5	15.3	0.6	0.8	0.4
2	443608	548136	28.0	90	13.3	13.2	13.3	0.1	+0.1	0.0
3	443756	547859	27.6	95	14.8	13.9	13.5	0.9	0.4	0.7

**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



● Cliff Top Monitoring Points

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

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

Analytical Report 3  
 'Full Measures' Survey 2010

Drawing Scale 1:10,000 at A4



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Drawn by: TC Date: 28/10/2010  
 Checked by: MD Date: 05/11/2010  
 Approved by: NC Date: 05/11/2010

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 www.northeastcoastalobservatory.org.uk