



**Cell 1 Regional Coastal Monitoring Programme  
Update Report 1: 'Partial Measures' Survey 2009**

**Hartlepool Borough Council  
Final Report**



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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 (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 <sup>(*)</sup>	-

<sup>(\*)</sup> The present report is **Update Report 1** and provides an analysis of the 2009 Partial Measures survey for Hartlepool Borough 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

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

- Full Measures survey annually each autumn/early winter comprising:
  - Beach profile surveys along 9 no. 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 9 no. 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 County Durham Council. For purposes of completeness, this report contains analysis of the full survey extent, including the area in County Durham Council's jurisdiction between Crimdon Park and Crimdon Beck.

The location of these surveys is shown in Figure 1. Also enclosed on the accompanying CD-ROM is a file which can be opened in Google Earth showing the locations of the surveys.

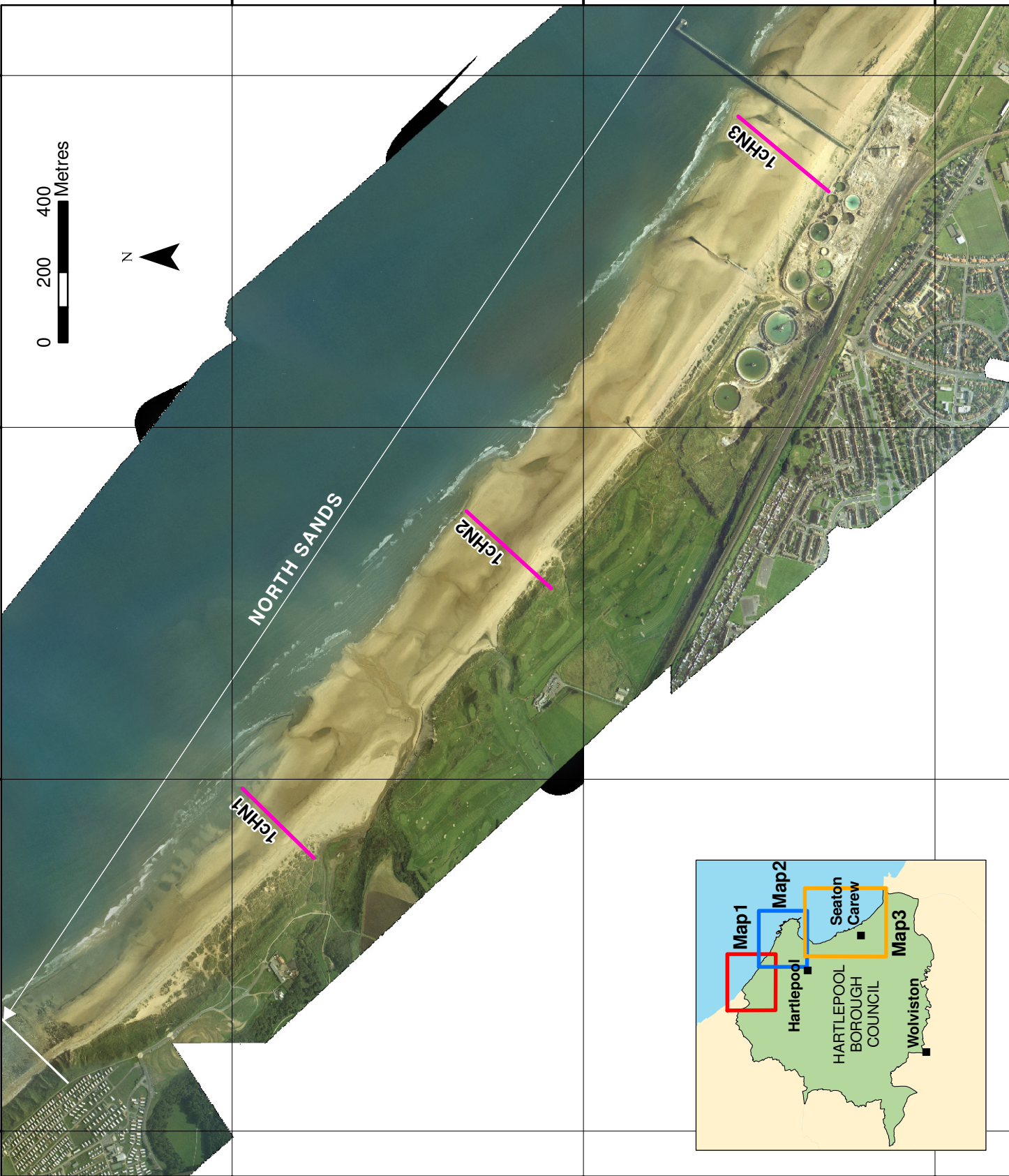
The Partial Measures surveys were undertaken in March 2009. During the Hartlepool North survey weather conditions were fine but breezy, with a calm sea state. The surveys at Hartlepool Central and Hartlepool South were undertaken during fine, dry and sunny weather conditions, with a calm sea state.

The survey at Hartlepool South was originally intended for incorporation in the Full Measures programme during November 2008 but was re-scheduled to be included in the present Partial Measures programme. The reason for this was that a similar survey along most of Hartlepool South (extending south from Newburn Bridge to the Tees Estuary) was undertaken in December 2008 as part of the work associated with the Seaton Carew Coastal Strategy Study.

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.



**SURVEY LOCATIONS**

**Topographic Profiles**

- Annual
- Bi-Annual

**Topographic Surveys**

- 6 monthly
- yearly
- 5 yearly

**Cliff Top Monitoring Pegs**

- @ 50 centres
- @ 100 centres
- @ 300 centres

(Indicative Survey Extents shown)

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

**Figure 1 - Map 1  
 Hartlepool Borough  
 Council Frontage**

Update Report 1  
 'Partial Measures' Survey 2009

Drawing Scale 1:15,000 at A4

Drawn by: TC Date: 08/05/2009  
 Checked by: NC Date: 08/05/2009  
 Approved by: NC Date: 08/05/2009



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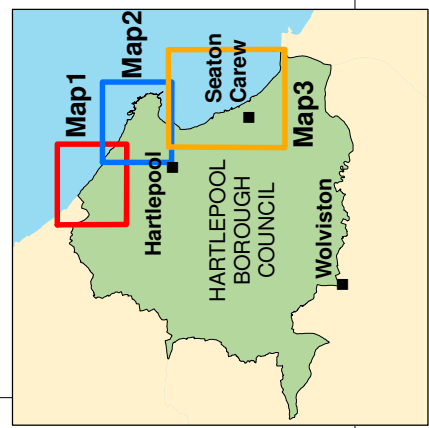


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**SURVEY LOCATIONS**

**Topographic Profiles**

- Annual
- Bi-Annual

**Topographic Surveys**

- 6 monthly
- yearly
- 5 yearly

**Cliff Top Monitoring Pegs**

- @ 50 centres
- @ 100 centres
- @ 300 centres

(Indicative Survey Extents shown)

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

**Figure 1 - Map 2  
Hartlepool Borough  
Council Frontage**

Update Report 1  
'Partial Measures' Survey 2009

Drawing Scale 1:15,000 at A4

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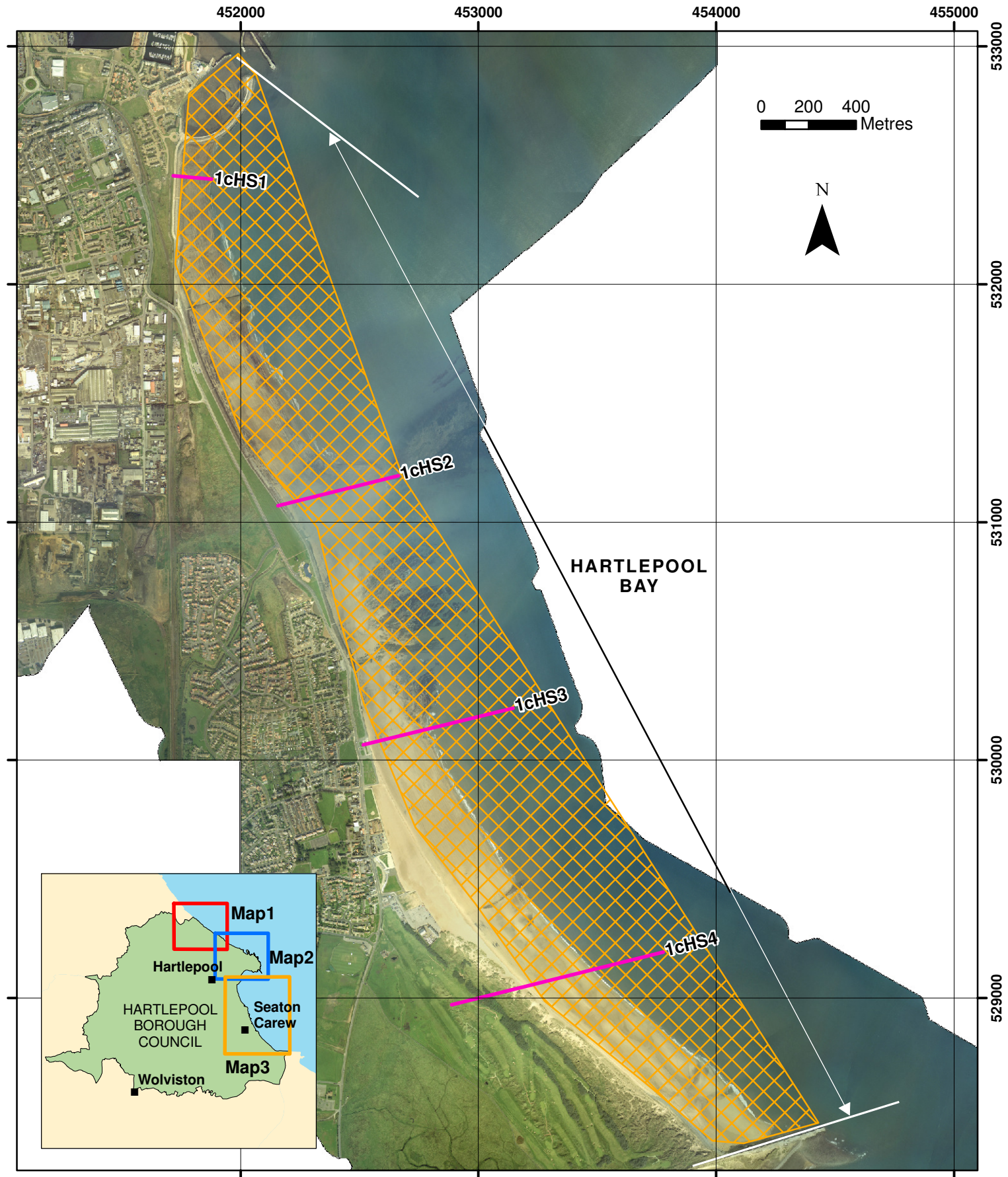
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- TOPOGRAPHIC SURVEY LOCATIONS**
- Annual Profile
  - Bi-Annual Profile
  - 6 monthly Survey
  - Yearly Survey
  - 5 yearly Survey
  - Cliff Top Survey @ 50 centres
  - Cliff Top Survey @ 100 centres
  - Cliff Top Survey @ 300 centres
- (Indicative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

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

**Figure 1 - Map 3  
 Hartlepool Borough  
 Council Frontage**

Update Report 1  
 'Partial Measures' Survey 2009

Drawing Scale 1:21,000 at A4



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Approved by: NC	Date: 13/05/2009

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## 2. Analysis of Survey Data

### 2.1 North Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2009	<p><b>Beach Profiles:</b></p> <p>North Sands is covered by four beach profile lines during the Partial Measures survey (Appendix A).</p> <p>Along HN1 the profile has lowered between a chainage of 70m and 180m, including a quite substantial lowering around 150m chainage of over 0.5m. However, accretion has occurred lower down the profile and at the toe of the dunes. Further accretion of blown sand has occurred on the dune crest and seaward face of the fronting dune ridge.</p> <p>HN2 experienced lowering along the entire profile length below HAT. At a chainage of around 200m this reached a maximum lowering of some 1.3m, but generally it was of the order of 0.5m. Above HAT there was very little change in the dune.</p> <p>The slag banks at the landward end of profile HN3 did not show any change, but the foreshore accreted slightly along its entire length seaward of MHWS. The maximum change was at a chainage of around 0.4m where the levels increased by around 0.4m</p> <p>HN4 showed a small amount of lowering directly at the toe of the sea wall and promenade, over a width of around 7m from the toe. Seaward of here, the profile experienced slight accretion to a chainage of around 65m. Thereafter, the profile lowered, resulting in rocky outcrops being exposed at a chainage of around 150m due to loss of sand coverage.</p>	<p>In general, profiles towards the north of North Sands experienced foreshore lowering along much (HN1) or all (HN2) of their length and areas further south, around HN3, experienced accretion. This may represent a modest longshore redistribution of sediment. In both cases, the backing dunes (in the north) and slag banks (further south) did not experience adverse change and in places there was modest accretion of blown sand.</p> <p>Further south still, along HN4, beach levels lowered to the extent that rock outcrops were exposed on the lower profile. Here, levels also lowered slightly at the toe of the sea wall and promenade.</p>

## 2.2 Middleton

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2009	<p><b>Beach Profiles:</b></p> <p>Middleton is covered by one beach profile line during the Partial Measures survey (Appendix A).</p> <p>Profile HC1 lowered in level along all of its surveyed length, in places by up to 0.35m. A similar profile form was observed on both surveys.</p>	<p>The lowering of profile HC1 is likely to be due to strong wave conditions stripping the beach of sediment. It will be important to continue monitoring here to see whether this is a seasonal behaviour or a longer term trend.</p>

## 2.3 Hartlepool Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2009	<p><b>Beach Profiles:</b></p> <p>Hartlepool Bay is covered by four beach profile lines during the Partial Measures survey (Appendix A). These were not surveyed during the Full Measures survey in November 2008 for the reasons previously described and so were recorded for the first time during the present survey.</p> <p>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. It then gently slopes down to low water level at the time of the survey.</p> <p>HS2 and HS3 are similar in that they both start across the promenade and then extend down the sea wall to beach level, crossing the rock armour protection at the toe of the wall. The profiles then both slope gently down to low water mark.</p> <p>HS4 is located further south, around 1km north of the North Gare breakwater. It is in the area of undefended dunes at Seaton Sands. The profile covers a width of approximately 350m of dunes before reaching beach level. The beach then slopes gently down to low water level.</p>	<p>These profiles will be monitored for evidence of seasonal behaviour in beach profile responses and longer term trends of net erosion or accretion.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2009	<p><b>Topographic Survey:</b></p> <p>Hartlepool Bay is scheduled to be covered during the Full Measures survey each autumn/early winter by an annual topographic survey between the South Pier and the North Gare Breakwater. However, this survey was not undertaken during the 2008 Full Measures survey to avoid unnecessary duplication with a survey of the frontage between Newburn Bridge and the North Gare Breakwater that was undertaken in December 2008 as part of the work associated with the Seaton Carew Coastal Strategy Study. Instead, the survey was postponed and undertaken as part of the present Partial Measures survey, for this year only.</p> <p>Data from the Partial Measures (March 2009) survey have been used to create a DGM (Appendix B – Map 3a).</p> <p>This shows that Hartlepool Bay has a relatively featureless foreshore and comparatively uniform cross-shore gradient along its length. In the recessed area towards the south of the Bay and adjacent to the North Gare Breakwater, sand has accumulated to levels exceeding HAT.</p> <p>This DGM has been compared against a similar DGM that was created using the survey data collected in December 2008 between Newburn Bridge and the North Gare Breakwater (Appendix B – Map 3b). From this, lower foreshore losses and upper foreshore gains of sediment can be identified in the north part of Hartlepool Bay. Further south, along the undefended dune section, a very slight reduction in levels was noted on the upper beach, with a slight increase in levels along the mid and lower beach. At the very southern end, adjacent to the North Gare Breakwater, accretion occurred over much of the foreshore.</p>	<p>There does not appear to be a uniform response along the frontage as a whole, but instead quite different responses in the north and south. At the southern-most end the North Gare Breakwater appears to be trapping drifting shoreline sediment.</p>

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

The December 2008 survey that was undertaken for purposes of informing the Seaton Carew Strategy Study extended south from Newburn Bridge. This means that the section between Newburn Bridge and the South Pier was not surveyed during this survey and therefore it was not possible to create a 'difference plot' between this survey and the March 2009 Partial Measures survey. However, the full topographic survey will be repeated as part of the 2009 Full Measures programme in autumn/early winter 2009 and therefore the present survey will provide a baseline against which changes in the area between Newburn Bridge and the South Pier can be compared.

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

No changes are needed at the present time.

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

- There was some foreshore lowering observed along the northern section of North Sands, although the backing dunes were unaffected and in places experienced modest accretion of wind blown sand.
- Further south, along central North Sands, the foreshore experience accretion, perhaps suggesting a net longshore drift of sediment.
- Further south still, just to the north-west of Hartlepool Headland, beach levels lowered to the extent that rock outcrops were exposed on the lower profile. Here, levels also lowered slightly at the toe of the sea wall and promenade which is an issue that will need to be monitored into the future.
- Along Middleton, the foreshore has been lowered, probably by wave action removing beach sediment. It will be important to continue monitoring here to see whether this is a seasonal behaviour or a longer term trend.
- Along Hartlepool Bay there does not appear to be a uniform response along the frontage as a whole, but instead quite different responses were observed in the north and south. This may be a reflection of the different behaviours in a defended versus an undefended section of beach, or due to a longshore redistribution of sediment.
- At the southern-most end the North Gare Breakwater appears to be trapping drifting shoreline sediment.



## **Appendices**



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



# Beach Profile

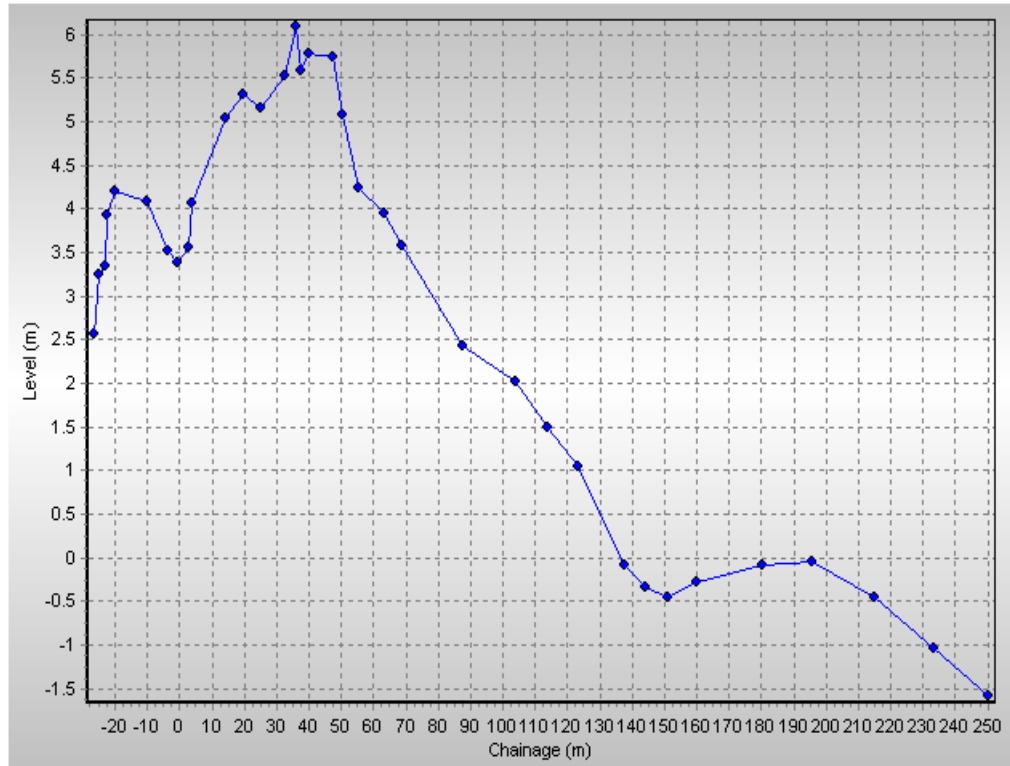
## 1cHN1

**Date** 31/03/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary**

**Low Tide (m)**  
**Visibility** Good **Low Tide Time**  
**Rain** No

**Easting** 448779.620 **Northing** 536767.420 **Bearing** 44

Chainage	Level
-26.510	2.577
-24.900	3.249
-23.060	3.342
-22.500	3.923
-20.070	4.206
-10.130	4.085
-3.850	3.517
-0.620	3.393
2.980	3.563
3.900	4.070
14.320	5.042
19.700	5.316
25.060	5.162
32.420	5.528
35.880	6.093
37.710	5.591
40.150	5.782
47.330	5.733
50.450	5.086
55.510	4.246
63.090	3.943
68.850	3.590
87.620	2.436
104.060	2.022
113.980	1.495
123.170	1.054
137.750	-0.079
143.850	-0.333
151.240	-0.452
160.020	-0.284
180.150	-0.077
195.640	-0.044
214.930	-0.457
233.330	-1.045
250.230	-1.581



Beach Profiles: 1cHN1



10/11/2008  
31/03/2009

# Beach Profile

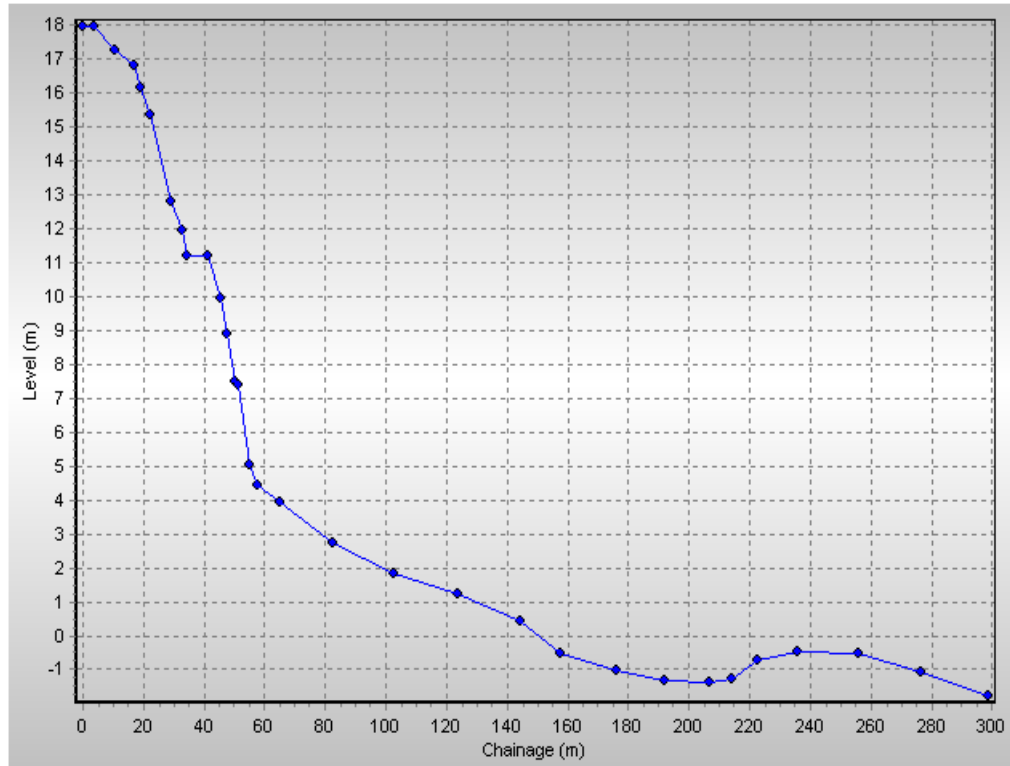
## 1cHN2

**Date** 31/03/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary**

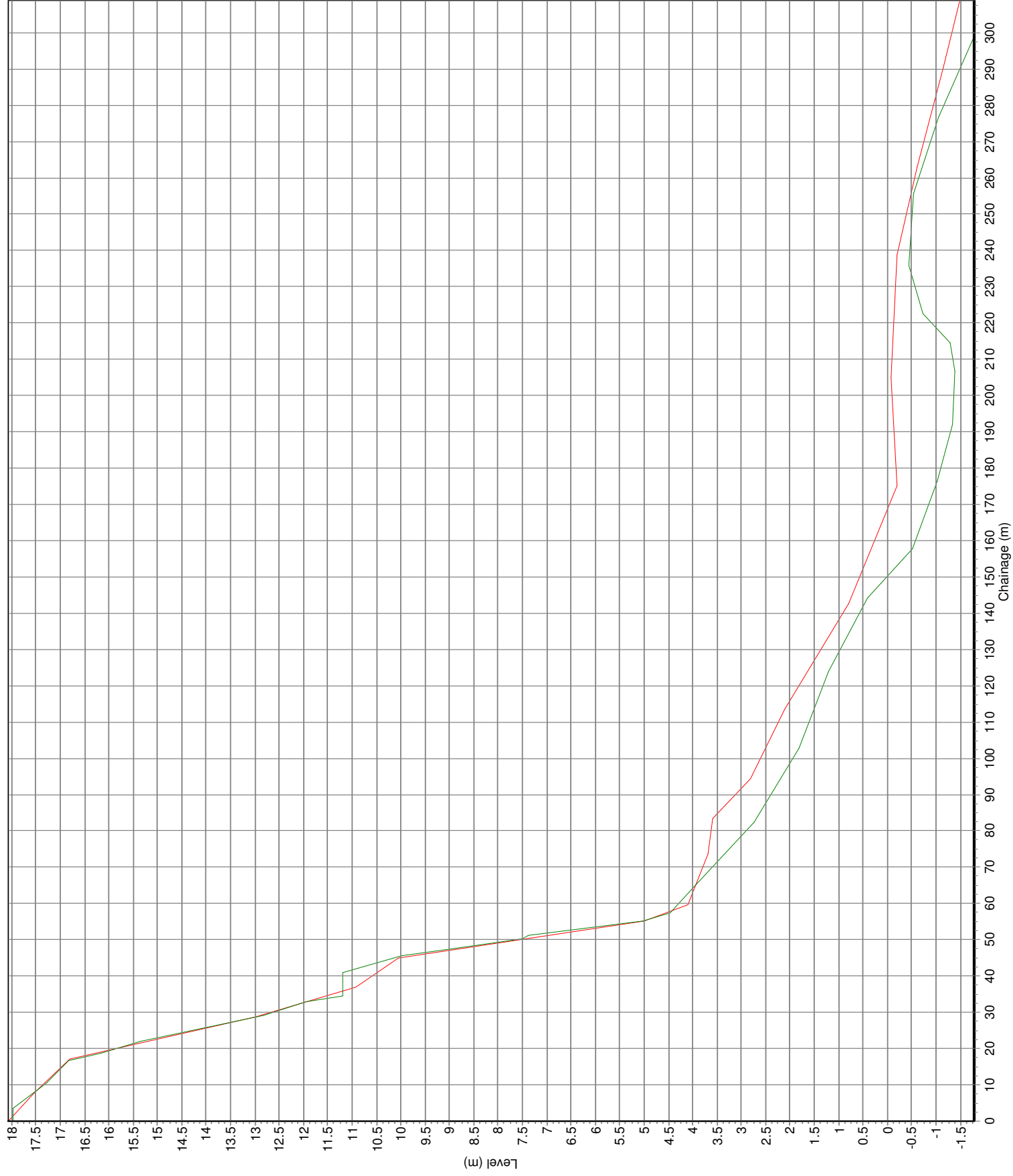
**Low Tide (m)**  
**Visibility** Good **Low Tide Time**  
**Rain** No

**Easting** 449547.220 **Northing** 536095.460 **Bearing** 42

Chainage	Level
0.000	17.969
0.040	17.969
3.500	17.971
10.440	17.289
16.750	16.828
18.800	16.182
22.070	15.360
29.100	12.811
32.840	11.942
34.500	11.203
41.050	11.186
45.690	9.968
47.570	8.897
50.270	7.504
51.190	7.379
55.150	5.026
57.450	4.461
65.100	3.927
82.230	2.743
102.760	1.809
123.910	1.215
144.150	0.413
157.720	-0.524
176.350	-1.020
191.980	-1.345
206.670	-1.401
214.410	-1.286
222.480	-0.736
235.870	-0.451
255.710	-0.540
276.600	-1.057
298.770	-1.779



Beach Profiles: 1cHN2



10/11/2008  
 31/03/2009



# Beach Profile

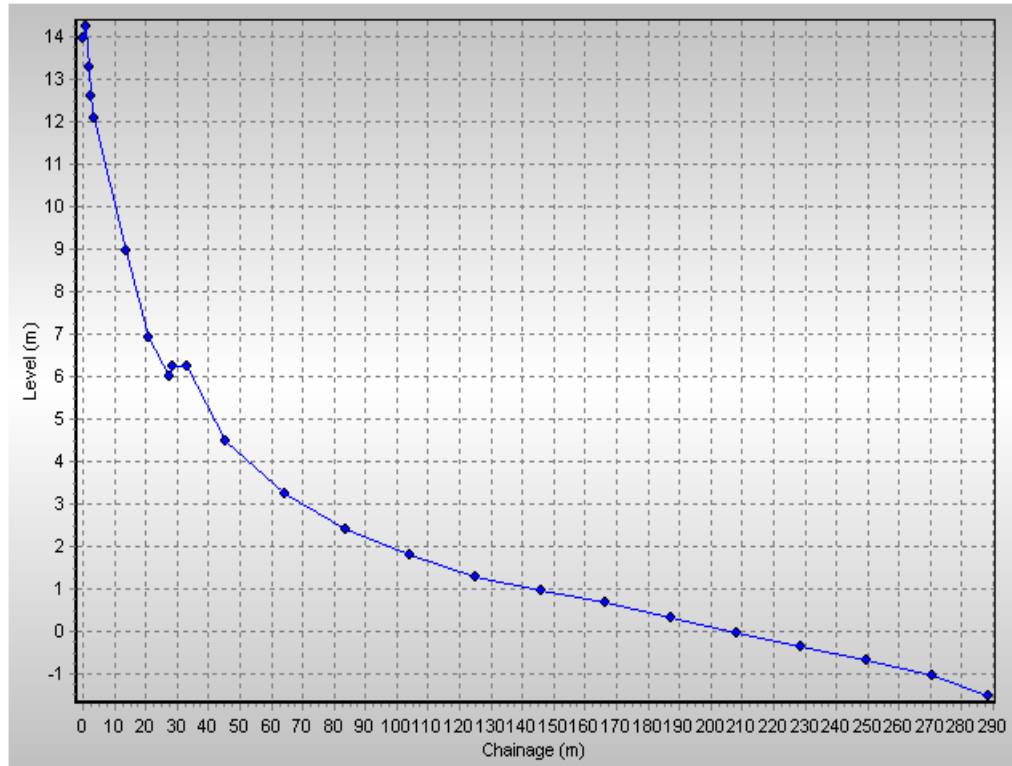
## 1cHN3

**Date** 31/03/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary** New Bearing introduced in March 2009

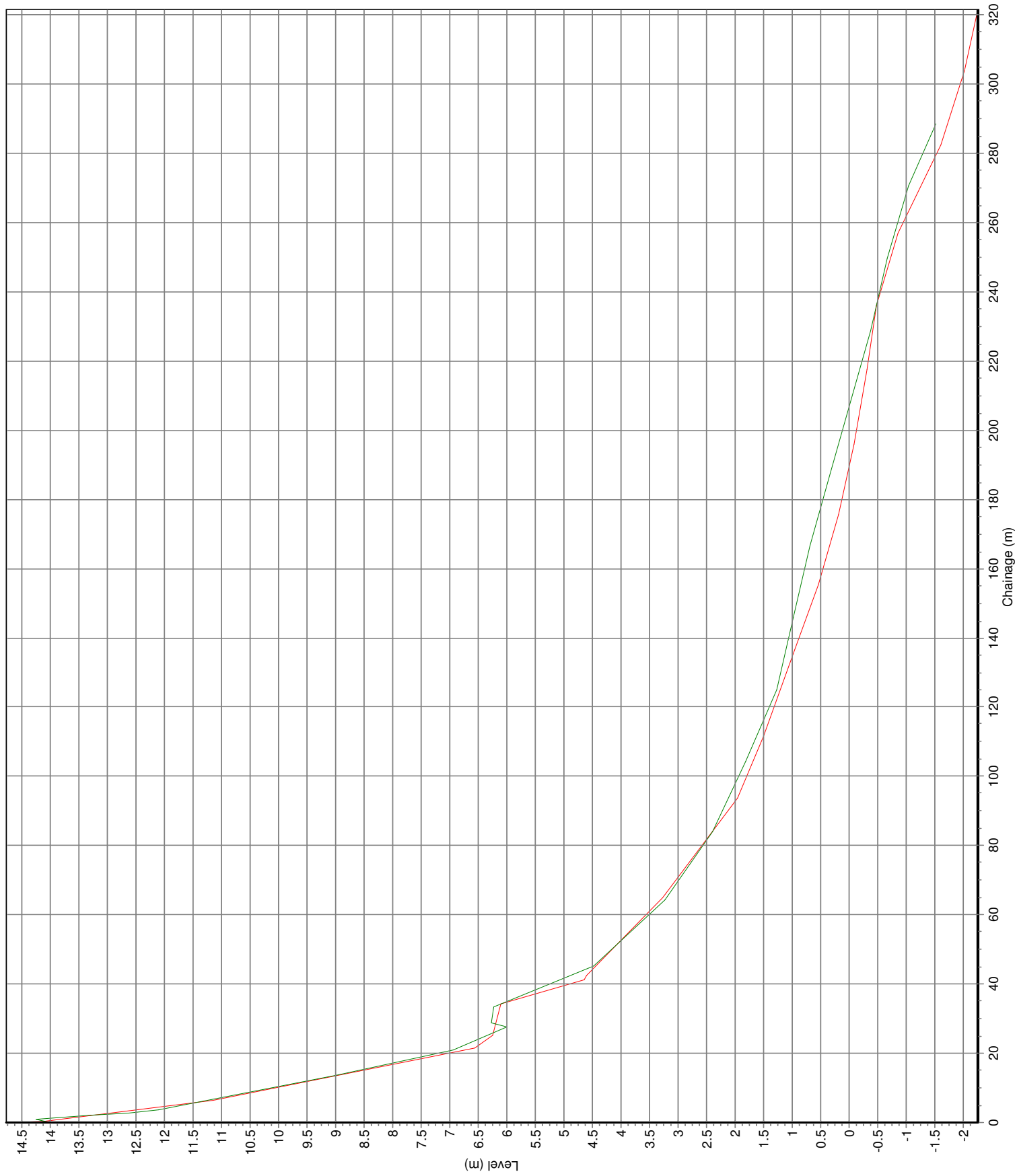
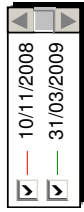
**Low Tide (m)**  
**Visibility** Good **Low Tide Time**  
**Rain** No

**Easting** 450674.420 **Northing** 535305.140 **Bearing** 30

Chainage	Level
0.000	13.987
0.060	13.987
0.790	14.251
2.240	13.285
2.720	12.620
3.630	12.105
13.620	8.973
20.870	6.928
27.460	5.986
28.750	6.256
33.330	6.232
45.190	4.478
64.200	3.225
83.940	2.393
104.250	1.802
125.020	1.267
125.030	1.270
145.830	0.968
166.610	0.676
187.370	0.337
208.120	-0.031
228.770	-0.380
249.730	-0.675
270.690	-1.053
288.430	-1.524



Beach Profiles: 1cHN3



# Beach Profile

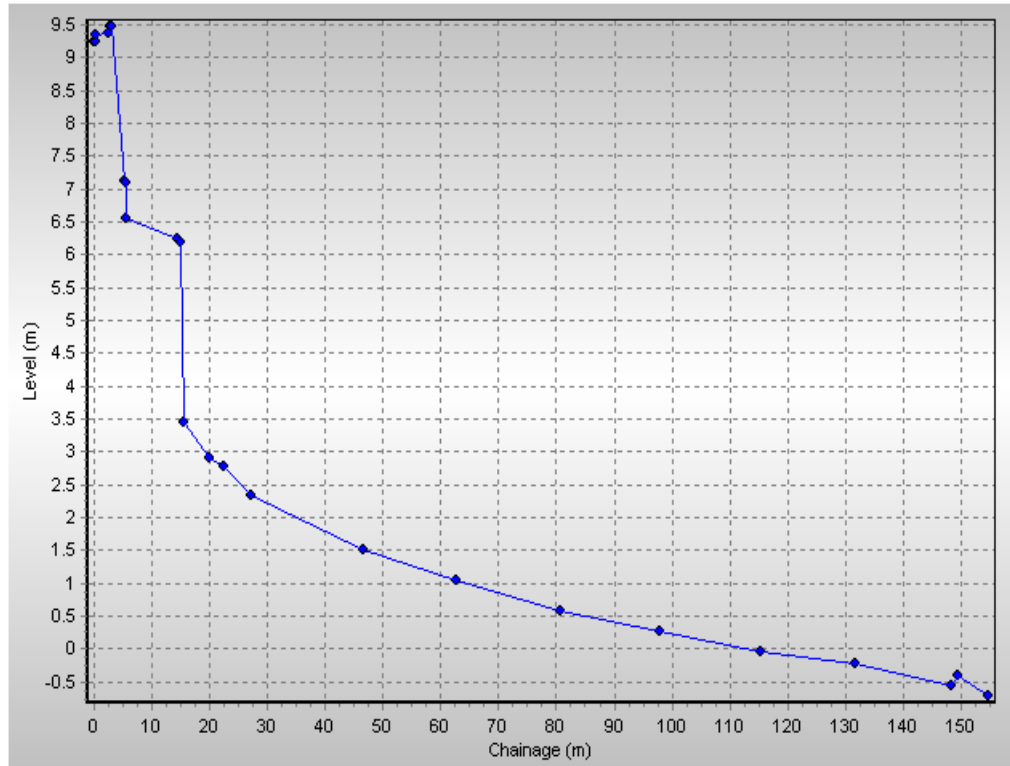
## 1cHN4

**Date** 31/03/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary** New Bearing introduced in March 2009

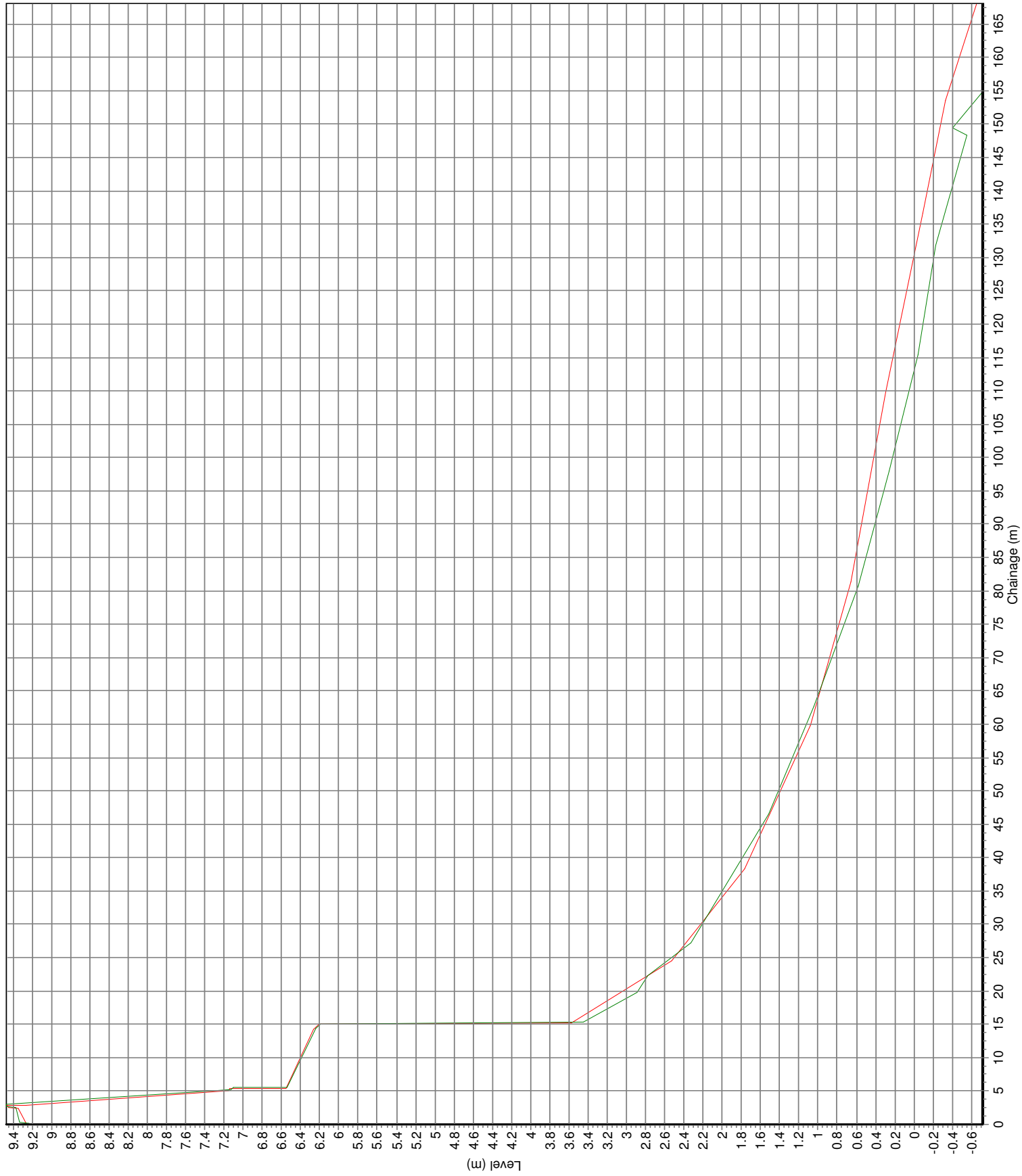
**Low Tide (m)**  
**Visibility** Good **Low Tide Time**  
**Rain** No

**Easting** 451997.110 **Northing** 534616.630 **Bearing** 34

Chainage	Level
0.000	9.244
0.020	9.244
0.180	9.232
0.240	9.332
2.580	9.369
2.650	9.471
2.950	9.468
5.270	7.127
5.520	7.105
5.540	6.540
14.440	6.247
14.970	6.190
15.410	3.443
19.840	2.894
22.380	2.776
27.220	2.330
46.590	1.515
62.740	1.039
80.810	0.581
97.920	0.261
115.330	-0.036
131.870	-0.228
148.320	-0.556
149.420	-0.398
154.760	-0.715



Beach Profiles: 1cHN4



10/1/2008  
31/03/2009

# Beach Profile

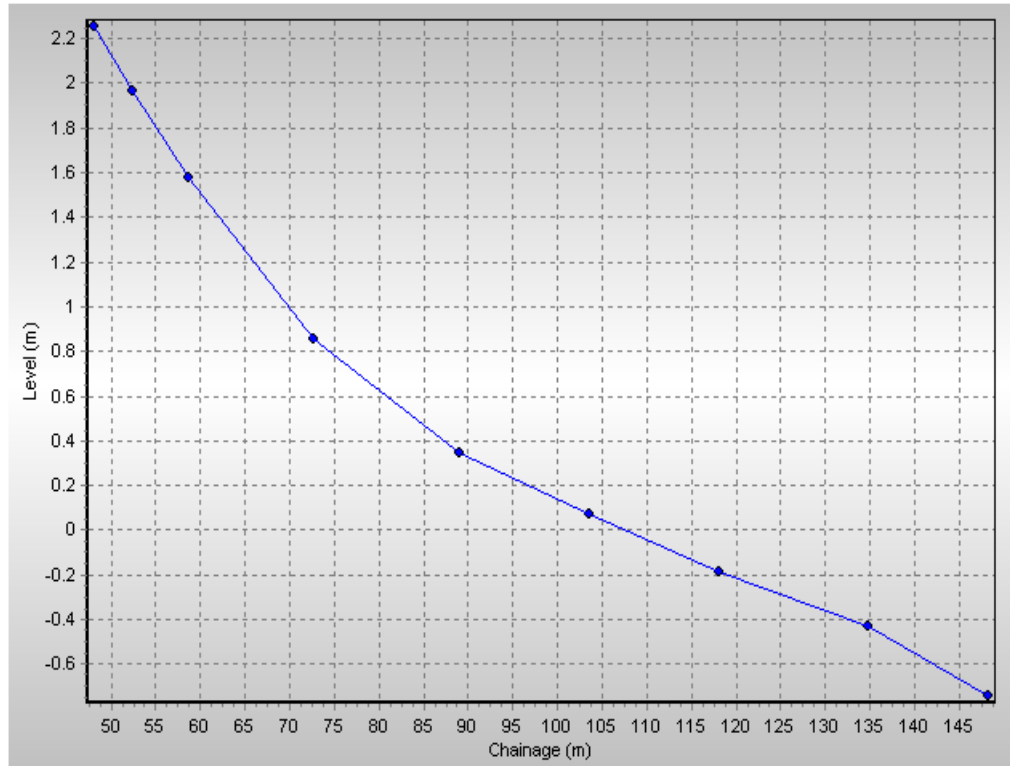
## 1cHC1

**Date** 31/03/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary** New Bearing introduced in March 2009

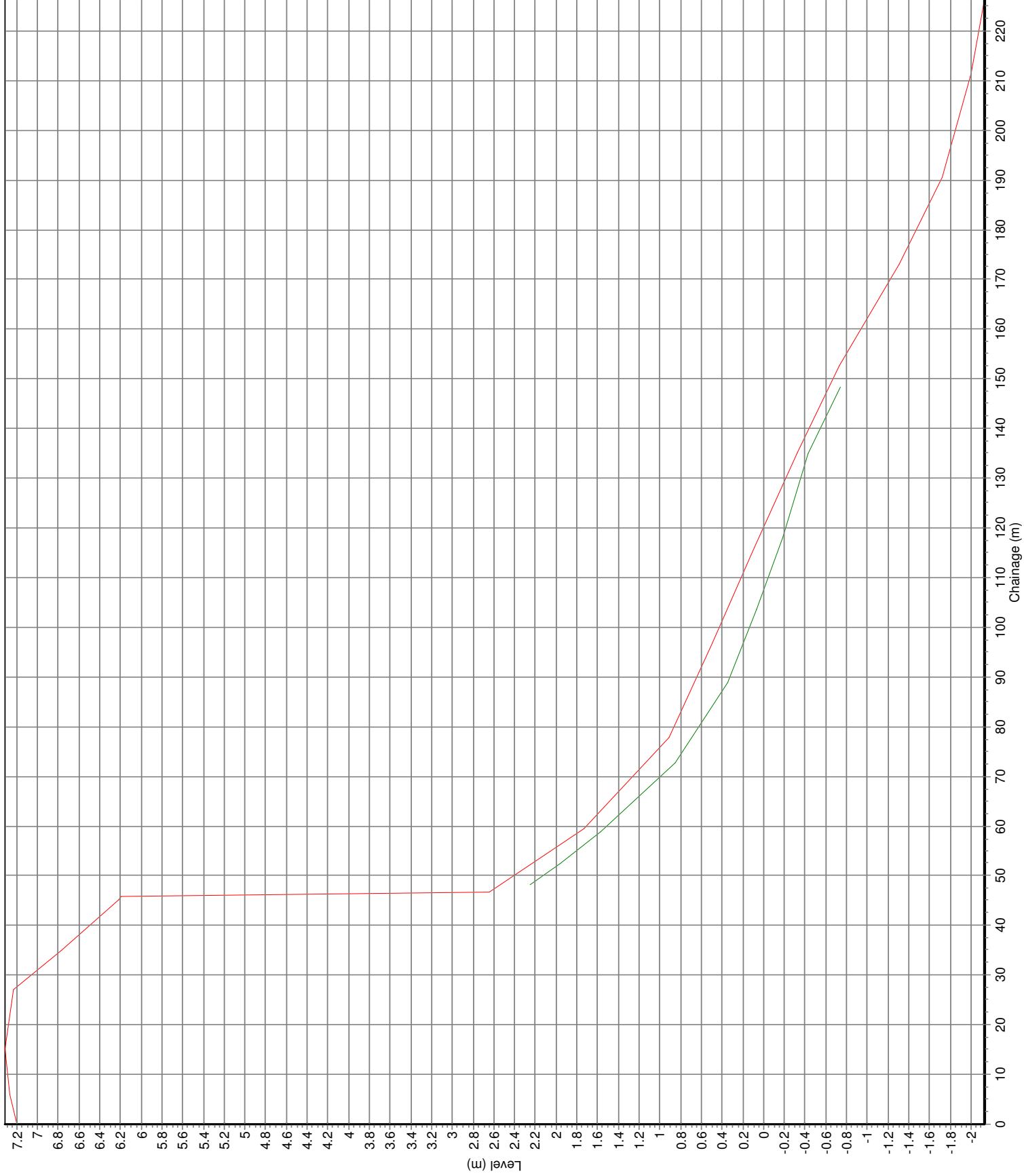
**Low Tide (m)**  
**Visibility** Good **Low Tide Time**  
**Rain** No

**Easting** 452108.080 **Northing** 533506.120 **Bearing** 11

Chainage	Level
48.100	2.253
52.390	1.961
58.740	1.573
72.750	0.852
88.960	0.343
103.630	0.069
118.160	-0.190
134.880	-0.430
148.260	-0.741



# Beach Profiles: 1cHC1



25/11/2008  
 31/03/2009

# Beach Profile

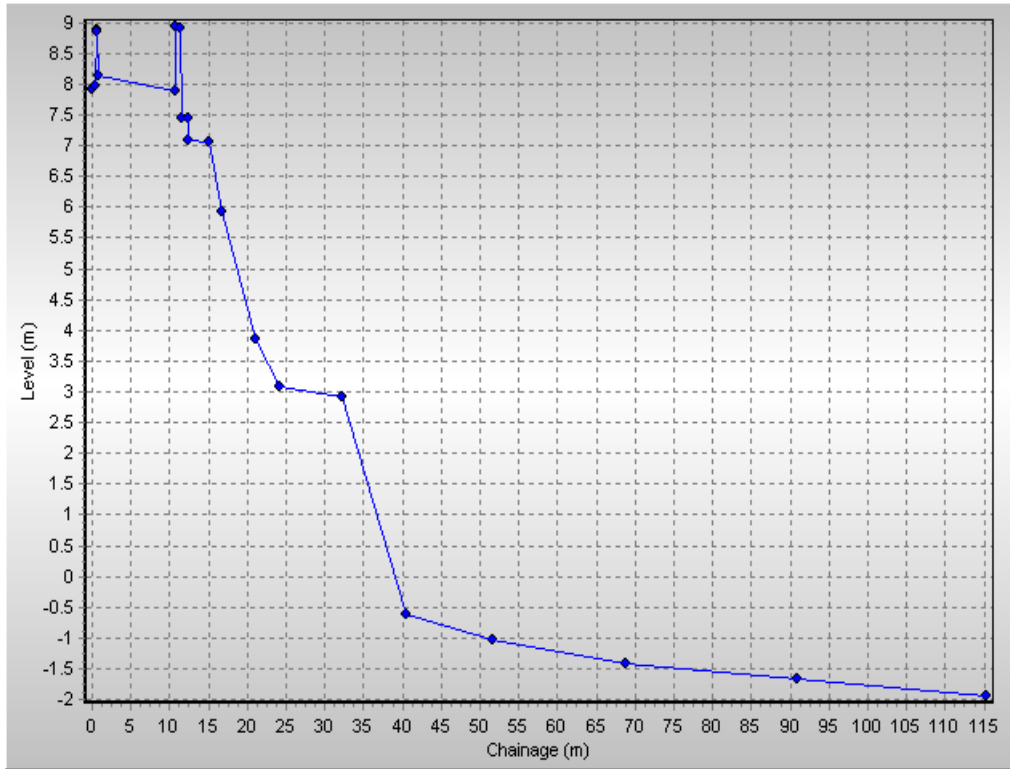
## 1cHS1

Date 27/03/2009 Inspector RH  
Wind Light Sea State  
Summary

Low Tide (m)  
Visibility Good  
Low Tide Time  
Rain No

Easting 451718.000 Northing 532455.000 Bearing 95

Chainage	Level
0.000	7.920
0.010	7.920
0.490	7.970
0.550	8.866
0.720	8.863
0.870	8.126
10.660	7.883
10.730	8.935
11.430	8.915
11.530	7.431
12.320	7.451
12.430	7.076
15.050	7.070
16.760	5.915
21.010	3.850
24.170	3.082
32.240	2.927
40.450	-0.609
51.670	-1.025
68.780	-1.409
90.970	-1.668
115.290	-1.940



# Beach Profile

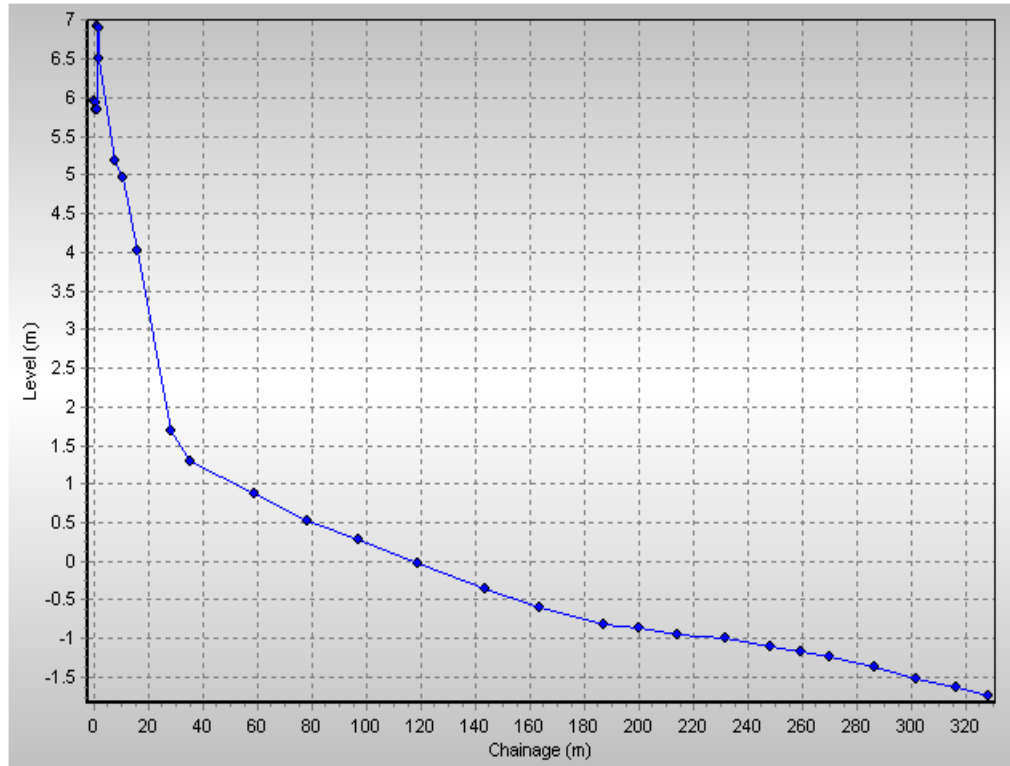
## 1cHS2

Date 27/03/2009 Inspector RH  
Wind Light Sea State  
Summary

Low Tide (m) Low Tide Time  
Visibility Good Rain No

Easting 452160.590 Northing 531071.390 Bearing 77

Chainage	Level
0.000	5.949
0.010	5.949
0.750	5.924
0.780	5.838
0.990	5.834
1.060	6.920
1.590	6.906
1.730	6.503
7.560	5.183
10.330	4.962
15.870	4.023
28.390	1.688
35.600	1.285
58.580	0.880
78.120	0.512
97.040	0.271
118.790	-0.029
143.900	-0.356
163.520	-0.594
187.030	-0.810
200.190	-0.866
214.340	-0.943
232.120	-1.004
248.700	-1.103
259.380	-1.170
270.380	-1.235
286.650	-1.380
302.080	-1.513
316.680	-1.639
328.480	-1.743





# Beach Profile

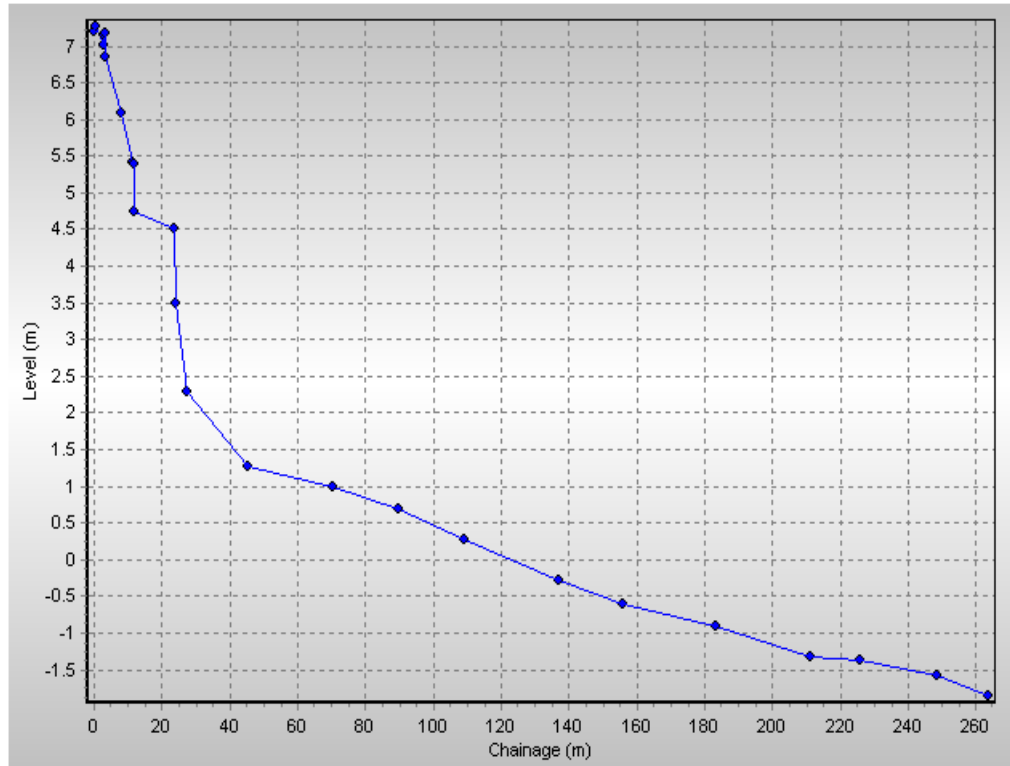
## 1cHS3

Date 27/03/2009 Inspector RH  
Wind Light Sea State  
Summary

Low Tide (m) Low Tide Time  
Visibility Good Rain No

Easting 452517.250 Northing 530064.570 Bearing 76

Chainage	Level
0.000	7.198
0.030	7.198
0.230	7.197
0.280	7.267
2.950	7.008
3.030	7.162
3.400	7.164
3.480	6.860
7.870	6.076
11.150	5.403
11.830	5.382
11.870	4.750
23.570	4.519
24.180	3.492
27.380	2.291
45.380	1.261
70.240	0.998
89.950	0.688
109.200	0.273
137.170	-0.277
155.860	-0.598
183.480	-0.899
211.220	-1.320
225.910	-1.366
248.540	-1.585
263.610	-1.858



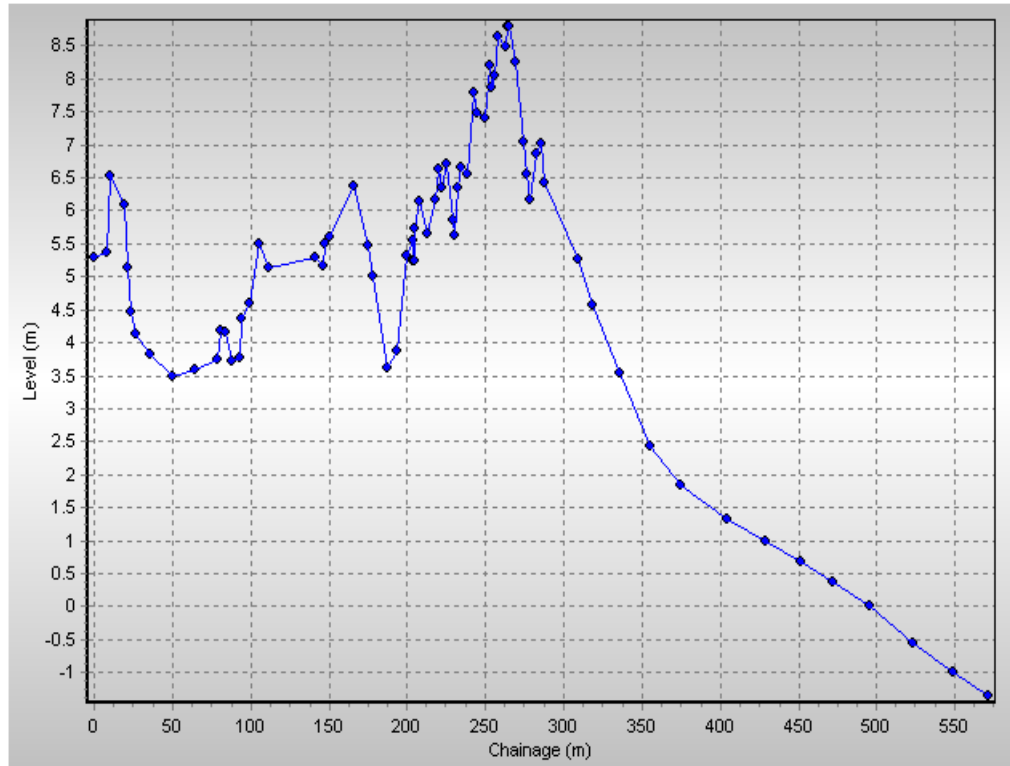
# Beach Profile

## 1cHS4

**Date** 27/03/2009 **Inspector** RH **Low Tide (m)** **Low Tide Time**  
**Wind** Light **Sea State** **Visibility** Good **Rain** No  
**Summary**

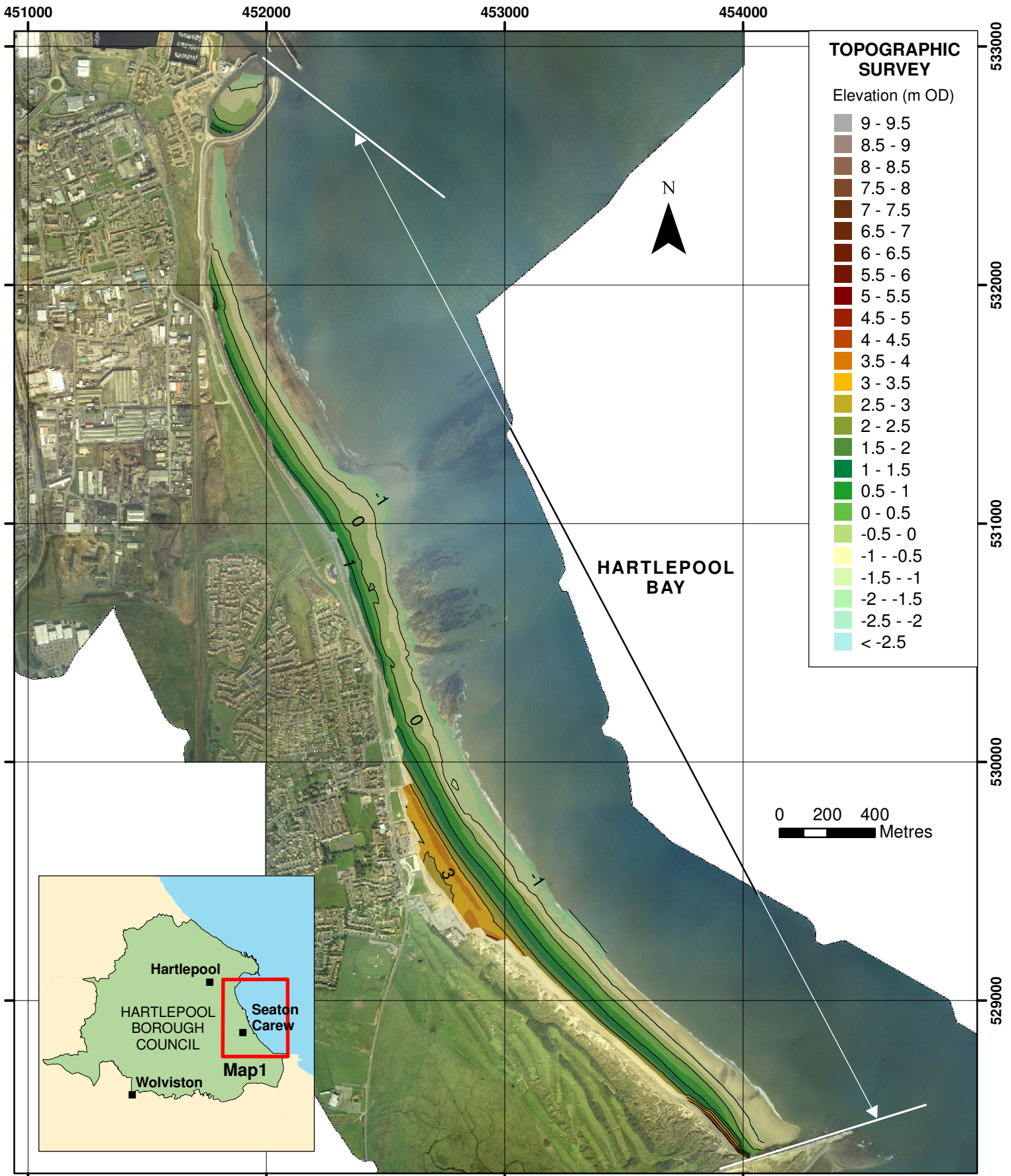
**Easting** 452889.000 **Northing** 528971.000 **Bearing** 76

Chainage	Level
0.000	5.293
0.030	5.293
7.740	5.360
10.500	6.527
18.970	6.084
21.670	5.127
23.810	4.470
26.240	4.125
35.390	3.835
49.980	3.498
64.260	3.603
78.430	3.745
81.290	4.194
83.970	4.155
88.510	3.719
92.820	3.773
94.110	4.360
99.000	4.587
105.300	5.486
111.100	5.147
141.020	5.303
146.670	5.150
147.850	5.502
150.550	5.607
166.080	6.367
175.020	5.484
177.930	4.998
187.570	3.621
193.120	3.881
199.810	5.327
203.320	5.559
203.980	5.242
204.520	5.243
205.030	5.736
207.850	6.142
213.210	5.654
218.310	6.168
220.280	6.629
221.690	6.354
225.420	6.712
229.550	5.848
230.050	5.623
230.670	5.618
232.090	6.349
234.780	6.661
238.750	6.564
243.100	7.798
244.750	7.479
249.420	7.395
252.950	8.207



**Appendix B**  
**Topographic Survey**





**TOPOGRAPHIC SURVEY**

Elevation (m OD)

9 - 9.5
8.5 - 9
8 - 8.5
7.5 - 8
7 - 7.5
6.5 - 7
6 - 6.5
5.5 - 6
4.5 - 5
4 - 4.5
3.5 - 4
3 - 3.5
2.5 - 3
2 - 2.5
1.5 - 2
1 - 1.5
0.5 - 1
0 - 0.5
-0.5 - 0
-1 - -0.5
-1.5 - -1
-2 - -1.5
-2.5 - -2
< -2.5



— Topographic Contours at 1 metre interval

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

**Appendix B - Map 1a  
 Hartlepool Borough  
 Council Frontage**

Update Report 1  
 'Partial Measures' Survey 2009

Drawing Scale 1:21,000 at A4



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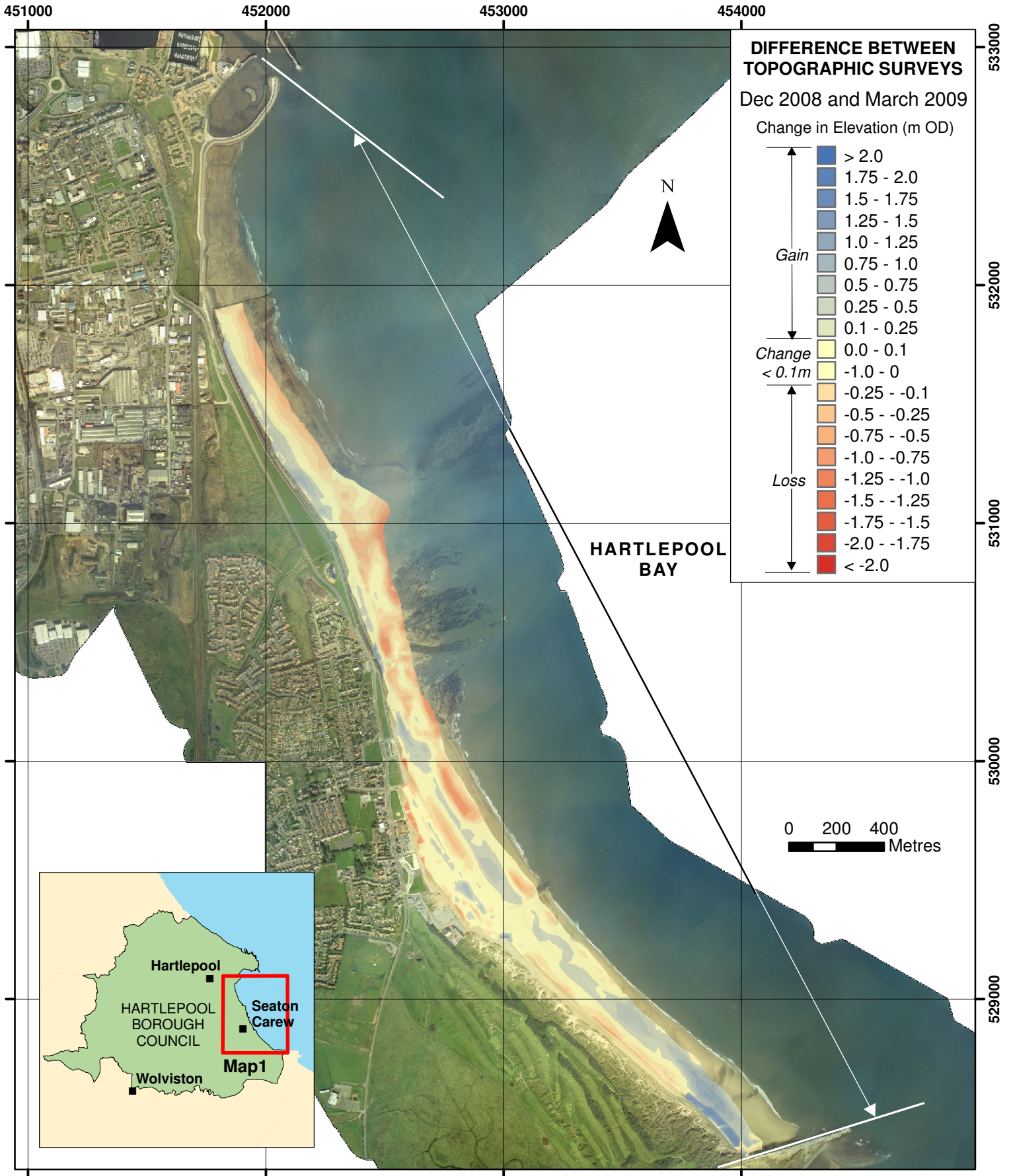
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 Approved by: NC Date: 13/05/2009

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

**Appendix B - Map 1b  
Hartlepool Borough  
Council Frontage**

Update Report 1  
'Partial Measures' Survey 2009

Drawing Scale 1:21,000 at A4



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