



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



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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 <sup>(+)</sup> | Mar-May 09       | June 09 <sup>(*)</sup> | -                      |

<sup>(+)</sup> An Analytical Report was not produced in May 2009 for Sunderland City Council as part of the Cell 1 Regional Monitoring Programme because the survey data collection and reporting was coordinated under an existing agreement with the Council's framework consultants.

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

Sunderland City Council's frontage extends from The Bents to Ryhope Dene. For the purposes of this report, it has been sub-divided into three areas, namely:

- Whitburn Bay (also referred to as Sunderland North or 'SNN')
- Sunderland Harbour and Docks (also referred to as Sunderland Central or 'SNC')
- Hendon to Ryhope (also referred to as Sunderland South or 'SNS')

### **1.2 Methodology**

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

- Full Measures survey annually each autumn/early winter comprising:
  - 58 no. beach profile lines
  - Topographic survey at Whitburn Bay
  - Topographic survey at Hendon to Ryhope
- Partial Measures survey annually each spring comprising:
  - 14 no. beach profile lines
- Cliff top survey bi-annually at:
  - Hendon to Ryhope

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 survey was undertaken along this frontage in March 2009, when weather conditions were wet and breezy and the sea state was moderate.

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.

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**TOPOGRAPHIC SURVEY LOCATIONS**

- Bi-Annual Profile
  - 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  
 Sunderland  
 Council Frontage**

Update Report 1  
 'Partial Measures' Survey 2009

Drawing Scale 1:15,000 at A4



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Drawn by: TC Date: 29/05/2009  
 Checked by: MD Date: 29/05/2009  
 Approved by: NC Date: 29/05/2009

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440000

441000

442000



1bSNN10

Harbour & Docks

0 200 400 Metres



559000

558000

557000

**TOPOGRAPHIC SURVEY LOCATIONS**

- Bi-Annual Profile
  - 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



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Approved by: NC Date: 29/05/2009

**Figure 1 - Map 2  
Sunderland  
Council Frontage**

Update Report 1  
'Partial Measures' Survey 2009

Drawing Scale 1:15,000 at A4

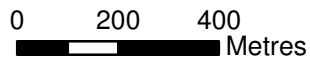
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440000

441000

442000



**TOPOGRAPHIC SURVEY LOCATIONS**

- Bi-Annual Profile
  - 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  
 Sunderland  
 Council Frontage**

Update Report 1  
 'Partial Measures' Survey 2009

Drawing Scale 1:15,000 at A4



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556000

555000

554000

441000

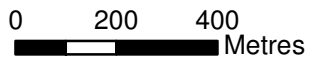
442000

554000

553000

552000

551000



**TOPOGRAPHIC SURVEY LOCATIONS**

- Bi-Annual Profile
  - 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 4  
 Sunderland  
 Council Frontage**

Update Report 1  
 'Partial Measures' Survey 2009

Drawing Scale 1:15,000 at A4



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## 2. Analysis of Survey Data

### 2.1 Whitburn Bay

| Survey Date | Description of Changes Since Last Survey  | Interpretation  |
|-------------|---|---|
| 03-2009     | <p><b>Beach Profiles:</b></p> <p>Whitburn Bay is covered by three beach profile lines during the Partial Measures survey (Appendix A).</p> <p>SNN1 is just to the south of Sunderland City Council's northerly boundary of jurisdiction. The profile line starts at the short length of low (1m high) masonry wall just to the south of the boat house and extends across the narrow width of dune/scrubland, then across the upper beach gravel and finally across the sandy profile down to low water. Towards the seaward end of the profile, some rock outcrop of White Steel was evident.</p> <p>SNN7 is at Seaburn, just to the north of Parson's Rock. The profile extends across the crest of the sea wall, which is at an elevation of 5.6mODN, and down the vertical face to a small patch of rocks at the toe. (Note, these are not present throughout the Seaburn frontage, but are locally present in discrete patches). There is then a relatively uniform gradient across the sandy foreshore down to low water.</p> <p>SNN10 is located approximately mid-way between Parson's Rock and Roker Pier. It extends across the beach access slope and fronting sea wall before dropping around 1.2m to beach level. The profile then drops at a relatively uniform gradient down to low water.</p> | <p>Through comparison with surveys from November 2006, provided by Sunderland City Council, some degree of interpretation of changes is possible.</p> <p>SNN1 had higher levels in March 2009 than were recorded in November 2006 between around MHWN and MLWN. The more recent survey also appears to have picked out more detail across the dune/scrubland in front of the masonry wall and across the rock outcrops at the seaward end of the profile.</p> <p>SNN7 presently exhibits a considerably different form at the toe of the sea wall than was observed in November 2006. Then, the beach levels at the toe were notably higher than in the most recent survey. It will be important to continue monitoring here to determine whether levels are naturally dynamic and will recover, or whether there has been an ongoing loss of material from the frontage.</p> <p>SNN10 exhibited very similar characteristics in the most recent survey to those observed in November 2006.</p> |

## 2.2 Hendon to Ryhope

| Survey Date | Description of Changes Since Last Survey  | Interpretation   |
|-------------|---|--|
| 03-2009     | <p><b>Beach Profiles:</b></p> <p>Hendon to Ryhope is covered by eleven beach profile lines during the Partial Measures survey (Appendix A). Seven of these are closely spaced and located at Halliwell Banks to specifically monitor erosion rates along the cliffs fronting the former landfill area.</p> <p>SNS4 crosses the concrete boundary wall of the Hendon Sewage Treatment Works, which has an elevation in excess of 7.0mODN, and extends a further 5m across the gently sloping concrete deck to the edge of the near vertical wall face. The profile then crosses the fronting rock revetment until it intercepts water. There is no foreshore exposed along the frontage as the area extends into deeper water.</p> <p>SNS8 and SNS11 both start at the coastal slope/cliff backing the Hendon Sea Wall and extend across the wall and fronting rock armour before reaching sand levels and then extending down to low water.</p> <p>SNS20 is located at Shirley Banks. The profile extends across the cliff top, which is at an elevation in excess of 25mODN, and drops over 21m in height down the steeply-sloping cliff face to the toe. The profile then extends across the foreshore down to low water, with some rock outcrops captured towards the land ward end.</p> <p>Profiles SNS26 to SNS32 are all located at close spacings at Halliwell Banks. Each profile exhibits a broadly similar form, with a gentle downward slope across the first 50m or so of cliff top followed by a slightly steeper upward slope to around 10m or so from the cliff edge. The profile then has a near-horizontal or very gently downward sloping form to the very cliff edge, which generally is around 26.8mODN, although slightly lower in elevation at SNS31 and SNS32. There is then a drop of around 22-24m down the steep cliff face to the upper foreshore. Each profile then extends a short distance across the gravely foreshore to low water.</p> | <p>Through comparison with surveys from November 2006, provided by Sunderland City Council, some degree of interpretation of changes is possible.</p> <p>SNS4 shows a similar profile form to the November 2006 survey, but is located slightly further landward.</p> <p>There is very little difference in form or position of profiles SNS8 and SNS11 between the November 2006 and March 2009 surveys.</p> <p>SNS20 demonstrates similar beach form (position and level) between the two surveys, but the cliff face has eroded by around 1.8m. If averaged over the period between surveys, this equates to an average recession rate of 0.75m per year.</p> <p>Profiles SNS26 to SNS32 were recorded in their present locations to better capture cliff recession in the area of former land fill at Halliwell Banks. The position was defined following geophysical investigations in 2008. The 2006 survey captures these profiles in different locations and therefore direct comparison between surveys has not been made in this report.</p> |

| Survey Date | Description of Changes Since Last Survey   | Interpretation   |
|-------------|--|--|
| 03-2009     | <p><b>Cliff Top Survey:</b></p> <p>Thirty-two ground control points have been established along the cliff top between Hendon and Ryhope (Figure B1). Measurements are taken from each ground control point along a fixed bearing to the edge of the cliff top.</p> <p>These cliff top surveys are undertaken bi-annually and are intended to inform on erosion rates of the sea cliffs extending from the defended industrial areas at Hendon southwards along the undefended cliffs to Ryhope Dene.</p> | <p>Appendix B provides results from the March 2009 survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. This provides a baseline against which future surveys will be compared.</p> |

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

Whilst beach profile data were provided by Sunderland City Council from a survey in November 2008, they have not been used in the present report because they seemed to have different origins (although correct bearings and positions) to the November 2006 and March 2009 datasets.

Data from the 2008 surveys is being used by the Council's Framework Consultants to update their analysis of changes. In undertaking the next Analytical Report associated with the Cell 1 Regional Coastal Monitoring Programme it would be advantageous to have all previous reports for Sunderland City Council's frontage available so that interpretation of changes can build from previous understanding and findings.

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

At present the cliff top surveys at Halliwell Banks, which are nominally at 50m spacings, could usefully be extended further south towards Pincushion. The surveyors have therefore been requested to add in a further 2 or 3 ground control points between points 28 and 29.

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

- Beach levels at Seaburn appear considerably lower than recorded during the November 2006 survey. It will be important to continue monitoring here to determine whether levels are naturally dynamic and will recover, or whether there has been an ongoing loss of material from the frontage.
- Erosion of the cliff face has been recorded at Shirley Banks by around 1.8m between November 2006 and March 2009. If averaged over the period between surveys, this equates to an average recession rate of around 0.75m per year.
- It is important to continue monitoring the cliff recession rates at Halliwell Banks in order to determine the time period before land fill becomes exposed at the coastal margin.
- Ongoing monitoring throughout Sunderland City Council's frontage remains important to continually improve understanding of coastal processes and recession rates, and to provide up-to-date information to inform design of future schemes.





## **Appendices**



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



# Beach Profile

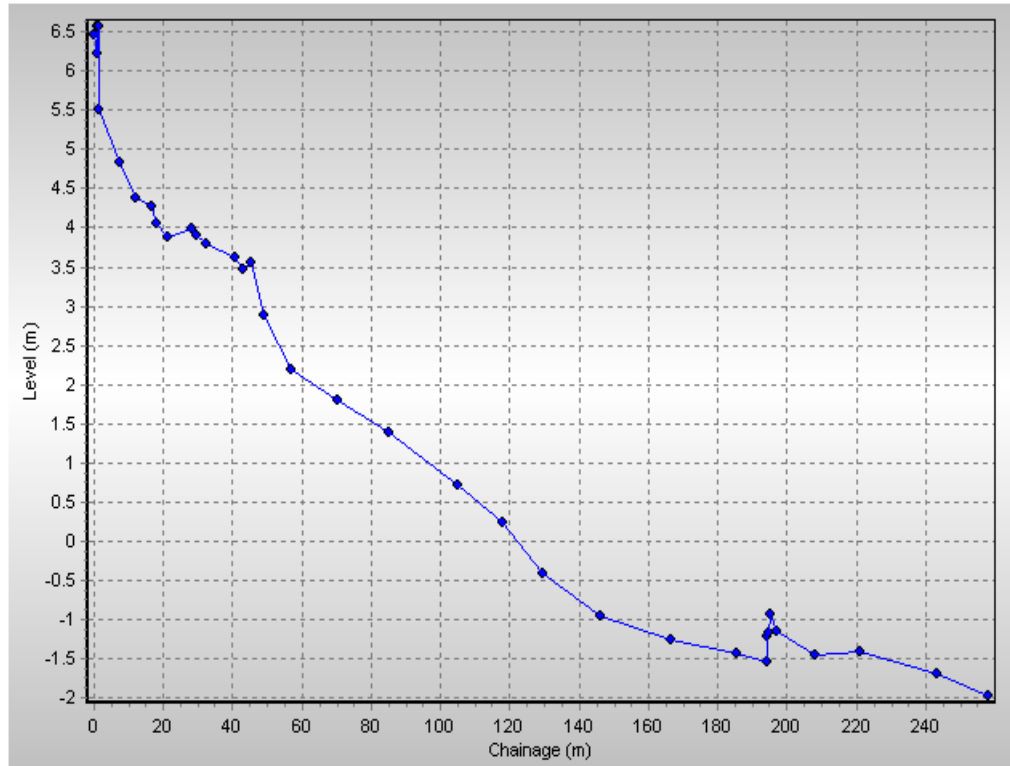
## 1bSNN1

**Date** 27/04/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary**

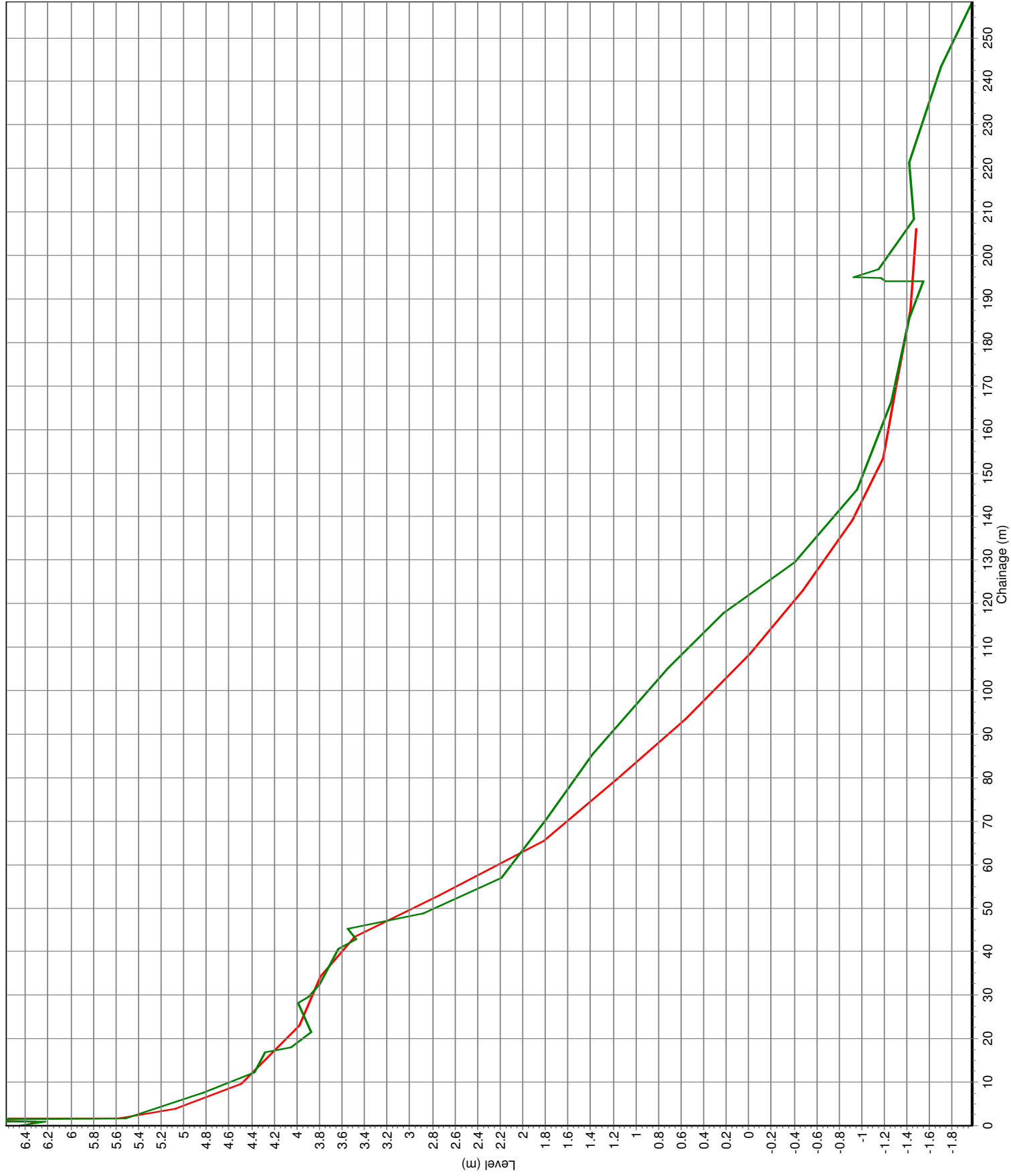
**Low Tide (m)**  
**Visibility** Good **Low Tide Time**  
**Rain** No

**Easting** 440797.426 **Northing** 561231.245 **Bearing** 97

| Chainage | Level  |
|----------|--------|
| 0.000    | 6.453  |
| 0.030    | 6.453  |
| 0.870    | 6.228  |
| 0.900    | 6.569  |
| 1.510    | 6.561  |
| 1.590    | 5.512  |
| 7.620    | 4.826  |
| 12.250   | 4.379  |
| 16.800   | 4.278  |
| 17.910   | 4.047  |
| 21.490   | 3.870  |
| 28.230   | 3.990  |
| 29.770   | 3.895  |
| 32.380   | 3.801  |
| 40.620   | 3.631  |
| 42.840   | 3.478  |
| 45.260   | 3.549  |
| 48.860   | 2.881  |
| 56.870   | 2.186  |
| 70.510   | 1.794  |
| 85.300   | 1.385  |
| 105.150  | 0.718  |
| 117.760  | 0.228  |
| 129.570  | -0.407 |
| 146.240  | -0.956 |
| 166.450  | -1.267 |
| 185.600  | -1.422 |
| 194.080  | -1.542 |
| 194.130  | -1.205 |
| 194.820  | -1.165 |
| 195.030  | -0.927 |
| 196.840  | -1.145 |
| 208.280  | -1.457 |
| 221.300  | -1.420 |
| 243.400  | -1.700 |
| 258.090  | -1.973 |



Beach Profiles: 1bSNN1



|                                     |            |
|-------------------------------------|------------|
| <input checked="" type="checkbox"/> | 10/11/2006 |
| <input checked="" type="checkbox"/> | 27/04/2009 |

# Beach Profile

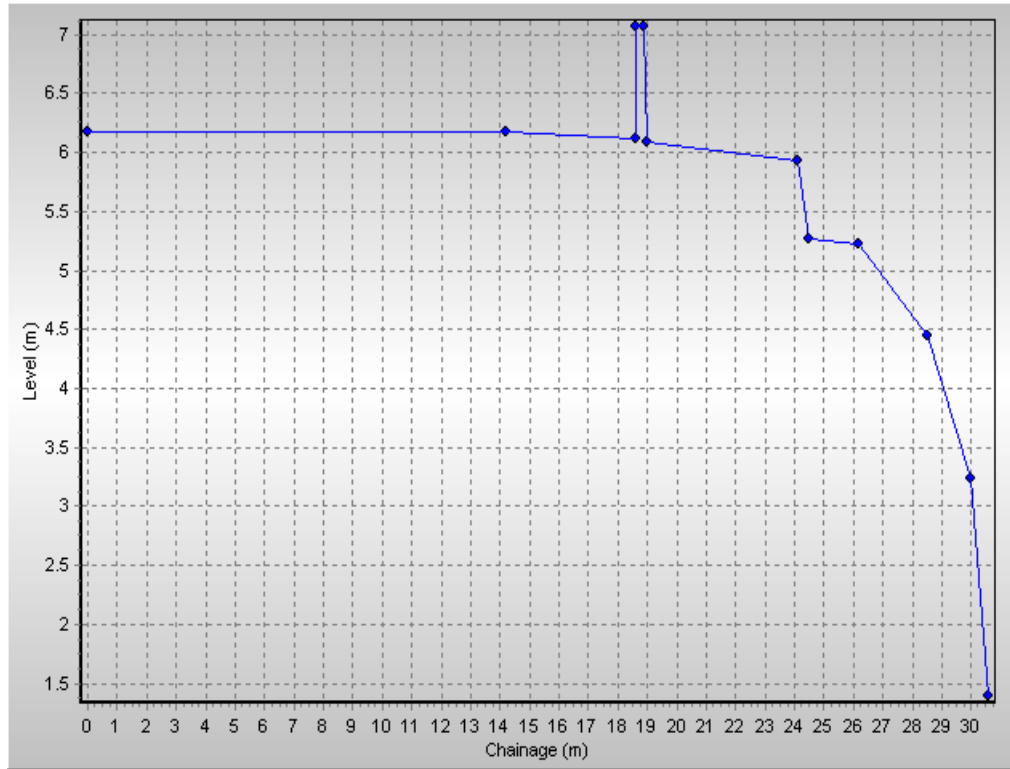
## 1bSNS4

**Date** 25/03/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary**

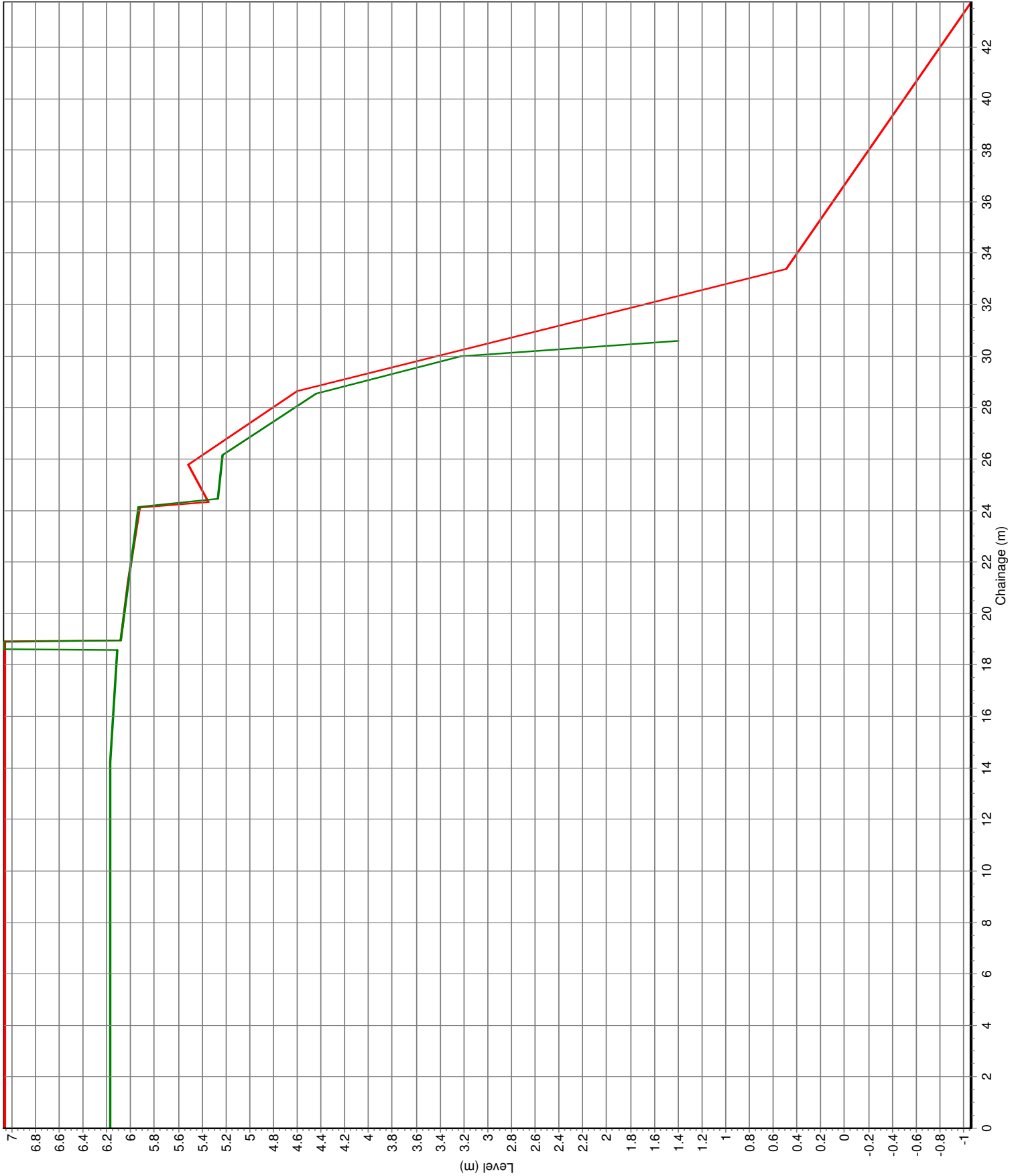
**Low Tide (m)** **Low Tide Time**  
**Visibility** Good **Rain** No

**Easting** 441060.940 **Northing** 556261.101 **Bearing** 82

| Chainage | Level |
|----------|-------|
| 0.000    | 6.170 |
| 14.220   | 6.170 |
| 18.590   | 6.116 |
| 18.620   | 7.068 |
| 18.880   | 7.065 |
| 18.970   | 6.085 |
| 24.130   | 5.930 |
| 24.470   | 5.269 |
| 26.150   | 5.226 |
| 28.530   | 4.443 |
| 29.990   | 3.231 |
| 30.580   | 1.393 |



Beach Profiles: 1bSNS4



10/11/2006  
 25/03/2009



# Beach Profile

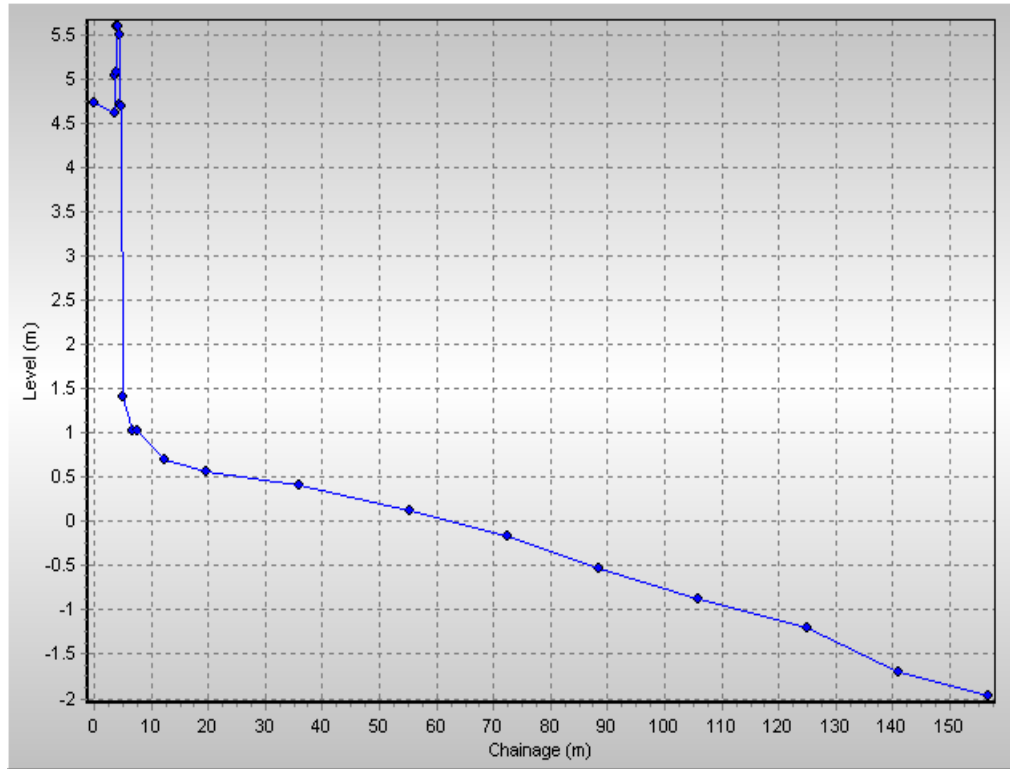
## 1bSNN7

**Date** 27/04/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary**

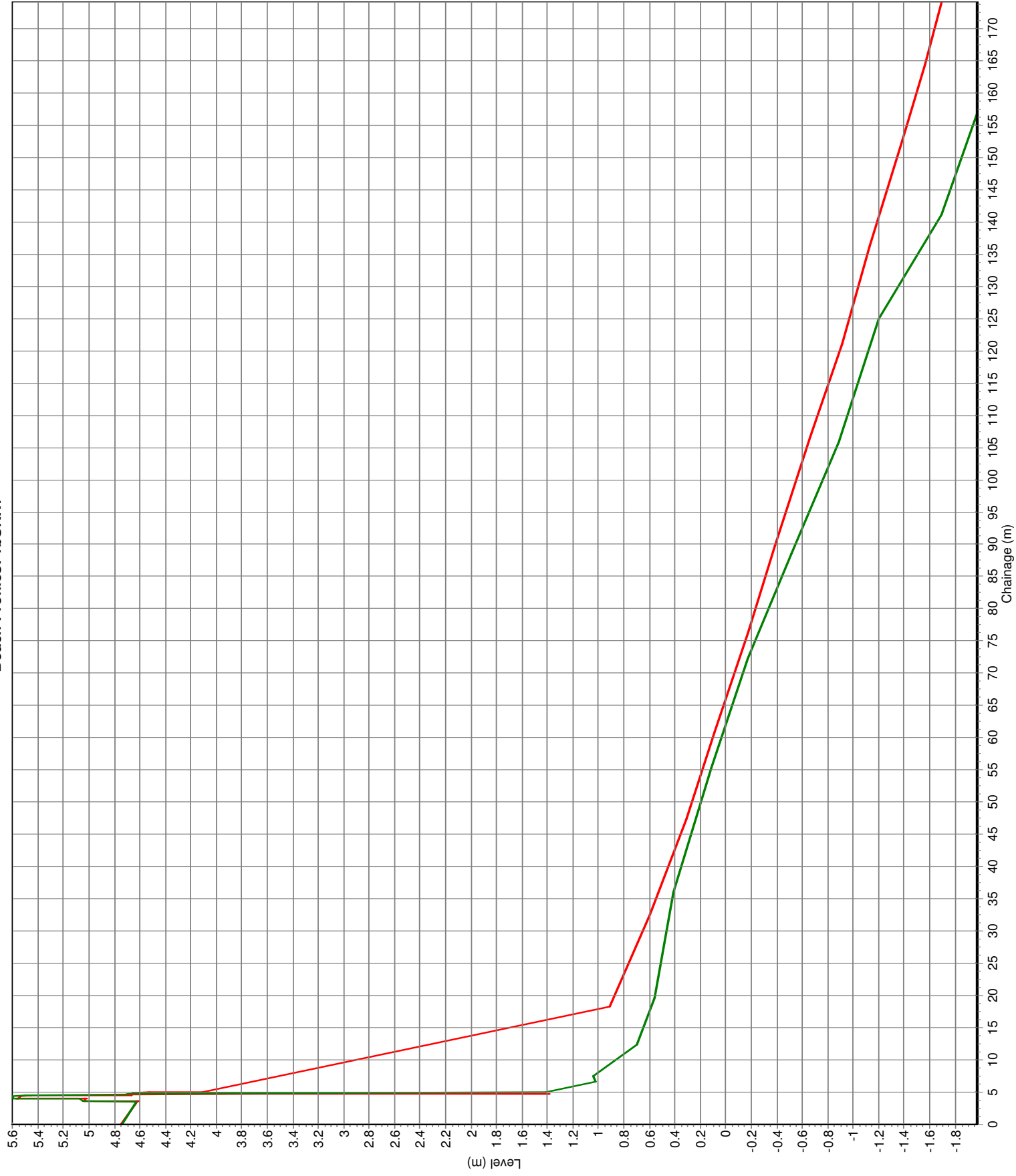
**Low Tide (m)** **Low Tide Time**  
**Visibility** Good **Rain** No

**Easting** 440623.801 **Northing** 560029.933 **Bearing** 81

| Chainage | Level  |
|----------|--------|
| 0.000    | 4.737  |
| 3.560    | 4.628  |
| 3.590    | 5.049  |
| 4.000    | 5.074  |
| 4.010    | 5.594  |
| 4.350    | 5.602  |
| 4.470    | 5.503  |
| 4.580    | 4.709  |
| 4.800    | 4.696  |
| 5.040    | 1.410  |
| 6.690    | 1.027  |
| 7.510    | 1.037  |
| 12.430   | 0.696  |
| 19.640   | 0.558  |
| 36.020   | 0.414  |
| 55.270   | 0.118  |
| 72.360   | -0.172 |
| 88.580   | -0.520 |
| 105.810  | -0.885 |
| 124.970  | -1.202 |
| 141.060  | -1.693 |
| 156.720  | -1.971 |



Beach Profiles: 1bSNN7



|                                     |            |
|-------------------------------------|------------|
| <input checked="" type="checkbox"/> | 10/11/2006 |
| <input checked="" type="checkbox"/> | 27/04/2009 |

# Beach Profile

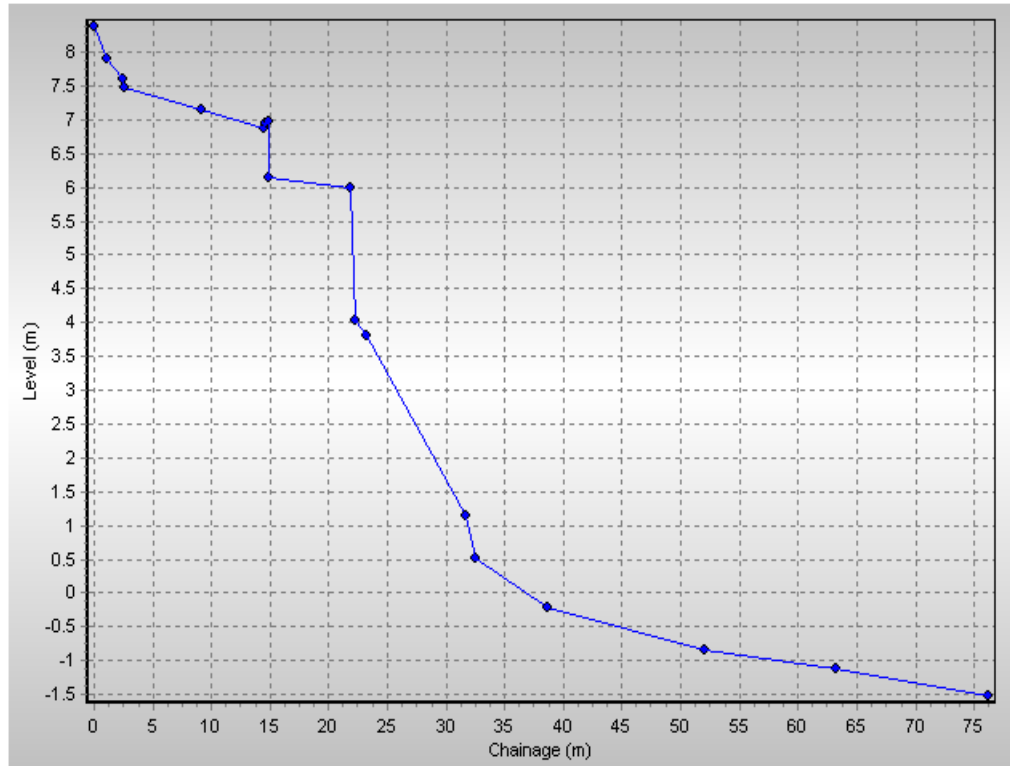
## 1bSNS8

**Date** 25/03/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary**

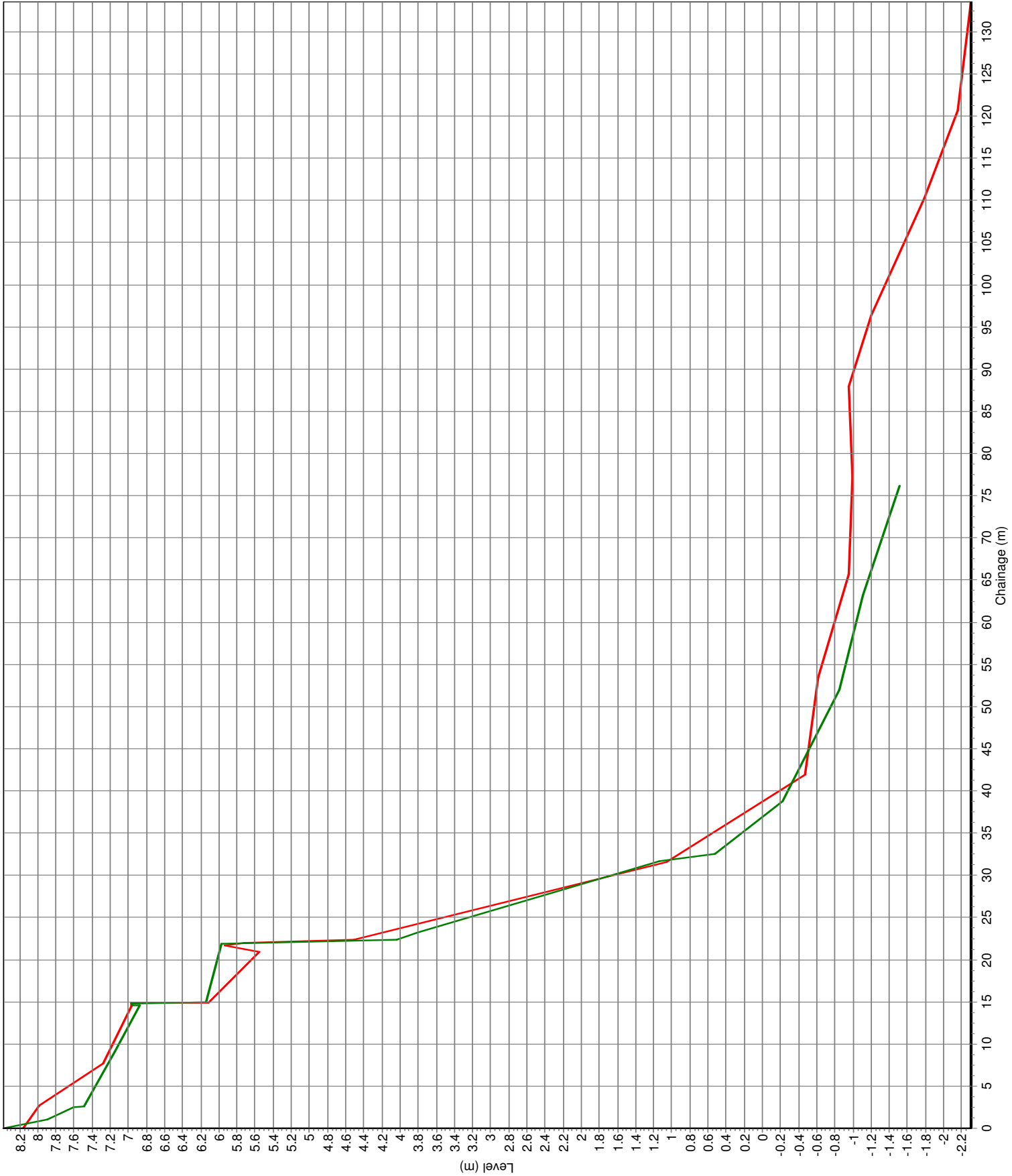
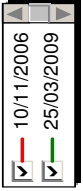
**Low Tide (m)**  
**Visibility** Good **Low Tide Time**  
**Rain** No

**Easting** 441092.263 **Northing** 555414.414 **Bearing** 80

| Chainage | Level  |
|----------|--------|
| 0.000    | 8.377  |
| 0.040    | 8.377  |
| 1.040    | 7.896  |
| 2.520    | 7.602  |
| 2.570    | 7.485  |
| 9.090    | 7.147  |
| 14.540   | 6.872  |
| 14.590   | 6.951  |
| 14.820   | 6.961  |
| 14.930   | 6.146  |
| 21.830   | 5.978  |
| 22.320   | 4.034  |
| 23.220   | 3.805  |
| 31.630   | 1.135  |
| 32.510   | 0.525  |
| 38.710   | -0.217 |
| 52.040   | -0.854 |
| 63.180   | -1.116 |
| 76.210   | -1.522 |



Beach Profiles: 1bSNS8



# Beach Profile

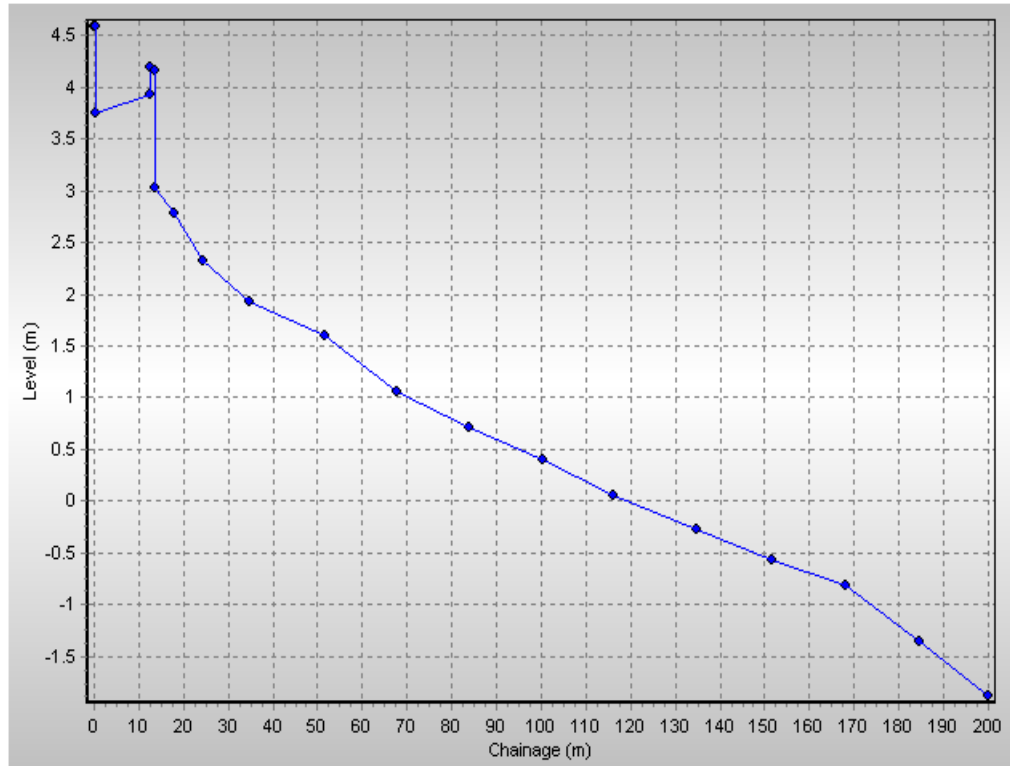
## 1bSNN10

**Date** 27/04/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary**

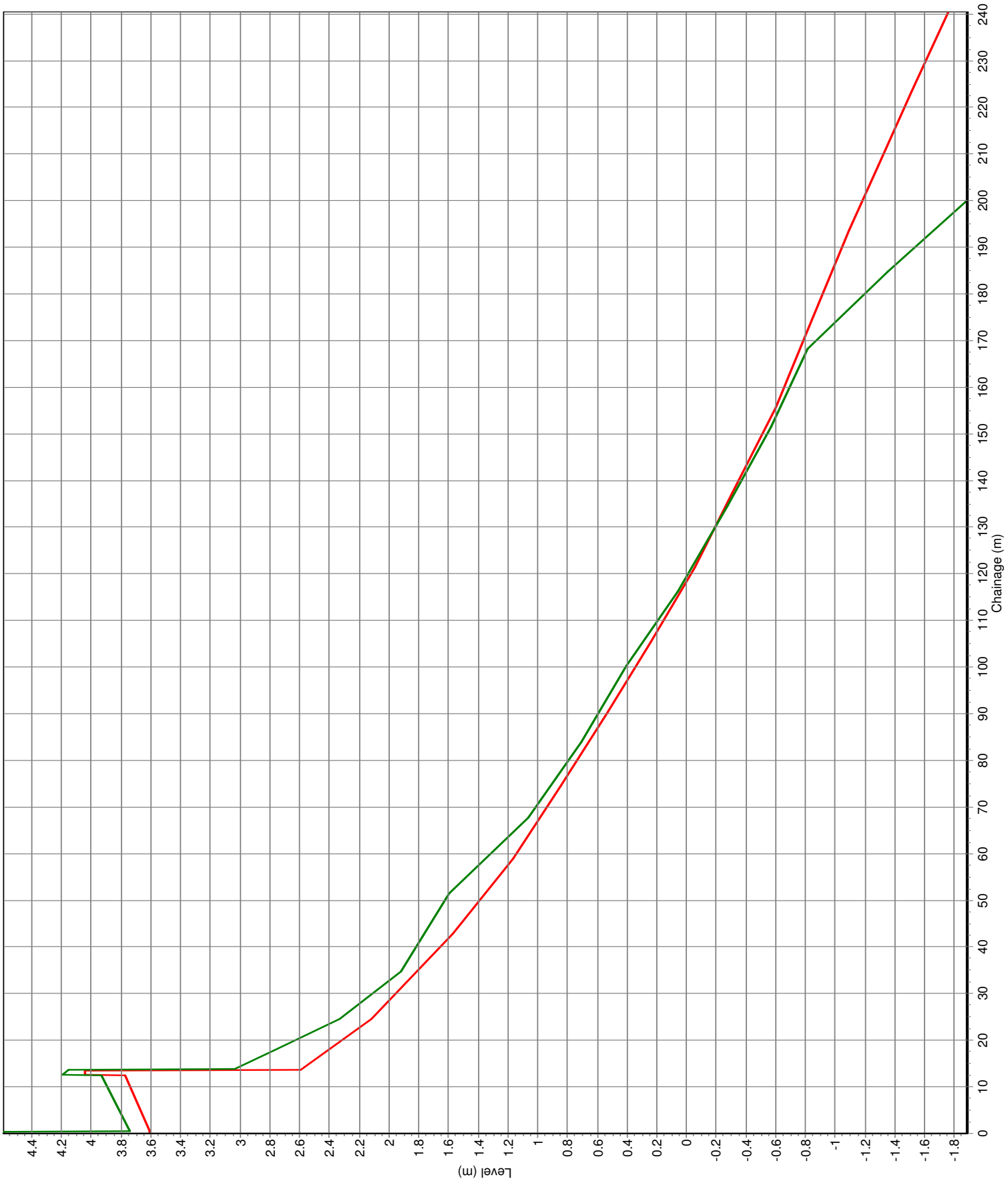
**Low Tide (m)**  
**Visibility** Good **Low Tide Time**  
**Rain** No

**Easting** 440728.714 **Northing** 559193.372 **Bearing** 74

| Chainage | Level  |
|----------|--------|
| 0.000    | 4.590  |
| 0.300    | 4.590  |
| 0.480    | 3.745  |
| 12.460   | 3.932  |
| 12.550   | 4.193  |
| 13.610   | 4.155  |
| 13.740   | 3.034  |
| 17.870   | 2.778  |
| 24.520   | 2.329  |
| 34.690   | 1.922  |
| 51.500   | 1.595  |
| 67.670   | 1.064  |
| 83.910   | 0.710  |
| 100.230  | 0.406  |
| 116.290  | 0.060  |
| 134.620  | -0.279 |
| 151.500  | -0.565 |
| 168.180  | -0.815 |
| 184.760  | -1.355 |
| 200.020  | -1.884 |



Beach Profiles: 1bSNN10



10/11/2006  
 27/04/2009

# Beach Profile

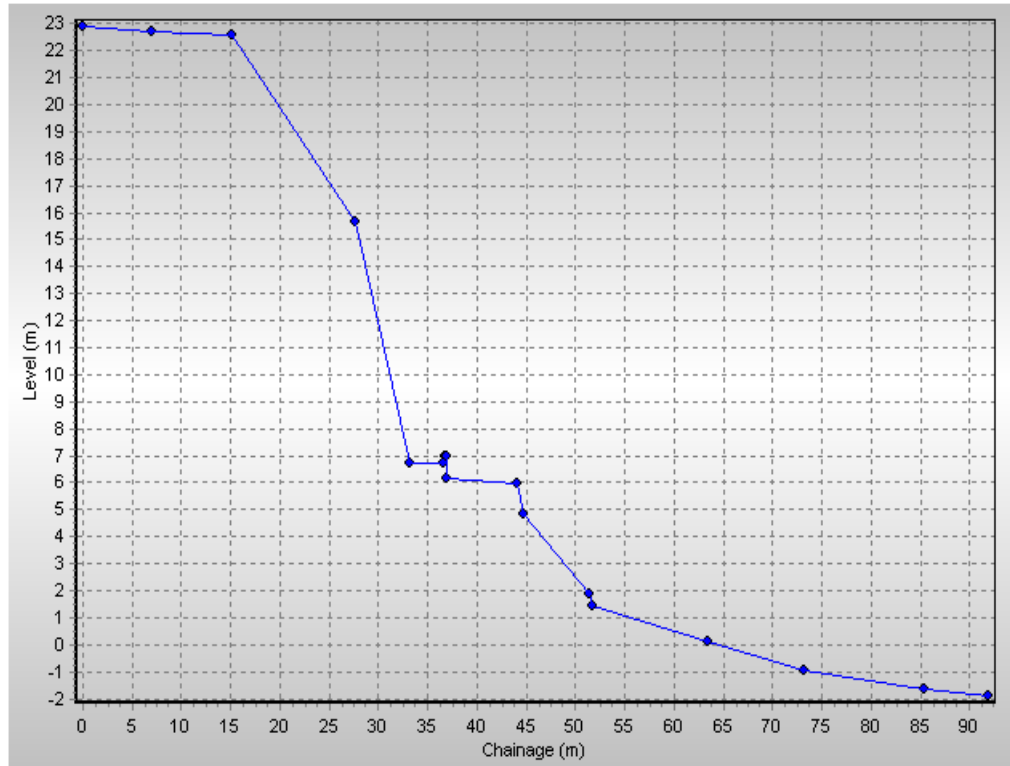
## 1bSNS11

**Date** 25/03/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary**

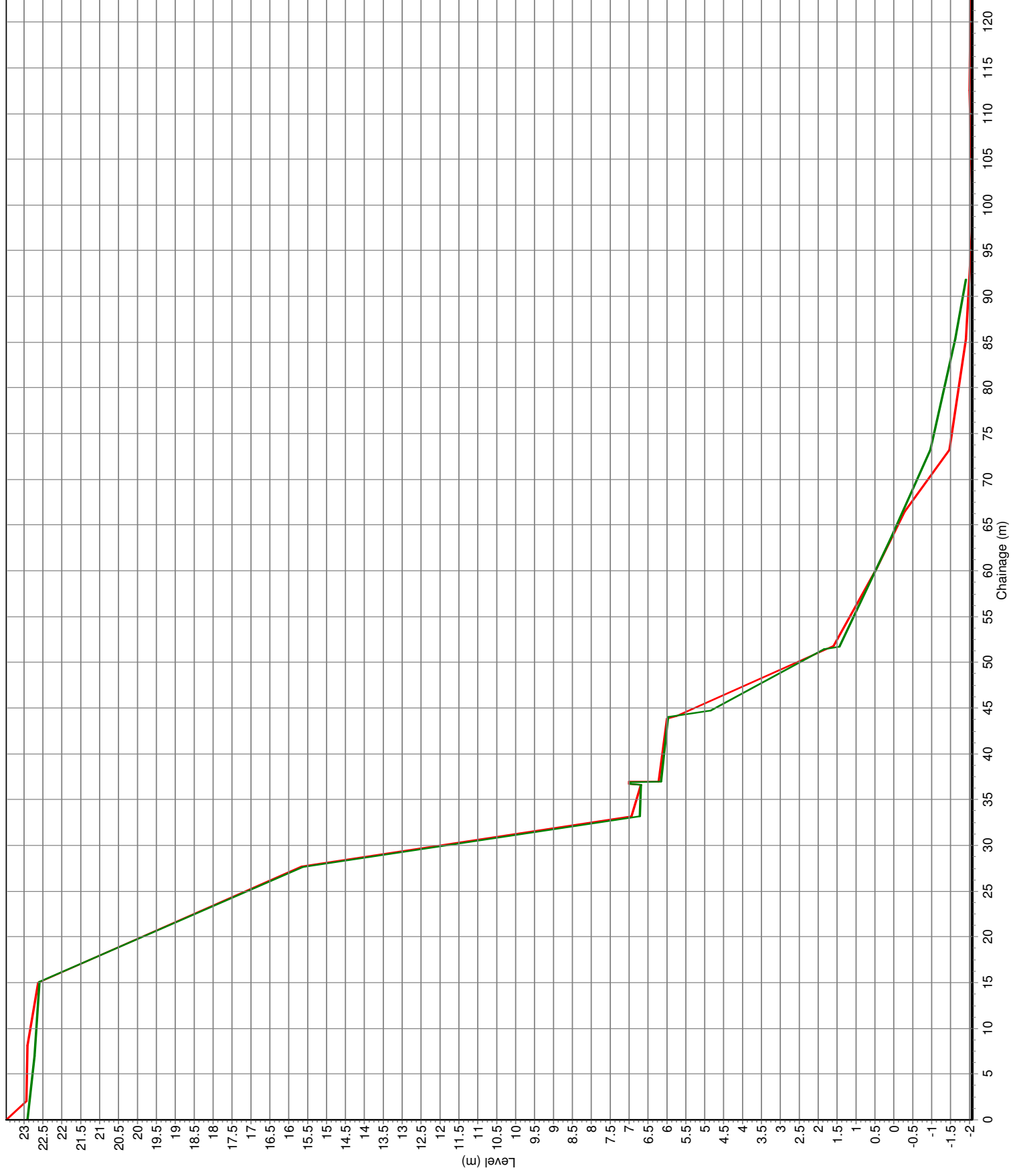
**Low Tide (m)** **Low Tide Time**  
**Visibility** Good **Rain** No

**Easting** 441225.182 **Northing** 554759.021 **Bearing** 75

| Chainage | Level  |
|----------|--------|
| 0.000    | 22.889 |
| 0.010    | 22.889 |
| 6.960    | 22.726 |
| 15.060   | 22.600 |
| 27.620   | 15.629 |
| 33.140   | 6.735  |
| 36.660   | 6.692  |
| 36.740   | 6.984  |
| 36.930   | 6.974  |
| 36.990   | 6.163  |
| 44.020   | 5.973  |
| 44.720   | 4.856  |
| 51.420   | 1.858  |
| 51.700   | 1.436  |
| 63.490   | 0.118  |
| 73.240   | -0.944 |
| 85.370   | -1.627 |
| 91.890   | -1.898 |



Beach Profiles: 1bSNS11



Legend for Beach Profiles:

- 10/11/2006
- 25/03/2009



# Beach Profile

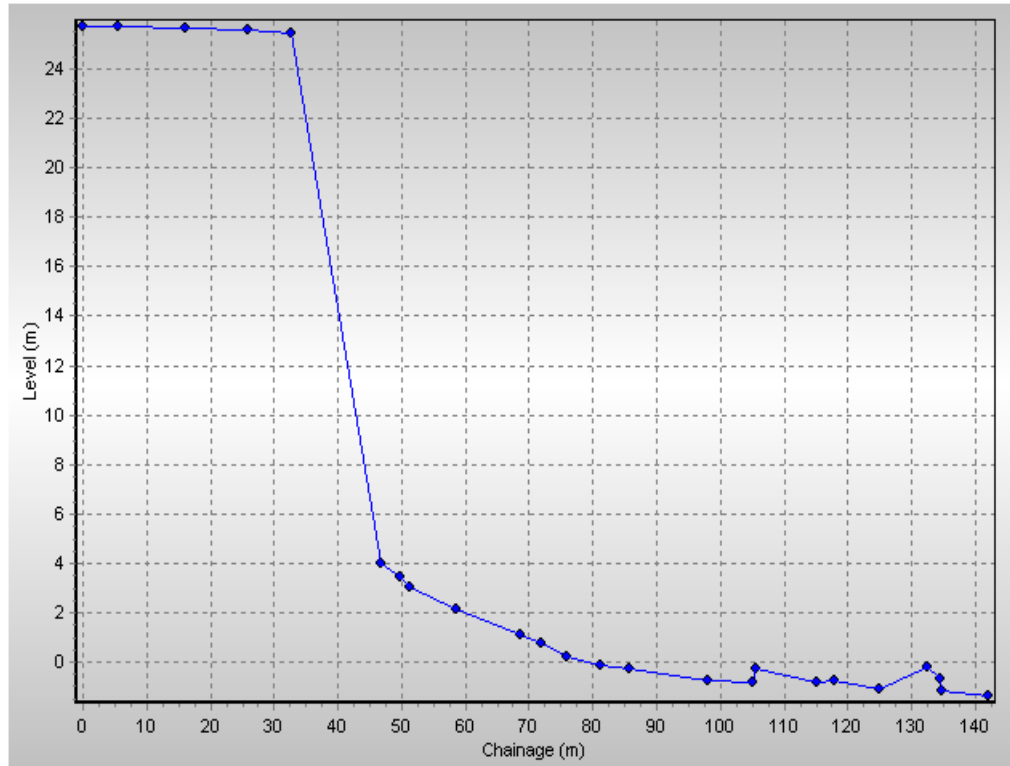
## 1bSNS20

**Date** 25/03/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary**

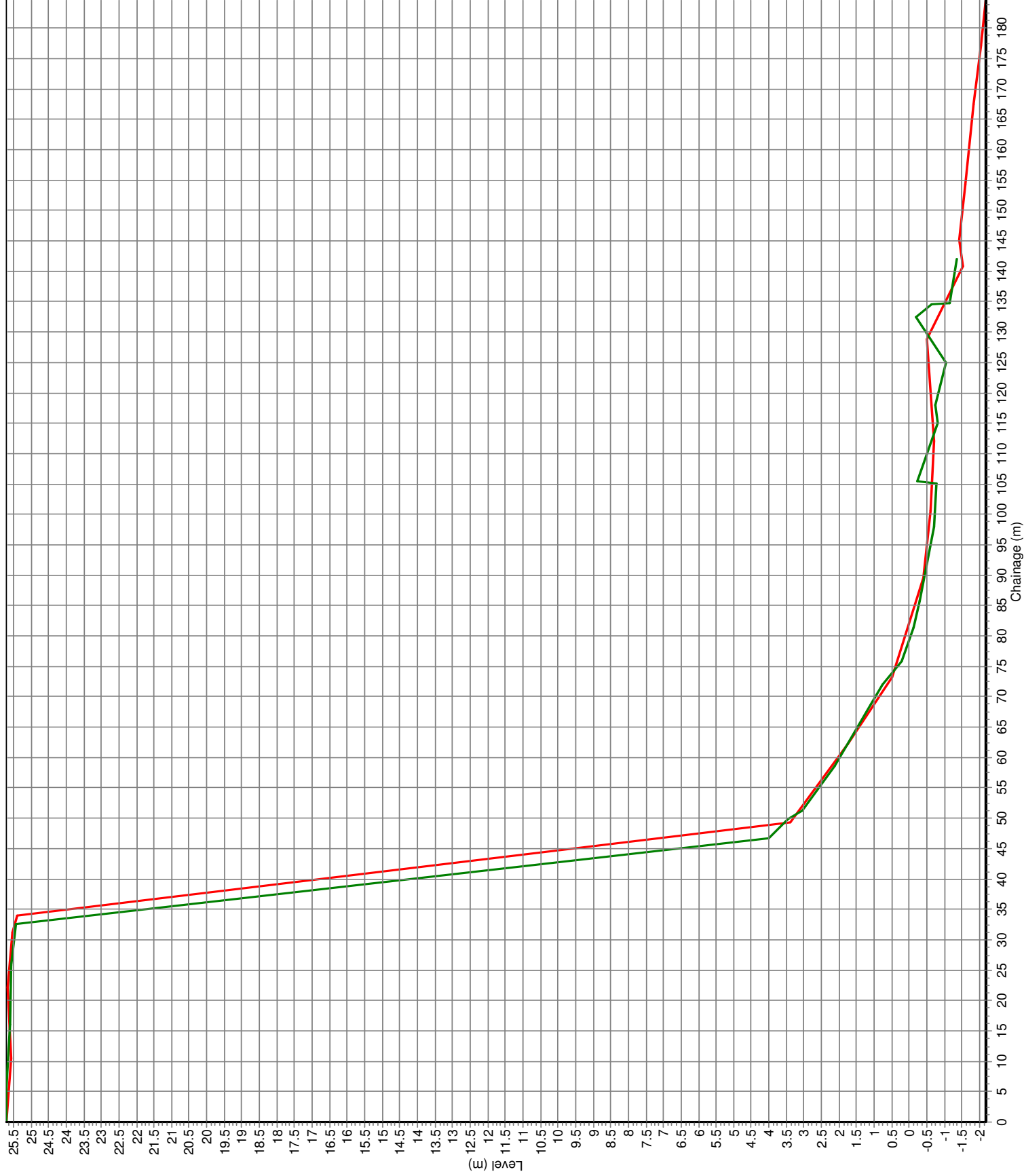
**Low Tide (m)**  
**Visibility** Good **Low Tide Time**  
**Rain** No

**Easting** 441378.054 **Northing** 553599.123 **Bearing** 81

| Chainage | Level  |
|----------|--------|
| 0.000    | 25.699 |
| 0.010    | 25.699 |
| 5.510    | 25.702 |
| 15.990   | 25.615 |
| 25.860   | 25.577 |
| 32.610   | 25.432 |
| 46.650   | 3.988  |
| 49.820   | 3.457  |
| 51.220   | 3.060  |
| 58.520   | 2.142  |
| 68.630   | 1.106  |
| 71.980   | 0.765  |
| 75.800   | 0.228  |
| 81.320   | -0.136 |
| 85.770   | -0.278 |
| 98.000   | -0.711 |
| 105.080  | -0.765 |
| 105.470  | -0.239 |
| 115.110  | -0.802 |
| 117.930  | -0.737 |
| 125.000  | -1.054 |
| 132.390  | -0.195 |
| 134.500  | -0.628 |
| 134.710  | -1.151 |
| 142.030  | -1.347 |



# Beach Profiles: 1bSNS20



10/11/2006  
25/03/2009

# Beach Profile

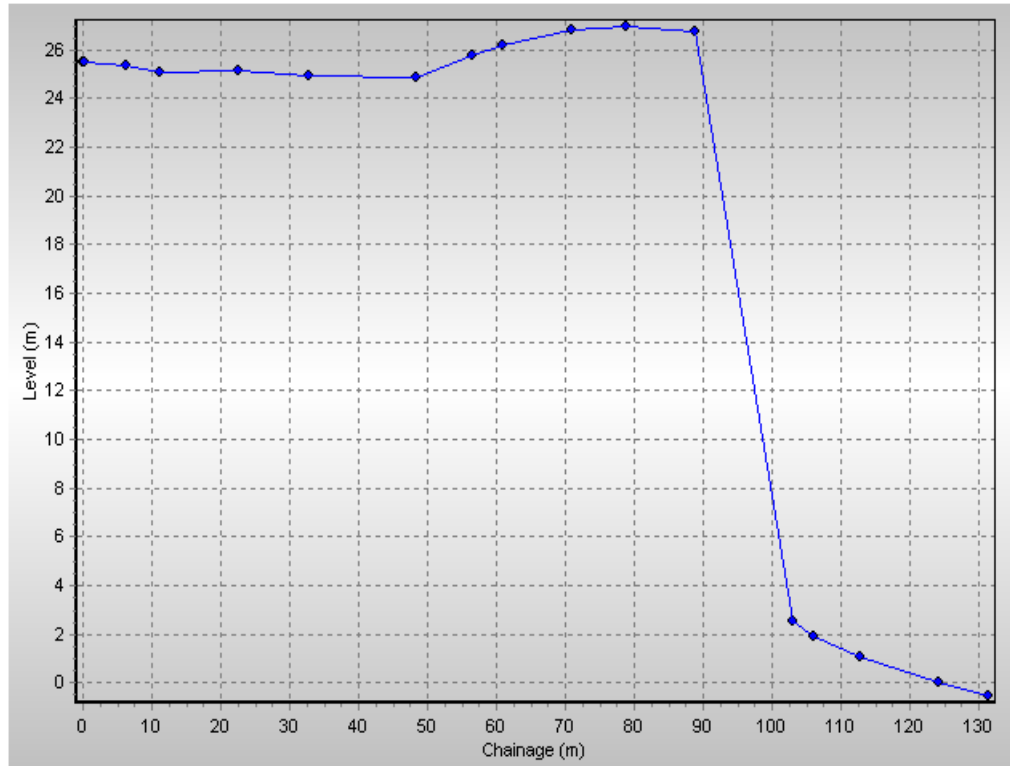
## 1bSNS26

**Date** 25/03/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary**

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

**Easting** 441726.053 **Northing** 552563.410 **Bearing** 60

| Chainage | Level  |
|----------|--------|
| 0.000    | 25.456 |
| 0.260    | 25.456 |
| 6.170    | 25.319 |
| 11.130   | 25.059 |
| 22.670   | 25.172 |
| 32.820   | 24.925 |
| 48.320   | 24.844 |
| 56.490   | 25.772 |
| 61.040   | 26.213 |
| 71.020   | 26.796 |
| 78.900   | 26.954 |
| 88.900   | 26.775 |
| 102.990  | 2.529  |
| 106.000  | 1.920  |
| 112.890  | 1.047  |
| 124.150  | 0.041  |
| 131.420  | -0.534 |



# Beach Profile

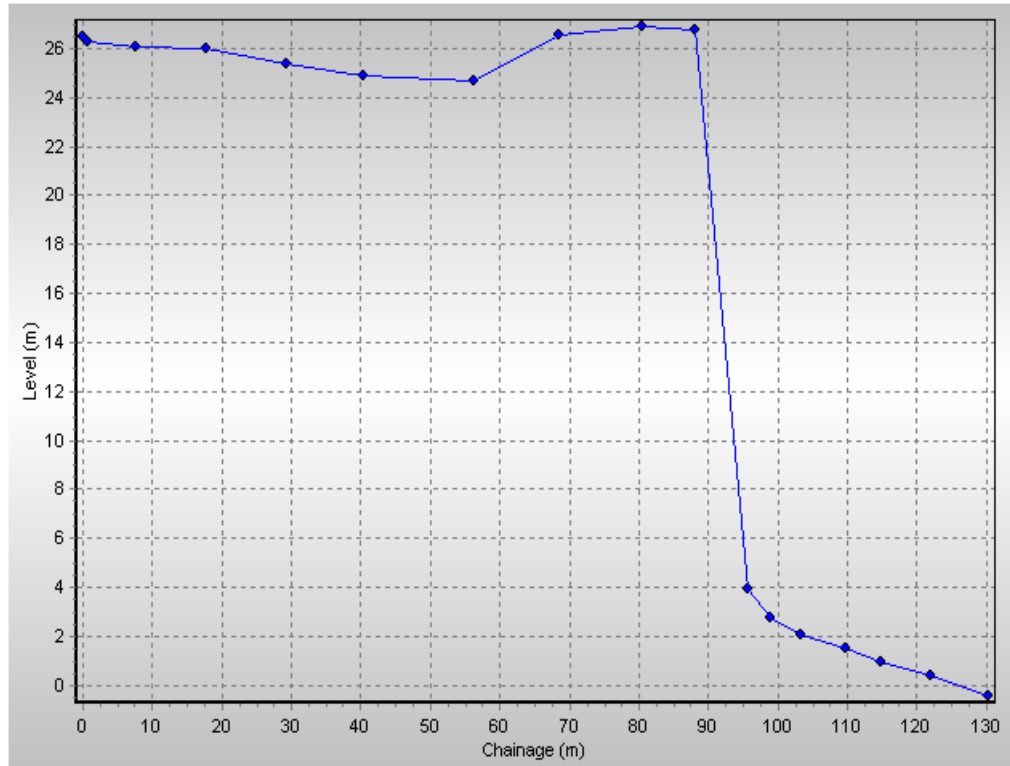
## 1bSNS27

**Date** 25/03/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary**

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

**Easting** 441733.630 **Northing** 552550.463 **Bearing** 60

| Chainage | Level  |
|----------|--------|
| 0.000    | 26.444 |
| 0.100    | 26.444 |
| 0.740    | 26.276 |
| 7.550    | 26.088 |
| 17.760   | 26.007 |
| 29.320   | 25.361 |
| 40.280   | 24.851 |
| 56.350   | 24.652 |
| 68.540   | 26.546 |
| 80.540   | 26.891 |
| 88.110   | 26.782 |
| 95.810   | 3.965  |
| 98.950   | 2.754  |
| 103.380  | 2.079  |
| 109.780  | 1.501  |
| 114.770  | 0.977  |
| 122.010  | 0.400  |
| 130.290  | -0.438 |



# Beach Profile

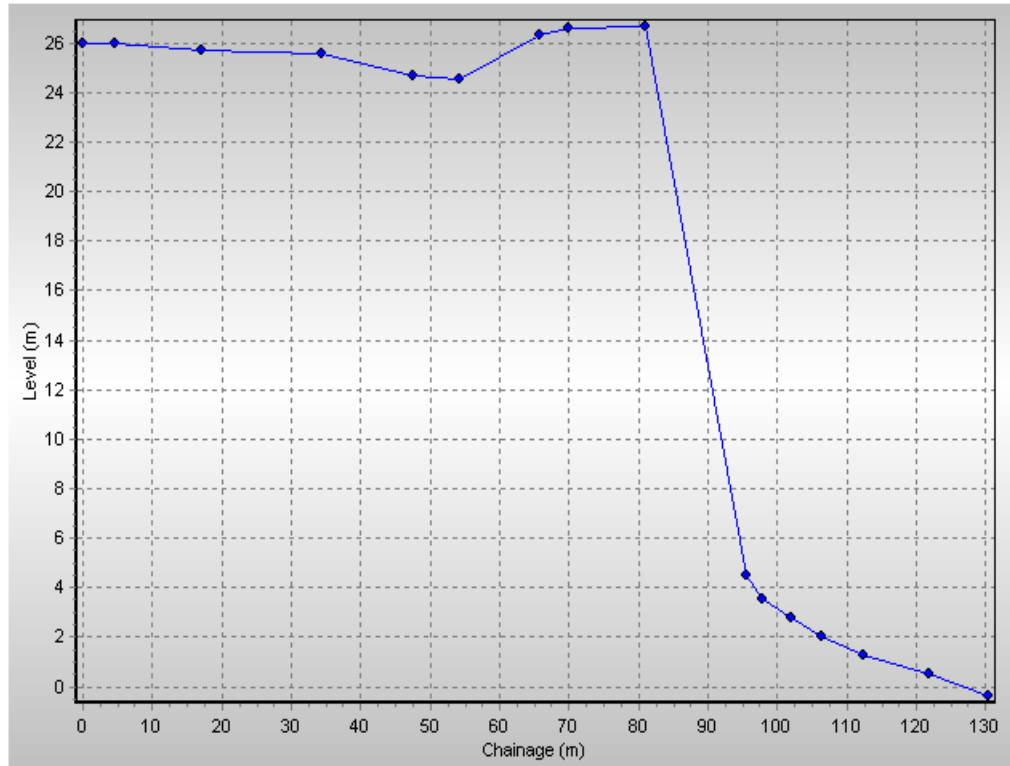
## 1bSNS28

**Date** 25/03/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary**

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

**Easting** 441741.207 **Northing** 552537.517 **Bearing** 60

| Chainage | Level  |
|----------|--------|
| 0.000    | 25.969 |
| 0.030    | 25.969 |
| 4.610    | 25.988 |
| 17.190   | 25.676 |
| 34.480   | 25.539 |
| 47.480   | 24.691 |
| 54.320   | 24.530 |
| 65.680   | 26.309 |
| 69.840   | 26.592 |
| 80.960   | 26.665 |
| 95.640   | 4.501  |
| 97.780   | 3.547  |
| 102.070  | 2.800  |
| 106.330  | 1.999  |
| 112.480  | 1.259  |
| 121.730  | 0.518  |
| 130.370  | -0.373 |



# Beach Profile

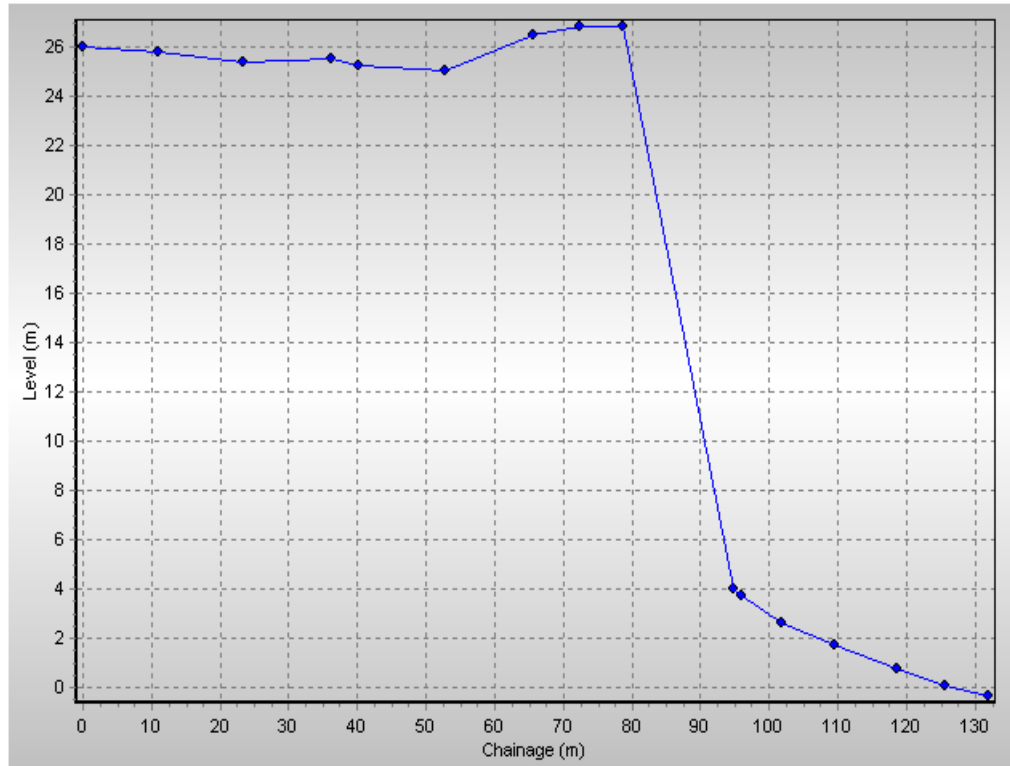
## 1bSNS29

**Date** 25/03/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary**

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

**Easting** 441748.776 **Northing** 552524.571 **Bearing** 60

| Chainage | Level  |
|----------|--------|
| 0.000    | 25.968 |
| 0.010    | 25.968 |
| 11.080   | 25.810 |
| 23.410   | 25.364 |
| 36.130   | 25.504 |
| 40.100   | 25.218 |
| 52.840   | 24.988 |
| 65.500   | 26.501 |
| 72.420   | 26.781 |
| 78.630   | 26.813 |
| 94.910   | 3.956  |
| 96.030   | 3.677  |
| 101.690  | 2.619  |
| 109.480  | 1.679  |
| 118.620  | 0.748  |
| 125.660  | 0.043  |
| 131.920  | -0.375 |



# Beach Profile

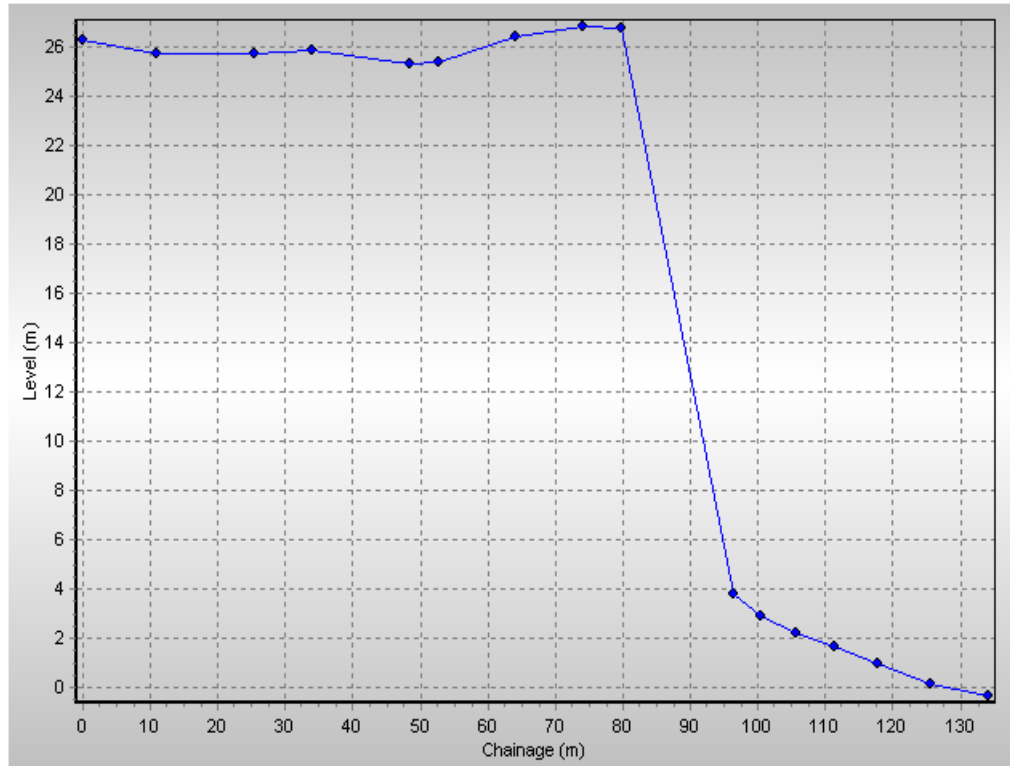
## 1bSNS30

**Date** 25/03/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary**

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

**Easting** 441756.353 **Northing** 552511.624 **Bearing** 60

| Chainage | Level  |
|----------|--------|
| 0.000    | 26.298 |
| 0.020    | 26.298 |
| 10.960   | 25.727 |
| 25.410   | 25.773 |
| 34.030   | 25.876 |
| 48.490   | 25.339 |
| 52.720   | 25.381 |
| 64.190   | 26.416 |
| 74.030   | 26.848 |
| 79.850   | 26.805 |
| 96.370   | 3.780  |
| 100.470  | 2.896  |
| 105.590  | 2.173  |
| 111.280  | 1.632  |
| 117.640  | 0.951  |
| 125.660  | 0.115  |
| 134.130  | -0.365 |



# Beach Profile

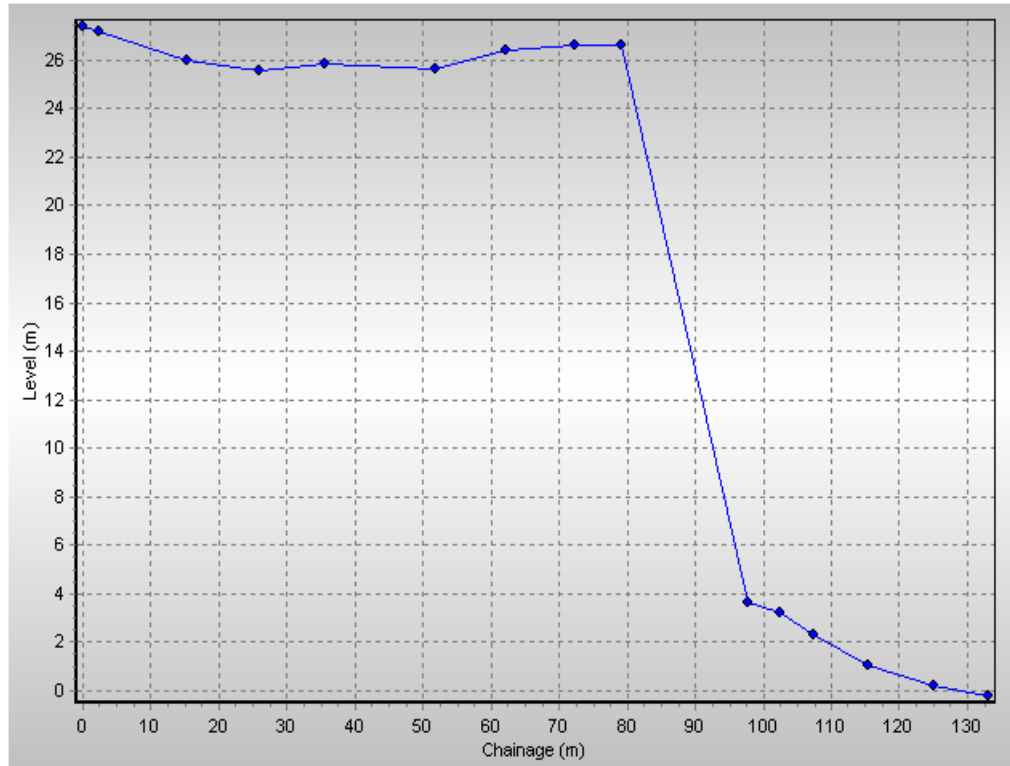
## 1bSNS31

**Date** 25/03/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary**

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

**Easting** 441763.931 **Northing** 552498.678 **Bearing** 60

| Chainage | Level  |
|----------|--------|
| 0.000    | 27.380 |
| 0.080    | 27.380 |
| 2.430    | 27.193 |
| 15.240   | 25.965 |
| 25.970   | 25.568 |
| 35.630   | 25.865 |
| 51.920   | 25.642 |
| 62.200   | 26.422 |
| 72.300   | 26.595 |
| 79.190   | 26.590 |
| 97.790   | 3.624  |
| 102.430  | 3.256  |
| 107.320  | 2.307  |
| 115.510  | 1.049  |
| 124.970  | 0.224  |
| 133.090  | -0.207 |





# Beach Profile

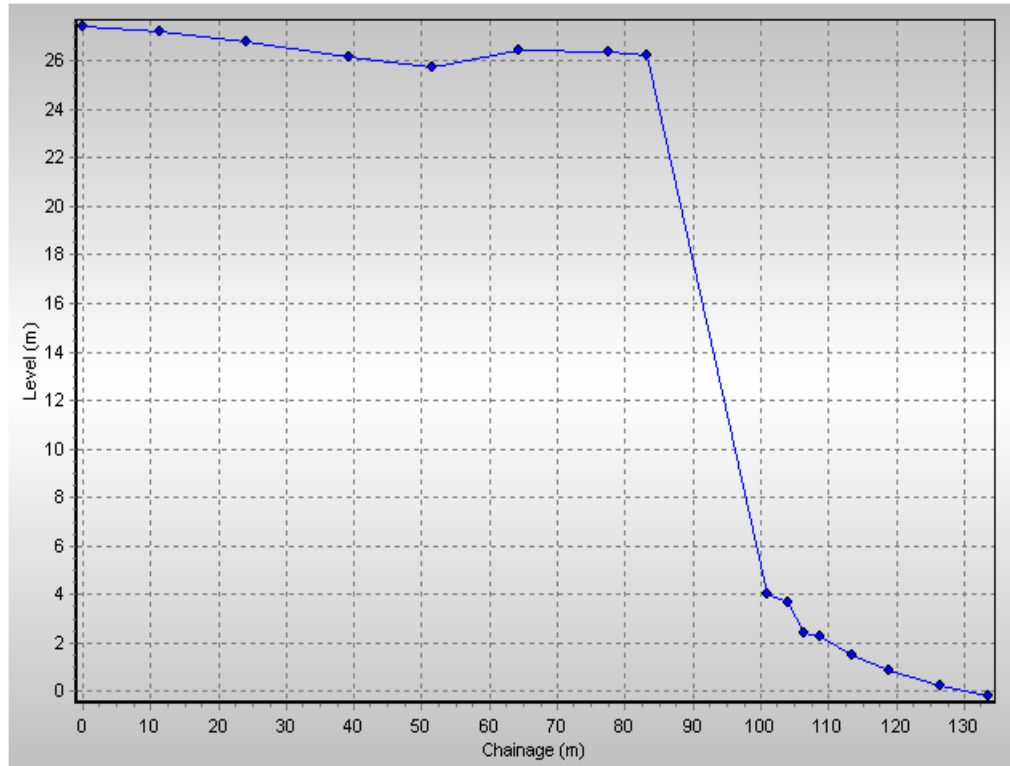
## 1bSNS32

**Date** 25/03/2009 **Inspector** RH  
**Wind** Light **Sea State**  
**Summary**

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

**Easting** 441771.500 **Northing** 552485.732 **Bearing** 60

| Chainage | Level  |
|----------|--------|
| 0.000    | 27.418 |
| 0.090    | 27.418 |
| 11.260   | 27.209 |
| 24.010   | 26.817 |
| 39.260   | 26.132 |
| 51.540   | 25.723 |
| 64.340   | 26.432 |
| 77.660   | 26.345 |
| 83.120   | 26.236 |
| 101.000  | 4.039  |
| 104.030  | 3.694  |
| 106.430  | 2.432  |
| 108.860  | 2.243  |
| 113.460  | 1.531  |
| 118.880  | 0.858  |
| 126.480  | 0.246  |
| 133.590  | -0.180 |





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



## Cliff Top Survey

### Hendon to Ryhope

Thirty-two ground control points have been established between Hendon and Ryhope (Figure C1). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion.

The cliff top surveys between Hendon and Ryhope 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 C1 provides baseline information about these ground control points and results from the 2008 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

**Table C1 – Cliff Top Surveys between Hendon and Ryhope**

| Ground Control Point Details |         |          |              |             | Distance to Cliff Top (m)  |                       |                      | Total Erosion (m)                    |                                 | Erosion Rate (m/year)                |
|------------------------------|---------|----------|--------------|-------------|----------------------------|-----------------------|----------------------|--------------------------------------|---------------------------------|--------------------------------------|
| Ref                          | Easting | Northing | Level (mODN) | Bearing (°) | Baseline Survey (Mar 2009) | Previous Survey (N/A) | Present Survey (N/A) | Baseline (Mar 2009) to Present (N/A) | Previous (N/A) to Present (N/A) | Baseline (Mar 2009) to Present (N/A) |
| 1                            | 441026  | 555571   | 75           | 18.9        | 8.2                        | -                     | -                    | -                                    | -                               | -                                    |
| 2                            | 441064  | 555355   | 85           | 17.3        | 7.1                        | -                     | -                    | -                                    | -                               | -                                    |
| 3                            | 441098  | 555124   | 82           | 17.9        | 10.0                       | -                     | -                    | -                                    | -                               | -                                    |
| 4                            | 441174  | 554939   | 65           | 17.0        | 10.3                       | -                     | -                    | -                                    | -                               | -                                    |
| 5                            | 441199  | 554861   | 65           | 20.0        | 7.7                        | -                     | -                    | -                                    | -                               | -                                    |
| 6                            | 441224  | 554774   | 71           | 22.4        | 10.8                       | -                     | -                    | -                                    | -                               | -                                    |
| 7                            | 441248  | 554690   | 74           | 22.8        | 10.2                       | -                     | -                    | -                                    | -                               | -                                    |
| 8                            | 441259  | 554597   | 101          | 22.5        | 10.1                       | -                     | -                    | -                                    | -                               | -                                    |
| 9                            | 441276  | 554513   | 66           | 23.0        | 10.5                       | -                     | -                    | -                                    | -                               | -                                    |
| 10                           | 441309  | 554421   | 58           | 22.0        | 8.8                        | -                     | -                    | -                                    | -                               | -                                    |
| 11                           | 441354  | 554346   | 68           | 19.9        | 8.2                        | -                     | -                    | -                                    | -                               | -                                    |

| Ground Control Point Details |         |          |              |             | Distance to Cliff Top (m)  |                       |                      | Total Erosion (m)                    |                                 | Erosion Rate (m/year)                |
|------------------------------|---------|----------|--------------|-------------|----------------------------|-----------------------|----------------------|--------------------------------------|---------------------------------|--------------------------------------|
| Ref                          | Easting | Northing | Level (mODN) | Bearing (°) | Baseline Survey (Mar 2009) | Previous Survey (N/A) | Present Survey (N/A) | Baseline (Mar 2009) to Present (N/A) | Previous (N/A) to Present (N/A) | Baseline (Mar 2009) to Present (N/A) |
| 12                           | 441400  | 554248   | 56           | 20.5        | 6.2                        | -                     | -                    | -                                    | -                               | -                                    |
| 13                           | 441452  | 554175   | 63           | 22.9        | 11.6                       | -                     | -                    | -                                    | -                               | -                                    |
| 14                           | 441472  | 554081   | 127          | 23.3        | 7.3                        | -                     | -                    | -                                    | -                               | -                                    |
| 15                           | 441413  | 554005   | 122          | 22.9        | 7.8                        | -                     | -                    | -                                    | -                               | -                                    |
| 16                           | 441385  | 553913   | 90           | 23.6        | 9.9                        | -                     | -                    | -                                    | -                               | -                                    |
| 17                           | 441404  | 553815   | 93           | 21.2        | 6.3                        | -                     | -                    | -                                    | -                               | -                                    |
| 18                           | 441404  | 553724   | 119          | 24.6        | 8.1                        | -                     | -                    | -                                    | -                               | -                                    |
| 19                           | 441398  | 553633   | 78           | 25.4        | 8.2                        | -                     | -                    | -                                    | -                               | -                                    |
| 20                           | 441438  | 553453   | 71           | 26.8        | 10.1                       | -                     | -                    | -                                    | -                               | -                                    |
| 21                           | 441506  | 553256   | 62           | 27.7        | 8.6                        | -                     | -                    | -                                    | -                               | -                                    |
| 22                           | 441550  | 553159   | 103          | 26.5        | 6.6                        | -                     | -                    | -                                    | -                               | -                                    |
| 23                           | 441585  | 553076   | 64           | 18.7        | 8.1                        | -                     | -                    | -                                    | -                               | -                                    |
| 24                           | 441624  | 552871   | 69           | 28.1        | 7.5                        | -                     | -                    | -                                    | -                               | -                                    |
| 25                           | 441689  | 552758   | 70           | 28.0        | 14.6                       | -                     | -                    | -                                    | -                               | -                                    |
| 26                           | 441715  | 552713   | 54           | 28.0        | 12.9                       | -                     | -                    | -                                    | -                               | -                                    |
| 27                           | 441749  | 552674   | 62           | 27.4        | 14.6                       | -                     | -                    | -                                    | -                               | -                                    |
| 28                           | 441777  | 552630   | 57           | 26.9        | 8.6                        | -                     | -                    | -                                    | -                               | -                                    |
| 29                           | 441880  | 552472   | 83           | 26.1        | 15.5                       | -                     | -                    | -                                    | -                               | -                                    |
| 30                           | 441921  | 552269   | 97           | 25.1        | 8.6                        | -                     | -                    | -                                    | -                               | -                                    |
| 31                           | 441853  | 552094   | 75           | 26.4        | 11.2                       | -                     | -                    | -                                    | -                               | -                                    |
| 32                           | 441883  | 551988   | 96           | 27.4        | 9.8                        | -                     | -                    | -                                    | -                               | -                                    |

440000

441000

442000



0 200 400 Metres



555000

555000

554000

● Cliff Top Monitoring Points

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

### Appendix B - Map 1 Sunderland Council Frontage

Update Report 1  
'Partial Measures' Survey 2009

Drawing Scale 1:15,000 at A4



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Checked by: MD Date: 29/05/2009  
Approved by: NC Date: 29/05/2009

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Scarborough Borough Council

441000

442000

443000

0 200 400 Metres



554000

553000

552000

551000

Hendon to Ryhope



● Cliff Top Monitoring Points

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

### Appendix B - Map 2 Sunderland Council Frontage

Update Report 1  
'Partial Measures' Survey 2009

Drawing Scale 1:15,000 at A4



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