



**Cell 1 Regional Coastal Monitoring Programme
Update Report 3: 'Partial Measures' Survey 2011**

South Tyneside Council



South Tyneside Council

June 2011

Contents

Preamble	vii
1. Introduction.....	1
1.1 Study Area	1
1.2 Methodology.....	1
2. Analysis of Survey Data	4
2.1 Littlehaven Beach.....	4
2.2 Herd Sands	4
2.3 Trow Quarry	6
2.4 Marsden Bay	6
3. Problems Encountered and Uncertainty in Analysis	7
4. Recommendations for 'Fine-tuning' the Monitoring Programme	7
5. Conclusions and Areas of Concern	7

Appendices

Appendix A	Beach Profiles
Appendix B	Topographic Surveys

List of Figures

Figure 1	Survey Locations
----------	------------------

List of Tables

Table 1	Analytical, Update and Overview Reports Produced to Date
---------	--

Authors	
Nick Cooper	Royal Haskoning
Tanja Cooper	Royal Haskoning

Abbreviations and Acronyms

Acronym / Abbreviation	Definition
AONB	Area of Outstanding Natural Beauty
DGM	Digital Ground Model
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
m	metres
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWS	Mean Low Water Neap
MLWS	Mean Low Water Spring
MSL	Mean Sea Level
ODN	Ordnance Datum Newlyn

Water Levels Used in Interpretation of Changes

Water Level Parameter	Water Level (mODN)			
	River Tyne to Frenchman's Bay	Frenchman's Bay to Souter Point	Souter Point to Chourdon Point	Chourdon Point to Hartlepool Headland
1 in 200 year	3.41	3.44	3.66	3.91
HAT	2.85	2.88	3.18	3.30
MHWS	2.15	2.18	2.48	2.70
MLWS	-2.15	-2.12	-1.92	-1.90
Water Level Parameter	Water Level (mODN)			
	Hartlepool Headland to Saltburn Scar	Skinningrove	Hummersea Scar to Sandsend Ness	Sandsend Ness to Saltwick Nab
1 in 200 year	3.87	3.86	4.1	3.88
HAT	3.25	3.18	3.15	3.10
MHWS	2.65	2.68	2.65	2.60
MLWS	-1.95	-2.13	-2.15	-2.20
Water Level Parameter	Water Level (mODN)			
	Saltwick Nab to Hundale Point	Hundale Point to White Nab	White Nab to Filey Brigg	Filey Brigg to Flamborough Head
1 in 200 year	3.88	3.93	3.93	4.04
HAT	3.10	3.05	3.05	3.10
MHWS	2.60	2.45	2.45	2.50
MLWS	-2.20	-2.35	-2.35	-2.30

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

Glossary of Terms

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

Preamble

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

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

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

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

To date the following reports have been produced:

Table 1 Analytical, Update and Overview Reports Produced to Date

Year		Full Measures		Partial Measures		Cell 1 Overview Report
		Survey	Analytical Report	Survey	Update Report	
1	2008/09	Sep-Dec 08	May 09	Mar-May 09	June 09	-
2	2009/10	Sep-Dec 09	Mar 10	Mar-May 10	May 10	-
3	2010/11	Sep-Nov 10	Nov 10	Mar-May 11	June 11 ^(*)	July 2011

^(*) The present report is **Update Report 3** and provides an analysis of the 2011 Partial Measures survey for South Tyneside 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

South Tyneside Council's frontage extends from the mouth of the River Tyne estuary in the north, to the outfall south of Whitburn. For the purposes of this report, it has been sub-divided into four areas, namely:

- Littlehaven Beach
- Herd Sands
- Trow Quarry (incl. Frenchman's Bay)
- Marsden Bay

1.2 Methodology

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

- Full Measures survey annually each autumn/early winter comprising:
 - Beach profile surveys along 17 no. transect lines
 - Topographic survey along Littlehaven (commenced in 2010)
 - Topographic survey along Herd Sands
 - Topographic survey along Trow Quarry (extending to Frenchman's Bay)
- Partial Measures survey annually each spring comprising:
 - Beach profile surveys along 11 no. transect lines
 - Topographic survey along Littlehaven (commenced in 2010)
- Cliff top survey (once every 2 years) at:
 - Trow Point (during Full Measures survey)

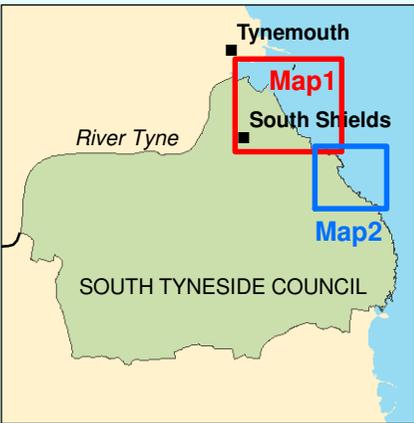
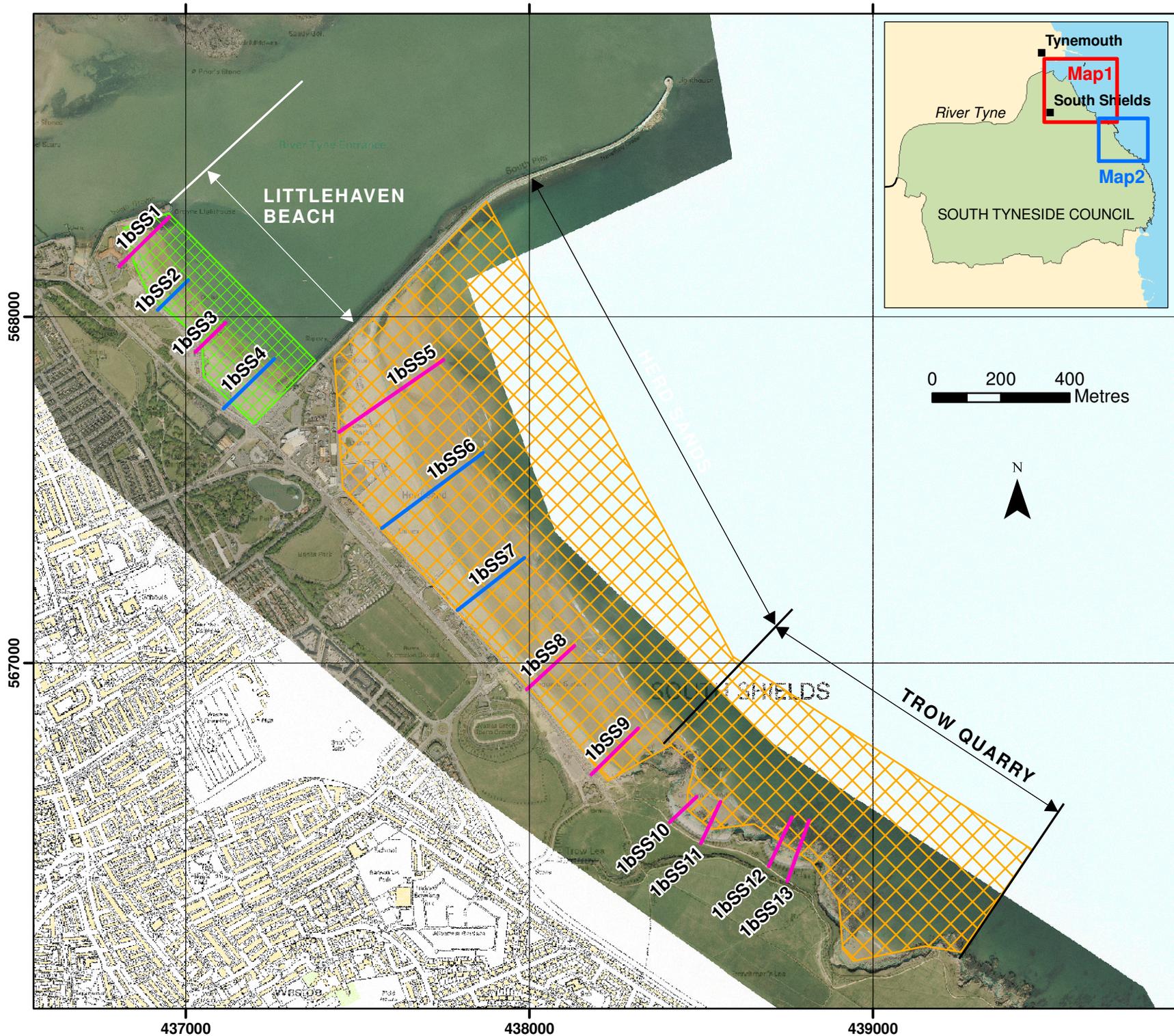
The location of these surveys is shown in Figure 1. Previously supplied on a CD-rom was a file which can be opened in Google Earth showing the locations of the surveys.

The Partial Measures survey was undertaken along this frontage in March 2011, when weather conditions were generally fine with a very strong wind and the sea state was calm.

The Update Report presents the following:

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

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



- 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 2 - Map 1
 South Tyneside Council Frontage**

Update Report 3
 'Partial Measures' Survey 2011

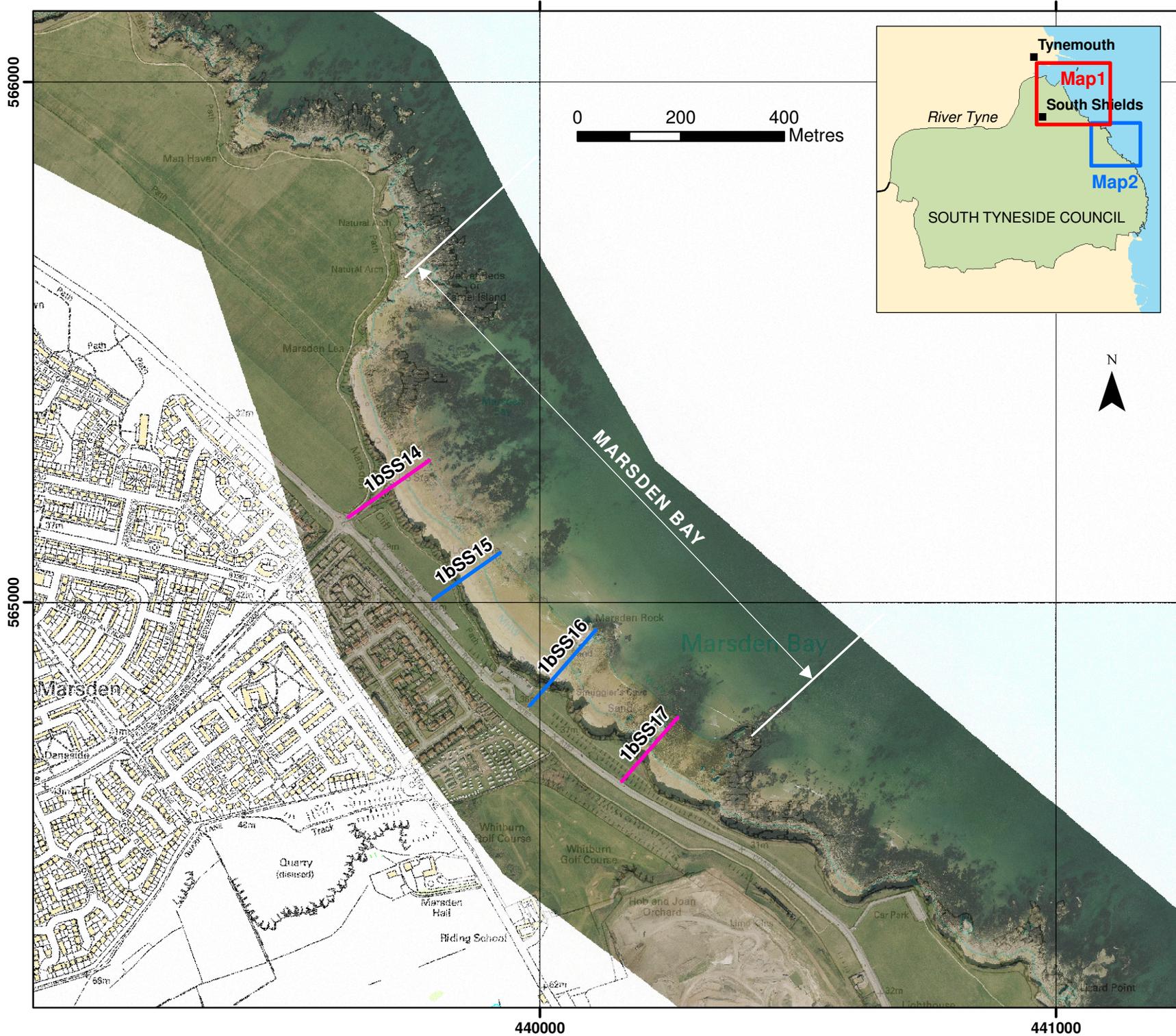
Drawing Scale 1:15,000 at A4

Drawn by: TC	Date: 05/05/2011
Checked by: NC	Date: 12/05/2011
Approved by: NC	Date: 12/05/2011

<p>ROYAL HASKONING</p> <p>Royal Haskoning Marlborough House Marlborough Crescent Newcastle upon Tyne NE1 4EE</p> <p>Tel: +44 (0)191 211 1300 Fax: +44 (0)191 211 1313 www.royalhaskoning.com</p>	<p>Halcrow</p> <p>Halcrow Group Ltd Lyndon House 62 Hagley Road Edgbaston Birmingham B16 8PE</p> <p>Tel: +44 (0)121 456 2345 Fax: +44(0)121 456 1569 www.halcrow.com</p>
---	--

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

I:\916403\Technical_Data\gis\figure 8_PARTIAL_Measures_2011\3_South_Shields\Figure1_South_Tyneside_Map1.mxd



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
South Tyneside
Council Frontage**

Update Report 3
'Partial Measures' Survey 2011

Drawing Scale 1:10,000 at A4

Drawn by: TC Date: 05/05/2011

Checked by: NC Date: 12/05/2011

Approved by: NC Date: 12/05/2011

<p>ROYAL HASKONING</p>	<p>Halcrow</p>
<p>Royal Haskoning Marlborough House Marlborough Crescent Newcastle upon Tyne NE1 4EE</p>	<p>Halcrow Group Ltd Lyndon House 62 Hagley Road Edgbaston Birmingham B16 8PE</p>

Tel: +44 (0)191 211 1300	Tel: +44 (0)121 456 2345
Fax: +44 (0)191 211 1313	Fax: +44(0)121 456 1569
www.royalhaskoning.com	www.halcrow.com

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

I:\916403\Technical_Data\gis\figure8_PARTIAL_Measures_2011\3_South_Shields\Figure1_South_Tyneside_Map2.mxd

2. Analysis of Survey Data

2.1 Littlehaven Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	<p>Beach Profiles:</p> <p>Littlehaven Beach is covered by two beach profile lines during the Partial Measures survey (Appendix A). SS1 is located at the northern end of Littlehaven Beach, close to the South Groyne, and extends seawards across the foreshore from the undefended dunes which front the Little Haven Hotel. The foreshore, to a chainage of 115m, appears to have relatively high beach levels, with new record high values recorded along much of this length. A short length of foreshore at the toe of the dunes has slightly cut back, but sand appears to have been deposited on the dune face and landward of the dune crest.</p> <p>SS3 extends seawards from the protruding section of Littlehaven Sea Wall. Here beach levels remain healthy despite some minor flattening of the mid and upper profile, although levels at the toe of the sea wall are some 0.45m higher than those recorded in March 2010 when major overtopping occurred.</p>	<p>The undefended dunes and fronting foreshore along SS1 continue to remain healthy.</p> <p>Beach levels have recovered in front of Littlehaven Sea Wall since the record low values in March 2010, although there has been some minor flattening of the profile along the mid and upper beach sections since September 2010.</p>
03-2011	<p>Topographic Survey:</p> <p>Topographic surveys were introduced to the Cell 1 Regional Coastal Monitoring Programme along Littlehaven Beach in March 2010 and have been repeated at six-monthly intervals since. Data from the March 2011 survey have been used to create a DGM (Appendix B – Map 1a). This shows how the beach contours between 2.5 and 3.0mODN are interrupted by the protruding sea wall in the centre of the bay, with higher beach levels on the upper foreshore to both the north and south of this central section.</p> <p>Comparing the March 2011 survey against the earlier September 2010 data (Appendix B – Map 1b) it can be seen that along the central and southern frontages material has been flattened from the mid beach and deposited both along the upper and lower sections. In the north, the lower foreshore and dunes have accreted.</p>	<p>The northern section of frontage remains relatively well sheltered by the port structures and the dunes have shown some accretion since the last survey.</p> <p>Along Littlehaven Sea Wall the beach levels have adjusted slightly following the notable accretion recorded between march 2010 and September 2010, although they remain at healthy levels.</p> <p>The southern section continues to exhibit a wide healthy upper foreshore, with little change above the high water mark.</p>

2.2 Herd Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	<p>Beach Profiles:</p> <p>Herd Sands is covered by three beach profile lines during the Partial Measures survey (Appendix A).</p> <p>SS5 showed little change along the dunes, although there was change in the level and chainage of the upper beach berm that is now located between MHWS and HAT (it was recorded above HAT in September 2010). Between a chainage of around 180m to around 320m, the foreshore levels were relatively low, caused mainly by the absence of the lower beach berm that was recorded in both March and September 2010.</p> <p>Profile SS8 shows a highly irregular beach form, with a series of berms separated by troughs. Notably, the beach levels between chainages of 45m to 90m are very low, setting new record low values. The gradient of the upper beach, between around MHWN and HAT, is very steep, matching the observations from March 2009. Another steep section, above HAT is in places near vertical and appears highly unnatural.</p> <p>SS9 showed low beach levels, especially between chainages of 65m and 135m. A small berm was apparent around HAT. The dunes appeared to have accreted slightly on their crest and seaward face.</p>	<p>Beach levels were relatively low along Herd Sands, although the dunes along the profiles in both the north and south of the bay were stable. Profile SS8, in front of Gypsies' Green, was highly irregular in appearance and along the upper beach an unnaturally steep gradient was recorded. This may have been affected by construction plant during the amenity enhancement works along the promenade.</p>

2.3 Trow Quarry

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	<p>Beach Profiles:</p> <p>Trow Quarry is covered by four beach profile lines during the Partial Measures survey (Appendix A), two in Graham's Sand and two in Southern Bay.</p> <p>All four profiles showed relatively low foreshore levels, but generally some areas of accretion since September 2010. All four profiles showed consistency in the position of the rock revetment and backing re-graded coastal slope.</p>	<p>The coastal defence scheme is performing well and although in places the foreshore levels were low, they were generally within the bounds of previous observations.</p>

2.4 Marsden Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
03-2011	<p>Beach Profiles:</p> <p>Marsden Bay is covered by two beach profile lines during the Partial Measures survey (Appendix A).</p> <p>SS14 and SS15 both showed high foreshore levels and stability in the backing cliffs.</p>	<p>The cliffs along SS14 and SS15 remain stable and the foreshore levels were healthy.</p>

3. Problems Encountered and Uncertainty in Analysis

Herd Sands

It appears that the upper foreshore along SS8 may have been temporarily affected by construction plant during the amenity enhancement works along the promenade.

Marsden Bay

Beach Profile SS14 is located at the northern end of Marsden Bay, close to the Redwell Steps. Surveys of the beach and the concrete platform and steps at the base of the cliffs are accurately undertaken on each survey. Due to this, it has become clear that the changes in the cliff form above the structure are 'apparent' changes caused by survey difficulties on this steeply bevelled cliff face. In particular, the rock that outcrops at the seaward face of the cliff is showing apparent signs of change (see Appendix A - Beach Profile 1bSS14).



A slight change in alignment of the profile across the cliff section can result in an apparently large change in form simply due to different rock features being picked up on each survey.

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

No further changes are recommended at the present time.

5. Conclusions and Areas of Concern

- After some notable changes in March 2010, including some very low beach levels at the toe of the sea wall, the foreshore at Littlehaven appears to have recovered, with current changes confined to local and minor redistribution of existing beach sediment. The undefended dunes in the north of the bay appear to be accreting.
- Foreshore levels in Herd Sands were relatively low, although the dunes in both the north and south of the bay remained stable. Profile SS8 which extends from Gypsies' Green was highly irregular in form, with several berms separated by troughs along the profile length. In two locations, the beach gradient was very steep.
- At Trow Quarry and Marsden Bay, the recorded profiles present no causes for concern.

Appendices

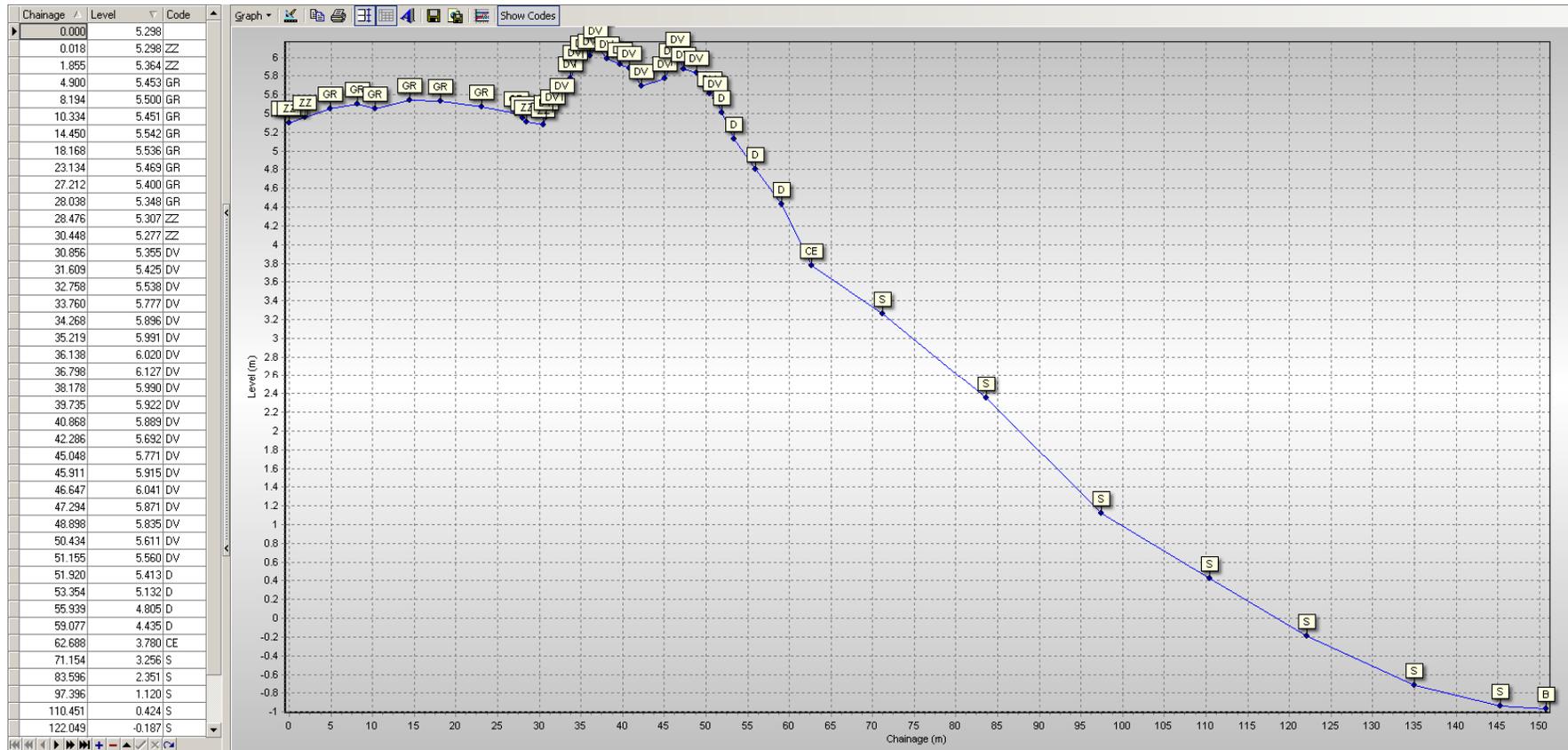
Appendix A
Beach Profiles

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

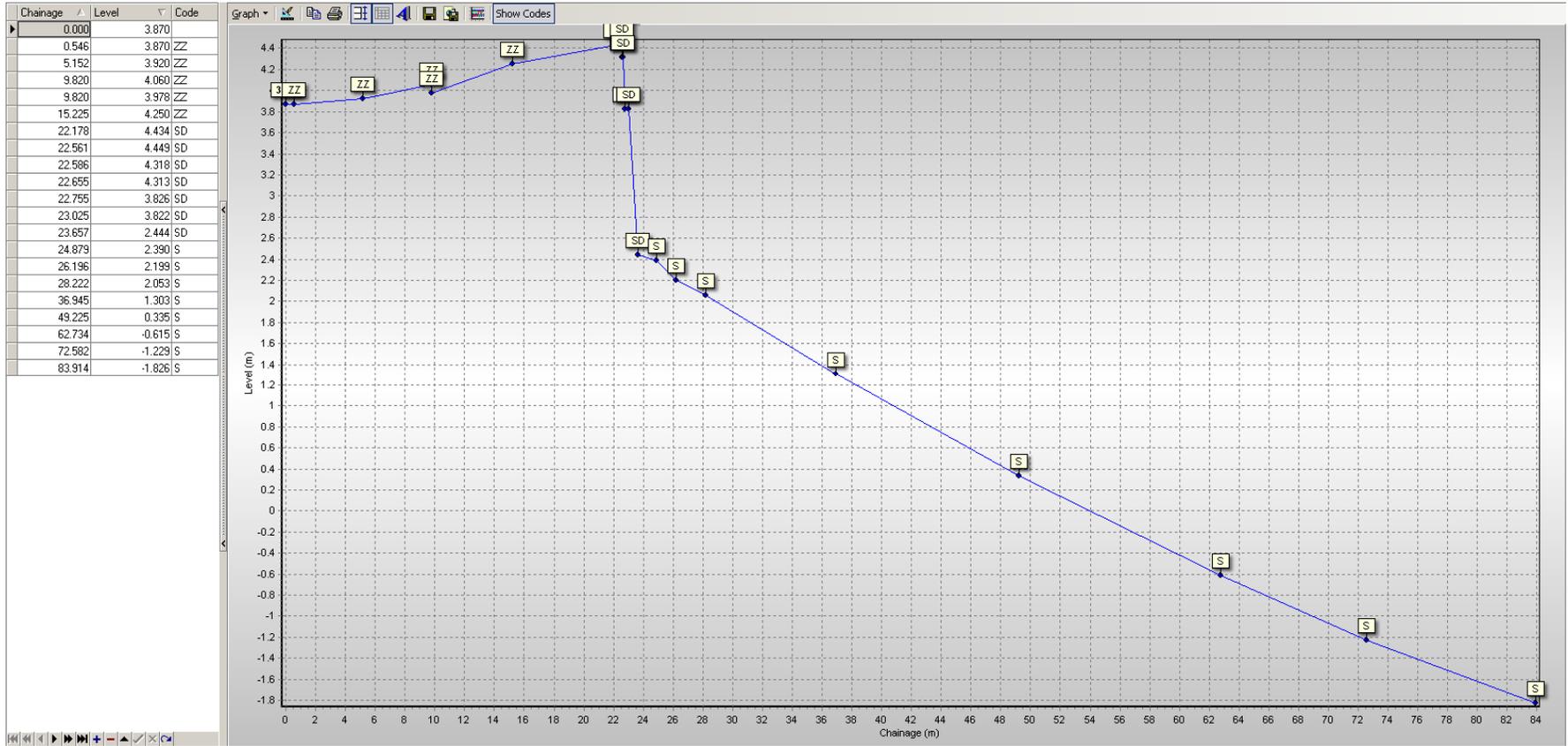
Code	Description
M	Mud
S	Sand
G	Gravel
GS	Gravel & Sand
GM	Gravel & Mud
MS	Mud & Sand
B	Boulders
R	Rock
SD	Sea Defence
SM	Salt Marsh
GR	Grass
D	Dune (non-vegetated)
DV	Dune (vegetated)
F	Forested
X	Mixture
FB	Obstruction
CT	Cliff Top
CE	Cliff Edge
CF	Cliff Face
SH	Shell
W	Water Body
ZZ	Unknown

South Shields

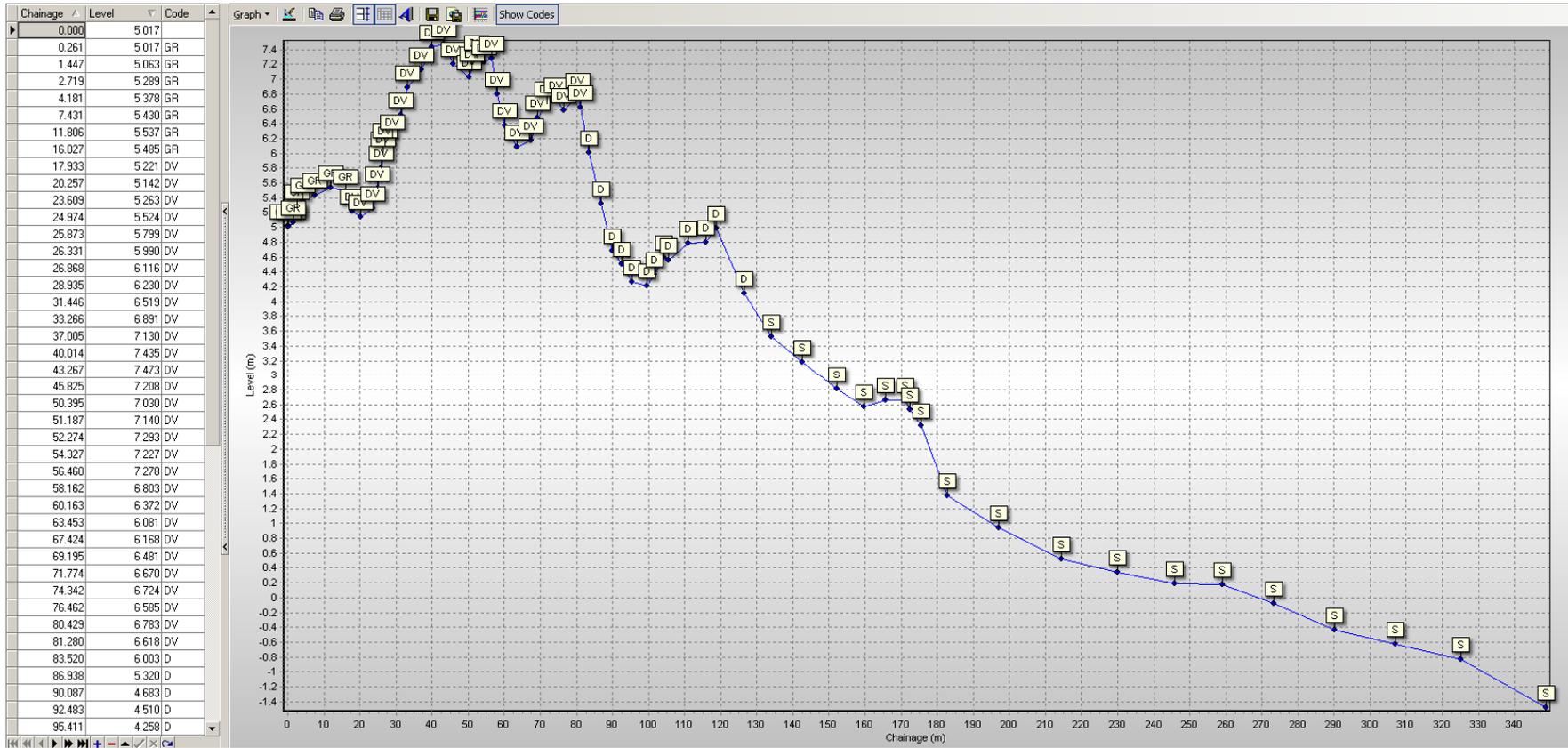
1bSS1 - 10/03/2011



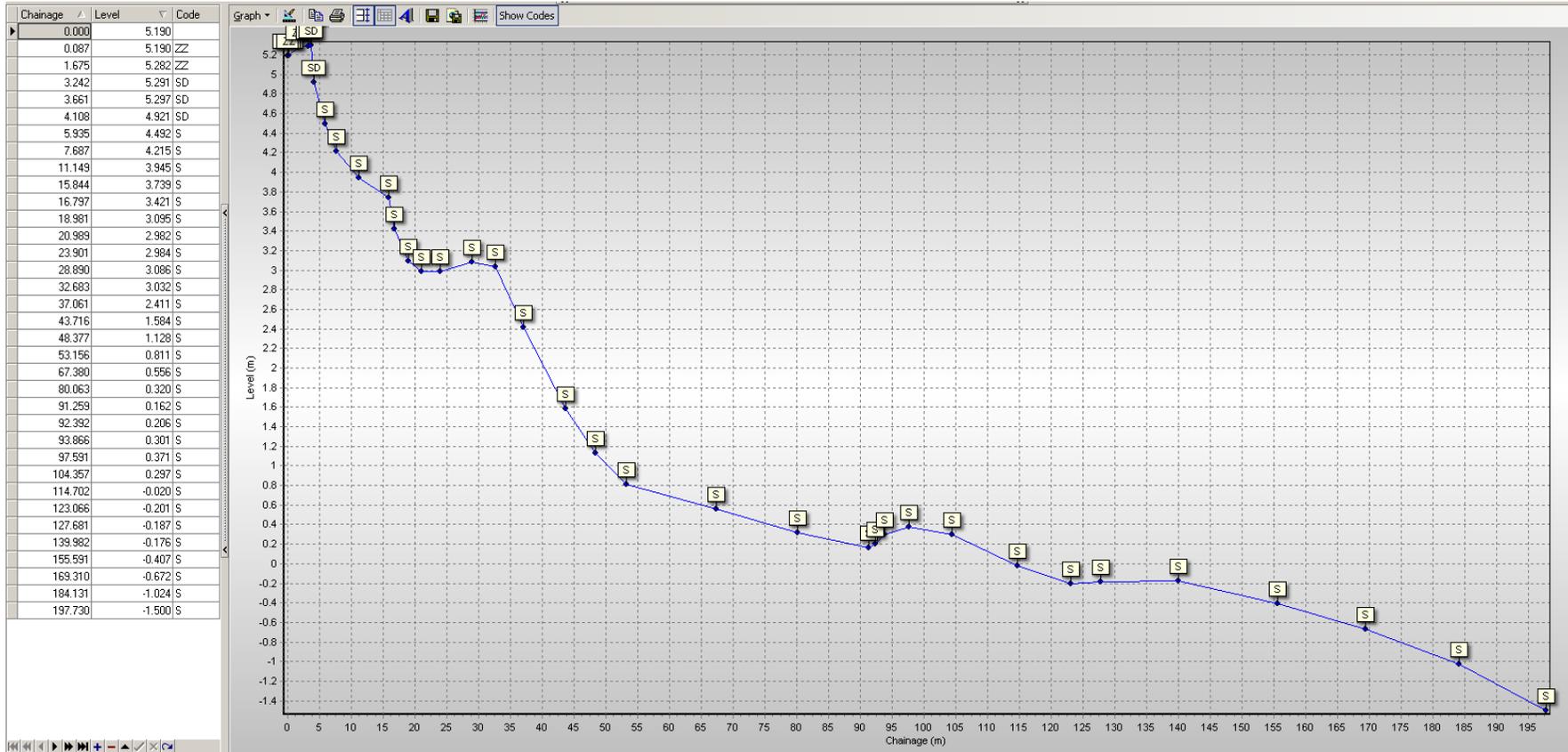
1bSS3 - 10/03/2011



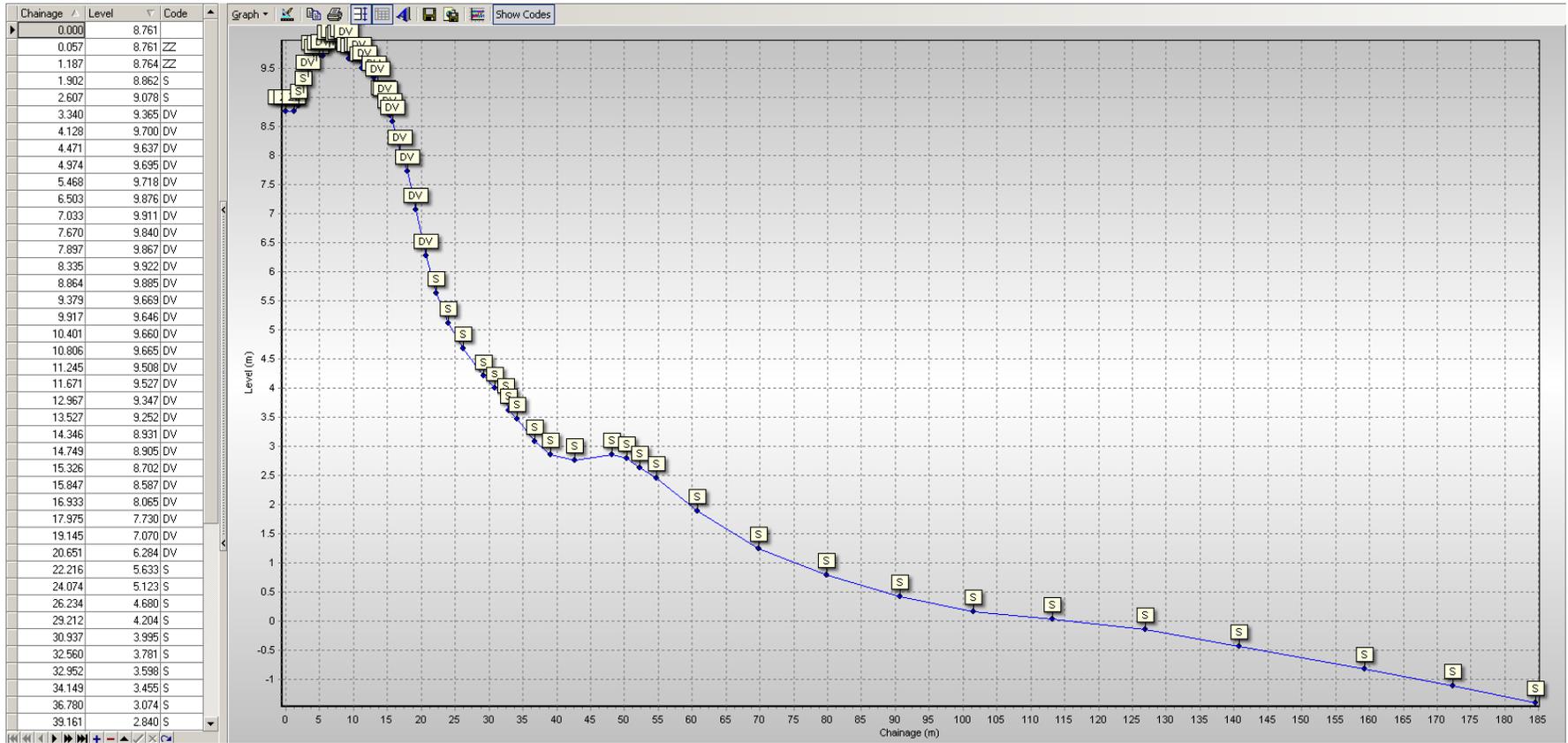
1bSS5 - 10/03/2011



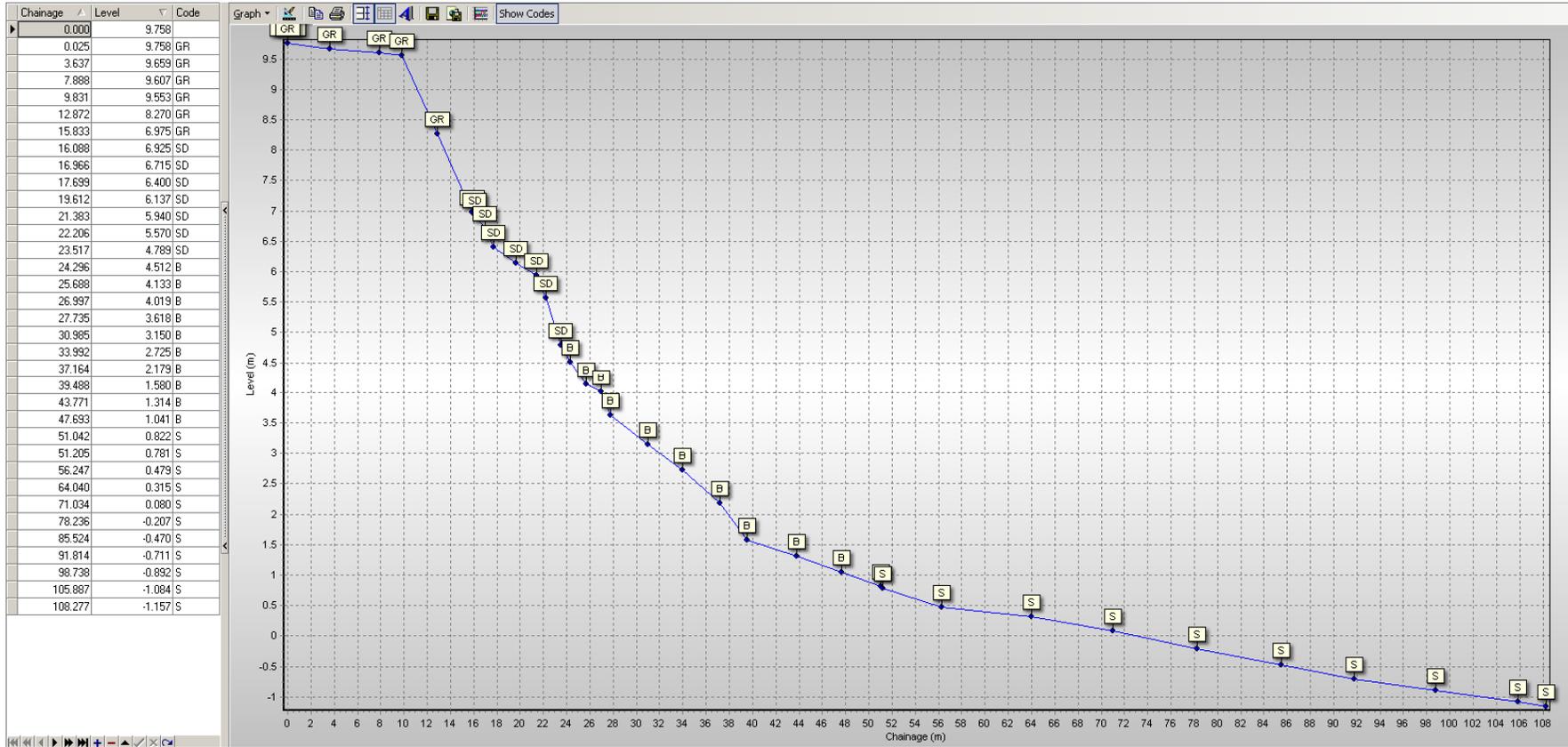
1bSS8 - 10/03/2011



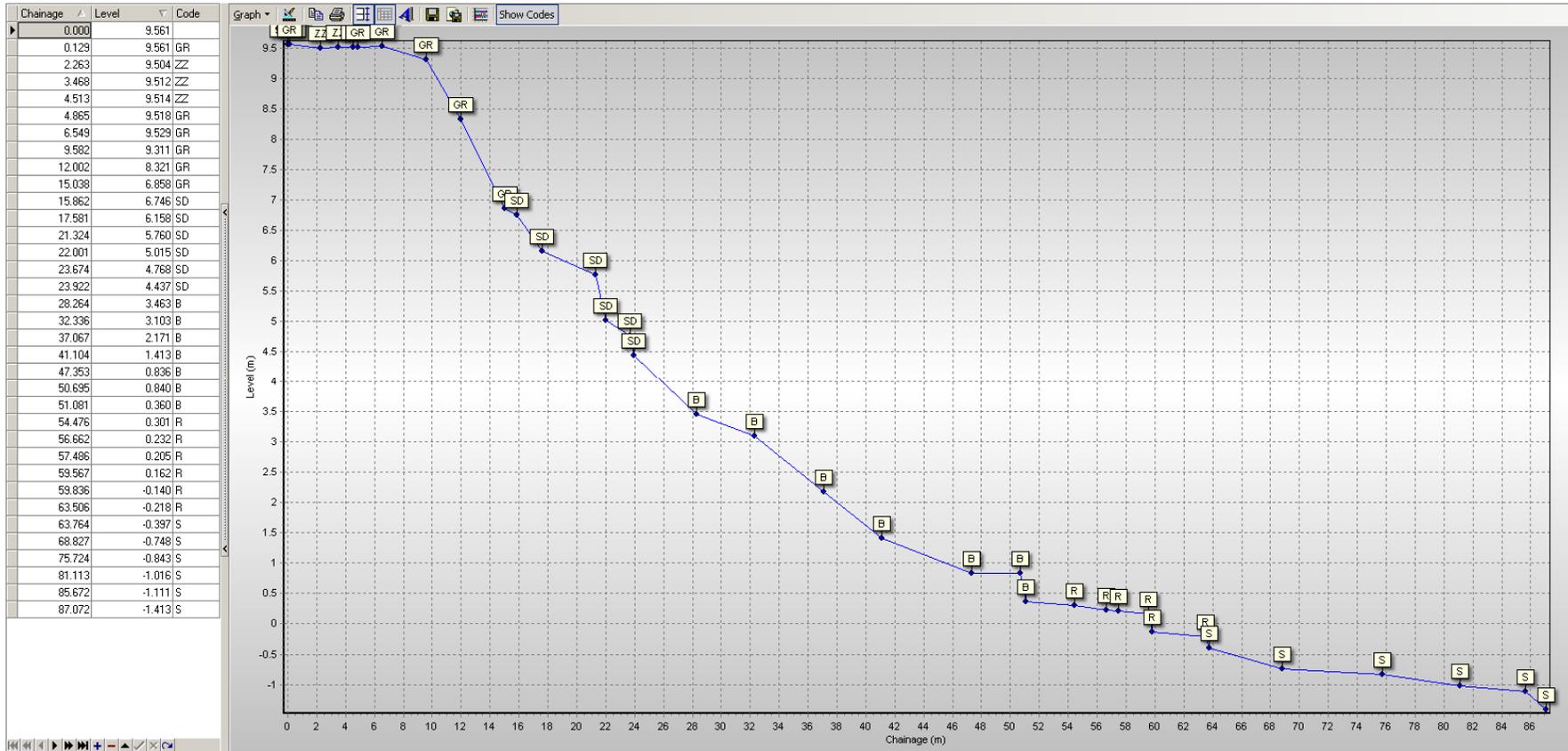
1bSS9 - 10/03/2011



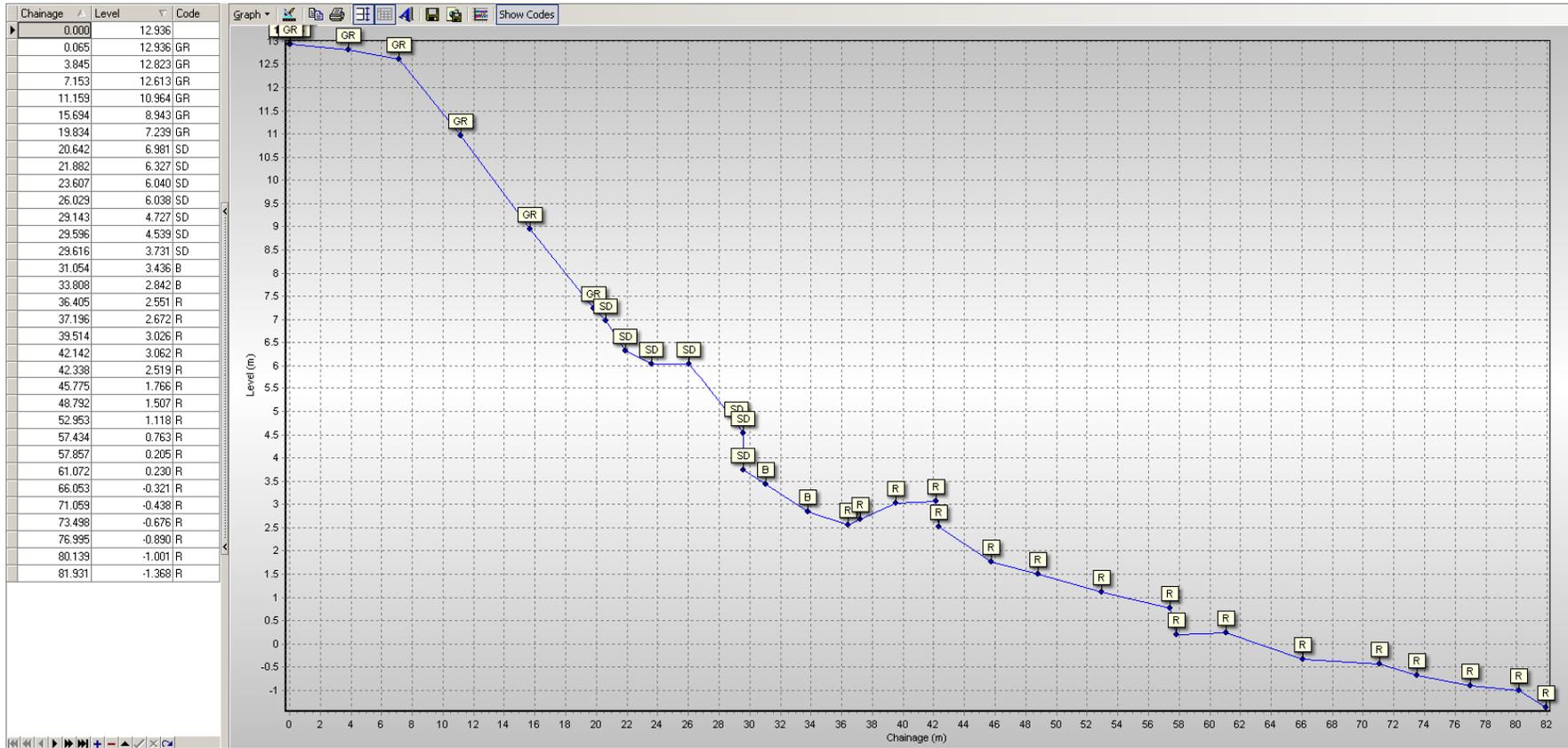
1bSS10 - 11/03/2011



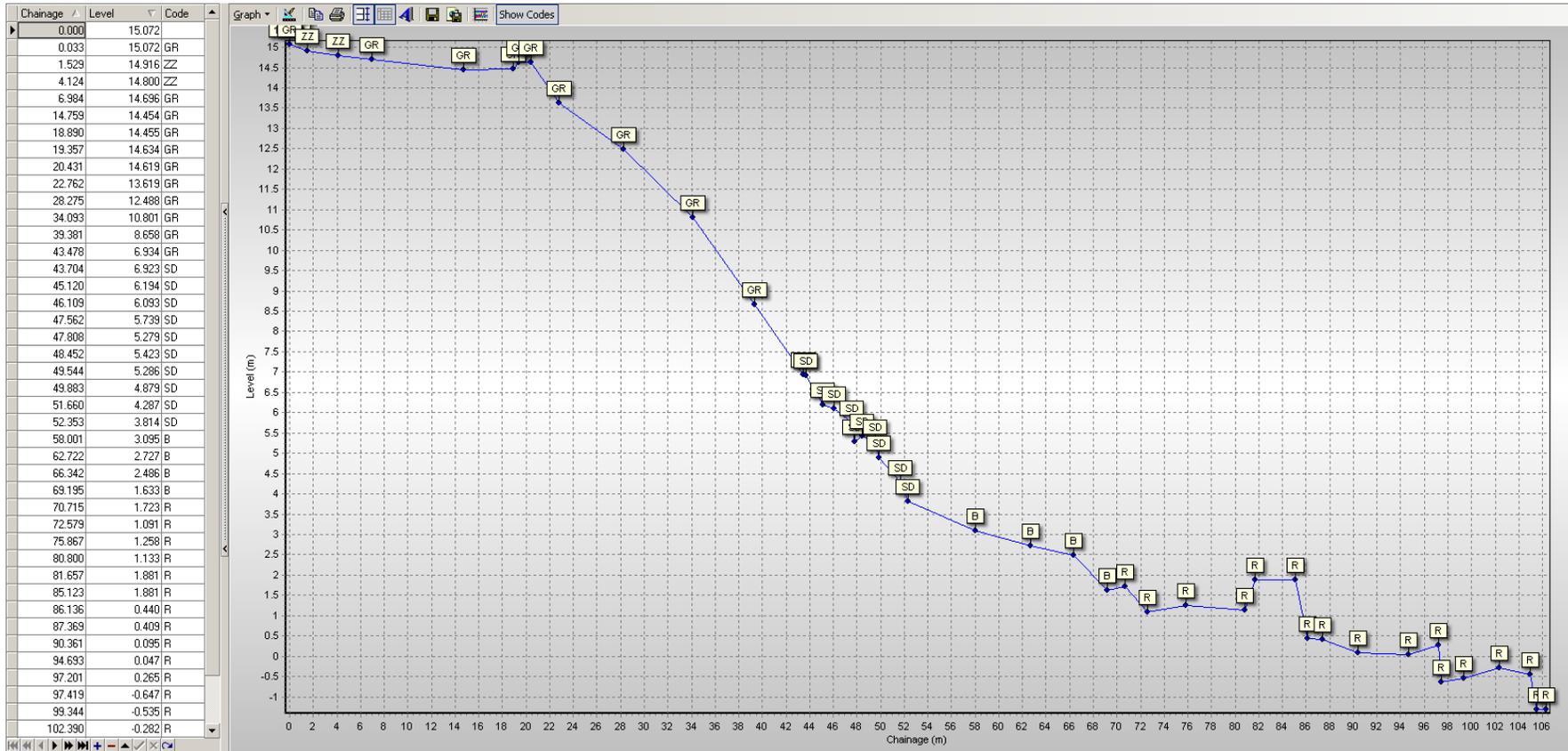
1bSS11 - 11/03/2011



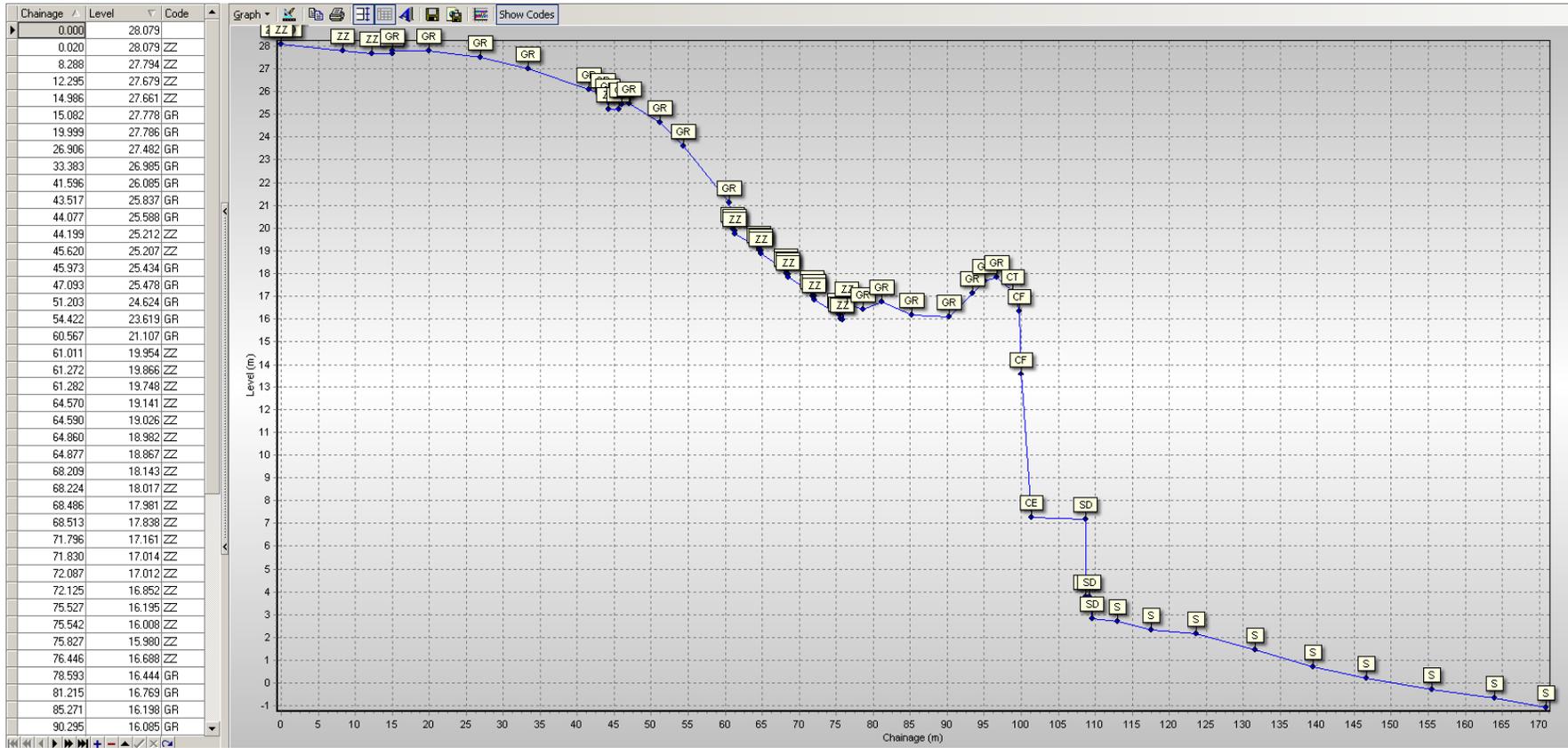
1bSS12 - 11/03/2011



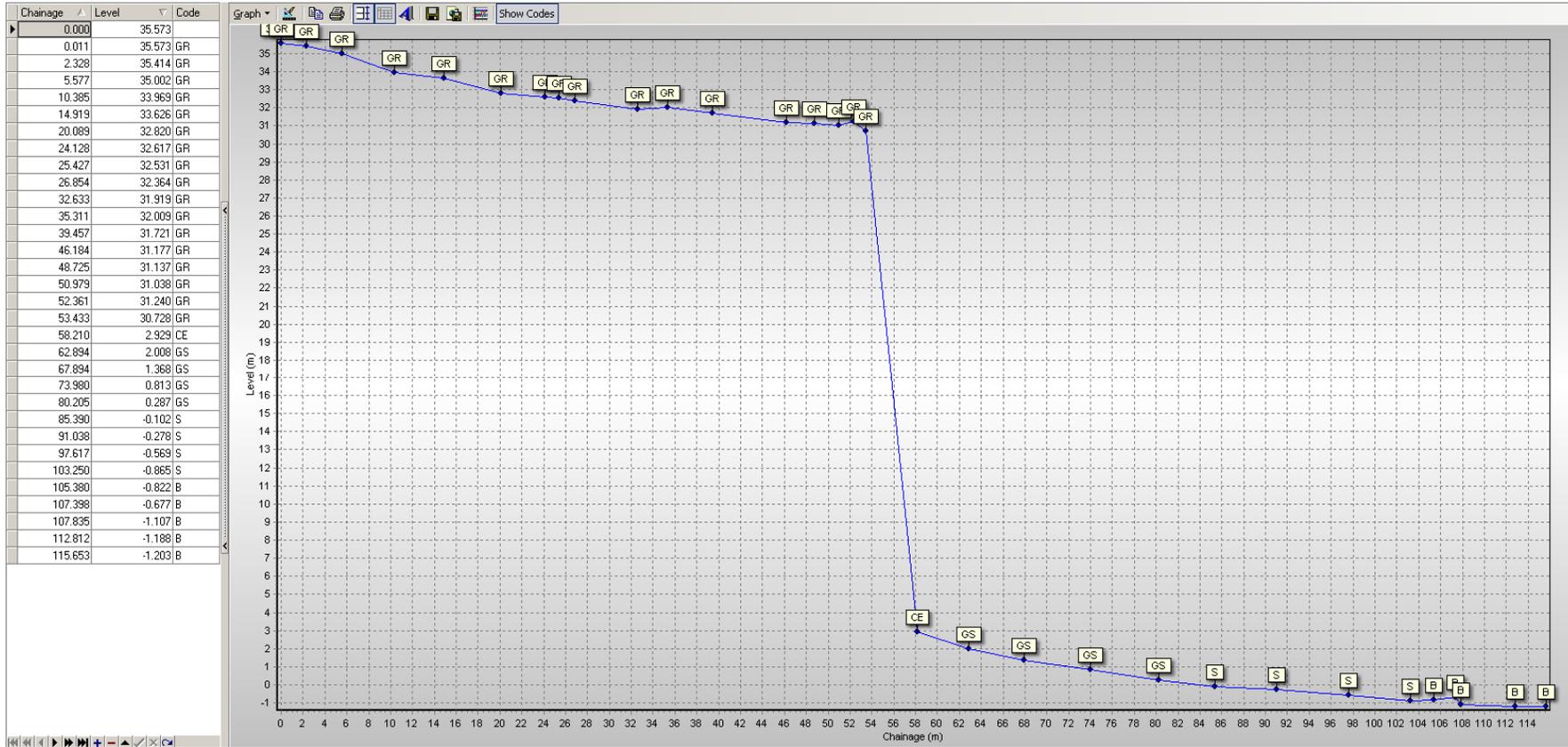
1bSS13 - 11/03/2011



1bSS14 - 11/03/2011



1bSS17 - 11/03/2011

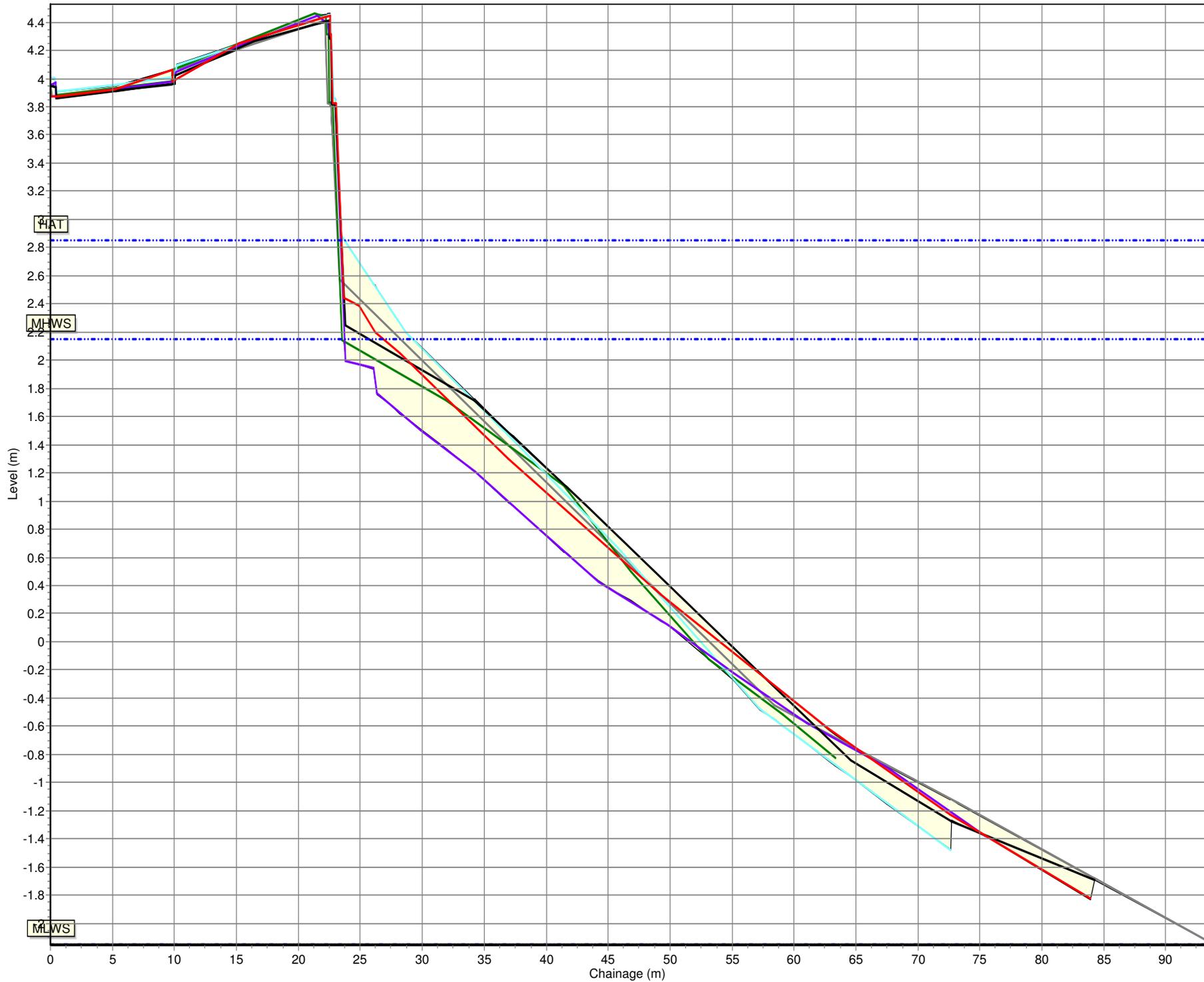


Beach Profiles: 1bSS1



- Profiles Envelope
- 02/11/2008
- 23/03/2009
- 08/09/2009
- 16/03/2010
- 14/09/2010
- 10/03/2011

Beach Profiles: 1bSS3



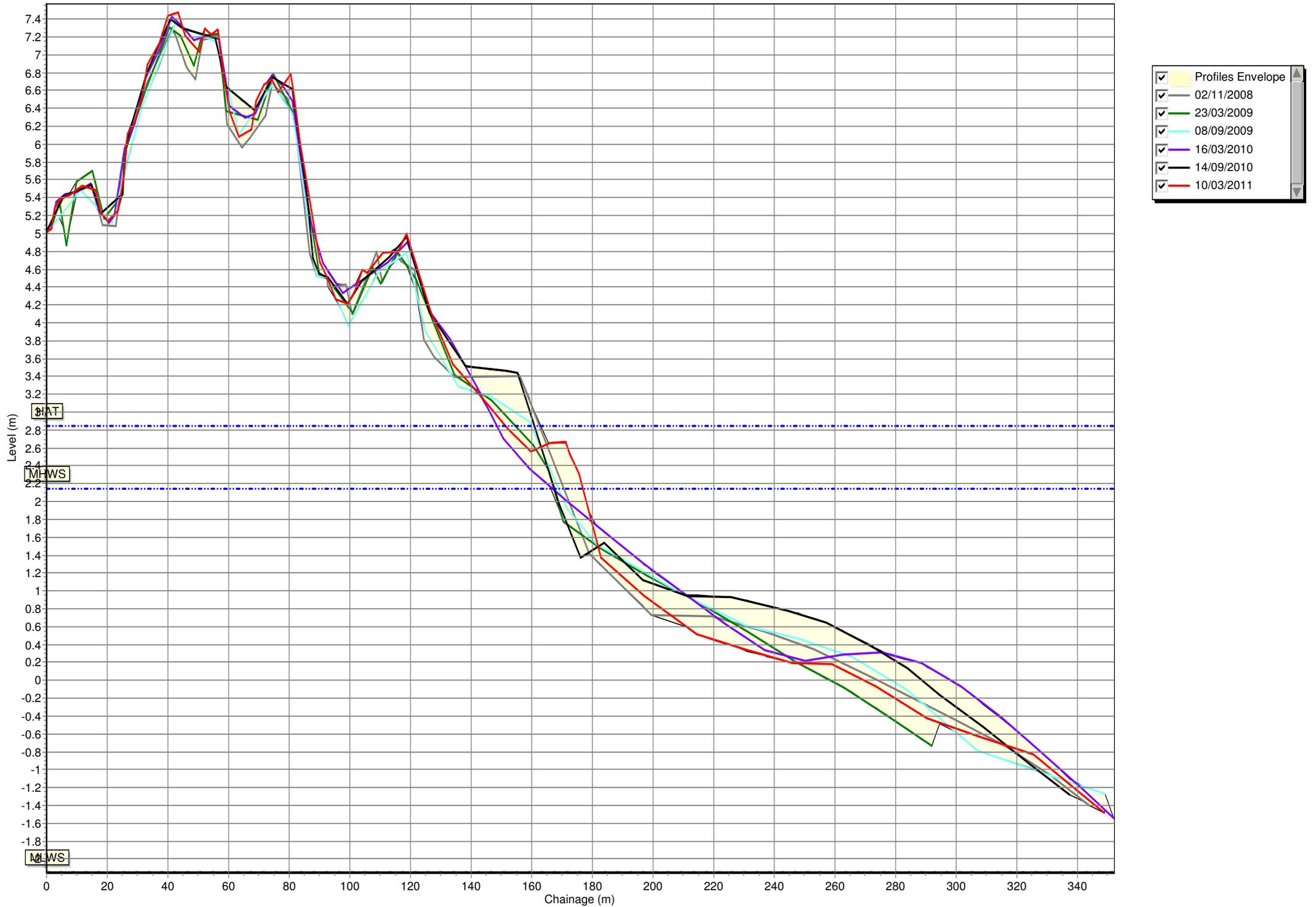
- Profiles Envelope
- 02/11/2008
- 23/03/2009
- 08/09/2009
- 16/03/2010
- 14/09/2010
- 10/03/2011

MLLW

MHW

MLWS

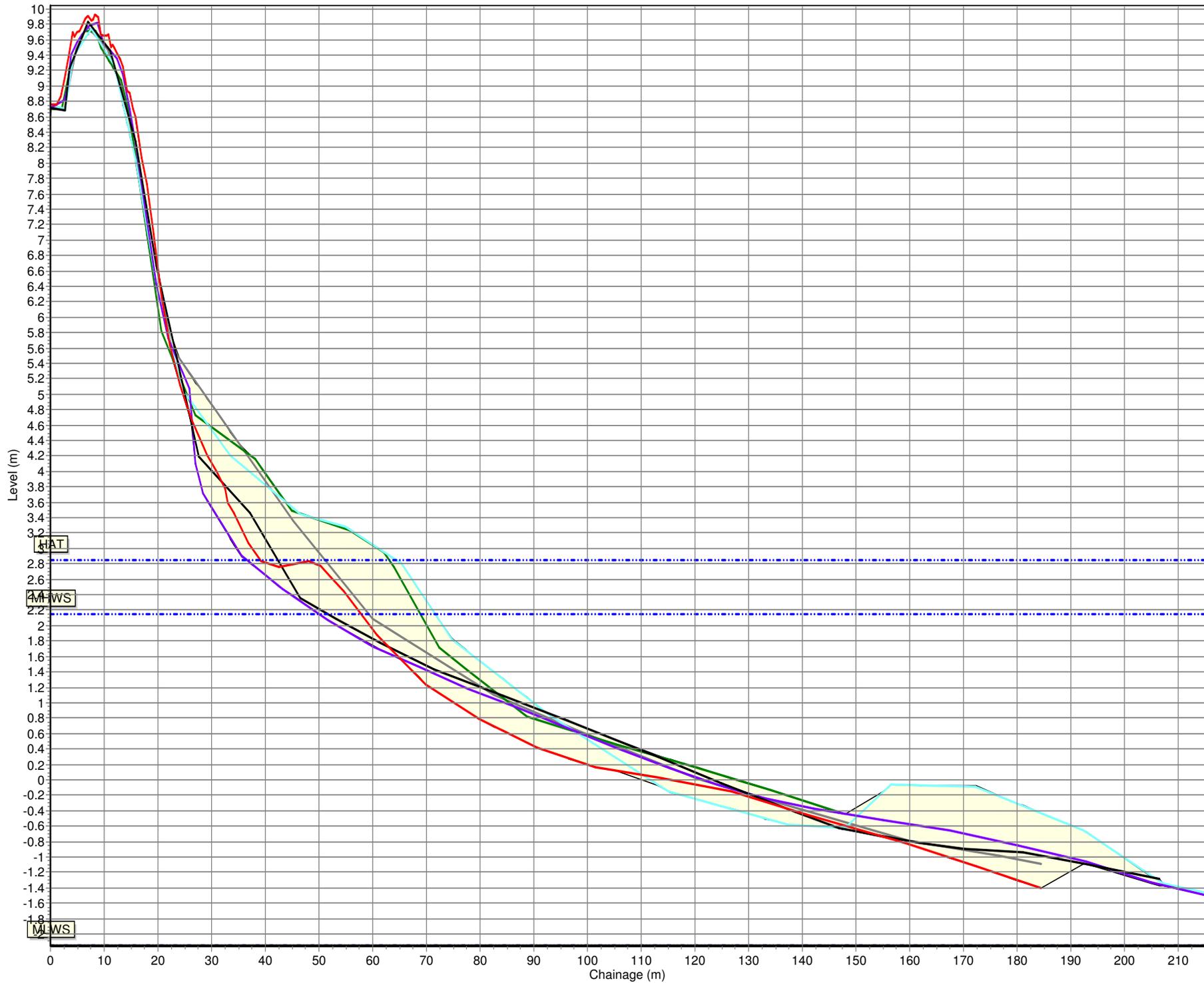
Beach Profiles: 1bSS5



Beach Profiles: 1bSS8

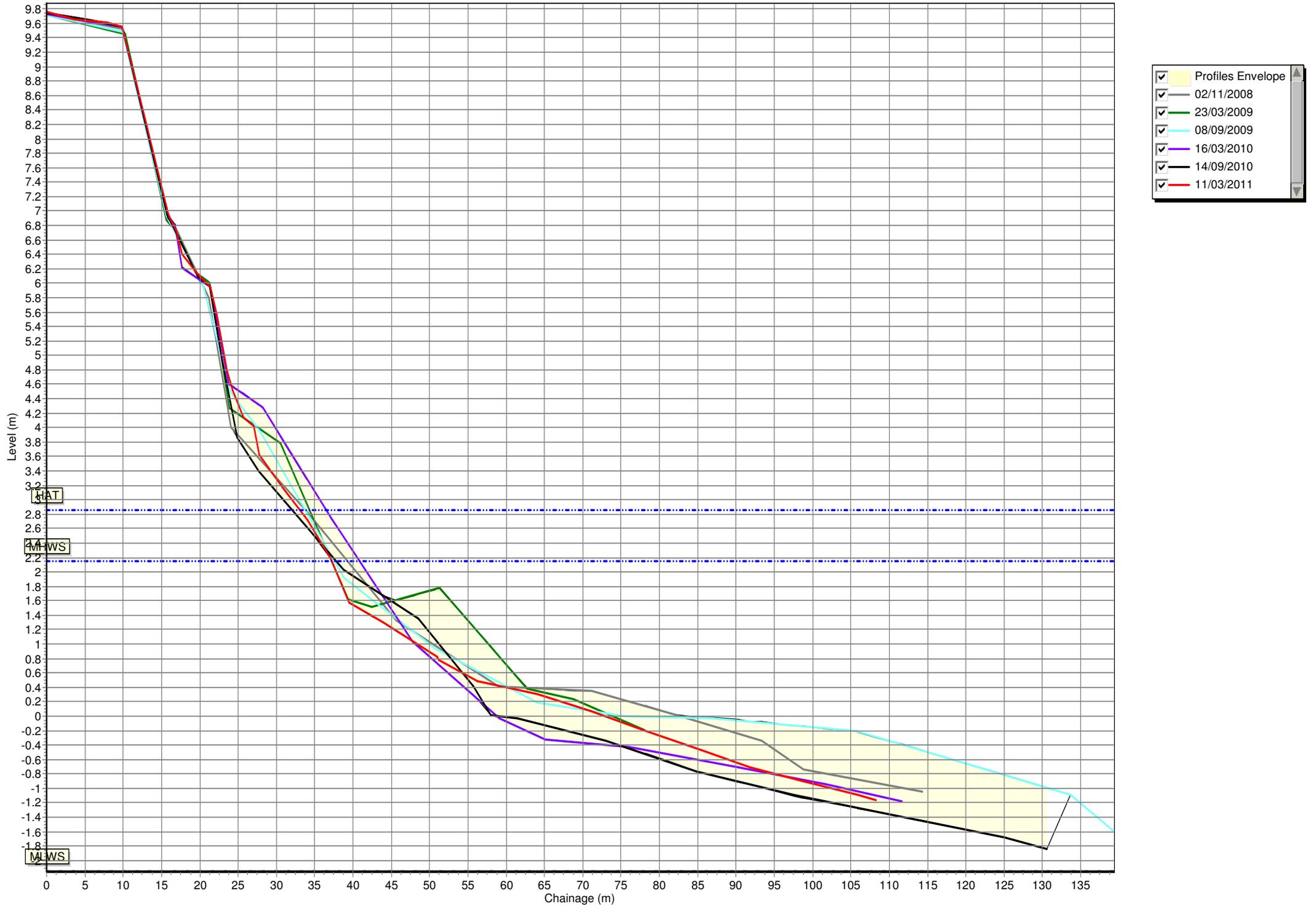


Beach Profiles: 1bSS9

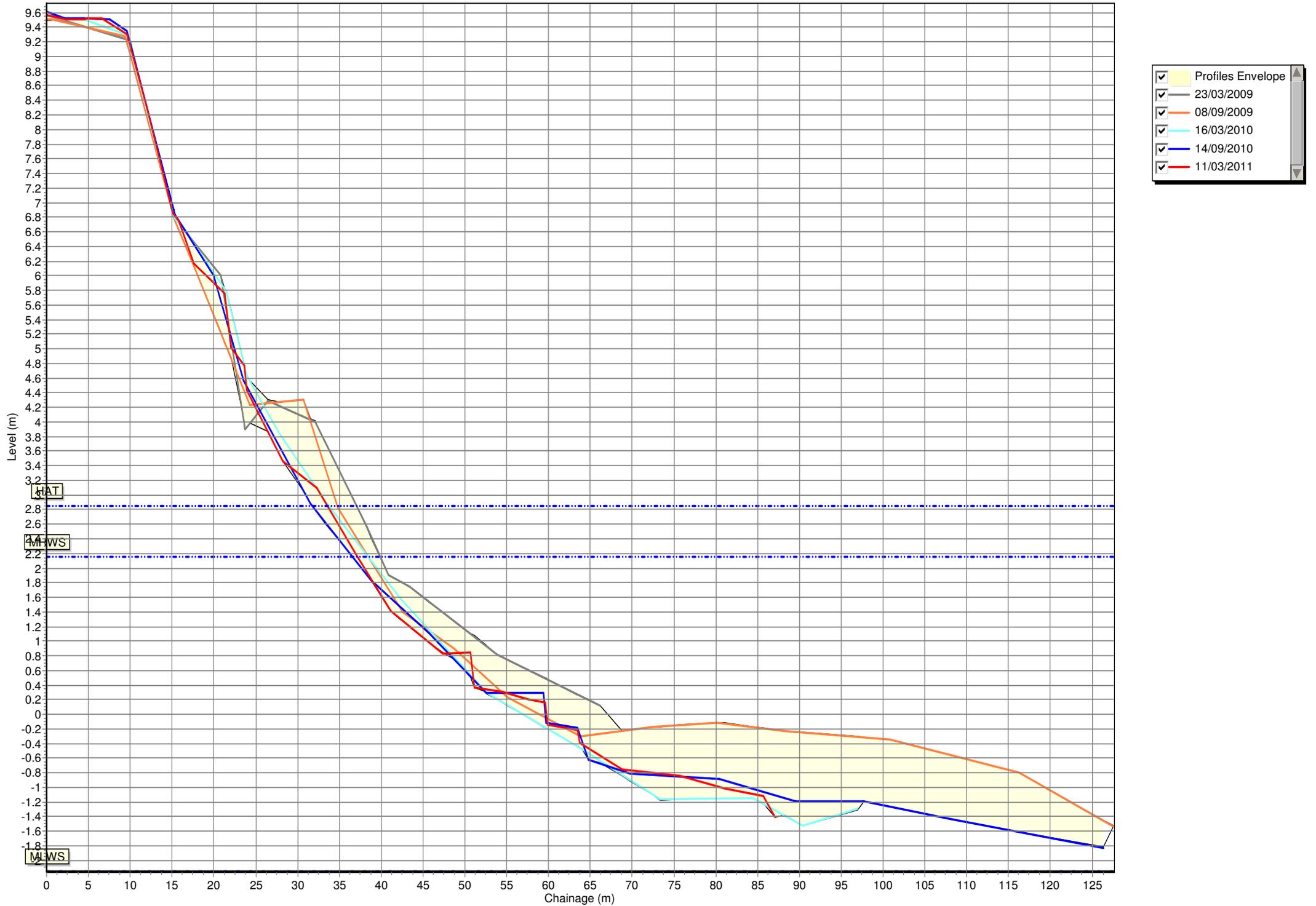


- Profiles Envelope
- 02/11/2008
- 23/03/2009
- 08/09/2009
- 16/03/2010
- 14/09/2010
- 10/03/2011

Beach Profiles: 1bSS10



Beach Profiles: 1bSS11



Beach Profiles: 1bSS12



- Profiles Envelope
- 23/03/2009
- 08/09/2009
- 16/03/2010
- 14/09/2010
- 11/03/2011

HAT

MWS

MWS

Beach Profiles: 1bSS13



- Profiles Envelope
- 23/03/2009
- 08/09/2009
- 16/03/2010
- 14/09/2010
- 11/03/2011

HAT

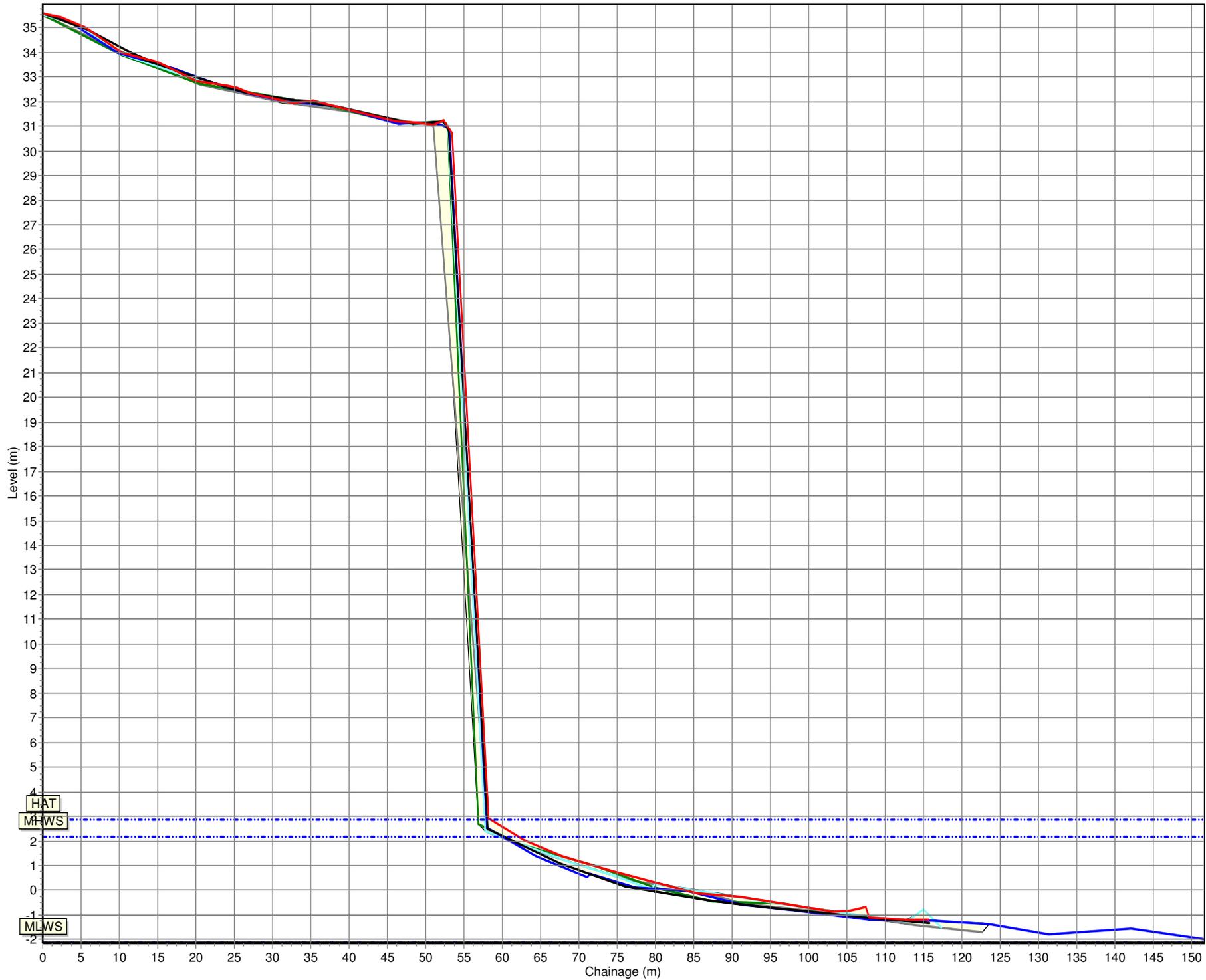
MWS

MLWS

Beach Profiles: 1bSS14



Beach Profiles: 1bSS17



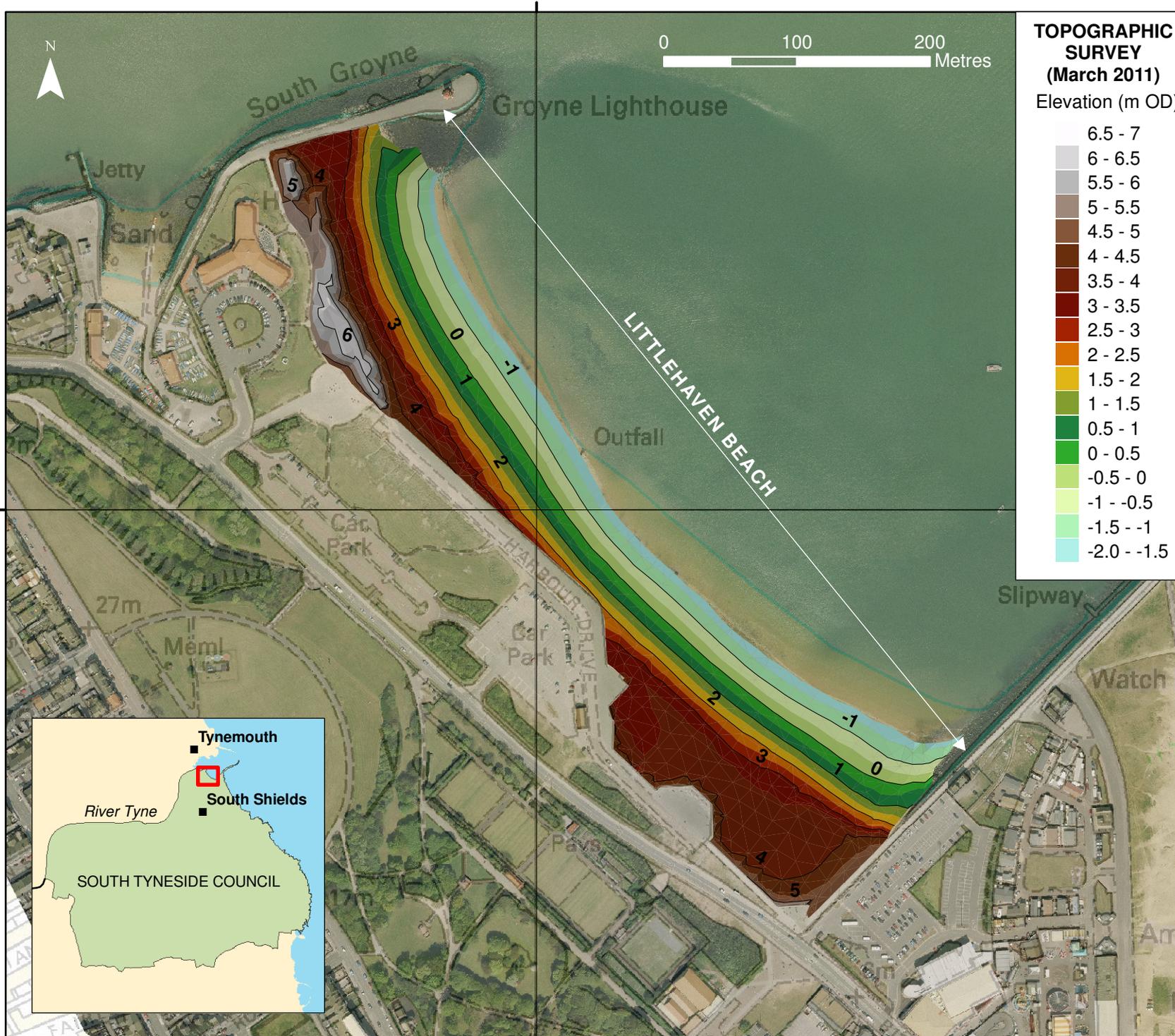
- Profiles Envelope
- 01/11/2008
- 23/03/2009
- 08/09/2009
- 16/03/2010
- 14/09/2010
- 11/03/2011

HAT

M+WS

MLWS

Appendix B
Topographic Survey



— Topographic Contours at 1 metre interval

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

Appendix B - Map 1a
South Tyneside Council Frontage

Update Report 3
'Partial Measures' Survey 2011

Drawing Scale 1:4,000 at A4

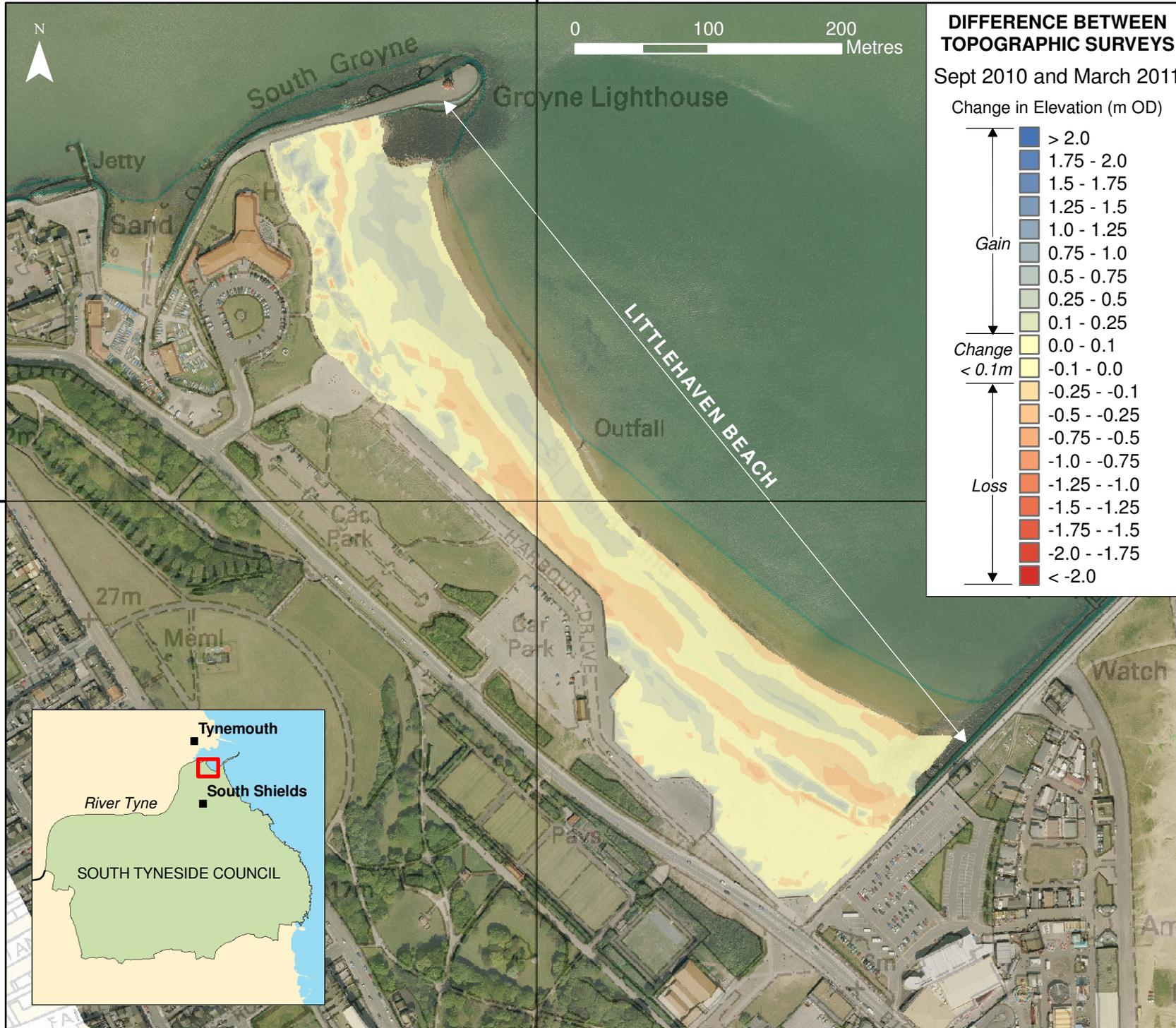
Drawn by: TC	Date: 05/05/2011
Checked by: NC	Date: 12/05/2011
Approved by: NC	Date: 12/05/2011

 ROYAL HASKONING	 Halcrow
Royal Haskoning Marlborough House Marlborough Crescent Newcastle upon Tyne NE1 4EE	Halcrow Group Ltd Lyndon House 62 Hagley Road Edgbaston Birmingham B16 8PE

Tel: +44 (0)191 211 1300	Tel: +44 (0)121 456 2345
Fax: +44 (0)191 211 1313	Fax: +44(0)121 456 1569
www.royalhaskoning.com	www.halcrow.com

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

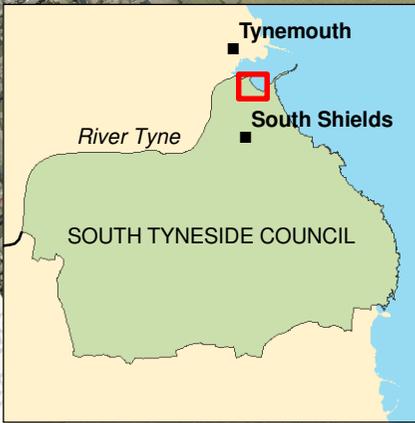
I:\916403\Technical_Data\gis\figure8_PARTIAL_Measures_2011\3_South_Shields\Appendix_B_South_Tyneside_1a.mxd



DIFFERENCE BETWEEN TOPOGRAPHIC SURVEYS
 Sept 2010 and March 2011

Change in Elevation (m OD)

Gain	> 2.0
	1.75 - 2.0
	1.5 - 1.75
	1.25 - 1.5
	1.0 - 1.25
	0.75 - 1.0
	0.5 - 0.75
	0.25 - 0.5
	0.1 - 0.25
	0.0 - 0.1
Change < 0.1m	-0.1 - 0.0
	-0.25 - -0.1
	-0.5 - -0.25
	-0.75 - -0.5
	-1.0 - -0.75
	-1.25 - -1.0
	-1.5 - -1.25
	-1.75 - -1.5
	-2.0 - -1.75
	< -2.0
Loss	



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

Appendix B - Map 1b
South Tyneside
Council Frontage

Update Report 3
 'Partial Measures' Survey 2011

Drawing Scale 1:4,000 at A4

Drawn by: TC	Date: 05/05/2011
Checked by: NC	Date: 12/05/2011
Approved by: NC	Date: 12/05/2011

<p>ROYAL HASKONING</p>	<p>Halcrow</p>
<p>Royal Haskoning Marlborough House Marlborough Crescent Newcastle upon Tyne NE1 4EE</p>	<p>Halcrow Group Ltd Lyndon House 62 Hagley Road Edgbaston Birmingham B16 8PE</p>
<p>Tel: +44 (0)191 211 1300 Fax: +44 (0)191 211 1313 www.royalhaskoning.com</p>	<p>Tel: +44 (0)121 456 2345 Fax: +44(0)121 456 1569 www.halcrow.com</p>

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

I:\916403\Technical_Data\gis\figure8_PARTIAL_Measures_2011\3_South_Shields\Appendix_B_South_Tyneside_1b.mxd