



**Cell 1 Regional Coastal Monitoring Programme  
Update Report 7: 'Partial Measures' Survey 2015**



North Tyneside Council

**North Tyneside Council  
Final Report**

**July 2015**

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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 (m AOD)
	River Tyne
1 in 200 year	3.7
HAT	3.1
MHWS	2.4
MLWS	-1.9

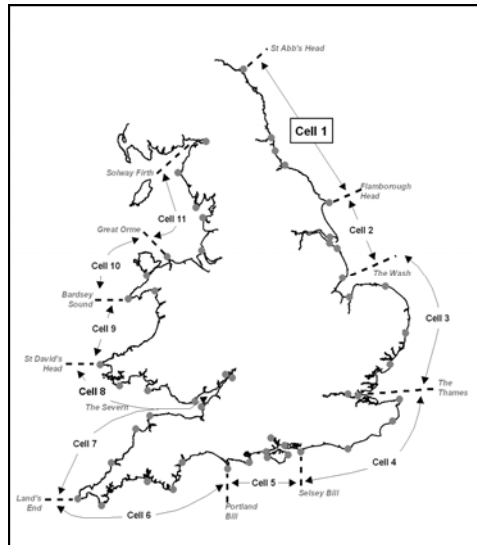
**Source:** *Scottish Border to River Tyne Shoreline Management Plan 2*.  
Royal Haskoning, May 2009.

## Glossary of Terms

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

## Preamble

The Cell 1 Regional Coastal Monitoring Programme covers approximately 300km of the north east coastline, from the Scottish Border (just south of St. Abb's Head) to Flamborough Head in East Yorkshire. This coastline is often referred to as 'Coastal Sediment Cell 1' in England and Wales (Figure 1).



**Figure 1 Sediment Cells in England and Wales**

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 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	Sept-Dec 08	May 09	Mar-May 09	June 09	
2	2009/10	Sept-Dec 09	Mar 10	Feb-Mar 10	Jul 10	
3	2010/11	Aug-Nov 10	Feb 11	Feb-Apr 11	Aug 11	Sept 11
4	2011/12	Oct-Nov 11	Oct 12	Mar-May 12	Feb 13	
5	2012/13	Sept-Oct 12	Mar 13	Mar-Apr 13	Jun 13	
6	2013/14	Sept-Oct 13	Feb 14	Mar-Apr 14	Jul 14	
7	2014	Oct-Nov 14	Feb 15	Mar 15	Jul 15 (*)	

(\*) The present report is **Update Report 7** and provides an analysis of the 2015 Partial Measures survey for North Tyneside Council's frontage.

## **1. Introduction**

### **1.1 Study Area**

North Tyneside Council's frontage extends from Hartley (just south of Blyth) in the north to River Tyne in the south. For the purposes of this report and for consistency with previous reporting, it has been sub-divided into four areas, namely:

- Whitley Sands
- Cullercoats Bay
- Tynemouth Long Sands
- King Edward's Bay

### **1.2 Methodology**

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

- Full Measures survey annually each autumn comprising:
  - Beach profile surveys along eight transect lines (commenced 2002)
  - Beach profile surveys along an additional two transects (commenced 2010)
  - Topographic survey along Whitley Sands (commenced 2010)
  - Topographic survey along Tynemouth Long Sands (commenced 2011)
- Partial Measures survey annually each spring comprising:
  - Beach profile surveys along all ten transect lines (commenced 2010)

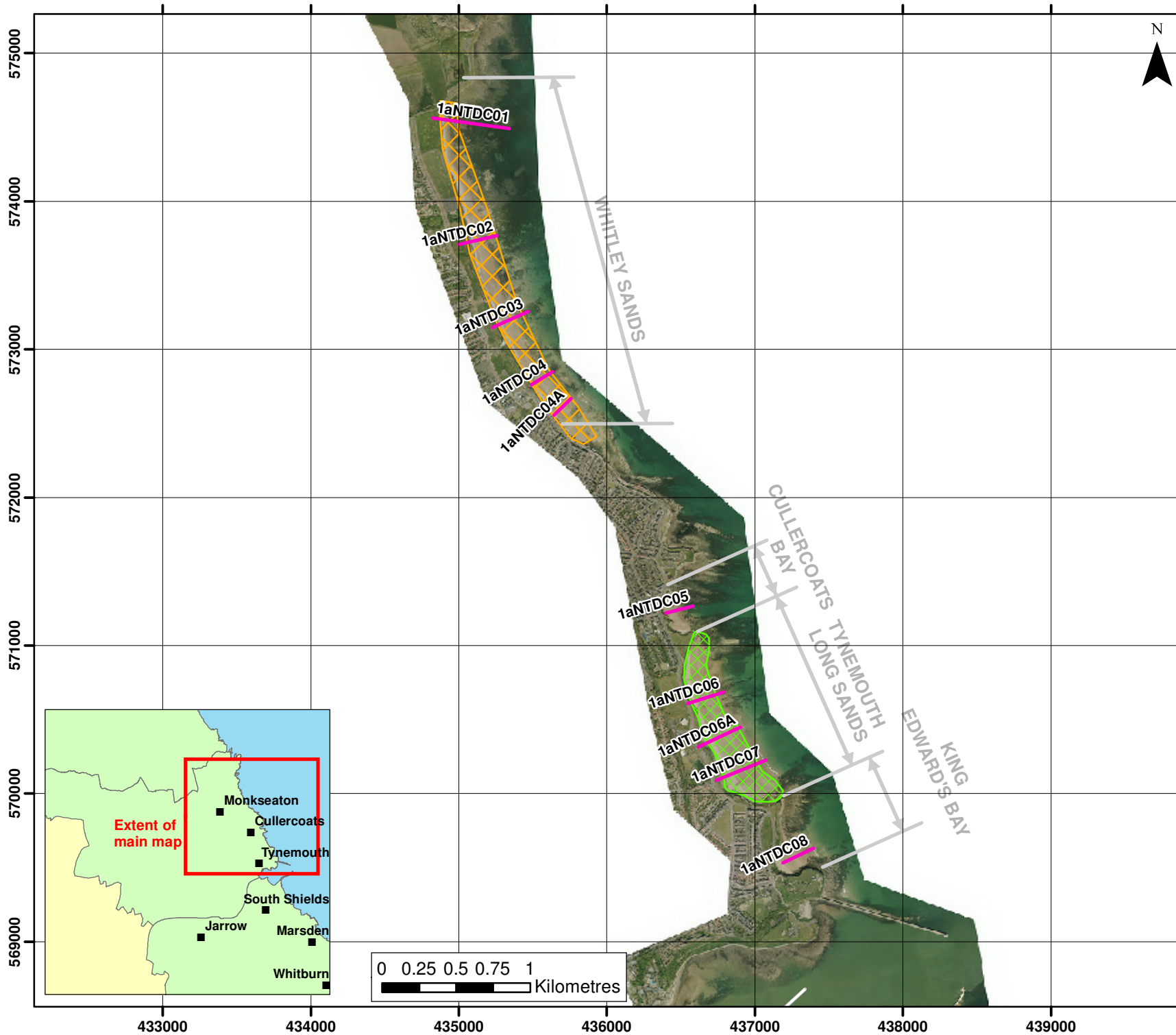
The location of these surveys is shown in Figure 2. The Partial Measures 2013 surveys were undertaken along this frontage on the 19<sup>th</sup> March 2015 and 20<sup>th</sup> March 2015. During this time weather conditions varied; refer to the survey reports for details of the weather conditions over this survey period.

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.





**KEY**

**Topographic Profiles**  
 — Annual  
 — 6 monthly

**Topographic Surveys**  
 ▨ 6 monthly  
 ▨ yearly  
 ▨ 5 yearly

**Cliff Top Monitoring Pegs**  
 ■ 50m centres  
 ■ 100m centres  
 ■ 300m centres

*(Indicative survey extents shown)*

Client: North East Coastal Group  
 Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Figure 2 - Map 1**  
**Survey Locations**  
**Whitley Sands**  
**to King Edward's Bay**  
**North Tyneside Council**

Update Report 7  
 Partial Measures Survey  
 Spring 2015

**ch2m**<sup>SM</sup>

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## 2. Analysis of Survey Data

### 2.1 Whitley Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2015	<p><b>Beach Profiles:</b></p> <p>Whitley Sands is covered by five beach profile lines for the Partial Measures survey (Appendix A). Four of these (1aNTDC01 to 1aNTDC04) were initially surveyed in April 2002 and were then re-surveyed annually to 2009 (Full Measures, autumn 2009) after which time they have been surveyed bi-annually. From March 2010 (Partial Measures, spring 2010) onwards, an additional beach profile line (NTDC04A) has been surveyed at the southern end of the frontage for the same time periods listed above. All profiles were last surveyed in autumn 2014 for the Full Measures survey.</p> <p><b>1aNTDC01</b> is located in the north of Whitley Sands, along the undefended cliffs immediately south of Trinity Road car park. The cliff profile shows the cliff to have retreated since the last survey, but comparison with previous surveys shows it in the same position as those, so the cliff is assumed to have remained stable and the change is a result of interpolation. Beach levels at the toe of the cliff have increased by 0.5m, but seaward of a chainage of 50m have generally decreased to leave a smoother profile.</p> <p>Profile <b>1aNTDC02</b> is located to the north of Whitley Sands opposite the seawall. Along this profile, there have been some fluctuations in profile height along the profile length, from the seawall to the lower rocky beach, to form a slightly more undulating profile. These changes are in the region of 0.2m, showing that the profile has generally remained stable since the last survey (Full Measures, autumn 2014).</p> <p>Profile <b>1aNTDC03</b> is located at the centre of Whitley Sands. Beach levels have increased by approximately 0.2m at the toe of the seawall, seaward to a chainage of 20m, and by approximately 0.5m seaward of the exposed rocky foreshore (seaward of a chainage of 90m). In between beach levels have fallen by approximately 0.2m, but the profile form has remained the same since the last survey (Full Measures, autumn 2014).</p> <p>Profile <b>1aNTDC04</b> is located to the south of Whitley Sands. The survey photograph taken during the most recent survey (see Plate 1) shows that the café and buildings that once existed on the promenade have</p>	<p>Since the last survey, beach levels at Whitley Sands have carried by approximately 0.5m, with relatively small changes in form as material has been moved across the beach. The largest change is observed at profile 1aNTCD04A, where beach level change was in the order of 0.7m.</p> <p>These changes indicate the occurrence of cross-shore transport occurring under winter/spring storms, and possibly the southerly movement of drawdown material to the southern end of the frontage.</p> <p>The construction of a new seawall to the north of 1aNTDC01 and the removal of the café and buildings at the site of profile 1aNTDC04A does not appear to have affected beach behaviour.</p> <p><b>Longer term trends:</b></p> <p>The data show that profiles are within the bounds of previous surveys, indicating generic behaviour with no clear trend.</p> <p>Aerial photographs show that the beach at the southern end of the White Sands (specifically profiles 1aNTDC04 and 1aNTDC04A) have been subject to a change in beach material; type, from sandy in the autumn of 2012 to a combination of shingle and sand, between autumn 2012 and autumn 2014, and back to</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>been taken down. As observed in previous reports, the sediment type on the beach is subject to change, and since the last survey, has changed again; this time from a combination of sand and shingle to sand. The photographs in Plates 2 to 6 show how the sediment type on the beach has changed; the last time the beach was sandy was in the autumn of 2013. The beach profile has changed in level by small and different amounts across the profile length, but the key trend is an overall decrease between 20m and 60m chainage by up to 0.5m and an increase in beach level seaward of 80m chainage by approximately 0.5m, indicating a cross-shore transfer of material seaward over the winter/spring months.</p> <p>Profile <b>1aNTDC04a</b> is located to the south of Whitley Sands. Beach levels have increased across the profile by up to 0.7m, although the beach has retained the same form. As at profile 1aNTDC04, there has been a change in the sediment type on the beach (refer to Plates 7 to 12) from a combination of sand and shingle to sand. The sand is on the beach is now similar to the content last observed during the September 2012 (Full Measures) survey, suggesting recovery.</p>	<p>sand by spring 2015. This suggests that the beach at these locations have recovered and sand that was removed from the beach by significant storms during the winter of 2013 and 2014 has now been returned.</p>



Plate 1 – Survey photograph 1aNTDC04\_20150319\_N4.JPG



Plate 2 – Survey photograph 1aNTDC04\_20141006\_N4



Plate 3 – Survey photograph 1aNTDC04\_20140402\_N14.JPG



Plate 4 – Survey photograph 1aNTDC04\_20131017\_N4.jpg



Plate 5 – Survey photograph 1aNTDC04\_20130312\_N3



Plate 6 – Survey photograph 1aNTDC04\_20120928\_N4



Plate 7 – Survey photograph 1aNTDC04A\_20120928\_N2



Plate 8 – Survey photograph 1aNTDC04a\_20130312\_N2

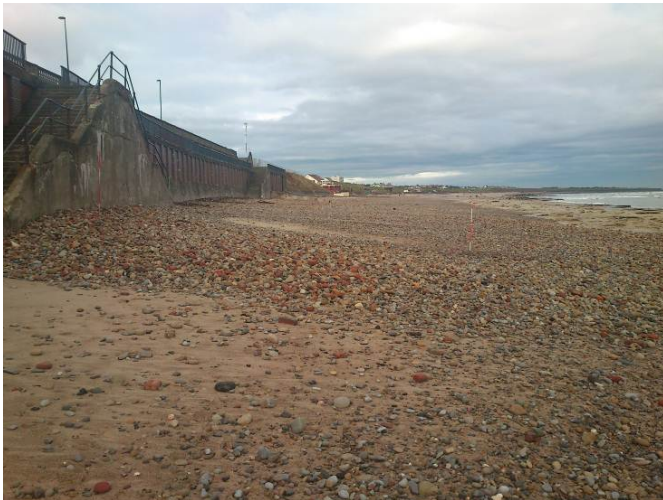


Plate 9 – Survey photograph 1aNTDC04A\_20131017\_N2



Plate 10 – Survey photograph 1aNTDC04A\_20140402\_N2



Plate 11 – Survey photograph 1aNTDC04A\_20141006\_N2



Plate 12 – Survey photograph 1aNTDC04A\_20150319\_N1

## 2.2 Cullercoats Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
<p><b>Mar 2015</b></p>	<p><b>Beach Profiles:</b></p> <p>Cullercoats Bay is covered by one beach profile line for the Partial Measures survey (Appendix A). This was surveyed annually each autumn between 2002 and 2009. From spring 2010 onwards, it has been surveyed bi-annually. The last survey was the autumn 2014 Full Measures survey.</p> <p>The cliff top position along <b>1aNTDC05</b> has remained constant since surveys began in April 2002, but there have been apparent changes along the cliff face. The profile shows the cliff face to have advanced. However, this result is a function of interpolation between limited data points. Seaward of a chainage of 30m, the beach has been subject to change, with a reduction of beach level by approximately 0.2 on the upper flatter beach (chainage 30m to 85m) and an increase in beach levels by approximately 0.2m along the downward sloping middle/lower beach (chainage 85m to 130m).</p>	<p>Changes in beach level since the last survey are minimal, with a drop in beach levels on the upper beach are matched by an increased in beach levels on the middle/lower beach suggesting some movement of material across the beach in response to winter/spring storms.</p> <p><b>Longer term trends:</b> The beach levels observed are within the bounds of previous surveys, indicating generic behaviour with no clear trend.</p>



### 2.3 Tynemouth Long Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
Apr 2015	<p><b>Beach Profiles:</b></p> <p>Tynemouth Long Sands is covered by three beach profile lines for the Partial Measures survey (Appendix A). Profiles 1aNTDC06 and 1aNTDC07 were initially surveyed annually each autumn between 2002 and 2009. A third profile, 1aNTDC06A, was later added in the centre of the frontage. From spring 2010 (Partial Measures) onwards, they have been surveyed bi-annually. The last survey was the autumn 2014 Full Measures survey.</p> <p><b>1aNTDC06</b> is located approximately 150m south of the access road/ramp towards the north of the bay. The profile for the dune-cliff face is limited due to a lack of data points in the profile plot; previous survey reports have noted "<i>no access to middle of section 6 due to seed protection fences</i>" and it is assumed that the same applies to the present survey. The survey photographs in Plates 13 and 14 show the dune face during the present and previous survey. Although there appears to be less vegetation, there is a clear build-up of sand behind the dune fencing and at the toe of the dune cliff. Beach levels have remained relatively stable, with movement anywhere between 0.1m and 0.2m across the beach with no clear trend.</p> <p>At profile <b>1aNTDC06A</b>, the profile for the dune-cliff face is a straight line; a result of a lack of data points in the profile plot. Previous survey reports have noted '<i>no access to middle of section 6A due to seed protection fences</i>' and it is assumed that the same applies to the present survey. The upper beach has accreted by approximately 0.7m since the previous survey, with build-up of sand against the dune fencing (see Plates 15 and 16). Beach levels seaward of a chainage of 180m have reduced by up to 0.7m. It is possible that material has been from the lower to the upper beach during the winter/spring months.</p> <p>Profile <b>1aNTDC07</b> is located approximately 50m south of the access route through the dunes towards the southern end of the bay. As with the other profiles the dune-cliff face is a straight line; a result of a lack of data points in the profile plot. Previous survey reports have noted '<i>no access to middle of section 7 due to seed protection fences</i>' and it is assumed that the same applies to the present survey. Beach levels have generally remained stable with discrete and adjacent sections of decrease/increase in the order of 0.2m at a chainage of around 80m and 250m. This suggests material has been moved seaward</p>	<p>At Tynemouth Long Sands, the dune-cliff face was not surveyed due to access constraints, but survey photographs suggest that there has been a build-up of wind-blown sand material in the lee of the defences and along the upper beach.</p> <p>Beach profile change has been relatively small over the winter/spring months since the last survey, with beach level change in the order of 0.2m to 0.7m, and generally showing a cross-shore movement of material both seaward and landward in response to winter/spring storms and wind-blown activity.</p> <p><b>Longer term trends:</b> Overall, the beaches have retained a similar form and are within the bounds of previous surveys.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	during the winter/spring months.	
Mar 2015	<p><b>Topographic Survey:</b></p> <p>Tynemouth Long Sands is a new survey area. The first survey was undertaken for the Full Measures survey in October 2010.</p> <p>Data from the current topographic survey have been used to create a digital ground model (DGM) (Appendix B – Map 1a) using a Geographical Information System (GIS). A difference plot has also been produced by comparing the current DGM (Appendix B – Map 1b) with that produced from the last topographic survey.</p> <p>In particular the difference plot shows (i) a general increase in beach elevation of between 0.0m and 1.0m along the upper beach; (ii) a general decrease in beach elevation of between 0.0m and 1.0m along lower beach at the centre of the bay, and towards the middle and lower beach to the north and south of the bay. These trends are the reverse of those observed during the previous survey (Full Measures, autumn 2014). These findings correspond well to the beach profile surveys, which show alternating changes in beach levels in a cross-shore direction.</p>	<p>Since the last survey, the beach at Tynemouth Long Sands has been dynamic, with formation of a band of accretion on the upper beach and a more distinct zone of beach elevation reduction on the middle and lower beach. The last survey identified an area of beach elevation reduction to the north, but this is now spread out over the beach.</p>



Plate 13 – 1aNTDC06\_20150320\_Up2.JPG



Plate 14 – Survey photograph 1aNTDC06\_20141007\_Up2.JPG



Plate 15 – Survey photograph 1aNTDC06A\_20150320\_N5.JPG



Plate 16 – Survey photograph 1aNTDC06A\_20141007\_N7.JPG

## 2.4 King Edward's Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2015	<p><b>Beach Profiles:</b></p> <p>King Edward's Bay is covered by one beach profile line for the Full Measures survey (Appendix A). This was surveyed annually each autumn between 2002 and 2009. From spring 2010 onwards, it has been surveyed bi-annually. The last survey was the autumn 2014 Full Measures survey.</p> <p>At profile <b>1aNTDC08</b> beach levels have changed quite considerably across the profile, with an increase in beach levels on the upper beach (chainage 0-50m) by approximately 0.5m (see Plates 17 and 18); a decrease along the centre of the beach between a chainage of 50m and 100m by approximately 0.5m, and an increase in beach level of up to 1.5m on the lower beach, between a chainage of 100m and 190m. The overall effect is the formation of a more undulating profile. The survey photograph in Plate 17 shows evidence of the accumulation of wind-blown on the access slipway.</p>	<p>Since the last survey, the beach at King Edward's Bay beach has been subject to some considerable change over the winter/spring months with the cross-shore movement of material across the beach, but notably accumulation of sand against the seawall and deposition of wind-blown sand on the slipway. The beach profile is now, as a result, more undulating.</p> <p><b>Longer term trends:</b> Although the changes observed since the last survey appear to be considerable, they are within the realms of previous change where a berm on the upper beach is not uncommon.</p>



Plate 17 – Survey photograph 1aNTDC08\_20150320\_N1.JPG



Plate 18 – Survey photograph 1aNTDC08\_20141007\_N2.JPG.

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

#### **Individual Profiles**

- At profile 1aNTDC05 the cliff was not measured due to dangerous access. Access to this profile is noted to have been dangerous in the previous partial measures and full measures reports, and therefore consideration should be given to changing the location of this survey.
- At Tynemouth Long Sands (profiles 1aNTDC06, 1aNTDC06A and 1aNTDC07) there was no access to the dunes in the middle of the profile due to seedling protection fences. This means it has not been possible to directly monitor the effectiveness of the dune stabilisation scheme, although observations made from the survey photographs do show the accumulation of sand in the lee of the dune fencing.

#### **Topographic Survey**

- At Tynemouth Long Sands, the topographic survey report notes 'new sea defence wall installation completed north of section 1aNTDC01'.

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

It is recommended that access to the stabilised dunes at Tynemouth Long Sands be attempted in future surveys in order to monitor the effectiveness of the stabilisation fences.

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

- At Whitley Sands, beach levels have remained mostly stable with discrete sections of beach level change associated with the cross-shore movement of material during winter/spring storms. There has been a change in sediment type from shingle/sand to sand, which is evident from the survey photographs for profiles 1aNTDC04 and 1aNTDC04A.
- At Cullercoats Bay, at profile 1aNTDC05, it is assumed that the cliff was not measured due to dangerous access. Access to this profile is noted to have been dangerous in the previous Partial Measures and Full Measures reports, and therefore consideration should be given to changing the location of this survey.
- Elsewhere at Cullercoats Bay, beach level change since the last survey are minimal and the recorded profiles and present no causes for concern.
- At Tynemouth Long Sands, the dune-cliff face was not surveyed due to access constraints, but survey photographs suggest that there has been a build-up of wind-blown sand material in the lee of the defences and along the upper beach.
- Elsewhere at Tynemouth Long Sands, beach profile change has been relatively small over the winter/spring months since the last survey and the recorded profiles and topographic survey present no causes for concern.
- At King Edward's Bay, the beach has been subject to some considerable change over the winter/spring months with the cross-shore movement of material across the beach, but notably accumulation of sand against the seawall and deposition of wind-blown sand on the slipway. Otherwise, the recorded profiles present no causes for concern.

## **Appendices**

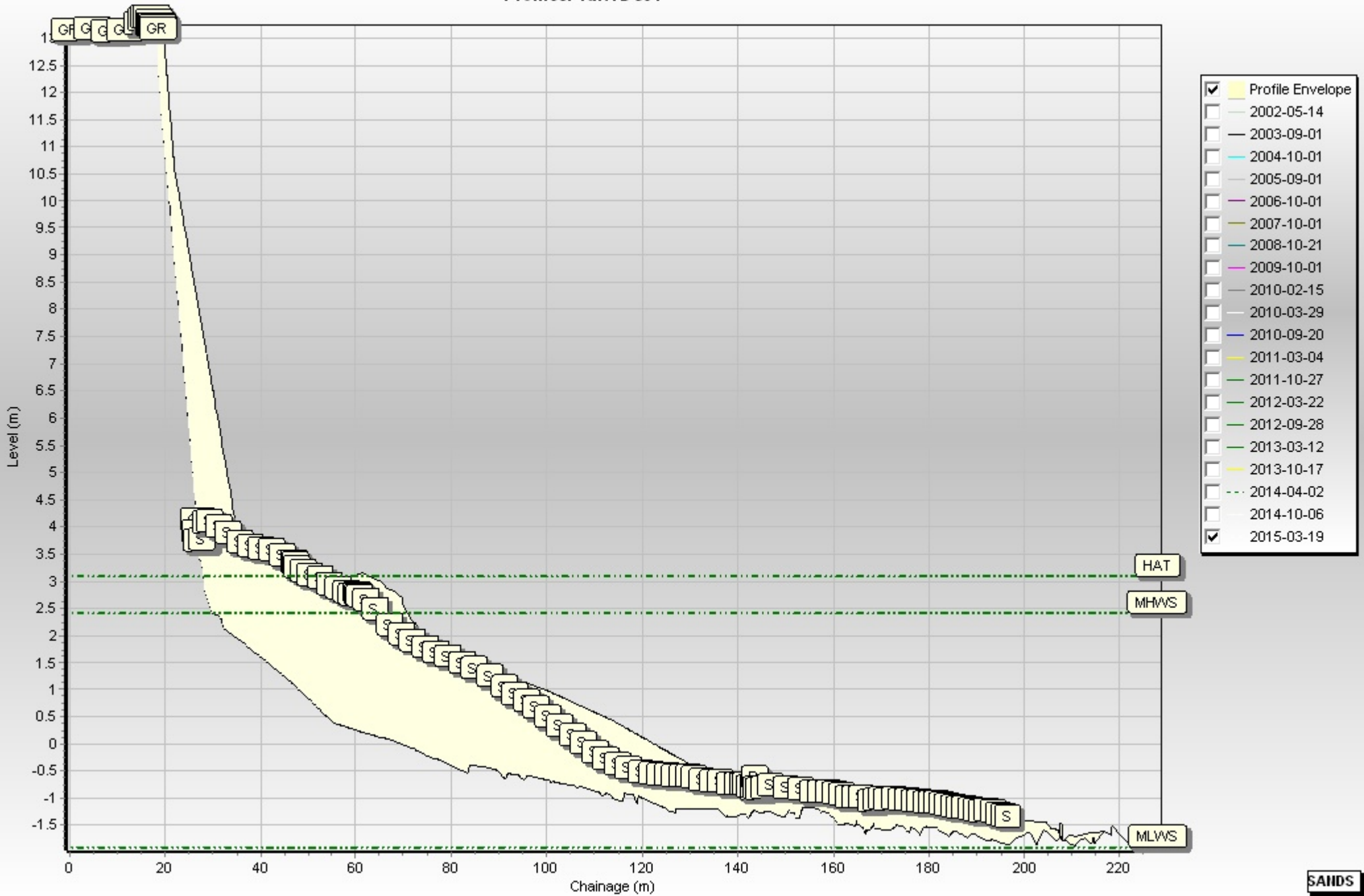
**Appendix A**  
**Beach Profiles**



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

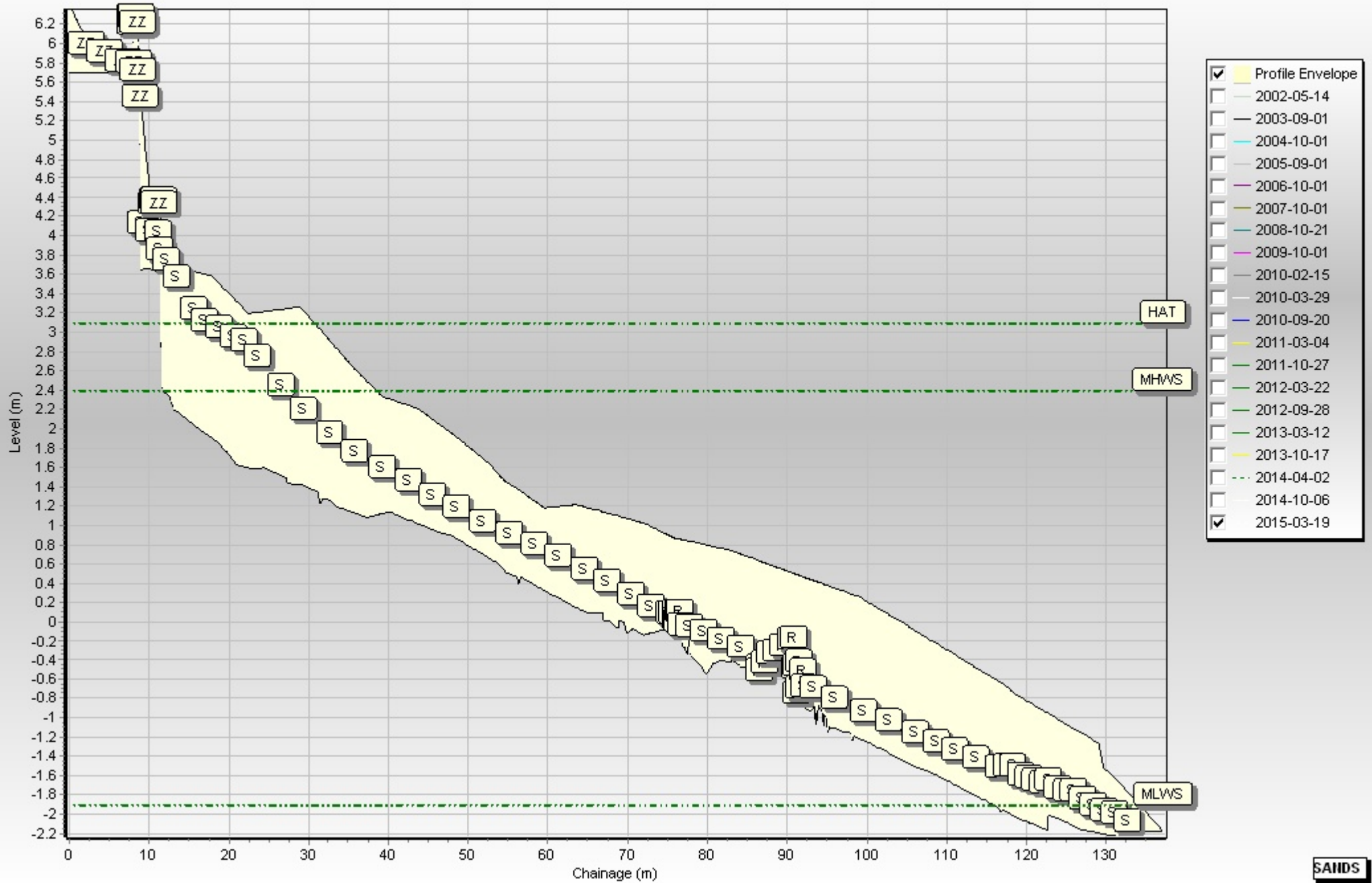
<b>Code</b>	<b>Description</b>
S	Sand
M	Mud
G	Gravel
GS	Gravel & Sand
MS	Mud & Sand
B	Boulders
R	Rock
SD	Sea Defence
SM	Saltmarsh
W	Water Body
GM	Gravel & Mud
GR	Grass
D	Dune (non-vegetated)
DV	Dune (vegetated)
F	Forested
X	Mixture
FB	Obstruction
CT	Cliff Top
CE	Cliff Edge
CF	Cliff Face
SH	Shell
ZZ	Unknown

# Profiles: 1aNTDC01

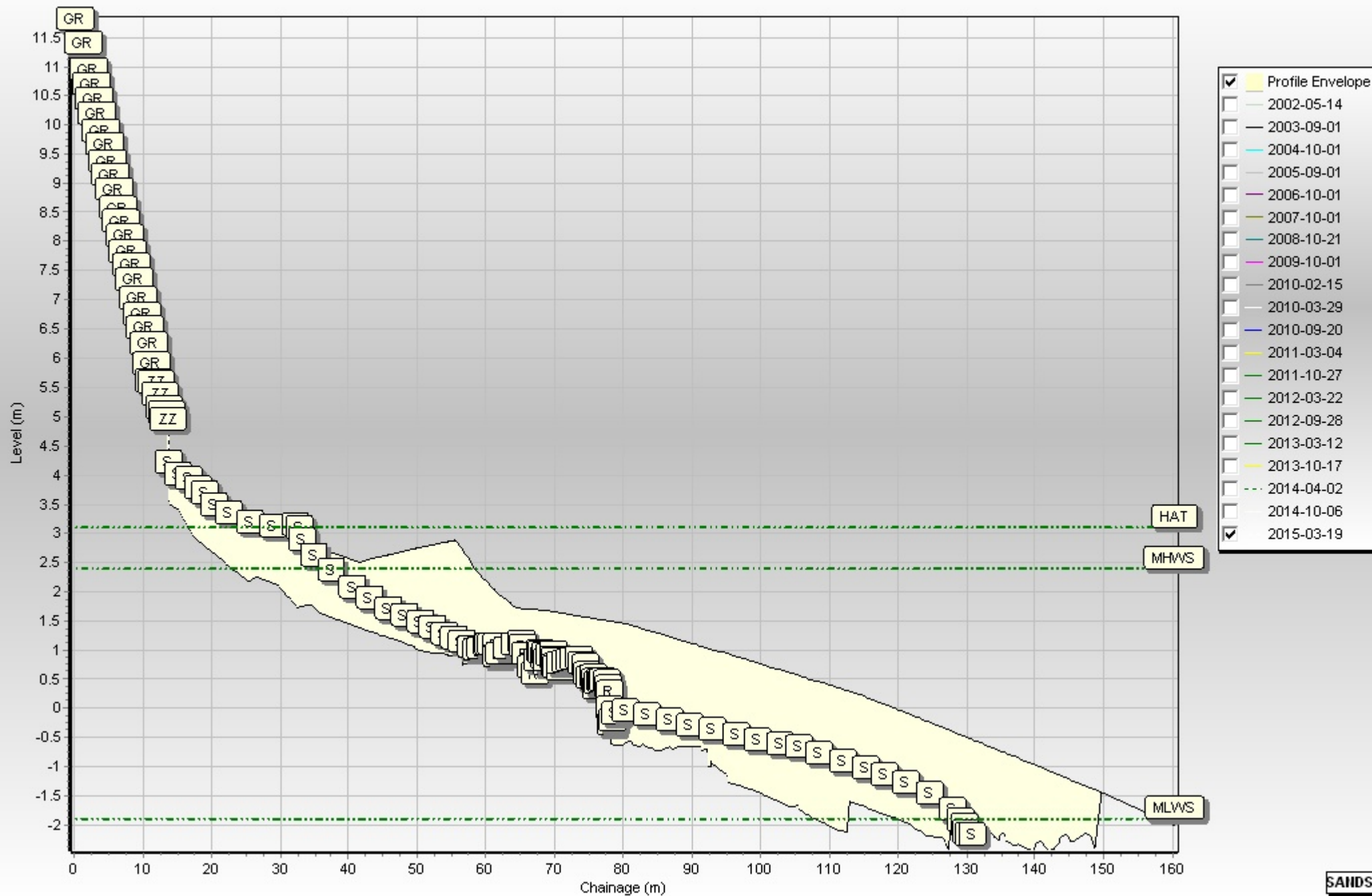




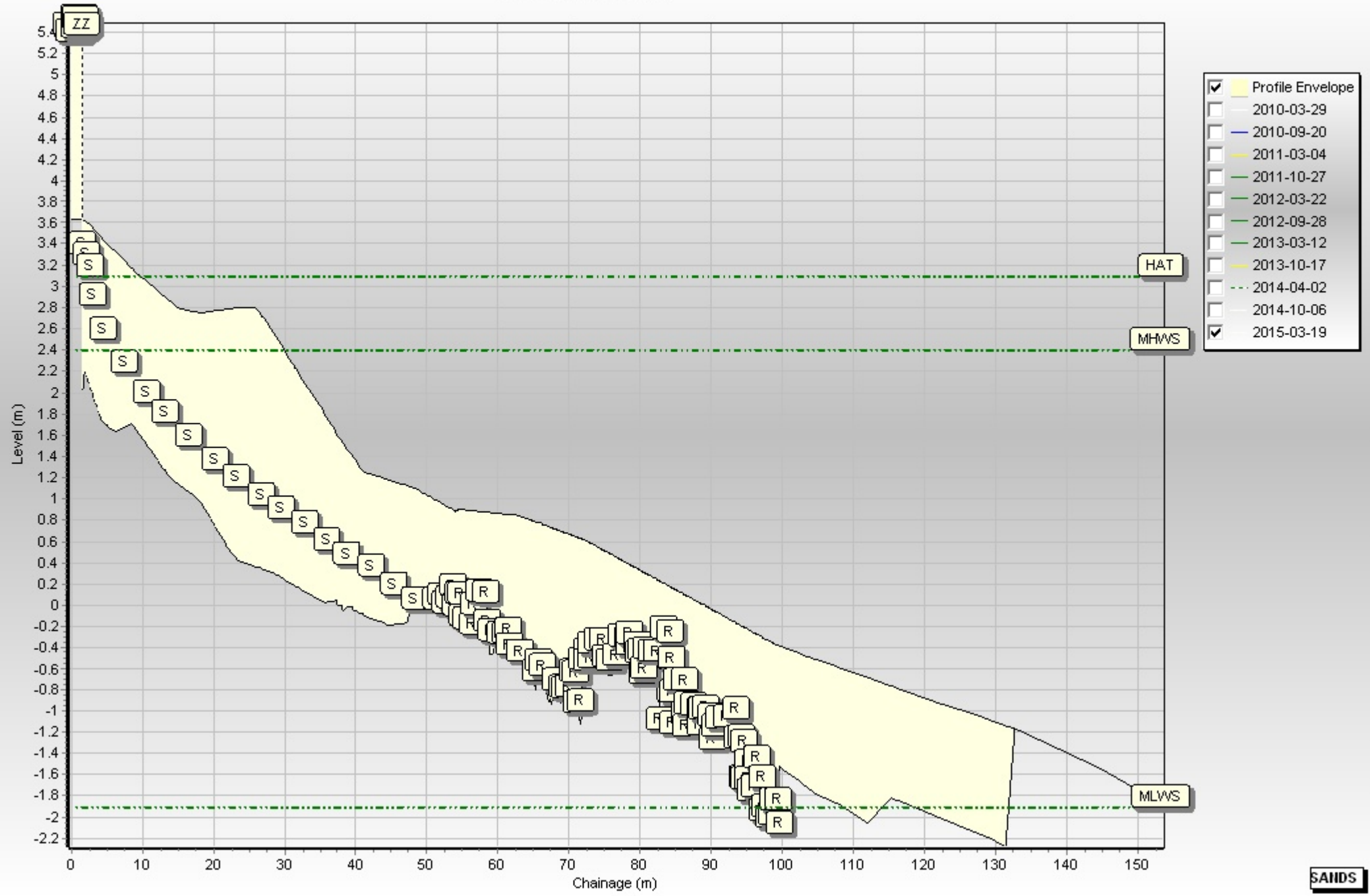
Profiles: 1aNTDC03



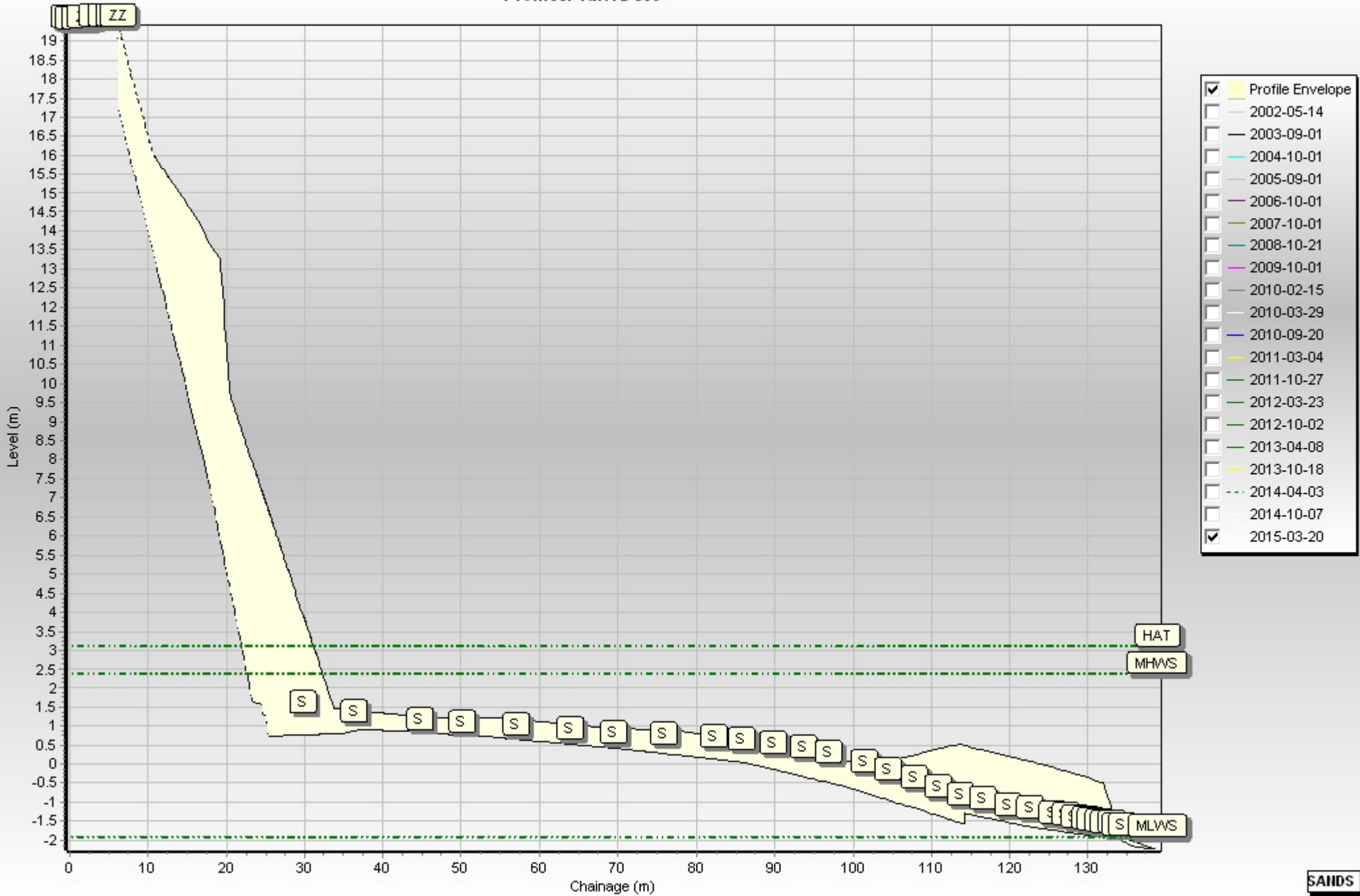
Profiles: 1aNTDC04



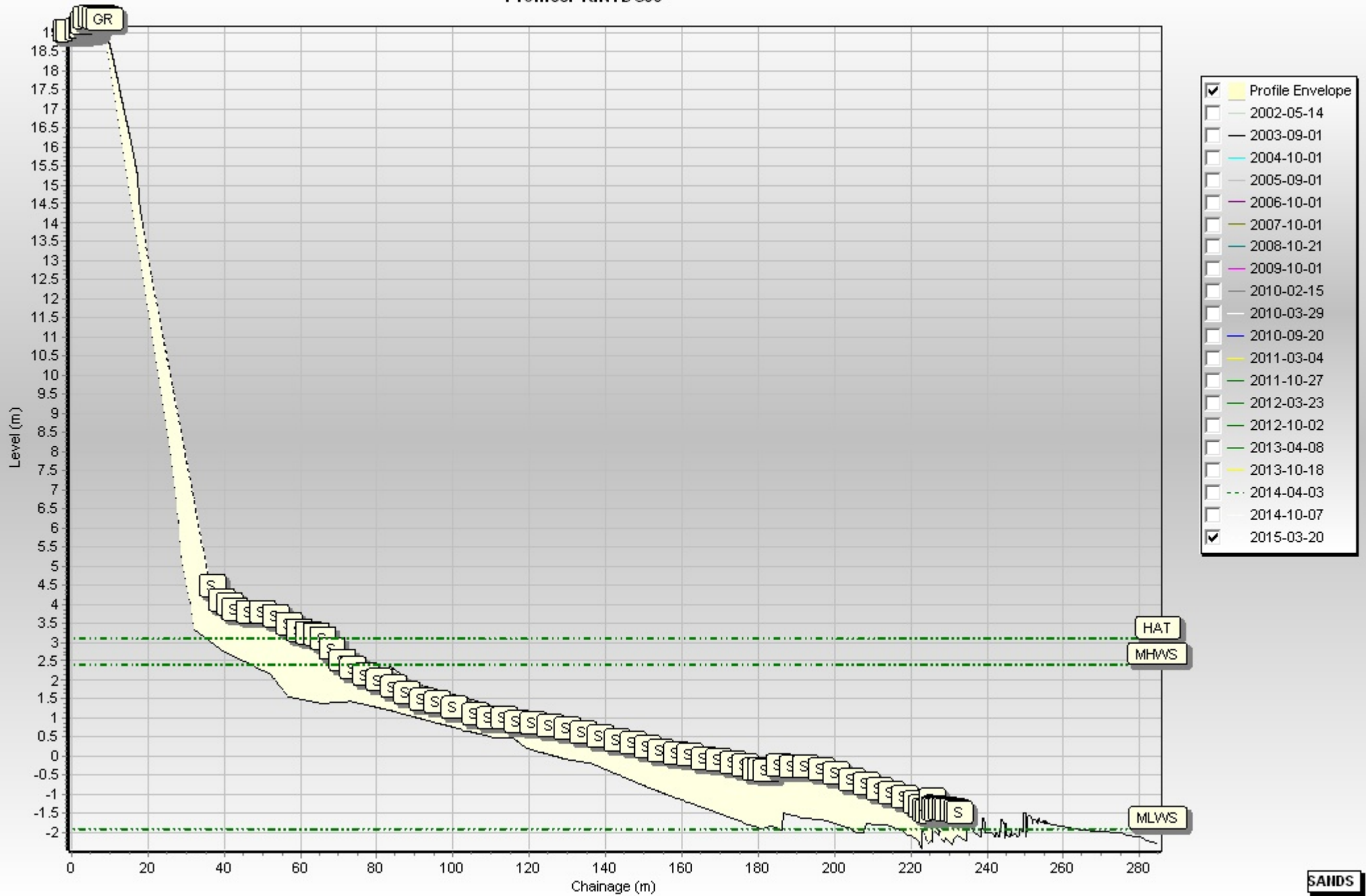
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Profiles: 1aNTDC05

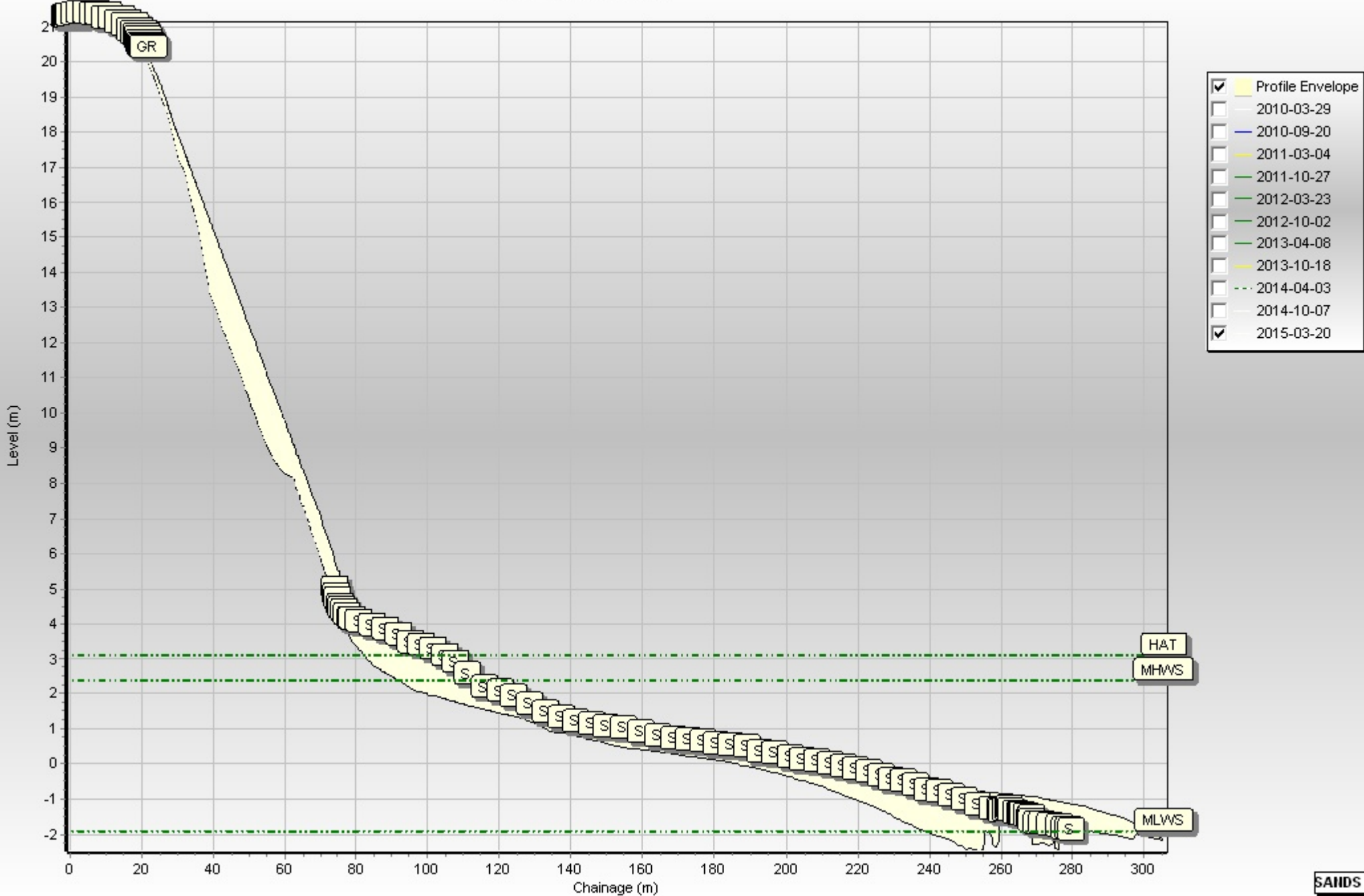


Profiles: 1aNTDC06

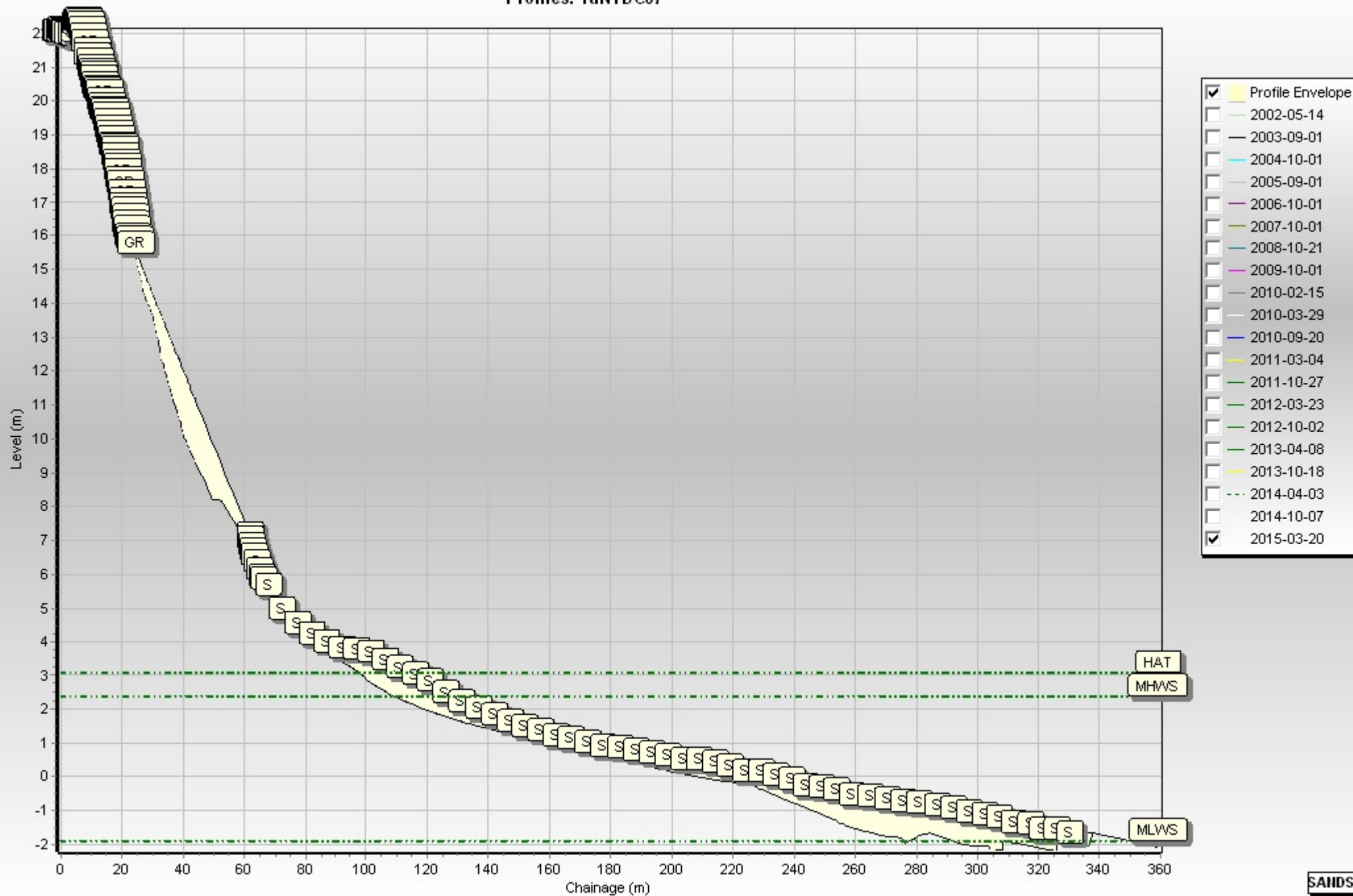




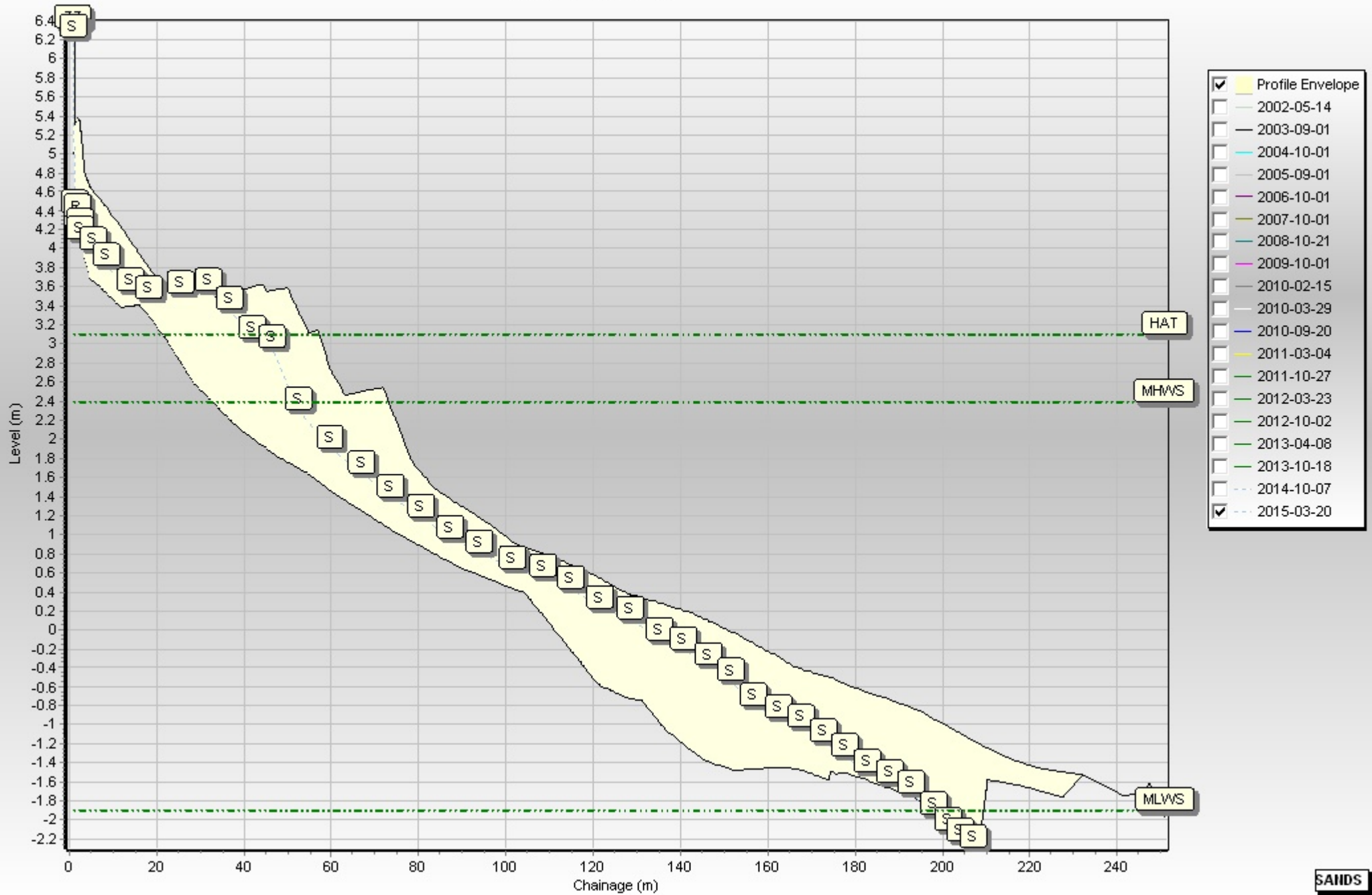
Profiles: 1aNTDC06A



Profiles: 1aNTDC07



Profiles: 1aNTDC08

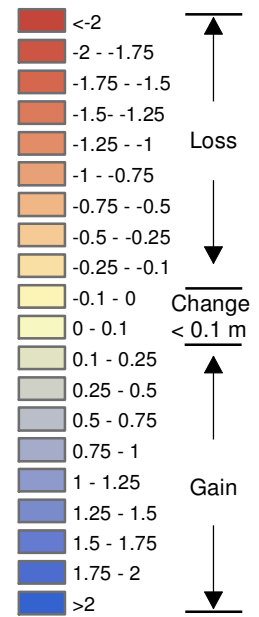


**Appendix B**  
**Topographic Survey**





**KEY** Autumn 2014 and Spring 2015  
Change in elevation (m)



— Contours of change

Client: North East Coastal Group  
Project: Cell 1 Regional Coastal  
Monitoring Programme 2011 to 2016

**Appendix B - Map 1b**  
**Short-term**  
**Elevation Change**  
**Tynemouth Long Sands**  
**North Tyneside Council**

Update Report 7  
Partial Measures Survey  
Spring 2015

**ch2m**<sup>SM</sup>

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Photography courtesy of North East Coastal Observatory  
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