



**Cell 1 Regional Coastal Monitoring Programme  
Update Report 5: 'Partial Measures' Survey 2013**

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Dr Andy Parsons – Approval of Final	Halcrow

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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)		
	Berwick upon Tweed	Holy Island	North Sunderland
HAT	2.8	2.8	2.8
MHWS	2.2	2.4	2.4
MLWS	-1.9	-1.8	-1.7
Water Level Parameter	Water Level (m AOD)		
	Amble	Blyth	River Tyne
HAT	3.1	3.1	3.1
MHWS	2.4	2.4	2.4
MLWS	-1.9	-1.8	-1.9

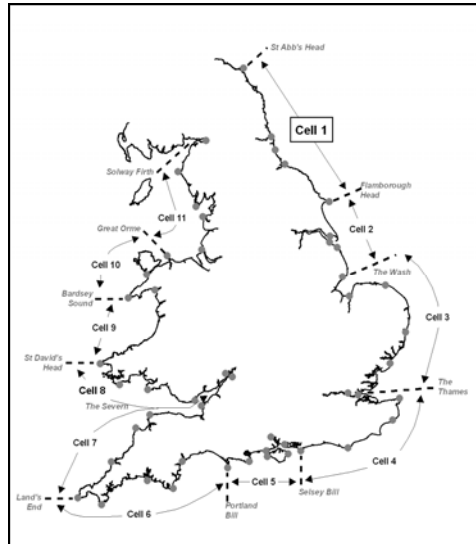
**Source:** *Scottish Border to River Tyne Shoreline Management Plan 2.*  
Royal Haskoning, May 2009.

## 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		-
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	Oct 12	
5	2012/13	Sept-Nov 12	Mar 13	Mar-Apr 13	June 13 (*)	

(\*) The present report is **Update Report 5** and provides an analysis of the 2013 Partial Measures survey for Northumberland County Council's frontage.

## **1. Introduction**

### **1.1 Study Area**

Northumberland Council's frontage extends from the Scottish Border in the north to Hartley (just south of Blyth) in the south. For the purposes of this report and for consistency with previous reporting, it has been sub-divided into 15 areas, namely:

- Sandstell Point (Spittal A)
- Spittal (Spittal B)
- Goswick Sands
- Holy Island
- Bamburgh
- Beadnell Village
- Beadnell Bay
- Embleton Bay
- Boulmer
- Alnmouth Bay
- High Hauxley and Druridge Bay
- Lynemouth Bay
- Newbiggin-by-the-Sea
- Cambois
- Blyth South Beach

### **1.2 Methodology**

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

Full Measures survey annually each autumn comprising:

- Beach profile surveys along 78 transect lines (commenced 2002)
- Beach profile surveys along an additional ten transect lines (commenced 2007)
- Beach profile surveys along an additional 26 transect lines (commenced 2010)
- Topographic survey along Holy Island (commenced 2004)
- Topographic survey along Alnmouth Bay (commenced 2005)
- Topographic survey along Sandstell Point (commenced 2009)
- Topographic survey along Newbiggin Bay (commenced 2010)

Partial Measures survey annually each spring comprising:

- Beach profile surveys along 29 transect lines (commenced 2002)
- Beach profile surveys along an additional ten transect lines (commenced 2007)
- Beach profile surveys along an additional one transect line (commenced 2010)
- Beach profile surveys along an additional two transect lines (commenced 2011)
- Topographic survey along Alnmouth Bay (commenced 2005)
- Topographic survey along Sandstell Point (commenced 2009)
- Topographic survey along Newbiggin Bay (commenced 2010)

Cliff top survey (bi-annually) at:

- Cliff top survey at Lynemouth Bay (commenced 2008)
- Cliff top survey at Cambois Bay (Sandy Bay) (commenced 2008)
- Cliff top survey at Cambois Bay (Cambois) (commenced 2009)

Sand extent survey (bi-annually) at:

- Edge of sand survey at Newbiggin Bay, Spital Carrs, (commenced 2011)

For all cliff-top surveys prior to Full Measures 2011, the data was previously saved in '.kmz' format for plotting and visual comparison in GoogleEarth. This data has been visualised in GIS, which revealed the quality was variable and reliable interpretations of short-term cliff change could not be made. For the present survey and going forward, the survey data will be plotted in GIS and change will be qualified along a series of transect lines. The resulting data on amount and rate of change is presented in tables and the survey results are compared.

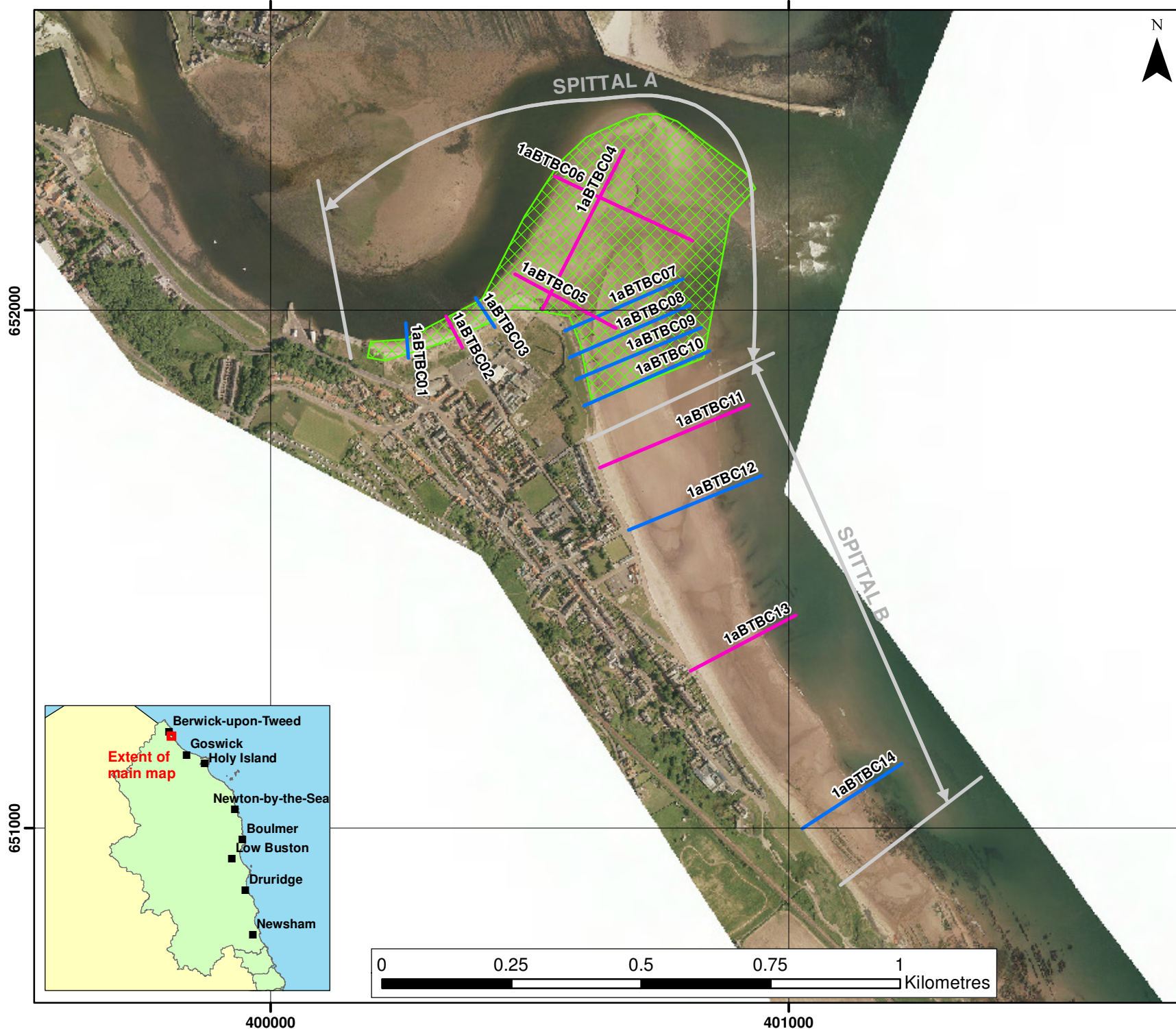
The location of these surveys is shown in Figure 2. The Partial Measures survey was undertaken along this frontage between 5<sup>th</sup> and 6<sup>th</sup> March 2013, 11<sup>th</sup> and 15<sup>th</sup> March 2013, 25<sup>th</sup> and 28<sup>th</sup> March 2013, 7<sup>th</sup> April 2013, 25<sup>th</sup> and 25<sup>th</sup> April, 28<sup>th</sup> April and 30<sup>th</sup> April. During this time weather conditions varied considerably; 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
- key conclusions and highlighting of areas of concern (Section 5).

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





**KEY**

**Topographic Profiles**  
 — Annual (blue line)  
 — 6 monthly (pink line)

**Topographic Surveys**  
 [Green cross-hatch] 6 monthly  
 [Orange cross-hatch] yearly  
 [Brown cross-hatch] 5 yearly

**Cliff Top Monitoring Pegs**  
 [Purple line] 50m centres  
 [Green line] 100m centres  
 [Red line] 300m centres  
*(Indicative survey extents shown)*

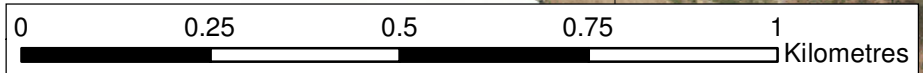
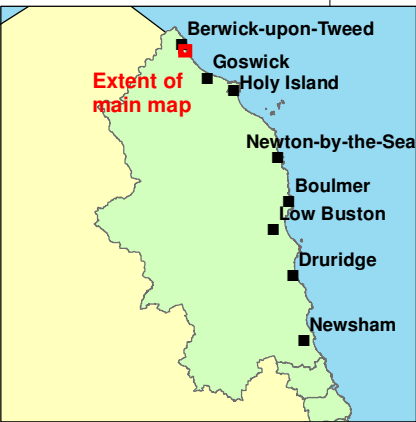
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 Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

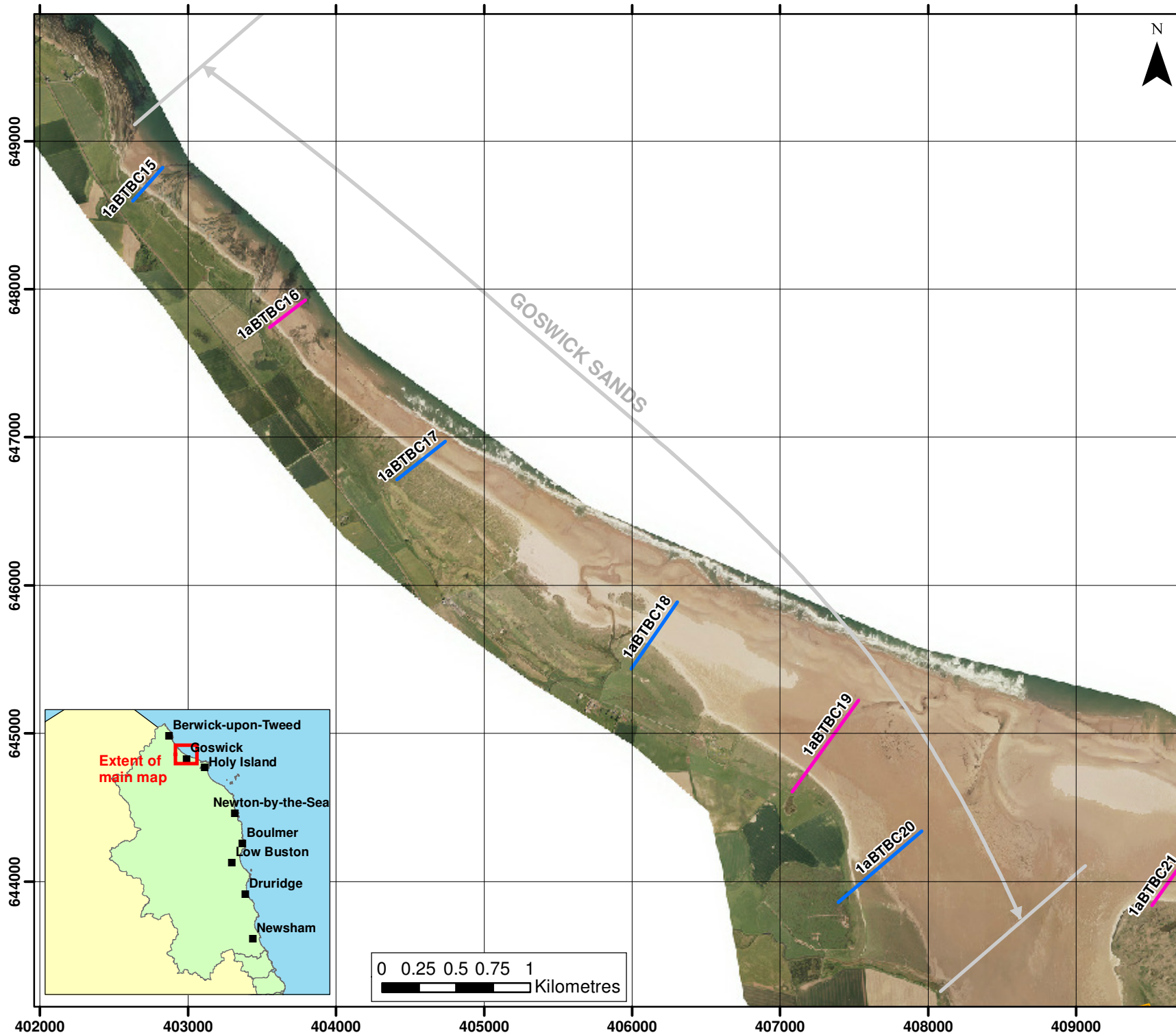
**Figure 2 - Map 1**  
**Survey Locations**  
**Sandstell Point (Spittal A)**  
**Northumberland**  
**County Council**

Update Report 5  
 Partial Measures Survey  
 Spring 2013

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**KEY**

**Topographic Profiles**  
 — Annual (blue line)  
 — 6 monthly (pink line)

**Topographic Surveys**  
 ▨ 6 monthly (green cross-hatch)  
 ▨ yearly (orange cross-hatch)  
 ▨ 5 yearly (brown cross-hatch)

**Cliff Top Monitoring Pegs**  
 ■ 50m centres (purple square)  
 ■ 100m centres (green square)  
 ■ 300m centres (red square)

*(Indicative survey extents shown)*

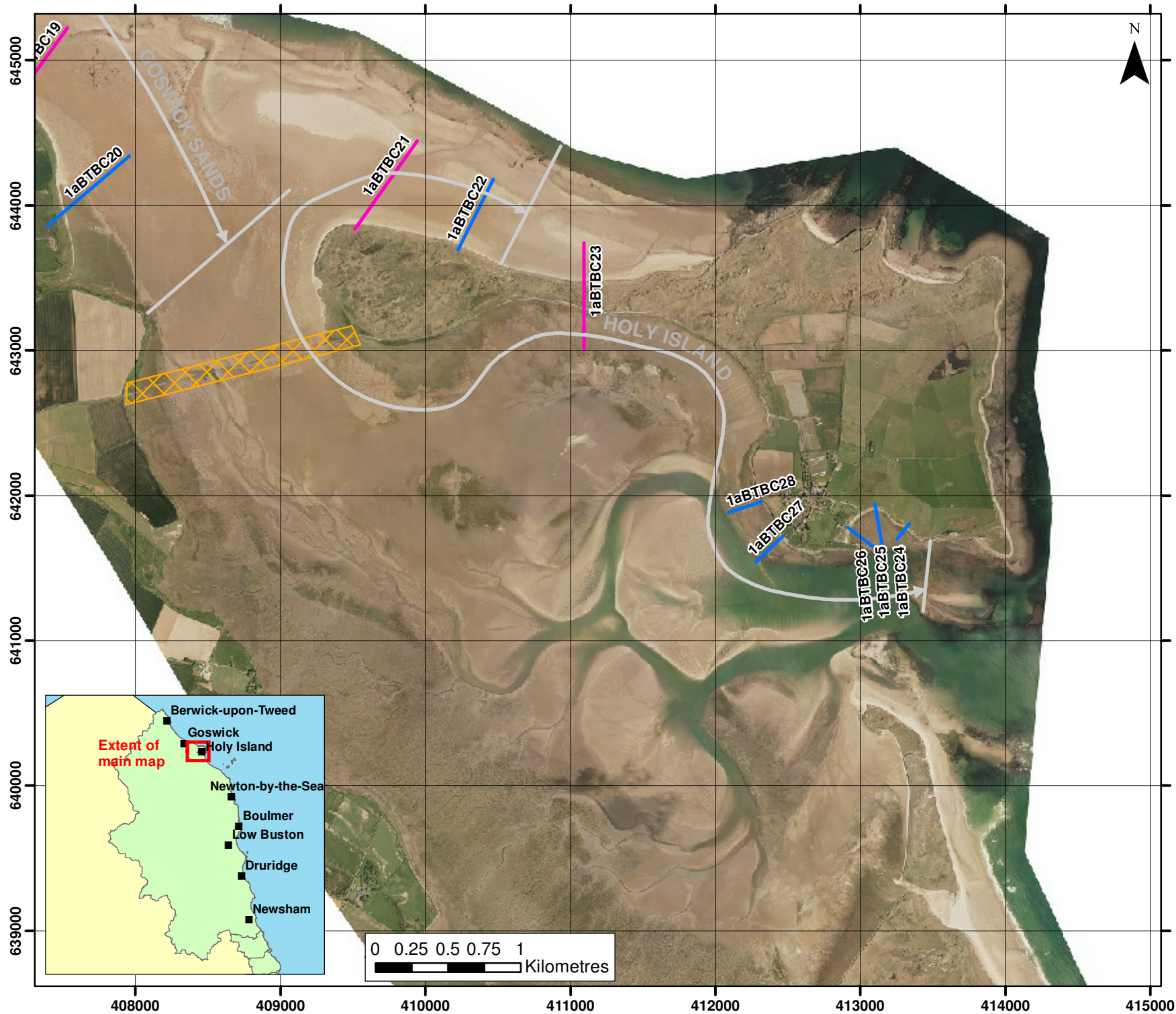
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**Figure 2- Map 2  
 Survey Locations  
 Goswick Sands  
 Northumberland  
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**KEY**

**Topographic Profiles**  
 — Annual (blue line)  
 — 6 monthly (pink line)

**Topographic Surveys**  
 ▨ 6 monthly (green hatched)  
 ▨ yearly (yellow hatched)  
 ▨ 5 yearly (orange hatched)

**Cliff Top Monitoring Pegs**  
 ■ 50m centres (purple)  
 ■ 100m centres (green)  
 ■ 300m centres (red)

*(Indicative survey extents shown)*

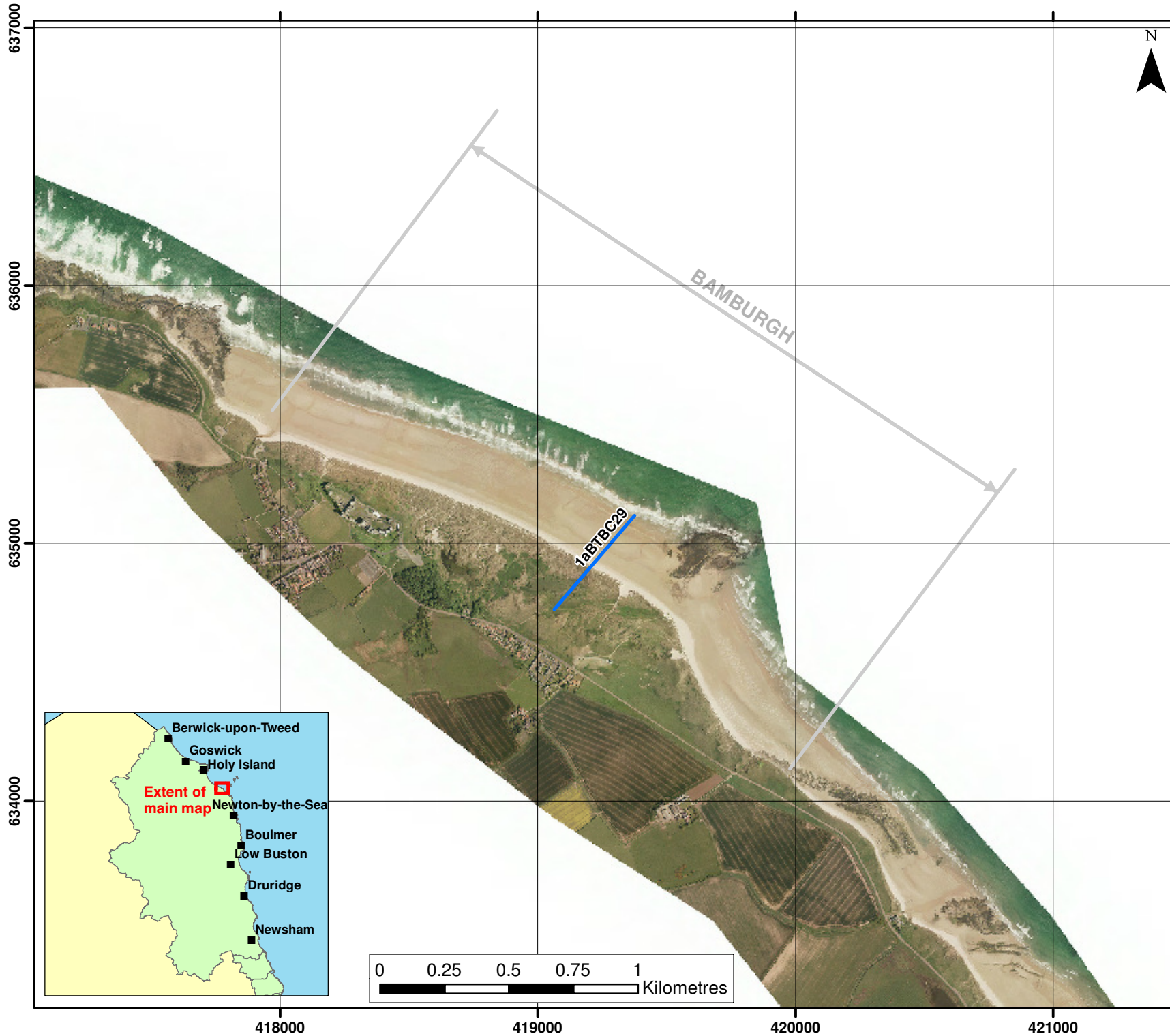
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**Figure 2 - Map 3  
 Survey Locations  
 Holy Island  
 Northumberland  
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**KEY**

**Topographic Profiles**

- Annual (blue line)
- 6 monthly (pink line)

**Topographic Surveys**

- 6 monthly (green cross-hatch)
- yearly (orange cross-hatch)
- 5 yearly (brown cross-hatch)

**Cliff Top Monitoring Pegs**

- 50m centres (purple bar)
- 100m centres (green bar)
- 300m centres (red bar)

*(Indicative survey extents shown)*

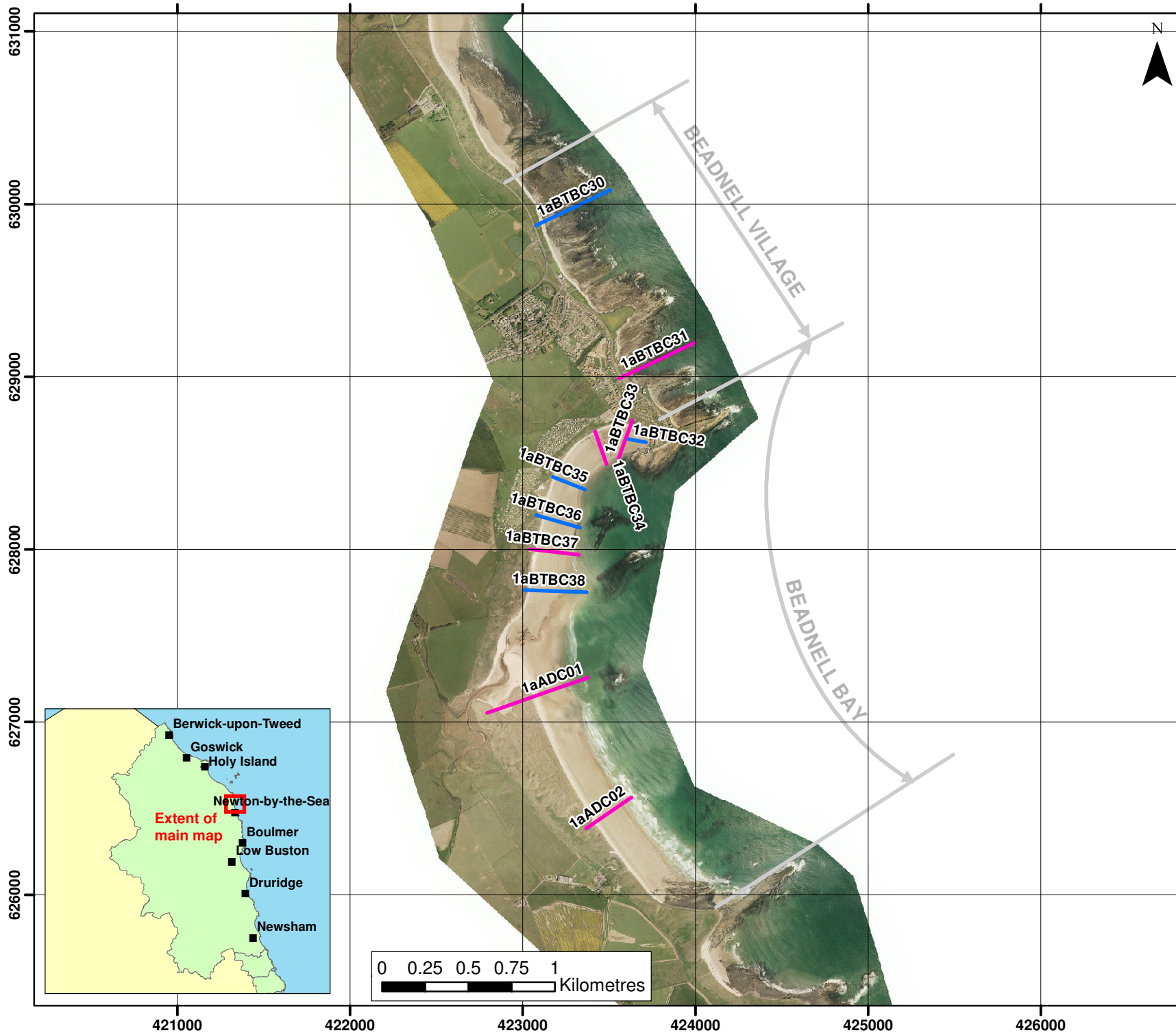
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**Figure 2 - Map 4  
 Survey Locations  
 Bamburgh  
 Northumberland  
 County Council**

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**KEY**

**Topographic Profiles**

- Annual (Blue line)
- 6 monthly (Pink line)

**Topographic Surveys**

- 6 monthly (Green cross-hatch)
- yearly (Orange cross-hatch)
- 5 yearly (Brown cross-hatch)

**Cliff Top Monitoring Pegs**

- 50m centres (Purple square)
- 100m centres (Green square)
- 300m centres (Red square)

*(Indicative survey extents shown)*

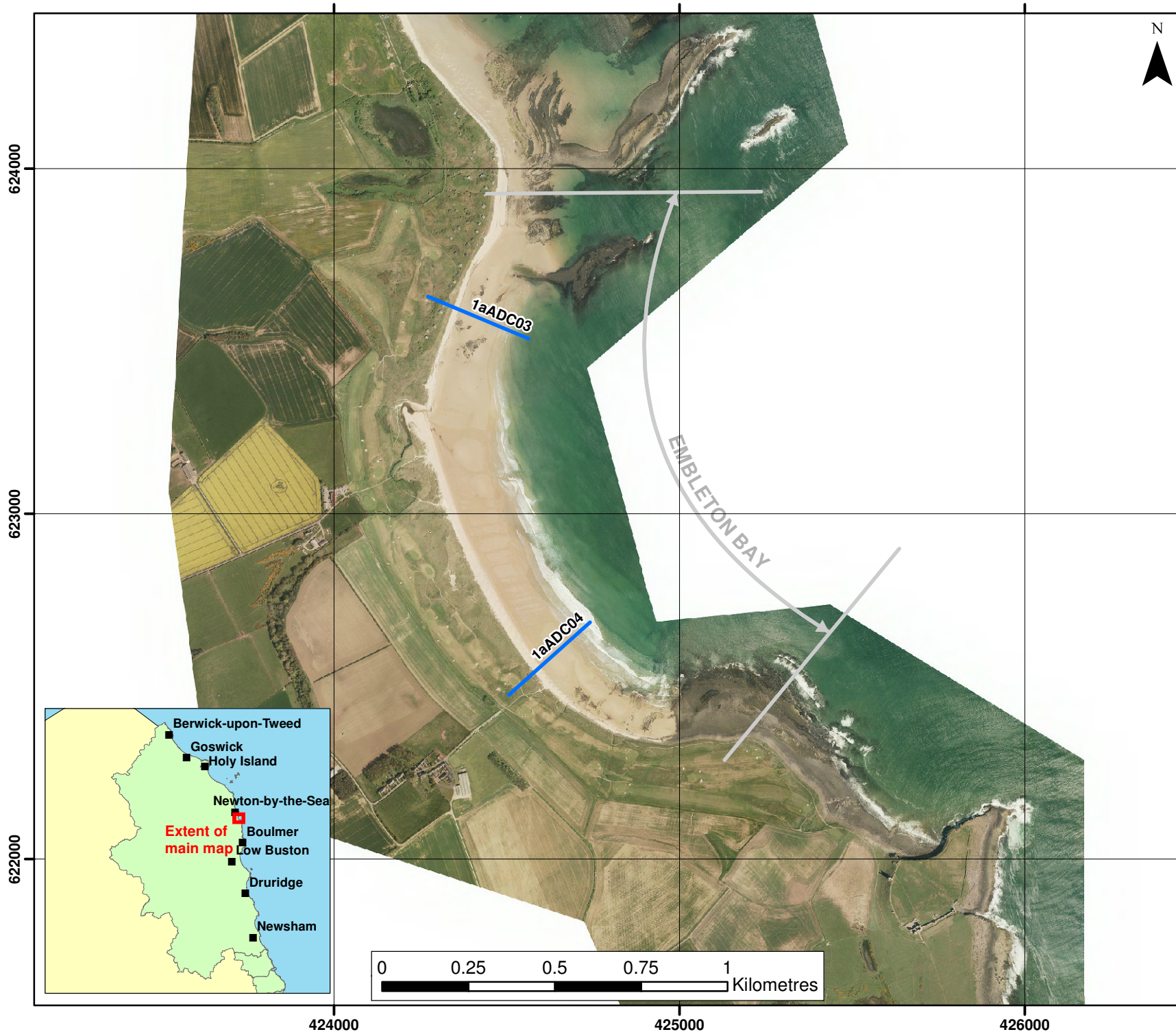
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 Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Figure 2 - Map 5**  
**Survey Locations**  
**Beadnell Villange and Bay**  
**Northumberland**  
**County Council**

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 Partial Measures Survey  
 Spring 2013

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KEY	
<b>Topographic Profiles</b>	
<span style="color: blue;">—</span>	Annual
<span style="color: magenta;">—</span>	6 monthly
<b>Topographic Surveys</b>	
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<span style="border: 1px dashed orange; padding: 2px;"> </span>	yearly
<span style="border: 1px dashed brown; padding: 2px;"> </span>	5 yearly
<b>Cliff Top Monitoring Pegs</b>	
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<span style="display: inline-block; width: 10px; height: 10px; background-color: lime; border: 1px solid black;"></span>	100m centres
<span style="display: inline-block; width: 10px; height: 10px; background-color: red; border: 1px solid black;"></span>	300m centres
<i>(Indicative survey extents shown)</i>	

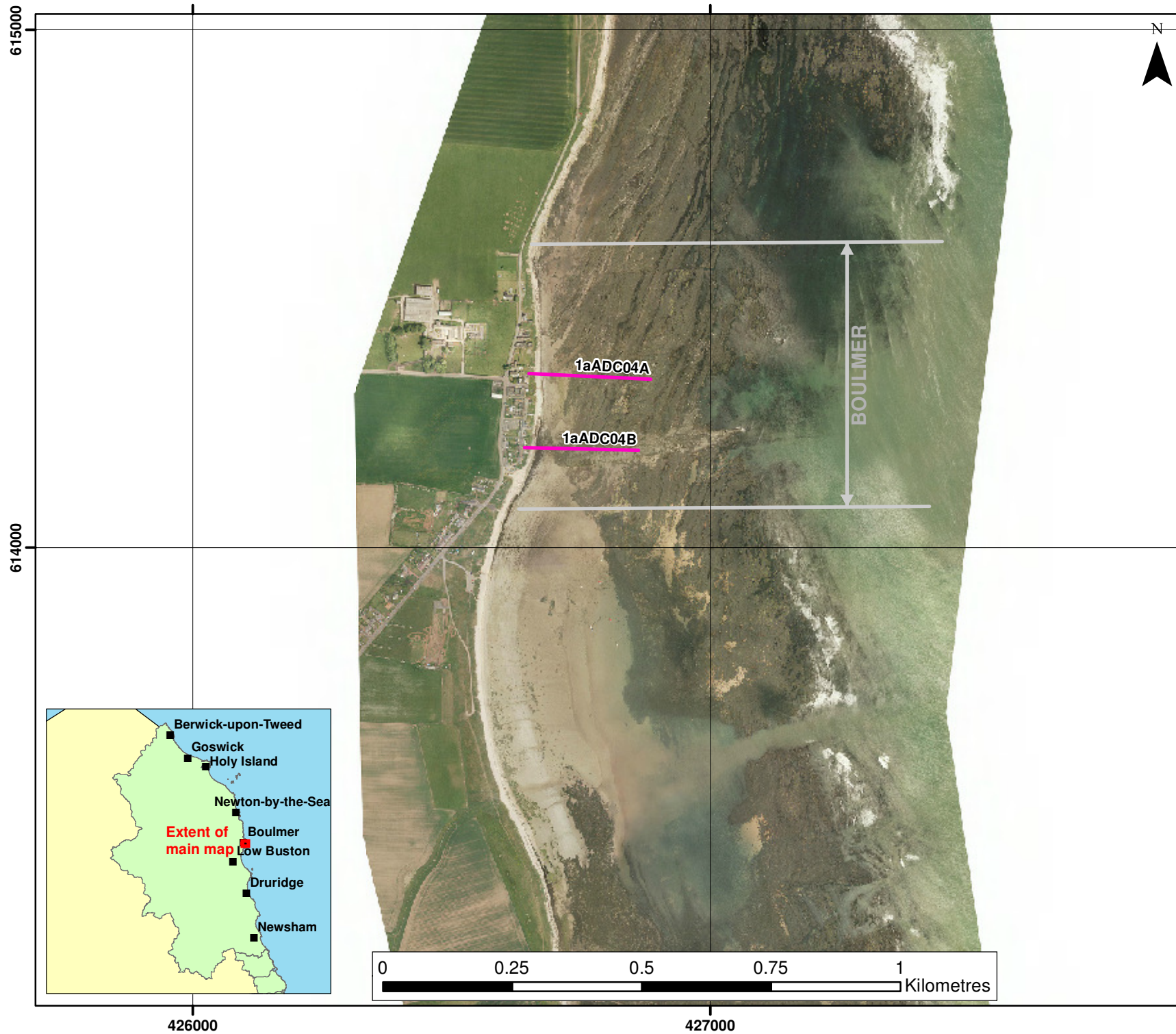
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**Figure 2 - Map 6  
 Survey Locations  
 Embleton Bay  
 Northumberland  
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- KEY**
- Topographic Profiles**
- Annual
  - 6 monthly
- Topographic Surveys**
- ▣ 6 monthly
  - ▣ yearly
  - ▣ 5 yearly
- Cliff Top Monitoring Pegs**
- 50m centres
  - 100m centres
  - 300m centres
- (Indicative survey extents shown)*

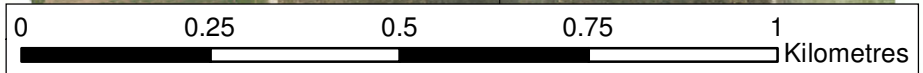
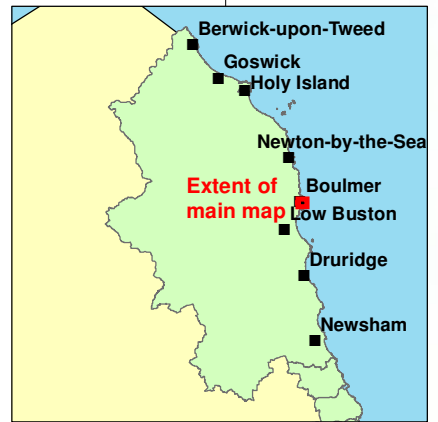
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 Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

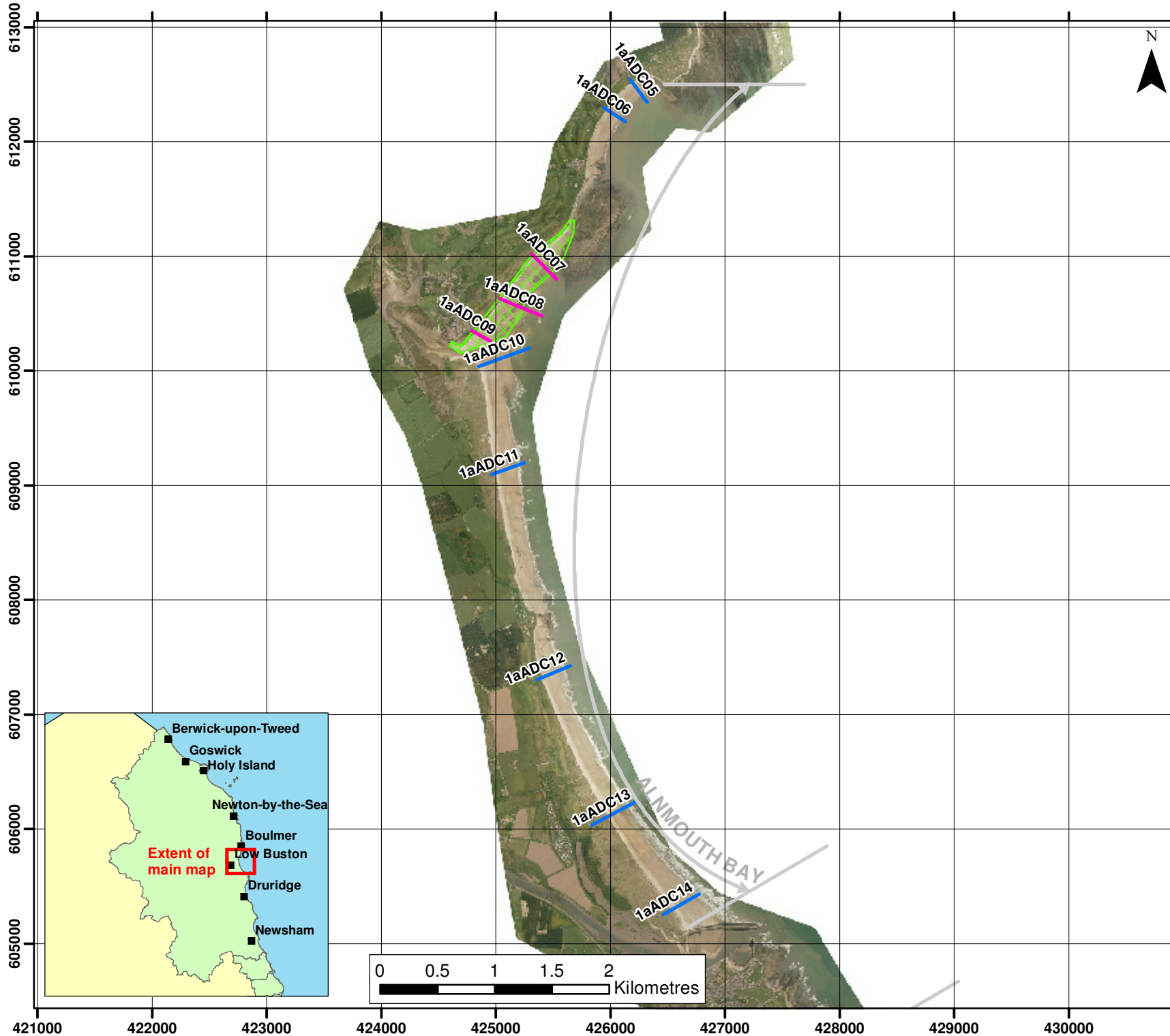
**Figure 2 - Map 7**  
**Survey Locations**  
**Boulmer**  
**Northumberland**  
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 Spring 2013

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**KEY**

**Topographic Profiles**

- Annual (Blue line)
- 6 monthly (Pink line)

**Topographic Surveys**

- 6 monthly (Green cross-hatch)
- yearly (Orange cross-hatch)
- 5 yearly (Brown cross-hatch)

**Cliff Top Monitoring Pegs**

- 50m centres (Purple square)
- 100m centres (Green square)
- 300m centres (Red square)

*(Indicative survey extents shown)*

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Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Figure 2 - Map 8**  
**Survey Locations**  
**Alnmouth Bay**  
**Northumberland**  
**County Council**

Update Report 5  
 Partial measures survey  
 Spring 2013

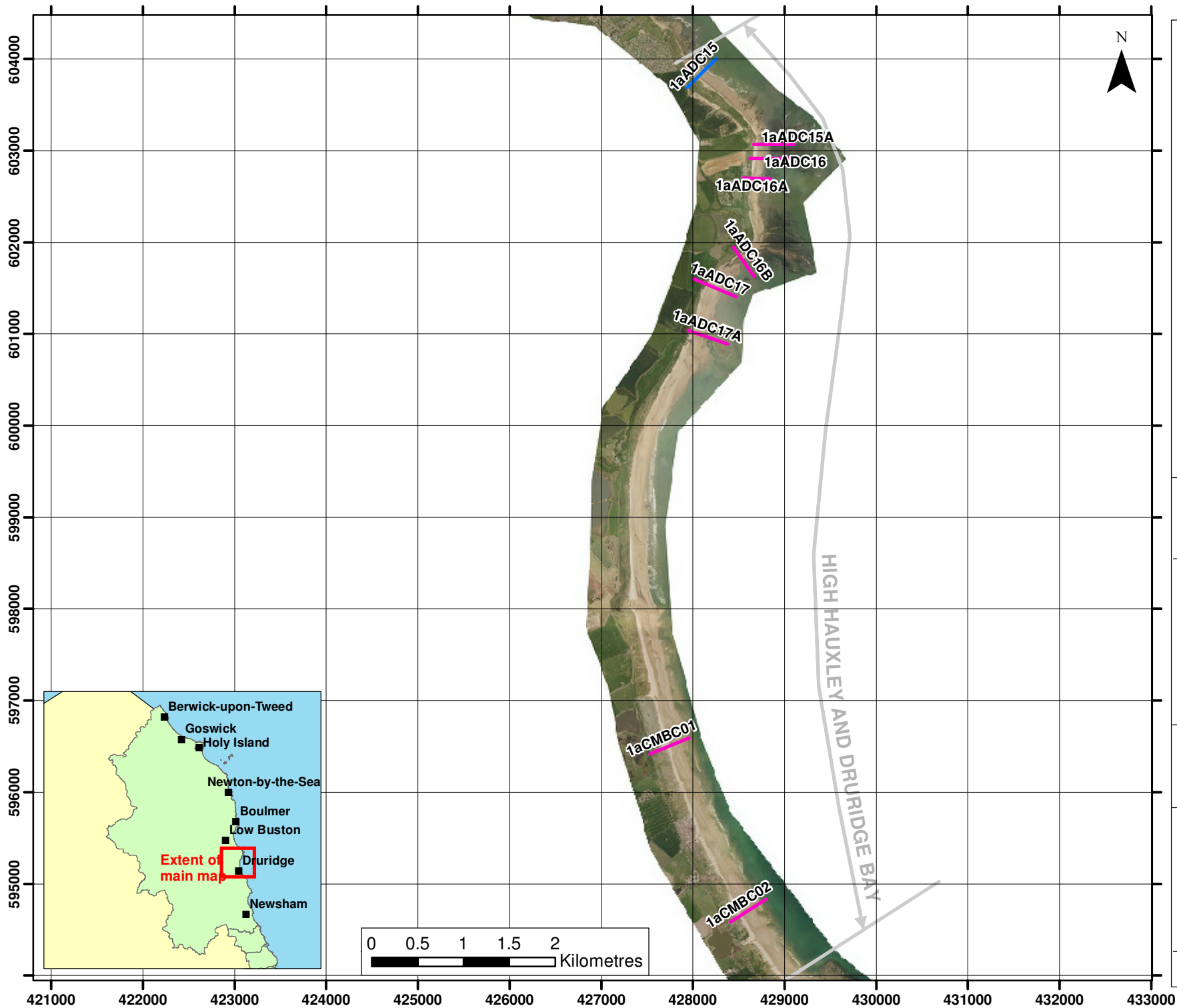
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**KEY**

**Topographic Profiles**

- Annual (Blue line)
- 6 monthly (Magenta line)

**Topographic Surveys**

- 6 monthly (Green cross-hatch)
- yearly (Yellow cross-hatch)
- 5 yearly (Brown cross-hatch)

**Cliff Top Monitoring Pegs**

- 50m centres (Purple bar)
- 100m centres (Green bar)
- 300m centres (Red bar)

*(Indicative survey extents shown)*

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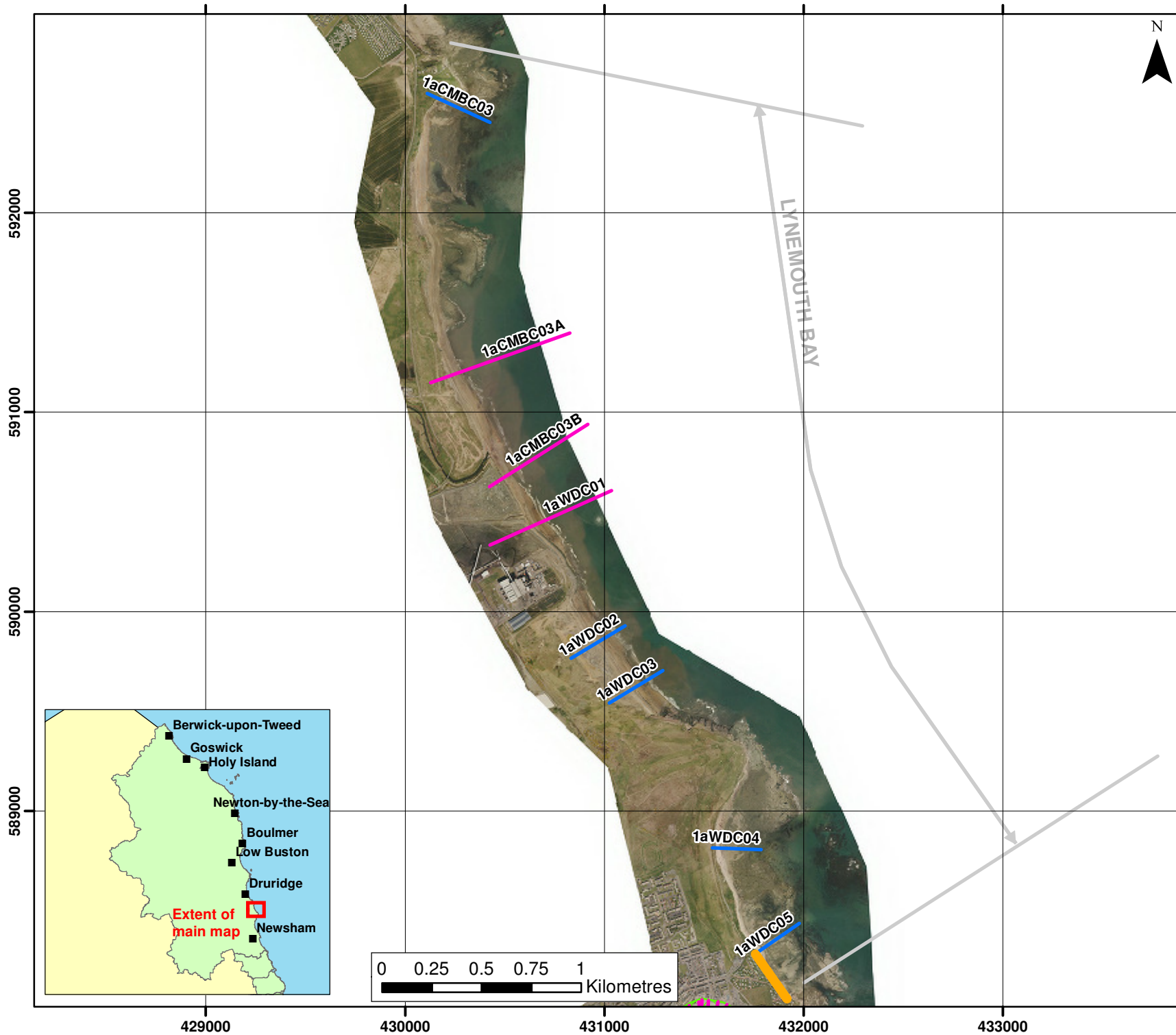
Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Figure 2 - Map 9**  
**Survey Locations**  
**High Hauxley**  
**& Druridge Bay**  
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**Topographic Surveys**  
 ☒ 6 monthly (green cross-hatch)  
 ☒ yearly (orange cross-hatch)  
 ☒ 5 yearly (brown cross-hatch)

**Cliff Top Monitoring Pegs**  
 ■ 50m centres (purple square)  
 ■ 100m centres (green square)  
 ■ 300m centres (red square)  
 — Cliff Top Edge Survey (orange line)

*(Indicative survey extents shown)*

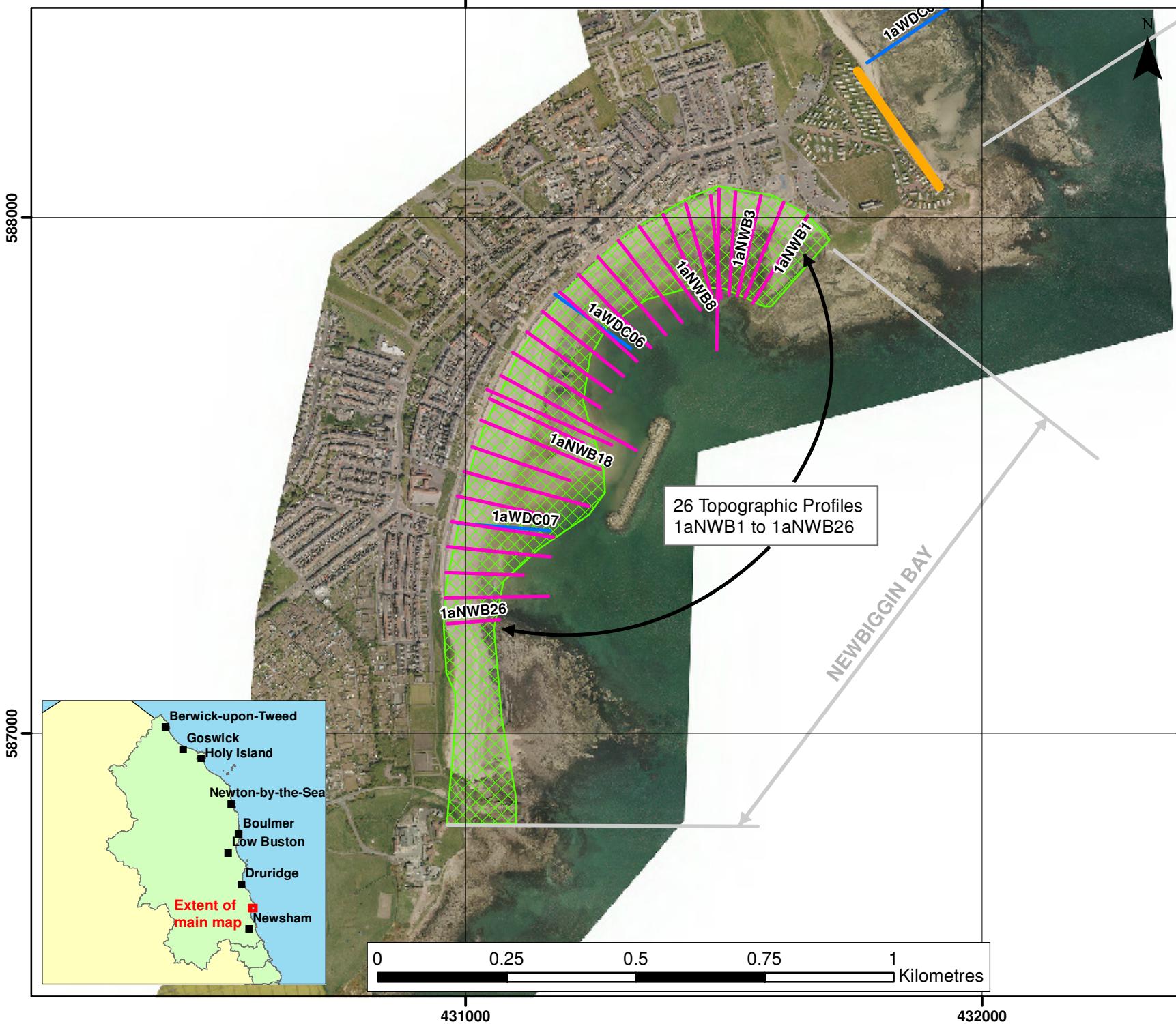
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**Figure 2 - Map 10  
 Survey Locations  
 Lynemouth Bay  
 Northumberland  
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 Partial Measures Survey  
 Spring 2013

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**KEY**

**Topographic Profiles**  
 — Annual (blue line)  
 — 6 monthly (pink line)

**Topographic Surveys**  
 [Green cross-hatch] 6 monthly  
 [Orange cross-hatch] yearly  
 [Brown cross-hatch] 5 yearly

**Cliff Top Monitoring Pegs**  
 [Purple square] 50m centres  
 [Green square] 100m centres  
 [Red square] 300m centres  
 [Orange line] Cliff Top Edge Survey  
*(Indicative survey extents shown)*

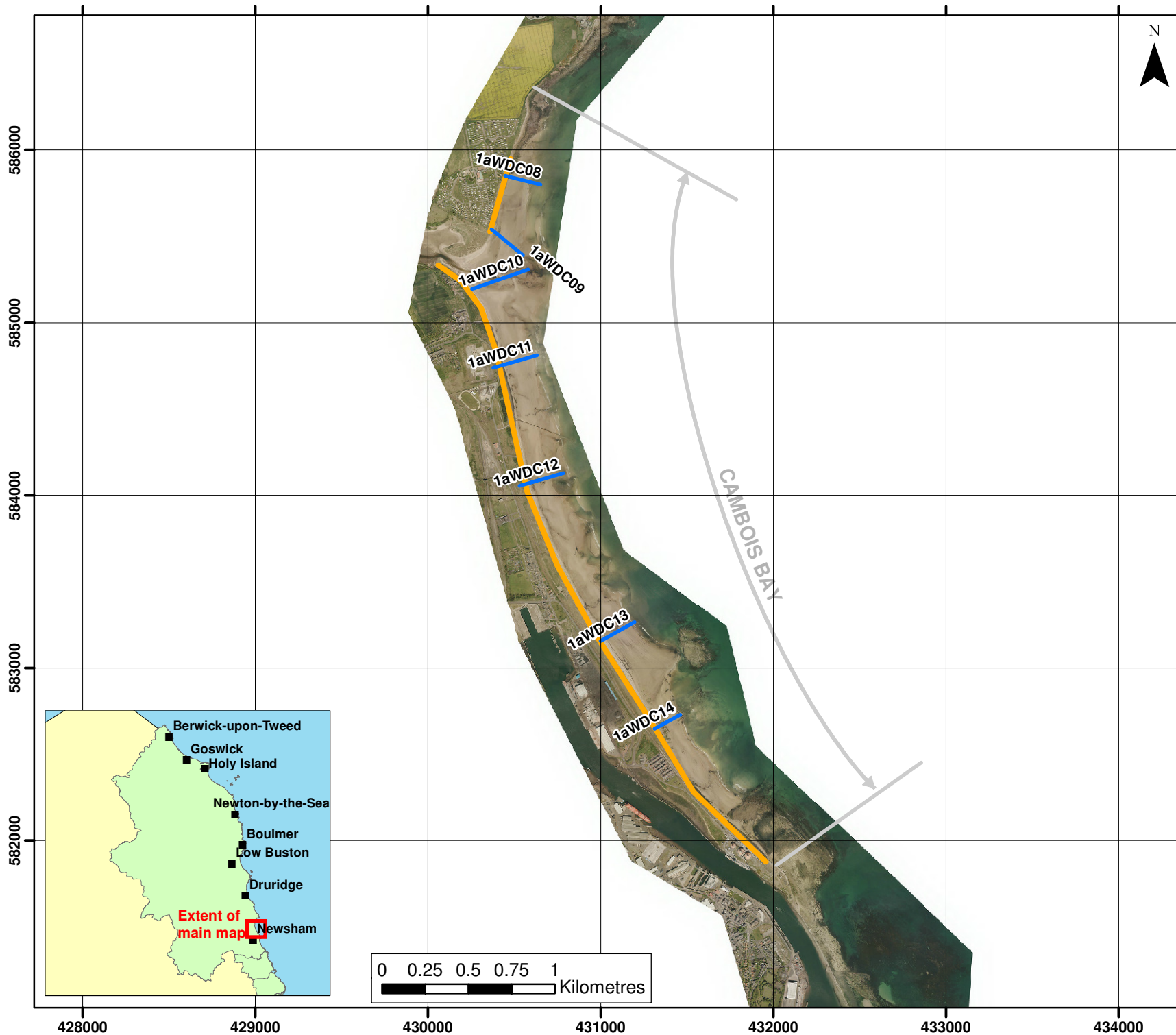
Client: North East Coastal Group  
 Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Figure 2 - Map 11  
 Survey Locations  
 Newbiggin Bay  
 Northumberland  
 County Council**

Update Report 5  
 Partial Measures Survey  
 Spring 2013

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



**KEY**

**Topographic Profiles**  
 — Annual  
 — 6 monthly

**Topographic Surveys**  
 ☒ 6 monthly  
 ☒ yearly  
 ☒ 5 yearly

**Cliff Top Monitoring Pegs**  
 ■ 50m centres  
 ■ 100m centres  
 ■ 300m centres  
 — Cliff Top Edge Survey  
*(Indicative survey extents shown)*

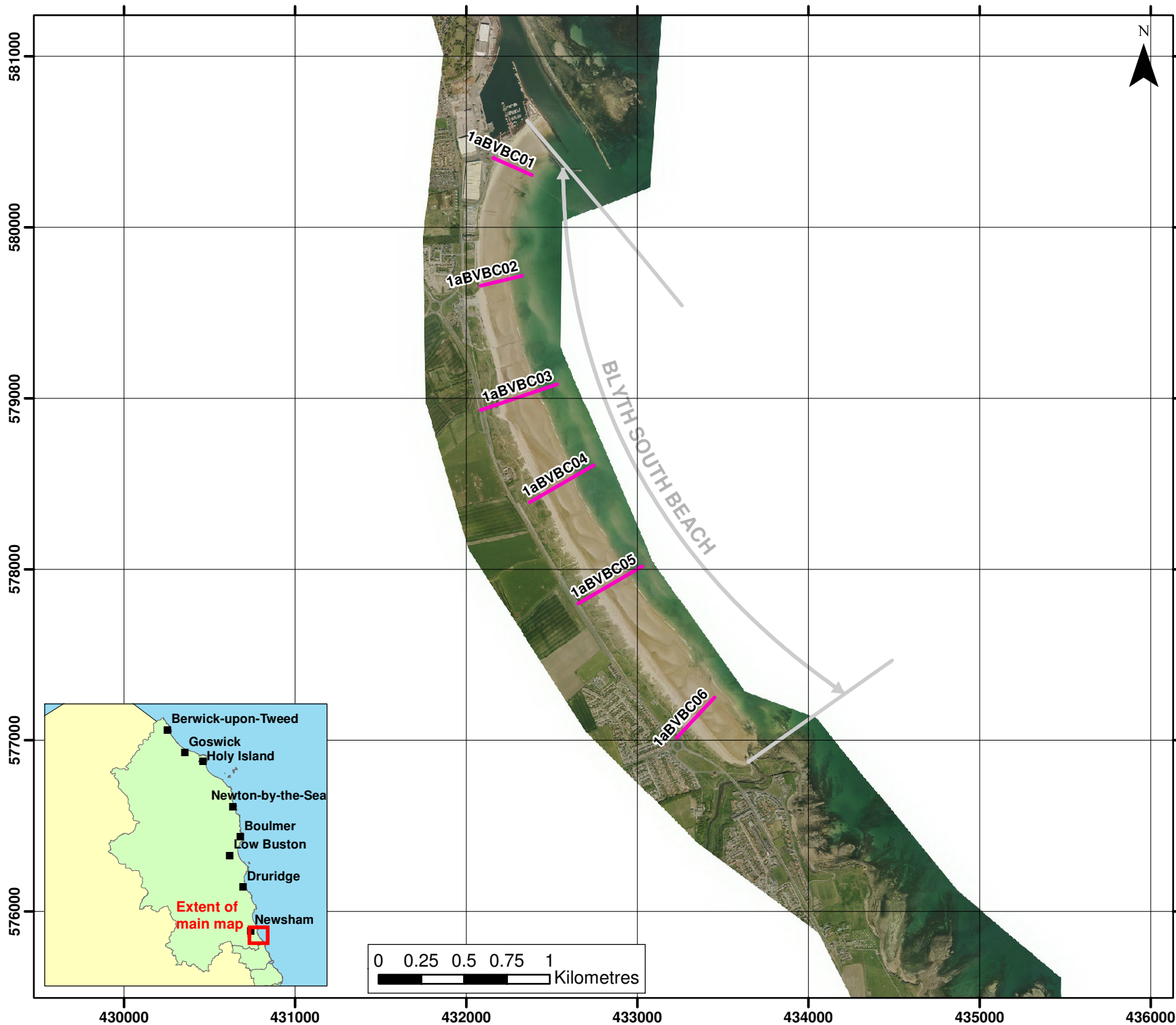
Client: North East Coastal Group  
 Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Figure 2 - Map 12  
 Survey Locations  
 Cambois Bay  
 Northumberland  
 County Council**

Update Report 5  
 Partial Measures Survey  
 Spring 2013

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**KEY**

**Topographic Profiles**

- Annual
- 6 monthly

**Topographic Surveys**

- ▣ 6 monthly
- ▣ yearly
- ▣ 5 yearly

**Cliff Top Monitoring Pegs**

- 50m centres
- 100m centres
- 300m centres
- Cliff Top Edge Survey

*(Indicative survey extents shown)*

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Figure 2 - Map 13  
Survey Locations  
Blyth South Beach  
Northumberland  
County Council**

Update Report 5  
Partial Measures Survey  
Spring 2013



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## 2. Analysis of Survey Data

### 2.1 Sandstell Point (Spittal A)

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2013	<p><b>Beach Profiles:</b></p> <p>Sandstell Point is covered by four beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2012.</p> <p>Profile <b>1aBTBC02</b> is located on the southern bank of the inner estuary. The dunes have remained mostly stable with only a slight fluctuation in height over the surface. Between the toe of the dunes and a chainage of 60m, beach levels have fallen by approximately 0.3m. Seaward of there, the beach has remained stable.</p> <p>Profiles <b>1aBTBC04</b> (longitudinal section) and <b>1aBTBC05</b> and <b>1aBTBC06</b> (both cross-sections) cover the spit at Sandstell Point.</p> <p>At profile <b>1aBTBC04</b>, the beach profile shows a significant change, with a drop in beach levels at the toe of the rock revetment in the order of 2m. The amount of change reduces in a seaward direction (chainage 60m), where beach levels have reduced in the region of 0.5m.</p> <p>Profiles <b>1aBTBC05</b> and <b>1aBTBC06</b> are transects across the spit, with the open sea on the left-hand side of the plot and the river channel on the right-hand side of the plot. At profile <b>1aBTBC05</b>, the beach has accreted and the crest has migrated transect towards the open sea (i.e. east / left side of plot). The profile at the river margin has eroded and steepened. At profile <b>1aBTBC06</b>, the beach profile at the river margin (i.e. west / right side of plot) has changed considerably, with beach level reduction, and erosion of the spit, to leave a narrow ridge. The beach on the side of the open sea (i.e. east / left side of plot) has accreted and the beach crest has migrated seawards.</p>	<p>Since the last survey, the dunes along the south bank of the River Tweed have remained mostly stable. The beach at profile 1aBTBC02 has experienced some erosion, but this is limited to the length of profile between the toe of the rock revetment and a chainage of approximately 60m.</p> <p>There have been some considerable changes to the profiles around the mouth of the River Tweed on Sandstell Point. Inside of the most seaward meander bend at profile 1aBTBC04, beach levels have fallen significantly. The spit has been particularly dynamic, with both alternating accretion and erosion on both sides of the spit.</p> <p><b>Longer term trends:</b> The change in dune profile is within the bounds of previous surveys, suggesting that they have remained generally stable over the past 11 years.</p> <p>Changes in beach levels are generally within the bounds of previous surveys. The only exception is at profile 1aBTBC04, where beach levels between a chainage of 50m and 180m are the lowest observed to date (April 2002, when monitoring began).</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
Apr 2013	<p><b>Topographic Survey:</b></p> <p>Due to the significant changes that have been observed from the beach profiles along the spit at Sandstell Point, and the three dimensional nature of these changes, a topographic survey was introduced to the monitoring programme in November 2009. The previous survey was undertaken for the Full Measures survey in autumn 2012.</p> <p>Data from the most recent topographic survey (Partial Measures, spring 2013) 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 using the DGM (Appendix B – Map 1b) produced from the last produced topographic survey and the present survey.</p> <p>In particular, the difference plot shows: (i) overall stability on the south bank of the River Tweed; (ii) reduction in beach levels across the majority of Sandstell Spit, particularly where the spit abuts the headland; and (iii) a linear band of beach elevation increase along the seaward side of the spit (it is noted in the topographic survey report for Berwick that a '<i>dune system formed on seaward side of Spittal</i>').</p>	<p>The findings of the topographic survey show similar trends with stability of the southern bank of the River Tweed and substantial changes across the spit. Notably, this is a reduction in levels/erosion across the spit, but accretion along the seaward side, such that dunes have formed.</p> <p><b>Longer term trends:</b> The longer term trends are covered by the long term topographic trends autumn 2011 to autumn 2013 (see next report, Full Measures 2013).</p>

## 2.2 Spittal (Spittal B)

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2013	<p><b>Beach Profiles:</b></p> <p>Spittal B is covered by two beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2012.</p> <p>Profile <b>1aBTBC11</b> is located to the north of Spittal Beach. Beach levels have fluctuated across the profile since the last survey, with a reduction in levels between the seawall and a chainage of 60m and also between 100m and 140m. Elsewhere across the profile, beach levels have increased. Seaward of a chainage of 100m, the profile form has changed slightly with the formation of a runnel between chainage 100m and 140m and berm seaward of a chainage of 140m. This suggests some cross-shore transfer of material, likely to have taken place by swash action under storm conditions during the winter months.</p> <p>Profile <b>1aBTBC13</b> is located to the centre of Spittal Beach. With the exception of a length of the profile between a chainage of 95m and 135m, beach levels have fallen across the profile by 0.2m to 0.4m. Similarly to profile 1aBTBC11, a runnel between chainage 60m and 90m and berm seaward of a chainage of 90m has formed. This indicates some cross-shore transfer of material, likely to have taken place by swash action under storm conditions.</p>	<p>Since the last survey, beach levels along Spittal have generally fallen across the beach. A ridge/runnel formation has developed on the lower beach (but above MHWS), suggesting some cross-shore transfer of material down the beach (likely to have occurred via swash action during a storm occurring over the winter months).</p> <p><b>Longer term trends:</b> At both profile locations along Spittal Beach, the changes observed from the present survey are within the bounds of previous surveys.</p>



### 2.3 Goswick Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2013	<p><b>Beach Profiles:</b></p> <p>Goswick Sands are covered by two beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2012.</p> <p>Profile <b>1aBTBC16</b> is located to the north of Goswick Sands, between Far Skerr and Cheswick Black Rocks. The dune has remained stable since the last survey. Beach levels at the toe of the dune have reduced slightly (0.1-0.2m), otherwise seaward to a chainage of 130m beach levels have remained stable. A berm and runnel have formed between a chainage of 130m and 185m. Similarly to Spittal Beach, this formation is reflective of some cross-shore transfer of material, likely to have taken place by swash action under storm conditions during the winter months.</p> <p>Profile <b>1aBTBC19</b> is located to the south of Goswick Sands. The dunes and beach have remained stable since the last survey, although it is noted that the offshore extent of the present survey is more limited than those undertaken in the past (as noted in the survey report for the North East Coast, section '<i>BTBC19 – Section ends at drain</i>').</p>	<p>The beach at Goswick Sands has remained relatively, stable since the last survey. The northern profile (1aBTBC16) shows signs of some cross-shore transfer movement of material towards MLWS, which may reflect swash action under storm conditions during the winter months.</p> <p><b>Longer term trends:</b> The changes observed since the last survey are generally within the bounds of the previous surveys. The only exception is the presence of a berm at profile 1aBTBC16, which is the only time that a berm like this has formed to date (April 2002, when monitoring began) and therefore beach levels at this location are the highest observed to date.</p>

## 2.4 Holy Island

Survey Date	Description of Changes Since Last Survey	Interpretation
<p><b>Mar 2013</b></p>	<p><b>Beach Profiles:</b></p> <p>Holy Island is covered by two beach profile lines for the Partial Measures surveys (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2012.</p> <p><b>1aBTBC21</b> and <b>1aBTBC23</b> are located on the north-west side of the island, along The Snook.</p> <p>At profile <b>1aBTBC21</b> the dunes have remained stable since the last survey. The beach has accreted by approximately 0.1m across the profile. The survey report for the North East Coast notes <i>'dunes forming beyond drain line above low water level'</i>.</p> <p>Profile <b>1aBTBC23</b> shows that the dunes and beach have remained stable since the last survey.</p>	<p>The dunes, sandy foreshore and sand flats around 'The Snook' on Holy Island have remained very stable in both form and position since the last survey. The beach on the north west corner of 'The Snook' has accreted by a small amount across the profile.</p> <p><b>Longer term trends:</b> The changes observed since the last survey are within the bounds of previous surveys.</p>

## 2.5 Beadnell Village

Survey Date	Description of Changes Since Last Survey	Interpretation
<p><b>Mar 2013</b></p>	<p><b>Beach Profiles:</b></p> <p>Beadnell Village is covered by one beach profile line for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2012.</p> <p><b>1aBTBC31</b> is in Nacker Hole and extends across the promenade and seawall. Since the last survey, beach levels at the toe of the seawall to HAT have increased by up to 0.2m, otherwise, the beach levels across the profile have remained relatively stable, only varying by 0.05m to 0.1m.</p>	<p>The beach to the south of Beadnell Village has generally remained stable with only a small increase in beach levels at the toe of the seawall and discrete fluctuations in beach level by less than 0.1m.</p> <p><b>Longer term trends:</b> The changes observed since the last survey are within the bounds of previous surveys. However, beach levels at HAT and MHWS are the highest observed to date (April 2002, when monitoring began).</p>

## 2.6 Beadnell Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2013	<p><b>Beach Profiles:</b></p> <p>Beadnell Bay is covered by five beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2012.</p> <p>Profiles <b>1aBTBC33</b> and <b>1aBTBC34</b> are located to the north of Beadnell Bay, in Beadnell Harbour. Profile <b>1aBTBC37</b> is located further south towards the outfall of Brunton Burn/Long Nanny.</p> <p>At <b>1aBTBC33</b>, the toe of the dunes has receded by up to 3m. The survey photographs in Plates 1 and 2 show the dune toe at the time of the present and previous surveys. The photographs show how the dune toe has cut-back to the vegetation line, with the occurrence of cliffing to form a vertical dune face at the toe. These changes indicate the occurrence of wave action at the dune toe, likely to have occurred under storm conditions over the winter months.</p> <p>At profile <b>1aBTBC34</b>, the dunes have remained stable since the last survey. Beach levels have fallen across the majority of the profile by approximately 0.5m, exposing the underlying rocky foreshore more than the previous survey (as shown by the survey photographs in Plates 3 and 4). Across a small section of profile seaward of chainage 160m, beach levels have increased by approximately 0.2m. This is likely to indicate material being drawn-down from the beach by cross-shore transport under winter storm conditions.</p> <p>At <b>1aBTBC37</b>, the dunes have remained stable since the last survey. There has been a slight change to the slope of the dune face, with the development of a steeper slope of continuous gradient to the toe and no slumping (shown by the survey photographs in Plates 5 and 6). Beach levels have fallen across the profile, by up to 0.5m.</p> <p>Profiles <b>1aADC01</b> and <b>1aADC02</b> are located along the frontage to the south of the outfall of Brunton Burn/Long Nanny. The dunes at 1aADC01 and 1aADC02 have not changed from or position. Beach levels at both locations have fallen across the profile, by up to 0.2m to 0.3m and 0.5m respectively.</p>	<p>Along the length of Beadnell Bay, the dunes have remained stable, retaining the same form and position since the last survey. The dune toe has been subject to some erosion. With the exception of the most northern section of the bay (at profile 1aBTBC33), beach levels have fallen across the profile.</p> <p><b>Longer term trends:</b> Along the length of Beadnell Bay, the dunes are of a similar form to those observed in the past. The changes in beach profile form and position observed since the last survey are also within the bounds of previous surveys.</p>



Plate 1 – Survey photograph 1aBTBC33\_20130328\_Up2.JPG



Plate 2 – Survey photograph 1aBTBC33\_20121031\_Up.JPG



Plate 3 – Survey photograph 1aBTBC34\_20130328\_Dwn2.JPG

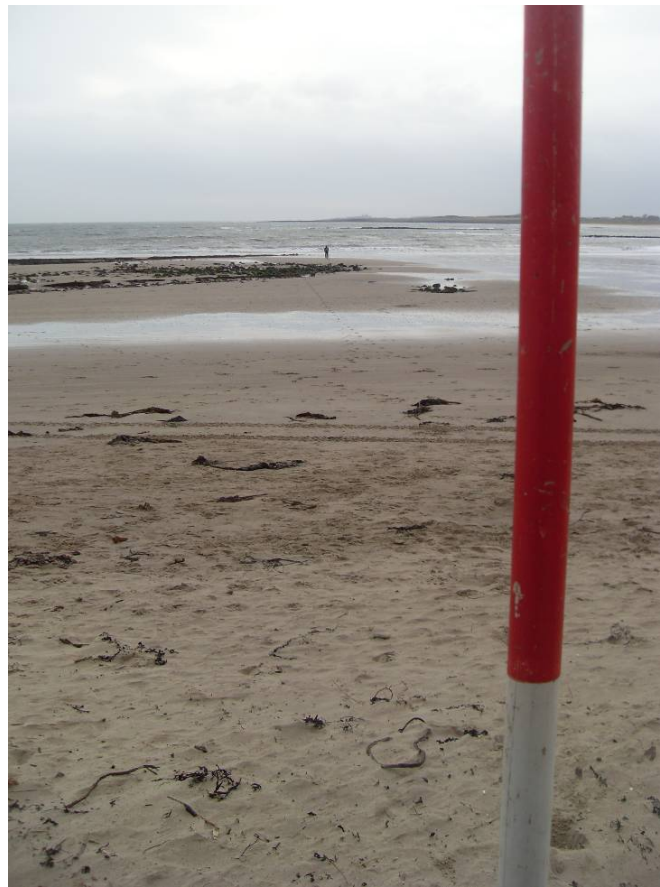


Plate 4 – Survey photograph 1aBTBC34\_20121031\_Dwn3.JPG



Plate 5 – Survey photograph 1aBTBC37\_20130328\_N6.JPG



Plate 6 – Survey photograph 1aBTBC37\_20121031\_N5.JPG

## 2.7 Boulmer

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2013	<p><b>Beach Profiles:</b></p> <p>Boulmer is covered by two beach profile lines for the Partial Measures survey (Appendix A). These were added to the programme in October 2007. The previous survey was undertaken for the Full Measures survey in autumn 2012.</p> <p>At profile <b>1aADC04A</b> the dune cliff backshore has retained a similar form and position since the last survey. Between a MHWS and a level of 1.2m (chainage of 60m), beach levels have increased by approximately 0.5m. Elsewhere, the beach profile remains unchanged.</p> <p>At profile <b>1aADC04B</b> the dune cliff backshore has retained a similar form and position since the last survey. Generally, the beach has retained a similar form and position to the last survey. The exception is between a chainage of 20m and 40m and 55m and 70m where beach levels have fallen by 0.1m to 0.2m.</p>	<p>The dune cliff backshore at Boulmer has remained stable since the last survey. The beach has fluctuated slightly, with an increase along part of the beach to the north and a reduction along parts of the beach to the south. Otherwise, they have generally remained stable, retaining a similar form and position.</p> <p><b>Longer term trends:</b> Generally, the changes in beach profile form and position observed since the last survey are within the bounds of previous surveys. The exception to this is the beach at profile to the north (1aADC04A) where beach levels between MHWS and a level of 1.2m (chainage of 60m) are the highest observed to date (October 2007, when monitoring began).</p>



## 2.8 Alnmouth Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
<p><b>Apr 2013</b></p>	<p><b>Beach Profiles:</b></p> <p>Alnmouth Bay is covered by three beach profile lines during the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2012.</p> <p>The three profiles are located to the north of Alnmouth Bay between Marden Rocks and the mouth of the River Aln Estuary.</p> <p>At profile <b>1aADC07</b> the dunes have remained stable since the last survey. However, the toe of the dune and beach levels between the dune toe seaward to a chainage of 50m have fallen by 0.1m to 0.2m. Seaward of chainage 50m, beach levels have increased to form a series of berms, in between depression/runnel (shown in the distance by the survey photograph in Plate 7). This is a feature commonly observed to occur along this coastline and is believed to be influenced by channel movements in the Aln Estuary and flow into and from the estuary.</p> <p>At profile <b>1aADC08</b> the dunes have remained stable since the last survey. Between the dune toe and a chainage of 150m, beach levels have fallen. However, between a chainage of 150m and 230m, they have increased. This suggests that some cross-shore movement from the upper to lower beach has occurred, possibly in response to winter storms and re-profiling under the influence of the Aln Estuary.</p> <p>At profile <b>1aADC09</b> the dunes have remained stable since the last survey. Beach levels have fallen considerably across the profile, notably at the dune toe where the dune slope has been re-profiled to form a flatter slope, devoid of vegetation, exposing the rock protection (shown by the survey photographs in Plates 8 and 9). Also, seaward of a chainage of 65m, beach levels have fallen by over 2.5m.</p>	<p>To the north of Alnmouth Bay, the dunes have remained stable since the last survey, although the dune toe has been subject to erosion, which is likely to have been caused by erosion by wave action during winter storms.</p> <p>The beach has been very mobile, with accretion occurring to the very north and erosion occurring towards the mouth of the Aln Estuary. The beach has changed form, with the development of ridges and runnels in the very north and beach steepening towards the Aln Estuary. Adjacent profiles showed distinctly different patterns of change, suggesting multiple influences including: channel movements in the Aln Estuary, flow to and from the estuary and the occurrence of winter storms.</p> <p><b>Longer term trends:</b> The dunes have demonstrated a long-term trend of stability. The changes in beach profile form and position observed since the last survey are within the bounds of previous surveys.</p>
<p><b>Apr 2013</b></p>	<p><b>Topographic Survey:</b></p> <p>The northern part of Alnmouth Bay (to the north of the River Aln estuary) is covered by bi-annual topographic survey, which commenced in April 2005. Data from the most recent topographic survey (Partial Measures, spring 2013) have been used to create a DGM (Appendix B – Map 2a) using a Geographical Information System (GIS). A difference plot has also been produced using the DGM (Appendix B – Map 2b) produced from the last produced topographic survey (Full Measures, autumn</p>	<p>The findings of the topographic survey show patchy areas of increased elevation interspersed with patchy areas of decreased elevation. This complies with the findings of the beach profile surveys, which show the beach to be very dynamics.</p> <p>The topographic survey report notes that a '<i>new line of formed dunes from the south end of car park to river</i></p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>2012) and the present survey.</p> <p>The difference plot shows (i) patchy areas of increased elevation interspersed with patchy areas of decreased elevation; (ii) accretion along the backshore to the river (it is noted in the topographic survey report for Alnmouth that 'a <i>new line of formed dunes from the south end of car park to river seems to be holding well and becoming more established</i>'); and (iii) accretion around the east bank of the river.</p>	<p><i>seems to be holding well and becoming more established</i>. This is supported by the findings of the topographic survey, which shows an increase in elevation along the backshore at this location.</p> <p><b>Longer term trends:</b> The longer term trends are covered by the long term topographic trends autumn 2011 to autumn 2013 (see next report, Full Measures 2013).</p>



Plate7 – Survey photograph 1aADC07\_20130407\_Dwn2.JPG



Plate 8 – Survey photograph 1aADC09\_20130407\_N4.JPG



Plate 9 – Survey photograph 1aADC09\_20121017\_N6.JPG

## 2.9 High Hauxley & Druridge Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2012	<p><b>Beach Profiles:</b></p> <p>High Hauxley to Druridge Bay is covered by eight beach profile lines during the Partial Measures survey (Appendix A). Four of these (with 'A' or 'B' suffixes) were added to the programme in October 2007. The previous survey was undertaken for the Full Measures survey in autumn 2012.</p> <p><b>1aADC15A, 1aADC16 and 1aADC16A</b> are located around Hauxley Haven. At profile <b>1aADC15A</b>, the dunes have remained stable since the last survey. With the exception of the dune toe, beach levels have increased across the profile by approximately 0.2m. This increase is greater on the lower shore, where the rocky outcrop, which was observed to be exposed in the previous survey, is once again buried. At profile <b>1aADC16</b>, the dunes have remained stable. Beach levels between the dune toe and a chainage of 175m have fallen by approximately 0.2m. Between a chainage of 175m and 250m, beach levels have increased to form a wider flatter beach. At profile <b>1aADC16A</b>, the dunes have remained stable. Between MHWs and a level of 0m (chainage 165m), beach levels have reduced by 0.5m, seaward of which they have increased by 0.5m. This suggests that material has been moved across the beach, likely to have taken place during winter storms.</p> <p><b>1aADC16B, 1aADC17 and 1aADC17A</b> are located to the north of Druridge Bay, between Bondi Carrs and Hadston Carrs and extend seawards from Togston Links. At <b>all locations</b>, the dunes have remained stable since the last survey. At profile <b>1aADC16B</b>, beach levels have virtually remained the same since the last survey. At profile <b>1aADC17</b>, beach levels have fallen across the majority of the profile, from the dune toe to a chainage of 165m. At profile <b>1aADC17A</b>, beach levels between the toe of the dunes and a chainage of 40m have increased marginally. Seaward of this point they have reduced by 0.4m across the profile.</p> <p><b>1aCMBC01 and 1aCMBC02</b> are located in the southern section of Druridge Bay. At both locations, the dunes have remained stable since the last survey. At profile <b>1aCMBC01</b>, beach levels have fallen considerably (by up to 1m), to form a more concave profile. This is a trend that has continued from the last survey. The concrete dune toe protection has become exposed (as shown by the survey photographs in Plates 10 and 11). At profile <b>1aCMBC02</b>, beach levels have fallen considerably (by up to 1m), to form a more concave profile. This is a trend that has continued from the last survey.</p>	<p>At Hauxley Haven, the dunes have remained stable, retaining the same form and position since the last survey. The beach to the north has accreted, while the beach to the centre and south of Hauxley Haven has been more dynamic with the cross-shore transport of material from the upper to the lower beach, likely to have taken place via draw-down during winter storms.</p> <p>North of Druridge Bay, the dunes have remained stable, retaining the same form and position since the last survey. To the north, in the lee of the rocky outcrop of Bondi Carrs / Elm Bush, the beach has remained stable. To the south, the beach levels have reduced, to form a slightly more concave profile.</p> <p>South of Druridge Bay, the dunes have remained stable, however, beach levels have fallen considerably across the profile.</p> <p><b>Longer term trends:</b> At Hauxley Haven, the dunes have demonstrated a long-term trend of stability. The changes in beach profile form and position observed since the last survey are generally within the bounds of previous surveys. The exception is at the centre and south of Hauxley Bay, where beach levels around a level of -0.4m, are highest observed to date (April 2002, when monitoring began).</p> <p>North of Druridge Bay, the dunes have demonstrated a long-term trend of stability. The changes in beach</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
		<p>profile form and position observed since the last survey are within the bounds of previous surveys.</p> <p>South of Druridge Bay, the dunes have demonstrated a long-term trend of stability. The changes in beach profile form and position observed since the last survey are within the bounds of previous surveys.</p>



Plate 10 – Survey photograph 1aCMBC01\_20130326\_N11.JPG



Plate 11 – Survey photograph 1aCMBC01\_20121029\_N15.JPG

## 2.10 Lynemouth Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2013	<p><b>Beach Profiles:</b></p> <p>Lynemouth is covered by three beach profile lines during the Partial Measures survey (Appendix A). Profile 1aWDC01 was added to the programme in May 2002. Profiles 1aCMBC03A and 1aCMBC03B were added to the programme in October 2007. The previous survey was undertaken for the Full Measures survey in autumn 2012.</p> <p><b>1aCMBC03A</b> is located opposite Lynemouth and extends across the extensive slag banks before reaching the foreshore. The slag bank has not experienced any change since the last survey. The survey report for the North East Coast notes that '<i>horse was tethered on start of section line</i>', which explains the lack of data points at the origin of the profile, but this does not detract from the overall trends observed for the slag bank. Beach levels from the toe of the slag bank across the profile have increased by approximately 0.4m to 0.5m.</p> <p><b>1aCMBC03B</b> is located to the north of Lynemouth Power Station and extends across the extensive slag banks before reaching the foreshore. The process of slag bank erosion has been progressively ongoing for some years. Since the last survey, the top of the slag bank has remained stable, however, as in previous years, the face of the bank has receded; since the last survey this was in the order of 3m. Beach levels have fallen by 0.5m across the profile.</p> <p><b>1aWDC01</b> extends from seaward of the rock revetment down to low water across the extensive slag banks. Beach levels seaward of the rock revetment have fallen considerably since the last survey, in the region of 1m.</p>	<p>Opposite Lynemouth, the slag bank has remained stable and the beach has accreted since the last survey.</p> <p>To the north of the power station, the slag bank has continued to erode. The beach has experienced erosion, with a fall in levels in the order of 0.5m.</p> <p>Opposite the power station (at profile 1aWDC01), the beach has experienced significant erosion, with a fall in levels in the order of 1m.</p> <p><b>Longer term trends:</b> Opposite Lynemouth, the slag bank has demonstrated a long-term trend of stability. The changes in beach profile form and position observed since the last survey are within the bounds of previous surveys.</p> <p>To the north of the power station, the slag bank has continued to recede and the beach lower as part of an ongoing trend.</p> <p>Opposite the power station (at profile 1aWDC01), newly available data from when monitoring began (in May 2002), shows that the coastline has undergone some significant change (this is reflected in the beach profile plot in Appendix A). Review of the survey photographs (refer to Plates 12 and 13) show that historically slag material was present in front of the metal fence, however, this was later eroded / replaced</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
		<p>by rock revetment. The beach profiles reflect this change clearly, with ongoing erosion of the graded slag material between April 2002 and October 2010. The profile for March 2011 is different, and reflects what is seen on the beach today (a metal fence fronted by a rock revetment and narrow beach). This suggests that the rock revetment was constructed sometime between October 2010 and March 2011. Since construction of the rock revetment, beach levels have fluctuated with a general trend of erosion.</p>
<p><b>Mar 2013</b></p>	<p><b>Cliff-top Survey:</b></p> <p>Cliff top survey data collected for baseline survey (autumn, 2008), the previous Full Measures survey (autumn 2012) and the present Partial Measures survey (spring, 2013) is presented in this report.</p> <p>Three transect lines (numbered 1-3) were established along the cliff top in Lynemouth Bay in October 2008. Measurements are from the landward end of the transect (the fixed datum) to the surveyed cliff top. Measured distances to cliff top can then be compared to calculate erosion rates. The cliff top surveys are intended to inform on erosion rates of the sea cliffs to the south of Lynemouth Bay on the north side of Newbiggin Point. Note: the numbering of ground control points is not intended to correlate with that of the beach profile lines and reference should be made to Appendix C - Map 1 for the location of the transects ground control points.</p> <p>The results from the cliff top monitoring are anticipated to have an accuracy of <math>\pm 0.2\text{m}</math> due to the technique used. Furthermore, problems in precisely locating the cliff top, due to vegetation growth or its smooth form, have also affected the data quality. Appendix C – Table C1 provides results from the cliff top survey, showing the position from the datum to the edge of the cliff top along each transect.</p> <p>Results show that erosion or an amount of movement greater than the survey error has occurred at ground control points 2 and 3 since surveys began in October 2008. At ground control points 2 and 3, movement of 0.3m and 0.4m respectively is recorded</p> <p>Since the last survey in October 2012, cliff movement greater than the survey error did not occur at any location, so therefore it is not possible to define any discernible trends. Review and analysis of the 2012</p>	<p>Since the last survey, movement greater than the survey error did not occur at any location. Therefore it is not possible to discern any trends since then.</p> <p><b>Longer term trends:</b> Since surveys began in October 2008, cliff movement greater than the survey error has occurred at 2 ground control points; 2 and 3, where cliffs are recorded to have eroded by 0.3m and 0.4m respectively.</p> <p>An additional assessment of cliff recession will be derived from analysis of time-series remote sensing data. A high quality baseline survey, comprising LiDAR and aerial photography, was collected in 2010, a repeat survey was completed in Sept/Oct 2012 and a second repeat survey is planned for 2014. These data will be analysed to give more accurate information on the behaviour of the cliffs in a separate report.</p>



<b>Survey Date</b>	<b>Description of Changes Since Last Survey</b>	<b>Interpretation</b>
	aerial photography will allow the nature of change to be better understood.	



Plate 12 – Survey photograph 1aWDC01\_20130326\_N1.JPG



Plate 13 – Survey photograph CMBC 3BB Start Point Looking North.JPG (from April 2008 survey)

## 2.11 Newbiggin-by-the-Sea

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2013	<p><b>Beach Profiles:</b></p> <p>Newbiggin-by-the-Sea is covered by four beach profile lines during the Partial Measures survey (Appendix A). Two of these (with 'A' suffices) were added to the programme in October 2007 specifically to help assess the performance of the capital scheme involving beach replenishment and construction of an offshore breakwater. It should be noted that an extended series of profiles and a topographic survey are also recorded via the Cell 1 Regional Coastal Monitoring Programme for purposes of post-project evaluation of this capital scheme. These profiles are not analysed here, however, the findings of the topographic survey are presented below. The previous survey was the Full Measures assessment undertaken in autumn 2012.</p> <p><b>1aWDC05A</b> is in the north of Newbiggin Bay. Since the last survey, beach levels between the seawall and HAT have increased, by up to 1.8m. Between MHWs and a chainage of 100m, beach levels have increased in the order of 0.2m. This change is reflective of the effect of the combination of the two breakwaters. It is understood that there has been beach management works in the autumn of 2012 and so the changes may not be completely natural.</p> <p><b>1aWDC06</b> is located in the centre of the northern part of Newbiggin Bay, between the two breakwaters. Beach levels from the toe of the seawall to a chainage of 50m have increased by approximately 1m and decreased by approximately 1m seaward of a chainage of 50m. It may be that this is due to the natural movement of material both across the beach and along the beach in response to the interaction of beach response to storms and the offshore breakwater, and/ or due to on-going beach management and re-profiling works.</p> <p><b>1aWDC06A</b> is located in the centre of Newbiggin Bay, behind the offshore breakwater. Beach levels between the toe of the seawall and a chainage of 70m have increased by approximately 0.3m, but reduced along the remainder of the profile. The beach form has changed with narrowing of the upper beach, formation of a narrower and higher crest and a narrower beach. This may reflect ongoing beach management and re-profiling works.</p> <p><b>1aWDC07</b> is located in towards the south of Newbiggin Bay. Beach levels seaward of the rock</p>	<p>Since the last survey, the beach at Newbiggin-by-the-Sea has fluctuated quite considerably, with the accretion of the upper beach and erosion of the lower beach. This is an opposite trend to beach behaviour observed for the beaches in the north of Northumberland, where beaches show the typical movement of sediment from upper to lower beach under winter drawdown processes. It is possible that this beach response at Newbiggin-by-the-Sea is due to the natural movement of material both across the beach and along the beach in response to the interaction of beach response to storms and the offshore breakwater, and/ or due to on-going beach management and re-profiling works.</p> <p><b>Longer term trends:</b> Newly available data from when monitoring began (in May 2002), reflects the change in beach width resulting from the beach nourishment scheme implemented at Newbiggin-by-the-Sea. This change is also reflected in the beach profile plot in Appendix A.</p> <p>The changes in beach profile form and position observed since the last survey are within the bounds of previous surveys. The only exception is a small section of beach at profile 1aWDC06A, between HAT and a level of 0m (chainage 110m), where beach levels are the lowest observed to date (October 2007 when monitoring began).</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>revetment have fluctuated across the beach, with a general increase seaward to HAT and a decrease seaward of HAT to a 0m (chainage 60m). The overall form of the profile is smooth and convex.</p>	
<p><b>Apr 2013</b></p>	<p><b>Topographic Survey:</b></p> <p>Newbiggin-by-the-Sea is covered by bi-annual topographic survey, which commenced in September 2010 specifically to help assess the performance of the capital scheme that was constructed in 2007. The scheme involved beach replenishment and construction of an offshore breakwater. The topographic survey comprises a series of 26 beach profiles plus additional intervening spot heights. Prior to incorporation in the programme, these surveys were undertaken on occasions between 2007 and 2010 as part of the scheme development. The previous survey was the Full Measures assessment undertaken in winter 2011.</p> <p>Data from the most recent topographic survey (Partial Measures, spring 2012) have been used to create a digital ground model (DGM) (Appendix B – Map 3a) using a Geographical Information System (GIS). A difference plot has also been produced using the DGM (Appendix B – Map 3b) produced from the previous and present surveys.</p> <p>The topographic survey shows areas of both gain and loss across the beach, with a general trend for erosion in the bays either side of the offshore breakwater and accumulation of sediment at the north and south margins of the bay and on the tombolo formed in the lee of the offshore breakwater, It is noted in the topographic survey report for Newbiggin Bay that '<i>buried sea wall visible between sections 1aNWB9 and 1aNWB12</i>', which compares well to an area of beach elevation decrease.</p>	<p>The topographic survey shows areas of both gain and loss across the beach, with no discernible trend.</p> <p><b>Longer term trends:</b> The longer term trends are covered by the long term topographic trends autumn 2011 to autumn 2013 (see next report, Full Measures 2013).</p>
<p><b>Apr 2013</b></p>	<p><b>Sand Extent Survey:</b></p> <p>Spital Carrs is located to the south of Newbiggin Bay and is covered by a bi-annual sand extent survey, which commenced in 2012. The survey was designed to address concern that the beach recharge scheme undertaken in the Newbiggin Bay may have impacts on the Spital Carrs SSSI and SPA if sand from the recharge scheme moves to the south to cover the rock shore platform. The sand extent survey therefore identifies the boundary of the sand beach on the rock platform.</p> <p>Data from the most recent sand extent survey (Partial Measures, spring 2013) has been plotted onto aerial imagery (refer to Appendix D – Map 1). The plot shows that there is some variation of the extent of sand between the autumn 2012 and the spring 2013 survey. There is some movement to the north</p>	<p>Since the last survey, there has been some movement to the north where the sand extent has moved slightly seaward and to the south where the sand extent has moved slightly landwards. Otherwise, there are no discernible trends.</p> <p><b>Longer term trends:</b> Review of the sand extent surveys for the past three surveys, shows that extent of the sand has oscillated and there are no clear discernible trends.</p>

<b>Survey Date</b>	<b>Description of Changes Since Last Survey</b>	<b>Interpretation</b>
	where the sand extent has moved slightly seaward and the south, where the sand extent has moved slightly landwards. Otherwise, there are no discernible trends suggesting the seawards extension of sand.	

## 12.12 Cambois Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2013	<p><b>Cliff-top Survey:</b></p> <p>Cliff top survey data collected for baseline survey (autumn, 2008), the Full Measures survey (autumn 2012) and the present Partial Measures survey (spring, 2013) is presented in this report.</p> <p>Five ground control points (numbered 1-5) were established along the cliff top to the north of Cambois Bay in October 2008. Measurements are taken along a fixed transect line from the landward datum to the edge of the cliff top. The cliff top surveys are intended to inform on erosion rates of the sea cliffs to the north of Cambois Bay, opposite North Seaton Colliery. Note: the numbering of ground control points is not intended to correlate with that of the beach profile lines and reference should be made to Appendix C - Map 2 for the location of the transects ground control points.</p> <p>These cliff top surveys are undertaken bi-annually. Measurements are taken from each ground control point along a fixed bearing to the edge of the cliff top. The results from the cliff top monitoring are anticipated to have an accuracy of <math>\pm 0.2\text{m}</math> due to the technique used.</p> <p>The results from the cliff top survey are presented in Appendix C – Table C2, showing the position from the ground control point to the edge of the cliff top along a defined bearing.</p> <p>Results show that change greater than the survey accuracy has occurred at three ground control points (1, 3 and 5) since surveys began in October 2008. However, of three sites, one location (3) is indicating cliff advance, which probably reflects difficulty in precisely locating the cliff edge and/or vegetation growth. The two locations with more reliable data show erosion of 0.3m, and 2.9m respectively. Other locations have not changed, or erosion is within the error band.</p> <p>Since the last survey in October 2012, change greater than the survey accuracy has occurred at three ground control points (3, 4 and 5). Other locations have not changed, or erosion is within the error band. The cliffs are eroding at ground control points 4 and 5, by 0.6m and 0.5m respectively. The surveyors note that in the survey report for the North East coast that at the '<i>South end of Sand Bay Caravan Park, numerous landslips evident and a number of caravans have been withdrawn from the front plots</i>'. Ground control point 3 is indicated to have advanced by 0.5m. This could suggest cliff advance, however, it is more likely to represent error in the survey, most likely due to problems precisely</p>	<p>Since the last survey in October 2012, the cliffs are eroding at two ground control points (4 and 5 by 0.6m and 0.5m respectively). The topographic survey report notes '<i>South end of Sand Bay Caravan Park, numerous landslips evident and a number of caravans have been withdrawn from the front plots</i>'. This provides further evidence of the mechanism of cliff recession.</p> <p><b>Longer term trends:</b> Since surveys began in October 2008, change greater than the survey accuracy has occurred at three ground control points (1, 3 and 5), where cliffs are recorded to have eroded by 0.3m, accreted by 0.4m, and eroded by -2.9m respectively. Other locations have not changed, or erosion is within the error band.</p> <p>An additional assessment of cliff recession will be derived from analysis of time-series remote sensing data. A high quality baseline survey, comprising LiDAR and aerial photography, was collected in 2010, a repeat survey was completed in Sept/Oct 2012 and a second repeat survey is planned for 2014. These data will be analysed to give more accurate information on the behaviour of the cliffs in a separate report.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>identifying the cliff edge. Review and analysis of the 2012 aerial photography will allow the nature of change to be better understood.</p>	
<p><b>Mar 2013</b></p>	<p><b>Cliff/Dune-top Survey:</b></p> <p>Cliff top survey data collected for baseline survey (autumn, 2008), the Full Measures survey (autumn 2012) and the present Partial Measures survey (spring, 2013) is presented in this report.</p> <p>A further 36 ground control points (numbered 6-41) were established along the cliff/dune top to the south of Cambois Bay in May 2009. The cliff/dune top surveys are intended to inform on erosion rates of the sea cliffs and dunes from Cambois to Blyth. Note: the numbering of ground control points is not intended to correlate with that of the beach profile lines and reference should be made to Appendix C - Map 2 for the location of the transects ground control points.</p> <p>The results from the cliff/dune top monitoring are anticipated to have an accuracy of <math>\pm 0.2\text{m}</math> due to the technique used. Appendix C – Table C3 provides results from the cliff/dune top survey, showing the position from the ground control point to the edge of the cliff/dune top along a defined bearing. A distinction is made in the table between whether the coastline is cliff/dune at the survey location.</p> <p>Results show that erosion or an amount of movement greater than the survey error has occurred at 22 ground control points since surveys began in May 2009. Other locations have not changed, erosion is within the error band, or data is not available.</p> <p>Since the last survey in April 2012, erosion that is greater than the survey error occurred at points 15, 16, 17 and 25. At point 17, erosion is recorded to have been 10m, but this very significant change is thought to be erroneous. Accretion that is greater than the survey error is recorded to have occurred at 6, 12, 18, 28 and 30.</p>	<p>Since the last survey in October 2012, erosion that is greater than the survey error occurred at points 15, 16, 17 and 25. At point 17, erosion is recorded to have been 10m, but this is thought to be erroneous. Accretion is recorded to have occurred at 6, 12, 18, 28 and 30, but this is likely to be error related to difficulty in precisely locating the cliff edge.</p> <p><b>Longer term trends:</b> Since surveys began in May 2009, erosion or an amount of movement greater than the survey error has occurred at 22 ground control points. Other locations have not changed, erosion is within the error band, or data is not available.</p> <p>Erosion greater than the survey error is recorded to have taken place at:</p> <ul style="list-style-type: none"> <li>- ground control point 8 (to the north of Cambois, close to the mouth of the River Wansbeck);</li> <li>- ground control point 10 to 12 (to the north of Cambois, close to the mouth of the River Wansbeck);</li> <li>- ground control point 15 to 25 (the centre of the frontage, opposite Cambois);</li> <li>- ground control point 29 (opposite the tidal basin); and</li> <li>- ground control point 34 and 35 (opposite Blyth).</li> </ul> <p>An additional assessment of cliff recession will be derived from analysis of time-series remote sensing</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
		<p>data. A high quality baseline survey, comprising LiDAR and aerial photography, was collected in 2010, a repeat survey was completed in Sept/Oct 2012 and a second repeat survey is planned for 2014. These data will be analysed to give more accurate information on the behaviour of the cliffs in a separate report.</p>



## 2.13 Blyth South Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
Mar 2013	<p><b>Beach Profiles:</b></p> <p>Blyth South Beach is covered by six beach profile lines for the Partial Measures survey (Appendix A). The previous survey was the Full Measures assessment undertaken in autumn 2012.</p> <p><b>1aBVBC01</b> is located towards the north of South Beach, in front of the land owned by Port of Blyth. There have been no significant changes to the position and form of the dunes since the last survey, although, the dune toe has cut-back (as shown by the survey photographs in Plates 14 and 15). Beach levels have fallen between the dune toe and a chainage of 85m by up to 1m, seaward of which they have increased by up to 1m. This suggests that material has been moved across the beach, likely to have taken place during winter storms.</p> <p>At profile <b>1aBVBC02</b>, there have been no significant changes to the position and form of the dunes since the last survey. Beach levels have fallen across the profile by approximately 0.3m, from the seawall to a chainage of 150m. Seaward of a chainage of 15m, beach levels have increased to form a berm. The berm is likely to be comprised of material draw-down from the beach above during winter storms.</p> <p>At profile <b>1aBVBC03</b>, there have been no significant changes to the position and form of the dunes since the last survey. Beach levels have reduced by up to 1m, in front of the dune toe around HAT/MHWS, and generally increased across the remainder of the profile. Similarly to profile 1aBVBC02, a berm has formed on the lower shore (at a chainage of 240m). Again, the berm is likely to be comprised of material draw-down from the beach above during winter storms.</p> <p>At profile <b>1aBVBC04</b>, there have been no significant changes to the position and form of the dunes since the last survey. Beach levels have reduced considerably across the profile (up to 1m), from the toe of the dunes to a chainage of 130m. Similarly to profile 1aBVBC02 and 1aBVBC03, a berm has formed on the lower shore (at a chainage of 130m). Again, the berm is likely to be comprised of material draw-down from the beach above during winter storms.</p> <p>At profile <b>1aBVBC05</b>, there have been no significant changes to the position and form of the dunes since the last survey. Beach levels have generally reduced across the majority of the profile, by up to</p>	<p>Since the last survey, the dunes at Blyth South Beach have remained stable, retaining the same form and position. The beach has been subject to erosion, with a considerable drop in beach levels (in the order of 1m), but the subsequent deposition of this eroded material as a berm on the lower shore.</p> <p><b>Longer term trends:</b> At Blyth South Beach, the dunes have generally demonstrated a long-term trend of stability. Newly available data from when monitoring began (in May 2002), shows that prior to April 2007(inclusive) , the seaward face of the dune and dune crest were positioned further seaward and was 1.5m higher. Thereafter the dune was narrower and the crest height lower, however, this position and form has been retained since then.</p> <p>The changes in beach profile form and position observed since the last survey are within the bounds of previous surveys. The only exception is a small section of beach at profile 1aBVBC04, a chainage of 100m and 130m, where beach levels are the lowest observed to date (October 2007 when monitoring began).</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>1m. Across a small section of beach between a chainage of 50m and 60m, a small berm has formed.</p> <p><b>1aBVBC06</b> is located at the southern end of the beach, towards Seaton Sluice. There have been no significant changes to the position and form of the dunes since the last survey. Beach levels have generally reduced across the majority of the profile, by up to 1m. Across a section of beach between a chainage of 150m and 180m, a small berm has formed.</p>	



Plate 14 – Survey photograph 1aBVBC01\_20130315\_N4.JPG



Plate 15 – Survey photograph 1aBVBC01\_20121015\_N6.JPG

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

#### **Individual Profiles**

At profile 1aBTBC04, the beach profile shows a significant change, with a drop in beach levels at the toe of the rock revetment in the order of 2m. The amount of change reduces in a seaward direction. The height of the beach may be integral to the integrity of the stability of the toe of the rock revetment. The structure should be assessed regularly for a further fall in beach levels and to identify if any trigger levels have been met.

At Profile BTBC19, the offshore extent of the present survey is more limited than those undertaken in the past. The survey report for the North East Coast notes that this section ends at a drain.

Profile BTBC21 ends at a drain and dunes have formed beyond drain line above low water level.

Profile BTBC23 ends at a drain and dunes have formed beyond drain line above low water level.

At profile 1aBTBC33 there is a gap in the data due to dense vegetation (previously called bushes on top of dunes, as first noted in Full Measures, autumn 2011). Care is needed interpolating the data as this would incorrectly imply erosion.

Profile 1aADC09 ends at the river.

At profile 1aCMBC03A, a horse was tethered on start of section line.

Profile 1aWDC01, revetment boulders very slippery.

#### **Topographic Surveys**

Berwick, the topographic survey report notes 'No quicksand encountered. Dune system formed on seaward side of Spittal'.

Alnmouth, the topographic survey report notes 'A new line of formed dunes from the south end of car park to river seems to be holding well and becoming more established'.

Newbiggin-by-the Sea, the topographic survey report notes 'Buried sea wall visible between sections 1aNWB9 and 1aNWB12'.

Cambois, the topographic survey report notes 'Undergrowth at north end of cliff top hinders survey of line.'

#### **Cliff Top Surveys**

Surveying any cliff top is difficult due to: (i) the safety risks posed to surveyors, especially during adverse weather; and (ii) the apparent changes that can arise due to problems in interpretation of the cliff edge on successive surveys. In particular, surveying the cliff top has been made challenging by growth of vegetation that makes identification of cliff edge in successive surveys difficult. For these reasons, it has been assumed that any changes of  $\pm 0.2\text{m}$  may be considered as being within the accuracy of the surveying technique and that advances in the cliff front are error.

Surveying the cliff top along Cambois Bay is more difficult than the similar surveys at Newbiggin Caravan Park and Sandy Bay Caravan Park because the cliff edge is less distinct and hard to precisely define due to vegetation coverage and its smooth, degraded form. At Cambois Bay, the surveyors noted that undergrowth at north end of cliff top hindered surveying. This was also noted in previous reports (partial measures, spring 2012 and full measures, autumn 2011).

Consequently a long-term record is required before results from this surveying technique become truly meaningful. In addition to the analysis of beach profiles, assessments of cliff recession will be derived from analysis of time-series remote sensing data. A high quality baseline survey, comprising LiDAR and aerial photography, was collected in 2010, a repeat survey was completed in autumn/winter 2012 and a second repeat survey is planned for 2014. This data will be analysed to give more accurate information on the behaviour of the cliffs in a separate report.

The surveyors note that at the South end of Sand Bay Caravan Park, numerous landslips evident and a number of caravans have been withdrawn from the front plots.

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

No changes are recommended at the present time.

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

- At Sandstell Point (Spittal A), at profile 1aBTBC04, the beach profile shows a significant change, with a drop in beach levels at the toe of the rock revetment in the order of 2m. The amount of change reduces in a seaward direction. The height of the beach may be integral to the integrity of the stability of the toe of the rock revetment. The structure should be assessed regularly for a further fall in beach levels and to identify if any trigger levels have been met.
- Elsewhere along Sandstell Point, the recorded profiles and topographic survey present no causes for concern.
- At Spittal (Spittal B), the recorded profiles present no causes for concern.
- At Goswick Sands, the recorded profiles present no causes for concern.
- At Holy Island, the recorded profiles present no causes for concern.
- At Beadnell Village, the recorded profiles present no causes for concern.
- At Beadnell Bay, the survey report notes that for profile 1aBTBC33 '*gap in data due to dense vegetation*'. This could impact on the accuracy of subsequent survey interpretation or volume calculations for this profile
- Elsewhere along Beadnell Bay, the recorded profiles present no causes for concern.
- At Boulmer, the recorded profiles present no causes for concern.
- At Alnmouth Bay, the concrete blocks have become exposed, but the changes are within the bounds of previous changes, so it is likely that in time, they will again be covered. A result of ongoing seasonal changes.
- Elsewhere along Alnmouth Bay, the recorded profiles and topographic survey present no causes for concern.
- At High Hauxley & Druridge Bay, the recorded profiles present no causes for concern.
- At Lynemouth Bay, opposite the Power Station (profile 1aCMBC03B), the slag bank and beach have been eroded significantly. It is possible that further mechanical re-grading of the slag tip profile has occurred between the present and previous Full Measures survey and could explain the observed erosion.
- Elsewhere along Lynemouth Bay, the recorded profiles and cliff top survey present no causes for concern.
- At Newbiggin-by-the-Sea, the beach has fluctuated quite considerably, with the accretion of the upper beach and erosion of the lower beach. This is an opposite trend to beach behaviour observed for the beaches in Northumberland and probably reflects beach management through re-profiling undertaken in autumns of 2011 and 2012. As in the previous Partial Measures report (spring 2011) and Full Measures report (autumn, 2012), it is anticipated that ongoing maintenance associated with the capital recharge scheme will again be required.

- Elsewhere along Newbiggin Bay, the recorded profiles and the sand extent survey present no causes for concern.
- At Cambois, the cliff top survey shows that at point 17 (opposite Cambois), erosion is recorded to have been 10m, but given the extent, it is thought that something different has been measured.
- Elsewhere along Cambois, the recorded profiles present no causes for concern.
- At Blyth South Beach, the recorded profiles present no causes for concern.

## **Appendices**

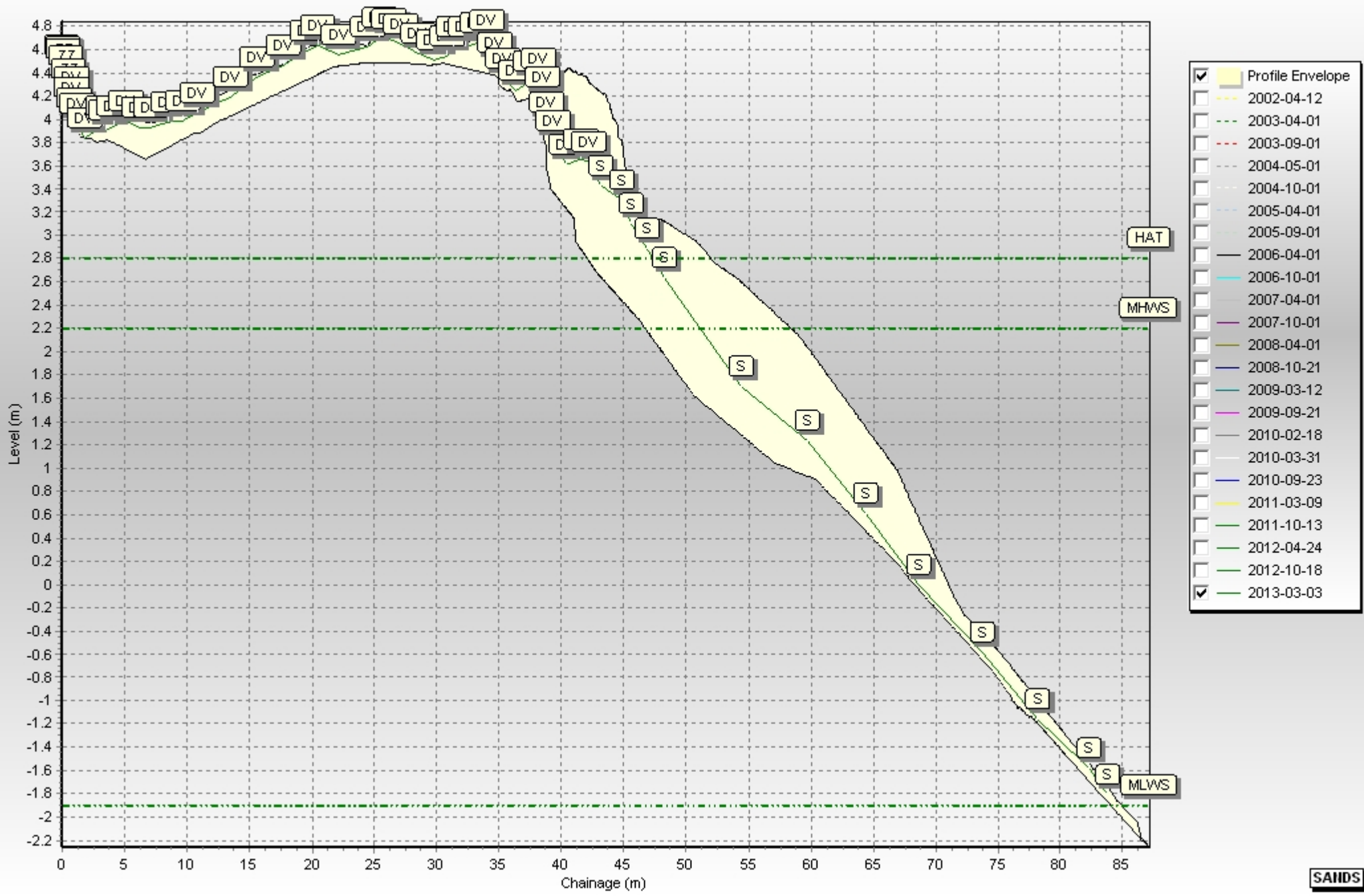
**Appendix A**  
**Beach Profiles**



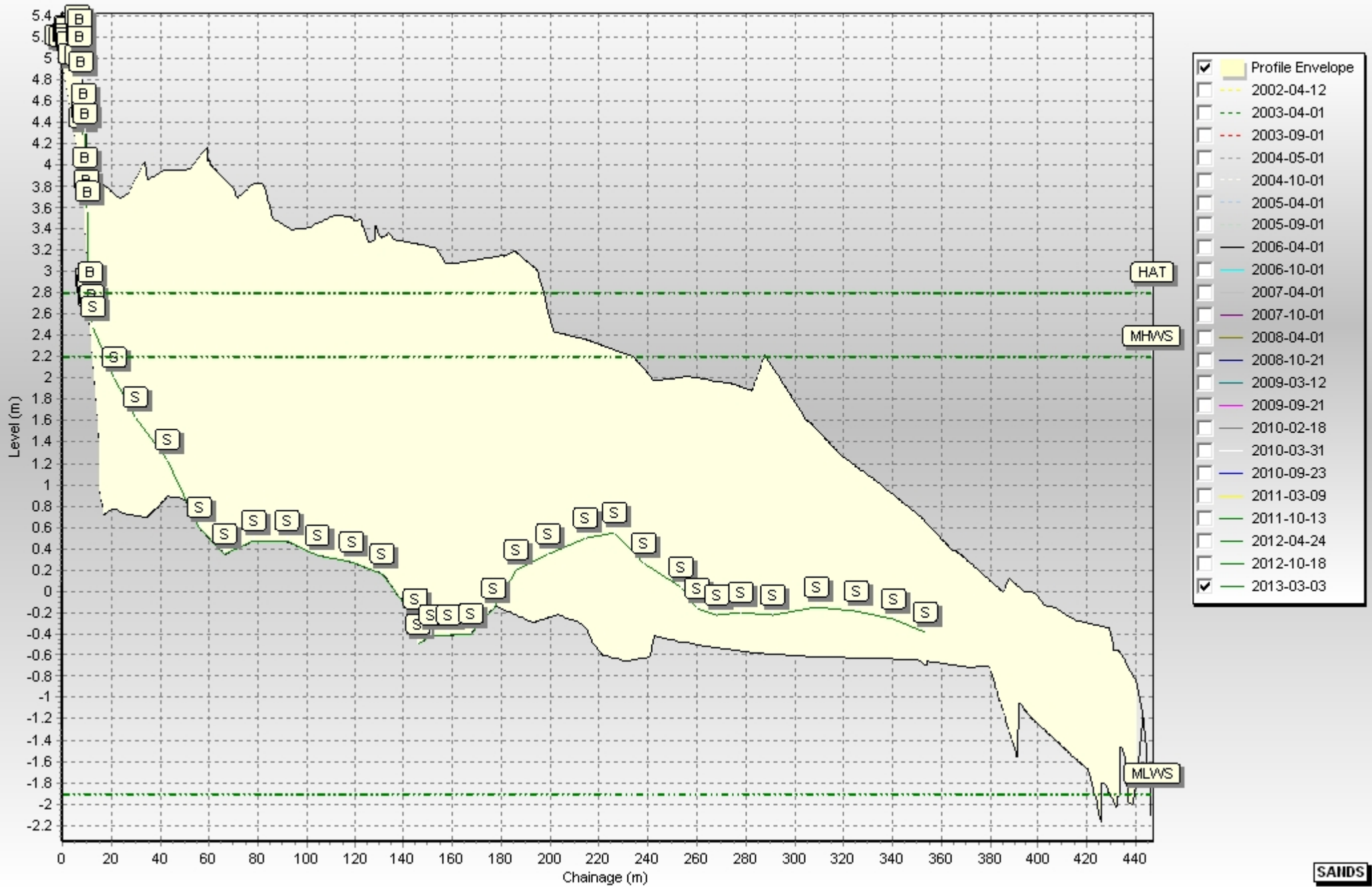
The following sediment feature codes are used on some profile plots:

<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

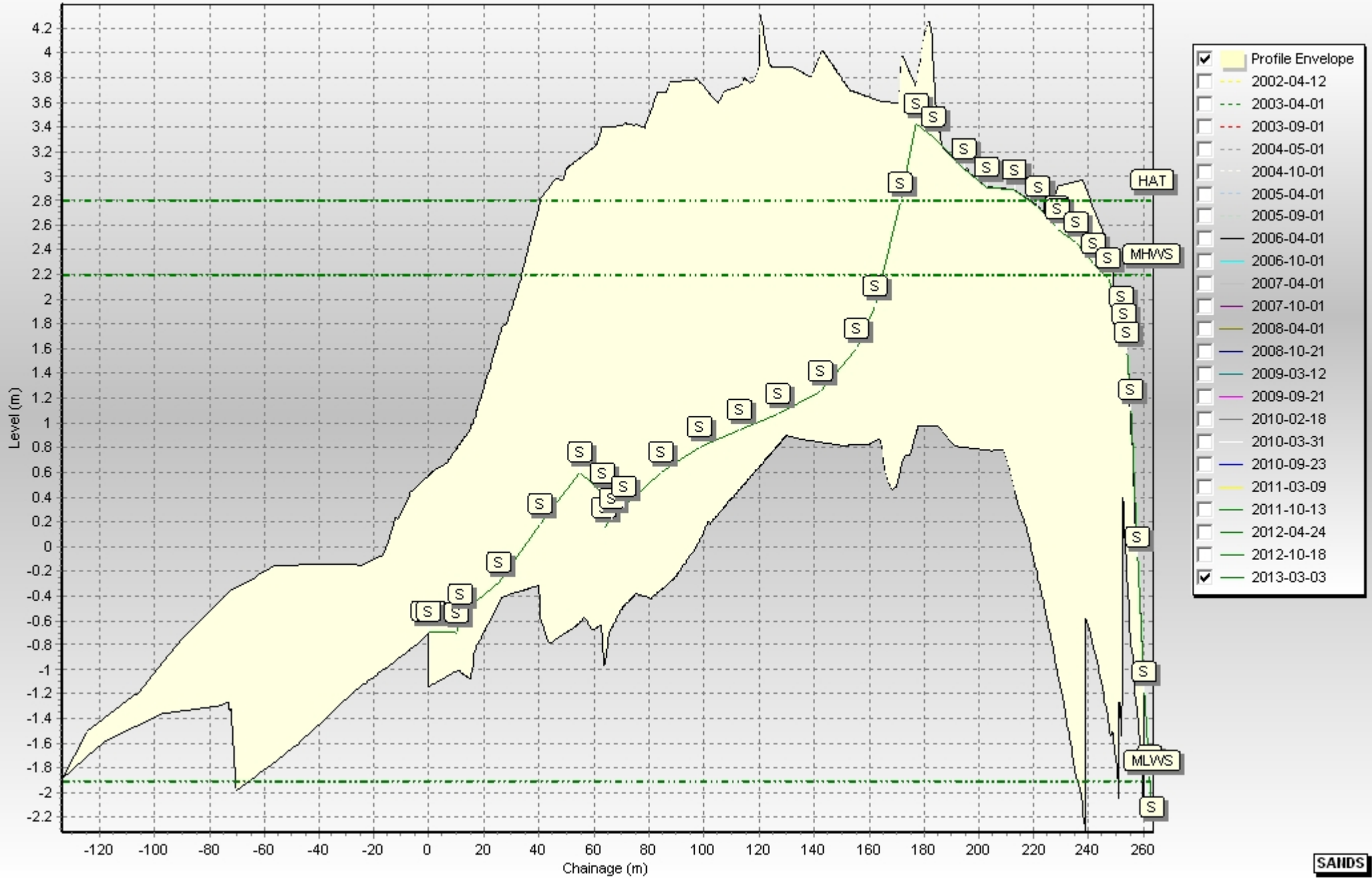
Profiles: 1aBTBC02



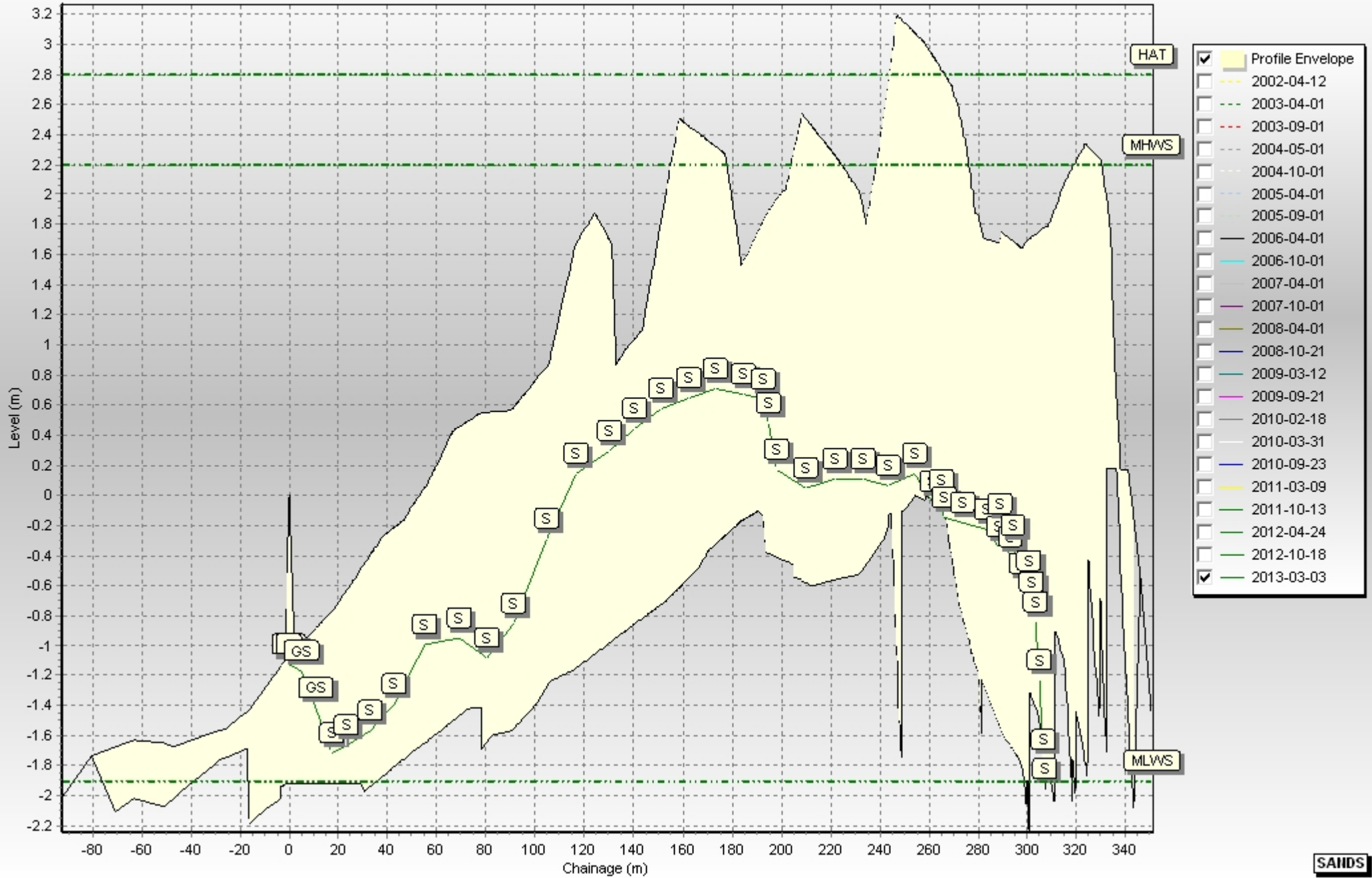
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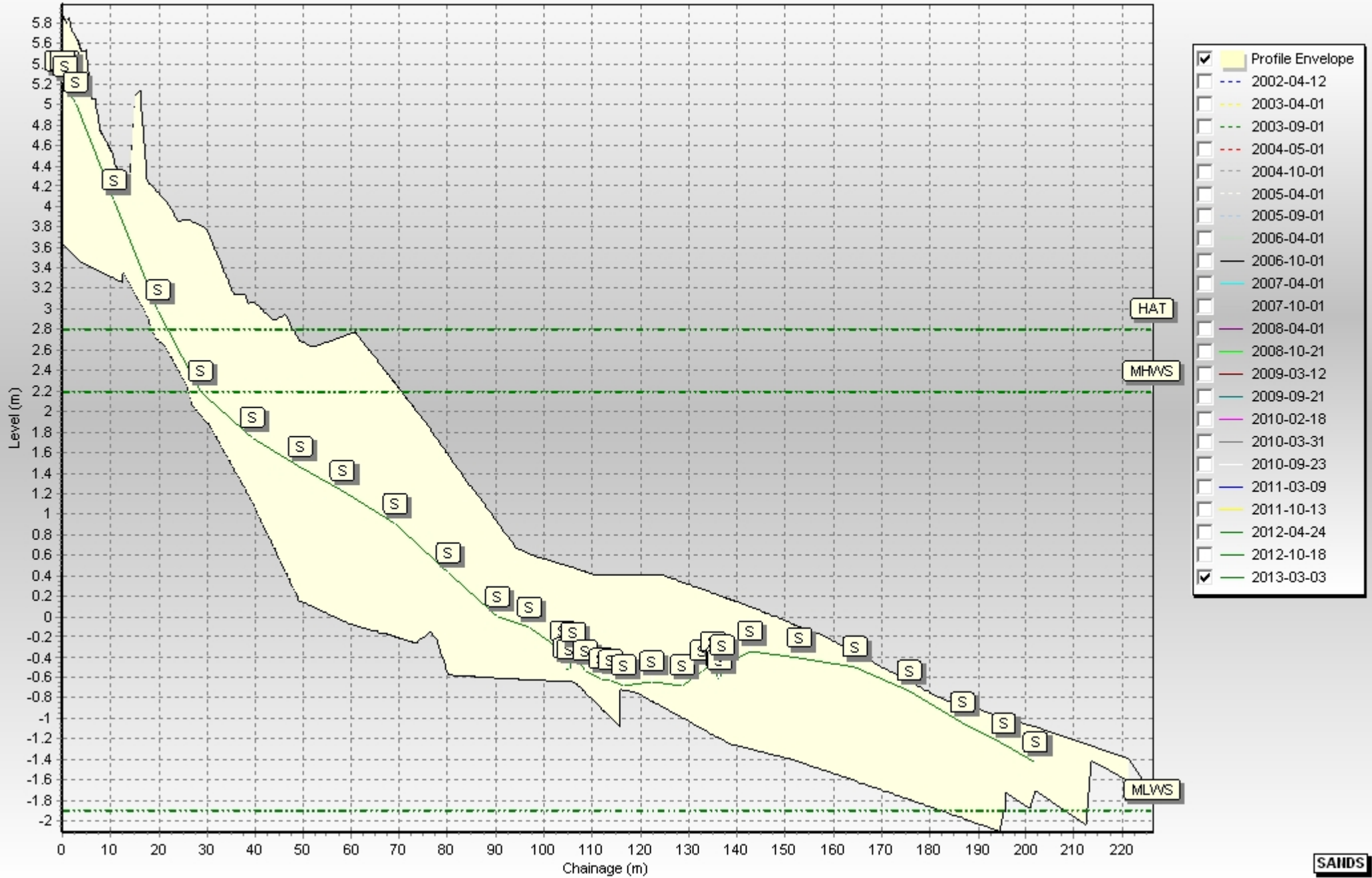
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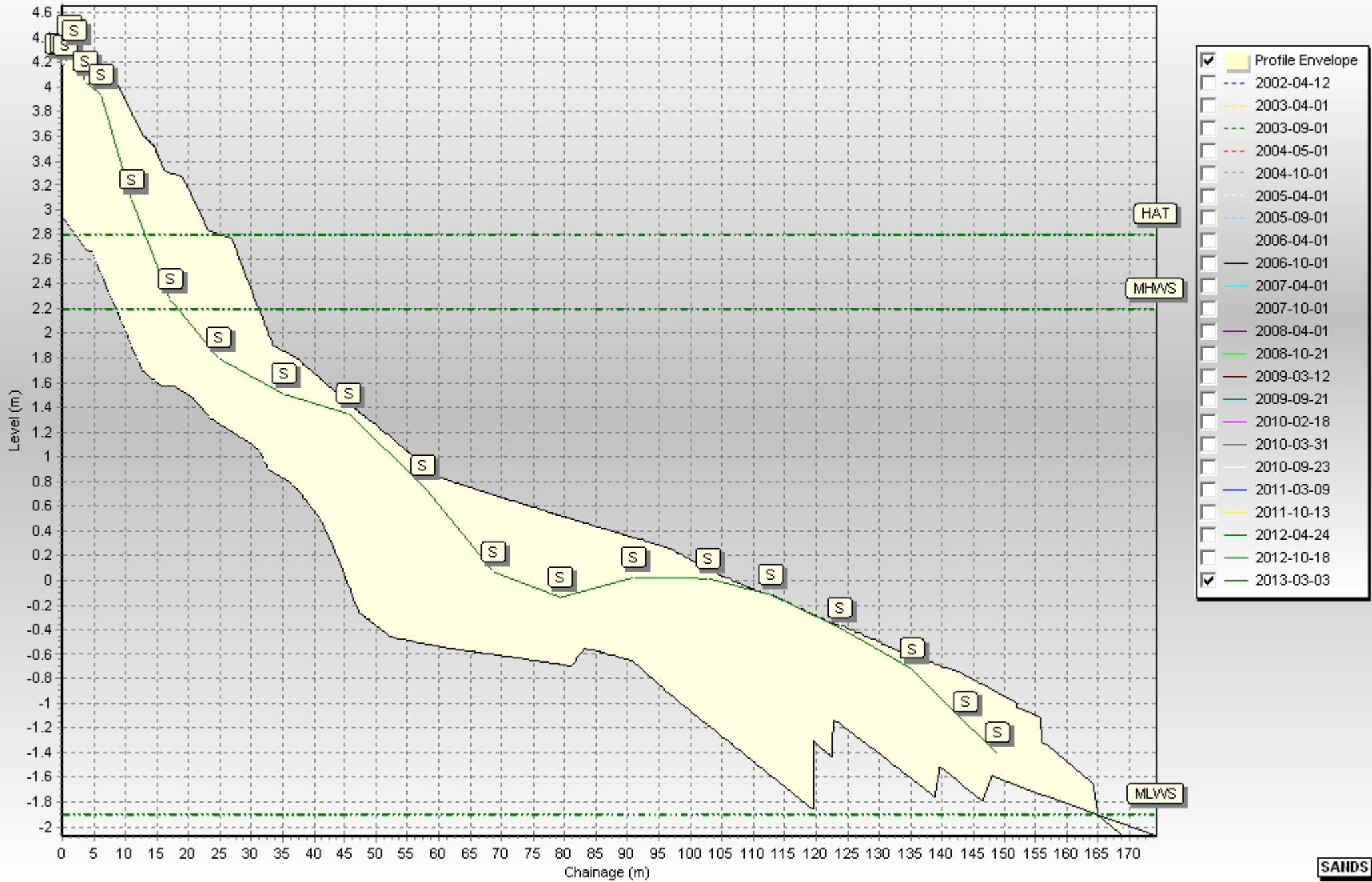
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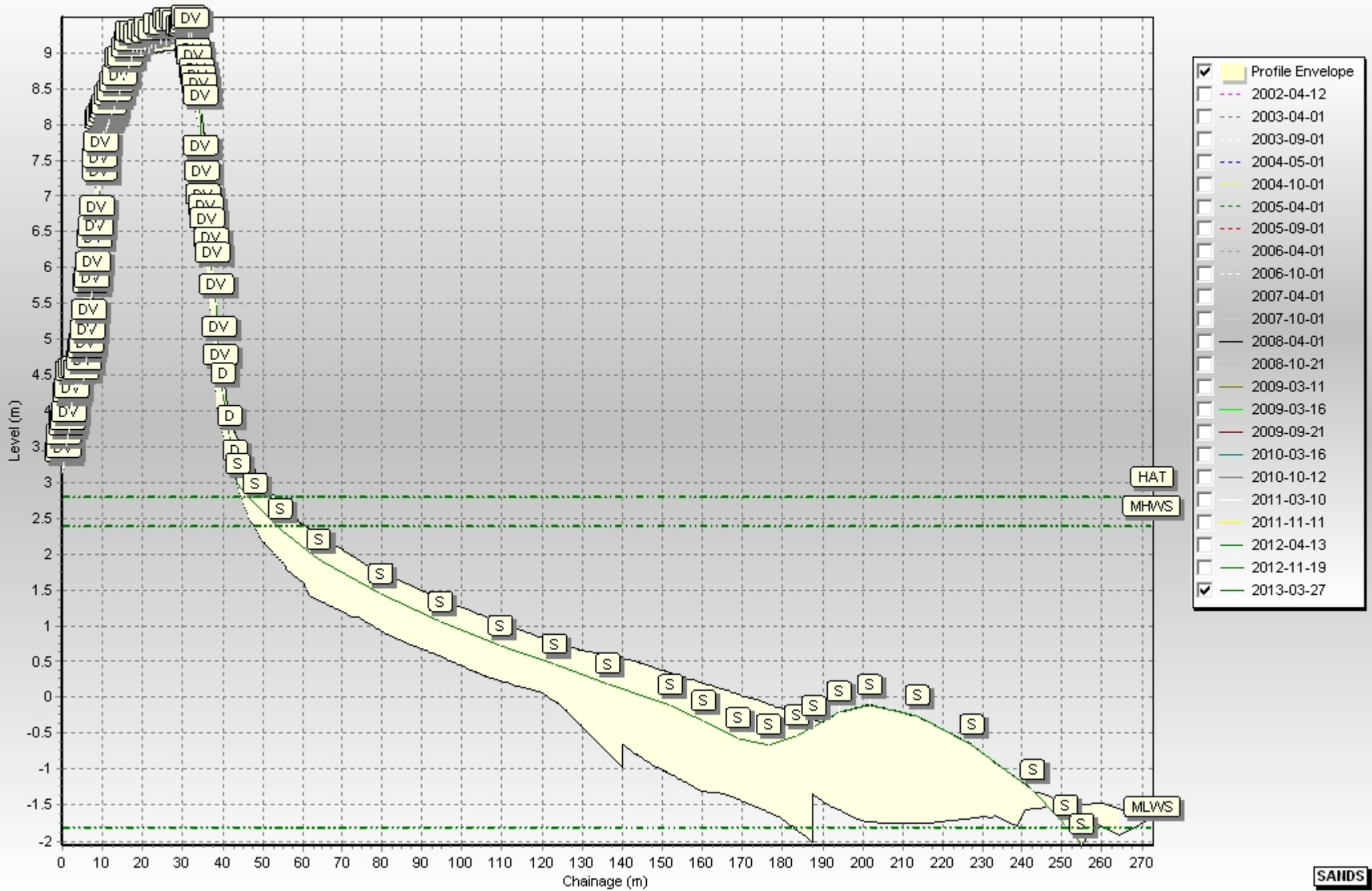
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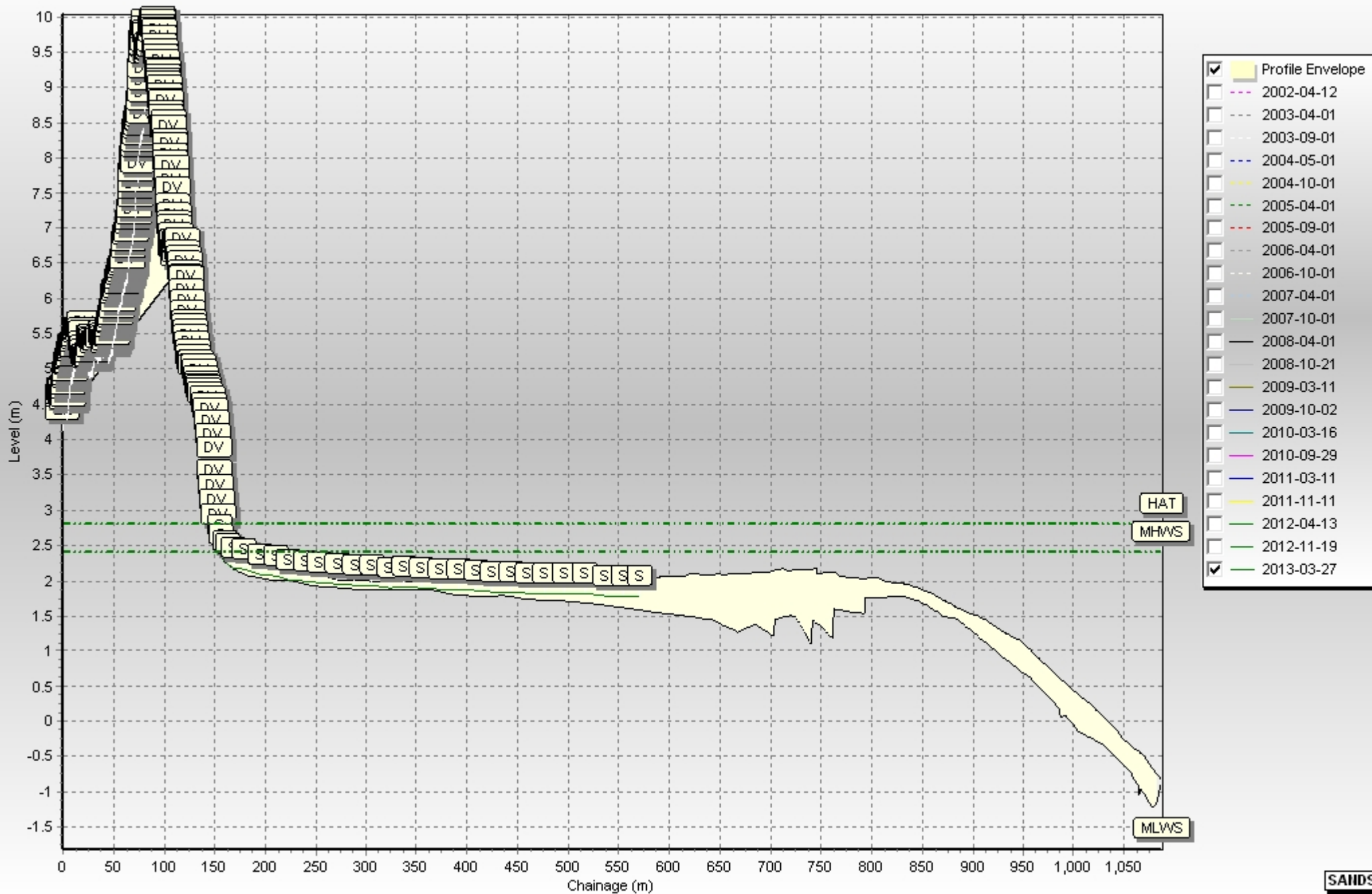


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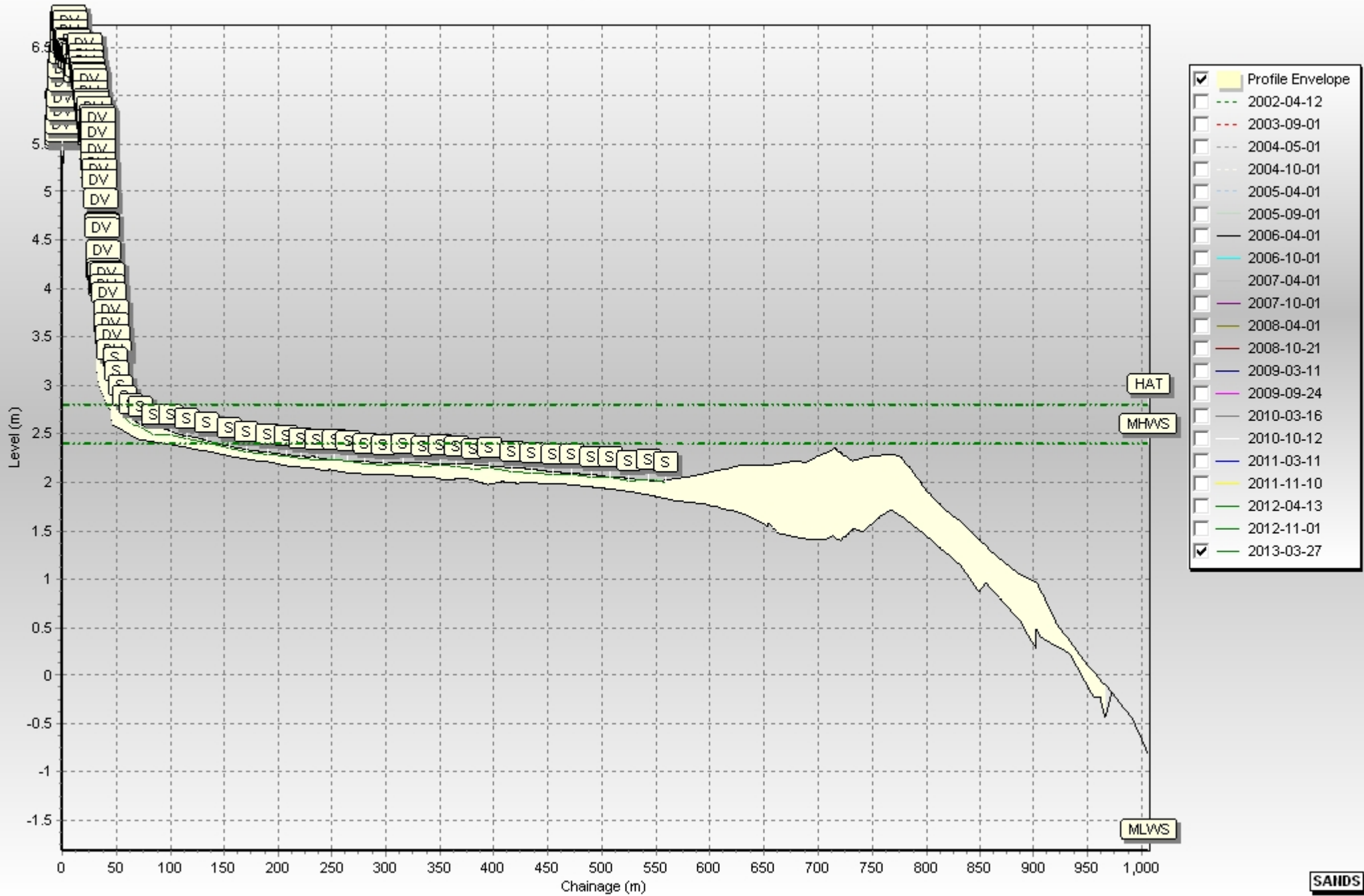




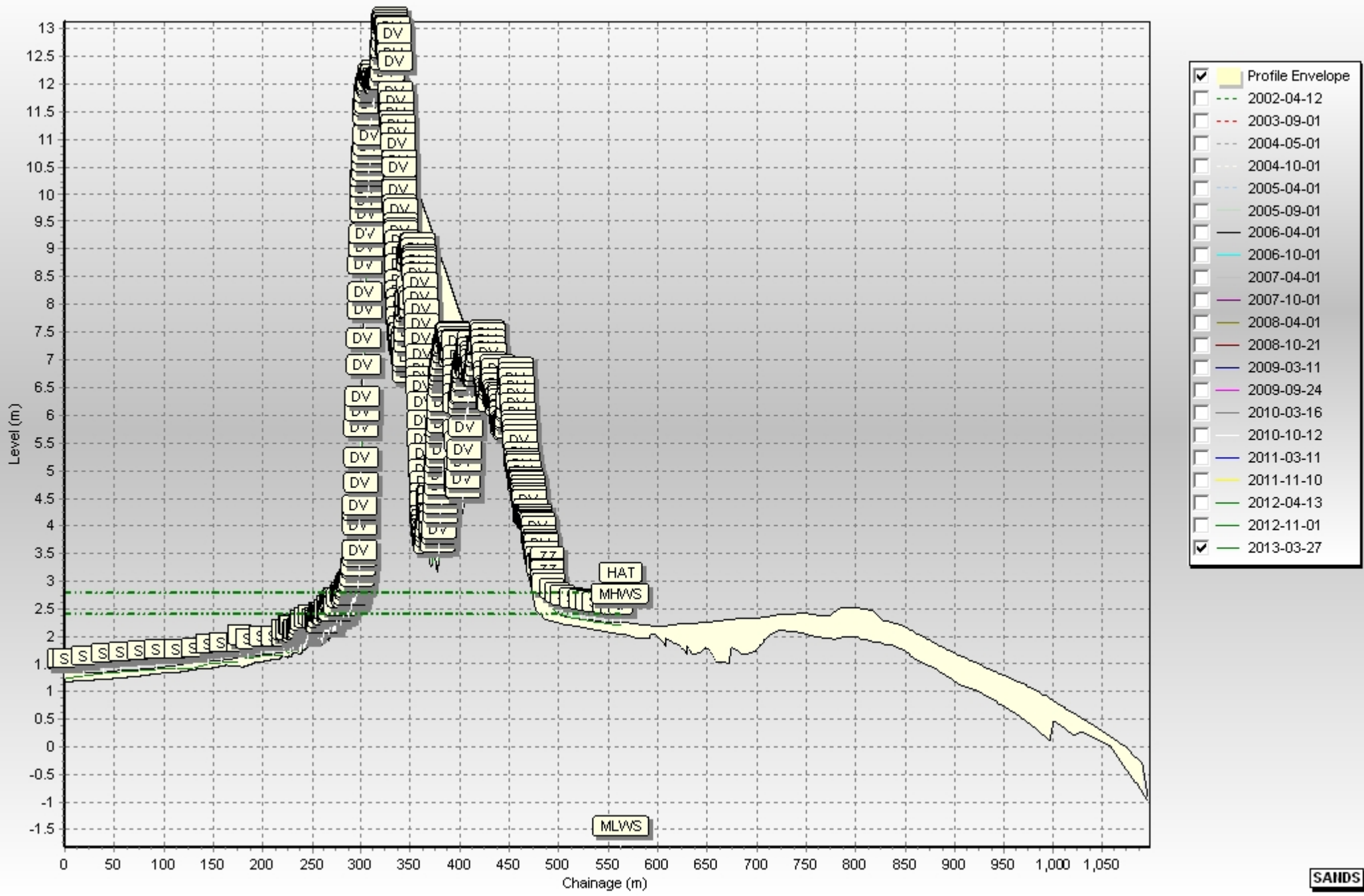
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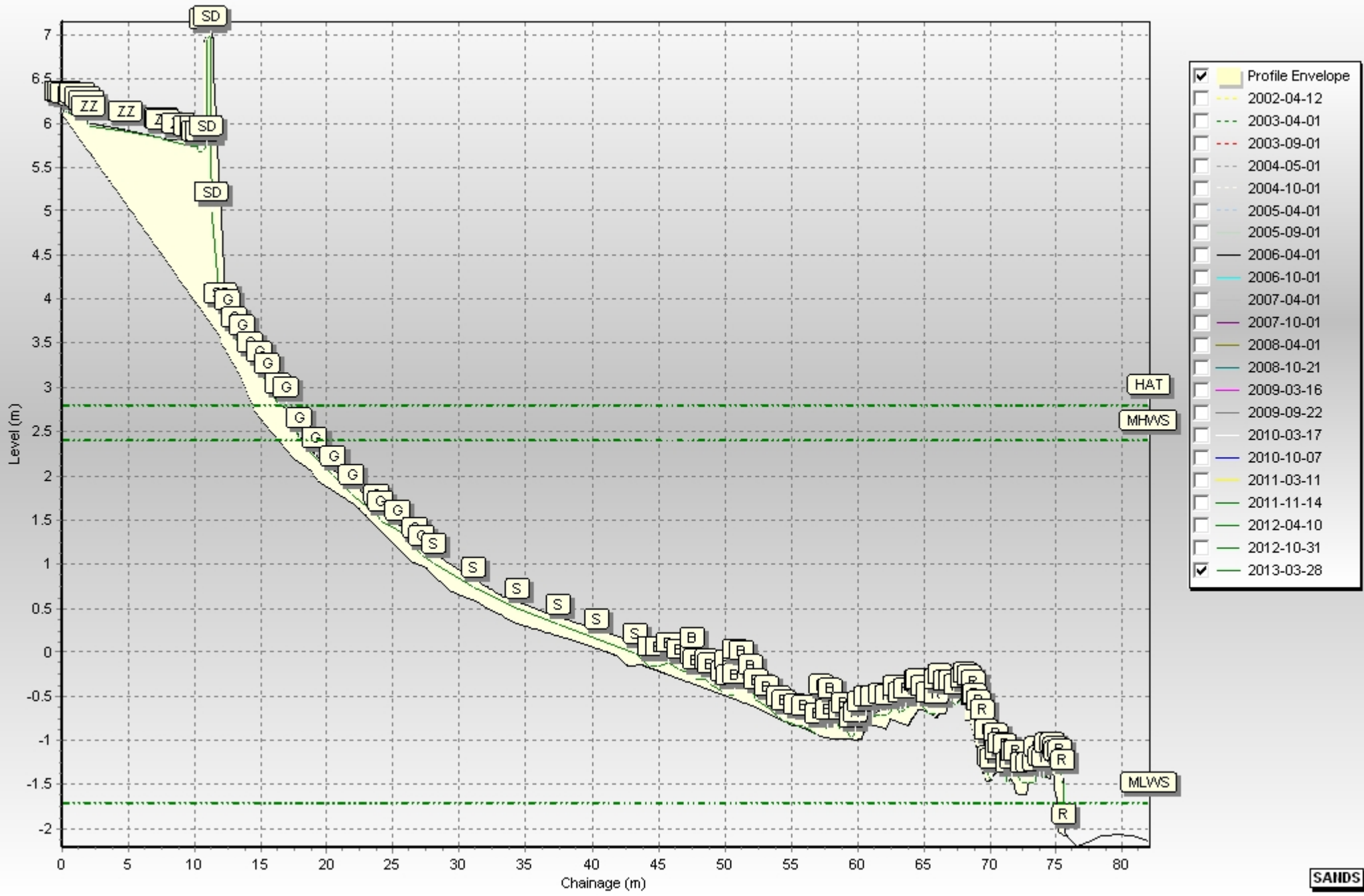
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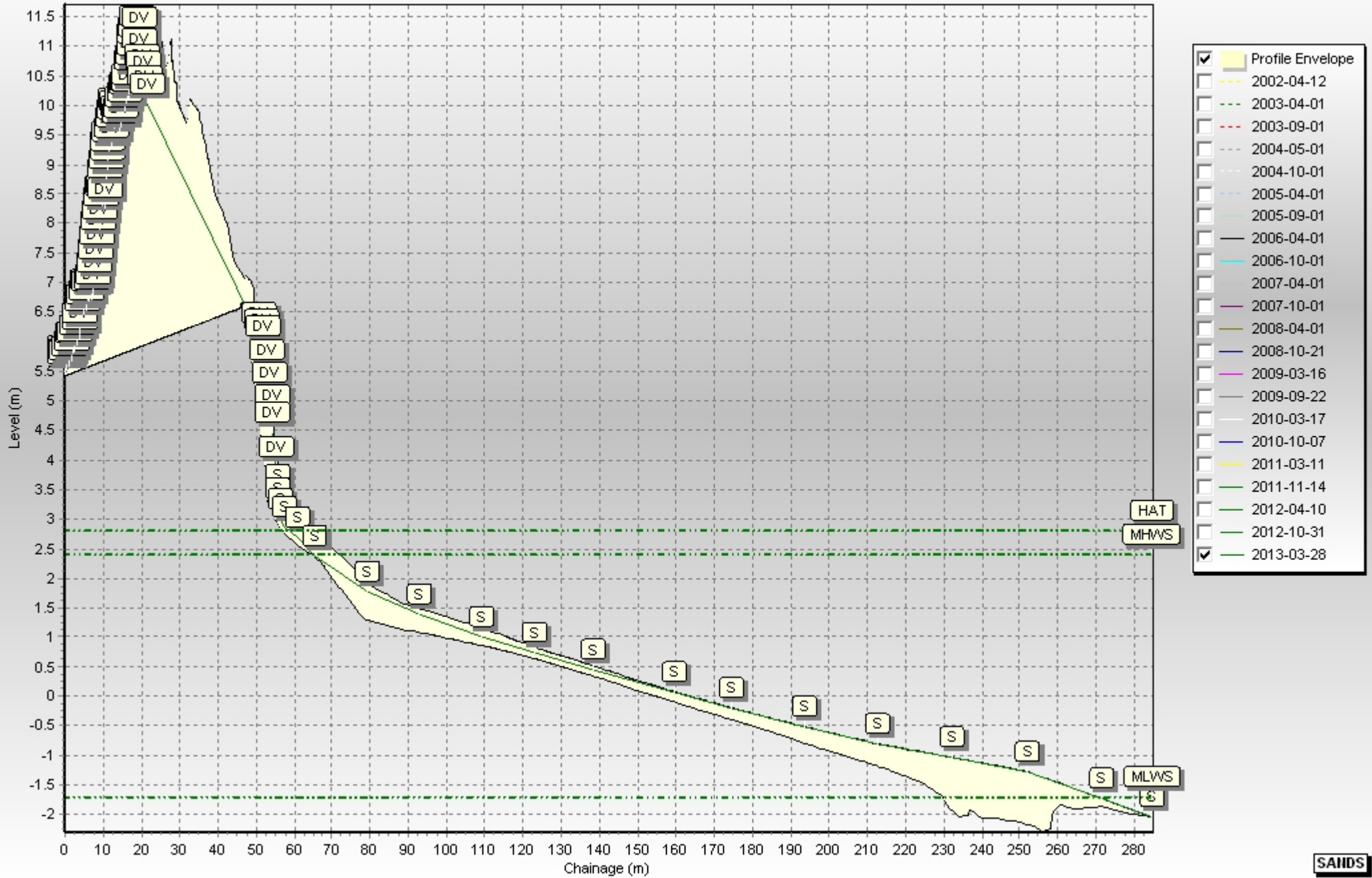
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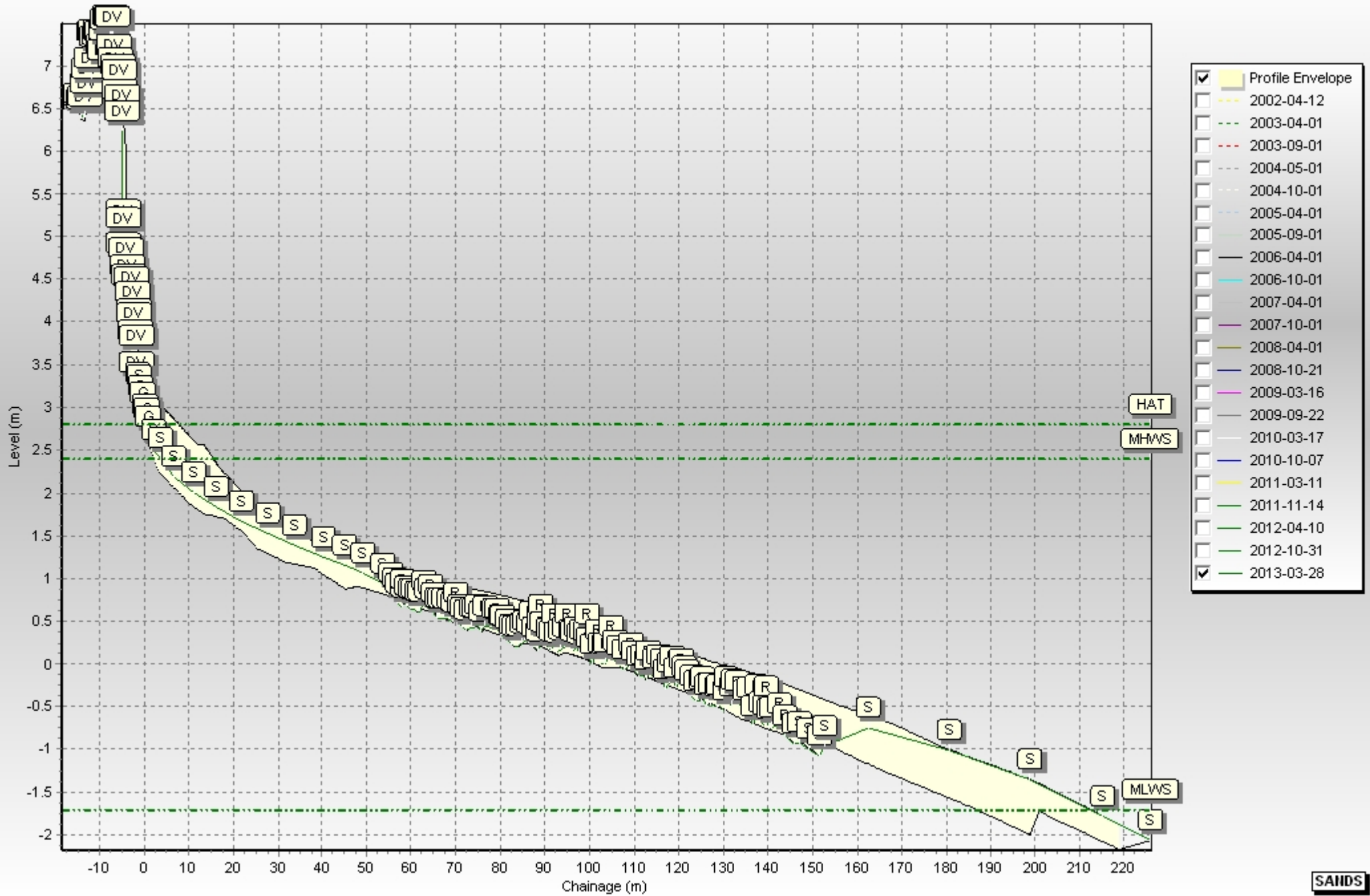
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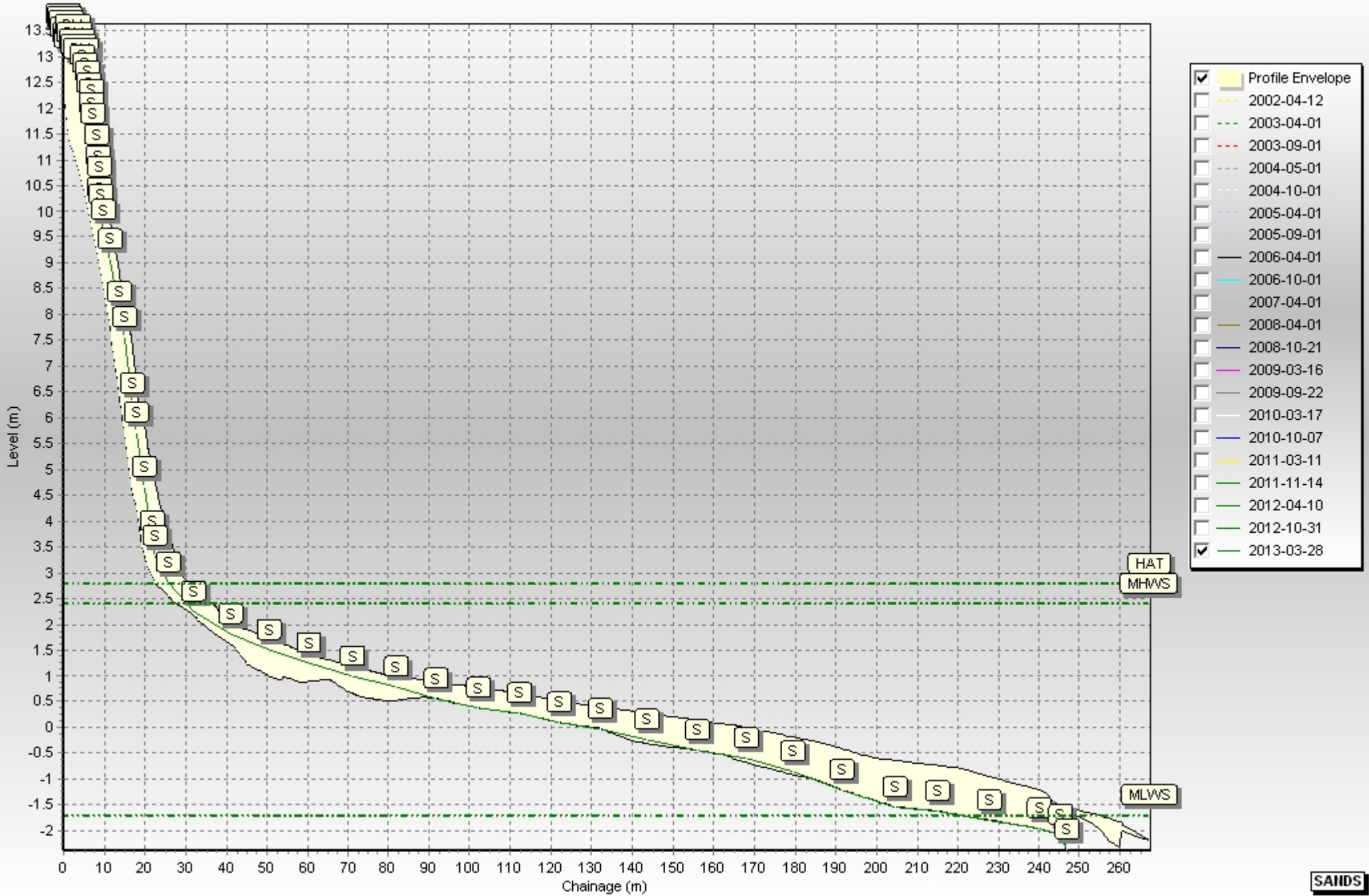
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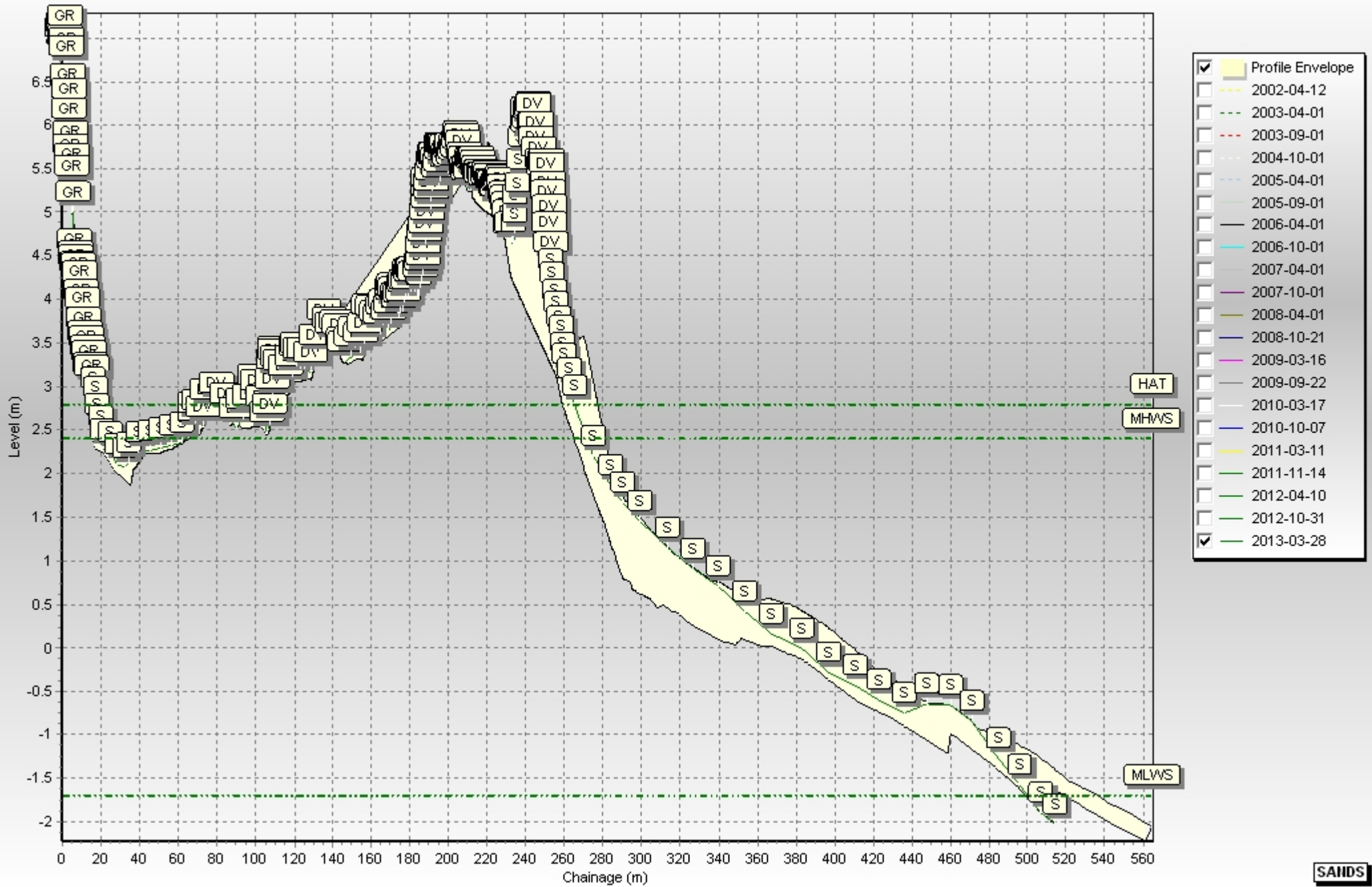
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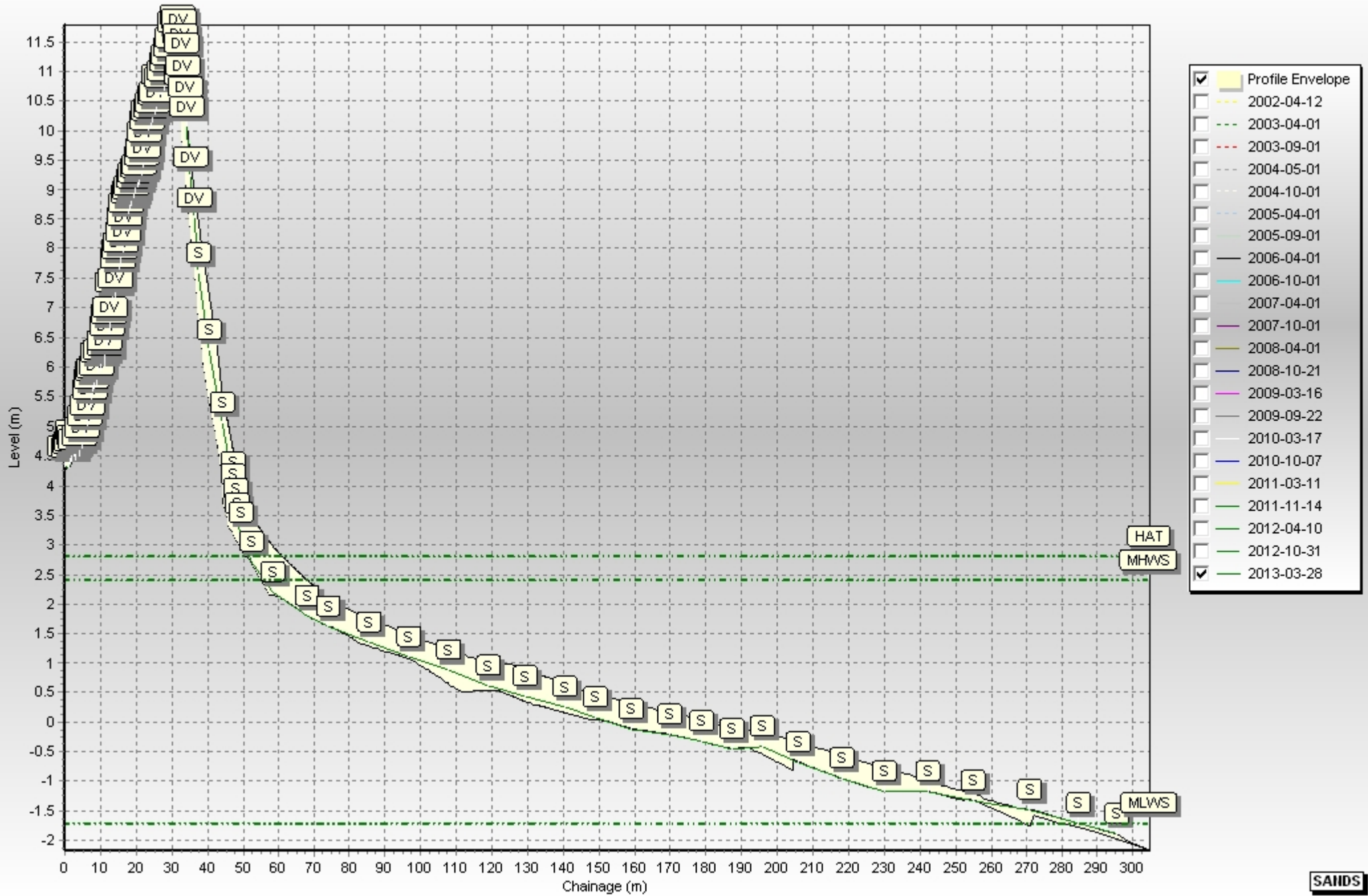


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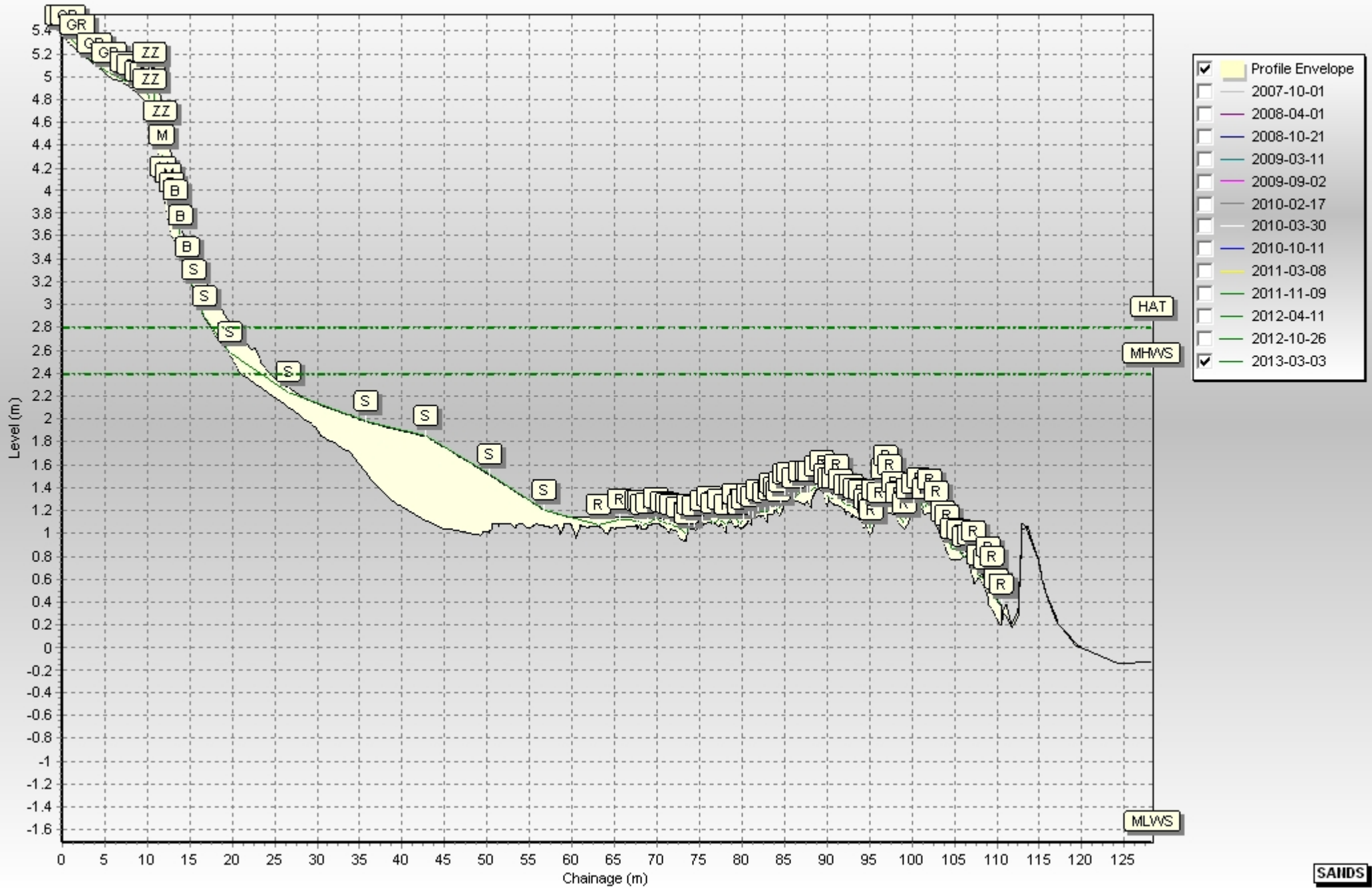




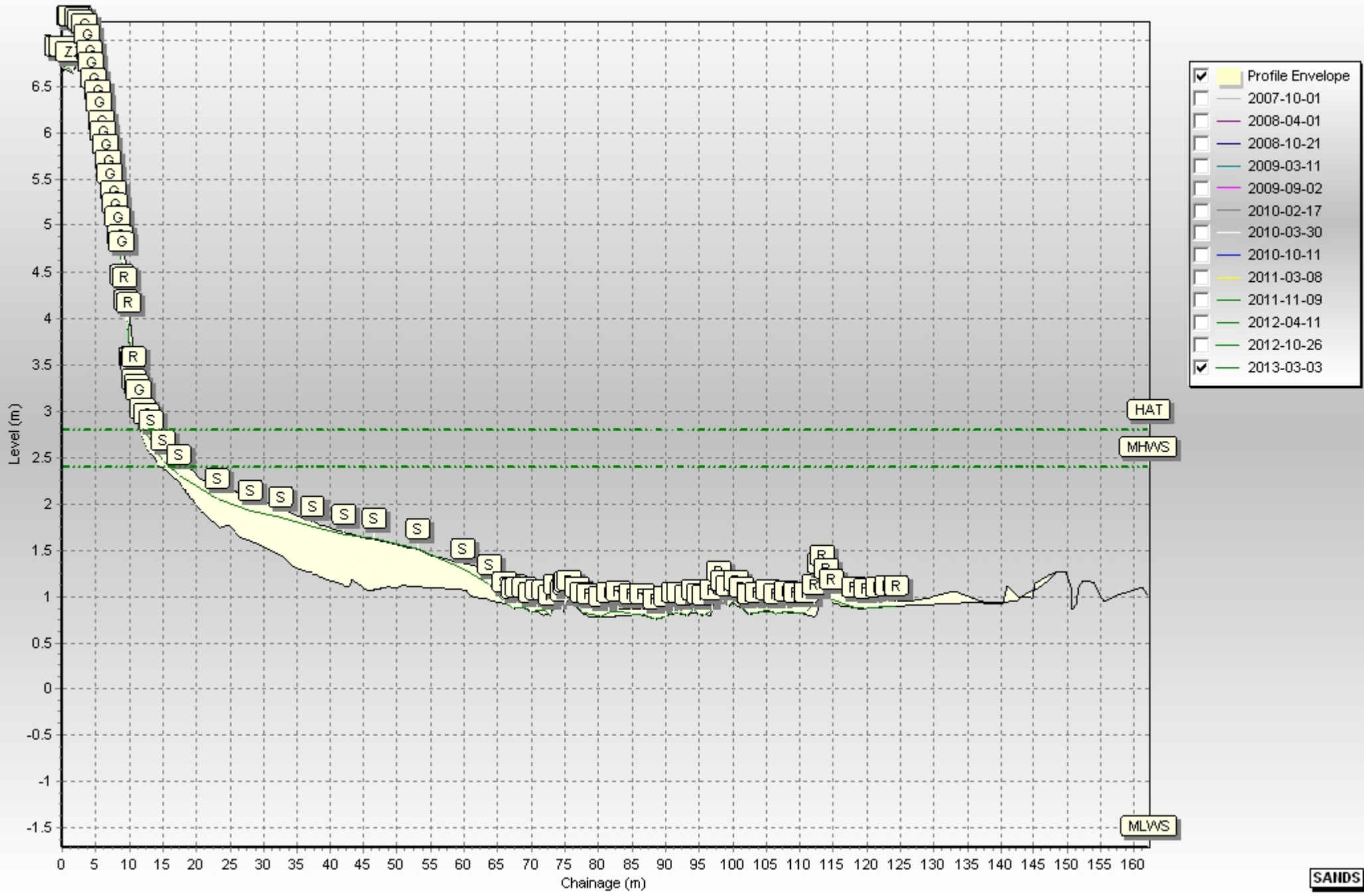
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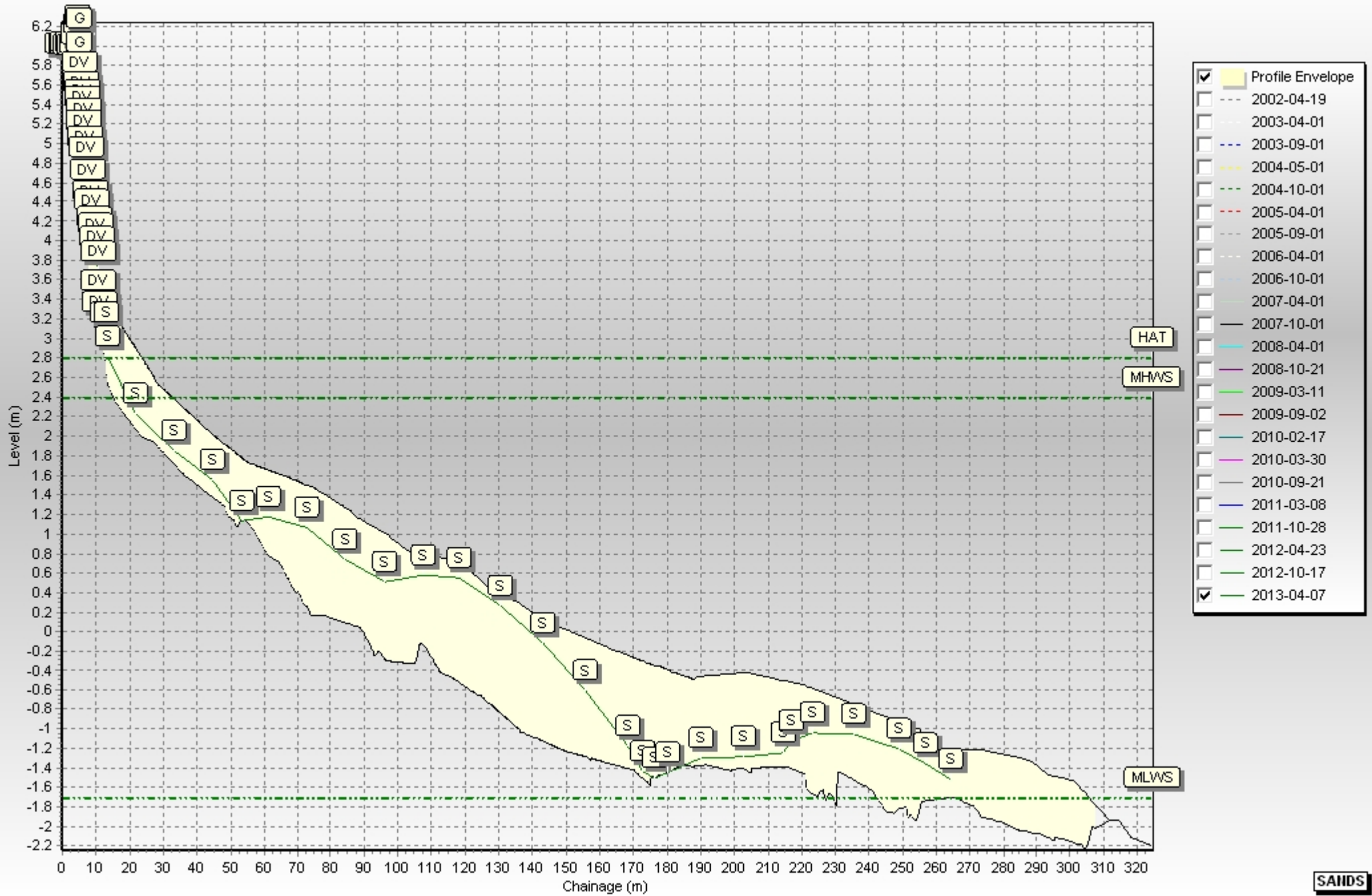
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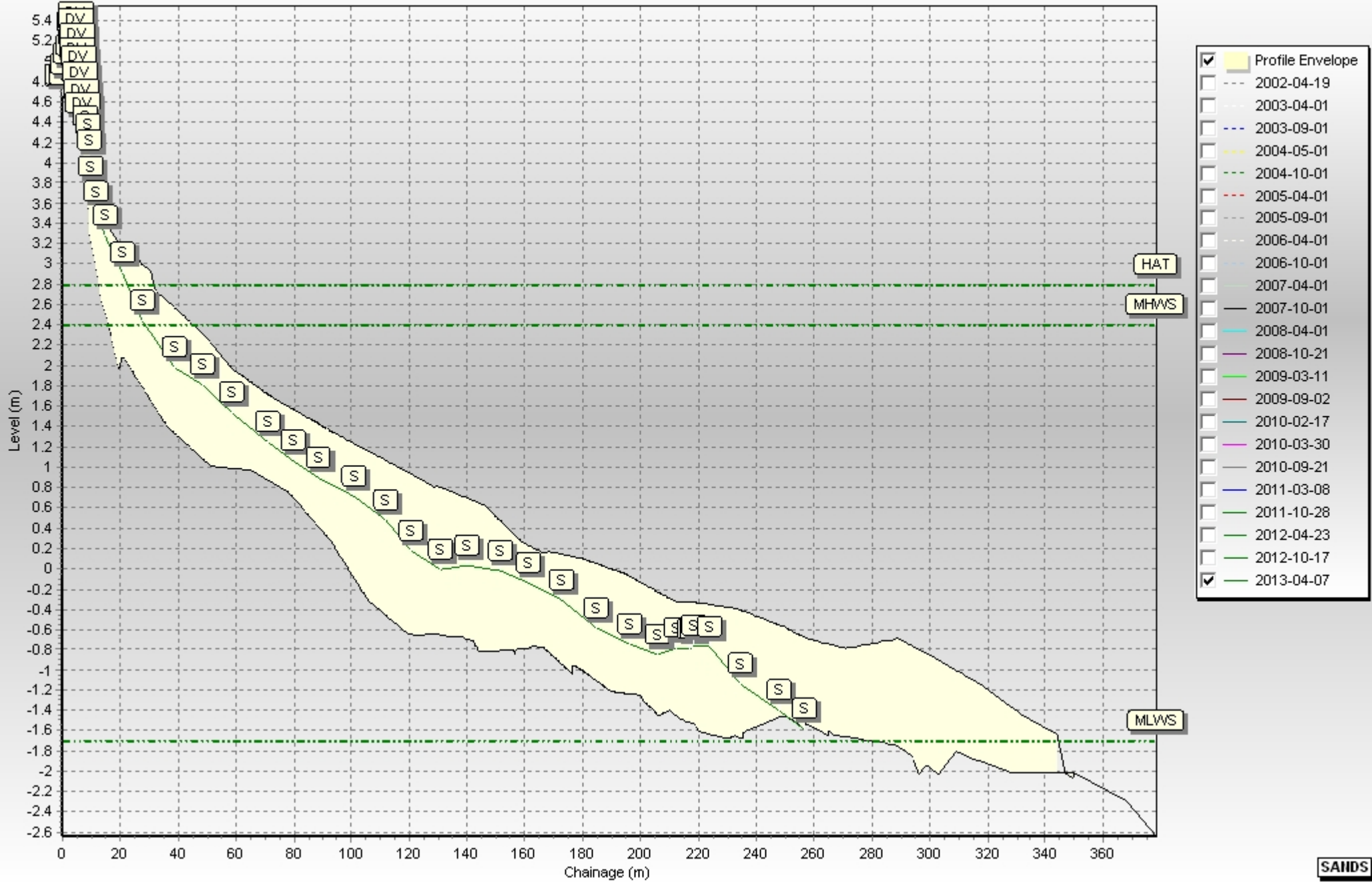
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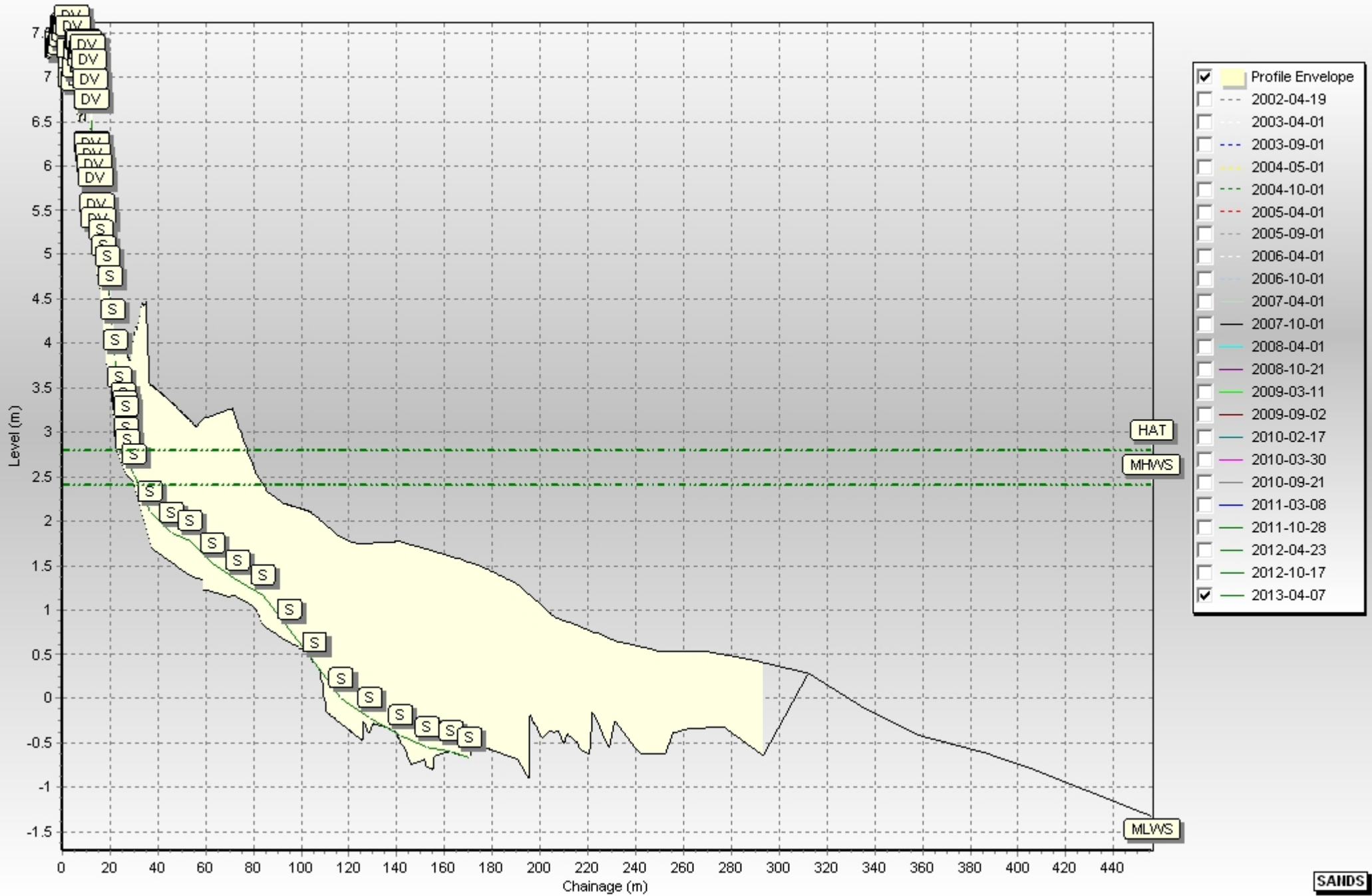
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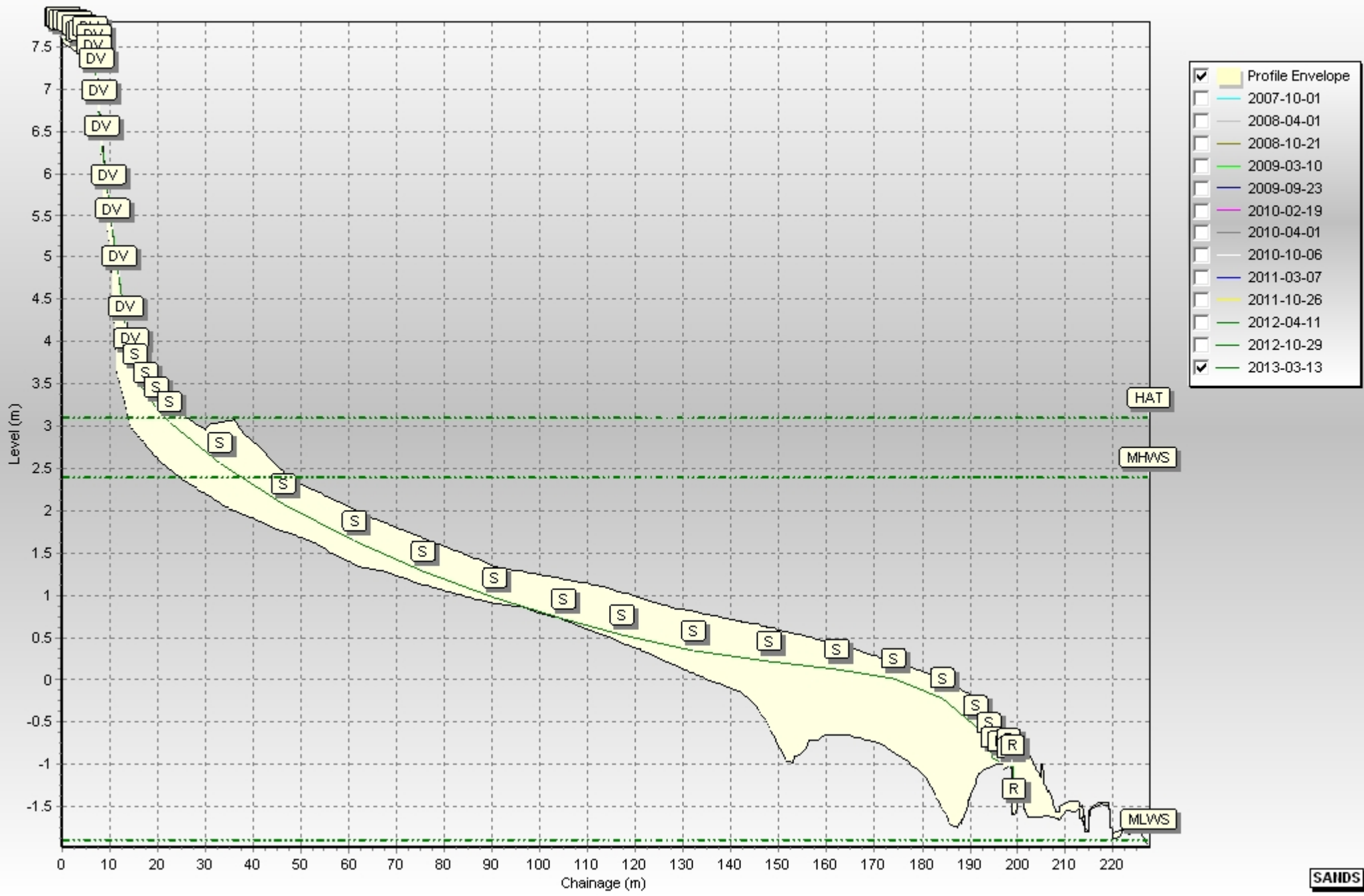
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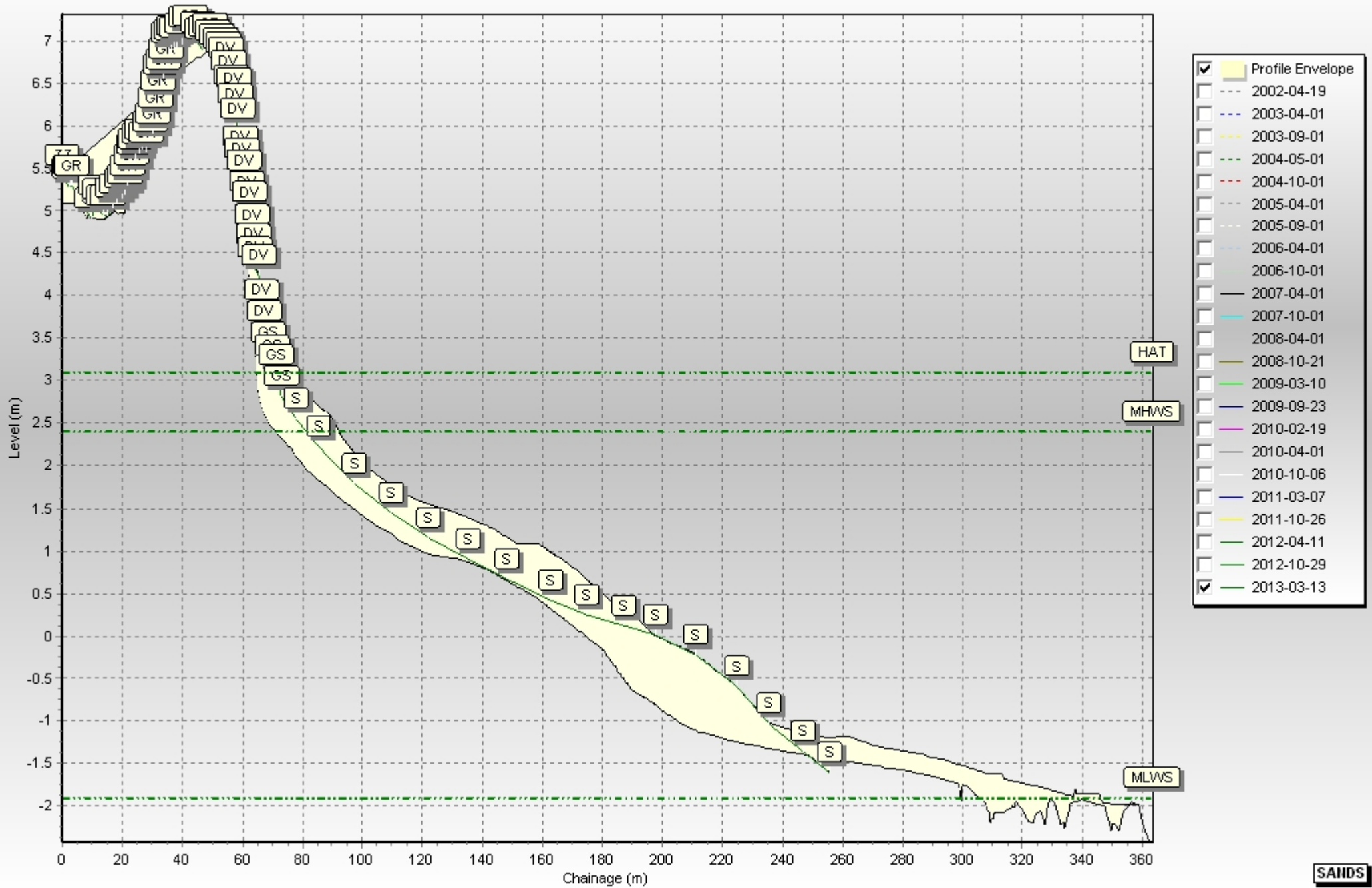
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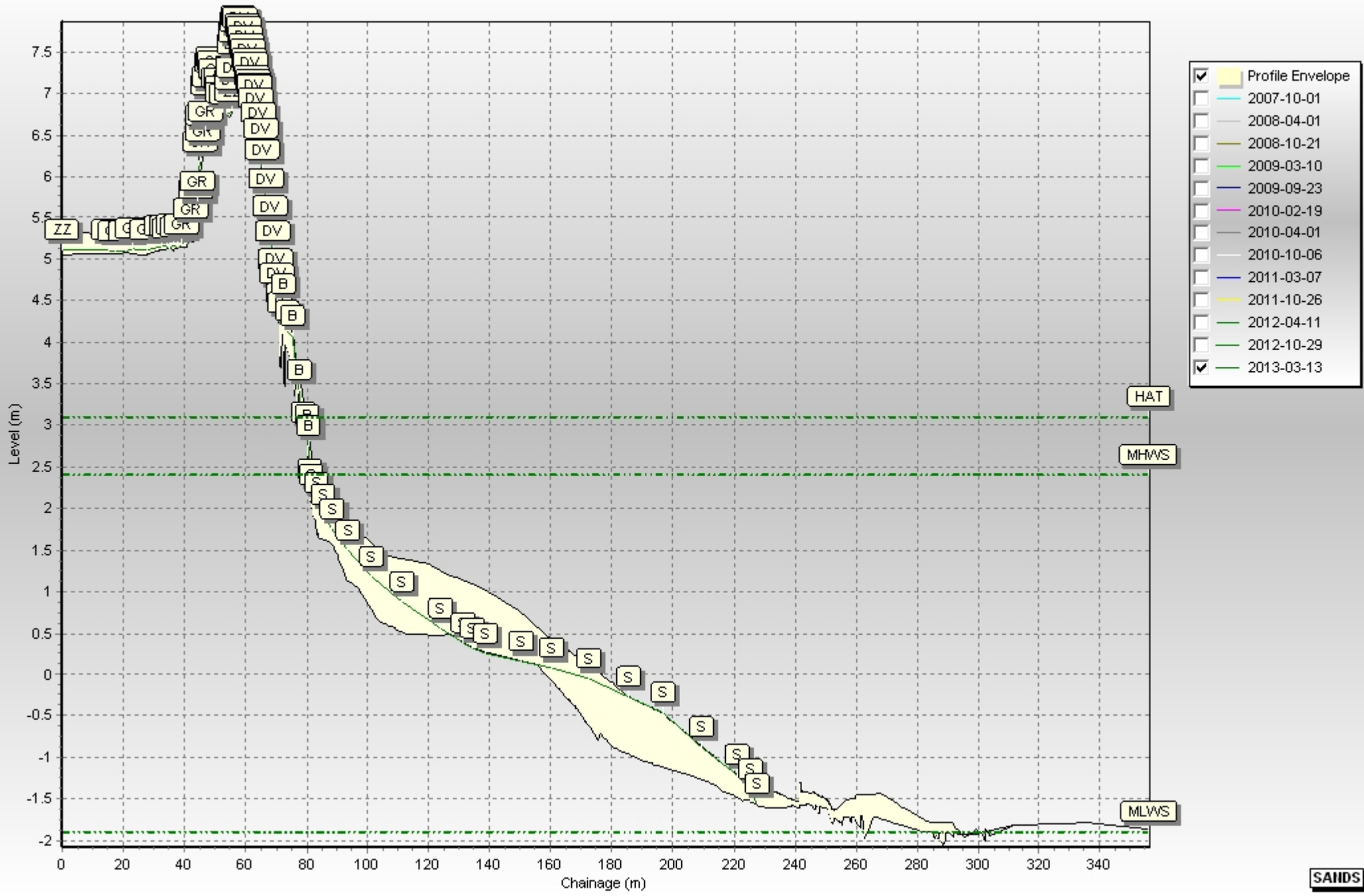


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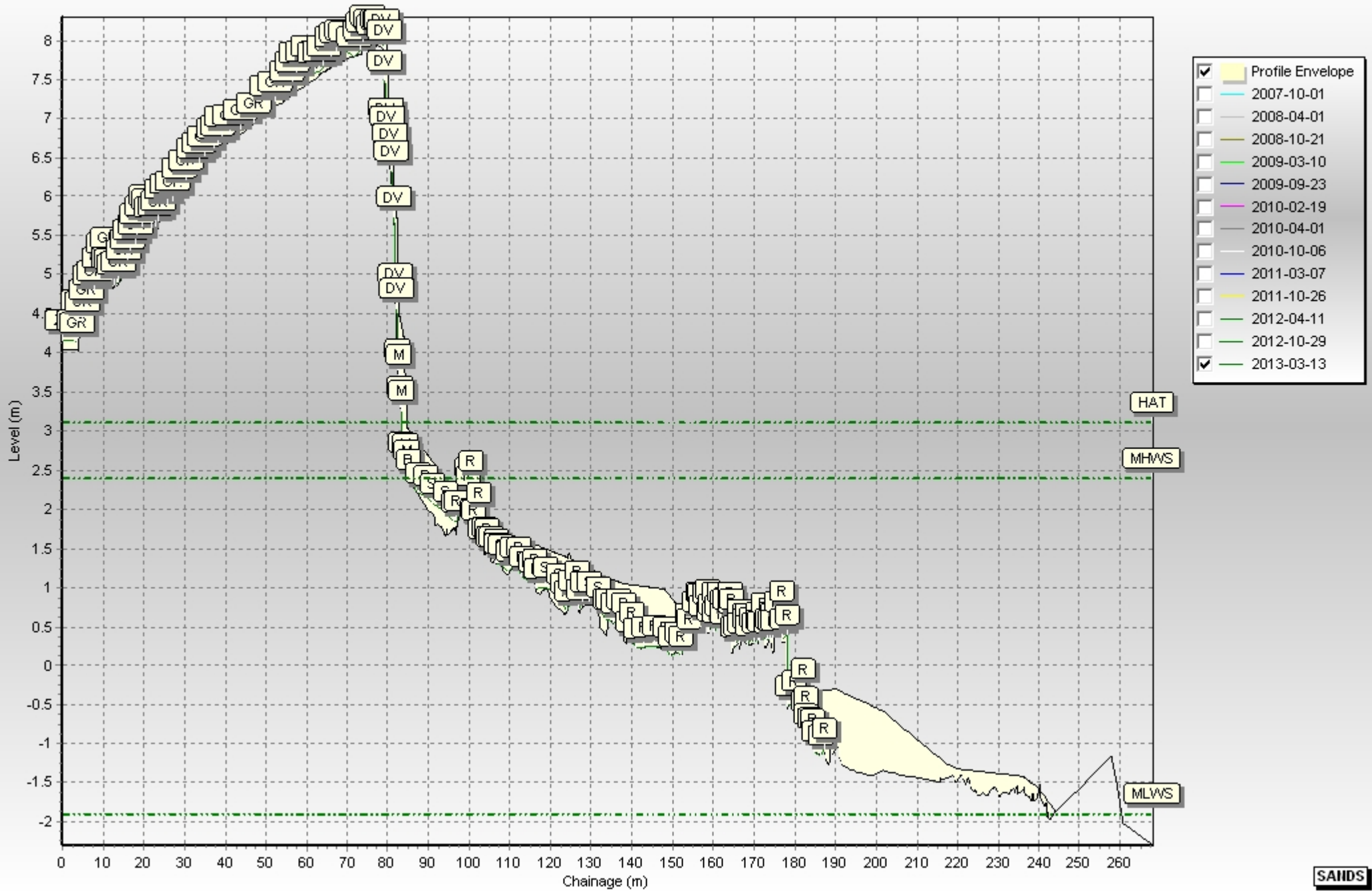




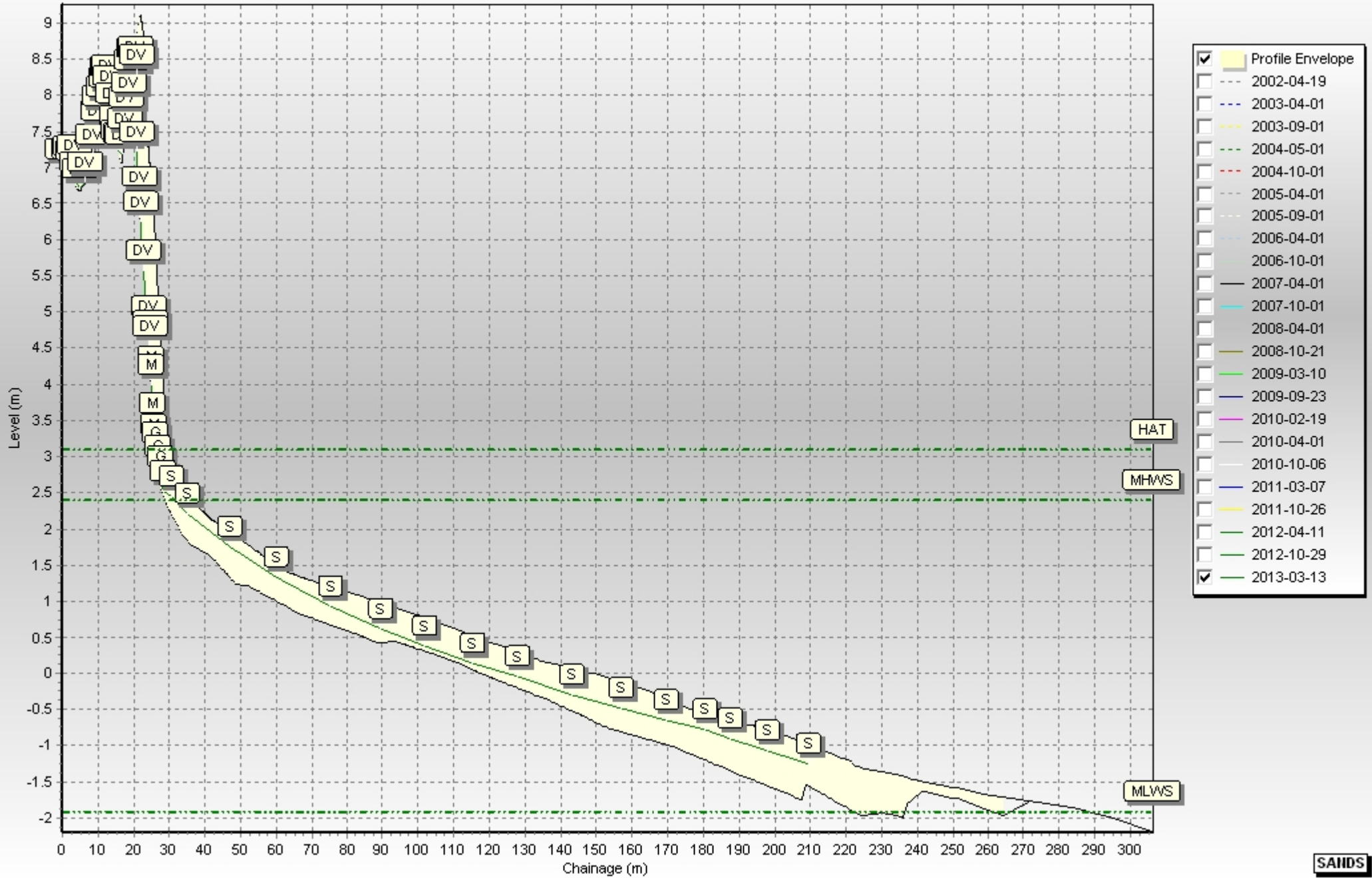
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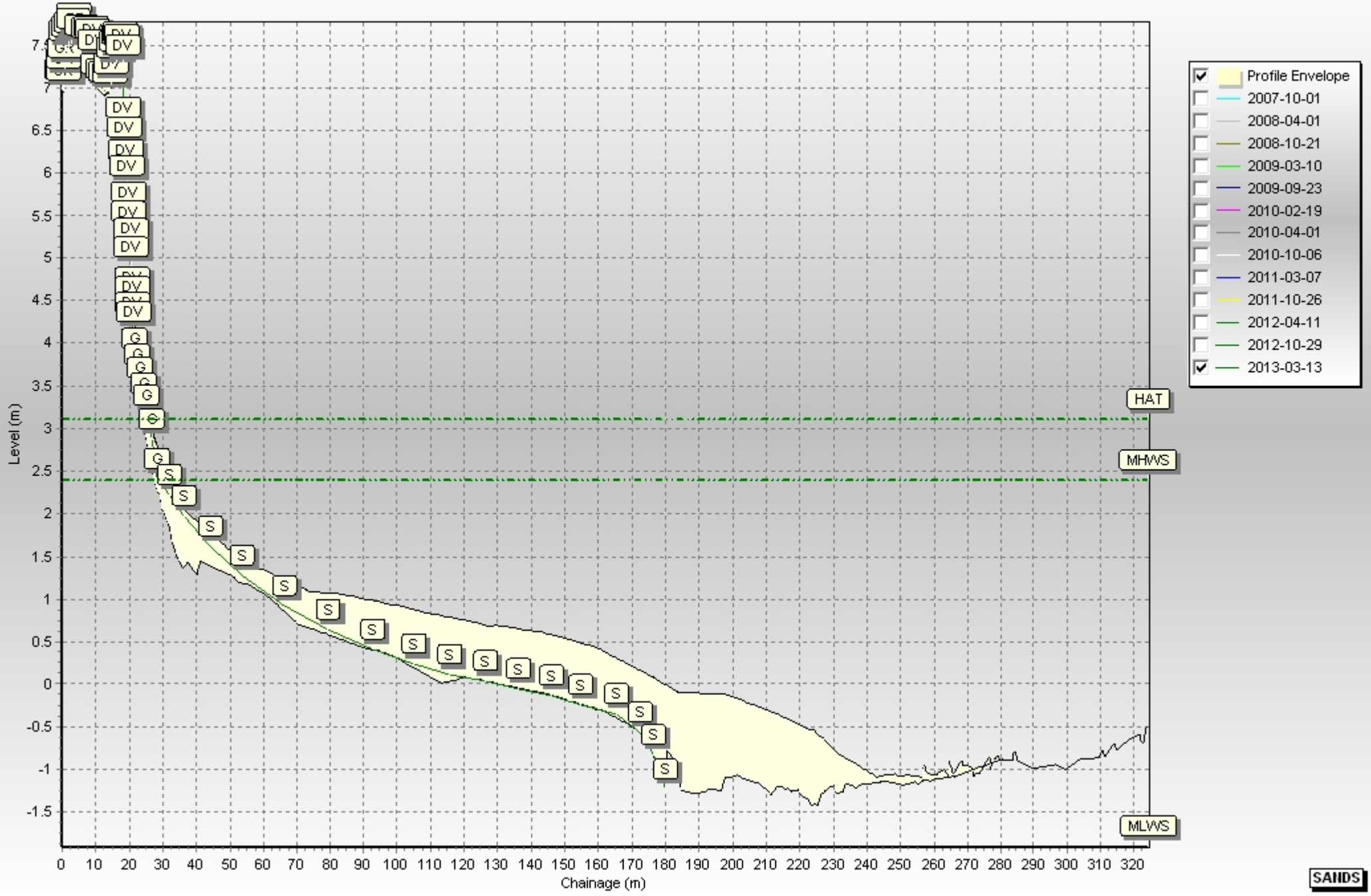
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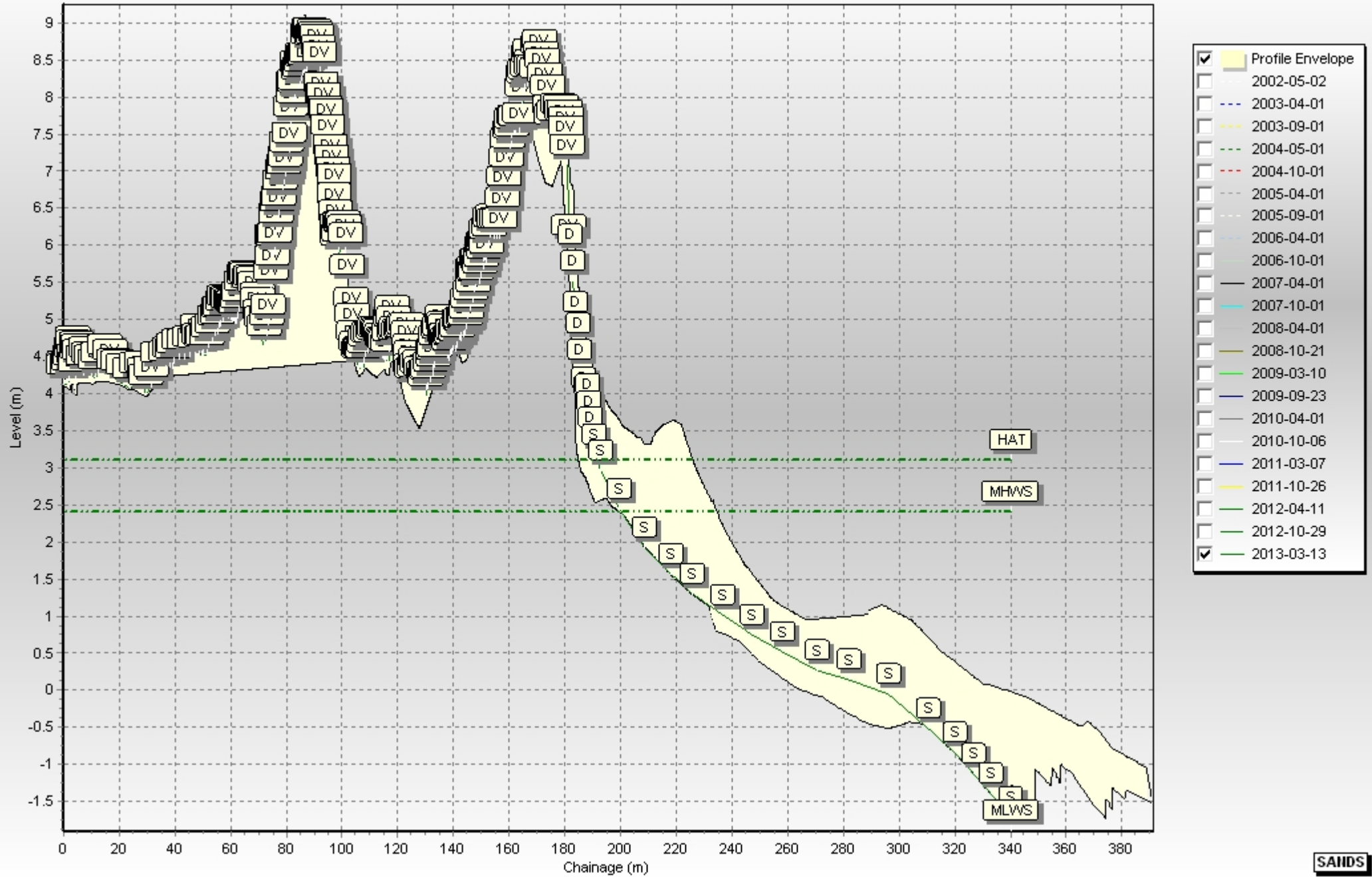
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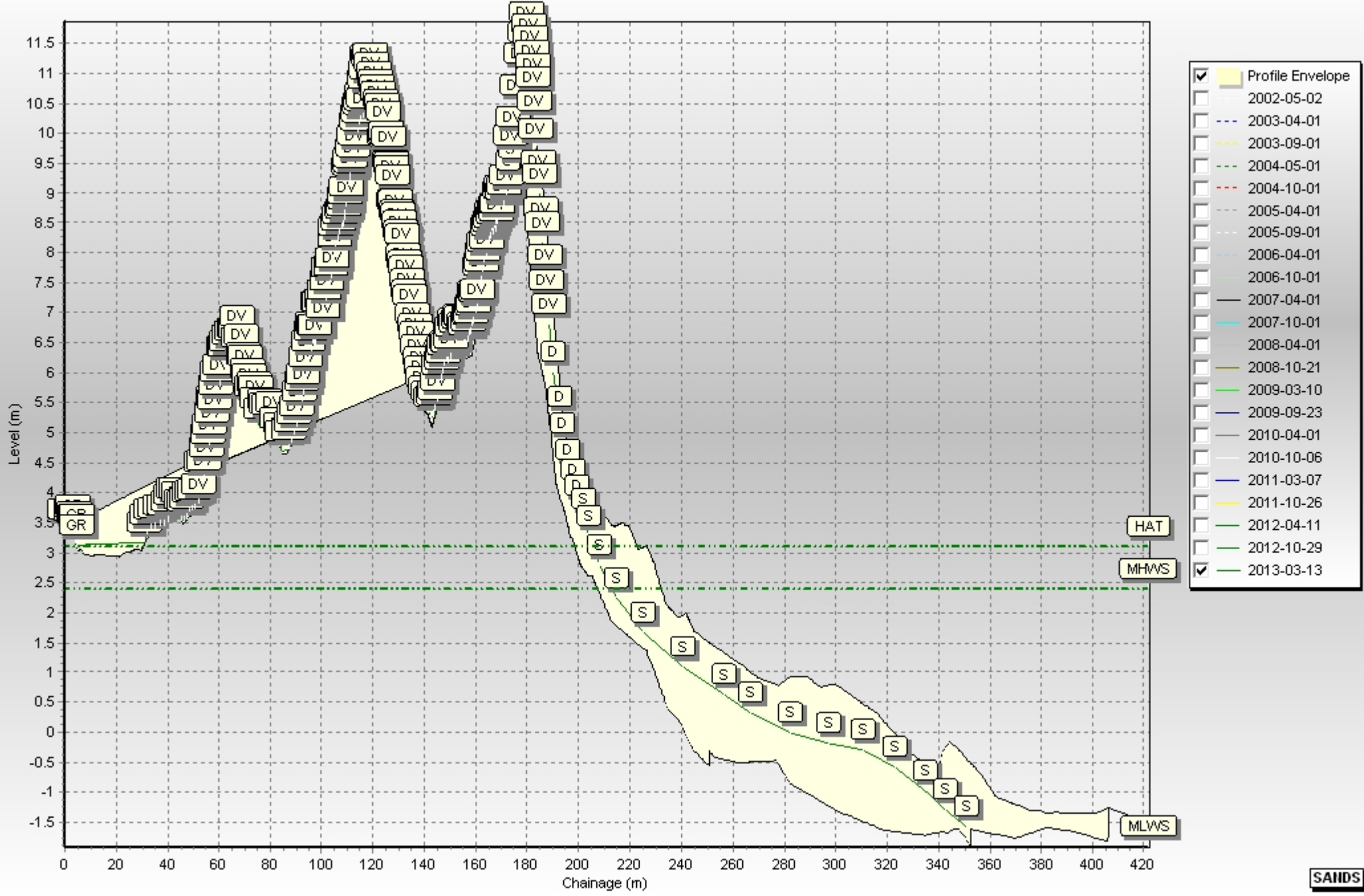
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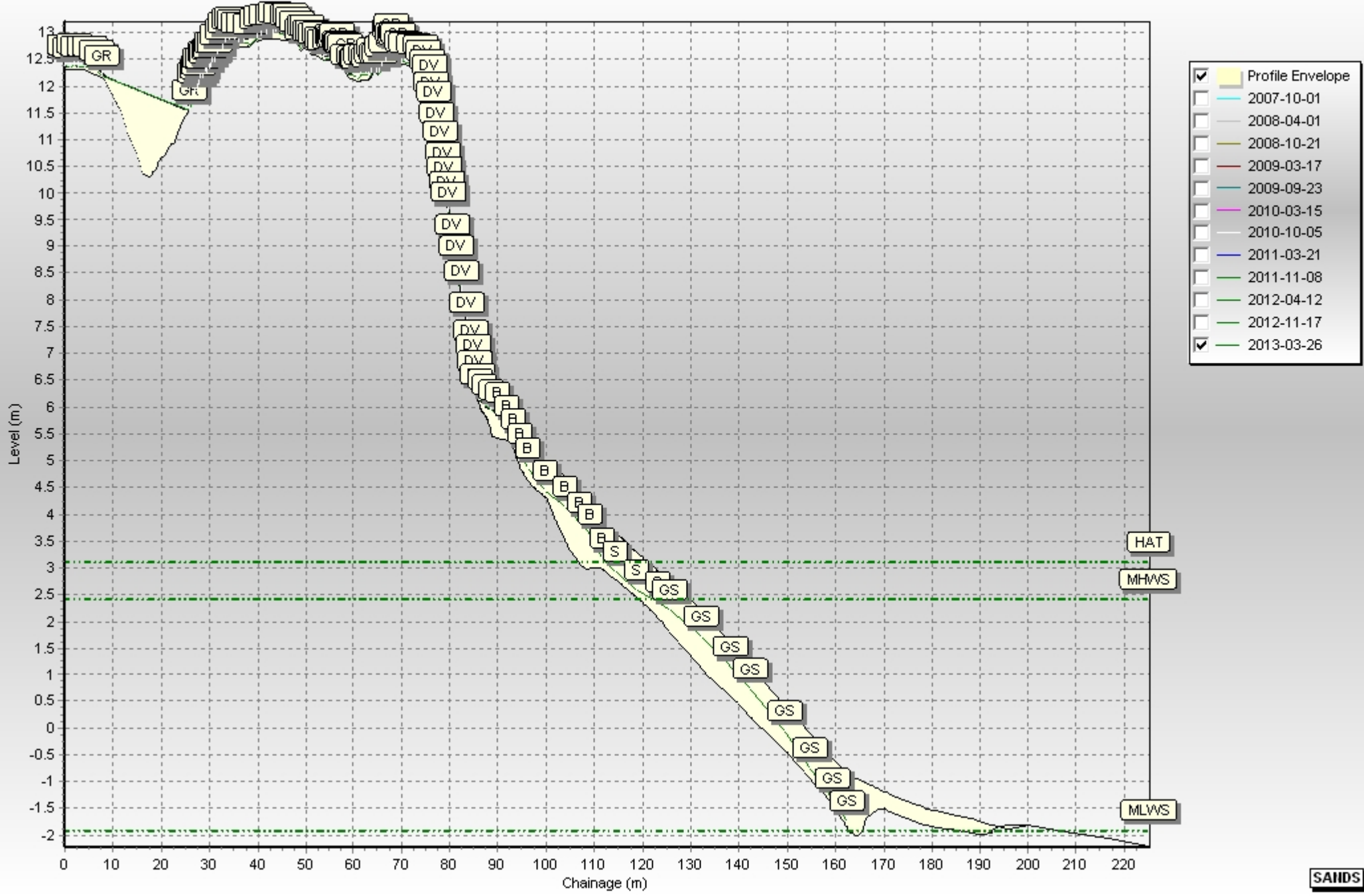
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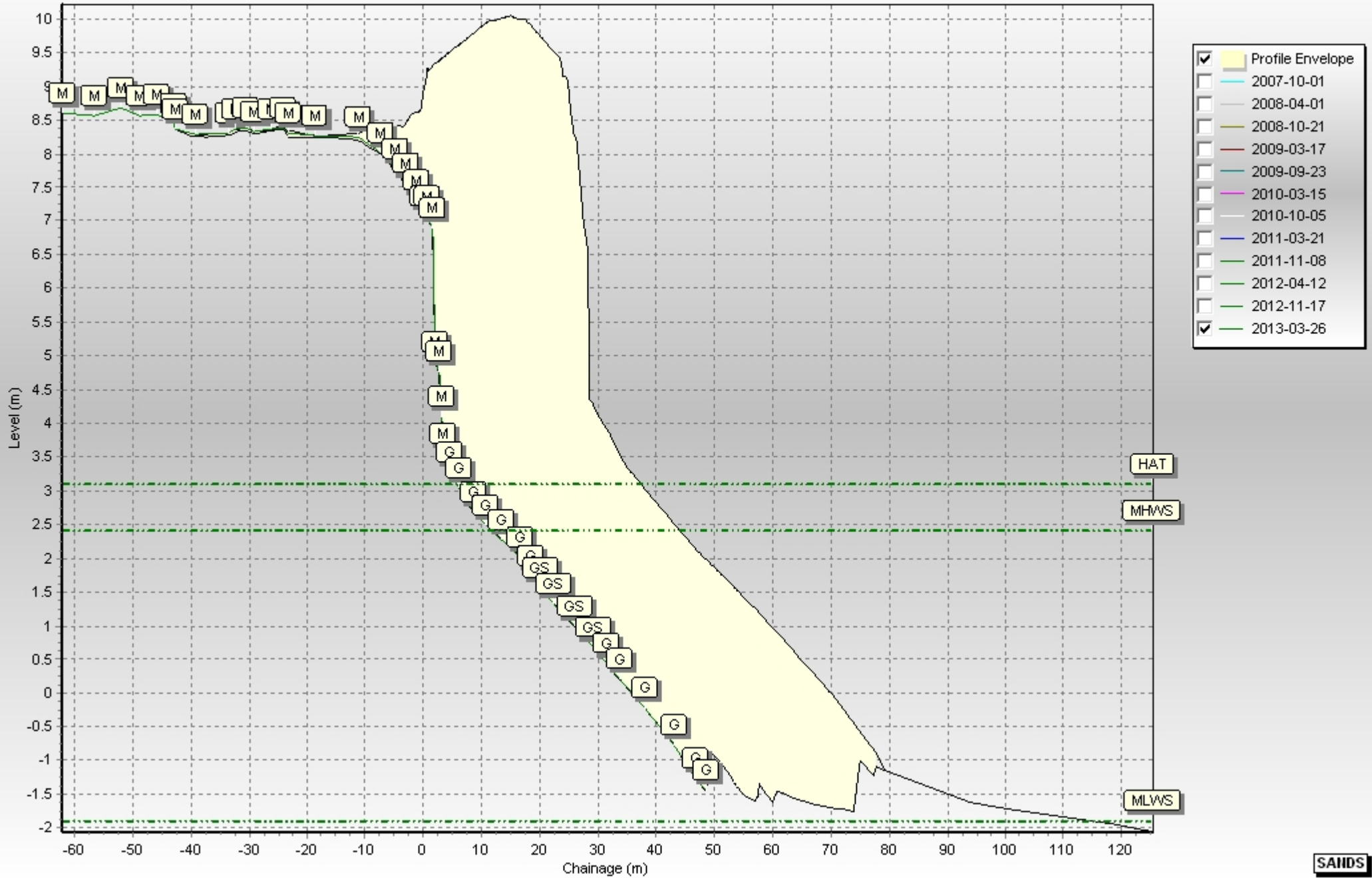
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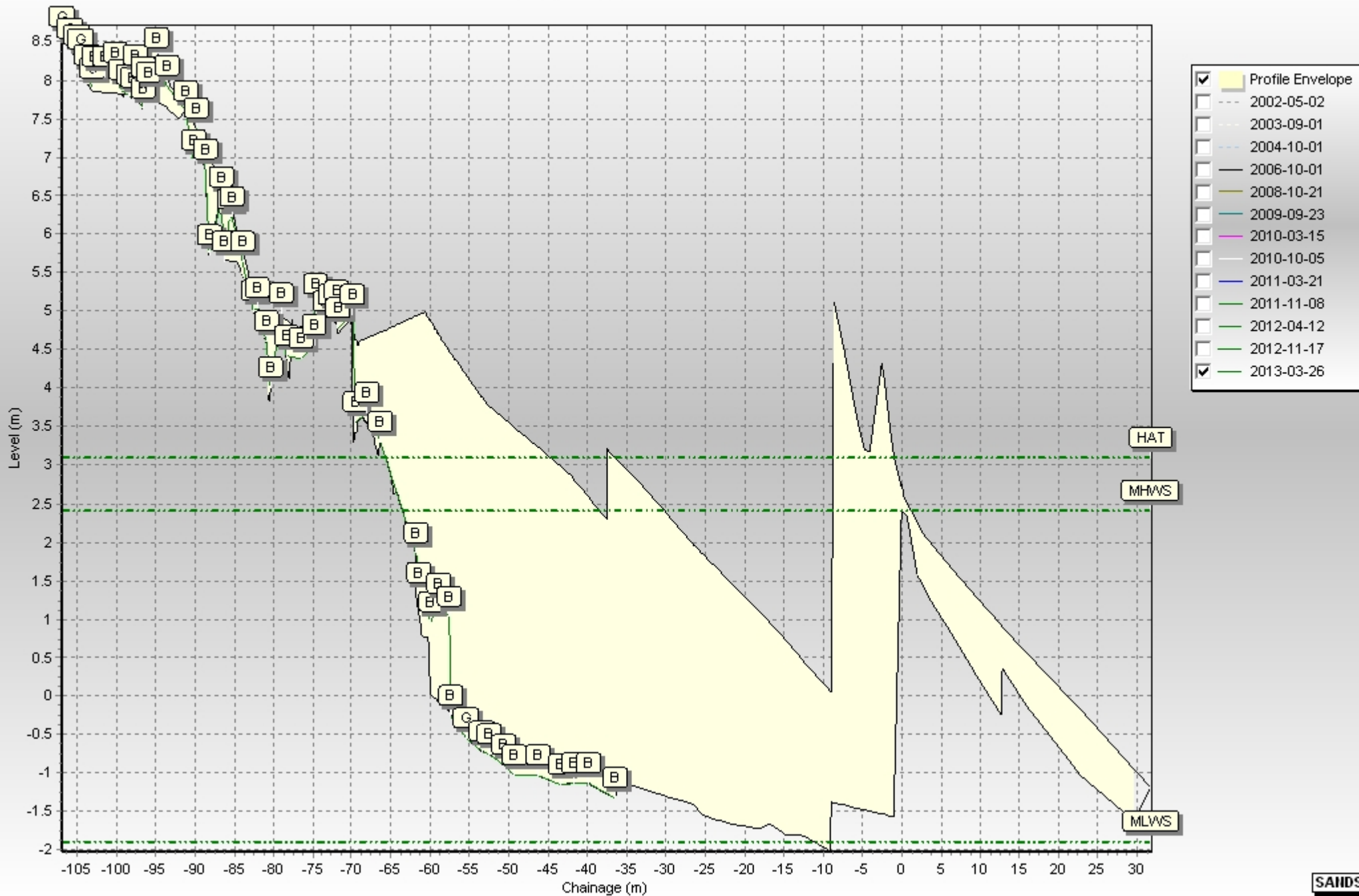


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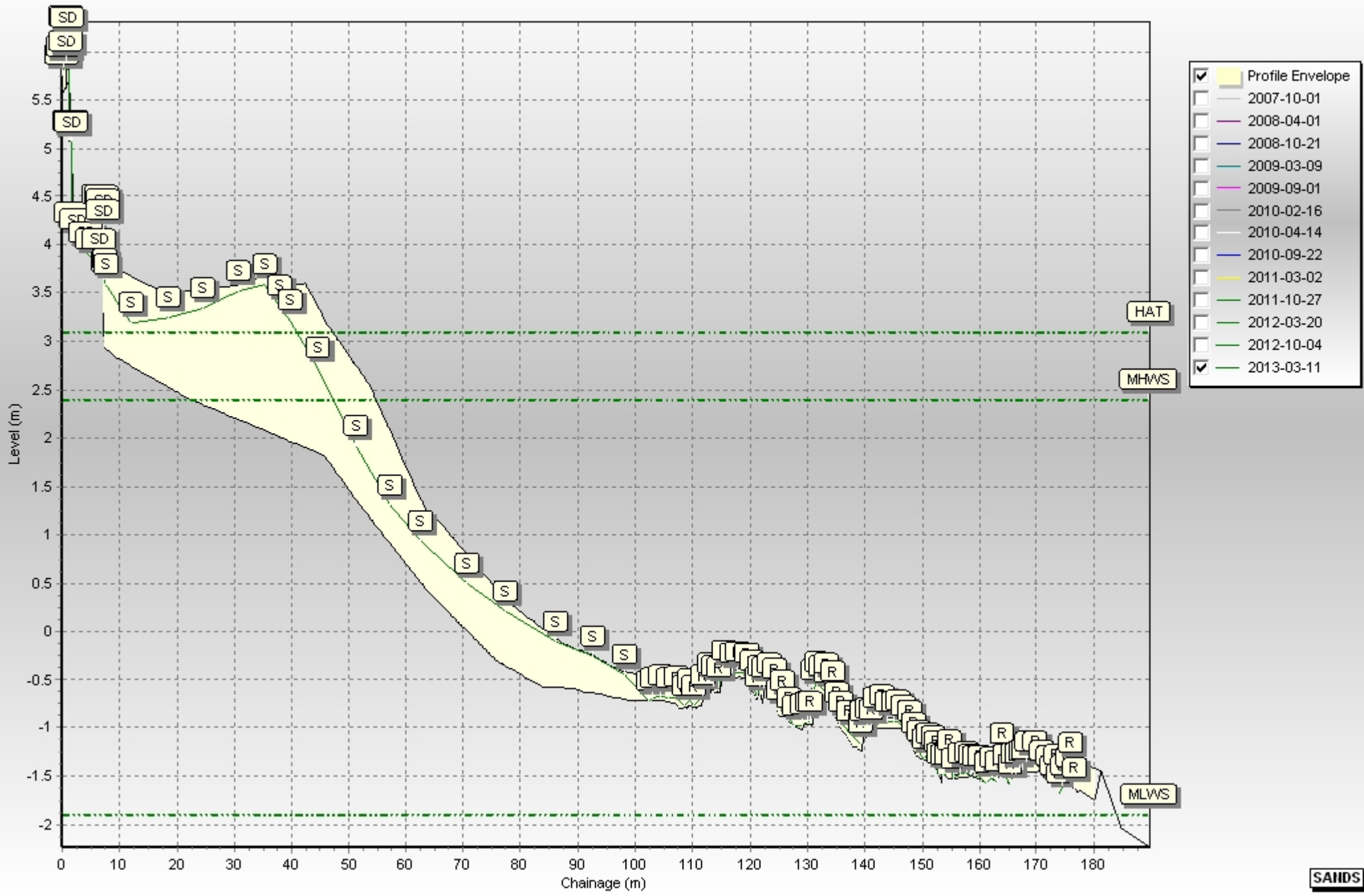




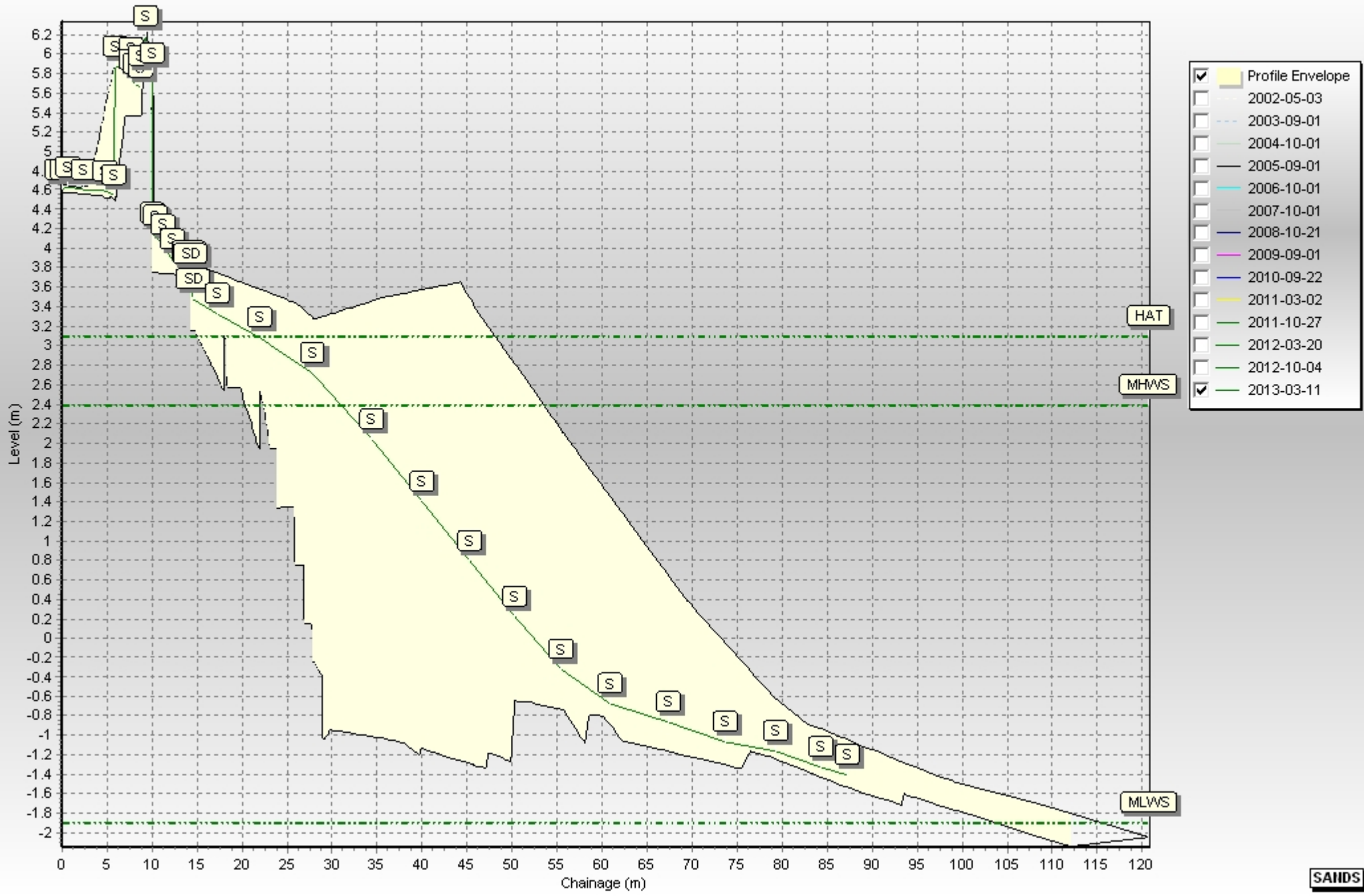
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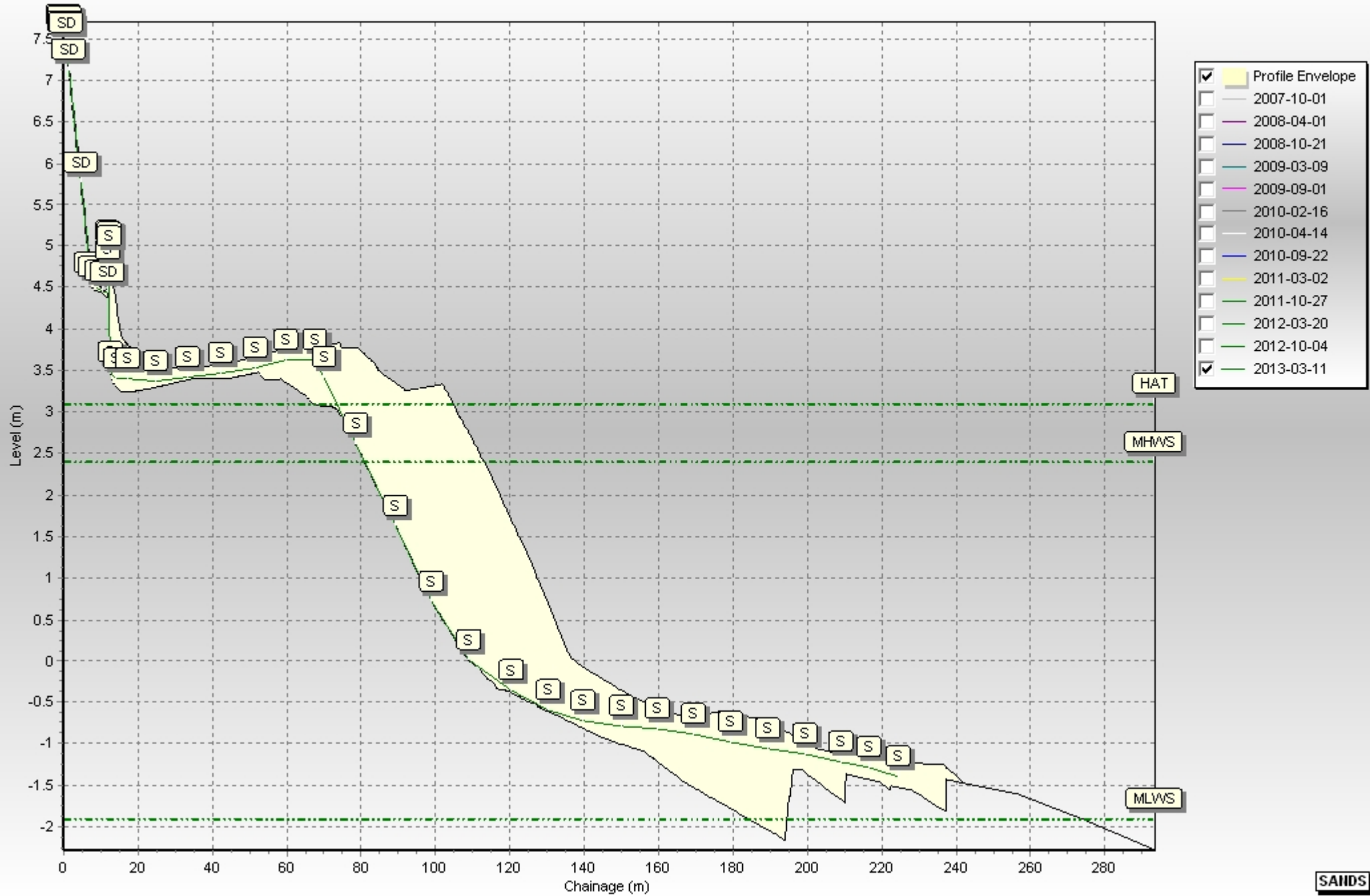
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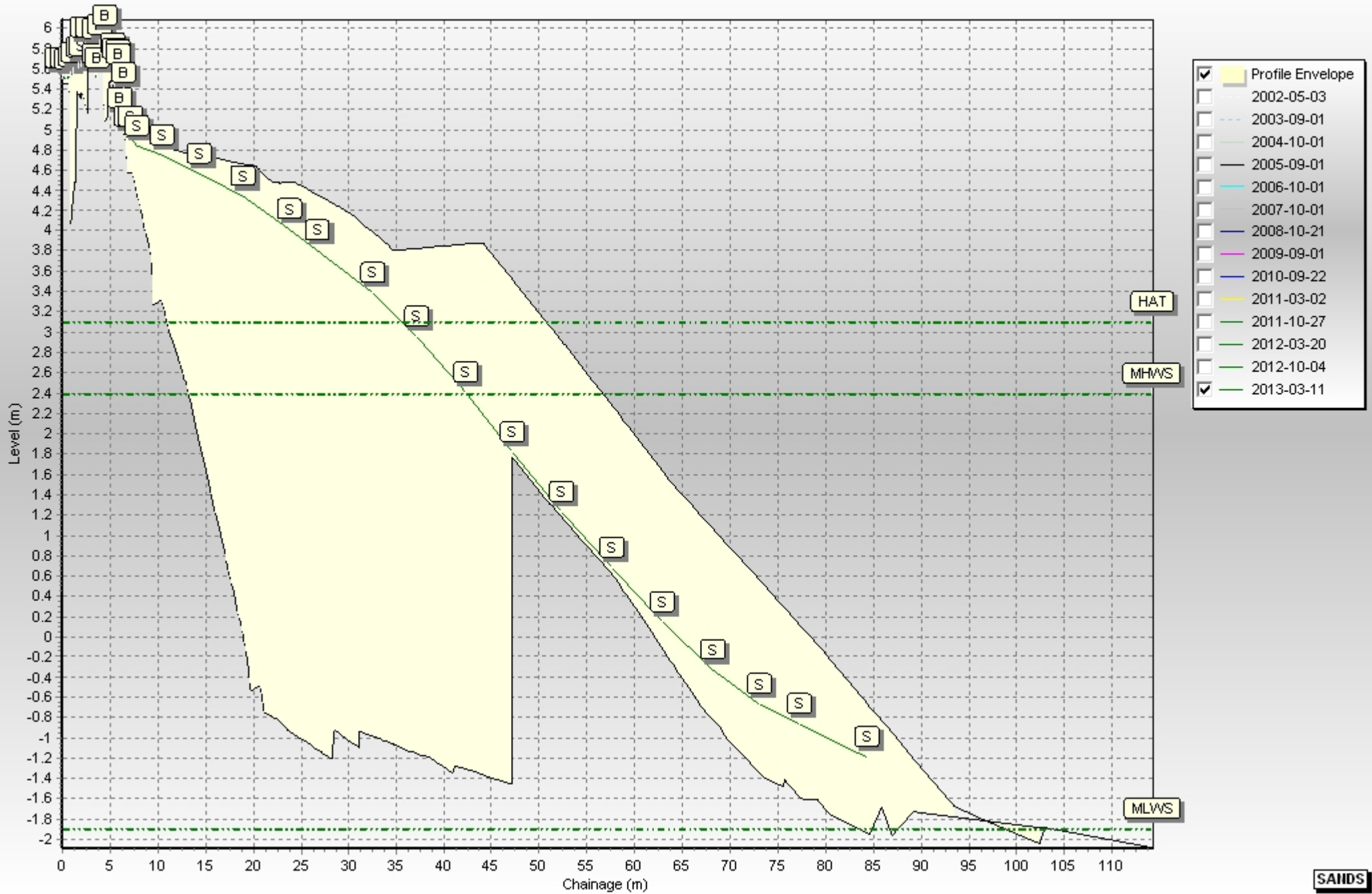
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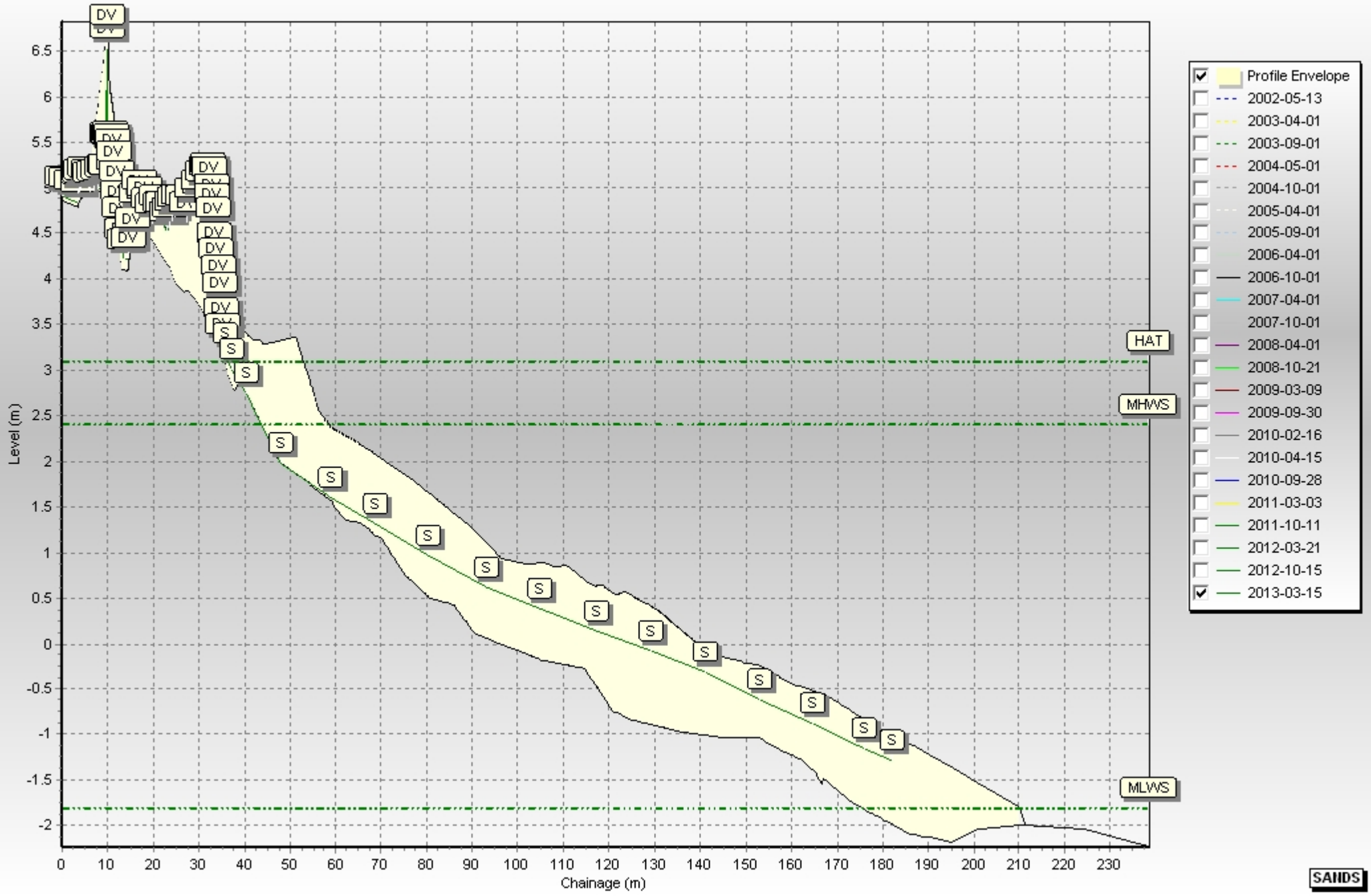
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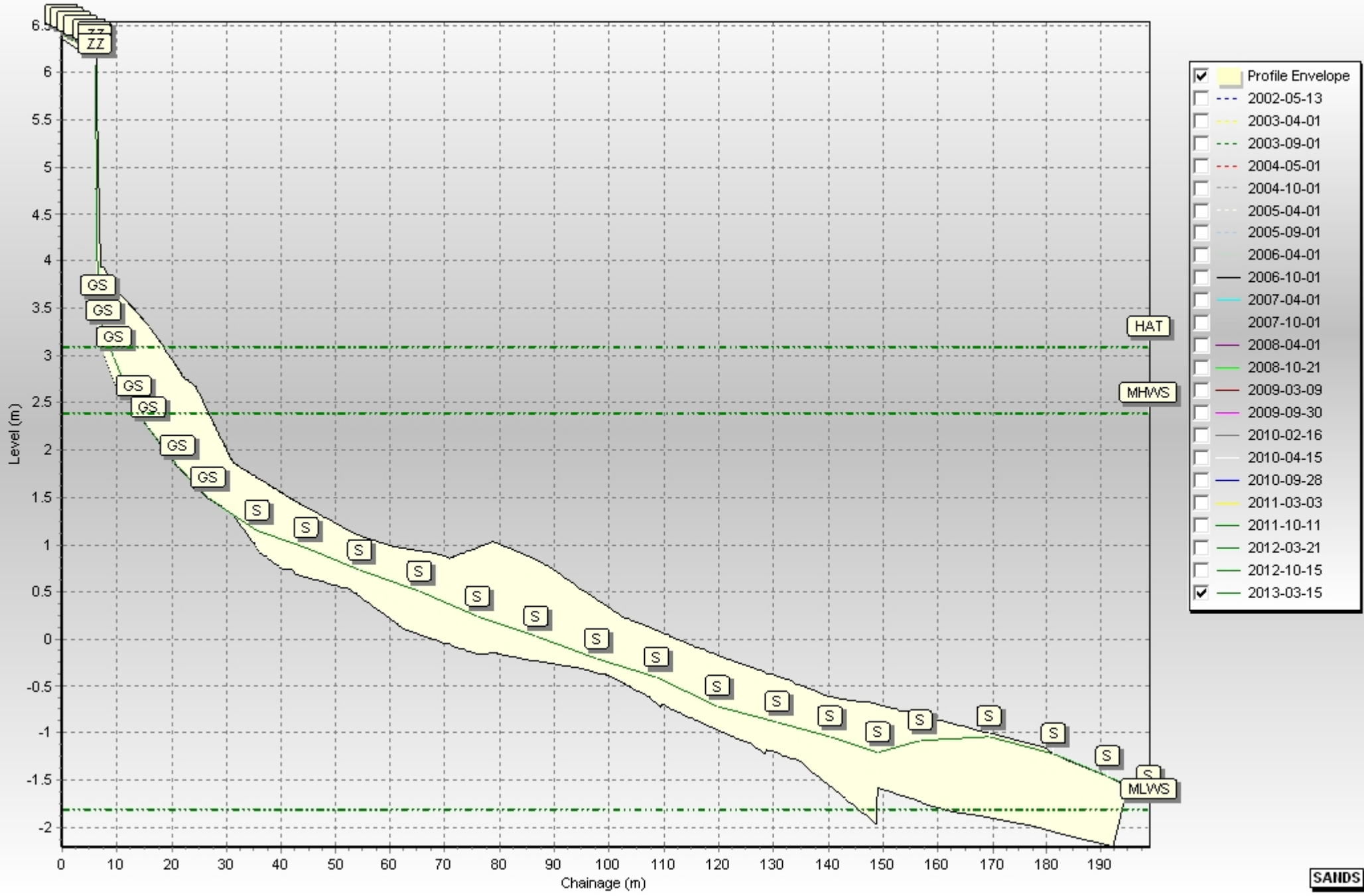
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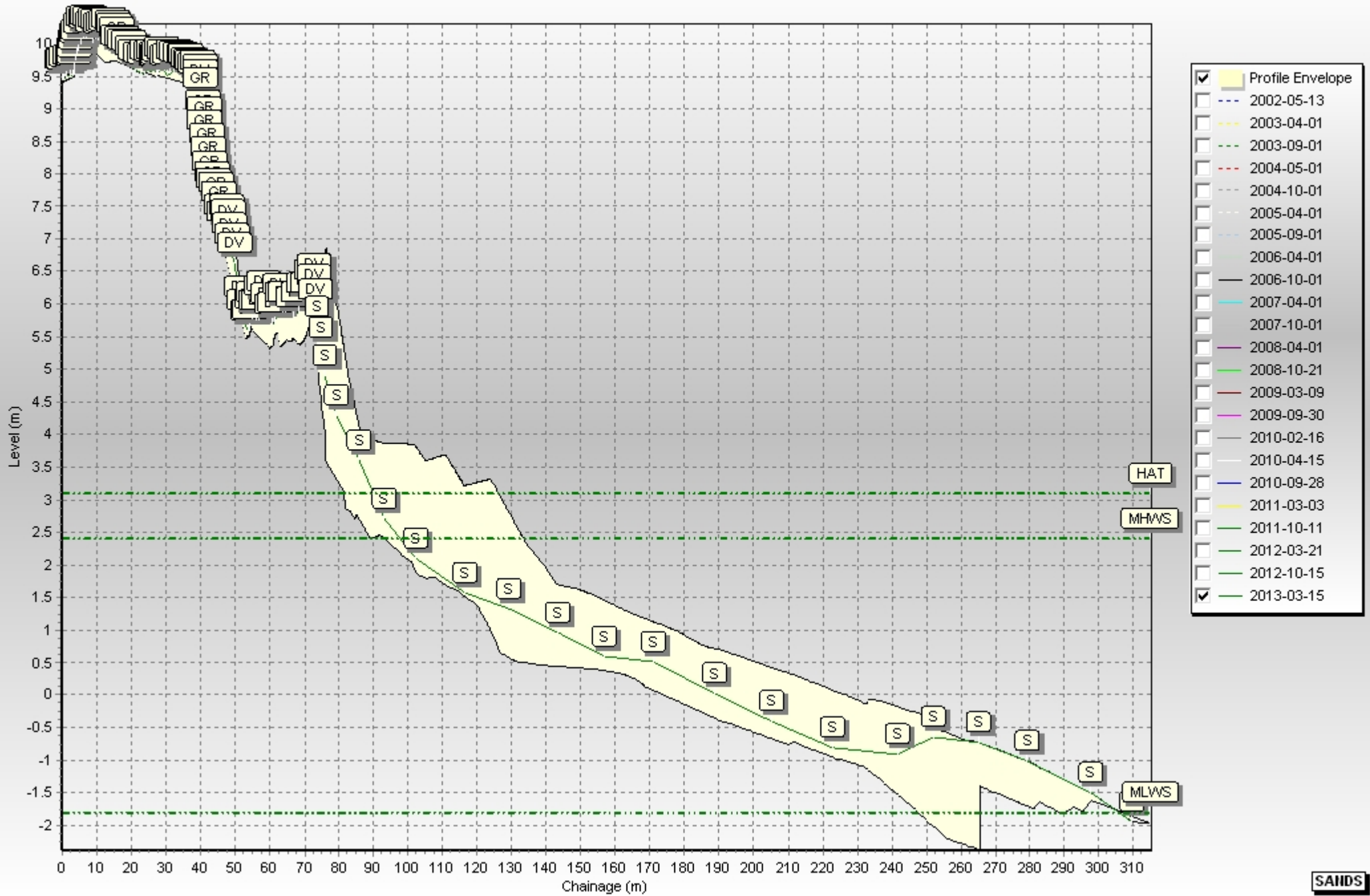
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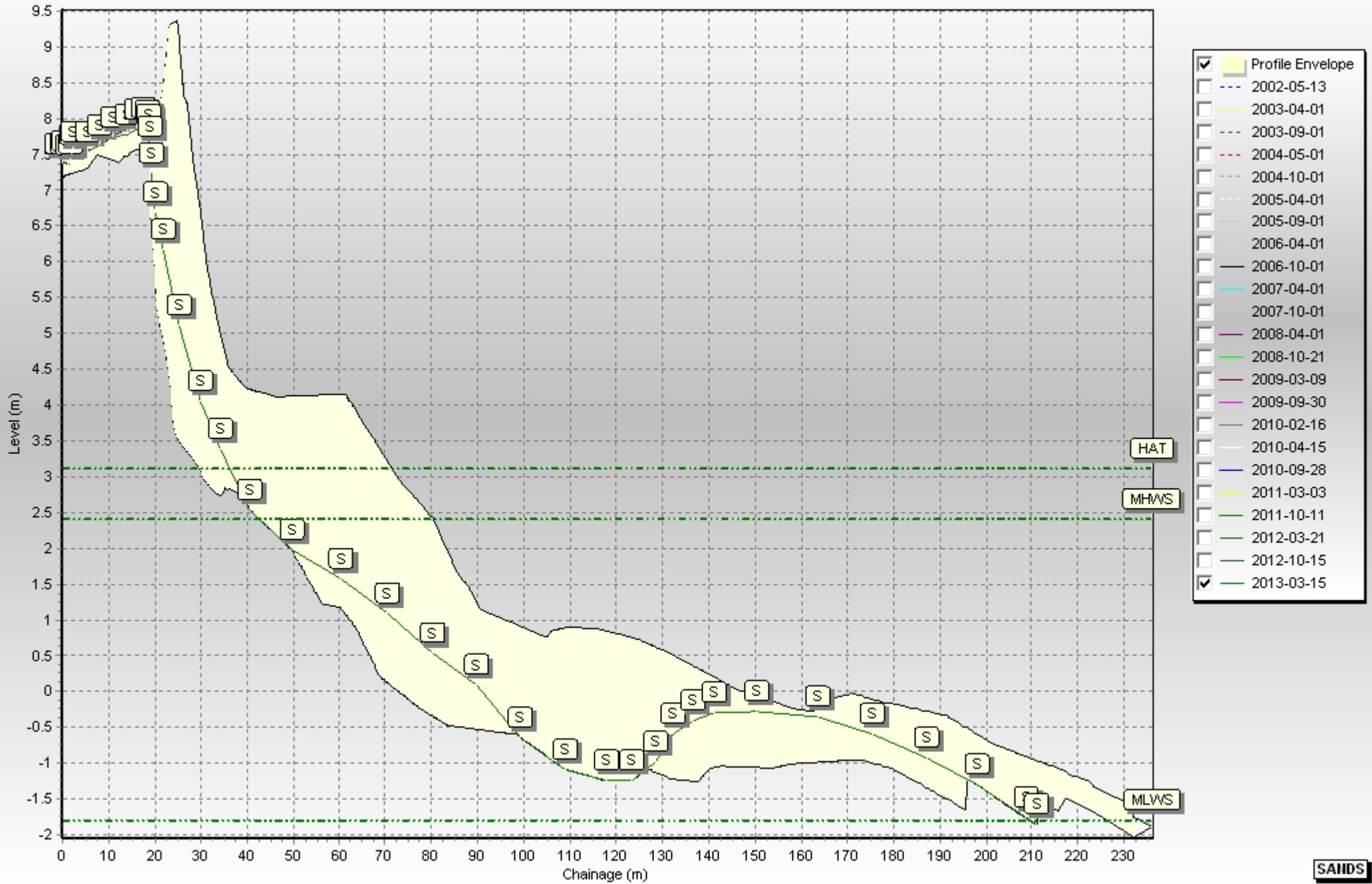


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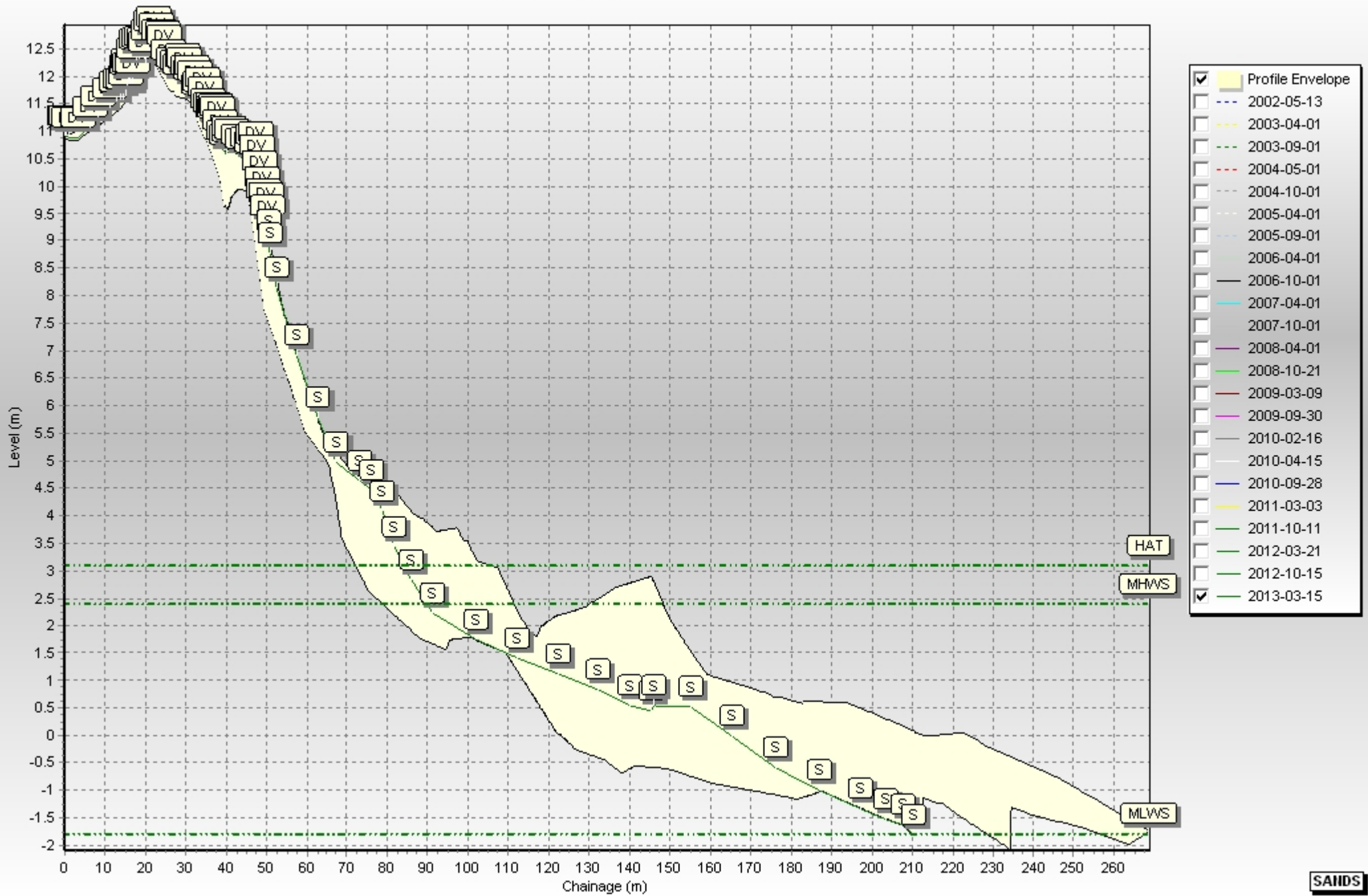




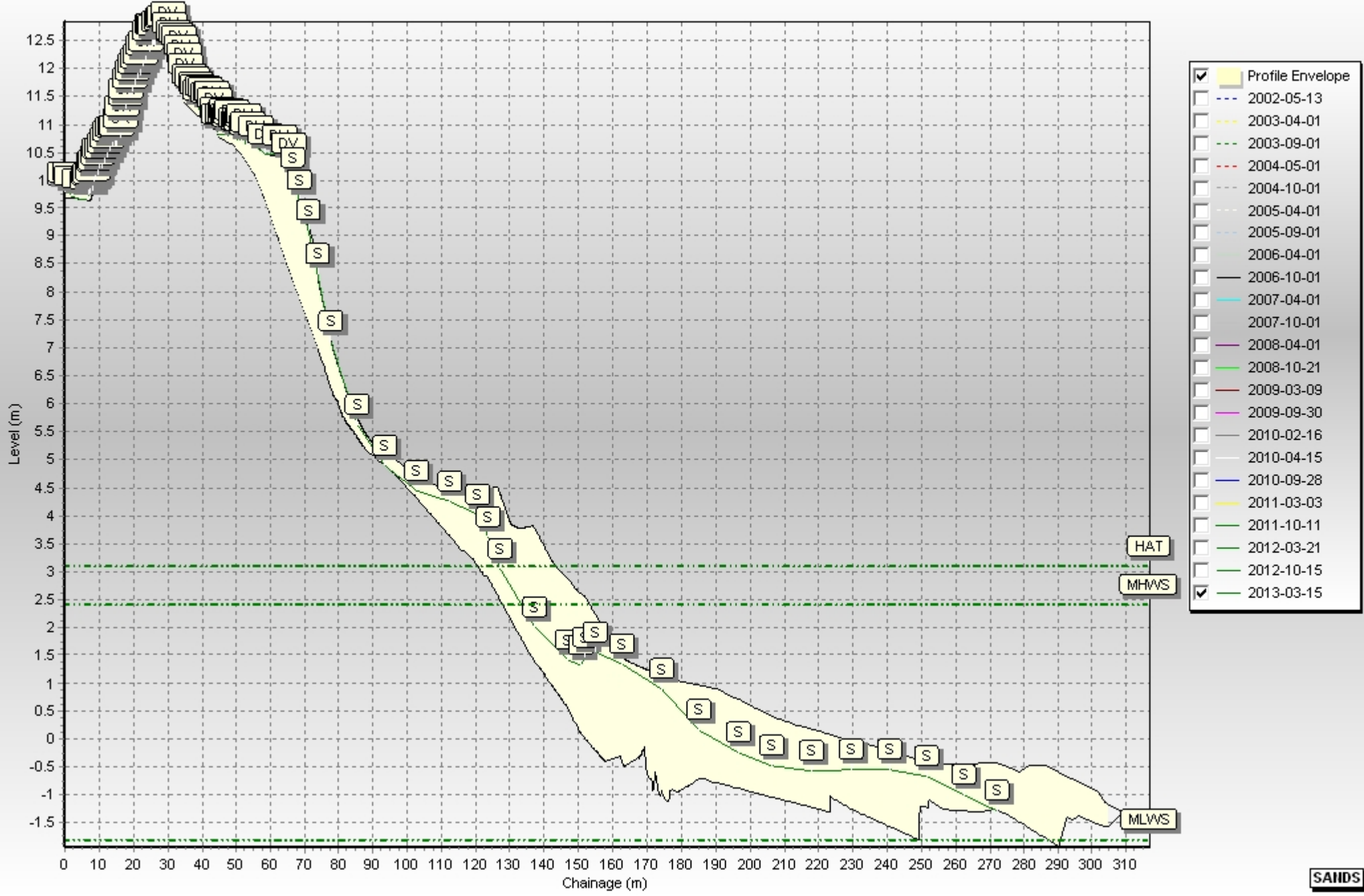
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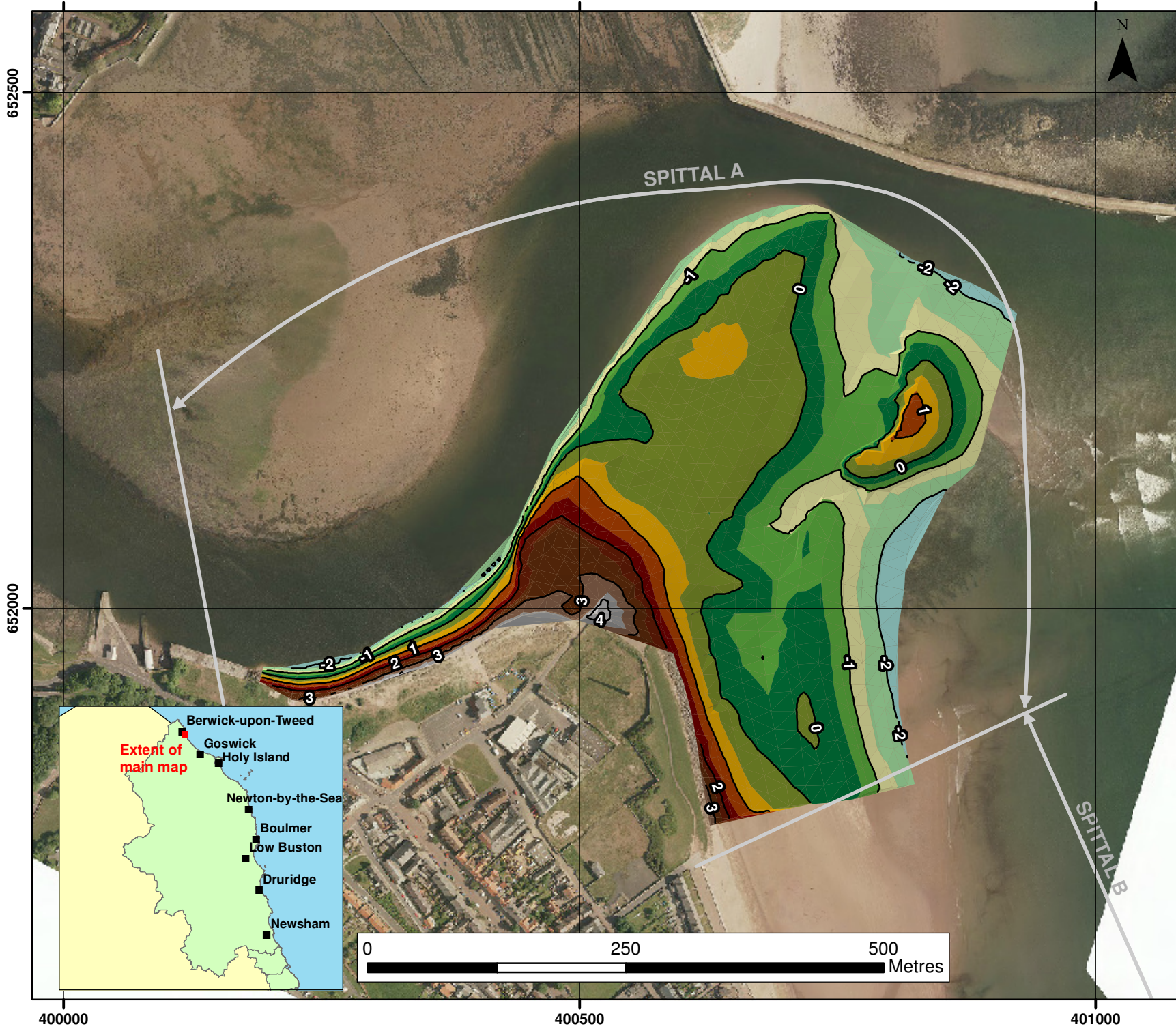
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Profiles: 1aBVBC06



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



**KEY**

**Elevation (m OD)**

4.5 - 5
4 - 4.5
3.5 - 4
3 - 3.5
2.5 - 3
2 - 2.5
1.5 - 2
1 - 1.5
0.5 - 1
0 - 0.5
-0.5 - 0
-1 - -0.5
-1.5 - -1
-2 - -1.5
-2.5 - -2
— Contour 1m

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Appendix B - Map 1a**  
**Topographic Survey**  
**Sandstell Point (Spittal A)**  
**Northumberland**  
**County Council**

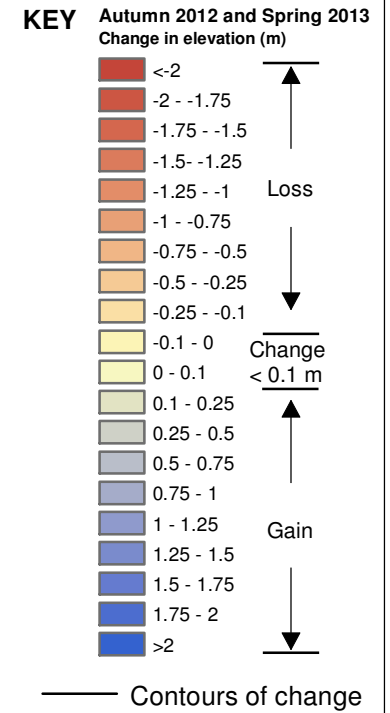
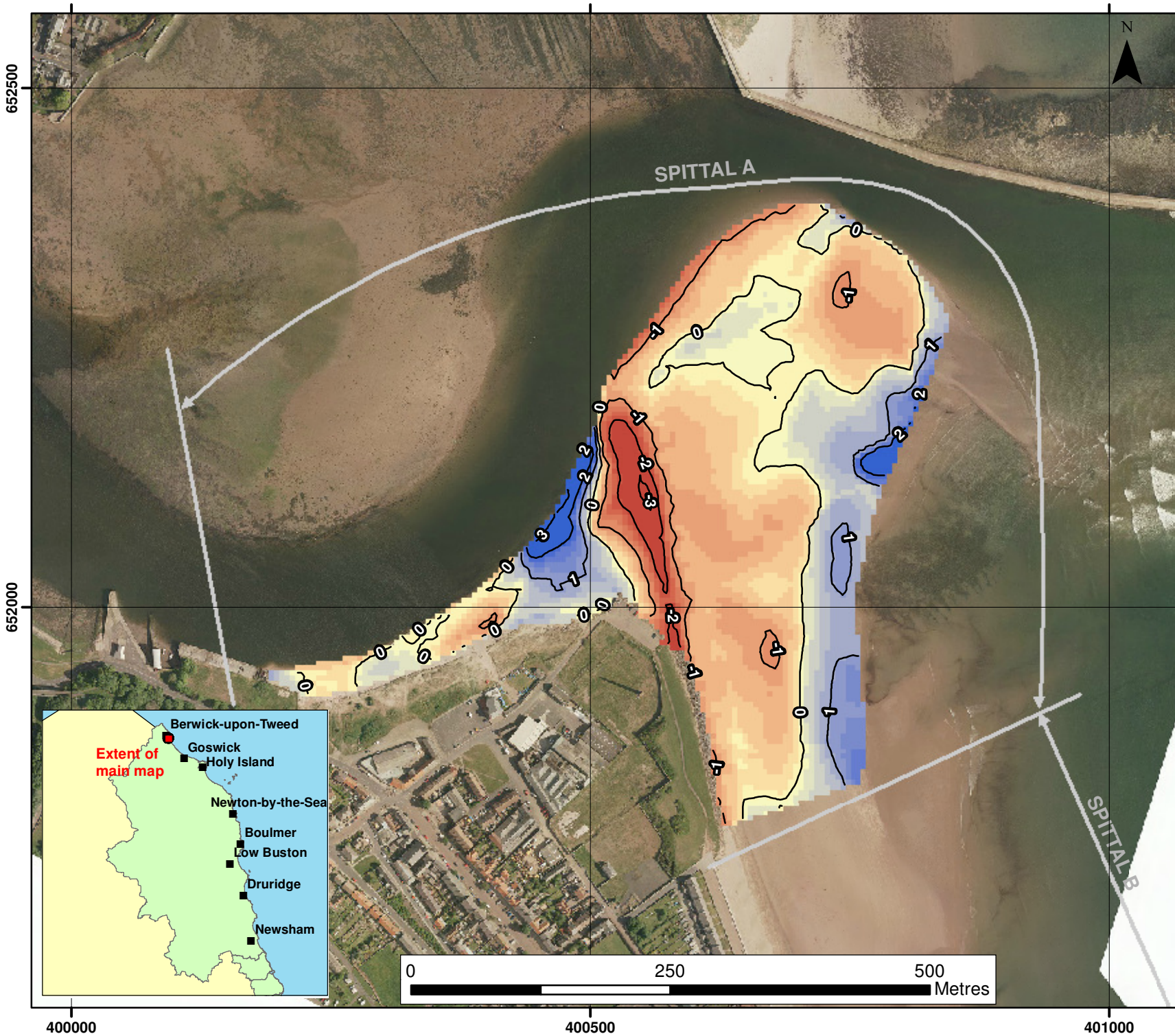
Update Report 5  
 Partial Measures Survey  
 Spring 2013

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

**Appendix B - Map 1b**  
**Short-term**  
**Elevation Change**  
**Berwick**  
**Northumberland**  
**County Council**

Update Report 5  
Partial Measures Survey  
Spring 2013

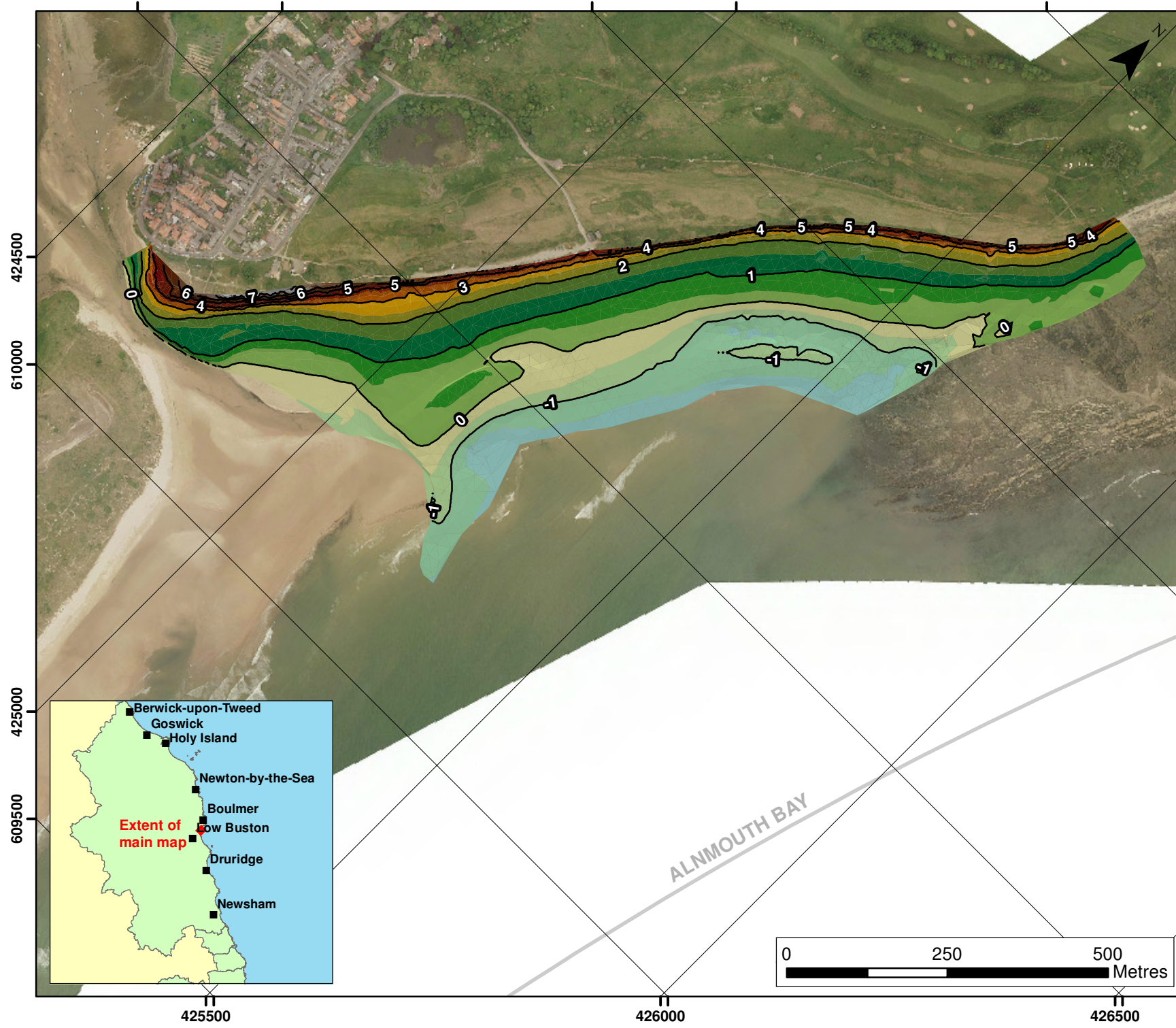
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**KEY**

Elevation (m OD)	
8.5 - 9	3 - 3.5
8 - 8.5	2.5 - 3
7.5 - 8	2 - 2.5
7 - 7.5	1.5 - 2
6.5 - 7	1 - 1.5
6 - 6.5	0.5 - 1
5.5 - 6	0 - 0.5
5 - 5.5	-0.5 - 0
4.5 - 5	-1 - -0.5
4 - 4.5	-1.5 - -1
3.5 - 4	-2 - -1.5
	— Contour 1m

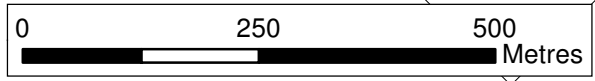
Client: North East Coastal Group  
 Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

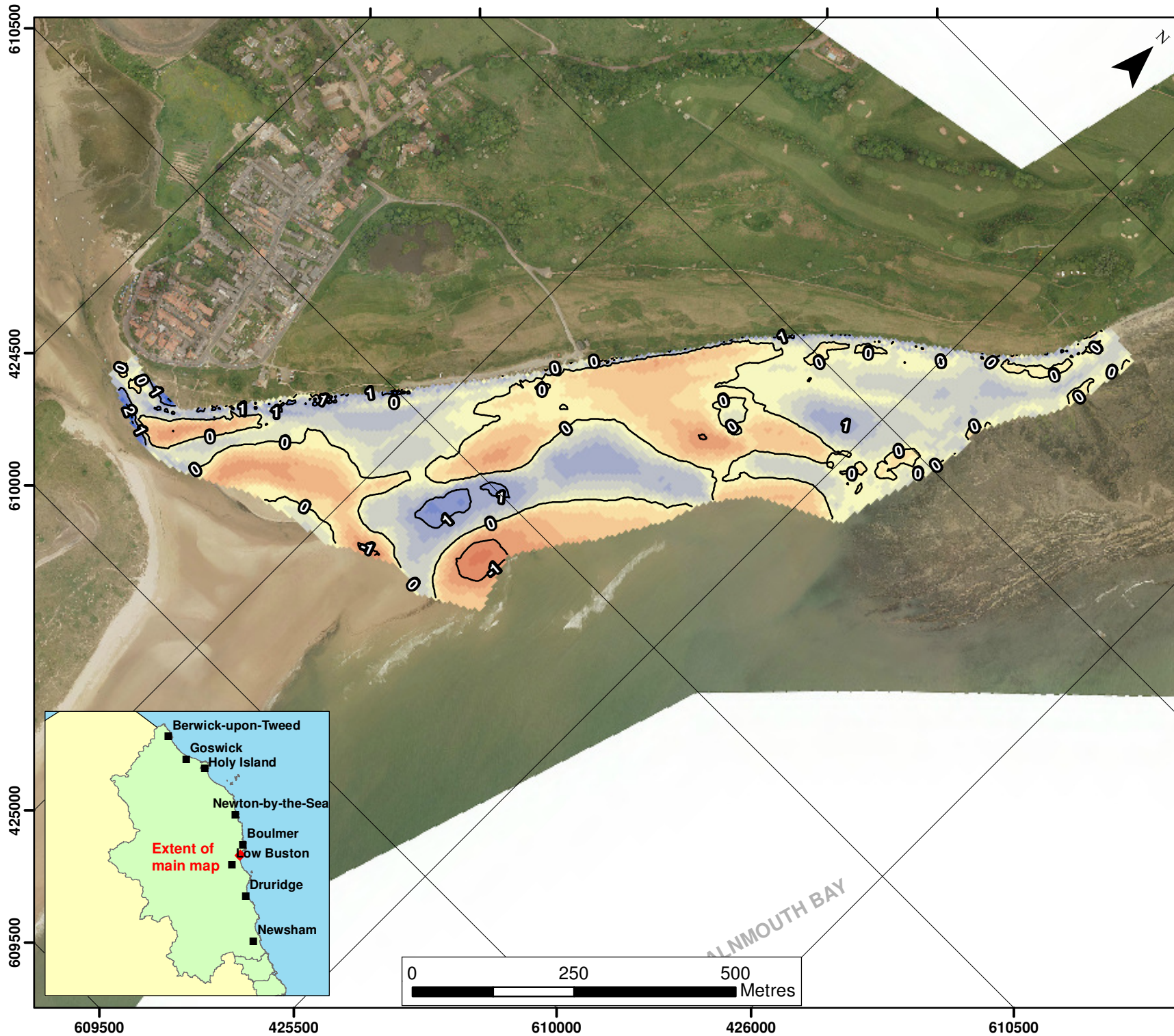
**Appendix B - Map 2a**  
**Topographic Survey**  
**Alnmouth Bay**  
**Northumberland**  
**County Council**

Update Report 5  
 Partial Measures Survey  
 Spring 2013

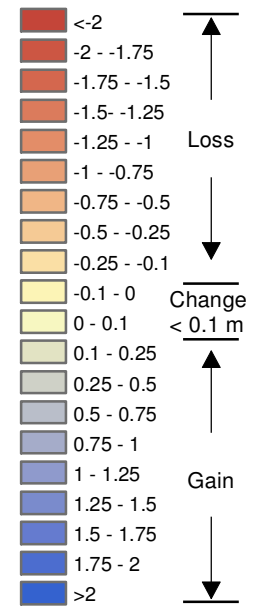
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**KEY** Autumn 2012 and Spring 2013  
Change in elevation (m)



— Contours of change

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

**Appendix B- Map 2b**  
**Short-term**  
**Elevation Change**  
**Alnmouth**  
**Northumberland**  
**County Council**

Update Report 5  
Partial Measures Survey  
Spring 2013



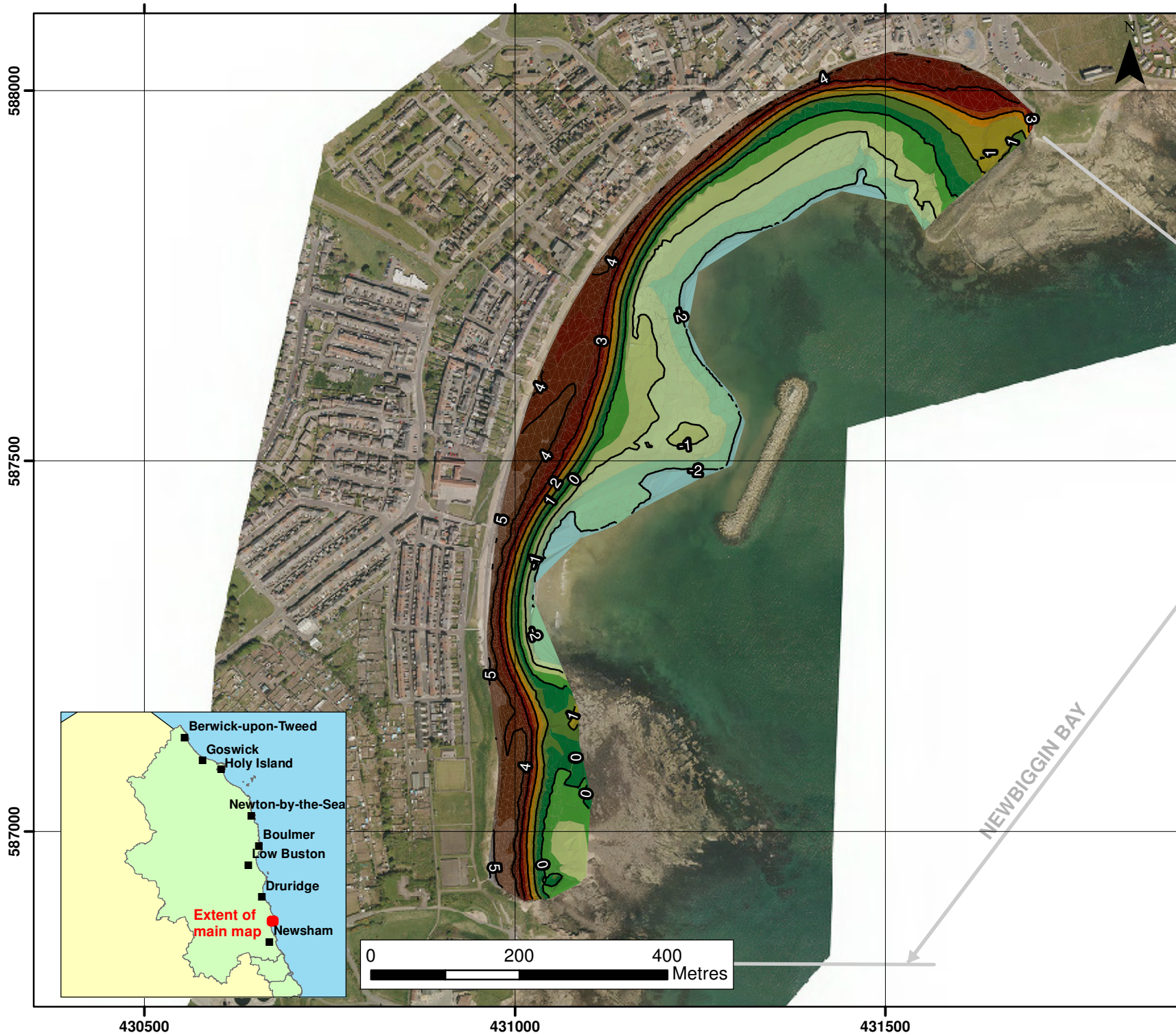
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**KEY**

**Elevation (m OD)**

6.5 - 7
6 - 6.5
5.5 - 6
5 - 5.5
4.5 - 5
4 - 4.5
3.5 - 4
3 - 3.5
2.5 - 3
2 - 2.5
1.5 - 2
1 - 1.5
0.5 - 1
0 - 0.5
-0.5 - 0
-1 - -0.5
-1.5 - -1
-2 - -1.5
-2.5 - -2
— Contour 1m

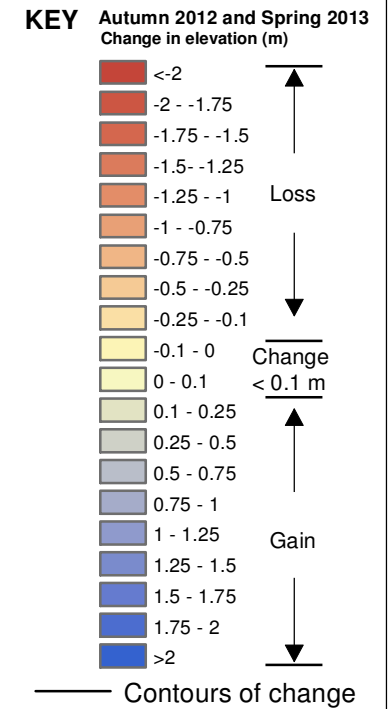
Client: North East Coastal Group  
 Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Appendix B - Map 3a**  
**Topographic Survey**  
**Newbiggin Bay**  
**Northumberland**  
**County Council**

Update Report 5  
 Partial Measures Survey  
 Spring 2013

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

**Appendix B Map 3b**  
**Short-term**  
**Elevation Change**  
**Newbiggin**  
**Northumberland**  
**County Council**

Update Report 5  
Partial Measures Survey  
Spring 2013



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**Appendix C**  
**Cliff Top Survey**

## Cliff Top Survey

### Lynemouth Bay

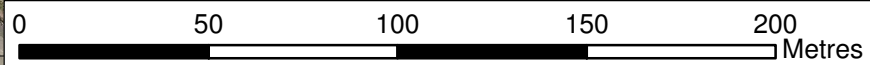
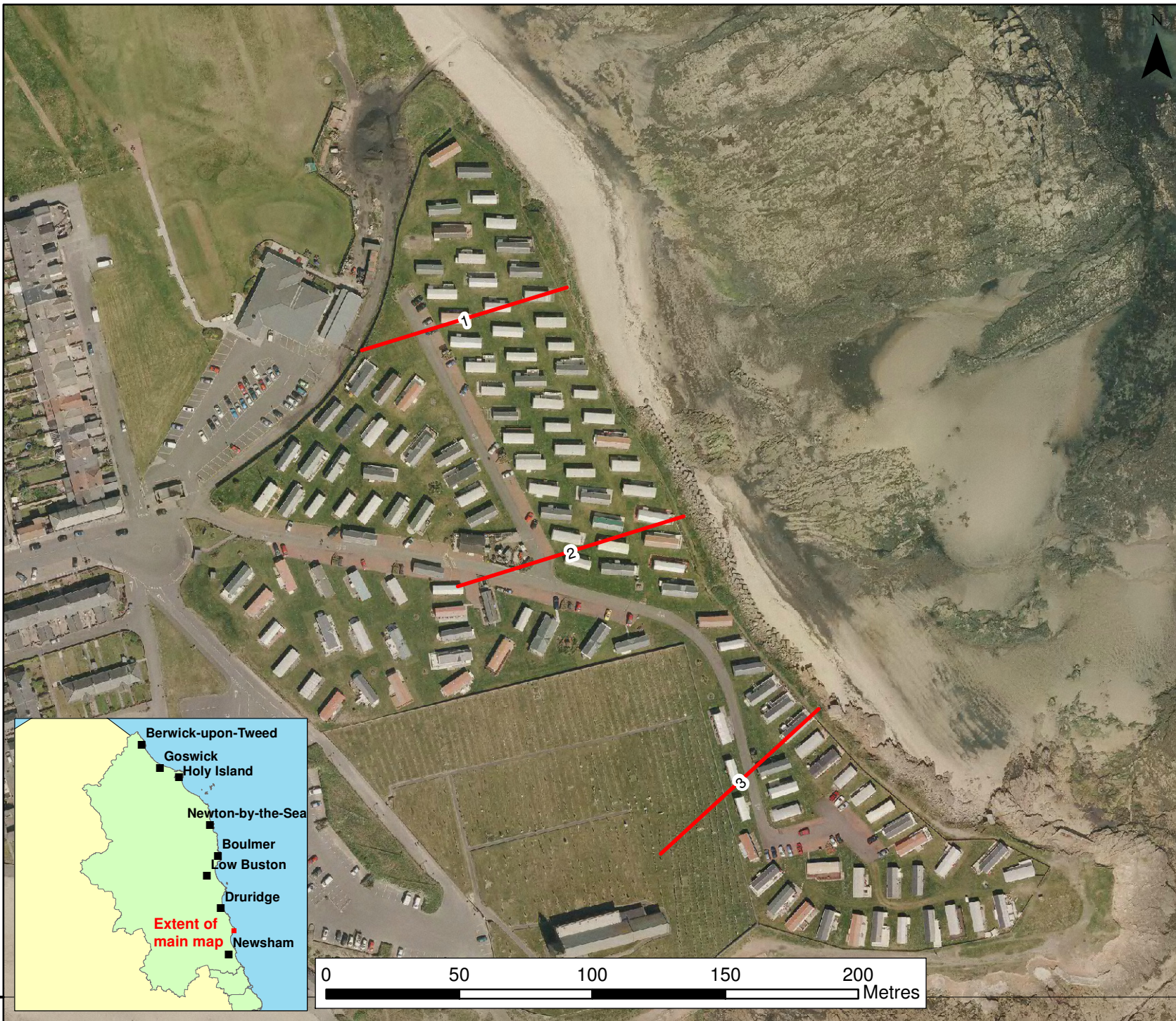
Three ground control points have been established at Lynemouth Bay (Map 1). The maximum separation between any two points varies along the coast, reflecting the erosion risk.

The cliff top surveys at Lynemouth Bay are undertaken bi-annually. Measurements are taken along a fixed transect from the landward datum to the surveyed cliff top position.

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 transect. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

**Table C1 – Cliff Top Surveys at Lynemouth Bay**

Ground Control Point Details		Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Type	Baseline Survey (Oct 2008)	Previous Survey (Oct 2012)	Present Survey	Baseline (Oct 2008) to Present (March 2013)	Previous (Oct 2012) to Present (March 2013)	Baseline (Oct 2008) to Present (March 2013)
1	Cliff	80.62	80.3	80.2	-0.4	0.0	-0.1
2	Defended	88.88	88.7	88.6	-0.3	-0.1	-0.1
3	Cliff	80.23	80.4	80.3	0.1	-0.1	0.0



**KEY**

 Transects

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

**Appendix C - Map 1  
Cliff Top Survey  
Lynemouth Bay  
Northumberland  
County Council**

Update Report 5  
Partial Measures Survey  
Spring 2013

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588000

432000

## Cliff Top Survey

### Cambois Bay (north)

Five ground control points have been established at Cambois Bay (north) (Map 2). The maximum separation between any two points varies along the coast, reflecting erosion risk.

The cliff top surveys at Cambois Bay (north) 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 C2 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 C2 – Cliff Top Surveys at Cambois Bay (north)**

Ground Control Point Details		Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Type	Baseline Survey (Oct 2008)	Previous Survey (Oct 2012)	Present Survey	Baseline (Oct 2008) to Present (March 2013)	Previous (Oct 2012) to Present (March 2013)	Baseline (Oct 2008) to Present (March 2013)
1		Cliff	125.47	125.3	125.2	-0.3	-0.1
2		Defended	146.01	146.0	145.9	-0.1	0.0
3		Defended	116.4	116.6	116.8	0.4	0.2
4		Cliff	114.44	115.0	114.4	-0.1	-0.6
5		Cliff	110.04	107.6	107.1	-2.9	-0.5

## Cliff Top Survey

### Cambois Bay (south)

36 ground control points have been established at Cambois Bay (south) (Map 2). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion.

The cliff top surveys at Cambois Bay (south) are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

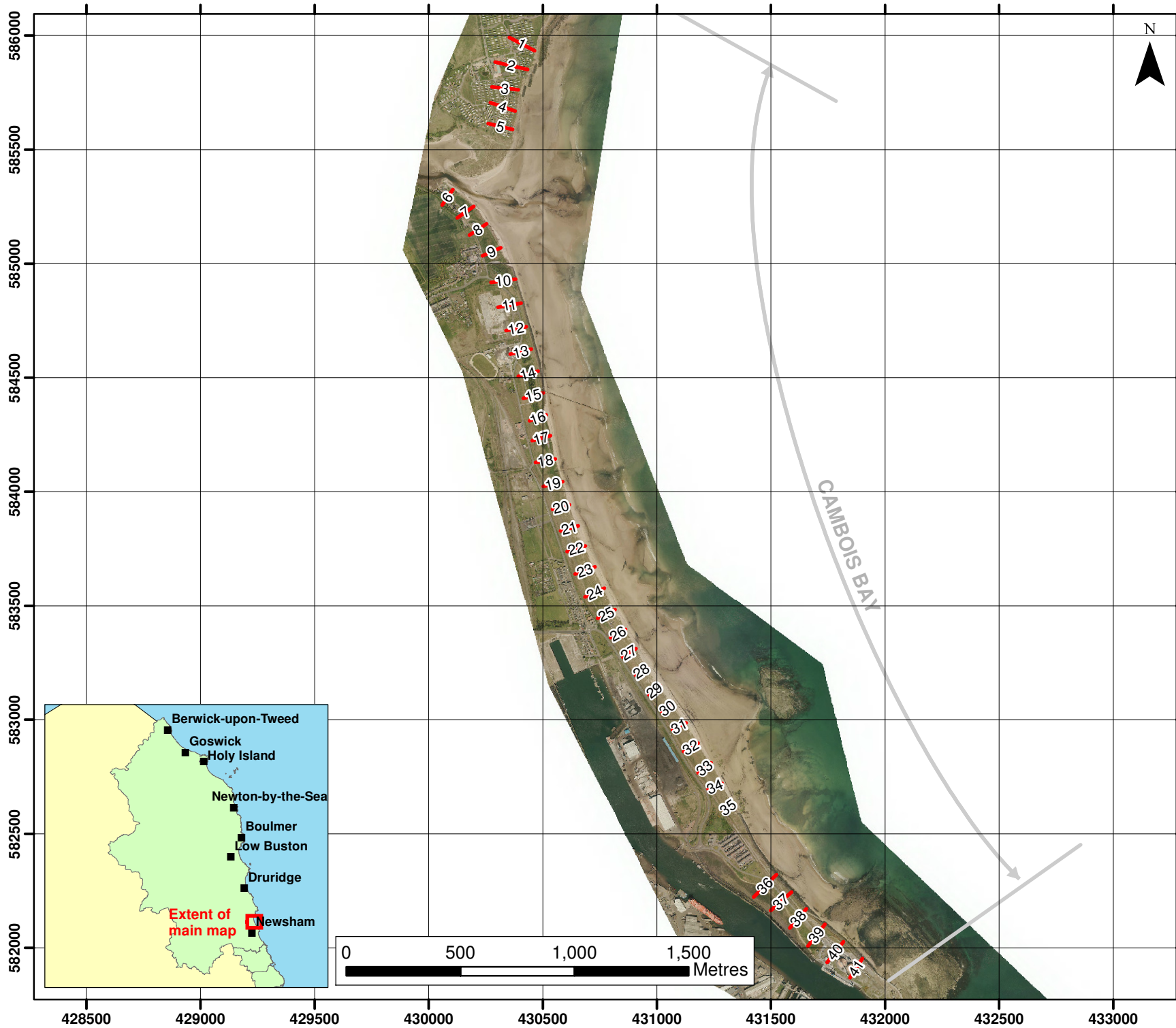
Table C3 provides baseline information about these ground control points and results from the 2008 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

**Table C3 – Cliff Top Surveys at Cambois Bay (north)**

Ground Control Point Details		Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Type	Baseline Survey (May 2009)	Previous Survey (Oct 2012)	Present Survey	Baseline (May 2009) to Present (March 2013)	Previous (Oct 2012) to Present (March 2013)	Baseline (May 2009) to Present (March 2013)
6	Dune	74.5	74.5	75.1	0.6	0.6	0.2
7	Cliff	80	80.0	80.0	0.0	0.0	0.0
8	Cliff	82.62	80.6	80.6	-2.0	0.0	-0.5
9	Cliff	76.91	76.7	76.8	-0.1	0.2	0.0
10	Defended	94.47	94.1	94.1	-0.4	0.0	-0.1
11	Defended	90.65	90.8	90.9	0.3	0.1	0.1
12	Defended	83.25	82.2	83.0	-0.3	0.8	-0.1
13	Defended	87.72	87.5	87.6	-0.1	0.1	0.0
14	Defended	80.09	80.0	79.9	-0.2	0.0	0.0
15	Defended	81.24	81.3	80.5	-0.7	-0.8	-0.2
16	Cliff	71.65	71.1	70.2	-1.4	-0.8	-0.4
17	Cliff	81.5	80.0	70.1	-11.4	-10.0	-2.9
18	Cliff	85.72	84.6	85.0	-0.8	0.3	-0.2

Ground Control Point Details		Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Type	Baseline Survey (May 2009)	Previous Survey (Oct 2012)	Present Survey	Baseline (May 2009) to Present (March 2013)	Previous (Oct 2012) to Present (March 2013)	Baseline (May 2009) to Present (March 2013)
19	Cliff	81.48	81.3	81.2	-0.3	-0.1	-0.1
20	Dune	71.04	69.7	69.7	-1.3	0.0	-0.3
21	Dune	75.11	72.6	72.7	-2.4	0.1	-0.6
22	Dune	78.69	75.6	75.8	-2.9	0.2	-0.7
23	Dune	86.59	81.5	81.7	-4.9	0.1	-1.3
24	Dune	87.99	84.6	84.6	-3.4	0.0	-0.9
25	Dune	78.24	82.7	76.4	-1.9	-6.3	-0.5
26	Dune	67.08	66.9	66.9	-0.2	-0.1	-0.1
27	Dune	61.31	61.2	61.1	-0.2	-0.1	-0.1
28	Dune	55.83	55.4	55.9	0.1	0.5	0.0
29	Dune	57.66	55.4	55.3	-2.3	-0.1	-0.6
30	Dune	56.66	56.8	60.9	4.2	4.1	1.1
31	Dune	63.03	63.6	63.6	0.6	0.1	0.2
32	Dune	68.35	68.3	68.4	0.0	0.1	0.0
33	Dune	65.17	64.9	65.0	-0.2	0.1	0.0
34	Dune	60.34	60.2	60.1	-0.3	-0.1	-0.1
35	Cliff	42.21	41.0	40.9	-1.3	-0.1	-0.3
36	Defended	129.88	129.9	129.9	0.1	0.1	0.0
37	Defended	113.71	113.6	113.7	0.0	0.1	0.0
38	Defended	No Data	101.7	101.8	No Data	0.1	No Data
39	Defended	111.71	111.9	111.8	0.1	-0.1	0.0
40	Defended	109.02	109.4	109.4	0.4	0.0	0.1
41	Defended	94.35	94.4	94.3	-0.1	-0.1	0.0





**KEY**  
 Transects

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

**Appendix C - Map 2  
 Cliff Top Survey  
 Cambois Bay  
 Northumberland  
 County Council**

Update Report 5  
 Partial Measures Survey  
 Spring 2013

**Halcrow**

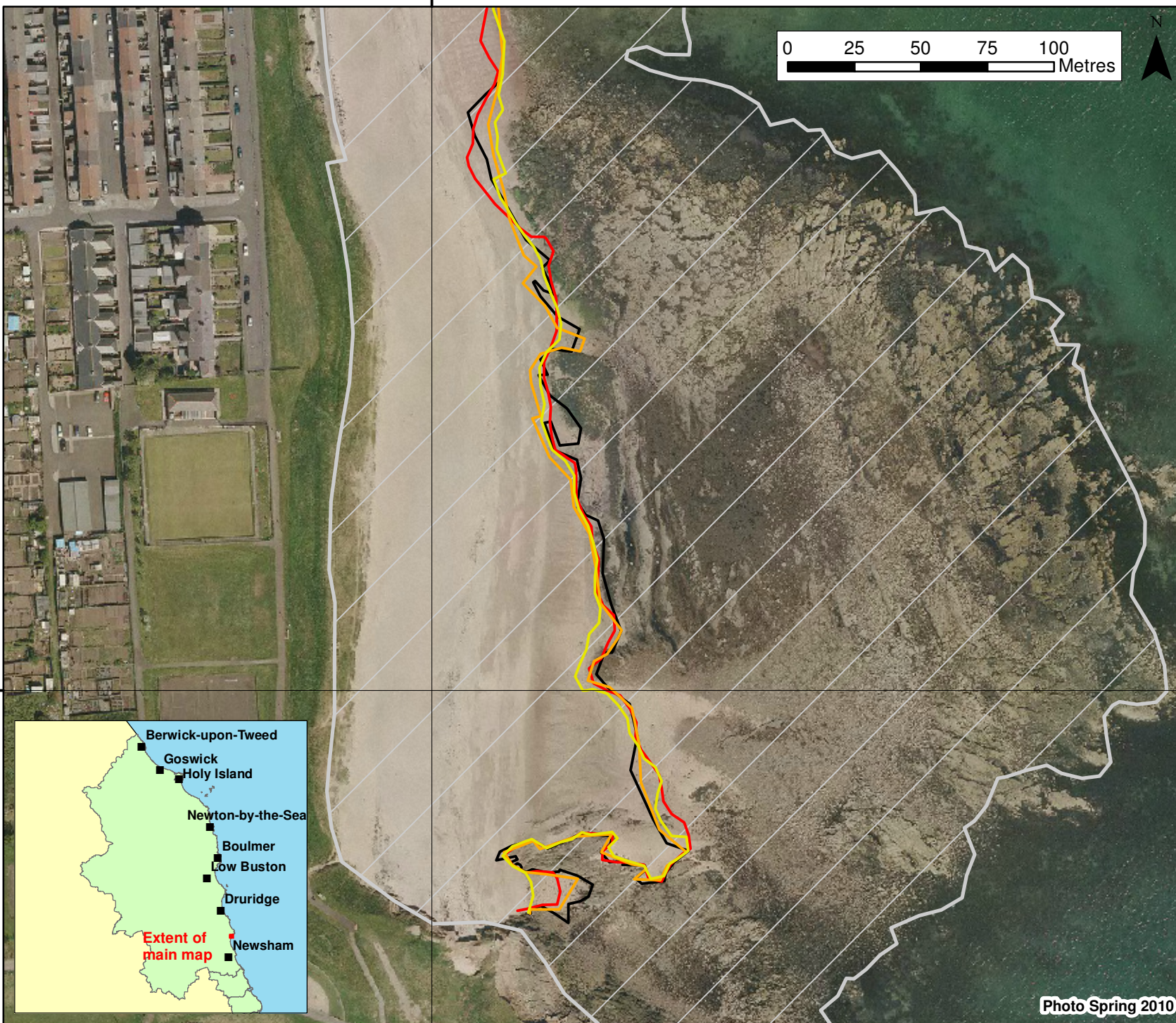
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Photography courtesy of North East Coastal Observatory  
 www.northeastcoastalobservatory.org.uk

**Appendix D**  
**Sand Extent Survey**



**KEY**

- Extent of sand (Autumn 2011)
- Extent of sand (Spring 2012)
- Extent of sand (Autumn 2012)
- Extent of sand (Spring 2013)
- ▭ Extent of SSSI

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

**Appendix D- Map 1  
 Sand Extent Survey  
 Newbiggin Bay  
 Northumberland  
 County Council**

Update Report 5  
 Partial Measures Survey  
 Spring 2013

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Photo Spring 2010

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