



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

**South Tyneside Council
Final Report**



July 2015

Contents

Disclaimer	i
Abbreviations and Acronyms	ii
Water Levels Used in Interpretation of Changes	ii
Glossary of Terms.....	iii
Preamble.....	iv
1. Introduction	1
1.1 Study Area	1
1.2 Methodology.....	1
2. Analysis of Survey Data.....	5
2.1 Littlehaven Beach.....	5
2.2 Herd Sands	8
2.3 Trow Quarry (incl. Frenchman's Bay)	11
2.4 Marsden Bay	12
3. Problems Encountered and Uncertainty in Analysis.....	13
4. Recommendations for 'Fine-tuning' the Monitoring Programme	13
5. Conclusions and Areas of Concern	13

Appendices

Appendix A	Beach Profiles
Appendix B	Topographic Survey
Appendix C	Cliff Top Survey

List of Figures

Figure 1	Sediment Cells in England and Wales
Figure 2	Survey Locations

List of Tables

Table 1	Analytical, Update and Overview Reports Produced to Date
Table 2	Sub-division of the Cell 1 Coastline

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Abbreviations and Acronyms

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

Water Levels Used in Interpretation of Changes

Water Level Parameter	Water Level (m AOD)	
	River Tyne to Frenchman's Bay	Frenchman's Bay to Souter Point
HAT	2.85	2.88
MHWS	2.15	2.18
MLWS	-2.15	-2.12

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

Glossary of Terms

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

Preamble

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

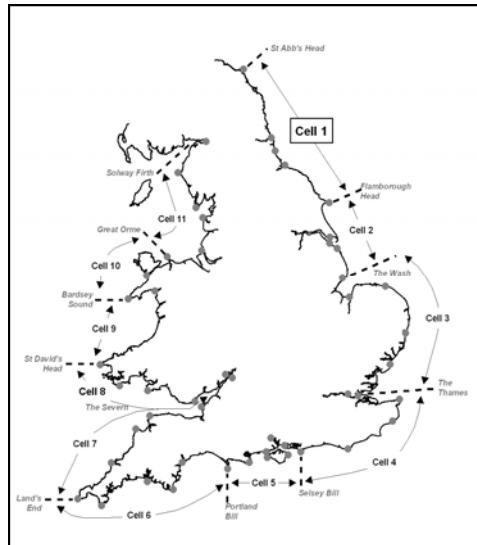


Figure 1 Sediment Cells in England and Wales

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	Nov 12	Mar 13	Mar 13	June 13	
6	2013/2014	Nov 13	Feb 14	Apr 14	Jul 14	
7	2014	Nov 14	Feb 15	Apr 15	Jul 15 (*)	

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

1. Introduction

1.1 Study Area

South Tyneside Council's frontage extends from the mouth of the River Tyne Estuary to the outfall south of Whitburn. For the purposes of this report and for consistency with previous reporting, it has been sub-divided into four areas, namely:

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

1.2 Methodology

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

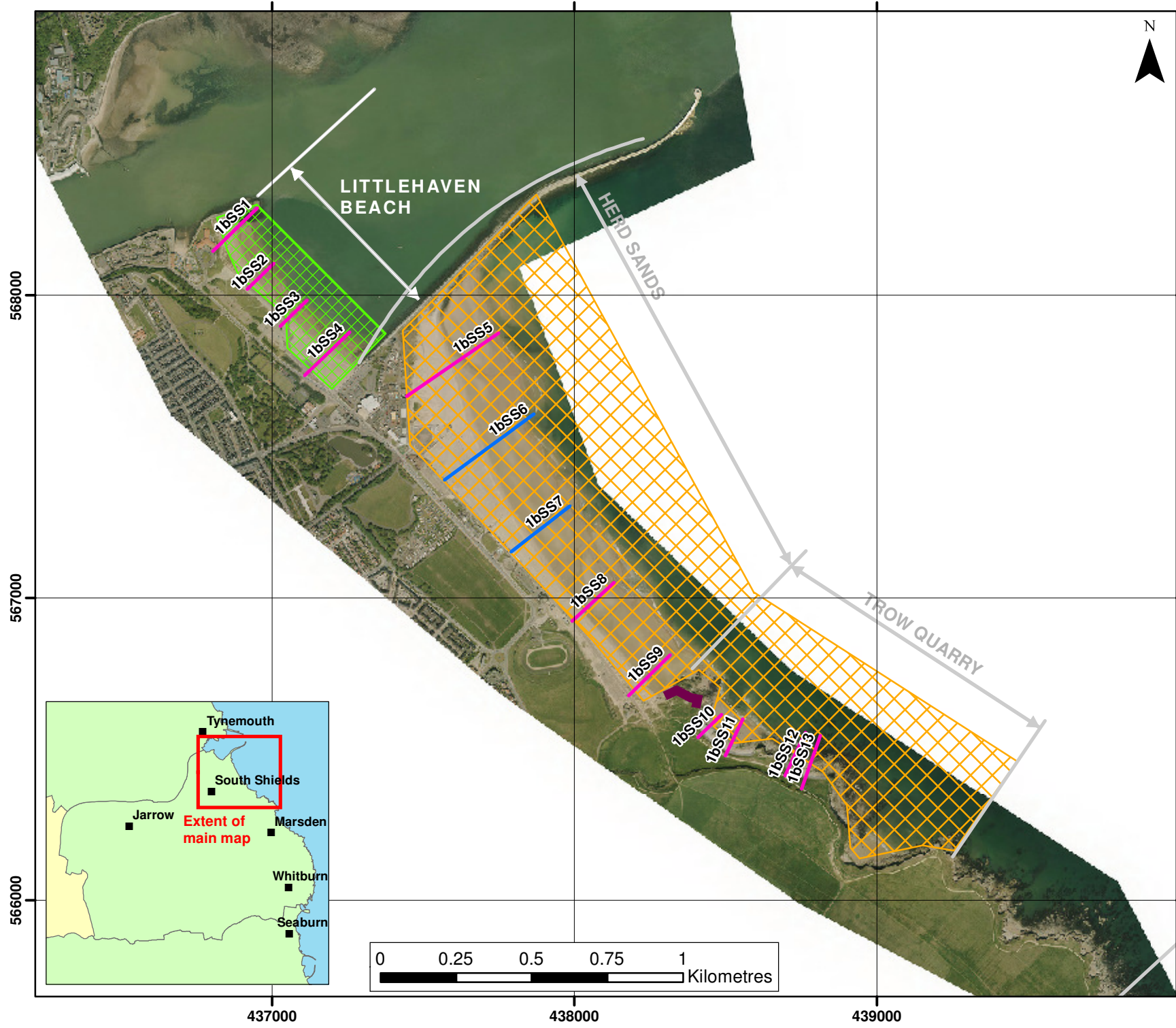
- Full Measures survey annually each autumn comprising:
 - Beach profile surveys along 17 transect lines (commenced 2008)
 - Topographic survey along Littlehaven Beach (commenced 2010)
 - Topographic survey along Herd Sands (commenced 2008)
 - Topographic survey along Trow Quarry (commenced 2008). Note the 2008 surveys at profiles 1bSS11, 1bSS12 and 1bSS13 were undertaken at a different location to subsequent surveys and have therefore been removed from the analysis presented here
- Partial Measures survey annually each spring comprising:
 - Beach profile surveys along 11 transect lines (commenced 2008)
 - Topographic survey along Littlehaven Beach (commenced 2010)
 - This 2014 Partial Measures survey also includes 2 additional profiles at Littlehaven. These were measured to record the new defence and beach profiles following completion of the sea defence works.
- Cliff top survey bi-annually at:
 - Cliff top survey at Trow Quarry (incl. Frenchman's Bay) (commenced 2008)

For all cliff-top surveys prior to Full Measures 2011, data was reported separately in Trow Quarry Coastal Defence Scheme - Monitoring Plan Year 2 (available from South Tyneside Council). The data was saved in '.kmz' format for plotting and comparison in GoogleEarth. For the present survey report, this data has been visualised in GIS, which revealed the quality was variable and reliable interpretations of cliff change could not be made. For this reason, the 'kmz' files are not presented or analysed as part of the present report. Therefore, cliff top survey data collected from Full Measures survey (autumn 2011) going forward is presented in this report. The location of these surveys is shown in Figure 2.

The Partial Measures survey was undertaken along this frontage between 28th April 2014 and 29^h April 2014. During this time weather conditions varied considerably; refer to the survey reports for details of the weather conditions over this survey period. This Update Report presents the following:

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

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



KEY

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

Topographic Surveys
 [Green grid] 6 monthly
 [Orange grid] yearly
 [Purple grid] 5 yearly

Cliff Top Monitoring Pegs
 [Purple bar] 50m centres
 [Green bar] 100m centres
 [Red bar] 300m centres

(Indicative survey extents shown)

NB Profiles 1bSS2 and 1bSS4 also surveyed in Spring 2014 for Update Report 6 to establish beach profiles post-completion of new sea defences at Littlehaven.

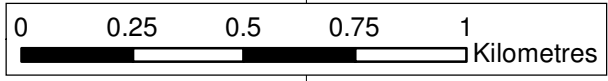
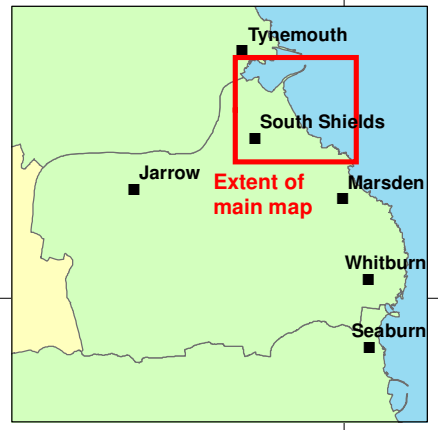
Client: North East Coastal Group
 Project: Cell 1 Regional Coastal Monitoring Programme 2011 to 2016

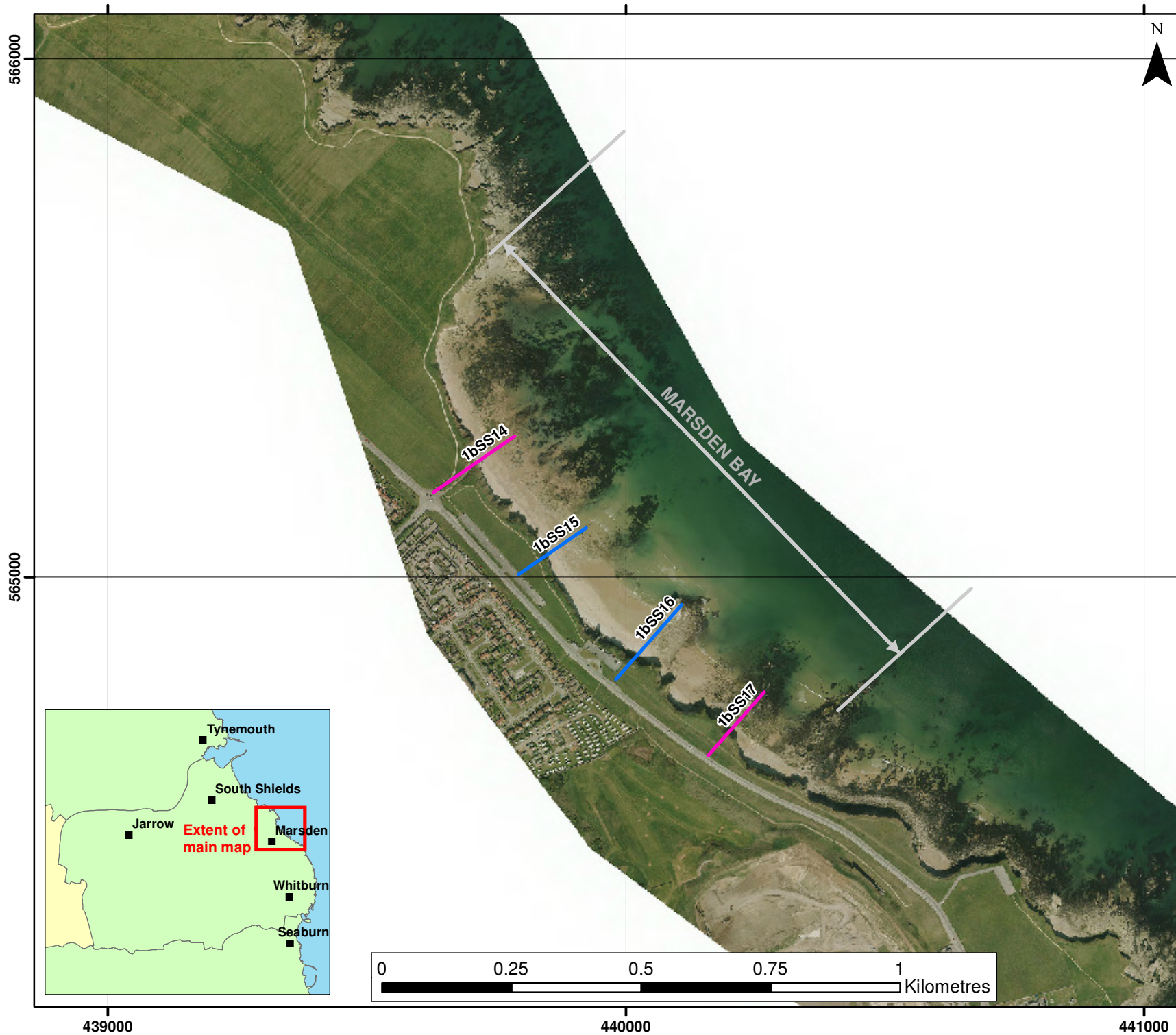
**Figure 2- Map 1
 Survey Locations
 Littlehaven Beach to
 Trow Quarry
 South Tyneside Council**

Update Report 7
 Partial Measures Survey
 Spring 2015

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





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)

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

**Figure 2 - Map 2
 Survey Locations
 Marsden Bay
 South Tyneside Council**

Update Report 7
 Partial Measures Survey
 Spring 2015

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

2. Analysis of Survey Data

2.1 Littlehaven Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
Apr 2015	<p>Beach Profiles:</p> <p>Littlehaven Beach is covered by two beach profile lines for the Partial Measures surveys, distributed between South Groyne and South Pier (1bSS1 and 1bSS3). In this survey two additional profiles were re-surveyed (1bSS2 and 1bSS4) to provide information on the impact of engineering works to realign the seawall that were completed in early 2014. The previous survey was the Full Measures survey undertaken in autumn 2014.</p> <p>Profile 1bSS1 is located to the north of Littlehaven Beach, in the lee of a rocky outcrop and harbour wall. The dunes have remained mostly stable since the previous survey with up to 0.5m retreat of the dune face and a small advance at the dune toe suggesting redistribution of sand. Beach levels have fallen between the dunes and lower foreshore by approximately 0.3m, although the profile shape is unchanged.</p> <p>Profiles 1bSS2 to 1bSS4 extend seawards from the new sea wall that was completed since the last survey.</p> <p>At profile 1bSS2 beach levels have changed across the profile, decreasing on the upper beach in front of the seawall by approximately 0.5m to form a lower and flatter beach berm, increasing by up to 0.8m on the middle beach to form a more gently sloping profile, and decreasing by approximately 0.5m seaward of a chainage of 70m. Overall, the survey photograph (see Plate 1) shows the beach to be in good condition.</p> <p>At profile 1bSS3 the upper beach has lowered and beach berm is lower and narrower. As at profile 1bSS2, beach levels on the middle beach have increased by approximately 0.7m, while on the lower beach (seaward of a chainage of 65m), they have lowered by 0.7m to give a steeper profile.</p> <p>At profile 1bSS4 the beach level on the upper beach has lowered by up to 0.2m. On the middle beach, between a chainage of 90m and 140m, beach levels have increased by approximately 0.7m, which is similar to the two profiles to the north (1bSS2 and 1bSS3). As a result of the higher beach levels, the</p>	<p>At Littlehaven Beach, the dune profile 1bSS1 has remained mostly stable over the winter/spring period, with a small amount of re-distribution of material across the dune face. Beach levels have fallen however.</p> <p>Profiles 1bSS2 to 1bSS4 show a very similar pattern of change with narrowing and lowering of the upper beach, accretion of the middle beach and erosion on the lower beach. These changes are likely to represent the adjustment of the profile following construction works to the day to day conditions and winter/spring storms. Survey photos show health beach levels and no significant impact from the recent construction is noted to date.</p> <p>Longer term trends: When compared with previous profile surveys, profiles 1bSS1 to 1bSS4 are generally within the bounds of previous surveys, indicating generic behaviour with no clear trend.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	boulders on the foreshore were covered by sand at the time of the survey when compared to the last survey (see Plates 2 and 3).	
Apr 2015	<p>Topographic Survey:</p> <p>Littlehaven Beach is covered by bi-annual topographic survey between the South Groyne and the South Pier, which commenced in March 2010.</p> <p>Data from the most recent topographic survey (Partial Measures, spring 2015) have been used to create a 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 (Full Measures, autumn 2014) and the present survey.</p> <p>The difference plots shows a clear a pattern of change across the beach, which reflects the beach profile data. The plots shows three bands of change, which extend from north to south, and comprise: (i) a band of beach lowering along the upper beach; (ii) a band of beach accretion along the middle beach; and (iii) beach lowering along the lower beach. The pattern of erosion at the upper and lower beach and accretion in the middle beach suggests development of a convex form</p>	<p>The pattern of beach elevation change observed from the topographic difference plot distinct areas of erosion and accretion, which is likely to be due to the beach responding to post construction day-today conditions and winter/spring storms.</p> <p>Comparison of the present topographic survey with the previous Full Measures (autumn, 2014) survey shows a reversal in the pattern of beach change which is typical of seasonal beach responses to storms.</p>



Plate 1 – Survey photograph 1bSS2_20150423_N3.JPG



Plate 2 – Survey photograph 1bSS4_20150423_N6.JPG



Plate 3 – Survey photograph 1bSS3_20141124_N6.JPG

2.2 Herd Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
Apr 2015	<p>Beach Profiles:</p> <p>Herd Sands is covered by three beach profile lines for the Partial Measures survey (Appendix A). The previous survey was the Full Measures survey undertaken in autumn 2014.</p> <p>Profile 1bSS5 is located to the north of Herd Sands and is located in the lee of the breakwater. Sand fences were constructed on the dunes in 2012 to encourage accretion and stabilisation. The dunes are unchanged since the last survey but the dune toe and upper beach have decreased to expose the tarmac path (refer to Plates 4 and 5). At chainage of 170m, beach levels have increased to form a berm and an overall higher beach. As Plate 3 shows, the berm appears to have become vegetated with early dune plants, suggesting some stability and growth of the foreshore dune.</p> <p>Profile 1bSS8 is located to south of Herd Sands. The beach profile has changed in form since the previous survey. Beach levels on the upper beach, from the seawall to a chainage of approximately 50m, have fallen by approximately 0.5m to form a wider and more gently sloping beach profile. Between 50m and 70m chainage, beach levels have increased by 0.7m, but the slope and form have remained the same. The largest change is observed at a chainage of 80m, where beach levels have increased by 1.5m to form a berm and runnel, which steeply slopes to the sea. The topographic survey report notes '<i>contractors have removed sand from the beach in the area of sections 8 and 9 leaving a prominent berm</i>'. These observations are likely to be related to dune management practices undertaken at Herd Sands (which includes the movement of sand that has blown inland over the footpath back onto the beach) and not associated with the removal of sand from the beach.</p> <p>Profile 1bSS9 is located to south of Herd Sands where dunes have remained stable since the previous survey. The beach profile shows a similar trend to profiles 1bSS8 with accretion of up to 2.5m at the upper/middle beach. As the survey photograph shows (see Plate 6), the beach profile has a convex shape, with a runnel and ridge on the lower beach. An explanation for these changes is likely to reflect cross-shore movement of material and the influence of storm activity over the winter/spring months. The topographic survey report notes that '<i>contractors have removed sand from the beach in the area of sections 8 and 9 leaving a prominent berm</i>.' As noted above these observations are likely to be related to dune management practices undertaken at Herd Sands (which includes the movement of sand that</p>	<p>Since the last survey, the dunes at Herd Sands have remained stable.</p> <p>Along the length of the Herd Sands the beach fronting the dune has eroded, while the upper/middle beach has accreted significantly to form a higher and wider slope. There is a clear runnel and ridge formation on the lower section of the beach, which is likely to have formed in response to cross-shore movement of material under the influence of storm activity over the winter/spring months.</p> <p>Longer term trends: Although the beach has experienced significant accretion, beach levels at profile 1bSS5 are within the bounds of previous surveys, indicating fluctuating levels with no net trend. The observed berm existed previously and appears to migrate across the beach. At profile 1bSS8 beach levels along the upper and middle beach are the highest recorded, but lowest at the seaward end of the beach indicating the most substantial movement across the beach yet. The southernmost profile, Profile 1bSS9 has the highest level along the middle beach recorded since surveys began in 2008; given that they were the lowest since surveys began during the last full measures, it is likely that this change is response to beach recovery over the winter/spring months.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	has blown inland over the footpath back onto the beach) and not associated with the removal of sand from the beach.	



Plate 4 – Survey photograph 1bSS5_20150423_N7.JPG



Plate 5 – Survey photograph 1bSS5_20141124_N7.JPG



Plate 6 – Survey photograph 1bSS9_20150423_N3.JPG

2.3 Trow Quarry (incl. Frenchman’s Bay)

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>Apr 2015</p>	<p>Beach Profiles:</p> <p>Trow Quarry is covered by four beach profile lines for the Partial Measures survey (Appendix A), two in Graham’s Sand and two in Southern Bay. The previous survey was the Full Measures survey undertaken in autumn 2014.</p> <p>Profiles 1bSS10 and 1bSS11 are located in Graham’s Bay. At profile 1bSS10, there has been no notable change to the rocky upper beach. Beach levels seaward of a chainage of 50m have increased by over 1m burying the underlying rock platform and forming a gently sloping beach dominated by sand. At profile 1bSS11, the beach profile has remained stable since the previous survey.</p> <p>Profiles 1bSS12 and 1bSS13 are located in Southern Bay. At both locations the beach profile has remained stable since the previous survey.</p>	<p>Since the last survey at Graham’s Bay and Southern Bay the cliff, rock revetment and upper boulder/cobble rocky beach have remained stable.</p> <p>The beach has remained stable, except at profile 1bSS10, in the north of the bay. Here, beach levels have increased across the profile, particularly on the lower foreshore burying the underlying rock and boulders.</p> <p>Longer term trends: At Graham’s Bay the beach levels are within the bounds of previous changes, indicating seasonal fluctuation with no net trend.</p>
<p>April 2015</p>	<p>Cliff-top Survey:</p> <p>Cliff top survey data collected for the baseline survey (autumn, 2011), Full Measures survey (autumn, 2014) and the present Partial Measures survey (spring, 2015) is presented in this report.</p> <p>Six ground control points (numbered 1-6) were established along the cliff top at Trow Point in 2011 to monitor cliff erosion at the headland adjacent to the site of a former landfill. 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 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 $\pm 0.2\text{m}$ due to the technique used. The results from the cliff top survey are presented in Appendix C – Table C1, showing the position from the ground control point to the edge of the cliff top along a defined bearing.</p> <p>Results show that since the last survey in November 2014, cliff movement greater than the survey error occurred at ground control point 4 where retreat of 0.3m was recorded.</p>	<p>Since the last survey, erosion has occurred at one ground control point 4, where loss of 0.3m is recorded.</p> <p>Longer term trends: Very limited change has been detected since surveys began in November 2011.</p>

2.4 Marsden Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>Apr 2015</p>	<p>Beach Profiles:</p> <p>Marsden Bay is covered by two beach profile lines for the Partial Measures survey (Appendix A). The previous survey was the Full Measures survey undertaken in autumn 2014.</p> <p>Profile 1bSS14 is located to the north of the bay and covers the cliffs and former lifeguard station adjacent to the Redwell Steps. The cliff profile has remained stable since the previous survey. Beach levels have increased by approximately 0.5m at the toe of the cliff on the upper beach, but decreased seaward of a chainage of 150m by approximately 0.5m to form a slightly steeper and narrower beach.</p> <p>Profile 1bSS17 is located to the south of the bay. At profile 1bSS14 the cliff has remained stable while the levels across the upper beach have fallen by approximately 0.5m.</p>	<p>Along the length of Marsden Bay, the cliff has retained the same form and position since the last surveys.</p> <p>At profiles 1bSS14 the beach has narrowed and steepened in response to winter/spring storm conditions. The beach at profile 1bSS17 remains unchanged from the previous survey. Changes documented over the winter are the opposite of those observed during the last Partial Measures (spring 2014) report, which was dominated by the impacts of the December 2013 storm surge.</p> <p>Longer term trends: At profile 1bSS14 and 1bSS17 the beach levels are within the bounds of previous changes, indicating fluctuating behaviour with no net trend.</p>

3. Problems Encountered and Uncertainty in Analysis

Individual Profiles / Topographic Survey

- At Littlehaven beach (profiles 1bSS1 to 1bSS4), the profiles and topographic survey show the beach to have changed form, whilst the survey photographs show that the beach is in good condition and therefore no adverse impacts related to the construction of the defences are reported on for this survey.
- At the southern end of Herd Sands, the survey report notes 'contractors have removed sand from the beach in the area of sections 8 and 9 leaving a prominent berm'. A number of beach and dune management activities are undertaken at Herd Sands to loss of wind-blown sand from the system, prevent build-up of blown sand on the footpath and to help prevent local dune erosion due to pedestrian access. One of those activities includes the movement of sand that has blown inland onto the beach to stop it being lost from the system. Observations made by the contractors are likely to be related to dune management and not associated with the removal of sand from the beach.

Cliff Top Surveys

- Surveying any cliff top is difficult due to the need for a consistent interpretation of the cliff edge in successive surveys, which can be challenging, especially when vegetation is thick. 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 any indication of an advancing cliff line is error.
- With the exception of the rock falls recorded during the last Partial Measures (spring 2014) report, no further cliff recession has been recorded at Trow Quarry since records began.

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

No changes are recommended at the present time.

5. Conclusions and Areas of Concern

- At Littlehaven Beach, the recorded profiles and topographic survey present no causes for concern.
- At Herd Sands, the recorded profiles present no causes for concern.
- At Tow Quarry, the recorded profiles present no causes for concern. The cliffs to the north west of Trow Headland appear to have been stable and the data does not indicate cause for concern.
- At Marsden Bay, the recorded profiles present no causes for concern.

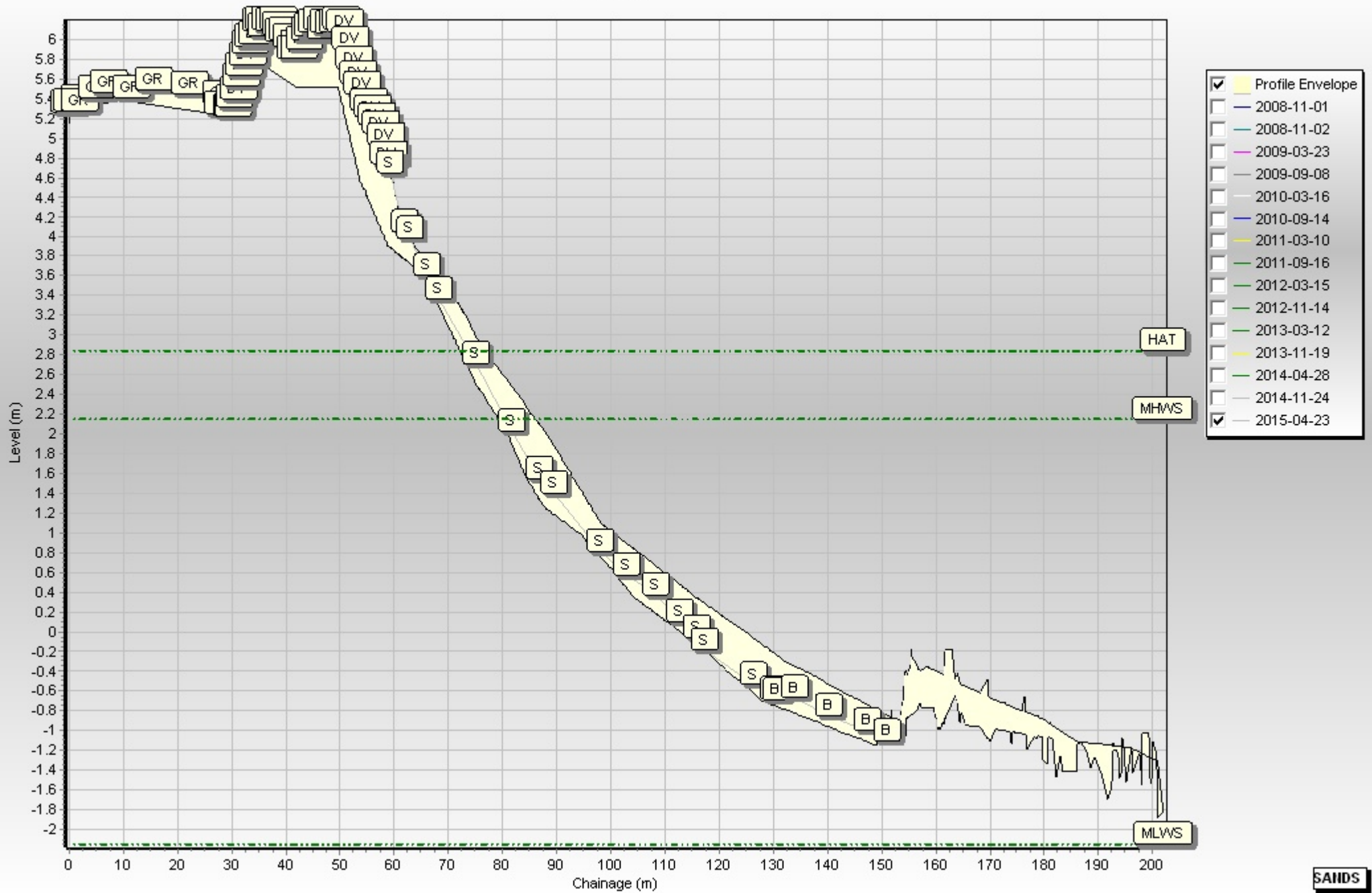
Appendices

Appendix A
Beach Profiles

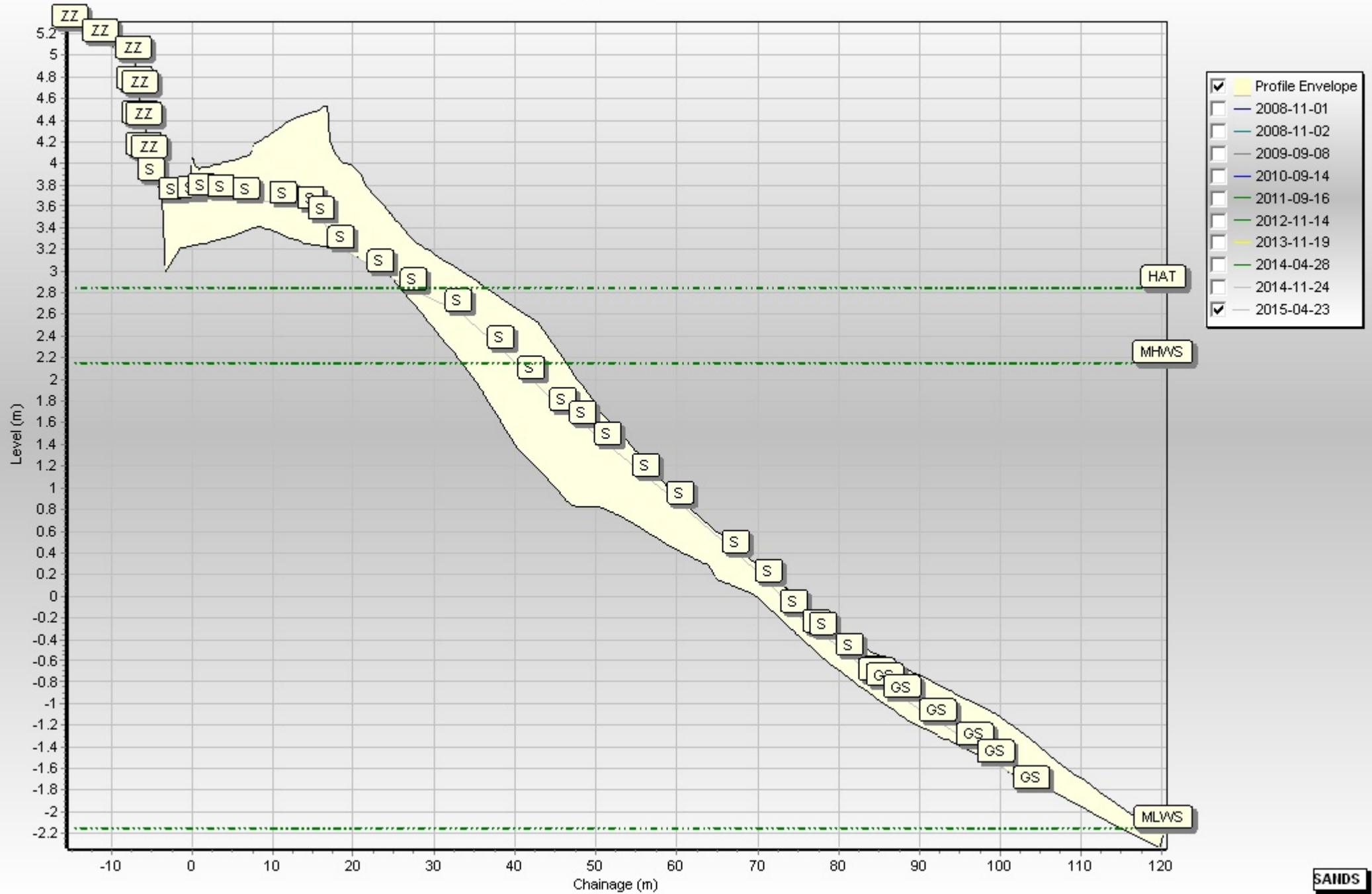
The following sediment feature codes are used on some profile plots:

Code	Description
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

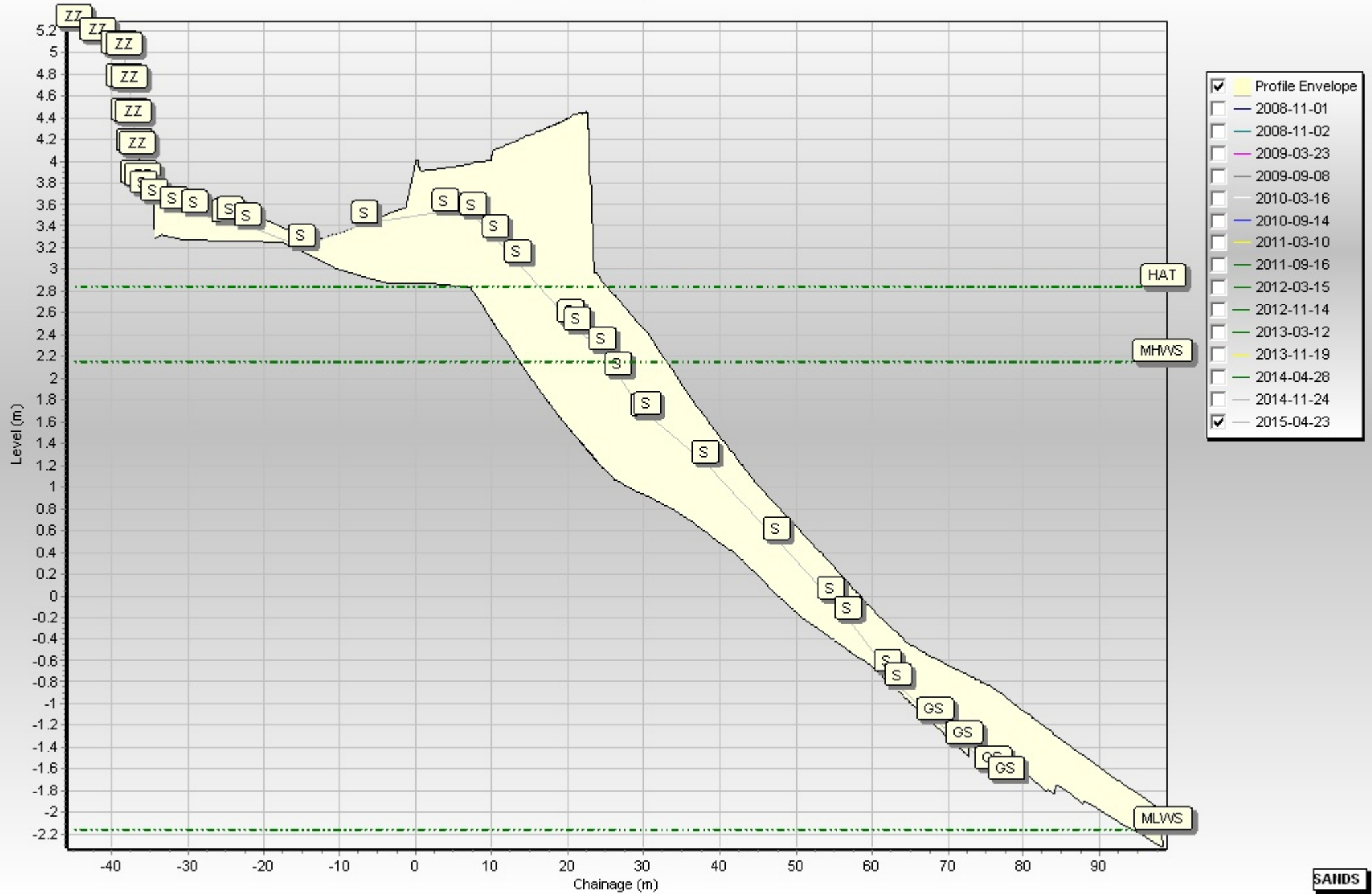
Profiles: 1bSS1



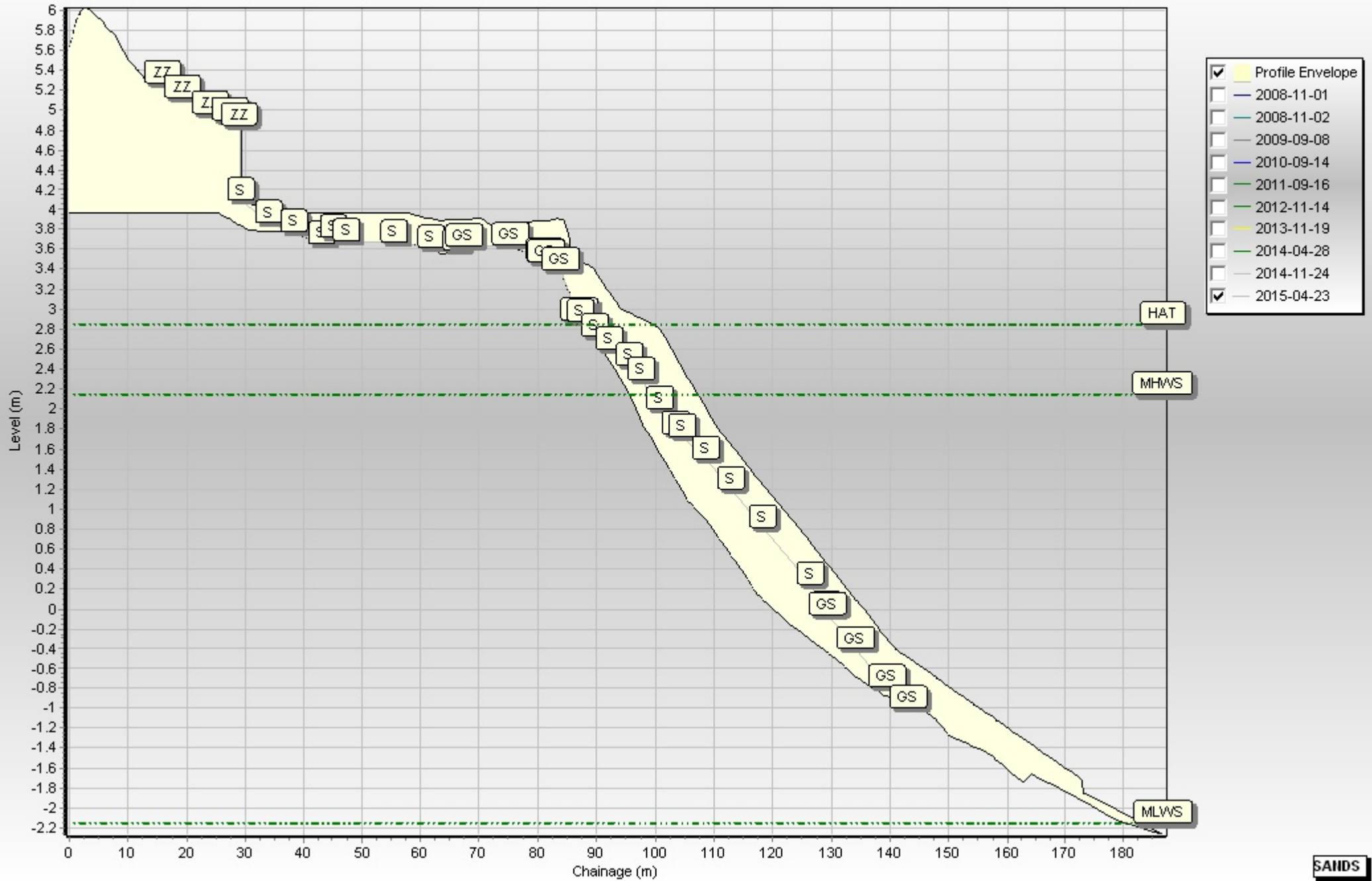
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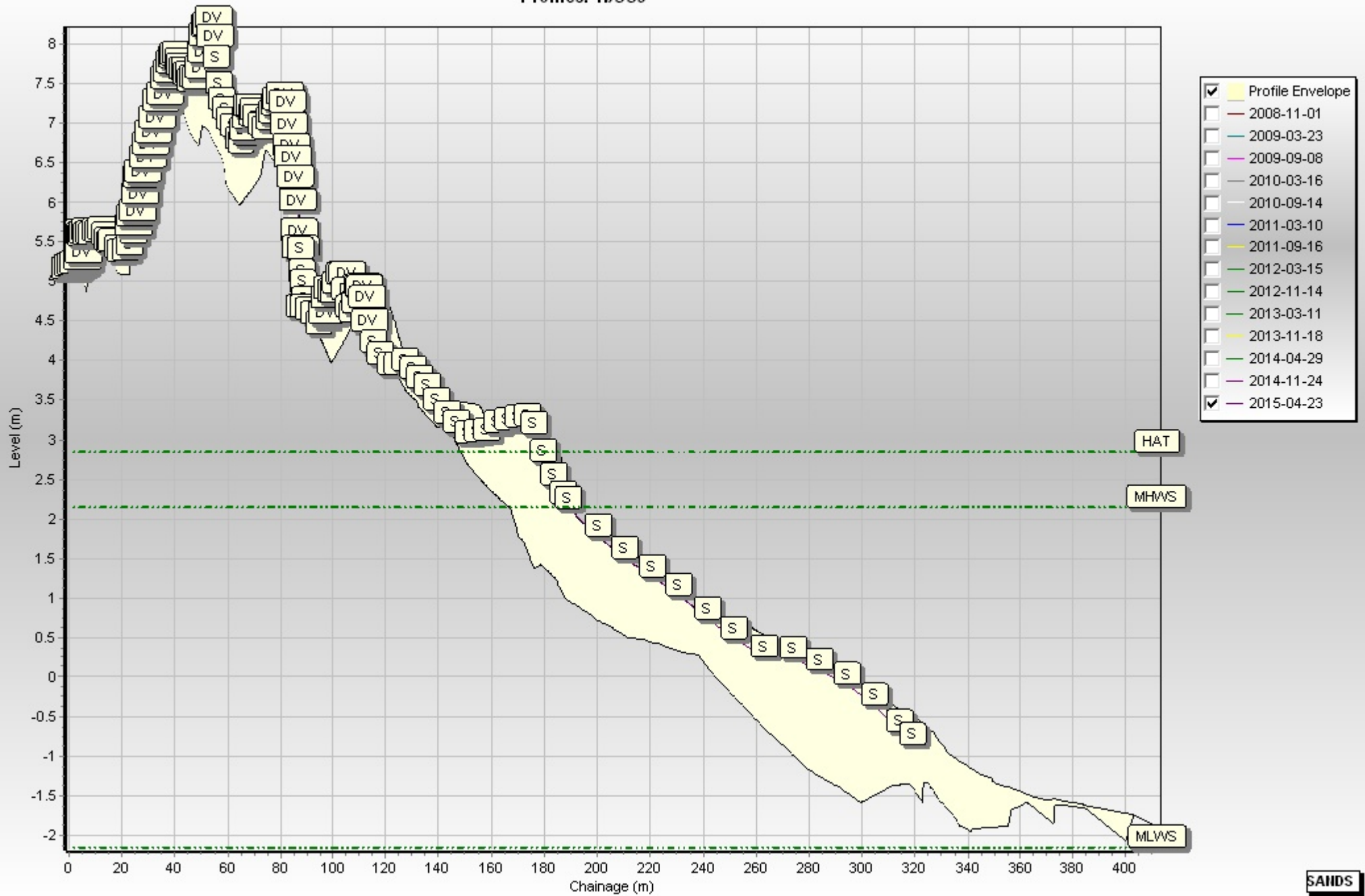
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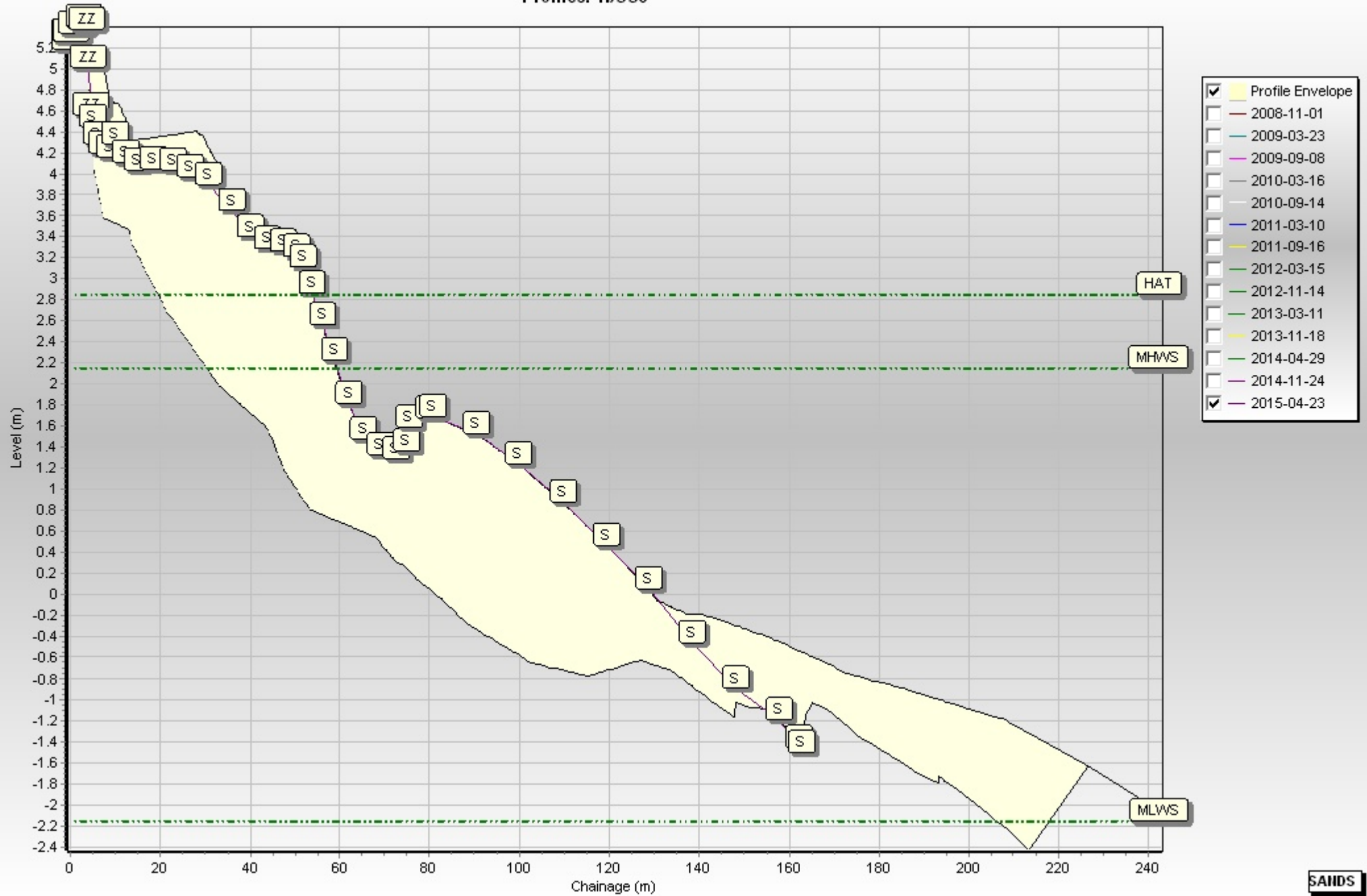
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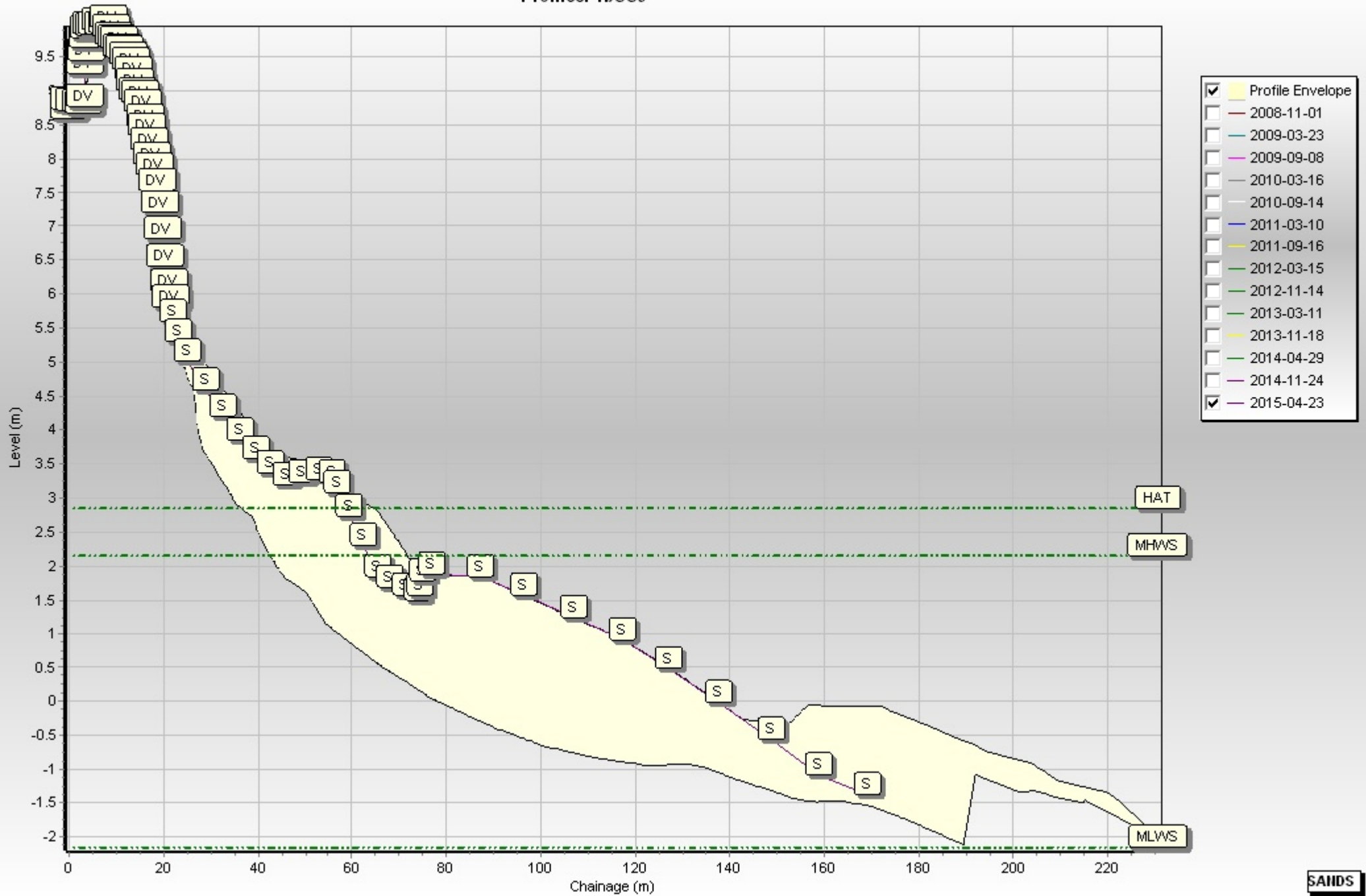
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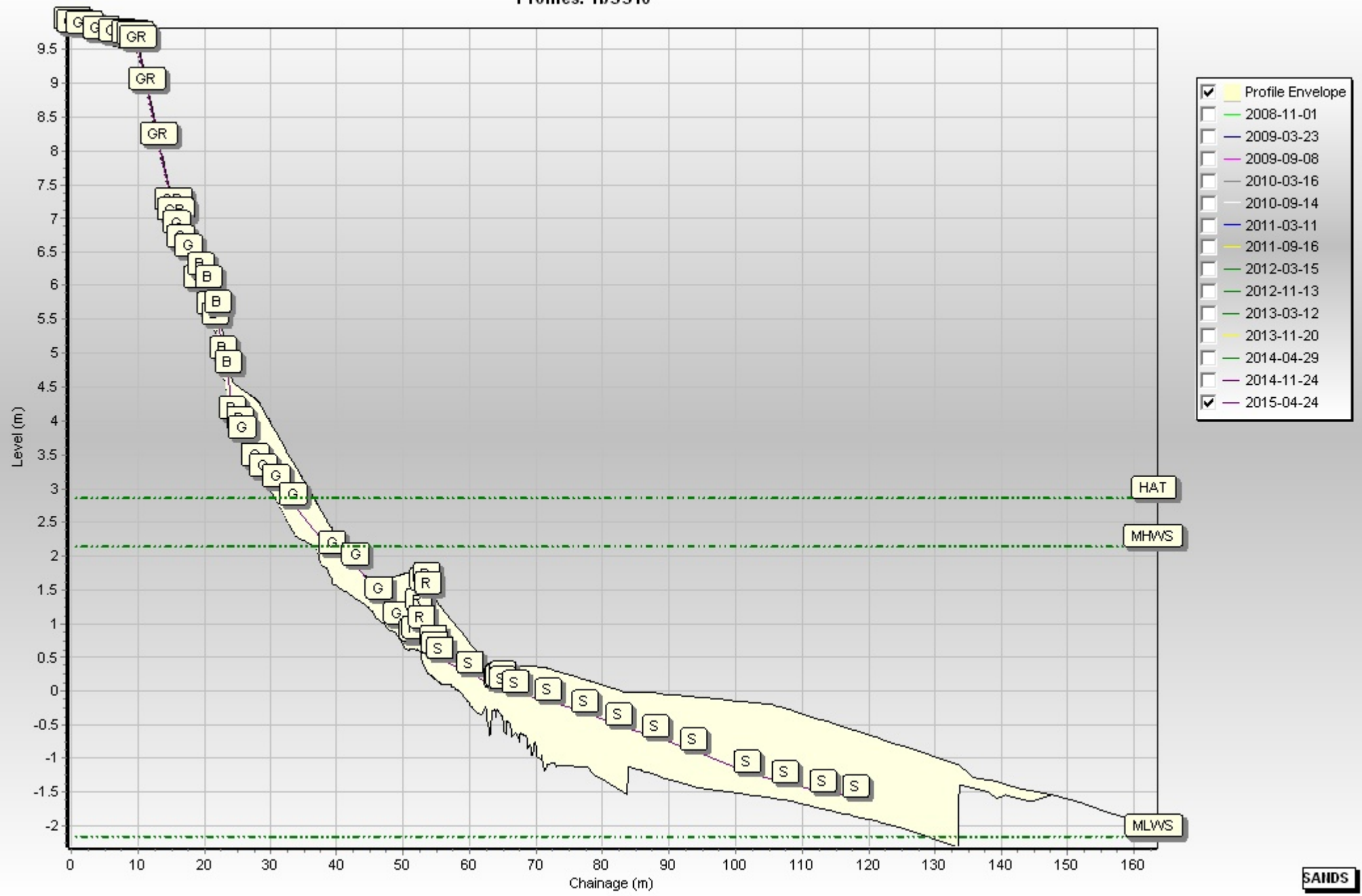
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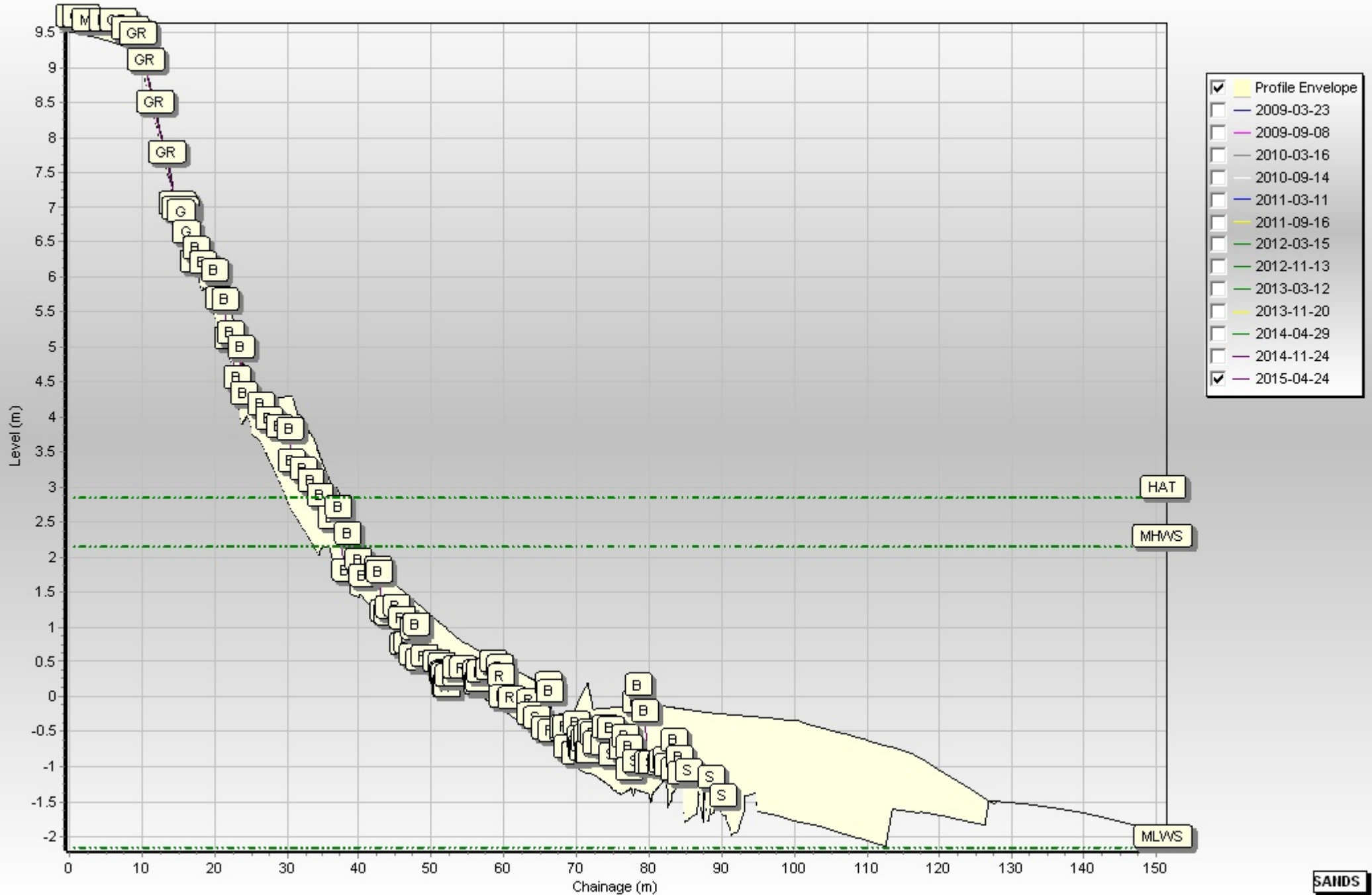
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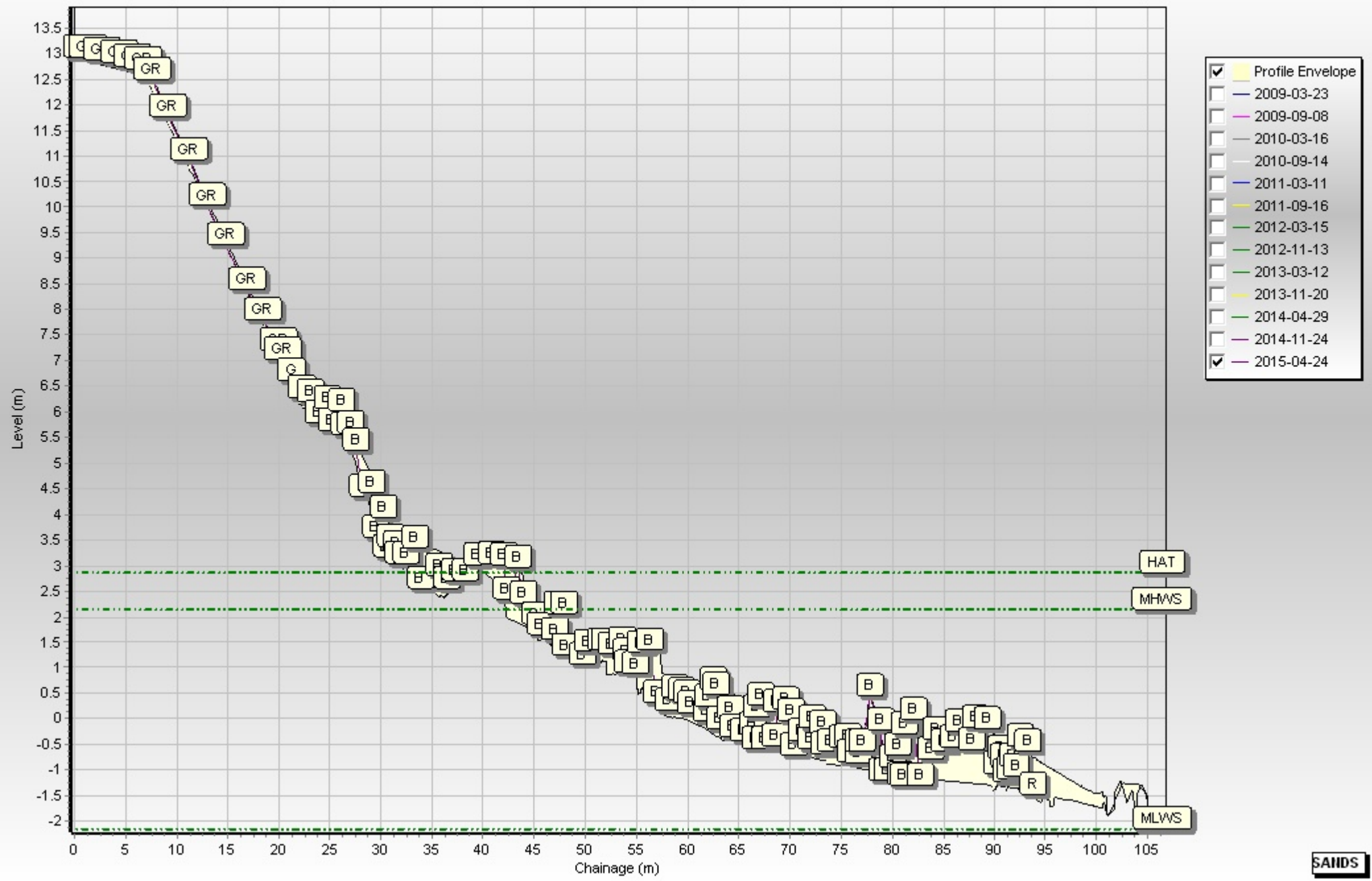
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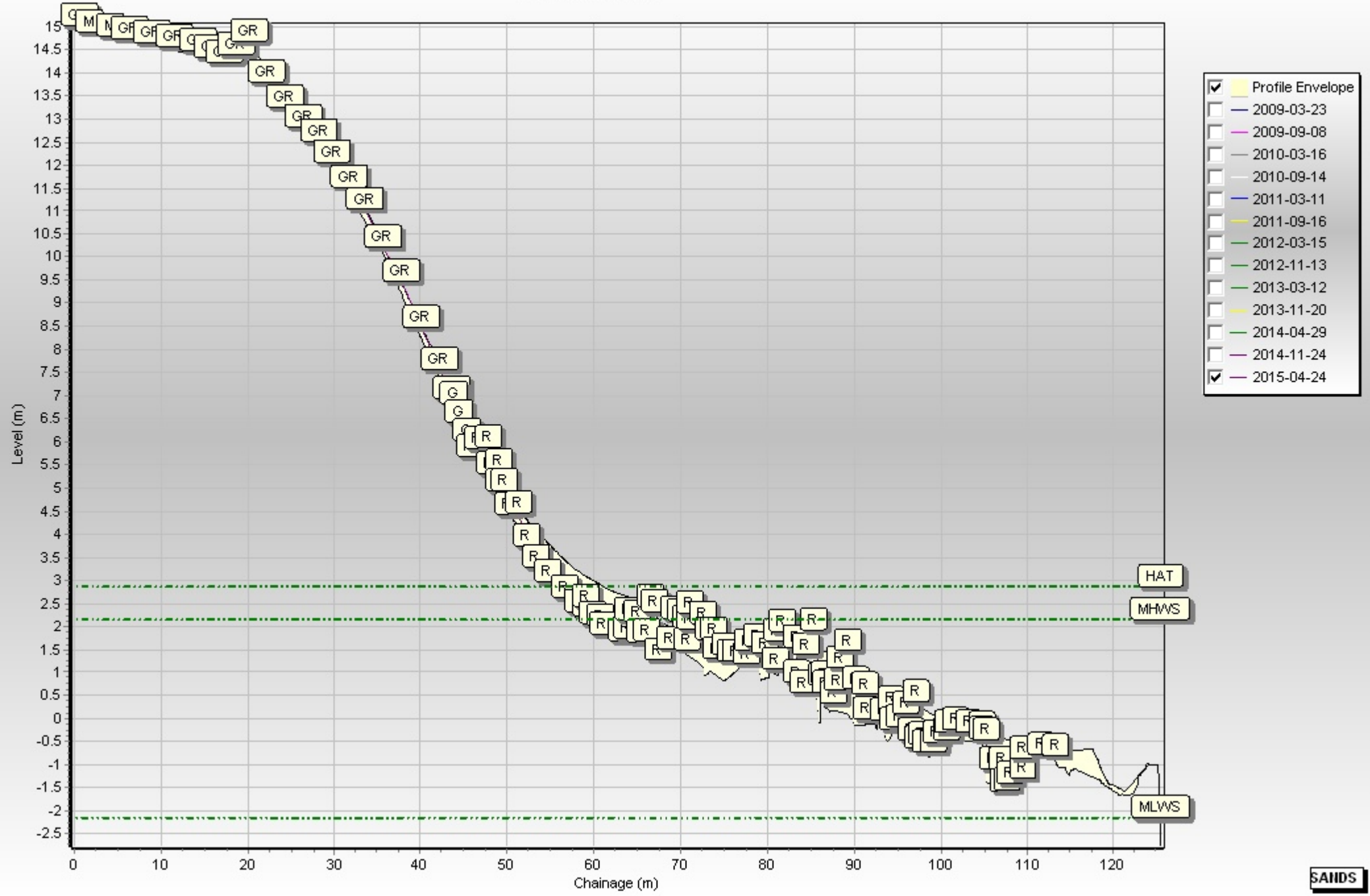
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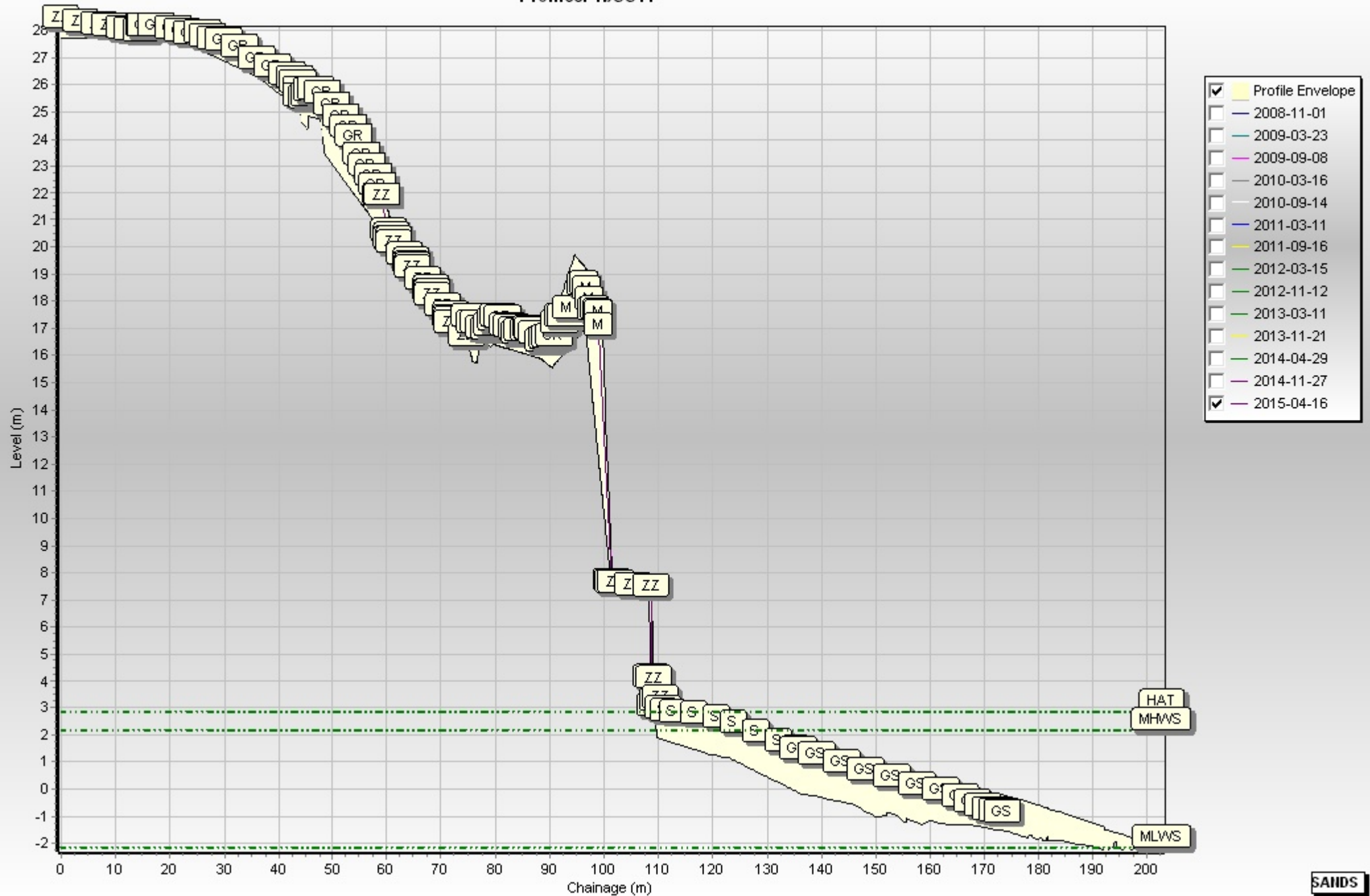
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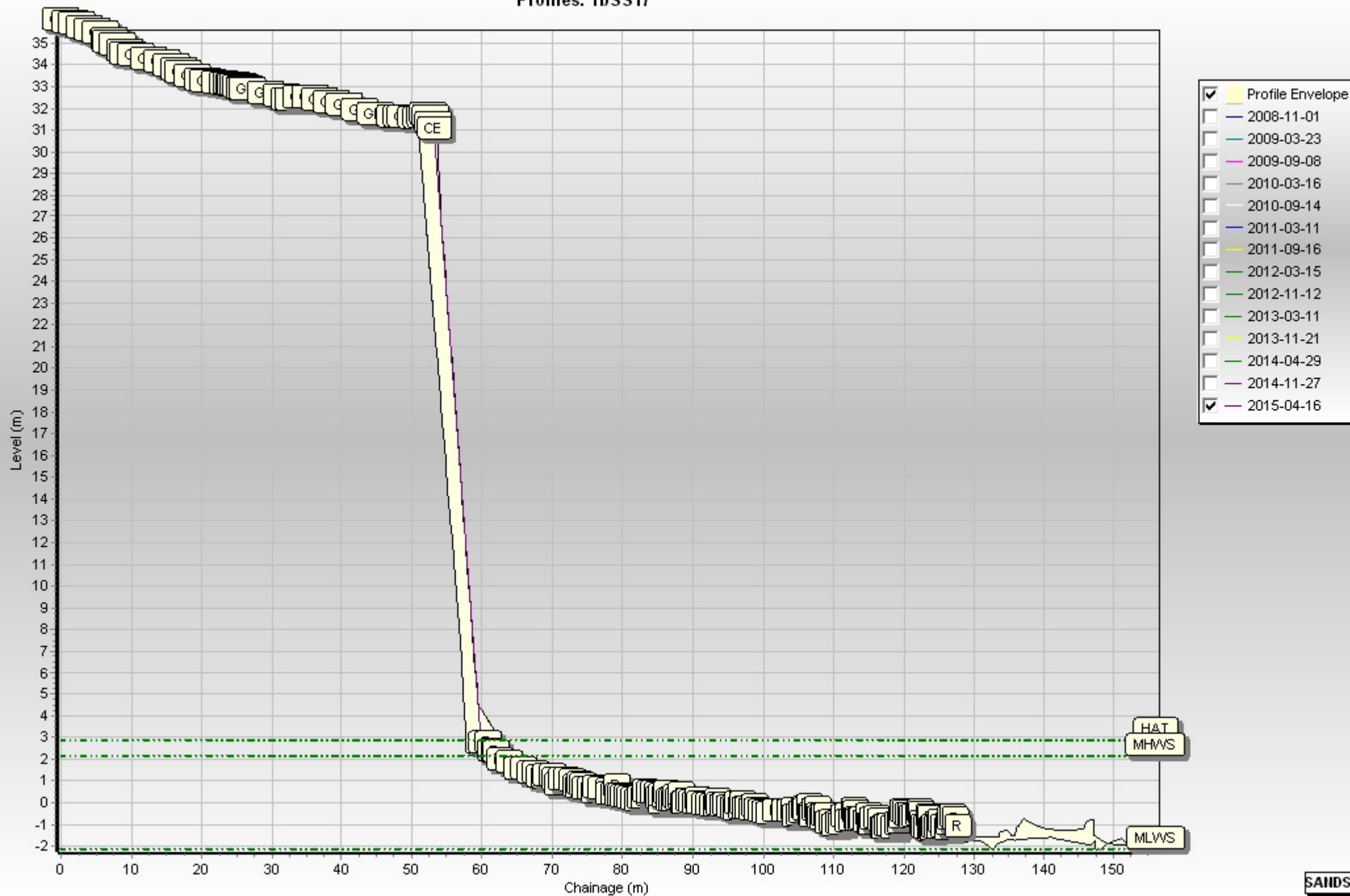
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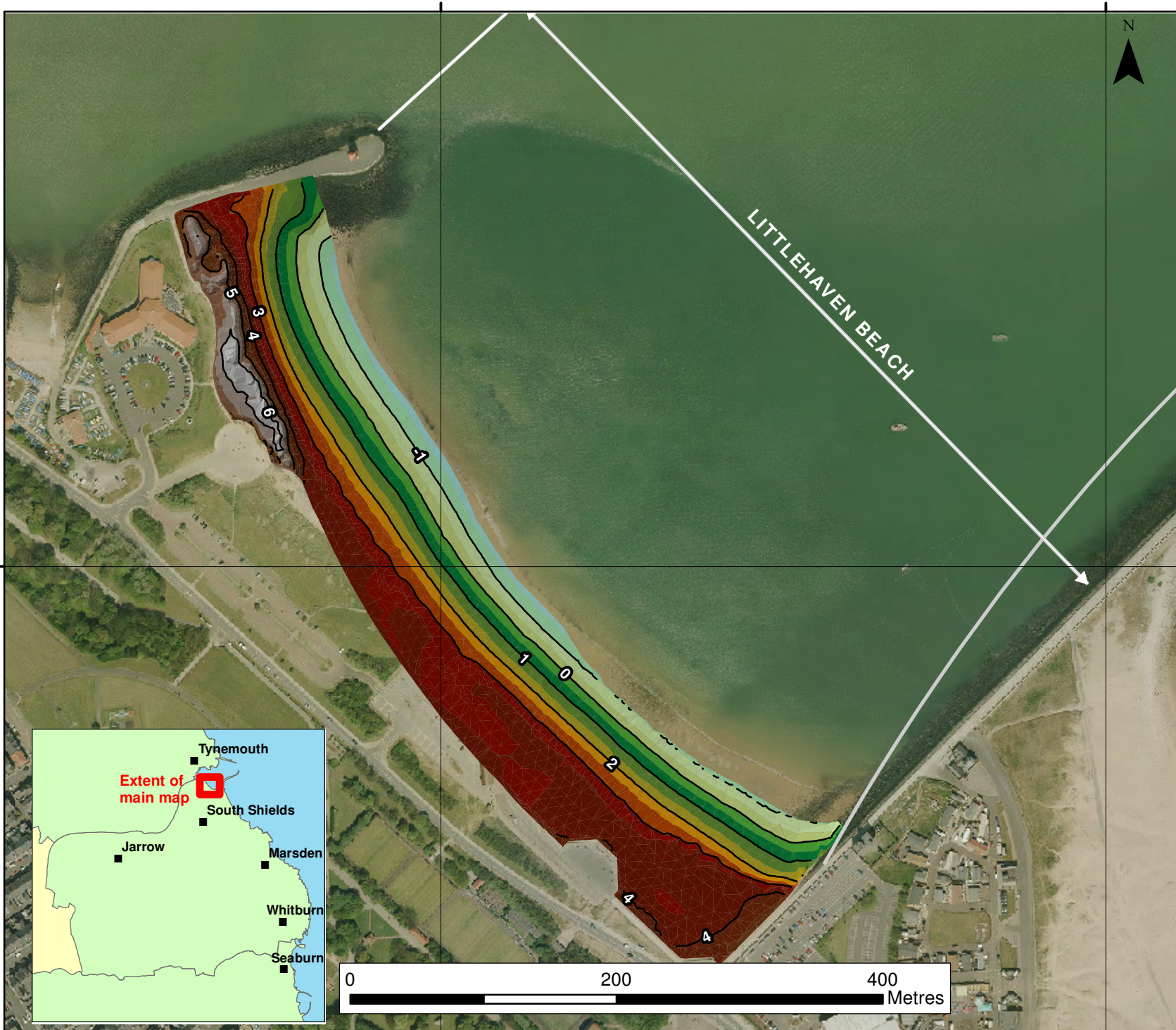
Profiles: 1bSS14



Profiles: 1bSS17



Appendix B
Topographic Survey



KEY
Elevation (m OD)

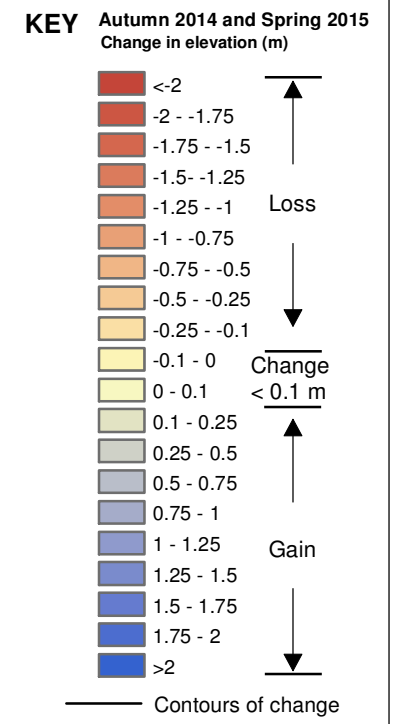
7 - 7.5
6.5 - 7
6 - 6.5
5.5 - 6
5 - 5.5
4.5 - 5
4 - 4.5
3.5 - 4
3 - 3.5
2.5 - 3
2 - 2.5
1.5 - 2
1 - 1.5
0.5 - 1
0 - 0.5
-0.5 - 0
-1 - -0.5
-1.5 - -1
-2 - -1.5
— Contour 1m

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

Appendix B - Map 1a
Topographic Survey
Littlehaven Beach
South Tyneside Council

Update Report 7
 Partial Measures Survey
 Spring 2015

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 Halcrow Group Ltd, Lyndon House, 62 Hagley Road, Edgbaston, Birmingham, B16 8PE
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 Fax: +44(0)121 456 1569
 www.ch2m.com
 Photography courtesy of North East Coastal Observatory
 www.northeastcoastalobservatory.org.uk



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

Appendix B- Map 1b
Short-term
Elevation Change
Littlehaven
SouthTyneside Council

Update Report 7
Partial Measures Survey
Spring 2015

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

Appendix C
Cliff Top Survey

Cliff Top Survey

Trow Quarry

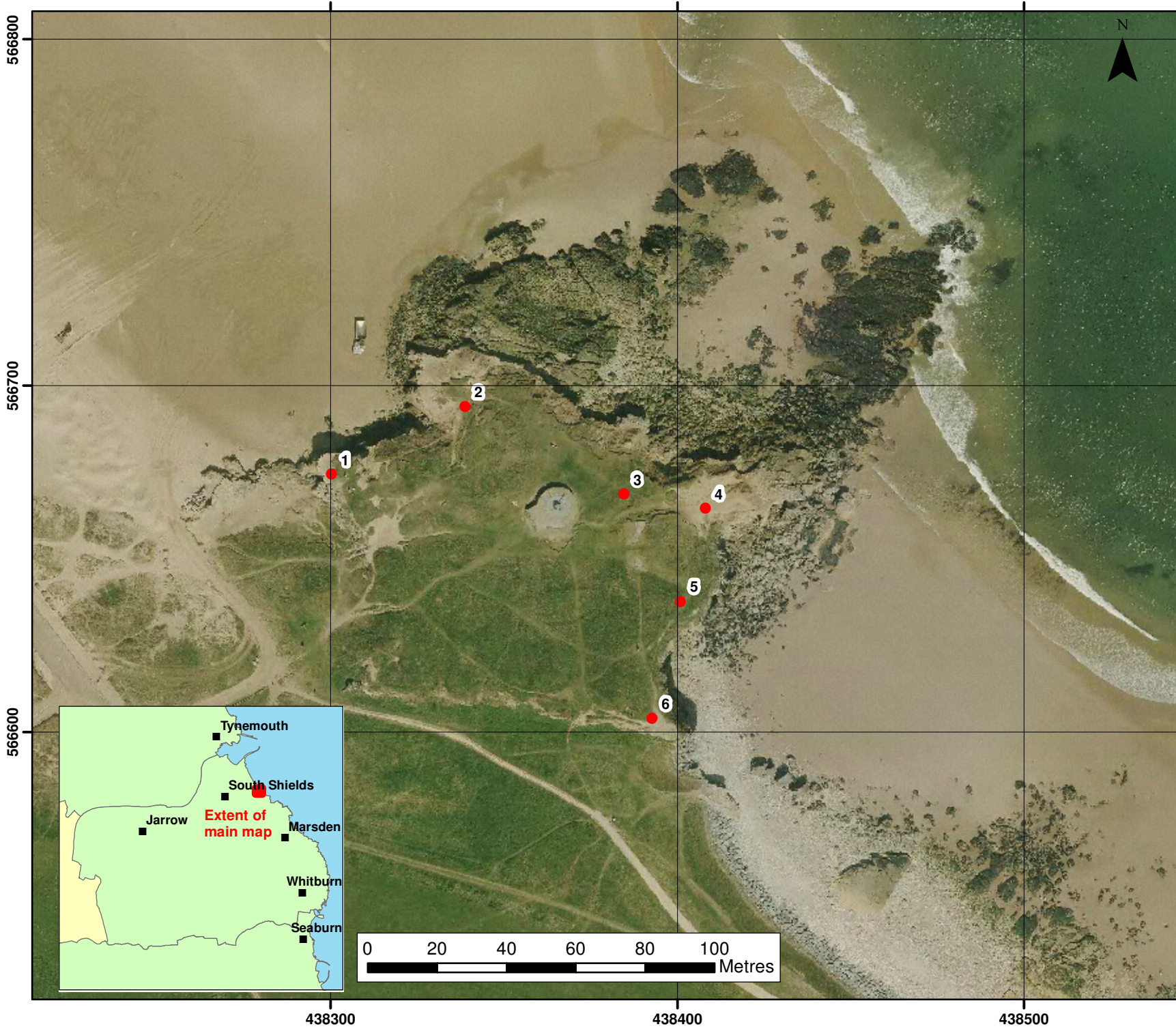
Six ground control points have been established at Trow Quarry (Figure C1). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion.

The cliff top surveys at Trow Quarry are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table C1 provides baseline information about these ground control points and results from the 2011 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

Table C1 – Cliff Top Surveys at Trow Quarry

Ground Control Point Details	Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
	Ref	Baseline Survey (Sept 2011)	Previous Survey (Nov 2014)	Present Survey (Apr 2015)	Baseline (Sept 2011) to Present (Apr 2015)	Previous Survey (Nov 2014) to Present (Apr 2015)
1	7.0	6.9	6.9	-0.2	0.0	0.0
2	9.4	9.3	9.3	-0.1	0.0	0.0
3	7.0	6.9	7.1	0.1	0.2	0.0
4	10.5	10.7	10.5	0.0	-0.3	0.0
5	7.0	7.6	7.6	0.6	-0.1	0.2
6	10.2	10.3	10.1	-0.1	-0.1	0.0



KEY

- Cliff top survey locations

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

Appendix C- Map 1
Cliff Top Survey
Trow Quarry
South Tyneside Council

Update Report 7
 Partial Measures Survey
 Spring 2015

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