



North East  
Coastal  
Observatory



**SCARBOROUGH**  
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HaskoningDHV**  
*Enhancing Society Together*



## **Cell 1 Regional Coastal Monitoring Programme Update Report 14: 'Partial Measures' Survey 2022**



**Sunderland City Council  
June 2022**

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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)
	Whitburn Bay to Ryhope
HAT	3.08
MHWS	2.58
MHWN	1.48
MLWN	-0.72
MLWS	-1.82

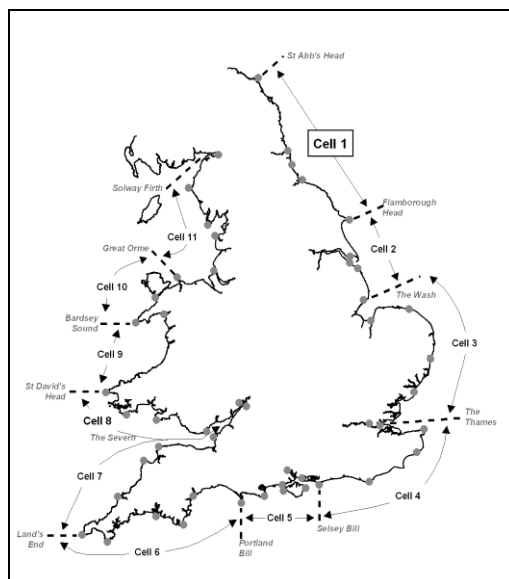
Source: UKHO Admiralty Tide Tables, 2020

## 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). Within this frontage the coastal landforms vary considerably, comprising low-lying tidal flats with fringing salt marshes, hard rock cliffs that are mantled with glacial sediment to varying thicknesses, softer rock cliffs and extensive landslide complexes.



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

The programme commenced in its present guise in September 2008<sup>1</sup> and is managed by Scarborough Borough Council on behalf of the North East Coastal Observatory. It is funded by the Environment Agency, working in partnership with the following organisations:



<sup>1</sup> Prior to 2008, coastal monitoring was undertaken on a consistent basis across Northumberland and North Tyneside as part of the (then) Northumbrian Coastal Authorities Group's monitoring programme which commenced in 2002, whilst several authorities between the River Tyne and Flamborough Head undertook their own local monitoring programmes.

Royal HaskoningDHV has been appointed to provide Analytical Services in relation to the present phase of the Cell 1 Regional Coastal Monitoring Programme, between 2016 - 2027.

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
- LiDAR Surveys
- walk-over cliff and coastal defence asset 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.

At the end of each phase of the programme, a Cell 1 Overview Report is also produced. This provides a region-wide summary of the main findings relating to trends and interactions along the entire Cell 1 frontage.

To date the following reports have been produced:

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

Year		Full Measures		Partial Measures		Cell 1 Overview Report
		Survey	Analytical Report	Survey	Update Report	
1	2008/09	Sep-Dec 08	May 09	Mar-May 09		
2	2009/10	Sep-Dec 09	Mar 10	Feb-Mar 10	Jul 10	
3	2010/11	Aug-Nov 10	Feb 11	Feb-Apr 11	Aug 11	Sep 11
4	2011/12	Oct-Nov 11	Oct 12	Mar-May 12	Oct 12	
5	2012/13	Sep-Oct 12	Mar 13	Mar 13	Jun 13	
6	2013/14	Sep-Oct 13	Feb 14	Mar 14	Jul 14	
7	2014/15	Sep-Nov 14	Feb 15	Mar-Apr 15	Jul 15	
8	2015/16	Sep-Nov 15	Feb 16	Mar 16	Jul 16	Jun 16
9	2016/17	Sep-Nov 16	Feb 17	Apr 17	Jul 17	
10	2017/18	Oct-Nov 17	Mar 18	Mar 18	May 18	Nov 18
11	2018/19	Oct-Nov 18	Feb 19	Feb-Mar 19	May 19	
12	2019/20	Sep-Nov 19	Jan 20	Mar 20	Apr 20	
13	2020/21	Sep-Oct 20	Jan 21	Mar-Apr 21	May 21	Aug 21
14	2022/23	Nov 21	Feb 22	Apr 22	Jun 22 (*)	

(\*) The present report is **Update Report 14** and provides an analysis of the 2022 Partial Measures survey for Sunderland City Council's frontage.

## **1. Introduction**

### **1.1 Study Area**

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

- Whitburn Bay
- Sunderland Harbour and Docks
- Hendon to Ryhope (including Halliwell Banks)

### **1.2 Methodology**

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

- Full Measures survey annually each autumn comprising:
  - Beach profile surveys along 58 transect lines (commenced 2009)
  - Topographic survey at Whitburn Bay (commenced 2009)
  - Topographic survey at Hendon to Ryhope (including Halliwell Banks) (commenced 2009)
- Partial Measures survey annually each spring comprising:
  - Beach profile surveys along 16 transect lines (commenced 2009)
- Cliff top survey bi-annually at:
  - Hendon to Ryhope (including Halliwell Banks) (commenced 2009)

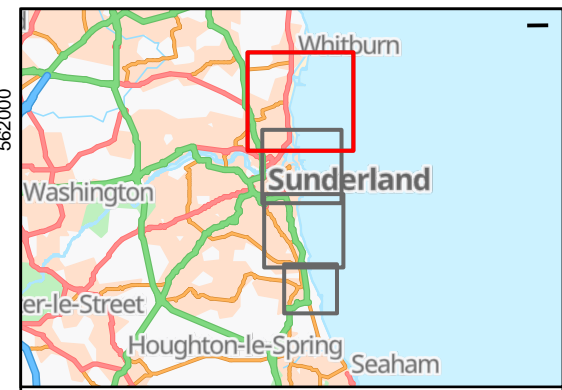
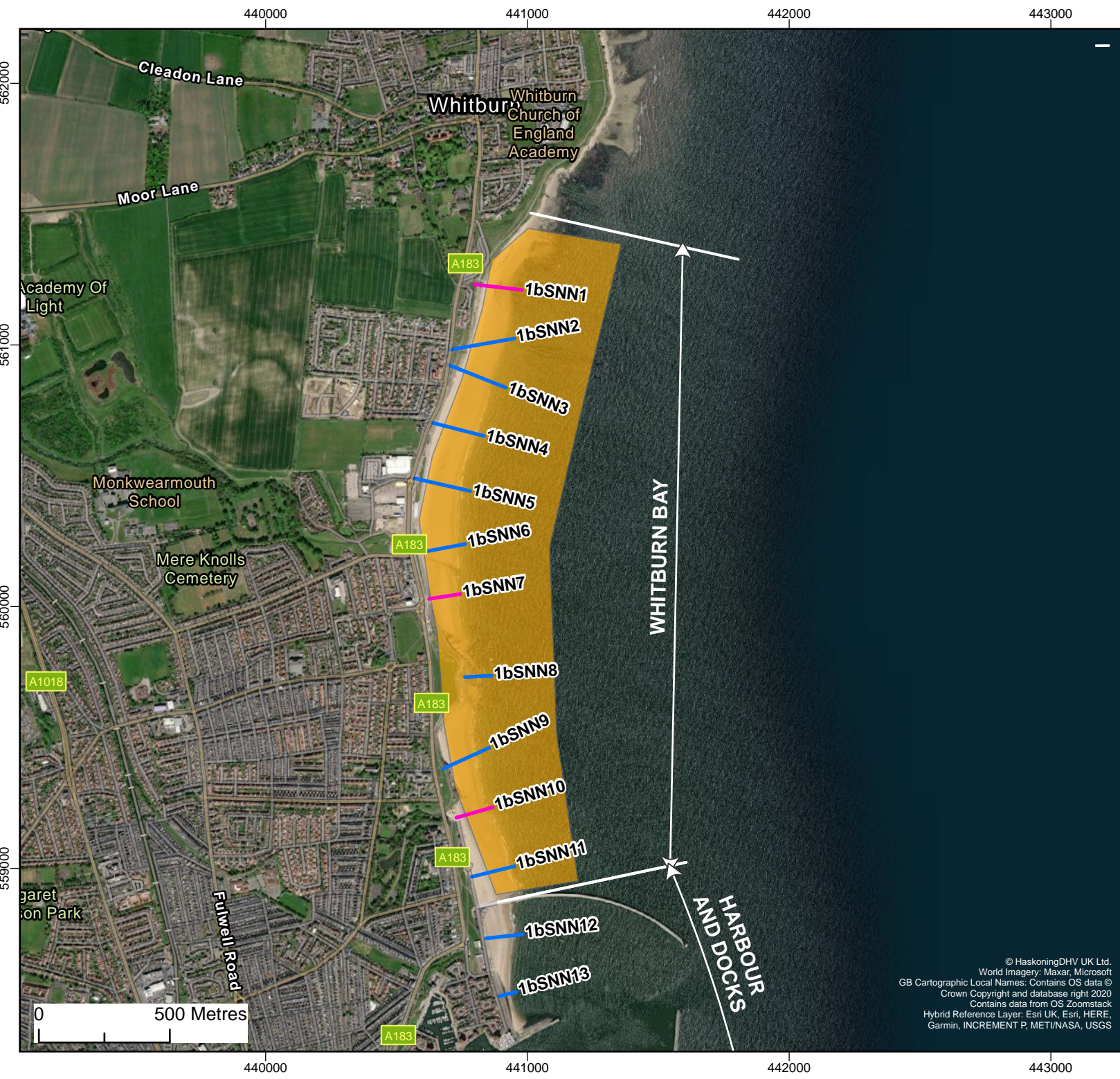
The location of these surveys is shown in Figure 2. The Partial Measures survey was undertaken along this frontage on 1<sup>st</sup> April 2022 (Whitburn Bay), and between 4<sup>th</sup> and 5<sup>th</sup> April 2022 (Hendon to Ryhope, including Halliwell Bank). During this time weather conditions varied, see surveyors reports for details.

The Update Report presents the following:

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

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





**SURVEY LOCATIONS**

**Topographic Profile**

- Annual (Blue line)
- Bi-Annual (Pink line)

**Topographic Area**

- 6 monthly (Light Green)
- yearly (Yellow)
- 5 yearly (Light Purple)

- Cliff Top Survey Points (Red dot)

(refer to Figure 3 for details)

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

**Figure 2 - Map 1**

**WHITBURN BAY**

**Sunderland City Council Frontage**

Report:

Survey Report

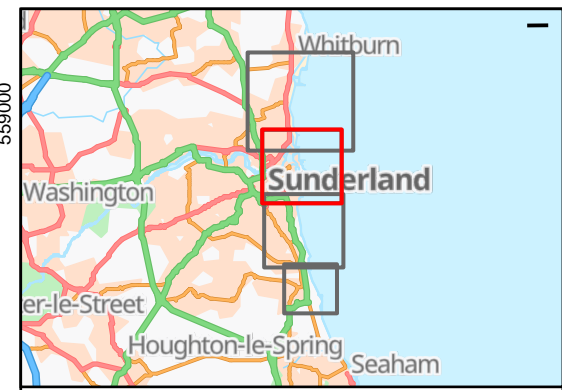
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**SURVEY LOCATIONS**

**Topographic Profile**

- Annual (Blue line)
- Bi-Annual (Pink line)

**Topographic Area**

- 6 monthly (Light Green)
- yearly (Yellow)
- 5 yearly (Light Purple)

● Cliff Top Survey Points (refer to Figure 3 for details)

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

Title:

**Figure 2 - Map 2**

**HARBOUR AND DOCKS**

**Sunderland City Council Frontage**

Report:

Survey Report

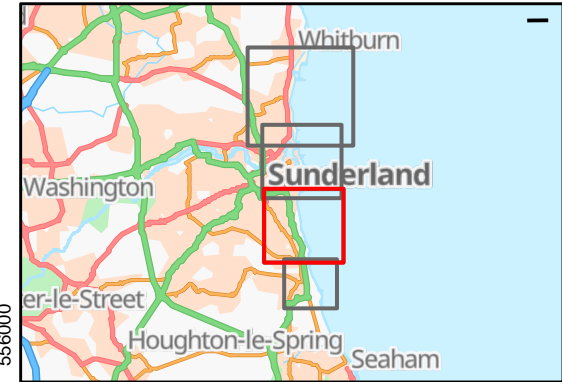
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Co-ordinate system: British National Grid

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**SURVEY LOCATIONS**

**Topographic Profile**

- Annual (Blue line)
- Bi-Annual (Pink line)

**Topographic Area**

- 6 monthly (Light Green)
- yearly (Yellow)
- 5 yearly (Light Purple)

- Cliff Top Survey Points (Red dot)

(refer to Figure 3 for details)

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

Title:

**Figure 2 - Map 3**

**HENDON TO RYHOPE (NORTH)**

**Sunderland City Council Frontage**

Report:

Survey Report

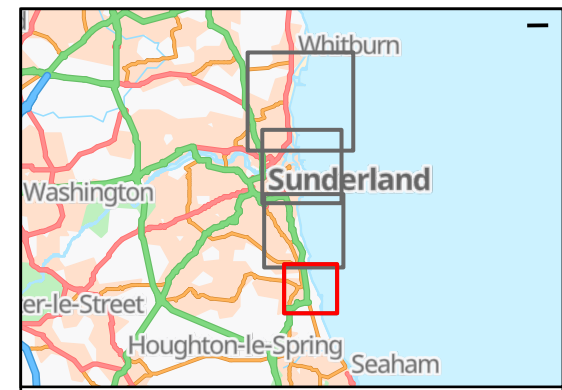
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Co-ordinate system: British National Grid

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**SURVEY LOCATIONS**

**Topographic Profile**

- Annual (Blue line)
- Bi-Annual (Pink line)

**Topographic Area**

- 6 monthly (Light Green)
- yearly (Yellow)
- 5 yearly (Light Purple)

- Cliff Top Survey Points (Red dot)

(refer to Figure 3 for details)

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

Title:

**Figure 2 - Map 4**

**HENDON TO RYHOPE (SOUTH)**

**Sunderland City Council Frontage**

Report:

Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:10,000

Co-ordinate system: British National Grid

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## 2. Analysis of Survey Data

### 2.1 Whitburn Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
1 <sup>st</sup> April 2022	<p><b>Beach Profiles:</b></p> <p>Whitburn Bay is covered by three beach profile lines for the Partial Measures survey (Appendix A). The last survey was Full Measures, undertaken in Autumn 2021.</p> <p><b>1bSNN1</b> is just to the south of Sunderland City Council's northern boundary. Since the last survey, the backshore landward of chainage 43m has mostly undergone accretion, with up to 0.5m of accretion at chainage 20m where a hollow has been infilled. The upper beach between chainage 43-109m has lowered by up to 0.5m, before switching to accretion on the lower beach by up to 0.5m. The rock at chainage 195m is still present and the beach profile terminates at chainage 220m, which is 0.3m lower than the profile from autumn 2021. Overall, the beach profile is at a medium-high level compared to the range recorded from previous surveys.</p> <p><b>1bSNN7</b> is at Seaburn, north of Parson's Rock. Beach levels have risen across the profile until the end of the survey at chainage 156m, which shows a slight lowering by less than 0.1m. A depression at chainage 7m has been infilled by up to 0.4m since the previous survey. Accretion is greatest on the middle beach where it reaches 0.35m, reducing to less than 0.1m on the lower beach. Overall, the upper and middle beach profile is at a high level and the lower beach is at a medium level compared to the range recorded from previous surveys.</p> <p><b>1bSNN10</b> is located mid-way between Parson's Rock and Roker Pier. Similar to profile 1bSNN7, the beach profile seaward of the seawall has risen since the previous survey. Accretion is greatest at the toe of the seawall where it reaches 0.6m, reducing to less than 0.1m on the middle beach and 0.2m on the lower beach. The profile across the upper, middle and lower beach is at a medium-high level compared to the range recorded from previous surveys.</p>	<p>Beach levels across Whitburn Bay have generally increased, particularly in the centre and south of the bay. The northern profile has lowered on the upper beach.</p> <p><b>Longer term trends:</b> Profiles in Whitburn Bay are within the bounds of previous surveys, with most profiles at a medium-high level.</p>

## 2.2 Hendon to Ryhope (incl. Halliwell Banks)

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>4<sup>th</sup>-5<sup>th</sup> April 2022</p>	<p><b>Beach Profiles:</b></p> <p>Hendon to Ryhope is covered by twelve beach profile lines for the Partial Measures survey (Appendix A). The last survey was Full Measures, undertaken in Autumn 2021.</p> <p>Profile <b>1bSNS8</b> extends across the seawall, rock revetment, and sandy beach. Beach levels have generally lowered across the beach profile by up to 0.2m on the upper beach and 0.4m on the lower beach, exposing a rock at chainage 93m. The middle beach between chainage 43-51m has undergone negligible change (less than 0.05m). The upper beach profile is at a high level compared to the range recorded from previous surveys, whilst the middle to lower beach profile is at a medium level.</p> <p>Profile <b>1bSNS11</b> starts at the coastal slope backing the sea wall and extends over the rock armour and beach. Beach levels have lowered evenly from the toe of the rock armour to the end of the survey by up to 0.3m. Overall, the beach profile is at a medium level compared to the range recorded from previous surveys.</p> <p>Profile <b>1bSNS20</b> is located at Shirley Banks. The lower cliff face has moved landward by approximately 1.0m. There has been accretion on the upper beach by up to 0.2m to chainage 53m, and erosion between chainage 53-63m by up to 0.3m. There appears to have been movement of some of the rocks between chainage 63-78m since the previous survey. Seaward of this point the beach has risen by 0.2m. The upper beach profile is at a low level on the upper beach, particularly between chainage 59-78m. The middle and lower beach is at a medium level compared to the range recorded from previous surveys, particularly between chainages 66-82m which is at its lowest level recorded.</p> <p>Profile <b>1bSNS25</b> is located at Halliwell Banks. The cliff top has retreated by less than 0.5m, whilst the cliff toe appears to move seaward by less than 0.5m. The beach between the cliff toe and the rock patch at chainage 89m has lowered by up to 0.4m. The rock patch remains unchanged. The beach level seaward of chainage 103m has undergone negligible change of <math>\pm 0.1</math>m. The beach profile is at a medium-low level compared to the range recorded from previous surveys.</p> <p>Profiles <b>1bSNS26</b> to <b>1bSNS33</b> are located on Halliwell Banks to assess erosion of a former land fill site. Cliff tops are between 26m and 27mOD.</p>	<p>Profiles from Hendon to Ryhope (1bSNS8 to SNS33) have generally lowered, with small sections of accretion generally at the cliff toe or middle beach. The cliff top at 1bSNS27 has retreated by up to 1.0m.</p> <p><b>Longer term trends:</b> In general, the profile change along the Hendon to Ryhope frontage is within the bounds of previous surveys, except between chainage 66-82m at 1bSNS20 which is at its lowest level recorded.</p> <p>At the landfill site, several profiles continue to show recession of the cliff top and toe. Overall, beach levels are at a medium-low level.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>At profiles <b>1bSNS26</b>, the beach level from the cliff toe to the end of the survey has lowered by up to 0.2m on the upper beach, 0.4m on the middle beach and 0.1m on the lower beach. The profile has exposed rocks at chainage 157m and 160m. Overall the profile is at a relatively medium level compared to the range recorded from previous surveys.</p> <p>At <b>1bSNS27</b> there has been a recession in the cliff top by up to 1.0m. The beach levels across the profile have lowered by up to 0.4m on the upper and middle beach and 0.2m on the lower beach. The upper cliff face is at its most landward position recorded. The beach profile is at a medium-low level compared to the range recorded from previous surveys.</p> <p>At <b>1bSNS28</b>, the beach profile has generally lowered by up to 0.3m on the upper beach, 0.4m on the middle beach and 0.2m on the lower beach. There is a small patch of accretion between chainages 141-160m however accretion levels are less than 0.1m. The beach profile is at a medium-low level on the upper and middle beach, and a middle level on the lower beach compared to the range recorded from previous surveys.</p> <p>At profile <b>1bSNS29</b>, there has been very little change in the position of the cliff face. The beach profile has undergone variable change; however erosion has dominated by up to 0.4m. Accretion is limited to 0.1m. Overall, the beach is at a low level compared to the range recorded from previous surveys.</p> <p>At profile <b>1bSNS30</b>, there has been a retreat of the cliff top by approximately 0.5m, and a retreat of the cliff toe by approximately 1.0m. The majority of the beach has lowered by up to 0.4m, except at the toe of the cliff where the beach has risen by 0.5m. Overall, the beach profile is at a medium-low level compared to the range recorded from previous surveys.</p> <p>Profile <b>1bSNS31</b> shows a similar pattern to profile 1bSNS30, with accretion at the cliff toe by up to 0.4m, and erosion across the rest of the profile by up to 0.4m. There has been relatively little change in the position of the cliff face. Overall, the profile is at a medium-low level compared to the range recorded from previous surveys.</p> <p>At profile <b>1BSNS32</b>, the beach profile has risen at the cliff toe by up to 0.4m to chainage 100m. Seaward of this point, the beach level has lowered by up to 0.4m on the middle beach and 0.1m on the lower beach. Overall, the beach profile is at a medium-low level compared to the range recorded from previous surveys.</p> <p>At profile <b>1bSNS33</b>, the cliff has not changed position since the previous survey. The beach profile has</p>	

Survey Date	Description of Changes Since Last Survey	Interpretation
	lowered by up to 0.6m on the upper and middle beach, and 0.2m on the lower beach. Overall, the beach profile is at a medium-low level compared to the range recorded from previous surveys.	
5 <sup>th</sup> April 2022	<p><b>Cliff-top Survey:</b></p> <p>32 ground control points (numbered 1-32) were established along the cliff top between Hendon and Ryhope in March 2009, with a further three (28A, 28B and 28C) added in September 2009 (Figure 3). Note: the numbering of ground control points is not intended to correlate with that of the beach profile lines.</p> <p>Measurements are taken from each ground control point along a fixed bearing to the edge of the cliff top. These cliff top surveys are undertaken bi-annually and are intended to inform on erosion rates of the sea cliffs extending from the defended industrial areas at Hendon southwards along the undefended cliffs to Ryhope Dene.</p> <p>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. These cliff top surveys are undertaken bi-annually and are intended to inform on erosion rates of the sea cliffs extending from the defended industrial areas at Hendon southwards along the undefended cliffs to Ryhope Dene. Appendix B – Table B1 provides results from the March 2009 cliff top survey, showing the position from the ground control point to the edge of the cliff top along a defined bearing. Also shown is the change in measurement since the original (March 2009) and previous (November 2021) cliff top surveys.</p> <p>Results show that since the last survey, five locations have shown erosion greater than the anticipated survey error; Point 4 by 0.2m, Point 11 by 0.46m, Point 23 by 1.36m, Point 24 by 0.45m and Point 28A by 0.71m.</p> <p>Since surveys began in March 2009 (or September 2009 for 28A, 28B, and 28C) erosion greater than the survey error has occurred at around 83% of the ground control points, where total losses are 12.4m (at Point 25) at their greatest, and more typically less than 5m. The long-term erosion rates are 0.95m/yr at their highest (Point 25), with up to 0.5m/yr being more typical.</p>	<p>Since the last survey, the cliffs at Points 4, 11, 23, 24 and 28A have shown erosion greater than the anticipated error of survey methods, with very little change elsewhere. Point 18 has shown 0.61m of accretion (seaward movement of the cliff top), however this is more likely due to differences in placement of survey equipment due to vegetation.</p> <p><b>Longer term trends:</b> Since 2009, the majority of the points south of the sea defences have eroded. The greatest erosion has occurred at points 10, 11, 25, 26, 27, 28A and 31 where between 7.6m and 12.4m has been lost.</p>



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

#### **Individual Profiles**

- No problems were encountered.

#### **Cliff Top Surveys**

- The largest cliff erosion encountered since the previous survey was located at Points 4, 11, 23, 24 and 28A where cliff top recession of between 0.2m and 1.36m was recorded.

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

- No changes are recommended at the present time.

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

- At Whitburn Bay, the recorded profiles are within the bounds of previous surveys and present no causes for concern.
- At Hendon to Ryhope (incl. Halliwell Banks), cliff top erosion at the landfill site in Halliwell Banks is ongoing, with several points recording erosion greater than the survey error. Points 4, 11, 23, 24 and 28A showed erosion of between 0.2m and 1.36m since the previous survey (see Table B1 in Appendix B). The greatest amount of erosion recorded to have taken place between March 2009 and April 2022 was 12.24m at Point 25 which is along the border of the landfill site.
- Elsewhere at Hendon to Ryhope, the recorded profiles and cliff top surveys show no cause for concern. Profiles have generally lowered, with small sections of accretion on the upper or middle beach. Beach levels are at a medium-low levels compared to the range recorded from previous surveys.

## **Appendices**

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

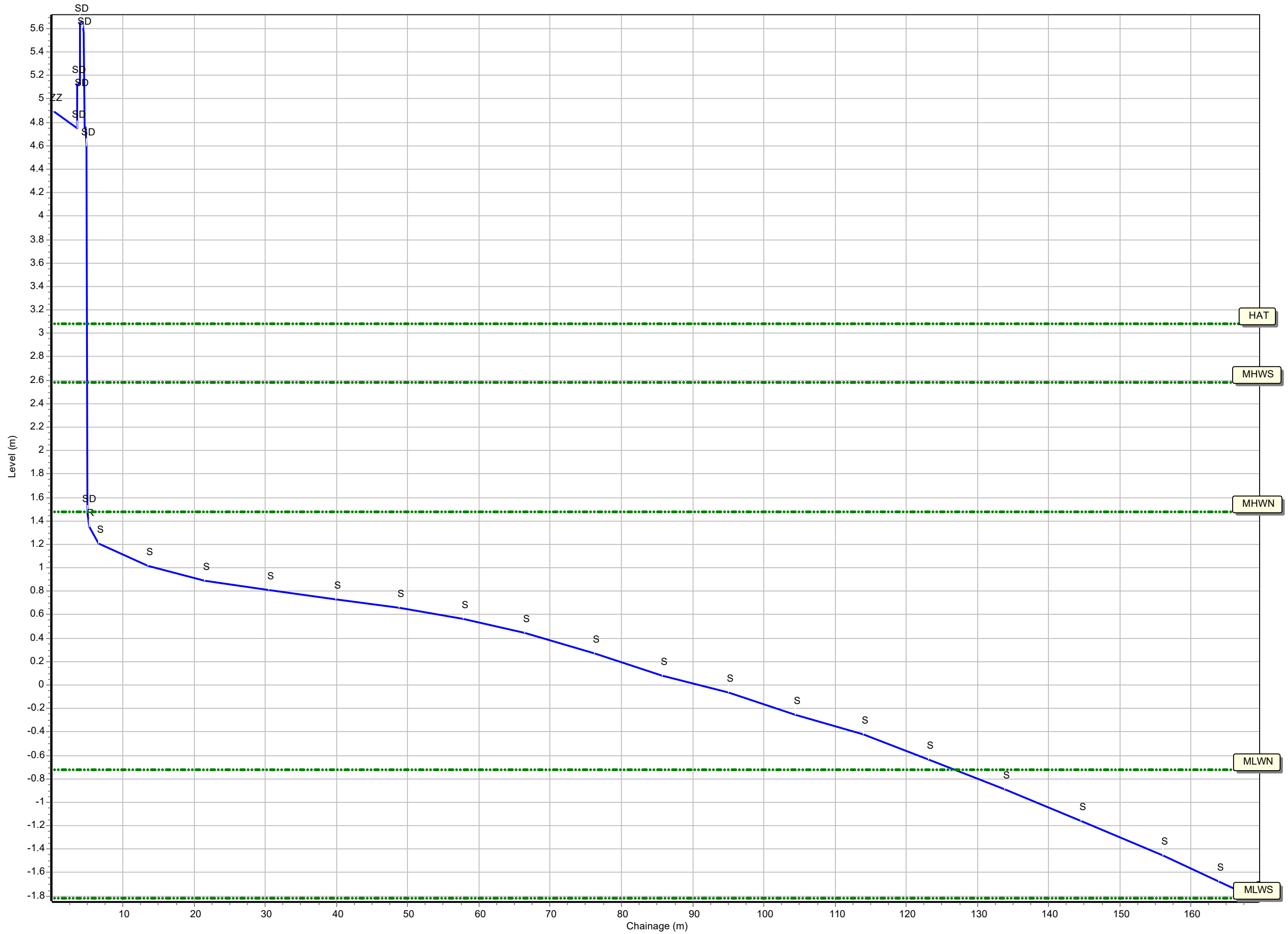
The following sediment feature codes are used on some profile plots:

<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

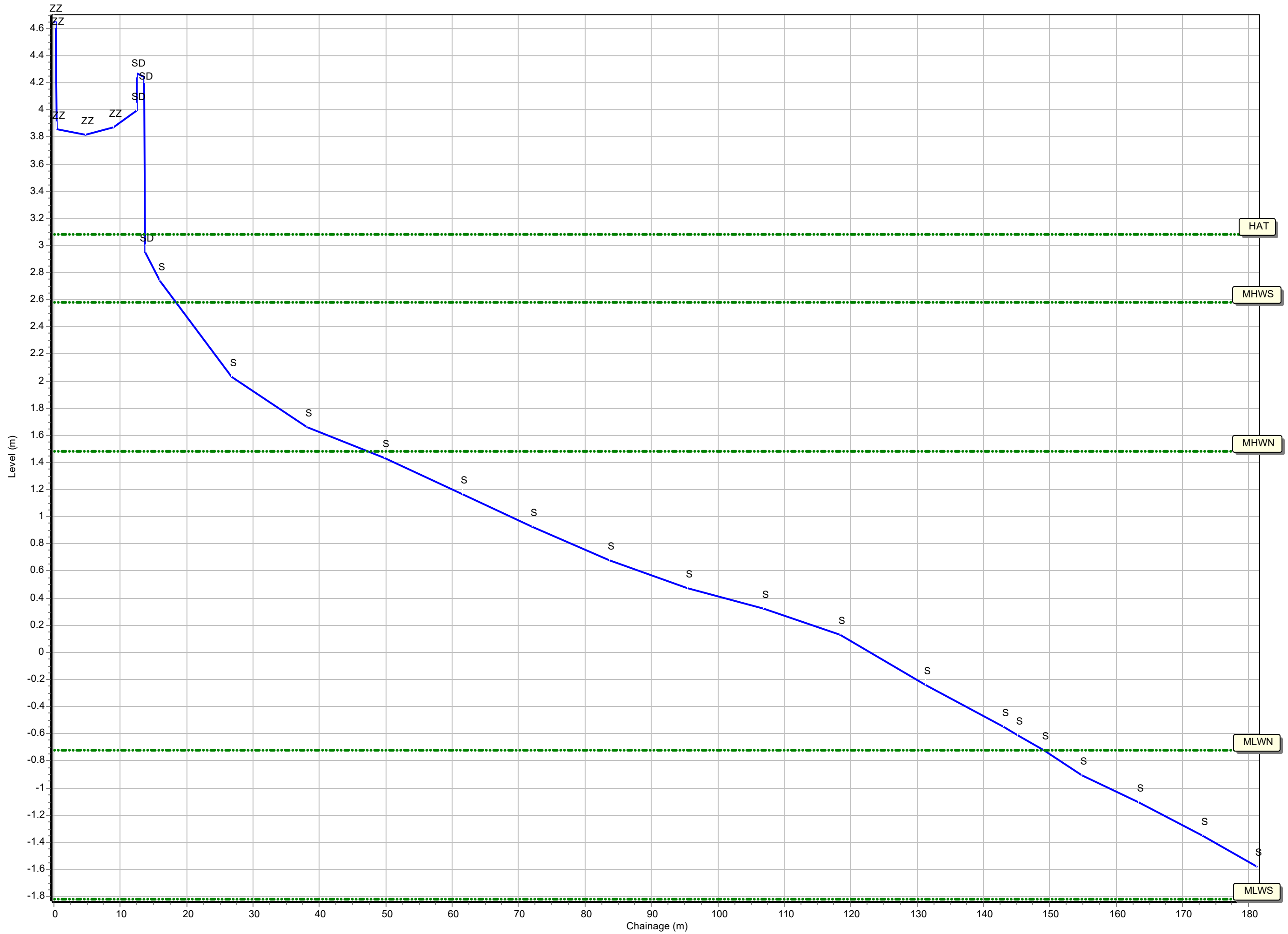
Profiles: 1bSNN1



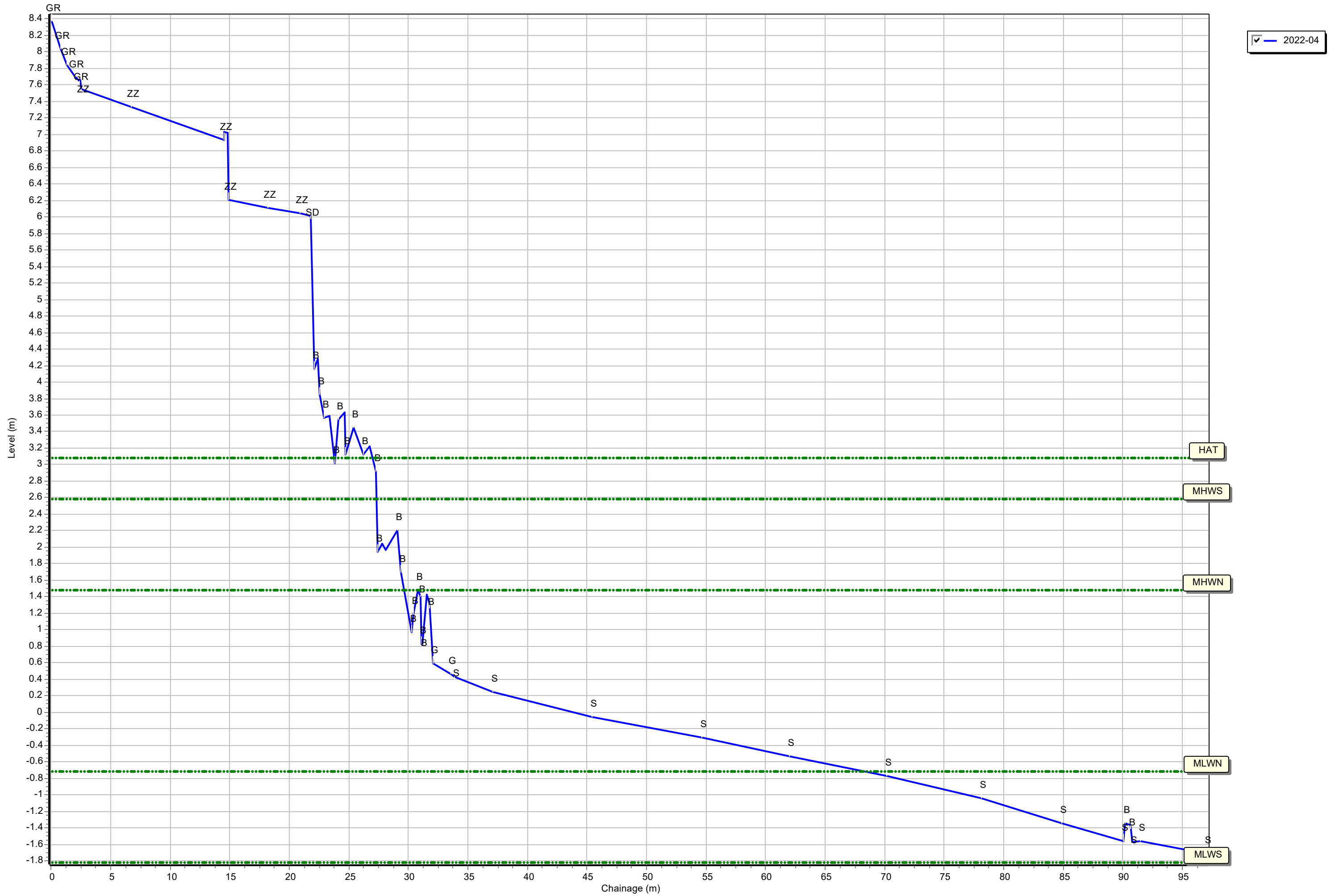
Profiles: 1bSNN7



Profiles: 1bSNN10

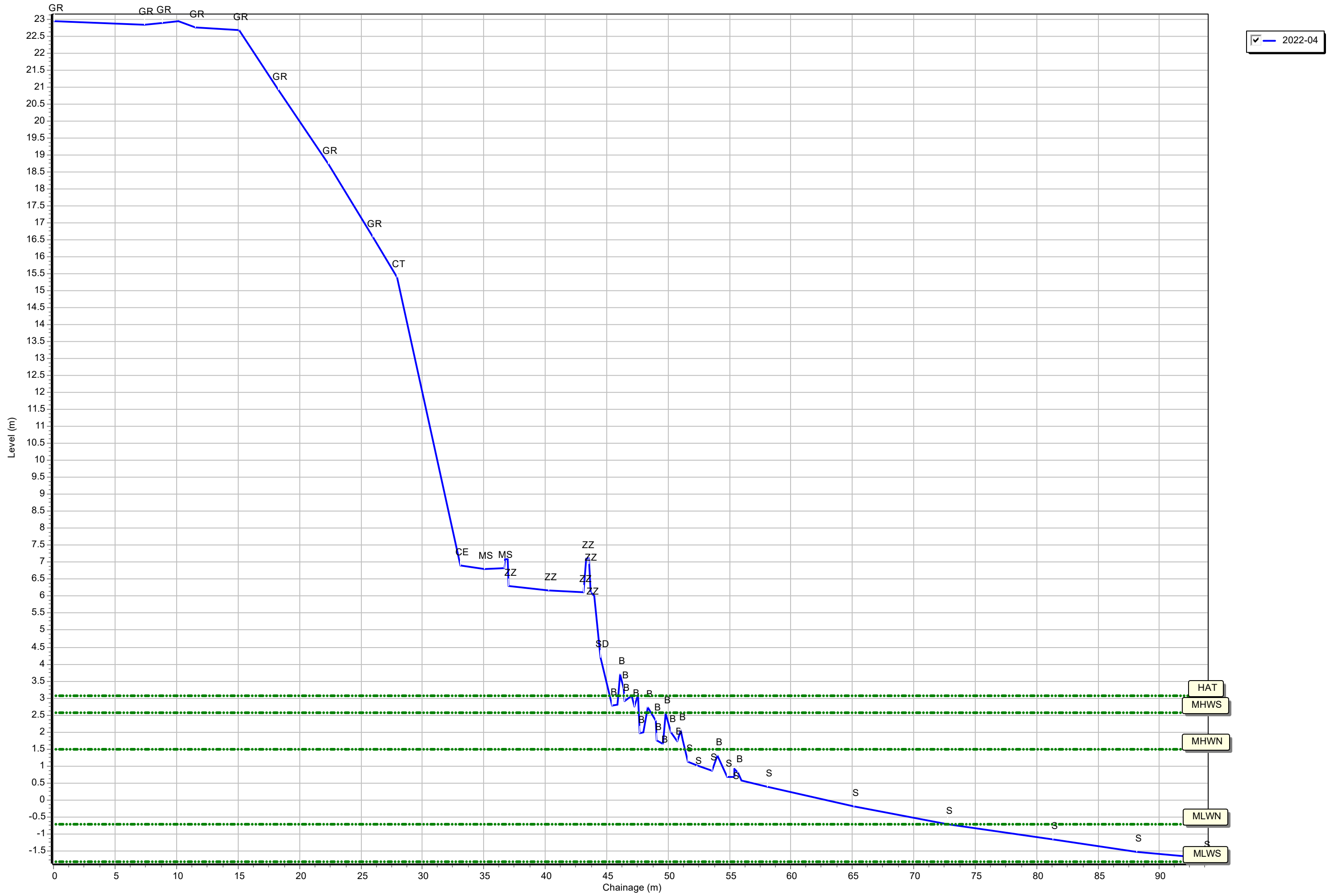


Profiles: 1bSNS8

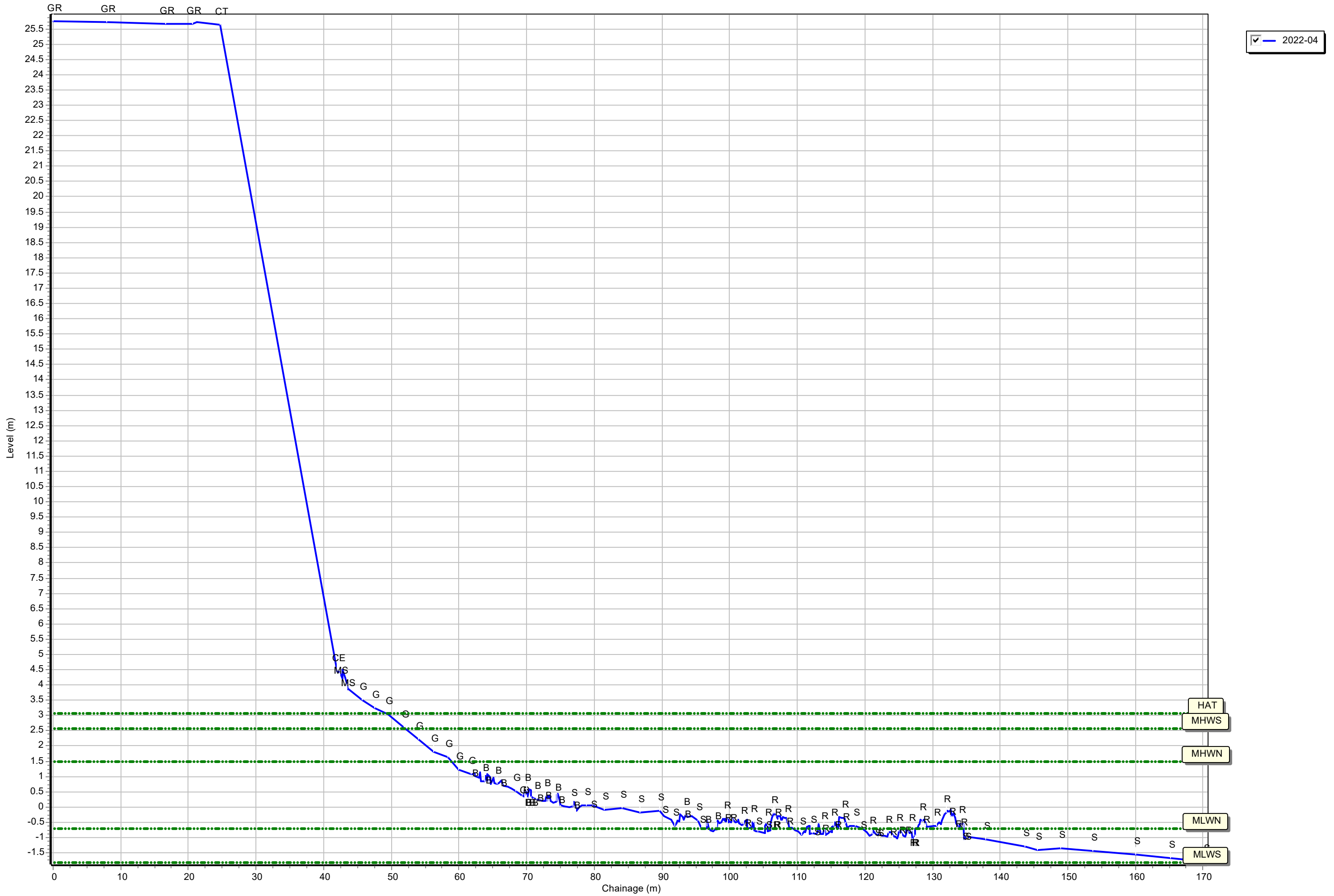




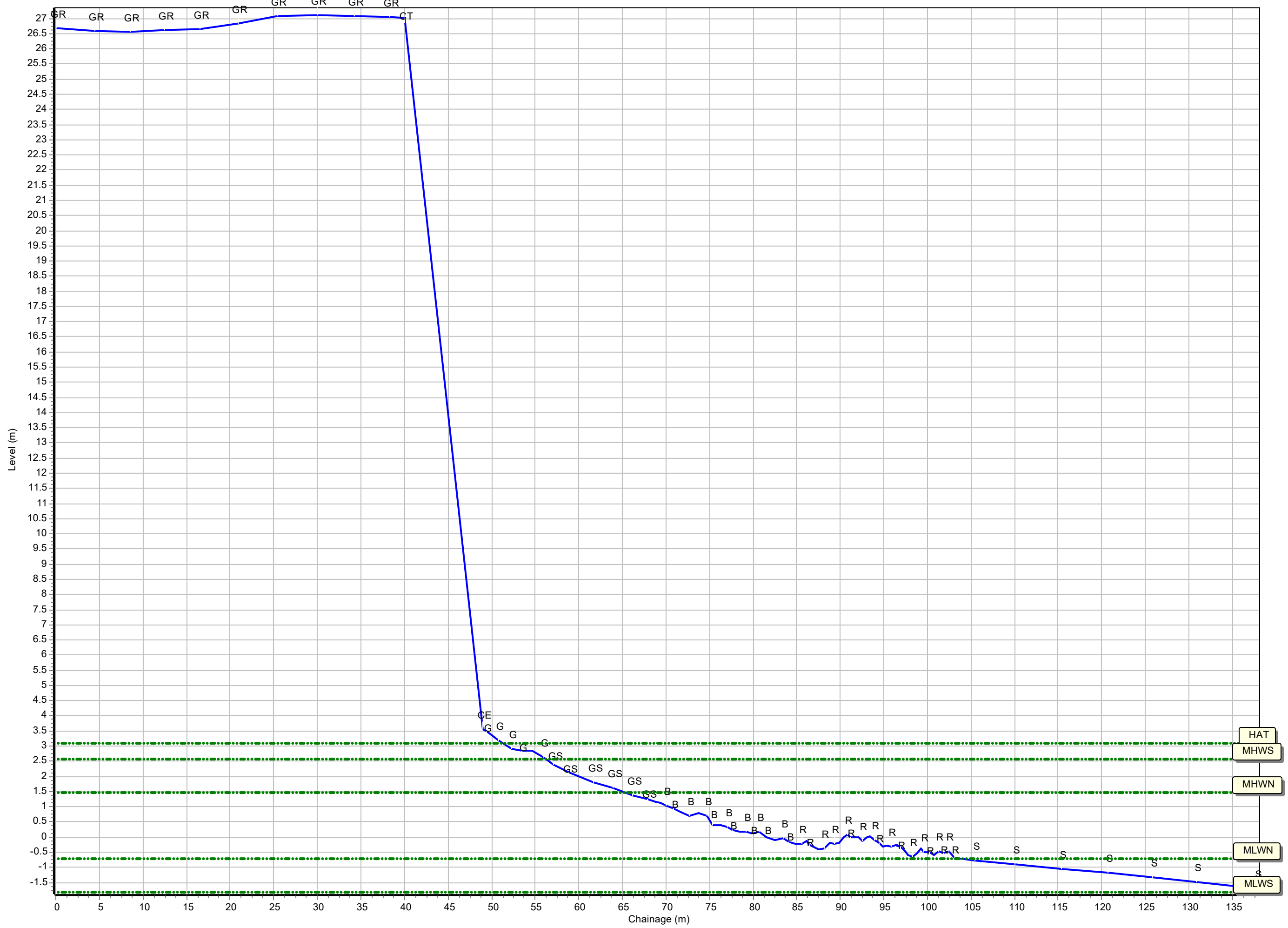
Profiles: 1bSNS11



Profiles: 1bSNS20



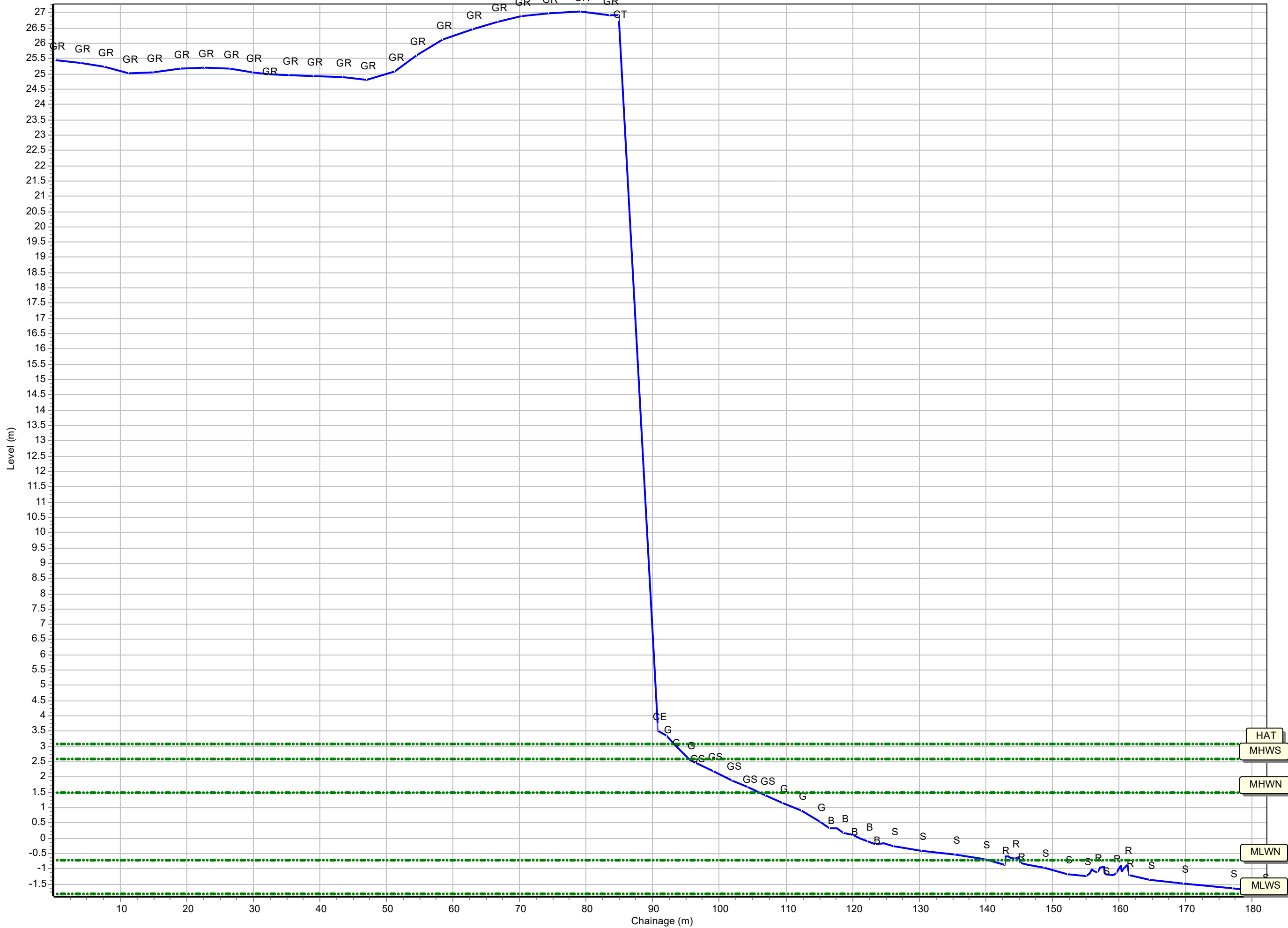
Profiles: 1bSNS25



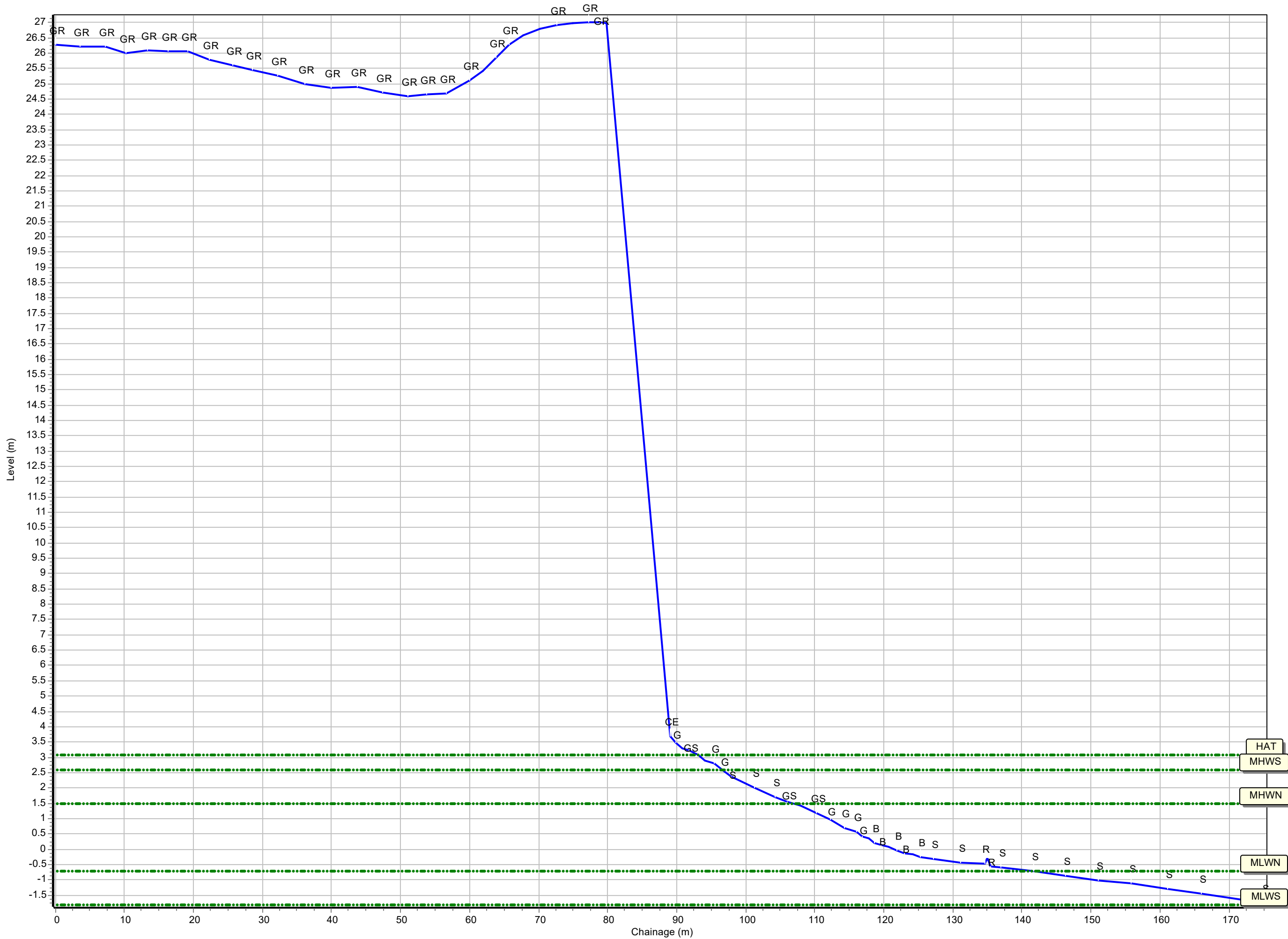
2022-04

HAT  
MHWS  
MHWN  
MLWN  
MLWS

Profiles: 1bSNS26



Profiles: 1bSNS27



2022-04

HAT

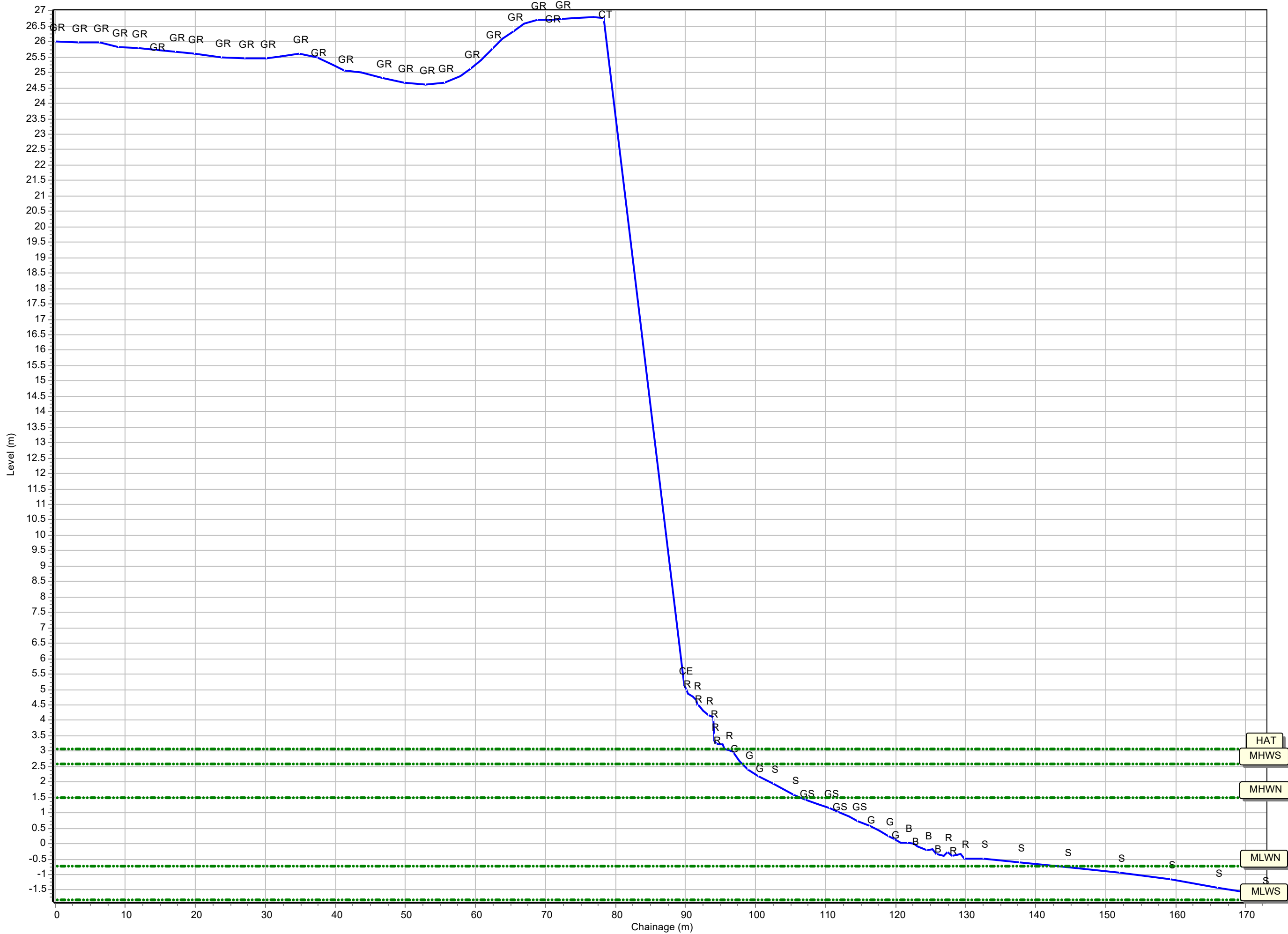
MHWS

MHWN

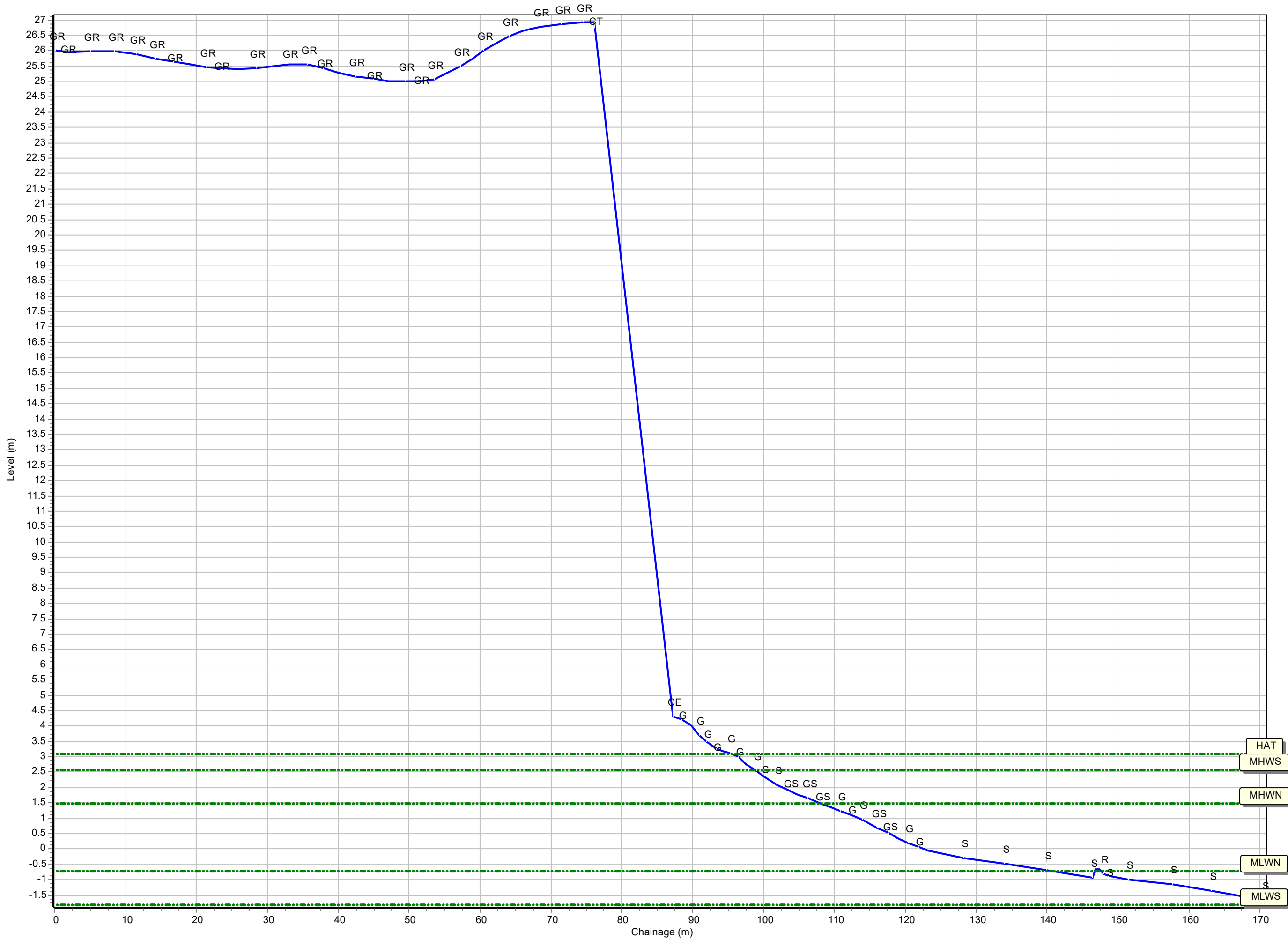
MLWN

MLWS

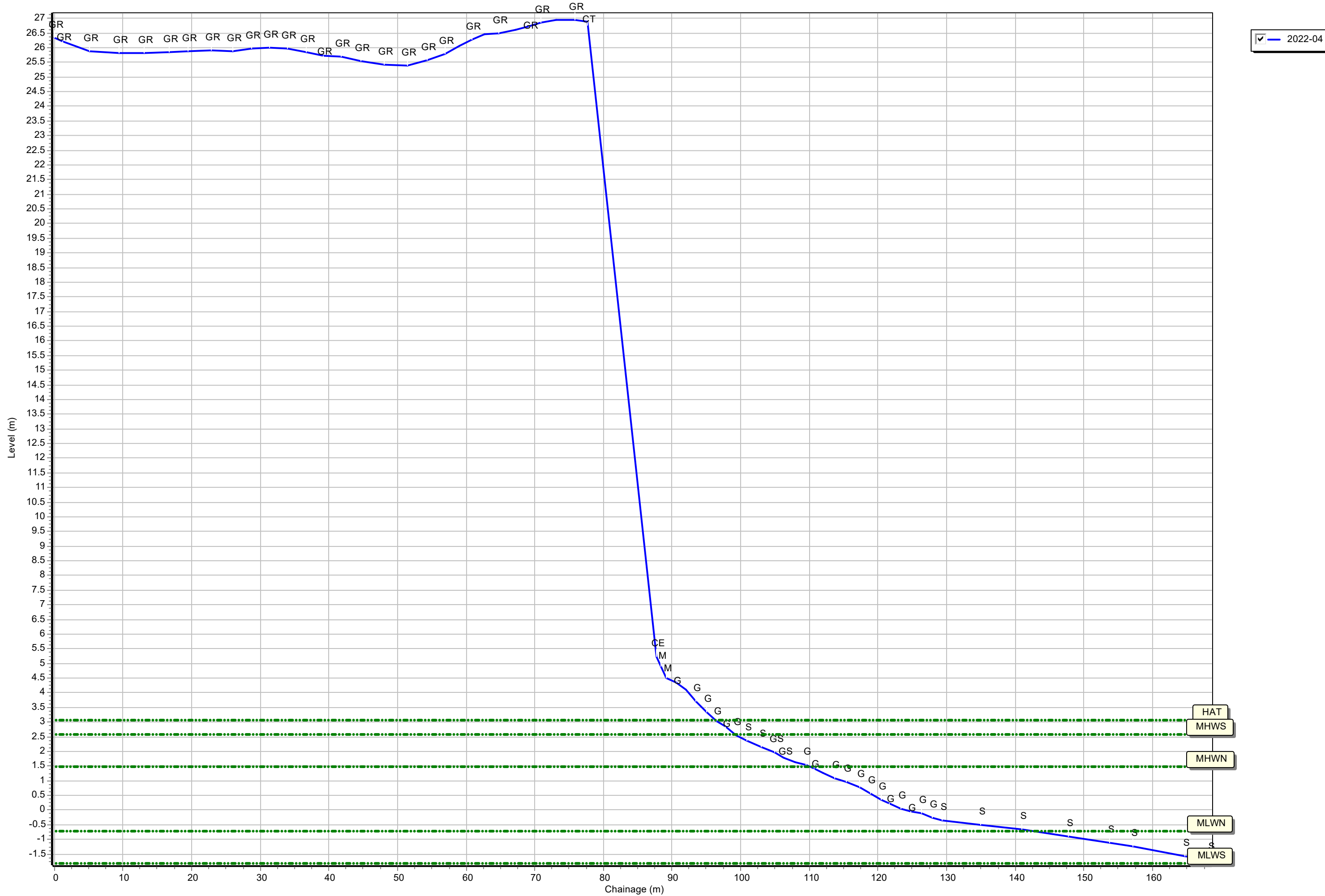
Profiles: 1bSNS28



Profiles: 1bSNS29

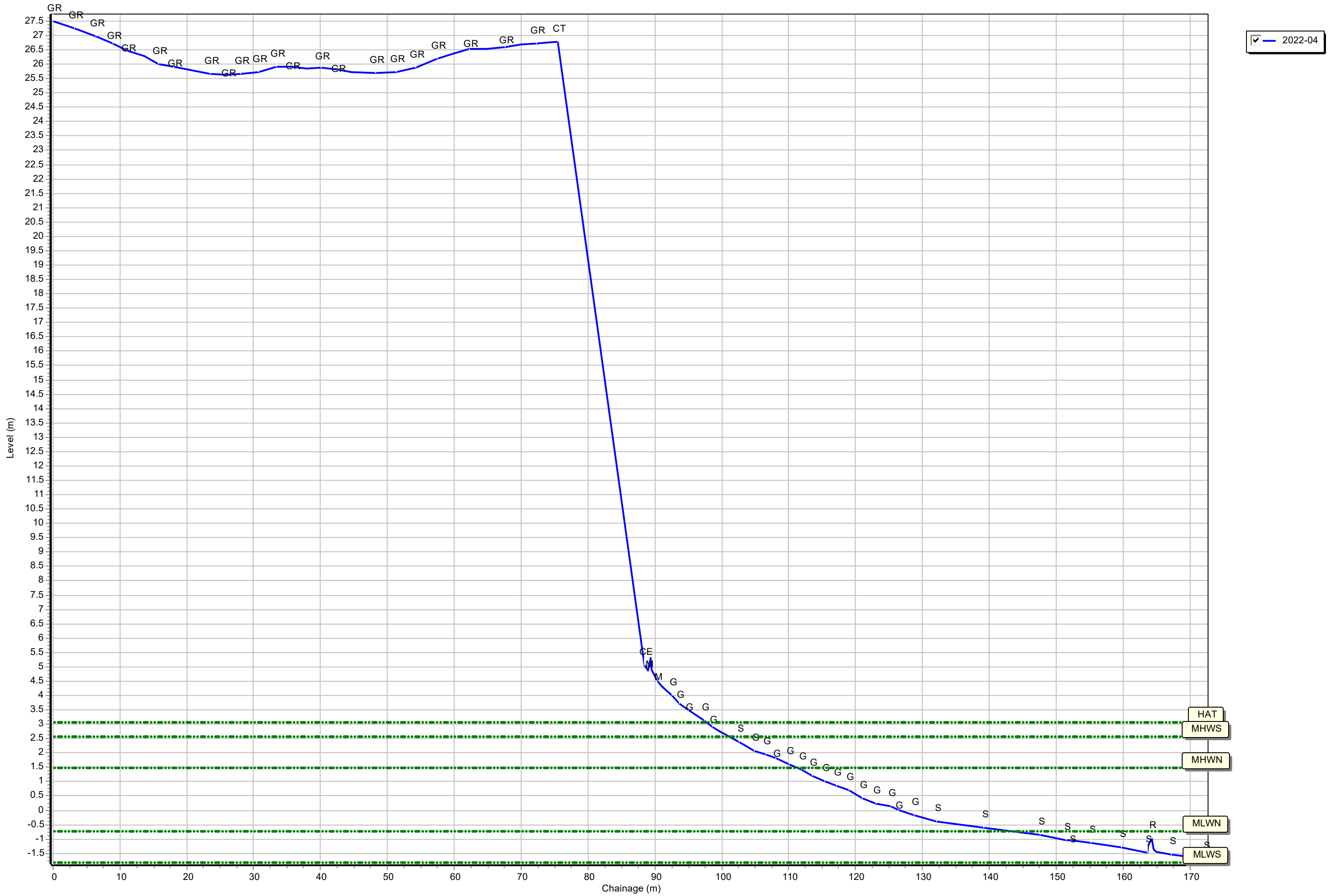


Profiles: 1bSNS30

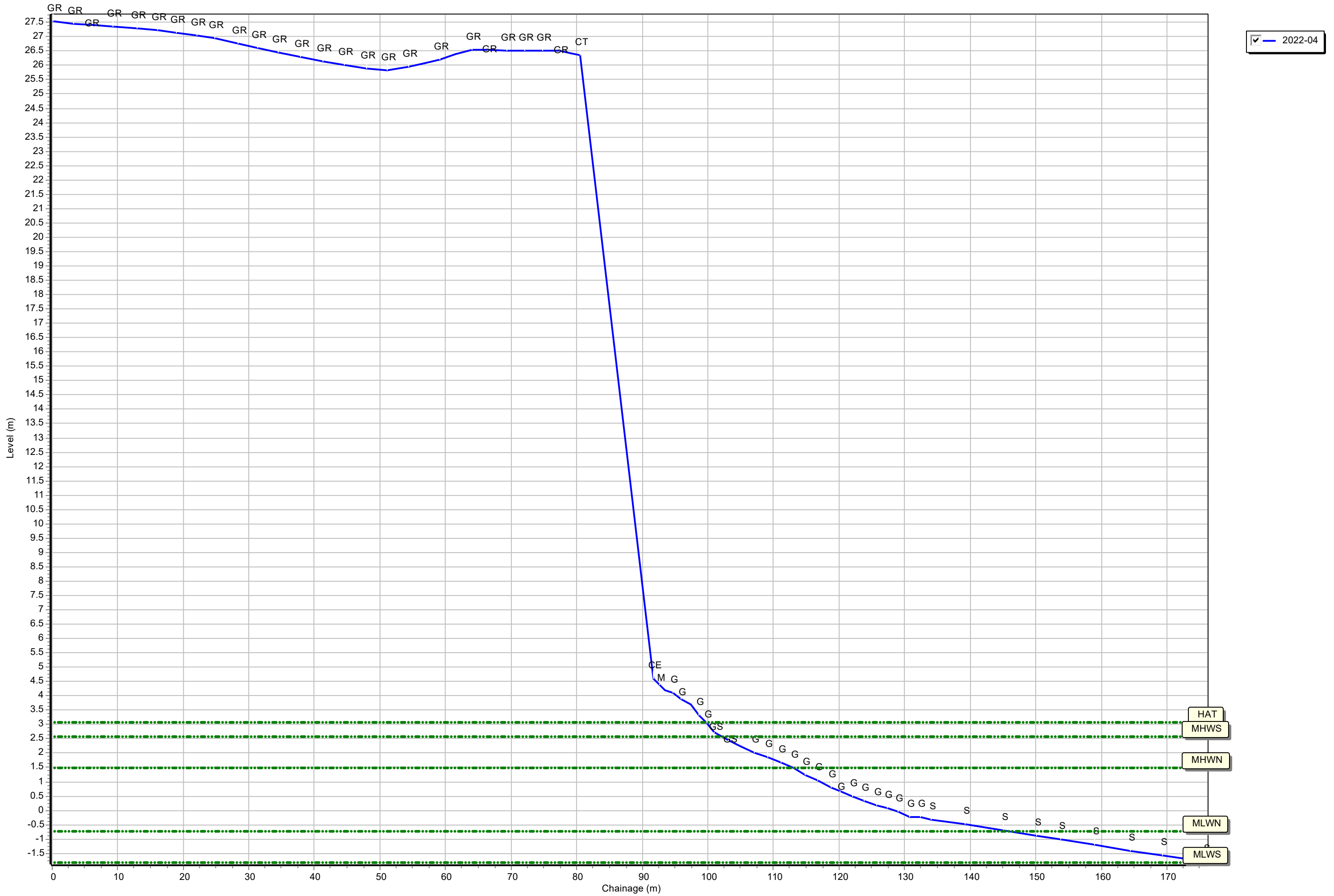




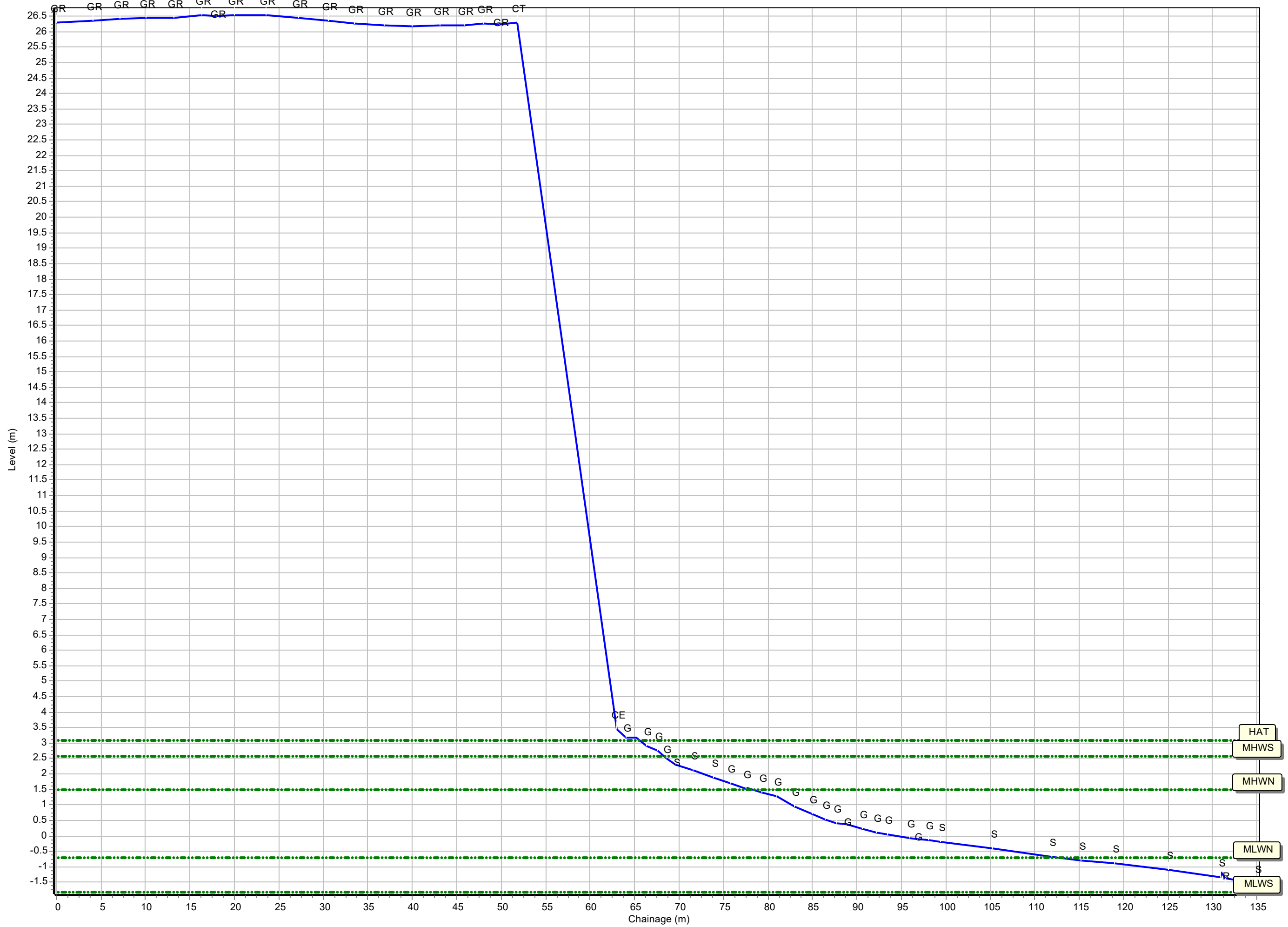
Profiles: 1bSNS31



Profiles: 1bSNS32



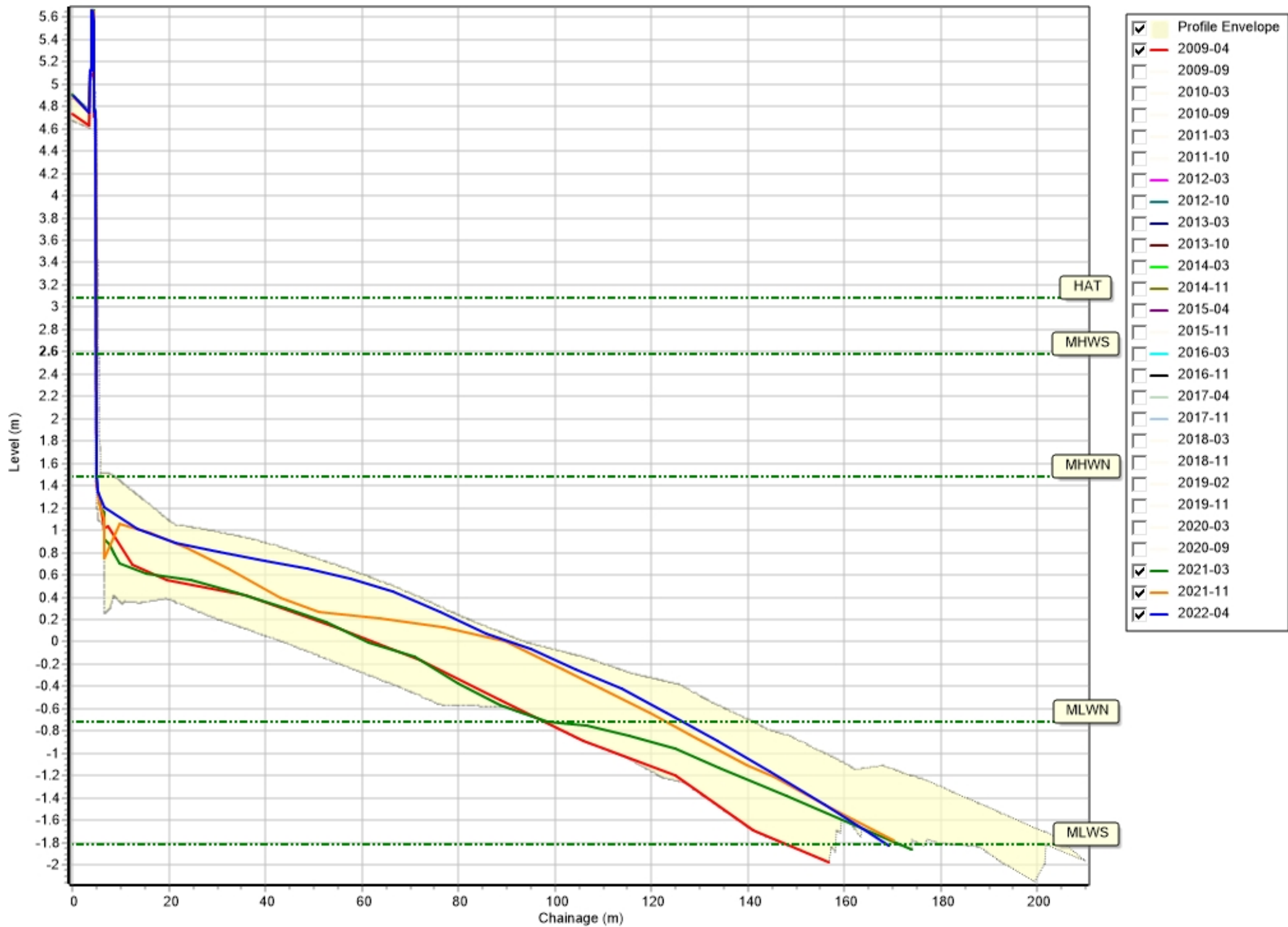
Profiles: 1bSNS33



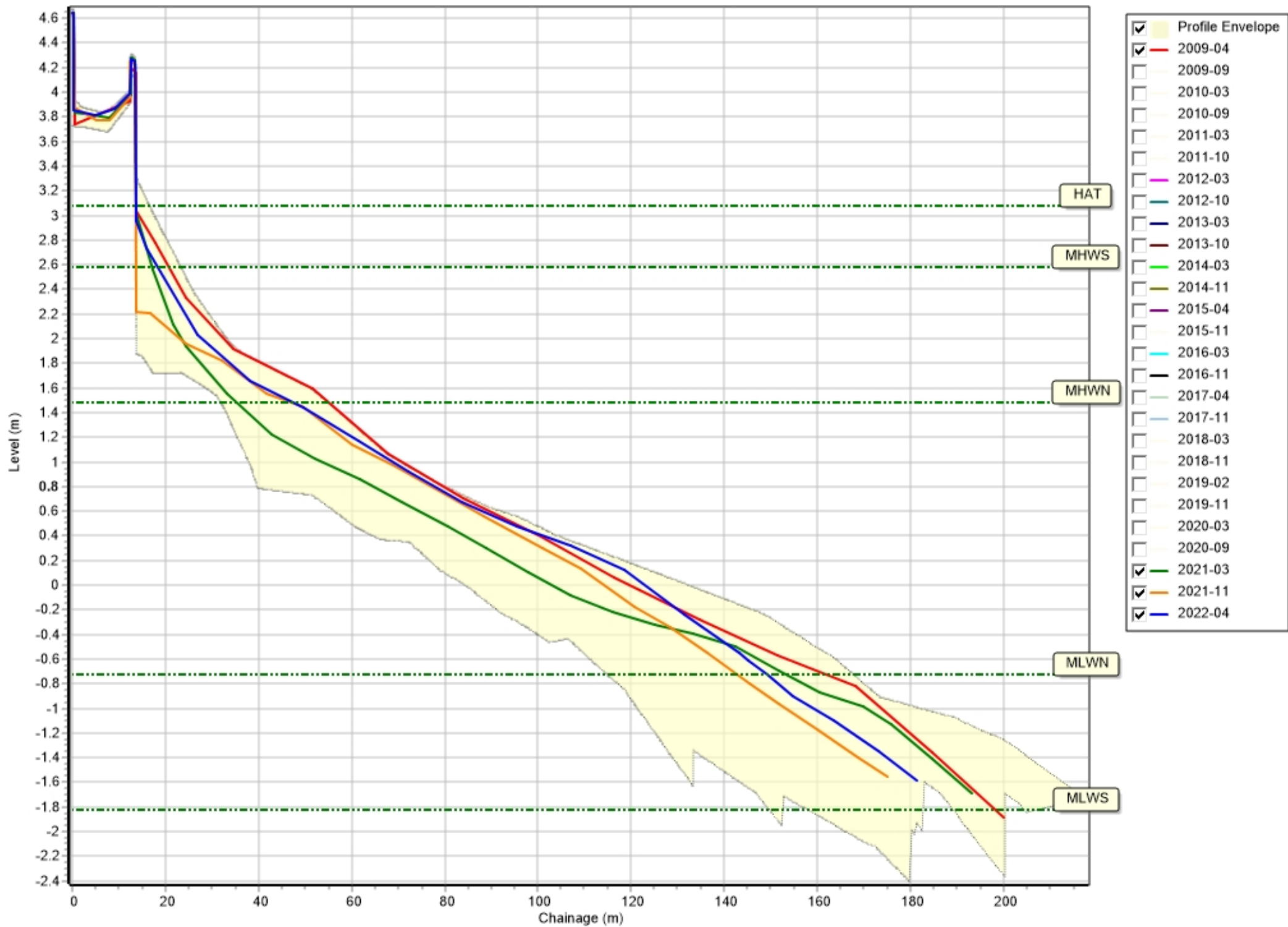
Profiles: 1bSNN1



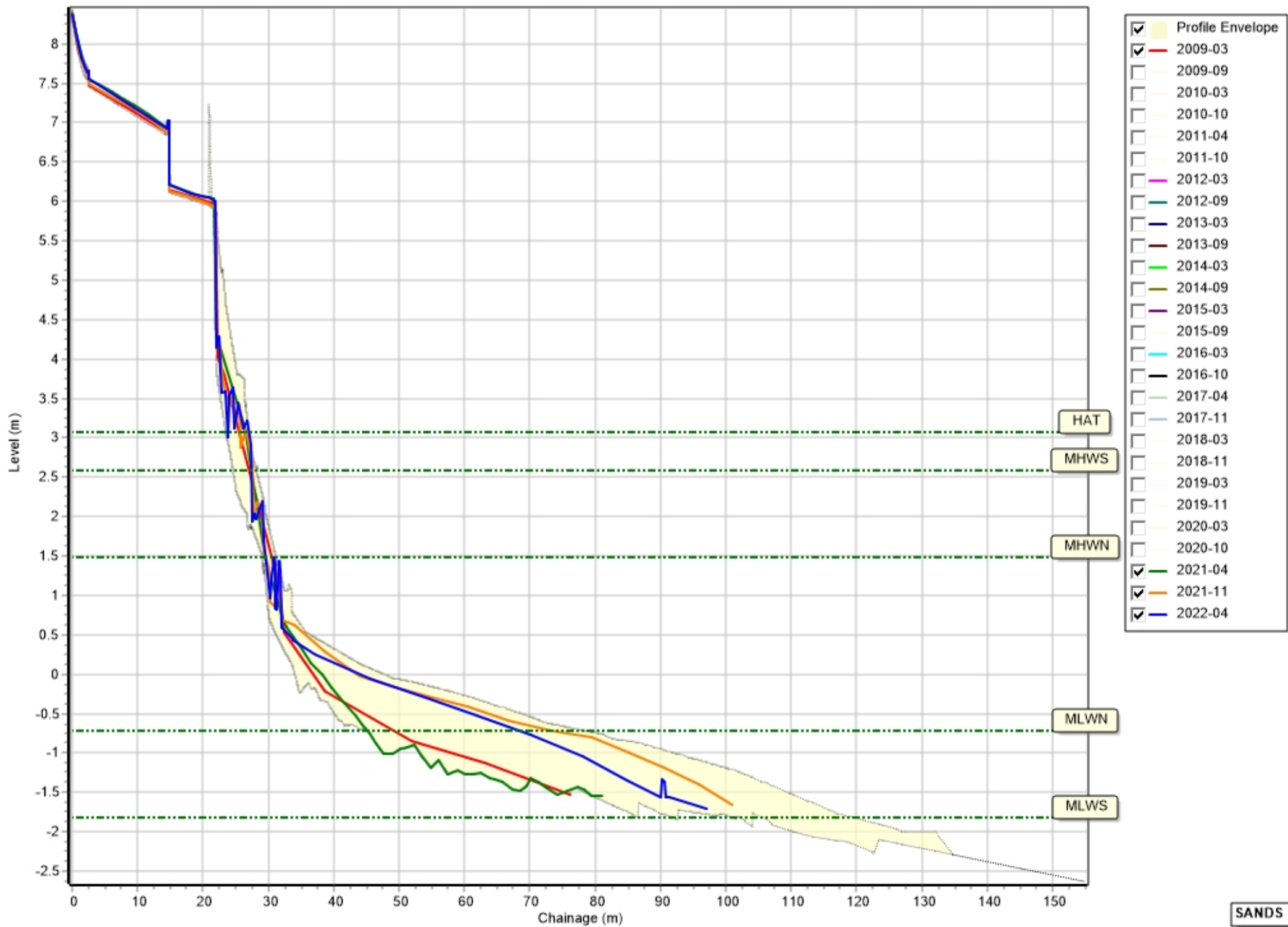
Profiles: 1bSNN7



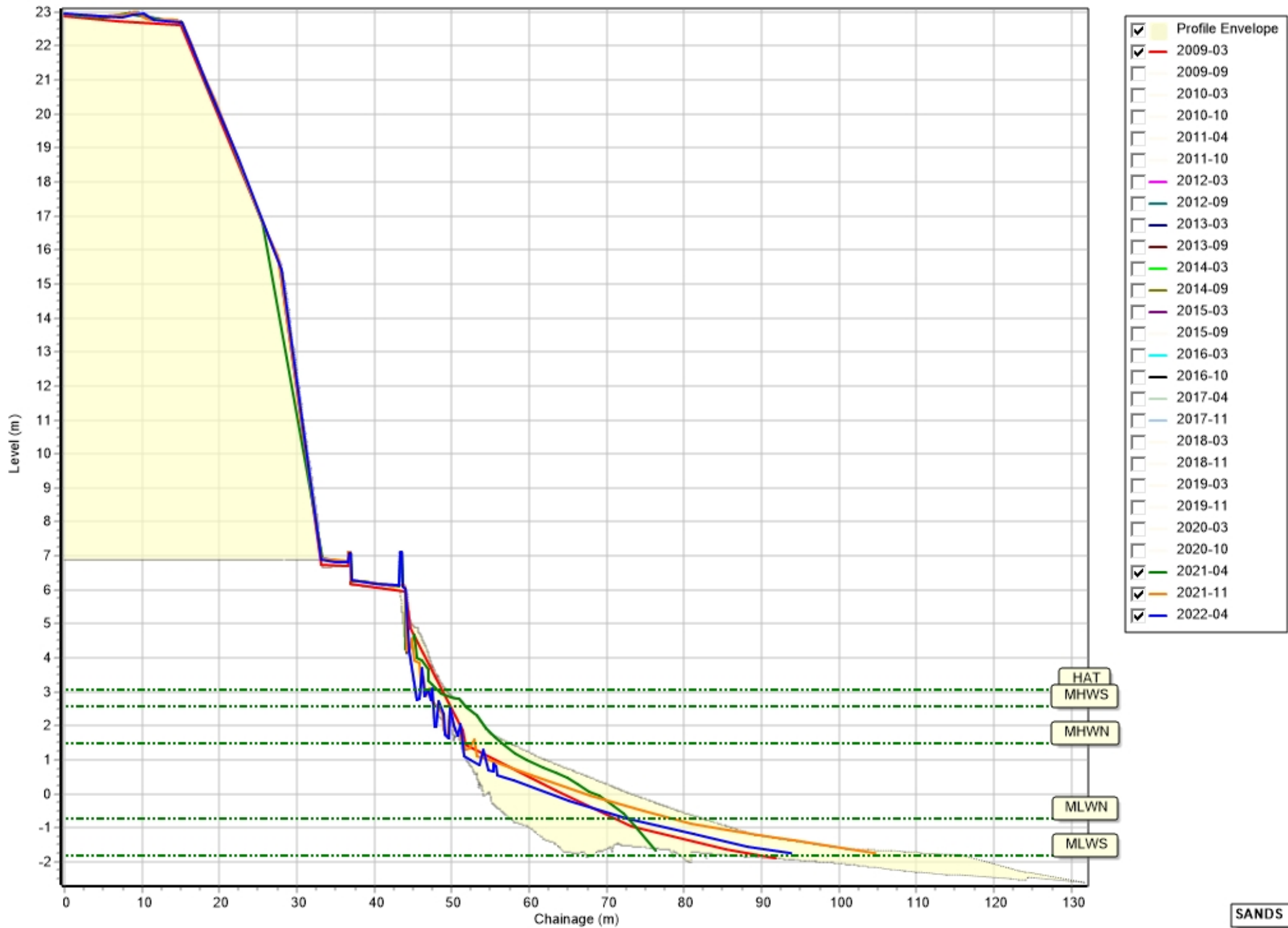
Profiles: 1bSNN10



# Profiles: 1bSNS8

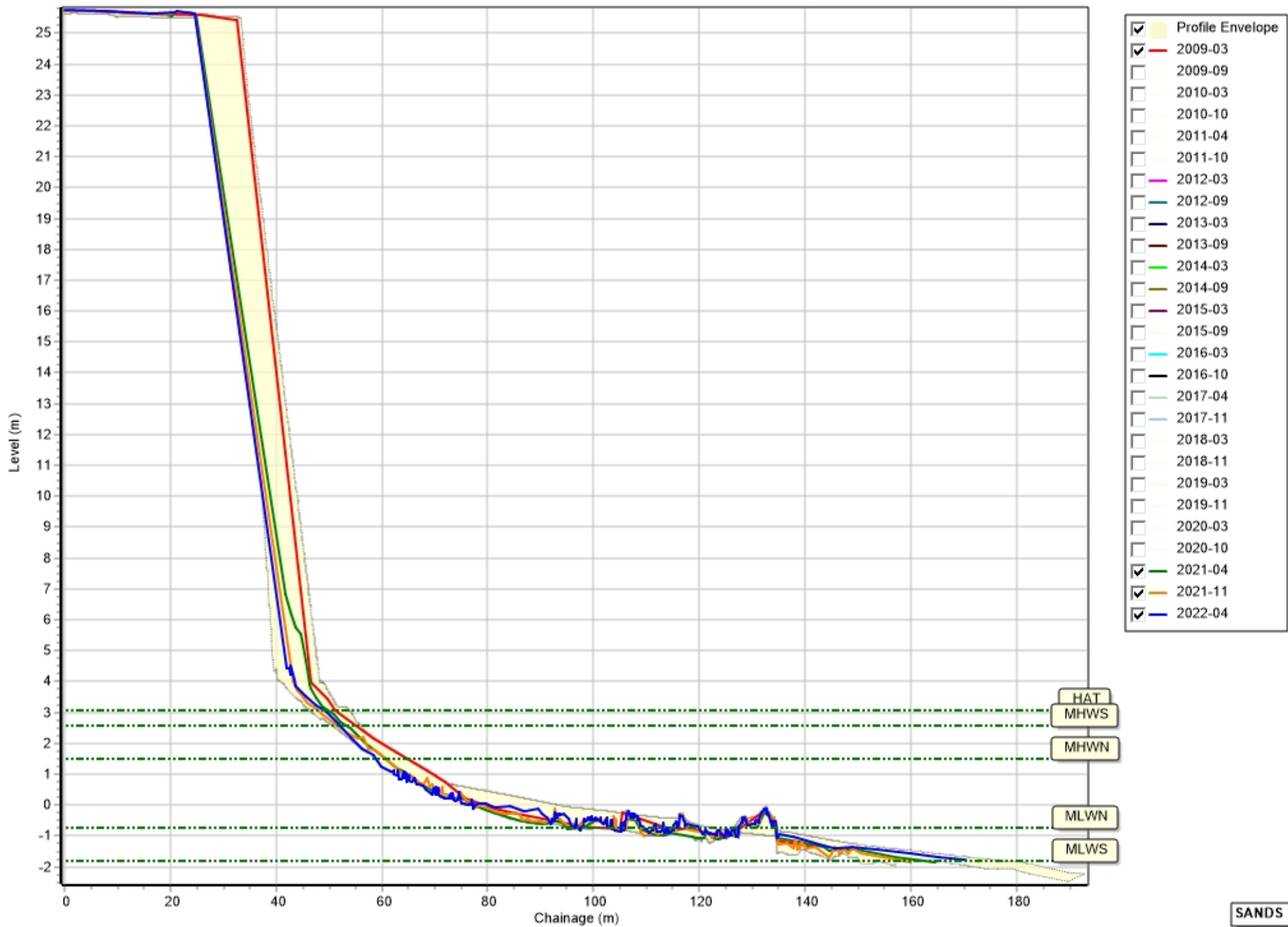


# Profiles: 1bSNS11

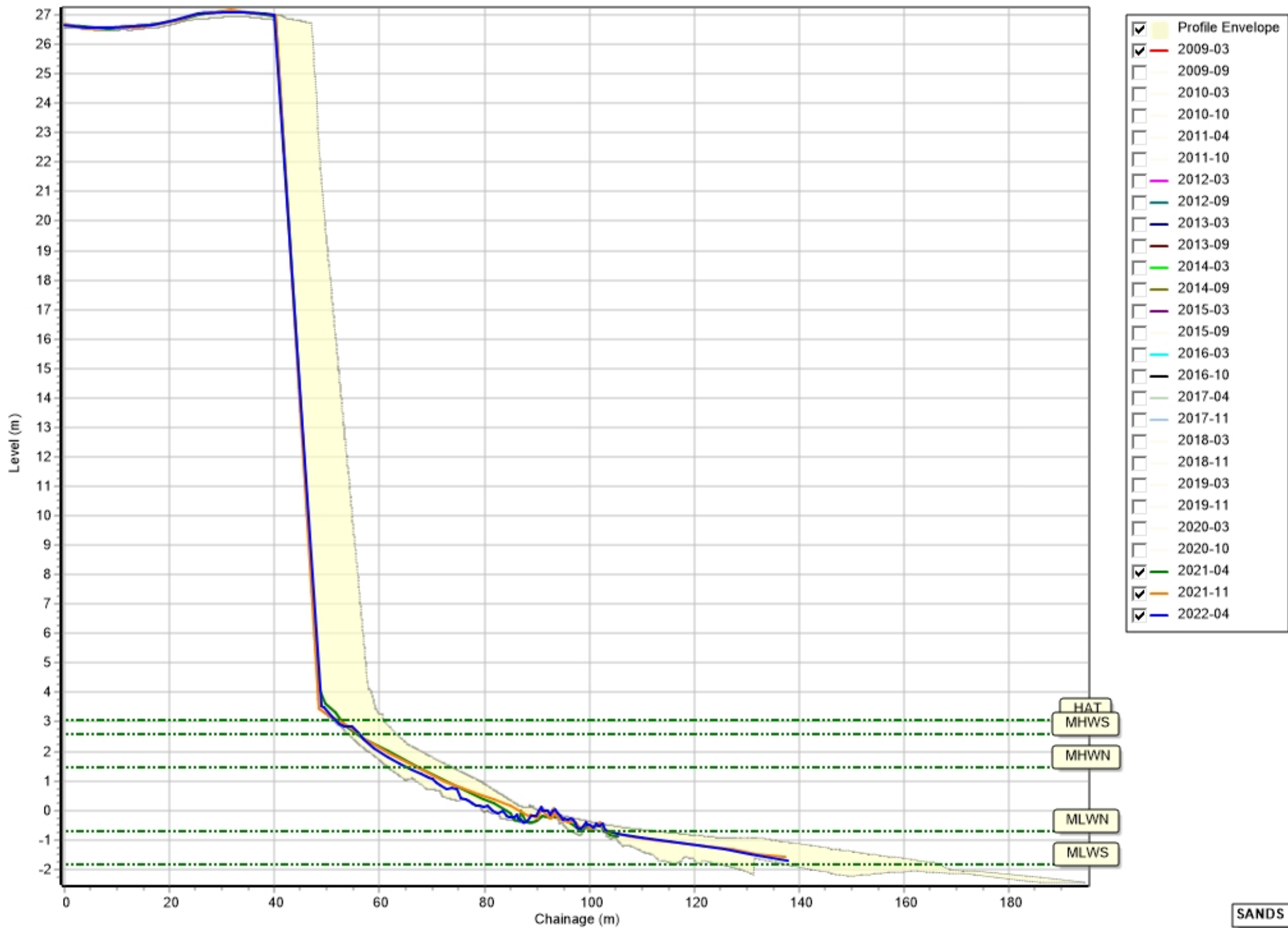




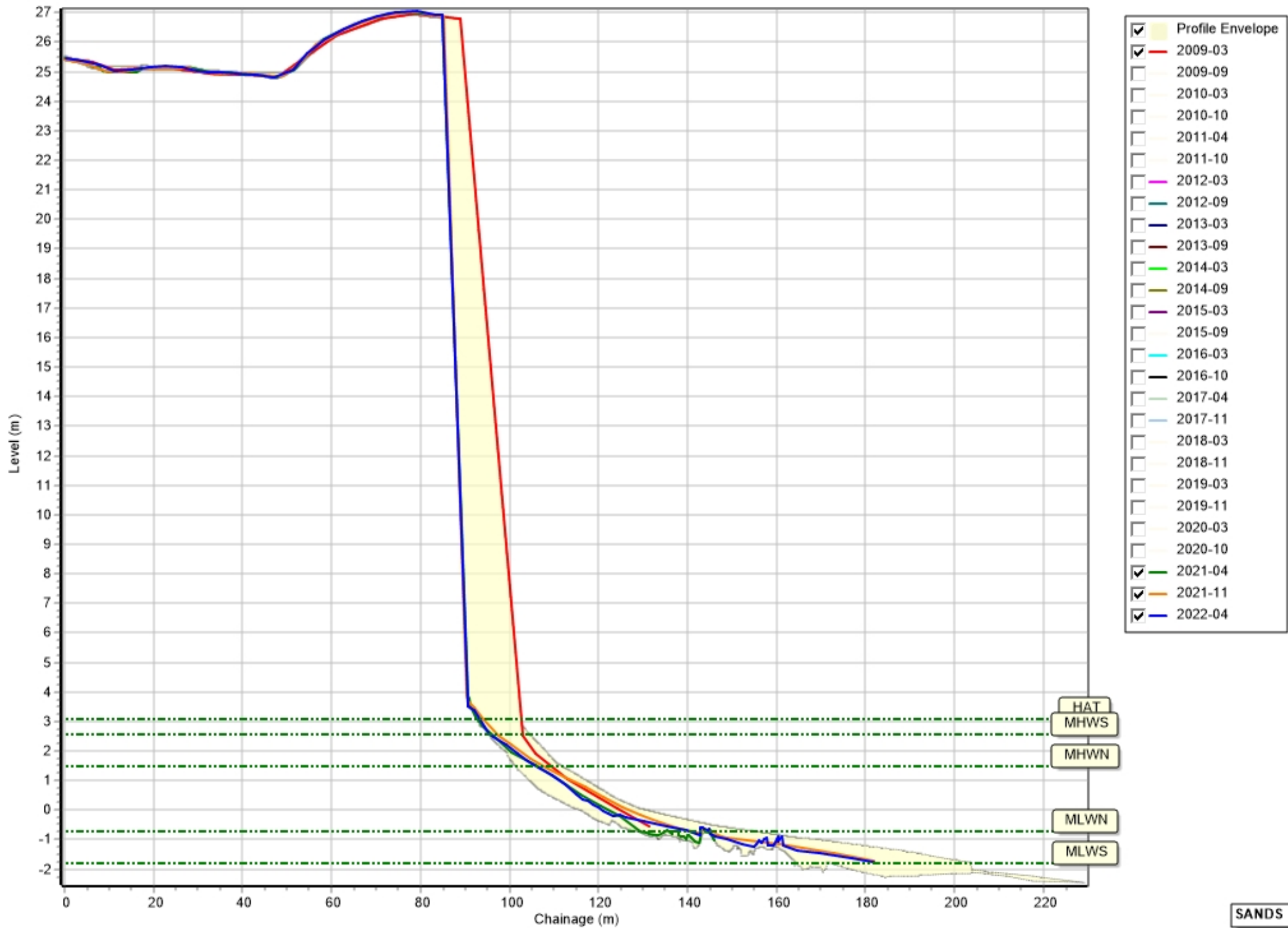
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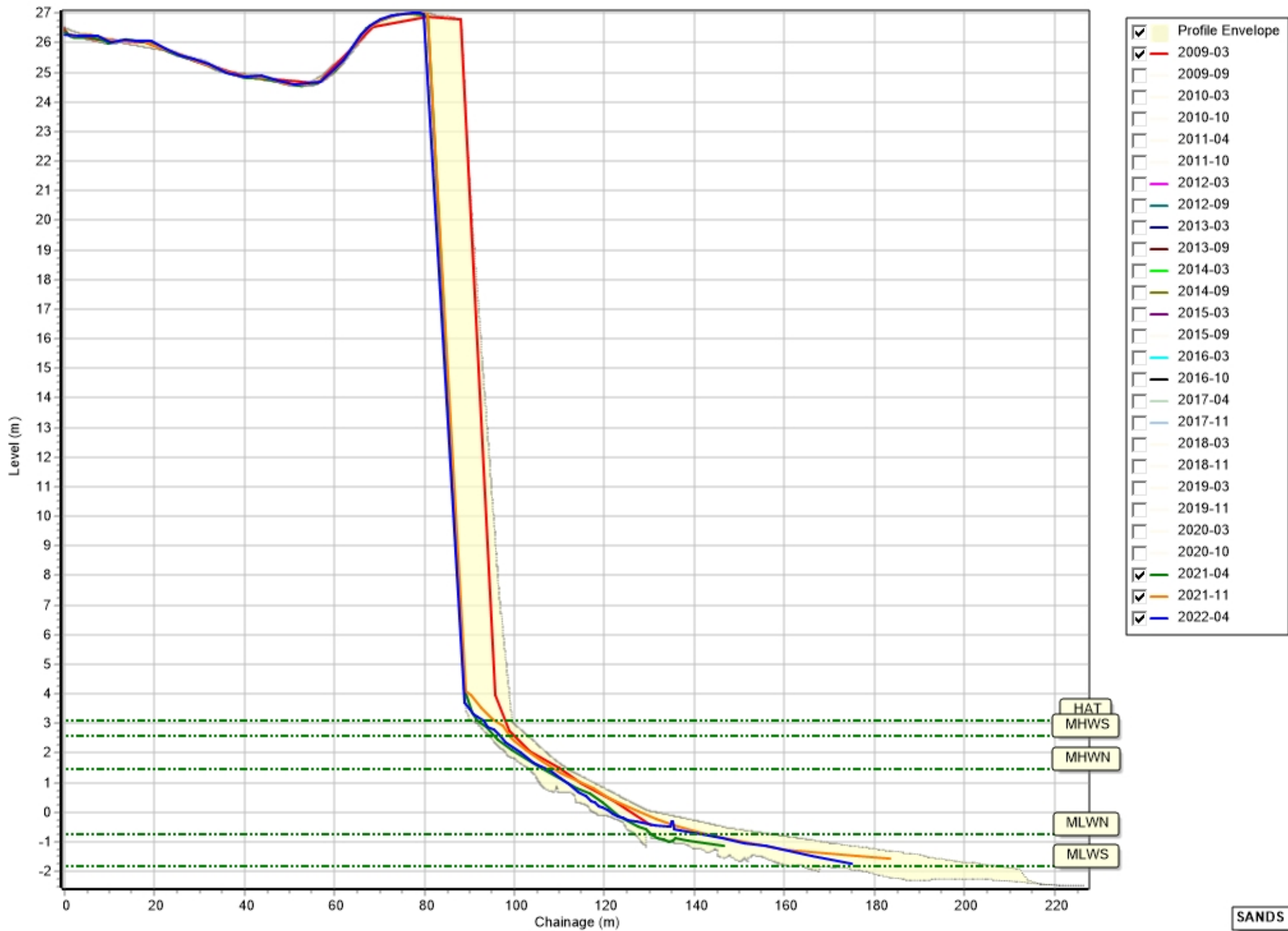
# Profiles: 1bSNS25



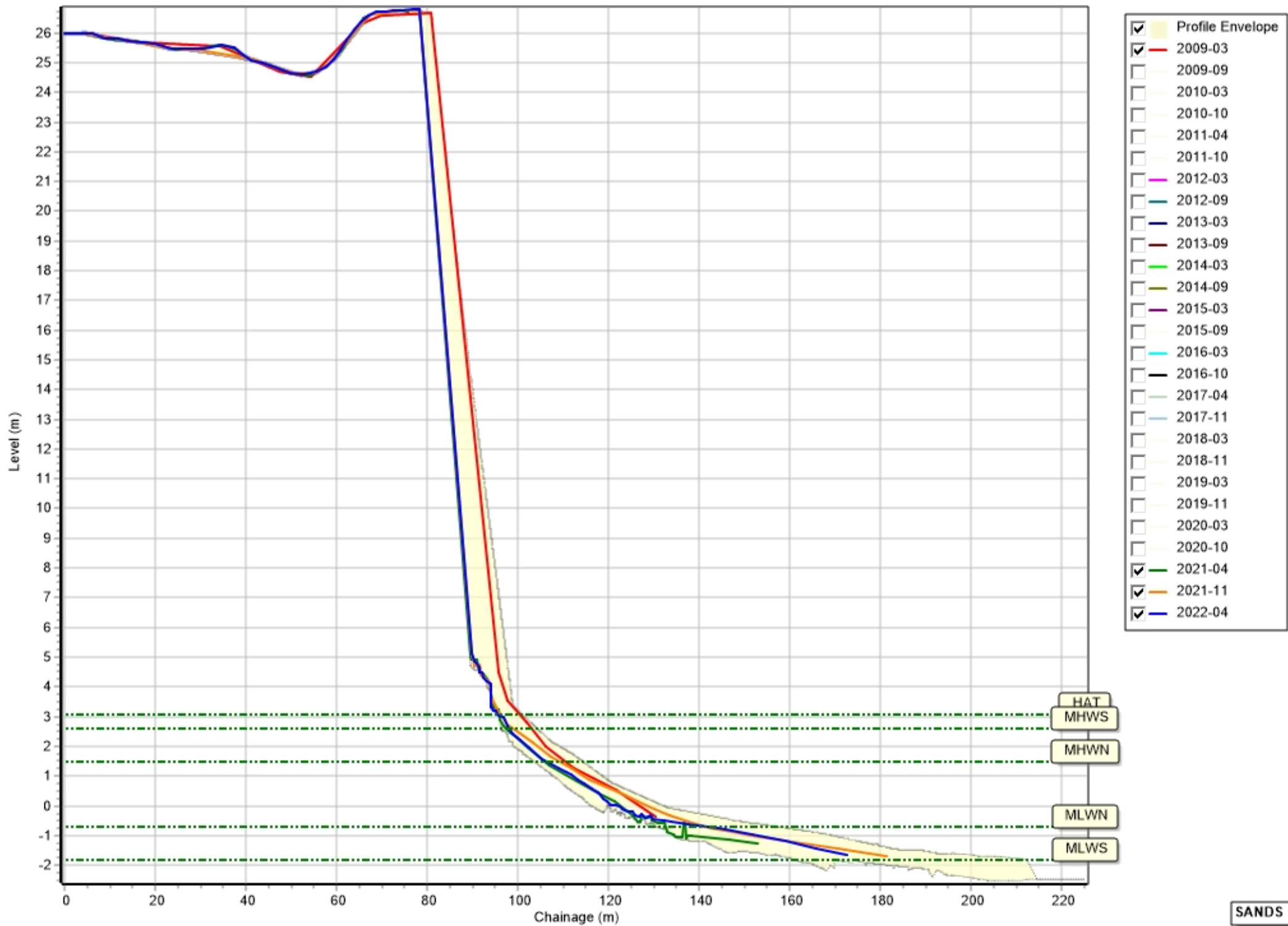
# Profiles: 1bSNS26



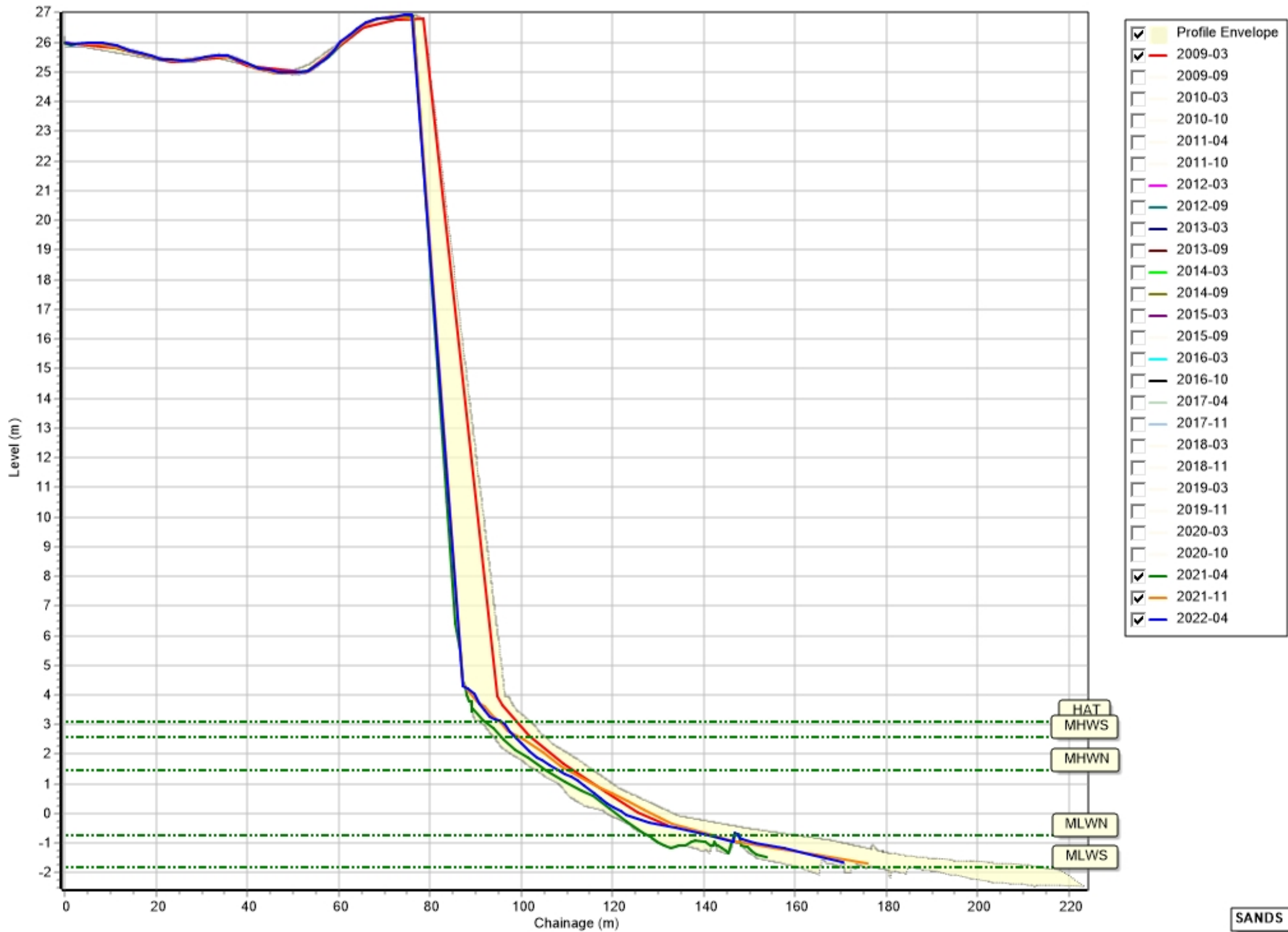
Profiles: 1bSNS27



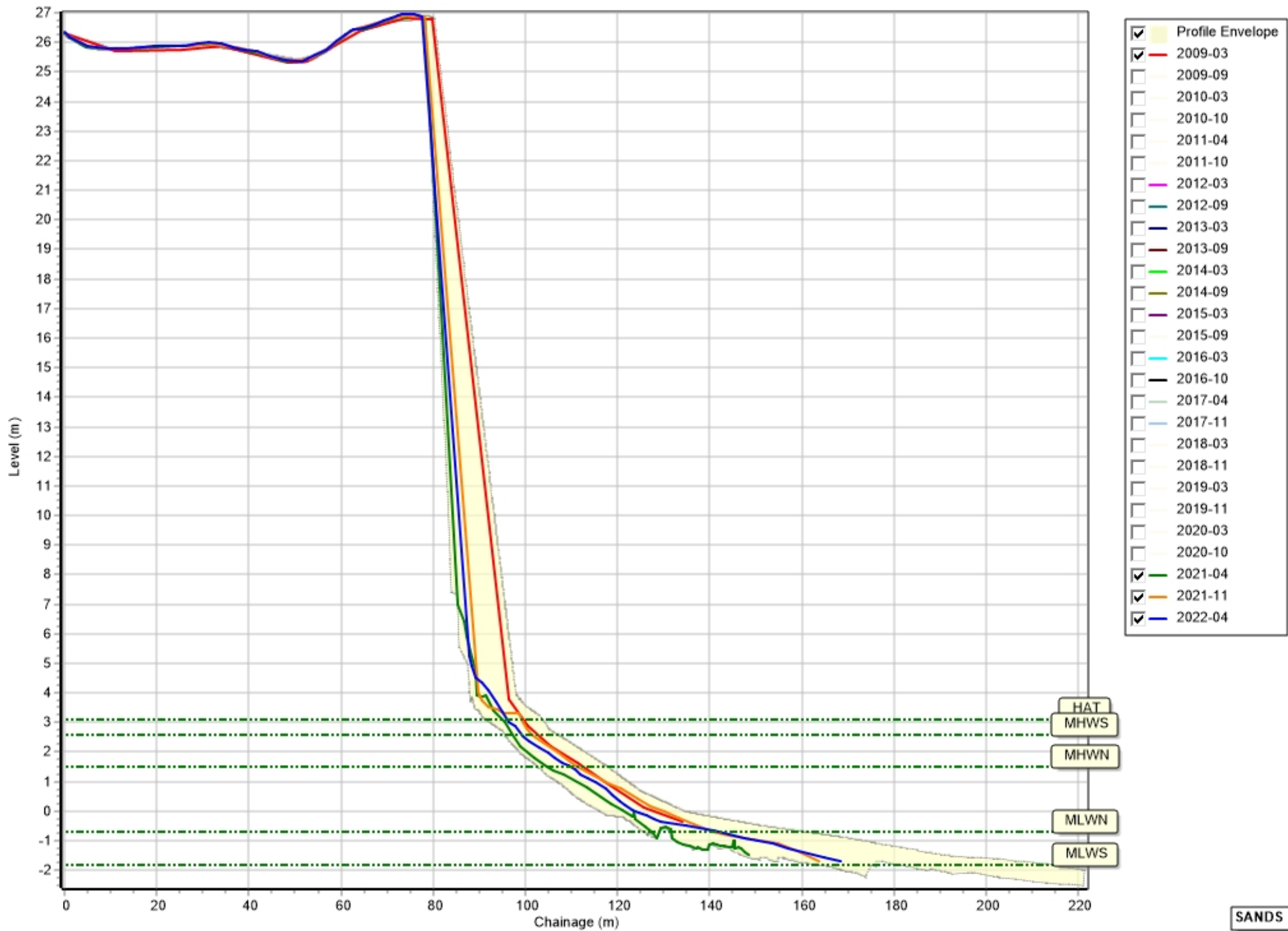
# Profiles: 1bSNS28



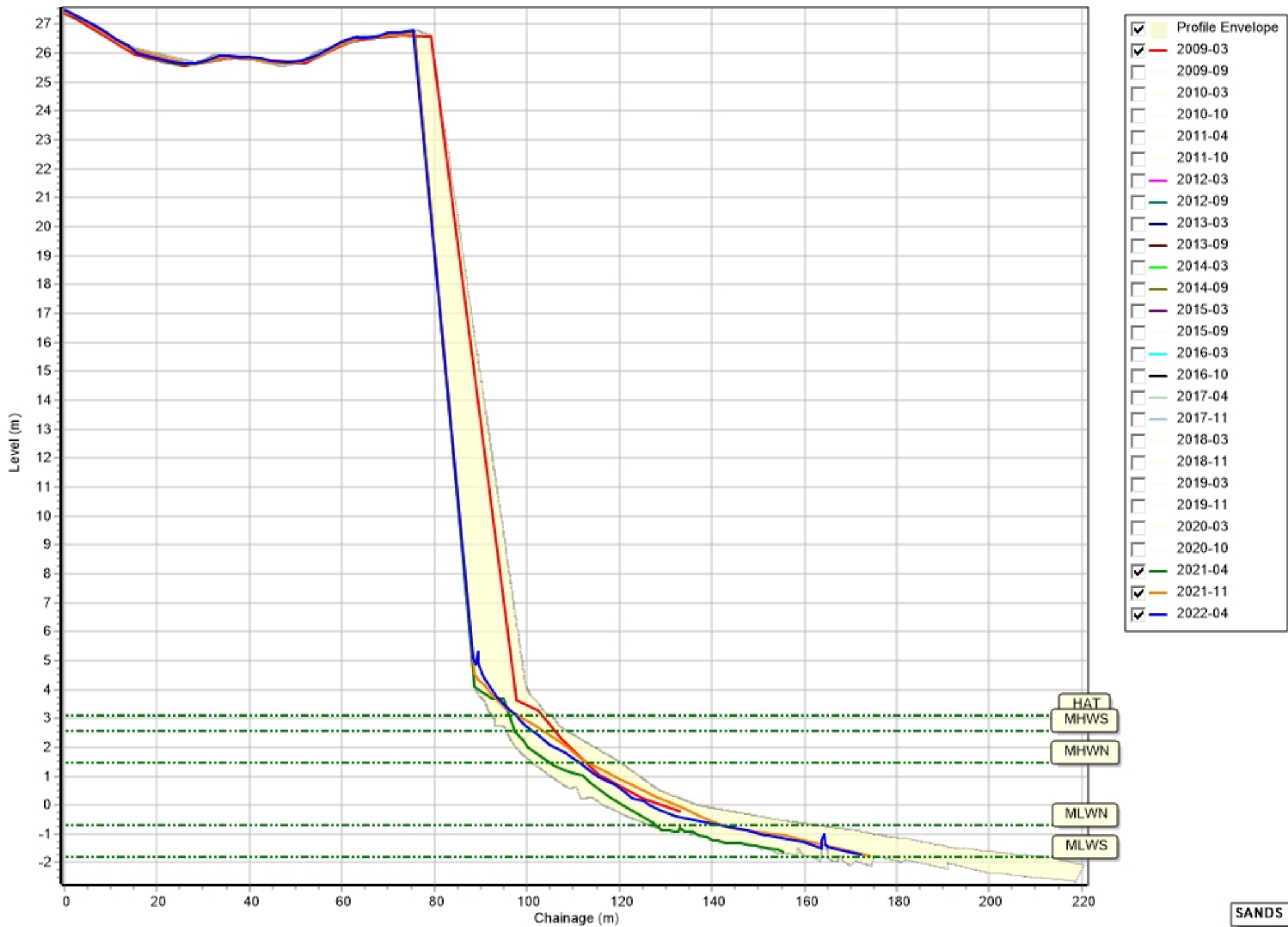
# Profiles: 1bSNS29



# Profiles: 1bSNS30

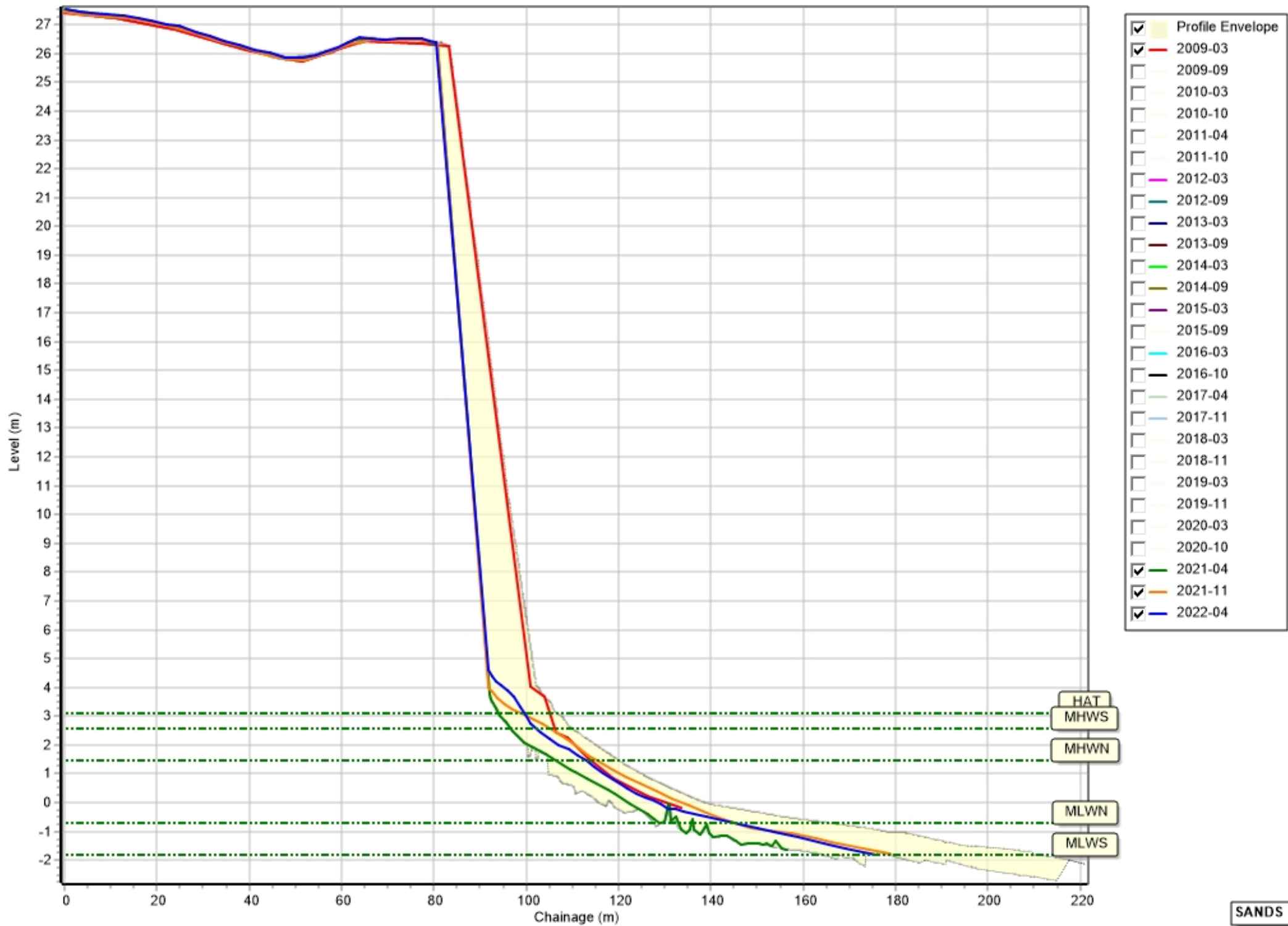


# Profiles: 1bSNS31

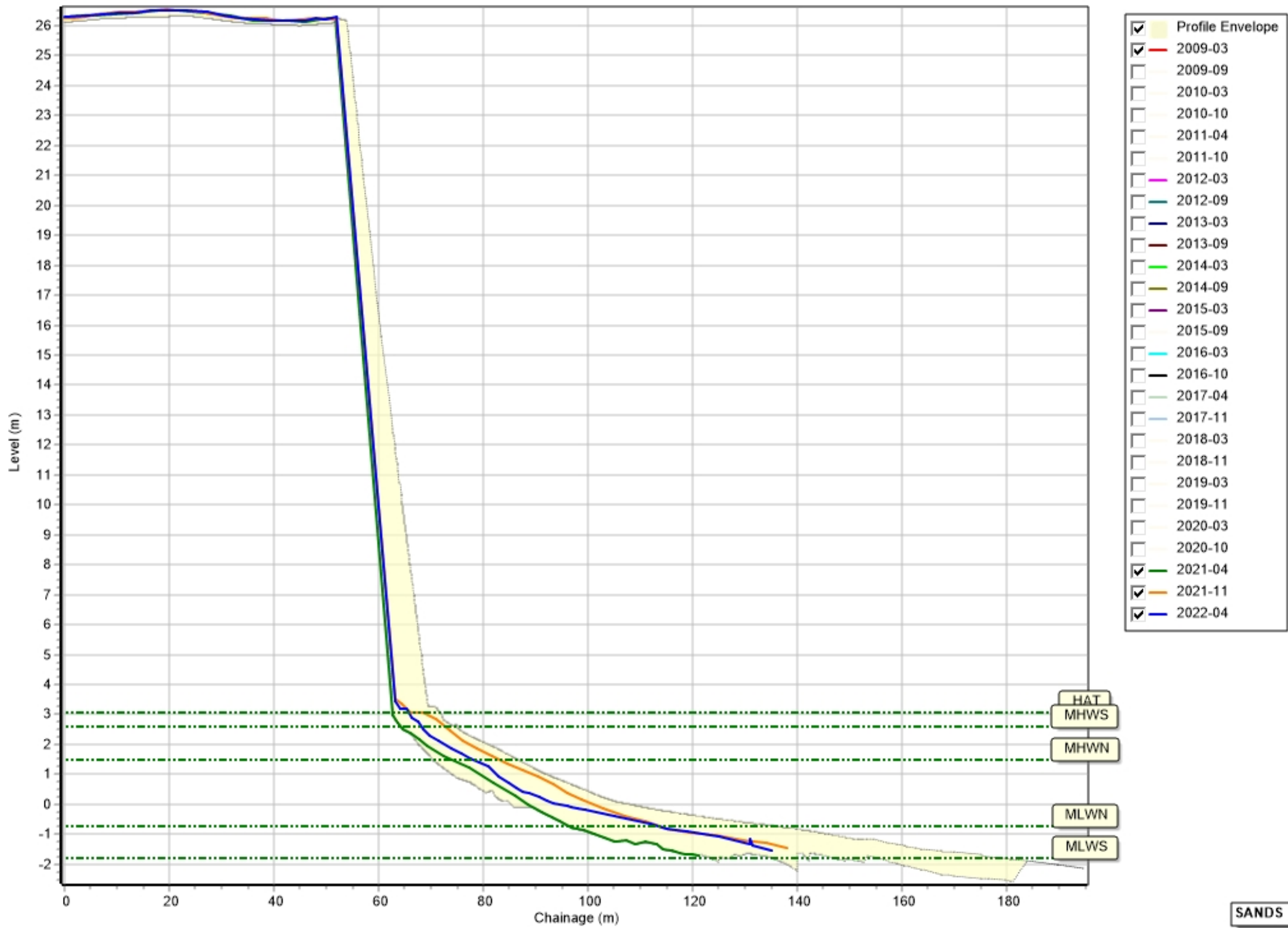




# Profiles: 1bSNS32



# Profiles: 1bSNS33



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

441000

441500

NORTH

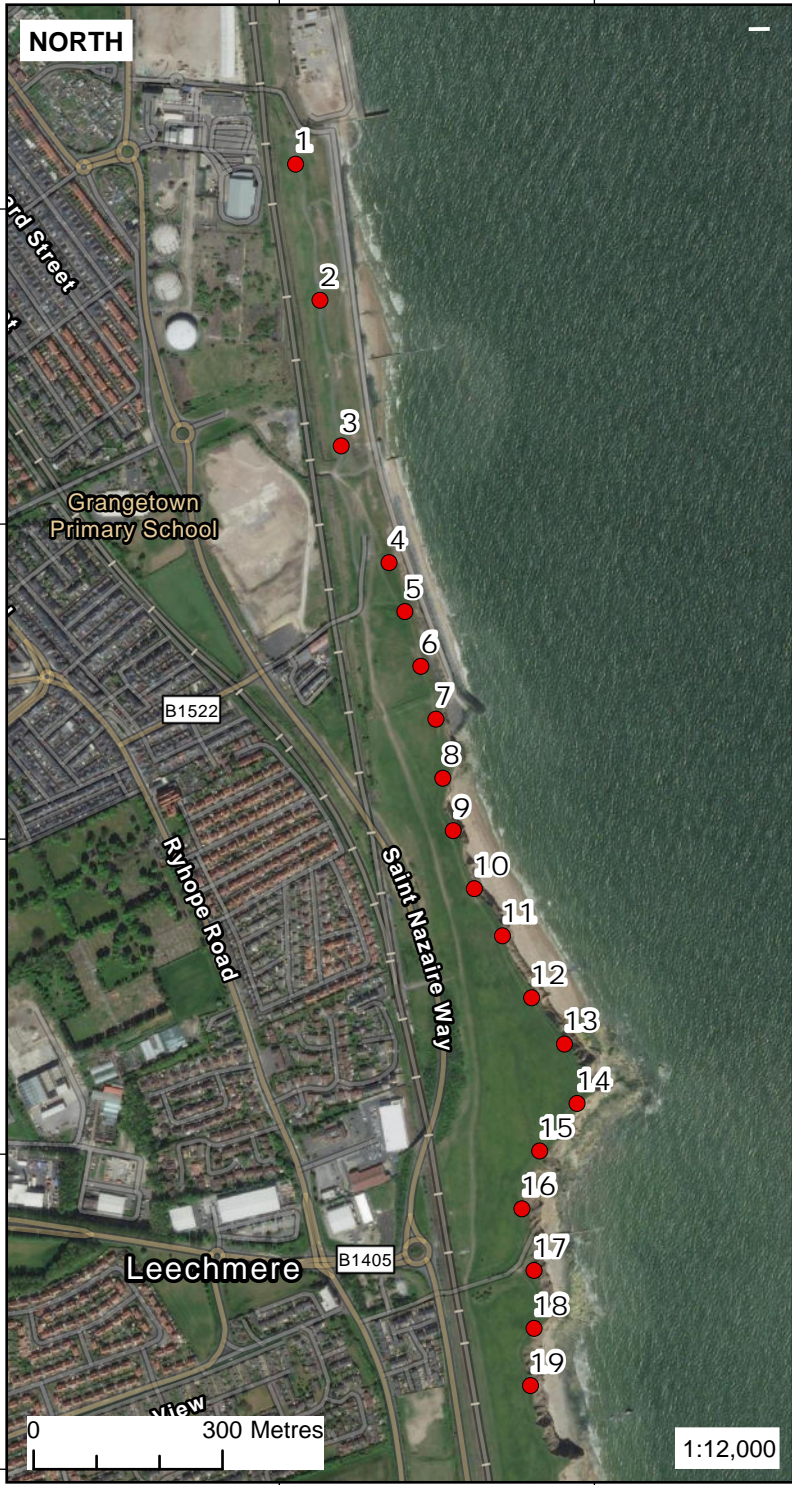
5555000

5550000

5545000

5540000

5535000



441000

441500

441500

442000

SOUTH

5535000

5530000

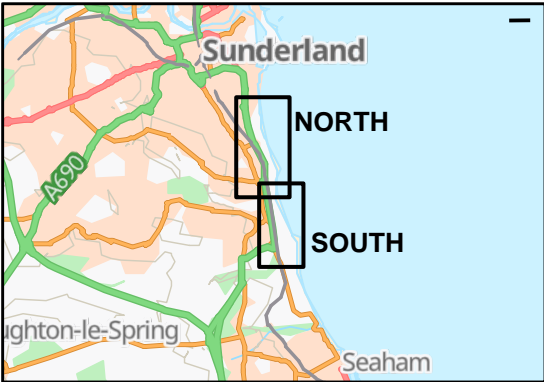
5525000

5520000



441500

442000



**SURVEY LOCATIONS**

- Cliff Top Survey Points

© HaskoningDHV UK Ltd.  
 World Imagery: Maxar, Microsoft  
 GB Cartographic Local Names: Contains OS data © Crown Copyright and database right 2020  
 Contains data from OS Zoomstack  
 Hybrid Reference Layer: Esri Community Maps Contributors, Esri UK, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS

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

Title:  
**Figure 3 - Map 1**  
**HENDON TO RYHOPE**  
**Sunderland City Council Frontage**

Report:  
 Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	as shown

Co-ordinate system: British National Grid



## Cliff Top Survey

### Hendon and Ryhope

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

The cliff top surveys between Hendon and Ryhope are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table B1 provides baseline information about these ground control points and results from the 2009 (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 B1 – Cliff Top Surveys between Hendon and Ryhope**

Ground Control Points				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing	Baseline Survey	Previous Survey	Present Survey	Baseline to Present	Previous to Present	Baseline to Present
			(°)	Mar 2009	Nov 2021	Apr 2022	Mar 2009 - Apr 2022	Nov 2021- Apr 2022	Mar 2009 - Apr 2022
1	441025.7	555571.1	75	8.16	8.21	8.11	-0.05	-0.1	0.00
2	441064.4	555355.1	85	7.09	5.06	4.93	-2.16	-0.13	-0.17
3	441098	555124	82	10.01	10.32	10.15	0.14	-0.17	0.01
4	441174	554938.7	65	10.3	10.48	10.28	-0.02	-0.2	0.00
5	441199.1	554861.1	65	7.71	10.96	10.88	3.17	-0.08	0.24
6	441224.5	554774.2	71	10.83	10.94	10.79	-0.04	-0.15	0.00
7	441248.4	554690.3	74	10.18	10.43	10.29	0.11	-0.14	0.01
8	441259.3	554596.6	101	10.08	9.47	9.53	-0.55	0.06	-0.04
9	441275.8	554513.4	66	10.52	5.7	5.7	-4.82	0	-0.37
10	441309.4	554421.3	58	8.77	1.2	1.13	-7.64	-0.07	-0.59
11	441354	554346.5	68	8.2	0.65	0.19	-8.01	-0.46	-0.62
12	441400.2	554248.2	56	6.17	5.59	5.62	-0.55	0.03	-0.04
13	441452.3	554174.7	63	11.61	5.51	5.61	-6	0.1	-0.46

Ground Control Points				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
14	441472.3	554080.5	127	7.33	5.81	5.76	-1.57	-0.05	-0.12
15	441413	554005.1	122	7.84	7.75	7.64	-0.2	-0.11	-0.02
16	441384.8	553913.3	90	9.89	7.01	6.93	-2.96	-0.08	-0.23
17	441404.1	553815.5	93	6.32	5.85	5.66	-0.66	-0.19	-0.05
18	441404.1	553723.6	119	8.1	2.19	2.8	-5.3	0.61	-0.41
19	441398.5	553632.8	78	8.23	3.99	3.94	-4.29	-0.05	-0.33
20	441438.3	553452.9	71	10.09	5.28	5.24	-4.85	-0.04	-0.37
21	441506.1	553256.1	62	8.57	3.53	3.61	-4.96	0.08	-0.38
22	441550.1	553158.7	103	6.57	3.06	3.1	-3.47	0.04	-0.27
23	441585.2	553076.5	64	8.11	3.48	2.12	-5.99	-1.36	-0.46
24	441624.4	552870.7	69	7.53	2.16	1.71	-5.82	-0.45	-0.45
25	441689.1	552758	70	14.58	2.32	2.18	-12.4	-0.14	-0.95
26	441715	552713.3	54	12.87	2.49	2.53	-10.34	0.04	-0.80
27	441749.2	552674.4	62	14.56	2.52	2.46	-12.1	-0.06	-0.93
28	441776.6	552629.9	57	8.62	2.45	2.44	-6.18	-0.01	-0.48
28A	441798.6	552586.3	56	13.63	6.15	5.44	-8.19	-0.71	-0.63
28B	441817.4	552542.4	64	12.3	8.39	8.35	-3.95	-0.04	-0.30
28C	441852.2	552502.6	52	13.11	12.45	12.39	-0.72	-0.06	-0.06
29	441880.1	552471.6	83	15.46	14.54	14.49	-0.97	-0.05	-0.07
30	441921.4	552269	97	8.55	4.21	4.25	-4.3	0.04	-0.33
31	441853.1	552094	75	11.2	2.1	2.11	-9.09	0.01	-0.70
32	441883.3	551988.5	96	9.82	2.54	2.62	-7.2	0.08	-0.55

\*Note that 28A-28C baseline is September 2009.