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## Cell 1 Regional Coastal Monitoring Programme Update Report 15: 'Partial Measures' Survey 2023



North Tyneside Council

**North Tyneside Council**

**May 2023**

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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)
	Whitley Sands to King Edward's Bay
HAT	3.1
MHWS	2.4
MHWN	1.3
MLWN	-0.8
MLWS	-1.9

Source: UKHO Admiralty Tide Tables, 2020

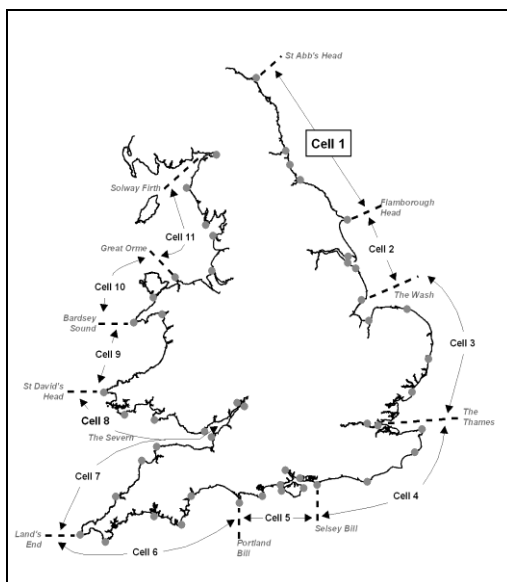


## Glossary of Terms

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 North Yorkshire 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/early winter every year. Some of these surveys are then repeated the following spring as part of a 'Partial Measures' survey.

Each year, an Analytical Report is produced for each individual authority, providing a detailed analysis and interpretation of the 'Full Measures' surveys. This is followed by a brief Update Report for each individual authority, providing ongoing findings from the 'Partial Measures' surveys.

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	Jun 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	Feb 13	
5	2012/13	Sep-Oct 12	Mar 13	Mar-Apr 13	Jun 13	
6	2013/14	Sep-Oct 13	Feb 14	Mar-Apr 14	Jul 14	
7	2014/15	Oct-Nov 14	Feb 15	Mar 15	Jul 15	
8	2015/16	Oct-Nov 15	Feb 16	Mar 16	Jul 16	Jun 16
9	2016/17	Sep 16	Feb 17	Mar 17	Jul 17	
10	2017/18	Sep-Oct 17	Feb 18	Mar 18	May 18	
11	2018/19	Sep-Oct 18	Jan 19	Feb-Mar 19	Aug 19	
12	2019/20	Sep-Nov 19	Dec 19	Mar 20	Mar 20	
13	2020/21	Sep 20	Nov 20	Mar 21	Apr 21	Aug 21
14	2021/22	Aug 21	Dec 21	Mar-Apr 22	May 22	
15	2022/23	Aug 22	Jan 23	Feb-Mar 23	May 23	

(\*) The present report is **Update Report 15** and provides an analysis of the 2023 Partial Measures survey for North Tyneside Council's frontage.

## 1. Introduction

### 1.1 Study Area

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

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

### 1.2 Methodology

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

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

The location of these surveys is shown in Figure 2. The Partial Measures 2022 surveys were undertaken along this frontage on the 23<sup>rd</sup> February and 22<sup>nd</sup> March 2023. During this time weather conditions varied; refer to the survey reports for details of the weather conditions over this survey period.

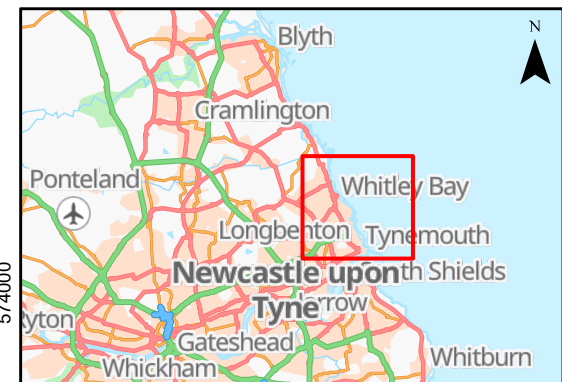
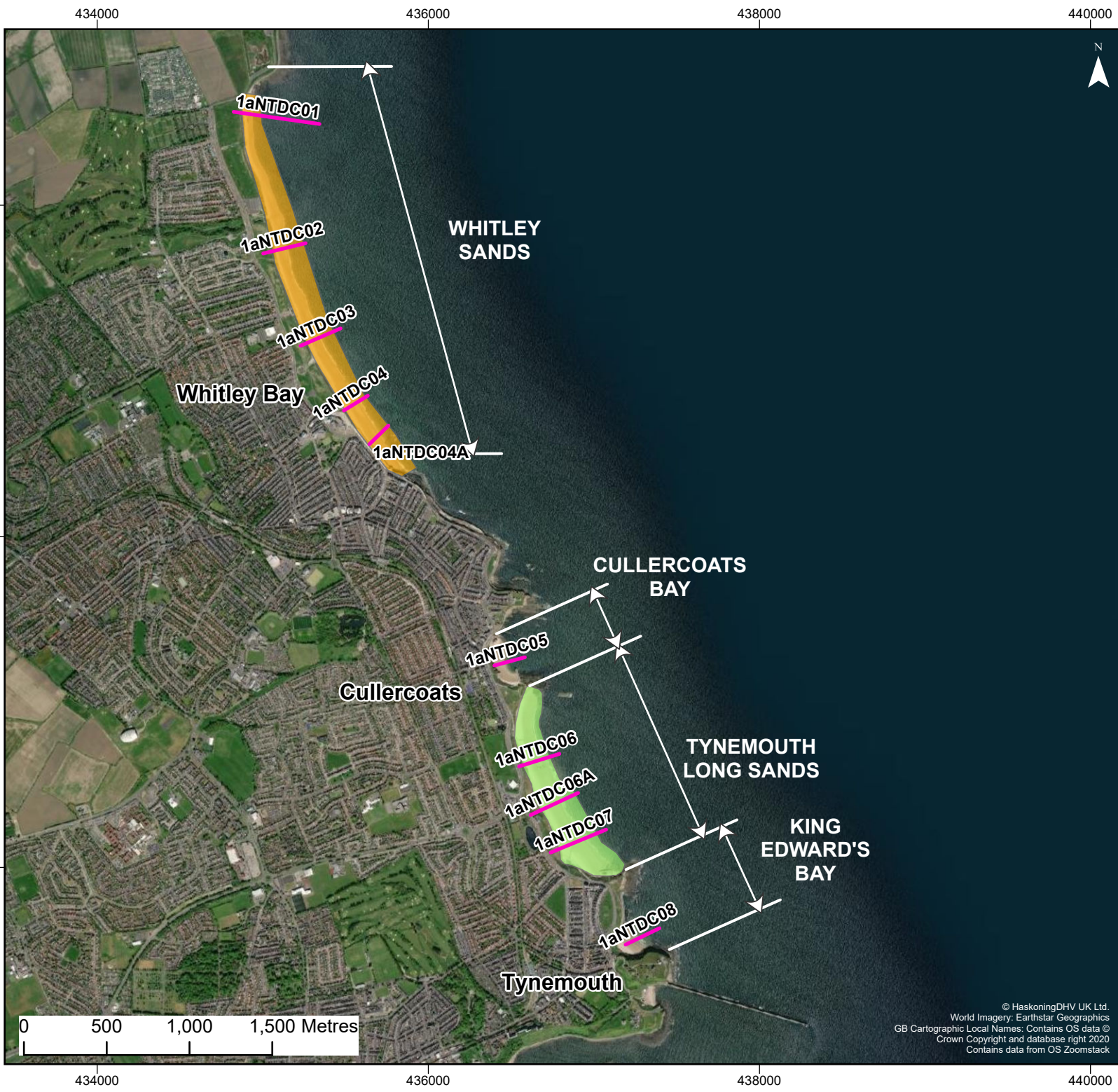
All data have been captured in a manner commensurate with the principles of the Environment Agency's *National Standard Contract and Specification for Surveying Services* and stored in a file format compatible with the software systems being used for the data analysis, namely SANDS and ArcGIS. This data collection approach and file format is comparable to that being used on other regional coastal monitoring programmes around England.

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 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)

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

Title:

**Figure 2 - Map 1**

**WHITLEY SANDS to KING EDWARD'S BAY**

**North Tyneside Council Frontage**

Report:

Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:32,000

Co-ordinate system: British National Grid

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## 2. Analysis of Survey Data

### 2.1 Whitley Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
22 <sup>nd</sup> March 2023	<p><b>Beach Profiles:</b></p> <p>Whitley Sands is covered by five beach profile lines for the Partial Measures survey (Appendix A). Four of these (1aNTDC01 to 1aNTDC04) were initially surveyed in April 2002 and were then re-surveyed annually to 2009 (Full Measures, autumn 2009) after which time they have been surveyed bi-annually. From March 2010 (Partial Measures, spring 2010) onwards, an additional beach profile line (NTDC04A) has been surveyed at the southern end of the frontage for the same time periods listed above. All profiles were last surveyed in autumn 2022 for the Full Measures survey.</p> <p><b>1aNTDC01</b> is located in the north of Whitley Sands, along the undefended cliffs immediately south of Trinity Road car park. According to the survey report, the cliff was not measured due to dangerous access. There has been lowering by up to 1.4m on the upper beach, from the toe of the cliff to chainage 78m, which has exposed some rocks between chainages 60-76m. The middle beach between chainages 76-100m has not changed since the previous survey. The lower beach between chainages 100-145m has lowered by up to 0.2m. Overall, the profile is at a one of its lowest levels recorded compared to the range recorded from previous surveys.</p> <p>Profile <b>1aNTDC02</b> is located towards the north of Whitley Sands. From the sea wall to chainage 143m, the beach has lowered by up to 0.4m on the upper beach, 0.2m on the middle beach and 0.3m on the lower beach. Overall, the beach profile is at a medium-low level compared to the range recorded from previous surveys.</p> <p>Profile <b>1aNTDC03</b> is located at the centre of Whitley Sands. Beach levels have decreased between the sea wall across the upper beach to chainage 62m by up to 1.1m. Seawards of chainage 62m, the beach level has risen by up to 1.3m, covering up a previously exposed rock patch at chainage 90m. Overall, the upper and lower beach is at a medium level compared to the range recorded from previous surveys, whilst the middle beach is at a low level.</p>	<p>Since the last survey, beach levels across Whitley Sands have generally lowered on the upper beach and risen on the lower beach, except at profile 1aNTDC01 and 1aNTC02 which have lowered across their profiles.</p> <p><b>Longer term trends:</b></p> <p>The data show that profiles are within the bounds of previous surveys.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>Profile <b>1aNDC04</b> is located to the south of Whitley Sands. There has been a small section from the toe of the dunes to chainage 22m where the beach level has risen by up to 0.3m. The middle beach between chainages 22-78m has lowered by up to 0.2m. Seaward of chainage 78m the beach has risen by up to 1.4m. Overall, the beach is at a relatively high level compared to the range recorded from previous surveys, particularly seaward of chainage 100m which is at its highest level recorded.</p> <p>Profile <b>1aNTDC04A</b> is located to the south of Whitley Sands. The beach at the toe of the dunes has risen by up to 0.4m to chainage 3m. The upper to middle beach has lowered by up to 0.6m to chainage 78m, before switching to erosion on the lower beach by up to 0.6m. Overall, the beach profile is at a medium-high level compared to the range recorded from previous surveys, particularly seaward of chainage 80m which is at its highest level recorded.</p>	

## 2.2 Cullercoats Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>23<sup>rd</sup> February 2023</p>	<p><b>Beach Profiles:</b></p> <p>Cullercoats Bay is covered by one beach profile line for the Partial Measures survey (Appendix A). This was surveyed annually each autumn between 2002 and 2009. From spring 2010 onwards, it has been surveyed bi-annually. The last survey was the autumn 2022 Full Measures survey.</p> <p>The cliff at <b>1aNTDC05</b> is not measured (through agreement) due to dangerous access. There has been alternating sections of erosion and accretion from the foot of the cliff at chainage 25m to the end of the survey. The upper beach has risen by up to 0.3m from the foot of the cliff to chainage 60m. The middle beach between chainages 60-95m has lowered by up to 0.3m, flattening a berm present during the previous survey. The lower beach has risen by up to 0.2m seaward of chainage 95m. Overall the beach is at a medium-high level compared to the range recorded from previous surveys.</p>	<p>The beach profile has not undergone any significant change since the previous survey, with sections of erosion and accretion across the profile.</p> <p><b>Longer term trends:</b> The beach levels observed are within the bounds of previous surveys, indicating generic behaviour with no clear trend.</p>



## 2.3 Tynemouth Long Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>23<sup>rd</sup> February 2023</p>	<p><b>Beach Profiles:</b></p> <p>Tynemouth Long Sands is covered by three beach profile lines for the Partial Measures survey (Appendix A). Profiles 1aNTDC06 and 1aNTDC07 were initially surveyed annually each autumn between 2002 and 2009. A third profile, 1aNTDC06A, was later added in the centre of the frontage. From spring 2010 (Partial Measures) onwards, they have been surveyed bi-annually. The last survey was the autumn 2022 Full Measures survey.</p> <p><b>1aNTDC06</b> is located approximately 150m south of the access road/ramp towards the north of the bay. The profile for the dune-cliff face is limited due to a lack of data points in the profile plot; the survey report for this monitoring period and previous survey reports have noted ‘<i>no access to middle of section 6 due to seed protection fences</i>’. The beach at the toe of the cliff has lowered by up to 0.5m to chainage 50m. The rest of the beach profile seaward of chainage 50m has risen by up to 0.6m. Overall, the profile is at a high level on the upper beach and at a medium level on the middle and lower beach compared to the range recorded from previous surveys.</p> <p>At profile <b>1aNTDC06A</b>, the profile for the dune-cliff face is a straight line; a result of a lack of data points in the profile plot; the survey report for this monitoring period and previous survey reports have noted ‘<i>no access to middle of section 6A due to seed protection fences</i>’. The beach profile alternates between erosion and accretion, with the greatest amount of change recorded between chainages 98-132m where the upper beach berm has been removed by up to 1.0m. Erosion is mostly limited to 0.2m and accretion to 0.1m. Overall, the profile is at high level compared to the range recorded from previous surveys.</p> <p>Profile <b>1aNTDC07</b> is located approximately 50m south of the access route through the dunes towards the southern end of the bay. As with the other profiles the dune-cliff face is a straight line; a result of a lack of data points in the profile plot. The survey report for this monitoring period and earlier reports note ‘<i>no access to middle of section 7 due to seed protection fences</i>’. The beach profile has undergone a similar pattern of change to 1aNTDC06A, with alternating sections and erosion and accretion (mostly limited to 0.4m) and the removal of an upper beach berm by up to 0.6m. Overall, the beach is at a high</p>	<p>At Tynemouth Long Sands, the dune-cliff face was not surveyed due to access constraints, but survey photographs suggest that wind-blown sand continues to accrete in the lee of the defences.</p> <p>Beach profile change has been relatively small over the winter/spring months. Beach levels have generally fluctuated between erosion and accretion across the profile.</p> <p><b>Longer term trends:</b> Overall, the beaches have retained a similar form and are within the bounds of previous surveys.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	level compared to the range recorded from previous surveys.	
February 2023	<p><b>Topographic Survey:</b></p> <p>The first survey for Tynemouth Long Sands was undertaken for the Full Measures survey in October 2010.</p> <p>Data from the current topographic survey have been used to create a digital ground model (DGM) (Appendix B – Map 1) using a Geographical Information System (GIS). A difference plot has also been produced by comparing the current DGM (Appendix B – Map 2) with that produced from the last topographic survey (August 2022).</p> <p>The difference plot shows that accretion / little change has dominated at the toe of the cliff across the bay, with an isolated area of erosion in the north. The middle and lower beach of the central – lower part of the bay is broadly characterised by thin parallel bands of erosion and accretion, with a wide band of ‘little change’ on the lower beach (<math>\pm 0.1\text{m}</math>). The northern part of the bay is generally characterised by a large patch of erosion across the middle-lower beach with patchy erosion and accretion in the lee of the headland in the northern and southern extremities of the bay. Overall, change is generally limited to <math>\pm 1.0\text{m}</math>, with only the narrow band of erosion on the upper beach in the central-lower part of the bay reaching up to 1.75m.</p>	<p>Since the last survey, the beach at Tynemouth Long Sands is generally dominated by accretion / little change across the beach profile, except for a narrow band of erosion on the upper beach in the central-lower bay and on the middle-lower beach in the northern part of the bay which have undergone erosion.</p>

## 2.4 King Edward's Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>23<sup>rd</sup> February 2023</p>	<p><b>Beach Profiles:</b></p> <p>King Edward's Bay is covered by one beach profile line for the Full Measures survey (Appendix A). This was surveyed annually each autumn between 2002 and 2009. From spring 2010 onwards, it has been surveyed bi-annually. The last survey was the autumn 2022 Full Measures survey.</p> <p>At profile <b>1aNTDC08</b> the upper beach between chainages 1.0m to 45m has risen by up to 0.4m. The middle beach between chainages 45-105m has lowered by up to 0.4m. The lower beach between chainages 105-155m has risen by up to 0.5m, before the profile once again lowers at the end of the profile (from chainage 155-161m) by up to 0.3m. Overall, the upper beach is at a high level, the middle beach is at a medium level and the lower beach is at a low level compared to the range recorded from previous surveys.</p>	<p>Since the last survey, the beach at King Edward's Bay beach has seen variable change. In general, the upper and lower beach has risen, whilst the middle beach has lowered.</p> <p><b>Longer term trends:</b> Changes recorded are within the bounds of previous surveys. The upper beach berm has maintained a similar form and height compared to previous surveys, with a slight landward retreat compared to the autumn 2022 survey.</p>

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

#### **Individual Profiles**

- At profiles 1aNTDC01 and 1aNTDC05 (through prior agreement) the cliff was not measured due to dangerous access. Future surveys at 1aNTDC05 shall start at the cliff toe and the cliff position should instead be monitored from aerial survey data.
- At Tynemouth Long Sands (profiles 1aNTDC06, 1aNTDC06A and 1aNTDC07) there was no access to the dunes in the middle of the profile due to seedling protection fences. This means it has not been possible to directly monitor the effectiveness of the dune stabilisation scheme, although observations have been made from the survey photographs.

#### **Topographic Survey**

- No problems were encountered.

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

It is recommended that the effectiveness of the stabilisation fences installed at the dunes along Tynemouth Long Sands be monitored by means of walkover inspection and aerial photography, rather than trampling in the restricted access sections.

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

- At Whitley Sands, beach levels have generally lowered on the upper beach and risen on the lower beach, except at profile 1aNTDC01 and 1aNTDC02 which have lowered across their profiles. Profiles are within the bounds of previous surveys and there is no cause for concern.
- At Cullercoats Bay, at profile 1aNTDC05, there has been varying sections of accretion and erosion, but there are no causes for concern.
- At Tynemouth Long Sands, the dune face was not surveyed due to access constraints. Beach profile change has generally shown fluctuations between beach lowering and beach accretion, with no clear trends. The topographic survey is generally dominated by low level accretion/little change across the survey. There are no causes for concern.
- At King Edward's Bay, the beach has risen on the upper and lower beach and lowered on the middle beach. There are no causes for concern.

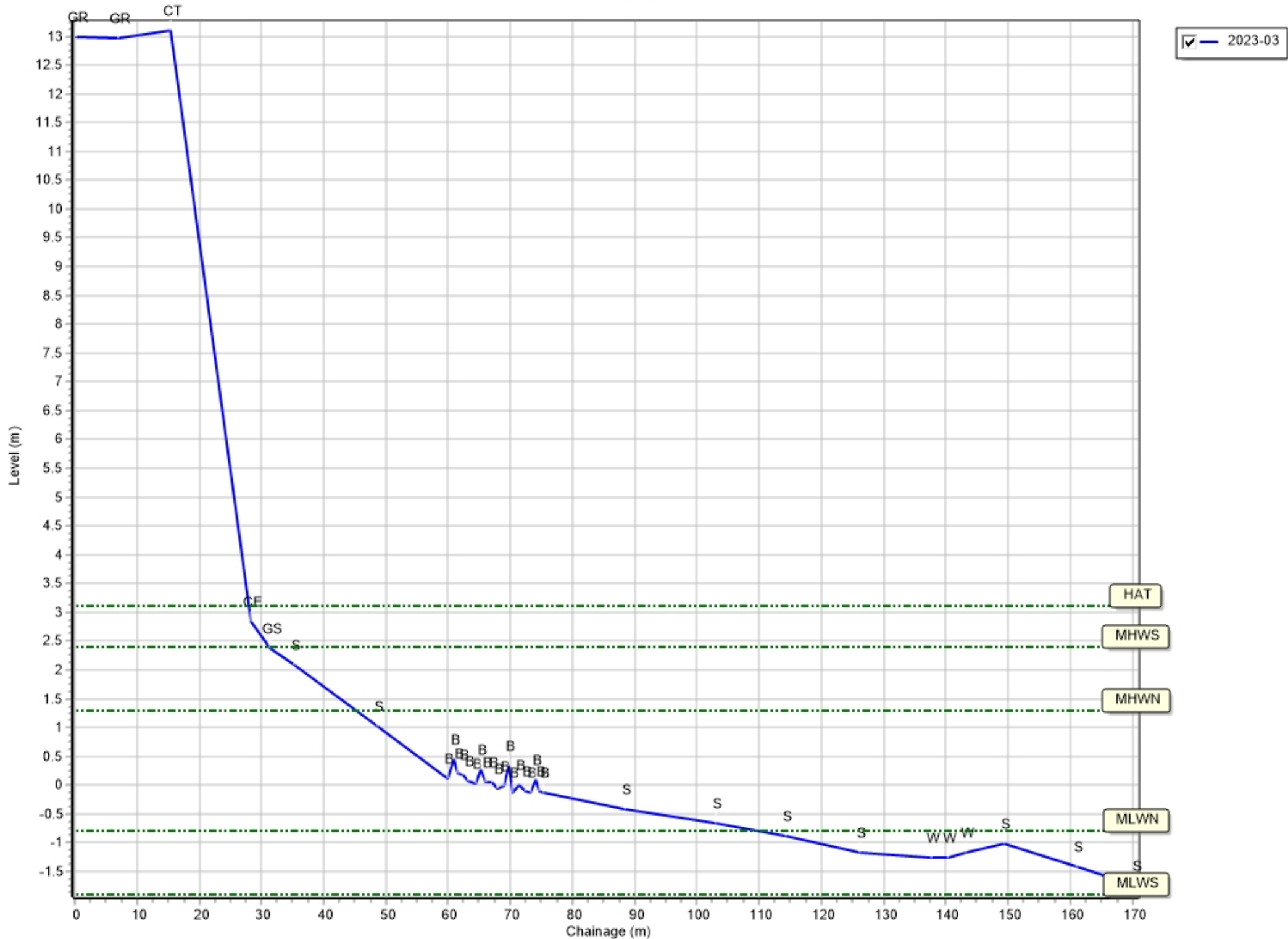
# Appendices

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

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

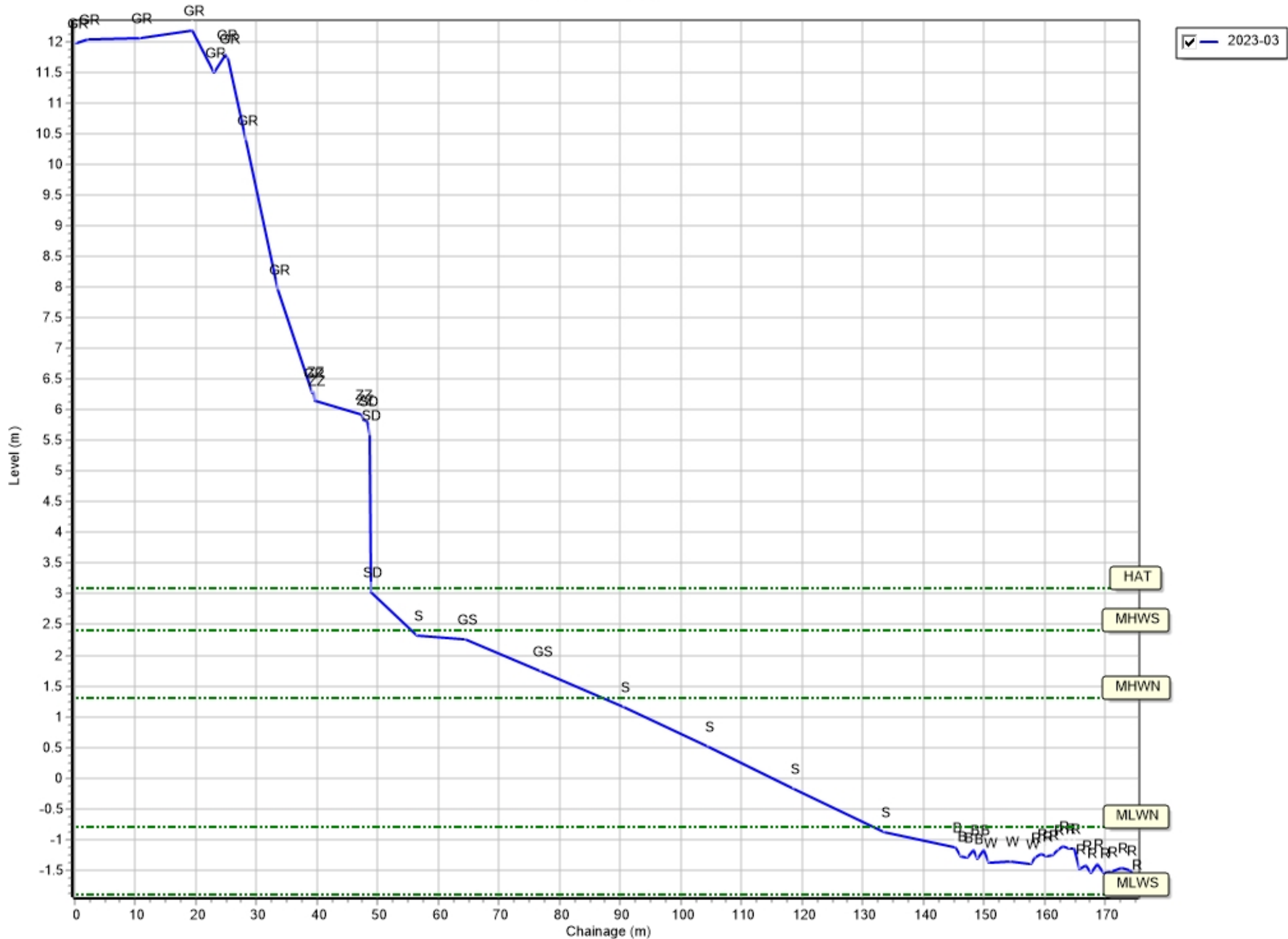
<b>Code</b>	<b>Description</b>
S	Sand
M	Mud
G	Gravel
GS	Gravel & Sand
MS	Mud & Sand
B	Boulders
R	Rock
SD	Sea Defence
SM	Saltmarsh
W	Water Body
GM	Gravel & Mud
GR	Grass
D	Dune (non-vegetated)
DV	Dune (vegetated)
F	Forested
X	Mixture
FB	Obstruction
CT	Cliff Top
CE	Cliff Edge
CF	Cliff Face
SH	Shell
ZZ	Unknown

Profiles: 1aNTDC01

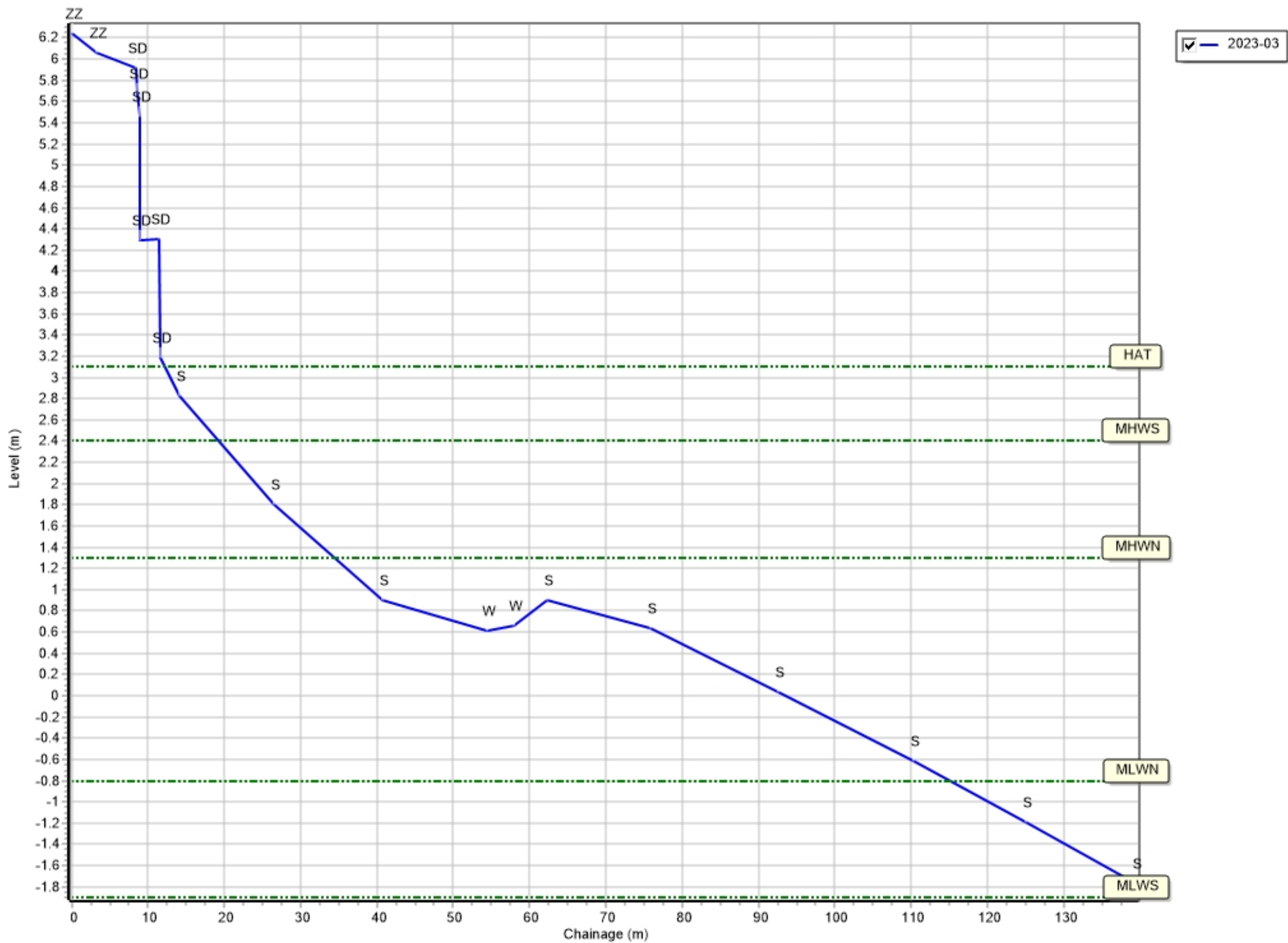




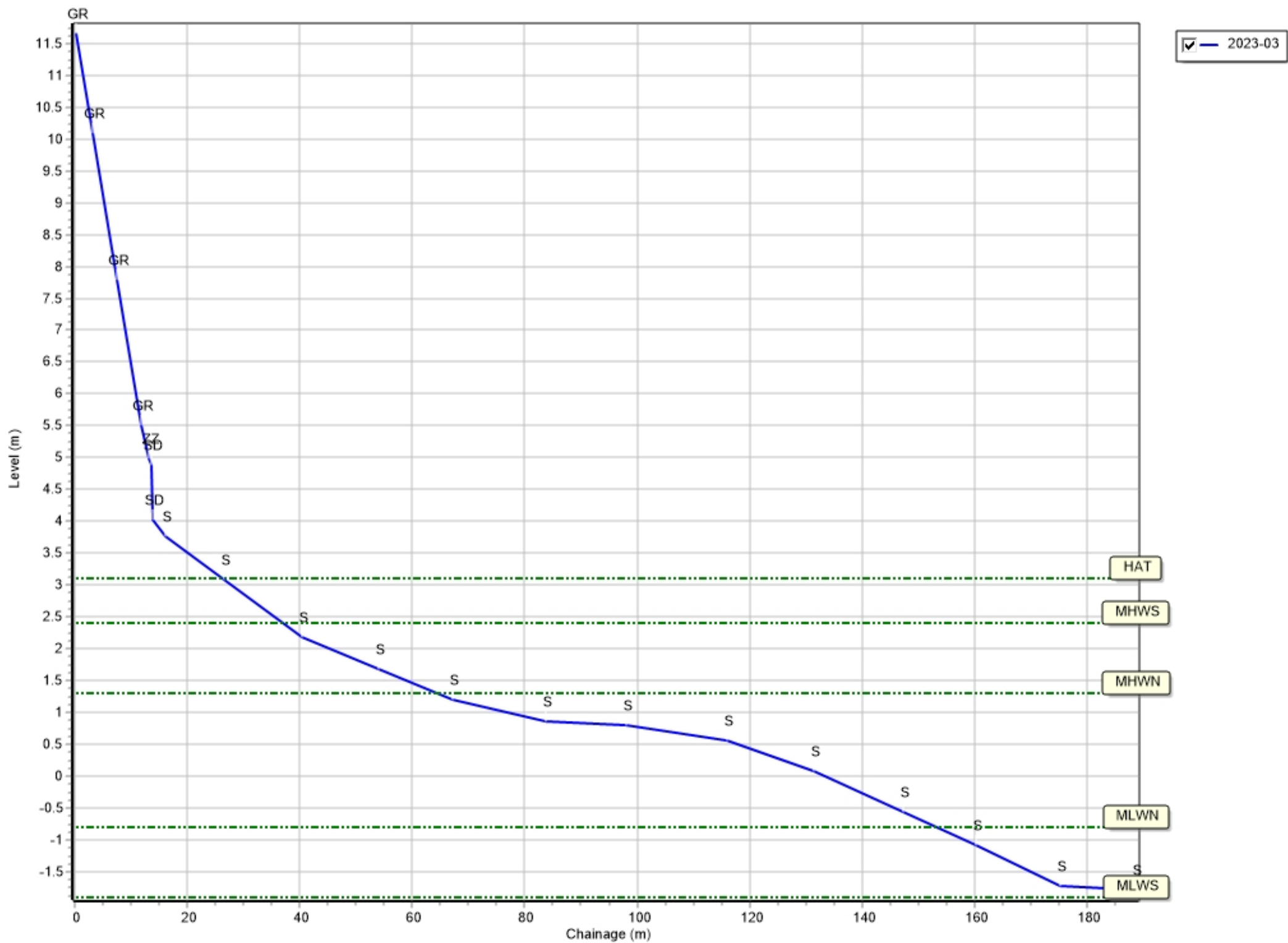
Profiles: 1aNTDC02



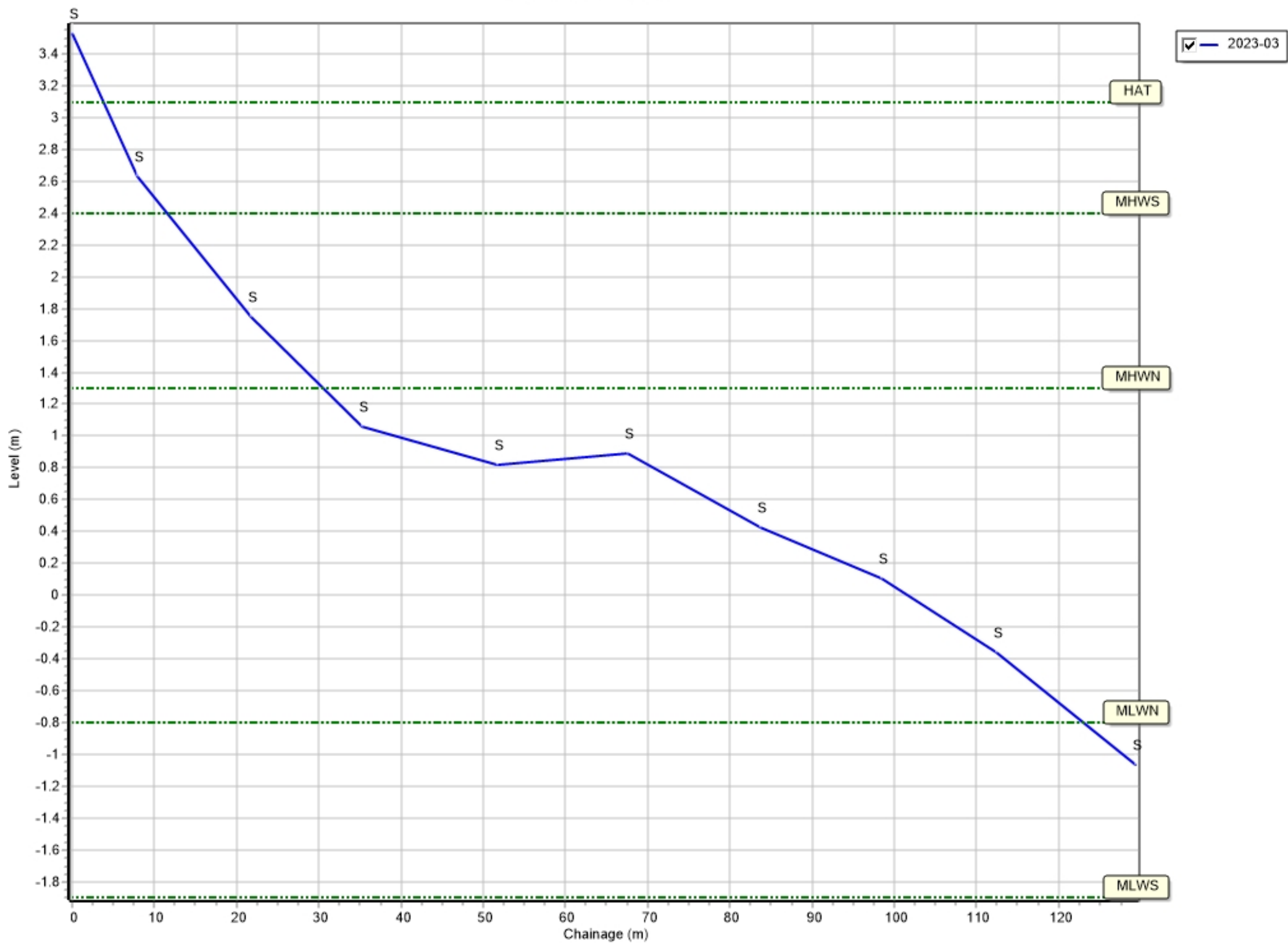
Profiles: 1aNTDC03



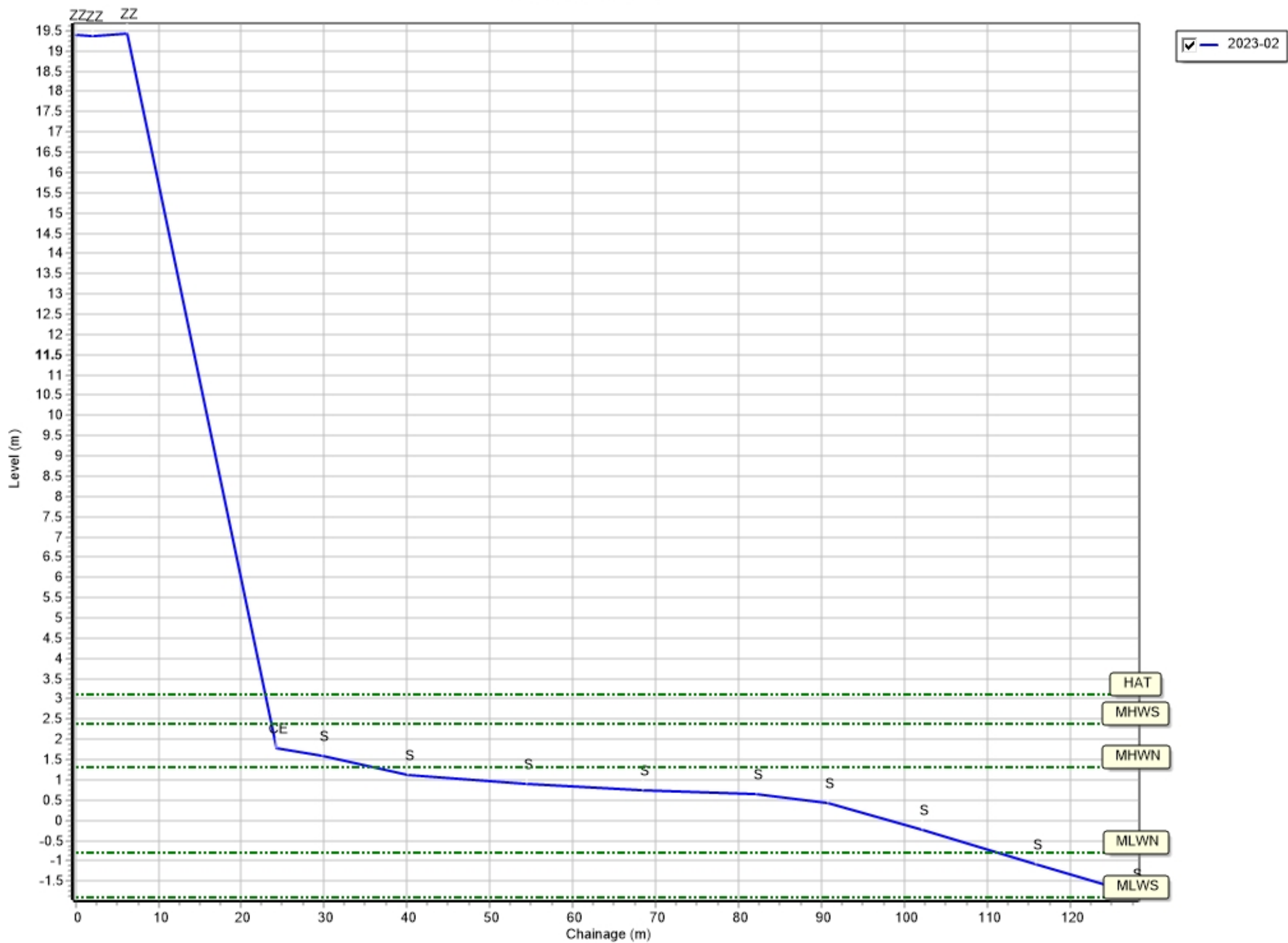
Profiles: 1aNTDC04



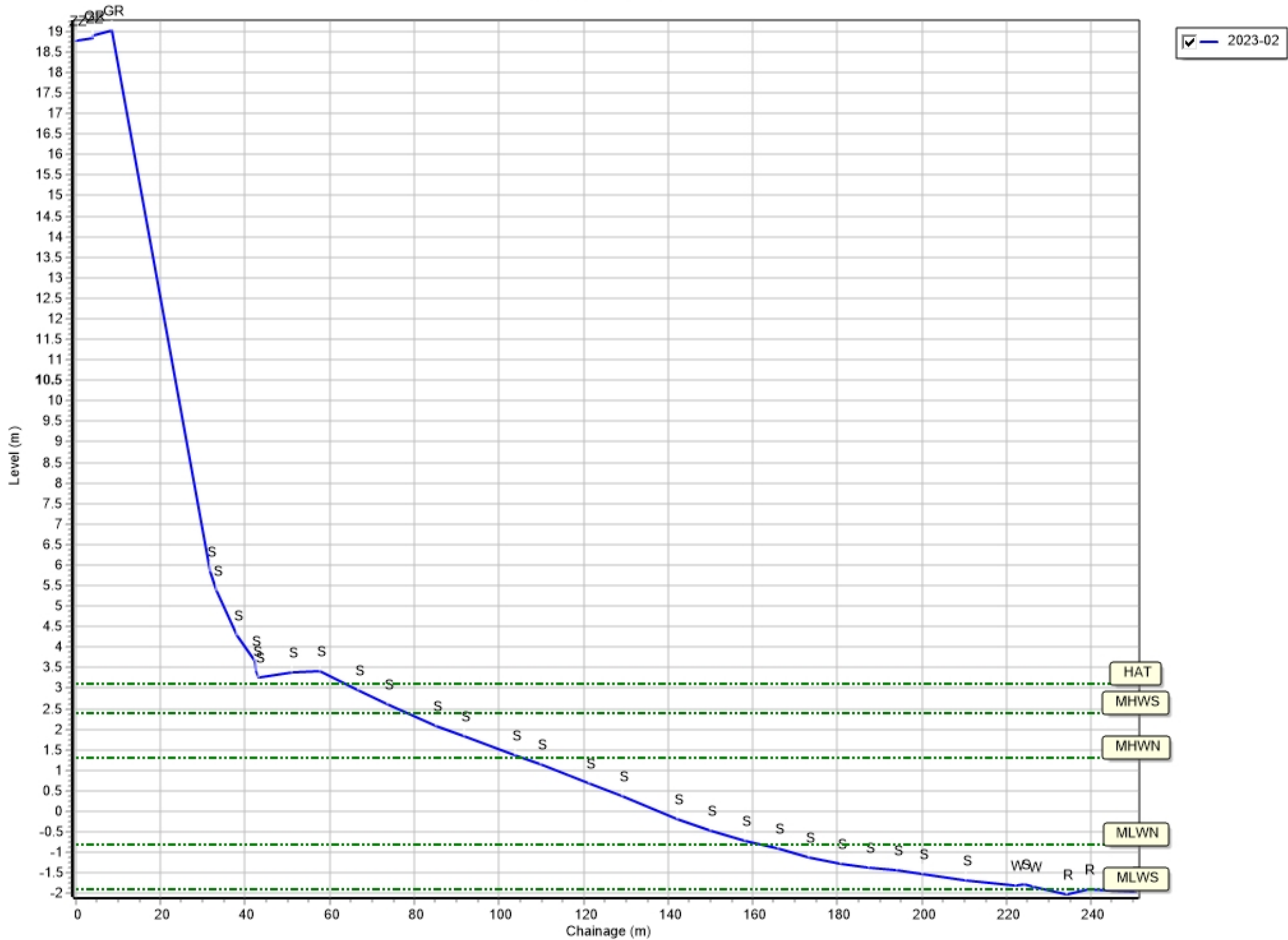
Profiles: 1aNTDC04A



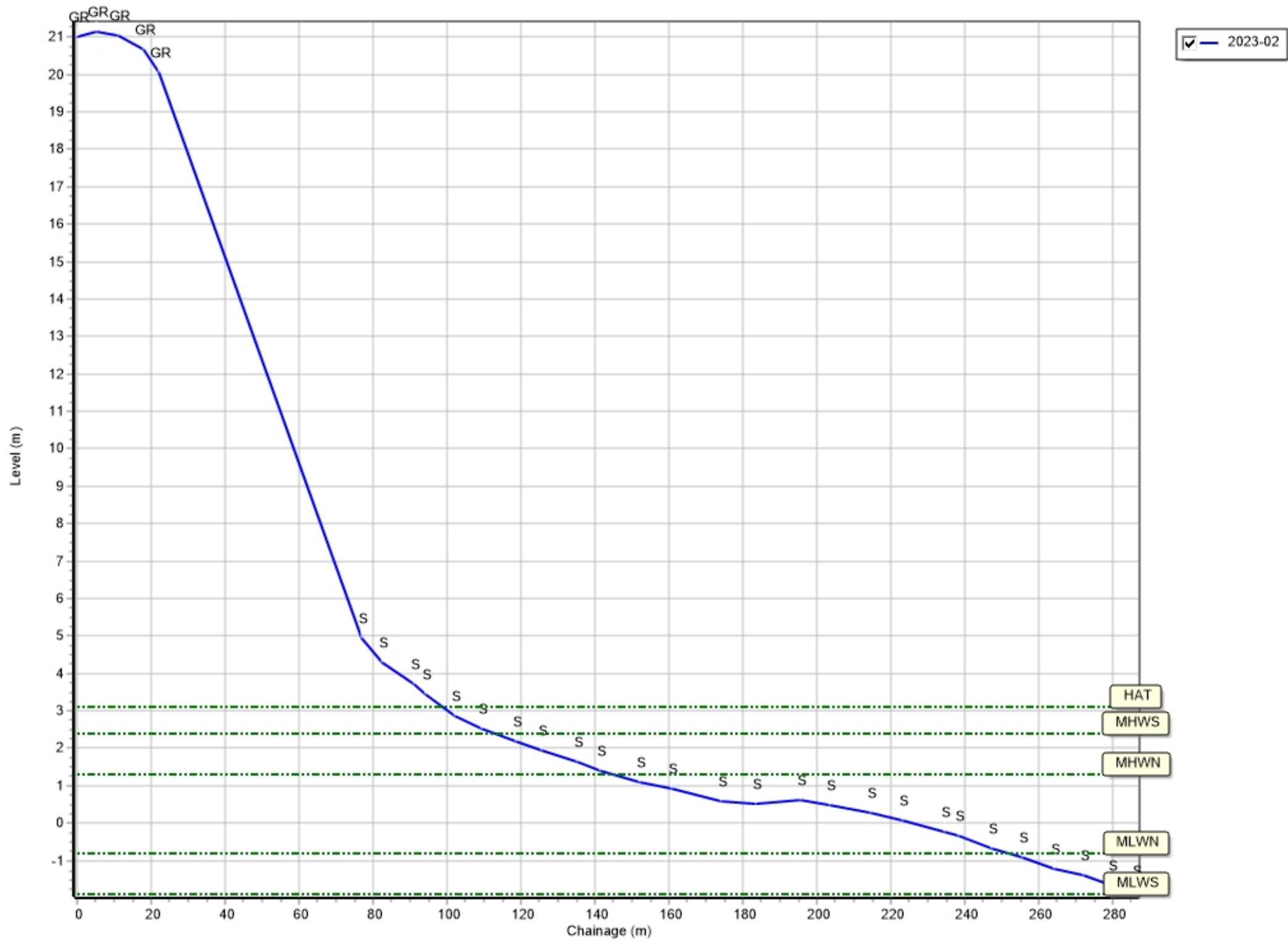
Profiles: 1aNTDC05



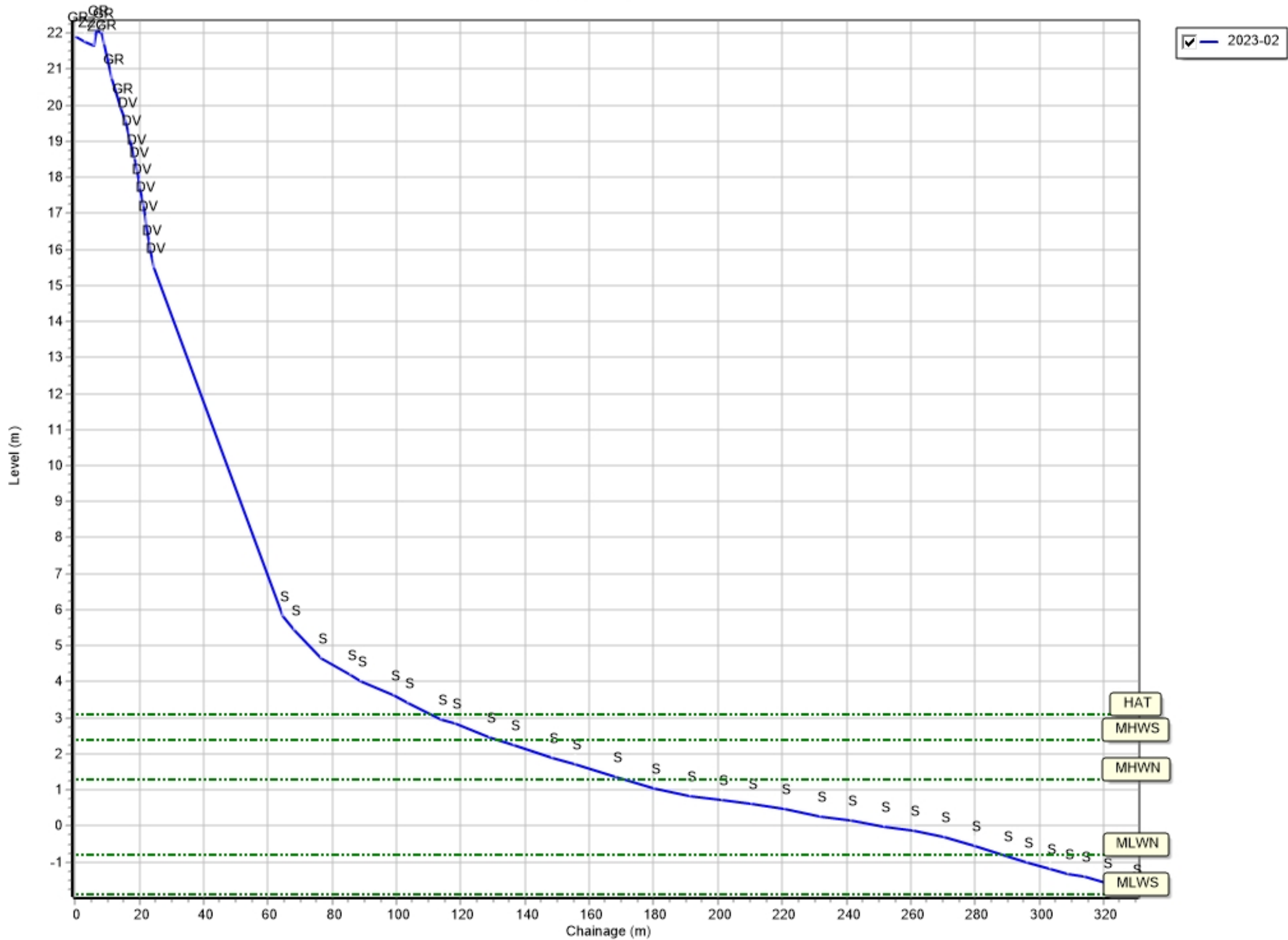
Profiles: 1aNTDC06



# Profiles: 1aNTDC06A

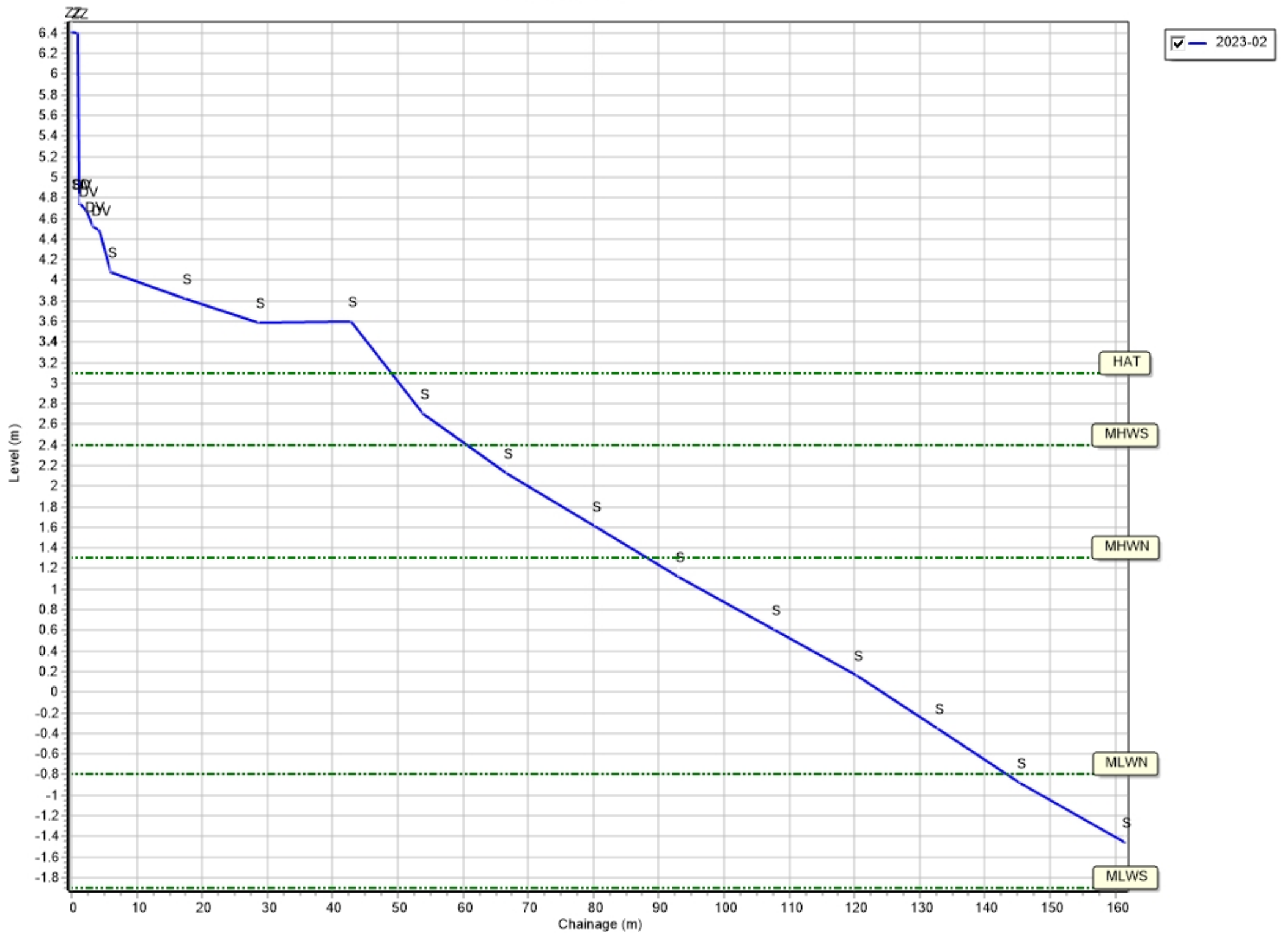


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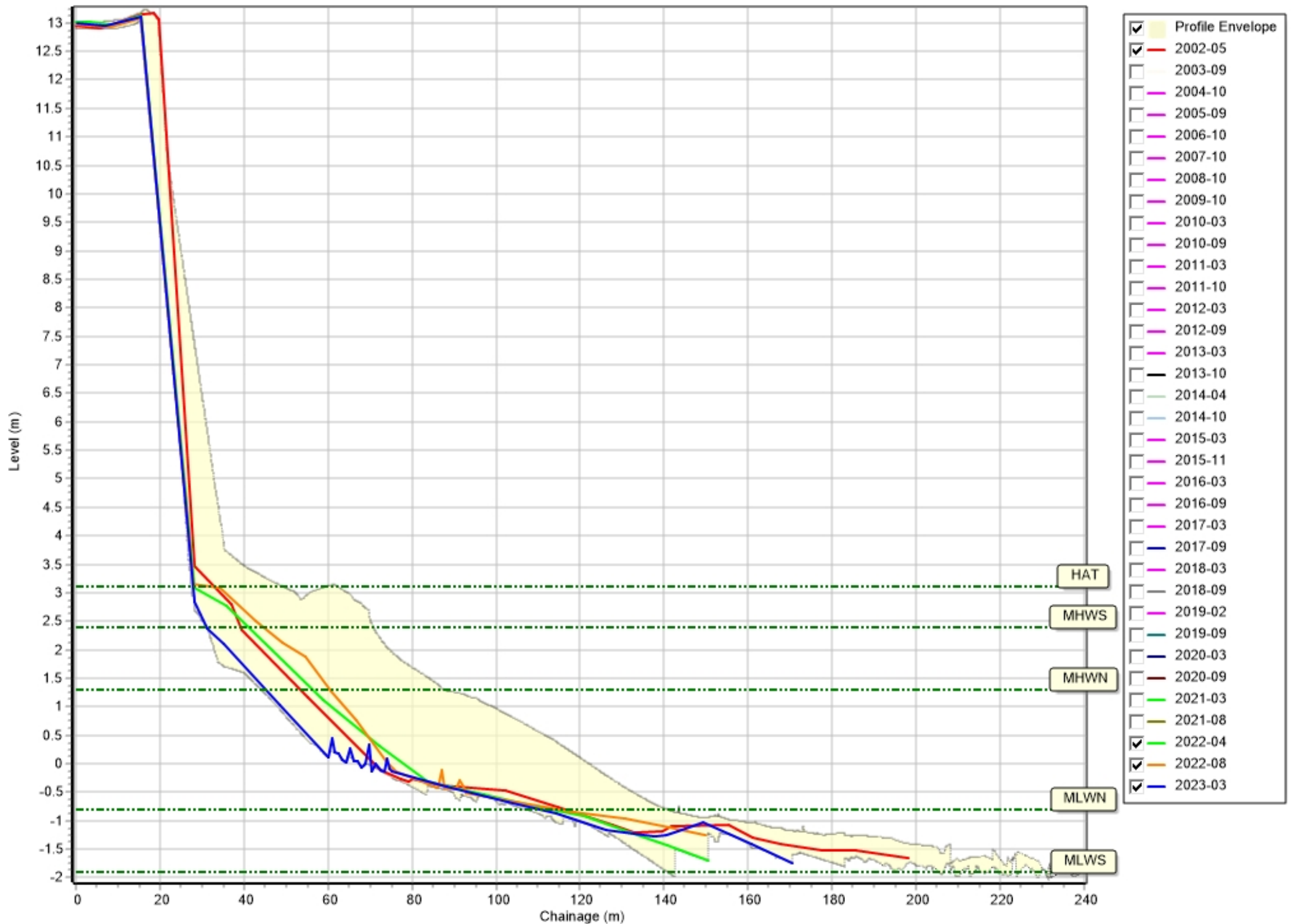




Profiles: 1aNTDC08



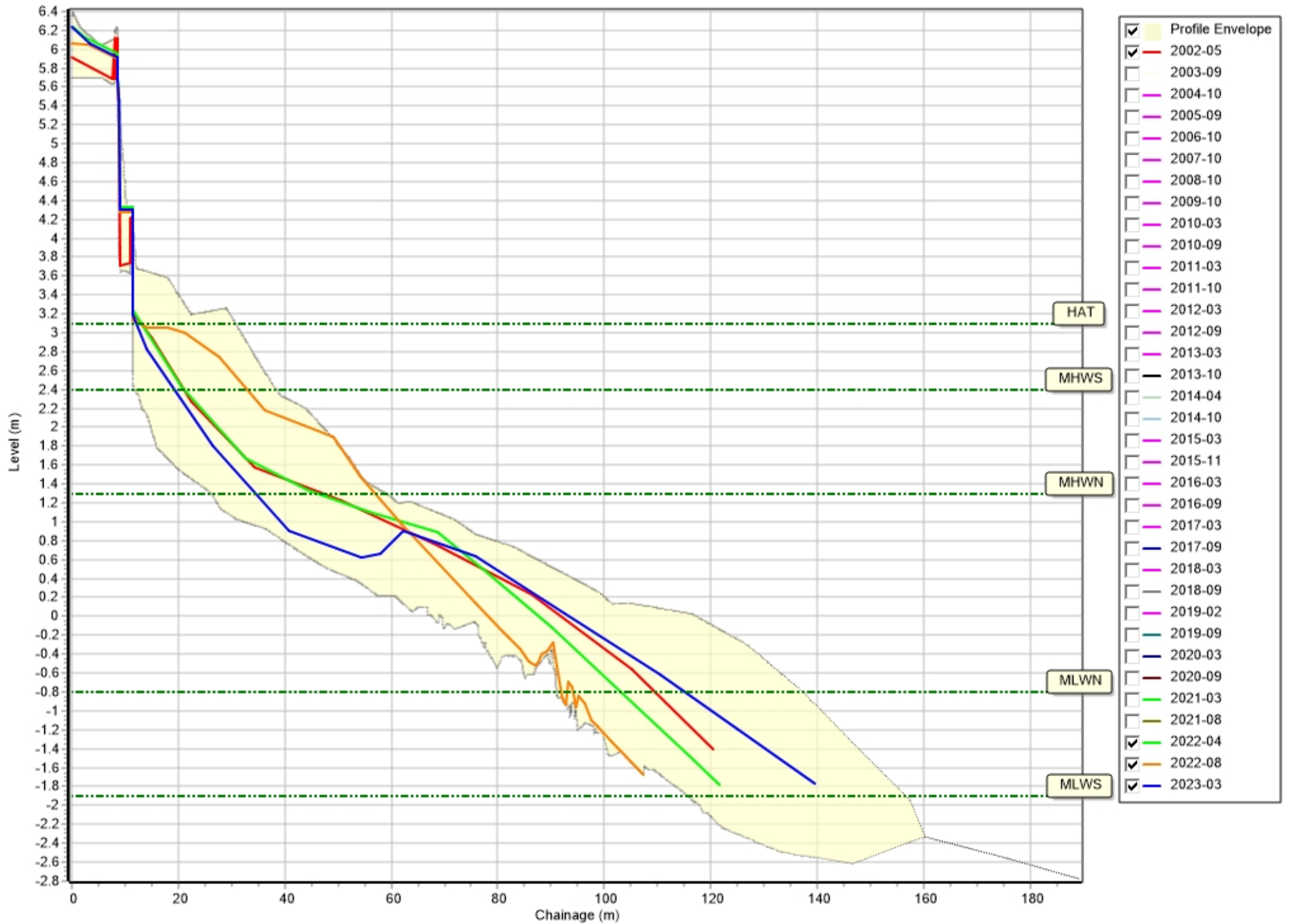
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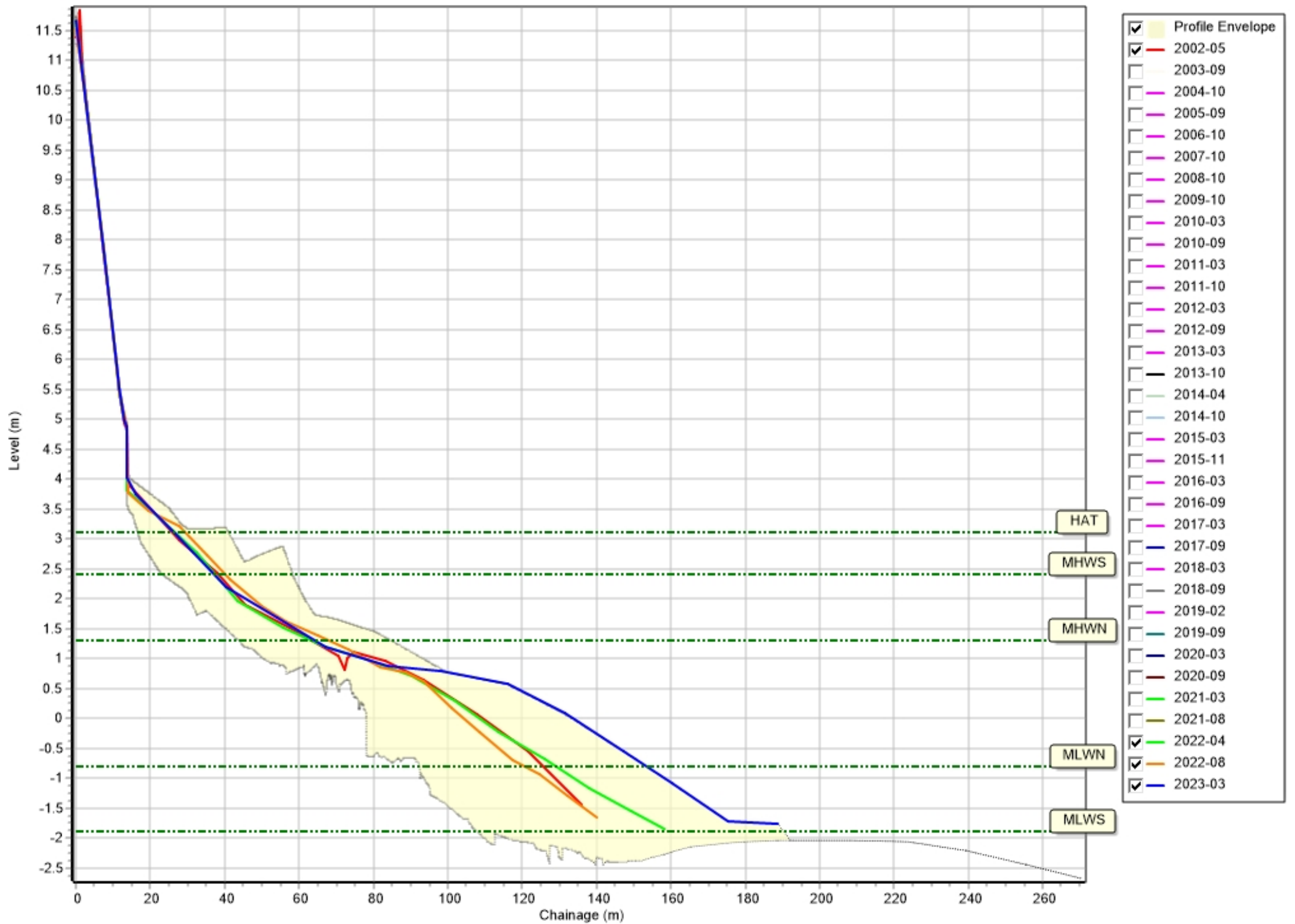
Profiles: 1aNTDC02



Profiles: 1aNTDC03

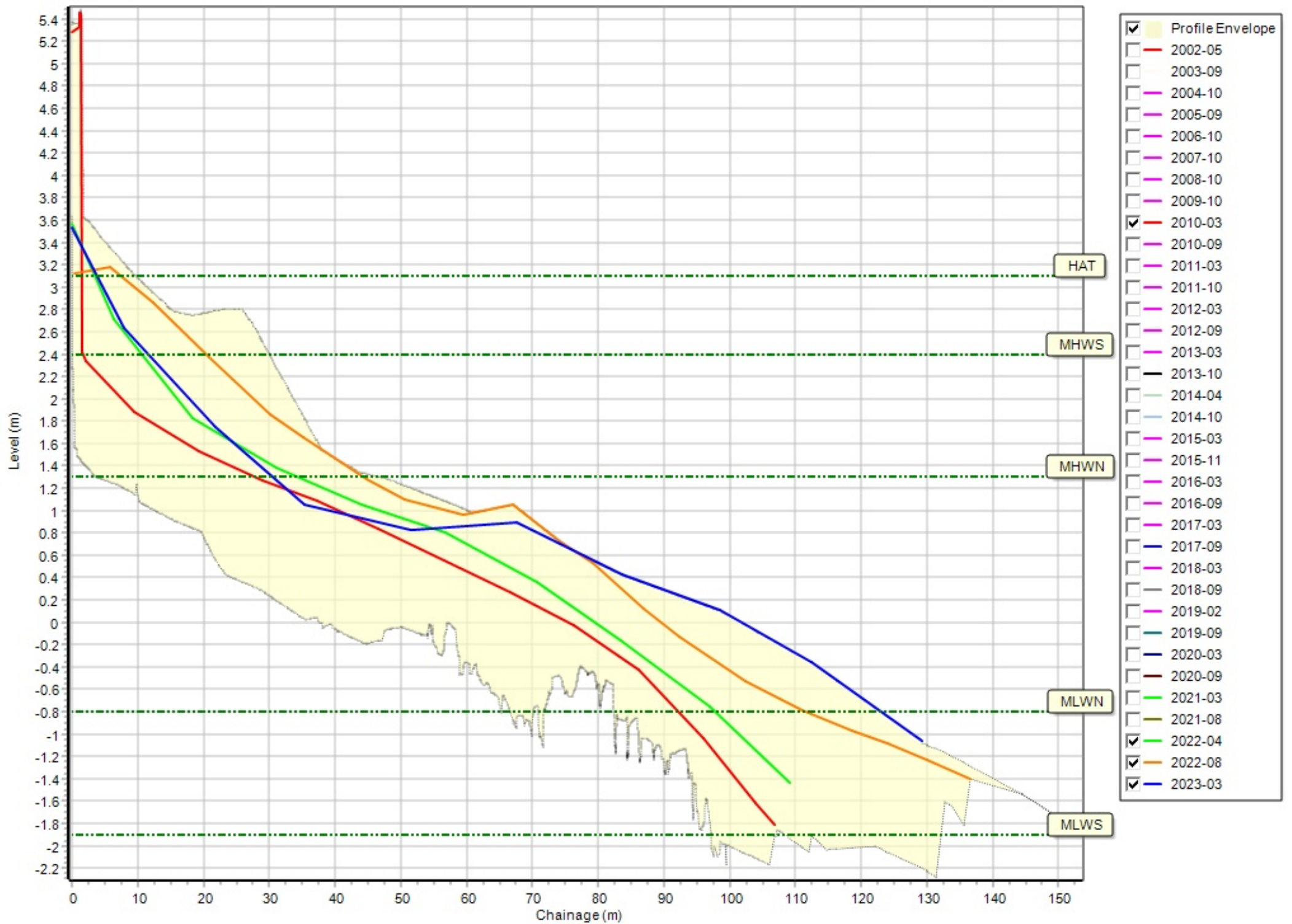


# Profiles: 1aNTDC04

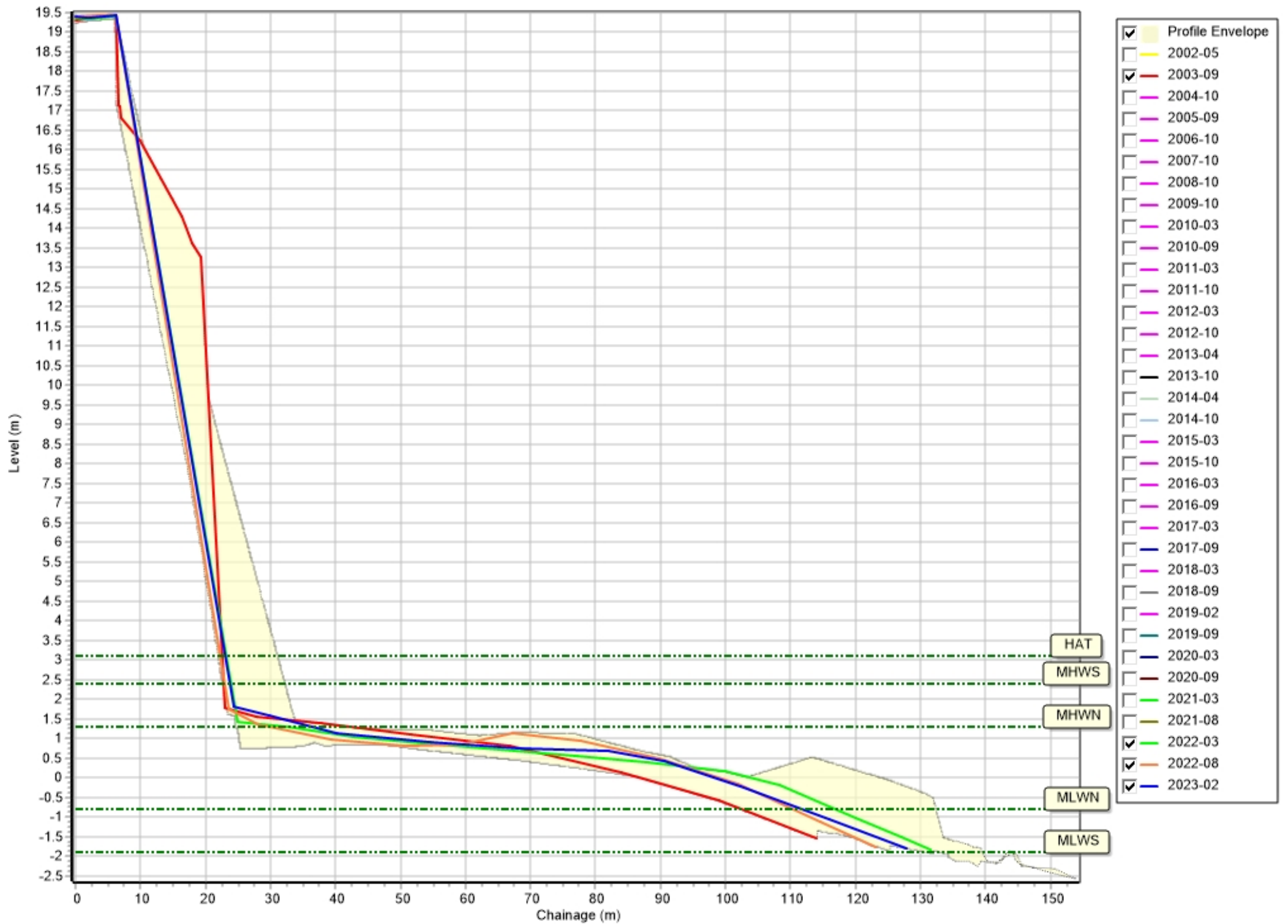




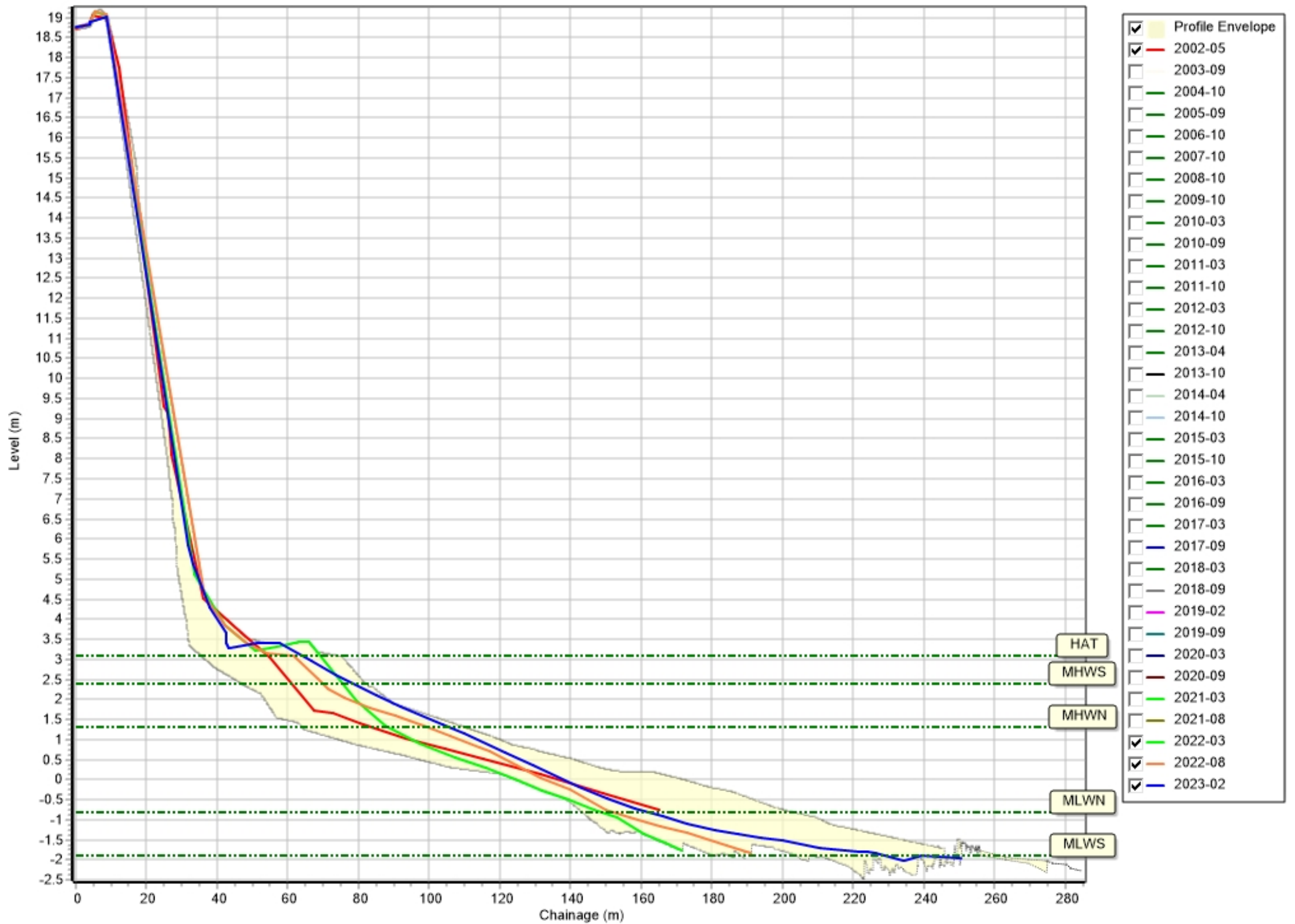
Profiles: 1aNTDC04A



Profiles: 1aNTDC05

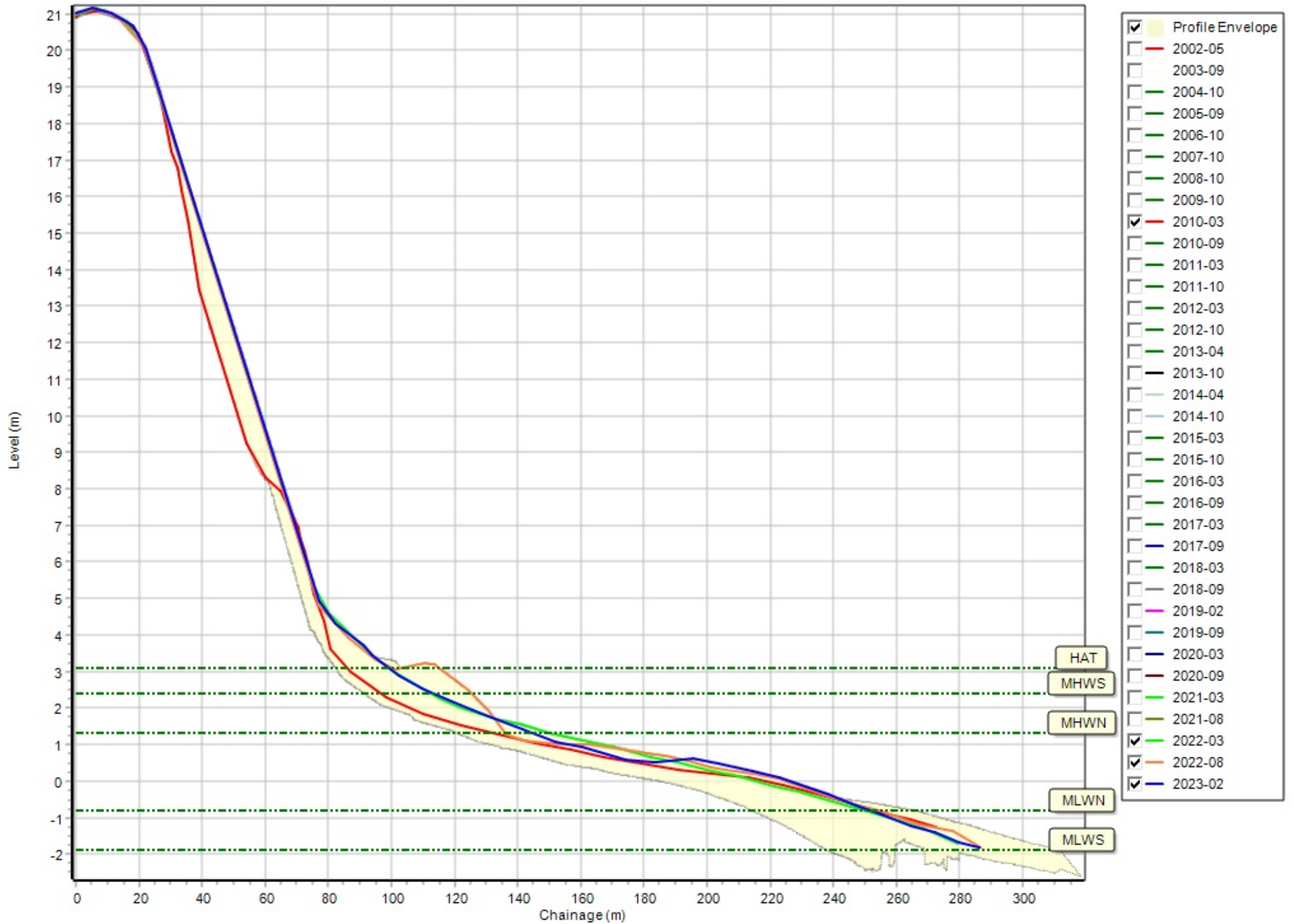


Profiles: 1aNTDC06

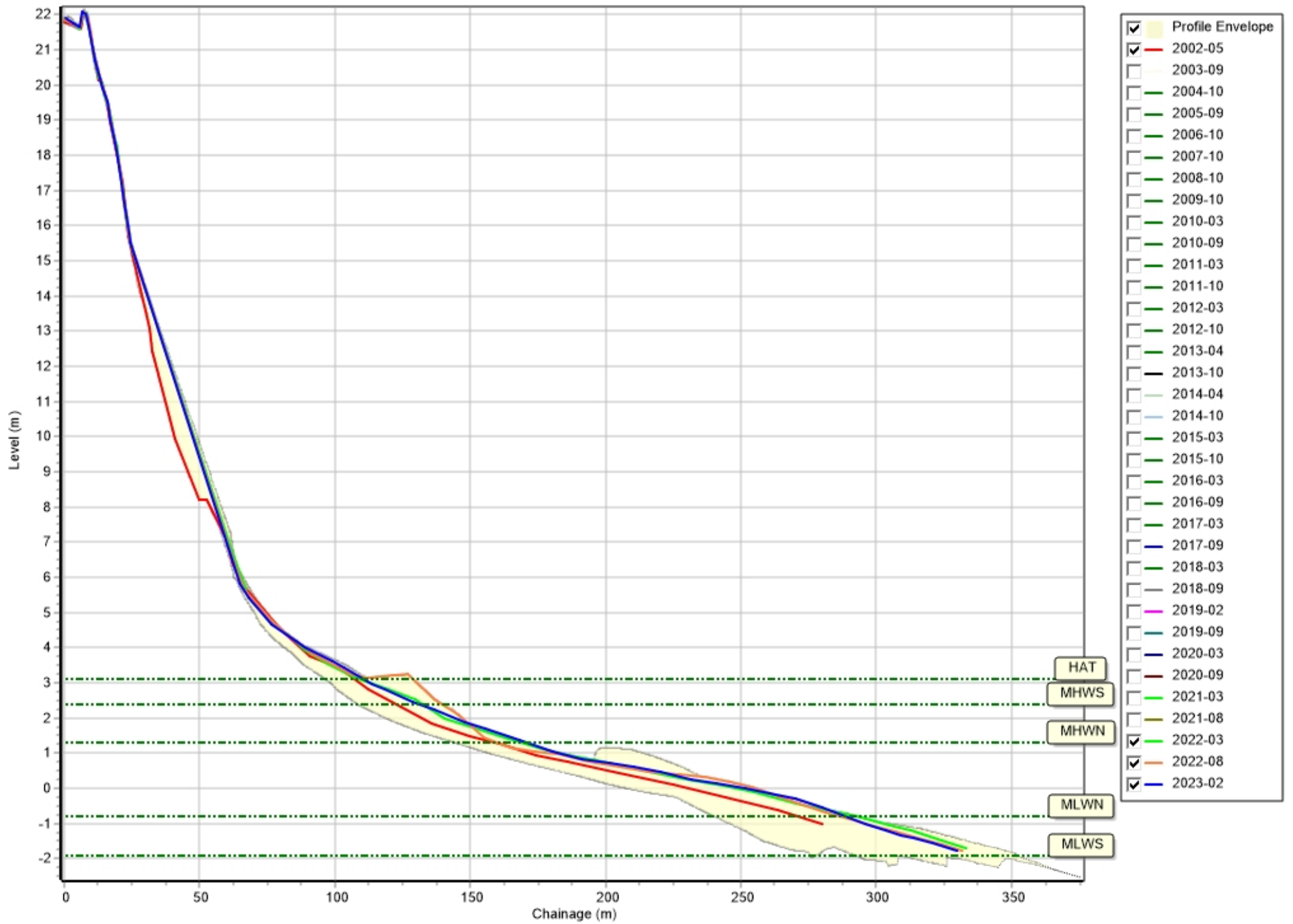




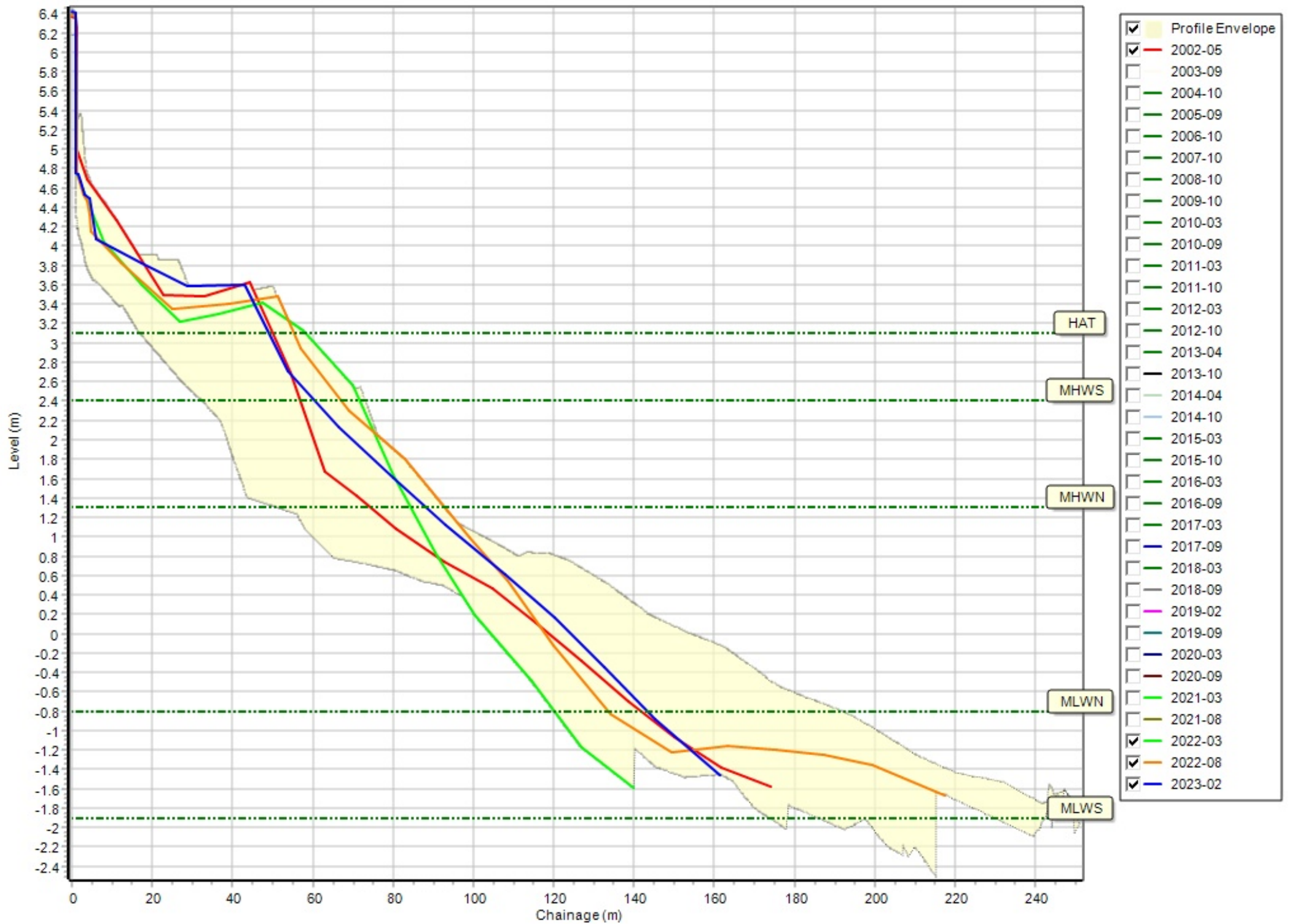
Profiles: 1aNTDC06A



Profiles: 1aNTDC07

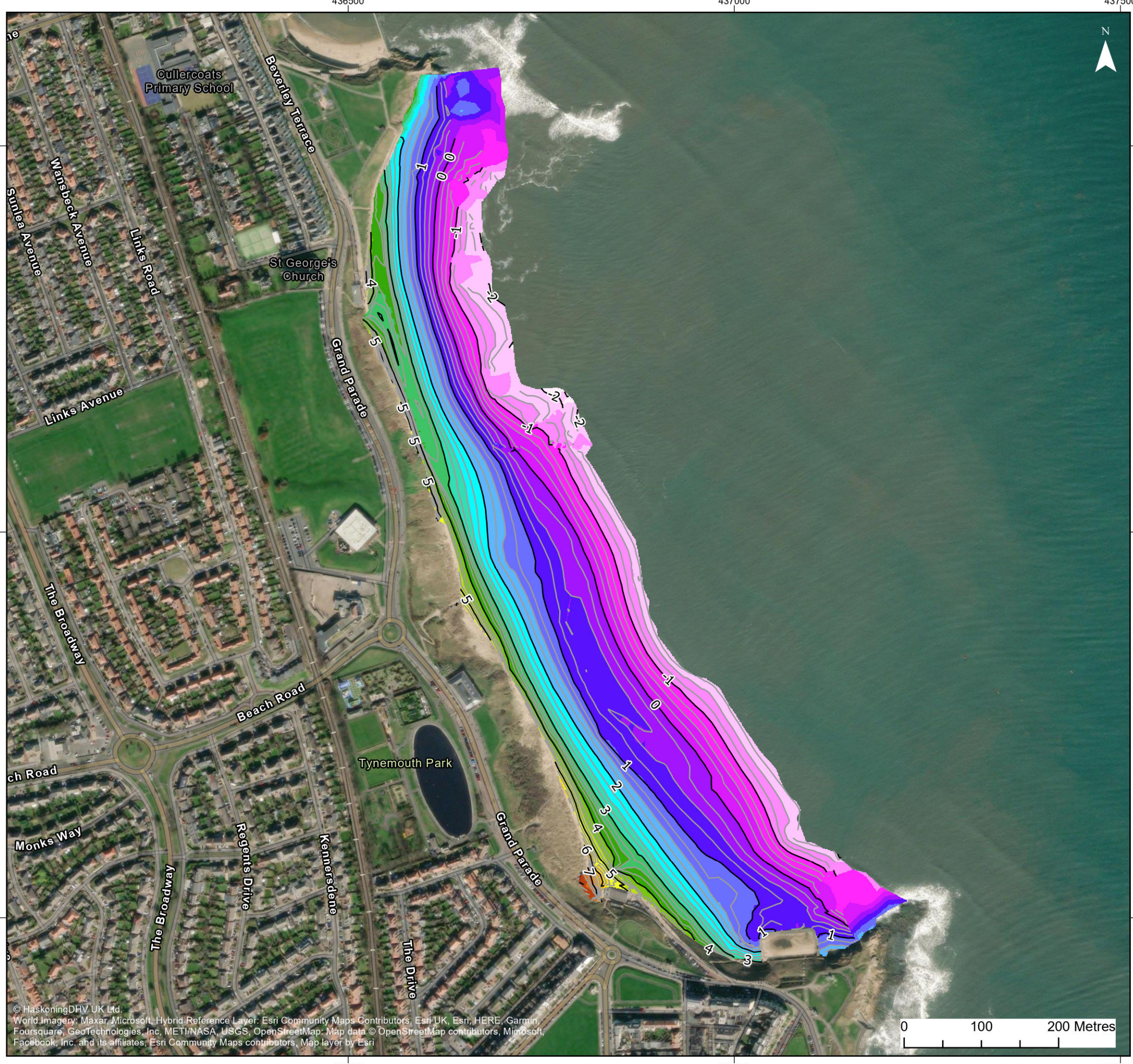


Profiles: 1aNTDC08



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





**TOPOGRAPHIC SURVEY** (February 2023)

Elevation (mOD)	Contours (mOD)*
-2.1 - -2	— 1.0m interval
-1.9 - -1.5	— 0.25m interval
-1.4 - -1	
-0.9 - -0.5	
-0.4 - 0	
0.1 - 0.5	
0.6 - 1	
1.1 - 1.5	
1.6 - 2	
2.1 - 2.5	
2.6 - 3	
3.1 - 3.5	
3.6 - 4	
4.1 - 4.5	
4.6 - 5	
5.1 - 5.5	
5.6 - 6	
6.1 - 6.5	
6.6 - 7	
7.1 - 7.5	
7.6 - 8	
8.1 - 8.5	

\* Contours only cover sandy beach areas.

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

Title:

## Appendix B - Map 1

### LONGSANDS

#### North Tyneside Council Frontage

Report: Update Report  
'Partial Measures' Survey 2023

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	25/04/2023	TC	NJC	A3	1:5,000

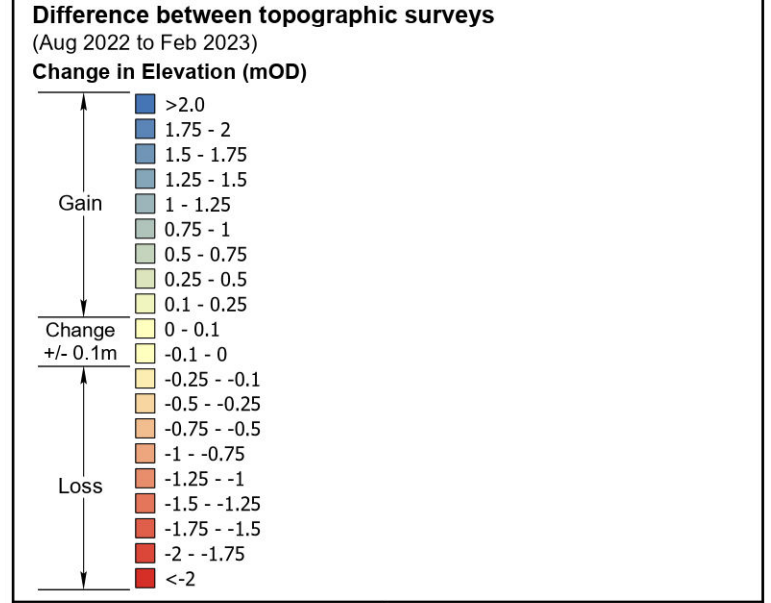
Co-ordinate system: British National Grid

**Royal HaskoningDHV**  
Enhancing Society Together

**North East Coastal Observatory**

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

Title:

**Appendix B - Map 2**

**LONGSANDS**

**North Tyneside Council Frontage**

Report:

Update Report  
'Partial Measures' Survey 2023

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	25/04/2023	TC	NJC	A3	1:5,000

Co-ordinate system: British National Grid



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