

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



**North Yorkshire Council
June 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)	Water Level (m AOD)	Water Level (m AOD)
	Sandsend Beach to Whitby Sands	Scarborough North Bay to Cayton Bay	Filey Bay
HAT	3.2	3.25	3.35
MHWS	2.6	2.45	2.95
MHWN	1.4	1.35	2.05
MLWN	-0.8	-0.95	-0.45
MLWS	-2.0	-2.35	-1.85

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.

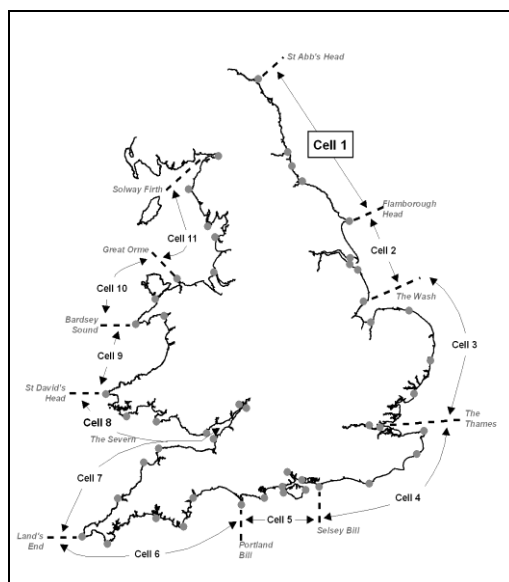


Figure 1 Sediment Cells in England and Wales

The programme commenced in its present guise in September 2008¹ 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:



¹ 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:

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	Feb 12	Mar-May 12	Jul 13	-
5	2012/13	Sep 12	Mar 13	Apr-May 13	May 13	-
6	2013/14	Oct-Nov 13	Feb 14	Mar-Apr 14	Jul 14	-
7	2014/15	Sep 14	Feb 15	Mar 15	Jul 15	-
8	2015/16	Sep 15	Feb 16	Mar-Apr 16	Jul 16	Jun 16
9	2016/17	Sep–Nov16	Feb 17	Feb-Apr 17	Jul 17	-
10	2017/18	Sep-Oct 17	Jan 18	Mar-May 18	Jun 18	-
11	2018/19	Sep-Oct 18	Mar 19	Mar-Apr 19	July 19	-
12	2019/20	Sep-Nov 19	Jan 20	Feb-Apr 20	Jun 20	-
13	2020/21	Nov-Dec 20	Mar 20	Mar-Apr 21	Jun 21	Aug 2021
14	2021/22	Oct-Nov 21	Feb 22	Apr-May 22	Aug 22	
15	2022/23	Sept-Oct 22	Jan 23	Mar 23	June 23	

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

1. Introduction

1.1 Study Area

North Yorkshire Council's frontage extends from Staithes Harbour in the north, to Speeton in Filey Bay in the south. For the purposes of this report, it has been sub-divided into eight areas, namely:

- Staithes²
- Runswick Bay
- Sandsend Beach, Uppang Beach and Whitby Sands
- Robin Hood's Bay
- Scarborough North Bay
- Scarborough South Bay
- Cayton Bay
- Filey Bay

1.2 Methodology

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

- Full Measures survey annually each autumn/early winter comprising:
 - Beach profile surveys along 20 transect lines
 - Topographic survey at Runswick Bay
 - Topographic survey along the Sandsend to Whitby frontage
 - Topographic survey at Robin Hood's Bay
 - Topographic survey at Scarborough North Bay
 - Topographic survey at Scarborough South Bay
 - Topographic survey at Cayton Bay
 - Topographic survey at Filey Bay
- Partial Measures survey annually each spring comprising:
 - Beach profile surveys along 20 transect lines
 - Topographic survey at Runswick Bay
 - Topographic survey at Robin Hood's Bay
 - Topographic survey at Filey Bay (Town coverage)
- Cliff top survey bi-annually at:
 - Staithes
 - Robin Hoods Bay (new addition Spring 2010)
 - Scarborough South Bay (new addition Spring 2010)
 - Cayton Bay
 - Filey

The location of these surveys is shown in Figure 2. The Partial Measures survey was undertaken along this frontage between 20th March to 24th March 2023, more specifically:

- Runswick Bay – 24th March 2023;
- Whitby – 20th March 2023;
- Robin Hood's Bay – 13th March 2023;
- Scarborough – 21st March 2023;
- Cayton Bay – 23rd March 2023;
- Filey – 22nd March 2023;

During this time weather conditions varied considerably; refer to the survey reports for details of the weather conditions over this survey period. Data from the present survey are presented in a processed form in the Appendices.

² The Staithes frontage straddles the boundary of jurisdiction of both Redcar & Cleveland Borough Council and North Yorkshire Council.



SURVEY LOCATIONS

Topographic Profile

- Annual
- Bi-Annual

Topographic Area

- 6 monthly
- yearly
- 5 yearly

- 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 1

RUNSWICK BAY

Scarborough Borough 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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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 2**
SANDSEND TO WHITBY
Scarborough Borough Council Frontage

Report: **Survey Report**

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:25,000

Co-ordinate system: British National Grid

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- SURVEY LOCATIONS**
- Topographic Profile**
- Annual
 - Bi-Annual
- Topographic Area**
- 6 monthly
 - yearly
 - 5 yearly
- 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 3

ROBIN HOOD'S BAY

Scarborough Borough Council Frontage

Report:

Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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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 (Orange)
- 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

SCARBOROUGH NORTH BAY

Scarborough Borough Council Frontage

Report:

Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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SURVEY LOCATIONS

Topographic Profile

- Annual
- Bi-Annual

Topographic Area

- 6 monthly
- yearly
- 5 yearly

● 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 5
SCARBOROUGH SOUTH BAY
Scarborough Borough Council Frontage

Report:

Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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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 (refer to Figure 3 for details)

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

Title: **Figure 2 - Map 6**
CAYTON BAY
Scarborough Borough Council Frontage

Report: **Survey Report**

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: British National Grid

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SURVEY LOCATIONS

Topographic Profile

- Annual
- Bi-Annual

Topographic Area

- 6 monthly
- yearly
- 5 yearly

- 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 7**
FILEY BAY
Scarborough Borough Council Frontage

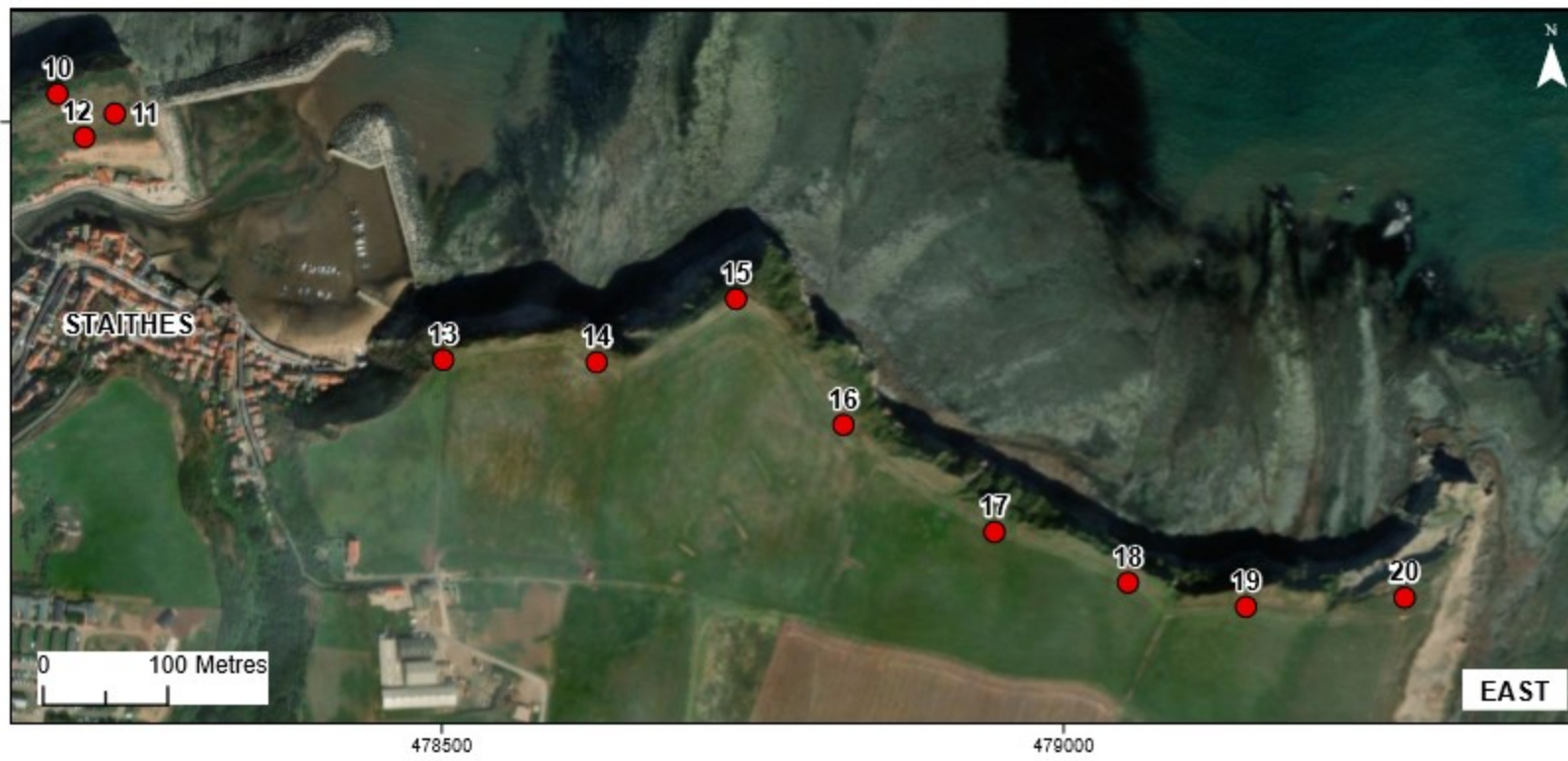
Report: **Survey Report**

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: British National Grid

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SURVEY LOCATIONS

- Cliff Top Survey Points

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

Title:
Figure 3 - Map 1
STAITHES
Scarborough Borough Council Frontage

Report:
 Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:6,000

Co-ordinate system: British National Grid





SURVEY LOCATIONS

● Cliff Top Survey Points

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

Title:

Figure 3 - Map 2

ROBIN HOOD'S BAY

Scarborough Borough Council Frontage

Report:

Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: British National Grid





SURVEY LOCATIONS

● Cliff Top Survey Points

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

Title:

Figure 3 - Map 3

SCARBOROUGH SOUTH BAY

Scarborough Borough Council Frontage

Report:

Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:15,000

Co-ordinate system: British National Grid





SURVEY LOCATIONS

- Cliff Top Survey Points

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

Title:

Figure 3 - Map 4

CAYTON BAY

Scarborough Borough Council Frontage

Report:

Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: British National Grid



SURVEY LOCATIONS
 ● Cliff Top Survey Points

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

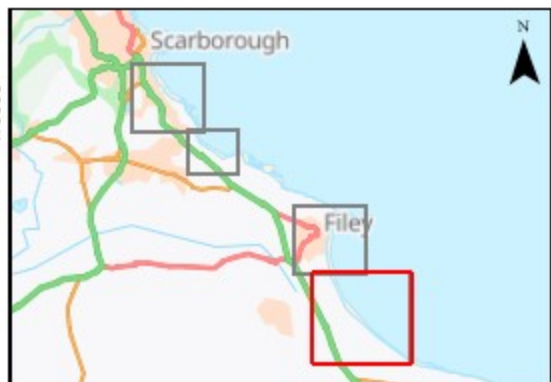
Title:
Figure 3 - Map 5
FILEY BAY (NORTH)
Scarborough Borough Council Frontage

Report:
 Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:15,000

Co-ordinate system: British National Grid





SURVEY LOCATIONS

- Cliff Top Survey Points

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

Title:

Figure 3 - Map 6
FILEY BAY (SOUTH)
Scarborough Borough Council Frontage

Report:

Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:20,000

Co-ordinate system: British National Grid



2. Analysis of Survey Data

2.1 Staithes

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>17th March 2023</p>	<p>Cliff-top Survey:</p> <p>Twenty ground control points have been established at Staithes for the purposes of cliff top monitoring. The separation between any two points is a nominal 100m. The cliff top surveys at Staithes are undertaken bi-annually. Data collection involves a distance offset measurement from the ground control point to the cliff edge along a fixed bearing.</p> <p>Appendix C provides results from the March 2023 survey, showing the distance from the ground control point to the edge of the cliff top along the defined bearing and changes in position since the November 2008 baseline survey and the previous October 2022 survey.</p> <p>The results provided in Appendix C shows that only one of the control points has experienced erosion greater than the survey error (0.2m), this point being Point 1 which has retreated 0.34m since the previous survey. Of the remaining control points, 75% have experienced less than 0.1m, indicating a period of stability. One point, point 18, shows ‘apparent’ accretion of 0.12m since the previous survey, this is likely to be due to difficulties in accurately identifying the cliff edge through vegetation rather than true change.</p> <p>The long term recession rates show that only two points at Staithes now have annual average recession greater than 0.2m/year (Point 1 along the road to the west of Staithes (0.51m) and Point 13 adjacent to the eastern breakwater at Staithes (0.23m)). A period of inactivity at Point 4, has reduced the long term recession rate to an average of 0.17m/year.</p>	<p>The change experienced over winter 2022/2023 follows the long term pattern with point 1 experiencing the greatest retreat and the vast majority of the remaining control points experiencing no change.</p> <p>Longer term trends: Table C1 in Appendix C presents the erosion rates calculated from the data collected since 2008. Points 1, 4, and 13 are the only locations with a significant annual average recession rate, which ranges from 0.17 to 0.51m/yr.</p>

2.2 Runswick Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>March 2023</p>	<p>Topographic Survey:</p> <p>Runswick Bay is covered by a 6-monthly topographic survey. A consistently applied GIS processing routine has been used to create a digital ground model (DGM) (Appendix B - Map 1) and to calculate the differences between the current topographic survey (March 2023) and the previous survey (September 2022) to highlight areas and amounts of erosion and deposition. In all cases, a 5m resolution raster grid has been used to identify areas of erosion and accretion (Appendix B – Map 4).</p> <p>Appendix B - Map 4 shows a clear pattern of change, particular across the central bay, of erosion on the upper beach and accretion on the lower beach. The magnitude of change is up to $\pm 1.5\text{m}$. The pattern varies at the northern and southern extents of the bay where erosion is more dominant across the lower beach also.</p>	<p>The bay appears to have experienced seasonal fluctuation with a drawdown of material from the upper beach to the lower beach typical of winter conditions.</p> <p>Longer term trends: The data collected since 2008 indicate a general pattern of winter drawdown and spring recovery with no measurable net longer-term change.</p>

2.3 Sandsend Beach, Upgang Beach and Whitby Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
20 th Mach 2023	<p>Beach Profiles:</p> <p>The Sandsend, Upgang and Whitby frontage is covered by three beach profile lines for the Partial Measures survey (Appendix A).</p> <p>Profile 1dWB1 is located around 400m south of Sandsend village. At the toe of the stepped revetment (now at chainage 39m), the beach has accreted by 0.6m in level tapering to no change by chainage 50m. Between chainage 50m and 120m the beach eroded, dropping in level by up to 0.4m. Seawards of chainage 120m the beach has accreted by up to 0.5m in level. The beach is at a low level when compared to the range of the previous surveys.</p> <p>Profile 1dWB2 is located in the centre of Upgang beach. The survey report notes that the cliff top area was not measured due to dense vegetation. A slip in the lower cliff has occurred since the previous survey, evident from the profile and corresponding photos, that has retreated the toe of the cliff by 1.5m. Seawards of this, the rest of the beach has accreted by up to 0.7m across the whole profile. The beach is now at a medium level when compared to the range of the previous surveys.</p> <p>Profile 1dWB3 is located on Whitby Sands. Up to chainage 88m, the profile is unchanged due to the presence of the coastal defence. At the toe of the defence, the beach has accreted by 0.3m in level tapering to no change by chainage 94m. Seawards of the is, the beach has generally been dominated by erosion lowering between chainages 94m to 149m and again seawards of chainage 170m for the remainder of the profile. The magnitude of erosion is up to 0.4m. The erosion is intercepted by a short length of minor accretion (+0.1). The beach is on a lower level when compared to the range of the previous surveys.</p>	<p>The pattern of change across the three profiles over the winter 22/23 is varied. However, the magnitude of the change limited and the profiles remain within the envelope of the previous surveys.</p> <p>Longer term trends:</p> <p>The beach profiles appear to be reasonably stable showing only seasonal fluctuations.</p>

2.4 Robin Hood's Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>March 2023</p>	<p>Topographic Survey:</p> <p>Data from the most recent topographic survey (Partial Measures, May 2022) have been used to create a digital ground model (DGM) (Appendix B – Map 2) using a Geographical Information System (GIS). A difference plot has also been produced using the DGM (Appendix B – Map 5) from the last topographic survey (September 2022) and the most recent survey (March 2023).</p> <p>The difference plot shows that the majority of the bay has experienced little change over winter 2022/23. Of the change that has occurred, it is low level and patchy in distribution, typical of the rocky outcrops that run perpendicular to the shore. The most intense change has occurred at the toe of the ramp through the rock armour, where accretion of up to +1.75m has occurred.</p>	<p>The distribution of change is very patchy typical of sediment movements over the rock promontories in the bay. The magnitude of change is low highlighting the lack of sediment with the bay. Longer term trends: The difference plots show a continuation of the trend of patchy distribution of erosion and accretion controlled by the nature of the rocky foreshore.</p>
<p>March 2023</p>	<p>Cliff-top Survey:</p> <p>Thirteen ground control points have been established at Robin Hood's Bay since 3rd March 2010 to monitor cliff top recession. The separation between any two points is a nominal 200m and monitoring is undertaken bi-annually. Appendix C provides results from the March 2023 survey showing change since the last survey in September 2022 and the baseline survey in March 2010 (Appendix C- Map 2). The accuracy of the survey technique means change of less than 0.2m is assumed to be error. Calculated advances of the cliff line are also assumed to be error associated with difficulty precisely identify the cliff top, particularly where vegetation is present.</p> <p>Since the previous, Only one of the 13 monitoring points show erosion greater than the margin or error($\pm 0.2m$) suggesting a period of stability. This was Point 10 that was noted to have retreated t 0.4m. Seven of the 13 points indicate that the cliff has advanced since the previous survey. All of these advancements are within the margin of error but may highlight variability in vegetation levels. It is noteworthy that the points with the second and third greatest change since the previous survey is point 11 (0.11m) and Point 1 (0.08m) which are the two points with the greatest long term change (point 1 0.41m/yr and point 11 0.14m/yr).</p>	<p>The cliff top has remained stable since the previous survey in September 2022, with only one of 11 points recording more than 0.2m erosion.</p> <p>Longer term trends: The erosion rates calculated from the changes since March 2010 show stability at most of the monitoring locations. The longer-term rates show that Point 1 has a recession rate of 0.41m/yr, followed by point 11 (0.14m/yr) with all other points having a rate of less than 0.1m/yr. This reflects localised and episodic cliff failure through rock fall.</p>

2.5 Scarborough North Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
21 st March 2023	<p>Beach Profiles:</p> <p>Scarborough North Bay is covered by five beach profile lines for the Partial Measures survey (Appendix A) that are monitored biannually. The previous Full Measures survey was undertaken in September 2022.</p> <p>Profile 1dSBN1 is located around 200m south of the Sea Life Centre. The beach at the toe of the sea wall (now at chainage 11m) has dropped by 0.6m exposing more of the stepped toe. The erosion continues at a decreasing magnitude until chainage 124m. At which point a small length of accretion has occurred, 0.15m in level, until chainage 154m. The rocky foreshore remains exposed seawards of chainage 179m. Overall, the beach is at a low level when compared to the range recorded from the previous surveys.</p> <p>Profile 1dSBN2 is located close to the former chair lift and is defended to chainage 8m. At the toe of the seawall the beach levels have dropped by 0.9m in level. The drop in level continues to chainage 100m, albeit at a reducing level of magnitude. Seawards of chainage 100m, the rocky foreshore remains exposed. The beach is on a lower level when compared to the range of the previous surveys.</p> <p>Profile 1dSBN3 is located near Royal Albert Drive. Beach level have accreted by 0.5m at the toe of the seawall (chainage 13m), reducing to no change by chainage 25m. Between chainages 25m to 73m, the beach has dropped by 0.2m in level. The lower beach has then accreted until chainage 150m at a similar magnitude. The beach is at high level when compared the range of the previous surveys, particular between chainage 82m and 109m which is at the highest level on record.</p> <p>Profile 1dSBN4 is located at the northern end of Clarence Gardens. At the toe of the stepped apron (chainage 26m), beach levels have dropped by 0.2m in level. The erosion continues until chainage 35m, at which point the rocky foreshore remains exposed until chainage 60m. The beach has also eroded between chainage 60m and chainage 140m, up to 0.4m in level. Seawards of chainage 140m the beach has slackened resulting in accretion across the lower beach compared to the previous survey. As a result, the lower beach is at a high level when compared to the range of the previous surveys where as the upper beach is at a low level.</p> <p>Profile 1dSBN5 is located to the south of Clarence Gardens. The profile is defended by rock armour</p>	<p>The profiles show that the beach in North Bay has been dominated by erosion over winter 22/23. The magnitude of erosion is most significant towards the north of the bay, with the southern profiles showing some accretion on the lower sections indicating seasonal draw down of material.</p> <p>Longer term trends: The observed changes in the profiles in North Bay are consistent with the seasonal fluctuations of sediment with a bay system.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>until chainage 28m over which length the profile has remained stable. The upper beach has also remained stable until chainage 64m with all change limited to ± 0.1m. Seawards of chainage 64m the beach has slackened resulting in accretion over the lower beach at an increasing level of magnitude. At the end of the profile (chainage 182m) the beach has accreted by up 0.55m in level. As a result, the lower beach is at a very high level when compared to the range of the previous surveys whereas the upper beach is at a medium level.</p>	

2.6 Scarborough South Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
21 st March 2023	<p>Beach Profiles:</p> <p>Scarborough South Bay is covered by four beach profile lines for the Partial Measures survey (Appendix A). The profiles were last surveyed during the Full Measures survey of September 2022.</p> <p>Profile 1dSBS1 is located around 250m south of the West Pier. The beach has dropped 0.2m at the toe of the seawall (chainage 13m) tapering to no change by chainage 17m. The profile generally has experienced alternating lengths of erosion and accretion caused by the formation of two shallow berms, one on the upper beach and one on the lower beach. Accretion has occurred between chainage 17m and 47m at a magnitude of 0.35m. Erosion has occurred between chainages 47m and 95m and again between 120m and 159m at a magnitude up to 0.15m. The beach remains within the envelope of the previous surveys.</p> <p>Profile 1dSBS2 is located on the shore fronting St Nicholas Cliff. The beach has accreted from the toe of the seal wall (chainage 4m) to chainage 64m at a magnitude of up to 0.25m in level. Seawards of chainage 64m the lower beach has steepened resulting in a drop in level of increasing magnitude, peaking at 0.3m at chainage 184m. The rocky foreshore is now exposed seawards of chainage 184m. When compared to the range of the previous survey, the upper beach is at a high level where as the lower beach is a low level.</p> <p>Profile 1dSBS3 is located 250m north of the Scarborough Spa complex. The profile has largely remained stable since the previous survey where, other than an initial drop at the seawall, all change limited to ± 0.15m. The beach has dropped by 0.5m at the seawall tapering to no change by chainage 15m. Generally, erosion has dominated the upper beach and accretion the lower. The profile is at a medium to high level</p> <p>Profile 1dSBS4 is located on the beach in front of the Scarborough Spa Complex. The profile has eroded on the upper beach, between 11m and 80m, by up to 0.2m in level. Then between chainage 80m and 158m the beach has then accreted by up to 0.15m in level. The beach remains at a high level when compared to the range of the previous surveys.</p>	<p>Scarborough South Bay has generally remained stable, with the magnitude of change across the bay limited, particularly the two more southerly profiles where change is restricted to ± 0.2m.</p> <p>Longer term trends: The observed changes in the profiles in South Bay are consistent with the seasonal fluctuations of sediment with a bay system.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
21 st March 2023	<p>Cliff-top Survey:</p> <p>Thirteen cliff top monitoring control points have been established at Scarborough South Bay and from Cornelian Bay to Knipe Point. The separation between points is around 300m. The cliff top surveys at Scarborough South Bay are undertaken bi-annually. Appendix C provides results from the March 2010 baseline survey to March 2023, showing the distance from the ground control point to the edge of the cliff top along the defined bearing (Appendix C- Map 3). Error in the technique means change of less than 0.2m cannot be relied on. Calculated advances of the cliff line are also assumed to be error associated with difficulty precisely identify the cliff top, particularly where vegetation is present.</p> <p>Between September 2022 and March 2023, zero of the 11 monitoring points show erosion (of greater than 0.2m), suggesting a period of stability. Despite this Points 11 and 12 still show significant erosion since the baseline survey in March 2010 of 3.72m and 2.99m respectively, this is equivalent to long term erosion rates of 0.31m/yr. and 0.25m/yr.</p>	<p>Zero of the survey points has shown erosion outside of the survey tolerance over the course of winter 2020/21.</p> <p>Longer term trends: The recession rates for the longer term only show erosion at Points 11 and 12 of between 0.31 and 0.25m/yr. The rest of the study area has remained stable.</p>

2.7 Cayton Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
23 rd March 2023	<p>Beach Profiles:</p> <p>Cayton Bay is covered by four beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken in September 2022.</p> <p>Profile 1dCY1A is located on the beach below Knipe Point at the north of the bay and was added to the programme in November 2015. The crest of the cobble berm on the upper beach has accreted by 0.25m with the depression on the landward side dropping level by a similar amount. The upper beach, between chainage 15m and 90m, has dropped in level by up to 0.3m exposing the rocky foreshore in several locations. A berm has formed at chainage 98m causing the lower beach to increase in level by up to 0.6m. The erosion on the upper beach has caused the profile to be at its lowest on record between chainages 19m and 73m. The lower beach is at a medium level.</p> <p>Profile 1dCY1 is located on the beach in front of Tenants' Cliff in the north of the Bay. The survey report notes that "<i>the top of section 1 could not be measured due to dense vegetation</i>". At the toe of the cliff, between chainages 0m and 21m, large stones/ boulders have been deposited on the upper beach causing the profile line in this location to become irregular. From the toe of cobble berm to chainage 62m the beach has experienced low level accretion (up to 0.2m in level). At chainage 62m, the beach has steepened significant causing erosion of the lower beach up to 1.1m in level. The rocky foreshore is exposed seaward of 93m. The lower beach is at a low level compared to the range of the previous survey with the rest of the profile at a medium level.</p> <p>117m to 263m</p> <p>Profile 1dCY2 is close to the former pumping station in the middle of Cayton Bay. The survey report notes that "<i>the middle of section 2 could not be measured due to the ground makeup, soft mud flows and unstable grass</i>". As a result, any change to the cliff face should be interpreted with caution. However, the photos suggest that the cliff is actively eroding. From the toe of the cliff (at chainage 117m) to chainage 263m, the beach has eroded by up to 0.6m in level. Seawards of chainage 263m, the beach has accreted by up to 0.4m. As a result, the lower beach is at a very high level (the highest on record between 264m and 308m) with the rest of the beach a medium level.</p> <p>Profile 1dCY3 is located around 600m southeast of the pumping station. The remains of a WW2 pill box</p>	<p>The two most easterly profiles (1dCY2 and 1dCY3) appear to have experienced drawdown of material from the upper beach to the lower beach, typical of seasonal patterns. Profiles 1dCY1a and 1dCY1 have been dominated by erosion with very low beach levels, exposing the rocky foreshore in several locations. The same pattern was observed in the PM22 surveys.</p> <p>Longer term trends:</p> <p>Following notably low levels in March 2018 and 2019 beach levels on the upper beach appear to be recovering, with the exception of the most northerly profile. There is evidence that material lost from the cliff face accumulates at the toe of the cliffs and is redistributed across the upper beach. Additional cliff failures will feed additional material onto the beach and drive erosion of the cliff top.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>are located at the toe of the cliff and are picked up on the profile between chainage 123m and 126m. Seawards of the pill box, the beach level has dropped by up to 0.7m in level tapering to no change by chainage 155m. A 10m length of no change is then followed by another length of erosion until chainage 246m at a magnitude up to 0.45m in level. Seawards of 246m, the lower beach has slackened causing accretion of the lower of up to 0.9m. The upper beach is at a low level and the lower beach a high level when compared to the range of the previous survey.</p>	
<p>23rd March 2023</p>	<p>Cliff-top Survey:</p> <p>Eight ground control points have been established within Cayton Bay for the purposes of cliff top monitoring. The separation between any two points is typically around 300m. The cliff top surveys at Cayton Bay are undertaken bi-annually. Appendix C provides results from the March 2023 survey showing the distance from the ground control point to the edge of the cliff top along the defined bearing and changes in position since the November 2008 baseline survey and the previous September 2022 survey. The accuracy of the technique means results of less than 0.2m are not considered reliable.</p> <p>Dense vegetation means that point 2 has not been surveyed since the March 2018 survey. Of the remaining seven points, zero experienced change greater than survey tolerance of $\pm 0.2\text{m}$ since the previous survey. Six of the seven points actually experienced a cliff advancement, All of which were within the margin of error but may highlight seasonal variability in vegetation levels.</p>	<p>Zero of the seven monitoring points have shown erosion outside of the survey tolerance since September indicating a period of stability.</p> <p>Longer term trends: The recession rates show that only Point 4 (0.23m/yr) has a long term recession rate greater than the survey tolerances.</p>

2.8 Filey Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
22 nd March 2023	<p>Beach Profiles:</p> <p>Filey Bay is covered by five beach profile lines for the Partial Measures survey (Appendix A). The previous programmed survey (Full Measures) was undertaken in September 2022.</p> <p>Profile 1dFB1 is located in front of Filey town in the north of the bay. The beach level at the toe of the seawall has very locally accreted by 0.35m in level, filling in an incised channel observed previously. From chainage 23m to chainage 75m the beach has dropped by up to 0.35m in level. The mid beach has remained stable. Seawards of chainage 112m the beach has again eroded, dropping in level by up to 0.15m. The profile remains within the envelope of the previous surveys.</p> <p>Profile 1dFB2 is located north of Primrose Valley Holiday Village. The survey report notes that chainages 0m to 2m and 12m to 19m were inaccessible due to dense vegetation. Overall, the profile has remained stable. The upper beach, between chainages 64m and 130m, has eroded by up to 0.25m. Seawards of chainage 130m the beach, there has been no significant change with all change limited ± 0.1m. The profile remains at a very high level relative to the range recorded from previous surveys.</p> <p>Profile 1dFB3 is located in front of Flat Cliffs hamlet. The survey report notes that chainages 0m to 14m and 21m to 29m were inaccessible due to dense vegetation. The profile has generally become more uniform and been dominated by erosion with two shallow berms observed previously having been removed. Erosion has occurred from the toe of the cliffs (chainage 32m) to 150m at a magnitude of up to 0.6m. Erosion has again occurred between 176m and 267m at a magnitude of 0.45m. Overall, the profile is at a medium level when compared with the range from the previous surveys.</p> <p>Profile 1dFB4 is located near Hunmanby Gap. The survey report notes that <i>“the middle of section 4 is unable to be measured from chainage 4m to approx. 25m, due to the cliff face being unsafe”</i>. At the toe of the cliff (chainage 26m) the cobble berm has accreted by up to 0.3m in level to chainage 35m. Seawards of chainage 35m the beach has been dominated by erosion, dropping in level consistently by 0.4m in level. Overall, the profile is at a medium level when compared with the range from the previous surveys.</p> <p>Profile 1dFB5 is located close to Reighton Gap. The survey report notes that <i>“the middle of section 5 was unable to be measured from chainage 65m to 208m, due to undergrowth and bushes”</i>. At the toe of</p>	<p>The two most northern profiles have remained largely stable since the previous survey, with beach levels remaining at a healthy level</p> <p>The three most southern profiles have showed more change with erosion dominated. There is evidence of material being drawn down the profile with minor accretion observed on the lower reaches.</p> <p>Longer term trends:</p> <p>Past trends dominated by migrating sand bars continue to the present day.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>the cliff, between 217m and chainage 226m, the cobble berm has accreted by up to 0.2m in level. Between chainage 226m and 296m, the upper beach has eroded by 0.4m in level. Accretion is then observed until chainage 364m at a magnitude of 0.5m, before switching back to erosion on the lower beach (up to 0.3m). Overall, the beach is at a medium level when compared to the range of previous surveys except on the mid beach which is at a very high level.</p>	
<p>22nd March 2023</p>	<p>Topographic Survey:</p> <p>Data from the most recent topographic survey (Partial Measures, March 2023) have been used to create a digital ground model (DGM) (Appendix B – Map 3) using a Geographical Information System (GIS). The topographic plot shows the gently sloping shore parallel bathymetry in front of Filey town. A difference plot has also been produced using the DGM (Appendix B – Map 6) comparing the last topographic survey (Full Measures, September 2022) to the present survey (March 2023).</p> <p>The plot shows that there has been very little change across Filey Bay since the previous survey with pale yellow (representing ± 0.1) dominating. Change is limited to a narrow band of erosion on the upper beach (up to -0.5m) and on the middle beach (-0.25m).</p>	<p>Filey Bay has remained stable since the previous survey with vast swathes of no change evident.</p> <p>Longer term trends:</p> <p>The erosion of the upper beach, close to the sea wall as observed over the winters of 2014/15 to 2016/17, 2018/19, 2019/20 and 2020/21 does not reflect the long-term trend between autumn 2008 and autumn 2016 that shows accretion on the upper beach and erosion on the lower beach. The atypical pattern seen in recent years is possibly a result of changes in wave climate.</p>
<p>22nd March 2023</p>	<p>Cliff-top Survey:</p> <p>Twenty-eight ground control points have been established within Filey Bay for the purposes of cliff top monitoring. This includes the installation of three additional locations in September 2010: points 12A (as a replacement for point 13 which can no longer be accessed due to vegetation growth), 24 & 25 (to the north of Filey Bay at Filey Brigg). A further replacement for monitoring point 13, 13A, has been added in 2014.</p> <p>The maximum separation between any two points is nominally 300 m. The cliff top surveys at Filey Bay are undertaken every six months. Data collection involves a distance offset measurement from the ground control point to the cliff edge along a fixed bearing. The accuracy of the technique means results of less than 0.2m are not reliable. The survey report notes that Points 5, 12, 12A and 13 were inaccessible due to heavy vegetation.</p> <p>Between the September 2022 and the current survey, two of the 28 markers showed erosion greater</p>	<p>Only two points have experienced a change greater than the survey error, indicating a period of stability. The point with the greatest change corresponds with the point with the greatest long term recession rate reinforcing the vulnerability of this point. Longer term trends:</p> <p>The greatest long-term recession rate is seen at Point 7 at Muston Sands, where 0.40m/yr has been recorded. Point 13A has also recorded a high average recession rate of 0.24m/yr.</p> <p>Points 10, 14, 16, have all experienced average recession retreats between 0.12m/yr and 0.13m/yr.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>than the survey error of 0.2m. These were Points 6 and 7 which retreated 0.24m and 0.57m respectively. The point (7) with the greatest change since the previous survey corresponds to the point with the greatest long term recession rate.</p>	

3. Problems Encountered and Uncertainty in Analysis

Individual Profiles

- At Whitby, the cliff top area of profile 1dWB2 was not measured due to dense vegetation.
- At Scalby the cliff edge was very overgrown resulting in areas that were unable to be surveyed.
- At Cayton Bay:
 - the top of profile 1dCY1 cannot be measured due to dense vegetation;
 - the middle of profile 1dCY2 could not be measured due to the ground make-up, soft mud flows, and unstable grass;
- At Filey Bay:
 - the surveyor was unable to measure profile 1dFB2 between chainage 0 to 2m and 12m and 19m due to dense vegetation.
 - the surveyor was unable to measure profile 1dFB3 between chainage 0 to 14m and 21m and 29m due to dense vegetation.
 - the surveyor was unable to measure profile 1dFB4 between chainage 4 to 25m, due to the cliff face being unsafe.
 - the surveyor was unable to measure profile 1dFB5 between 65m and 208m due to dense undergrowth and bushes.

Cliff Top Surveys

- At Robin Hoods Bay:
 - the dumping of waste vegetation at monitoring point 5 is a known source of error.
 - the survey report notes that VMPs 1, 3, 4 and 11 have undefined edges that are hard to distinguish.
 - Work is underway on the footpath North of VMP 10 restricting access.
- At Cayton Bay:
 - VMP2 was not surveyed due to dense vegetation prohibiting access.
- At Filey Bay:
 - VMPs 5, 12, 12A and 13 were inaccessible due to heavy vegetation.

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

No changes are recommended at the present time.

5. Conclusions and Areas of Concern

- At Staithes, the change experienced over winter 2022/23 follows the long term pattern with point 1 experiencing the greatest retreat and the vast majority of the remaining control points experiencing no change.
- At Runswick Bay, the bay appears to have experienced seasonal fluctuation with a drawdown of material from the upper beach to the lower beach typical of winter conditions.
- At Sandsend, Upgang and Whitby, the pattern of over the winter 2022/23 is varied. However, the magnitude of the change limited, and the profiles remain within the envelope of the previous surveys.
- At Robin Hoods Bay, the distribution of change is very patchy typical of sediment movements over the rock promontories. The magnitude of change is low highlighting the lack of sediment with the bay. The cliff top has remained stable since the previous survey in September 2022, with only one of 11 points recording more than 0.2m erosion.
- At Scarborough North Bay, the profiles show that the beach has been dominated by erosion over winter 2022/23. The magnitude of erosion is most significant towards the north of the bay, with the southern profiles showing some accretion on the lower sections indicating seasonal draw down of material.

- Scarborough South Bay has generally remained stable, with the magnitude of change across the bay limited, particularly the two more southerly profiles where change is restricted to $\pm 0.2\text{m}$. Zero of the survey points has shown erosion outside of the survey tolerance over the course of winter 2022/23.
- At Cayton Bay, the two most easterly profiles (1dCY2 and 1dCY3) appear to have experienced drawdown of material from the upper beach to the lower beach, typical of seasonal fluctuations. Profiles 1dCY1a and 1dCY1 have been dominated by erosion with very low beach levels, exposing the rocky foreshore in several locations. None of the seven monitoring points have shown erosion outside of the survey tolerance since September indicating a period of stability
- At Filey, the two most northern profiles have remained largely stable since the previous survey. The three most southernly profiles have showed more change with erosion dominant. There is evidence of material being drawn down the profile with minor accretion observed on the lower reaches.

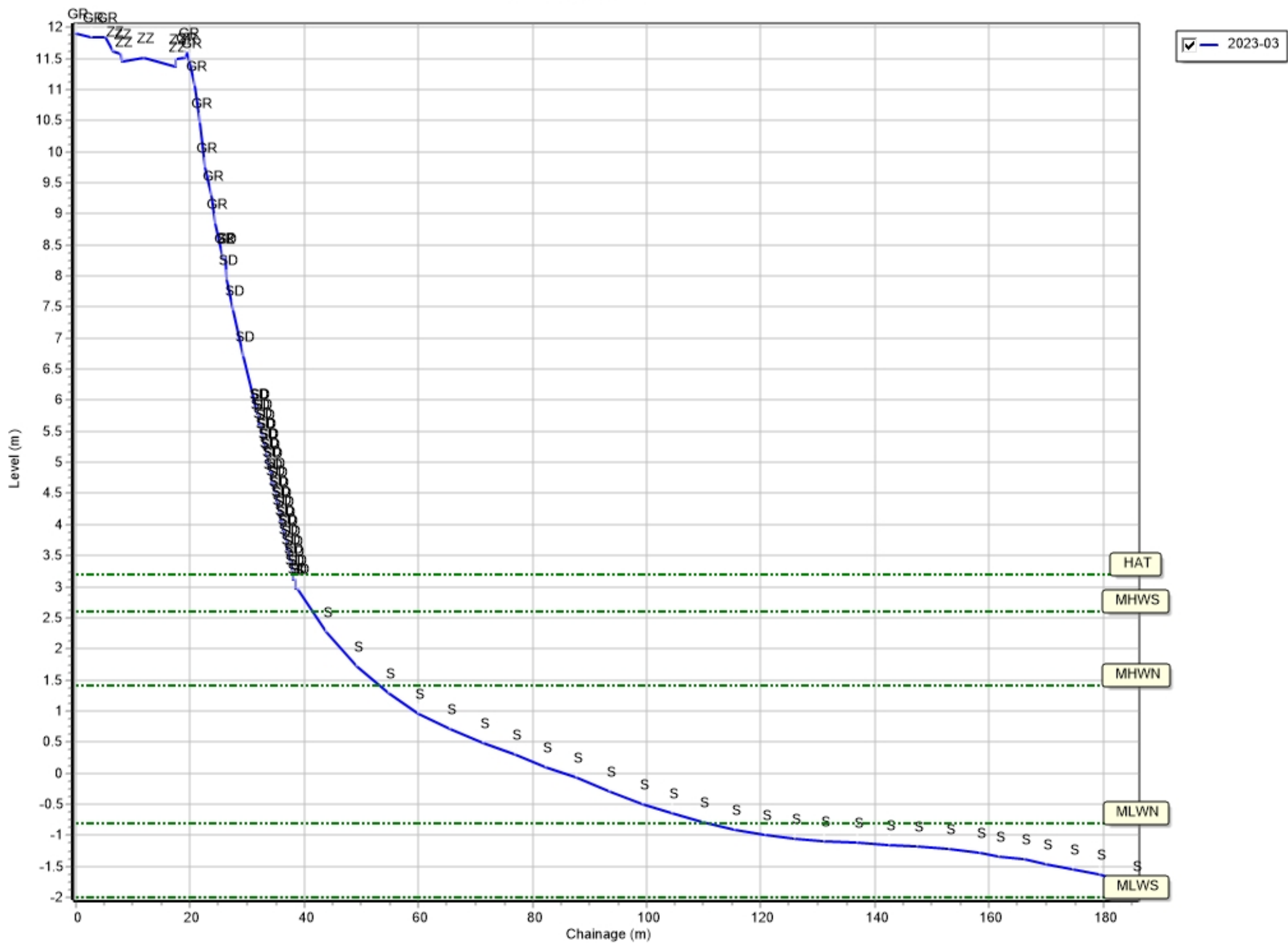
Appendices

Appendix A
Beach Profiles

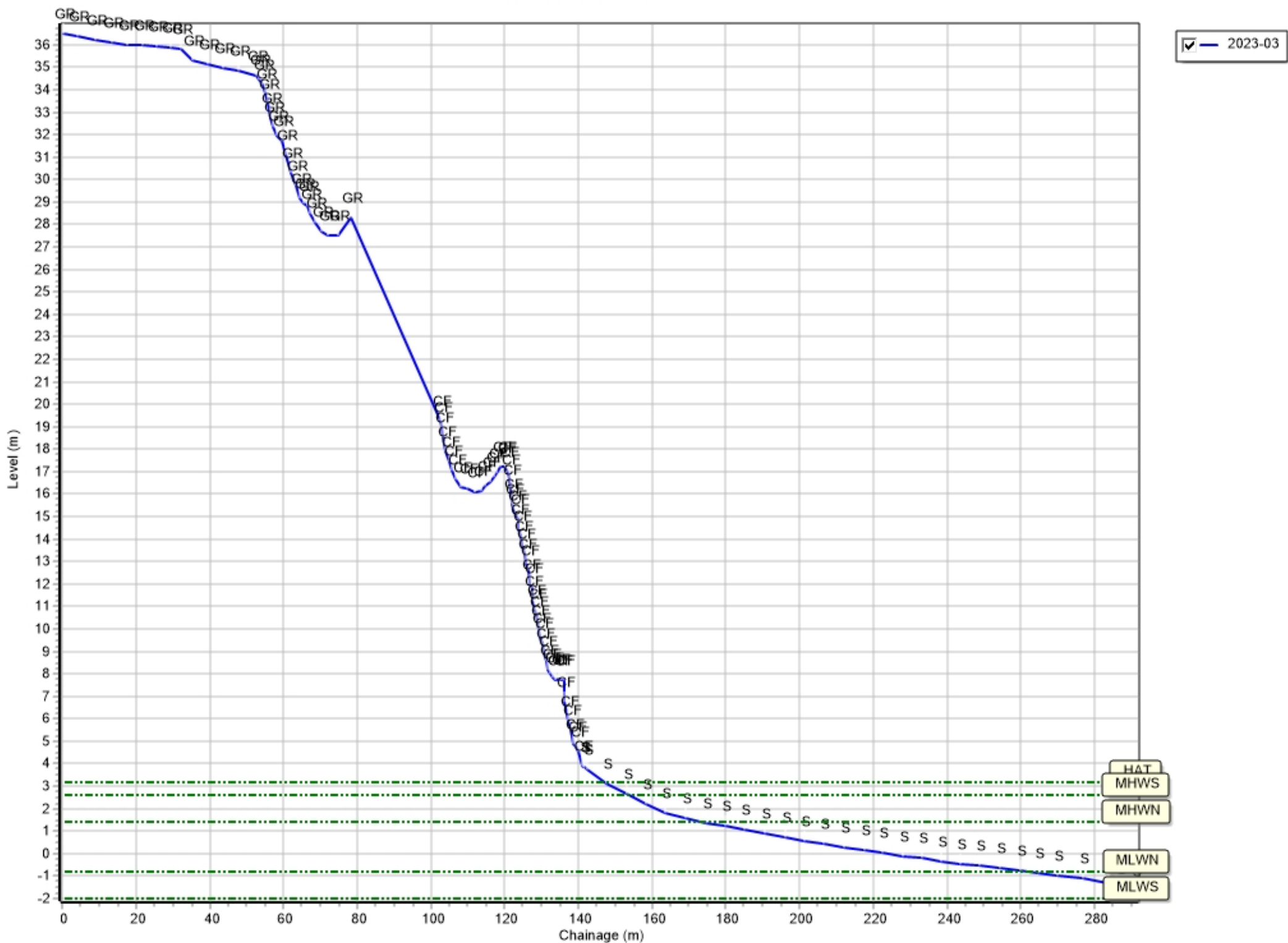
The following sediment feature codes are used on some profile plots:

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

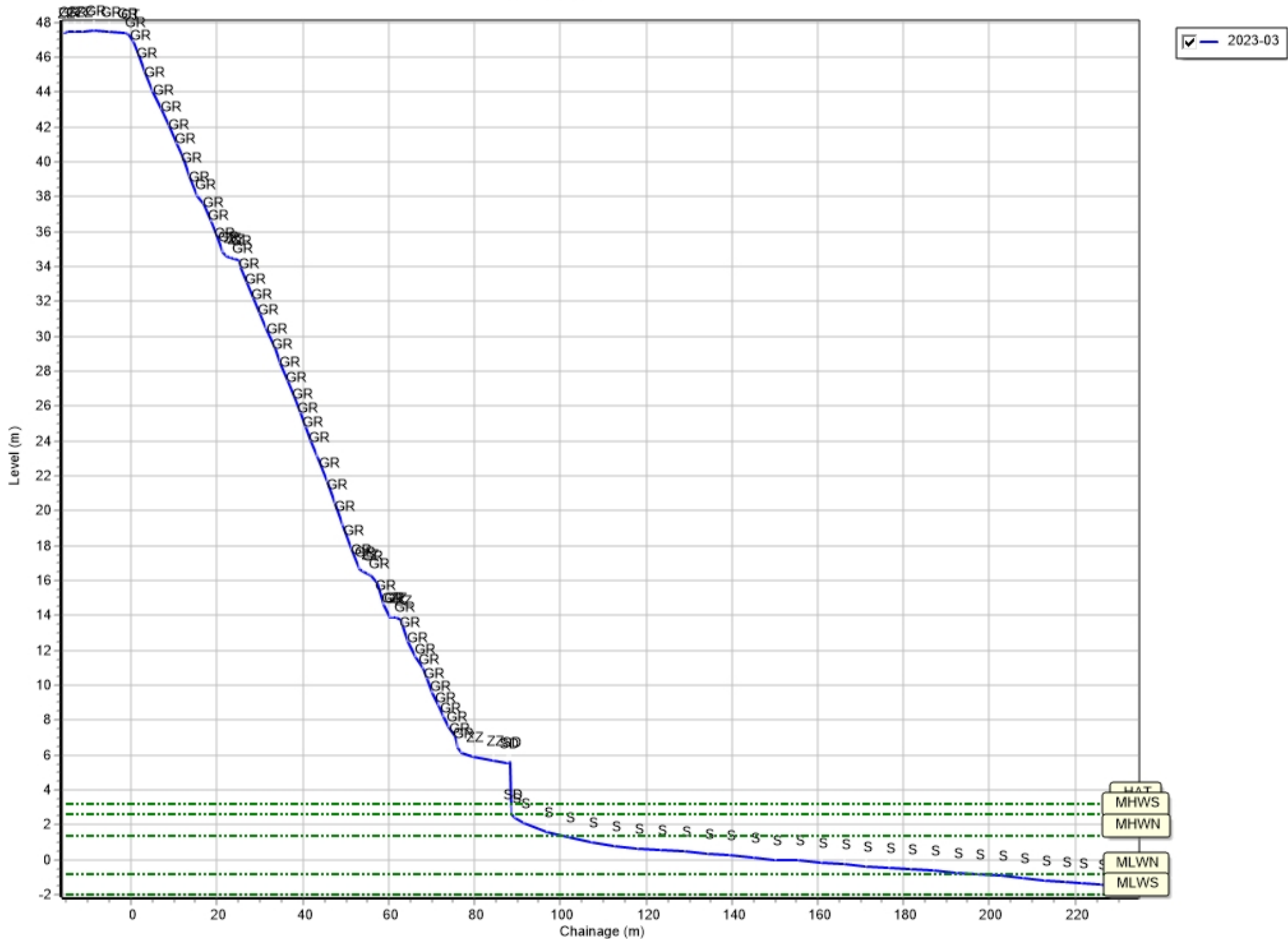
Profiles: 1dWB1



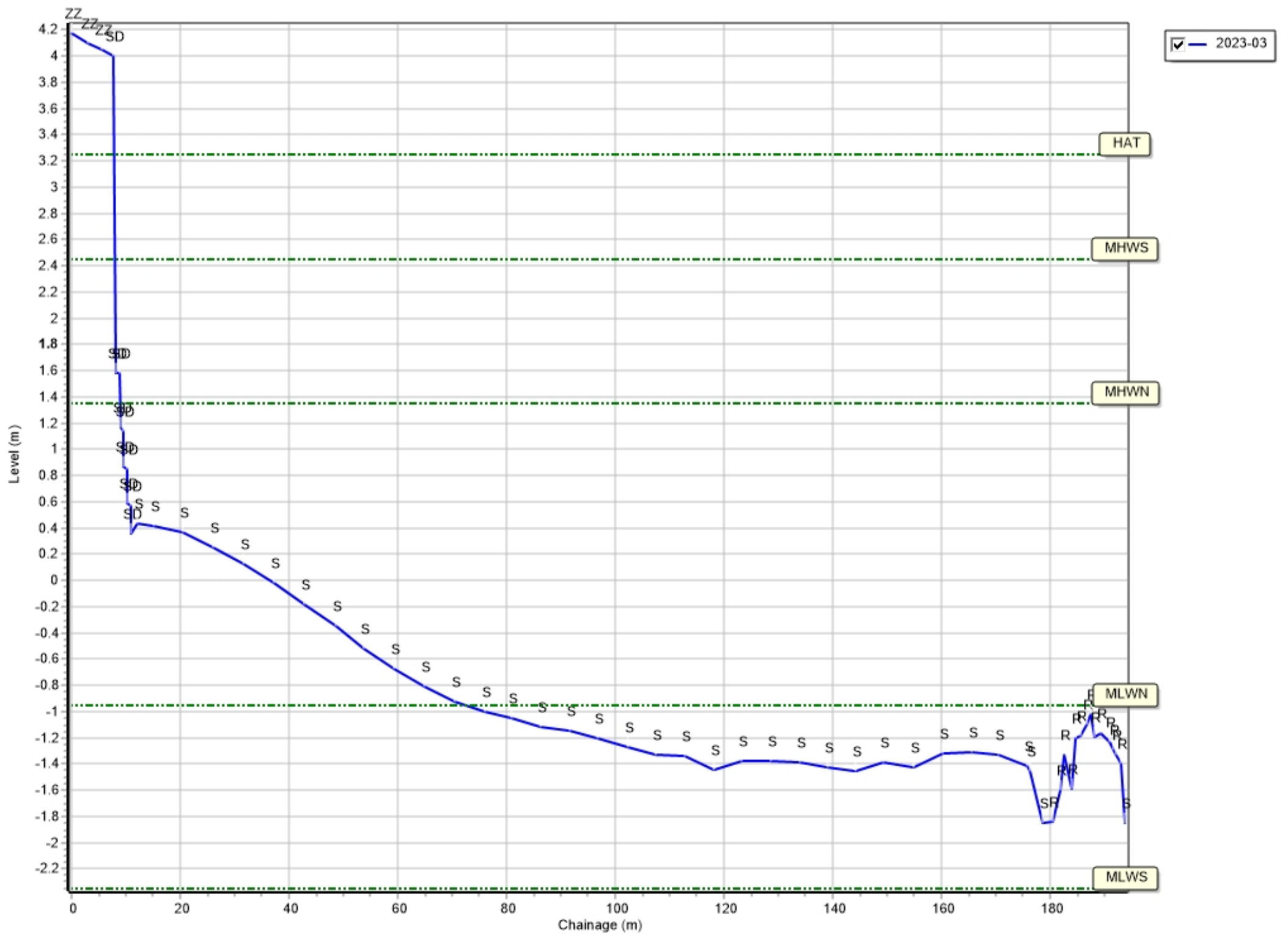
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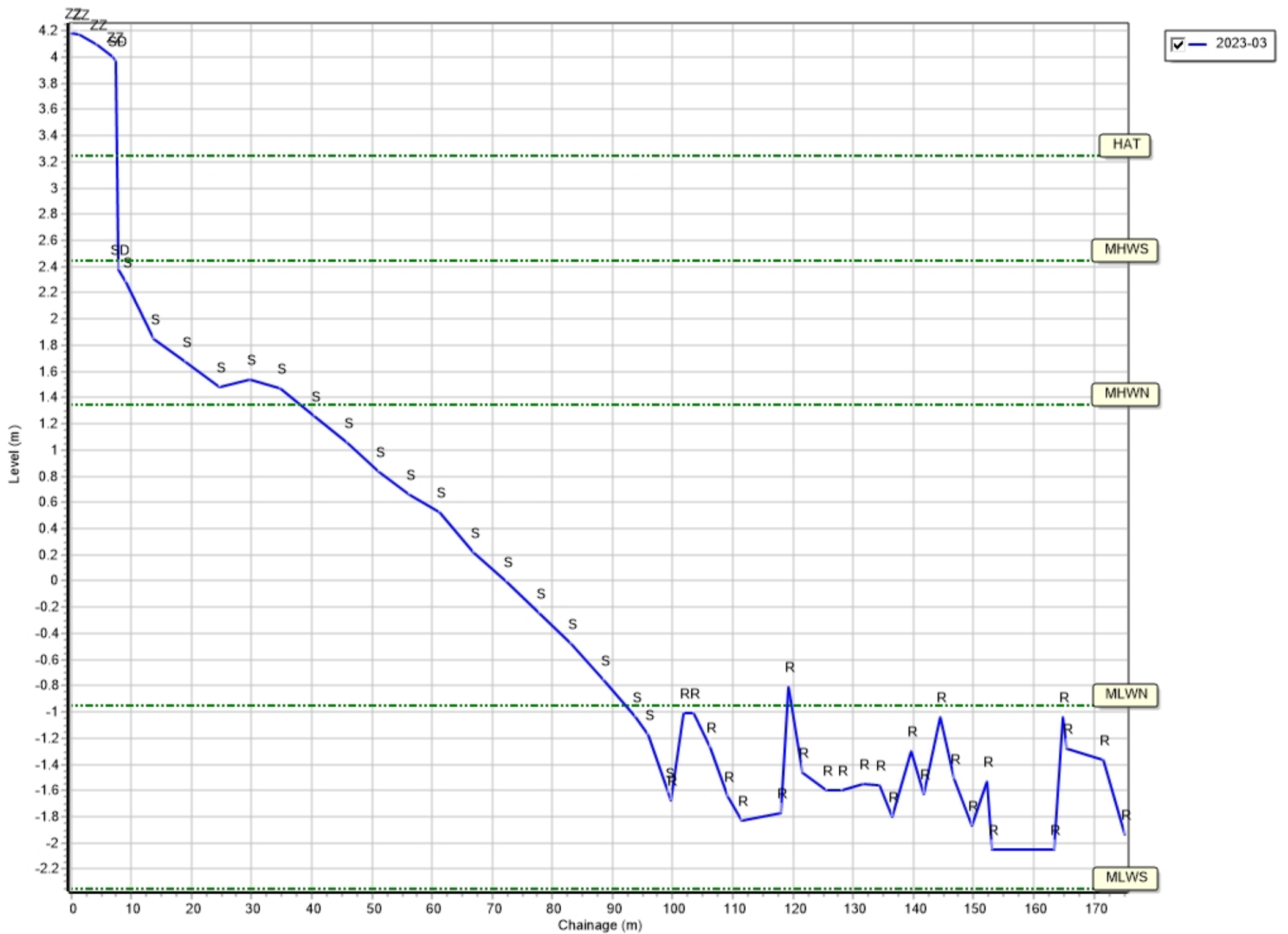
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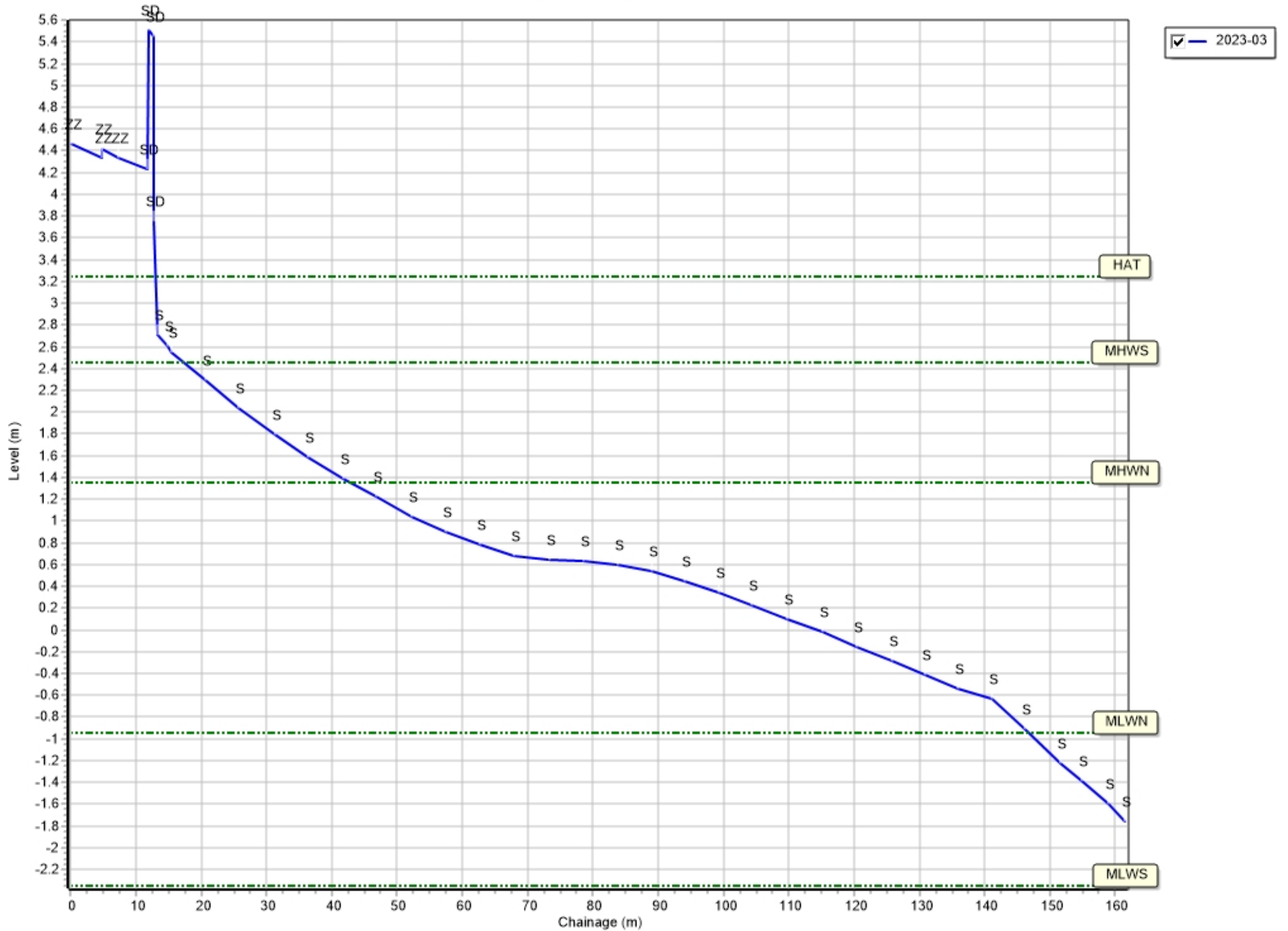
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Profiles: 1dSBN2



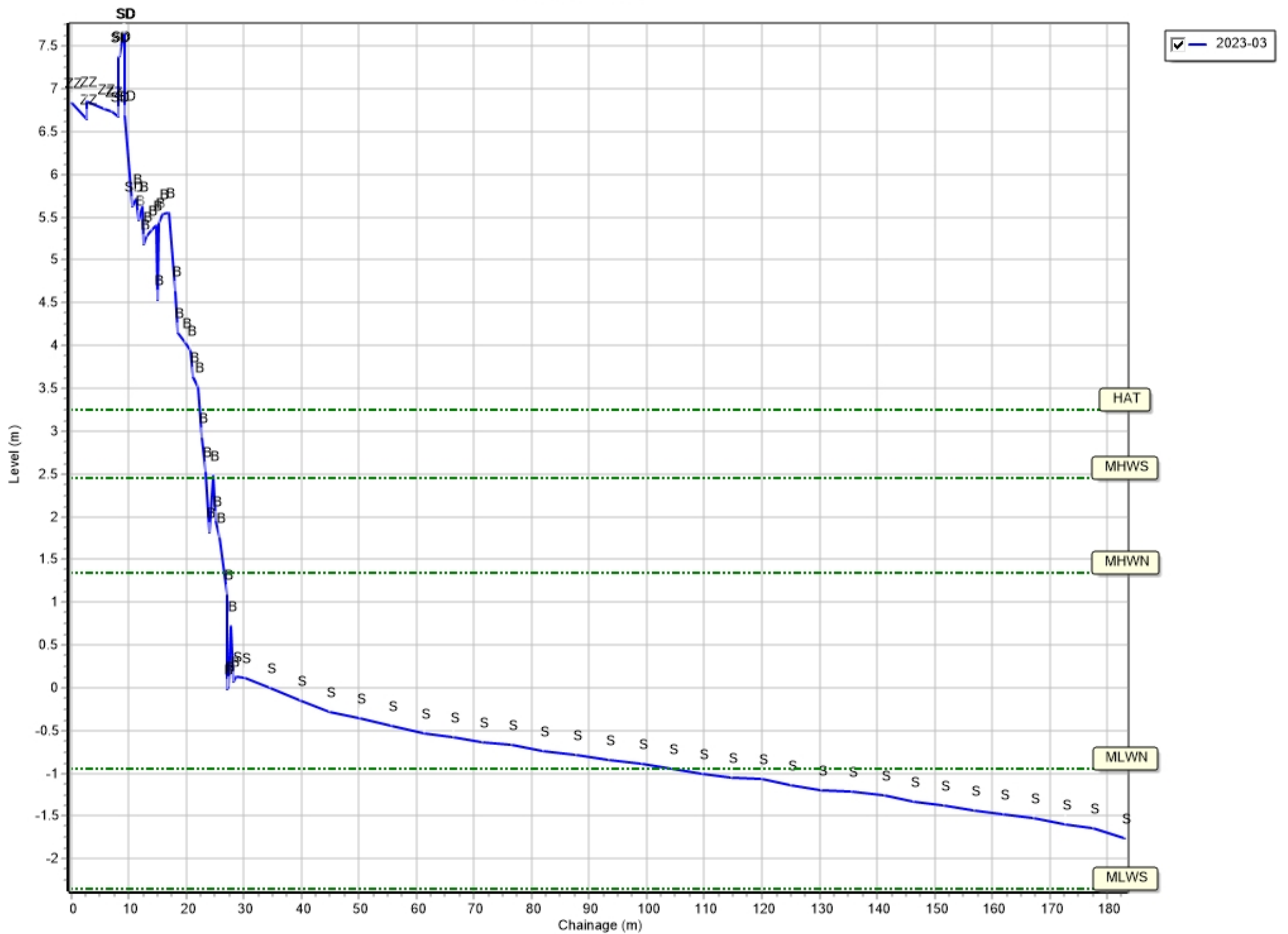
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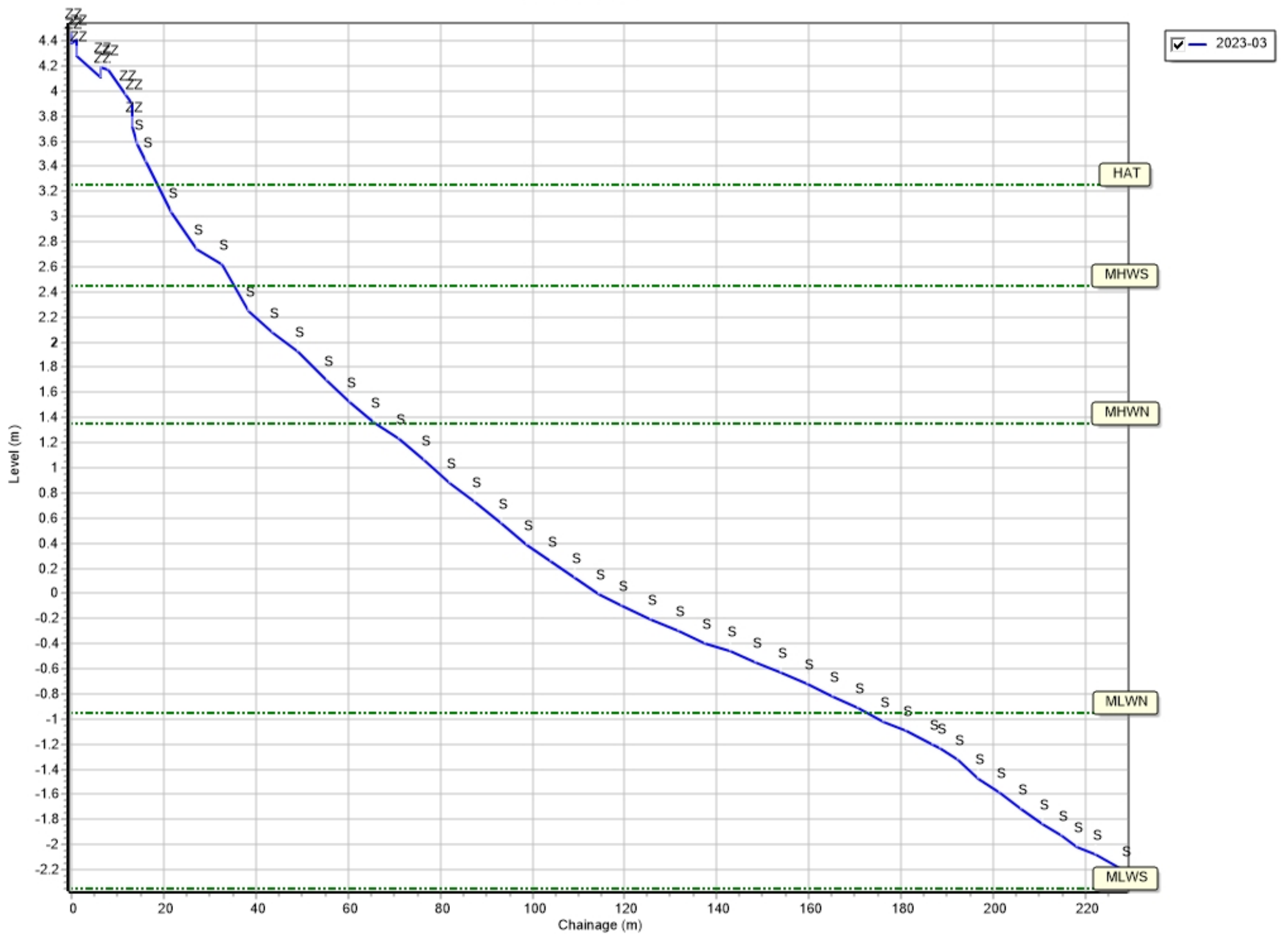
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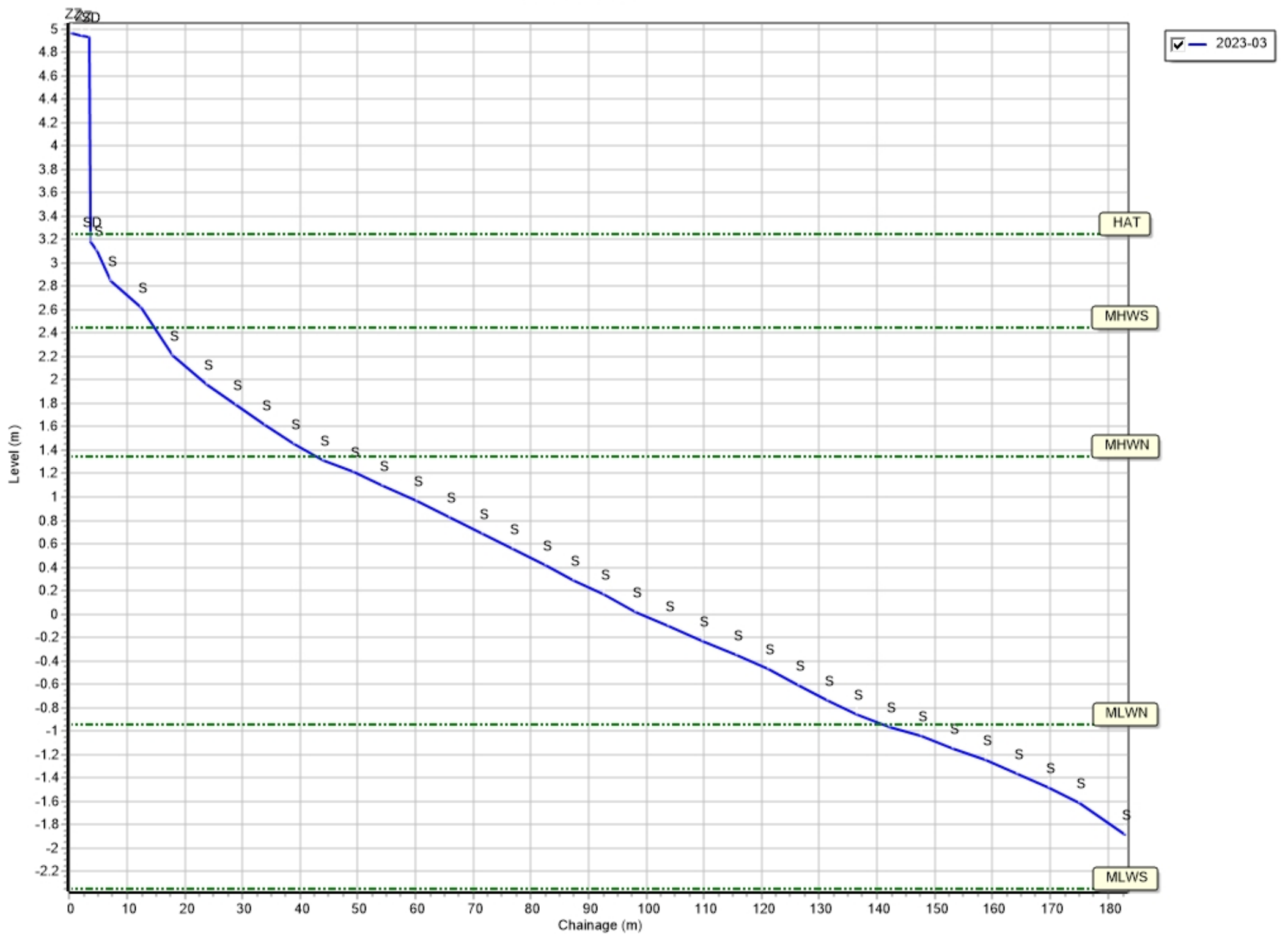
Profiles: 1dSBN5



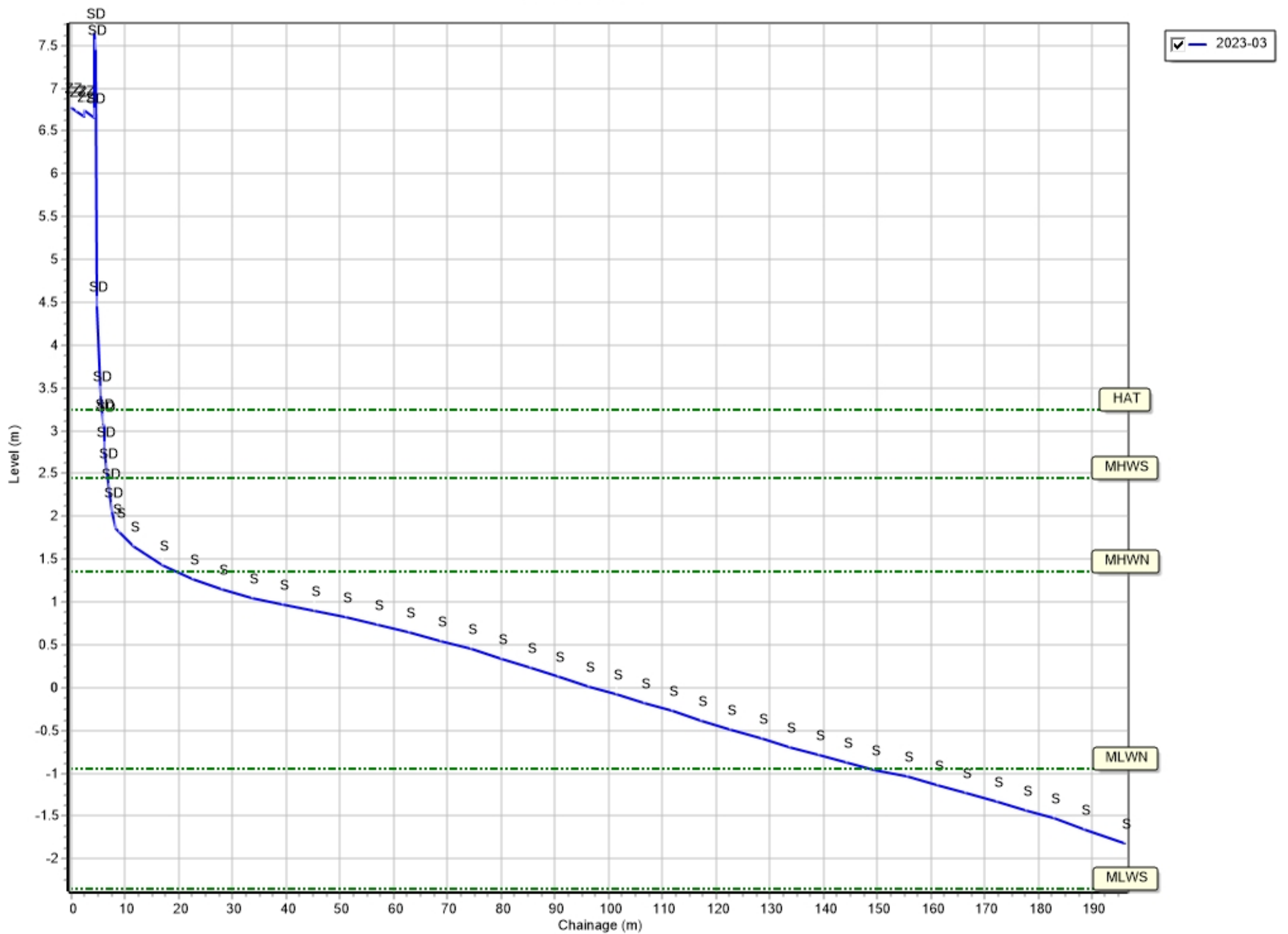
Profiles: 1dSBS1



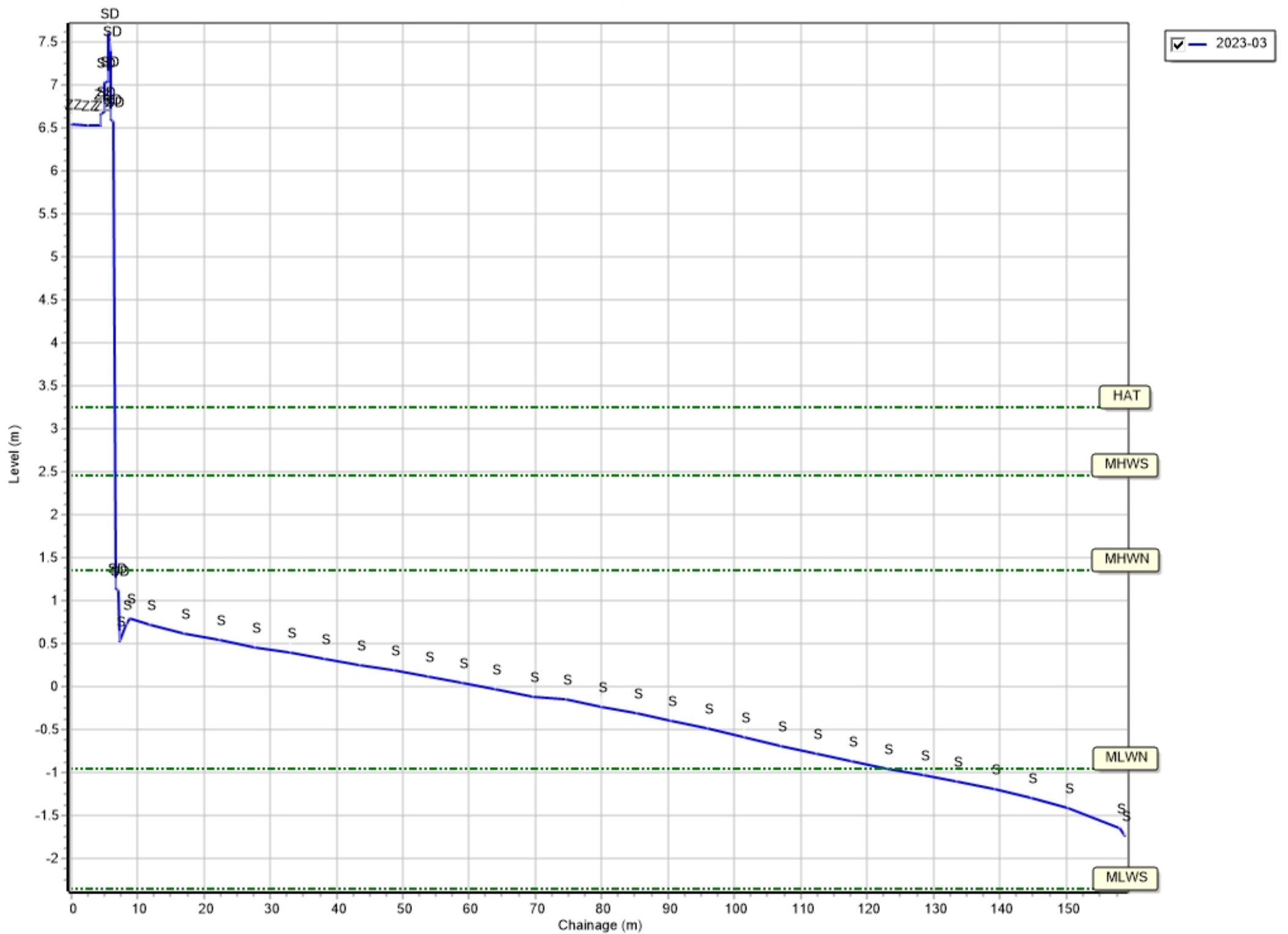
Profiles: 1dSBS2



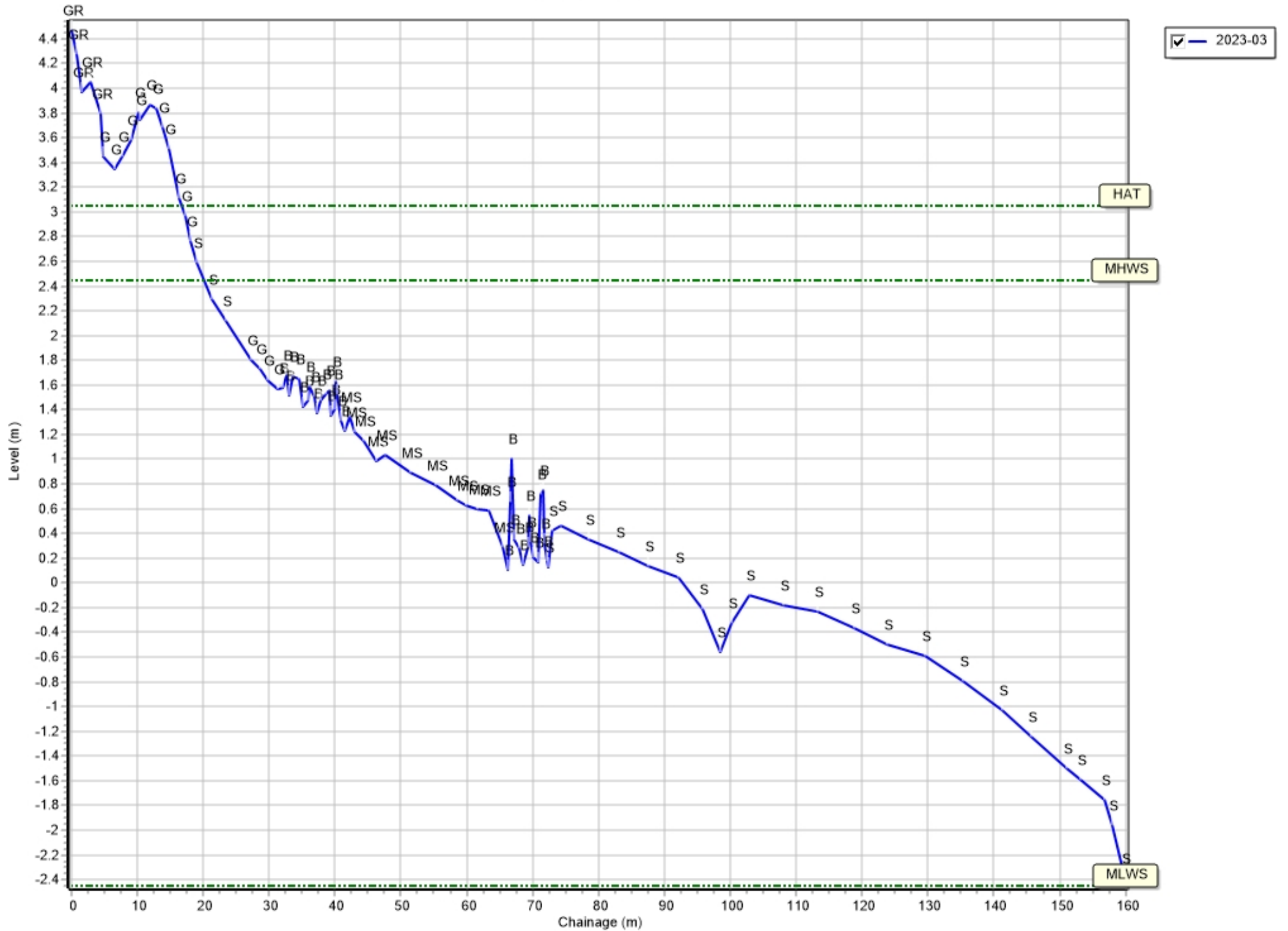
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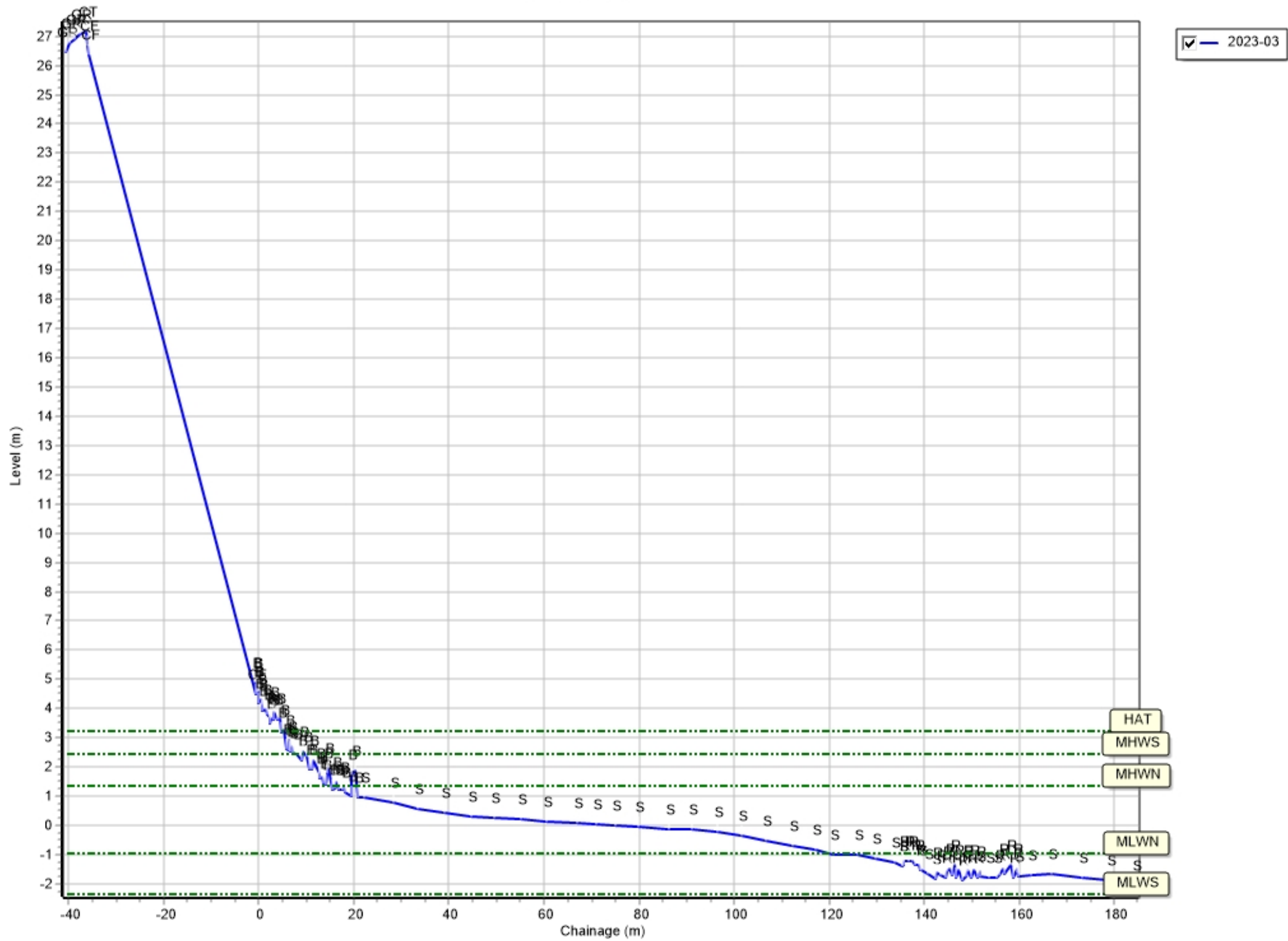
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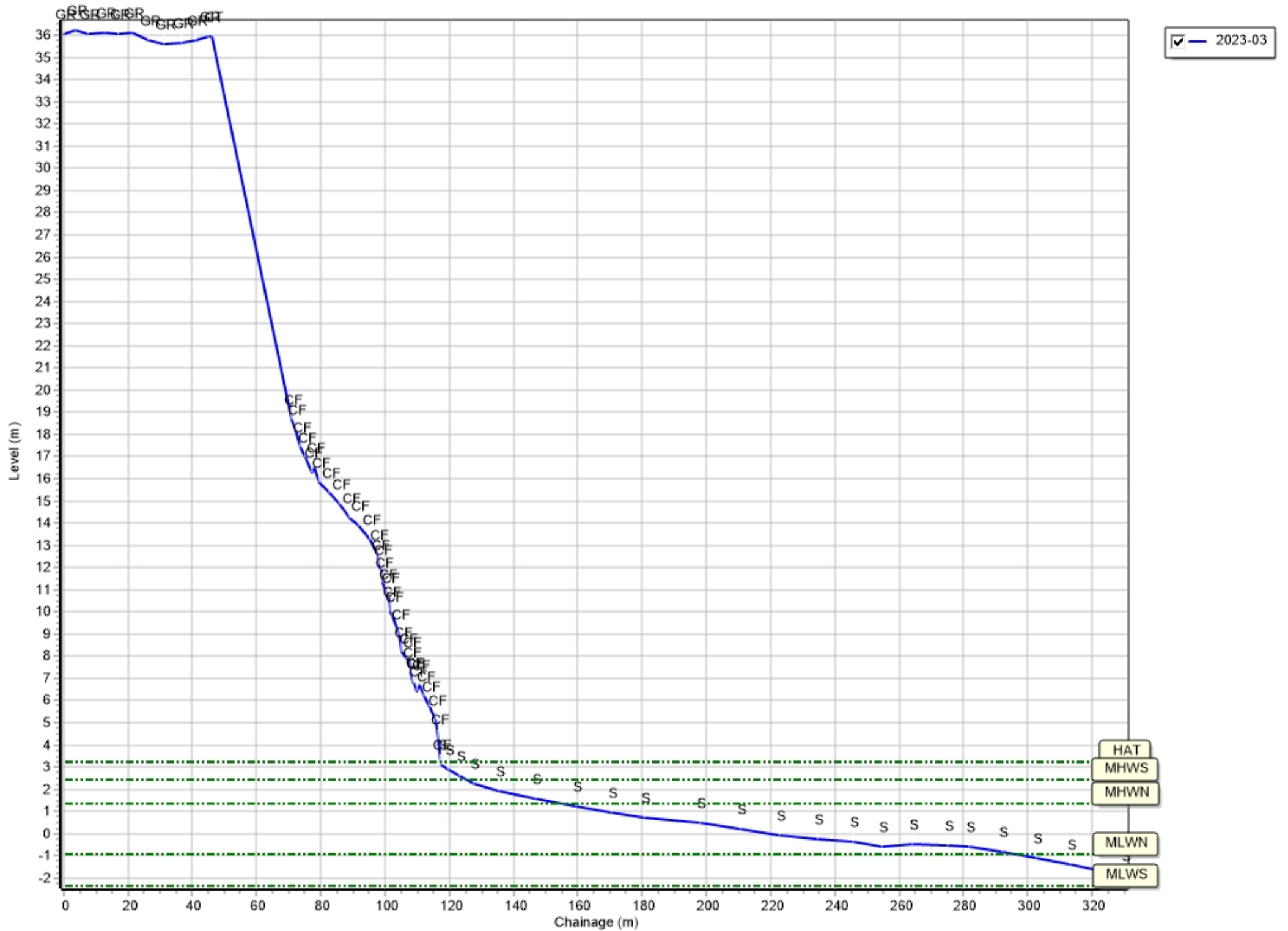
Profiles: 1dCY1A



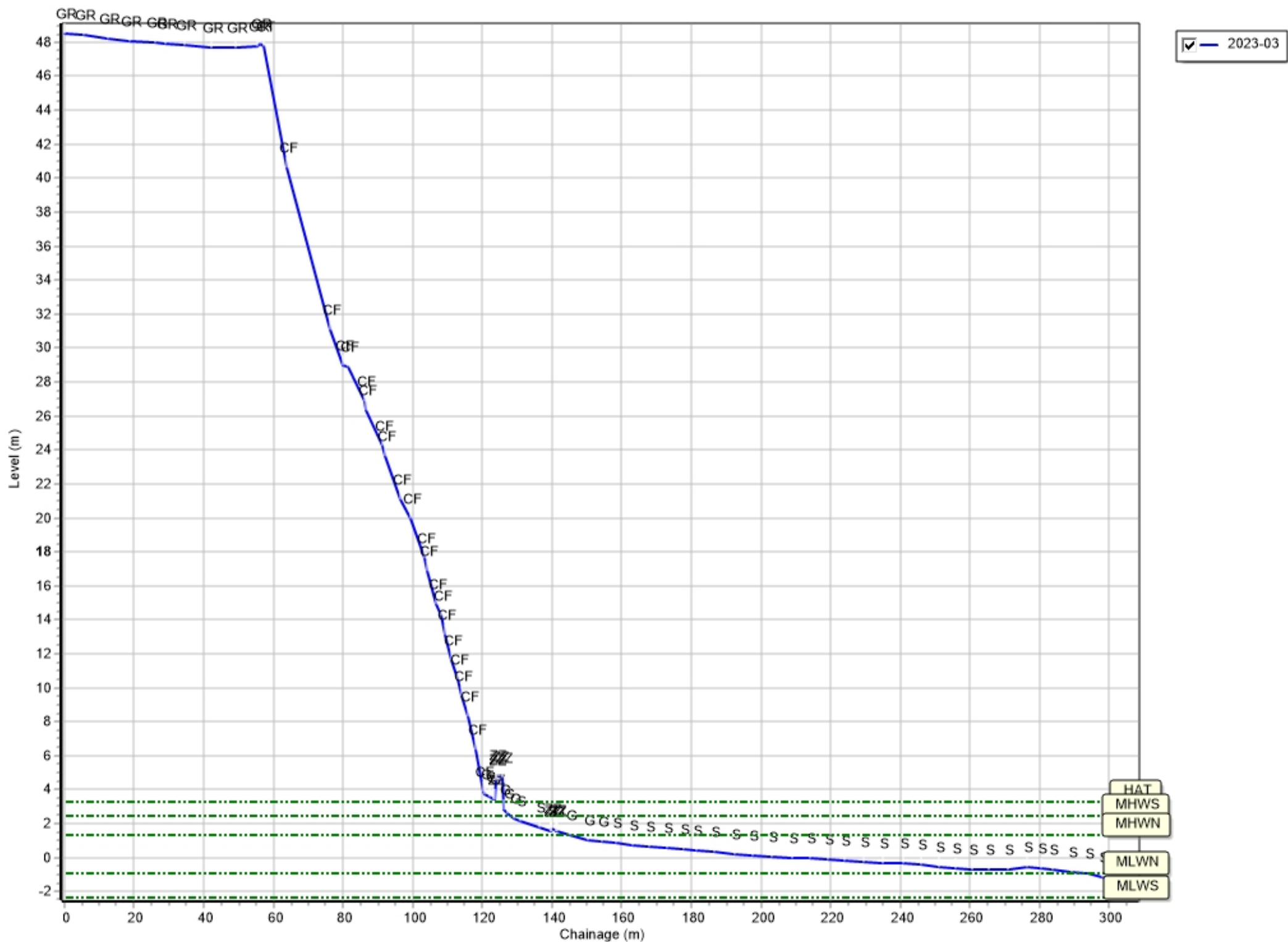
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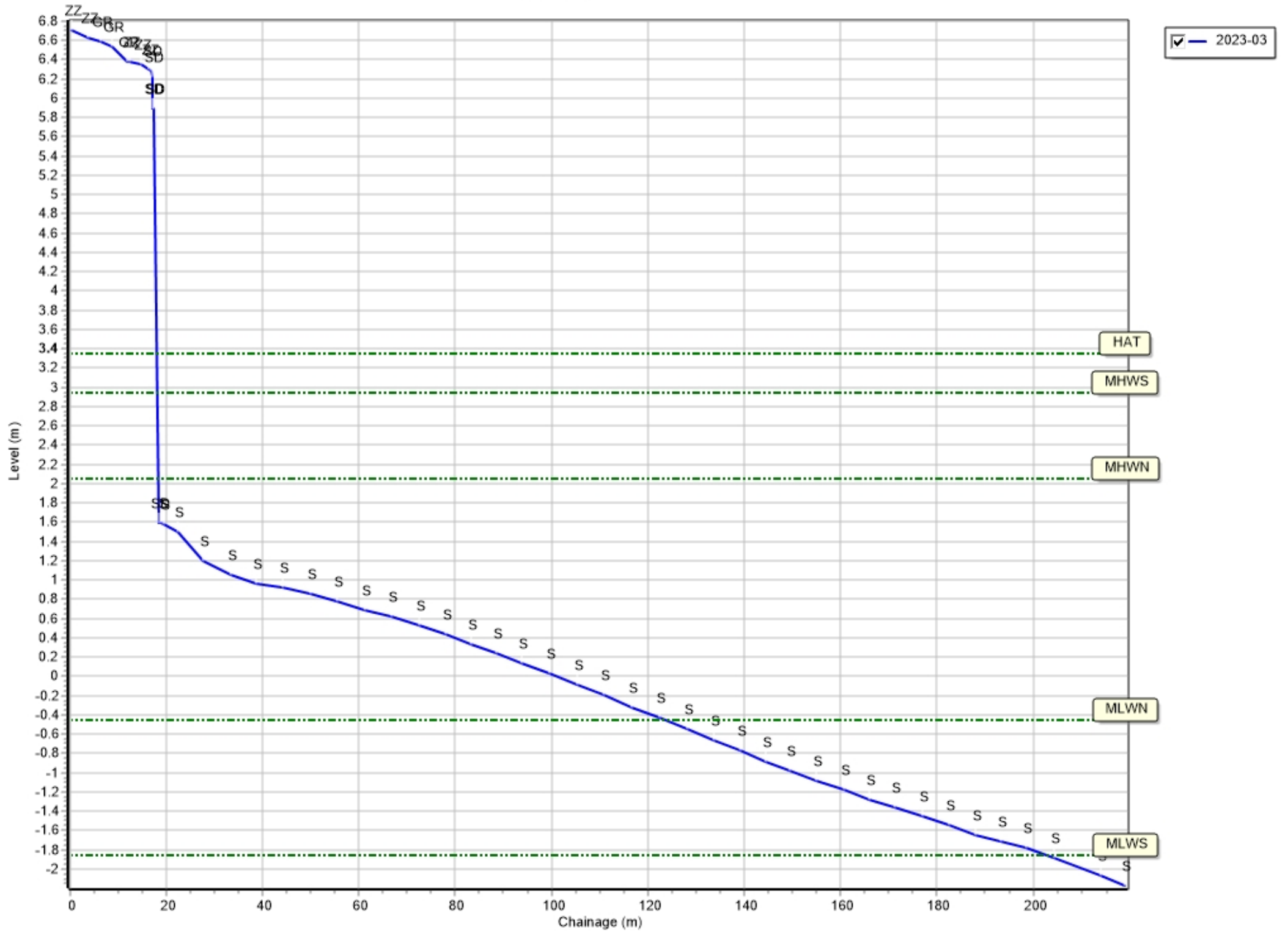
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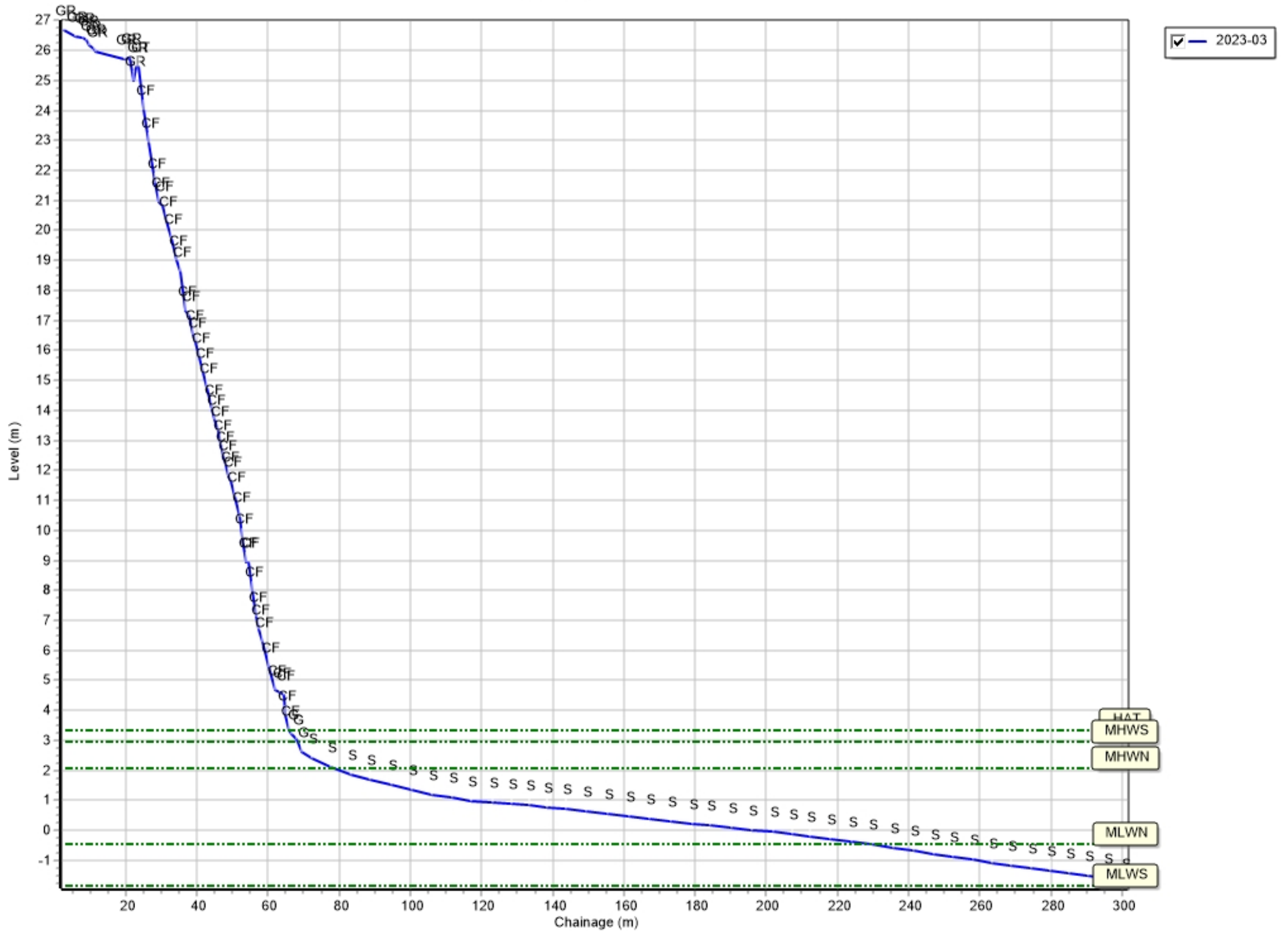
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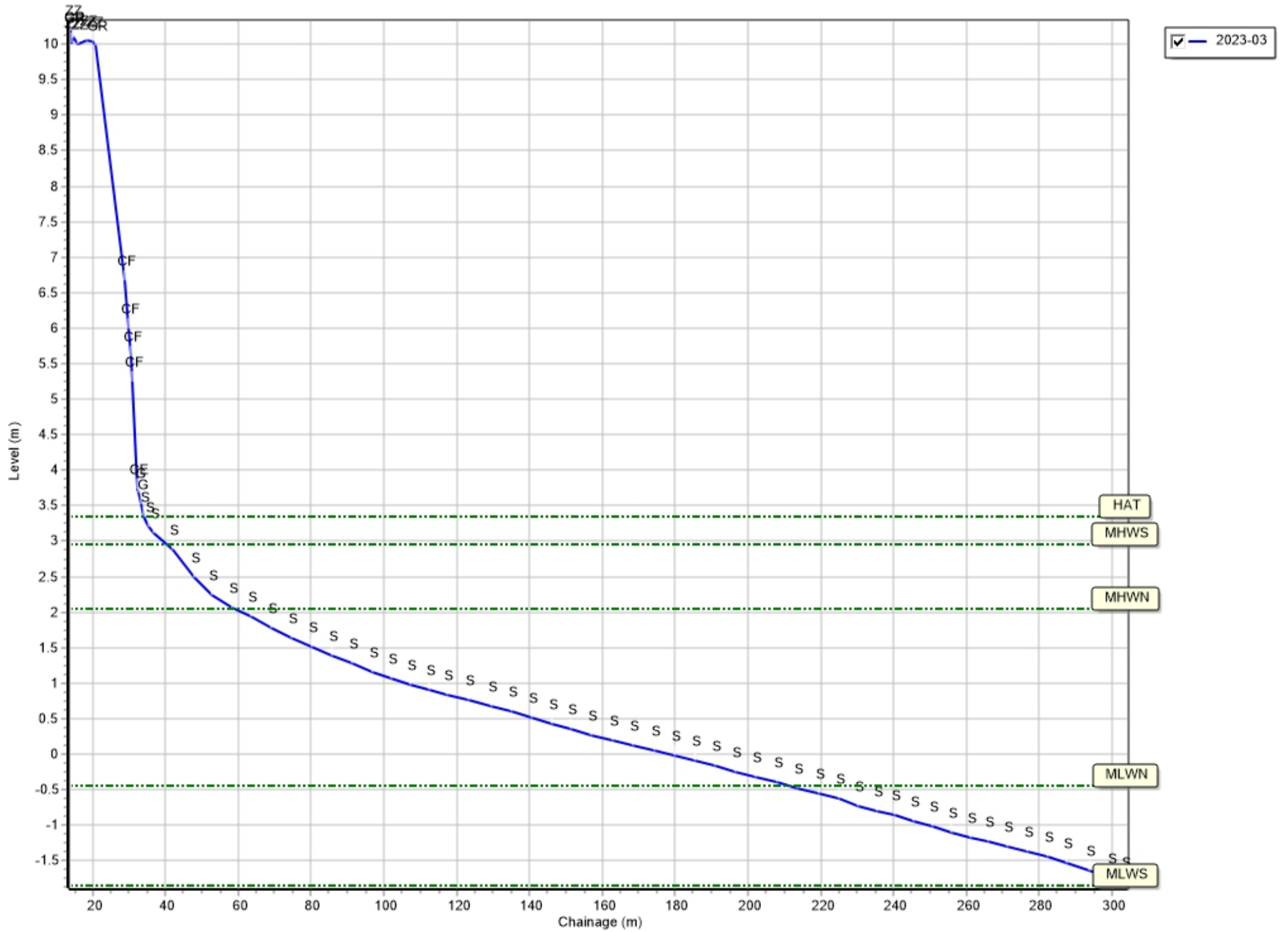
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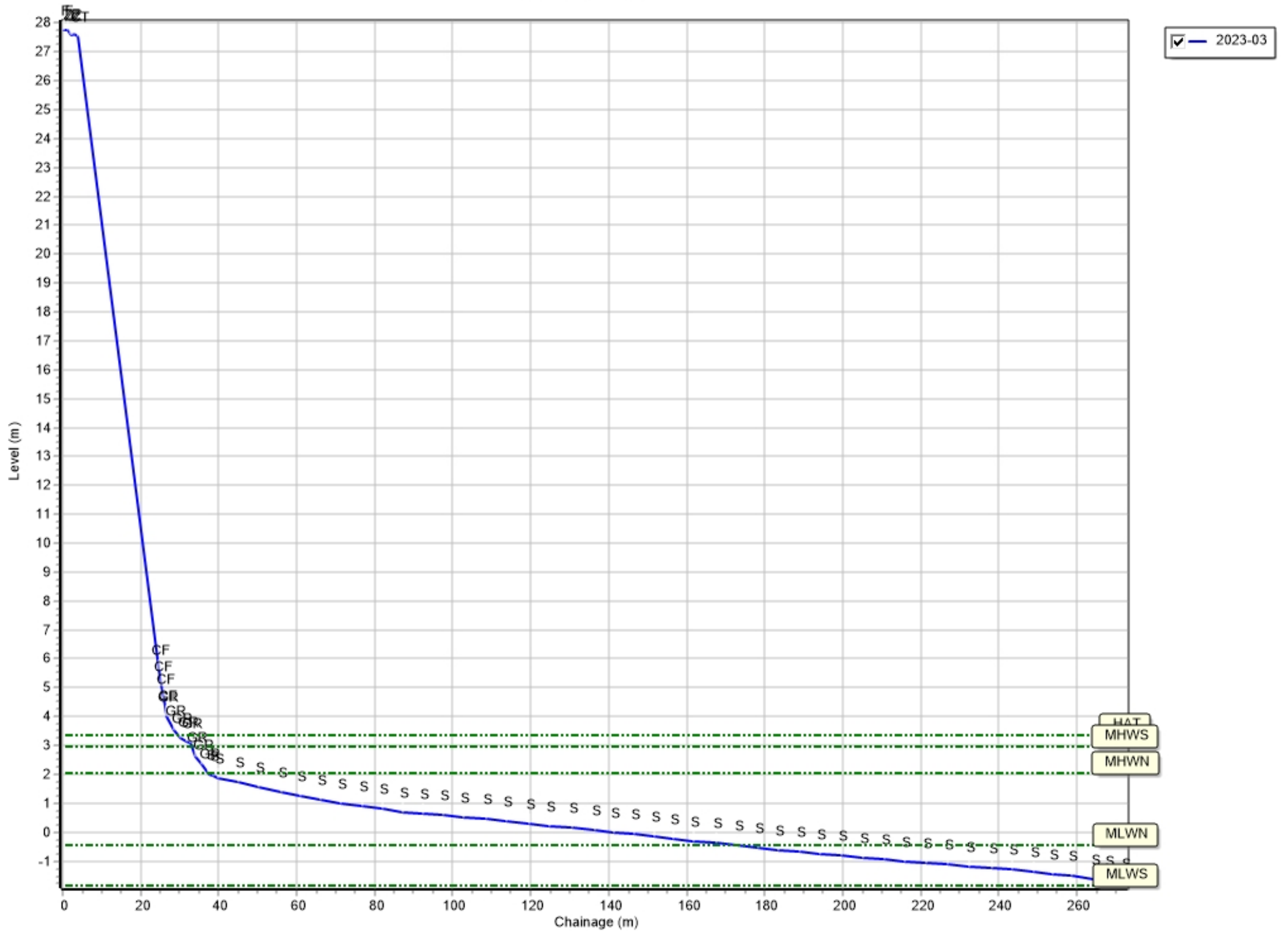
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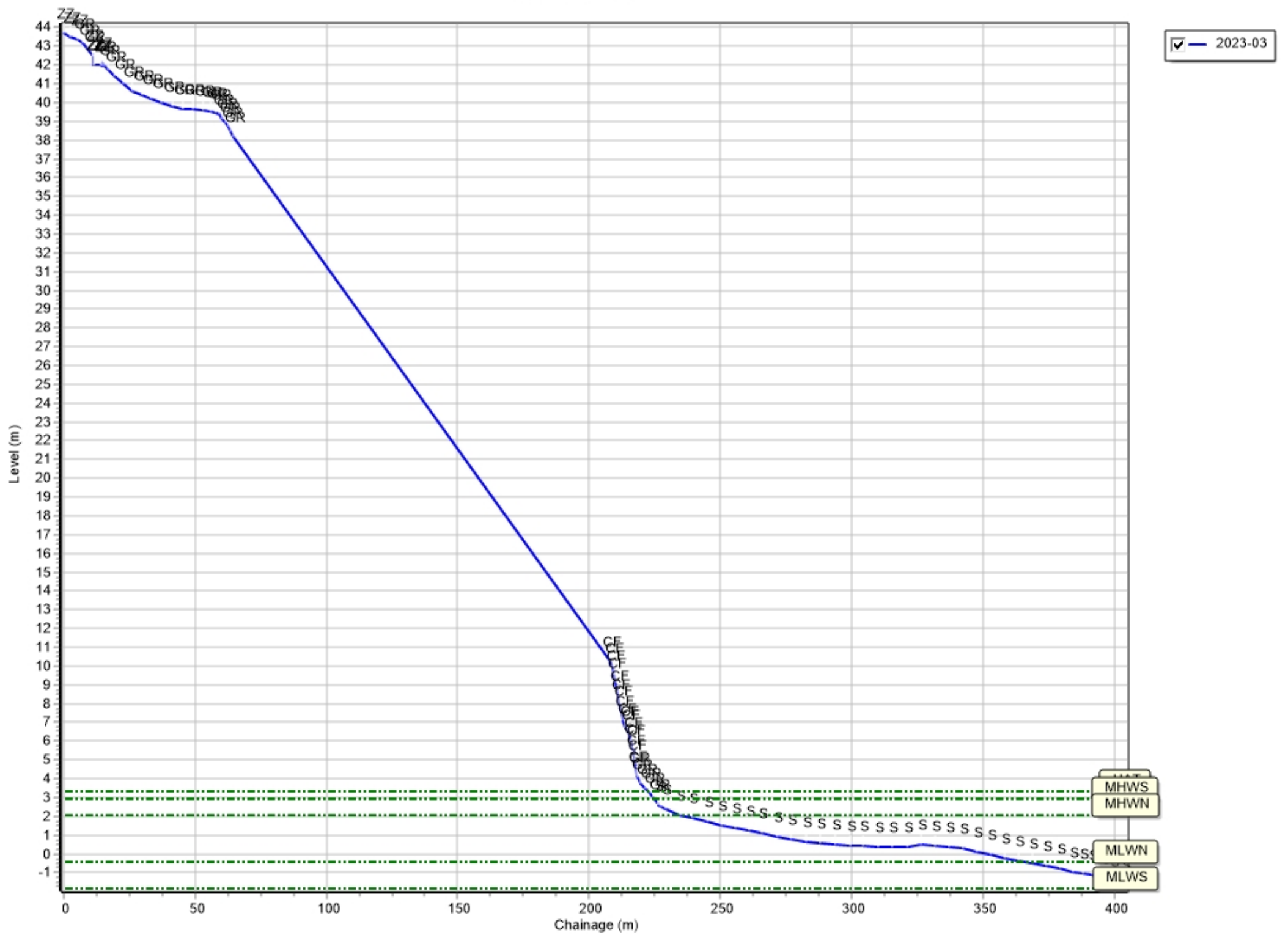
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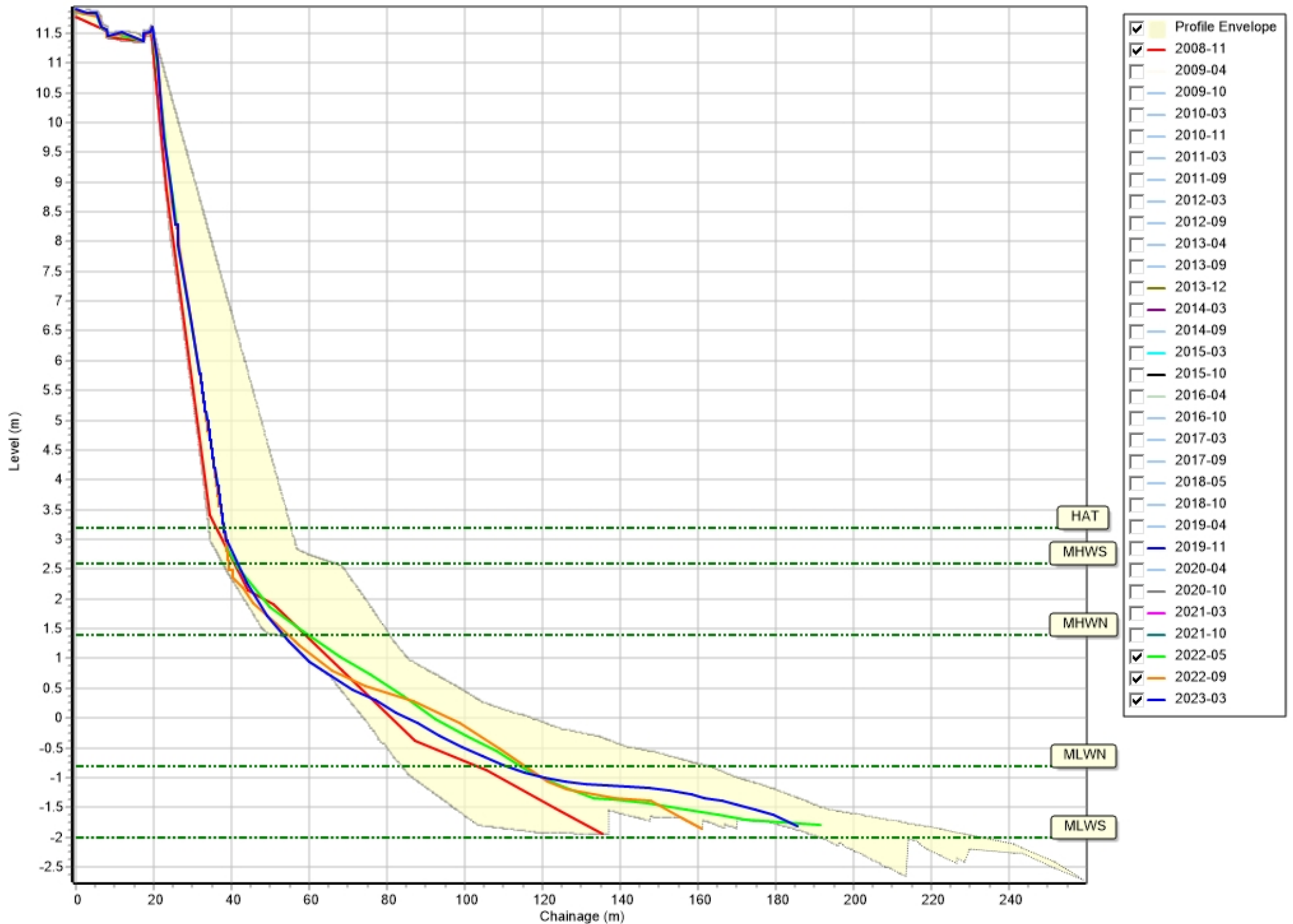
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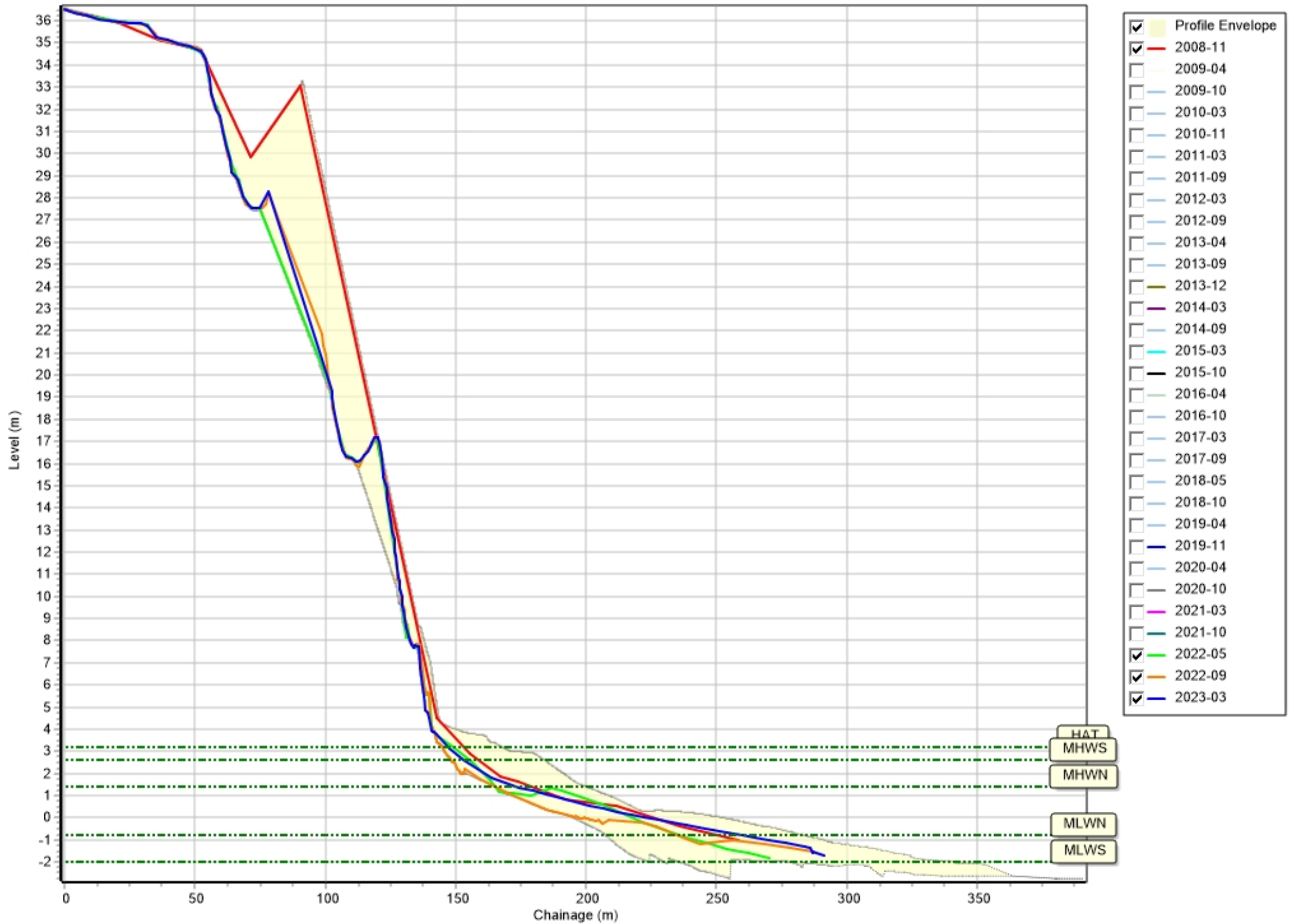
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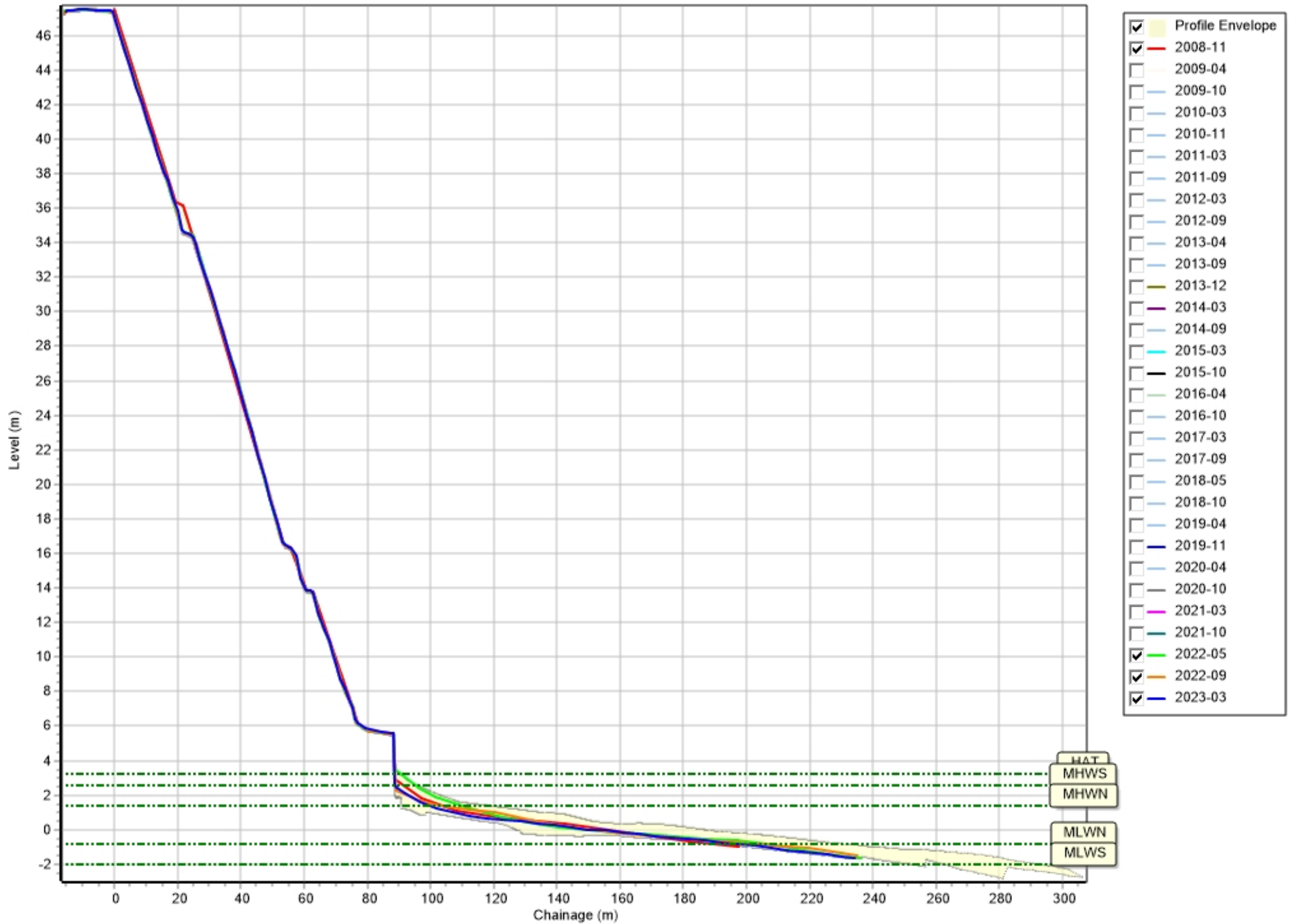
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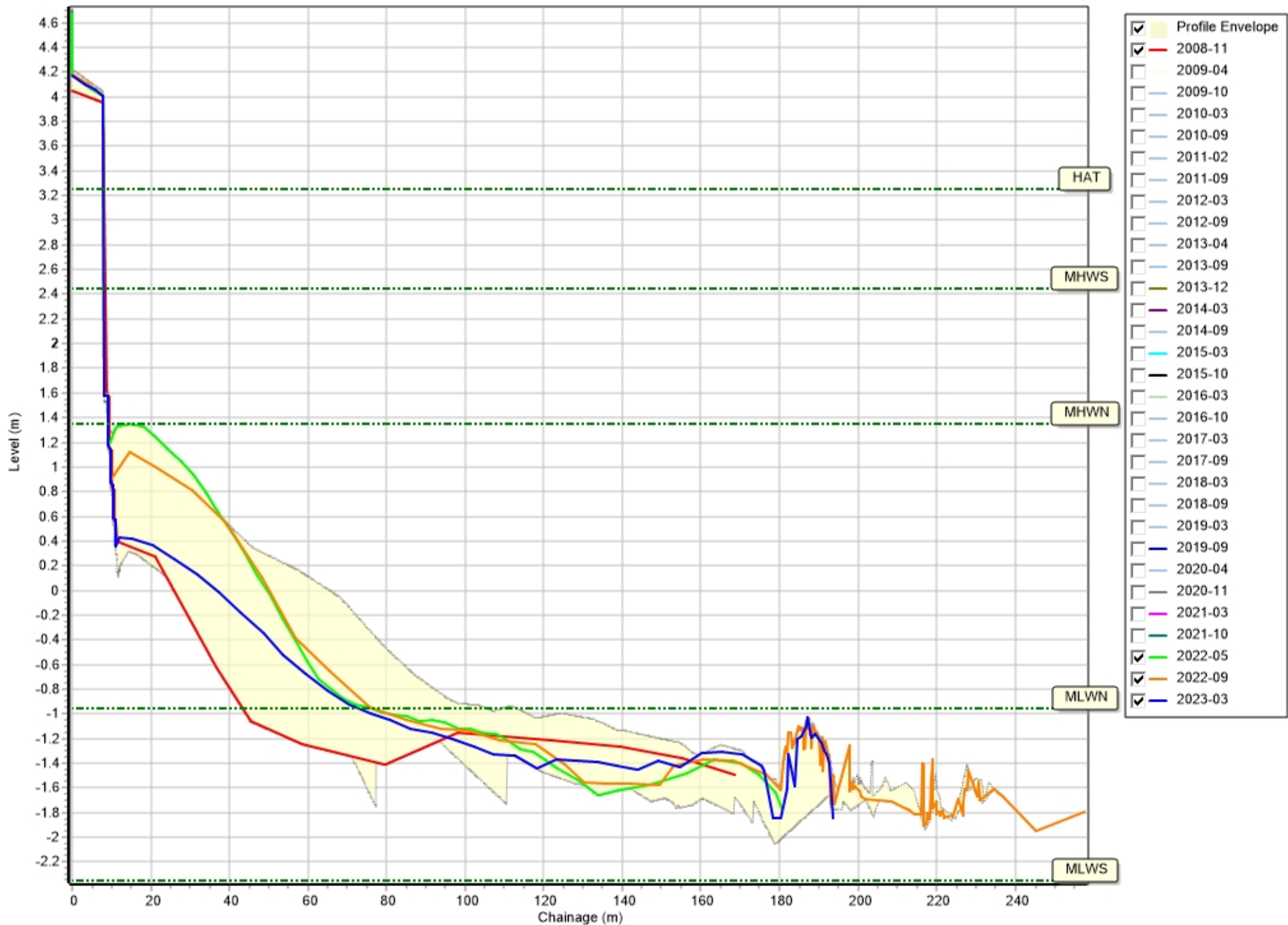
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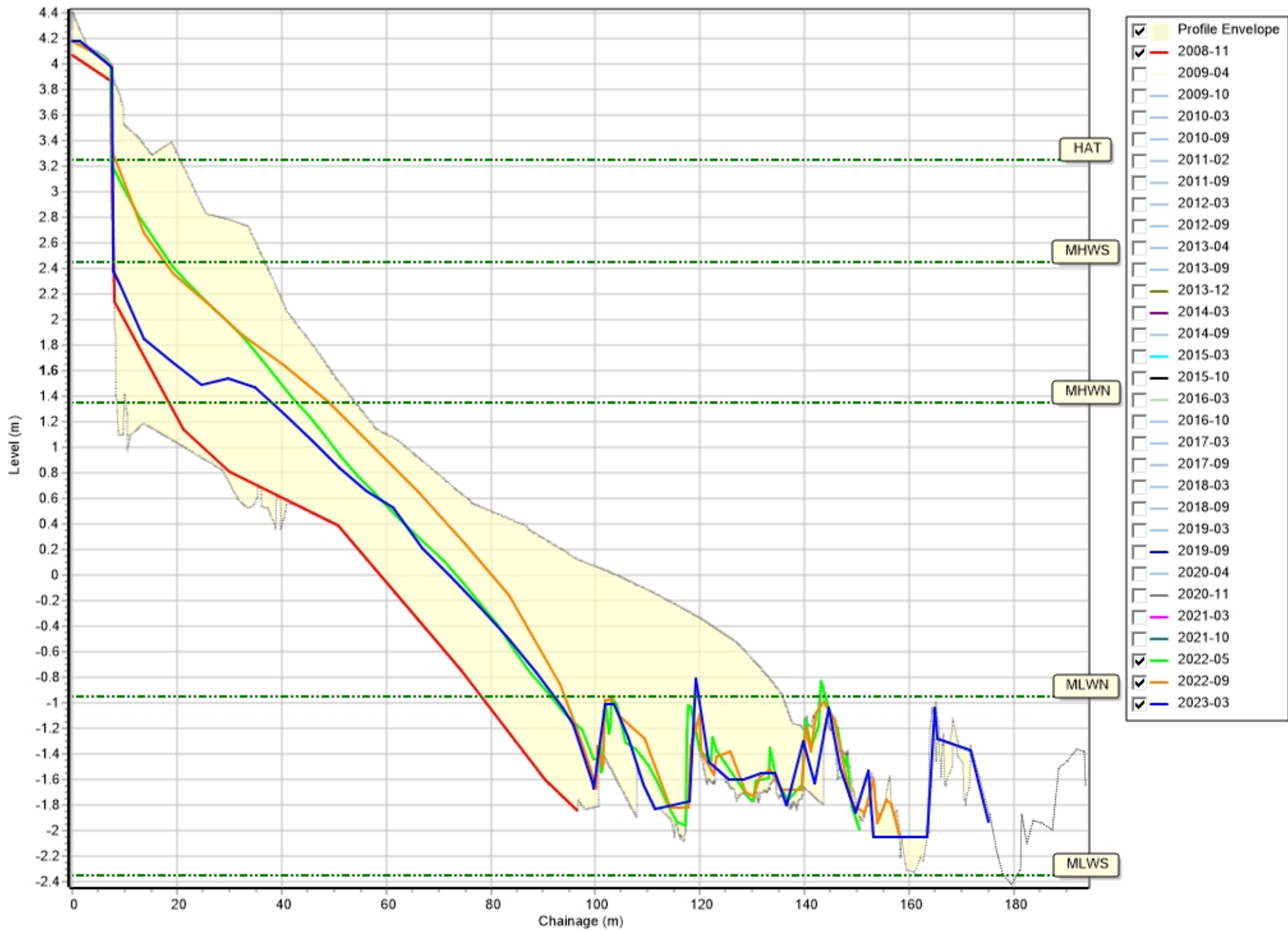
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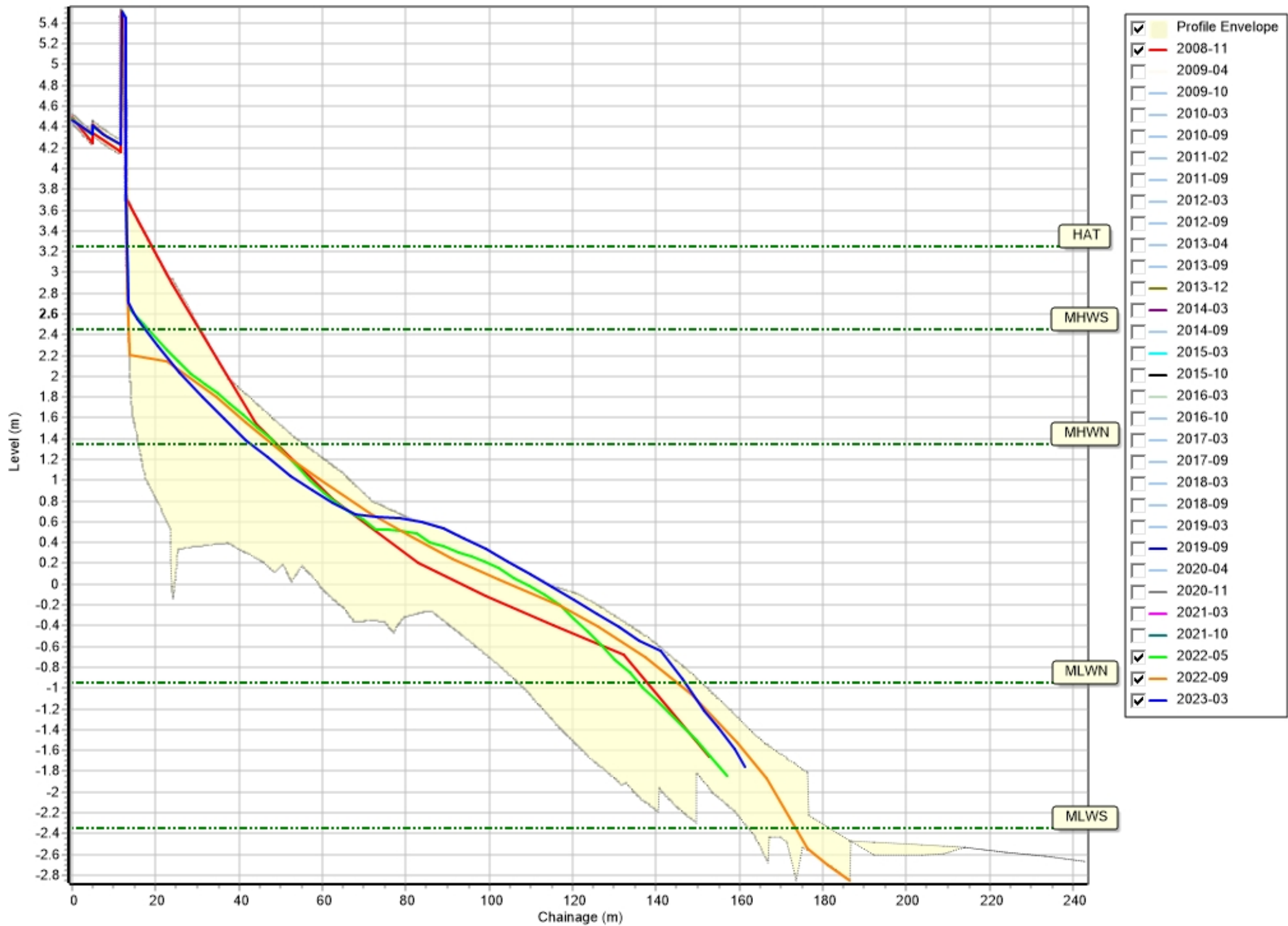
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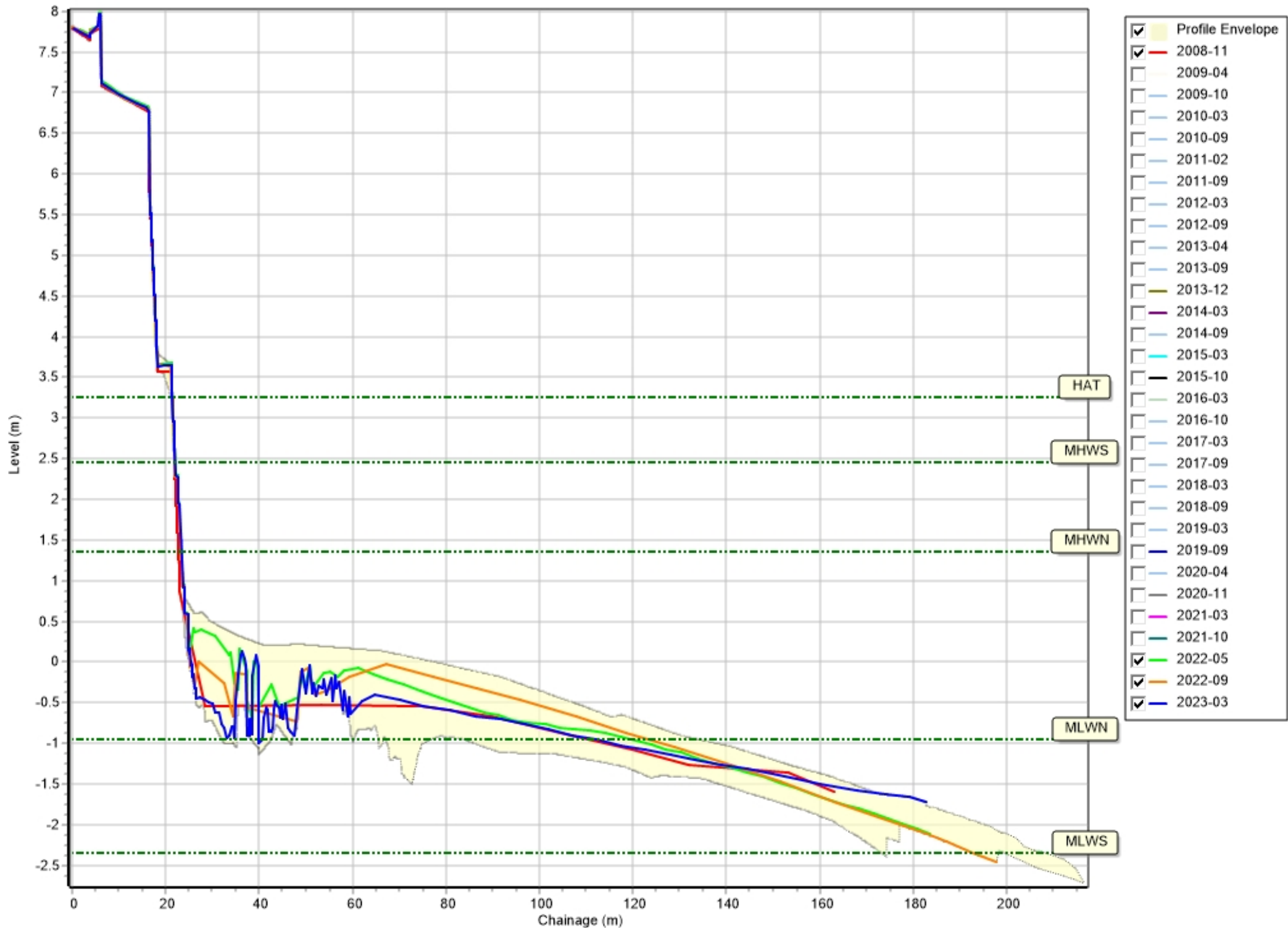
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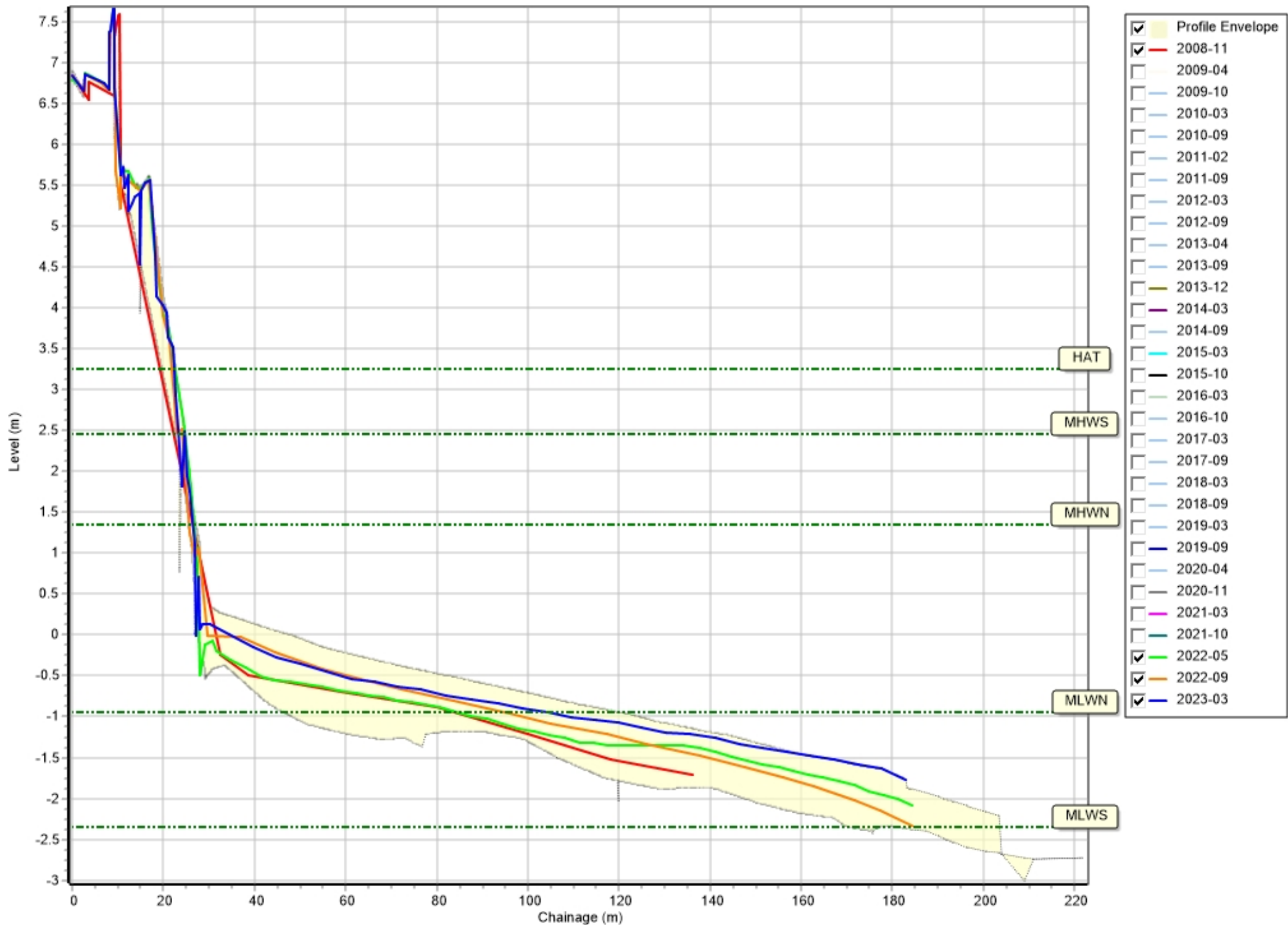
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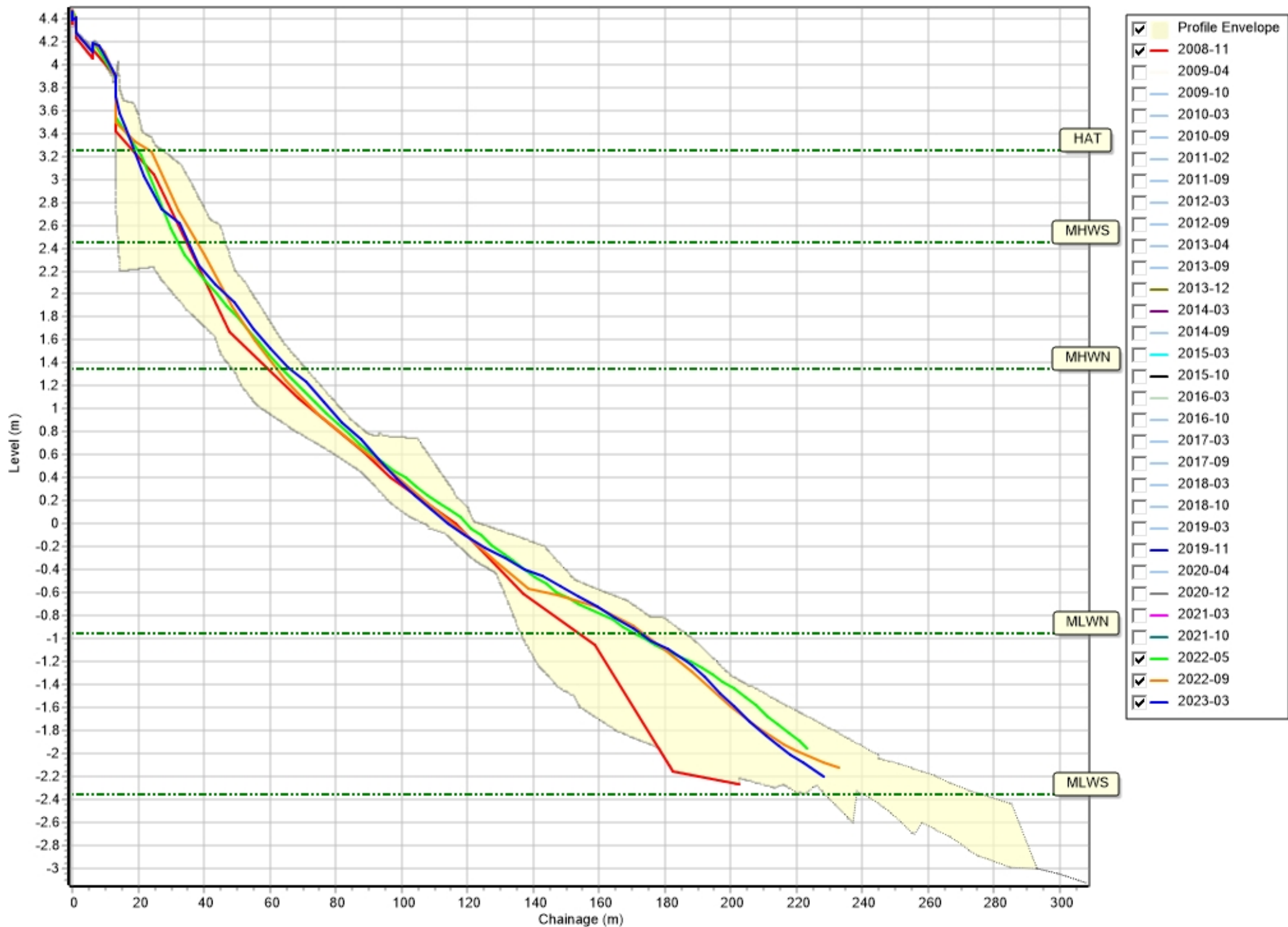
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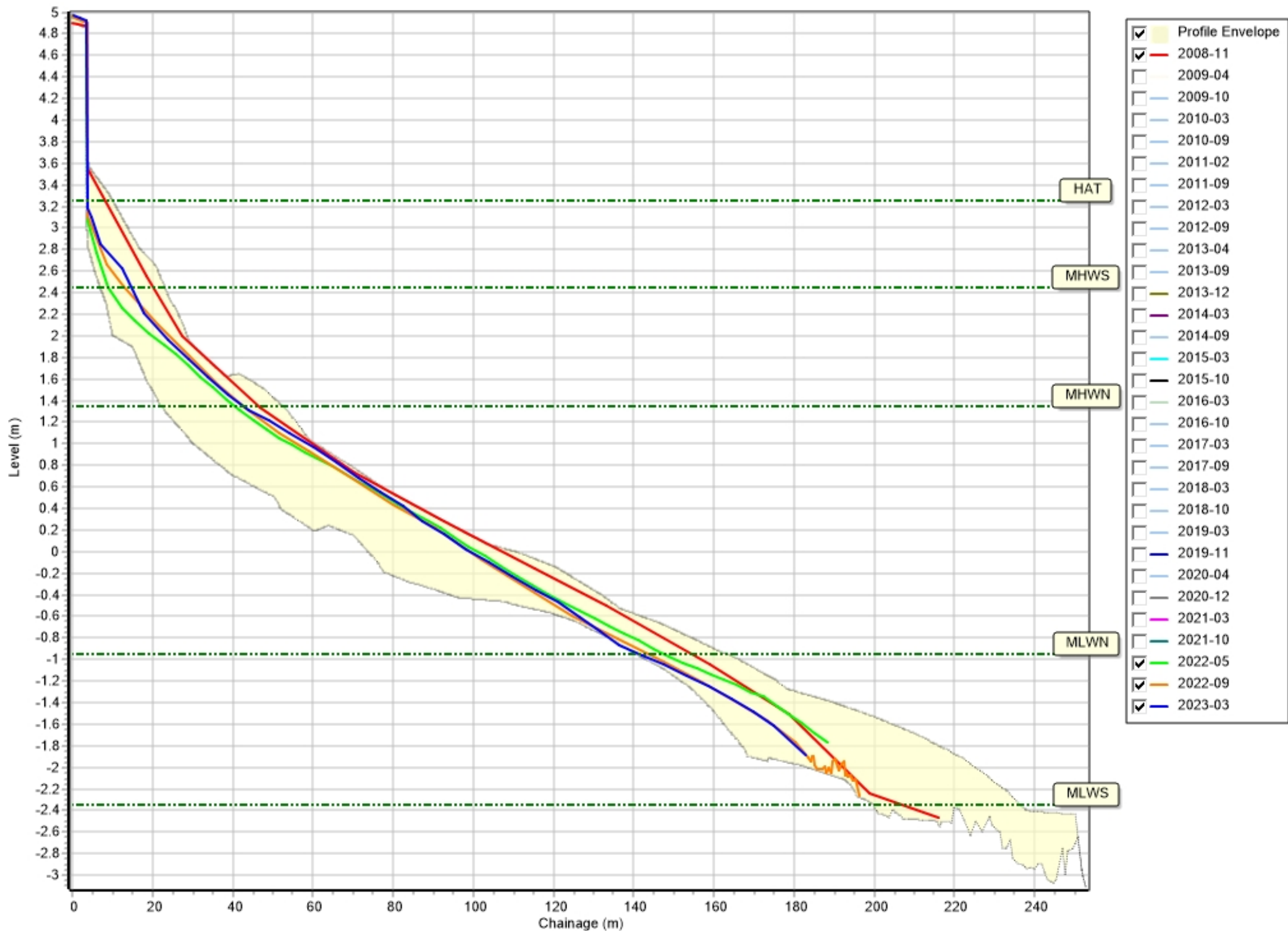
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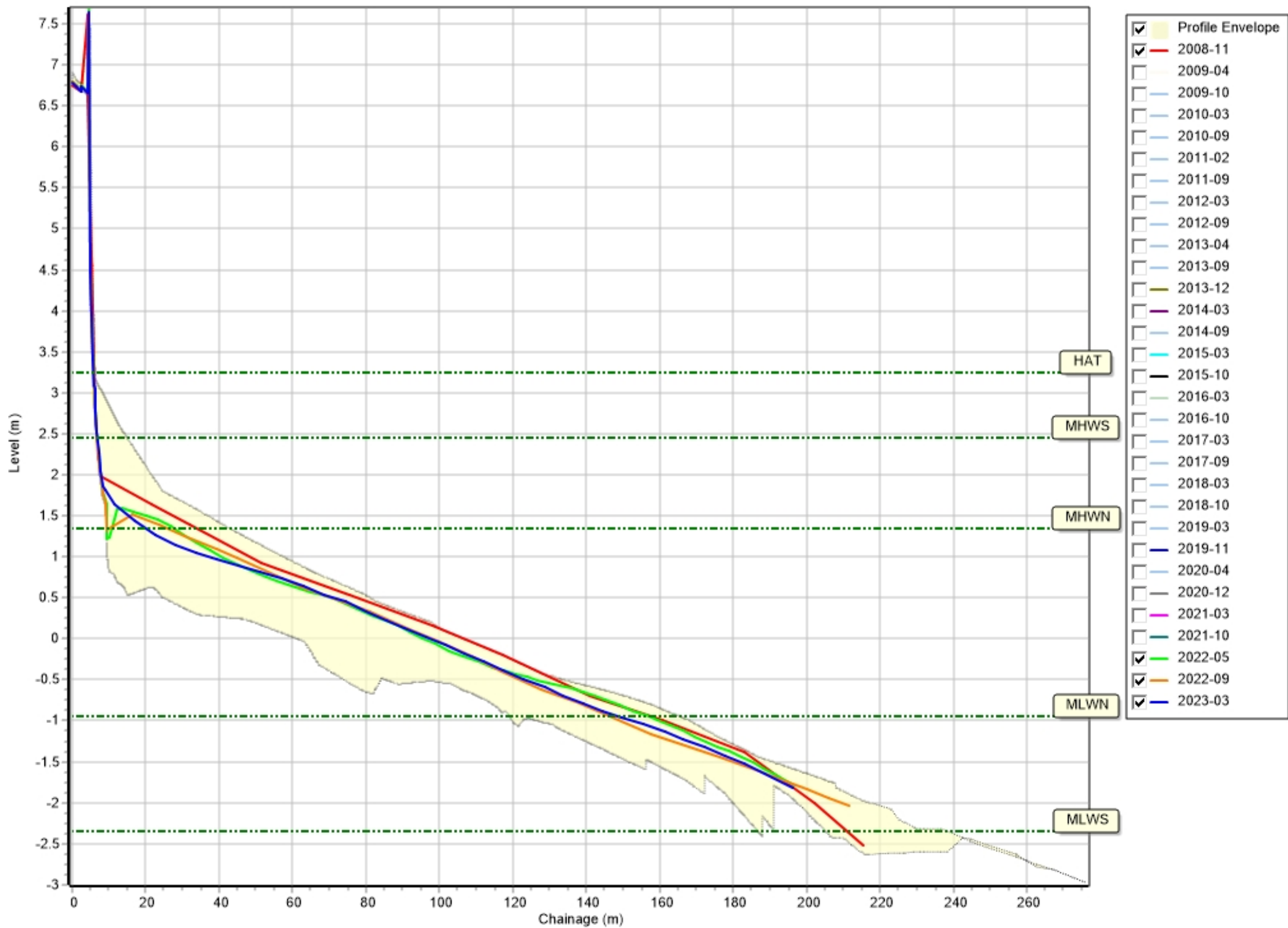
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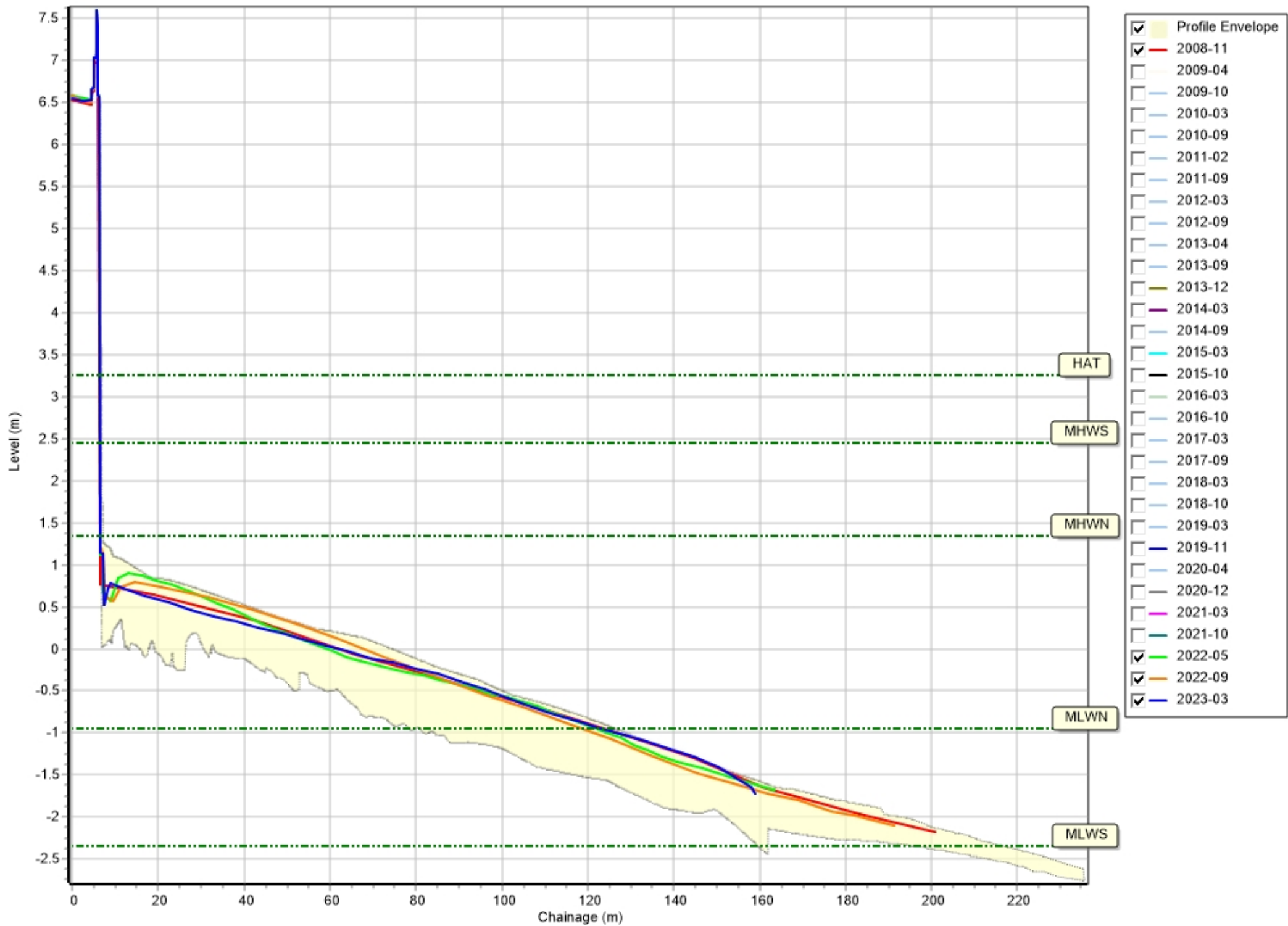
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Profiles: 1dSBS3



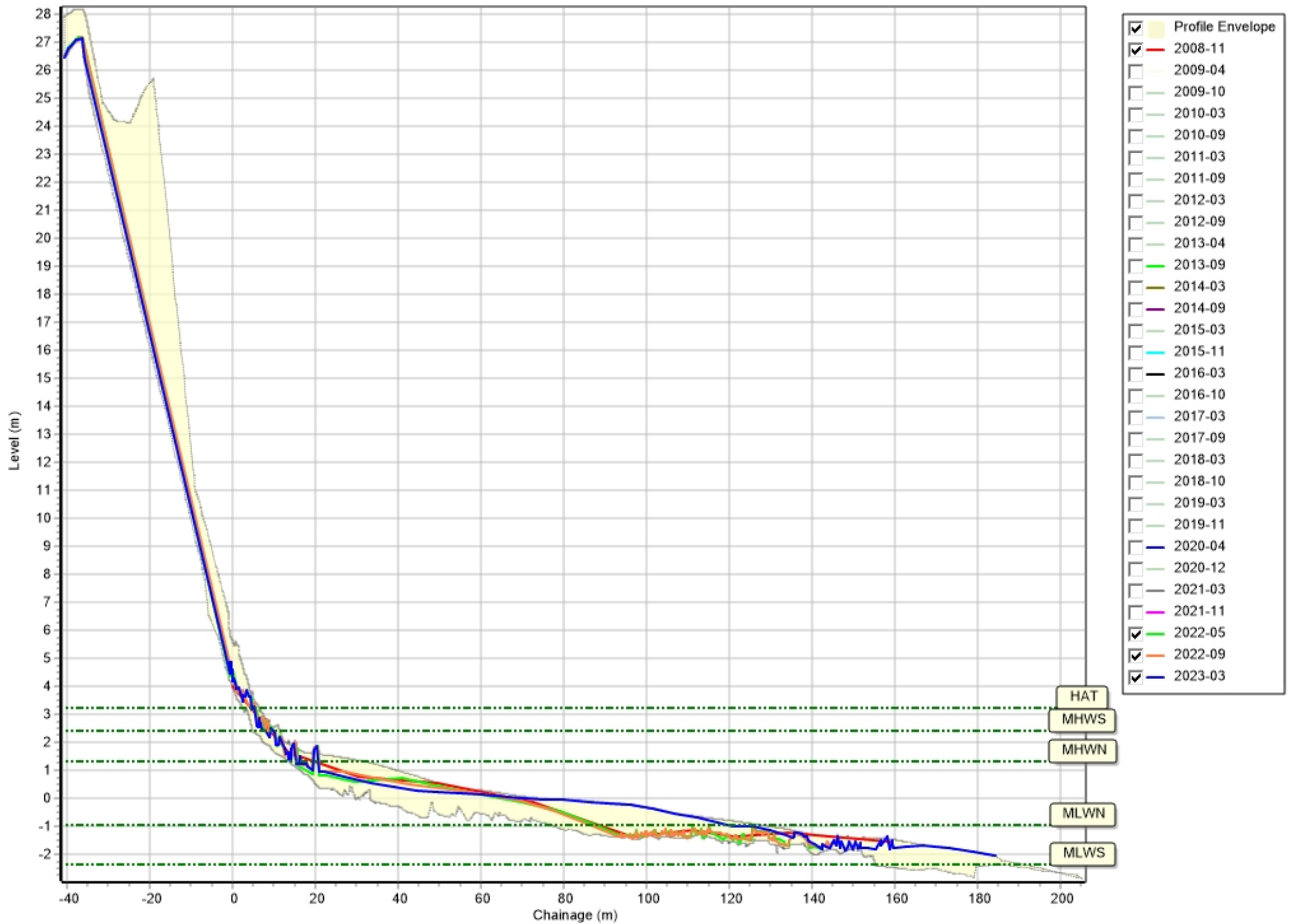
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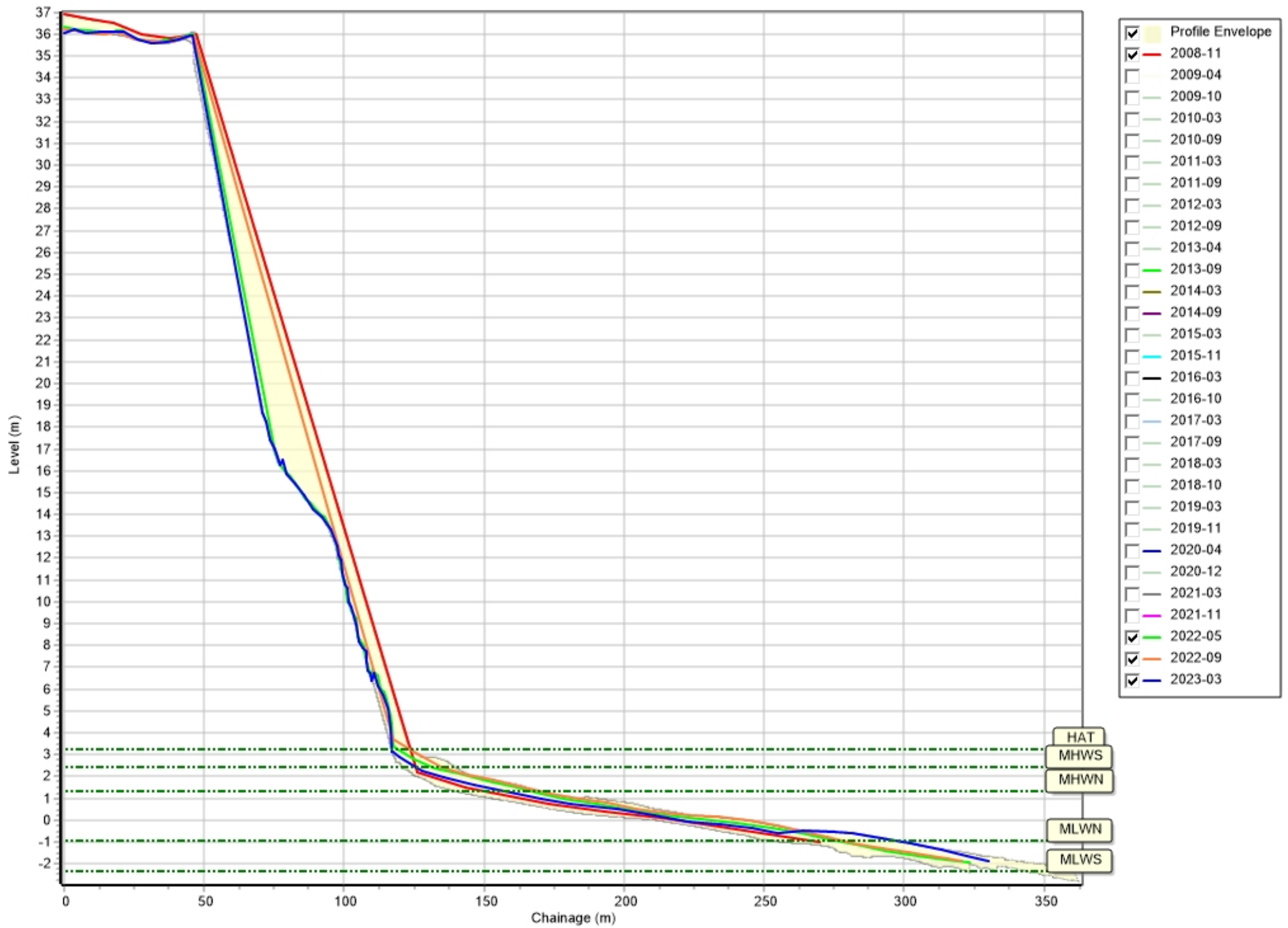
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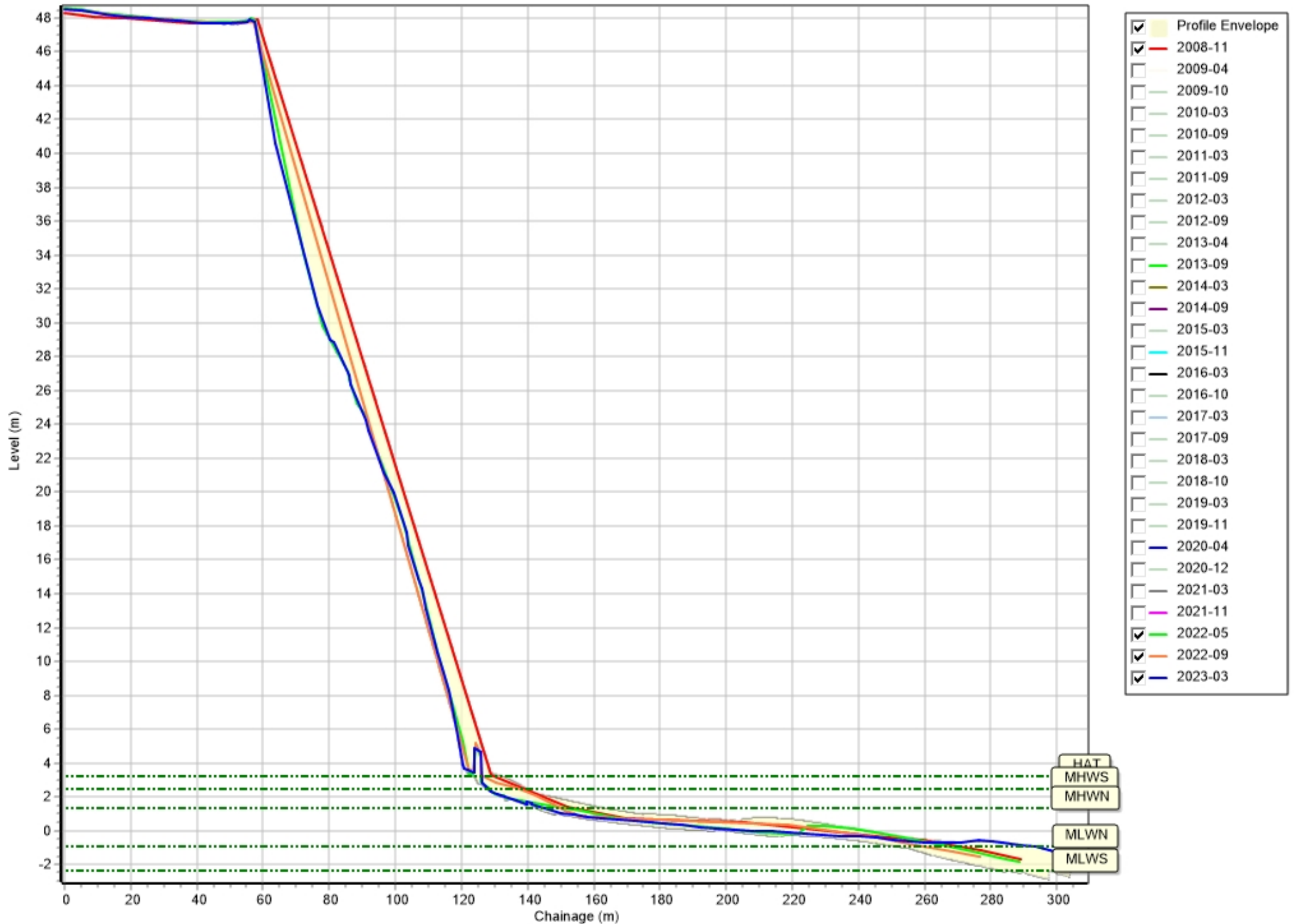
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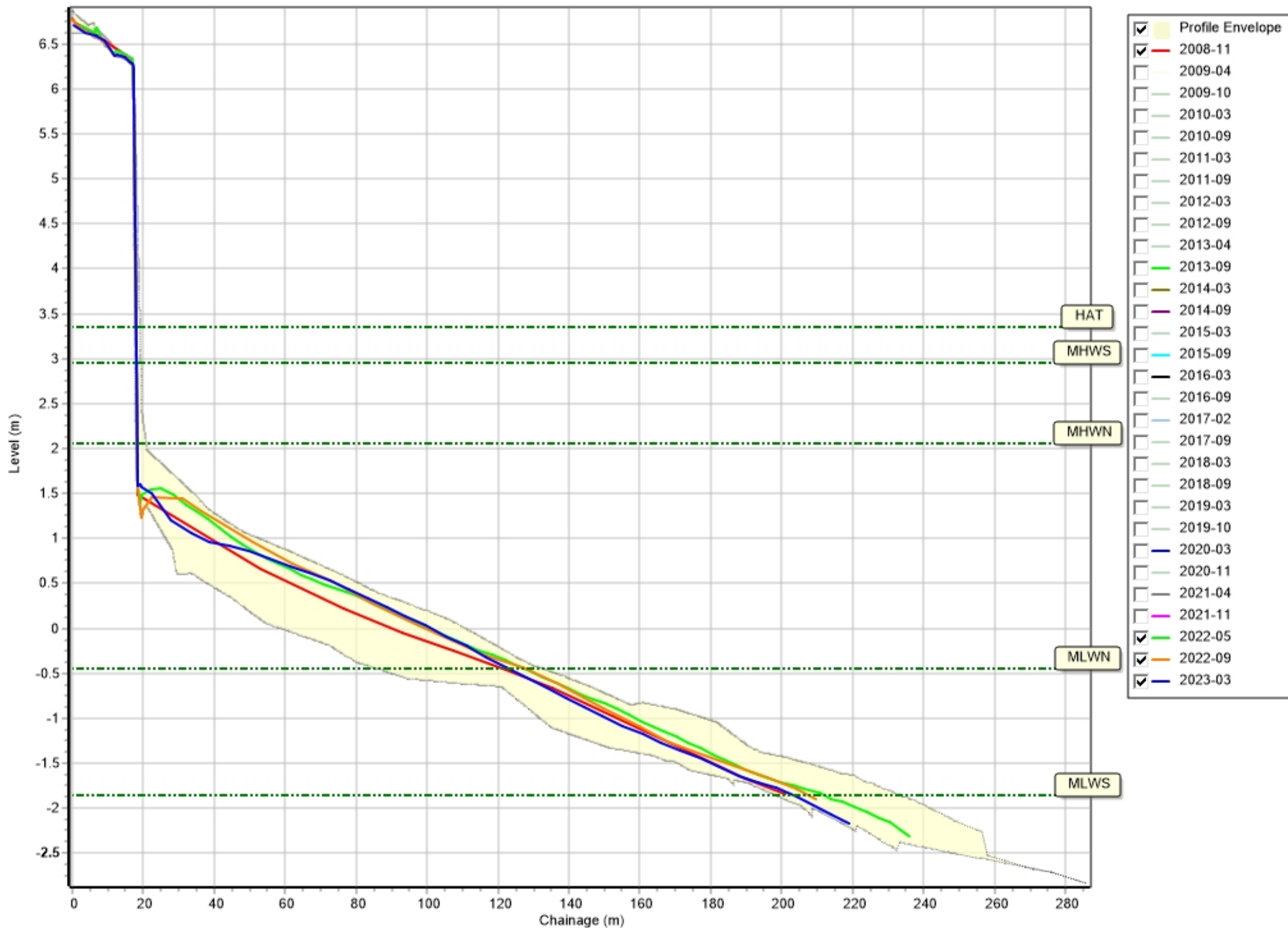
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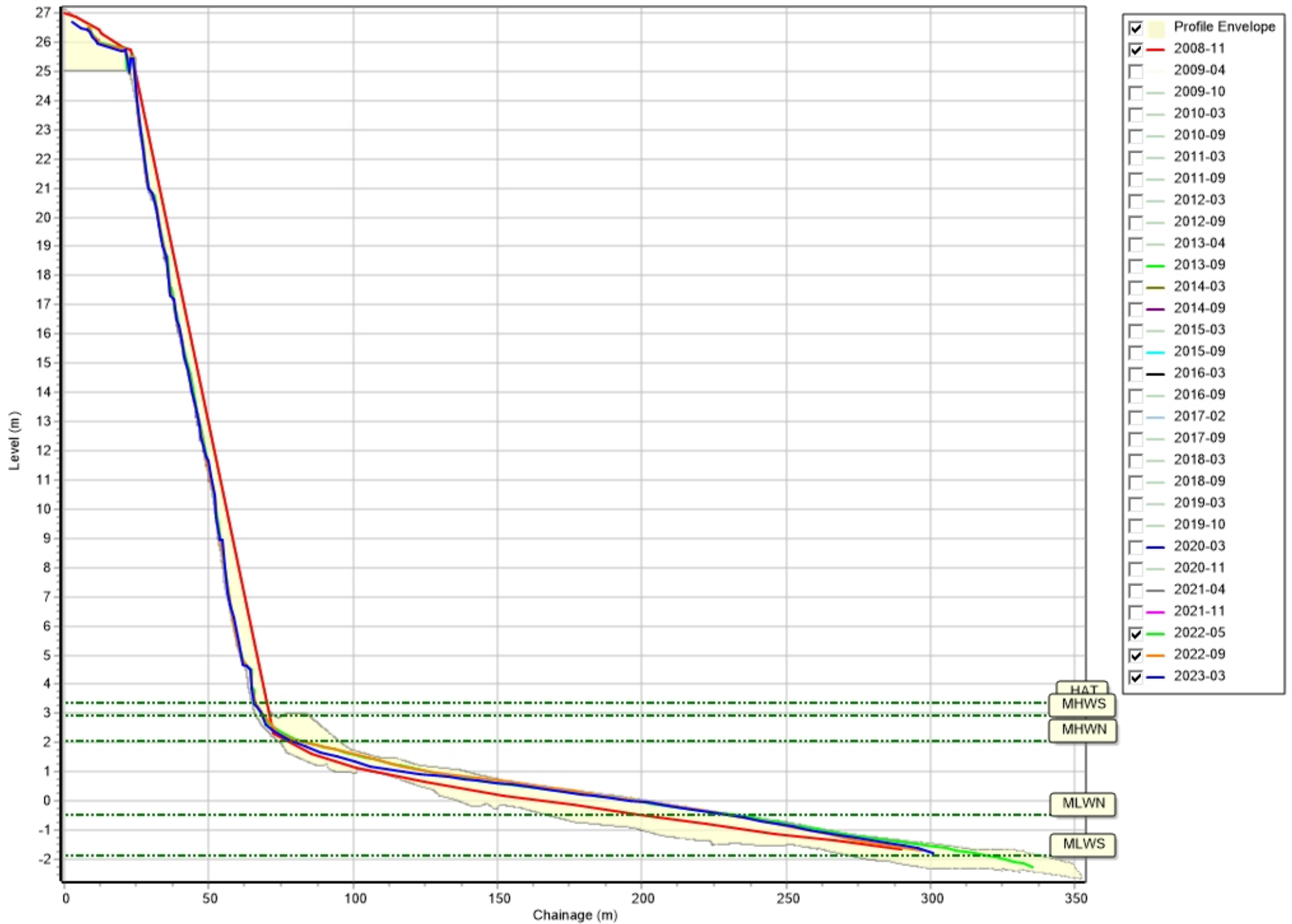
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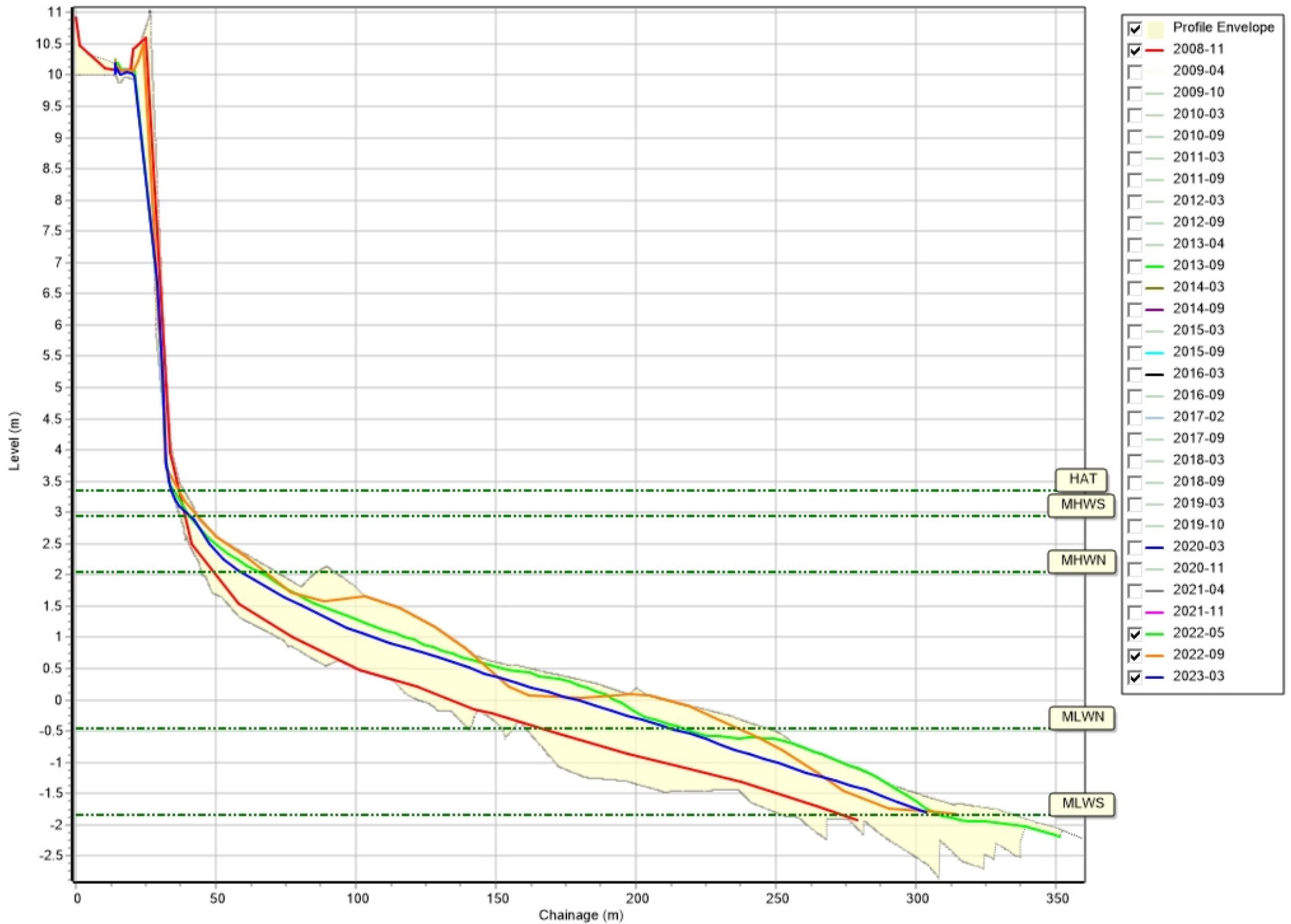
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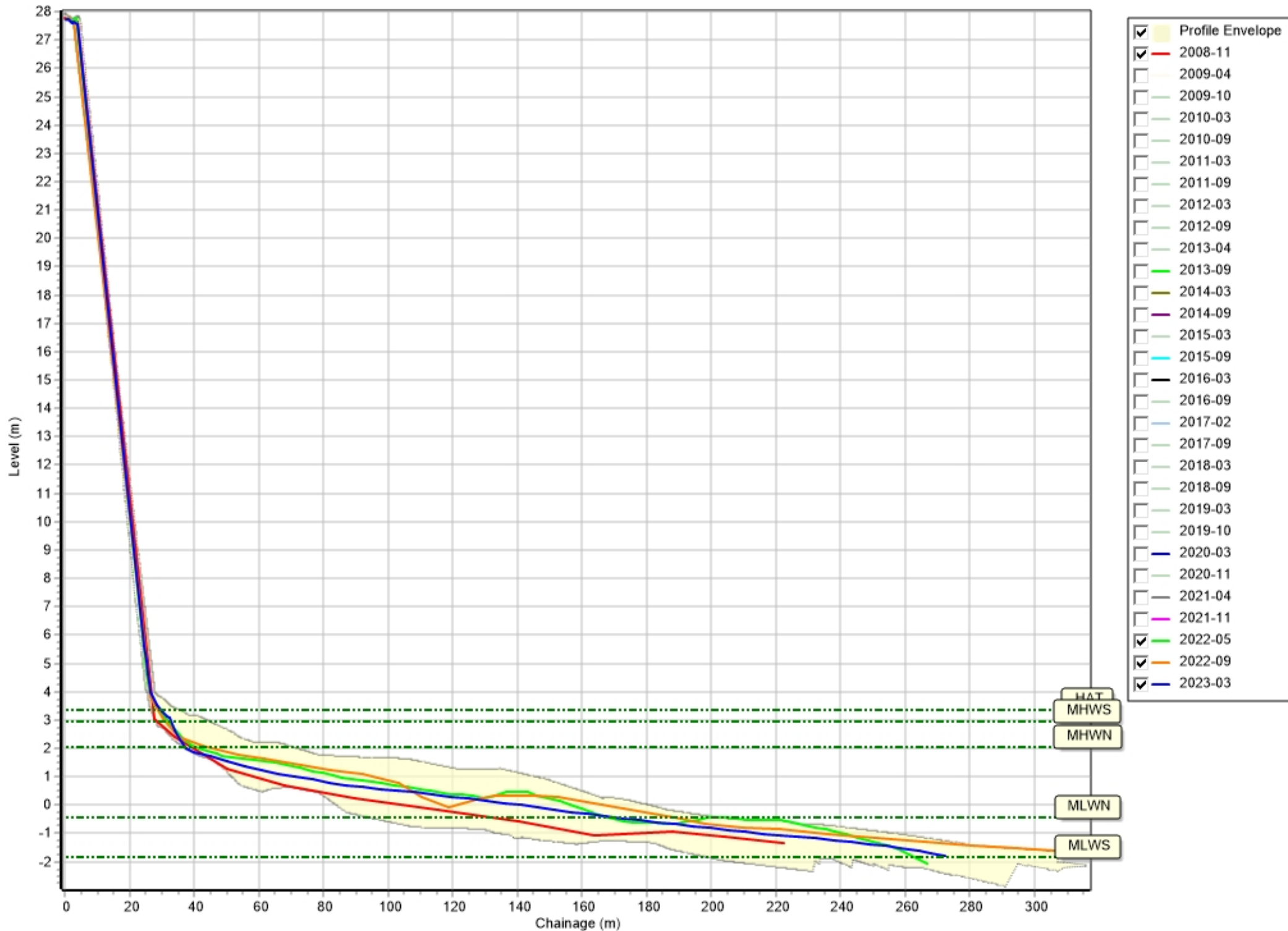
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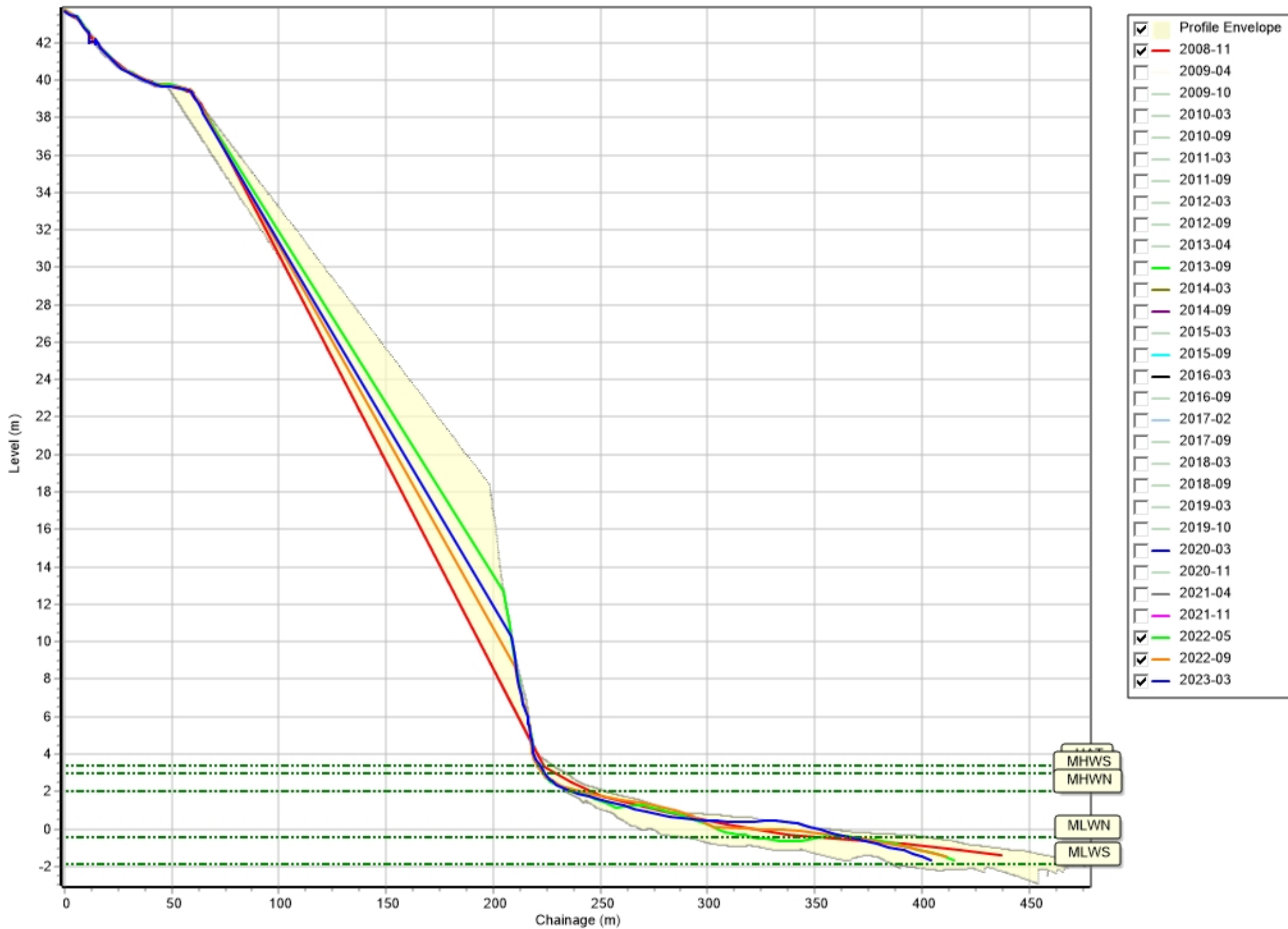
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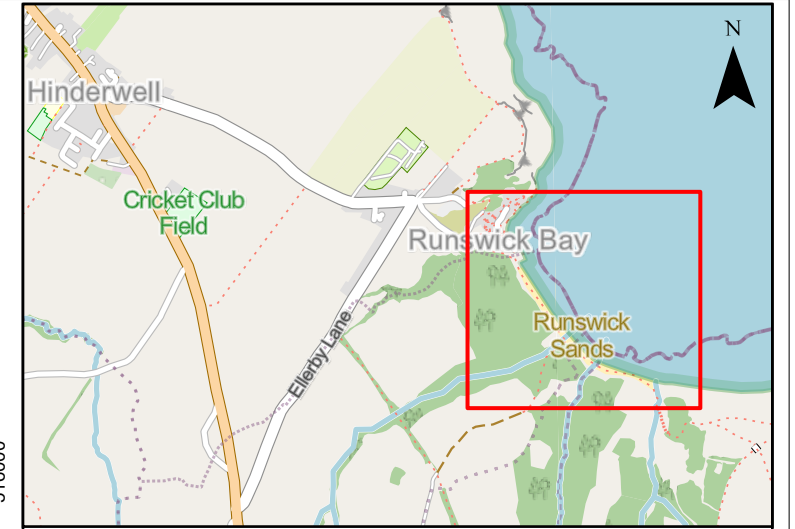
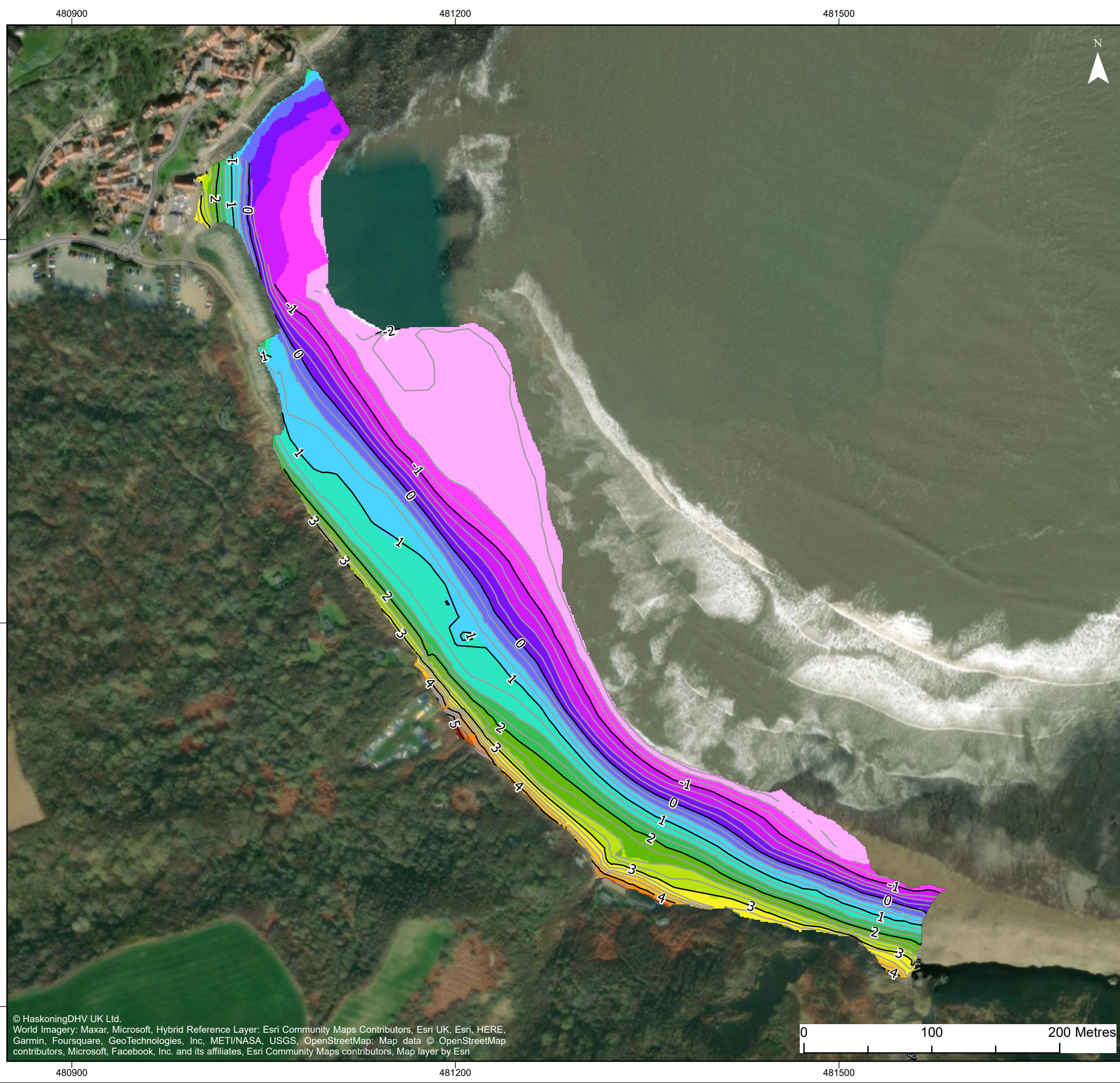
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Profiles: 1dFB5



Appendix B
Topographic Survey



TOPOGRAPHIC SURVEY (March 2023)

Elevation (mOD)	Contours (mOD)*
<ul style="list-style-type: none"> -2 - -2 -1.9 - -1.5 -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 	<ul style="list-style-type: none"> 1.0m interval 0.25m interval <p>* Contours only cover sandy beach areas.</p>

Client: North East Coastal Group	Project: Cell 1 Regional Coastal Monitoring Programme
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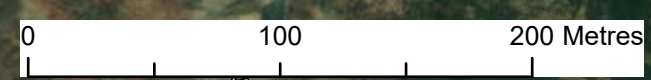
Title:
**Appendix B - Map 1
RUNSWICK BAY
North Yorkshire Council**

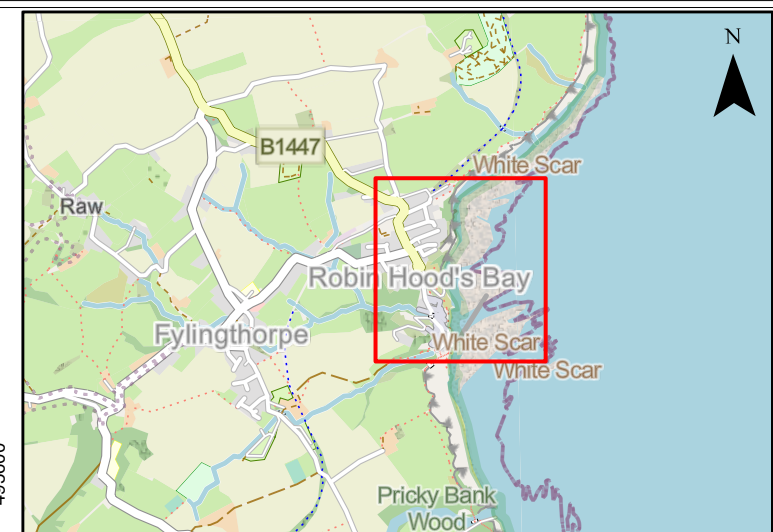
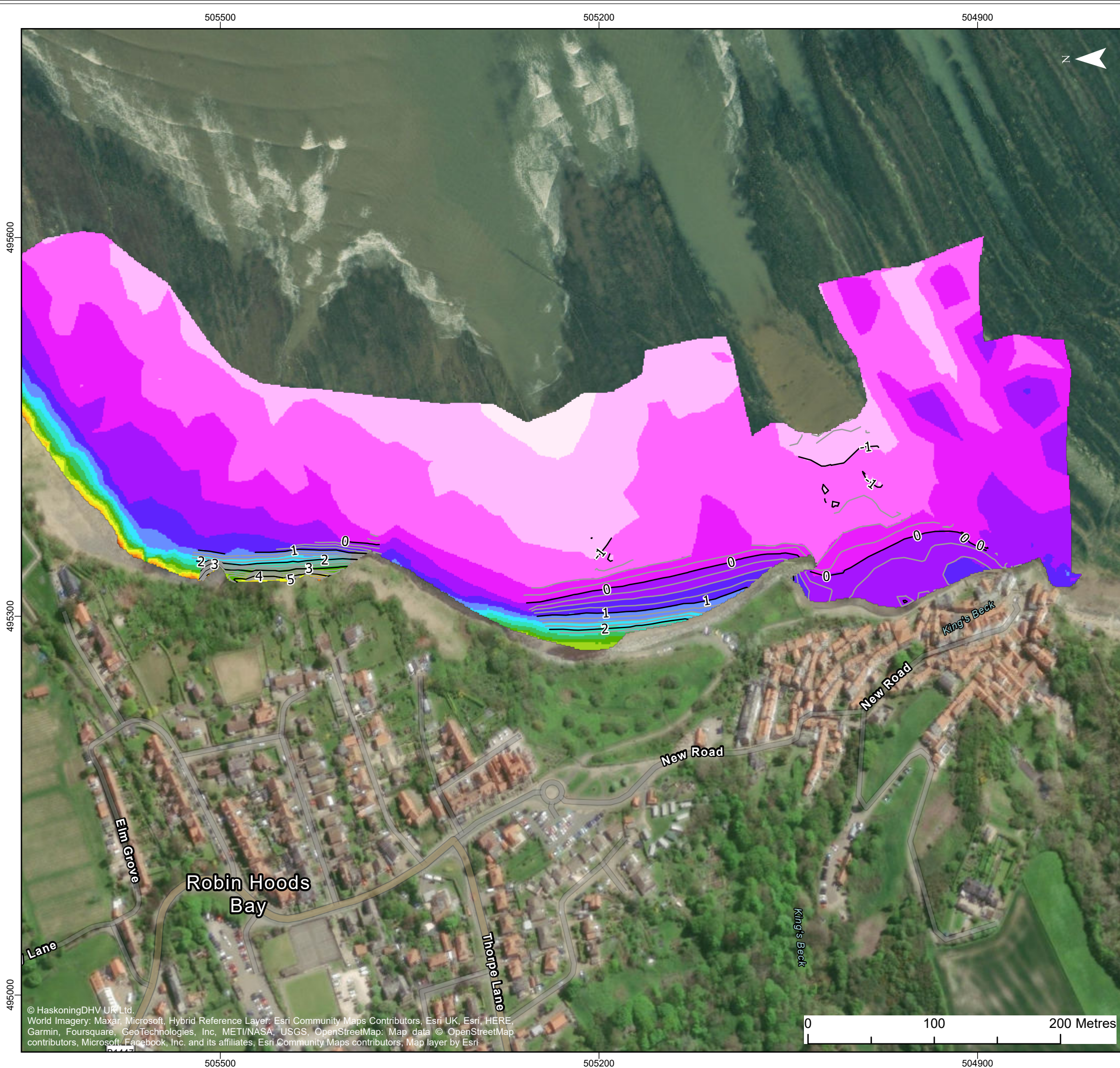
Report:
**Update Report
'Partial Measures' Survey 2023**

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	30/05/2023	TC	NJC	A3	1:3,000

Co-ordinate system: British National Grid

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TOPOGRAPHIC SURVEY (March 2023)

Elevation (mOD)	Contours (mOD)*
-1.7 - -1.5	— 1.0m interval
-1.4 - -1	— 0.25m interval
-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	

* Contours only cover sandy beach areas.

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

Title:

Appendix B - Map 2

ROBIN HOOD'S BAY

North Yorkshire Council

Report:

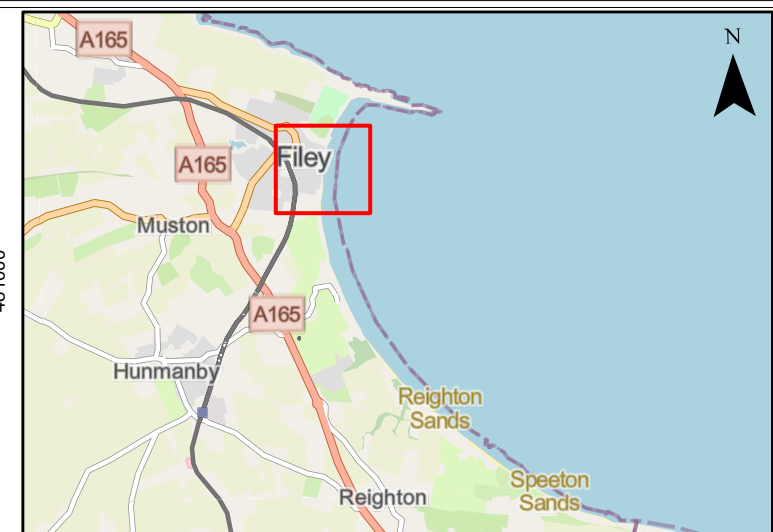
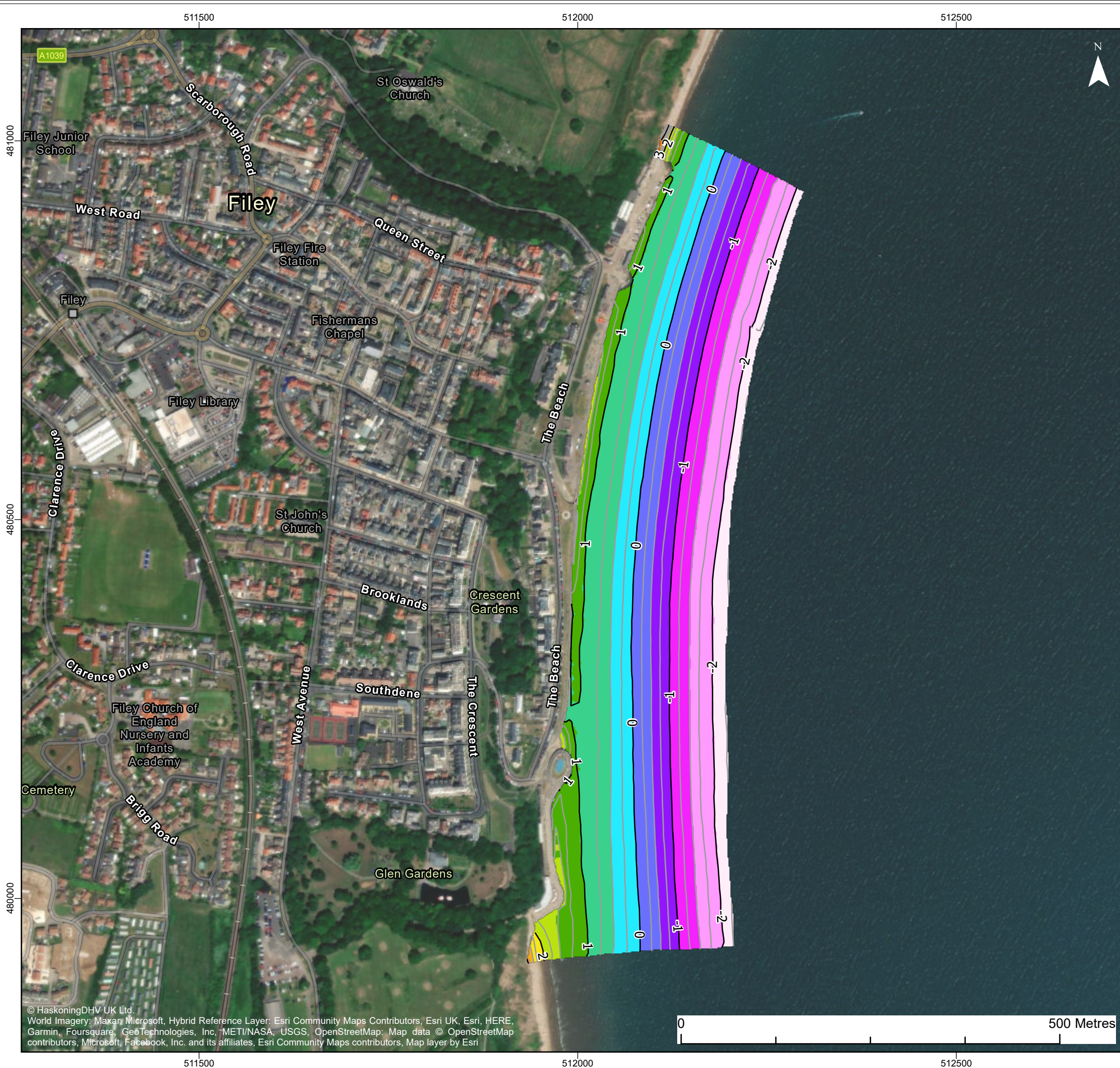
Update Report
'Partial Measures' Survey 2023

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	30/05/2023	TC	NJC	A3	1:3,000

Co-ordinate system: British National Grid



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TOPOGRAPHIC SURVEY (March 2023)

Elevation (mOD)	Contours (mOD)*
-2.2 - -2	— 1.0m interval
-1.9 - -1.5	— 0.25m interval
-1.4 - -1	
-0.9 - -0.5	* Contours only cover sandy beach areas.
-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	

Client: North East Coastal Group	Project: Cell 1 Regional Coastal Monitoring Programme
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Title:
Appendix B - Map 3
FILEY
North Yorkshire Council

Report:
Update Report
'Partial Measures' Survey 2023

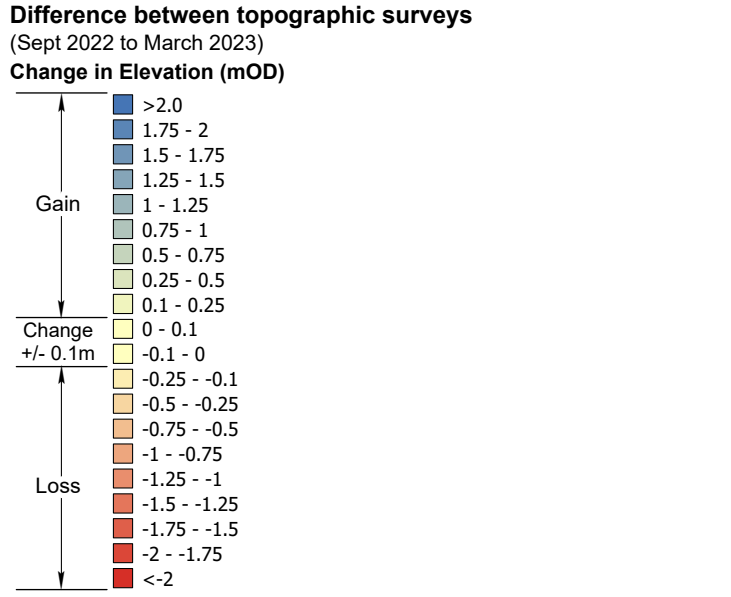
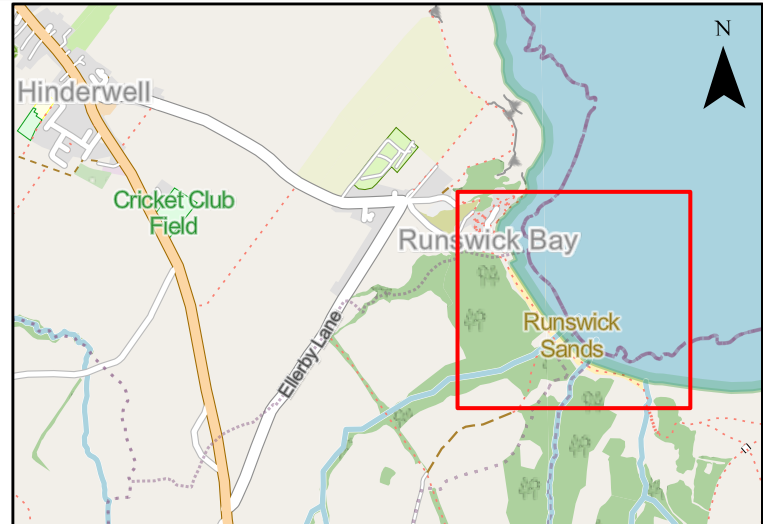
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	30/05/2023	TC	NJC	A3	1:5,000

Co-ordinate system: British National Grid

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North East Coastal Observatory

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

Title:

Appendix B - Map 4

RUNSWICK BAY

North Yorkshire Council

Report:

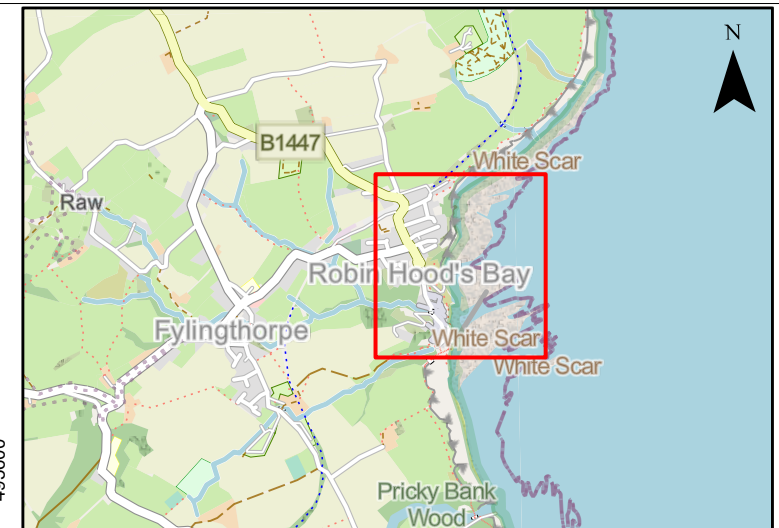
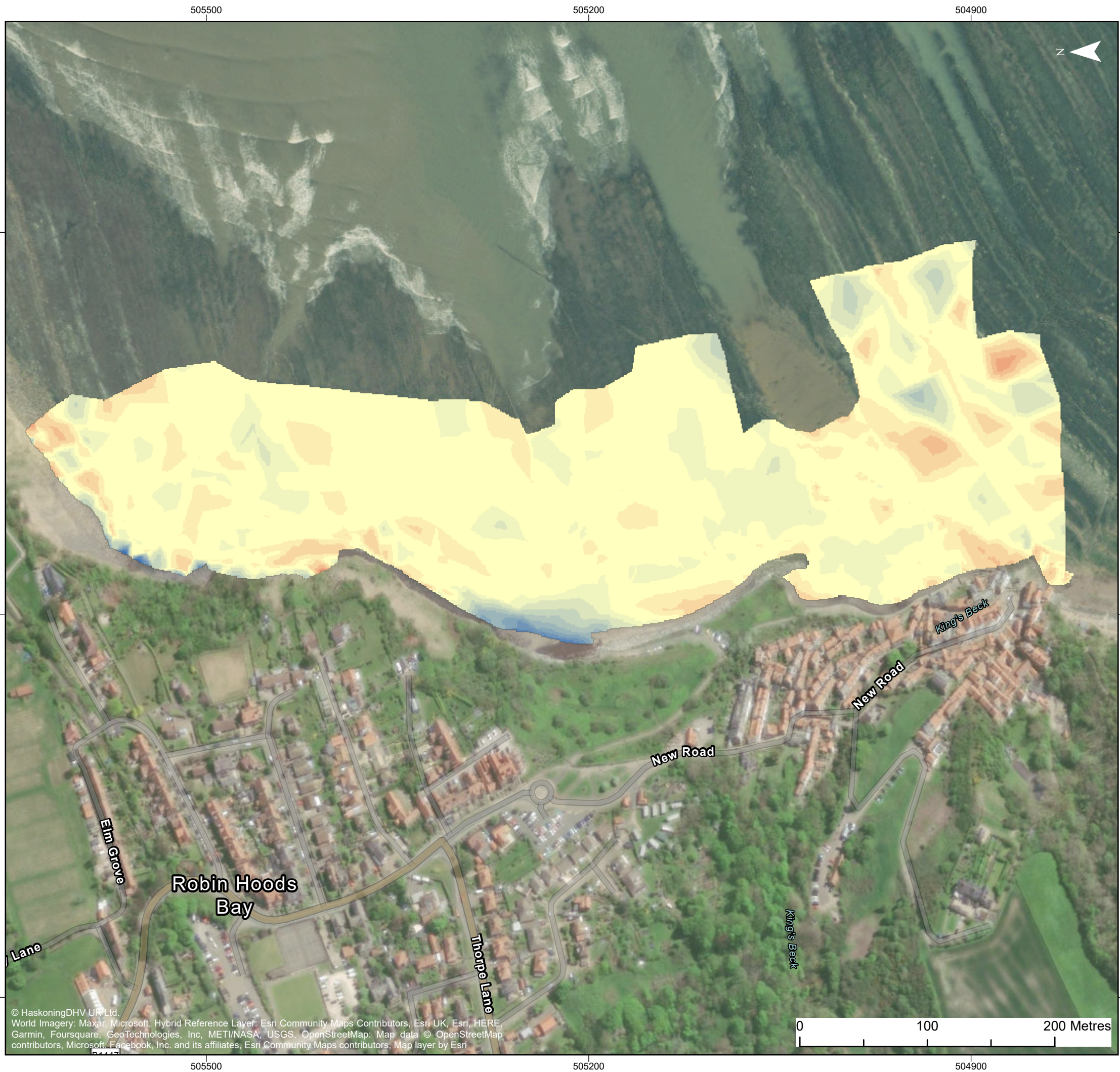
Update Report
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Co-ordinate system: British National Grid

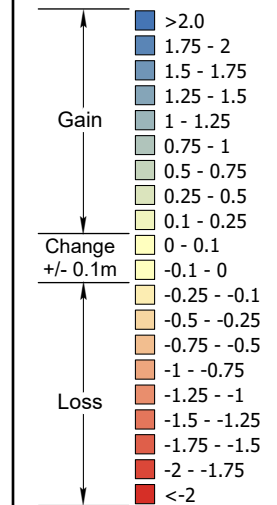


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Difference between topographic surveys
(Sept 2022 to March 2023)

Change in Elevation (mOD)



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

Title:

Appendix B - Map 5

ROBIN HOOD'S BAY

North Yorkshire Council

Report:

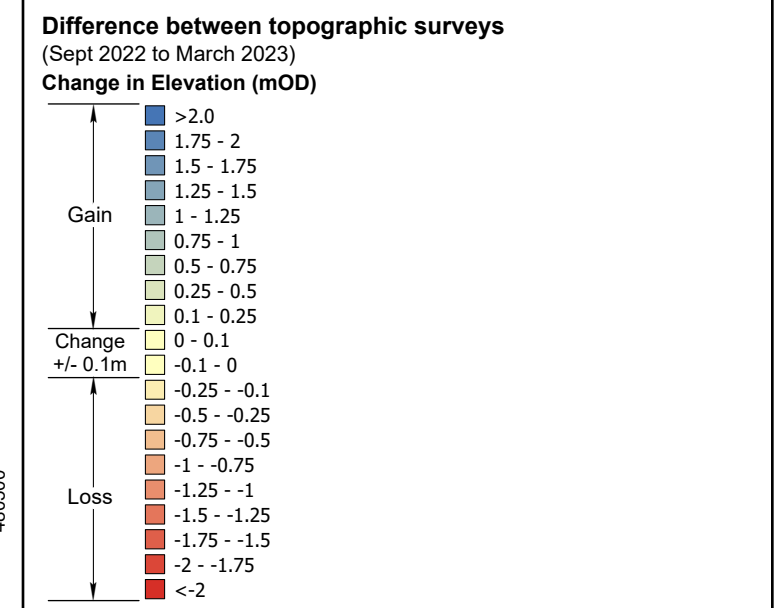
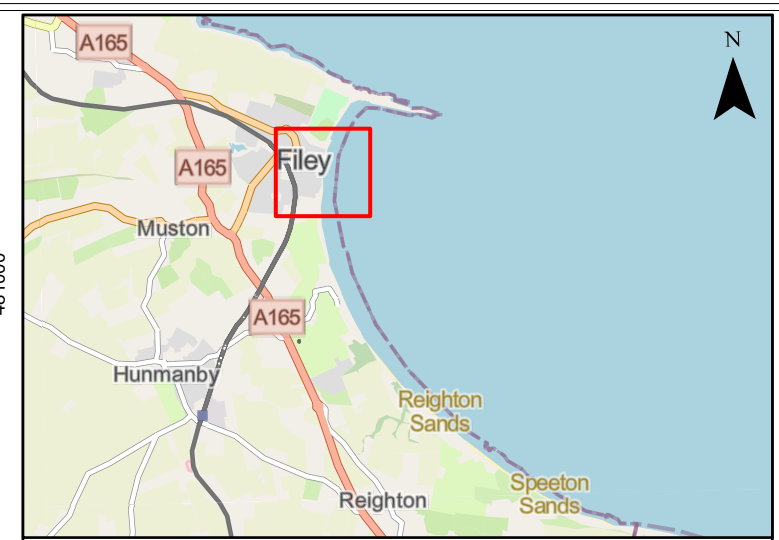
Update Report
'Partial Measures' Survey 2023

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	30/05/2023	TC	NJC	A3	1:3,000

Co-ordinate system: British National Grid



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Client: North East Coastal Group	Project: Cell 1 Regional Coastal Monitoring Programme
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Title:
Appendix B - Map 6
FILEY
North Yorkshire Council

Report:
Update Report
'Partial Measures' Survey 2023

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
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Co-ordinate system: British National Grid



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Appendix C
Cliff Top Survey

Cliff Top Survey

Staithes

Twenty ground control points have been established at Staithes (Figure C1). The maximum separation between any two points is nominally 100m.

The cliff top surveys at Staithes 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 2008 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

Table C1 – Cliff Top Surveys at Staithes

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
STAITHES				Nov 2008	Oct 2022	March 2023	Nov 2008 - Mar 2023	Oct 2022 - Mar 2023	Nov 2008 - Mar 2023
1	477228	518769	320	1.90	-5.36	-5.70	7.60	0.34	0.51
2	477334	518798	0	10.90	10.65	10.61	0.29	0.04	0.02
3	477487	518789	350	7.10	8.03	7.90	-0.80	0.13	0.00
4	477594	518801	340	5.90	3.41	3.41	2.49	0.00	0.17
5	477683	518911	350	8.40	8.21	8.21	0.19	0.00	0.01
6	477792	518867	30	8.60	8.45	8.44	0.16	0.01	0.01
7	477891	518828	60	7.70	7.25	7.17	0.53	0.08	0.04
8	477959	518873	350	8.70	8.36	8.31	0.39	0.05	0.03
9	478088	518950	350	7.60	7.86	7.84	-0.24	0.02	0.00
10	478191	519023	340	8.40	8.58	8.53	-0.13	0.05	0.00
11	478237	519007	60	6.90	6.49	6.50	0.40	-0.01	0.03
12	478213	518988	150	6.10	6.44	6.28	-0.18	0.16	0.00
13	478501	518809	15	11.40	8.17	8.15	3.25	0.02	0.22

14	478624	518807	20	7.50	7.26	7.15	0.35	0.11	0.02
15	478737	518858	60	6.10	6.24	6.19	-0.09	0.05	0.00
16	478823	518757	60	8.00	8.64	8.61	-0.61	0.03	0.00
17	478944	518671	30	9.30	8.62	8.62	0.68	0.00	0.05
18	479052	518630	20	9.20	8.90	9.02	0.18	-0.12	0.01
19	479147	518610	0	14.20	13.77	13.75	0.45	0.02	0.03
20	479274	518618	20	11.40	11.15	11.16	0.24	-0.01	0.02

Cliff Top Survey

Robin Hoods Bay

Thirteen ground control points have been established at Robin Hoods Bay (Figure C2). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion. The cliff top surveys at Robin Hoods Bay are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table C2 provides baseline information about these ground control points and results from the 2010 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

Table C2 – Cliff Top Surveys at Robin Hoods Bay

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
ROBIN HOODS BAY				Mar 2010	Sep 2022	March 2023	Mar 2010 - Mar 2023	Sep 2022 - Marc 2023	Mar 2010 - Mar 2023
1	495799.5	506002.2	130	11.60	6.34	6.26	5.34	0.08	0.41
2	495549.2	505807.3	135	9.30	8.95	8.96	0.34	-0.01	0.03
3	495456.3	505740	130	5.00	5.10	5.04	-0.04	0.06	0.00
4	495389.9	505683.7	140	6.30	6.01	6.02	0.28	-0.01	0.02
5	495259.4	505342.5	130	11.30	14.22	14.23	-2.93	-0.01	0.00
6	495231.2	505315.7	95	5.90	5.62	5.68	0.22	-0.06	0.02
7	495184.8	505210.7	85	6.40	7.25	7.26	-0.86	-0.01	0.00
8	495206.5	505153	75	5.00	5.06	5.09	-0.09	-0.03	0.00
9	495287.8	505060.5	80	4.30	4.45	4.48	-0.18	-0.03	0.00
10	495187.8	504708.8	70	3.10	2.32	1.92	1.18	0.40	0.09
11	495226.2	504615.7	120	3.80	2.05	1.94	1.86	0.11	0.14
12	495297.5	504380.2	80	11.00	10.75	10.73	0.27	0.02	0.02
13	495350.4	504193	55	3.70	3.68	3.67	0.03	0.01	0.00

Cliff Top Survey

Scarborough South Bay

Thirteen ground control points have been established at Scarborough South Bay (Figure C3). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion. The cliff top surveys at Scarborough South Bay are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table C3 provides baseline information about these ground control points and results from the 2010 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

Table C3 – Cliff Top Surveys at Scarborough South Bay

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
SCARBOROUGH SOUTH BAY				Mar 2010	Sep 2022	March 2023	Mar 2010 - Mar 2023	May 2022 - Sep 2023	Mar 2010 - Mar 2023
1	504339.5	487887.3	70	7.00	6.97	6.96	0.04	0.01	0.00
2	504422.3	487603.7	80	4.80	4.82	4.82	-0.02	0.00	0.00
3	504534.8	487318.3	40	15.10	14.96	14.96	0.14	0.00	0.01
4	504730.2	487137.9	55	9.60	9.56	9.55	0.05	0.01	0.00
5	504922.9	486837.8	60	8.80	8.48	8.48	0.32	0.00	0.03
6	50571.1	486652.1	75	3.80	3.65	3.63	0.17	0.02	0.01
7	505284.3	486480	35	7.00	6.61	6.65	0.35	-0.04	0.03
8	505597.9	486363.4	30	8.60	8.28	8.24	0.36	0.04	0.03
9	505758.6	486005.1	45	9.10	8.41	8.46	0.64	-0.05	0.05
10	505896	485889.6	15	14.80	14.62	14.66	0.14	-0.04	0.01
11	505990	485657.1	80	4.70	0.89	0.98	3.72	-0.09	0.31
12	506024.9	485421.8	55	6.10	2.90	3.11	2.99	-0.21	0.25
13	506036	485315.3	90	7.00	6.60	6.86	0.14	-0.26	0.01

Cliff Top Survey

Cayton Bay

Eight ground control points have been established at Cayton Bay (Figure C4). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion.

The cliff top surveys at Cayton Bay 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 C4 provides baseline information about these ground control points and results from the 2008 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

Table C4 – Cliff Top Surveys at Cayton Bay

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
CAYTON BAY				Nov 2008	Sep 2022	March 2023	Nov 2008 - Mar 2023	May 2022 - Sep 2023	Nov 2008 - Mar 2023
1	506325.5	484849.7	50	4.00	3.48	3.45	0.55	0.03	0.04
2	506459.4	484715.9	65	5.00	UTS	UTS	UTS	UTS	UTS
3	506597.4	484538.6	65	5.00	5.50	5.51	-0.51	-0.01	0.00
4	506778.1	484345.5	21	9.00	5.59	5.60	3.40	-0.01	0.24
5	507018.6	484221.6	342	7.70	7.86	7.93	-0.23	-0.07	0.00
6	507242.3	484121.7	2	7.40	5.78	5.79	1.61	-0.01	0.12
7	507518.2	484008.2	25	7.50	7.36	7.54	-0.04	-0.18	0.00
8	507818.7	484006	1	5.50	5.42	5.49	0.01	-0.07	0.00

Cliff Top Survey

Filey Bay

Twenty-eight ground control points have been established in Filey Bay (Figure C5 and C6). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion.

The cliff top surveys at Filey Bay 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 C5 provides baseline information about these ground control points and results from the 2008 (baseline) (and 2011 baseline for profiles 12A and 24-27) 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 C5 – Cliff Top Surveys in Filey Bay

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
FILEY				Nov 2008	Sep 2022	March 2023	Nov 2008 - Mar 2023	Sep 2022 - March 2023	Nov 2008 - Mar 2023
1	512444.9	481630.9	130	8.70	8.35	8.29	0.41	0.06	0.03
2	512306.7	481490.3	144	7.60	7.76	7.72	-0.12	0.04	0.00
3	512153.6	481234.6	122	8.30	8.00	8.18	0.12	-0.18	0.01
4	512029.2	480959.9	115	7.40	6.80	7.17	0.23	-0.37	0.02
5	511895.4	479888	89	7.10	UTS	UTS	UTS	UTS	UTS
6	511908.5	479597.1	48	6.70	5.62	5.38	1.32	0.24	0.09
7	511991.4	479310.4	69	6.70	1.34	0.77	5.93	0.57	0.42
8	512083.4	478981.5	66	10.20	10.25	10.06	0.14	0.19	0.01
9	512121.3	478786.3	76	8.30	8.26	8.18	0.12	0.08	0.01
10	512226.2	478547.9	74	7.50	5.71	5.69	1.81	0.02	0.13
11	512471.4	478153.5	53	6.60	6.72	6.69	-0.09	0.03	0.00
12*	512558.9	477901.9	66	7.70	UTS	UTS	UTS	UTS	UTS
12A*	512655.8	477822.4	67	13.90	UTS	UTS	UTS	UTS	UTS
13**	512697.6	477719	34	4.20	UTS	UTS	UTS	UTS	UTS

13A*	512805.5	477572.1	32	13.42	9.94	9.86	3.56	0.08	0.25
14	512939.4	477400.9	66	8.00	6.26	6.23	1.77	0.03	0.13
15	513157	477192.7	51	5.20	4.61	4.52	0.68	0.09	0.05
16	513299.5	477024.6	30	7.70	5.87	5.68	2.02	0.19	0.14
17	513507.7	476821.1	34	10.70	10.05	9.95	0.75	0.10	0.05
18	513721	476602.3	31	7.20	5.98	5.88	1.32	0.10	0.09
19	513916.6	476354.1	51	6.60	6.21	6.19	0.41	0.02	0.03
20	514174.8	476179.4	32	7.00	6.06	6.07	0.93	-0.01	0.07
21	514471.5	475965.7	66	7.60	7.04	7.40	0.20	-0.36	0.01
22	514656.2	475728.8	101	8.10	6.94	6.93	1.17	0.01	0.08
23	514889.5	475537.6	60	9.10	7.63	7.66	1.44	-0.03	0.10
24*	512603.7	481665.9	14	19.90	19.83	19.76	0.14	0.07	0.01
25*	512607.1	481648.9	184	17.20	16.97	16.93	0.27	0.04	0.02
26*	512301.9	481825.5	18	11.00	10.79	10.69	0.31	0.10	0.02
27*	512475.8	481712.1	20	11.60	11.24	11.22	0.38	0.02	0.03

NOTE: *baseline for 12A and 24-27 is March 2011

**Surveyor's report has previously stated that 'VMPs 5, 12 and 13 were inaccessible due to heavy vegetation'