



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



Redcar and Cleveland 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)
	Coatham Sands to Saltburn Sands
HAT	3.25
MHWS	2.65
MHWN	1.45
MLWN	-0.85
MLWS	-1.95

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.

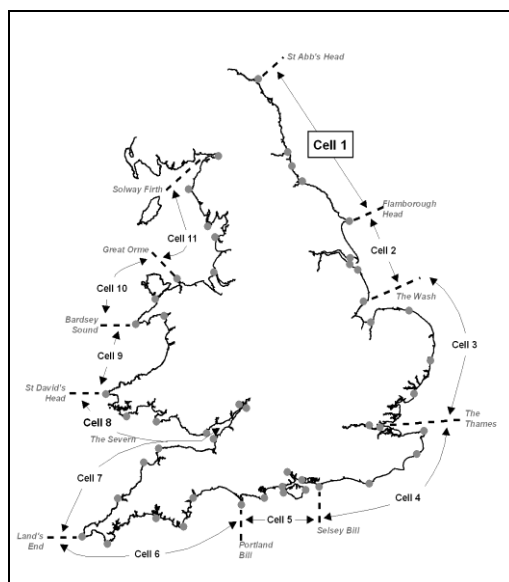


Figure 1 Sediment Cells in England and Wales

The programme commenced in its present guise in September 2008¹ and is managed by Scarborough Borough Council on behalf of the North East Coastal Observatory. It is funded by the Environment Agency, working in partnership with the following organisations:



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

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

1. Introduction

1.1 Study Area

South Gare Breakwater at the mouth of the River Tees estuary to Cowbar Nab at Staithes. For the purposes of this report, it has been sub-divided into six areas, namely:

- Coatham Sands
- Redcar Sands
- Marske Sands
- Saltburn Sands
- Cattersty Sands (Skinningrove)
- Staithes²

1.2 Methodology

Along Redcar & Cleveland Borough Council's frontage, the following surveying is undertaken:

- Full Measures survey annually each autumn/early winter comprising:
 - Beach profile surveys along nine transect lines
 - Topographic survey along Coatham Sands
 - Topographic survey along Redcar Sands
 - Topographic survey along Marske Sands
 - Topographic survey along Saltburn Sands
 - Topographic survey at Skinningrove along Cattersty Sands
- Partial Measures survey annually each spring comprising:
 - Beach profile surveys along nine transect lines
 - Topographic survey along Redcar Sands
 - Topographic survey along Saltburn Sands
 - Topographic survey at Skinningrove along Cattersty Sands
- Cliff top survey (biannually) at:
 - Staithes

The location of these surveys is shown in Figure 2 and 3. The Partial Measures survey was undertaken along this frontage between 19th and 21st April at Redcar (Coatham Sands, Redcar Sands, Marske Sands and Saltburn Sands), 18th March at Skinningrove and 17th March at Staithes. During the surveys the weather was varied with varying sea states. Specific weather conditions are detailed in the survey reports.

Processed data from the present survey are presented in the Appendices.

² The Staithes frontage straddles the boundary of jurisdiction of Redcar & Cleveland Borough Council and Scarborough Borough Council



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 1**
COATHAM SANDS TO SALT BURN SANDS
Redcar and Cleveland Borough Council Frontage

Report: **Survey Report**

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:65,000

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**
CATTERSTY SANDS (SKINNINGROVE)
Redcar and Cleveland Borough Council Frontage

Report: **Survey Report**

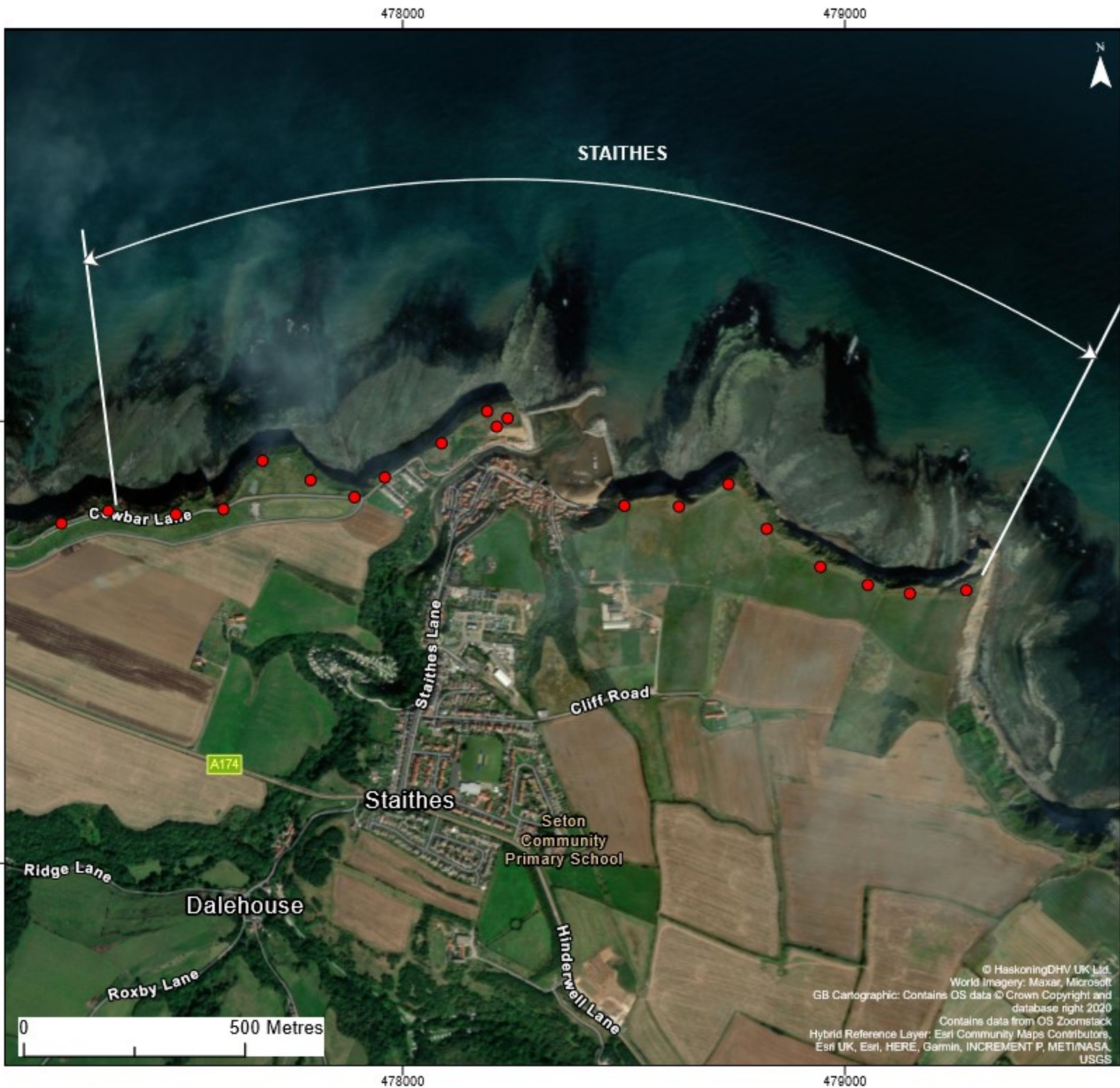
Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:10,000

Co-ordinate system: British National Grid

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 Hybrid Reference Layer: Esri Community Maps Contributors,
 Esri UK, Esri, HERE, Garmin, INCREMENT P, METI/NASA,
 USGS



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

STAITHES

Redcar and Cleveland Borough Council Frontage

Report:

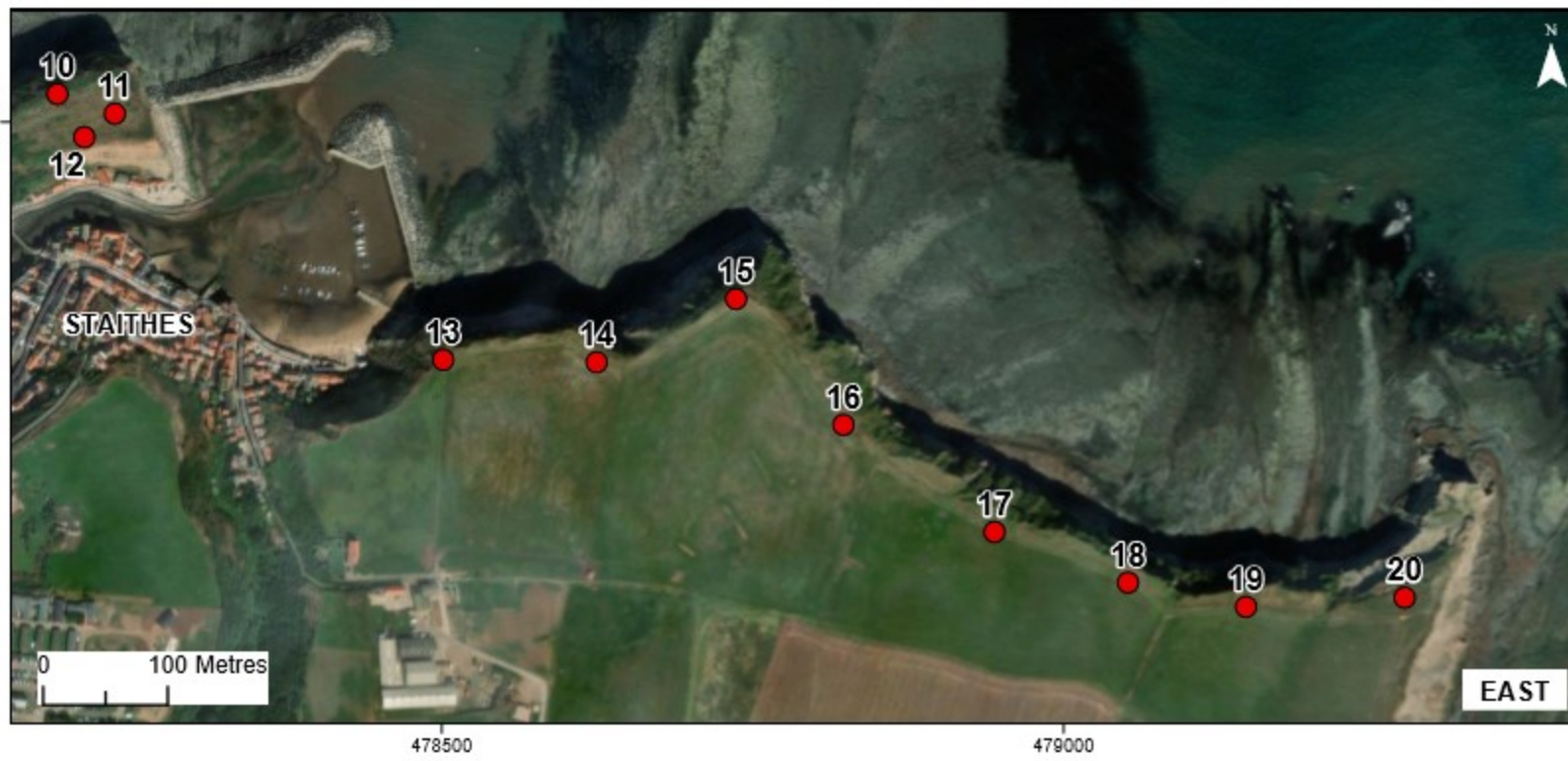
Survey Report

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
Redcar and Cleveland 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



2. Analysis of Survey Data

2.1 Coatham Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>19th – 21st April 2023</p>	<p>Beach Profiles:</p> <p>Coatham Sands is covered by four beach profiles during the Partial Measures survey (1cRC1 to 1cRC4; Appendix A) that were last surveyed in autumn 2022.</p> <p>Profile 1cRC1 is located 300m southeast of the South Gare Breakwater, in the lee of the German Charlies slag banks. The upper profile to 107m chainage is dominated by dunes that have remained stable since the previous survey with all change limited to ± 0.1m. The highest dune (chainage 60m) is unchanged since October 2013. At the toe of the foredune the upper beach has accreted by 0.25m in level up to chainage 135m. Over which length the survey photos highlight embryonic dune growth. At chainage 135m a shallow berm, present in the previous survey, has been eroded / drawn down resulting in a drop in level across the profile, to chainage 220m, of 0.4m. At 220m, the berm is now present resulting in an increase in level to chainage 286m of 0.9m in level. On average, the beach is at a high level when compared to the range of the previous surveys.</p> <p>At profile 1cRC2 the dune system, up until the crest of the foredune at 94m, has remained largely stable with change limited to ± 0.1m. Between 69m and 79m, there is apparent erosion of the landward face of the foredune but through analysis of previous survey profiles and pictures it appears to be as a result of an error in the October 2022 survey. On the face of the foredune there has been accretion of 0.2m up to chainage 115m. Seawards of chainage 155m the beach profile has been dominated by erosion dropping by 0.8m in level. When compared to the range of the previous surveys, the dunes and upper beach are at a high level with the rest of the beach at a medium level.</p> <p>Profile 1cRC3 showed the main dune has remained stable since April 2014, with little change again observed to chainage 55m since October 2022. From chainage 55m to chainage 253m, the beach has increased in level by 0.2m. At chainage 260m to chainage 314m, a shallow berm has formed resulting in an increase in level of up to 0.35m. Seawards of chainage 314m the lower profile has steepened, resulting in a drop in level. The beach is at a very high level when compared to the range of the previous surveys.</p>	<p>Since the previous survey in October 2022, the pattern of change across Coatham Sands is varied. The two most northern profiles have typically experienced more change with erosion dominating along parts of these cross-sections. The two most southern profiles have remained more stable, with a small net accretion evident. The beach remains at healthy level.</p> <p>Longer term trends:</p> <p>All beach profiles at Coatham show the dunes are stable or accreting on their seaward extent. The beaches to the west show a typical longer-term trend of progressive accretion. The beaches in the centre and to the east have a more fluctuating long-term pattern.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>Profile 1cRC4 is located at the beginning of the defended section at Coatham and Redcar. There has been no change in the profile up to the seawall at chainage 12m. At the toe of the seawall the upper beach, between chainage 12m and chainage 19m, has steepened causing an initial accretion against the defence of 0.4m and before switching to erosion of a similar magnitude. This erosion tapers out until no change at chainage 40m. Between chainage 40m and 289m the beach has experienced alternating lengths of low-level erosion and accretion limited to ± 0.15m. A shallow berm on the beach has been removed resulting in a drop in level of 0.3m. Overall, the beach is at a medium level when compared to the range of previous surveys.</p>	

2.2 Redcar Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
19 th - 21 st April 2023	<p>Beach Profiles:</p> <p>Redcar Sands is covered by three beach profiles (1cRC5 to 1cRC7; Appendix A), with 1cRC7 being approximately on the boundary with the Marske Sands area. They were last surveyed in October 2022.</p> <p>At profile 1cRC5 the sea defences constructed in 2012 remain unchanged as far as 18m chainage. The beach levels at the toe of the structure have dropped by 0.15m in level, exposing an additional step on the revetment. The upper beach between chainage 27m and chainage 50m has dropped in level by up to 0.4m exposing an additional length of rocky foreshore. The rocky foreshore remains exposed seaward of chainage 50m. For much of the profile, the beach is at the lowest level on record compared to the range of the previous surveys.</p> <p>Profile 1cRC6 is defended up until chainage 52m and has remained unchanged over this length. At the toe of the defence, the cobble berm has also experienced negligible change up to chainage 65m. Between chainages 65m and 275m, the beach has lowered by to 0.2m in level. Similarly, the beach seawards of chainage 290m has eroded by a comparable magnitude. Despite this, the profile on the whole remains at a medium level when compared to the range of the previous surveys.</p> <p>Profile 1cRC7 is undefended. The cliff top, between chainages 3m and 48m appears to have accreted up to 0.1m in level. This is likely due to vegetation growth. The upper beach, including the cobble berm at the toe of the cliff, has remained stable to chainage 118m with any change limited to ± 0.1m. Between chainage 118m and 214m, and again between 234m and 296m, the beach has eroded by up to 0.35m. When compared to the range of the previous surveys, the beach on the whole is at a medium level with the exception of the upper beach which is at the lowest level on record.</p>	<p>Beach levels remain low between Coatham Rocks and Redcar Rocks, with further erosion taking the beach to its lowest level on record at the toe of the defence. The eastern profiles have also been dominated by erosion but remain at a medium level compared to the range of previous surveys.</p> <p>Longer term trends:</p> <p>Profiles 1cRC5 and 1cRC7 show movement of beach berms across the profile.</p>
	<p>Topographic Survey:</p> <p>Redcar Sands is covered by a 6-monthly topographic survey. Data have been used to create a DGM (Appendix B – Map 1) using a GIS. The DGM shows that the beach topography is broadly parallel to the shore, although there is a slight embayment with a slightly steeper beach between the two headlands at Coatham Rocks and Redcar Rocks. The contours around Redcar Rocks are distorted due to the exposed rocky foreshore.</p>	<p>The topographic difference plots show low level erosion has been dominant across Redcar Sands over Winter 22/23. The most significant change has occurred to the beach fronting Coatham Rocks.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>The GIS has also been used to calculate the differences between the current topographic survey (April 2023) and the previous topographic survey (October 2022), as shown in Appendix B – Map 4, to identify areas of erosion and accretion.</p> <p>The difference plot shows that over winter 22/23, the dominant process across Redcar Sands has been erosion, At the eastern extent, at the transition to Marske Sands, the beach is dominated by low level erosion of between 0.1m and 0.25m in level. At Redcar Rocks, the change is more varied with accretion and erosion evident, the pattern is typical of pockets of sediment moving across the rocky foreshore. The most significant erosion has occurred fronting Coatham Rocks, where erosion across the whole profile is up to 1m in level. To the west, the change again becomes less in magnitude with a balance of accretion and erosion evident.</p>	

2.3 Marske Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>19th – 21st April 2023</p>	<p>Beach Profiles:</p> <p>Marske Sands is covered by two beach profiles during the Partial Measures survey (1cRC7 to 1cRC8; Appendix A). 1cRC7 is on the boundary with the Redcar Sands area.</p> <p>Profile 1cRC7 is located along The Stray and has been discussed in Section 2.2.</p> <p>Profile 1cRC8 is located to the south of Church Howle at Marske by the Sea. The first 55m of the profile are covered by dunes over which all change is limited to ± 0.1m. The beach has generally been dominated by erosion with three bands of erosion evident. The erosion has occurred between chainages 65m and 110m at a magnitude of up to 0.5m, between 136m and 204m at a magnitude of 0.3m and finally between 236m and 300m at a magnitude of 0.5m. Despite this, the profile is generally at a medium level when compared to the range recorded from previous survey with the exception of the upper beach which is at a low level.</p>	<p>Both beach profiles at Marske Sands have been dominated by erosion. Despite this levels remain medium compared to the range of the previous surveys.</p> <p>Longer term trends:</p> <p>The beach and dunes have been recovering since the exceptionally stormy winter of 2013/14 causing record lows The beach levels in April 2022 were at medium level.</p>

2.4 Saltburn Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>Beach Profiles:</p> <p>Saltburn Sands is covered by one beach profile (1cRC9; Appendix A).</p> <p>Profile 1cRC9 is covered by a sea defence as far as chainage 20m and has experienced no change over this defended length. The toe of defence is fronted by a cobble berm to chainage 24m that has remained unchanged. At the toe of the berm the beach level has dropped by 0.3m tapering to no change by chainage 45m. The beach has also been eroded between chainage 60m and 155m (by up to 0.3m in level) and again between chainage 182m and 249m (by up to 0.2m in level). A shallow berm has formed at chainage 249m resulting in an increase in level of the lower beach by 0.2m. Overall, the beach is at a medium level when compared to the range of previous surveys, with the exception of the berm on the beach which is at a high level.</p>	<p>Erosion of the upper beach and accretion of the lower beach suggest a drawdown of material, typical of seasonal patterns.</p> <p>Longer term trends:</p> <p>Over the 12-year monitoring period (2011 – 2023), the range envelope across profile 1cRC9 is limited to 1.1m indicating the stability of the profile at Saltburn.</p>
19 th – 21 st April 2023	<p>Topographic Survey:</p> <p>Saltburn Sands is covered by a 6-monthly topographic survey. Data have been used to create a DGM (Appendix B – Map 2). The beach topography consists of shore parallel contours, distorted only at the interface with Skelton Beck. DGM has been compared against the previous (October 2022) survey in Appendix B – Map 5.</p> <p>The difference plot comparing the DGM's shows that over winter 22/23, Saltburn Sands has been dominated by shoreline parallel bands of erosion. The bands are typically on the middle and lower beach, punctuated by bands of no change or very low-level accretion. The magnitude of erosion is typically between 0.25m and 0.5m. Erosion has also dominated where Skelton Beck discharges across the beach, this erosion is particularly intense at the mouth where the magnitude is up to 1.5m.</p>	

2.5 Cattersty Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
18 th April 2023	<p>Topographic Survey:</p> <p>Cattersty Sands is covered by a 6-monthly topographic survey. Data has been used to create a DGM (Appendix B – Map 3). The beach is steeper to the west of the breakwater than the east, but in both areas the gradient is relatively smooth. East of the breakwater, the beach is punctuated by Kilton Beck and the harbour. Immediately east of the former fishtail groyne (which has since been modified to a rock breakwater arm), the stream has cut a channel, which is most deeply incised at its landward extent. The survey report notes that “<i>strong onshore winds restricted the depth which was achievable on the day.</i>”</p> <p>The April 2023 DGM has been compared against the previous survey (October 2022) in Appendix B – Map 8. To the west of the breakwater, the upper beach has largely been dominated by erosion of up to -0.5m in level. The lower beach has broadly remained stable with the majority of change limited to ± 0.1m. Some low-level accretion is observed on the very lower reaches of the beach and at the toe of the cliffs.</p> <p>A similar pattern is observed to East of the breakwater with large swathes of erosion evident in the lee of the breakwater, across the middle beach and around the reconfigured rock armour roundhead. The most intense swathe of change has occurred landward of the rock armour outcrop, east of the beck, at a magnitude of up to 1m. The lower beach has been dominated by accretion of a low magnitude (+0.25m). The survey report notes that a disused pipeline was also exposed in this location which is usually covered by sand.</p> <p>The survey report also notes a noticeable rock fall to the east of Skinninggrove. This roughly correlates with a patch of accretion observed at the toe of the cliff approximately 1m in magnitude.</p>	<p>The data plot shows that Cattersty Sands has been dominated by erosion over winter 2022/2023. Some low-level accretion across the lower reaches of the beach indicates some level of drawdown of material typical of seasonal patterns.</p> <p>Longer term trends:</p> <p>At Cattersty Sands, the winter erosion dominates the overall behaviour of the beach but the calmer weather in the summer months should lead to some accretion. If the erosion of the upper beach continues it is likely to drive cliff failures which would add material to the upper beach for redistribution.</p>

2.6 Staithes

Survey Date	Description of Changes Since Last Survey	Interpretation
17 th March 2023	<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>

3. Problems Encountered and Uncertainty in Analysis

Cliff Top Surveys

- The cliff top surveys at Staithes are assumed to have an accuracy of ± 0.2 m due to the methodology.
- Survey points 9 to 12 at Staithes were previously cordoned off by the National Trust due to a landslide on the headland. However, access to these points has been permitted since spring 2020.

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

- No further recommendations are made at this stage for the fine-tuning of the monitoring programme.

5. Conclusions and Areas of Concern

- At Coatham Sands, the pattern of change since the previous survey in October 2022 is varied. The two most northern profiles have typically experienced more change with erosion dominating along parts of each cross-section. The two most southern profiles have remained more stable, with a small net accretion evident. The beach remains at healthy level.
- Along Redcar Sands, beach levels remain low between Coatham Rocks and Redcar Rocks with levels now at the lowest level on record at the toe of the defence. The eastern profiles have also been dominated by erosion but remain at a medium level compared to the range of previous surveys
- At Marske Sands, both beach profiles at Marske Sands have been dominated by erosion. Despite this, levels remain medium compared to the range of the previous surveys.
- At Saltburn Sands, Erosion of the upper beach and accretion of the lower beach suggest a drawdown of material, typical of seasonal patterns.
- Across Cattersty Sands, the data plot shows that erosion has dominated over winter 2022/2023. Some low-level accretion across the lower reaches of the beach indicates some level of drawdown of material typical of seasonal patterns.
- At Staithes, 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 measurable change.

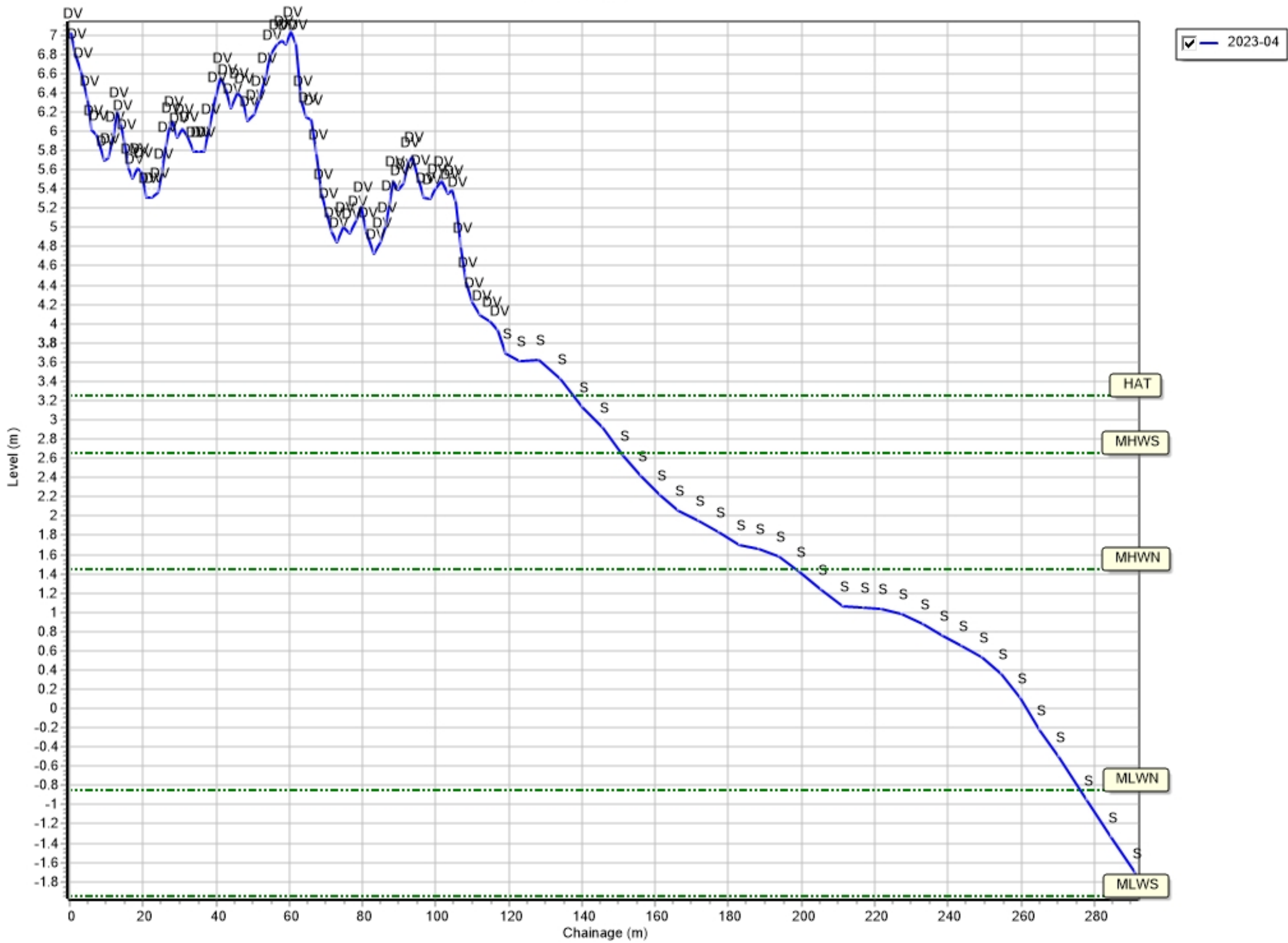
Appendices

Appendix A
Beach Profiles

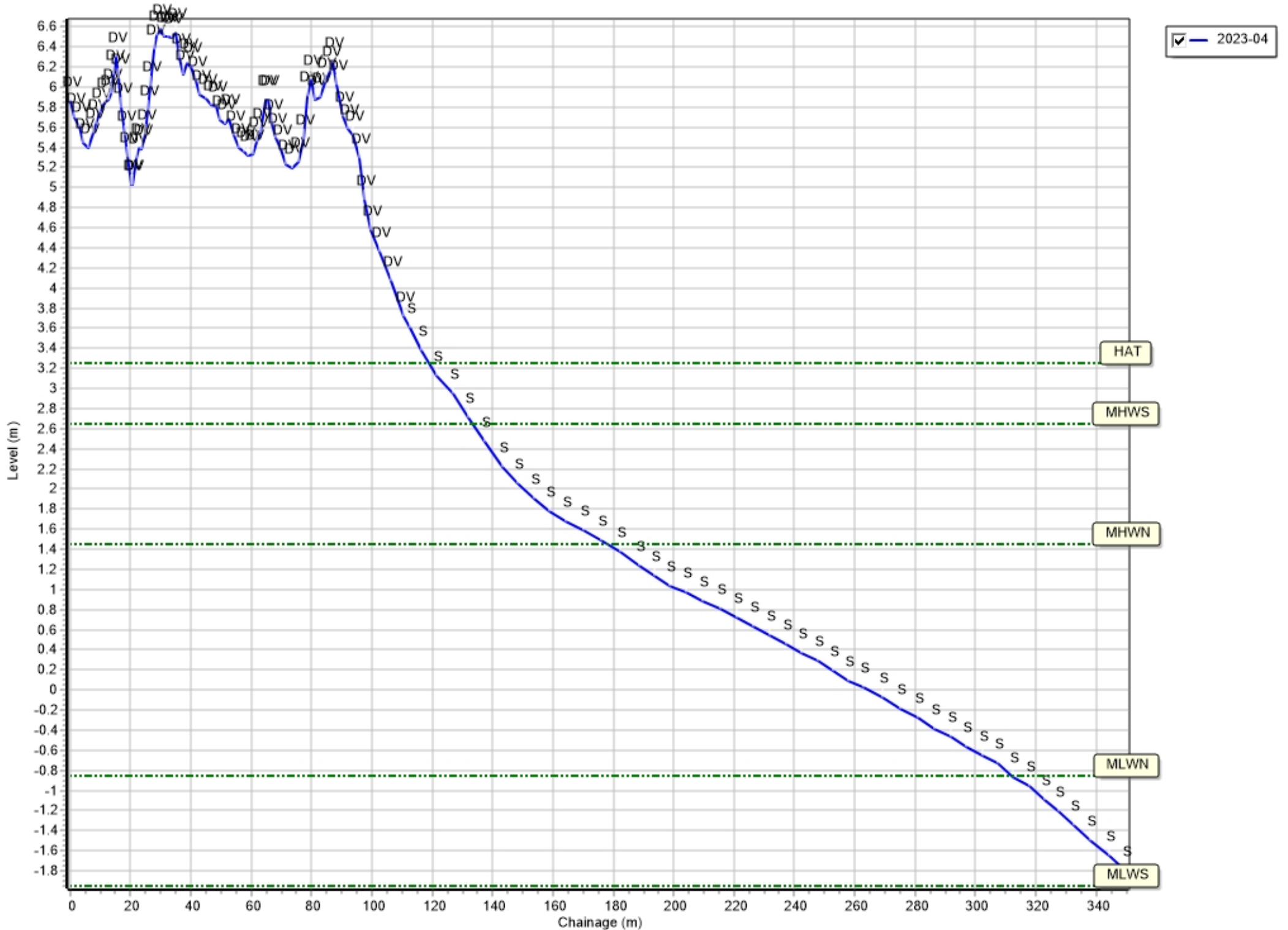
The following sediment feature codes are used on some profile plots:

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

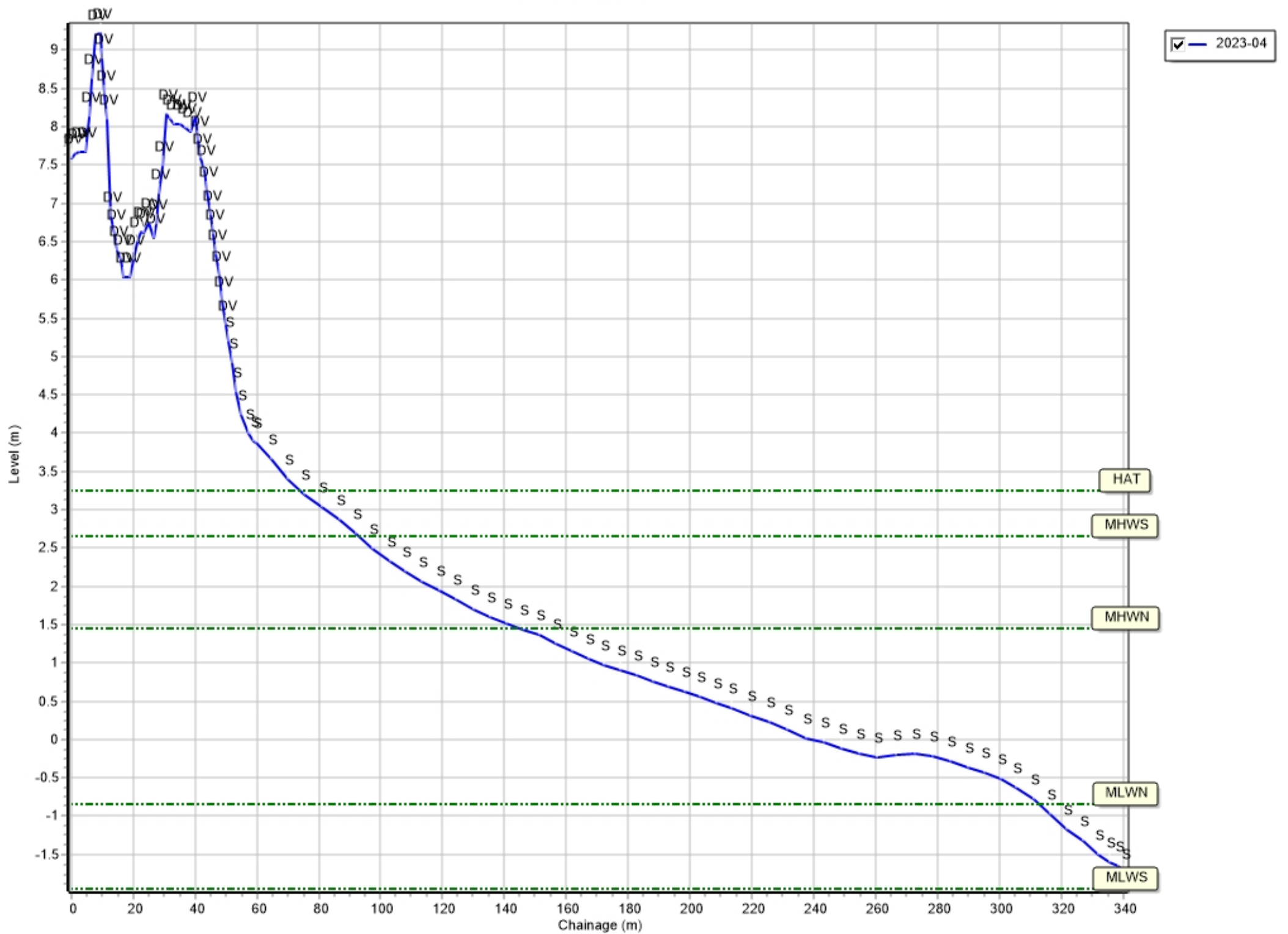
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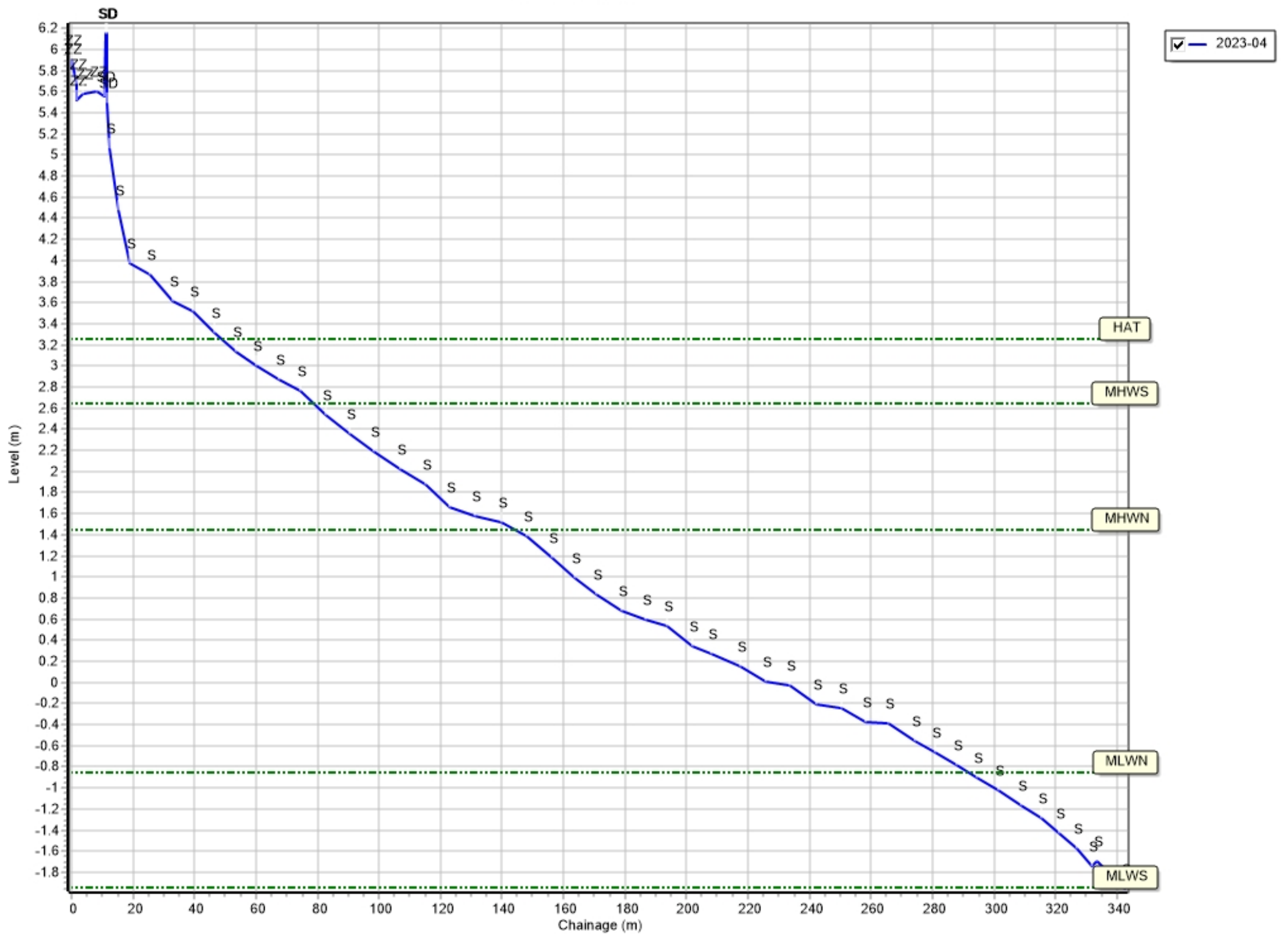
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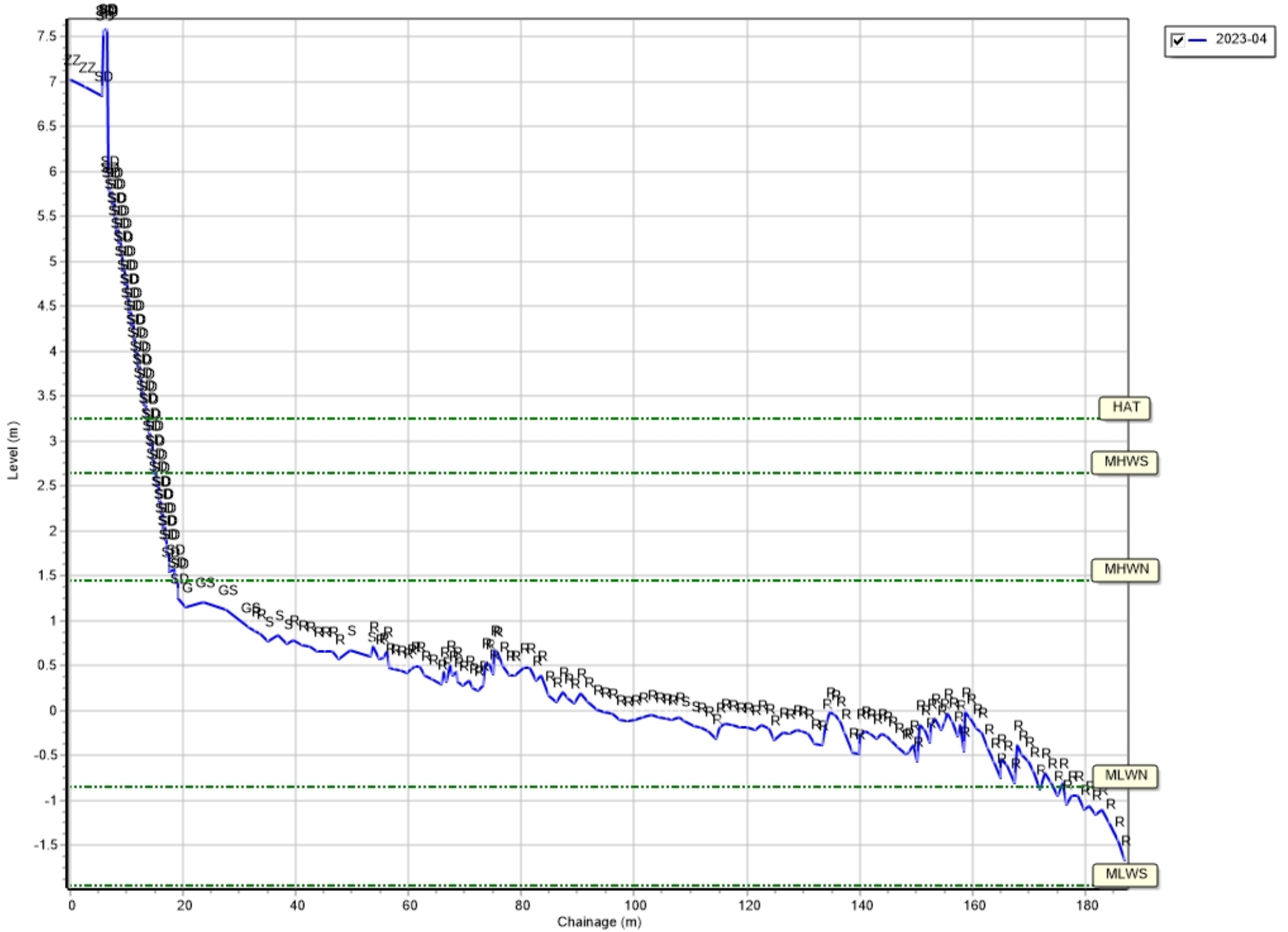
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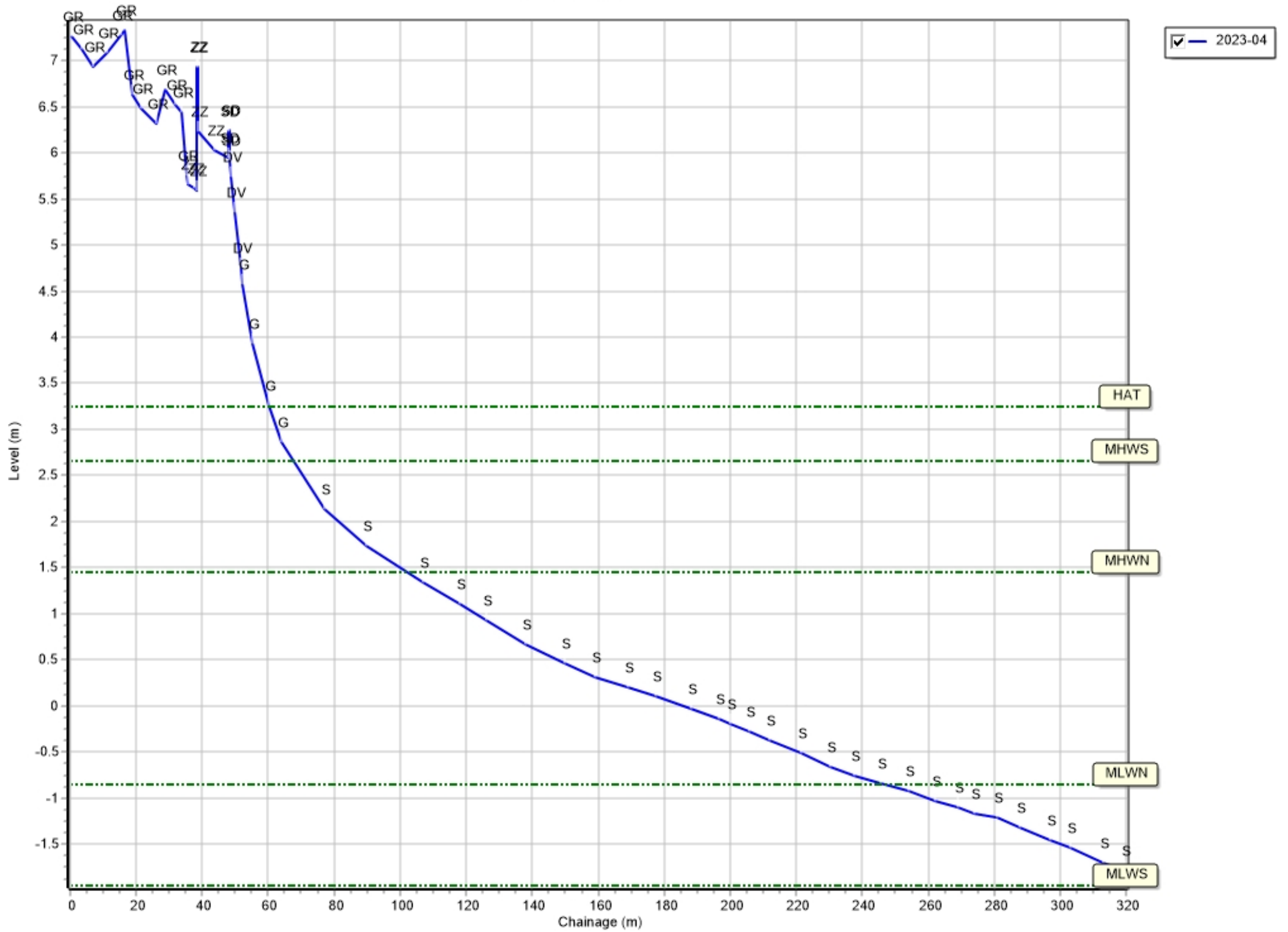
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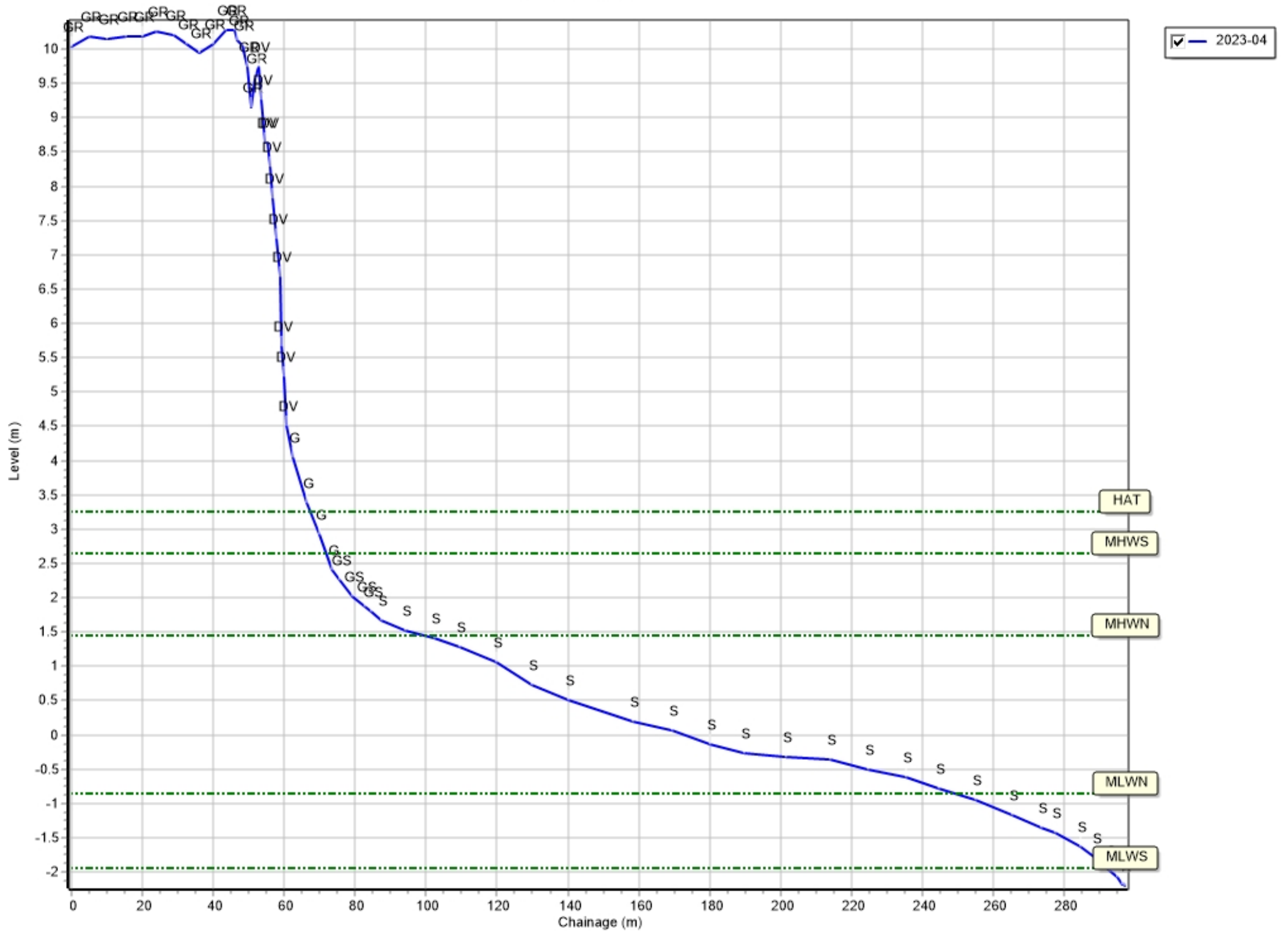
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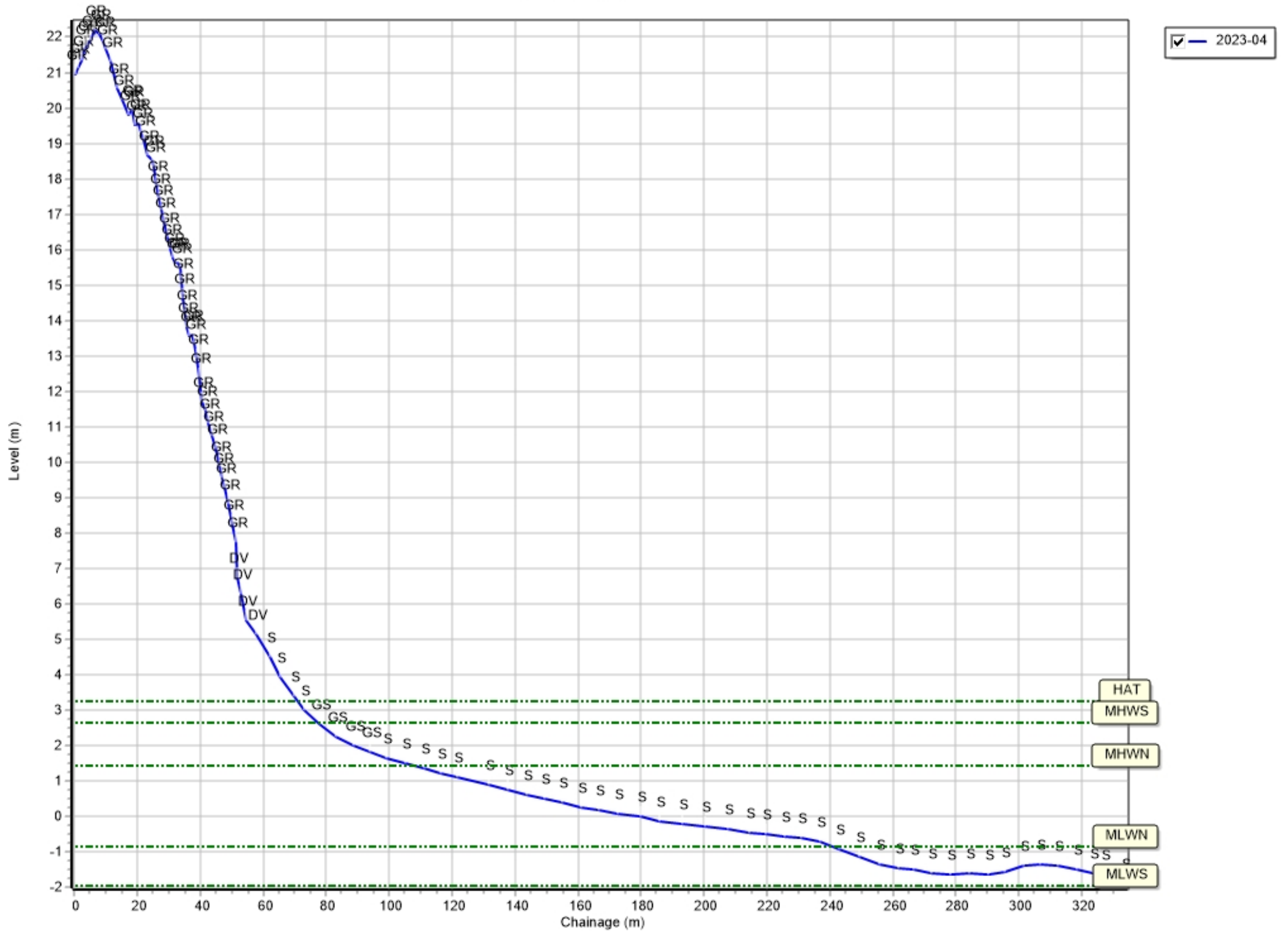
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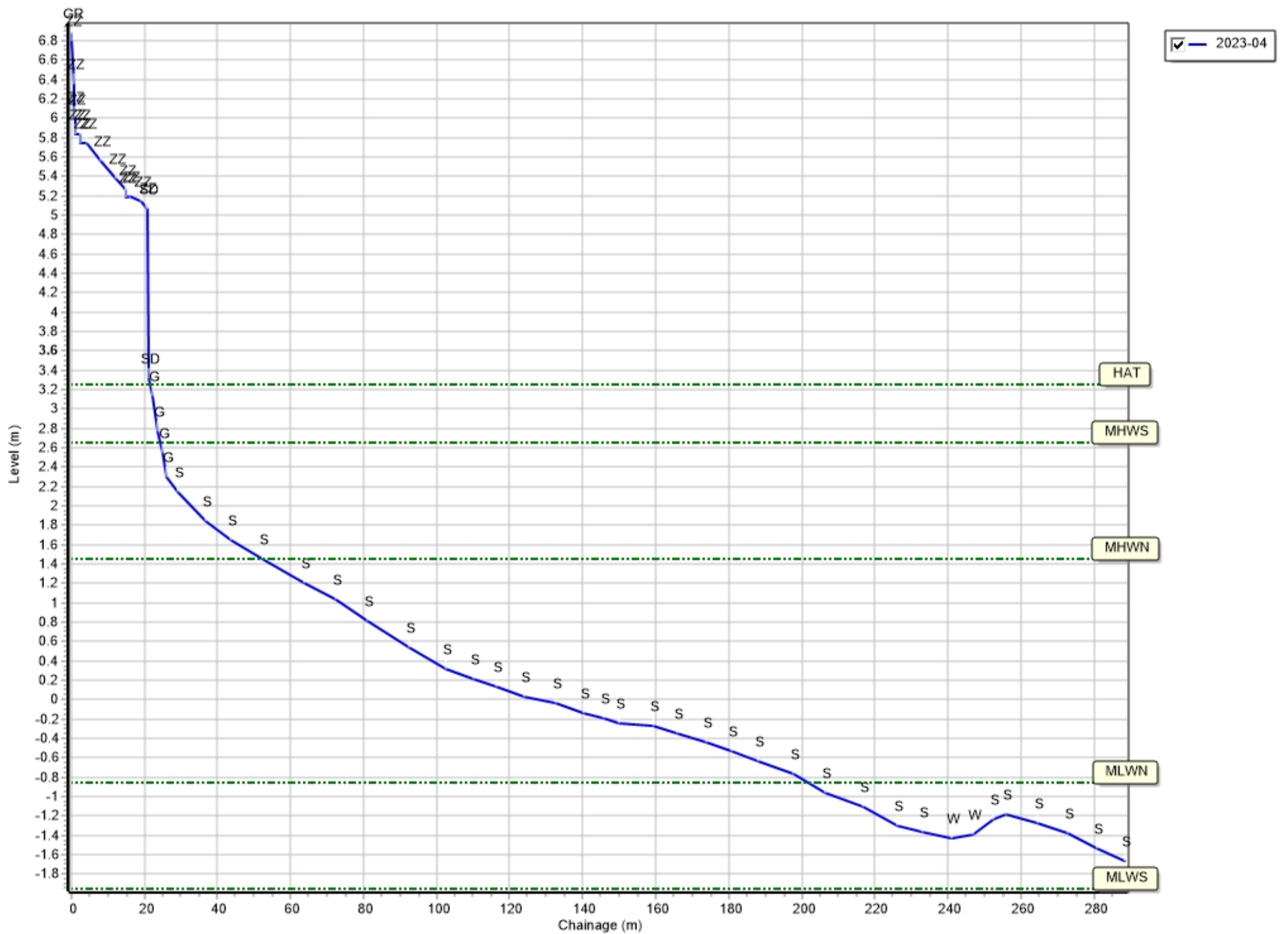
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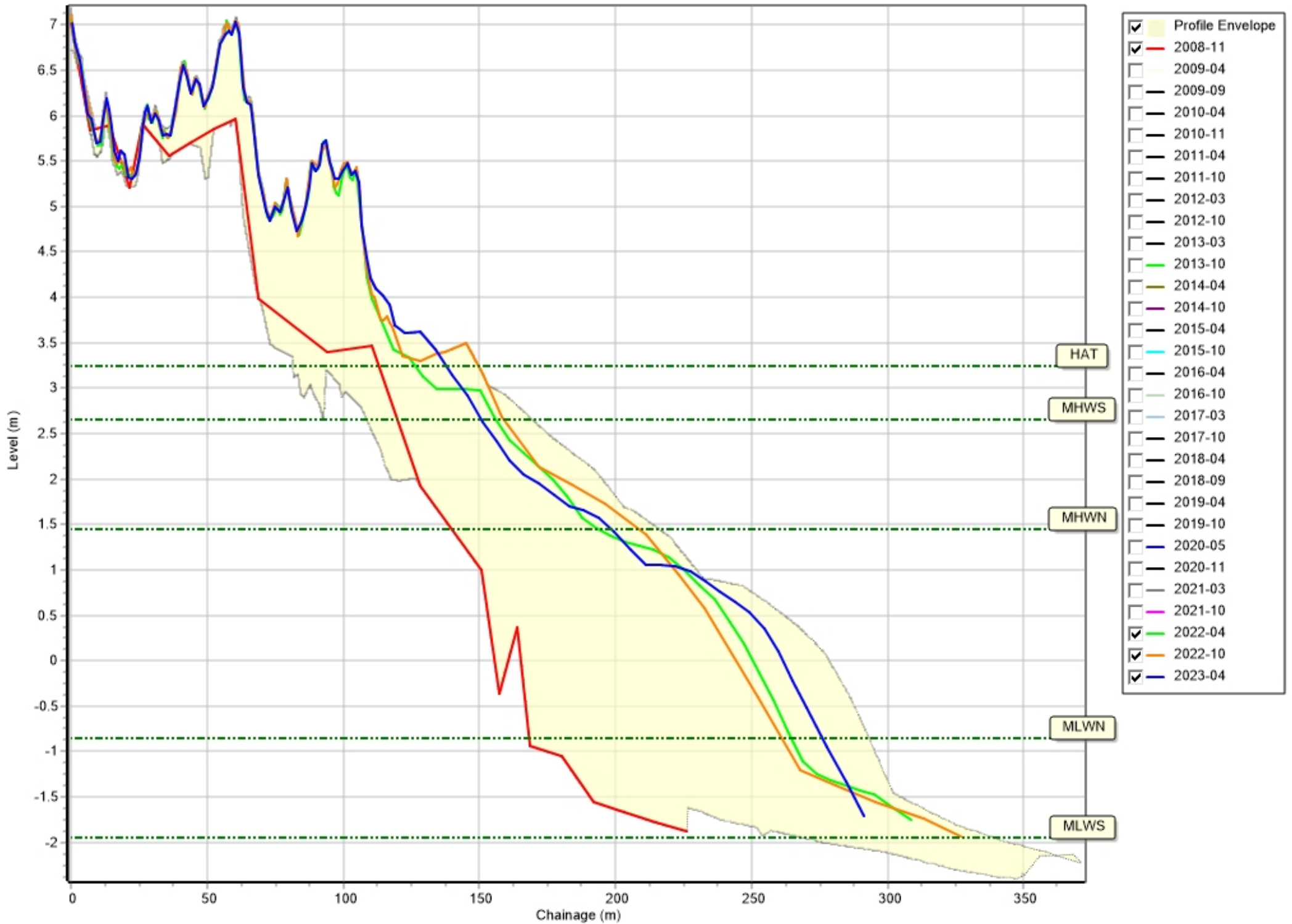
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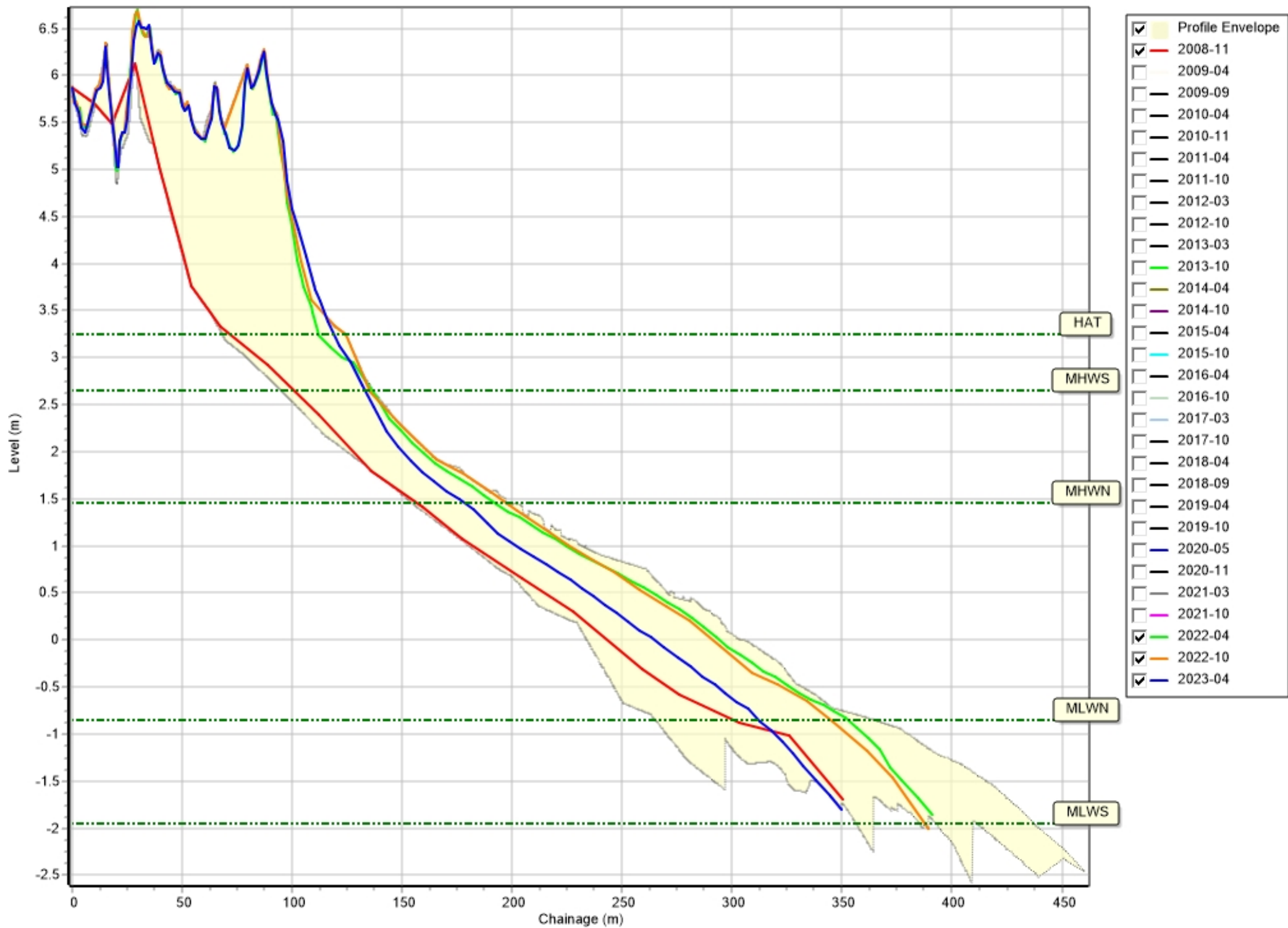
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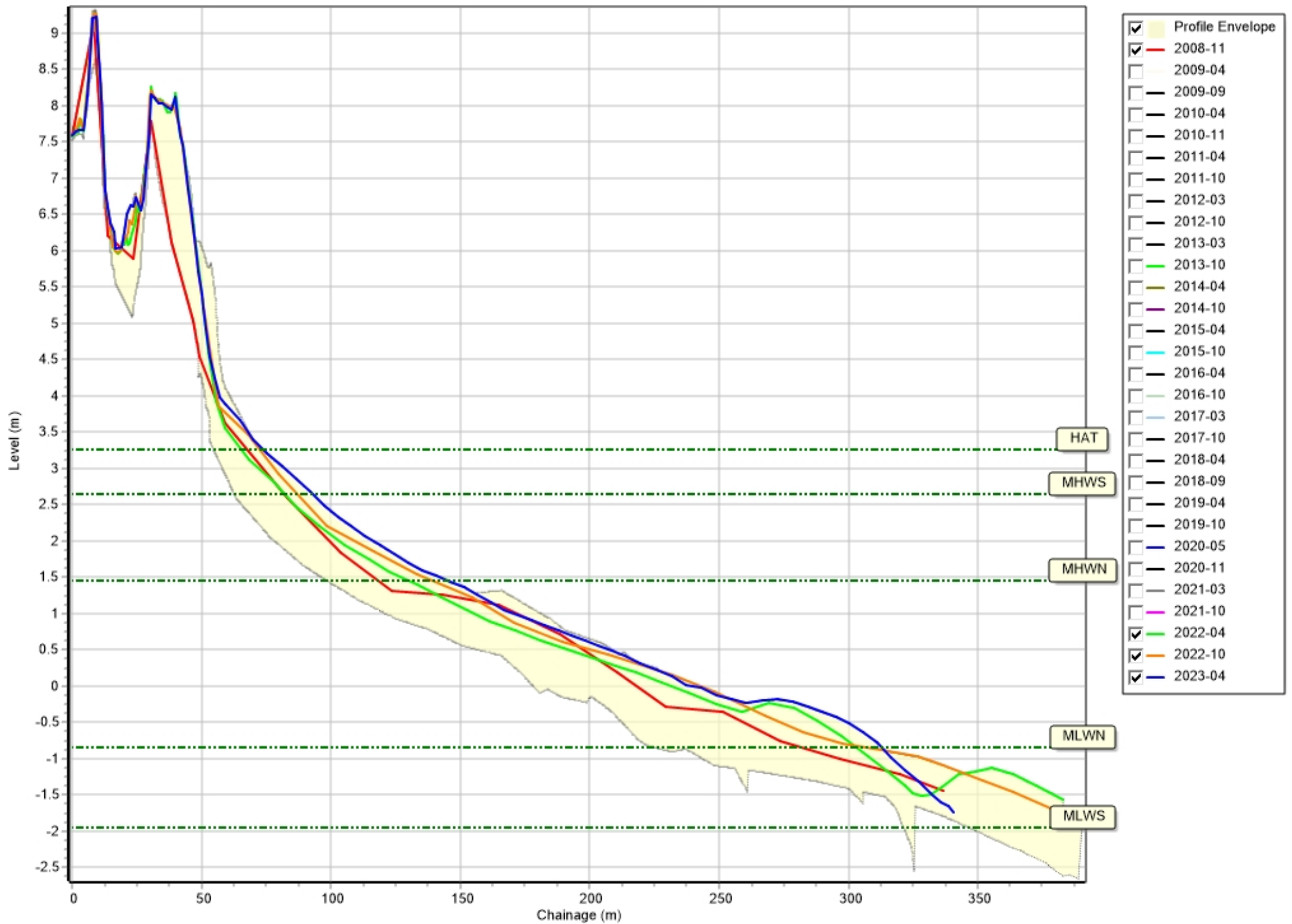
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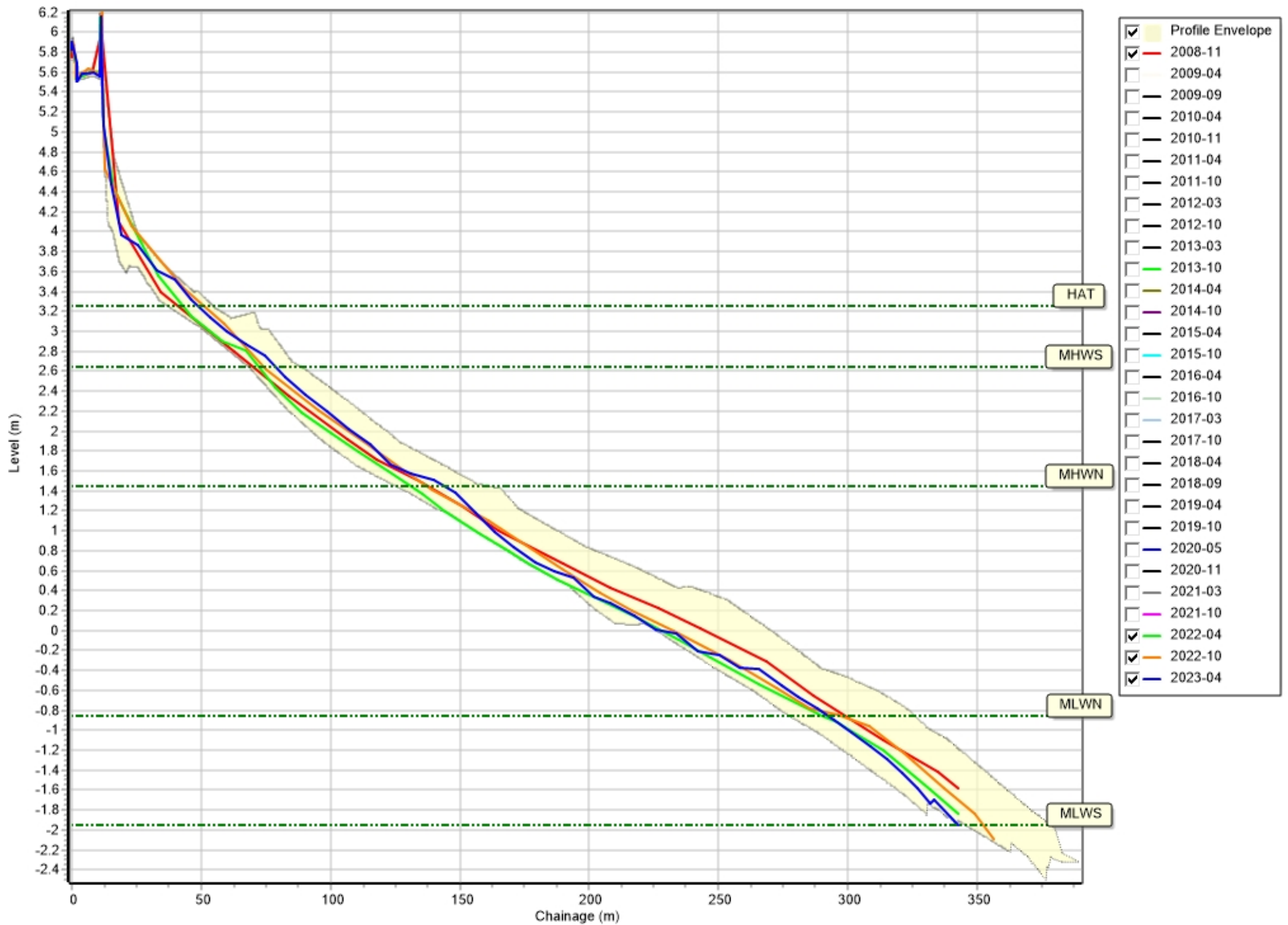
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Profiles: 1cRC3



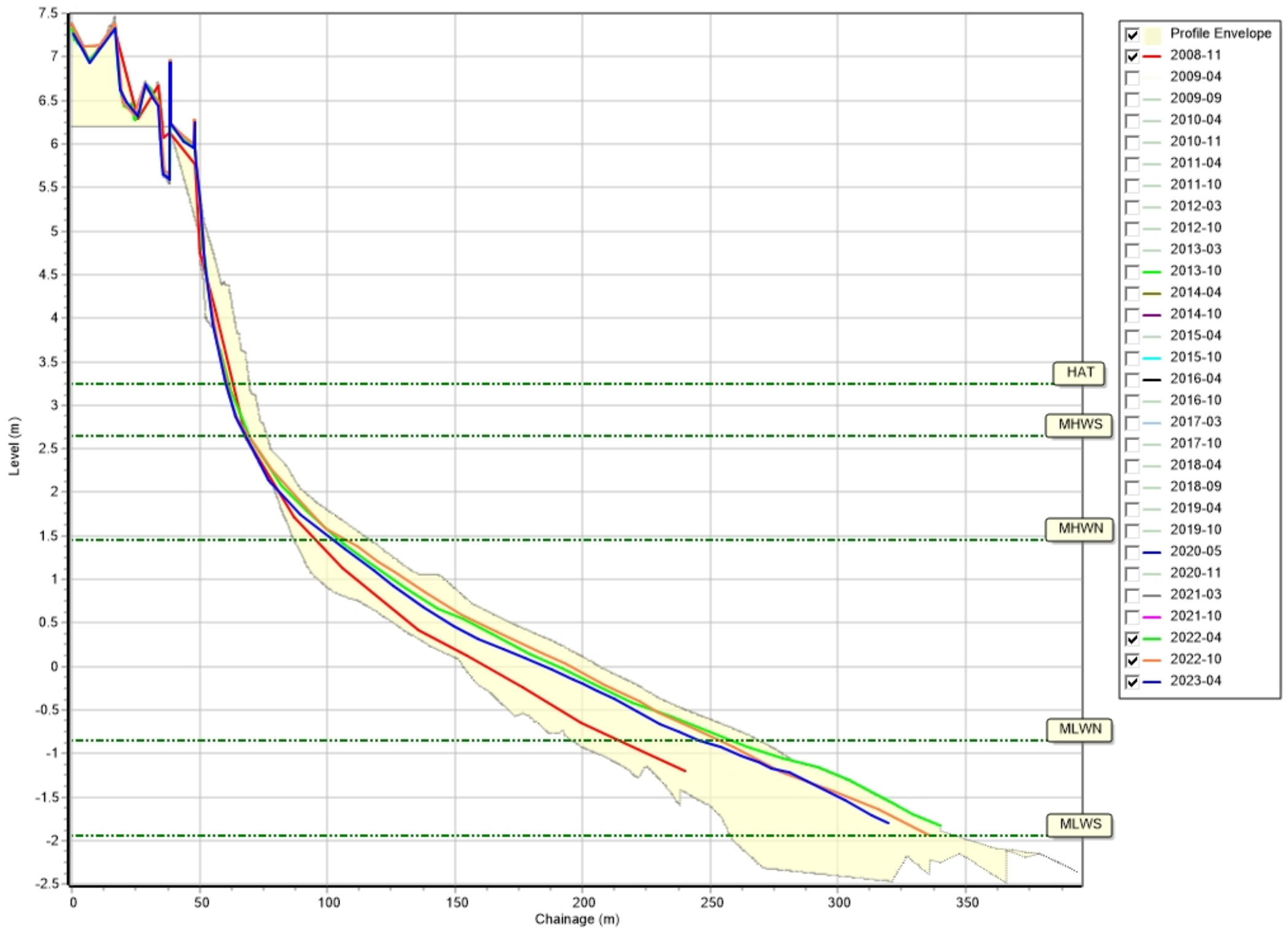
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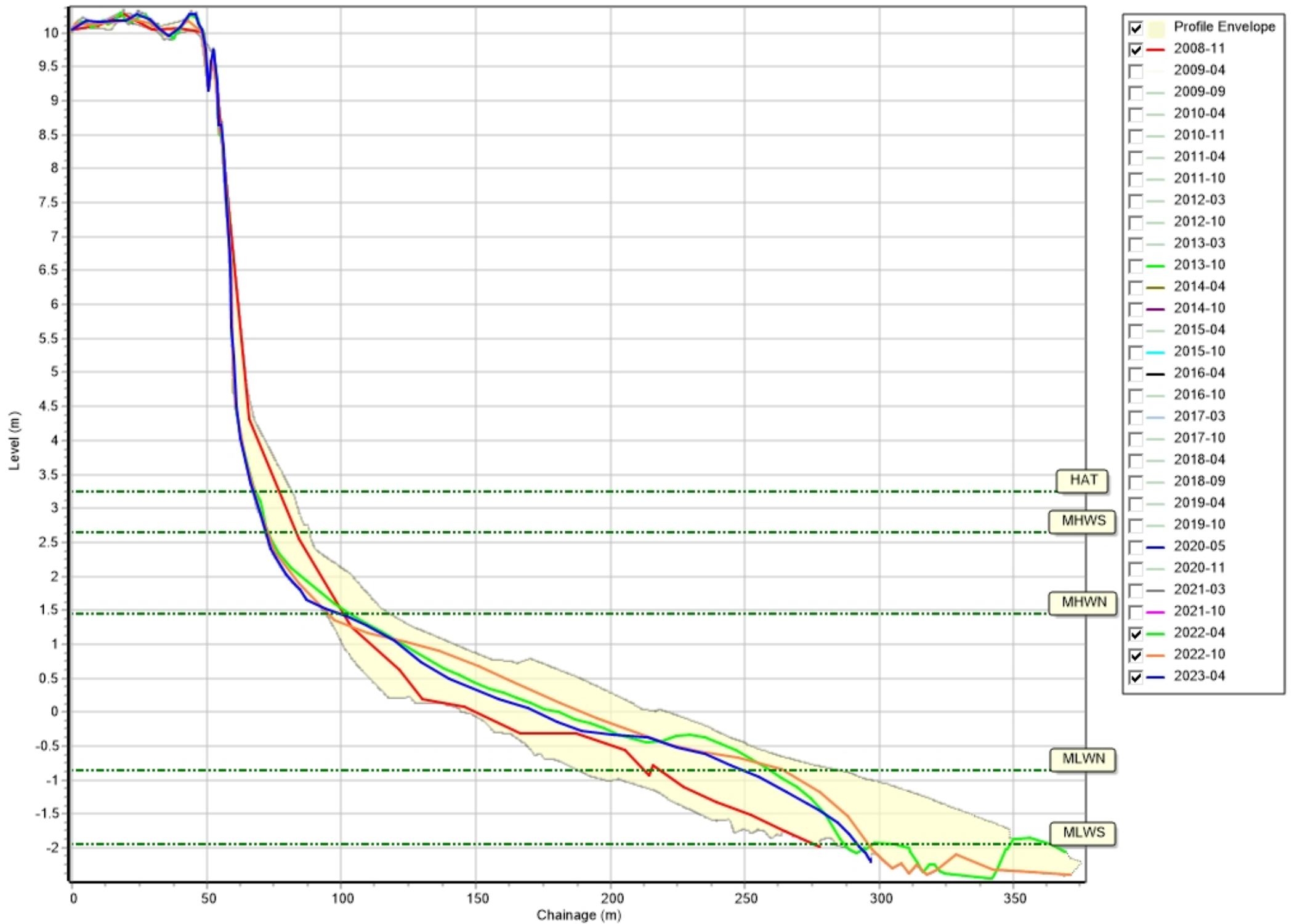
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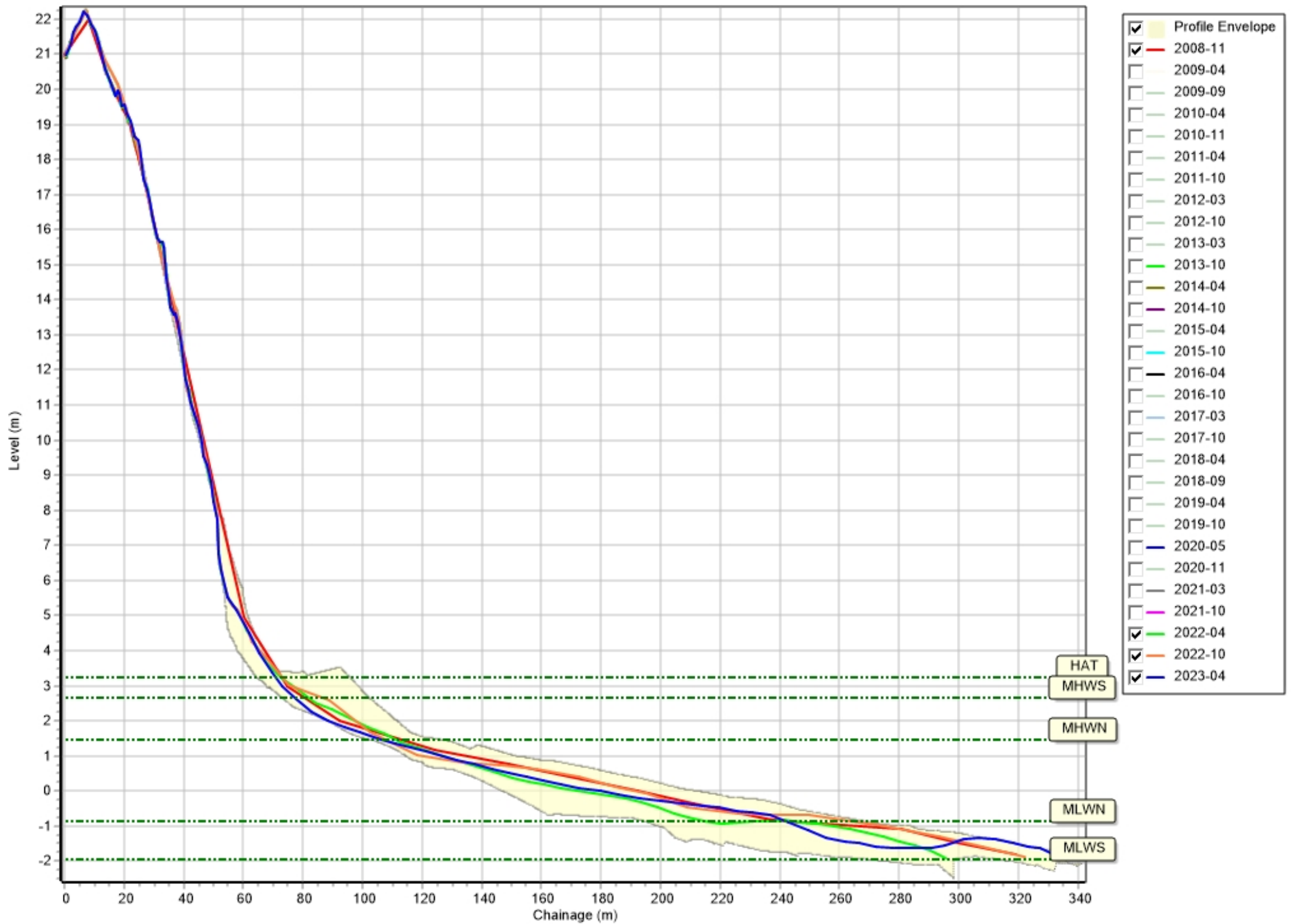
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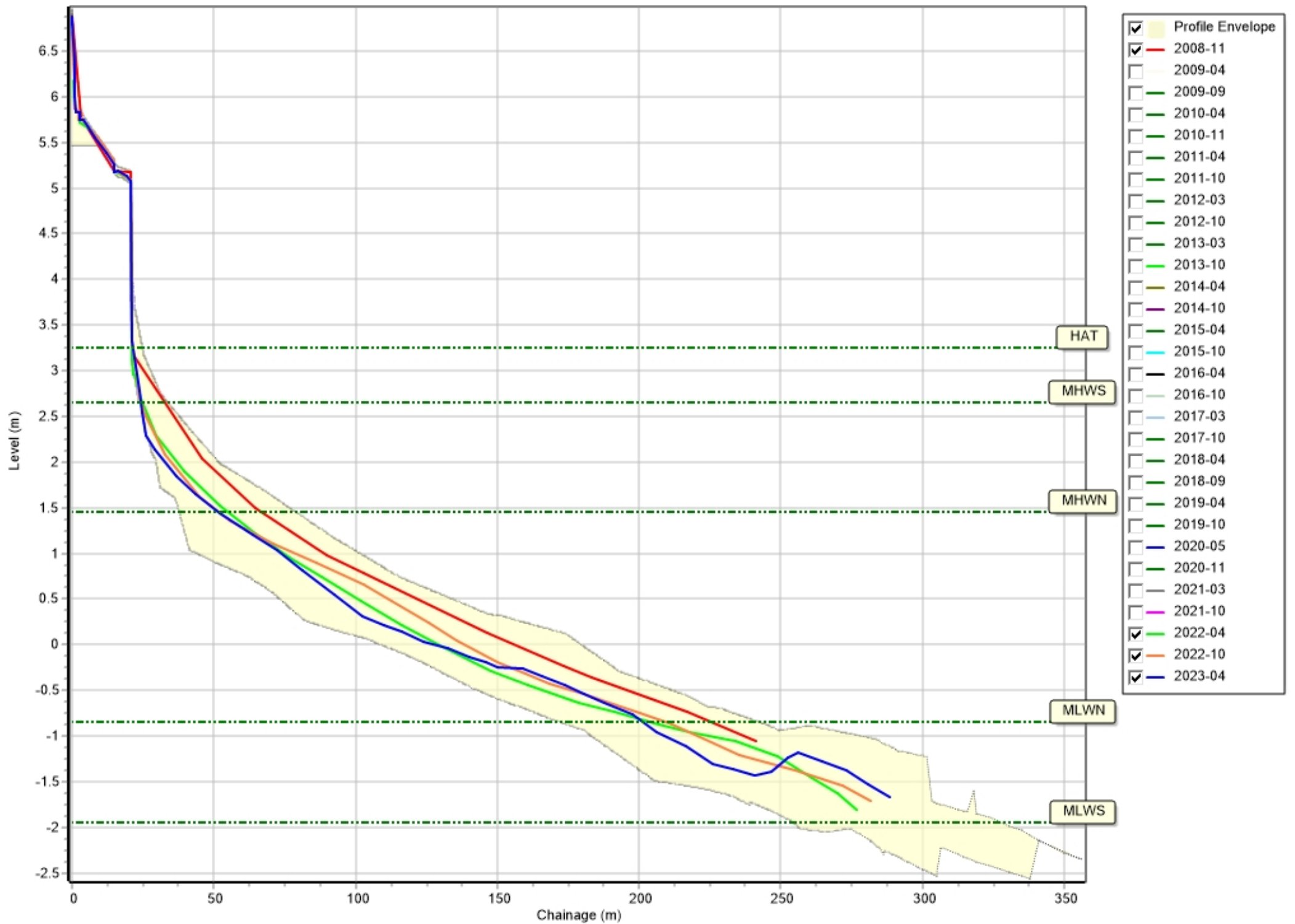
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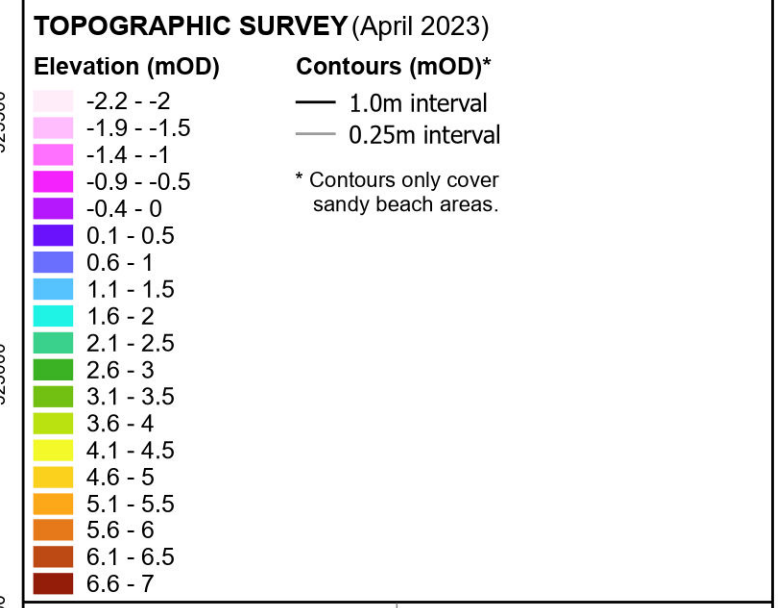
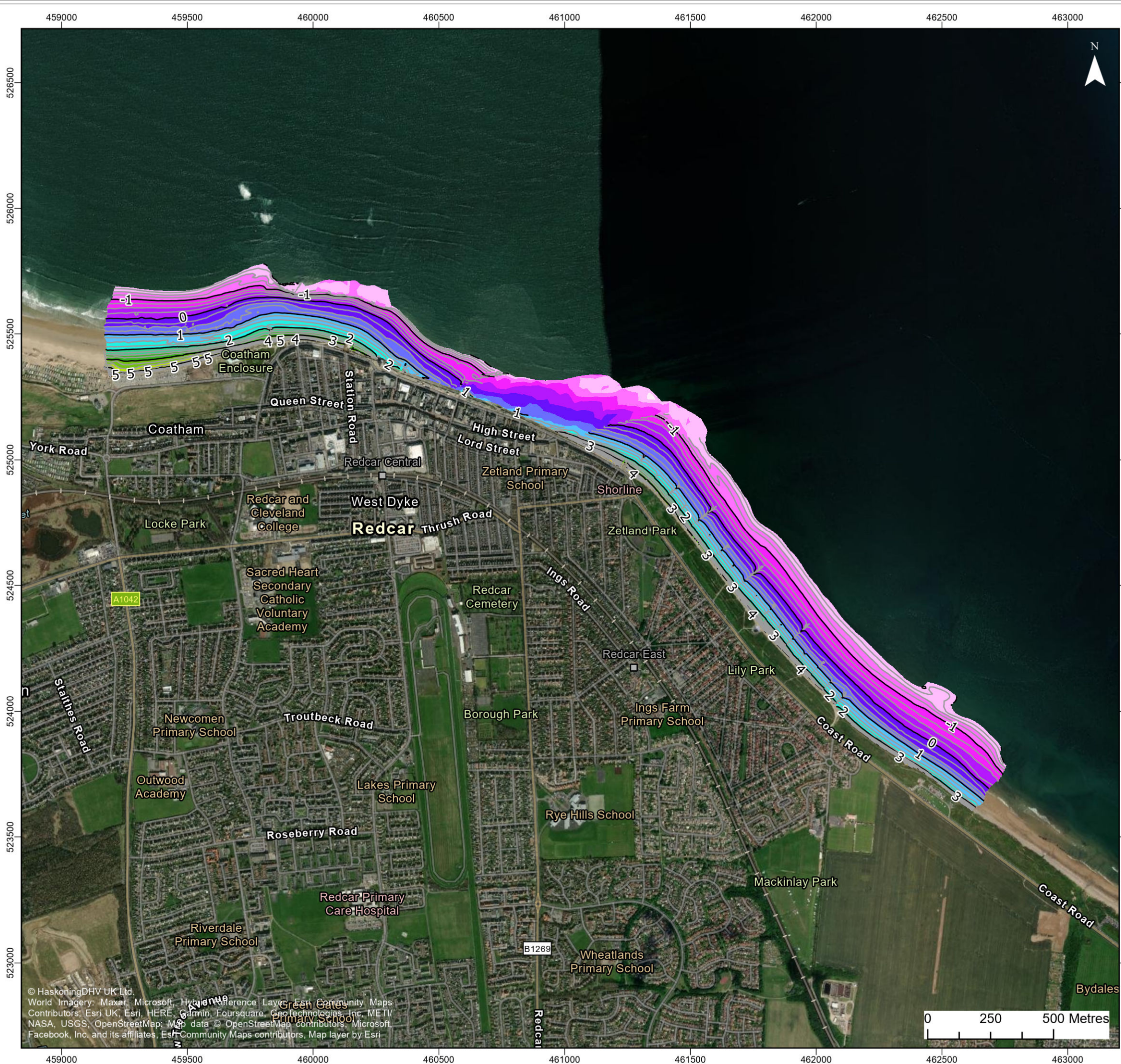
Profiles: 1cRC8



Profiles: 1cRC9



Appendix B
Topographic Survey



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

Title:

Appendix B - Map 1

REDCAR SANDS

Redcar and Cleveland Borough Council Frontage

Report:

Update Report
 'Partial Measures' Survey 2023

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	24/05/2023	TC	NJC	A3	1:15,000

Co-ordinate system: British National Grid





TOPOGRAPHIC SURVEY (April 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	* 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	
4.1 - 4.5	
4.6 - 5	
5.1 - 5.5	
5.6 - 6	

Client: North East Coastal Group	Project: Cell 1 Regional Coastal Monitoring Programme
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Title:
Appendix B - Map 2
SALTBURN SANDS
Redcar and Cleveland Borough Council Frontage

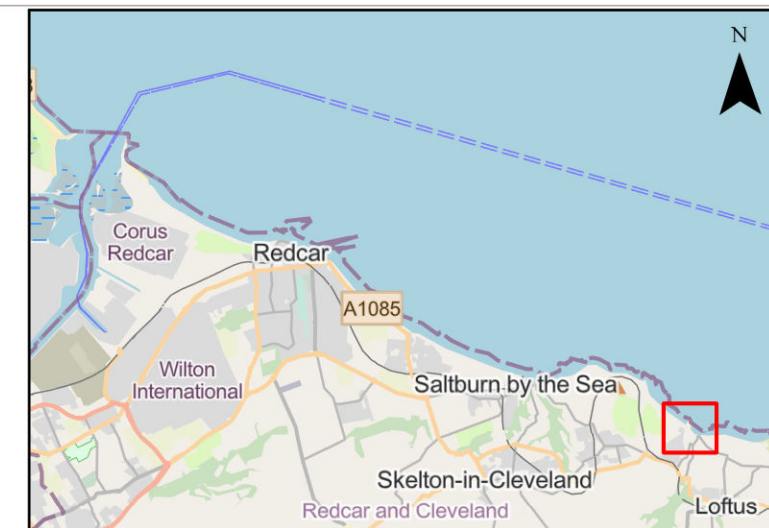
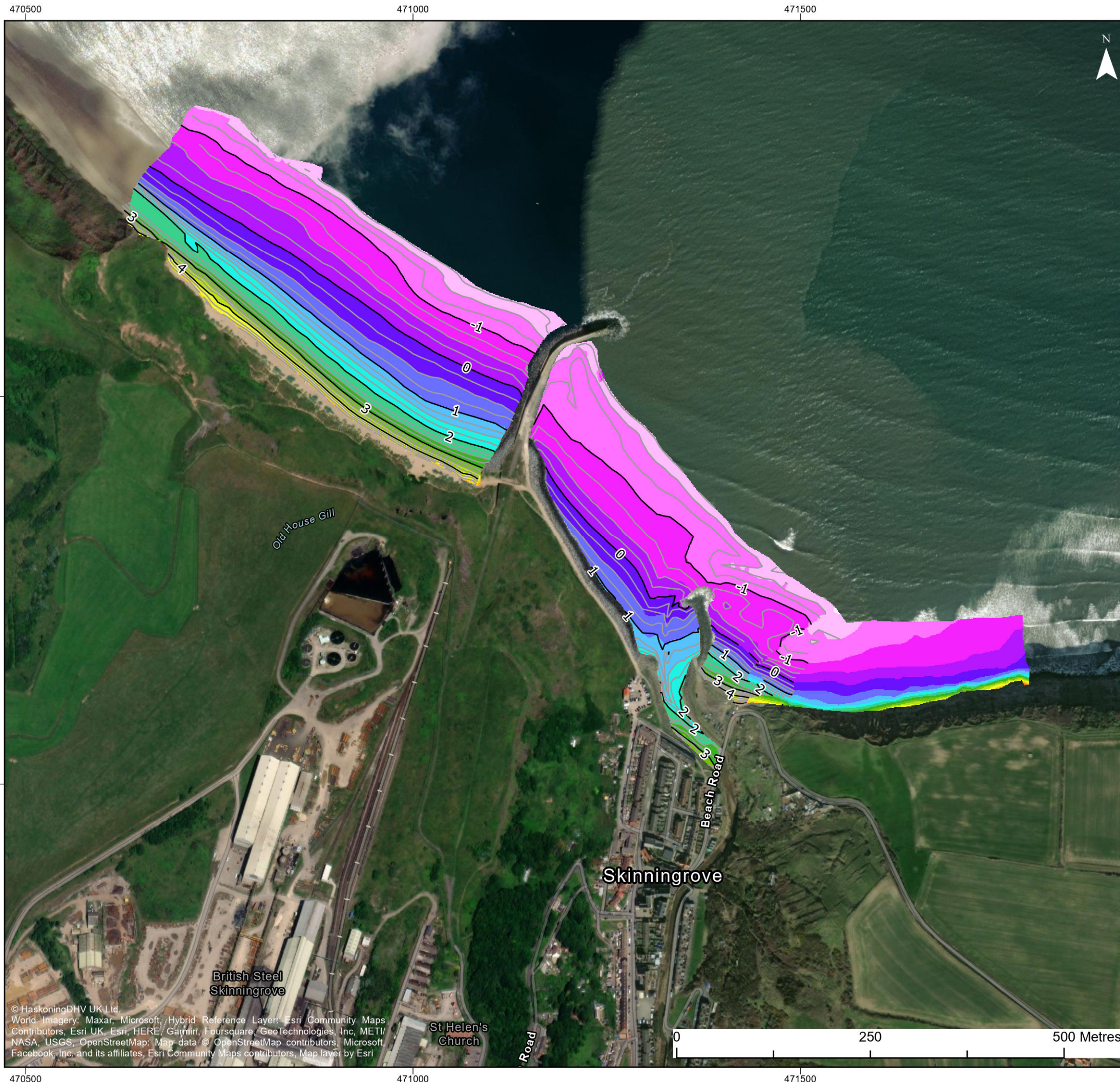
Report:
 Update Report
 'Partial Measures' Survey 2023

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	24/05/2023	TC	NJC	A3	1:8,000

Co-ordinate system: British National Grid

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North East Coastal Observatory



TOPOGRAPHIC SURVEY (April 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	

* Contours only cover sandy beach areas.

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

Title:

Appendix B - Map 3

CATTERSTY SANDS (SKINNINGROVE)

Redcar and Cleveland Borough Council Frontage

Report:

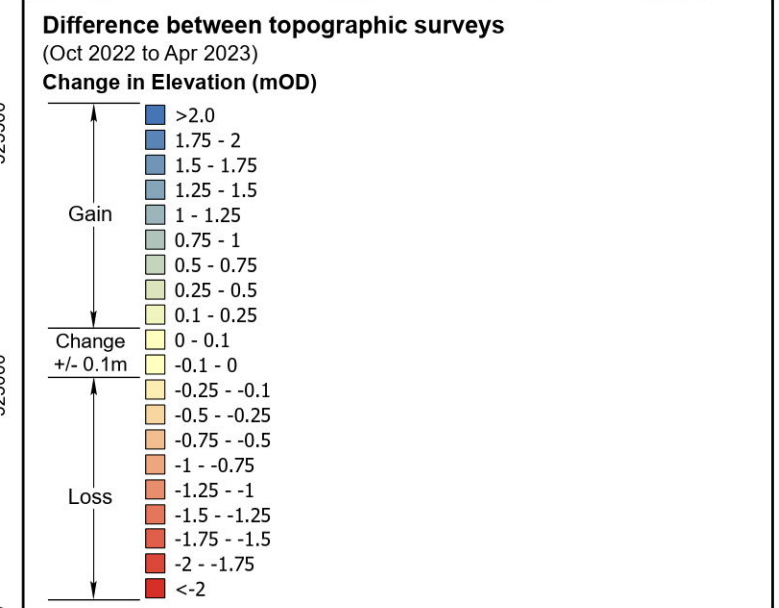
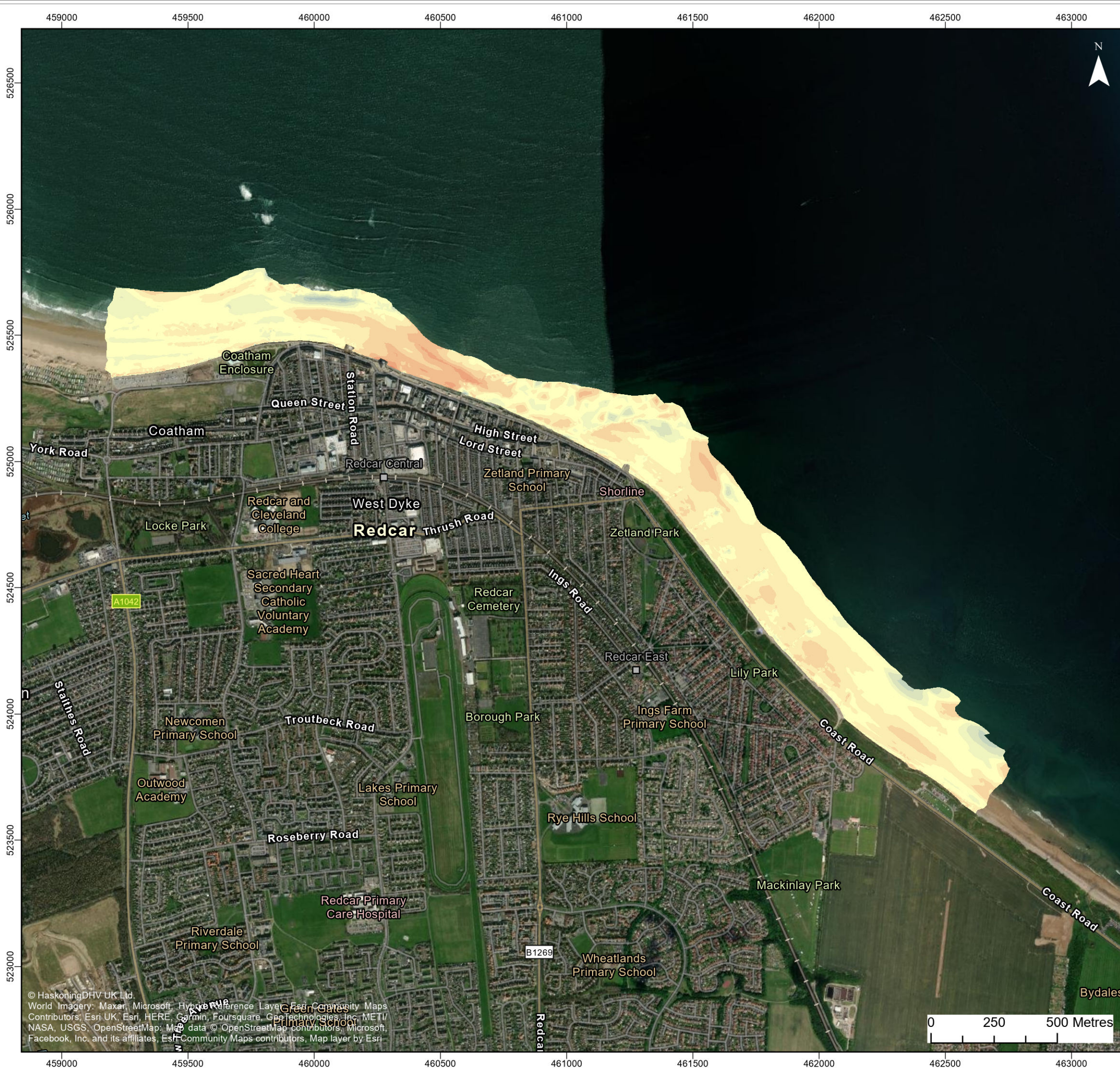
Update Report
'Partial Measures' Survey 2023

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	24/05/2023	TC	NJC	A3	1:5,000

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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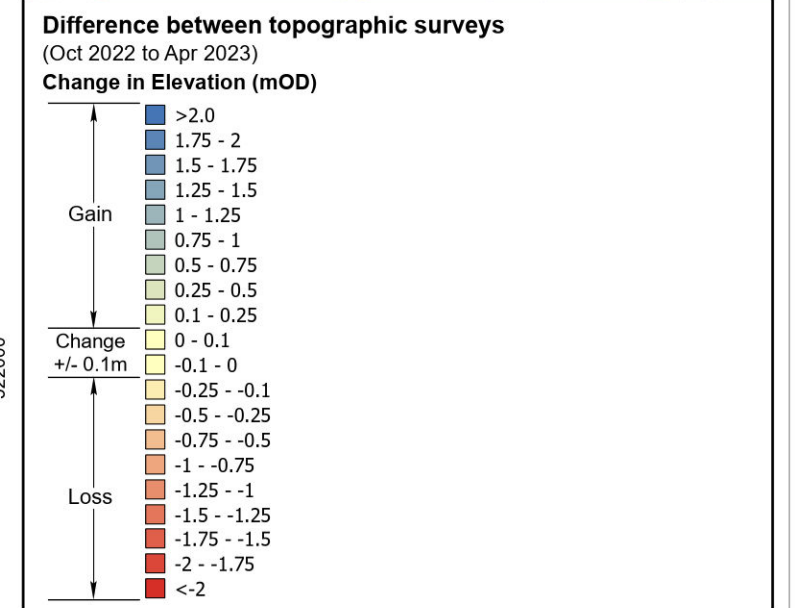
Title:
Appendix B - Map 4
REDCAR SANDS
 Redcar and Cleveland Borough Council Frontage

Report:
 Update Report
 'Partial Measures' Survey 2023

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





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

Title:

Appendix B - Map 5

SALTBURN SANDS

Redcar and Cleveland Borough Council Frontage

Report:

Update Report
'Partial Measures' Survey 2023

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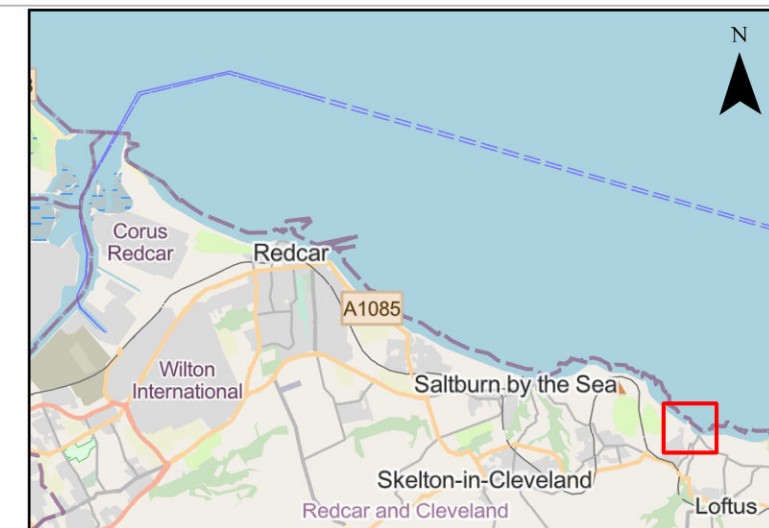
Co-ordinate system: British National Grid



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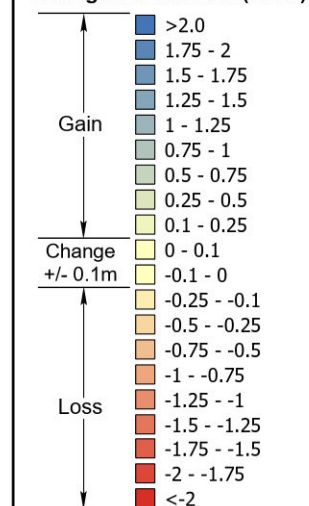


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Difference between topographic surveys
 (Oct 2022 to Apr 2023)

Change in Elevation (mOD)



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

Title:

Appendix B - Map 6

CATTERSTY SANDS (SKINNINGROVE)

Redcar and Cleveland Borough Council Frontage

Report:

Update Report
 'Partial Measures' Survey 2023

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



Appendix C
Cliff Top Survey

Cliff Top Survey

Twenty ground control points have been established at Staithes (Figure 3 – Map 1). The maximum separation between any two points varies along the coast, reflecting the degree of risk from the erosion. 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 November 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