

Cell 1 Regional Coastal Monitoring Programme Analytical Report 15: 'Full Measures' Survey 2022



Durham County Council

January 2023

Contents

Disclaimer	i
Abbreviations and Acronyms.....	ii
Water Levels Used in Interpretation of Changes	ii
Glossary of Terms.....	iii
Preamble	iv
1. Introduction.....	1
1.1 Study Area	1
1.2 Methodology.....	1
2. Analysis of Survey Data.....	1
2.1 Featherbed Rocks.....	1
2.2 Seaham (Dawdon)	2
2.3 Blast Beach.....	3
2.4 Hawthorne Hive.....	5
2.5 Blackhall Colliery	6
3. Problems Encountered and Uncertainty in Analysis.....	7
4. Recommendations for 'Fine-tuning' the Monitoring Programme.....	7
5. Conclusions and Areas of Concern.....	7

Appendices

Appendix A	Beach Profiles
Appendix B	Cliff Top Survey

List of Figures

Figure 1	Sediment Cells in England and Wales
Figure 2	Survey Location Maps
Figure 3	Cliff Top Survey Locations

List of Tables

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

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Abbreviations and Acronyms

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

Water Levels Used in Interpretation of Changes

Water Level Parameter	Water Level (m AOD)
	Featherbed Rocks to Blackhall Colliery
HAT	3.0
MHWS	2.5
MHWN	1.4
MLWN	-0.7
MLWS	-2.0

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.

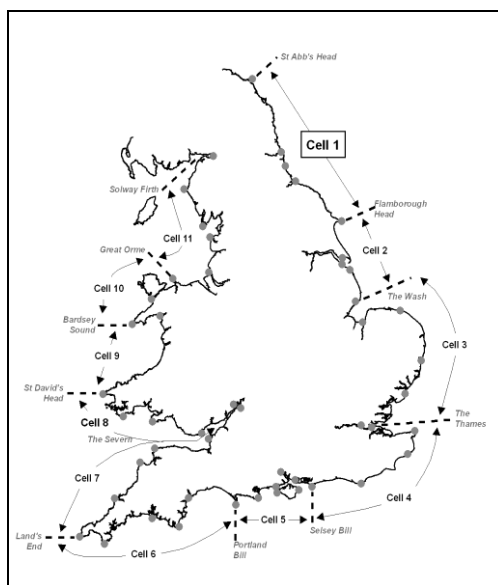


Figure 1 Sediment Cells in England and Wales

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

To date the following reports have been produced:

Table 1 Analytical, Update and Overview Reports Produced to Date

Year		Full Measures		Partial Measures		Cell 1 Overview Report
		Survey	Analytical Report	Survey	Update Report	
1	2008/09	Sep-Dec 08	May 09	Mar-May 09		-
2	2009/10	Sep-Dec 09	Mar 10	Feb-Mar 10	Jul 10	-
3	2010/11	Aug-Nov 10	Feb 11	Feb-Apr 11	Aug 11	Sep 11
4	2011/12	Sep 11	Aug 12	Mar-May 12	Feb 13	
5	2012/13	Sept 12	Feb 13	Mar-Apr 13	May 2013	
6	2013/14	Oct 13	Feb 14	Mar-Apr 14	Jul 14	
7	2014/15	Nov 14	Feb 15	Mar15	Jun 15	
8	2015/16	Nov 15	Feb 16	Apr 16	Jul 16	Jun 16
9	2016/17	Aug / Sep 16	Jan 17	Mar 17	Jul 17	
10	2017/18	Sep 17	Feb 18	April 18	Jun 18	
11	2018/19	Oct & Dec 18	Jan 19	Apr 19	May 19	
12	2019/20	Oct & Nov 19	Jan 20	May 20	Jul 20	
13	2020/21	Oct 20	Jan 21	Mar 21	Jun 21	Aug 21
14	2021/22	Nov 21	Jan 22	Apr 22	Jun 22	
15	2022/23	Nov 22	Jan 23 (*)			

(*) The present report is **Analytical Report 15** and provides an analysis of the 2022 Full Measures survey for County Durham Council's frontage.

In addition, separate reports are produced for other elements of the programme as and when specific components are undertaken, such as wave data collection, bathymetric and sea bed sediment data collection, aerial photography, and walk-over visual inspections.

For purposes of analysis, the Cell 1 frontage has been split into the sections listed in Table 2.

Table 2 Sub-divisions of the Cell 1 Coastline

Authority	Zone
Northumberland County Council	Spittal A
	Spittal B
	Goswick Sands
	Holy Island
	Bamburgh
	Beadnell Village
	Beadnell Bay
	Embleton Bay
	Boulmer
	Alnmouth Bay
	High Hauxley and Druridge Bay
	Lynemouth Bay
	Newbiggin Bay
	Cambois Bay
Blyth South Beach	
North Tyneside Council	Whitley Sands
	Cullercoats Bay
	Tynemouth Long Sands
	King Edward's Bay
South Tyneside Council	Littehaven Beach
	Herd Sands
	Trow Quarry (incl. Frenchman's Bay)
	Marsden Bay
Sunderland Council	Whitburn Bay
	Harbour and Docks
	Hendon to Ryhope (incl. Halliwell Banks)
Durham County Council	Featherbed Rocks
	Seaham
	Blast Beach
	Hawthorn Hive
	Blackhall Colliery
Hartlepool Borough Council	North Sands
	Headland
	Middleton
	Hartlepool Bay
Redcar & Cleveland Borough Council	Coatham Sands
	Redcar Sands
	Marske Sands
	Saltburn Sands
	Cattersty Sands (Skinningrove)
Scarborough Borough Council	Staithes
	Runswick Bay
	Sandsend Beach, Uppang Beach and Whitby Sands
	Robin Hood's Bay
	Scarborough North Bay
	Scarborough South Bay
	Cayton Bay
	Filey Bay

1. Introduction

1.1 Study Area

Durham County Council's frontage extends from Ryhope Dene to Crimdon Beck. For the purposes of this report and for consistency with previous reporting, it has been sub-divided into five areas, namely:

- Featherbed Rocks
- Seaham (Dawdon)
- Blast Beach
- Hawthorn Hive
- Blackhall Colliery

1.2 Methodology

Along Durham County Council's frontage, the following surveying is undertaken:

- Full Measures survey annually (since 2008) each autumn/early winter comprising:
 - Beach profile surveys along nine transect lines
- Partial Measures survey annually (since 2009) each spring comprising:
 - Beach profile surveys along six transect lines
- Cliff top survey bi-annually at:
 - Seaham (Dawdon)

The location of these surveys is shown in Figure 2. The 2022 Full Measures survey was undertaken along the Seaham and Easington frontage on the 24th November 2022 and along the Blackhall frontage on the 23rd November 2022. During the Seaham & Easington survey the weather was dry and overcast. The wind was force five from the south and the sea state was smooth. During the Blackhall survey, the weather was overcast and showery. The wind force was four from the north-east. The sea state was moderate.

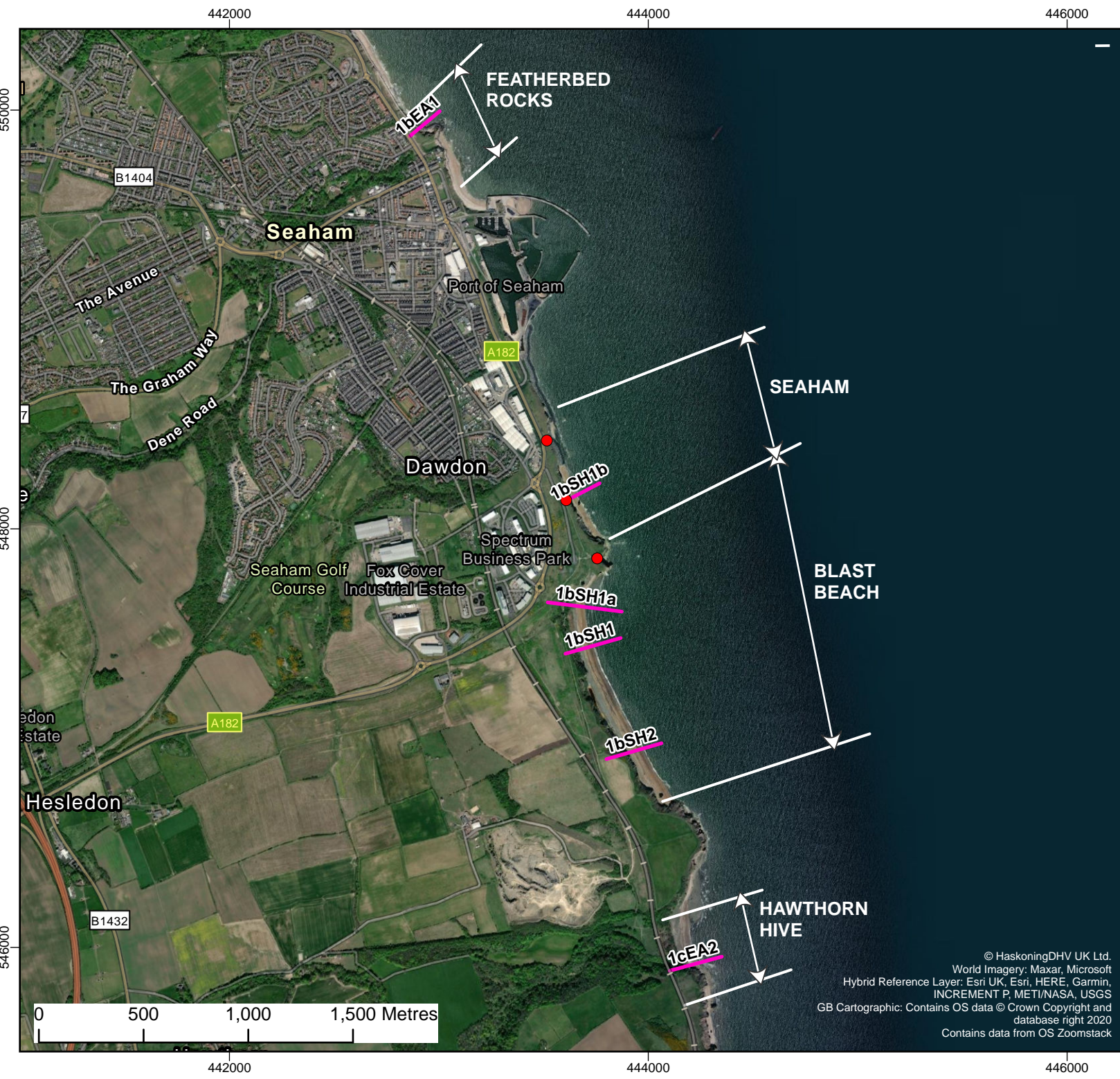
All data have been captured in a manner commensurate with the principles of the Environment Agency's *National Standard Contract and Specification for Surveying Services* and stored in a file format compatible with the software systems being used for the data analysis, namely SANDS and ArcGIS. This data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

Upon receipt of the data from the survey team, they are quality assured and then uploaded onto the programme's website for storage and availability to others and also input to SANDS and GIS for subsequent analysis.

The Analytical Report is then produced following a standard structure for each authority. This involves:

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

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



SURVEY LOCATIONS

Topographic Profile

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

Topographic Area

- 6 monthly (Light Green)
- yearly (Orange)
- 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 1**
FEATHERBED ROCKS TO HAWTHORN HIVE
Durham County 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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 World Imagery: Maxar, Microsoft
 Hybrid Reference Layer: Esri UK, Esri, HERE, Garmin,
 INCREMENT P, METI/NASA, USGS
 GB Cartographic: Contains OS data © Crown Copyright and
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 Contains data from OS Zoomstack



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 2

BLACKHALL COLLIERY

Durham County 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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World Imagery: Maxar, Microsoft
Hybrid Reference Layer: Esri UK, Esri, HERE, Garmin, INCREMENT P, METI/NASA, USGS
GB Cartographic: Contains OS data © Crown Copyright and database right 2020
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SURVEY LOCATIONS

- Cliff Top Survey Points

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

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

Title:

Figure 3 - Map 1

SEAHAM

Durham County 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



2. Analysis of Survey Data

2.1 Featherbed Rocks

Survey Date	Description of Changes Since Last Survey	Interpretation
24 th November 2022	<p>Beach Profiles:</p> <p>Beach profile line 1bEA1, located at Featherbed Rocks (Appendix A), has been monitored since April 2009. The profile extends across the cliff top and cliff face then extends across the promenade (chainage 55m), rock armour sea defence (chainage 55m to 80m) and beach. Seaward of the rock armour at chainage 80m, there has again been very little change over the summer of 2022. The beach profile reflects the rocky nature of the foreshore with any minor change reflecting the movement of pockets of sediment between the rock outcrops. Previous surveys have shown accumulations of material at the base of the revetment, but this has not been present since the 2012 Full Measures survey.</p>	<p>Longer term trends: The cliff top and cliff face in this location appear stable and are unlikely to activate whilst the coastal defences remain present.</p> <p>The rocky nature of this foreshore means it is unlikely to undergo significant changes in morphology unless sediment is deposited upon it. A veneer beach was reportedly present between 2010 and 2012 but has not been recorded since.</p>

2.2 Seaham (Dawdon)

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>24th November 2022</p>	<p>Cliff-top Survey:</p> <p>Three ground control points have been established along the cliff top at Dawdon (Figure B1). The separation between any two points is nominally 300m. These cliff top surveys are intended to inform on erosion rates of the undefended sea cliffs extending south of the rock armour revetment to the south of Seaham Harbour.</p> <p>The cliff top surveys at Dawdon are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top. Appendix B provides information about the ground control points and results from between the 2008 (baseline) cliff top survey and the current (November 2021) survey.</p> <p>Between April 2022 and November 2022, none of the three control points have experienced any significant movement (>0.1m), recording 0.07m, -0.03m and 0.03m respectively. Any movement less than the 0.1m is considered within the margin of error of the monitoring technique, highlighted by the apparent advancement in cliff line in Point 2.</p> <p>Appendix B provides results from the November 2022 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.</p>	<p>None of the three control points recorded a retreat greater than the margin of error (0.1m) over of the summer of 2022 indicating a period of stability which is to be expected in calmer summer months.</p> <p>Longer term trends: Long-term recession rates calculated from the data collected since November 2008 show retreat at 0.09m/yr. for Point 1, 0.03m/yr. for point 2 and 0.10m/yr. at Point 3.</p>

2.3 Blast Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>24th November 2022</p>	<p>Beach Profiles:</p> <p>Blast Beach and Chemical Beach are covered by four beach profile lines (Appendix A). All the profiles exhibit similar forms, with a rock cliff, wide colliery spoil beach with a distinct low cliff at its eroding seaward edge, and a mixed gravel and sand foreshore extending to MLW. The survey report notes that; <i>'Dense vegetation restricts access to the cliff tops of sections SH1, SH2 & SH1A and the cliff base of SH1A.'</i></p> <p>Profile 1bSH1b was added to the programme during the Full Measures survey in October 2015. The profile is located on Chemical Beach, adjacent to the sewage works south of Seaham. The profile consists of cliff to chainage 30m, fronted by a gravel beach. The beach is bisected by a large concrete block between chainage 59m and 63m. Over the summer 2022, there has been a slight steepening of the upper beach resulting in accretion at the toe of cliff (0.6m in level) and erosion at the seaward face of the concrete blocks (0.4m in level). Seaward of the concrete blocks, beach levels have dropped by 0.25m in level over a 5m length before the foreshore is exposed. On average beach levels are at a medium level when compared to the envelope of previous inspections.</p> <p>Profile 1bSH1a was added to the programme during the Full Measures survey in September 2009. It is located to the north of the previously established 1bSH1. The cliff top, face and landward extents of the colliery spoil platform have all remained unchanged since the previous survey. The eroding face of the spoil, now at chainage 135m, has retreated an additional 0.5m over the summer of 2022. The spoil platform is fronted by a small, steep sediment beach followed an exposed rocky platform. The beach (between 135m and 166m) has accreted in level by up to 1.2m in level in places, supplemented by the eroding spoil. From 166m chainage to the end of the survey at chainage 250m, the foreshore remains exposed and stable. The November 2022 profile remains low compared to the range of previously recorded profiles, except for the beach fronting the spoil platform.</p> <p>At 1bSH1, the beach profile has remained unchanged across the cliff top and cliff face up to chainage 40m. At the toe of the cliff, on the colliery spoil platform, an incised channel holds water. The beach profile shows that the channel has deepened by 0.4m over summer 2022, however it is unclear whether this true change or in fact a reflection of varying water levels altering where the surveyors could take</p>	<p>The colliery spoil platform on all profiles across Blast Beach appears to have remained stable over the summer 2022, particularly to the south, where the spoil has not retreated. The northern most profile has experienced a small amount of change retreating 0.5m in the 6-month period. Beach levels have also remained stable, with a net accretion across the bay observed, no doubt supplemented by the eroding spoil. This stability is to be expected during the calmer summer months</p> <p>Longer term trends: The cliffs behind Blast Beach are currently inactive because they are fronted by colliery spoil. The sea cliffs will eventually reactivate as on-going erosion of the colliery spoil removes the protection it affords to the cliffs. This is most likely to occur at the southern end of the bay where the spoil is most rapidly eroding. The accumulating sediment seaward of the colliery spoil in the northern part of the bay will offer the cliffs more protection. However, since the winter of 2014 there has been a reversal in the trend with erosion in the north of the bay and accretion in the south, this trend was continued in the November 2022 and so should remain area of focus.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>readings. The spoil platform face (chainage 75m), previously shown to be retreating, has remained unchanged. Seawards of colliery spoil cliff, the beach has been dominated by accretion up to 0.9m in level in places. The rocky foreshore from chainage 130m to 180m remains exposed.</p> <p>At 1bSH2, the most southerly profile along Blast Beach, dense vegetation at the cliff top (noted in the survey report) has resulted in anomalous readings on the profile between chainage 64m and the toe of the cliff at chainage 95m. Between the toe of the cliff and the edge of the colliery spoil, the profile has remained unchanged, There is little to no cliffing between the edge of the spoil and the beach sediment unlike elsewhere on Blast Beach. Other than between chainage 129m and 144m, which has experienced a drop in level of 0.4m, the beach profile in general has experienced little to no change across its length, limited to ± 0.1m. Overall, the profile is at a medium to high level compared to the range recorded from previous surveys.</p>	

2.4 Hawthorne Hive

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>24th November 2022</p>	<p>Beach Profiles:</p> <p>Hawthorne Hive is monitored by beach profile 1cEA2 (Appendix A). The survey report notes “<i>unable to measure start of Section EA2 as the vegetation has choked out the section line and route over cliff faces</i>” and therefore all surveys following October 2012 start at 95m chainage.</p> <p>Over the Summer 2022, the profile shows a uniform loss of material across the upper beach (chainage 100m and 143m) at a magnitude of 0.2m. Across the lower beach, seaward of chainage 143m, the rocky foreshore remains exposed. Overall, the profile is at a low level when compared to the range recorded from previous surveys. The course of Hawthorne Burn has not intercepted the profile since April 2013 and remains that way in 2022.</p>	<p>Longer term trends: The upper beach levels were recorded to be notably low in 2014, 2018 and May 2021. On all occasion the beach levels appeared to demonstrate some recovery but not enough to alter the long-term pattern that suggests the beach is undergoing progressive erosion.</p> <p>Limited cliff erosion occurs in this section and therefore sediment supply is limited to erosion of colliery spoil.</p> <p>Storm events which may block the channel and varying flows in Hawthorne Burn are likely to continue to episodically block the channel and change its course across the beach.</p>

2.5 Blackhall Colliery

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>23rd November 2022</p>	<p>Beach Profiles:</p> <p>Blackhall Colliery is covered by three beach profile lines (Appendix A) that are monitored annually. As at Blast Beach, profiles are dominated by colliery spoil and exhibit similar forms with a rock cliff, wide spoil beach with a distinct cliff at the eroding face of the colliery spoil, and a gravel and sand foreshore that extends to MLW. The survey report notes that the surveyor was <i>'unable to survey part of section BH1 and BH2 due to dense vegetation'</i>.</p> <p>1cBH1 is located near Horden Point. The Full Measures 2022 survey shows that the profile has again remained stable up to the toe of the cliff at chainage 115m. On the colliery spoil platform, between the toe of the cliff and the face of the colliery spoil, now a chainage 137m, the change is negligible limited to the movement of large cobbles/boulders. The face of the colliery spoil platform has retreated approximately 1m since the previous survey. The cobble beach/foreshore has maintained a very similar profile to the November 2021 profile with change again limited to the movement of large rocks.</p> <p>Profile 1cBH2 has again exhibited negligible change up to the colliery spoil platform face, now at chainage 149m. This means the spoil, has eroded landward a further 6m since November 2021 and total of 11m since November 2020. Seaward of the spoil, the beach profile is split into a steeper upper beach formed of larger sediments (chainage 149m to 192m) and a shallower lower beach (chainage 192m to 270m). At the change in gradient, the beach has lowered by 1.1m in level when compared to the previous survey in November 2021.</p> <p>Profile 1cBH3 shows that since 2008 there has been episodic migration, infilling and scouring of the outflow of Castle Eden Burn, which crosses the profile. The channel has been migrating landward over the years and now is located at the toe of the cliff. Since the previous inspection the channel bed has accreted 0.3m in level and narrowed by up to 4m as a result encroachment from the beach berm on its seaward edge. The berm crest has also experienced a similar level of accretion (0.2m in level). On the seaward aspect of the berm, the beach between chainage 165m to 201m has eroded by 0.6m in level before switching to accretion up to the end of the profile (chainage 255m). Comparing the levels of the beach to the previous year's envelope, it appears the beach is at a low level, particular at the toe of the cliff (due to the burn) and on the upper beach.</p>	<p>As in previous years, the colliery spoil platform continues to erode at Profile 1cBH1 having retreated an additional 1m in 2022. With approximately 30m of spoil remaining, the cliff will remain defended in the short term.</p> <p>The spoil platform at Profile 1cBH2 appears to be eroding at a significantly greater rate, having eroded a further 6m since the previous inspection on top of the 5m in 2021. With ~25m of platform remaining, if the spoil continues to erode at the same rate as the previous 2 years, the cliffs in this section may become exposed within the next 5 years.</p> <p>Longer term trends: The surveys show that the spoil beach along much of the Blackhall Colliery shore is progressively eroding but continues to protect the cliffs in the short term. The colliery spoil face at profile 1cBH1 and profile 1cBH2 has eroded back ~8m and 24m respectively since the first survey in 2011. However, as mentioned above with profile 1cBH2 retreating 11m in the last two years it indicates a change in erosion rate.</p>

3. Problems Encountered and Uncertainty in Analysis

The cliff top position surveys at Dawdon are assumed to have a limit of accuracy of $\pm 0.1\text{m}$ due to the techniques used. The accuracy of short-term recession data are therefore limited, but longer-term recession rates will become more reliable as further data is obtained (see section 1.3).

At Blast Beach 1bSH1, 1bSH1A and 1bSH2 there was no access to the cliff top and at the cliff bottom of 1bSH1A due to dense vegetation.

At Hawthorne Hive the surveyor was unable to measure the start of Section 1cEA2 as the vegetation has choked out the section line and route over cliff faces.

At Blackhall the surveyor was unable to access part of sections 1cBH1 and 1cBH2 due to dense vegetation. The surveyor was also unable to survey part of Section BH3 due to deep water at the back of the beach.

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

No changes are recommended at the present time.

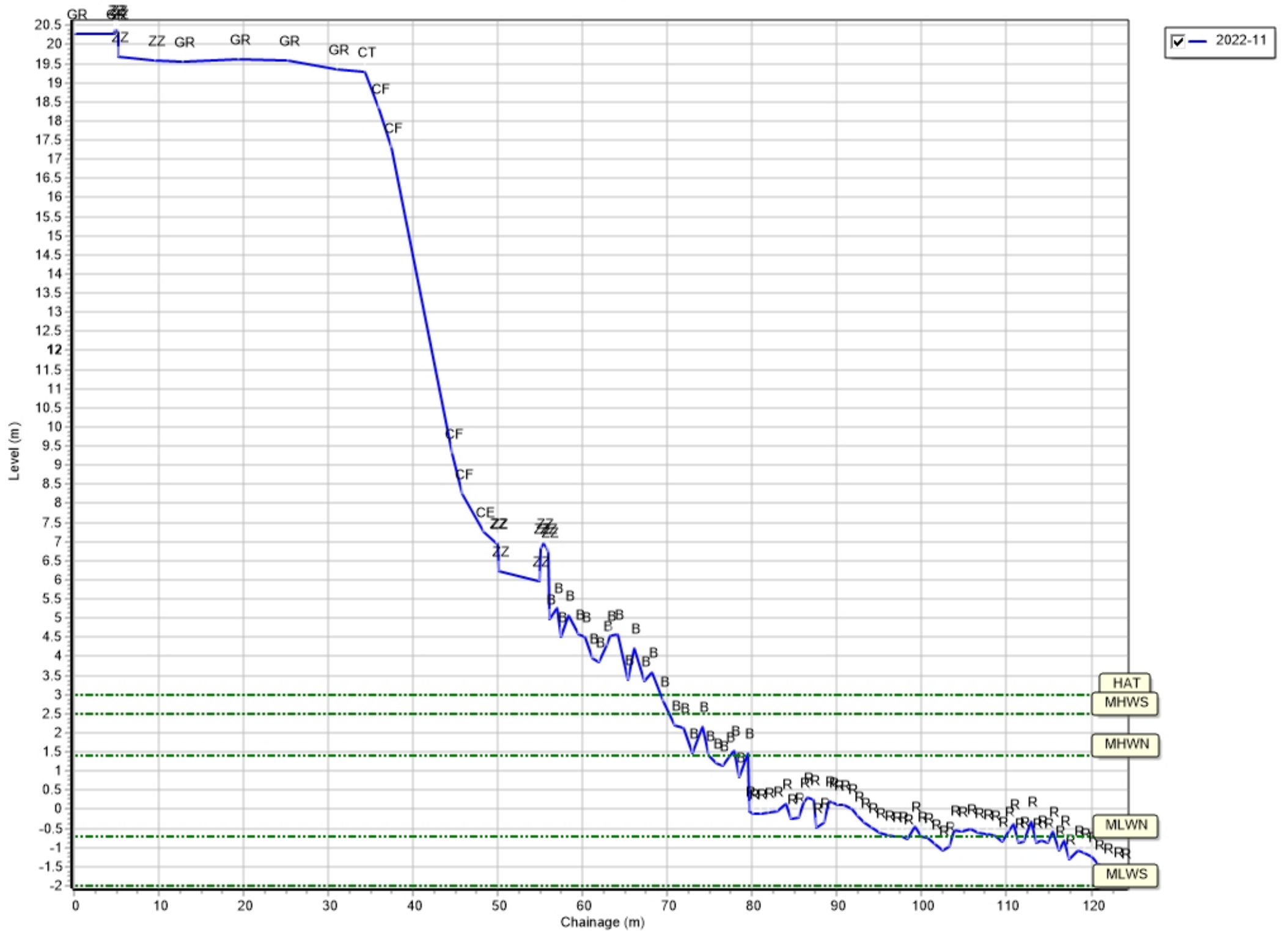
5. Conclusions and Areas of Concern

- There has been little change at Featherbed Rocks. The rocky shore platform remains exposed with the veneer beach that was present in earlier surveys still absent since autumn 2012.
- At Seaham cliffs, none of the three control points showed any significant retreat (all were $< 0.1\text{m}$) between summer and autumn 2022 indicating the cliffs have been largely stable.
- The colliery spoil platform on all profiles across Blast Beach appears to have remained generally stable over the summer 2022, particular to the south, where the spoil has not retreated. The northern most profile has experienced a small amount of change retreating 0.5m in the 6-month period. Beach levels have also remained stable, with a minor net accretion across the bay observed, supplemented by the eroding spoil.
- At Hawthorne Hive, beach levels have dropped since the previous inspection and remain at a low level compared to the envelope of previous inspections.
- At Blackhall Colliery, the spoil platform at Profile 1cBH2 appears to be eroding at significantly greater rate, having eroded a further 6m since the previous inspection in addition to the 5m erosion recorded in 2021. With $\sim 25\text{m}$ of platform remaining, if the spoil continues to erode at the same rate as the previous two years, the cliffs in this section may become exposed within the next five years.

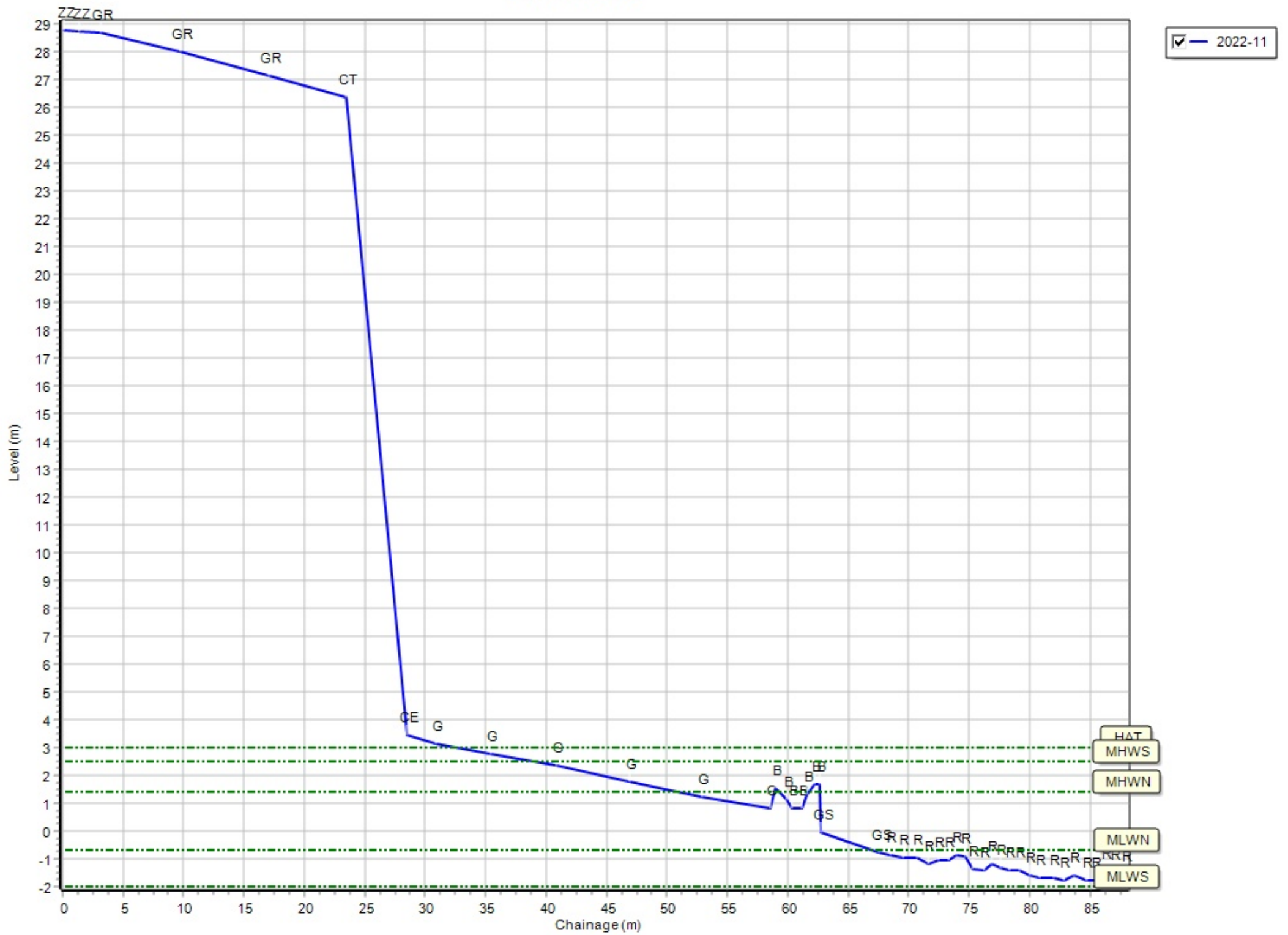
Appendices

Appendix A
Beach Profiles

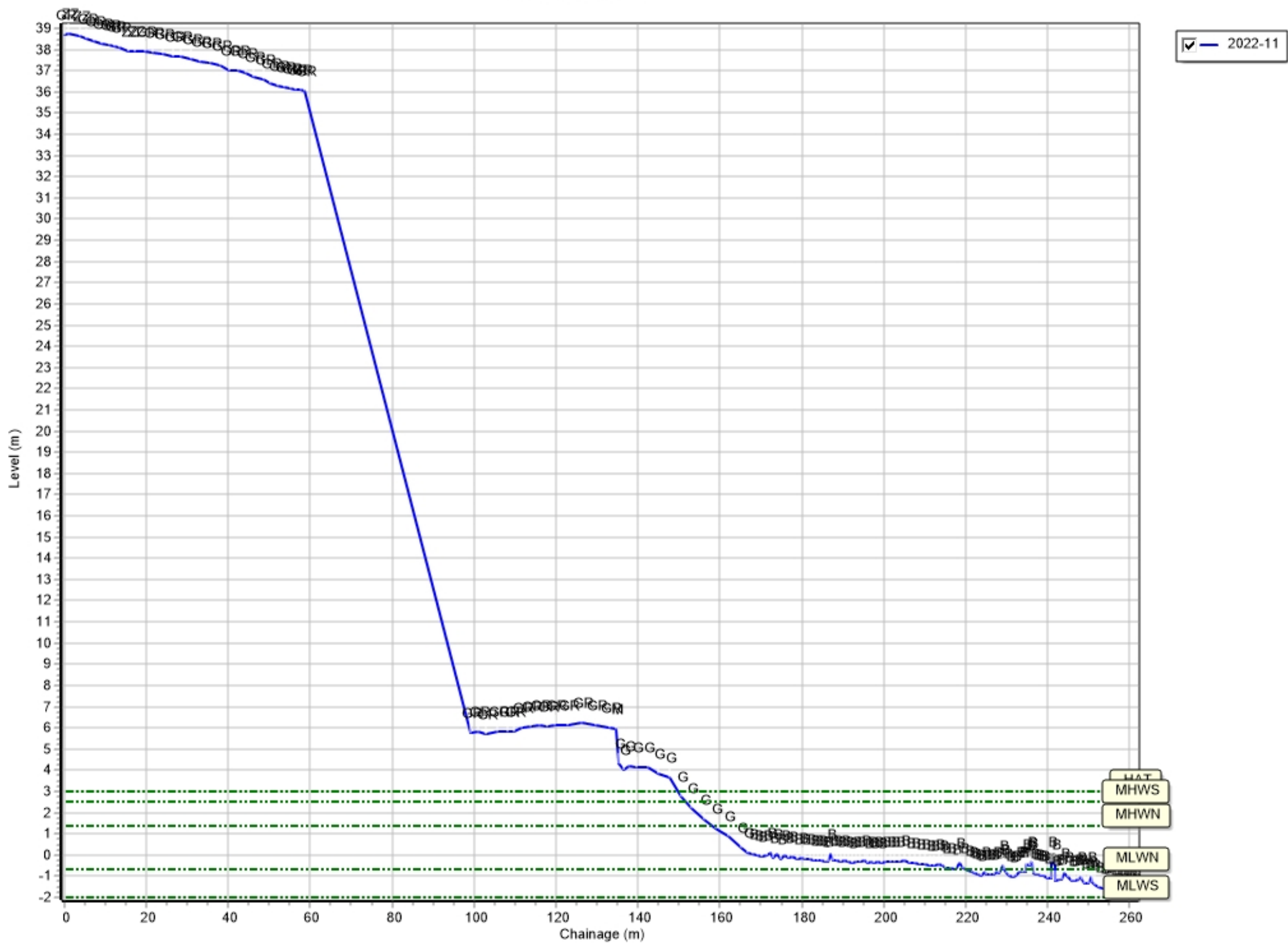
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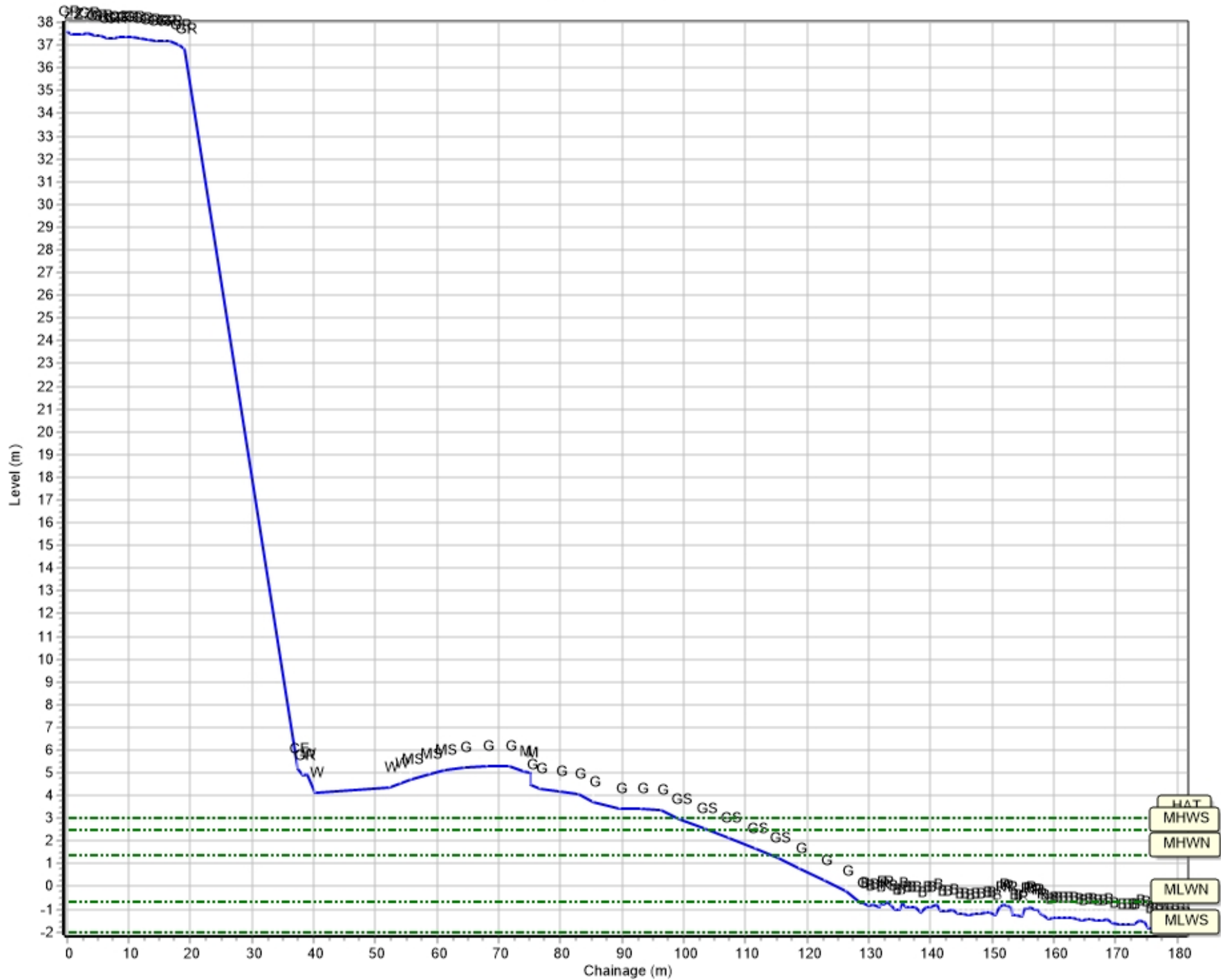
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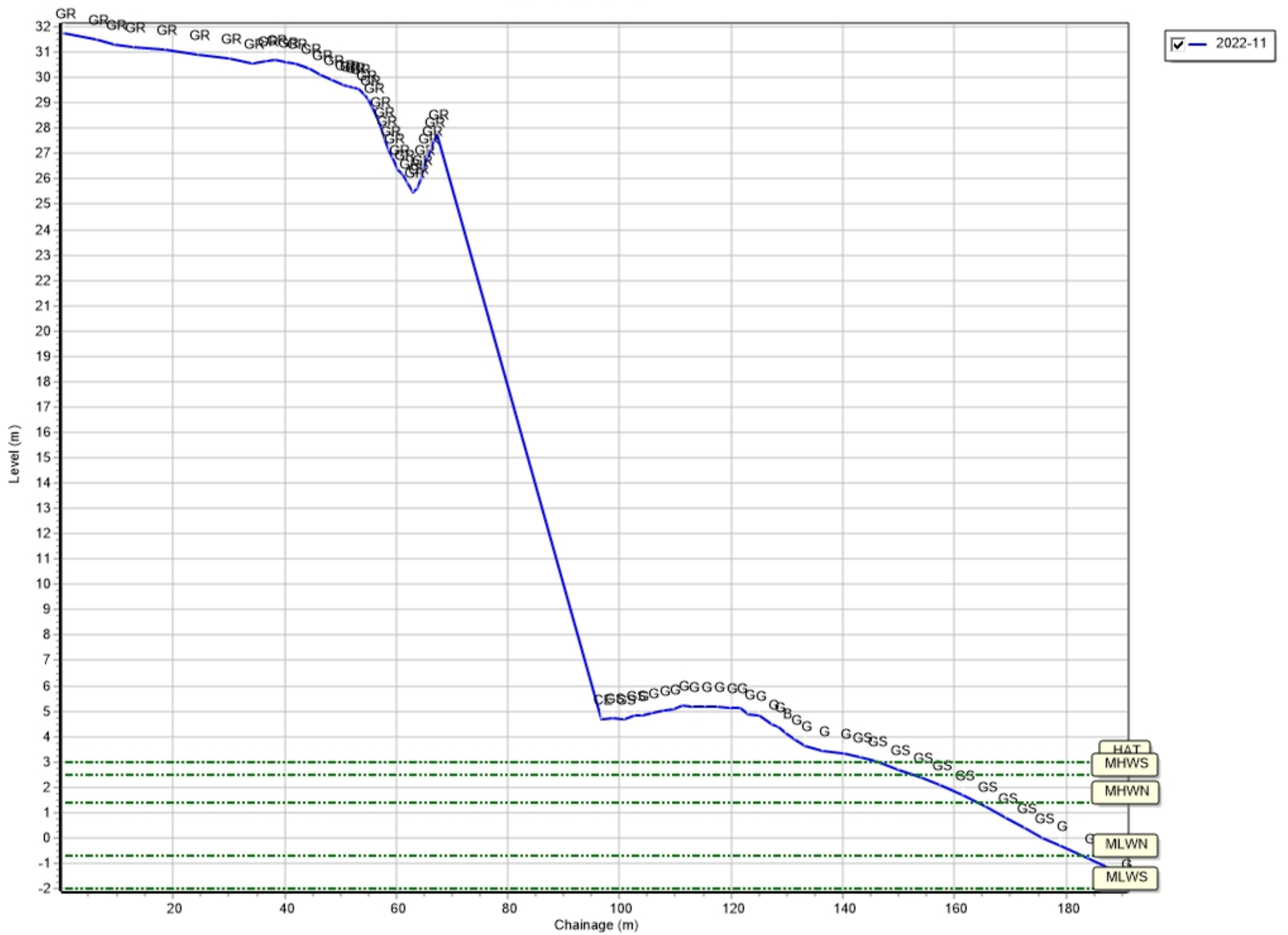
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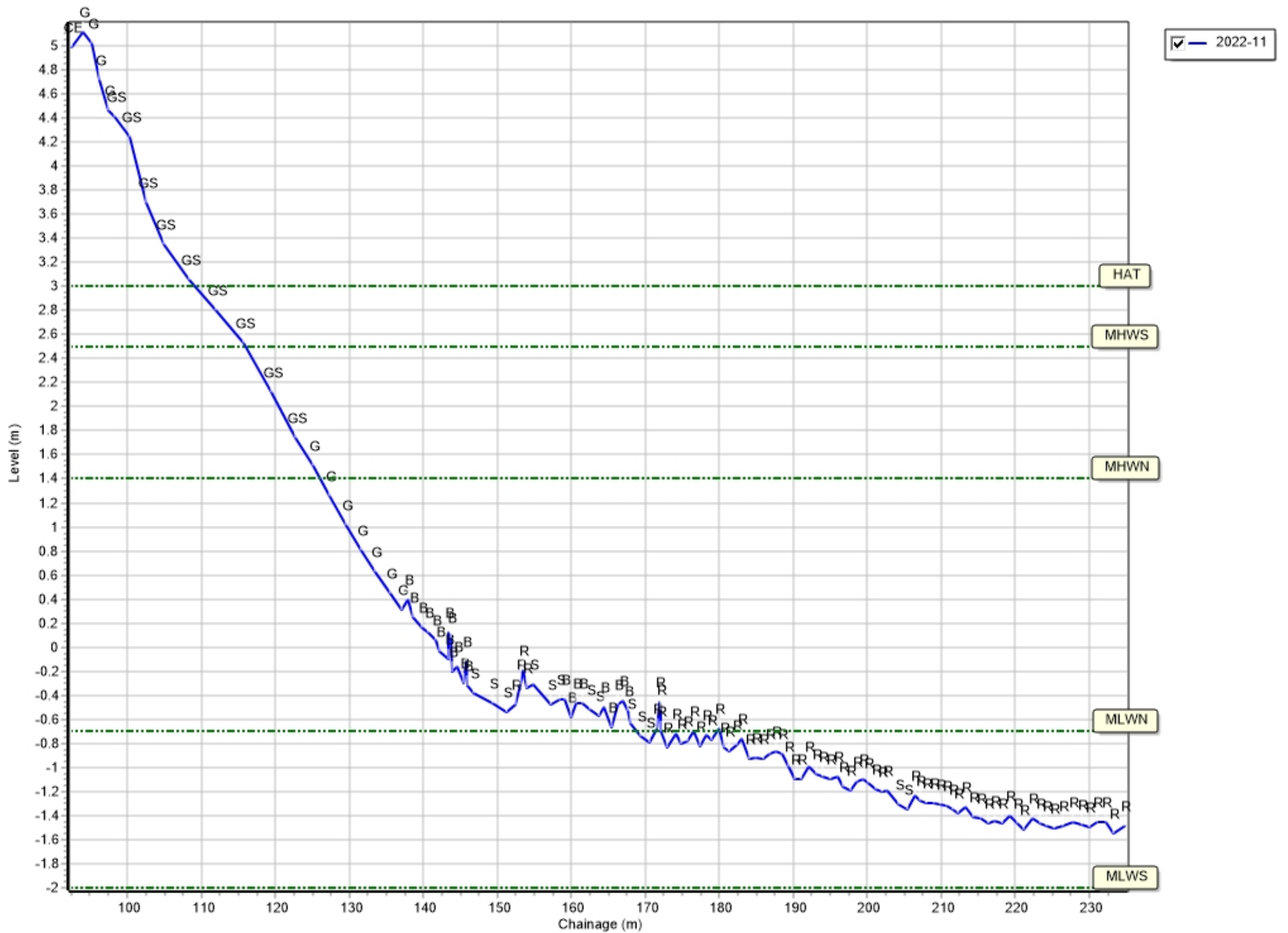
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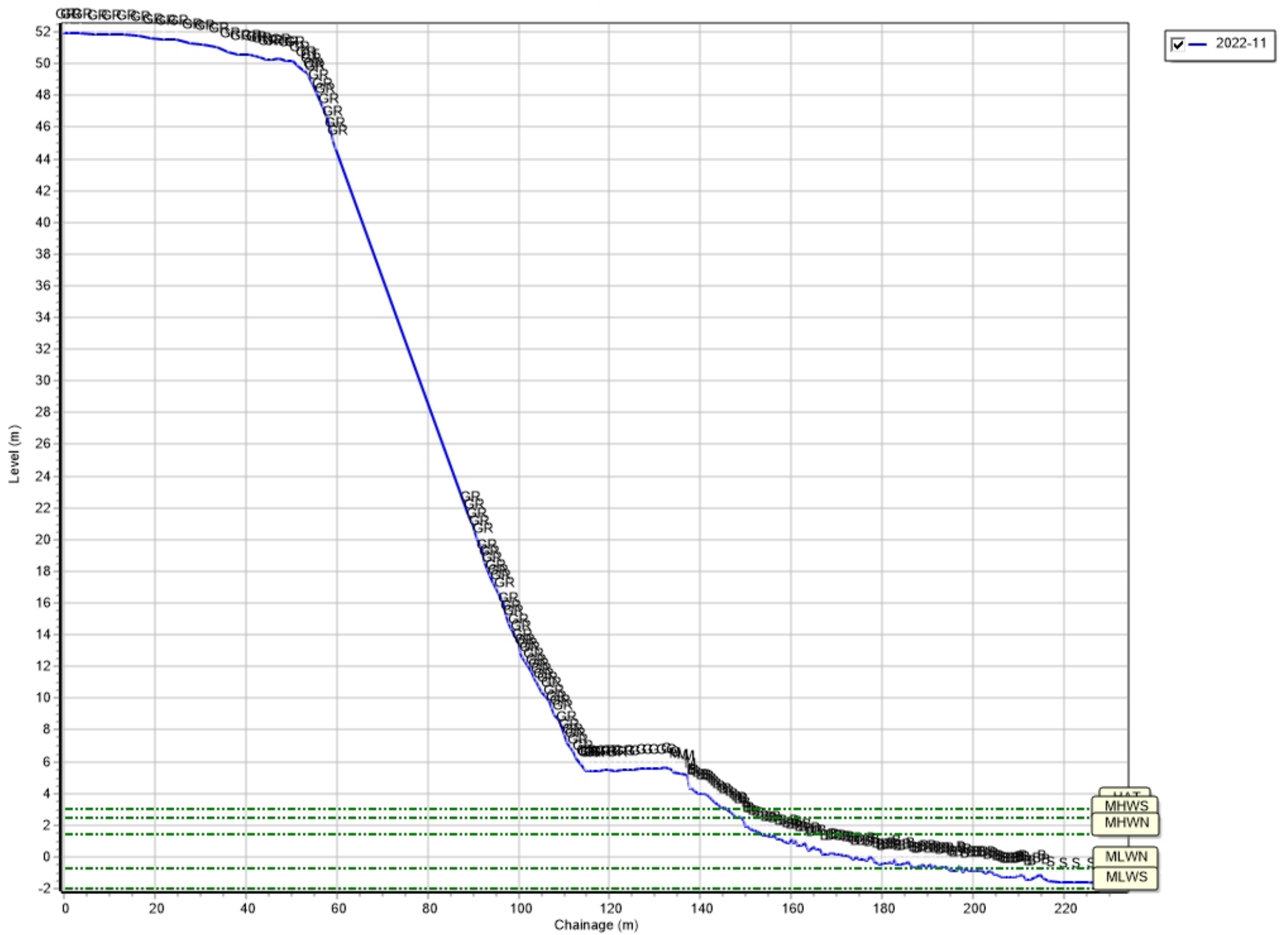
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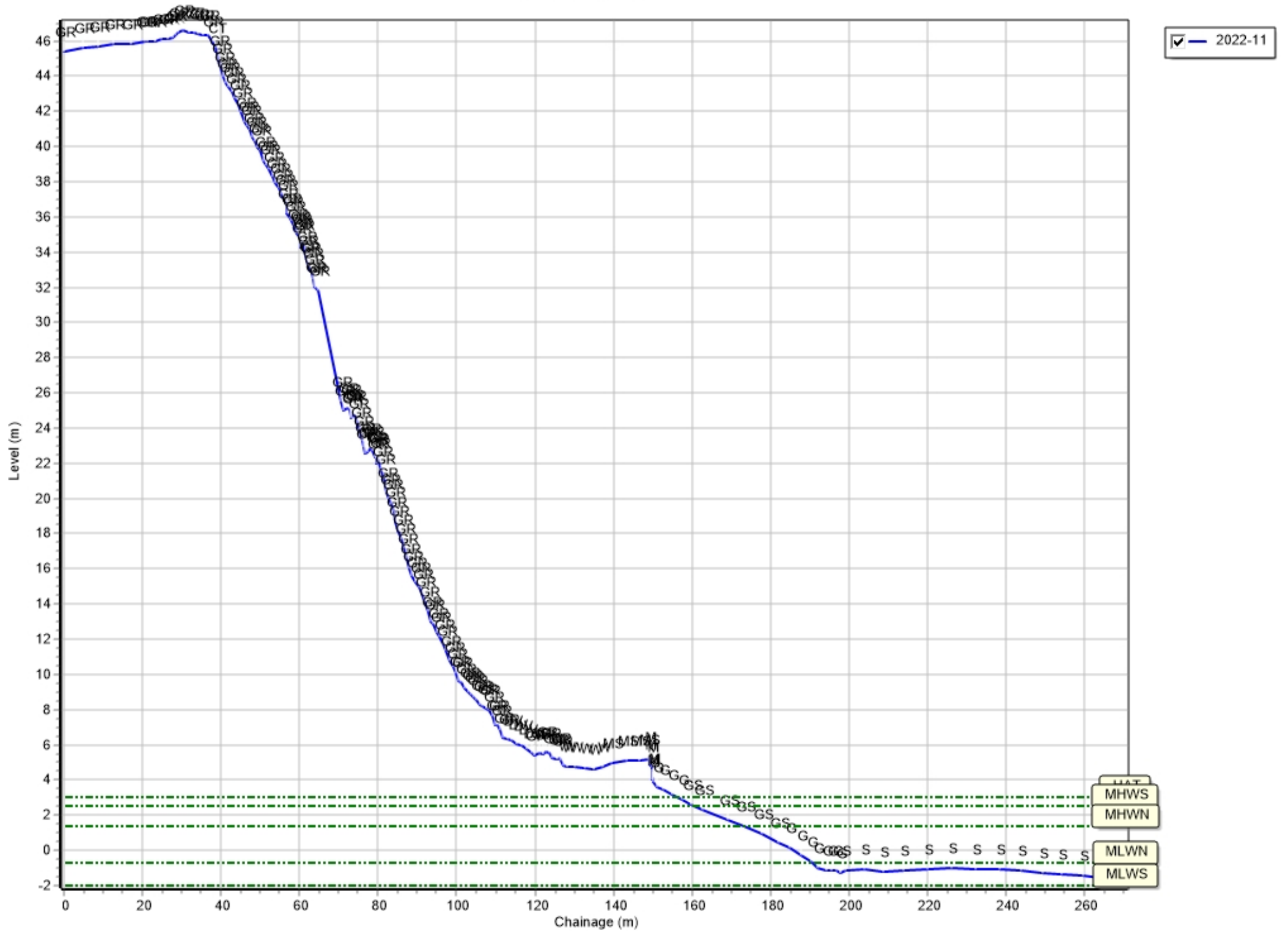
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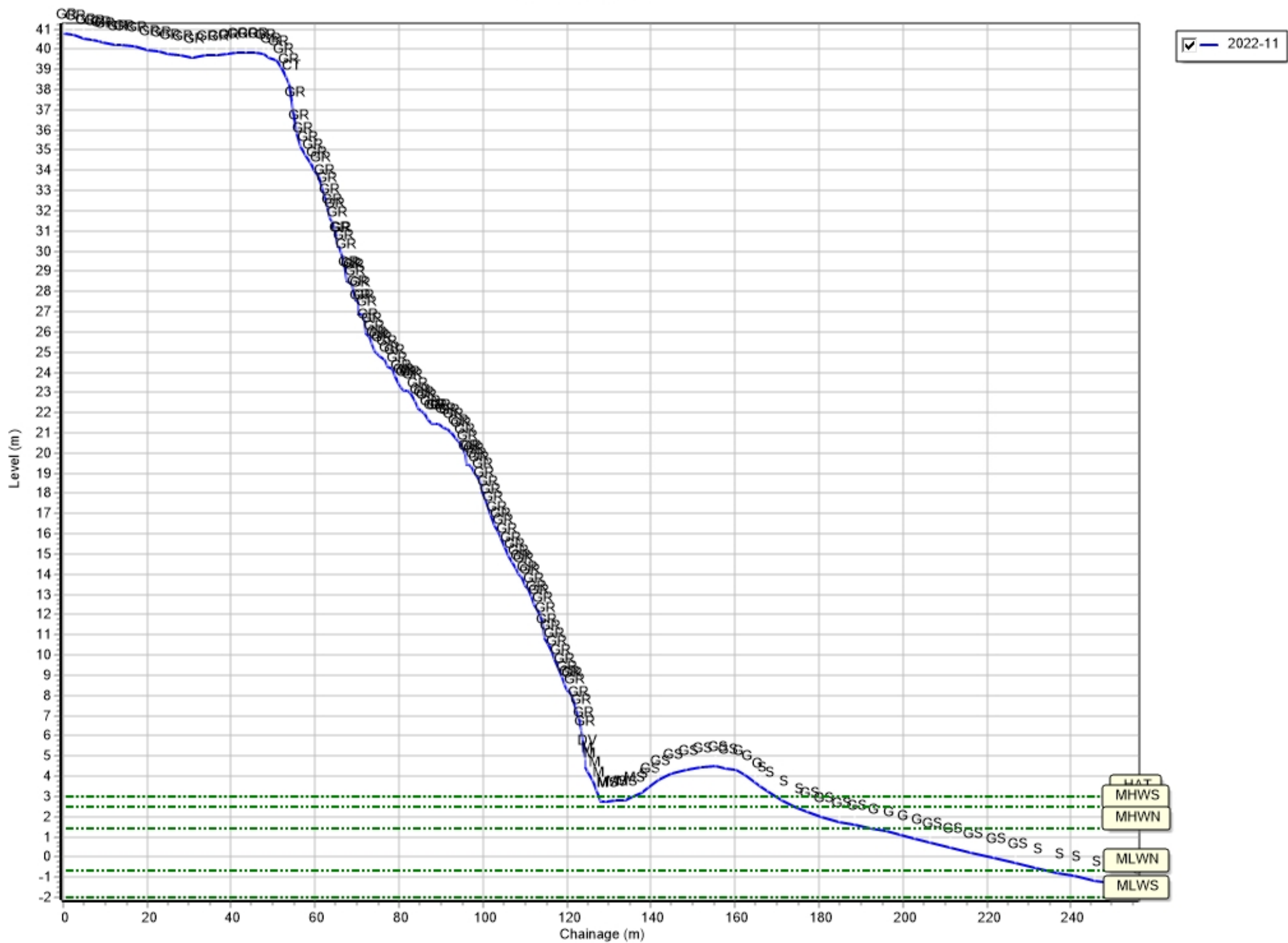
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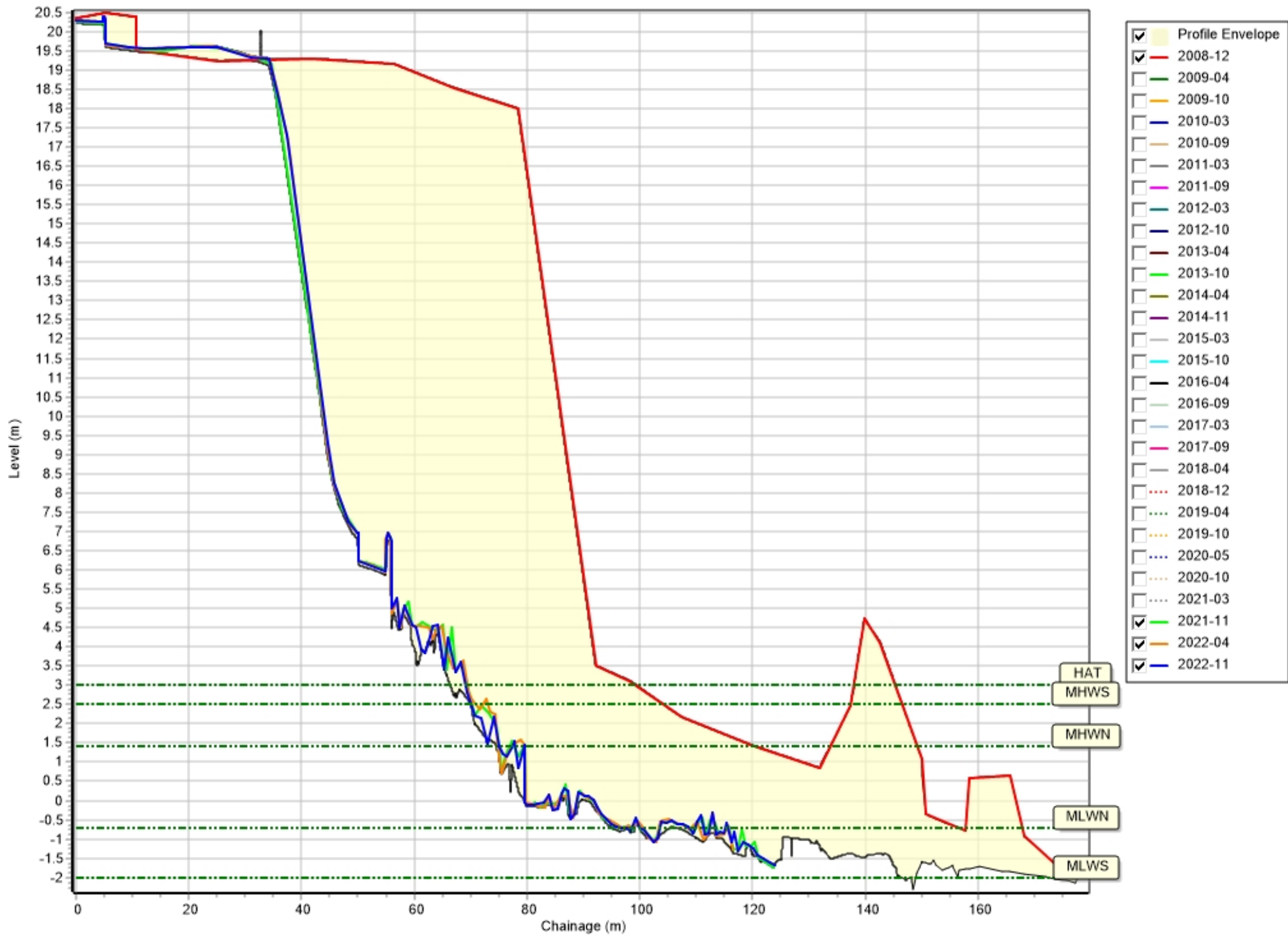
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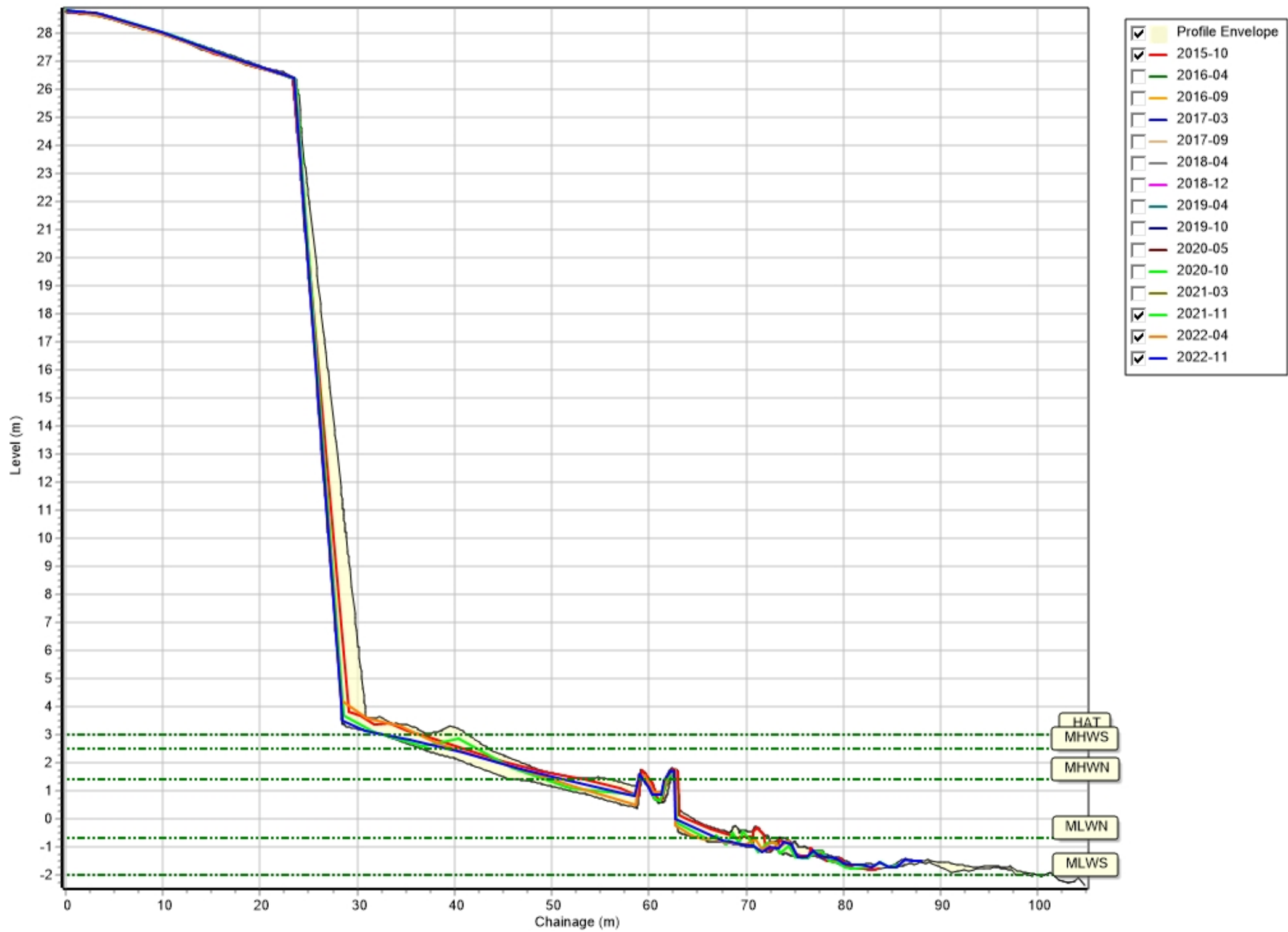
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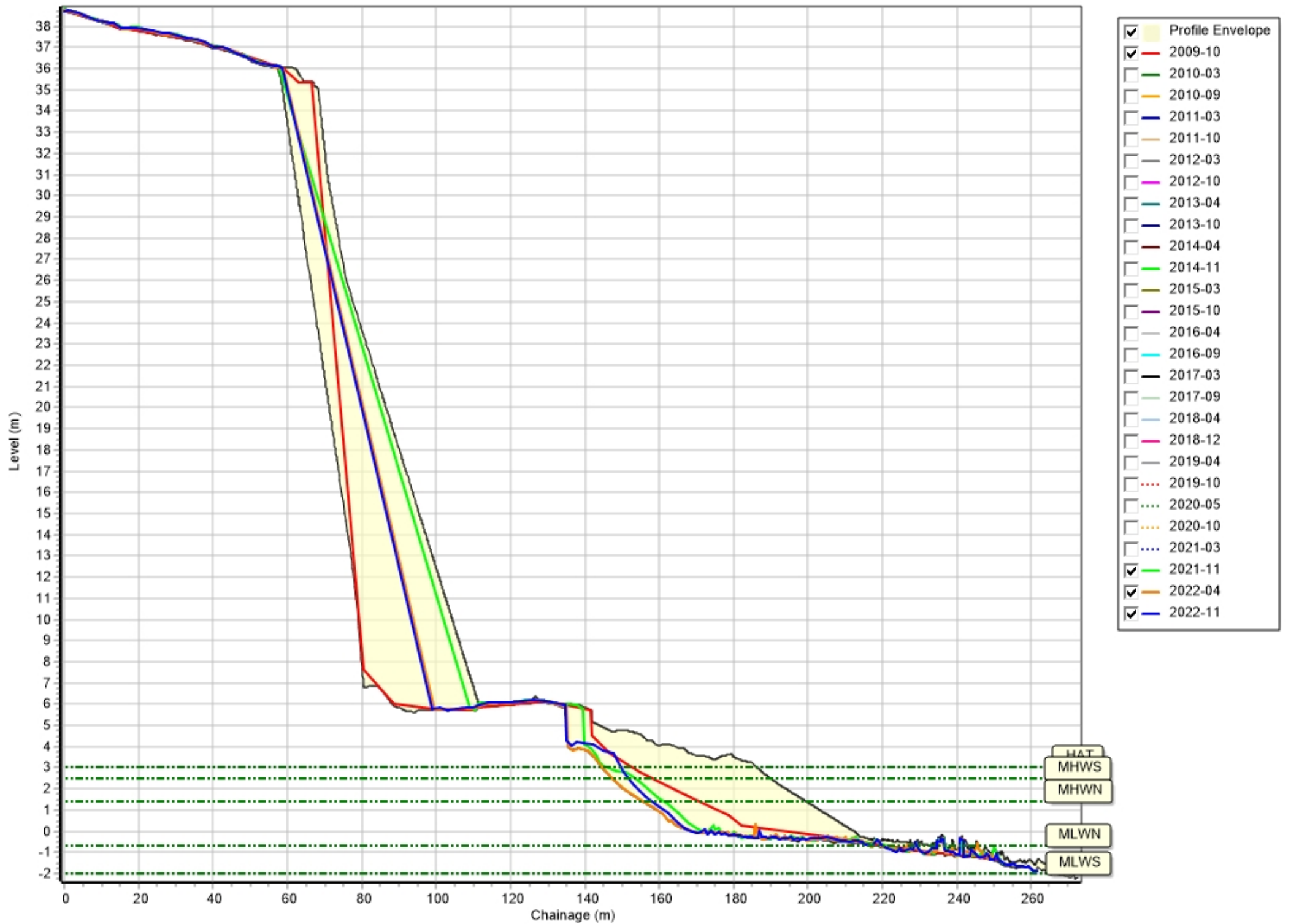
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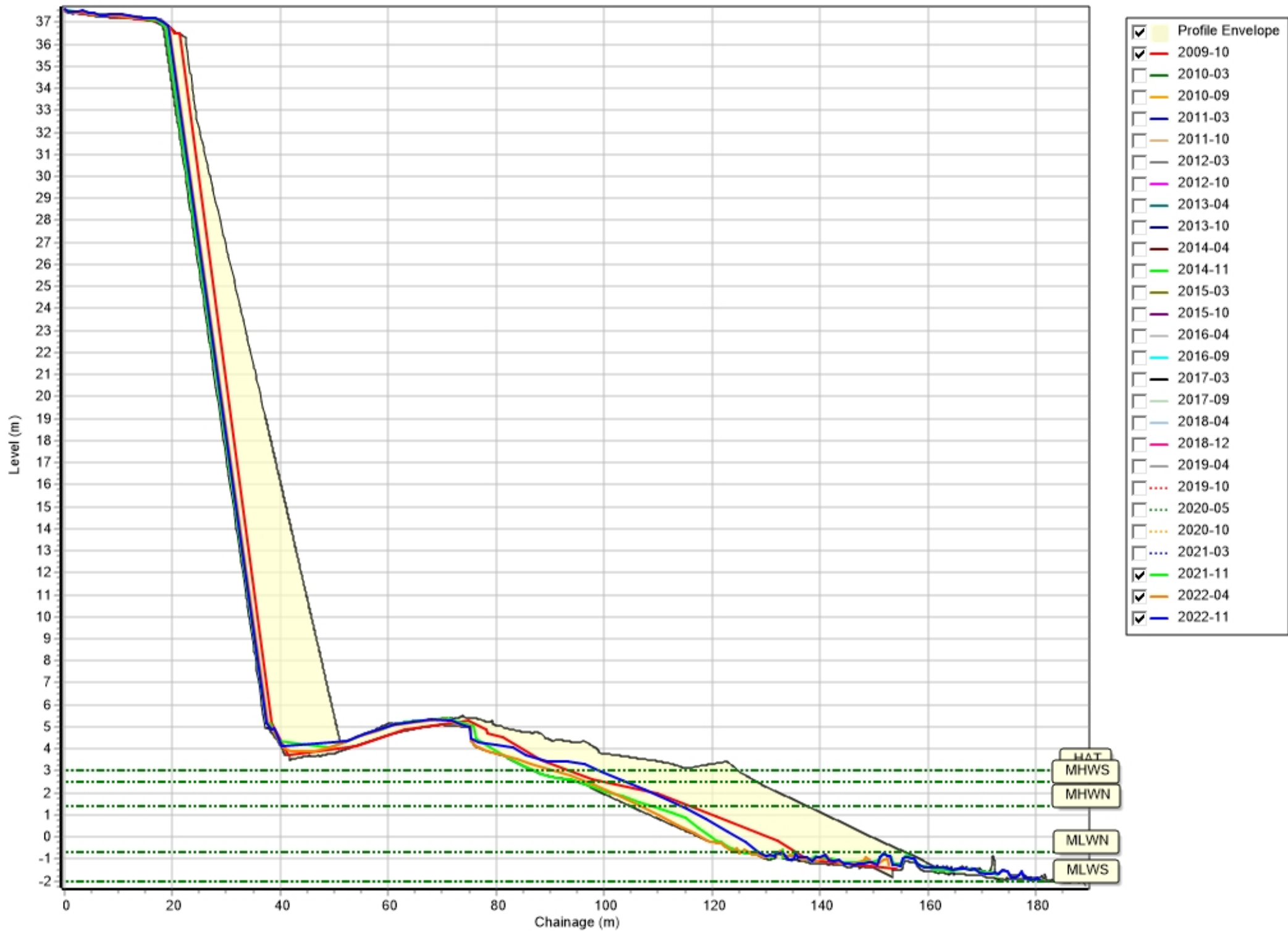
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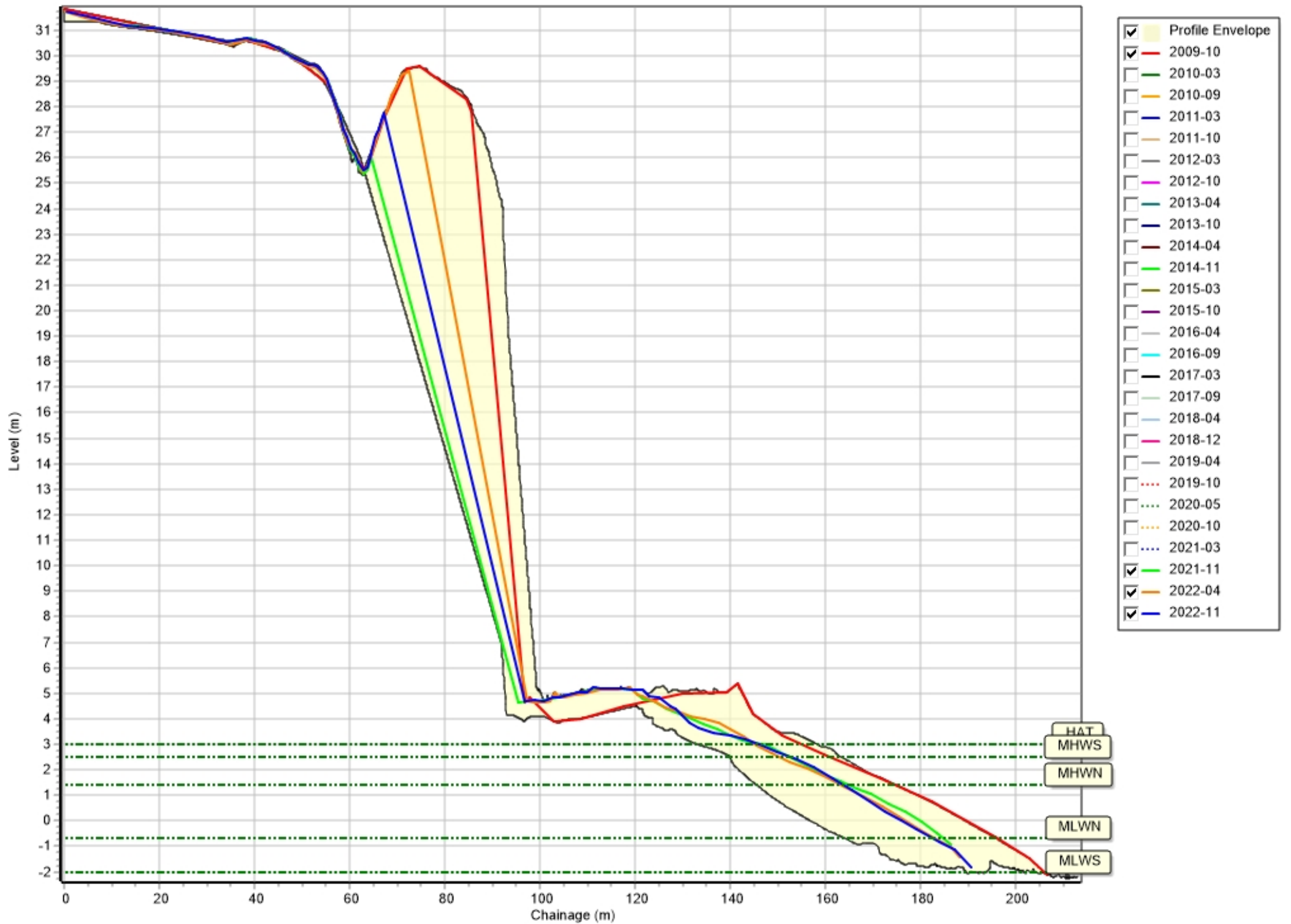
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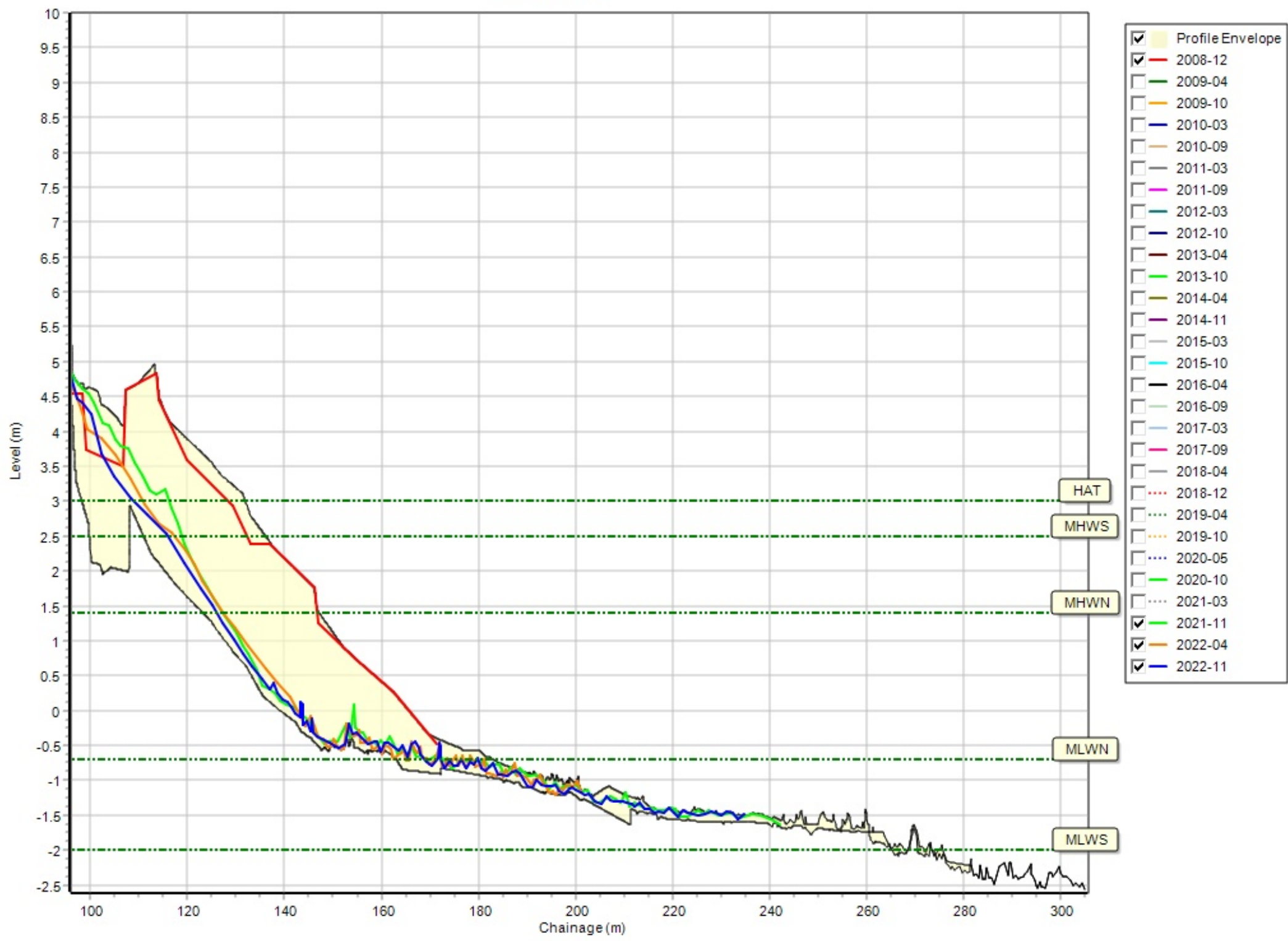
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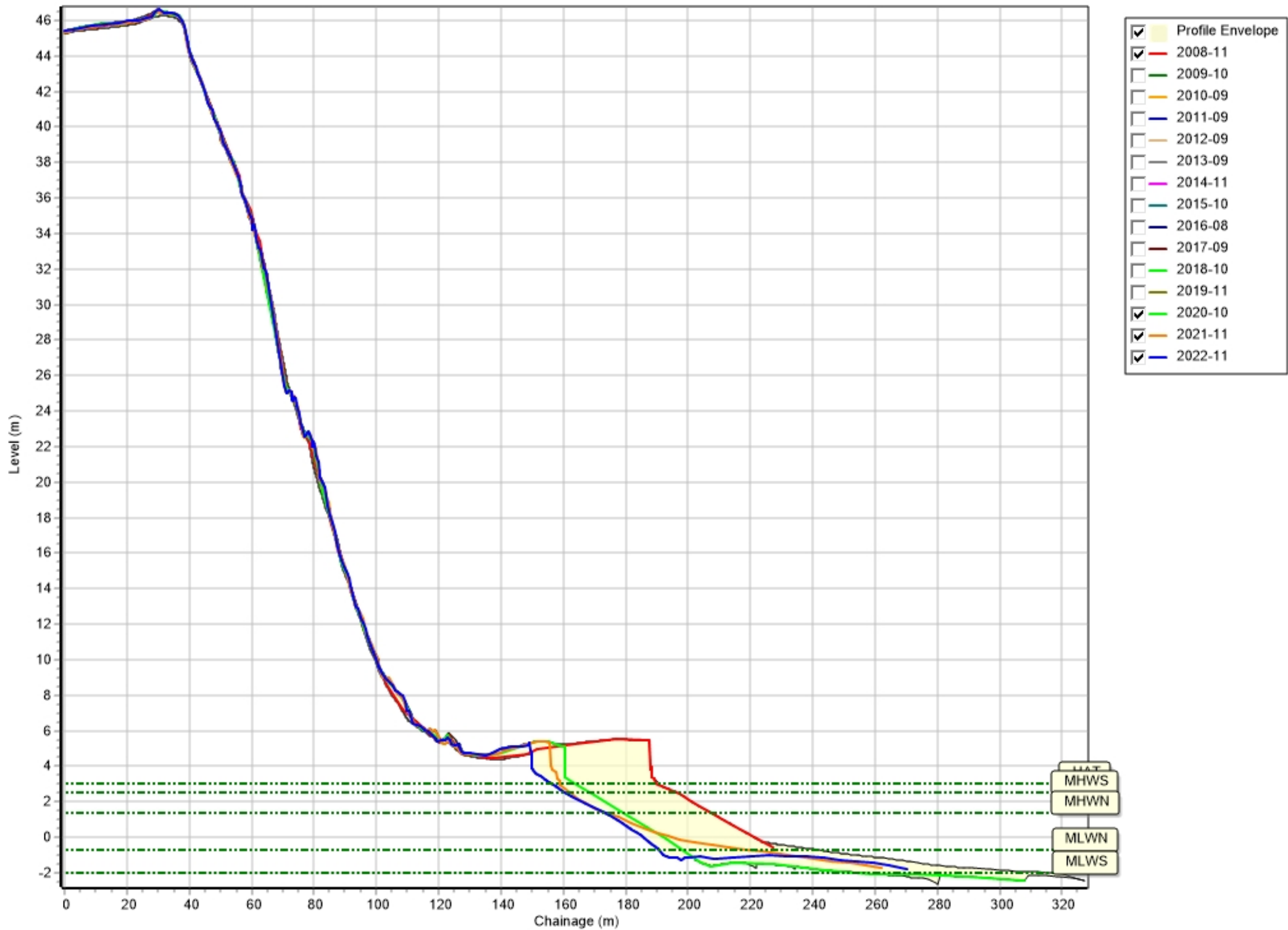
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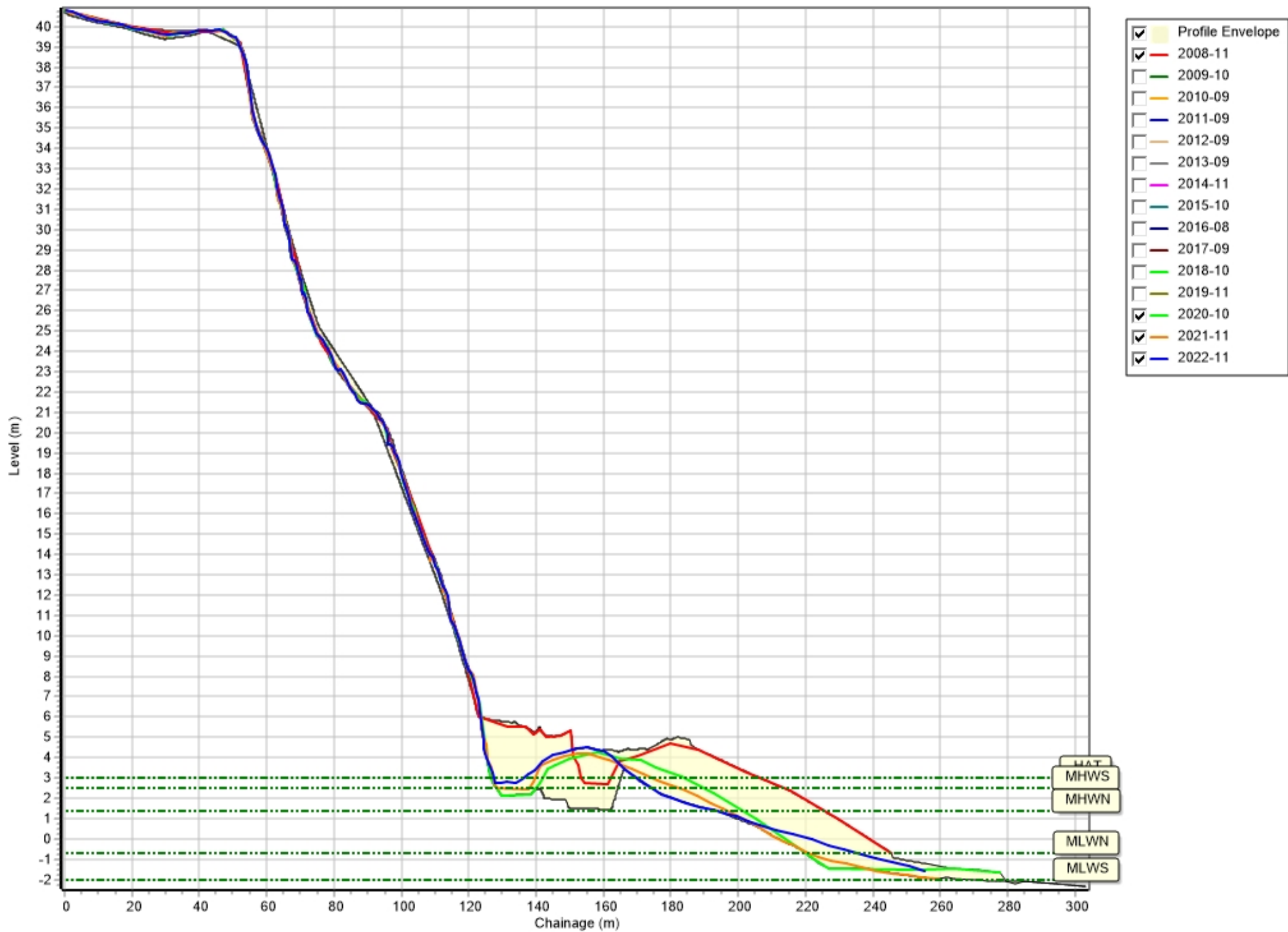
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Profiles: 1cBH2



Profiles: 1cBH3



Appendix B
Cliff Top Survey

Cliff Top Survey

Seaham

Three ground control points have been established on the Seaham frontage (Figure B1). The maximum separation between any two points is nominally 300m.

The cliff top surveys at Seaham are undertaken biannually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table B1 provides baseline information about these ground control points and results from the 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 B1 – Cliff Top Surveys at Seaham

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
			(°)	Nov 2008	April 2022	Nov 2022	Nov 2008 - Nov 2022	April 2022 - Nov 2022	Nov 2008 - Nov 2022
1	443515.4	548421.7	70	16.1	14.93	14.86	1.24	0.07	0.09
2	443607.8	548136.3	90	13.3	12.92	12.95	0.35	-0.03	0.03
3	443756.1	547858.5	95	14.8	13.46	13.43	1.37	0.03	0.10

