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

Northumberland County Council

August 2022

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 15
2.1 Sandstell Point (Spittal A) 15
2.2 Spittal (Spittal B) 18
2.3 Goswick Sands 19
2.4 Holy Island 20
2.5 Beadnell Village 21
2.6 Beadnell Bay 22
2.7 Boulmer 24
2.8 Alnmouth Bay 25
2.9 High Hauxley & Druridge Bay 27
2.10 Lynemouth Bay 29
2.11 Newbiggin-by-the-Sea 32
2.12 Cambois Bay 35
2.13 Blyth South Beach 37
3. Problems Encountered and Uncertainty in Analysis 39
4. Recommendations for 'Fine-tuning' the Monitoring Programme 39
5. Conclusions and Areas of Concern 39

Appendices

Appendix A Beach Profiles
Appendix B Topographic Survey
Appendix C Sand Extent Survey

List of Figures

Figure 1 Sediment Cells in England and Wales
Figure 2 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) Berwick upon Tweed to Goswick Sands	Water Level (m AOD) Holy Island	Water Level (m AOD) Goswick Sands to Embleton Bay
HAT	2.8	3.1	3.1
MHWS	2.2	2.4	2.4
MHWN	1.3	1.3	1.3
MLWN	-1.3	-1.0	-0.9
MLWS	-1.8	-1.7	-1.6

Water Level Parameter	Water Level (m AOD) Boulmer to Druridge Bay	Water Level (m AOD) Lynemouth Bay to Blyth South Beach
HAT	3.05	3.0
MHWS	2.35	2.4
MHWN	1.25	1.3
MLWN	-0.85	-0.9
MLWS	-1.75	-1.8

Source: UKHO Admiralty Tide Tables, 2020

Glossary of Terms

Term	Definition
Beach nourishment	Artificial process of replenishing a beach with material from another source.
Berm crest	Ridge of sand or gravel deposited by wave action on the shore just above the normal high water mark.
Breaker zone	Area in the sea where the waves break.
Coastal squeeze	The reduction in habitat area which can arise if the natural landward migration of a habitat under sea level rise is prevented by the fixing of the high water mark, e.g. a sea wall.
Downdrift	Direction of alongshore movement of beach materials.
Ebb-tide	The falling tide, part of the tidal cycle between high water and the next low water.
Fetch	Length of water over which a given wind has blown that determines the size of the waves produced.
Flood-tide	Rising tide, part of the tidal cycle between low water and the next high water.
Foreshore	Zone between the high water and low water marks, also known as the intertidal zone.
Geomorphology	The branch of physical geography/geology which deals with the form of the Earth, the general configuration of its surface, the distribution of the land, water, etc.
Groyne	Shore protection structure built perpendicular to the shore; designed to trap sediment.
Mean High Water (MHW)	The average of all high waters observed over a sufficiently long period.
Mean Low Water (MLW)	The average of all low waters observed over a sufficiently long period.
Mean Sea Level (MSL)	Average height of the sea surface over a 19-year period.
Offshore zone	Extends from the low water mark to a water depth of about 15 m and is permanently covered with water.
Storm surge	A rise in the sea surface on an open coast, resulting from a storm.
Swell	Waves that have travelled out of the area in which they were generated.
Tidal prism	The volume of water within the estuary between the level of high and low tide, typically taken for mean spring tides.
Tide	Periodic rising and falling of large bodies of water resulting from the gravitational attraction of the moon and sun acting on the rotating earth.
Topography	Configuration of a surface including its relief and the position of its natural and man-made features.
Transgression	The landward movement of the shoreline in response to a rise in relative sea level.
Updrift	Direction opposite to the predominant movement of longshore transport.
Wave direction	Direction from which a wave approaches.
Wave refraction	Process by which the direction of approach of a wave changes as it moves into shallow water.

Preamble

The Cell 1 Regional Coastal Monitoring Programme covers approximately 300km of the north east coastline, from the Scottish Border (just south of St. Abb's Head) to Flamborough Head in East Yorkshire. This coastline is often referred to as 'Coastal Sediment Cell 1' in England and Wales (**Figure 1**). Within this frontage, the coastal landforms vary considerably, comprising low-lying tidal flats with fringing salt marshes, hard rock cliffs that are mantled with glacial sediment to varying thicknesses, softer rock cliffs and extensive landslide complexes.

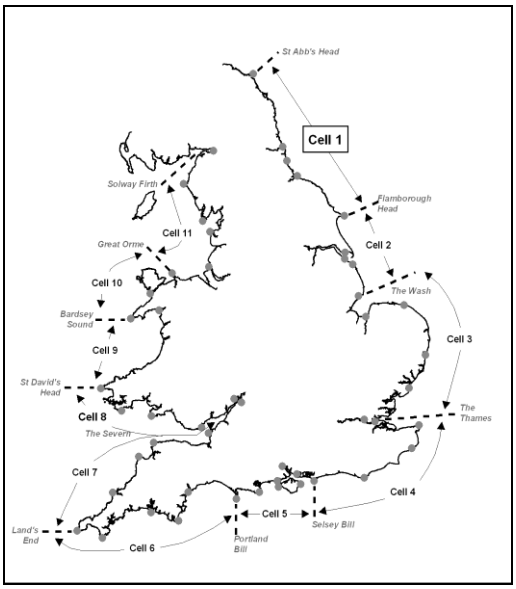

Figure 1 Sediment Cells in England and Wales

The programme commenced in its present guise in September 2008[1] 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:

Northumberland County Council
North Tyneside Council
South Tyneside Council
Northumberland Coast AONB
Durham County Council
Redcar & Cleveland Borough Council
Sunderland City Council
Hartlepool Borough Council
Scarborough Borough Council
East Riding of Yorkshire Council
Environment Agency
Natural England
The National Trust

[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 seabed 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	Sept-Dec 08	May 09	Mar-May 09		-
2	2009/10	Sept-Dec 09	Mar 10	Feb-Mar 10	Jul 10	-
3	2010/11	Aug-Nov 10	Feb 11	Feb-Apr 11	Aug 11	Sept 11
4	2011/12	Oct-Nov 11	Oct 12	Mar-May 12	Feb13	-
5	2012/13	Sept-Nov 12	Mar 13	Mar-Apr 13	Jun 13	-
6	2013/14	Sept-Oct 13	Feb 14	Mar-Apr 14	Jul 14	-
7	2014/15	Sept-Nov 14	Feb 15	Mar-Apr 15	Jul 15	-
8	2015/16	Sept-Dec 15	Feb 16	Mar-May 16	Jul 16	Jun 16
9	2016/17	Aug-Nov 16	Mar 17	Feb-Apr 17	Jul 17	
10	2017/18	Sep-Dec 17	Mar 18	Feb-Apr 18	Jul 18	
11	2018/19	Sep-Dec 18	Feb 19	Feb-Apr 19	Jul 19	
12	2019/20	Aug-Dec 19	Mar 20	Mar-May 20	Jun 20	
13	2020/21	Oct-Dec 20	Feb 21	Mar 21	May 21	Aug 21
14	2021/22	Aug-Oct 21	Feb 22	Aug-Oct 22	August 22	

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

1. Introduction

1.1 Study Area

Northumberland County Council's frontage extends from the Scottish border in the north to Hartley, just south of Blyth, in the south. For the purposes of this report and for consistency with previous reporting, it has been sub-divided into 15 areas, namely:

- Sandstell Point (Spittal A)
- Spittal (Spittal B)
- Goswick Sands
- Holy Island
- Bamburgh
- Beadnell Village
- Beadnell Bay
- Embleton Bay
- Boulmer
- Alnmouth Bay
- High Hauxley and Druridge Bay
- Lynemouth Bay
- Newbiggin-by-the-Sea
- Cambois
- Blyth South Beach

1.2 Methodology

Along the Northumberland frontage, the following surveying is undertaken:

Full Measures survey annually each autumn comprising:

- Beach profile surveys along 78 transect lines (commenced 2002)
- Beach profile surveys along an additional ten transect lines (commenced 2007)
- Beach profile surveys along an additional 26 transect lines (commenced 2010)
- Topographic survey along Holy Island (commenced 2004)
- Topographic survey along Alnmouth Bay (commenced 2005)
- Topographic survey along Sandstell Point (commenced 2009)
- Topographic survey along Lynemouth Bay (commenced 2020)
- Topographic survey along Newbiggin Bay (commenced 2010)

Partial Measures survey annually each spring comprising:

- Beach profile surveys along 29 transect lines (commenced 2002)
- Beach profile surveys along an additional ten transect lines (commenced 2007)
- Beach profile surveys along an additional one transect line (commenced 2010)
- Beach profile surveys along an additional two transect lines (commenced 2011)
- Topographic survey along Alnmouth Bay (commenced 2005)
- Topographic survey along Sandstell Point (commenced 2009)
- Topographic survey along Lynemouth Bay (commenced 2021)
- Topographic survey along Newbiggin Bay (commenced 2010)

Cliff top survey (bi-annually) at:

- Colliery spoil edge survey at Lynemouth Bay (commenced 2020)
- Cliff top survey at Cambois Bay (Sandy Bay) (commenced 2008)
- Cliff top survey at Cambois Bay (Cambois) (commenced 2009)

Sand extent survey (bi-annually) at:

- Edge of sand survey at Newbiggin Bay, Spital Carrs, (commenced 2011 to determine potential adverse impact on foreshore SSSI of the Newbiggin beach recharge scheme)

For all cliff-top surveys prior to Full Measures 2011, the data was previously saved in '.kmz' format for plotting and visual comparison in GoogleEarth. This data has been visualised in GIS, which revealed the quality was variable and reliable interpretations of short-term cliff change could not be made. For the present and future surveys, the data will be plotted in GIS and change will qualified along a series of pre-defined transect lines. The resulting data on amount and rate of change is presented in tables and the survey results are compared.

The location of these surveys is shown in Figure 2. The Partial Measures survey was undertaken along this frontage between 21st February 2022 to 4th April 2022. During this time weather conditions varied considerably; refer to the survey reports for details of the weather conditions over this survey period.

The Update Report presents the following:

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

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

SURVEY LOCATIONS

Topographic Profile

- Annual
- Bi-Annual

Topographic Area

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title:

Figure 2 - Map 1

SPITTAL A and B

Northumberland County Council Frontage

Report:

Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:9,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
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North East Coastal Observatory

SURVEY LOCATIONS

Topographic Profile

- Annual
- Bi-Annual

Topographic Area

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title:

Figure 2 - Map 2

GOSWICK SANDS

Northumberland County Council Frontage

Report: Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:35,000

Co-ordinate system: British National Grid

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North East Coastal Observatory

SURVEY LOCATIONS

Topographic Profile

- Annual
- Bi-Annual

Topographic Area

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title:

Figure 2 - Map 3

HOLY ISLAND

Northumberland County Council Frontage

Report: Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:35,000

Co-ordinate system: British National Grid

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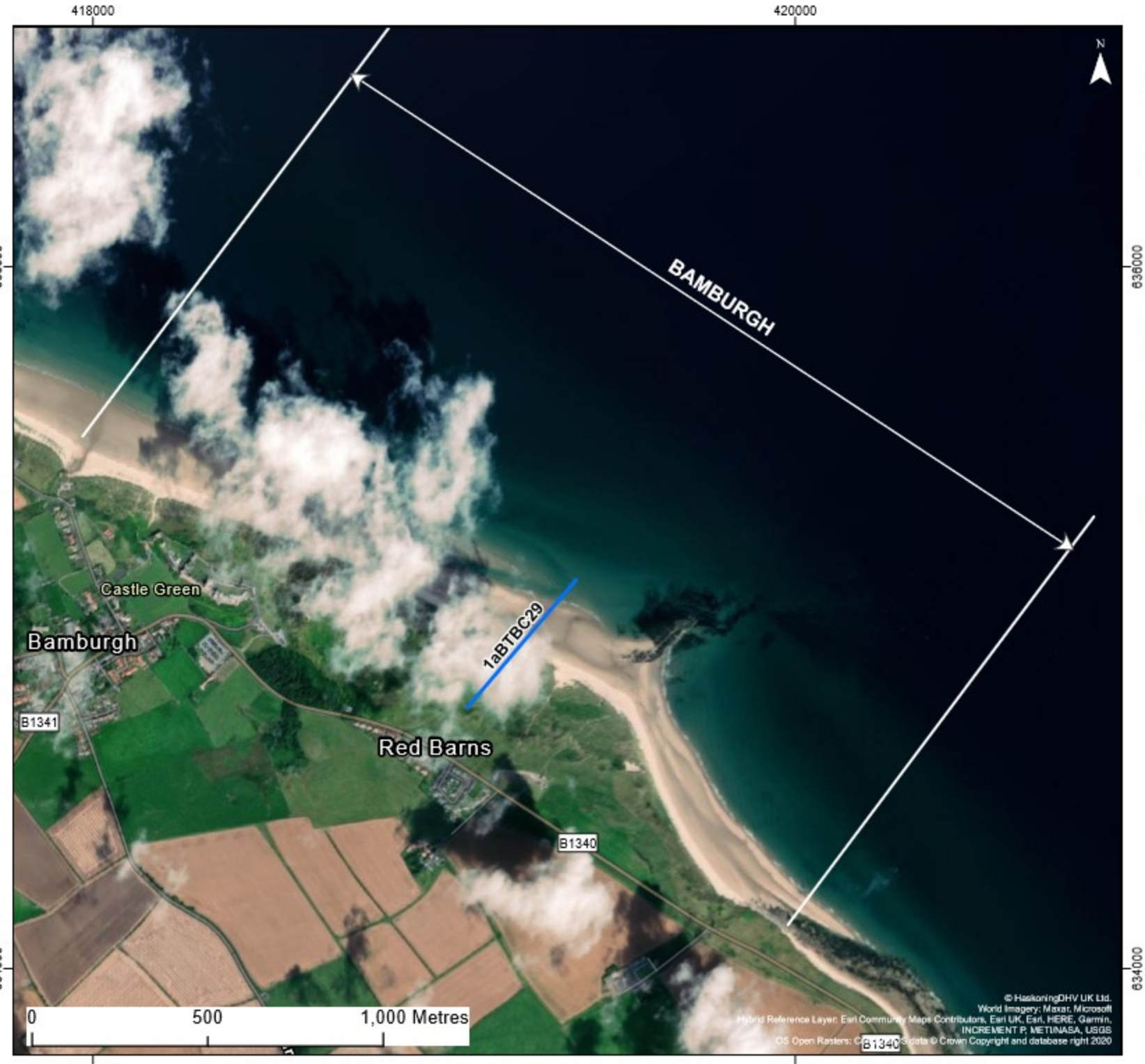

SURVEY LOCATIONS

Topographic Profile

- Annual
- Bi-Annual

Topographic Area

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title:

Figure 2 - Map 4

BAMBURGH

Northumberland County 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 Edge Survey
- Edge of Sand Survey

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

Title:

Figure 2 - Map 5

BEADNELL VILLAGE AND BAY

Northumberland 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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North East Coastal Observatory

SURVEY LOCATIONS

Topographic Profile

- Annual
- Bi-Annual

Topographic Area

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title:

Figure 2 - Map 6

EMBLETON BAY

Northumberland 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

Royal HaskoningDHV
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North East Coastal Observatory

SURVEY LOCATIONS

Topographic Profile

- Annual
- Bi-Annual

Topographic Area

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title:

Figure 2 - Map 7

BOULMER

Northumberland 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

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North East Coastal Observatory

SURVEY LOCATIONS

Topographic Profile

- Annual
- Bi-Annual

Topographic Area

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title:

Figure 2 - Map 8

ALNMOUTH BAY

Northumberland County Council Frontage

Report: Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:45,000

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 Edge Survey
- Edge of Sand Survey

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

Title:

Figure 2 - Map 9

HIGH HAUXLEY AND DRURIDGE BAY (NORTH)

Northumberland County 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

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SURVEY LOCATIONS

Topographic Profile

- Annual
- Bi-Annual

Topographic Area

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title:

Figure 2 - Map 11

HIGH HAUXLEY AND DRURIDGE BAY (SOUTH)

Northumberland County 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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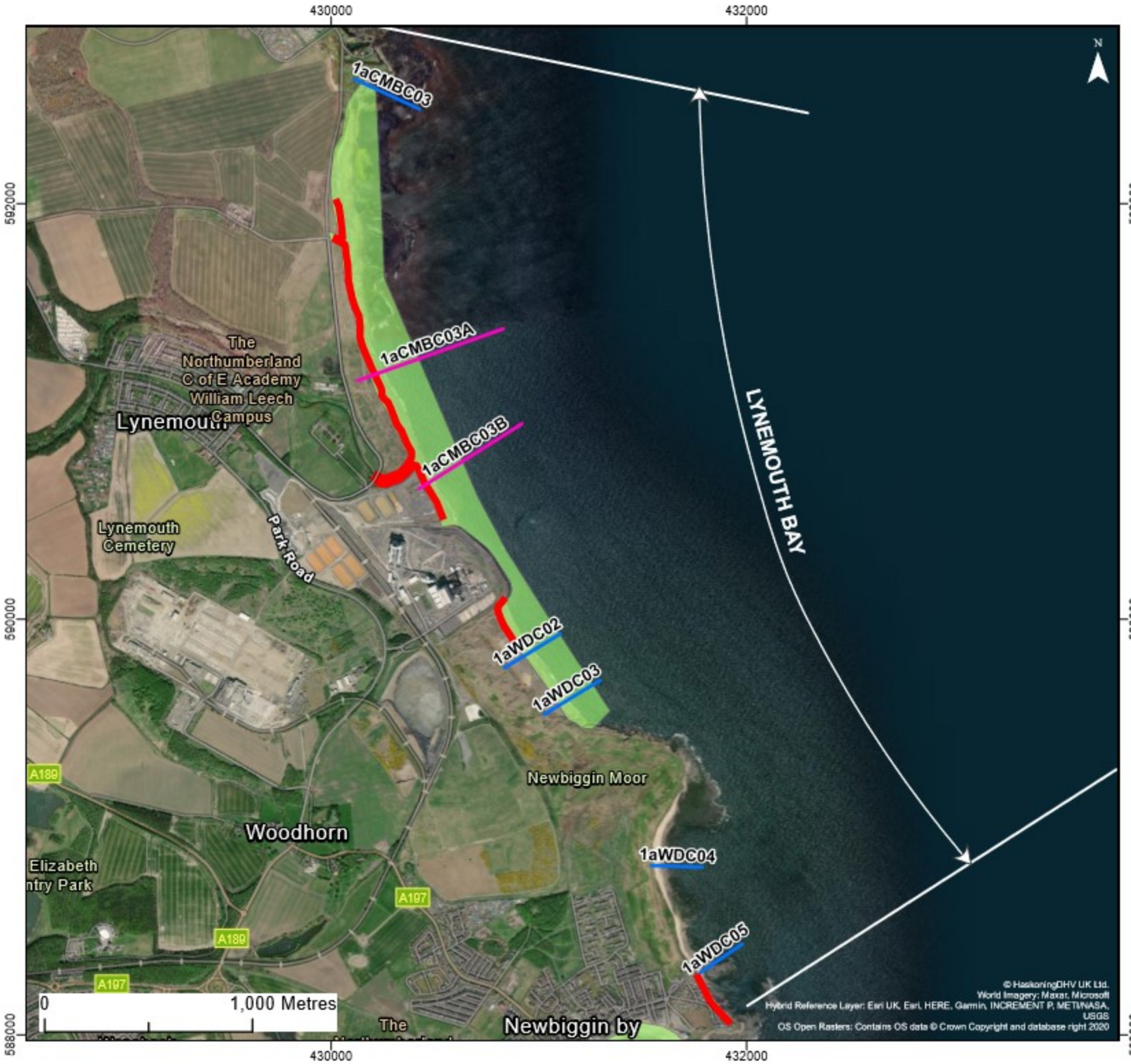

SURVEY LOCATIONS

Topographic Profile

- Annual
- Bi-Annual

Topographic Area

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title:

Figure 2 - Map 10

LYNEMOUTH BAY

Northumberland 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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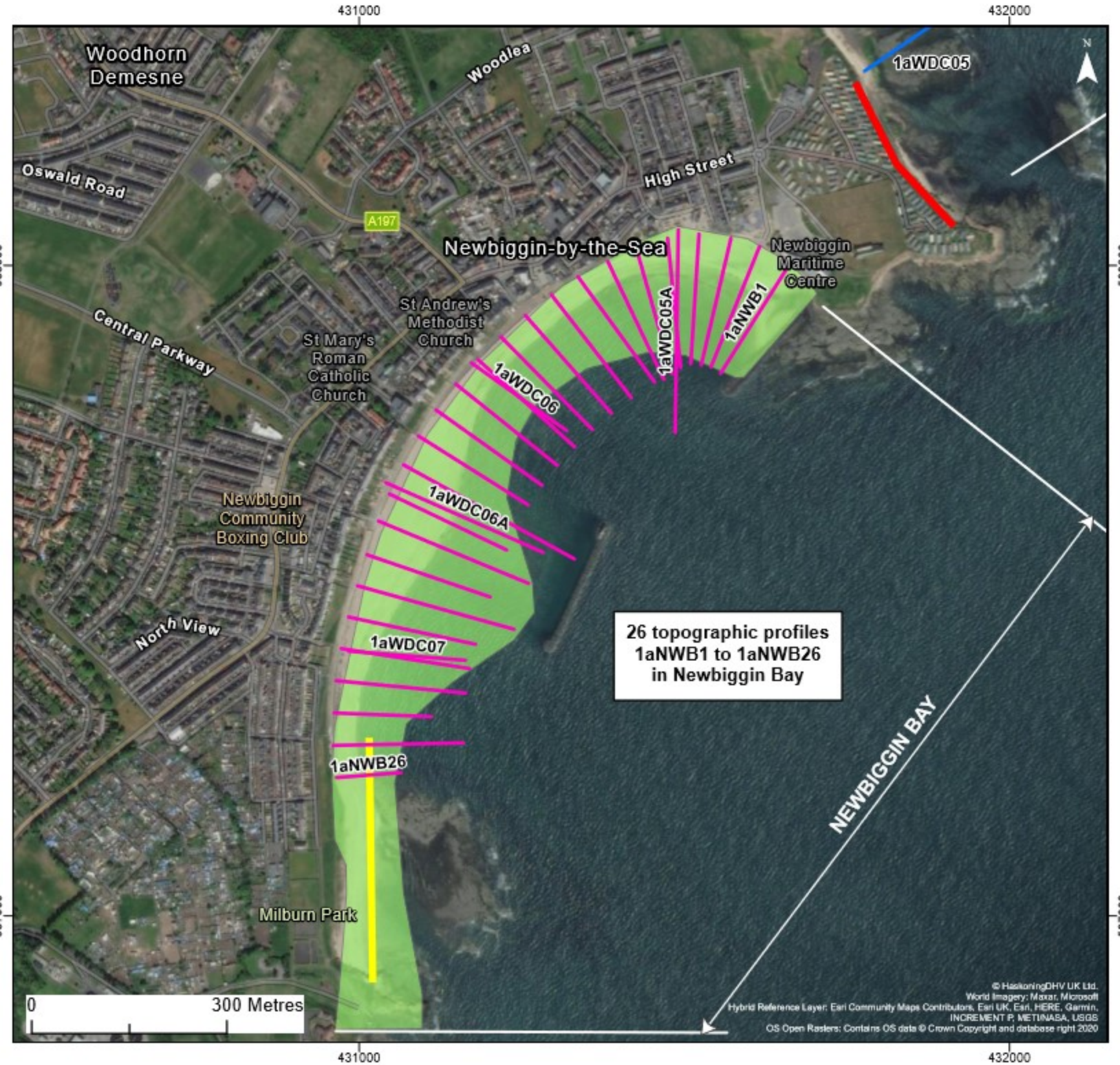

SURVEY LOCATIONS

Topographic Profile

- Annual
- Bi-Annual

Topographic Area

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title:

Figure 2 - Map 12

NEWBIGGIN BAY

Northumberland County Council Frontage

Report: Survey Report

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	n/a	TC	NJC	A4	1:8,000

Co-ordinate system: British National Grid

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North East Coastal Observatory

SURVEY LOCATIONS

Topographic Profile

- Annual
- Bi-Annual

Topographic Area

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title:

Figure 2 - Map 13

CAMBOIS BAY

Northumberland 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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North East Coastal Observatory

SURVEY LOCATIONS

Topographic Profile

- Annual
- Bi-Annual

Topographic Area

- 6 monthly
- yearly
- 5 yearly

- Cliff Top Edge Survey
- Edge of Sand Survey

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

Title:

Figure 2 - Map 14

BLYTH SOUTH BEACH

Northumberland 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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2. Analysis of Survey Data

2.1 Sandstell Point (Spittal A)

Survey Date	Description of Changes Since Last Survey	Interpretation
4th March 2022	**Beach Profiles:** Sandstell Point is covered by four beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2021. Profile **1aBTBC02** is located on the southern bank of the inner Tweed estuary. From the beginning of the survey to the toe of the dunes at chainage 45m the dunes have undergone small sections of erosion and accretion by less than 0.1m. The upper beach has lowered by up to 0.7m to chainage 60m. The middle-lower beach between chainage 60-78m has risen by up to 0.2m. Seaward of this point the beach has lowered to the end of the survey by up to 0.1m. Overall, the dunes remain at a high level and the beach profile is at a medium level across the upper-middle beach, whilst the lower beach is now at a high level compared to the range recorded from previous surveys. Profiles **1aBTBC04** (longitudinal section) and **1aBTBC05** and **1aBTBC06** (both cross-sections) cover the spit at Sandstell Point. Profile **1aBTBC04** shows that the upper beach between chainages 10 – 60m has risen by 0.2m, switching to erosion between 60-91m by up to 0.2m. The beach profile between chainage 91-420m has risen by up to 1.8m, filling in a depression along the crest from the previous survey The beach seaward of this point has lowered by up to 0.5m. Overall, the spit has increased in elevation and the crest at the distal end of the spit has slightly receded landward by less than 2m. The profile is at a relatively medium level compared to the range recorded from previous surveys, with the end of the spit being relatively high. Profiles **1aBTBC05** and **1aBTBC06** are transects across the spit, with the open sea on the left-hand side of the plot and the river channel to the right. At **1aBTBC05**, the seaward side of the spit has risen by up to 0.5m on the upper half of the spit between chainage 45-102m. The lower half of the spit has lowered by up to 0.8m between chainage -95m-45m. The crest of the spit lowered on the seaward side by 0.4m and risen on the riverside by 0.5m. There has	Since the last survey, the dunes along the south bank of the River Tweed have remained stable, experiencing little change of ±0.1m. The crest of the distal end of the spit has slightly receded by 2.0m. The overall profile has smoothened since the previous survey, where there was a depression at chainage 180m. **Longer term trends:** The small change in dune profile is within the bounds of previous surveys that indicate they have remained stable over the past 12 years. The beach profiles show that the form of the spit is within the range of past observations. The wide variation in profile forms over time is indicative of this being one of the most dynamic systems on the north east coast.

Survey Date	Description of Changes Since Last Survey	Interpretation
	been less change on the riverside of the spit. The upper half has lowered by 0.3m between chainage 196-218m. The lower half has alternated between erosion and accretion by ±0.1m to the lower end of the spit. Overall, the crest of the profile has widened in profile and is within the middle of its range recorded from previous surveys, both in terms of height and position, except the seaward side of the spit which is at a low level. At **1aBTBC06** the seaward side of the spit has alternated between accretion to erosion. The upper section between chainages 187-235m has risen by up to 0.6m. The central section between chainages 60-187m has lowered by up to 1.5m. The lower section has risen by up to 1.0m. The crest of the spit has lowered by up to 0.7m and migrated toward the river by approximately 20m. The riverside of the spit risen on the upper section by up to 0.7m between chainage 264-312m. The lower section of the spit has lowered by up to 0.3m. Overall the spit profile is at a low level on the seaward side and a medium level on the river side in height and position compared to the range recorded from previous surveys. The combination of movement observed at 1aBTBC05 and 1aBTBC06 suggests the spit has remained relatively stable at the landward end of the spit, with slumping of material at the crest towards the sea at the seaward end of the spit.	
March 2022	**Topographic Survey:** Due to the significant changes that have been observed from the beach profiles along the spit at Sandstell Point and the three-dimensional nature of these changes, a topographic survey was introduced to the monitoring programme in 2011. The previous survey was undertaken for the Full Measures survey in autumn 2021. The survey report notes that "*A temporary station was used as a vehicle was blocking station 4*". Data from the most recent topographic survey (Partial Measures, spring 2022) have been used to create a digital ground model (DGM) (Appendix B – Map 1) using a Geographical Information System (GIS). A difference plot has also been produced using the DGM (Appendix B – Map 5) produced from the last produced topographic survey and the present survey. The difference plot generally shows little change / small scale erosion in the dunes on the south bank of the River Tweed. The seaward side of the spit has shore parallel bands of erosion and accretion running south-east to north-west parallel to the coastline, with the highest rates of erosion at the distal end of the spit (upwards of 2.0m). The highest rates of accretion are exhibited on the seaward side of the crest	The findings of the topographic survey show similar trends to the profile survey. This appears to show migration of both the river channel and the spit in a clockwise direction around the headland, similar to the trend seen in the previous partial measures survey in 2021.

Survey Date	Description of Changes Since Last Survey	Interpretation
	opposite the car park approximately 100m from the land.	

2.2 Spittal (Spittal B)

Survey Date	Description of Changes Since Last Survey	Interpretation
4th March 2022	**Beach Profiles:** Spittal B is covered by two beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2021. Profile **1aBTBC11** is located to the north of Spittal Beach. The dunes have lowered by up to 1.7m to chainage 55m and are at their lowest level recorded. The middle beach has lowered by up to 0.5m between chainages 55-135m. The lower beach seaward of chainage 135m has lowered by up to 0.5m. Overall, the dunes are at their lowest level recorded. The rest of the beach profile is at a medium-low level compared to the range recorded from previous surveys. Profile **1aBTBC13** is located towards the centre of Spittal Beach. The upper beach to chainage 34m has lowered by up to 1.6m, switching to accretion across the rest of the beach by up to 0.9m. A depression on the middle beach has been infilled since the previous survey. Overall, the upper beach profile is at a low level, whilst the middle and lower beach is at a medium level compared to the range recorded from previous surveys.	Since the last survey, the changes in beach level at Spittal have generally shown significant erosion in the dunes and upper beach and accretion on the middle beach, indicating a redistribution of sediment throughout the profiles. **Longer term trends:** At both profile locations along Spittal Beach, the changes observed from the present survey are generally within the bounds of previous surveys, except at the dunes at profile 1aBTBC11 between chainages 0-55m where the dunes are now at their lowest level recorded.

2.3 Goswick Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
22nd March 2022	**Beach Profiles:** Goswick Sands are covered by two beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2021. Profile **1aBTBC16** is located to the north of Goswick Sands, between Far Skerr and Cheswick Black Rocks. The dune has remained stable since the last survey, with a small amount of erosion on the crest by up to 0.1m. Between the dune toe at chainage 46m to 131m, the beach level has lowered by up to 1.5m. The lower beach has lowered by up to 1.5m to the end of the survey. Overall, the profile is at a medium level compared to the range recorded from previous surveys. Profile **1aBTBC19** is located to the south of Goswick Sands. The dunes have remained stable since the last survey, with changes generally restricted to ±0.1m. The foredune has widened by less than 0.1m and remains at its highest level recorded. The toe of the dunes has lowered by up to 0.4 to chainage 156m. Beach levels have generally risen by up to 0.1m across the beach profile. Beach levels are at a relatively medium level compared to the range recorded from previous surveys.	Beach levels have undergone very little change since the previous survey. The foredune has continued to accrete since 2009. **Longer term trends:** Both profiles are within the range recorded from previous surveys. However, the range of variation on record is limited compared to beaches elsewhere along the north east coast.

2.4 Holy Island

Survey Date	Description of Changes Since Last Survey	Interpretation
22nd March 2022	**Beach Profiles:** Holy Island is covered by two beach profile lines for the Partial Measures surveys (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2021. **1aBTBC21** and **1aBTBC23** are located on the north-west side of the island, along The Snook. At profile **1aBTBC21** the dunes have remained stable since the last survey, with small sections of erosion and accretion limited to 0.1m on the dunes and dune face to chainage 60m. The foredune has experienced accretion of up to 0.1m and is now at its highest level recorded, whilst the dune toe has lowered by 0.2m to chainage 95m. There is a small section of accretion of less than 0.1m between chainage 95-130m. The beach level seaward of this point has lowered by less than 0.1m as far as the end of the survey. The beach is at a relatively low-medium level compared to the range recorded from previous surveys. Profile **1aBTBC23** shows that the dunes and beach have remained stable since the last survey. The foredune has migrated seaward by approximately 2m and remains at one of its highest levels recorded. The beach has risen by up to 0.1m between the foredune and chainage 662m, switching to erosion seaward of chainage 662m by up to 0.7m. Overall, the beach levels are at a high level compared to the range recorded from previous surveys, except the end of the profile which is at a medium level.	The dunes, sandy foreshore and sand flats around The Snook have remained stable in both form and position since the last survey. The foredune at both profiles remains at one of the highest levels recorded. **Longer term trends:** The minor changes observed since the last survey are within the bounds of previous surveys.

2.5 Beadnell Village

Survey Date	Description of Changes Since Last Survey	Interpretation
21st March 2022	**Beach Profiles:** Beadnell Village is covered by one beach profile line for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2021. **1aBTBC31** is in Nacker Hole and extends across the promenade and seawall. There has been up to 0.2m of accretion from the toe of the sea wall to chainage 29m. The rest of the beach profile has alternated between erosion and accretion, limited to ±0.2m. Overall the profile is at a high level on the upper beach, whilst the middle and lower beach are at a medium level compared to the ranges recorded in previous surveys. The upper beach between chainage 13-15m is now at its highest level recorded.	The beach to the south of Beadnell Village has remained stable. **Longer term trends:** The changes observed since the last survey are within the bounds of previous surveys.

2.6 Beadnell Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
21st March 2022	**Beach Profiles:** Beadnell Bay is covered by five beach profile lines for the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2021. Profiles **1aBTBC33** and **1aBTBC34** are located in Beadnell Harbour to the north of Beadnell Bay. Profile **1aBTBC37** is located further south towards the outfall of Brunton Burn/Long Nanny. At profile **1aBTBC33**, there has been very little change on the dunes, limited to ±0.1m. There has been accretion at the toe of the dunes by up to 0.3m to chainage 61m. The majority of the rest of the beach profile has lowered by up to 0.2m on the upper beach and lower beach. There is a small section of accretion on the middle beach by up to 0.2m.Overall, the dunes and beach profile are at a medium-high level compared to the range recoded from previous surveys. At profile **1aBTBC34**, the dunes have accreted by up to 0.4m, filling in a depression at chainage -6m. The beach from the toe of the dunes to chainage 26m has lowered by up to 0.3m. The middle beach between chainage 26m and the rock patch at chainage 116m has risen by up to 0.4m. Seaward of the rock patch has lowered by up to 0.3m.Overall, the upper and middle beach is at a high level compared to the range recorded from previous surveys, whilst the lower beach is at a medium level. At profile **1aBTBC37**, the upper dune face has accreted by 0.5m, while the lower dune face and dune toe has lowered by p to 0.5m. The upper and lower beach has lowered by up to 0.4m. The middle beach between chainage 82-155m has risen by up to 0.8m. Overall the profile is at a high level compared to the range recorded from previous surveys, particularly on the upper dune face which is at its highest level recorded. Profiles **1aADC01** and **1aADC02** are located along the frontage to the south of the outfall of Brunton Burn/Long Nanny. At profile **1aADC01** the dune has risen by between 0.2-0.4m. The dune toe has lowered by up to 0.9m and the lower beach by up to 0.8m. The middle beach between chainage 320-470m has risen by up to 0.9m. Overall the foredune is at its highest level recorded. The rest of the beach profile is at a medium-high level compared to the range recorded from previous surveys.	Along the length of Beadnell Bay, the dunes have remained largely stable since the last survey, with some signs of growth. The profiles along the frontage show variable trends since the previous survey, with no discernible pattern. Beach levels are generally at a high level. **Longer term trends:** Along the length of Beadnell Bay, the dunes are of a similar form to those observed in the past. The changes in beach profile form and position observed since the last survey are within the bounds of previous surveys.

Survey Date	Description of Changes Since Last Survey	Interpretation
	At profile **1aADC02** the dunes have accreted by up to 0.2m. The beach profile from the toe of the dunes to the end of the profile has risen by up to 0.2m on the upper beach, 0.3m on the middle beach and 0.6m on the lower beach. Overall, the dunes and beach are at a high level, and is at its highest level recorded at several small sections compared to the range recorded from previous surveys.	

2.7 Boulmer

Survey Date	Description of Changes Since Last Survey	Interpretation
18th March 2022	**Beach Profiles:** Boulmer is covered by two beach profile lines for the Partial Measures survey (Appendix A). These were added to the programme in October 2007. The previous survey was undertaken for the Full Measures survey in autumn 2021. At profile **1aADC04A**, the upper and middle beach has lowered by up to 0.7m from the dune cliff to the exposed rocky outcrop at chainage 62m. The rock outcrop has maintained a similar form since the previous survey. Overall, the profile is at a medium level compared to the range recorded from previous surveys, except at the toe of the dune cliff which is at a high level. At profile **1aADC04B** the backshore (now rock armour) has remained stable since the last survey. There has been accretion at the toe of the rock armour of up to 0.3m to chainage 21m. Between chainage 21m and 86m the beach has lowered by up to 0.4m. There have been small changes across the rock platform, associated with the movement of rocks. The profile is at a medium-high level compared to the range recorded from previous surveys.	The dune cliff backshore at Boulmer is now fixed in position by the rock armour at both profiles. Beach levels at Boulmer have lowered since the last survey. **Longer term trends:** The changes in beach profile, form and position observed since the last survey are within the bounds of previous surveys. The rocky shore platform continues to be mainly exposed in the lower foreshore.

2.8 Alnmouth Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
18th March 2022	**Beach Profiles:** Alnmouth Bay is covered by three beach profile lines during the Partial Measures survey (Appendix A). The previous survey was undertaken for the Full Measures survey in autumn 2021. The three profiles are located to the north of Alnmouth Bay between Marden Rocks and the mouth of the River Aln Estuary. At profile **1aADC07** the overall position of the dunes has remained stable since the last survey. The beach level at the toe of the dunes has increased by 0.2m to chainage 26m. The upper beach between chainages 26-90m has lowered by up to 0.4m, switching to accretion on the middle beach by up to 0.9m and lower beach by up to 0.3m. There is a section of erosion on the middle-lower beach by up to 0.6m between chainages 190-235m. Overall, the beach is at a medium-high level compared to the range recorded from previous surveys, particularly between chainages 232-282m which is at its highest level recorded. At profile **1aADC08** the dunes have remained largely stable since the last survey, with a small section of erosion by up to 0.1m. From the toe of the dune to chainage 21m the beach has lowered by up to 0.3m.The middle beach between chainage 21-66m has risen by up to 0.2m. Seaward of chainage 66m the lower beach has been lowered by up to 0.3m. Overall, the profile is at a low level compared to the range recorded from previous surveys. At profile **1aADC09** the dunes have shown accretion of up to 0.4m on the seaward face of the dune to chainage 22m.The upper-middle beach to chainage 102m has undergone little change limited to ±0.1m. Seaward of chainage 102m the beach has risen by 1.1m. The survey terminates at a river due to quicksand. Overall, the profile is at a relatively high level compared to the range recorded from previous surveys.	The dunes have remained largely stable since the last survey, showing growth at profile 1aADC09. There has generally been alternating patterns of accretion and erosion across the beach profile. The continued migration of the river channel is the most notable change. **Longer term trends:** The dunes show long-term stability. The changes in beach profile form and position observed since the last survey are within the bounds of previous surveys, although change in the position of the river channel has substantially curtailed profile 1aADC09 and therefore no information is available about beach elevations on the opposite bank of this channel along this profile alignment (this been the case since 2015).

Survey Date	Description of Changes Since Last Survey	Interpretation
March 2022	**Topographic Survey:** The northern part of Alnmouth Bay (to the north of the River Aln estuary) is covered by bi-annual topographic survey, which commenced in April 2005. Data from the most recent topographic survey (Partial Measures, spring 2021) have been used to create a DGM (Appendix B – Map 2) using a Geographical Information System (GIS). A difference plot has also been produced using the DGM (Appendix B – Map 6) produced from the last produced topographic survey (Full Measures, autumn 2021) and the present survey. The difference plot shows a mixed pattern of erosion and accretion. In the northern extent of the survey area, erosion dominates across the upper to middle beach, with little change on the middle-lower and lower beach. Patchy erosion and accretion occurs at the toe of the dunes. Moving southward, the middle extent of the survey area is characterised by alternating bands of erosion and accretion across the profile ranging from ±1.25m. To the south of the survey area, accretion is dominant in the area fronting the village of Alnmouth itself with a small patch of erosion at the southern-most part of the survey extent on the middle beach closest to the mouth of the River Aln. The toe of the dunes has mostly undergone patchy accretion. In general, the beach is characterised by alternating bands of accretion and erosion from the upper beach to the lower beach.	The findings of the topographic survey show a mixture of erosion and accretion, some resulting from winter erosion of the upper beach and consequent accretion in the lower beach (draw down), whereas other changes result from migration of the mouth of the River Aln across the beach.

2.9 High Hauxley & Druridge Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
1st April 2022	**Beach Profiles:** High Hauxley to Druridge Bay is covered by eight beach profile lines during the Partial Measures survey (Appendix A). Four of these (with A or B suffixes) were added to the programme in October 2007. The previous survey was undertaken for the Full Measures survey in autumn 2021. **1aADC15A**, **1aADC16** and **1aADC16A** are located around Hauxley Haven. Dunes at these three profiles have remained stable since the last survey. At profile **1aADC15A**, the beach at the toe of the dunes has lowered by up to 0.5m to chainage 45m. Most of the rest of the beach profile has accreted by between 0.2-0.6mm to chainage 177m, before switching to erosion at the end of the survey by up to 0.1m. The beach profile is at a relatively low level on the upper beach and a medium level on the middle-lower beach compared to the range of previously recorded surveys. At profile **1aADC16** there has been accumulation at the toe of the dunes to chainage 74m by up to 0.2m. Between chainages 74m – 218m, the upper-middle beach has lowered by up to 0.3m. Seaward of chainage 218m the lower beach has accreted by up to 0.3m. Overall, the beach profile is at a medium level compared to the range recorded from previous surveys. The survey report notes '*gaps in section due to bushes and no access to resident's garden'* which appear to be in the dune part of the section. At profile **1aADC16A** there has been an accumulation at the toe of the dunes to chainage 106m by up to 0.3m. Seaward of this point, the beach has lowered by up to 0.1m on the middle beach and less than 0.1m on the lower beach. Overall, the beach profile is at a medium level compared to the range recorded from previous surveys. **1aADC16B**, **1aADC17** and **1aADC17A** are located to the north of Druridge Bay, between Bondi Carrs and Hadston Carrs and extend seawards from Togston Links. At profile **1aADC16B** there has been minimal change within the dunes at the cliff top. There has been a rise in beach profile across the survey, ranging from 0.5m on the upper beach, 0.4m on the middle beach and 0.3m on the lower beach. The rock patches at chainages 100m, 160m and 255m remain exposed. Overall, the beach remains at a high level relative to the range recorded from previous	At Hauxley Haven, the dunes have remained stable since the last survey. Beach levels have generally experienced varying sections of erosion and accretion across the beach profile, exhibiting seasonal berm movement. Profiles remain within the bounds of previous surveys. In most of Druridge Bay the dunes and low cliff at their toe, where present, have experienced little change. However, the beaches have varied with accretion tending to dominate, particularly in the north of the bay. **Longer term trends:** At Hauxley Haven and Druridge Bay, the dunes have demonstrated a long-term trend of stability, with the majority of profiles at a medium-high level. The changes in beach profile form and position observed since the last survey are within the bounds of previous surveys.

Survey Date	Description of Changes Since Last Survey	Interpretation
	surveys, reaching its highest level in some places. The survey report notes '*survey starts at new fence'.* At profile **1aADC17** the dunes have remained stable. Between the toe of the dunes at chainage 25m to 53m the cliff toe has lowered by up to 0.7m. The rest of the beach profile has risen by up to 0.3m. Overall the profile is at a medium-high level compared to the range of previously recorded results. At profile **1aADC17A** the dunes have remained stable, with some sections experiencing accretion of up to 0.2m. There has been alternating sections of erosion and accretion across the profile, limited to ±0.4m. Overall, the beach profile is at a medium-high level compared to the range of previously recorded results. **1aCMBC01** and **1aCMBC02** are located in the southern section of Druridge Bay. At profile **1aCMBC01**, the dunes appear to have remained stable, with small sections of accretion by up to0.2m on the top of the dunes and up to 0.5m at the dune toe. The upper beach between chainages 197-241m has lowered by up to 0.8m. The middle and lower beach has risen by up to 0.8m on the middle beach and 0.3m on the lower beach. Overall, the beach is at a high level compared to the range of previously recorded surveys, particularly on the crest of the foredune between chainages 170-180m which is at its highest level recorded. At profile **1aCMBC02**, the dunes have remained stable, with small sections of erosion and accretion of up to ±0.3m. The beach profile has exhibited varying sections of erosion and accretion by up to ±0.6m. Overall, the beach profile is at a medium level on the upper beach, low level on the middle beach and high level on the lower beach compared to the range recorded from previous surveys. The survey report notes that '*livestock with young prevented access to parts of the section*' which appears to be between chainage 70-110m.	

2.10 Lynemouth Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
16-23rd March 2022	**Beach Profiles:** Lynemouth is covered by two beach profile lines during the Partial Measures survey (Appendix A). Profiles 1aCMBC03A and 1aCMBC03B were added to the programme in October 2007. The previous survey was undertaken for the Full Measures survey in autumn 2021. **1aCMBC03A** is located c.450m north of the mouth of the River Lyne and extends across the extensive colliery spoil banks before reaching the foreshore. The profile of the top of the colliery spoil bank has not experienced any significant change since the last survey. The lower face and toe of the colliery spoil bank has receded landward by up to 4.0m. The toe of the colliery spoil bank has lowered by up to 1.0m to chainage 124m. The remaining beach profile has alternated between erosion and accretion by up to 0.1m. The lower face and toe of the colliery spoil bank, and upper beach to chainage 106m is at its most landward/lowest level recorded. **1aCMBC03B** is located to the north of Lynemouth Power Station and extends across the extensive colliery spoil banks before reaching the foreshore. The process of colliery spoil bank erosion has been progressing for some years. Since the last survey, the top of the colliery spoil bank has lowered by up to 0.1m to the crest at chainage -30m. The colliery spoil bank face has receded landward by approximately 1.0m. The upper and middle beach from the colliery spoil bank toe to chainage 14m has risen by up to 0.2m. The beach seaward of this point has lowered by up to 0.3m. Overall, the beach profile is low compared to earlier surveys, particularly the face of the colliery spoil bank which is at its most landward position recorded.	North of the mouth of the River Lyne, the top of the colliery spoil bank has remained stable, whilst the lower spoil bank face and upper beach has lowered to its lowest level recorded. To the north of the power station, the colliery spoil bank has remained mostly stable, however the lower face of the colliery spoil bank has reached its most landward position recorded. The beach has accreted across the majority of its length. **Longer term trends:** Opposite Lynemouth, the colliery spoil has demonstrated a total recession between the first survey in autumn 2007 and the most recent survey in spring 2022 of 38m overall. The rate of erosion has increased since the rate up to the last survey (from 2.4m/yr to 2.5m/yr). The backing coastal slopes have remained relatively stable over this time. To the north of the power station, total recession between the first survey in autumn 2007 and the most recent survey in spring 2022 is 55.00m. The average annual rate of erosion is 3.6m/yr which is a slight reduction on the rate seen up to the last survey (4.0m/yr).
March 2022	**Beach Topographic Survey:** Lynemouth Bay is covered by a 6-monthly topographic survey, which was added to the programme in	The highest rates of erosion across Lynemouth Bay are found at the cliff toe in the central survey area north of the River Lyne (up to 1.75m), and on the

Survey Date	Description of Changes Since Last Survey	Interpretation
	December 2020. Data from the most recent topographic survey (Partial Measures, spring 2022) have been used to create a DGM (Appendix B – Map 3) using a GIS. A difference plot has also been produced using the DGM (Appendix B – Map 7) produced from the last topographic survey (Full Measures, autumn 2021) and the present survey. **Figure 7** shows a variable pattern of erosion and accretion across the survey extent. The north of the survey extent is characterised by little change – low magnitude erosion to the north of the Headagee outcrop. The beach in the lee of the Headagee outcrop has undergone little change (±0.1m) with some patches of low magnitude accretion. Between the Headagee outcrop and the northern bank of the River Lyne, the beach has generally eroded across the profile, reaching a higher magnitude of erosion along the colliery spoil bank on the upper beach. In the southern extent of the survey area, there has generally been shore parallel bands of accretion and erosion of higher magnitude than in the north of the survey extent (±1.5m). Erosion dominates over the middle beach, with accretion/little change on the upper and lower beach.	middle to lower beach in the southern extent of the survey (up to 1.5m). **Longer term trends:** The beach in the northern survey extent and in the lee of Headagee has remained relatively stable since the previous survey. The areas where the largest landward retreat has occurred are the areas where historically tipped colliery spoil is eroded on an ongoing basis.
May 2022	**Colliery Spoil / Cliff Edge Survey:** Colliery spoil edge survey data was collected for a baseline survey in autumn 2021, and again in spring 2022. In the very north of the bay, the colliery spoil forms a beach and protects the natural cliffs/ coastal slopes behind. The most recent survey of the low cliffed edge of this spoil beach shows a small section of erosion in the lee of the Headagee rock outcrop of up to 1.5m along a 30m extent. The edge of the colliery spoil beach then merges back into the colliery spoil cliff toe just to the south of the rock outcrops. It has been observed empirically that the spoil beach is eroding landwards and the point where it merges into the cliff is moving northwards, causing the cliffs to become exposed and start eroding. In the centre of the bay (immediately north of the power station towards Headagee) the colliery spoil cliff is no longer protected by a distinct fronting colliery spoil beach (although the natural beach is very much intermixed with spoil, it does not form a distinct spoil beach like that present in the north of the bay). Colliery spoil between the Power Station and the River Lyne has remained relatively stable, with only small areas of recession of less than 1.5m. The greatest changes are recorded north of the River Lyne, with several sections retreating by between 1-3m. The largest area of retreat (occurring approximately 513m north of the River Lyne) is a 2680m section of cliff which has eroded by up to 8.0m.	Where a spoil beach is present on the foreshore, the backing spoil cliffs or natural cliffs/dune are stable because they are not currently affected by marine processes. Where the spoil beach is absent (such as in the centre of the bay), the backing colliery spoil cliffs are actively eroding, causing measurable landward recession. **Longer term trends:** Since cliff top surveys began in December 2020, cliff movement has been greatest in the centre of the bay (north of the River Lyne) with up to 18.0m of cliff top retreat, whilst the northern and southern parts of the survey area have shown less movement with small sections of retreat up to 3.0m. The most significant erosion south of the power station has occurred since the previous survey. Future repeat cliff top surveys are expected to help

Survey Date	Description of Changes Since Last Survey	Interpretation
	In the south of the bay (south of the power station) the colliery spoil extends some distance seaward of the backing (and underlying) natural dunes, forming a 'berm' (rather than a distinct cliff edge) at the seaward edge. There has been a uniform retreat of the colliery spoil edge of between 6-7m s since the previous survey.	quantify rates of erosion (landward recession) of the historically tipped colliery spoil on a wider basis than is possible from the beach profile surveys alone.

2.11 Newbiggin-by-the-Sea

Survey Date	Description of Changes Since Last Survey	Interpretation
3rd March 2022	**Beach Profiles:** Newbiggin-by-the-Sea is covered by four beach profile lines during the Partial Measures survey (Appendix A). Two of these (with an 'A' suffix) were added to the programme in October 2007 specifically to help assess the performance of the capital scheme involving beach replenishment and construction of an offshore breakwater. It should be noted that an extended series of profiles and a topographic survey are also recorded via the Cell 1 Regional Coastal Monitoring Programme for purposes of post-project evaluation of this capital scheme. These profiles are not analysed here, however, the findings of the topographic survey are presented below. The previous survey was the Full Measures assessment undertaken in autumn 2021. The survey report noted that "*sand was covering most of the revetment rocks at the back of the beach*", "*concrete steps were exposed for stretches at the back of the beach*" and "*Section 4 promenade has increased in height to accommodate new ramping*". Profile **1aWDC05A** is in the north of Newbiggin Bay. There has been accretion of up to 0.6m on the landward side of the seawall caused by the wash-over of sediment from the beach. Between the sea wall and chainage 60m the upper beach has lowered by up to 0.5m. The middle beach has risen by up to 0.3.m until the rock platform at chainage 112m. The rock platform remains exposed seaward of chainage 112m. The profile is at a medium level across the upper beach, rising to a high level on the middle beach compared to the range recorded from previous surveys. The landward side of the seawall is at its highest level recorded. Profile **1aWDC06** is located in the centre of the northern part of Newbiggin Bay, between the two breakwaters. There has been no change from the base of the seawall to chainage 21m. The upper beach between chainages 21-49m has lowered by up to 0.6m followed by a rise in beach level of 0.3m across the middle beach to chainage 88m. The lower beach seaward of chainage 88m has undergone no change (the survey terminates at chainage 101m). The beach profile is at a relatively medium-high level compared to the range recorded from previous surveys. Profile **1aWDC06A** is located in the centre of Newbiggin Bay, behind the offshore breakwater. There has been varying sections of erosion and accretion from the base of the breakwater to chainage 80m limited to ±0.1m. The upper-middle beach has lowered by up to 0.7m to chainage 113m before	Since the last survey, the beach at Newbiggin-by-the-Sea generally shows erosion on the upper – middle beach and accretion on the lower beach. The profiles are generally at a medium-high level, except profile 1aWDC07 which is at a low level (relative to post-2007 beach replacement levels). **Longer term trends:** Data collected since the start of monitoring in May 2002 reflects the change in beach width resulting from the beach nourishment scheme implemented at Newbiggin-by-the-Sea. This change is also reflected in the beach profile plot in Appendix A. The changes in beach profile form and position observed since the last survey are within the bounds of previous surveys, except profile 1aWDC07 which is generally continuing to decrease in level.

Survey Date	Description of Changes Since Last Survey	Interpretation
	switching to accretion on the middle beach by up to 0.1m to chainage 172m. Seaward of chainage 172m the beach has lowered by up to 0.2m. Overall, the profile is at a high level relative to the range recorded from previous surveys. **1aWDC07** is located towards the south of Newbiggin Bay. There has been accretion on the upper beach between chainage 0-8m by up to 0.3m. The upper-middle beach from chainage 8m to 45m has lowered by up to 0.4m before switching to accretion on the lower beach by up to 0.4m to the end of the survey. Overall, the profile is at a low level throughout the profile compared to the range recorded from previous surveys ("low" relative to beach levels following the beach replenishment scheme).	
March 2022	**Topographic Survey:** Newbiggin-by-the-Sea is covered by bi-annual topographic survey, which commenced in September 2010 to assess the performance of the capital scheme constructed in 2007. Prior to incorporation in the programme, these surveys were undertaken on occasions between 2007 and 2010 as part of the scheme development. The previous survey was the Full Measures assessment undertaken in autumn 2021. Data from the most recent topographic survey (Partial Measures, spring 2021) have been used to create a digital ground model (DGM) (Appendix B – Map 4) using a Geographical Information System (GIS). A difference plot has also been produced using the DGM (Appendix B – Map 8) produced from the previous and present surveys. The topographic survey shows shore-parallel bands of accretion and erosion in the north and central areas since the previous survey. The upper beach at the toe of the sea defence shows little change (±0.1m), followed by erosion on the upper beach (migrating toward the middle beach in the central survey area) accretion on the middle beach and little change towards the low water mark. The tombolo behind the central breakwater shows low-level erosion of approximately 0.25-0.5m. The south of the bay is dominated by accretion on the upper beach, little change on the middle beach and patchy areas of erosion on the lower beach. The survey report notes that "*sand was covering most of the revetment rocks at the back of the beach and the concrete steps were exposed for stretches at the back of the beach*".	The topographic survey shows shore parallel bands of erosion and accretion in the north and central bay, whilst the southern end of the bay shows a much patchier distribution of change. Changes are limited to ±1.25m. The topographic survey generally shows a trend of sand bar movement across the beach profile.

Survey Date	Description of Changes Since Last Survey	Interpretation
March 2022	**Sand Extent Survey**: Spital Carrs is located to the south of Newbiggin Bay and is covered by a bi-annual sand extent survey, which commenced in 2011. The survey was designed to address concerns that the beach recharge scheme undertaken in Newbiggin Bay may impact on the Spital Carrs SSSI and SPA. The sand extent survey therefore identifies the boundary of the sand beach on the rock platform. Data from the most recent sand extent survey (Partial Measures, spring 2022) has been plotted onto aerial imagery (refer to Appendix C – Map 1). In general, the plot shows a seaward migration of the extent of sand in the south, little change in the middle and a landward retreat of sand in the north between the autumn 2021 and the spring 2022 survey. The landward retreat in the north is up to a maximum of 12m over an 85m stretch. Accretion in the south is up to a maximum of 80m over a 155m stretch. The north of the survey extent remains at one of its most landward positions recorded, whilst the south is at one of its most seaward positions recorded.	Since the last survey, there has been retreat of the edge of the sand across the north of the survey area, and an accretion of the edge of sand in the south. There has been relatively little change in the central survey area. **Longer term trends:** Sand extent surveys for the past 19 surveys shows oscillation of the edge of the beach with no net trend, however the most recent survey remains at one of its most landward position across the north of the survey area and one of its most seaward positions in the south of the survey area.
March 2022	**Cliff-top Survey:** Cliff top survey data collected for baseline survey (autumn, 2008), the previous Full Measures surveys (autumn 2021) and the present Partial Measures (spring 2022) is presented in this report. The cliff top survey is carried out as a continuous cliff edge line survey at the Newbiggin Caravan Park at Newbiggin Point. The results from the cliff top monitoring are anticipated to have an accuracy of ±0.2m due to the technique used. Furthermore, problems in precisely locating the cliff top, due to vegetation growth or the indistinct form of the cliff top, have also affected the data quality. There has been very little change in the position of the cliff top since the previous survey in autumn 2021. There are a few isolated sections of erosion up to 0.5m mostly located at the cliff edge adjacent to the northern end of the concrete armour blocks.	Since the last survey there has been no significant movement recorded. **Longer term trends**: Since surveys began in October 2008, cliff movement has been greatest in the north of the survey area with up to 3.3m of cliff top retreat, whilst the central and southern parts of the survey area have shown less movement with retreat of less than 2.0m.

2.12 Cambois Bay

Survey Date	Description of Changes Since Last Survey	Interpretation
21st - 23rd February 2022	**Cliff-top Survey:** Cliff top survey data collected for baseline survey (spring, 2009), the previous Full Measures survey (autumn 2021) and the present Partial Measures survey (spring 2022) is presented in this report. The cliff top survey is carried out as a continuous cliff edge line survey in two locations within Cambois Bay; at Sandy Bay Caravan Park to the north of the River Wansbeck estuary, and Cambois Bay from south of the River Wansbeck to the breakwater at the southern end of the bay. The results from the cliff top monitoring are anticipated to have an accuracy of ±0.2m due to the technique used. Furthermore, problems in precisely locating the cliff top, due to vegetation growth or the indistinct form of the cliff top, have also affected the data quality. The survey report noted that '*very thick dense vegetation at north end of Cambois cliff top hinders survey of line*', '*a small section of the gabion baskets at Cambois have been displaced*' and a '*small section of cliff approx. 380m long and up to 8m wide has collapsed*' which has been described further below. Overall, the majority of the position of the cliff top at Sandy Bay Caravan Park has remained stable since the previous survey in autumn 2021. There are relatively few sections of erosion, with the largest section (11m) located to the north of the river which has retreated landwards by up to 1.6m. In the south, several sections (up to a maximum of 6m in length) have eroded by up to 2.5m since the previous survey. The dunes on the southern bank of the River Wansbeck show very little change since the previous survey in autumn 2021. There has generally been very little change along the majority of the survey length in Cambois Bay, with small isolated sections of retreat of typically less than 0.1m. The largest area of retreat is located in the centre of the survey extent, where the vegetation line has eroded up to a maximum of 7.0m along a length of 368m. This was noted in the survey report and photos are provided in **Plate 1** and **Plate 2**.	Since the last survey in autumn 2021, there has been relatively little change except for a few sections of erosion along the northern-most and southern-most Sandy Bay Caravan Park survey area measuring up to 1.6m. In Cambois Bay the erosion is generally localised small sections, with the most notable section of retreat in the south of the bay of up to 7.0m. **Longer term trends:** At Sandy Bay Caravan Park the cliff top retreat has been more significant in the southern part of the survey area with up to 5.0m of erosion since 2013, whilst the northern part has eroded by c.1-3m since 2013. In Cambois Bay, the area of greatest cliff top retreat since the surveys began in 2009 is in the centre of the bay opposite the car park in the dunes, Cambois, where up to 12m of erosion has occurred. The north and south of the bay have more typical retreats of c.3-7m.

Plate 1 Section of erosion along Cambois bay

Plate 2 Section of erosion along Cambois bay

2.13 Blyth South Beach

Survey Date	Description of Changes Since Last Survey	Interpretation
3rd March – 4th April 2022	**Beach Profiles:** Blyth South Beach is covered by six beach profile lines for the Partial Measures survey (Appendix A). The previous survey was the Full Measures assessment undertaken in autumn 2021. Profile **1aBVBC01** is located towards the north of South Beach, in front of the land owned by the Port of Blyth. The dunes have remained stable with accretion of up to 0.1m on the dune crest and 0.2m on the most seaward dune face to chainage 48m. The beach profile has smoothened since the previous survey, with erosion of previous beach berms by up to 0.5m and accretion of up to 0.6m. Overall, the dunes are at their highest level recorded compared to previous surveys. The upper and middle beach are at a high level, gradually reducing to a medium level on the lower beach. At profile **1aBVBC02**, the upper beach at the base of the seawall has risen by up to 0.9m to chainage 12m. The upper beach has lowered by up to 1.0m to chainage 47m, switching to accretion over the rest of the beach profile by up to 0.4m. Overall the upper and middle beach profile is at a high level compared to the range recorded from previous surveys, whilst the lower beach is at a low level. At profile **1aBVBC03**, the toe of the dune has retreated by up to 3.0m, with an accumulation of sediment between chainages 80-100m of up to 0.9m. The beach profile shows a redistribution of sediment, with erosion on the upper and lower beach by up to 0.9m. The middle beach between chainages 140-214m has risen by up to 1.2m. Overall the profile is at a medium level on the upper beach, a high level on the middle beach and a low level on the lower beach compared to previous surveys. The dune toe is at one of its most landward positions recorded. At profile **1aBVBC04**, up to 0.2m of accretion has taken place on the dune crest and dune face, however the dune toe has lowered by up to 0.2m to chainage 42m. The rest of the beach profile has risen by up to 0.6m on the upper beach, up to 1.0 on the middle beach and up to 0.6m on the lower beach. Overall, the upper and middle beach profile is at a medium level compared to the range recorded from previous surveys, and the lower beach is at a low level. The dunes are at a high level compared to previous surveys. At profile **1aBVBC05**, the dunes have remained stable, with an accumulation of 0.4m between the dune	Since the last survey, the dune crests at Blyth South Beach have remained stable, generally retaining the same form and position with some minor advances of the dune crest and dune toe. There have been variable amounts of erosion and accretion across the profiles, with a general trend of erosion on the upper and lower beach and accretion on the middle beach. Profiles range from a low to high level compared to the range recorded from previous surveys, however the dunes at 1aBVBC01 and 1aBVBC06 are at their highest level recorded, while the dune toe at 1aBVBC03 is at its most landward position recorded. **Longer term trends:** At Blyth South Beach, the dunes have generally demonstrated a long-term trend of stability. Beach profiles exhibit a seasonal movement of berms.

Survey Date	Description of Changes Since Last Survey	Interpretation
	toe and chainage 66m. Similar to previous profiles, alternating sections of erosion and accretion have occurred across the beach profile, with the largest erosion on the upper beach by up to 1.6m and the largest accretion on the lower beach by up to 0.5m. Overall, the dunes are at a high level, whilst the rest of the beach profile is at a medium-low level compared to the range recorded from previous surveys. Profile **1aBVBC06** is located at the southern end of the beach, towards Seaton Sluice. The dunes have remained stable, accreting by up to 0.2m on the crest of the dune and 0.4m on the dune face to chainage 90m. The upper beach has lowered by up to 0.5m to chainage 136m. The middle beach has risen by up to 1.6m to chainage 240m, filling in a depression at chainage 170m present in the previous survey. Seaward of chainage 240m the lower beach level has lowered by up to 0.3m. The dunes are at a high level, reaching their highest level recorded between chainage 45-90m. The rest of the beach profile is at a medium-high level compared to the range recorded from previous surveys.	

3. Problems Encountered and Uncertainty in Analysis

Individual Profiles

- Profiles 1aBTBC19, 1aBTBC21, and 1aBTBC23 all end at drains.
- At profiles 1aADC08 and 1aADC09, the profiles end at the River Aln channel due to quicksand.
- At profile 1aADC16 there are gaps in the section due to bushes, and no access to resident's gardens.
- Profile 1aADC16B now starts at the new fence.
- At profile 1aCMC02 livestock with young prevented access to the start of the section.

Topographic Surveys

- At Newbiggin-by-the Sea, the topographic survey report notes that sand was covering most of the revetment rocks at the back of the beach, and that the concrete steps were exposed for long stretches at the back of the beach. Section 4 promenade had increased in height to accommodate new ramping.
- At Lynemouth, the River Lyne was too deep to survey bed levels.

Cliff Top Surveys

Surveying any cliff top is difficult due to the need for a consistent interpretation of the cliff edge in successive surveys, which can be challenging, especially when vegetation is thick. For these reasons, it has been assumed that any changes of ±0.2m may be considered as being within the margins of error of the surveying technique, and that any indication of an advancing cliff line is error.

Surveying the cliff top along Cambois Bay is more difficult than the similar surveys at Newbiggin Caravan Park and Sandy Bay Caravan Park because the cliff edge is less distinct and hard to precisely define due to vegetation coverage and its smooth, degraded form.

The surveyors noted the following at Cambois:

- there was very thick dense vegetation at the north end of the cliff top which hindered the survey of the line;
- A small section of the gabion baskets were displaced; and
- A section of cliff of approximately 380m long and up to 8m wide had collapsed.

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

No changes to the monitoring programme are recommended at this time.

5. Conclusions and Areas of Concern

- At Sandstell Point (Spittal A), the crest of the distal end of the spit has slightly receded landward by approximately 2.0mm and has generally smoothened across the profile. The recorded profiles and topographic survey present no causes for concern.
- At Spittal (Spittal B), there has been a redistribution of sediment throughout the profiles, with significant erosion recorded in the dunes and upper beach, however the recorded profiles present no causes for concern.
- At Goswick Sands, the beach has undergone very little change since the previous survey. The recorded profiles present no causes for concern.
- At Holy Island, the Snook and beach have remained stable since the previous survey. The recorded profiles present no causes for concern.
- At Beadnell Village, the beach is at a medium-high level and the recorded profiles present no causes for concern.

- At Beadnell Bay, the profiles have undergone variable patterns of erosion and accretion, and the dunes have generally remained stable with some signs of growth. The recorded profiles present no causes for concern
- At Boulmer the profiles have generally lowered since the last survey. The recorded profiles present no causes for concern.
- At Alnmouth Bay, there has been alternating patterns of accretion and erosion across the beach profile. The recorded profiles and topographic surveys present no causes for concern.
- At High Hauxley & Druridge Bay, the dunes have remained stable and beach profiles have undergone variable patterns of erosion and accretion. The recorded profiles present no causes for concern.
- At Lynemouth Bay, the colliery spoil bank to the north of the River Lyne (profile 1aCMBC03A) and Power Station (CMBC03B) has continued to retreat by erosion following the enabling works for the Lynemouth Coastal Landfill Scheme which involved a battering back of the cliffs. The largest amount of erosion has occurred just south of Headagee rock outcrop, where a 513m section of colliery spoil cliff has eroded landward by up to 8m.
- At Newbiggin Bay, the beach has remained stable, and the recorded profiles present no cause for concern.
- At Cambois Bay, the cliff top survey shows localised small sections of erosion, with the most notable section of retreat in the south of the bay of up to 7.0m. At the Sandy Bay Caravan Park survey area, there has been relatively little change since the previous survey.
- At Blyth South Beach, there have been variable amounts of erosion and accretion across the profiles, whilst the dune crest and dune toe have generally accreted since the previous survey.

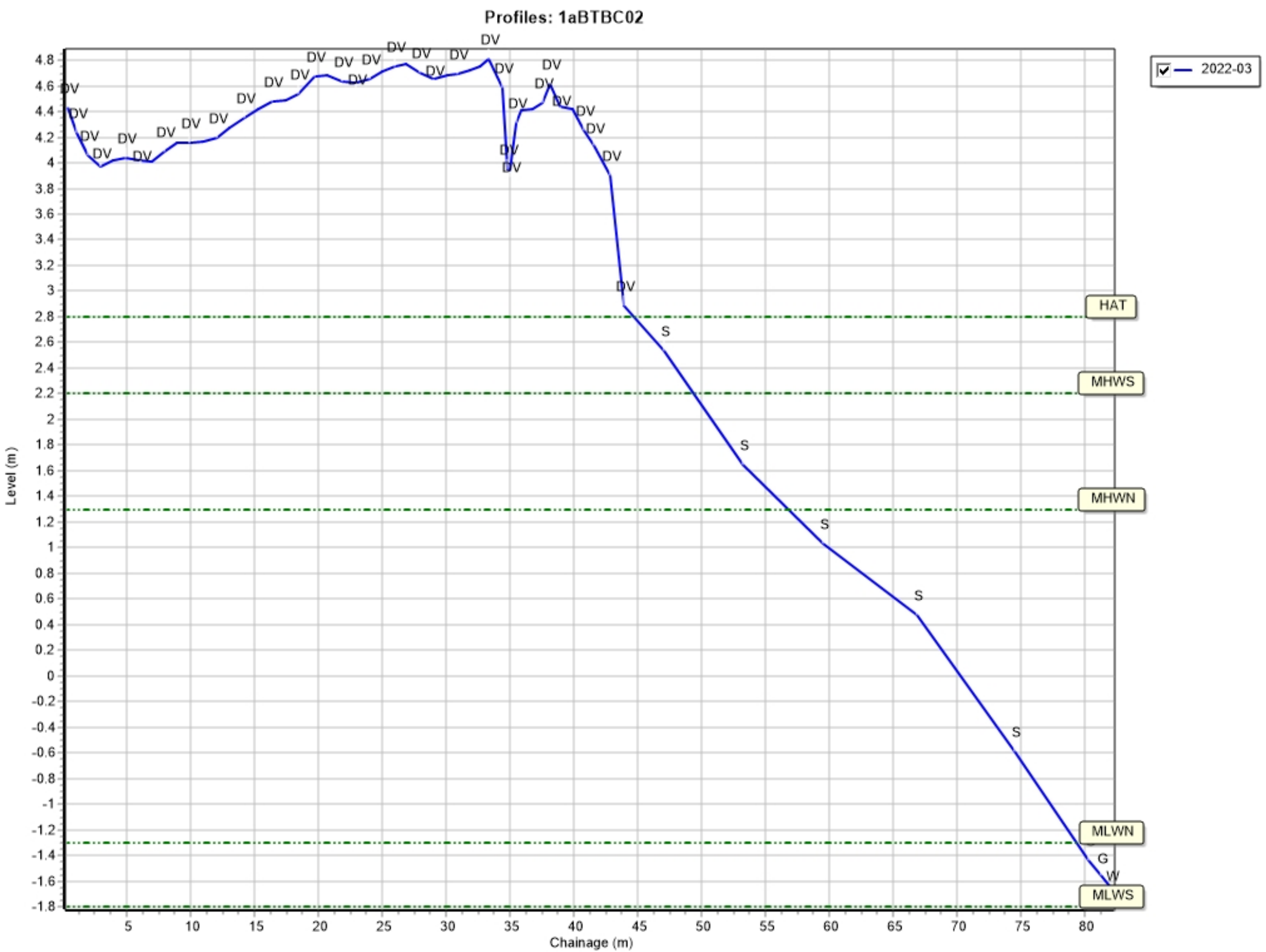
Appendices

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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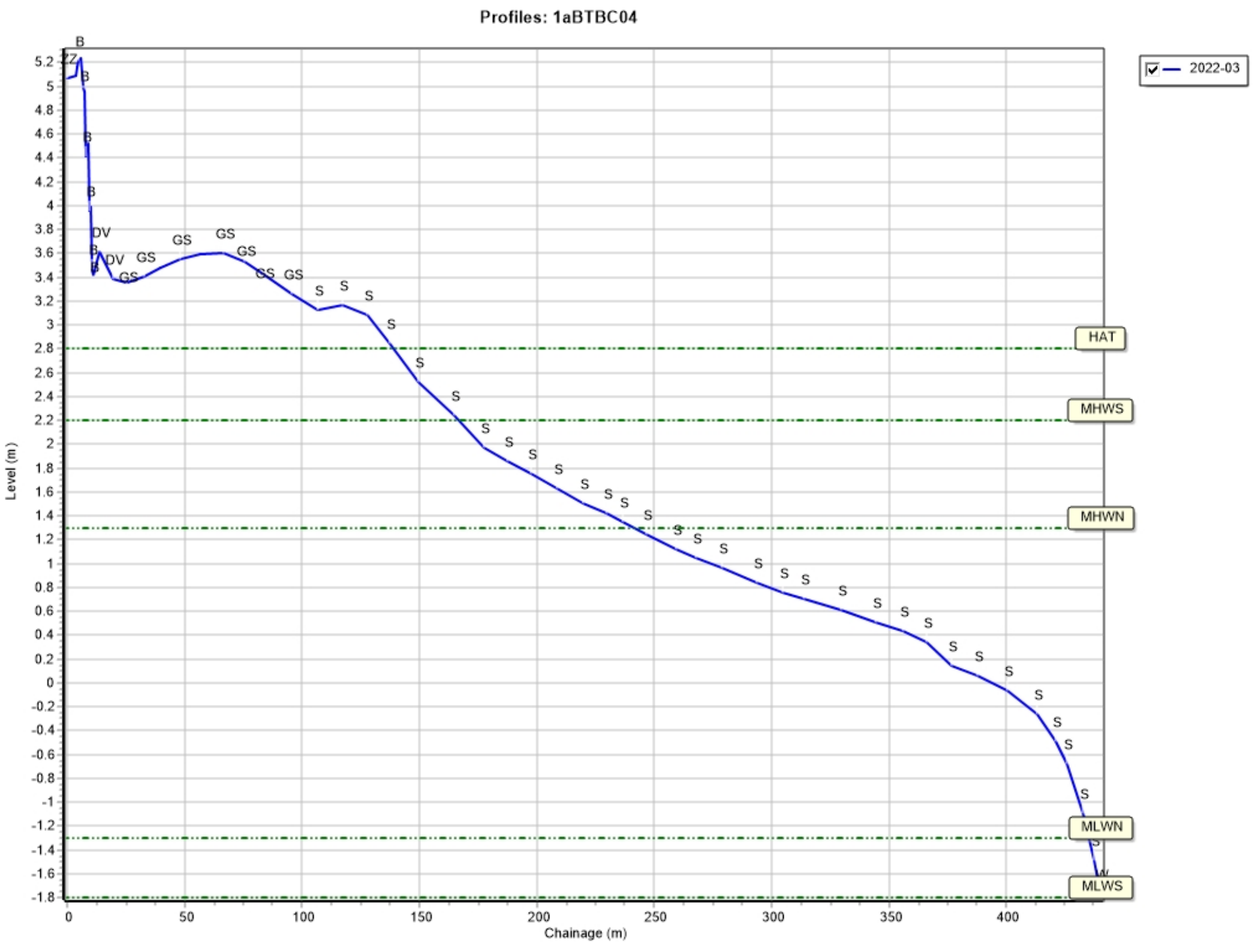
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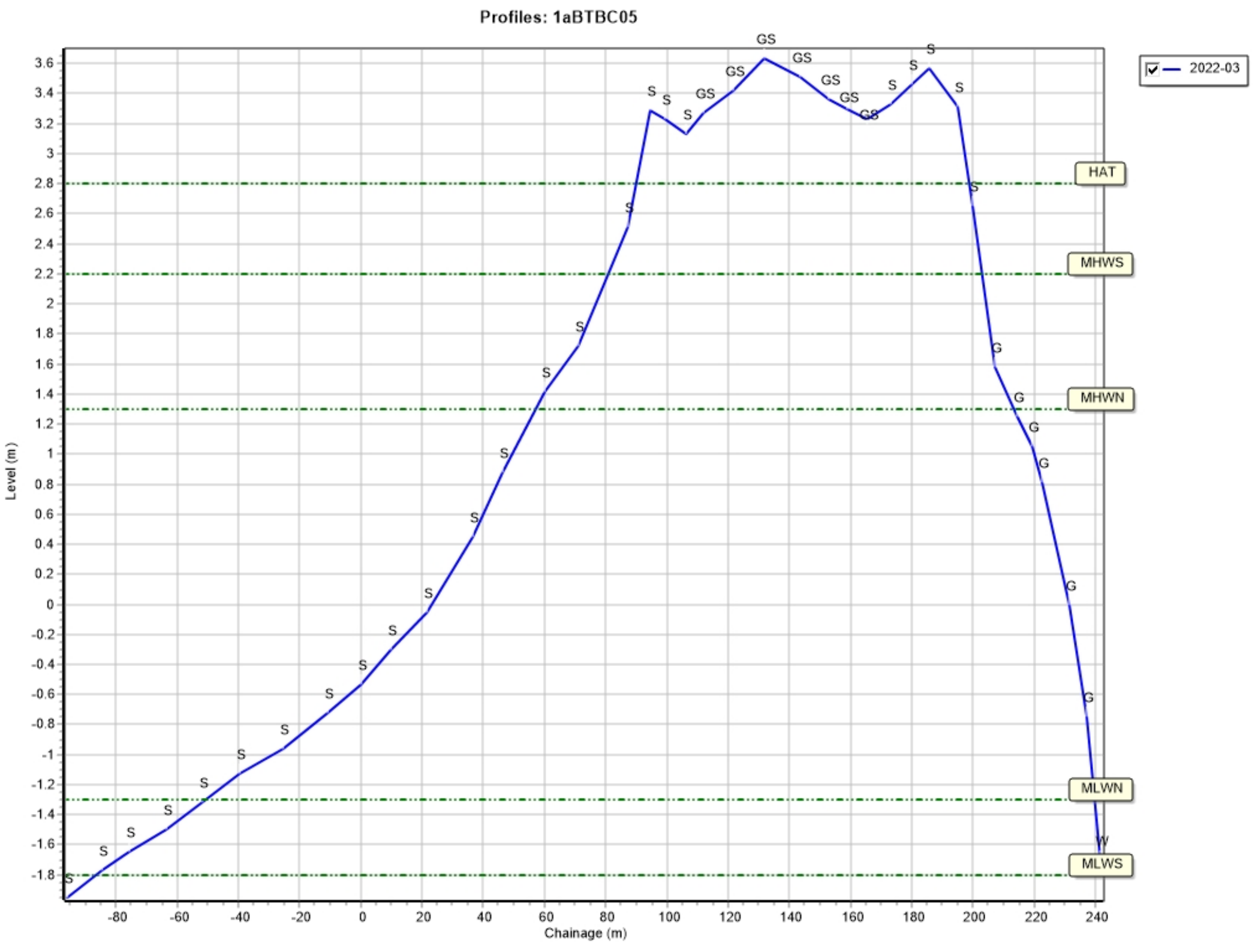
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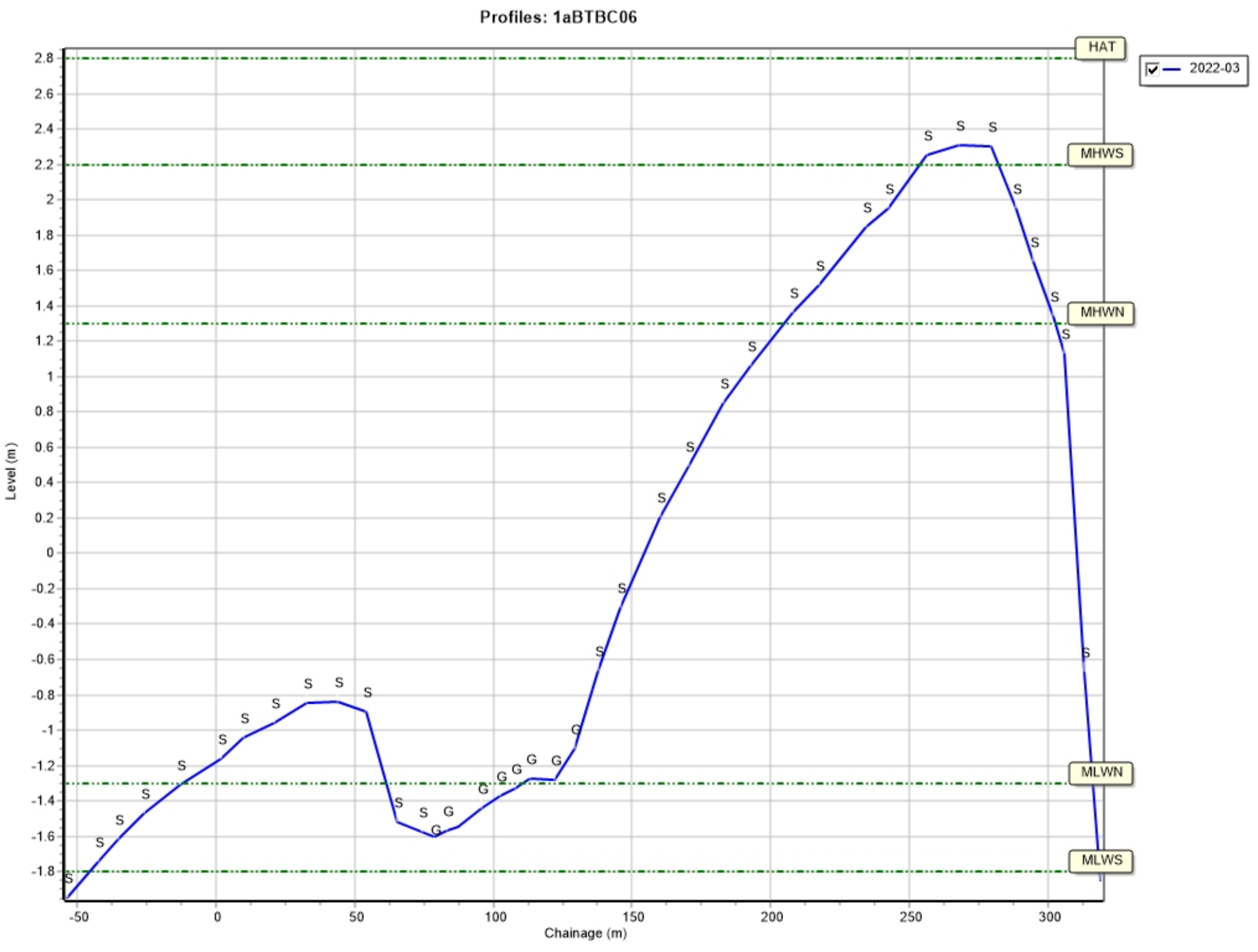
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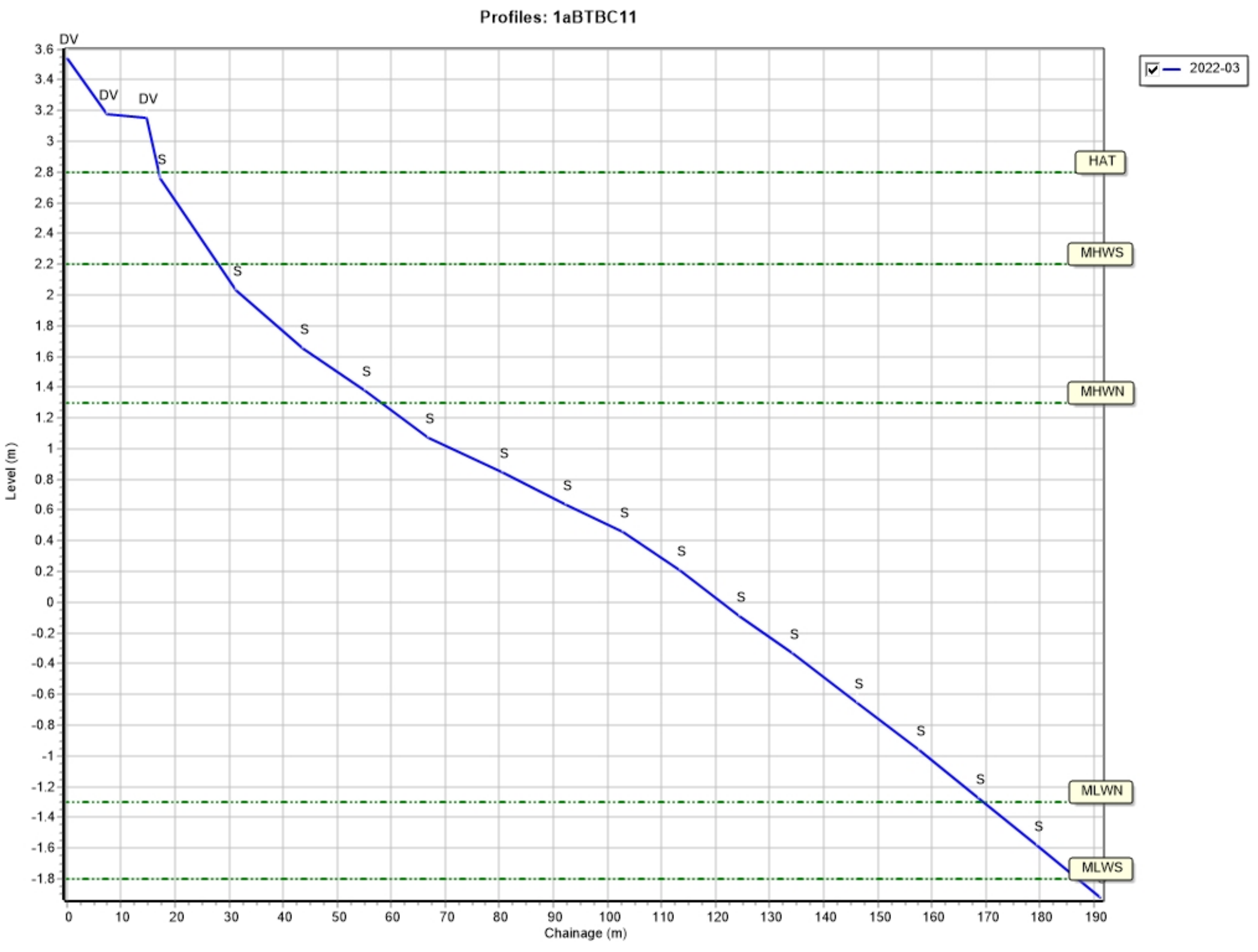
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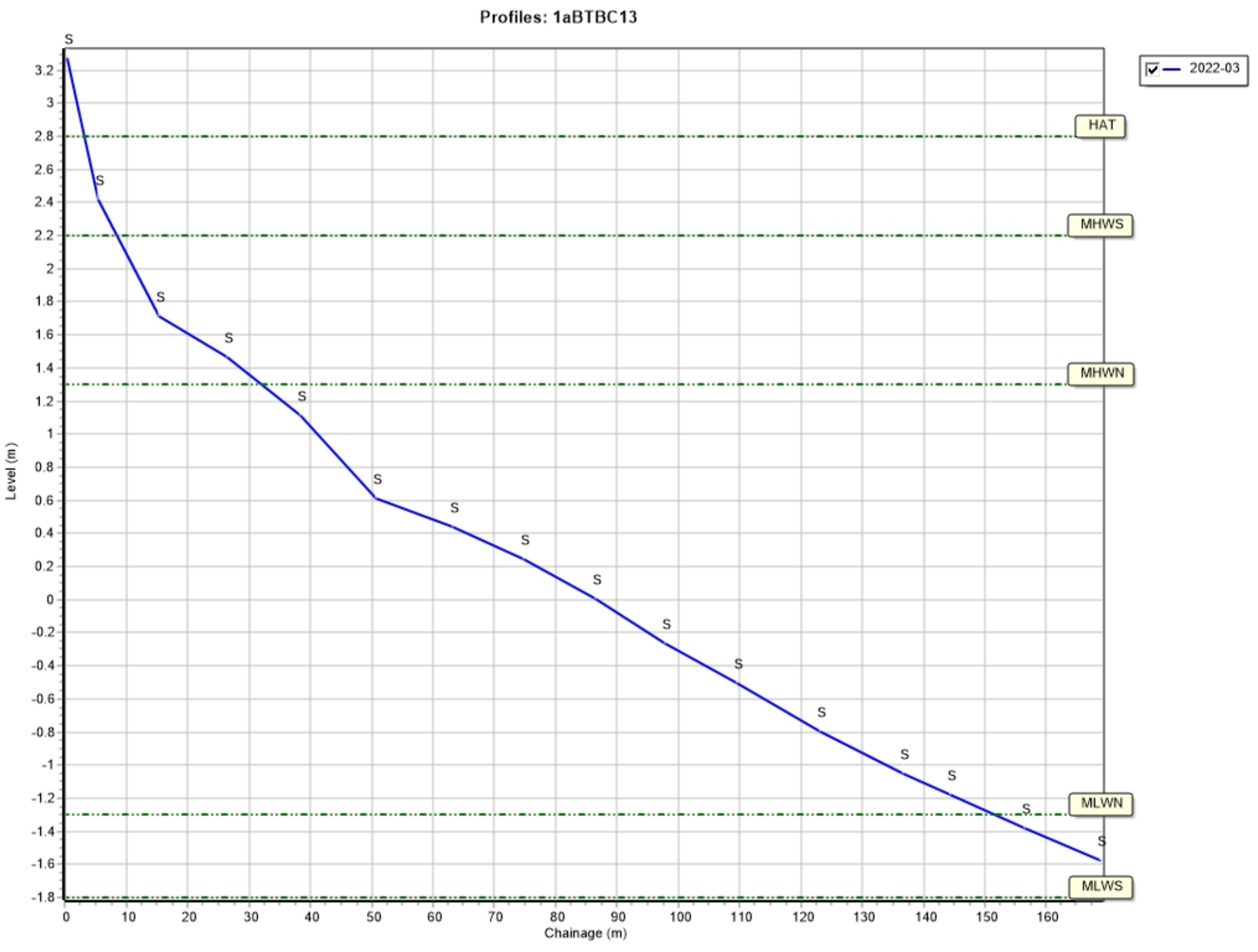
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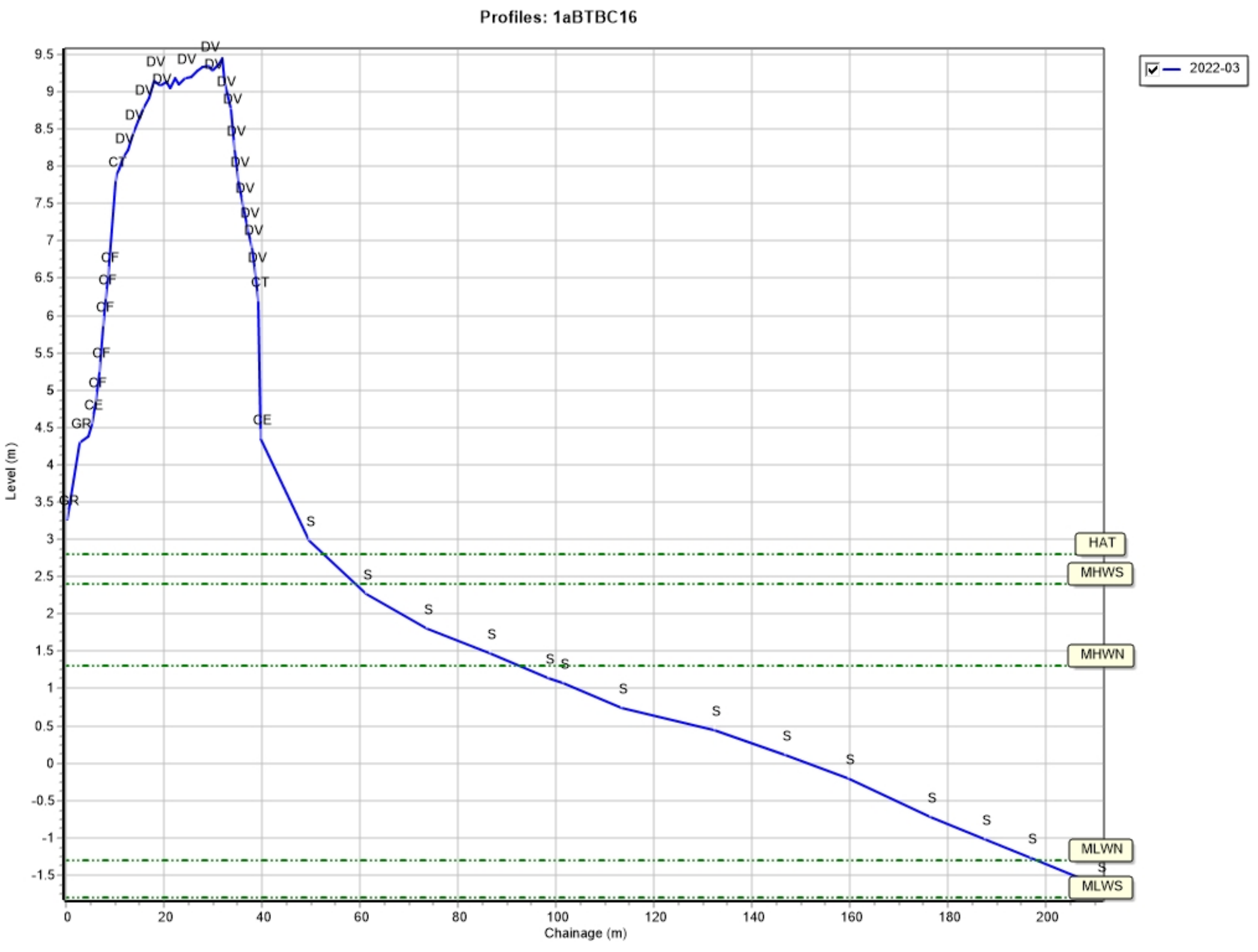
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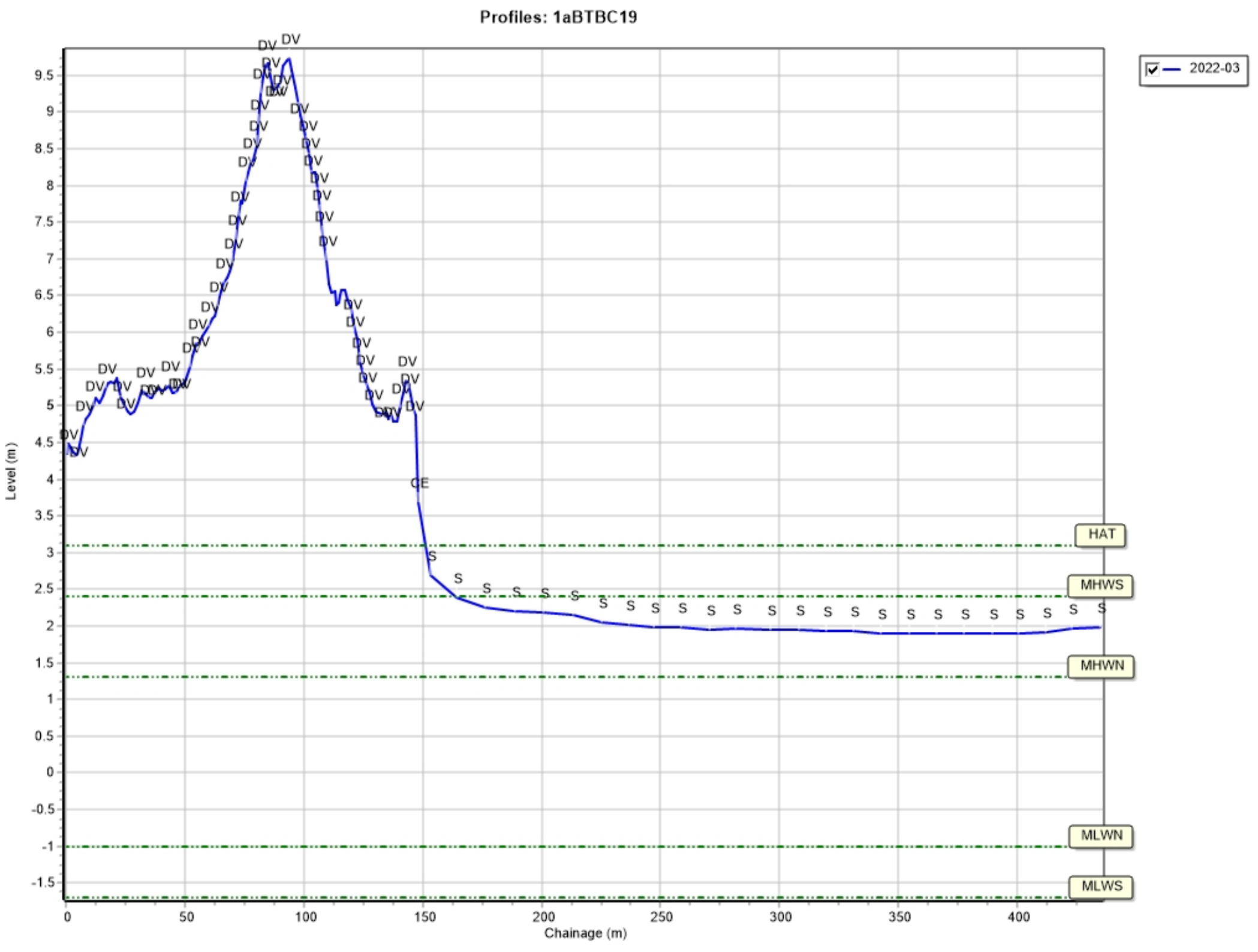
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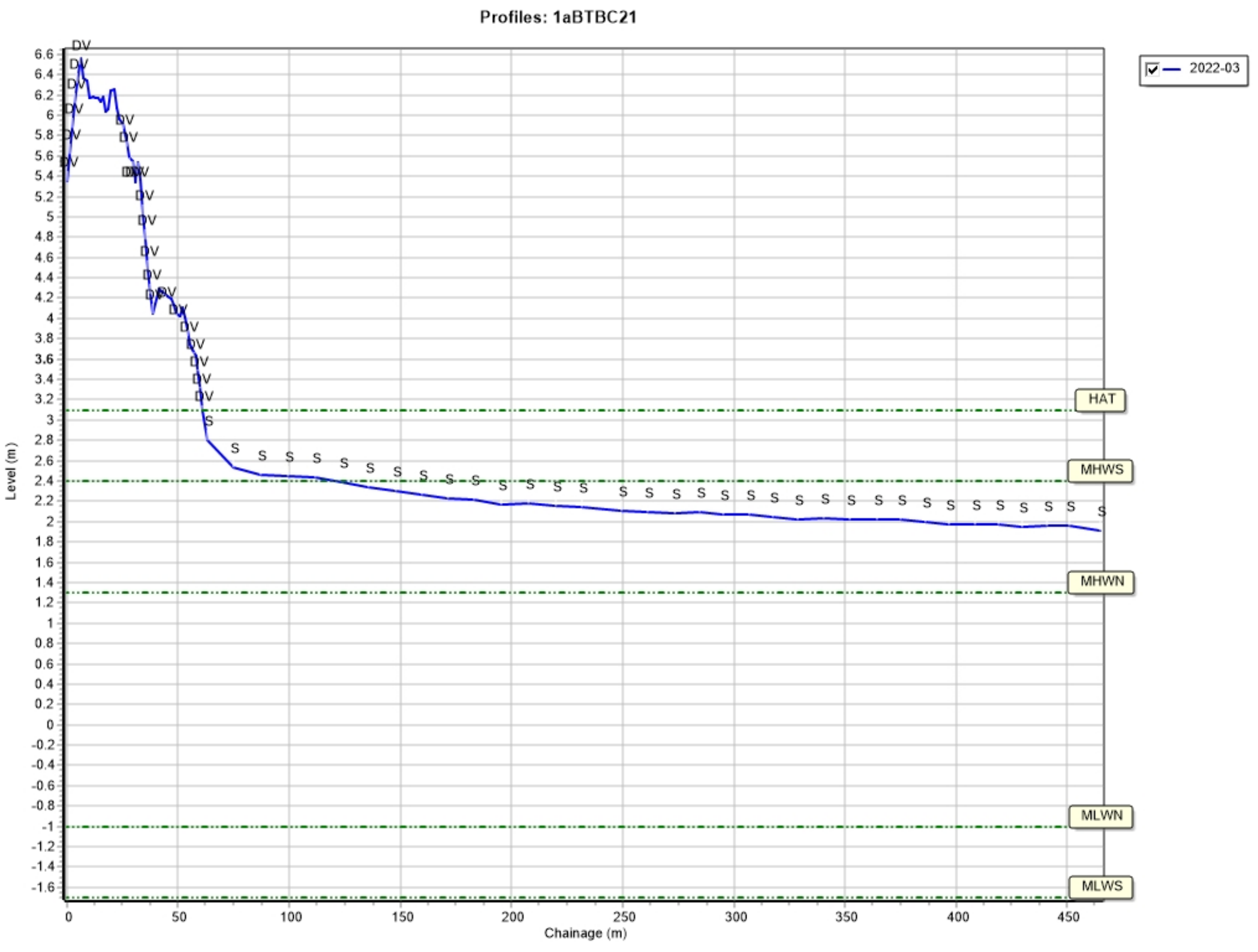
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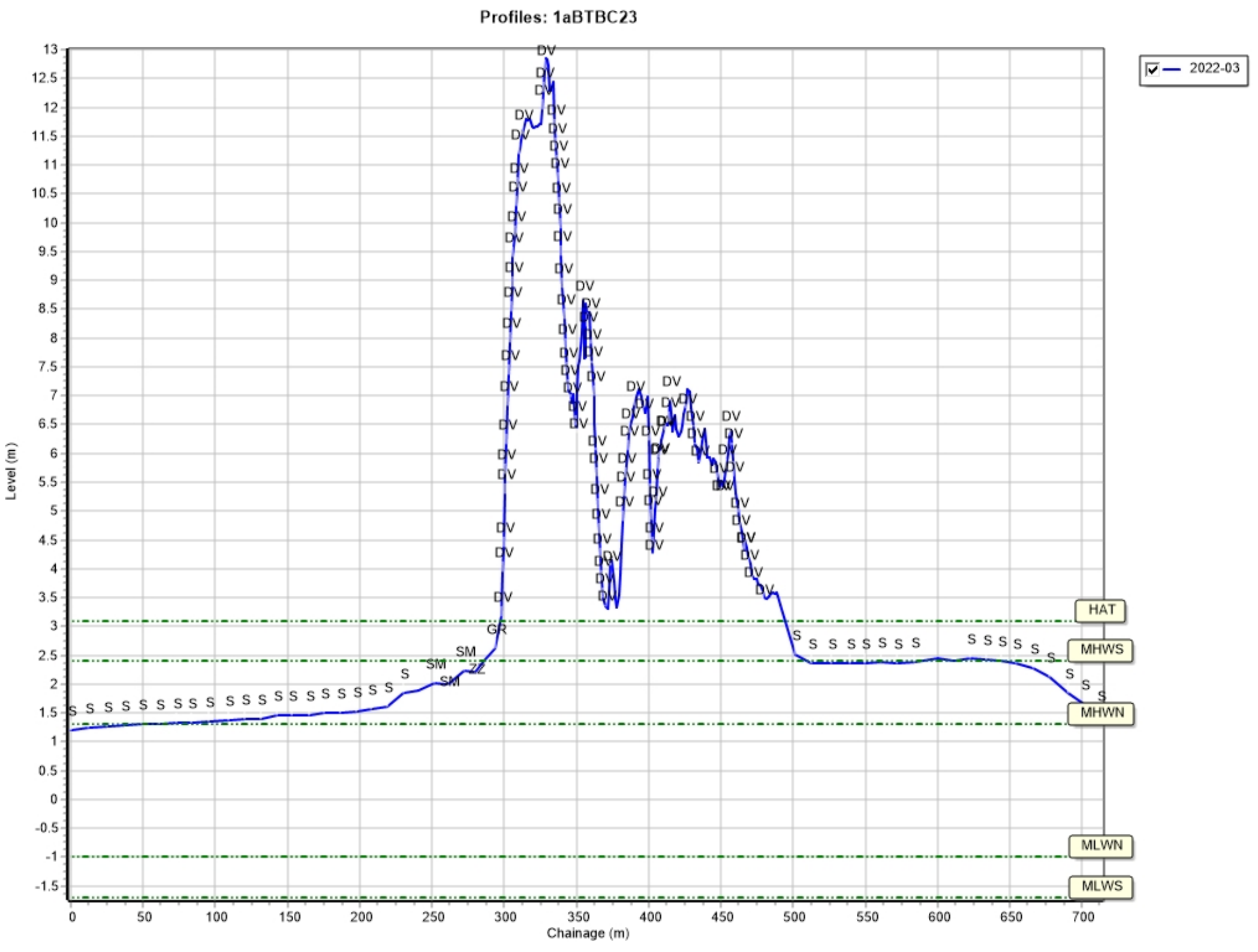
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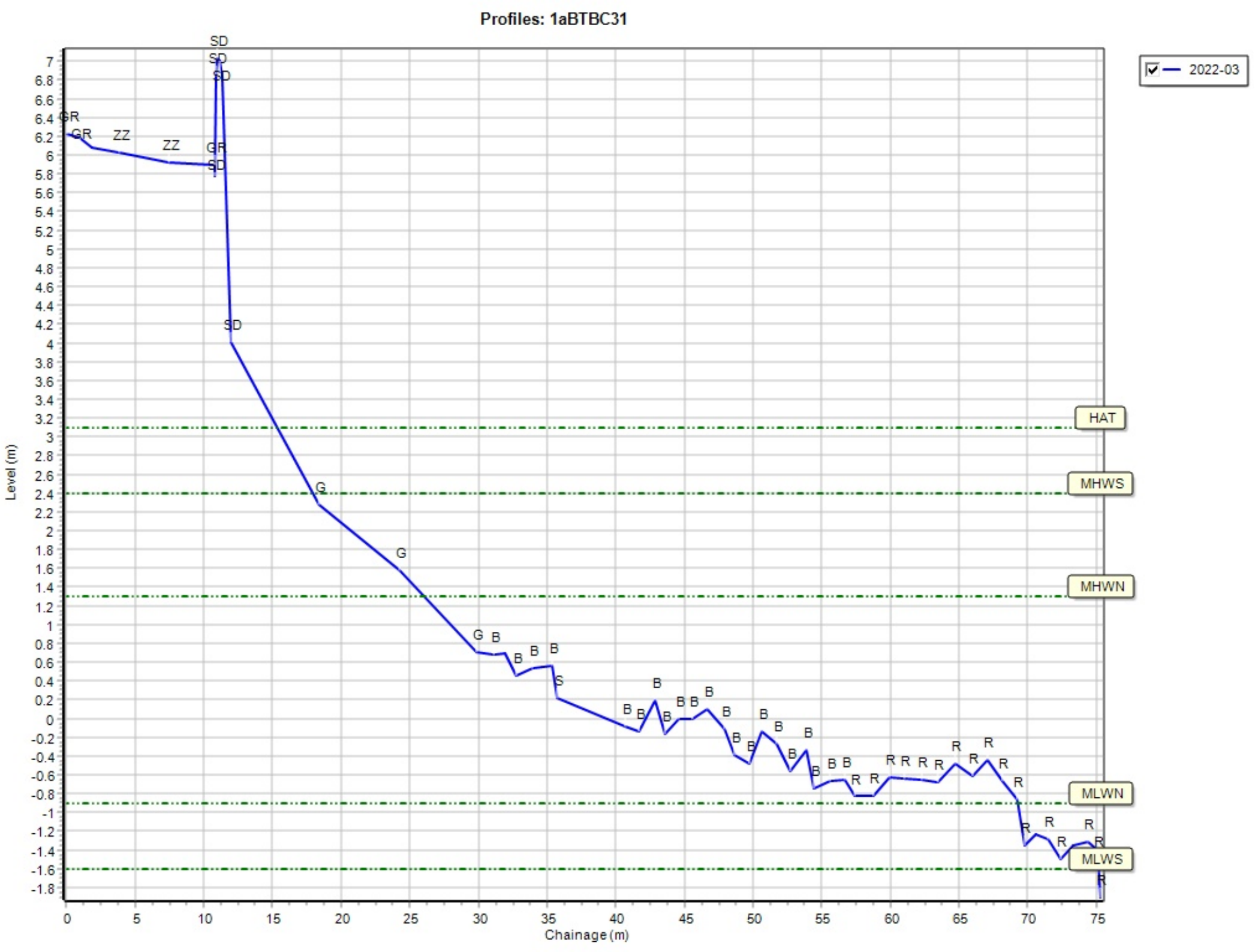
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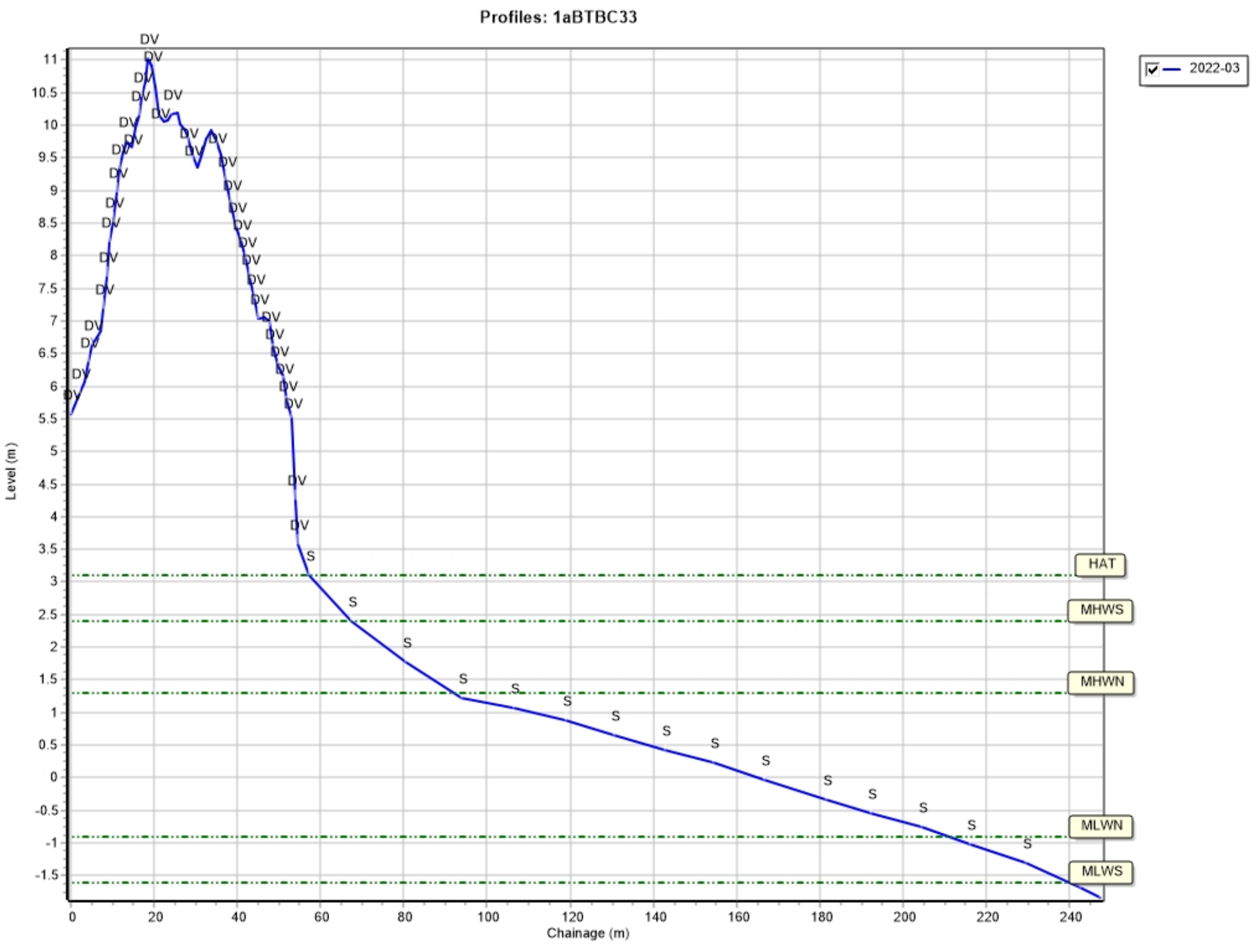
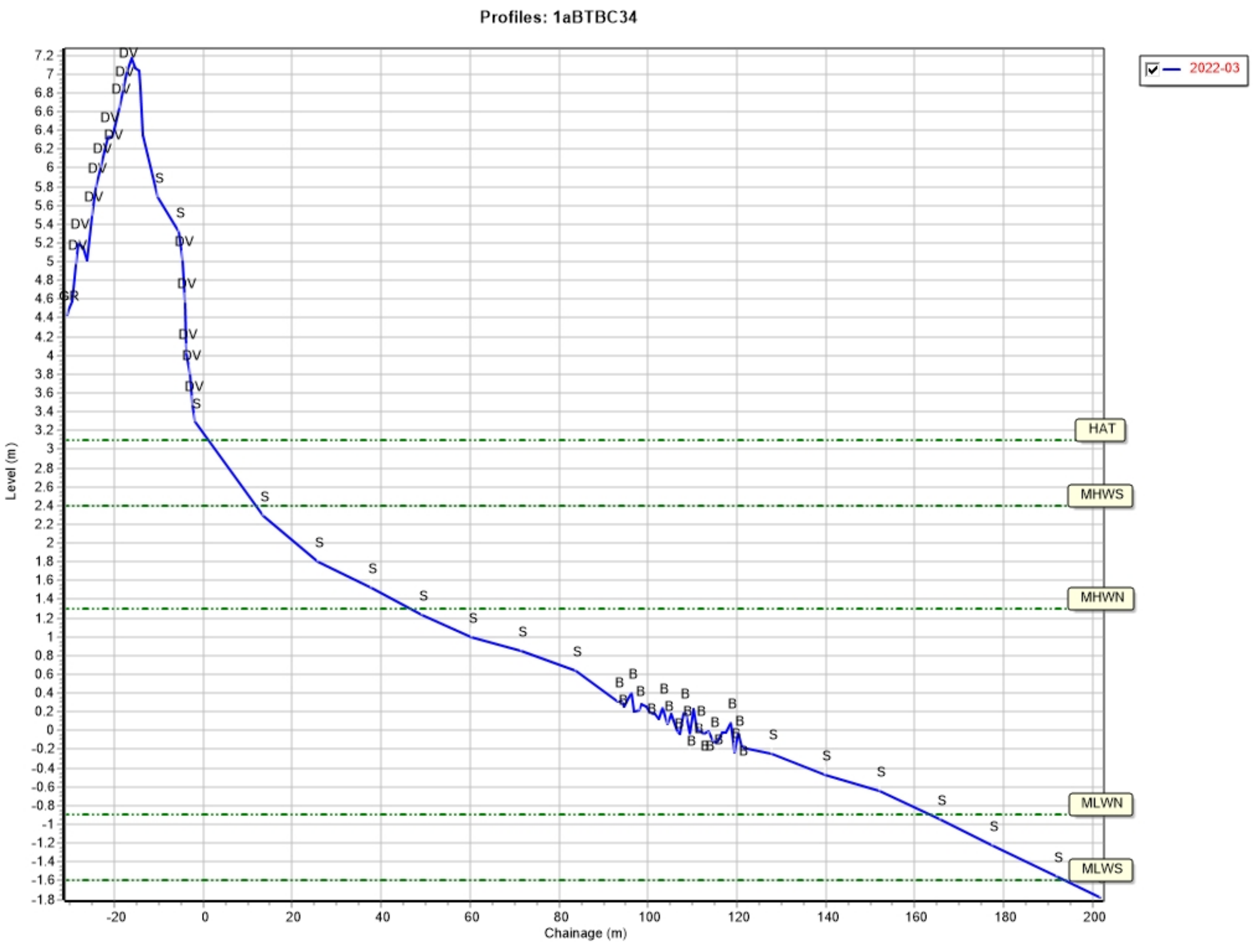
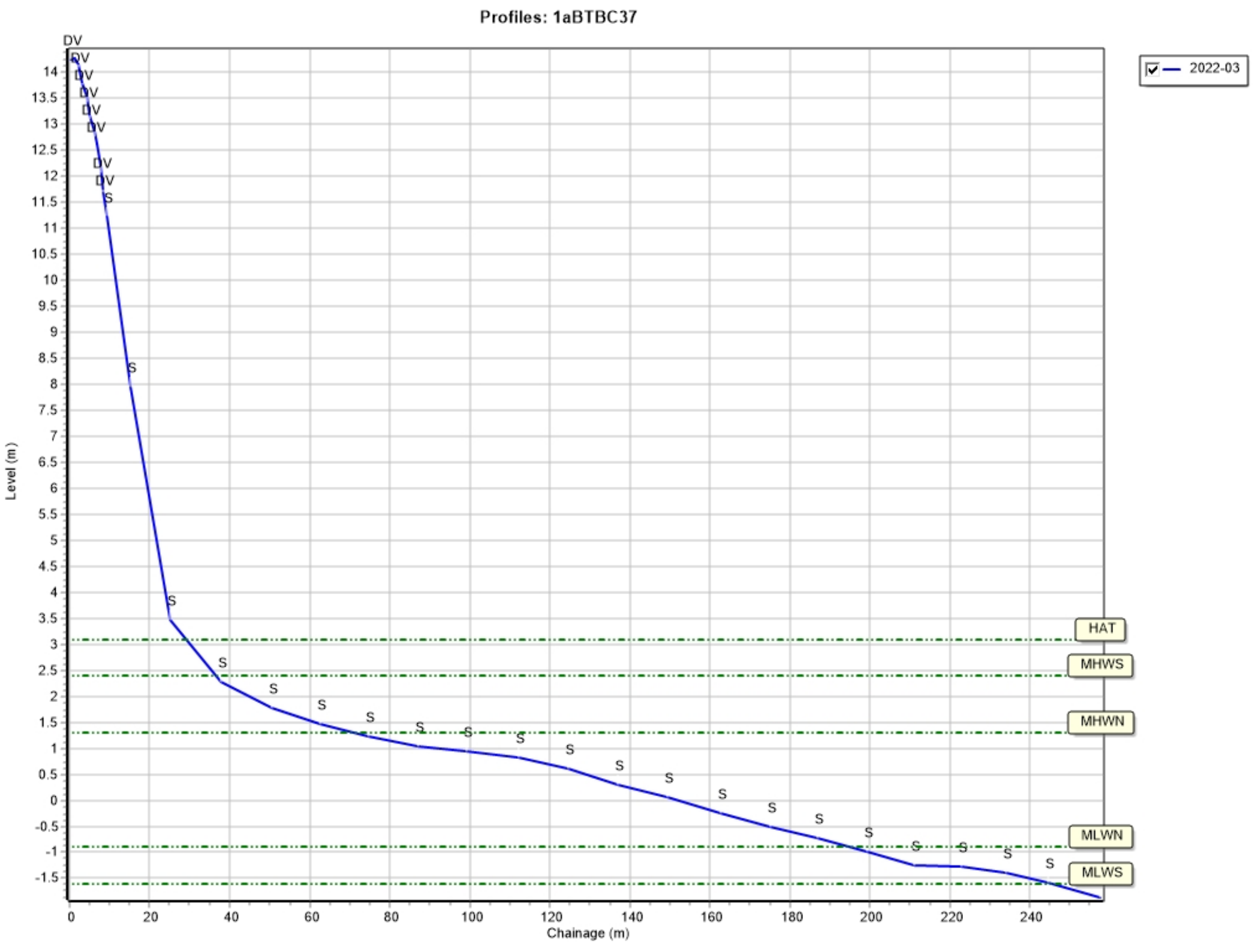
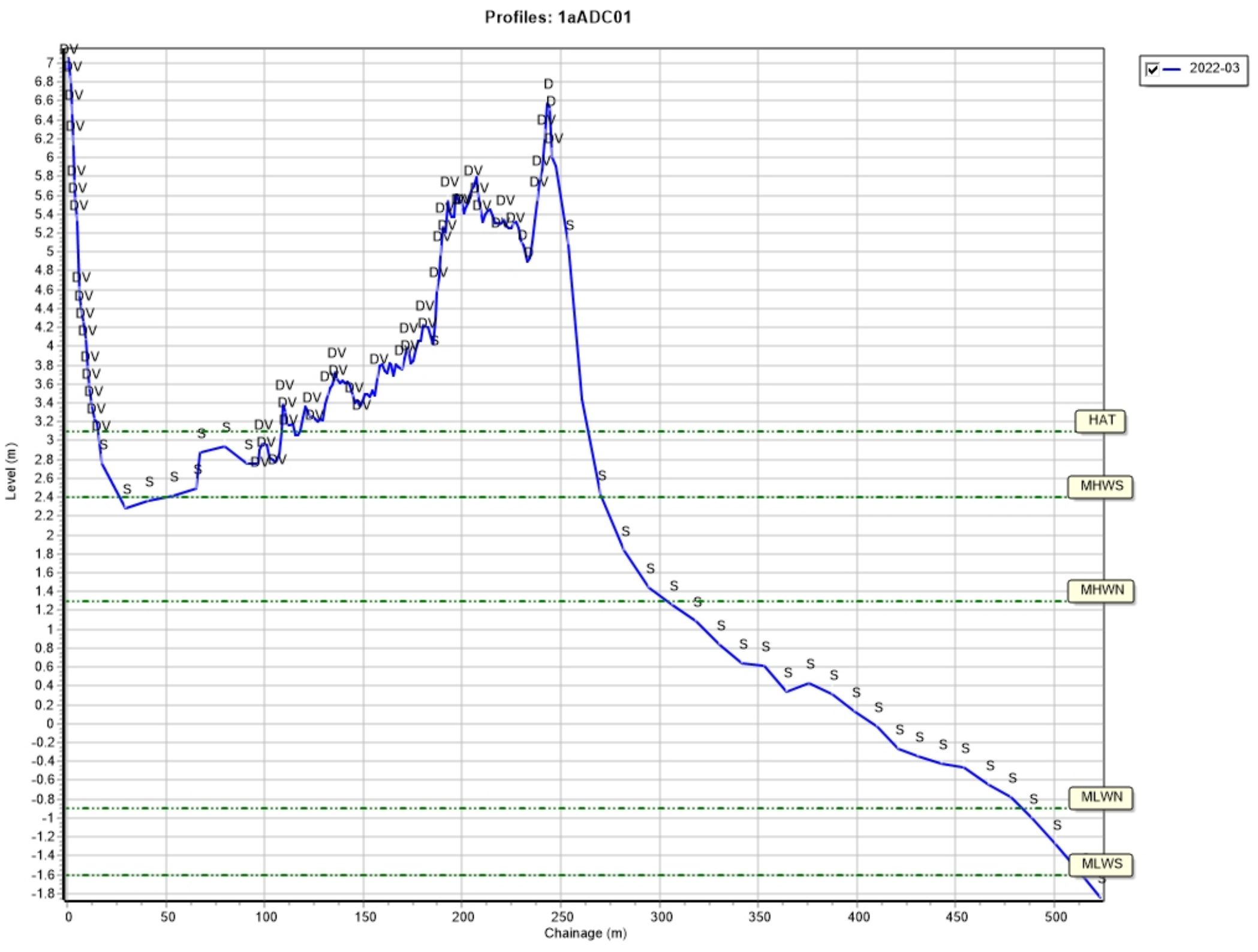
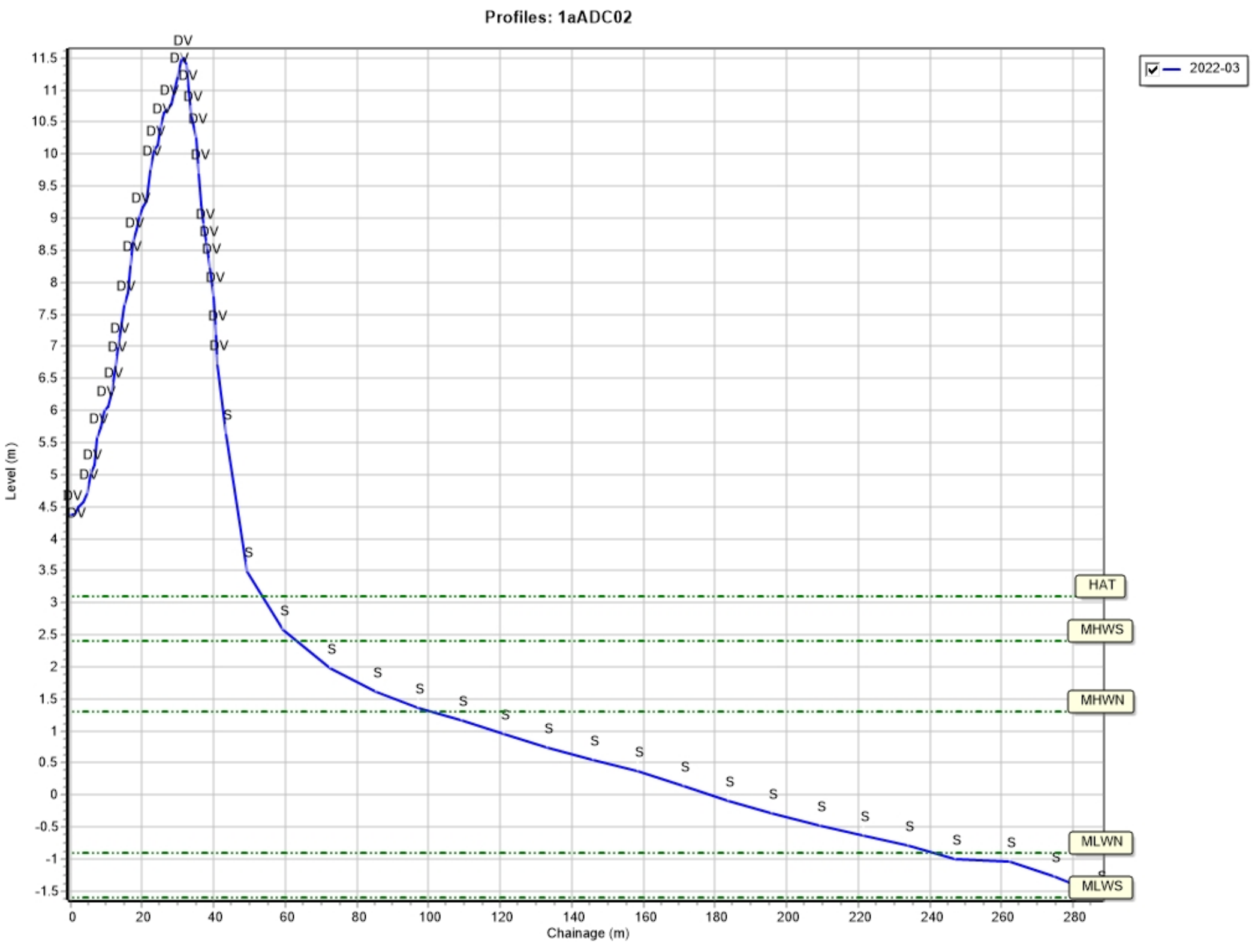
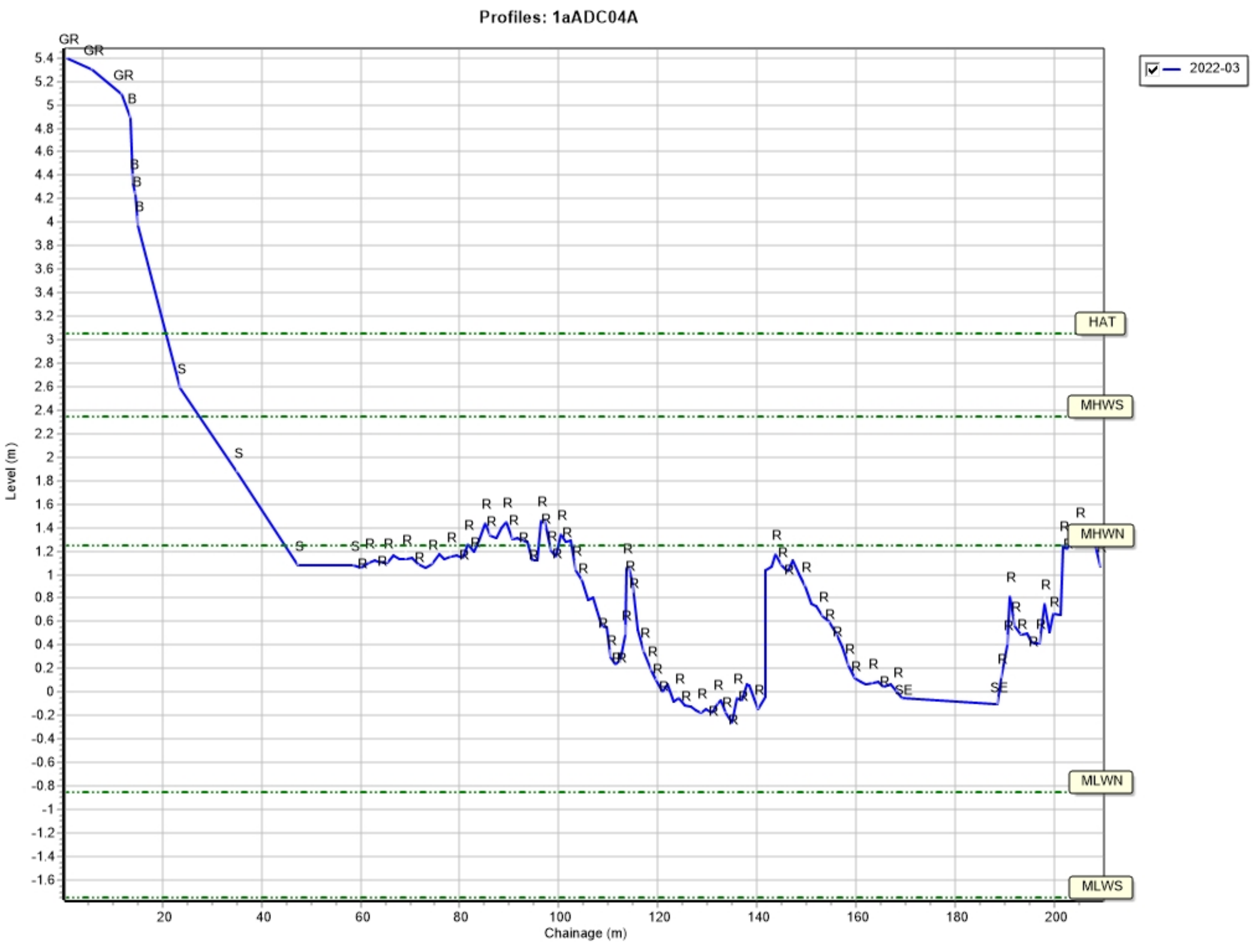

Profiles: 1aBTBC33
2022-03
Level (m)
Chainage (m)
HAT
MHWS
MHWN
MLWN
MLWS
DV
S

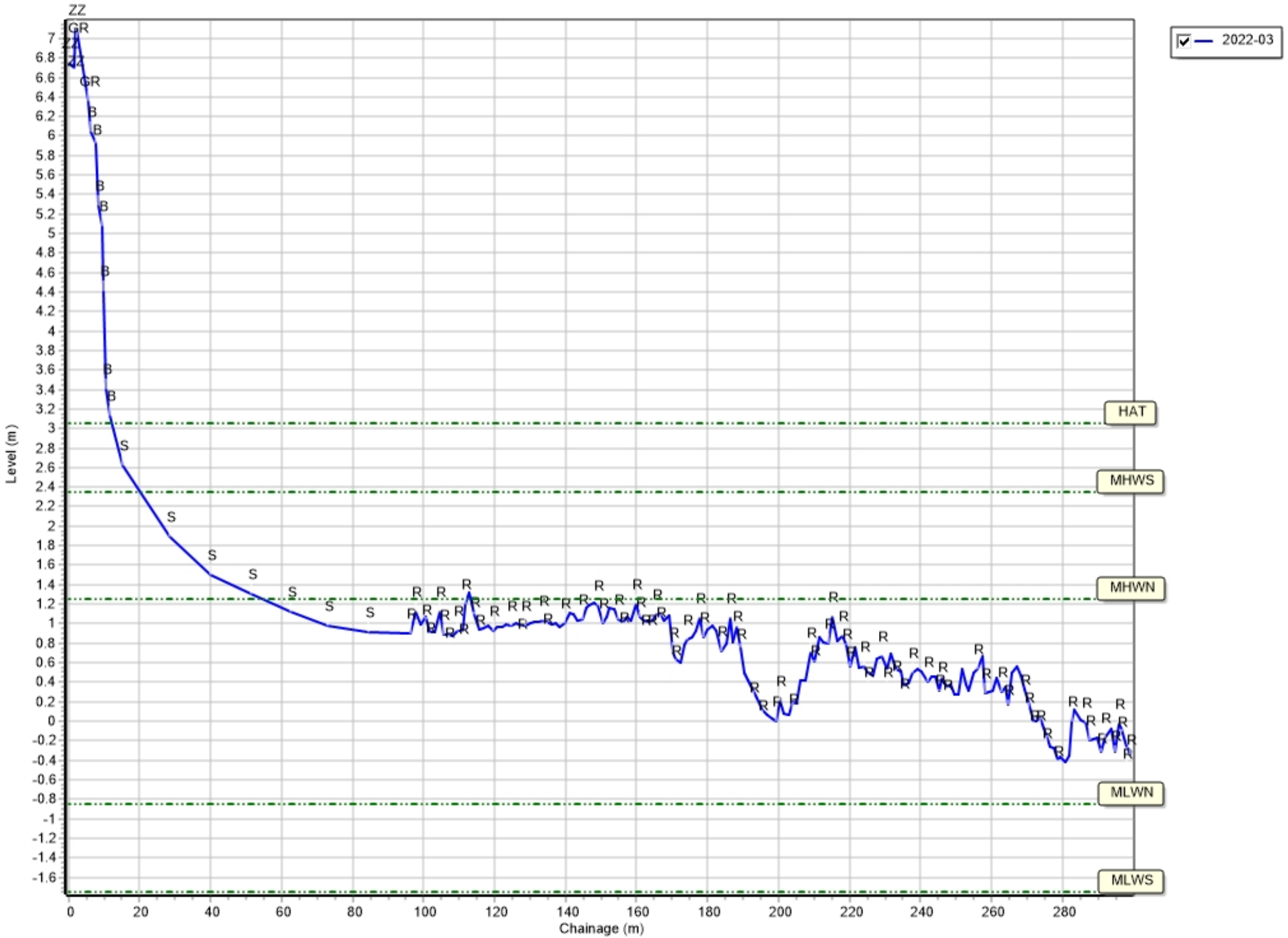

Profiles: 1aBTBC34
2022-03
Level (m)
Chainage (m)
HAT
MHWS
MHWN
MLWN
MLWS
GR
DV
S
B

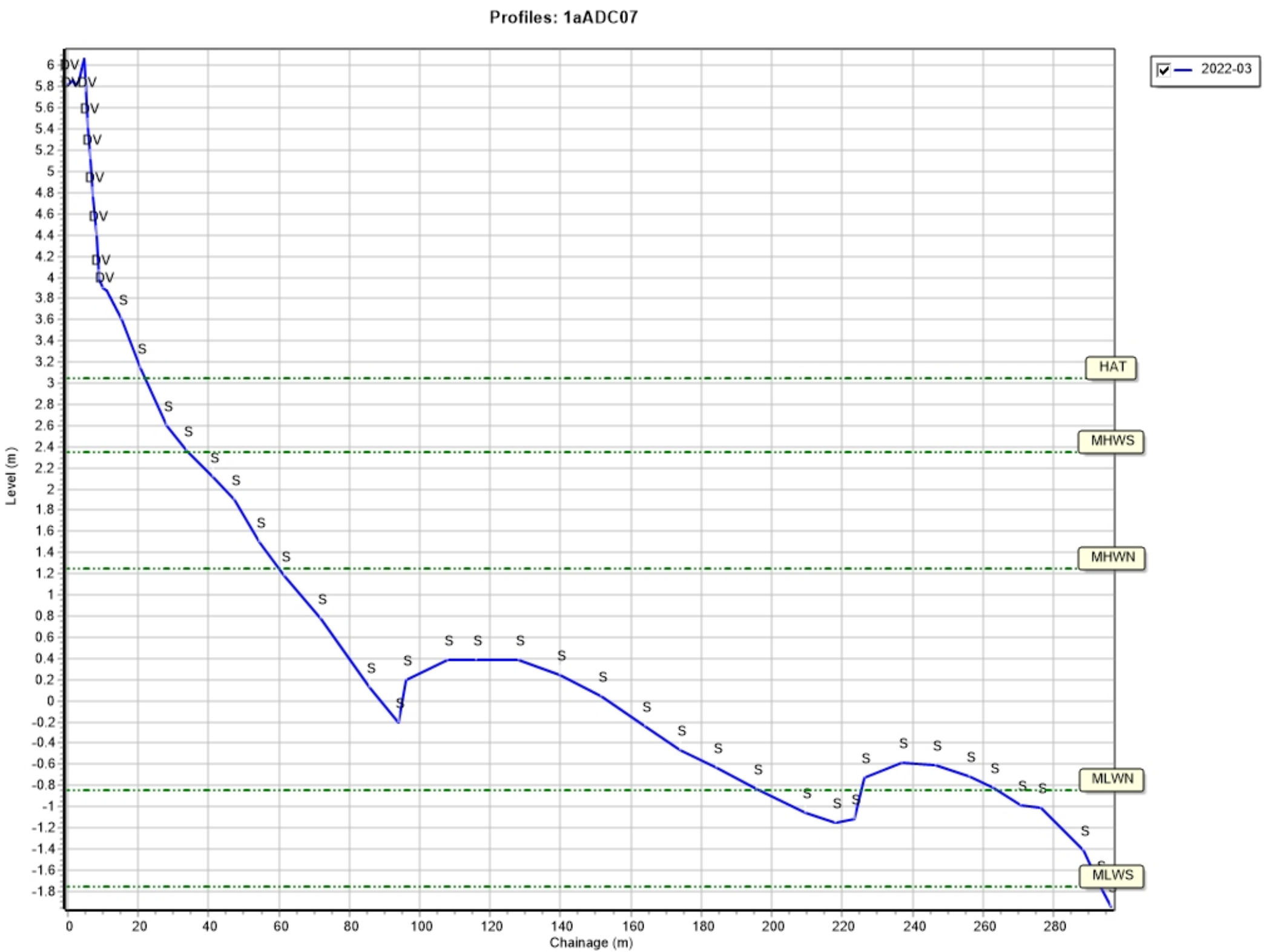

Profiles: 1aBTBC37
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
DV
S

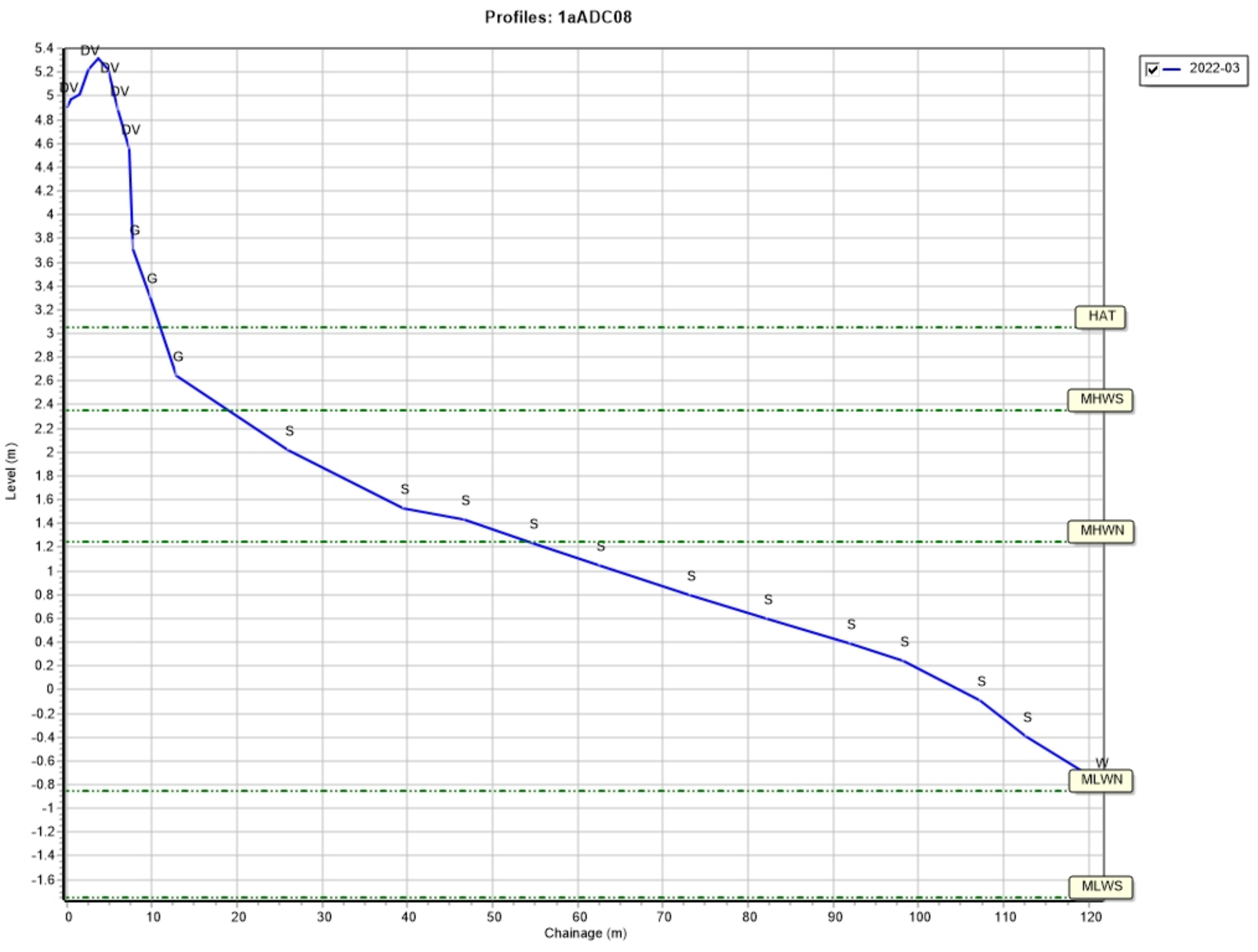

Profiles: 1aADC01
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
0
50
100
150
200
250
300
350
400
450
500

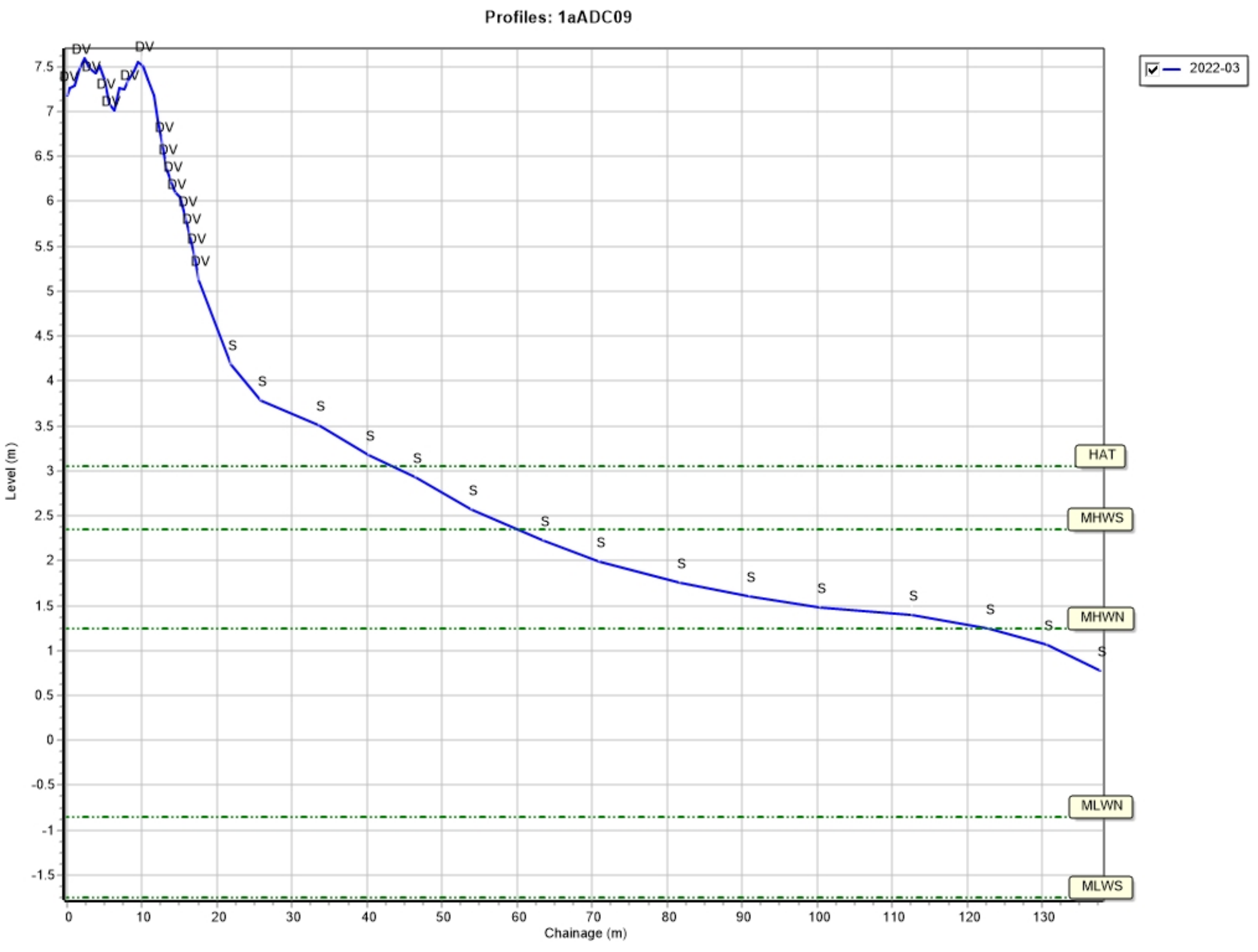

Profiles: 1aADC02
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
11.5
11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
DV
S

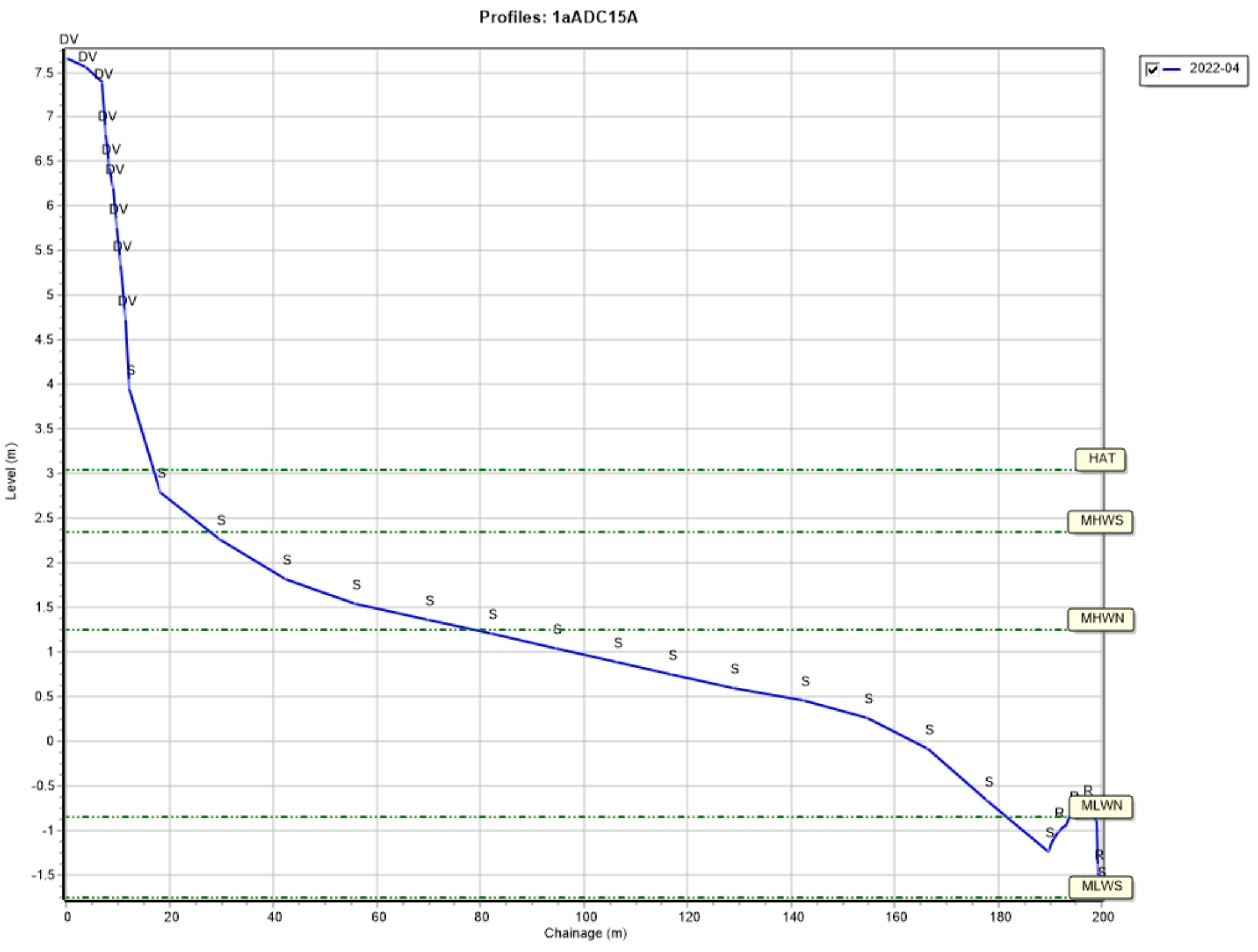

Profiles: 1aADC04A
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
20
40
60
80
100
120
140
160
180
200

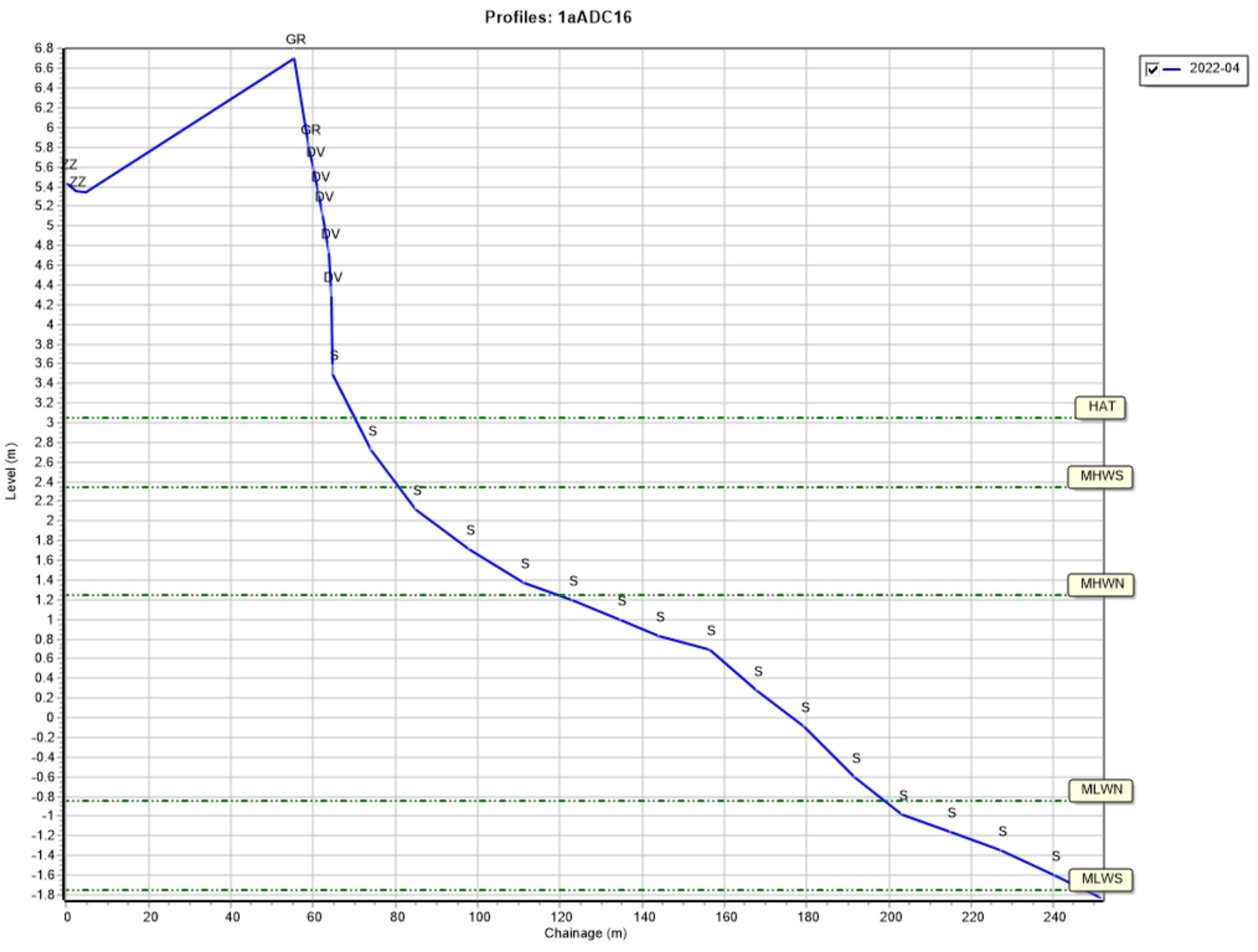

Profiles: 1aADC04B
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)

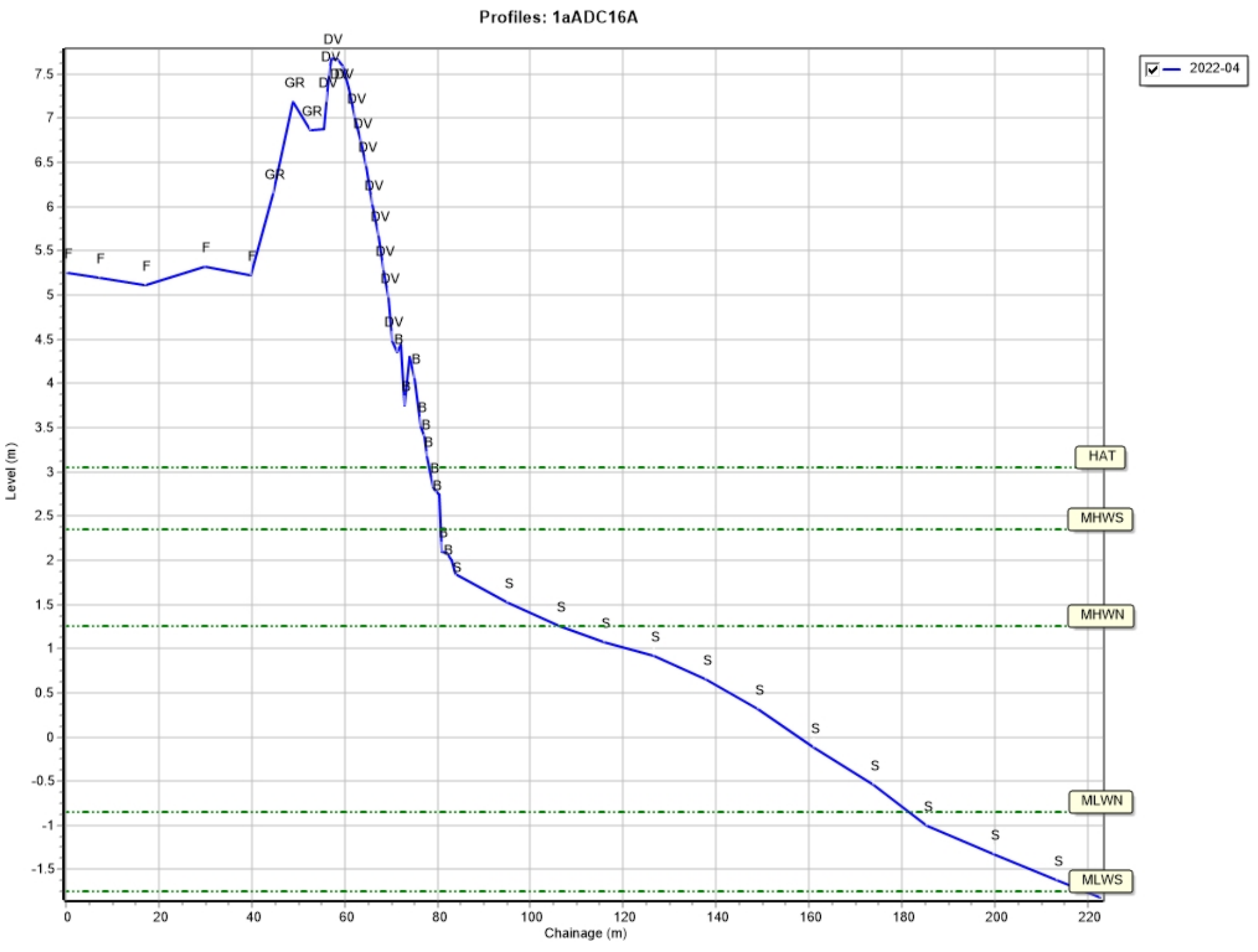

Profiles: 1aADC07
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
6
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280

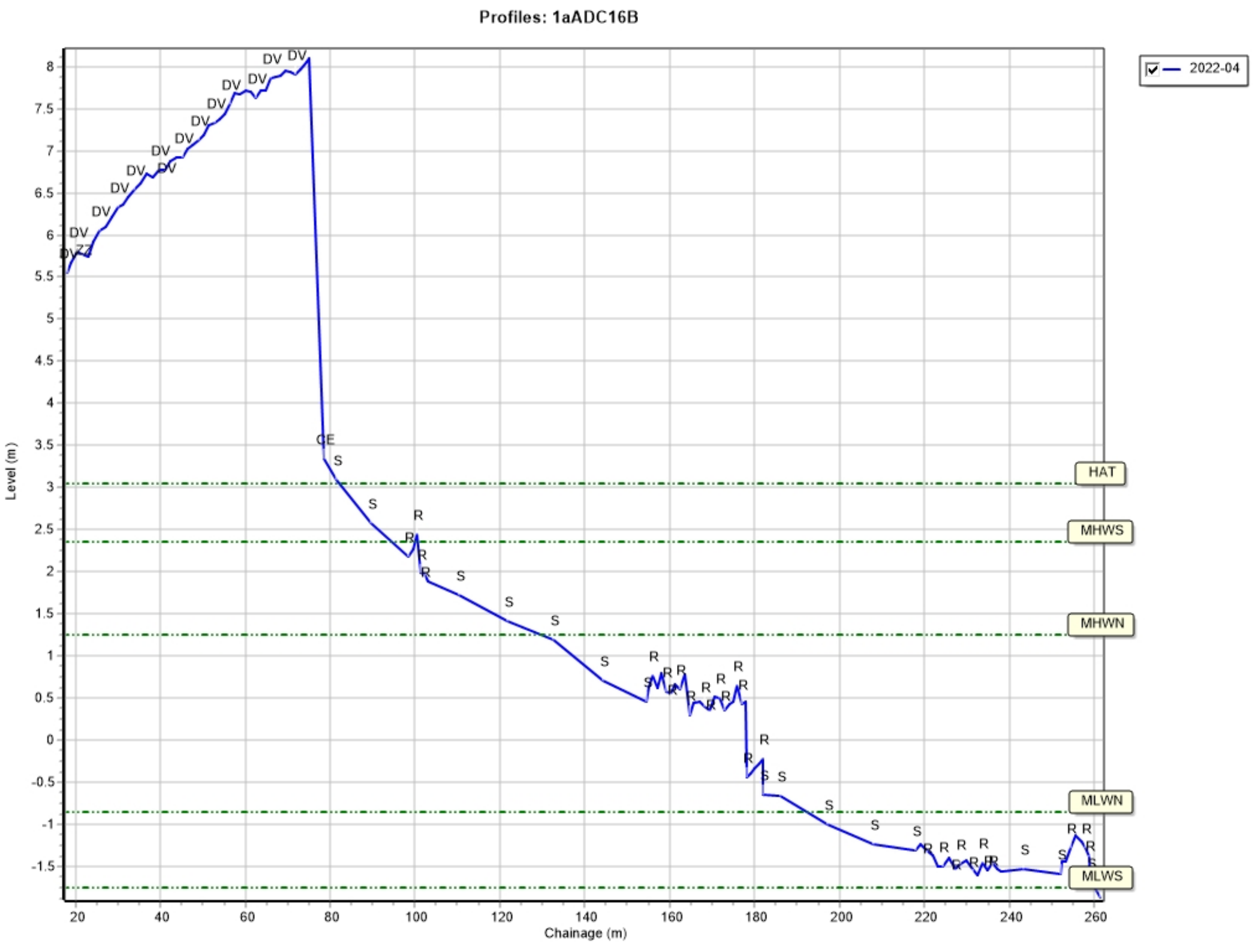

Profiles: 1aADC08
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
DV
G
S
W


Profiles: 1aADC09
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
DV
S
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
0
10
20
30
40
50
60
70
80
90
100
110
120
130


Profiles: 1aADC15A
2022-04
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
0
20
40
60
80
100
120
140
160
180
200


Profiles: 1aADC16
2022-04
GR
GR
DV
DV
DV
DV
DV
ZZ
ZZ
S
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
6.8
6.6
6.4
6.2
6
5.8
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
0
20
40
60
80
100
120
140
160
180
200
220
240


Profiles: 1aADC16A
2022-04
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
0
20
40
60
80
100
120
140
160
180
200
220


Profiles: 1aADC16B
2022-04
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
20
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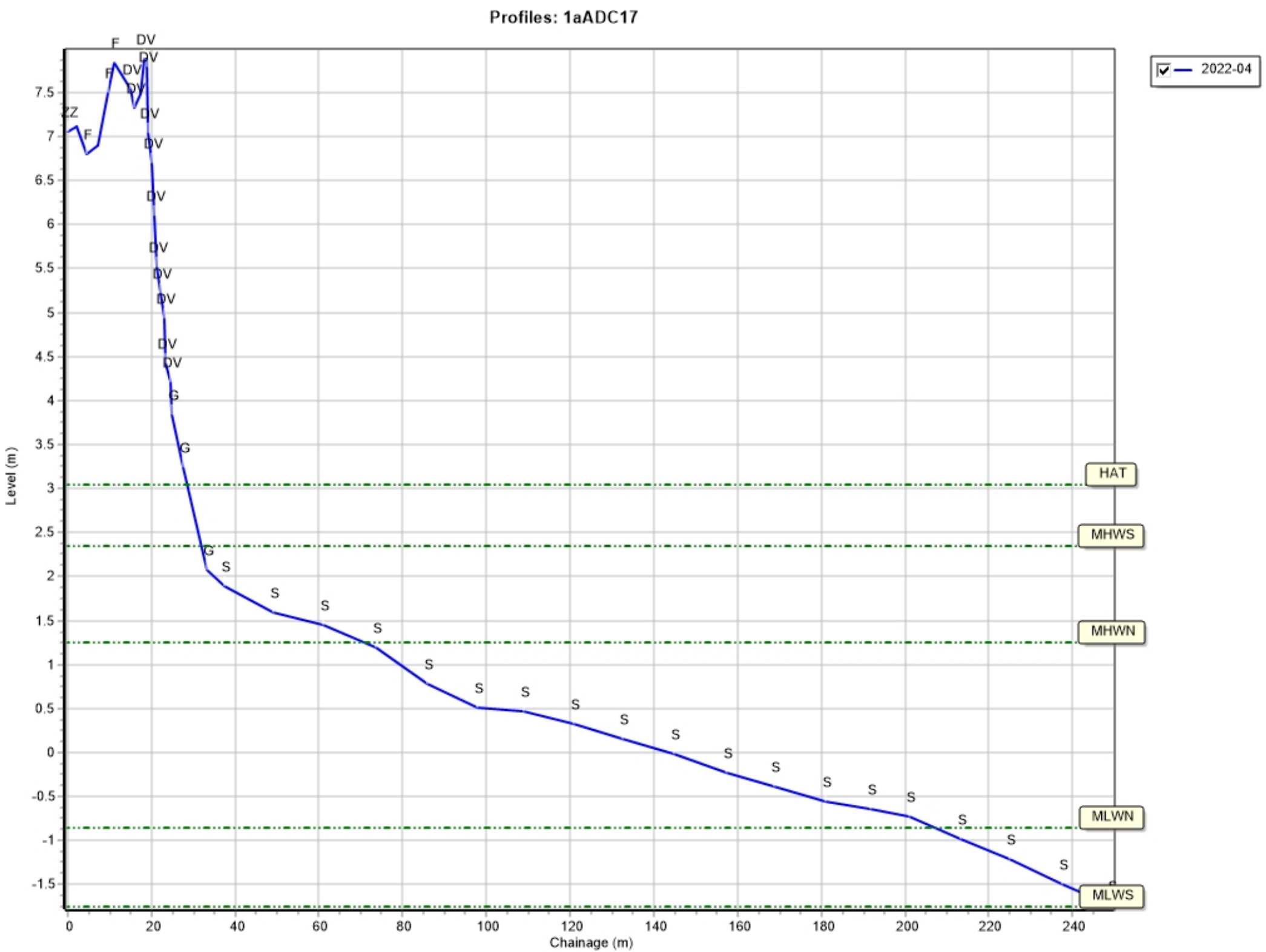
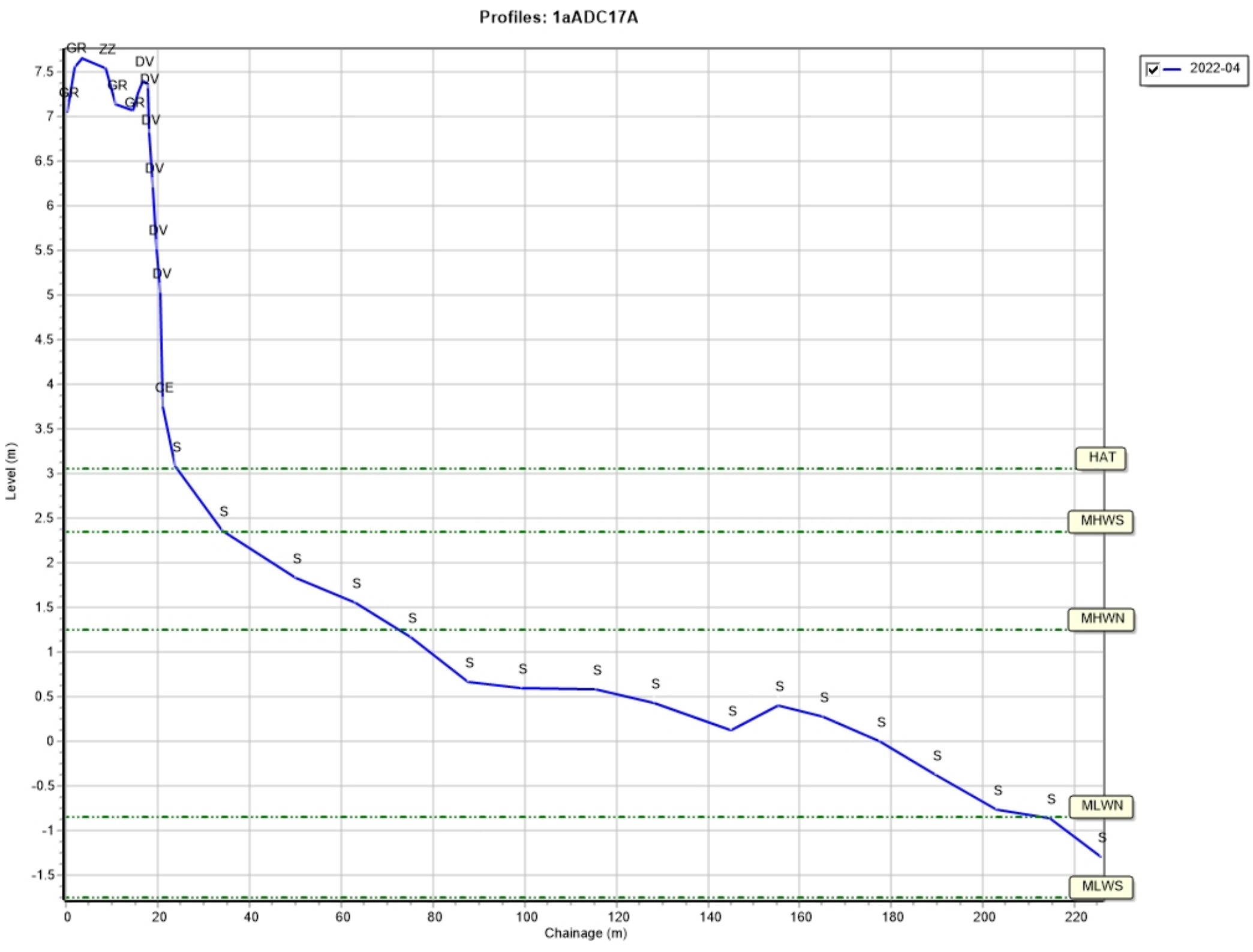
60
80
100
120
140
160
180
200
220
240
260


Profiles: 1aADC17
2022-04
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
0
20
40
60
80
100
120
140
160
180
200
220
240


Profiles: 1aADC17A
2022-04
GR
ZZ
DV
CE
S
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
0
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40
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80
100
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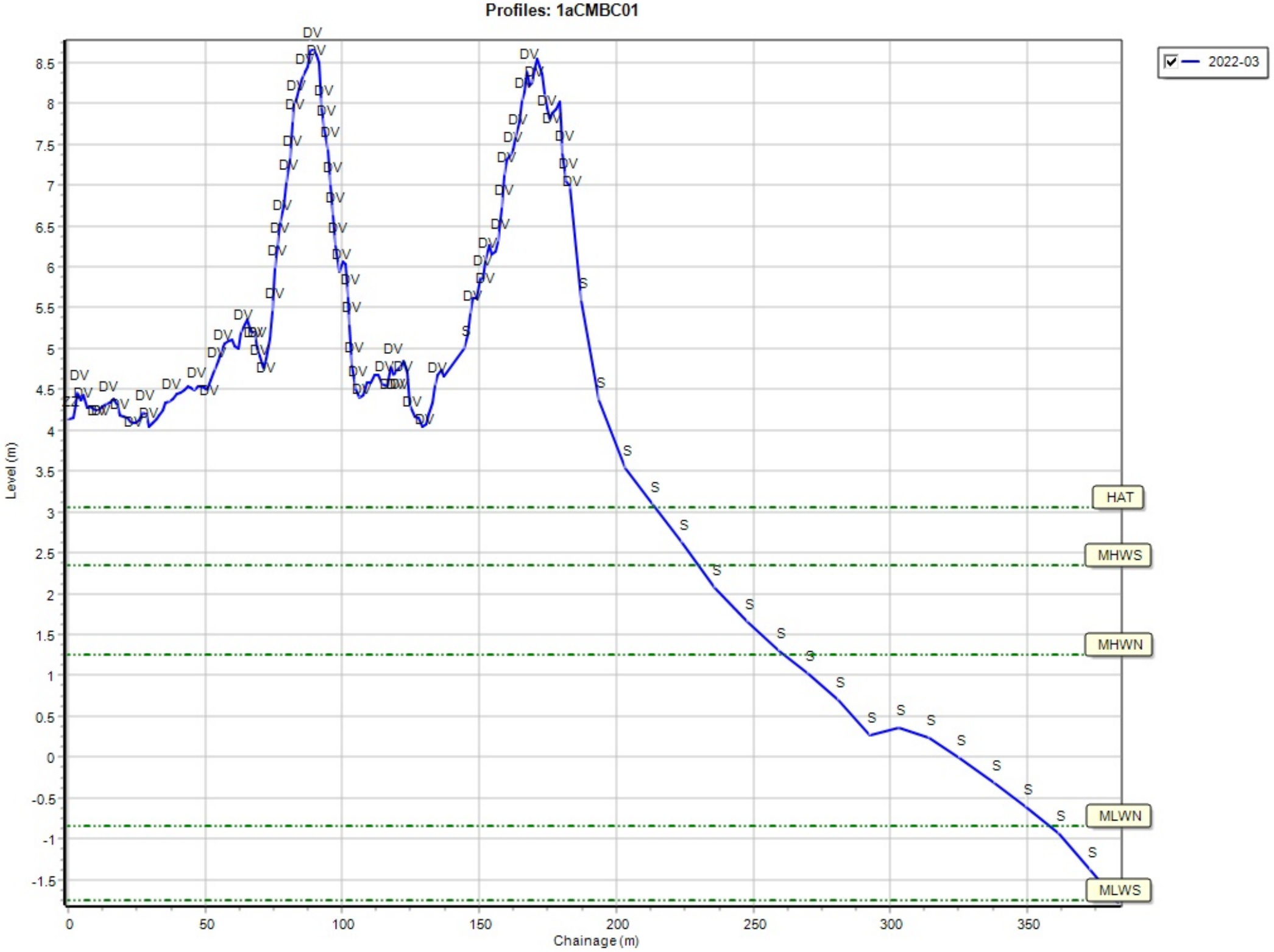
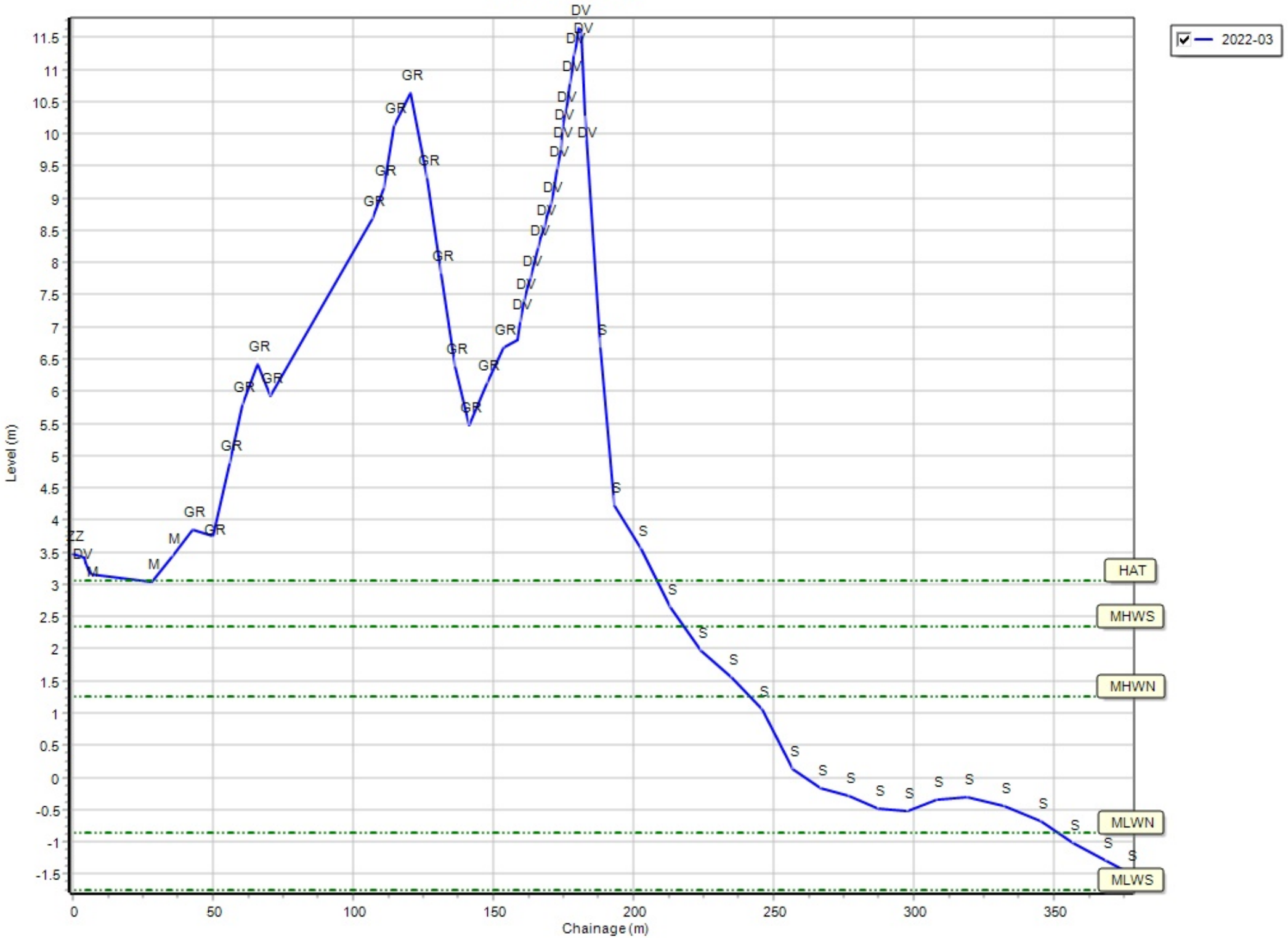
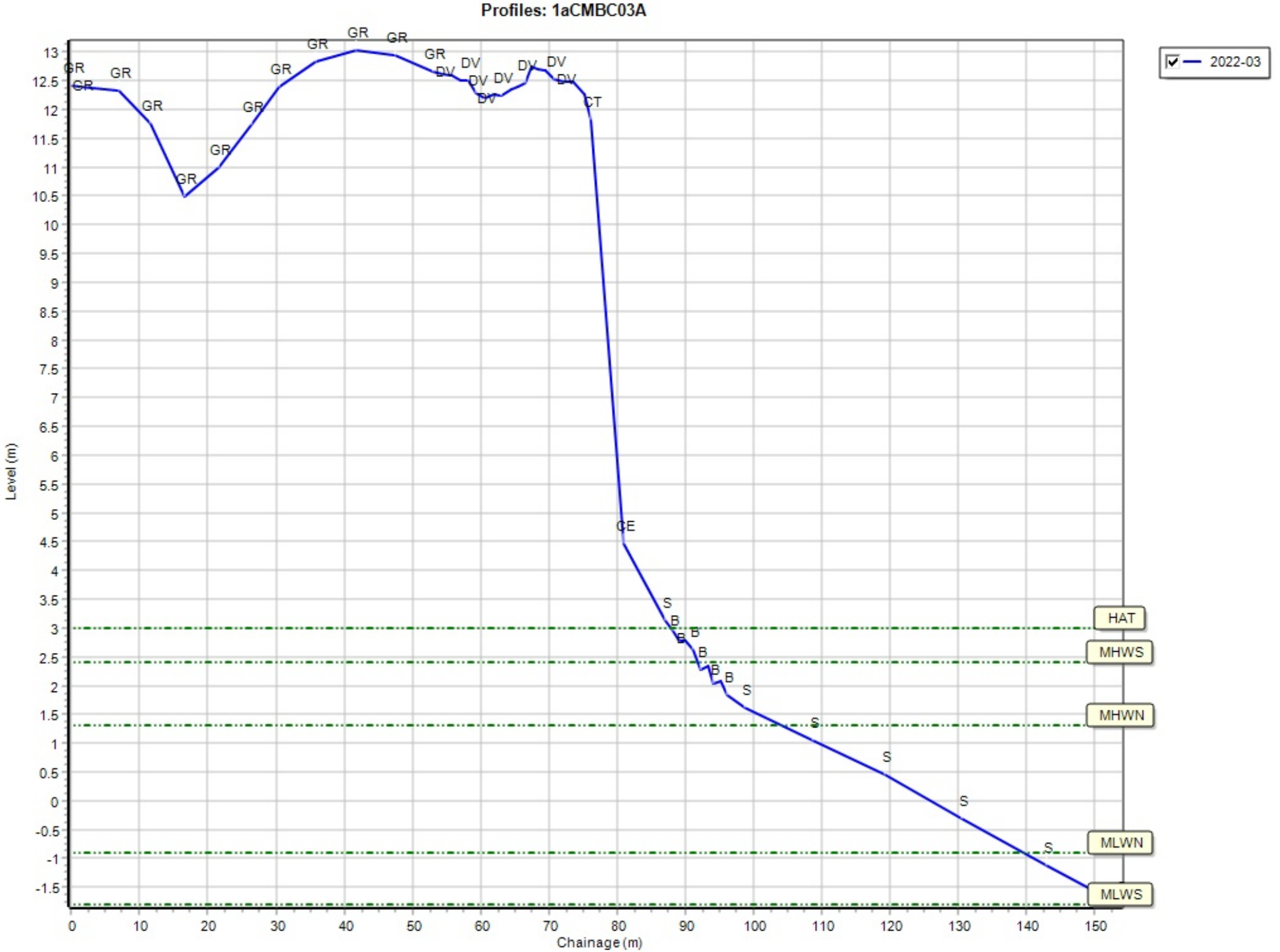
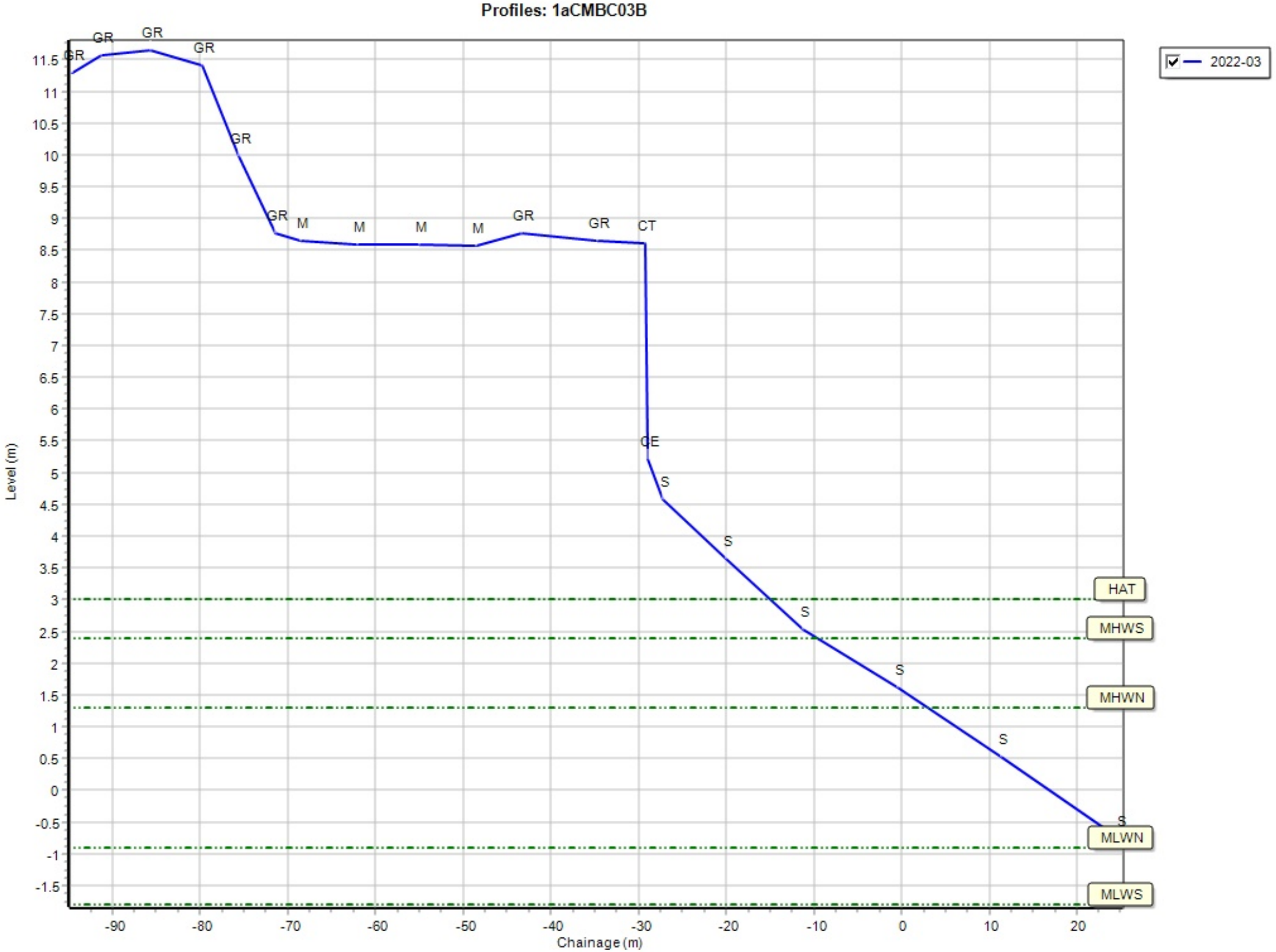
200
220


Profiles: 1aCMBC01
2022-03
Level (m)
Chainage (m)
HAT
MHWS
MHWN
MLWN
MLWS
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
0
50
100
150
200
250
300
350
DV
S


Profiles: 1aCMBC02
2022-03
Level (m)
Chainage (m)
HAT
MHWS
MHWN
MLWN
MLWS


Profiles: 1aCMBC03A
2022-03
Level (m)
Chainage (m)
HAT
MHWS
MHWN
MLWN
MLWS
GR
DV
CT
CE
B
S


Profiles: 1aCMBC03B
2022-03
GR
M
CT
CE
S
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
11.5
11
10.5
10
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
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-60
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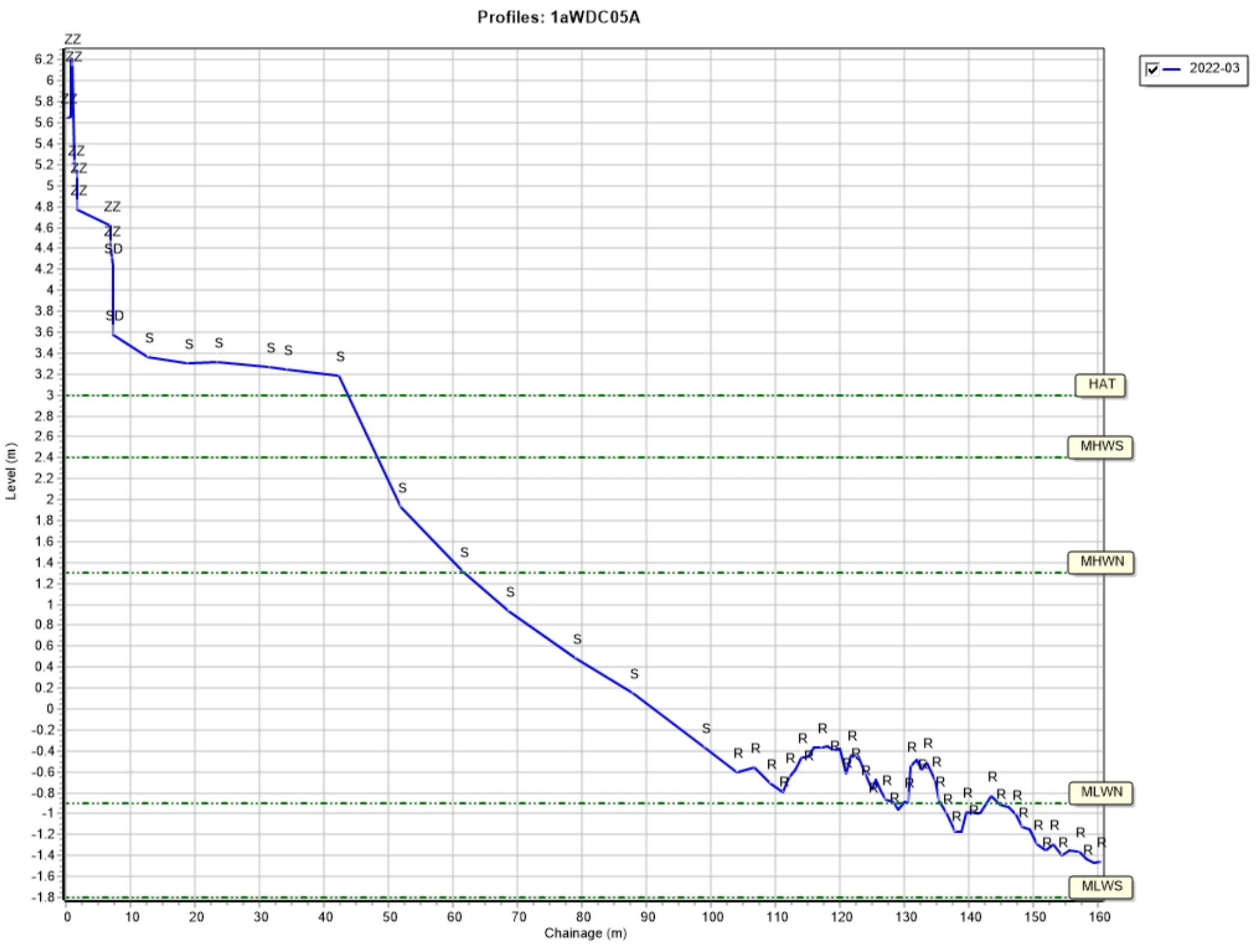
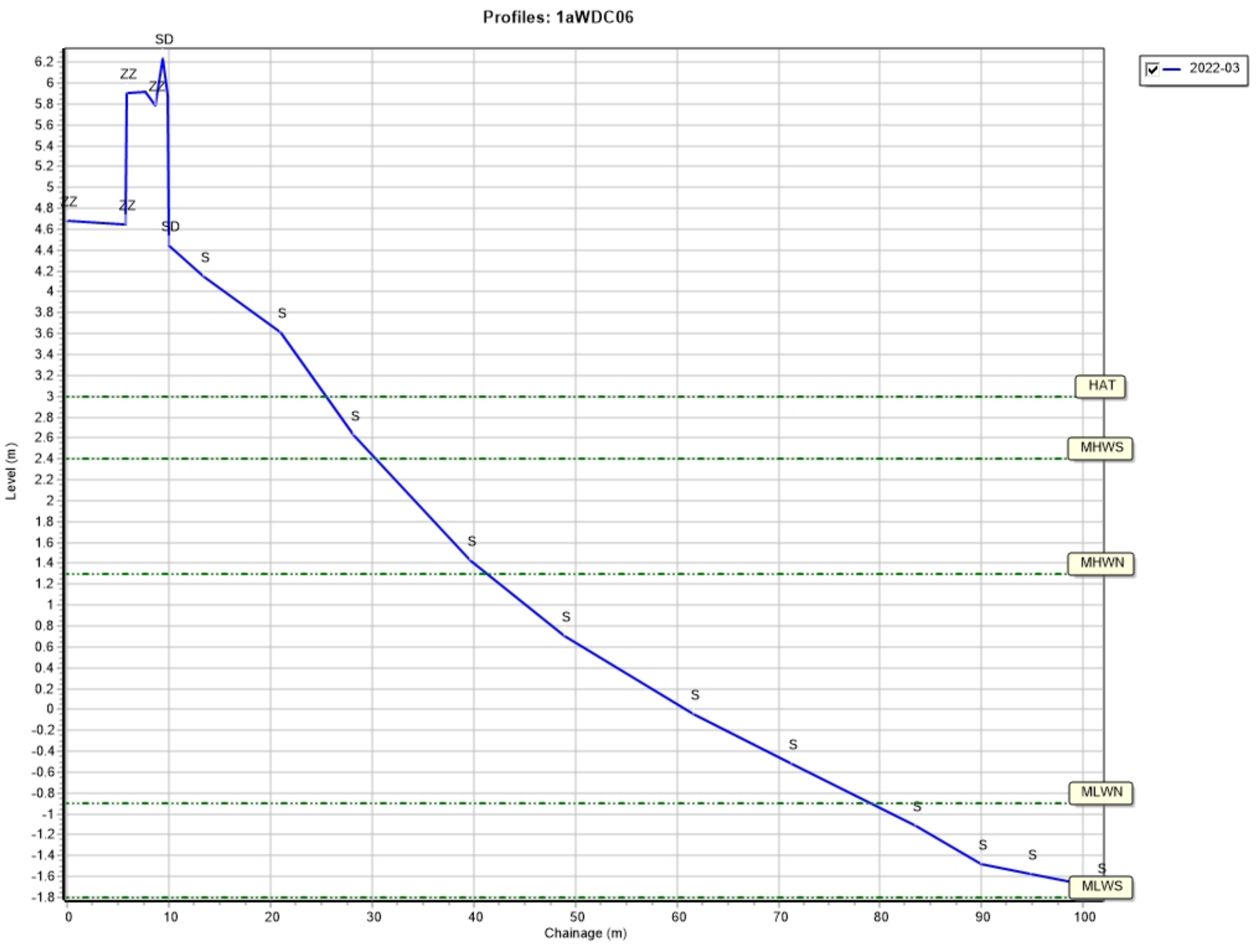
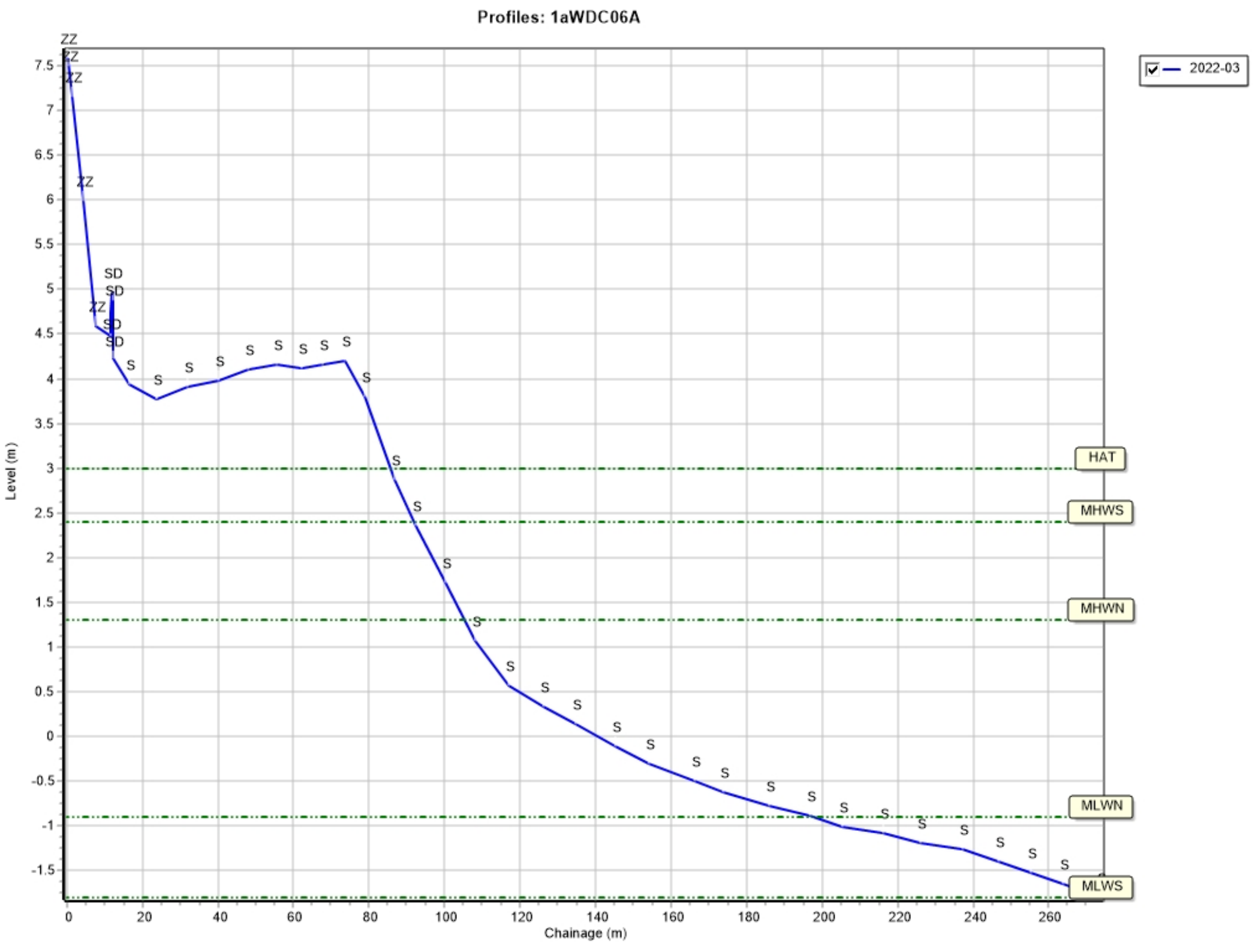
-40
-30
-20
-10
0
10
20


Profiles: 1aWDC05A
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)


Profiles: 1aWDC06
2022-03
Level (m)
Chainage (m)
HAT
MHWS
MHWN
MLWN
MLWS
SD
ZZ
S


Profiles: 1aWDC06A
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
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-1.5
0
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60
80
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120
140
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200
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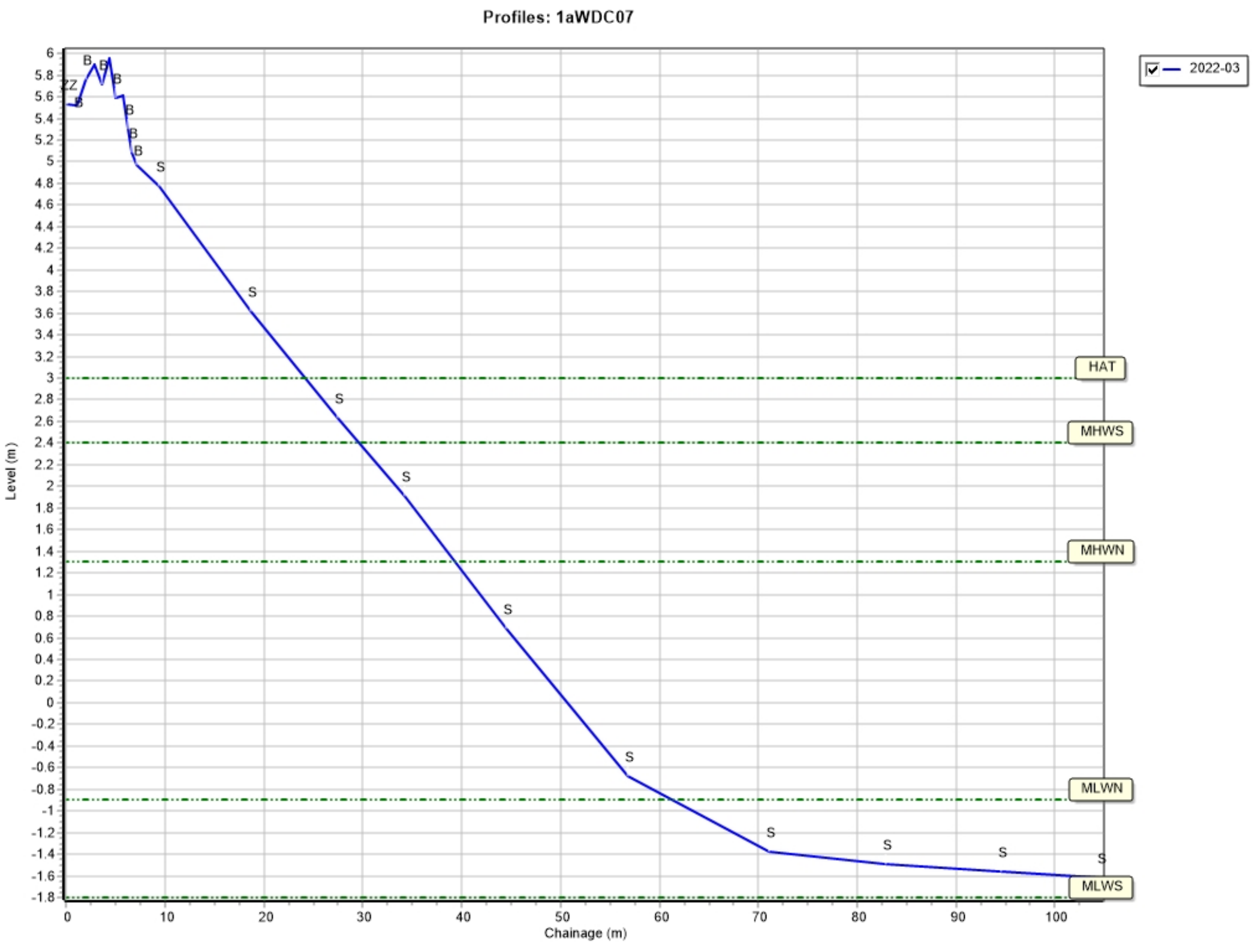
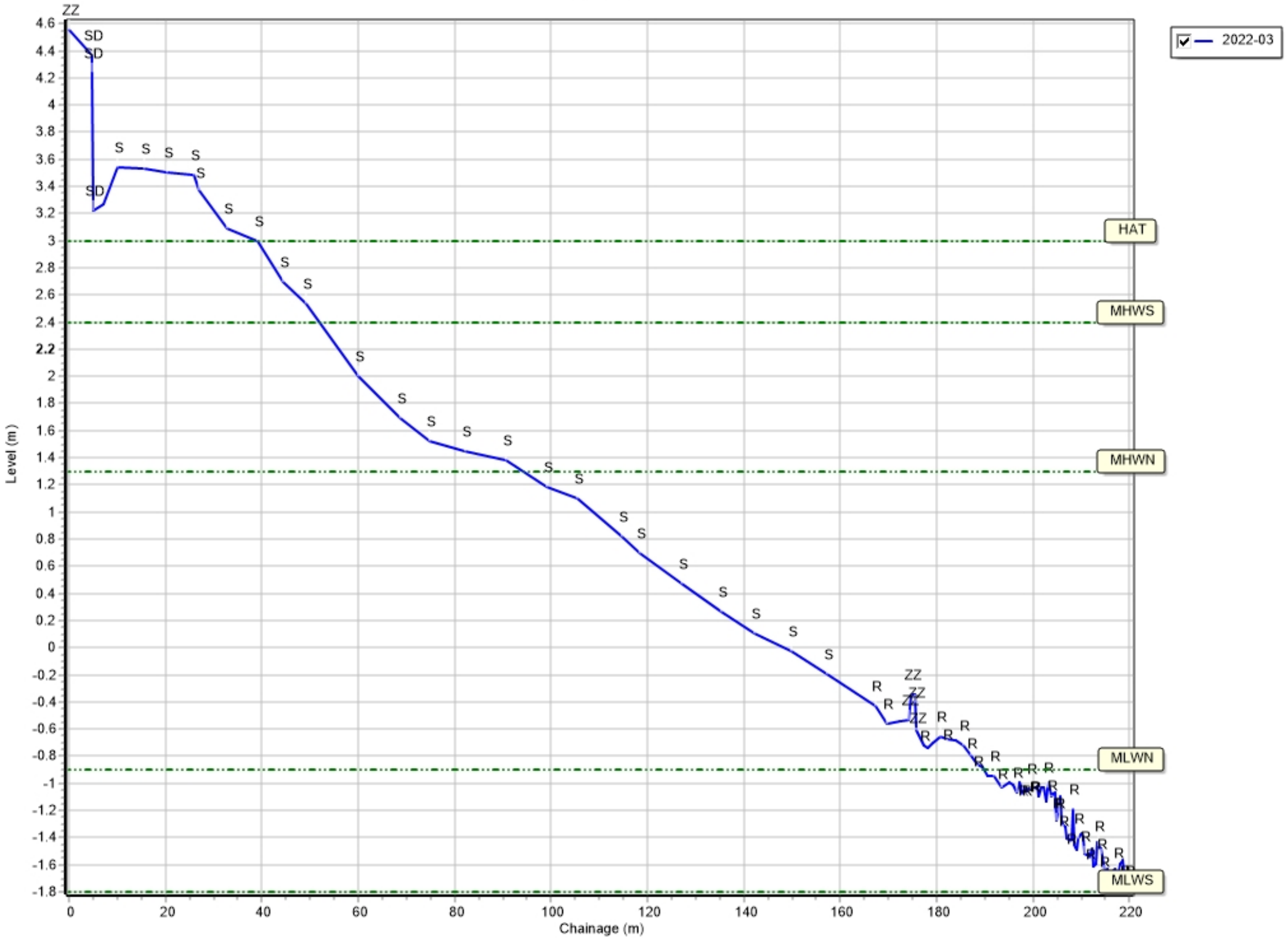
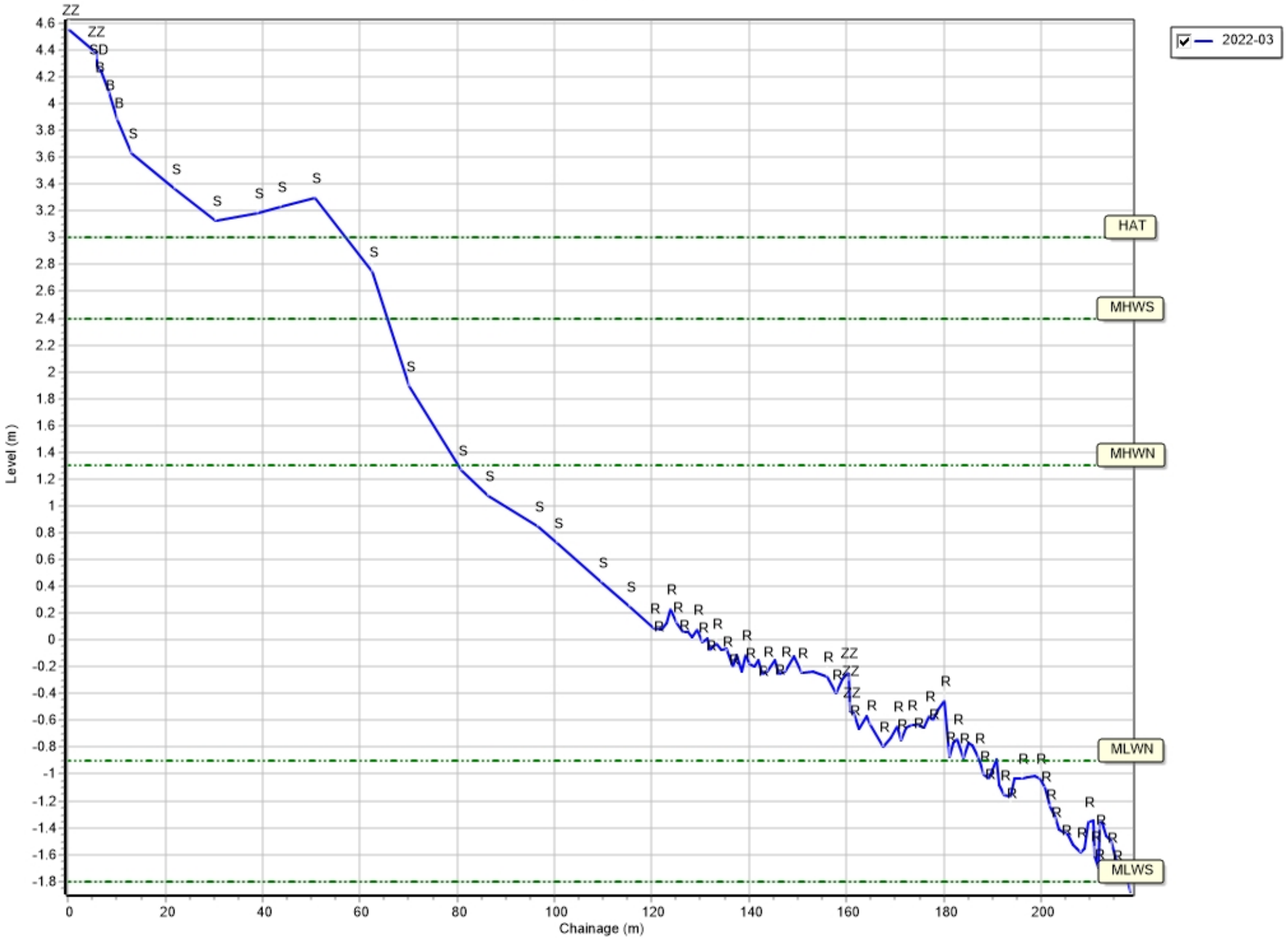
240
260


Profiles: 1aWDC07
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
ZZ
B
S


Profiles: 1aNWB1
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
ZZ
SD
S
R


Profiles: 1aNWB2
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
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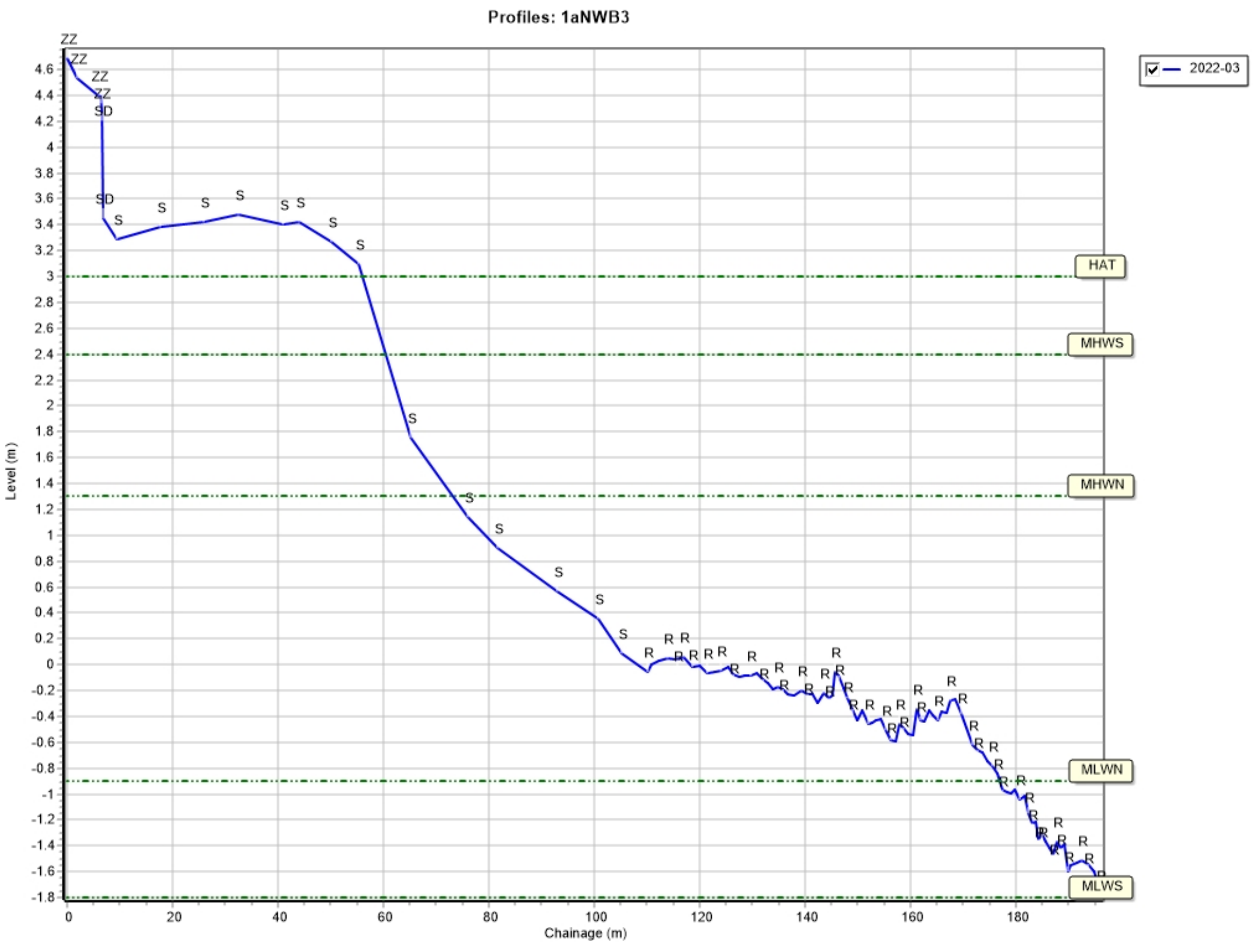
60
80
100
120
140
160
180
200


Profiles: 1aNWB3
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
0
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40
60
80
100
120
140
160
180
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
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1.2
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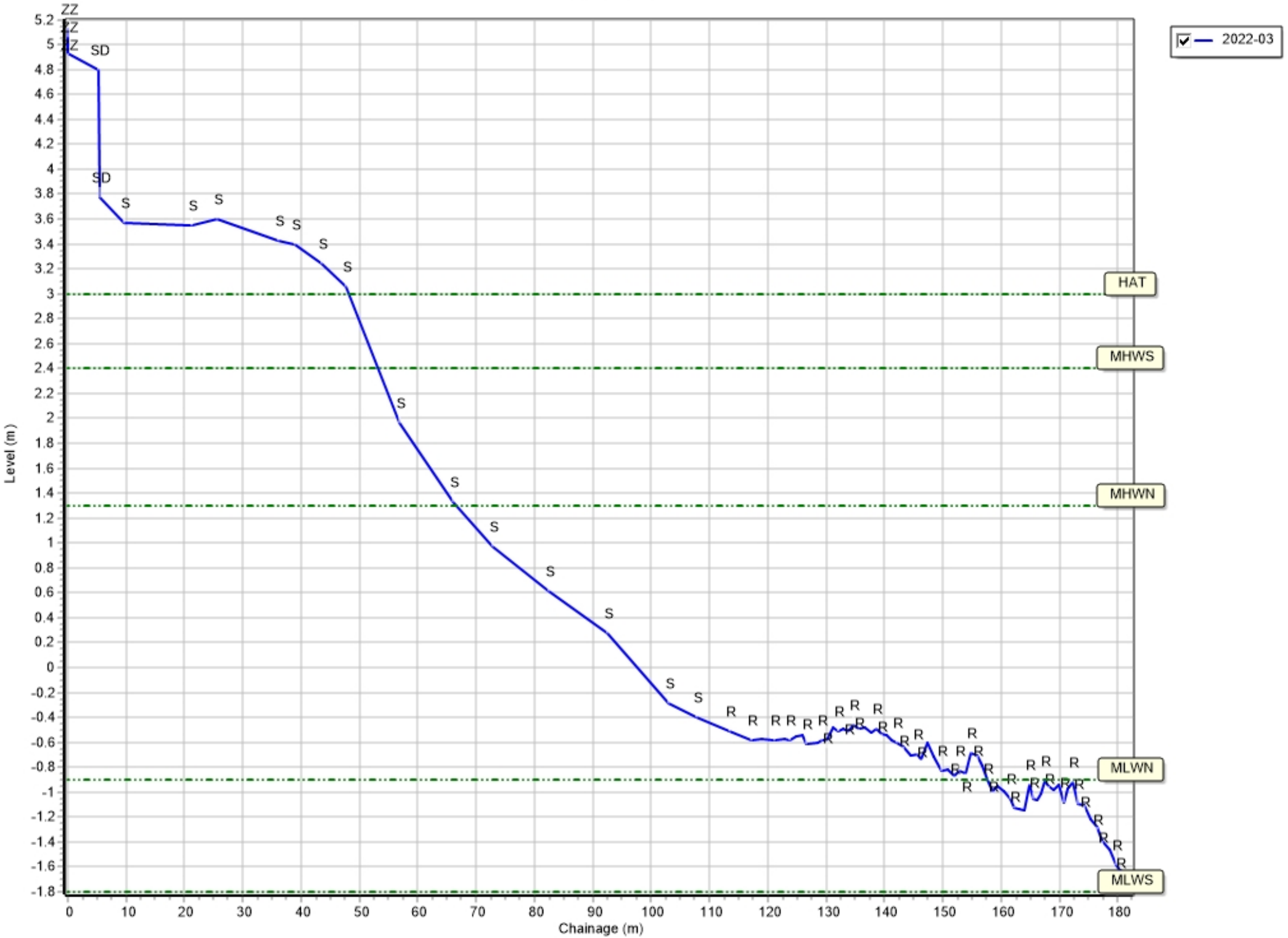
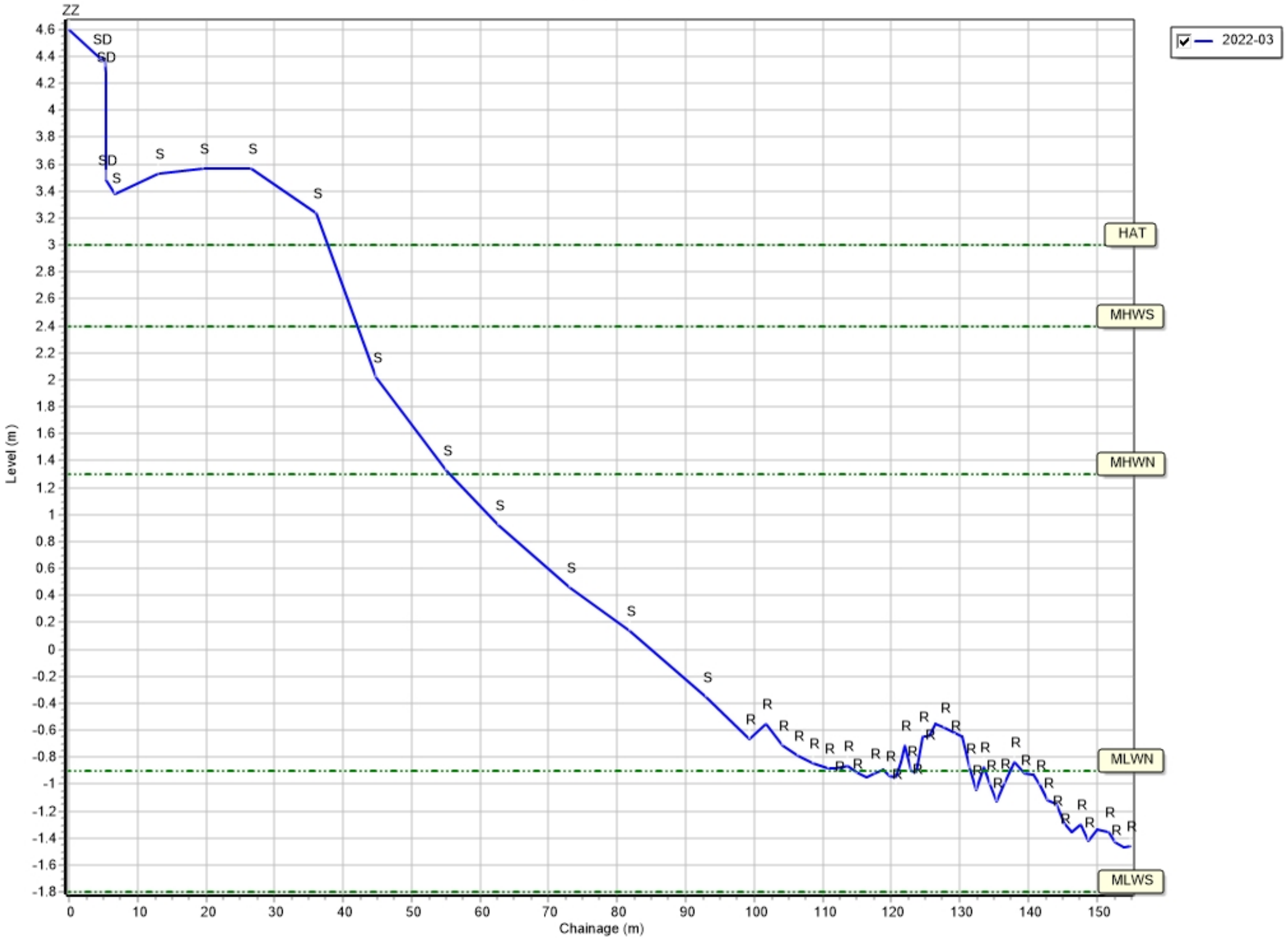
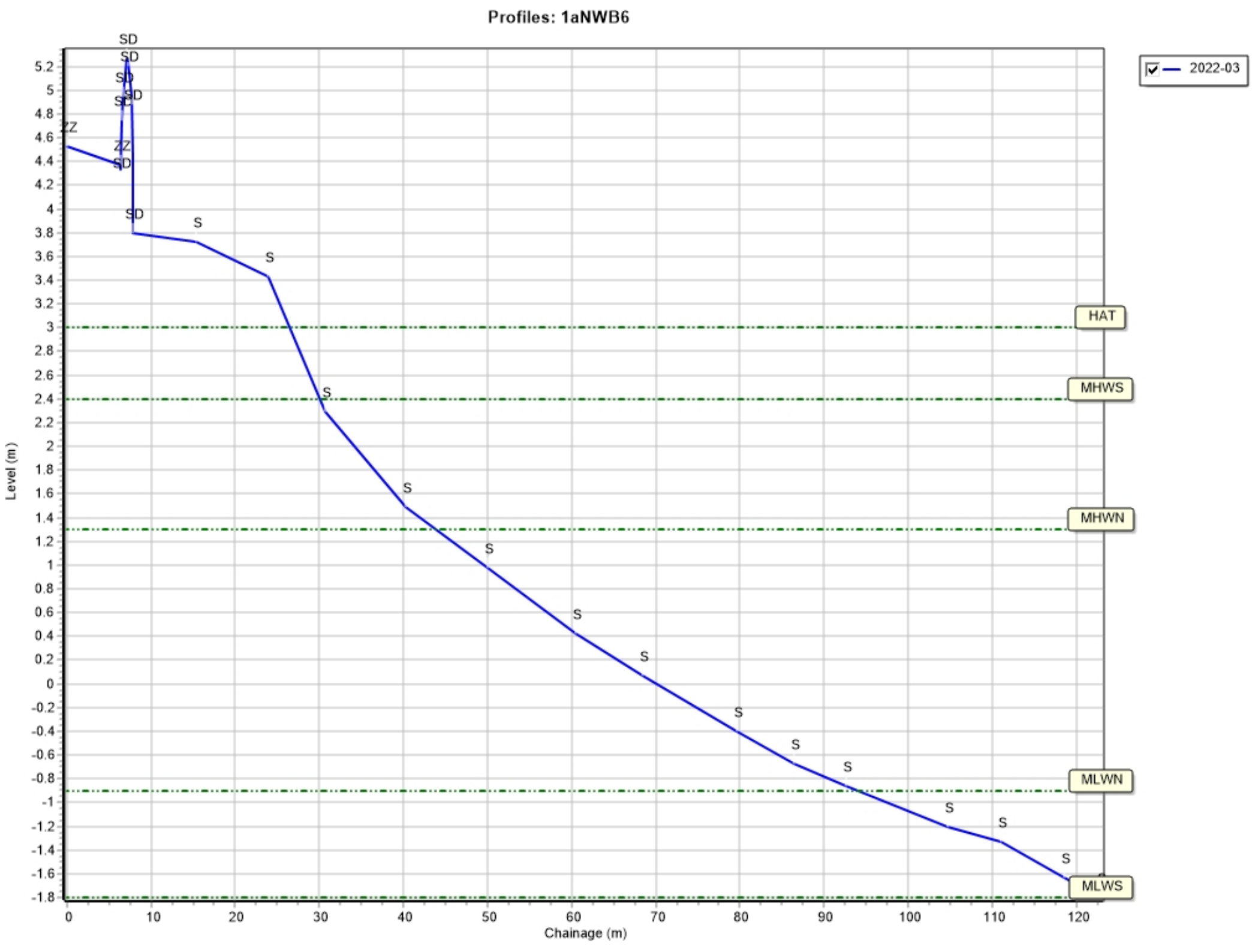
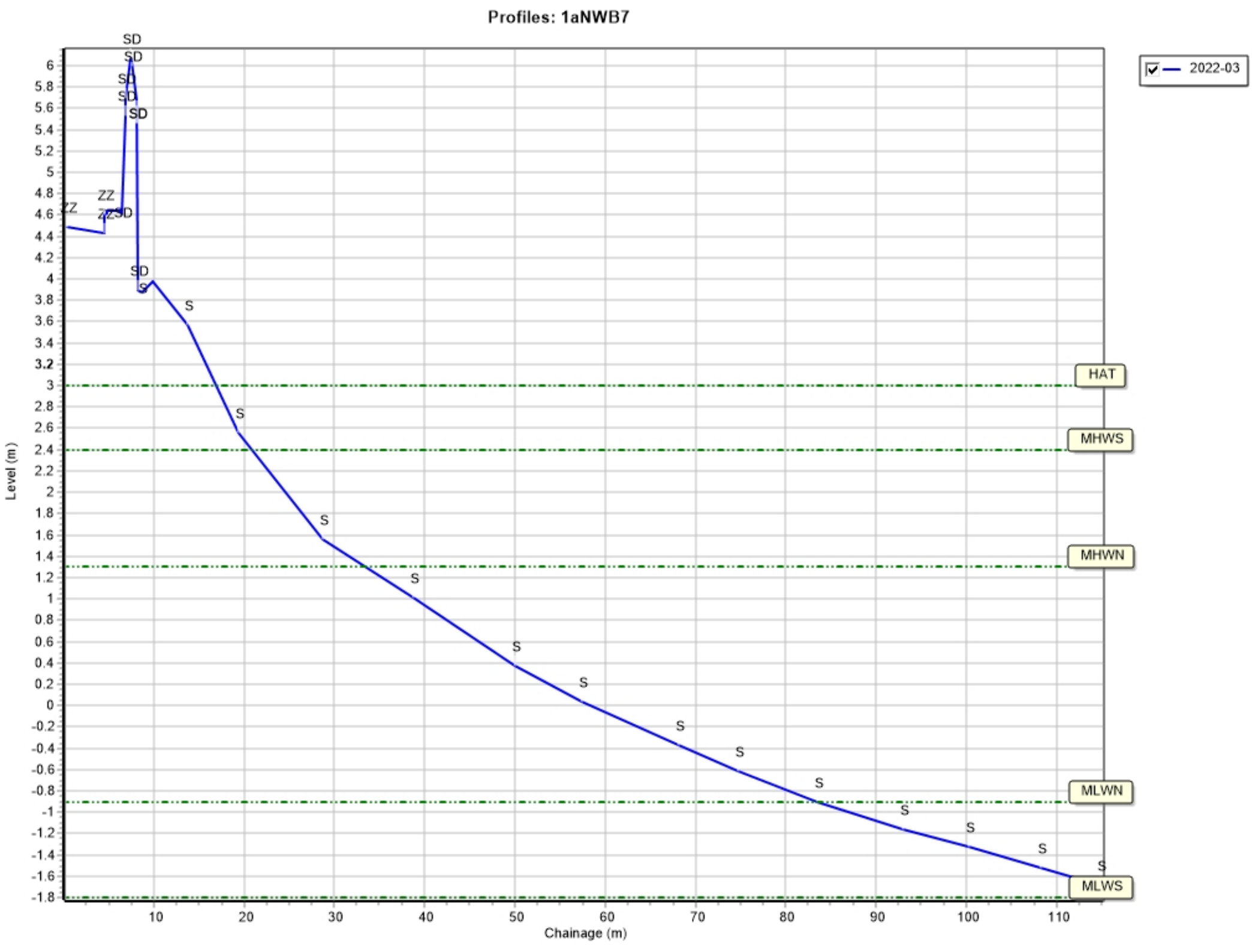
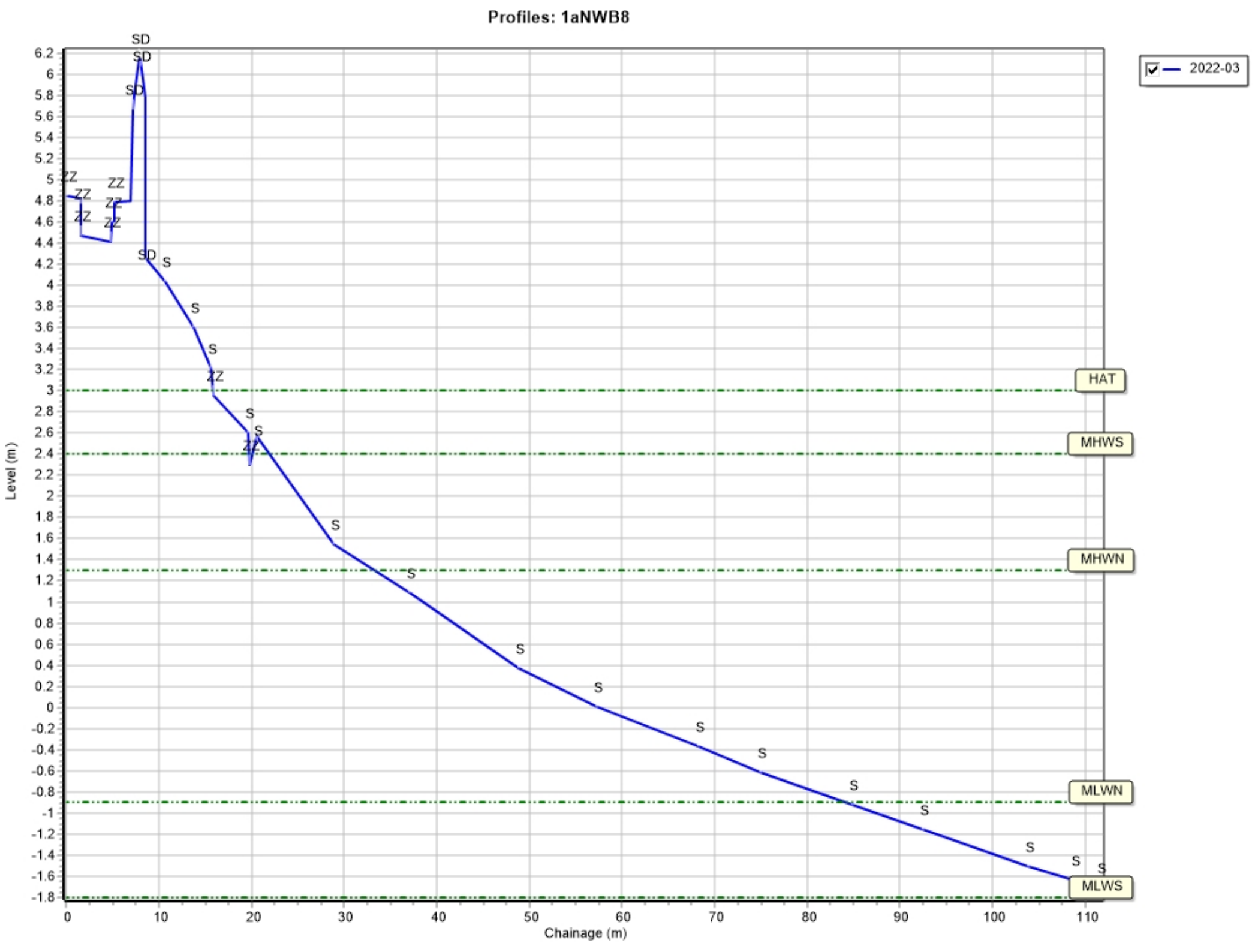

Profiles: 1aNWB4
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)


Profiles: 1aNWB5
ZZ
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)


Profiles: 1aNWB6
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
SD
ZZ
S


Profiles: 1aNWB7
2022-03
HAT
MHWS
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
SD
ZZ
S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Level (m)
Chainage (m)
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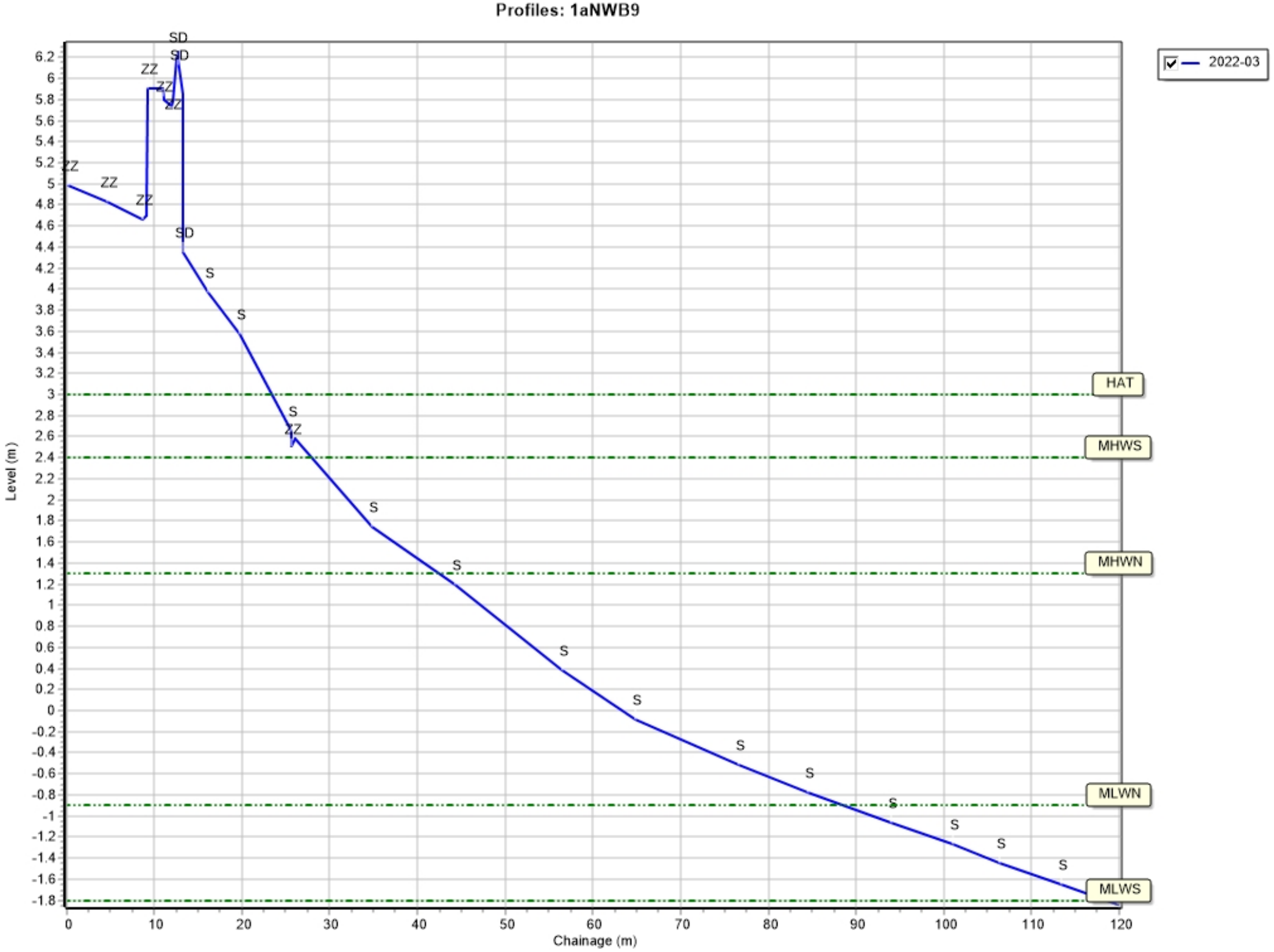
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Level (m)
Chainage (m)
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ZZ
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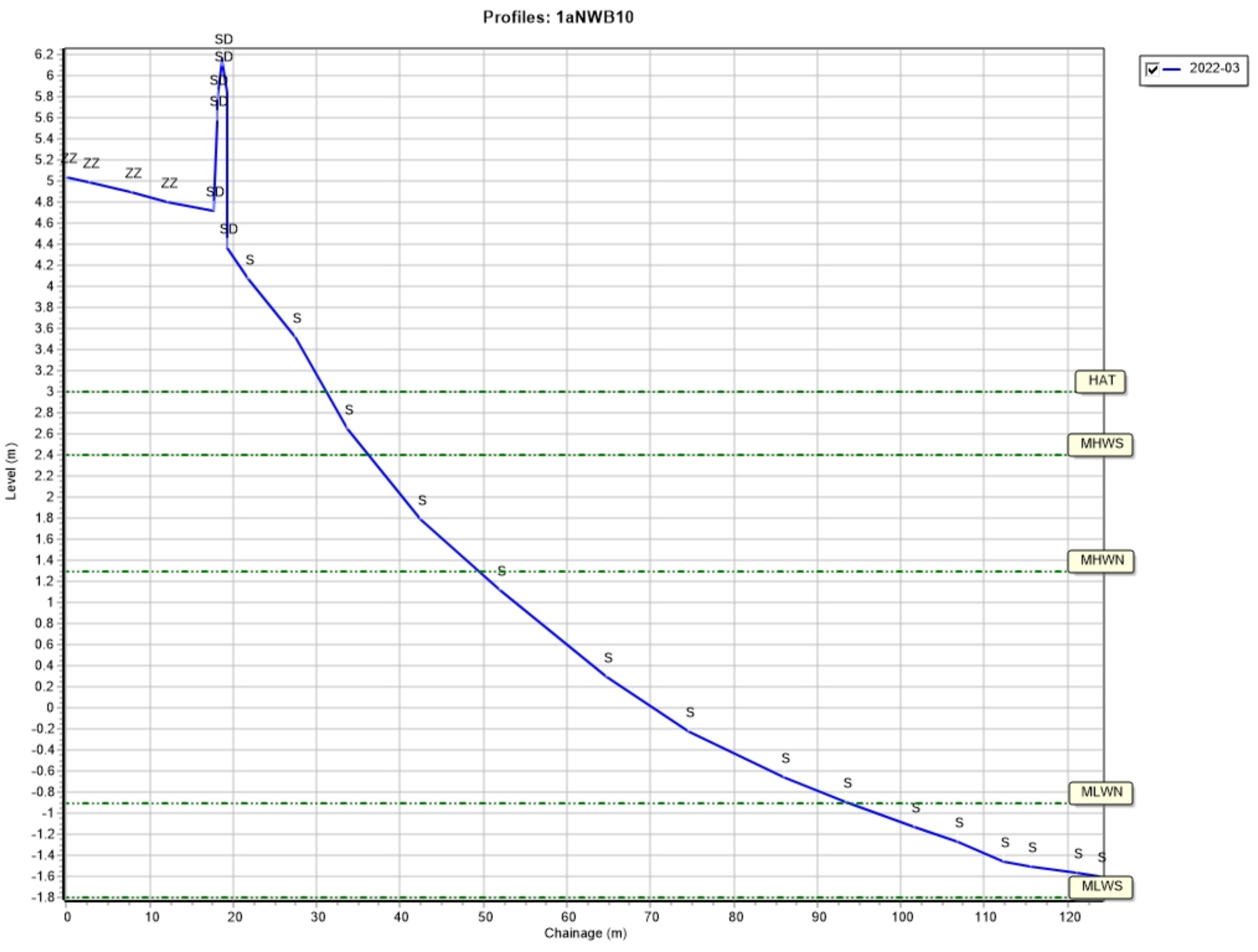
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Level (m)
Chainage (m)
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SD
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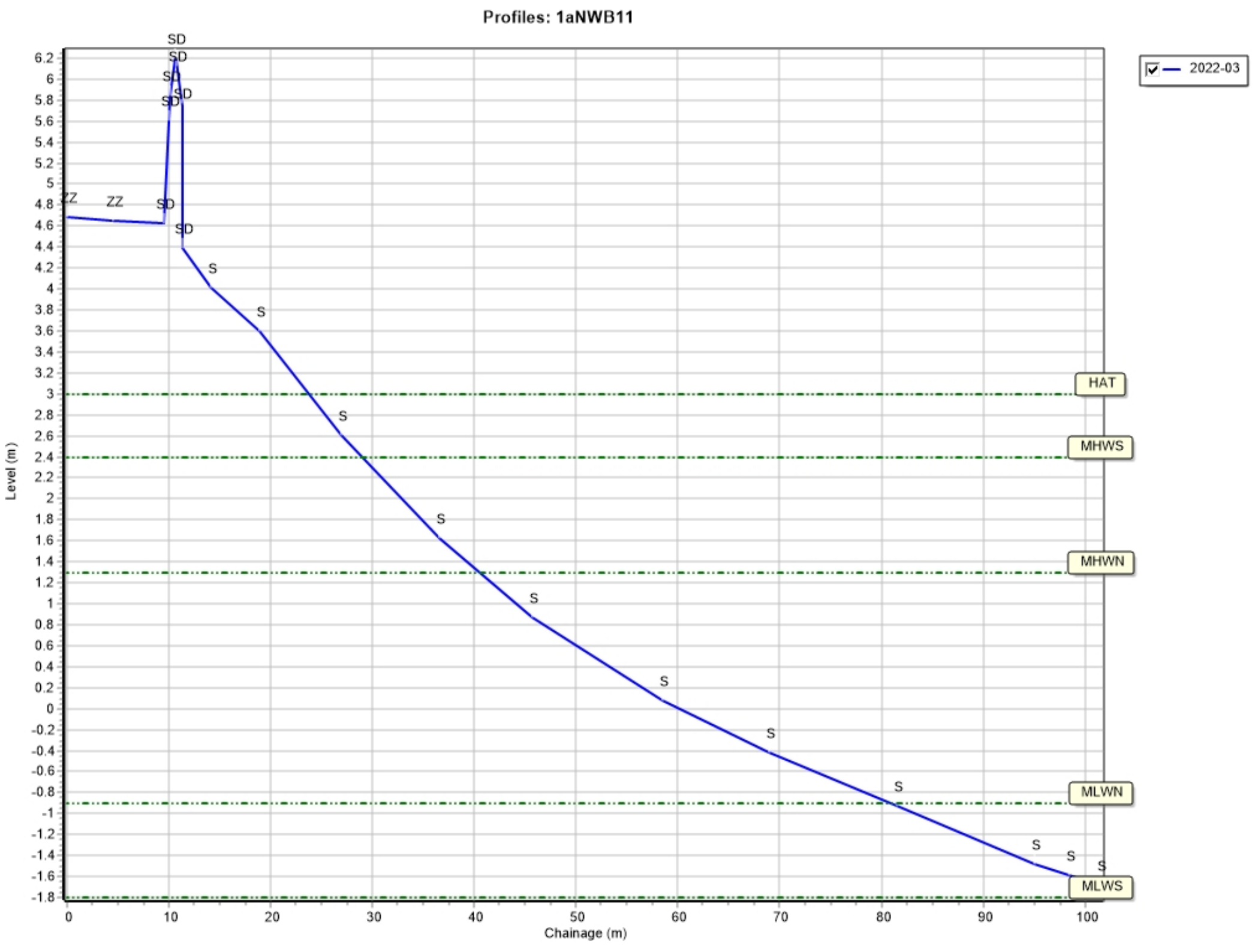
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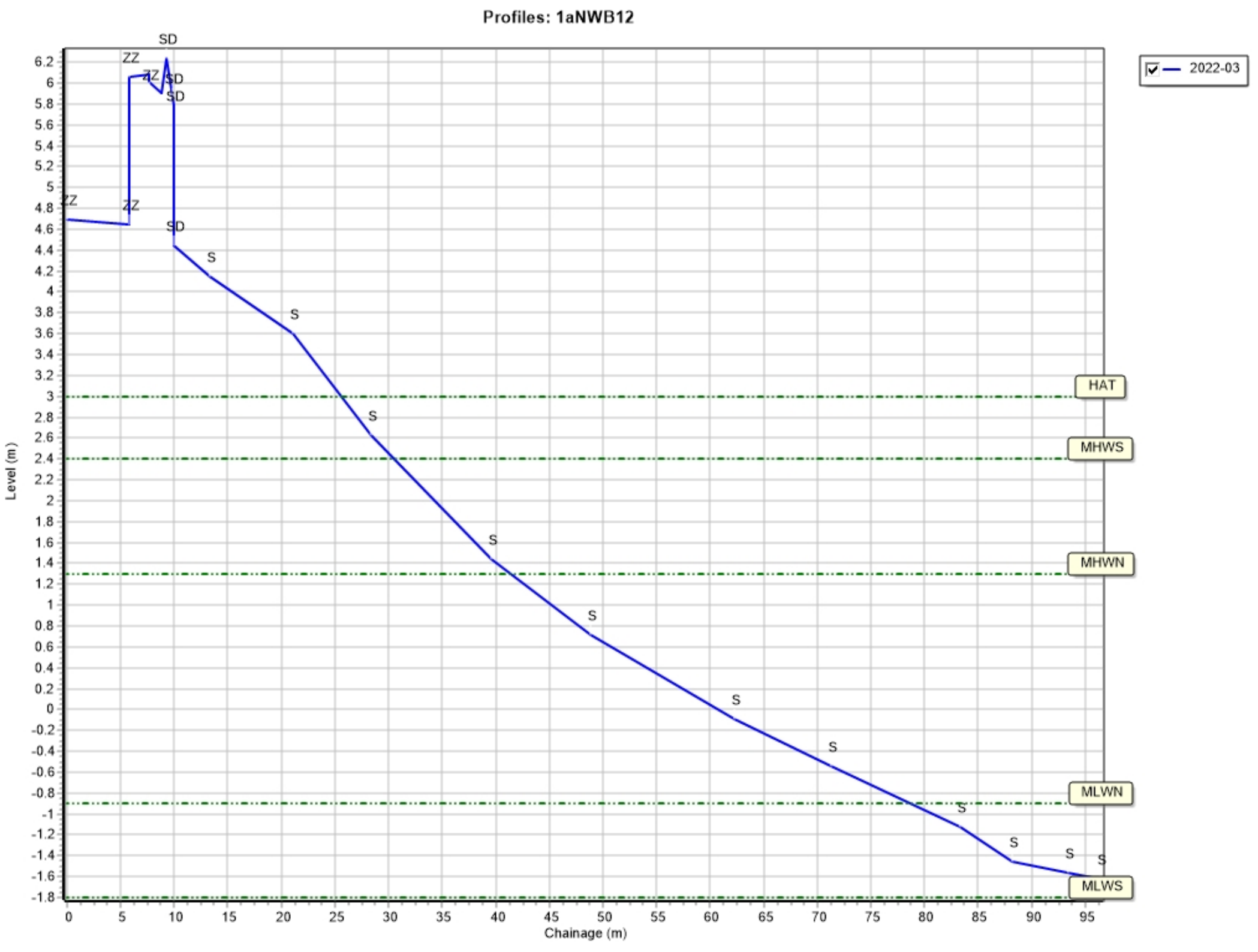
Level (m)
Chainage (m)
ZZ
SD
S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Chainage (m)
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SD
ZZ
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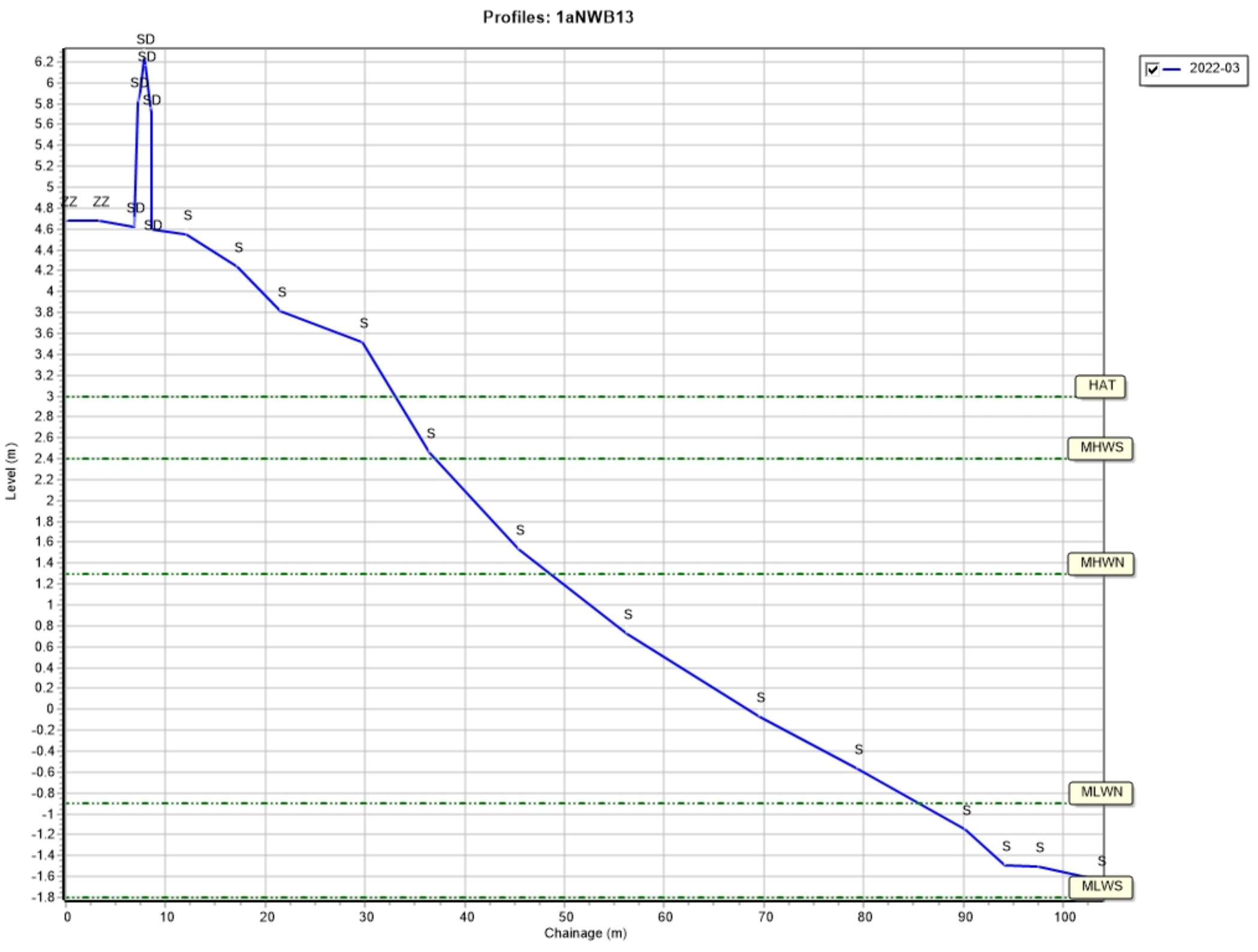
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MLWS
Level (m)
Chainage (m)
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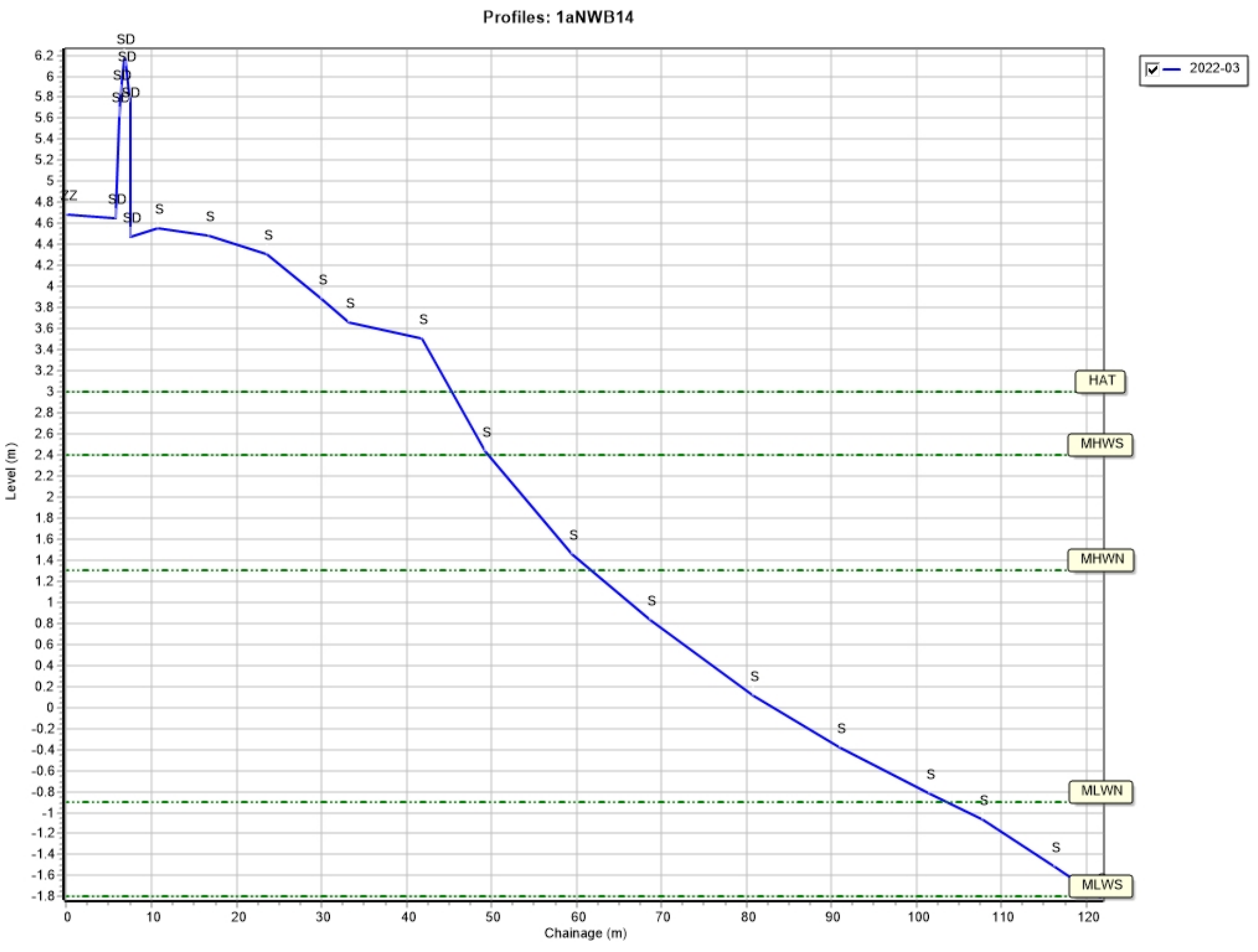
SD
S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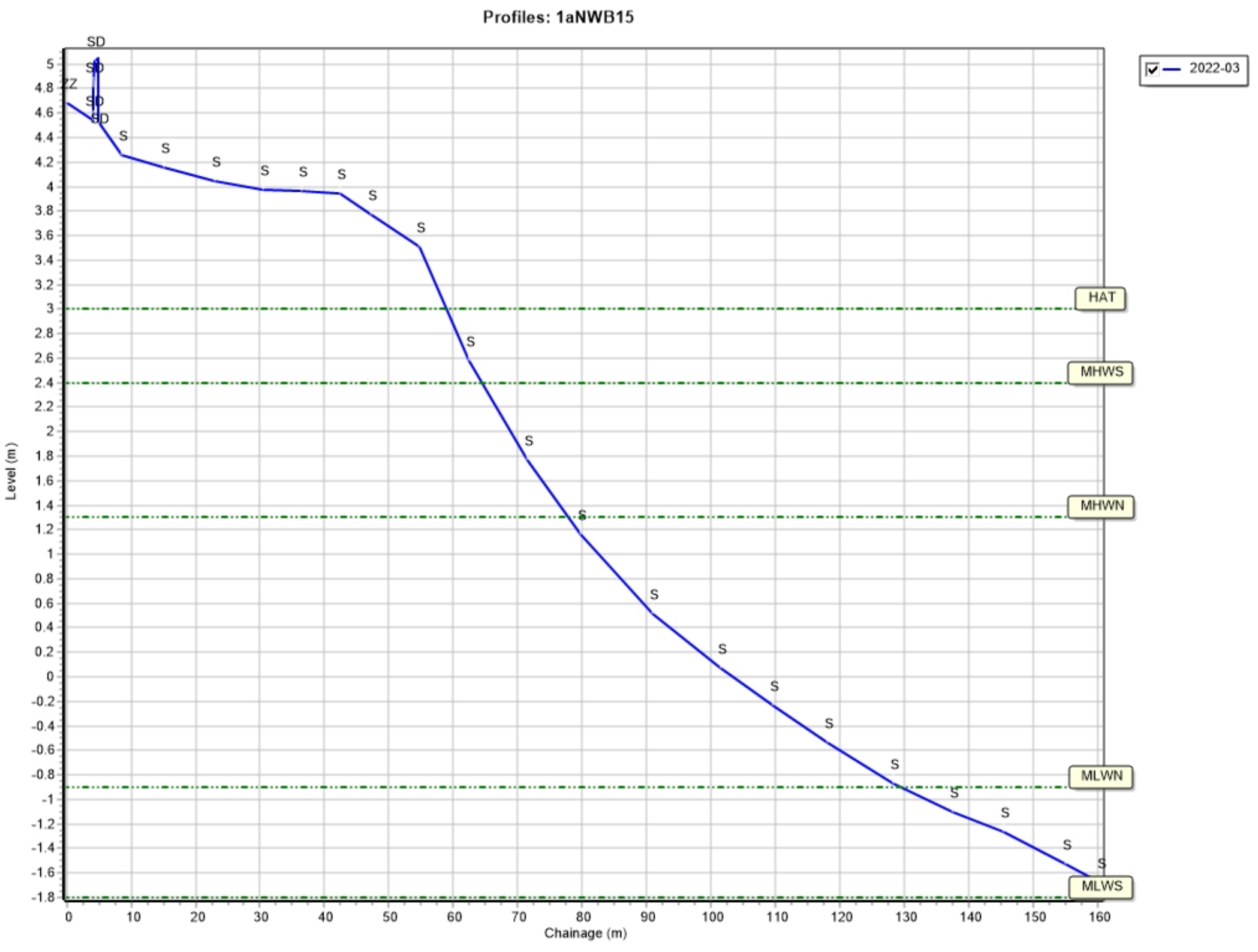
Level (m)
Chainage (m)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Level (m)
Chainage (m)
SD
ZZ
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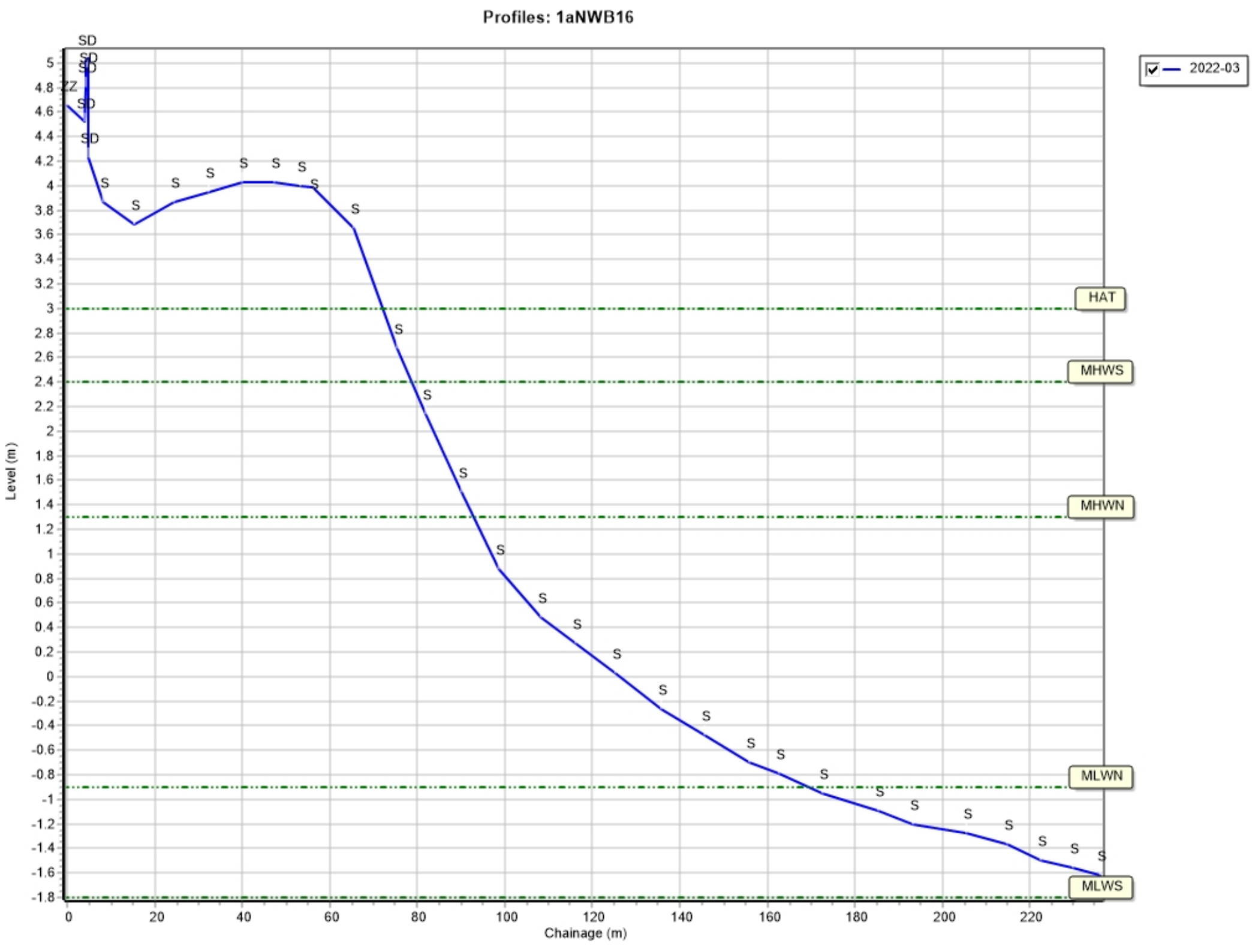
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Level (m)
Chainage (m)
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140
160
180
200
220
5
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4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
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0.6
0.4
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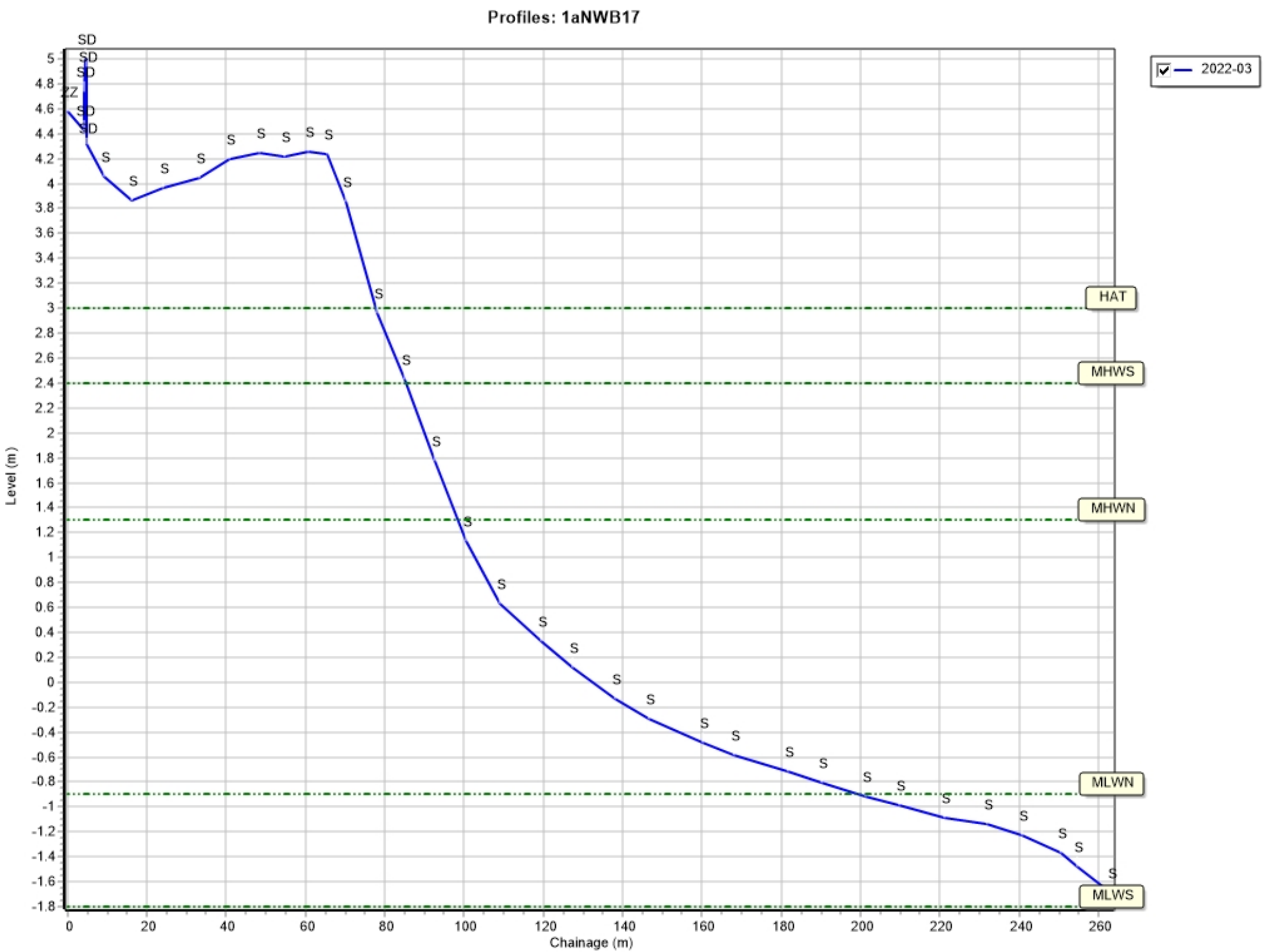
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MLWN
MLWS
Level (m)
Chainage (m)
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140
160
180
200
220
240
260
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
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2.8
2.6
2.4
2.2
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1.6
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0.4
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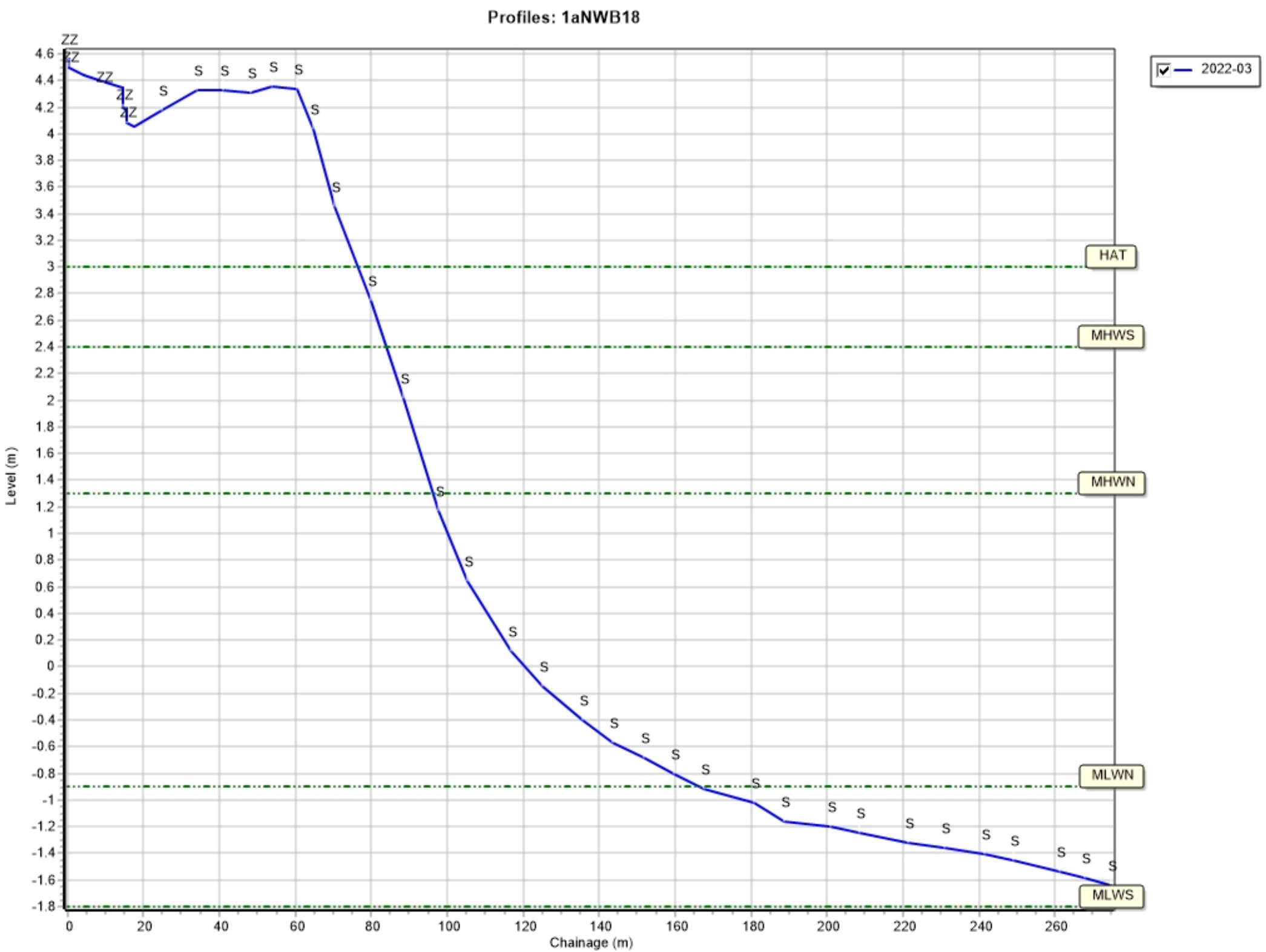
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MLWN
MLWS
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3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
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1.6
1.4
1.2
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0.4
0.2
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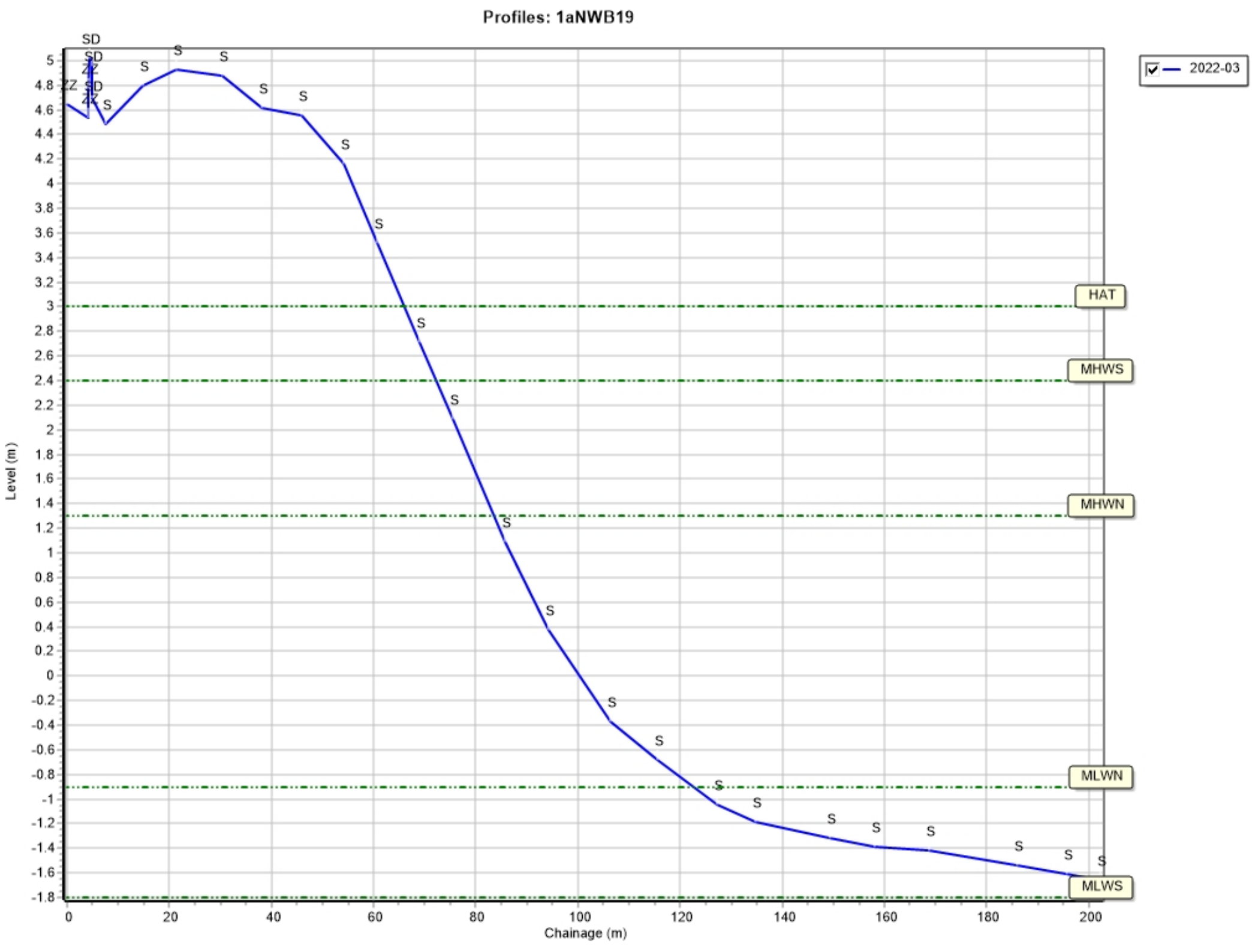
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MLWN
MLWS
Level (m)
Chainage (m)
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4.8
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4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
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0.8
0.6
0.4
0.2
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-0.8
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180
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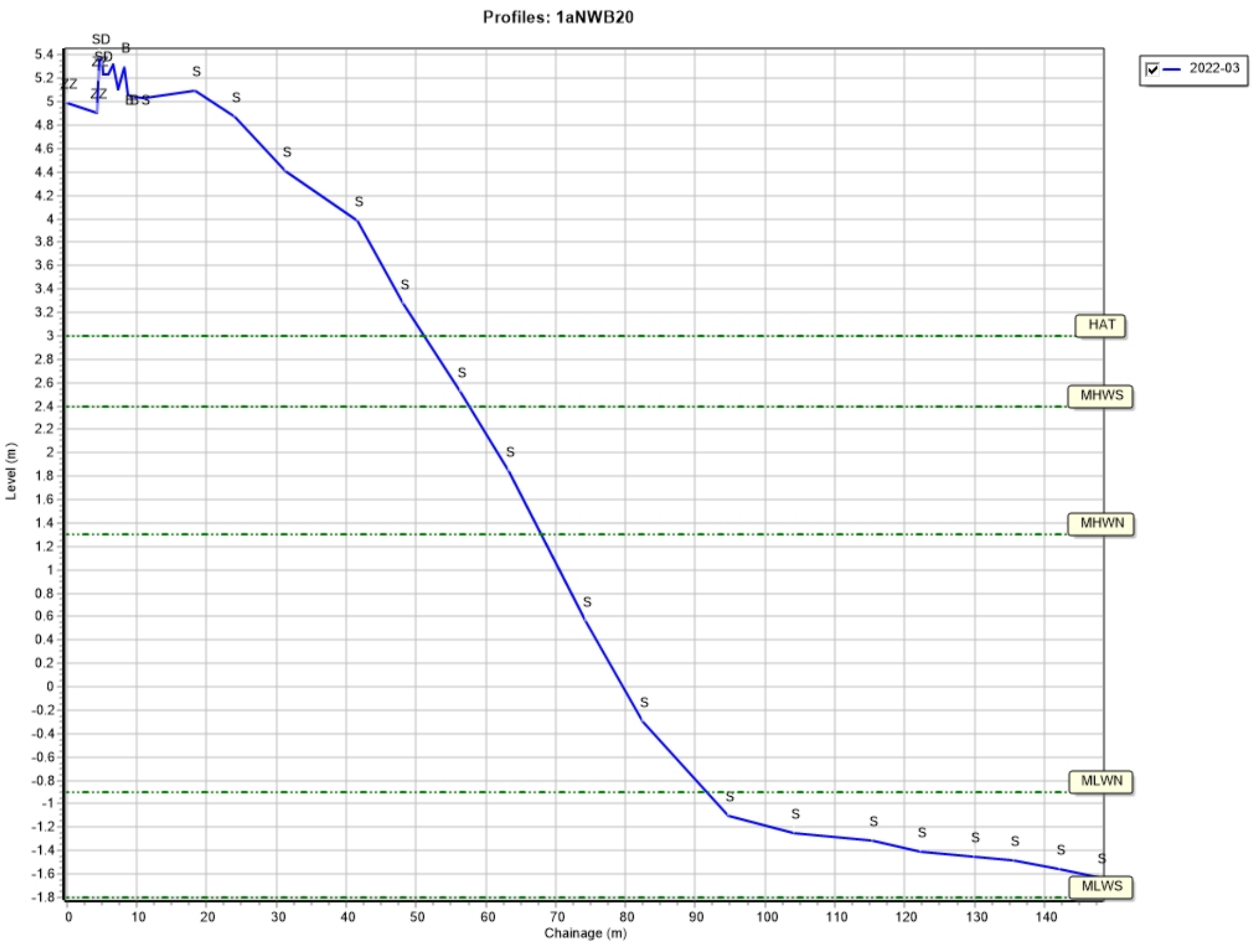
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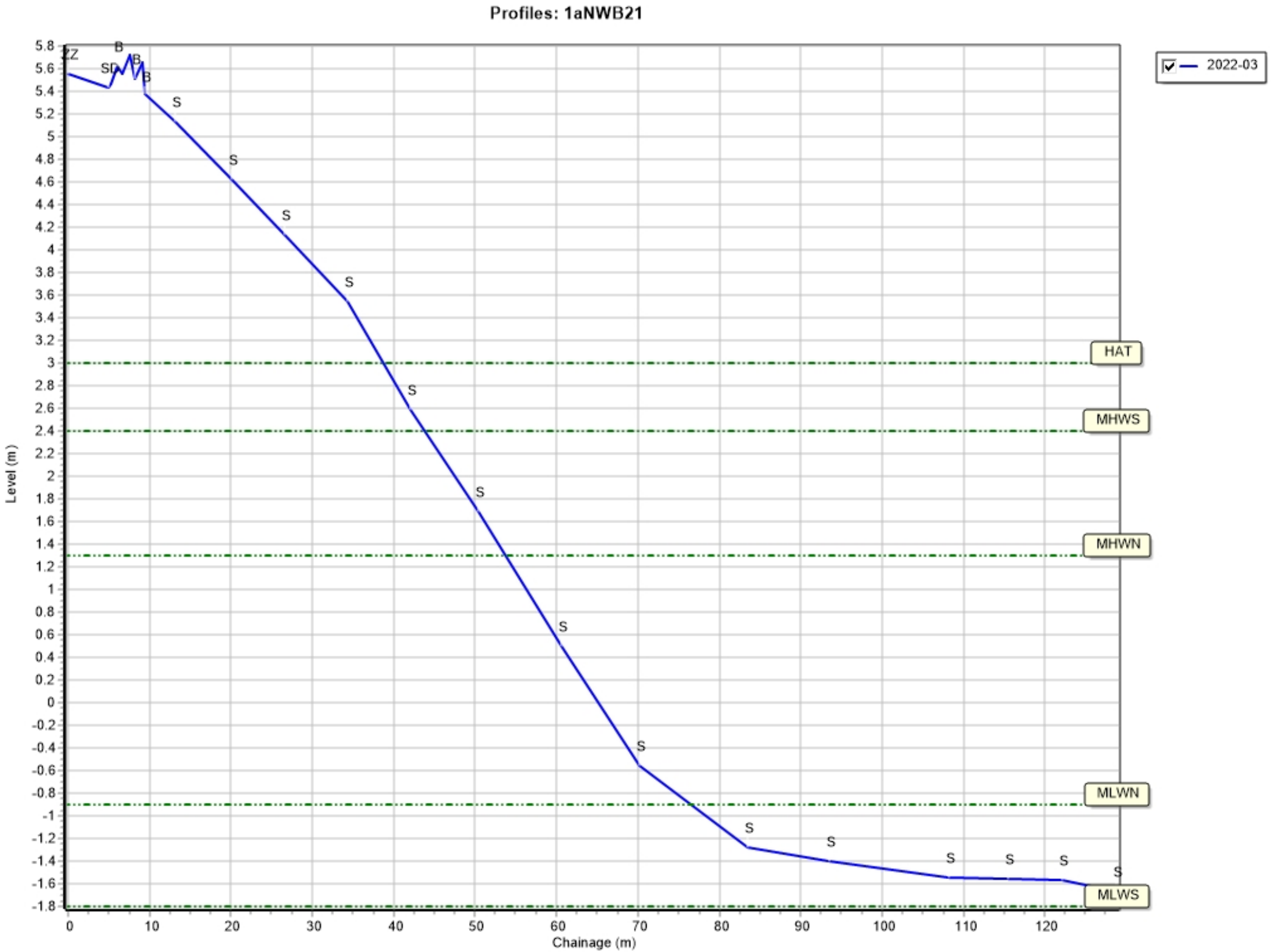
MHWN
MLWN
MLWS
Level (m)
Chainage (m)
SD
B
ZZ
S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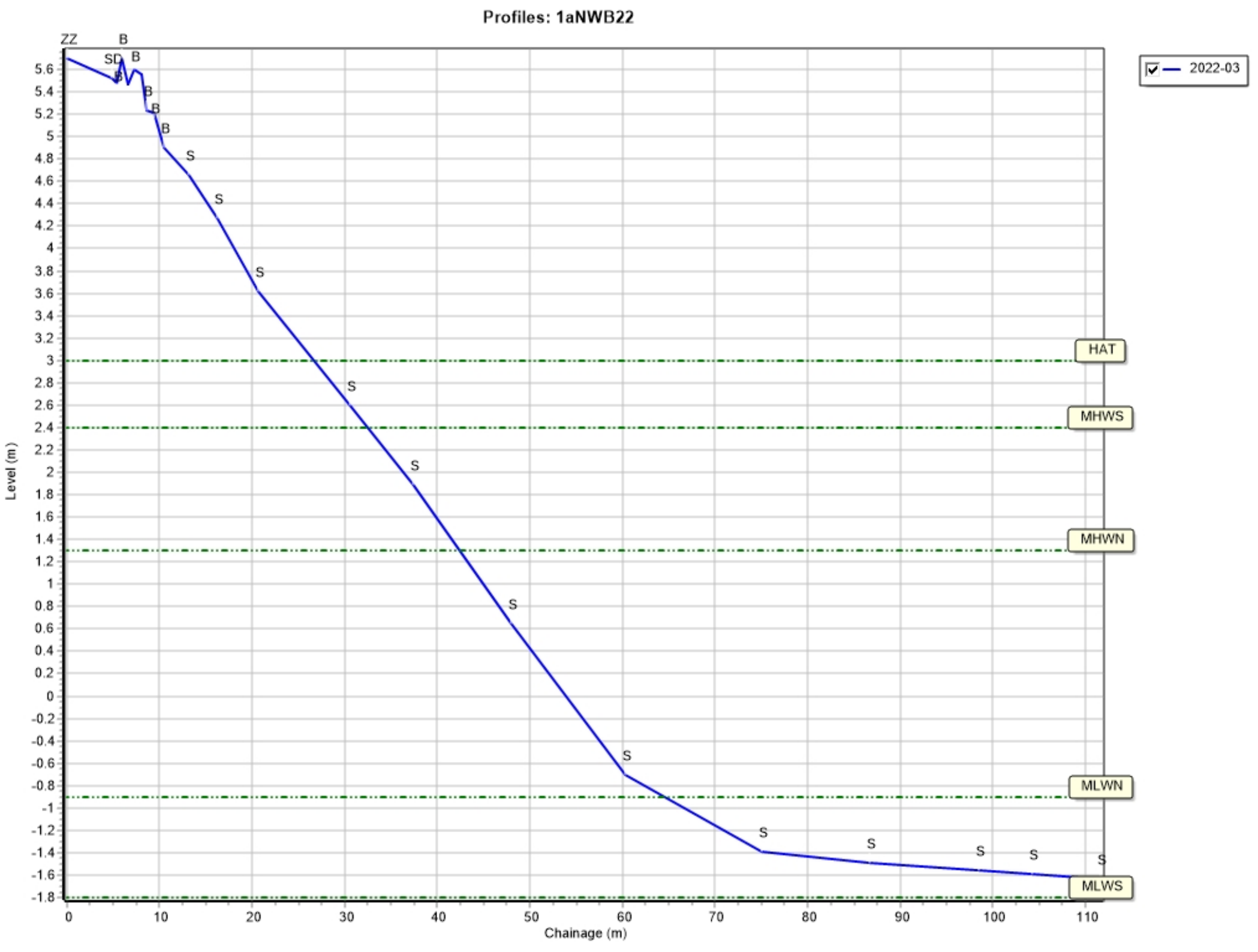
MLWN
MLWS
Level (m)
Chainage (m)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Level (m)
Chainage (m)
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MHWS
MHWN
MLWN
MLWS
ZZ
SD
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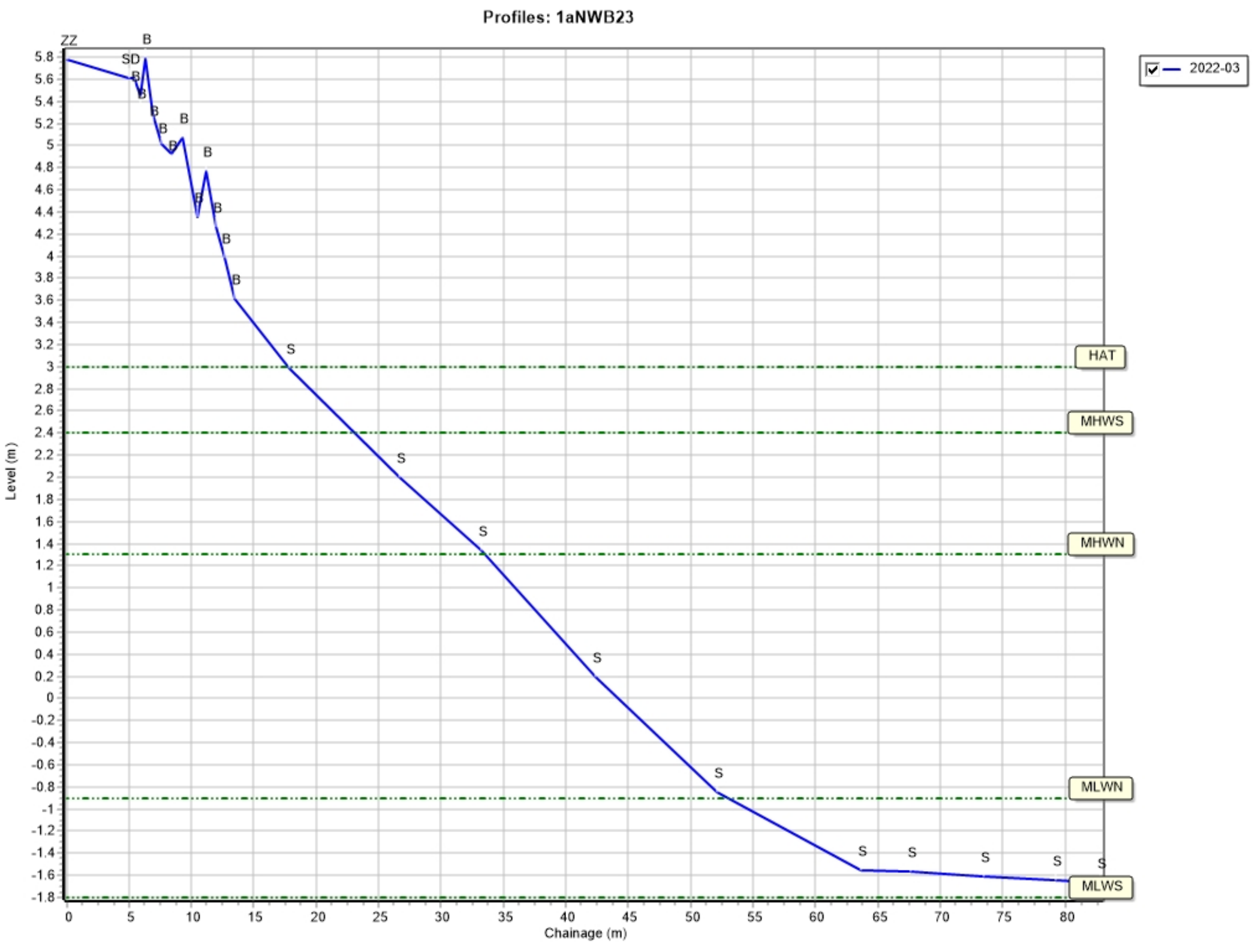
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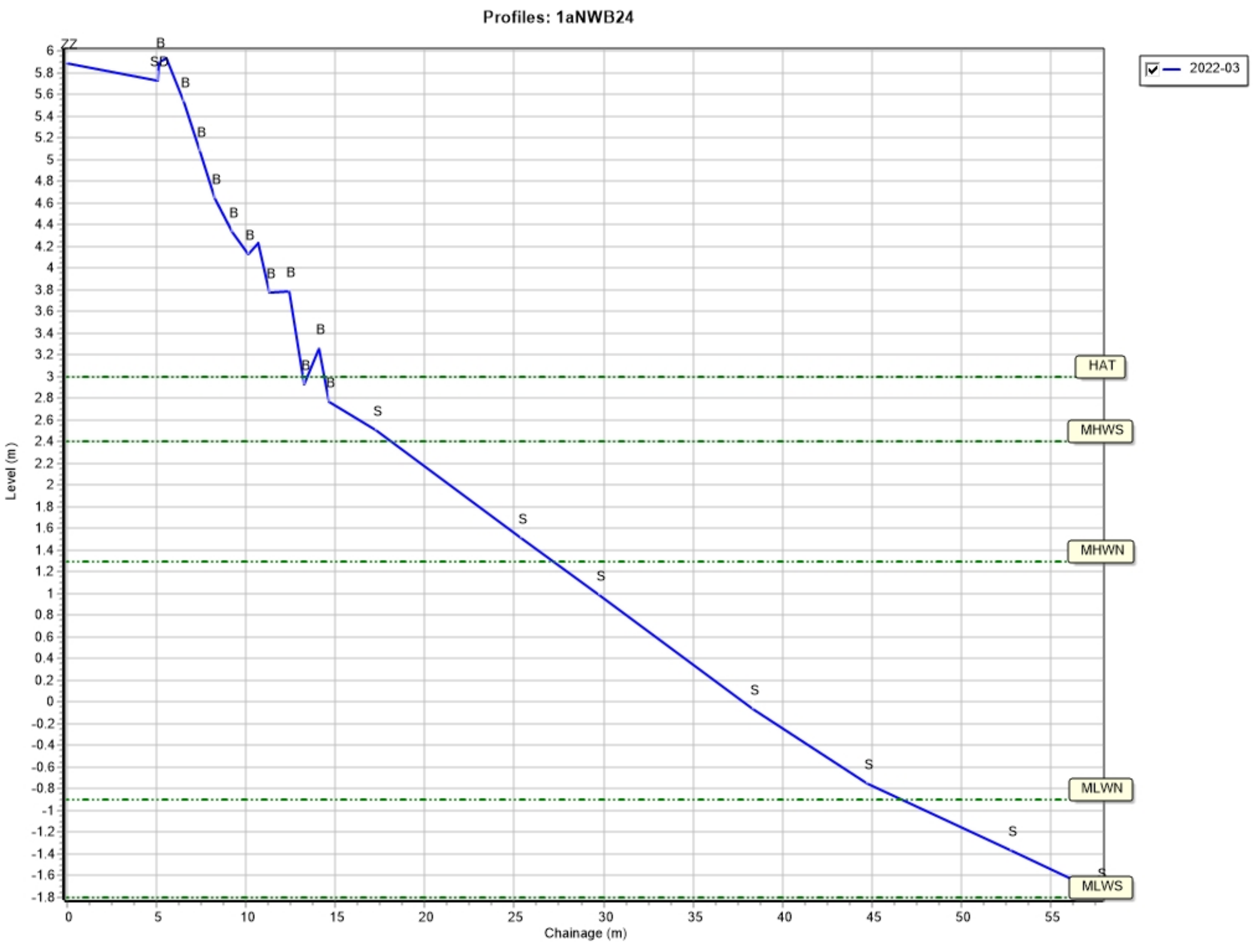
MLWS
Level (m)
Chainage (m)


Profiles: 1aNWB24
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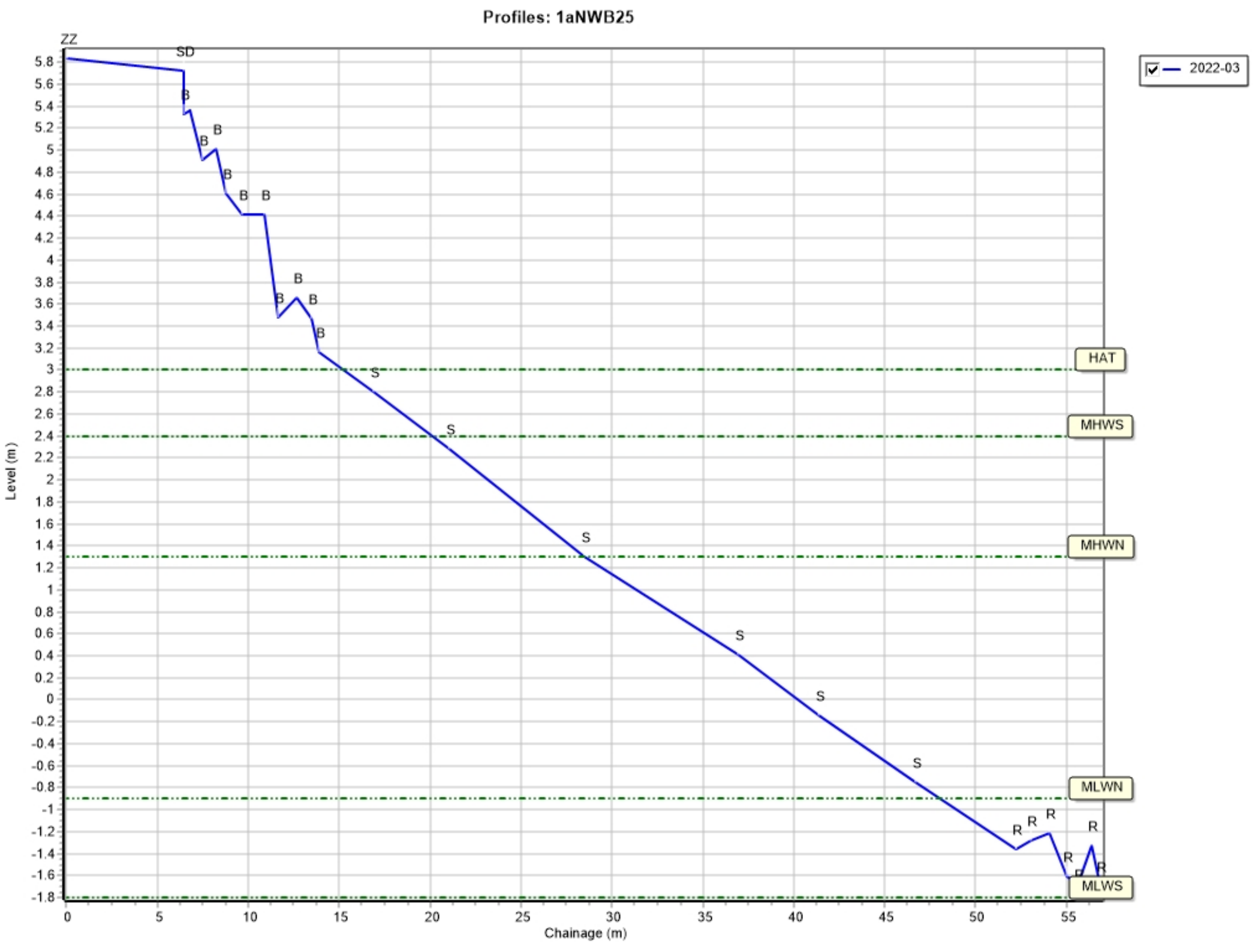
Level (m)
Chainage (m)
HAT
MHWS
MHWN
MLWN
MLWS
ZZ
SP
B
S


Profiles: 1aNWB25
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B
S
R
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MLWS
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Chainage (m)
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5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
3.6
3.4
3.2
3
2.8
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1.2
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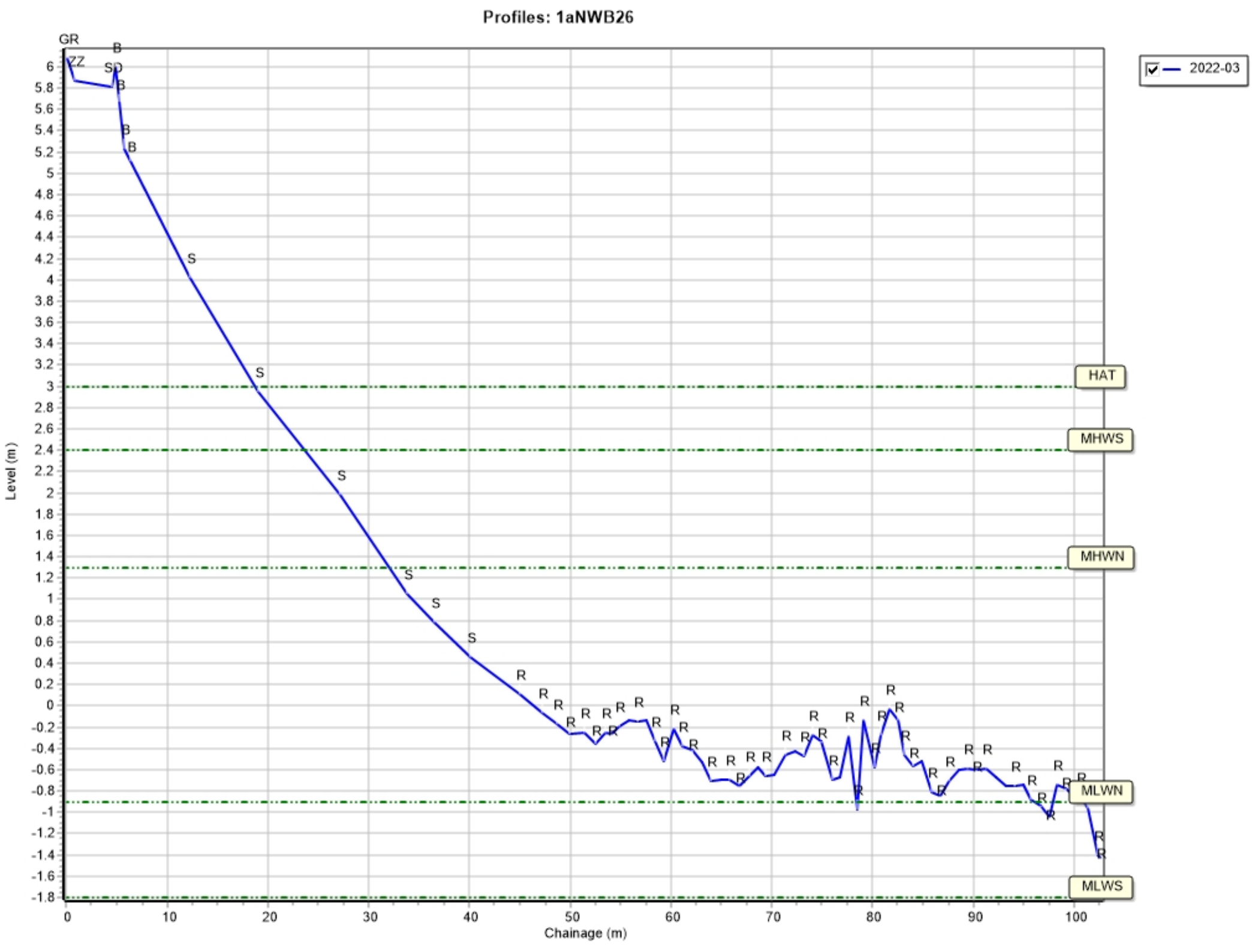
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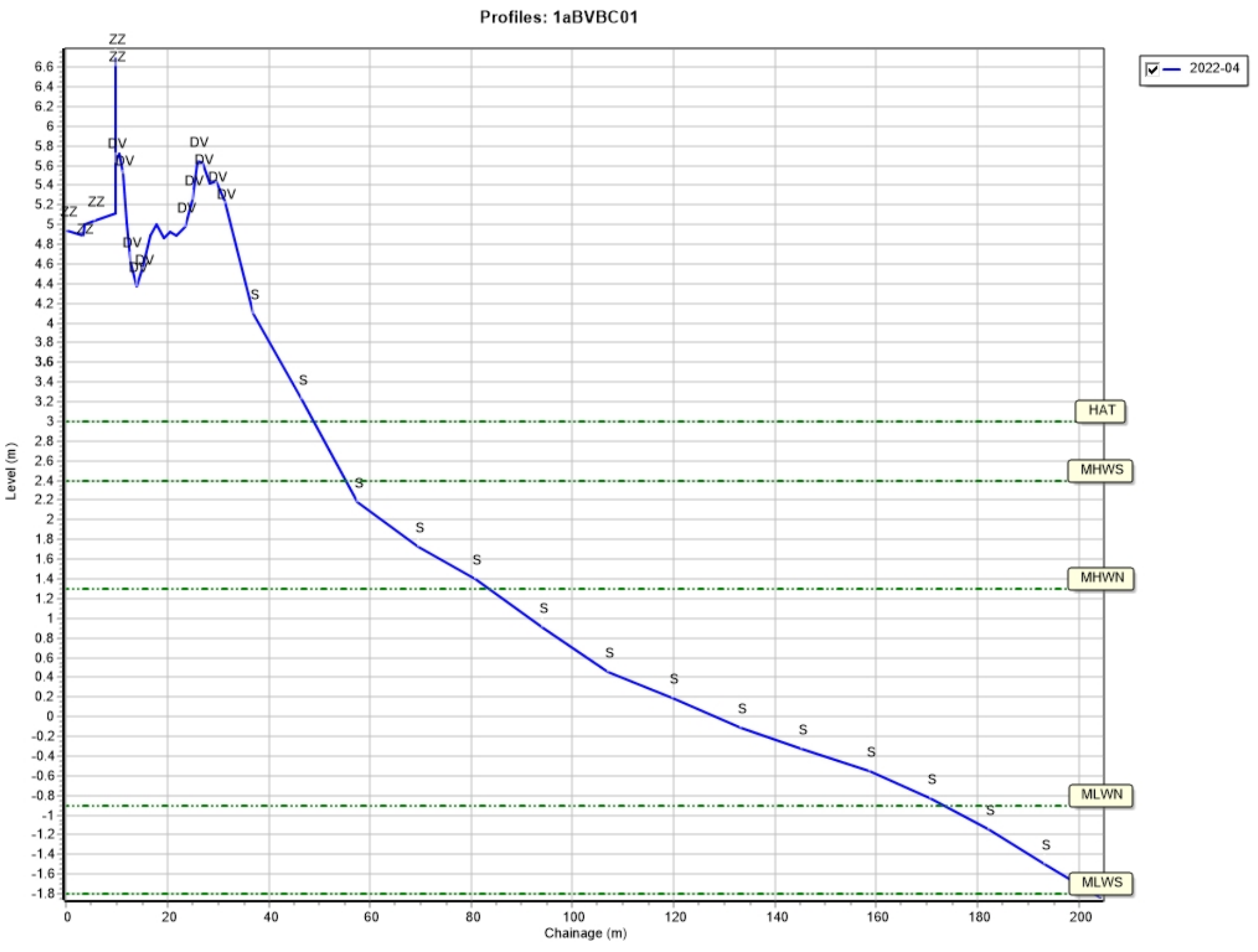
Level (m)
Chainage (m)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DV
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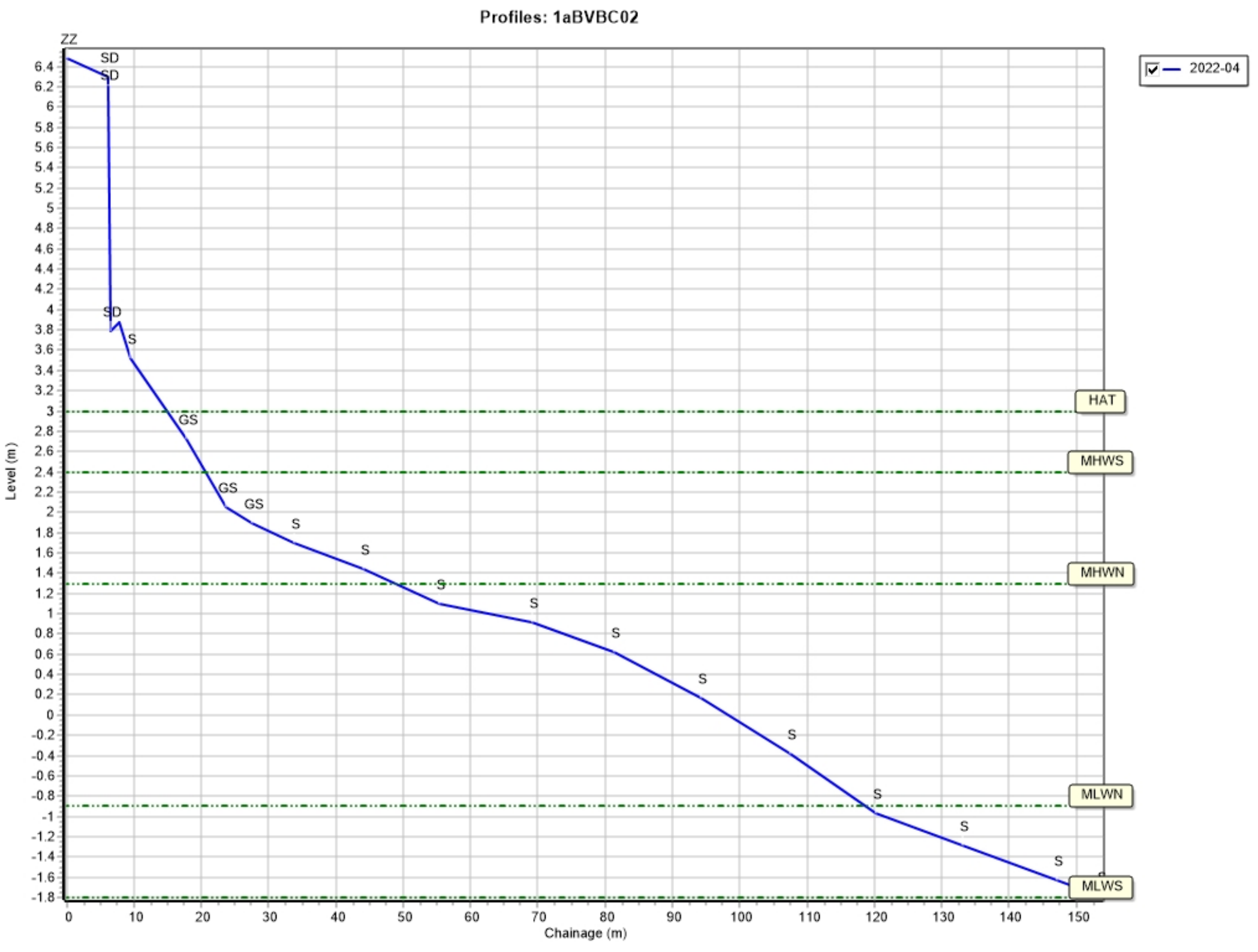
Profiles: 1aBVBC02
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GS
GS
GS
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S
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S
S
S
S
S
S
S
HAT
MHWS
MHWN
MLWN
MLWS
2022-04
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Chainage (m)
6.4
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6
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5.2
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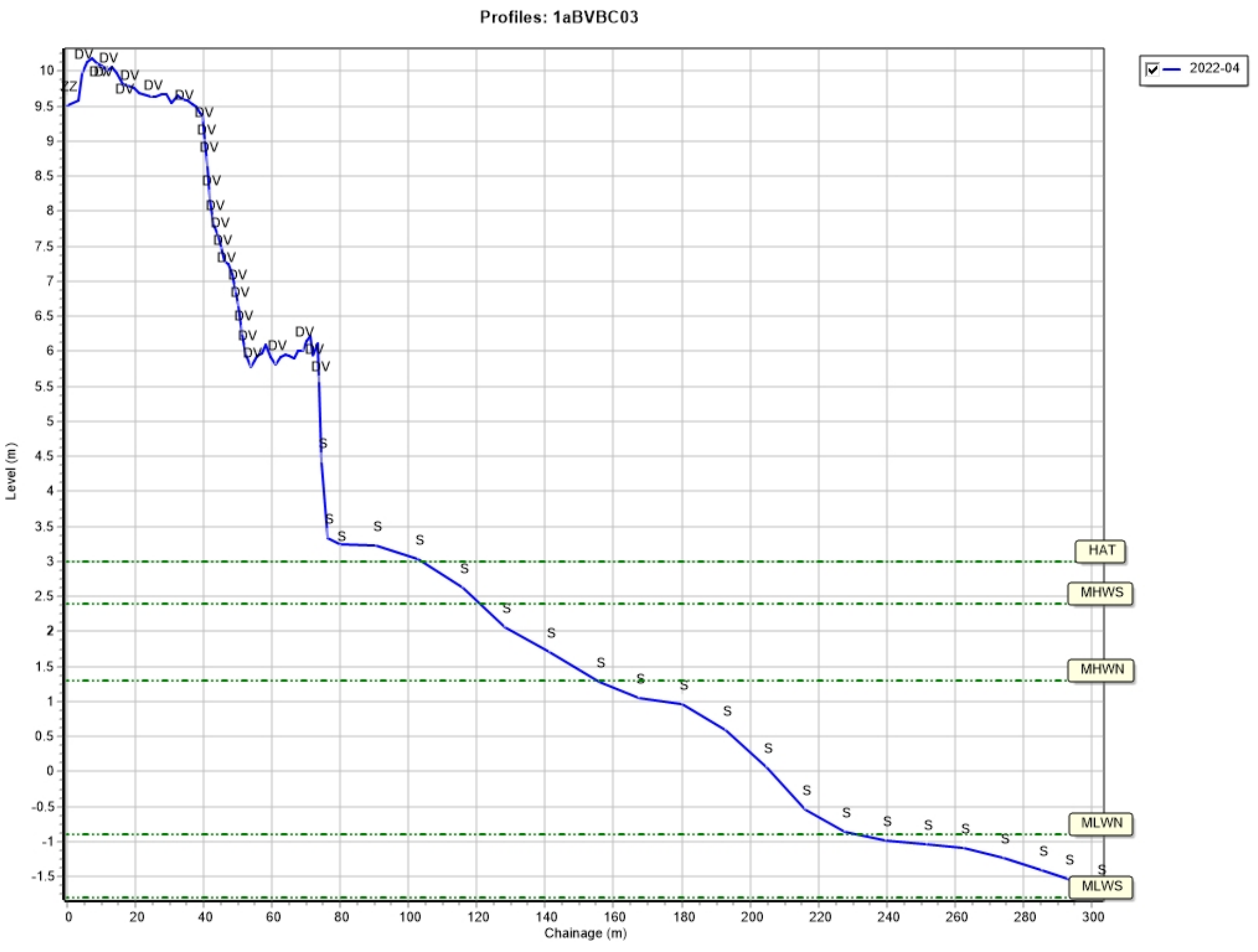
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6.5
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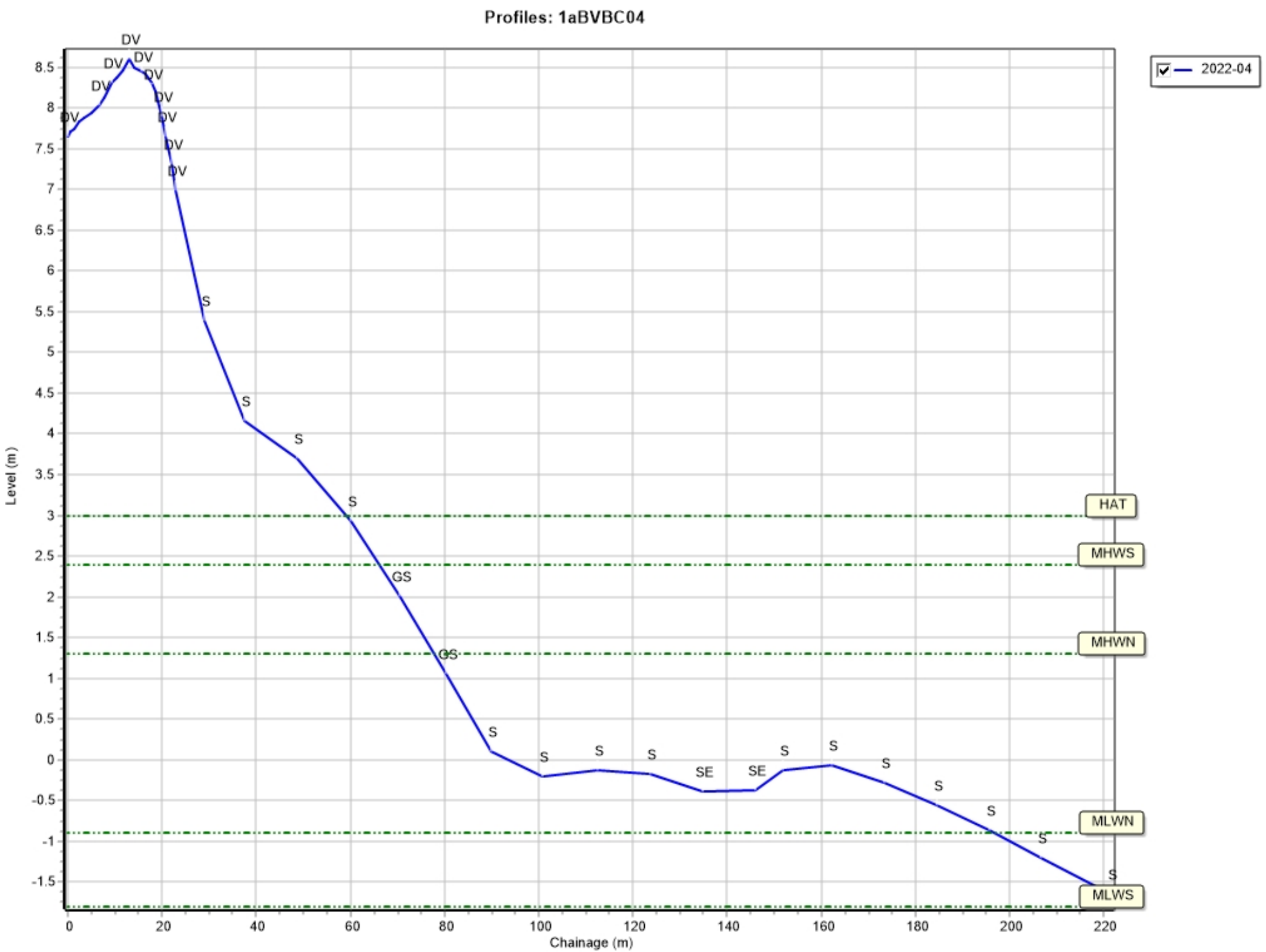
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Chainage (m)
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MHWN
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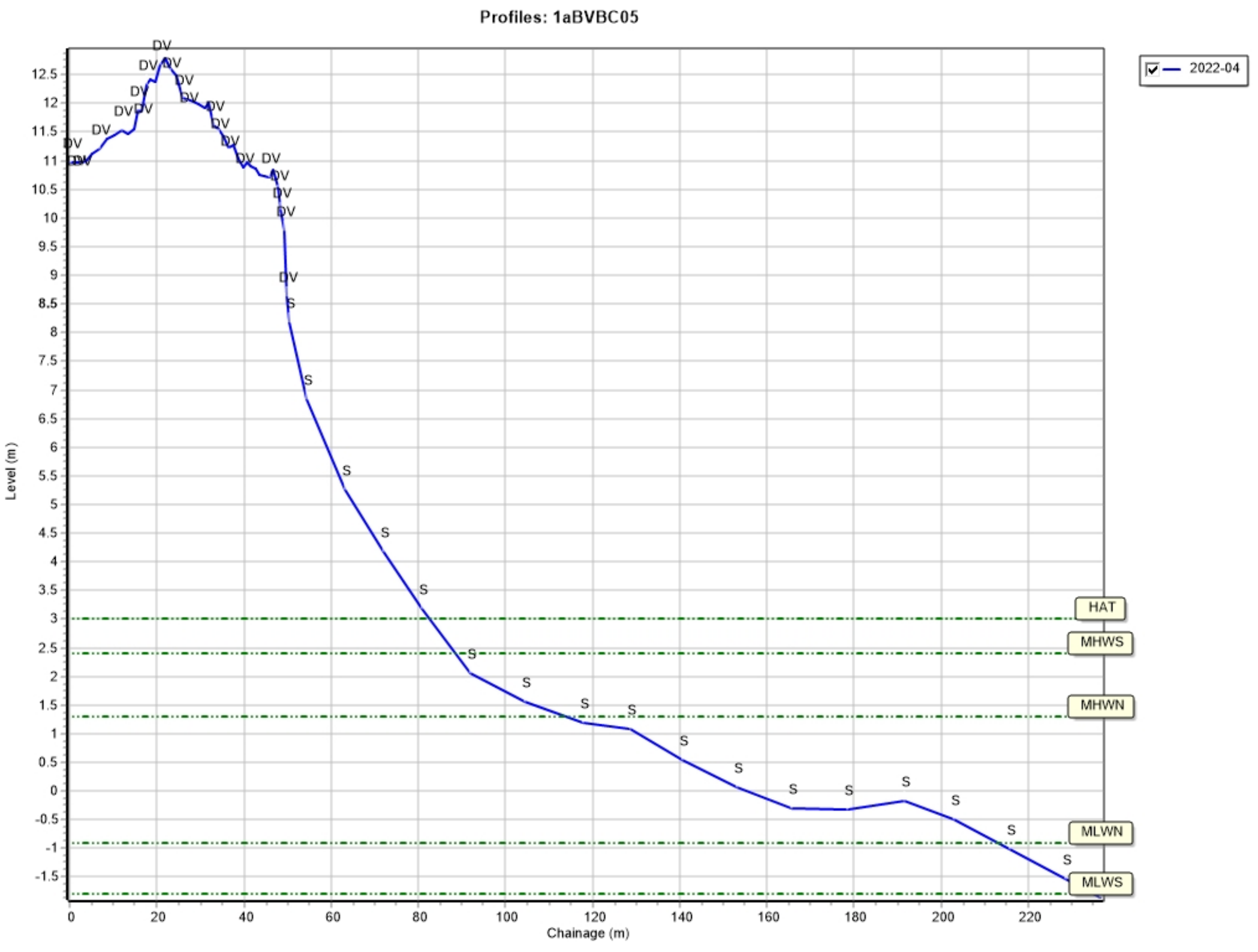
MLWS
DV
S
GS
SE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Level (m)
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11
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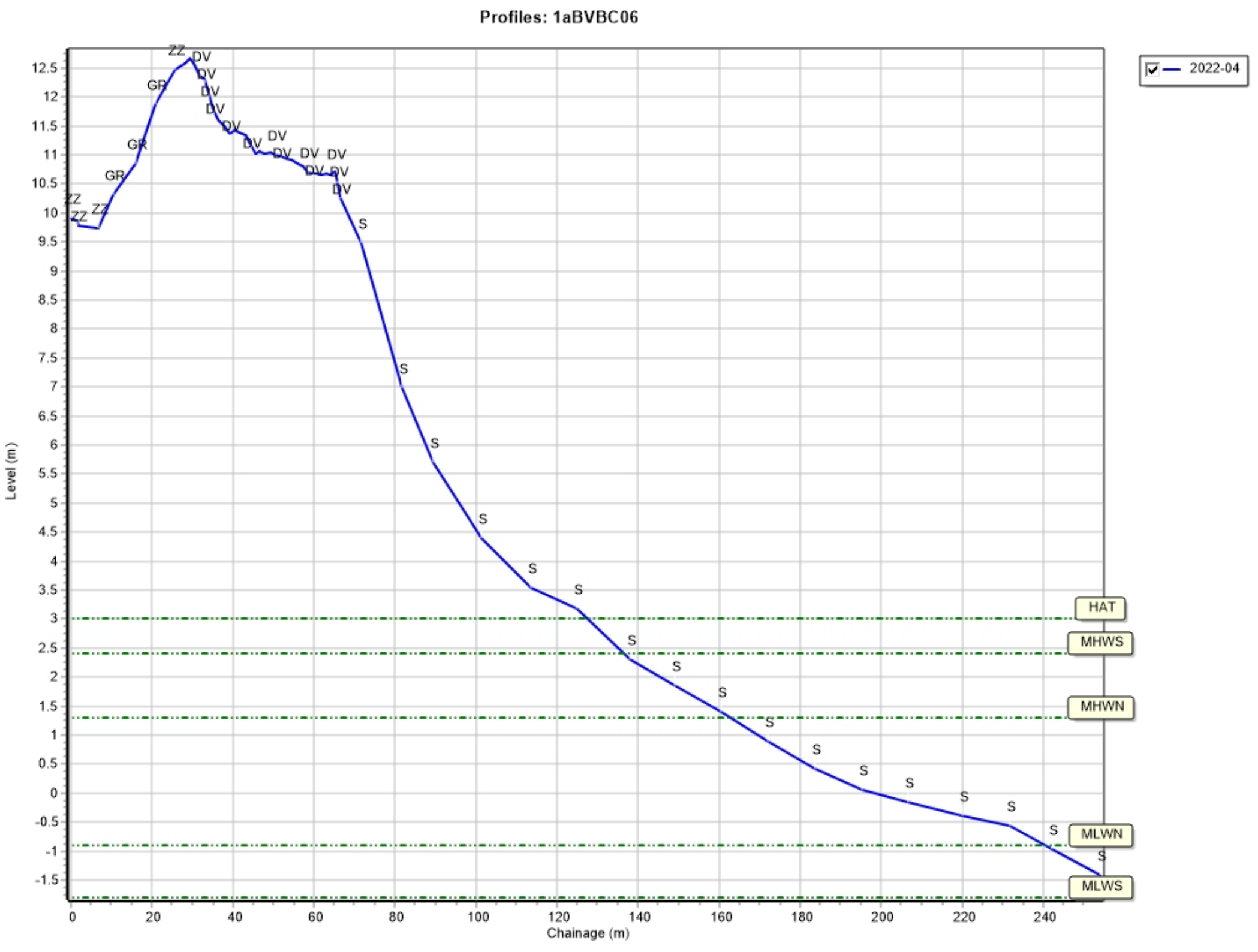
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GR
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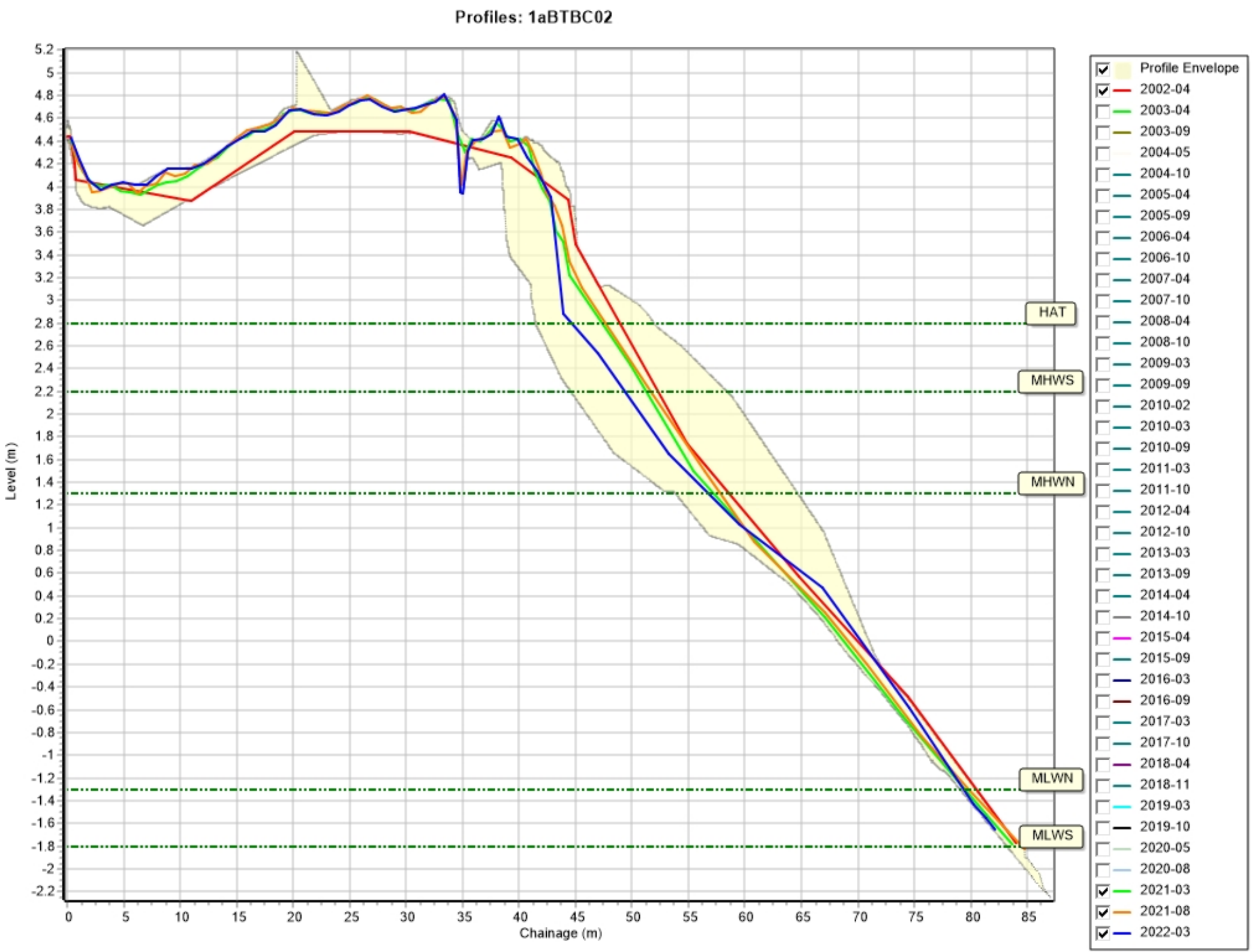
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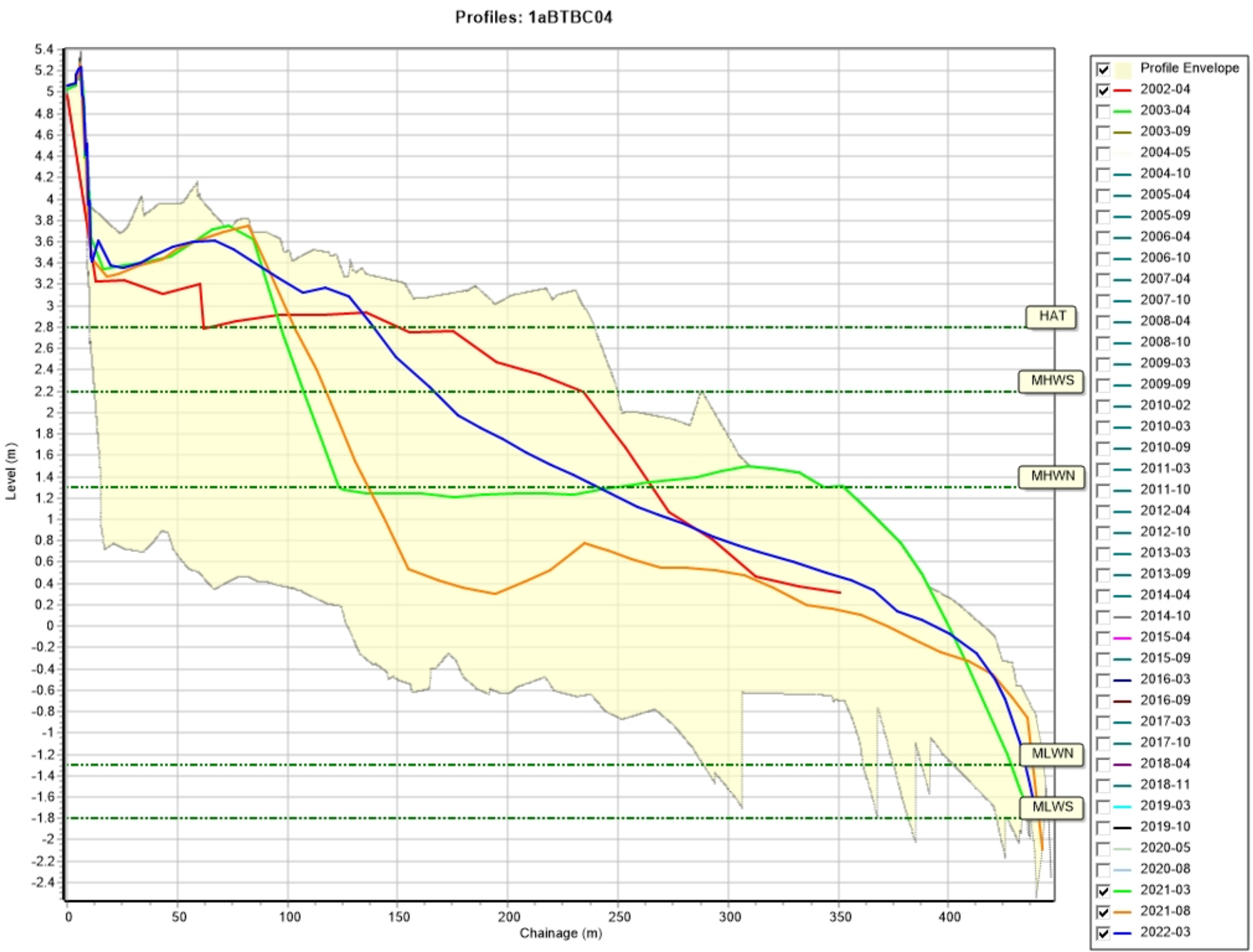
2022-03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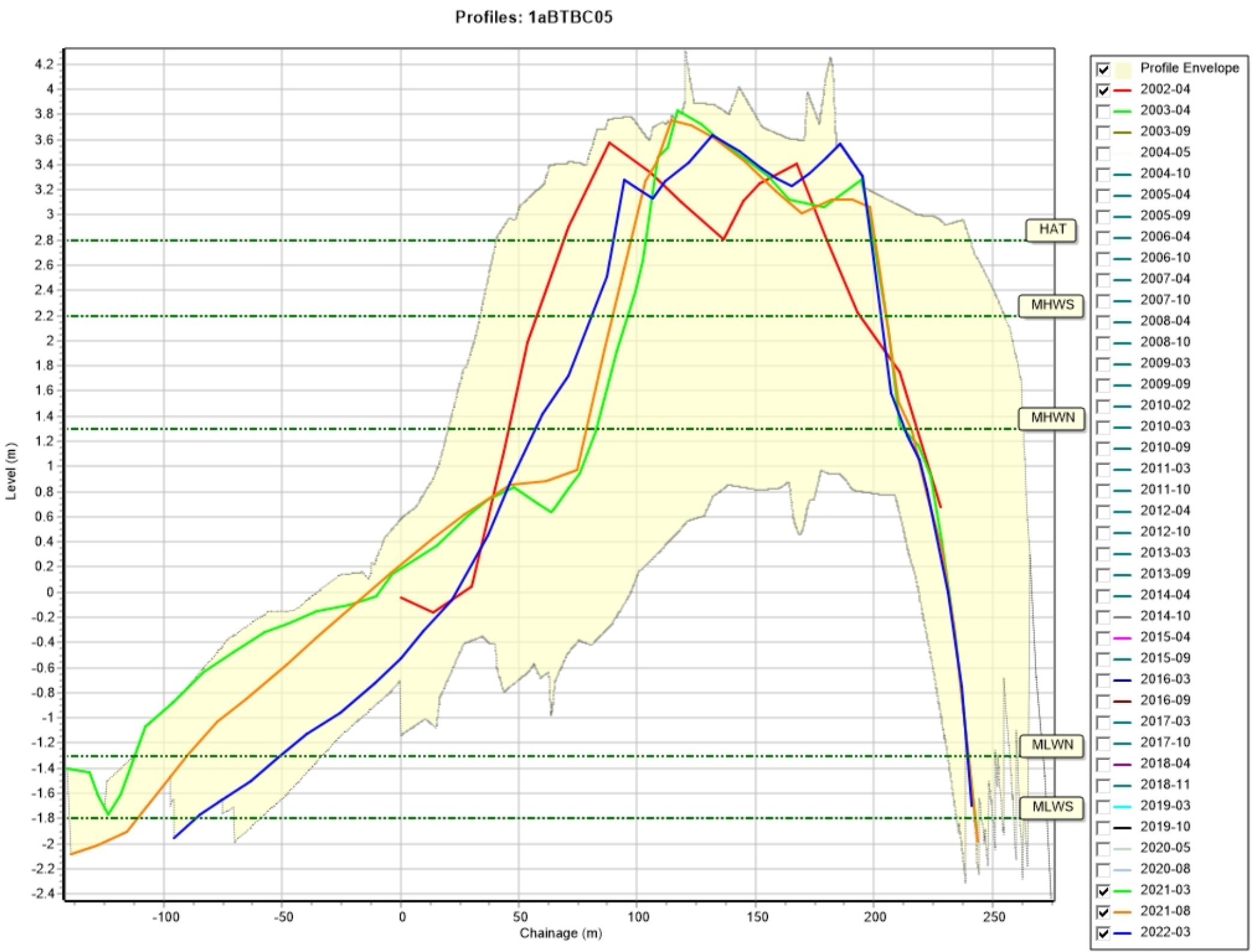
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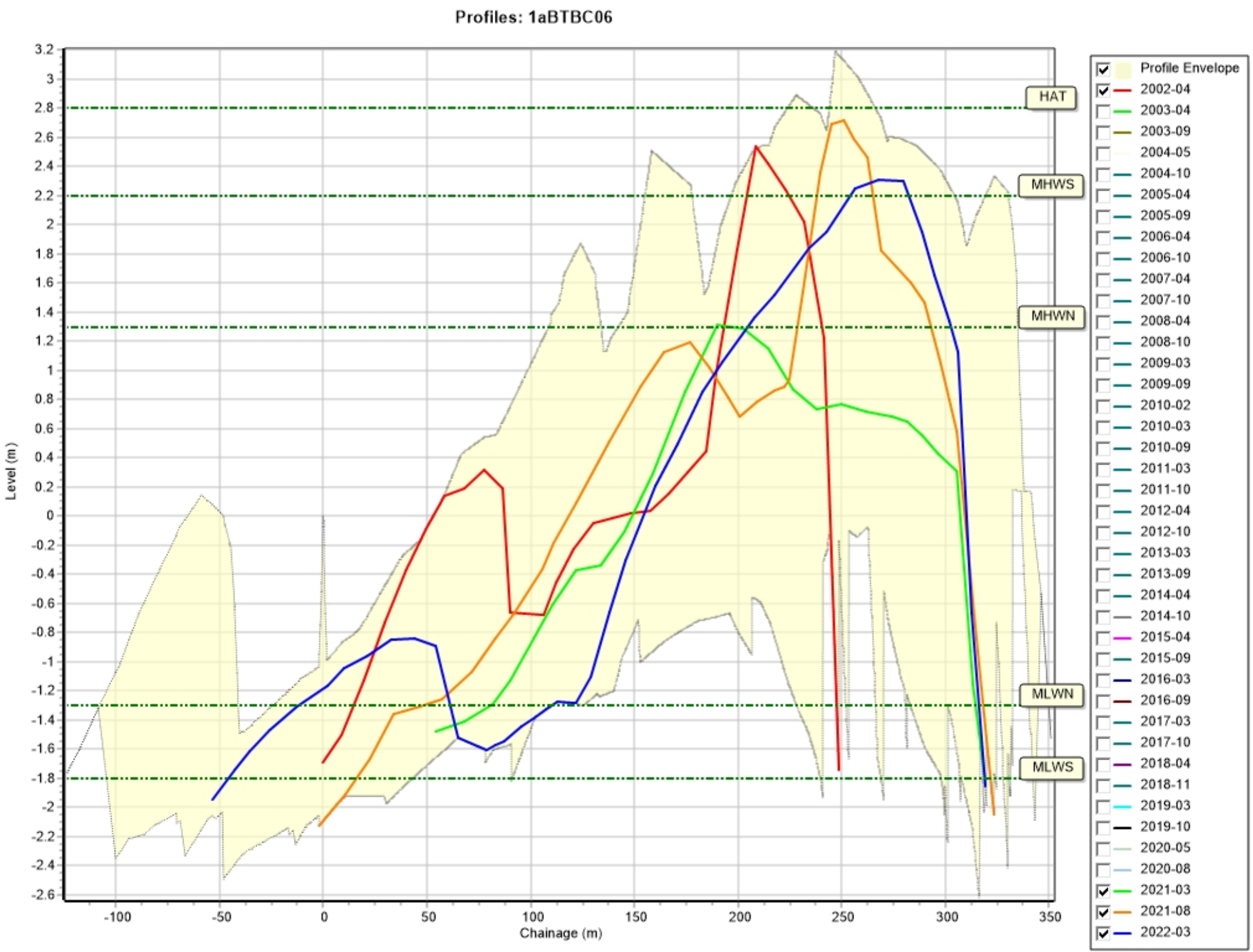
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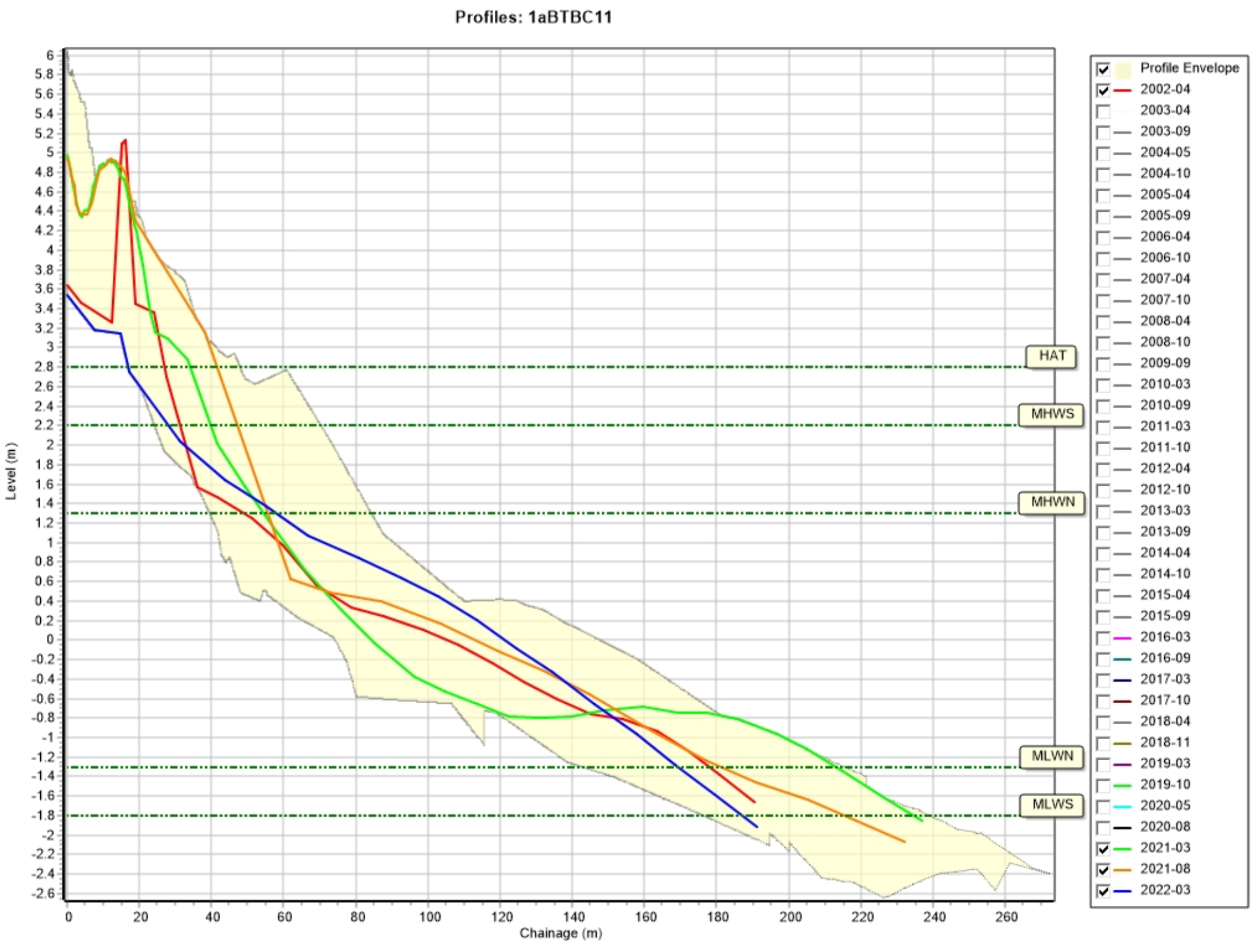
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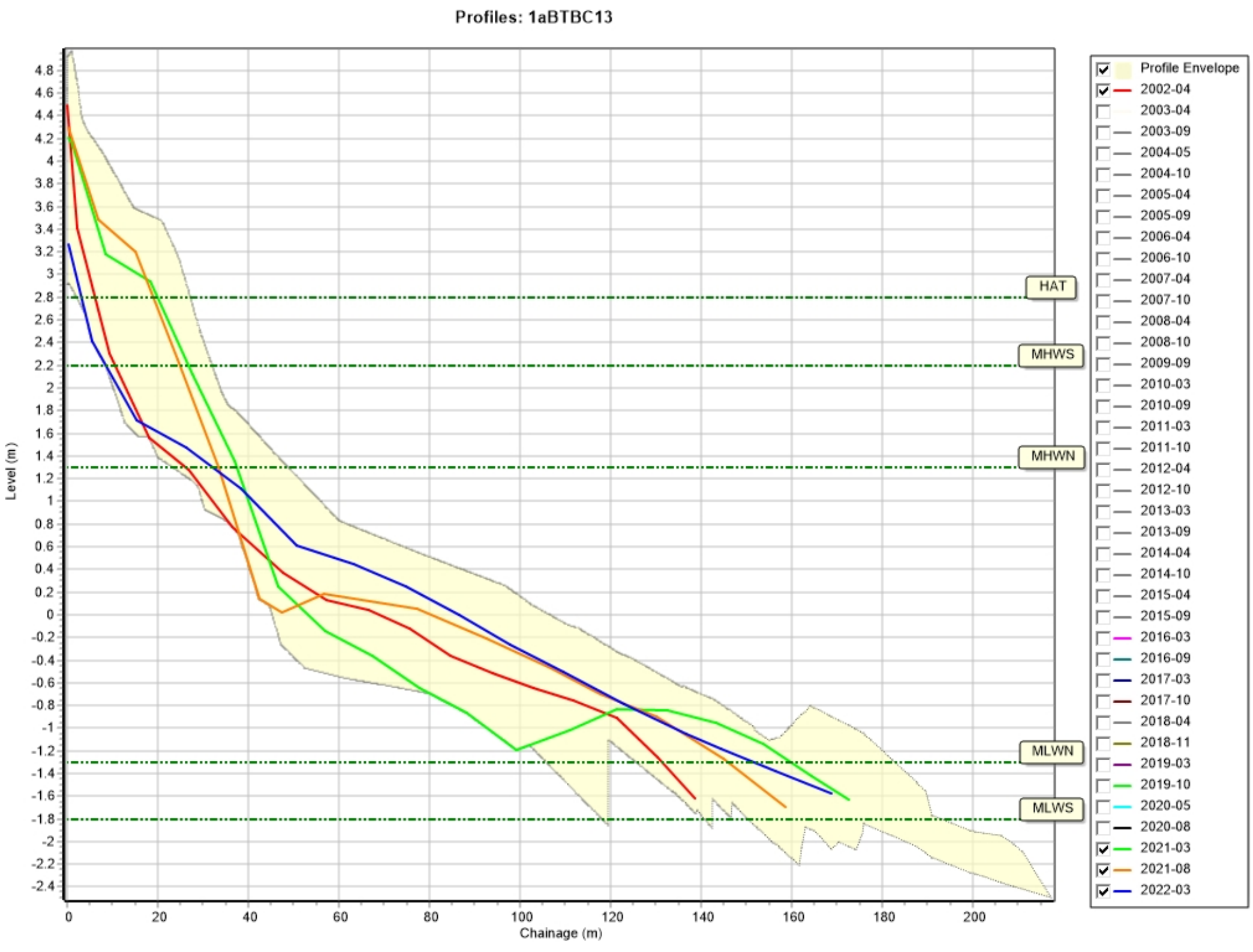
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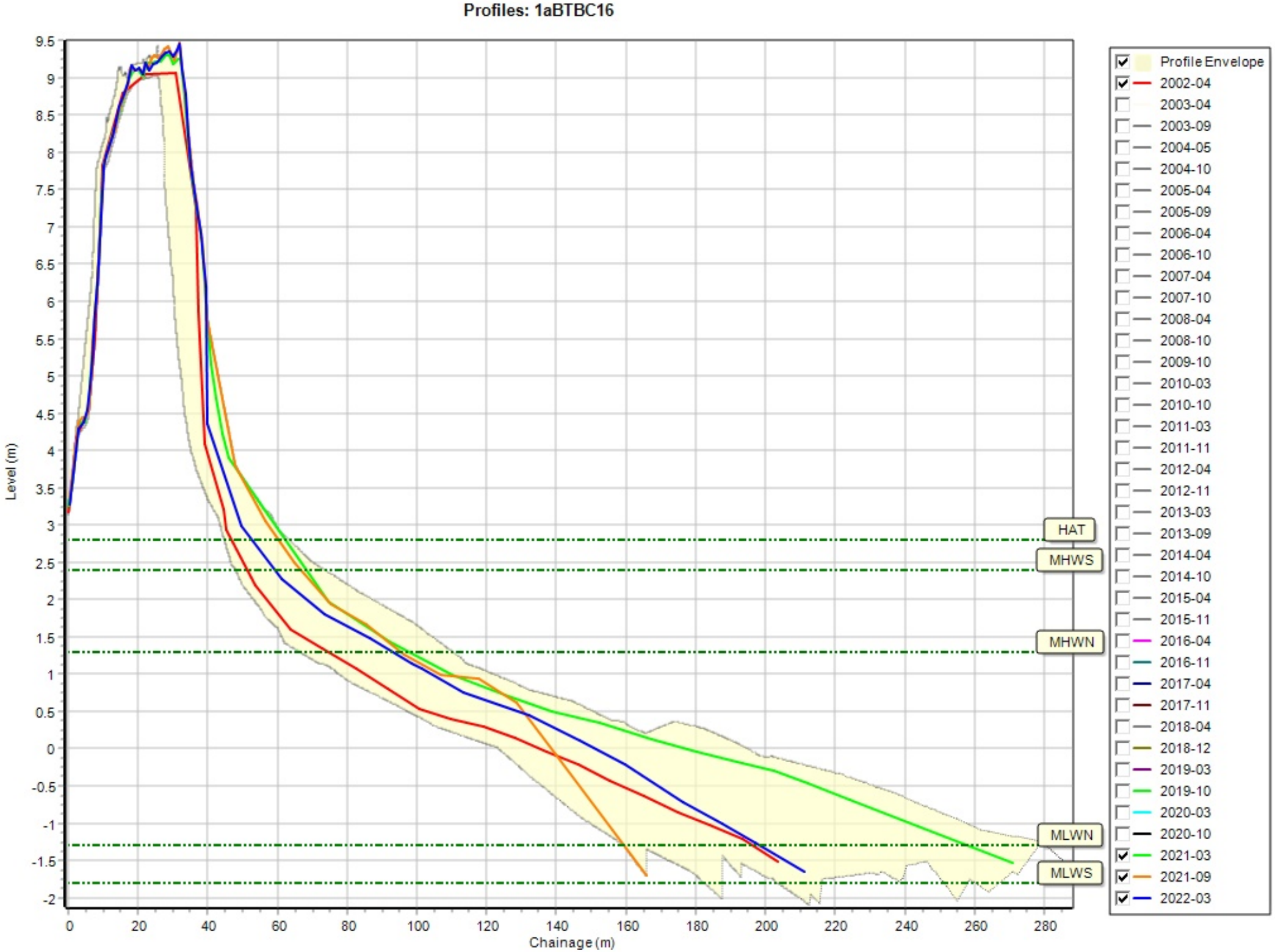
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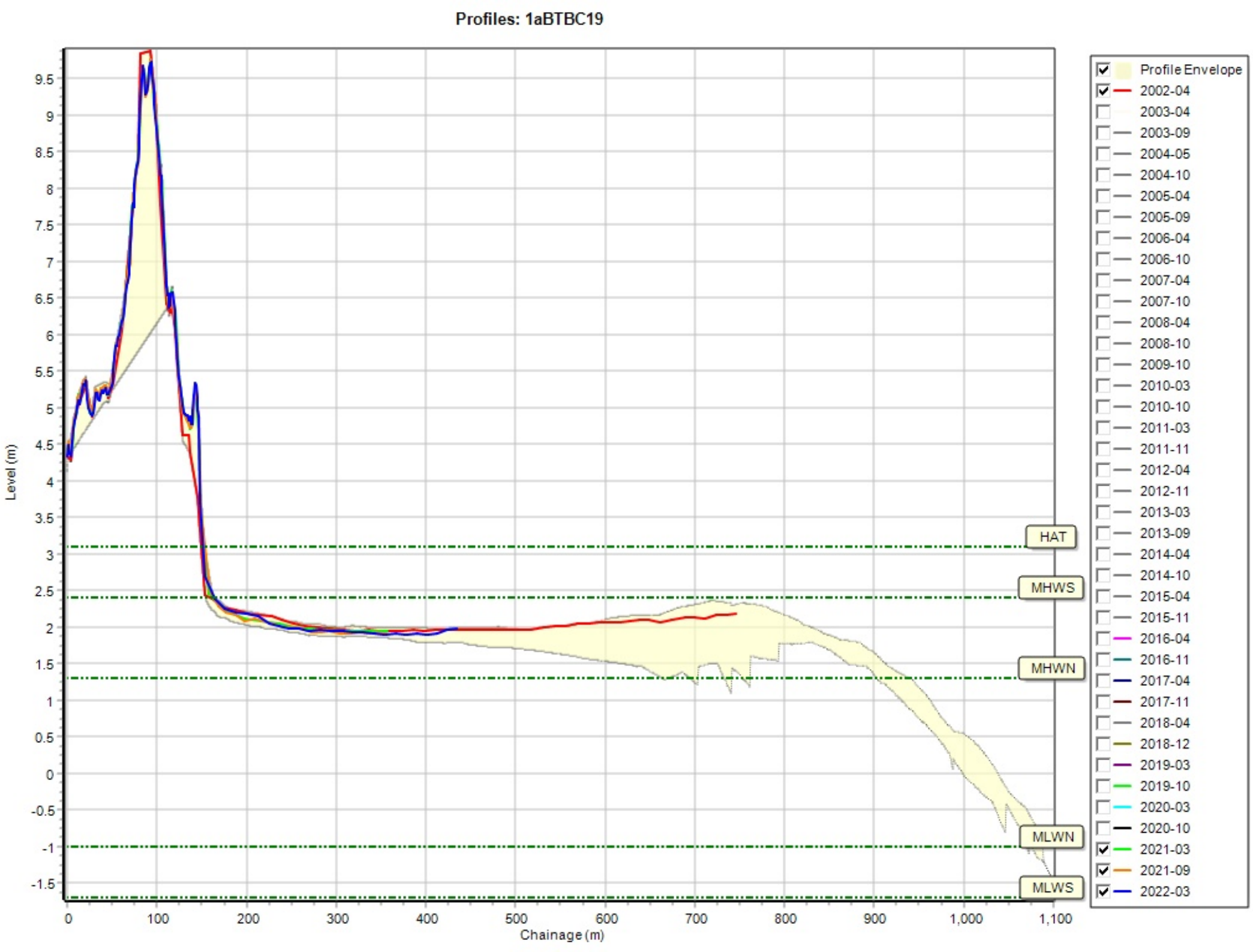
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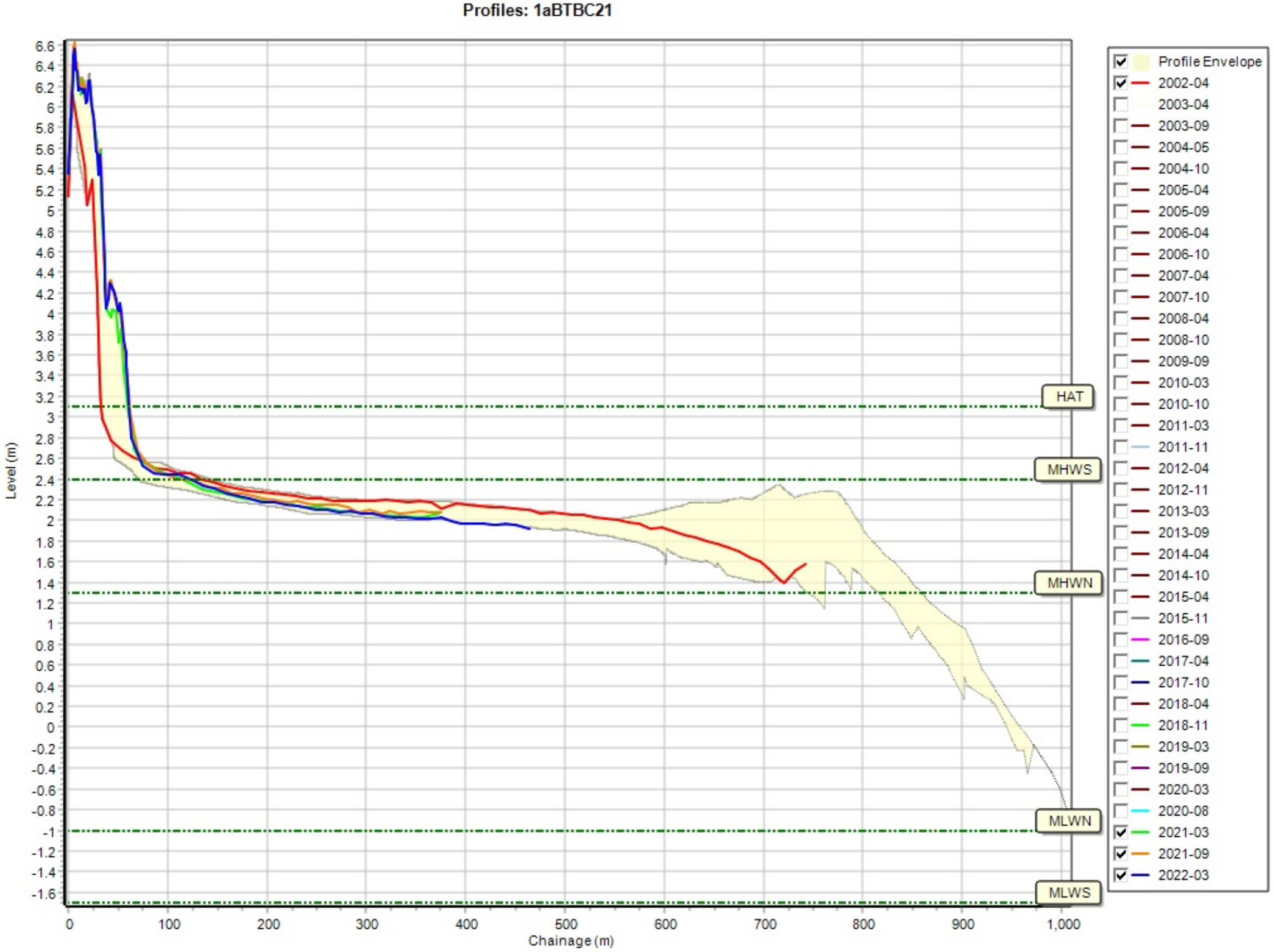
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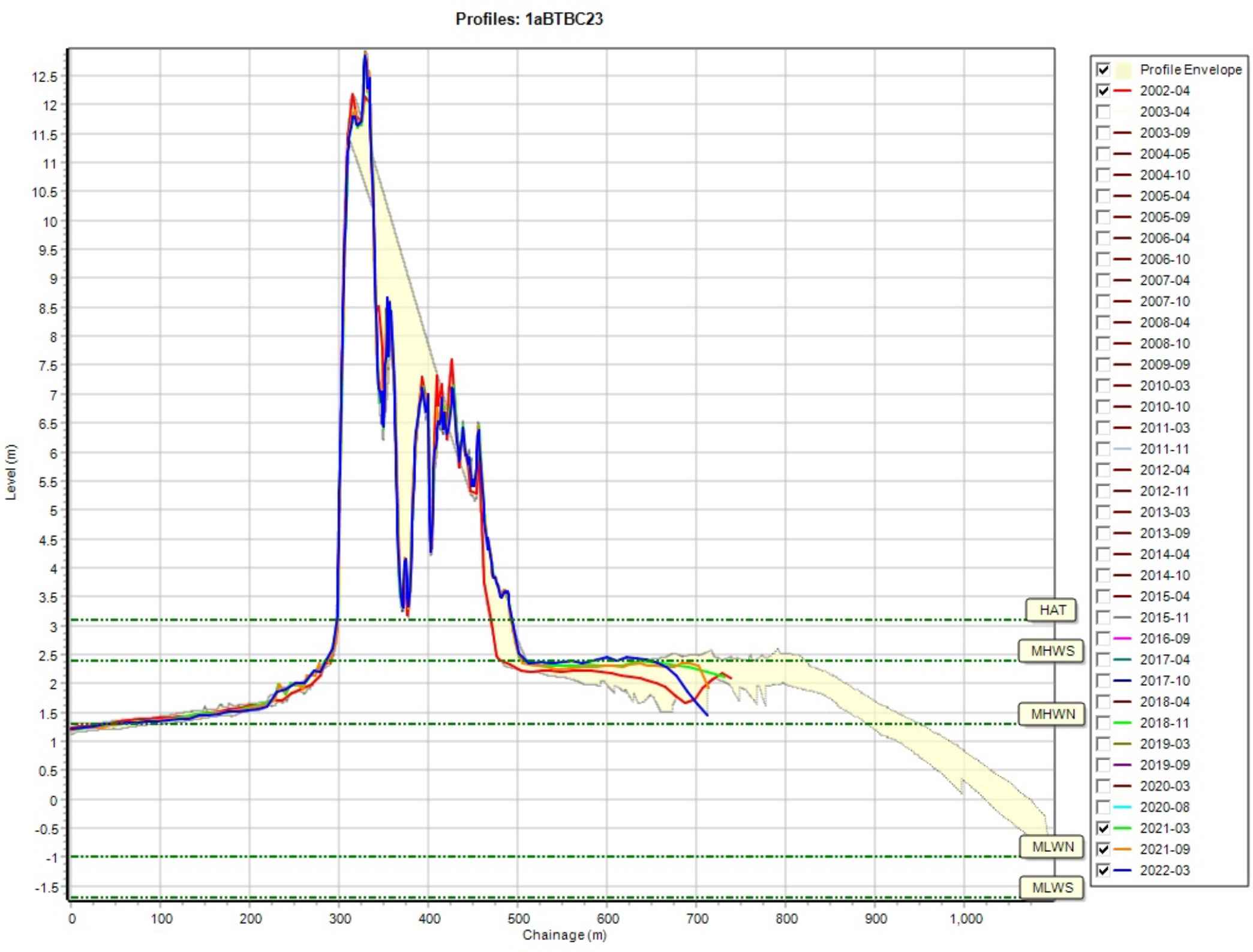
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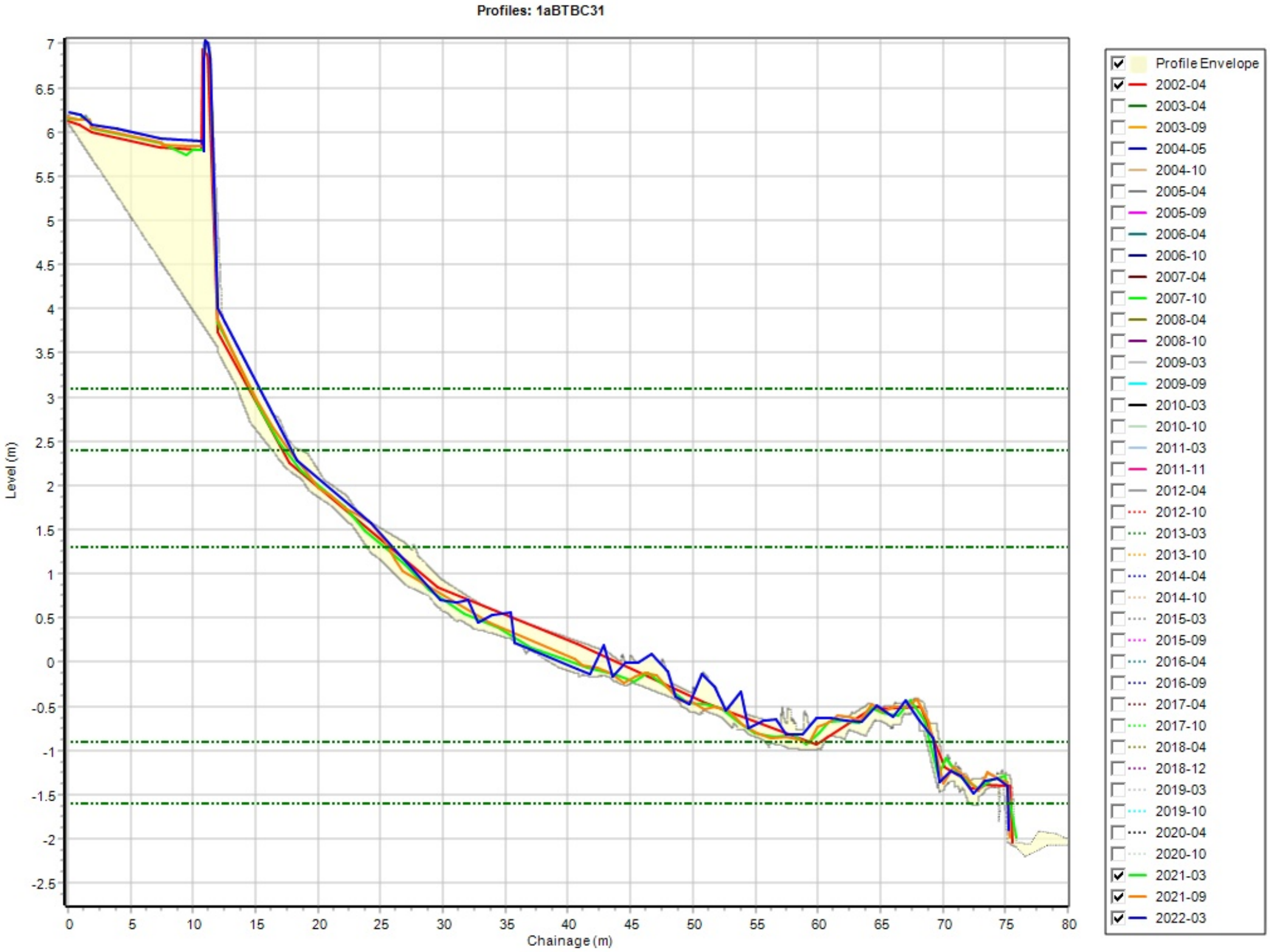
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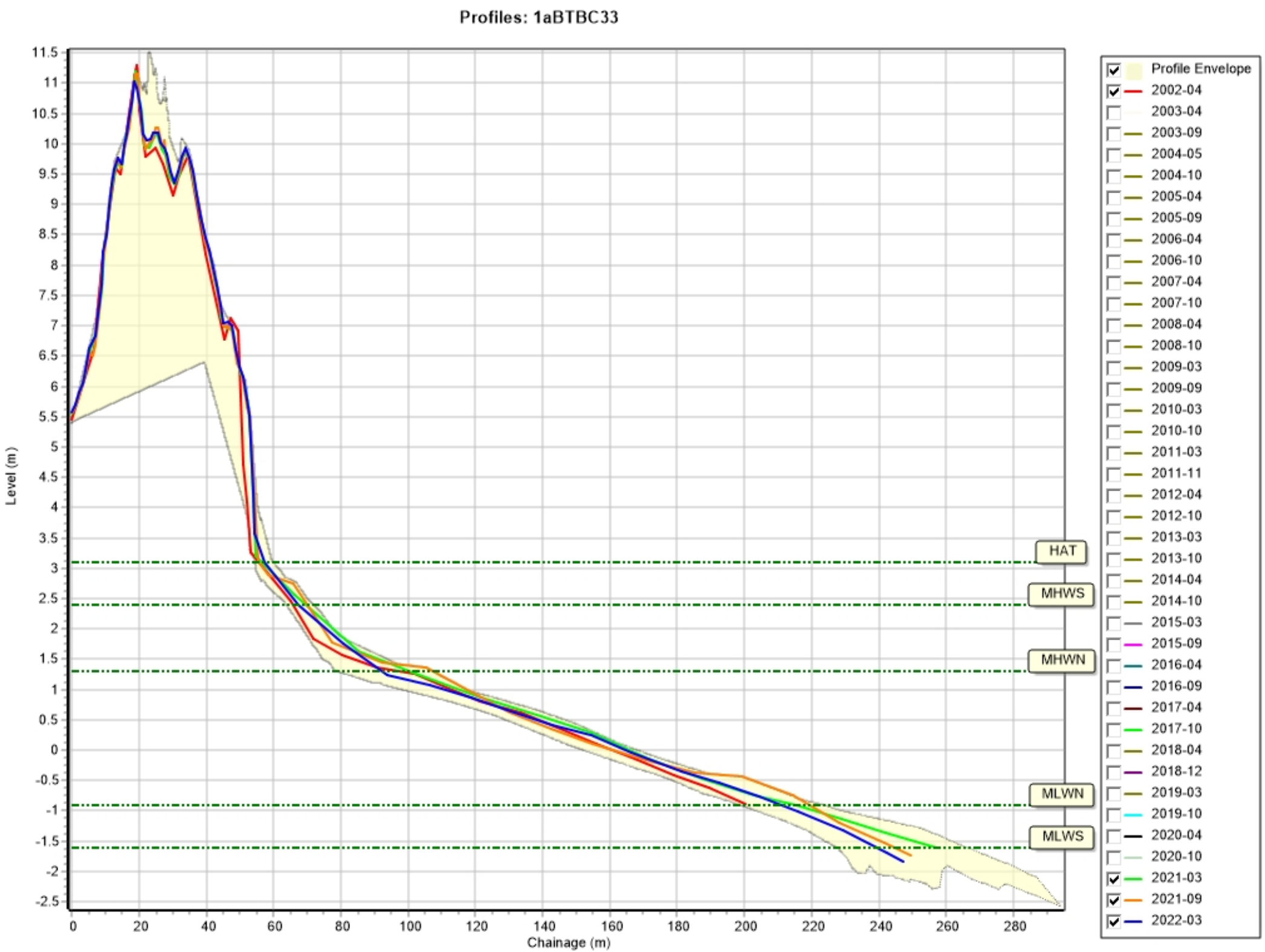
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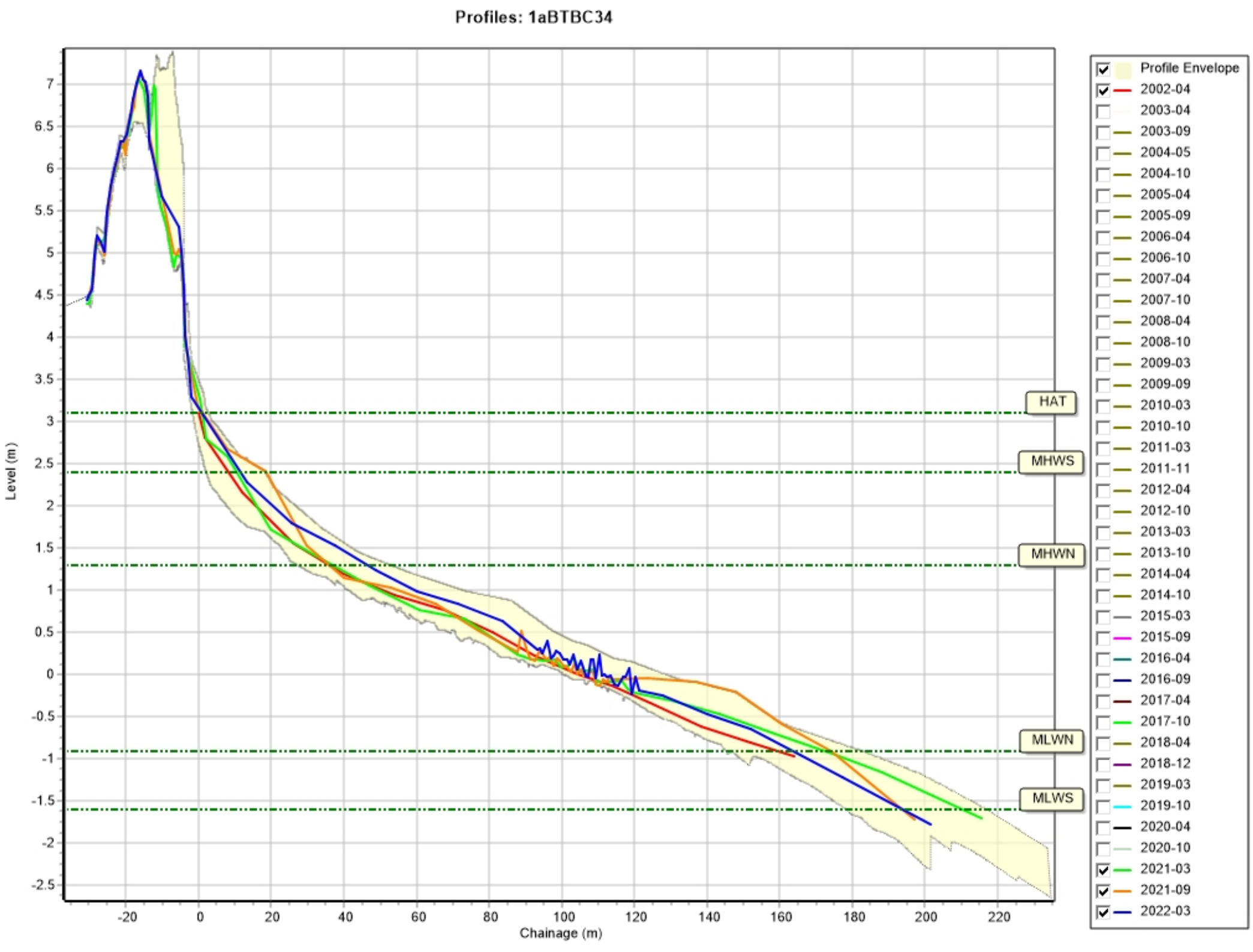
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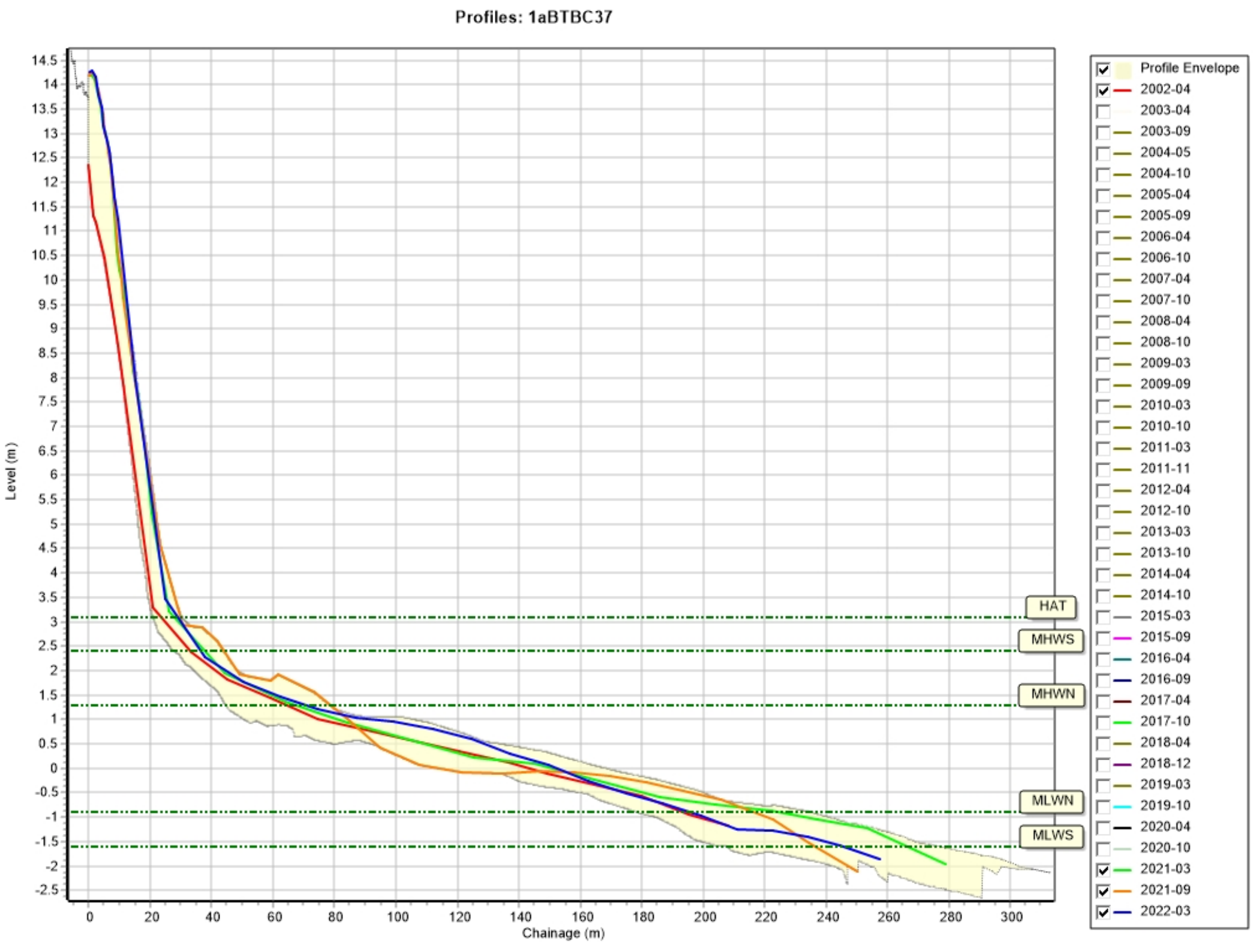
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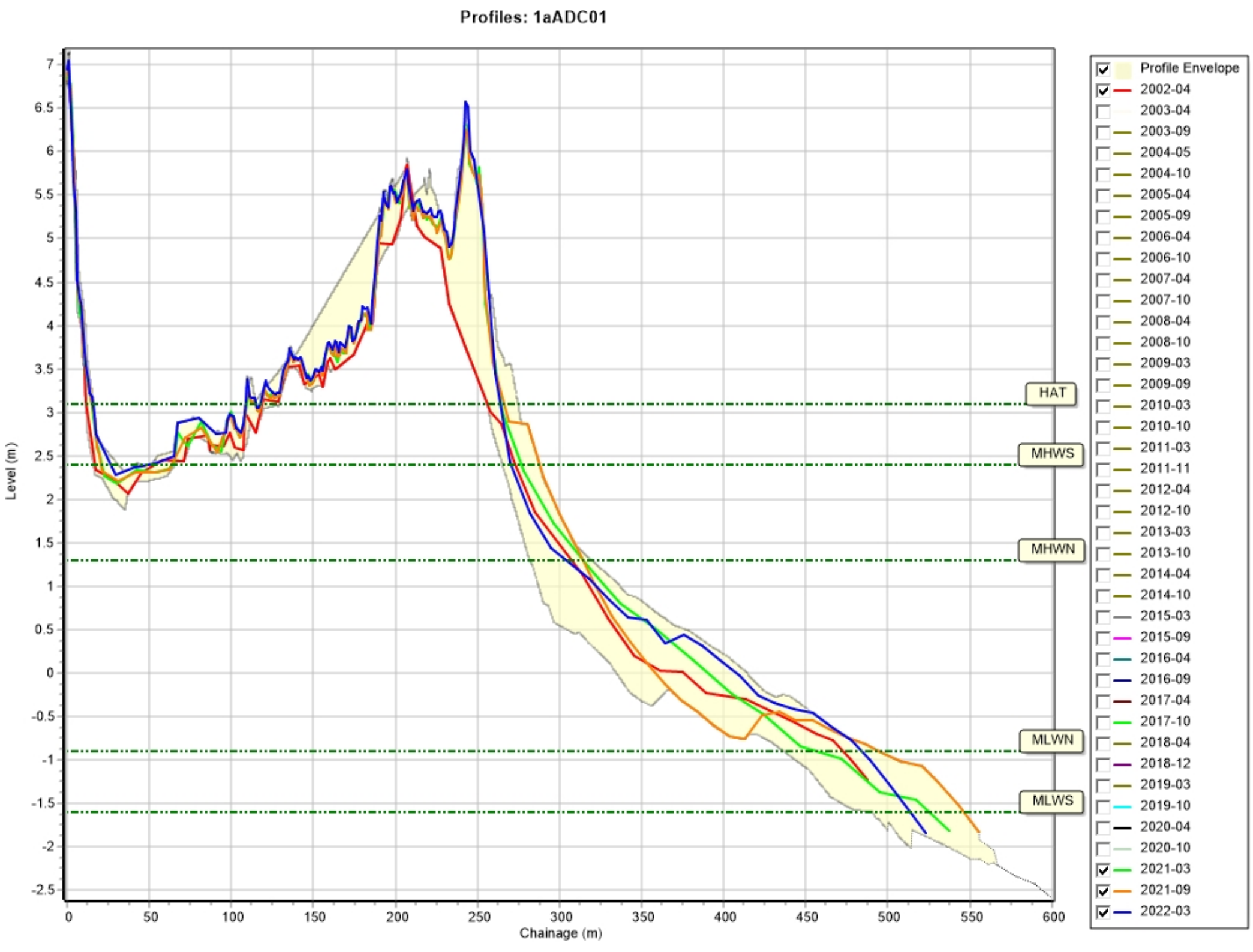
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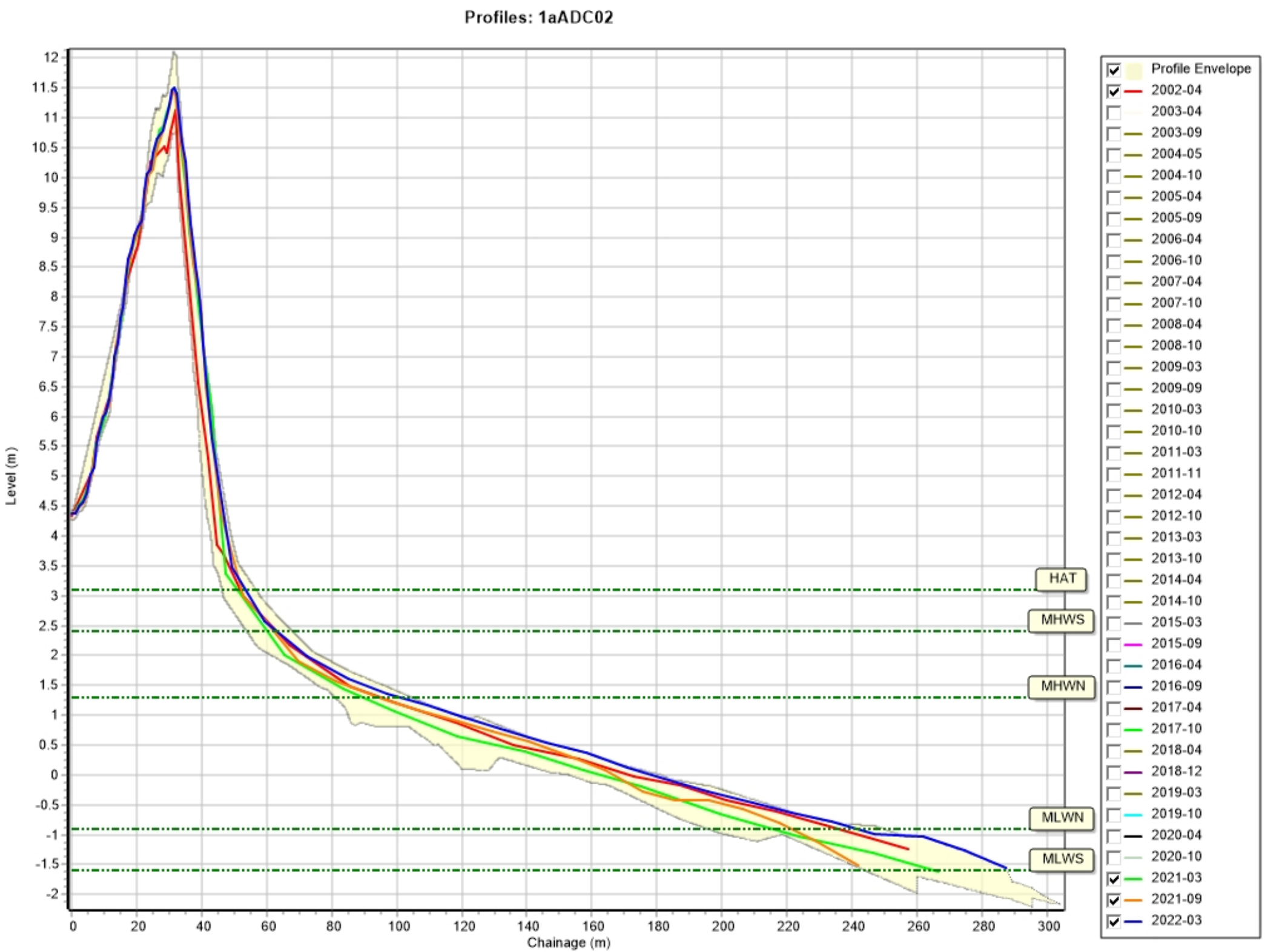
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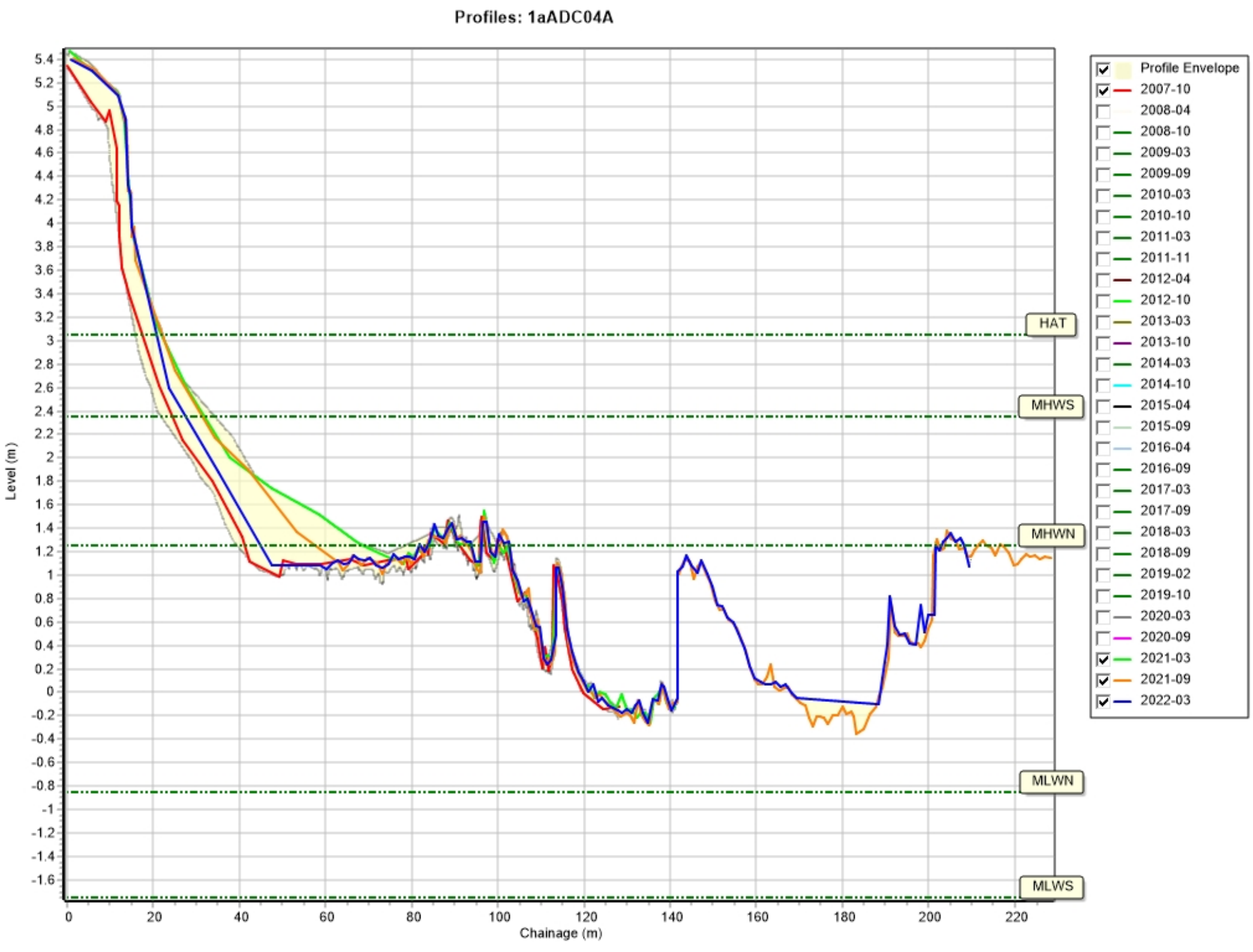
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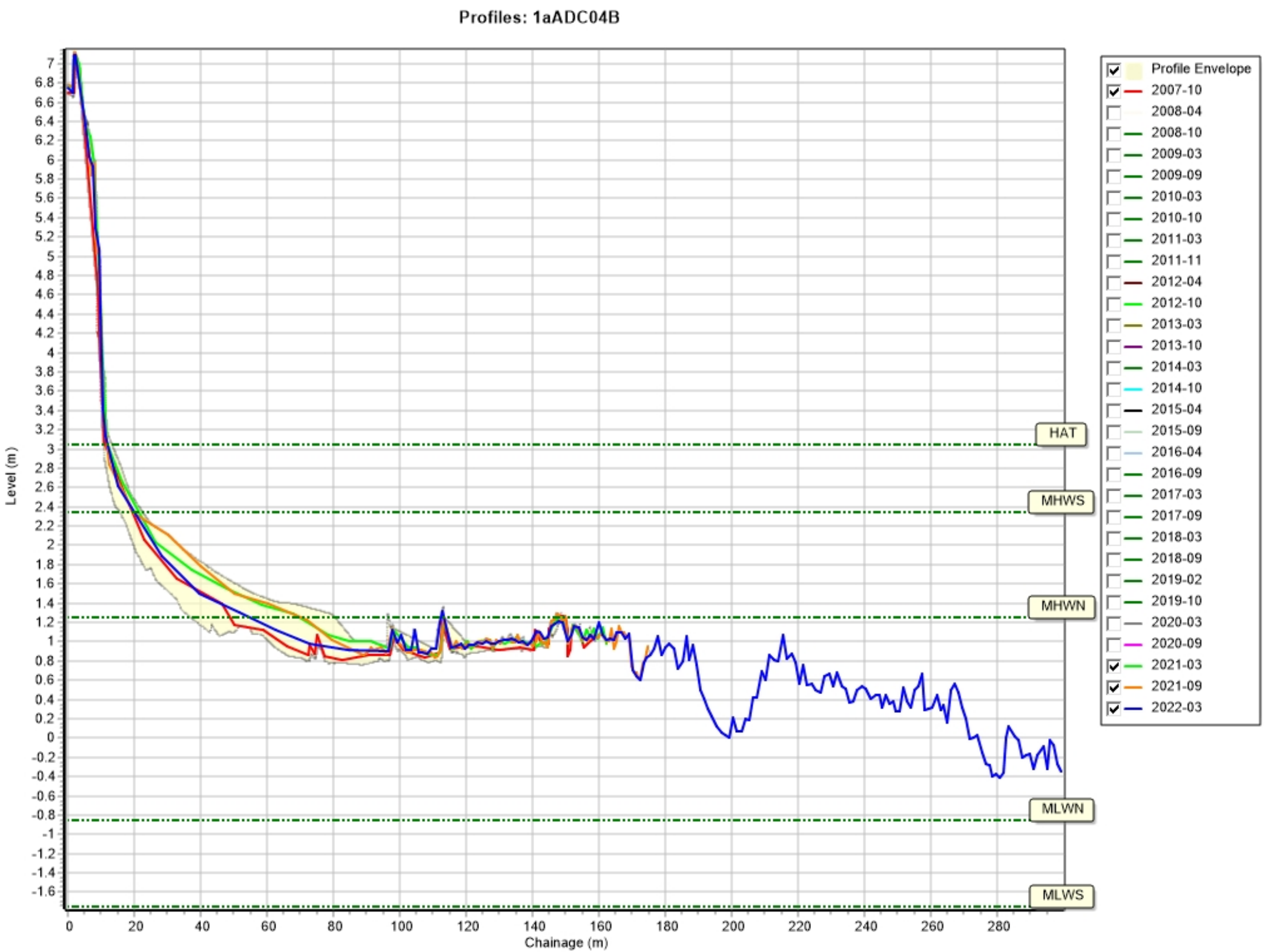
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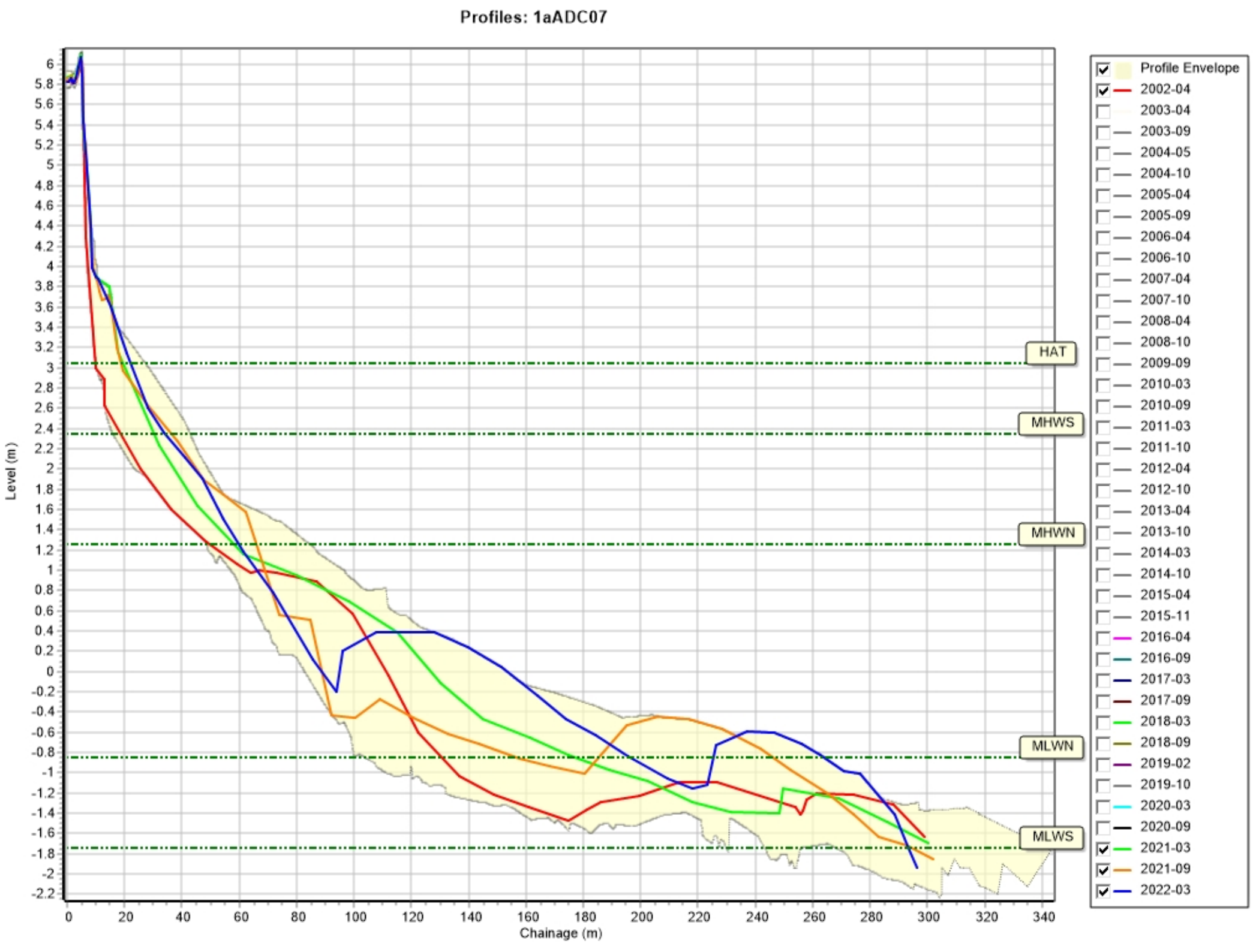
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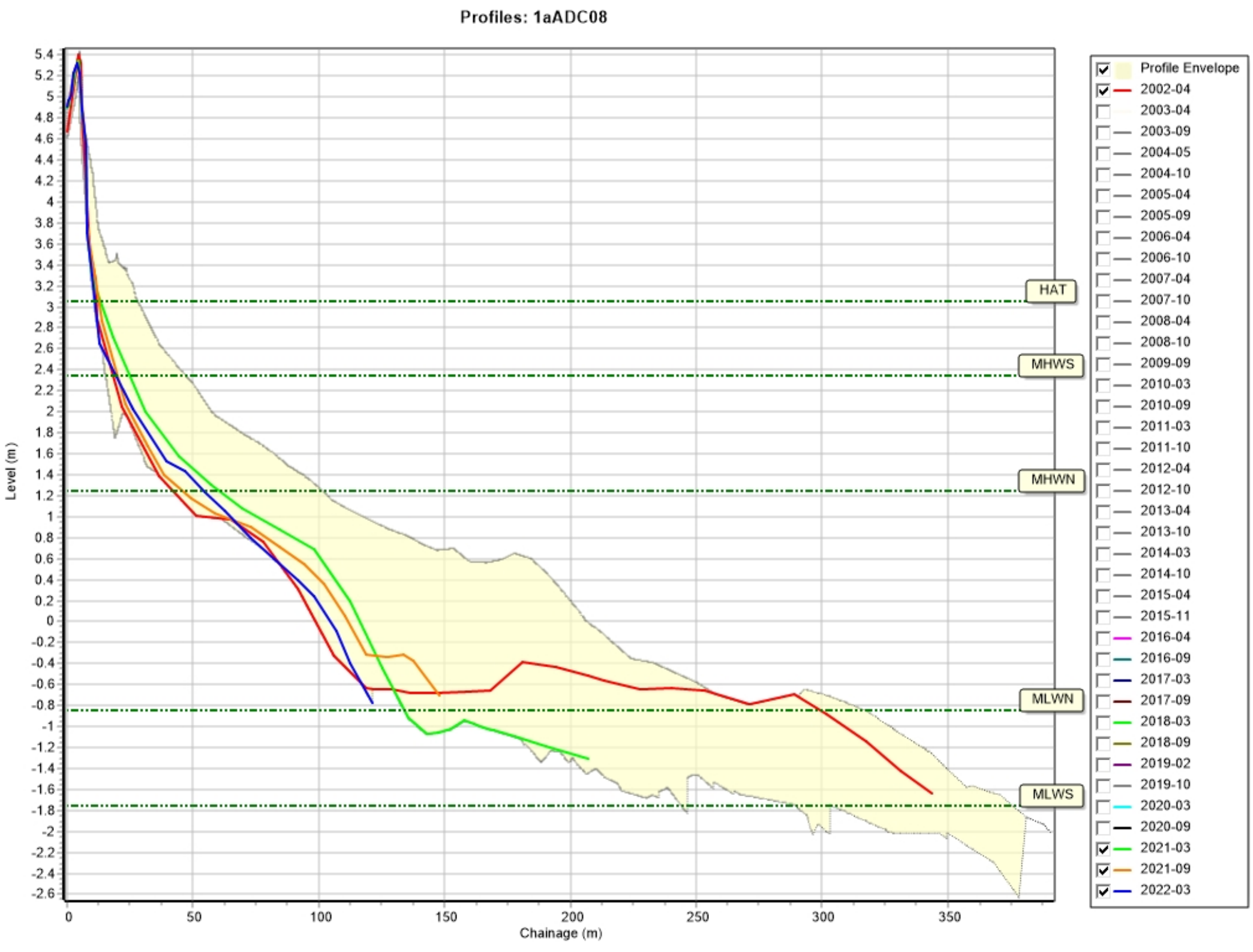
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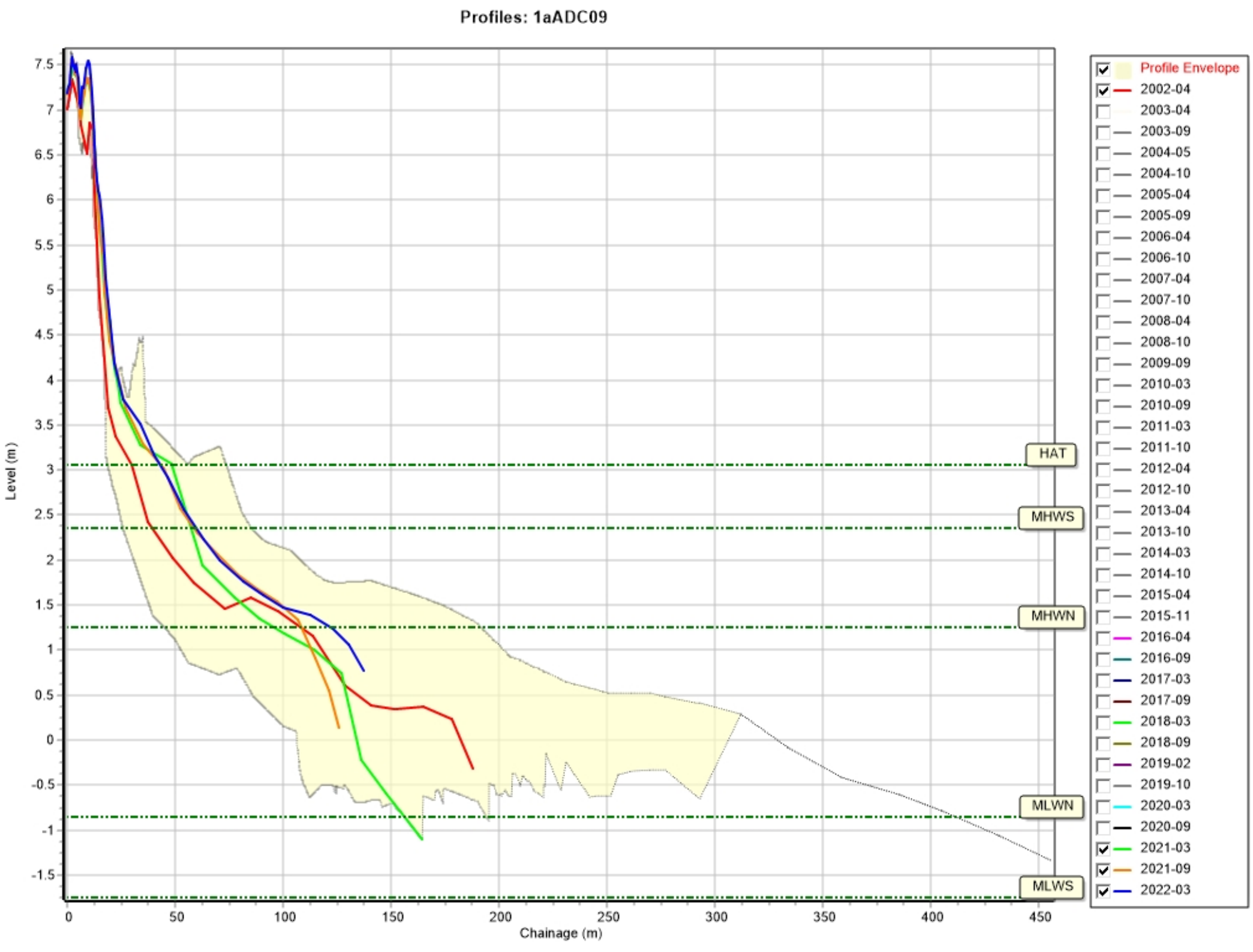
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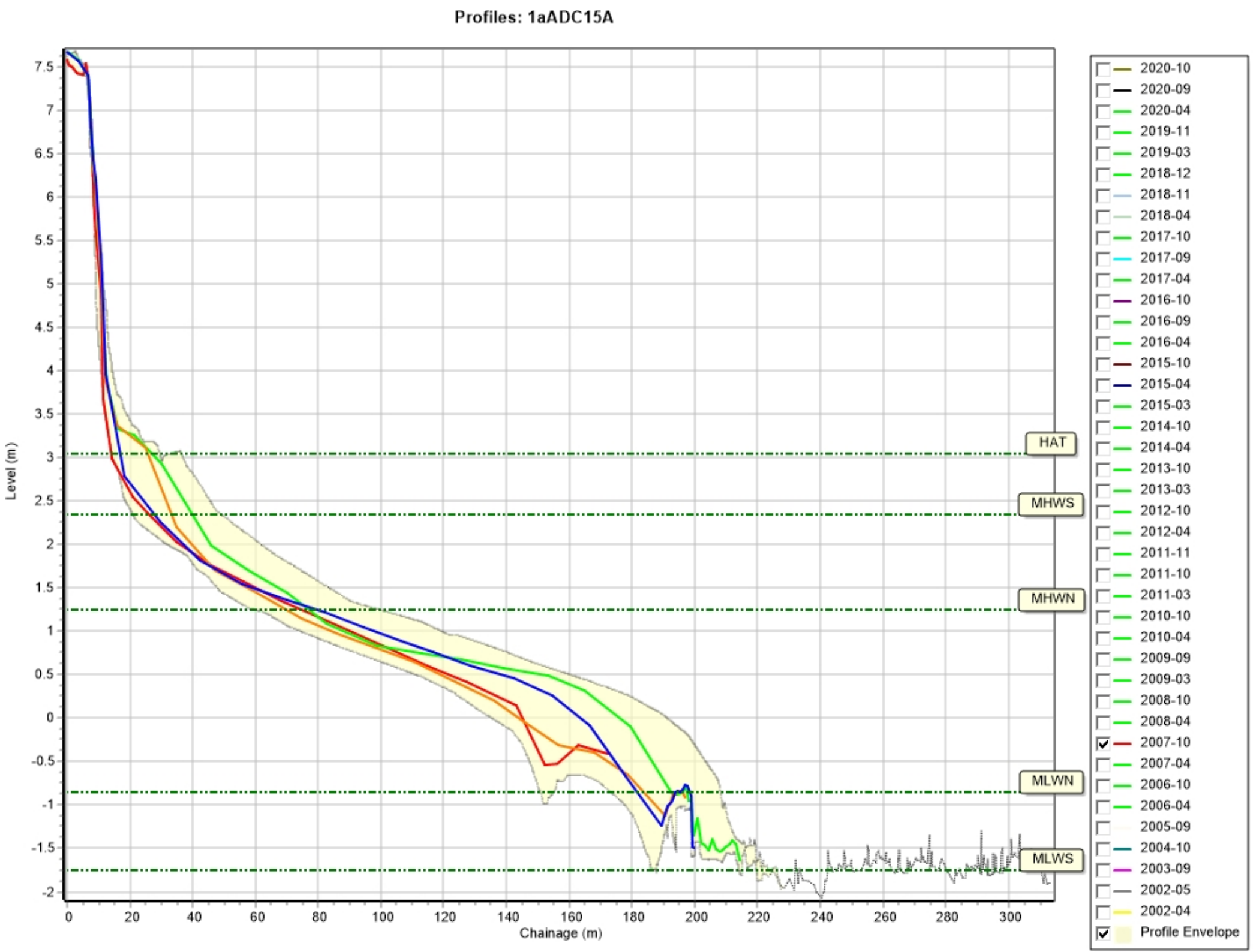
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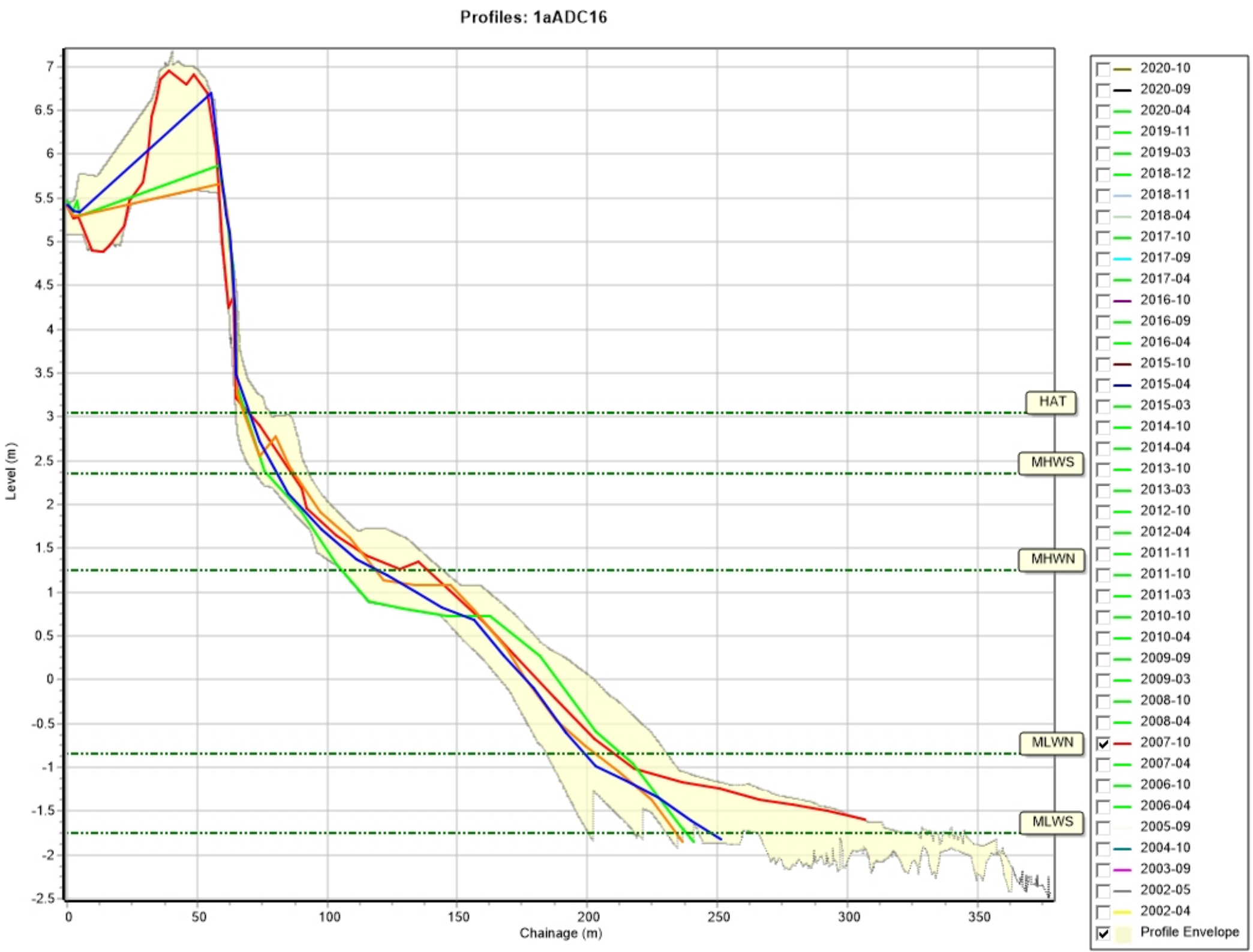
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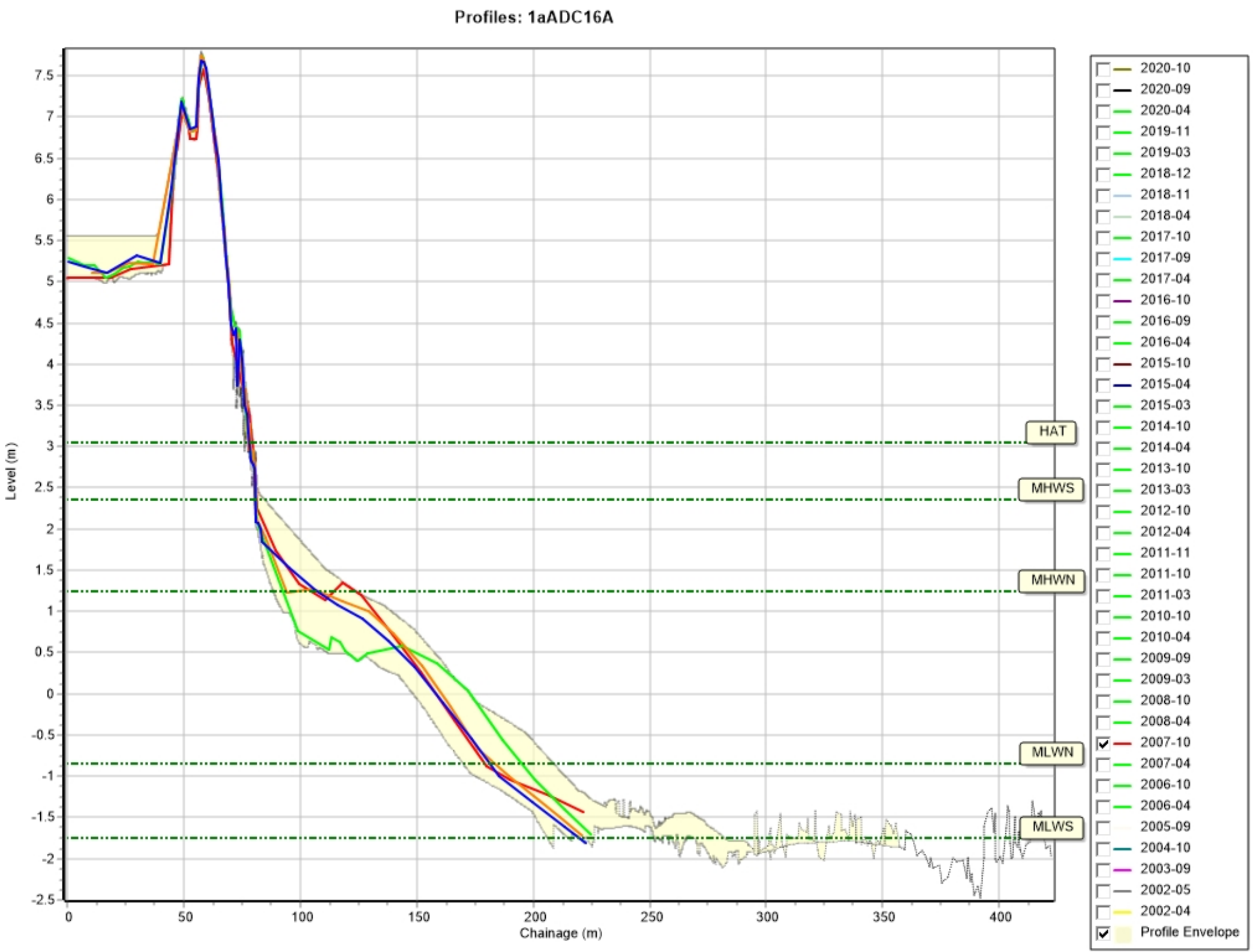
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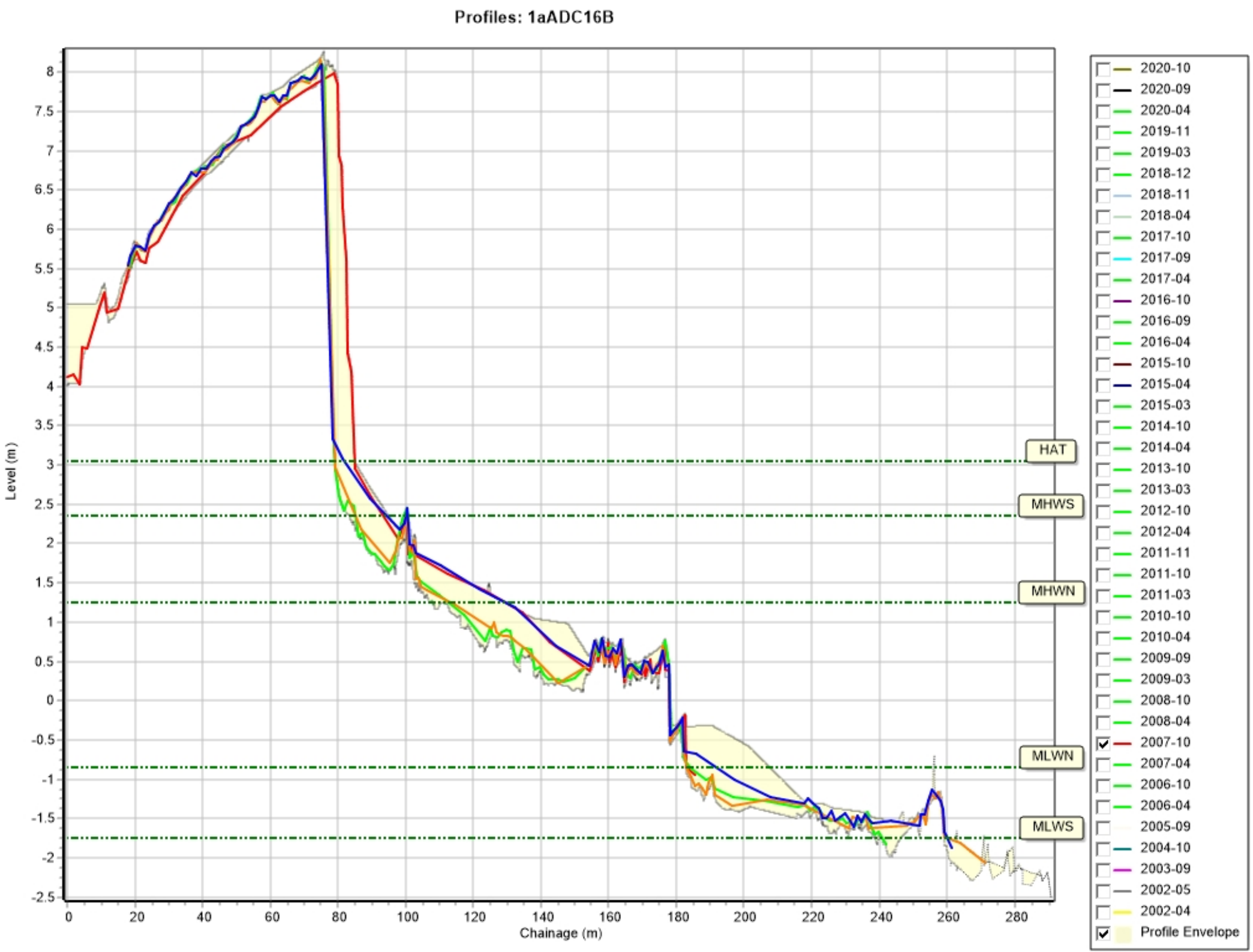
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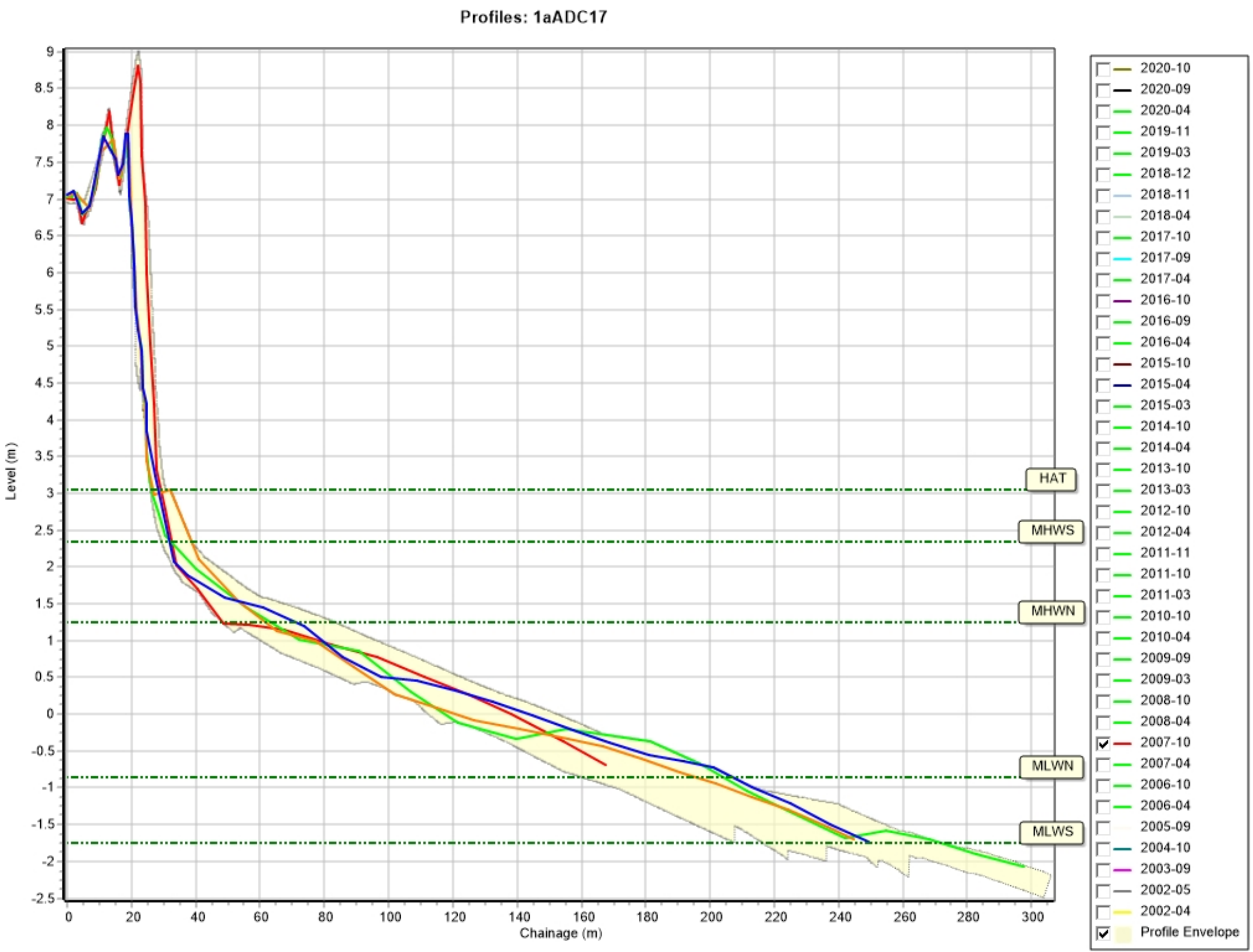
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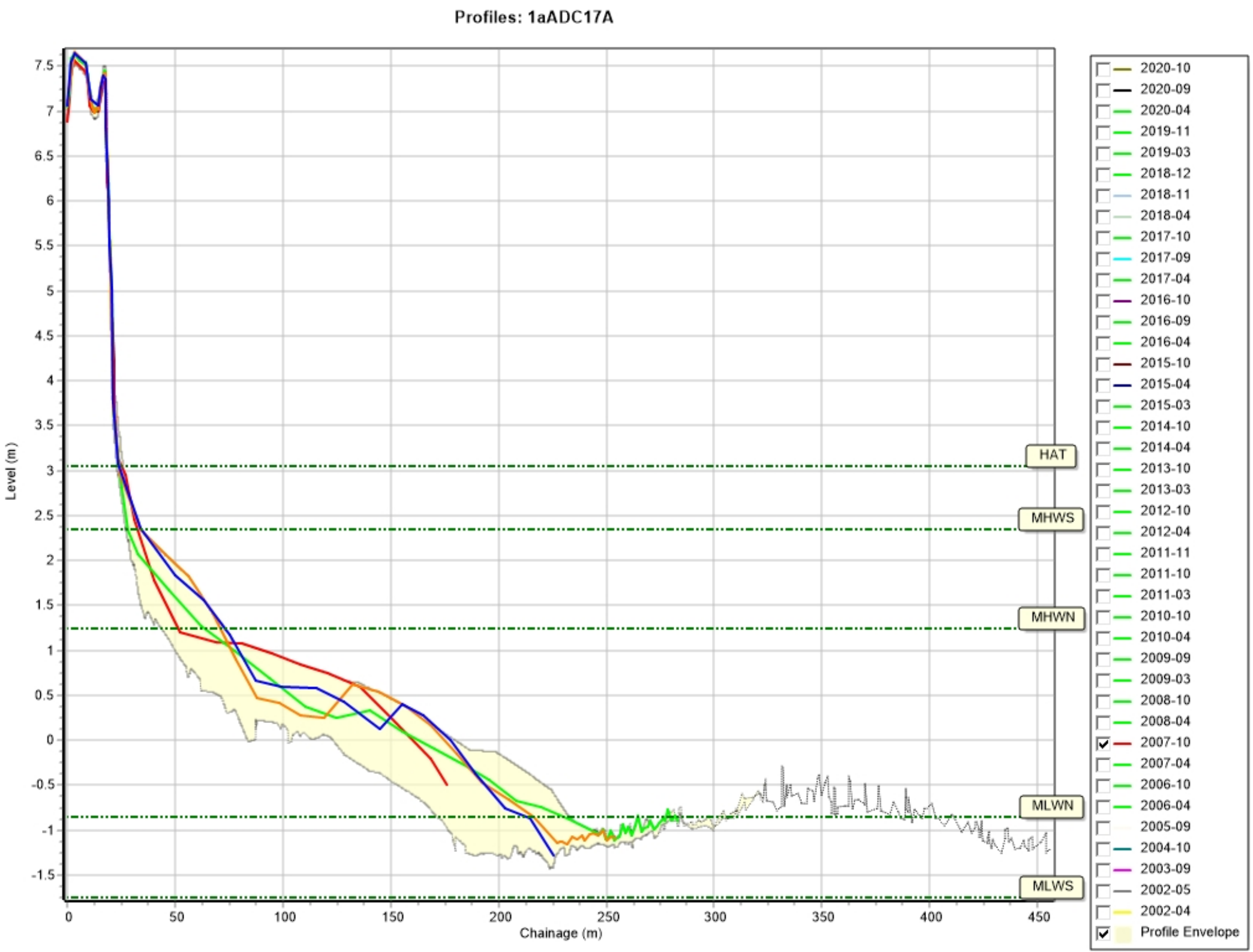
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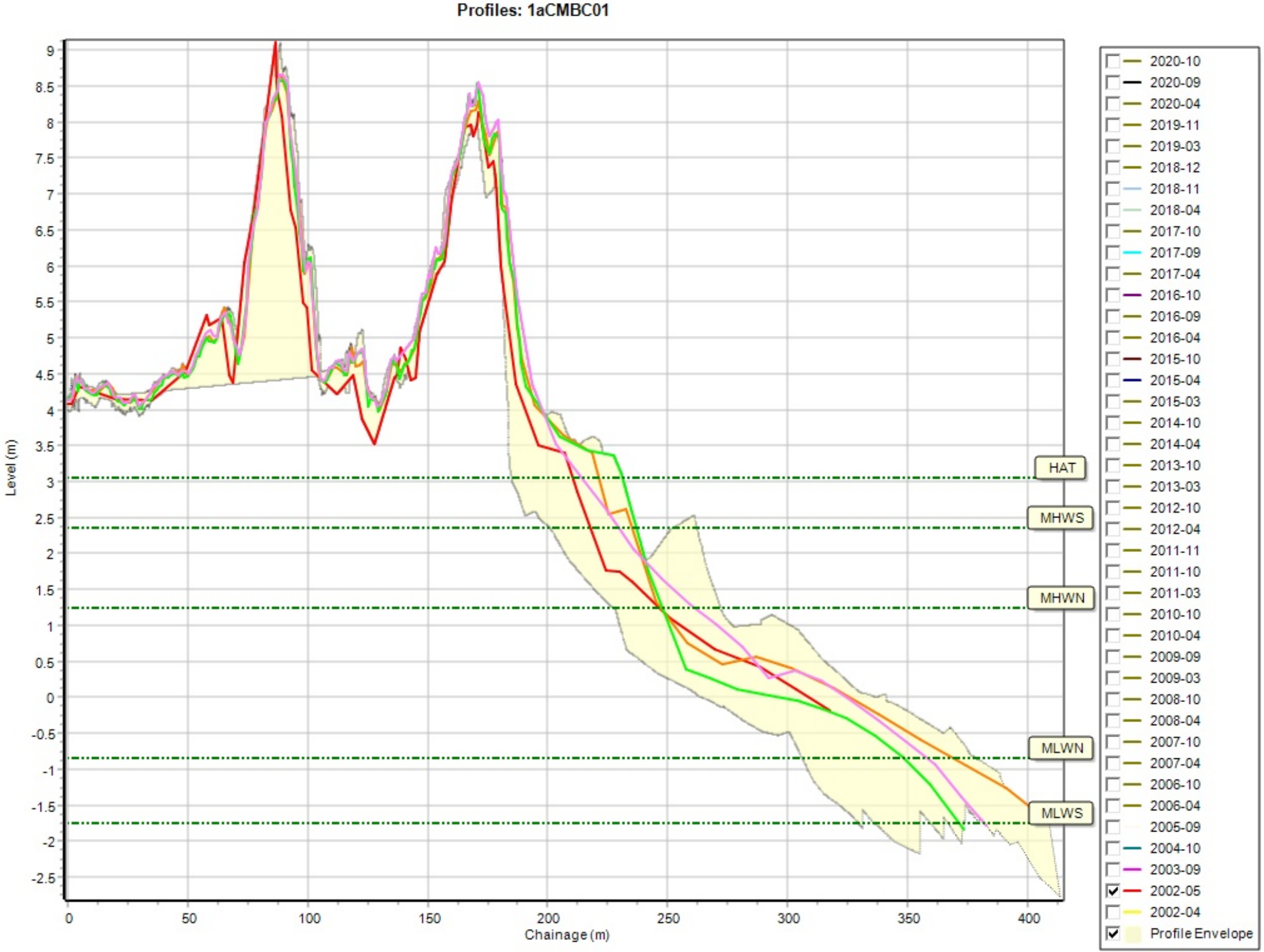
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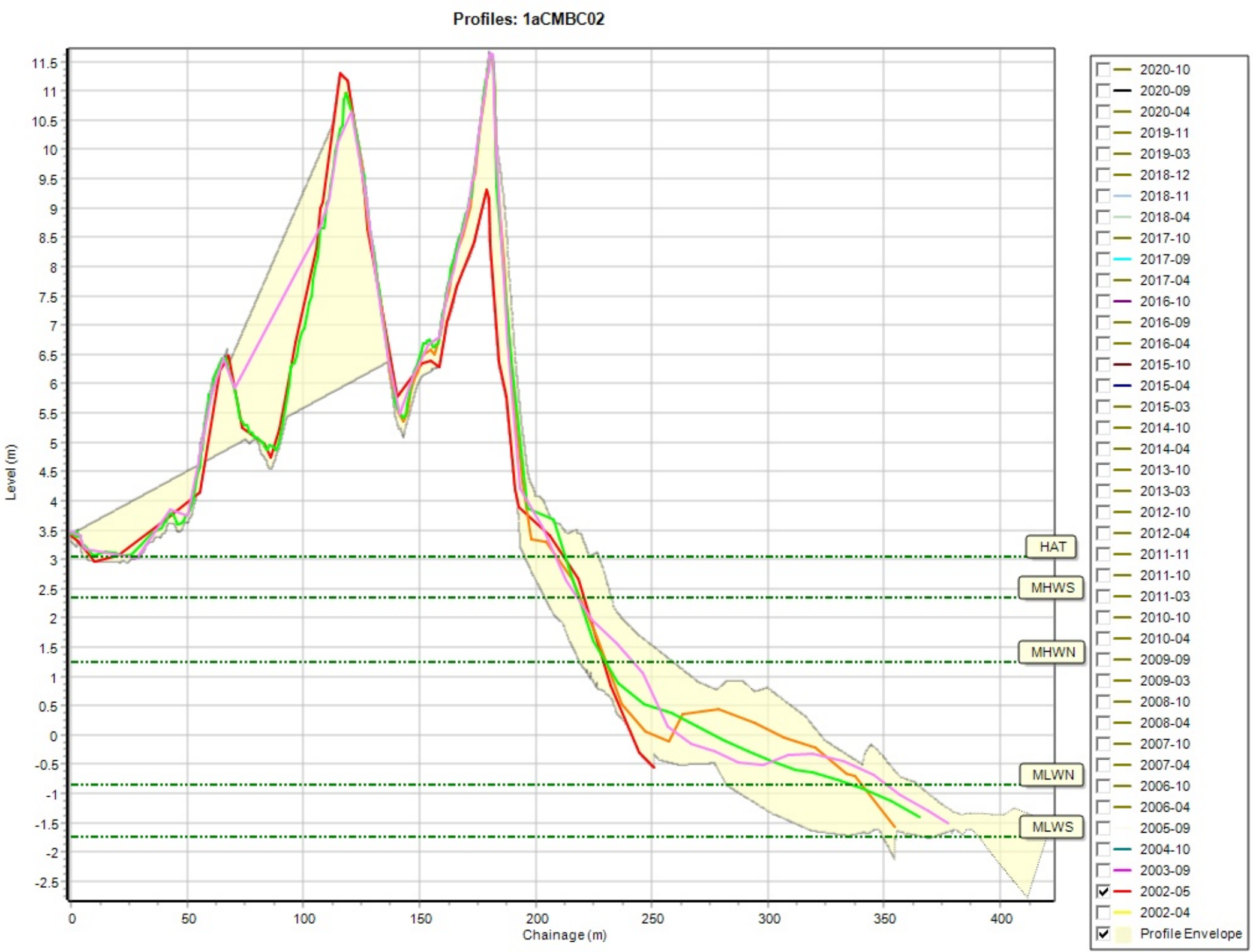
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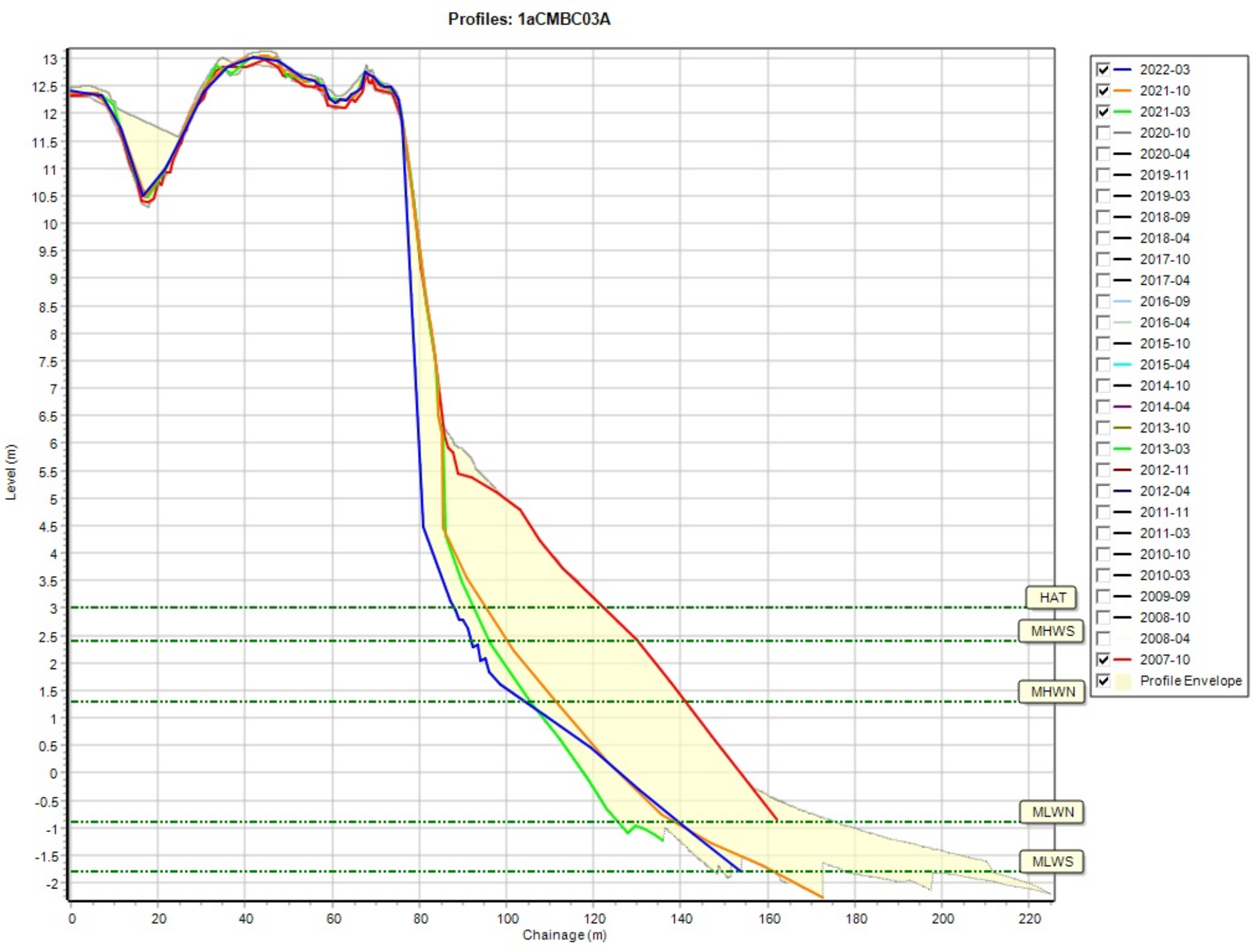
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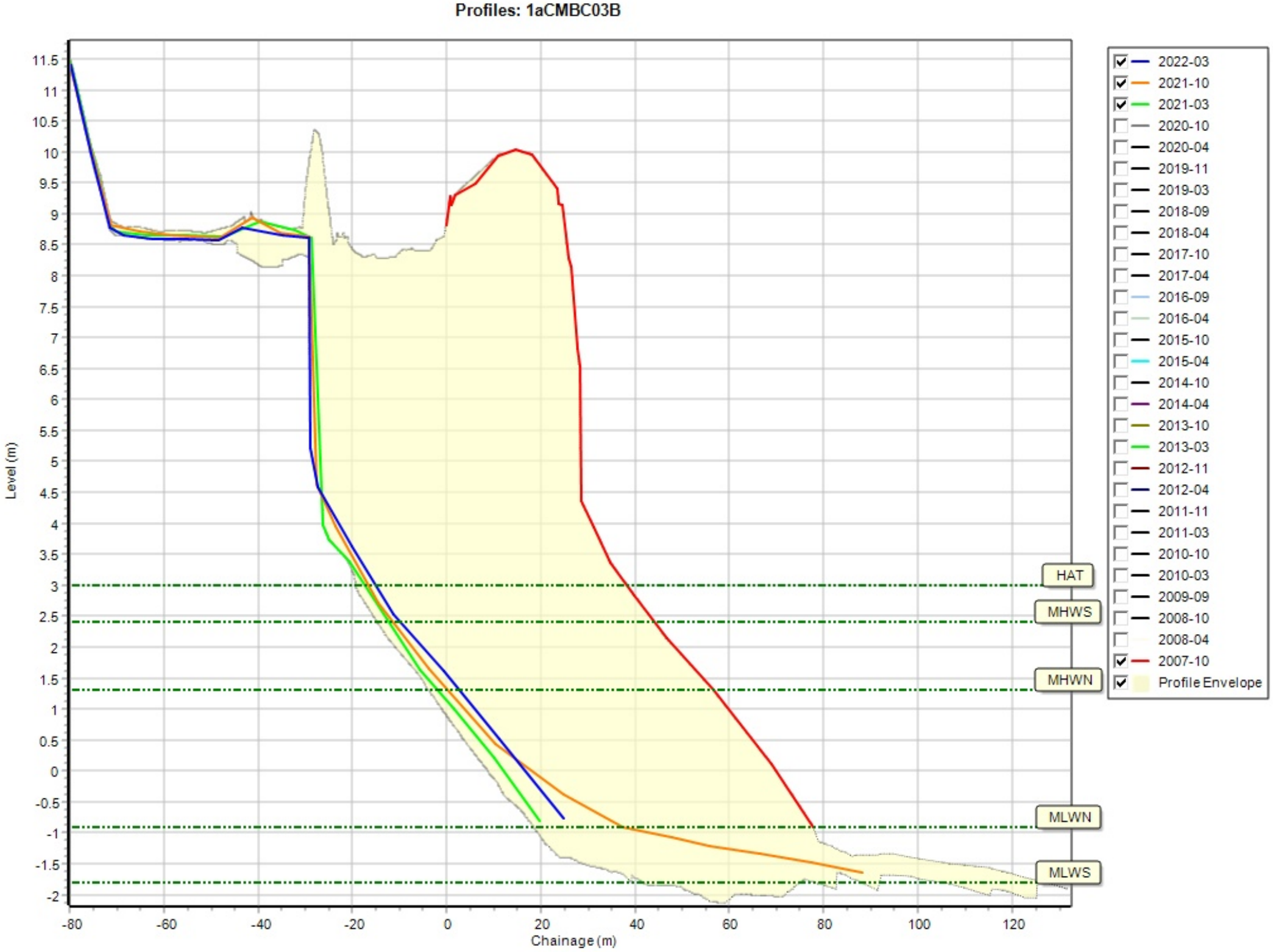
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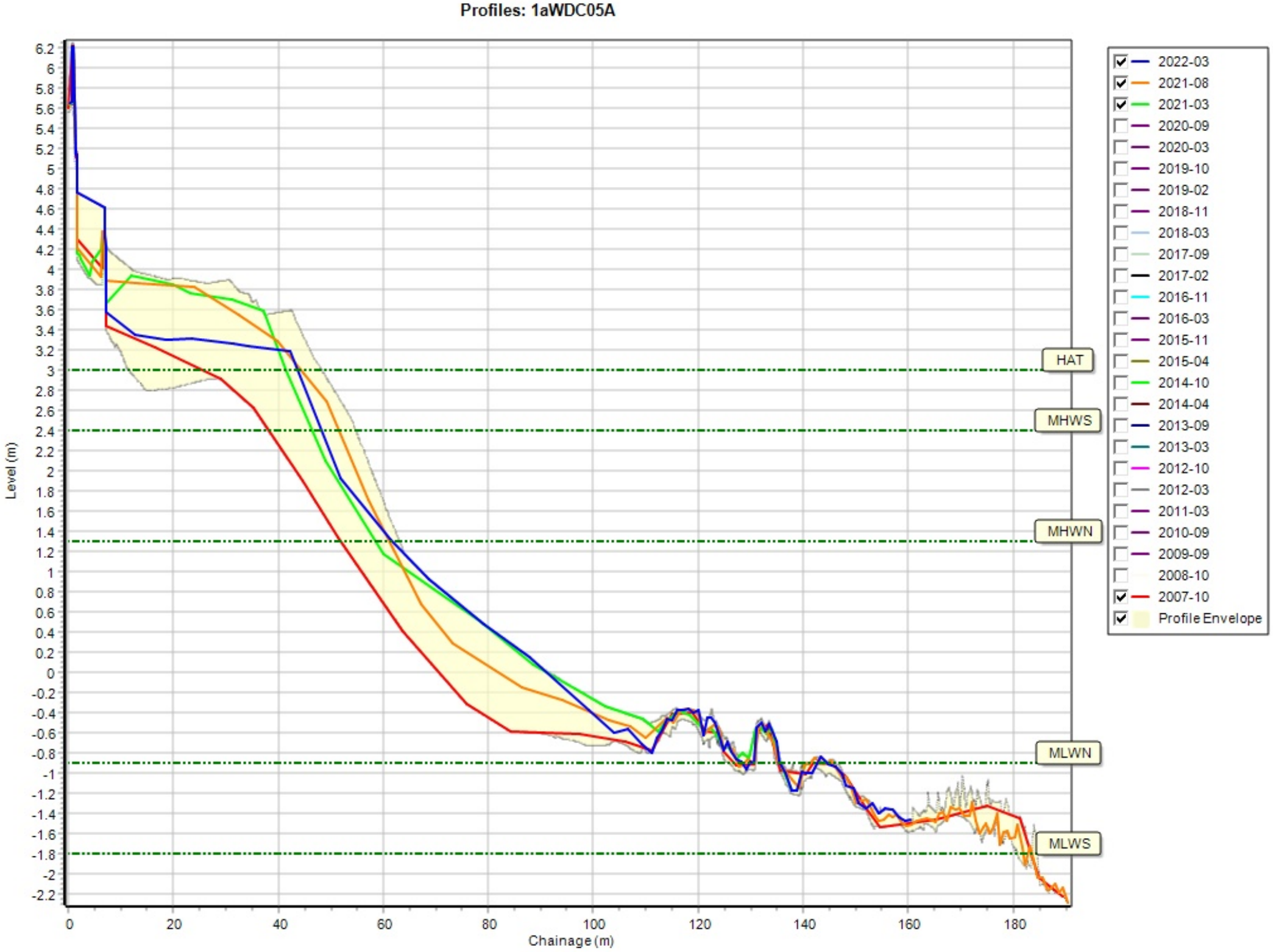
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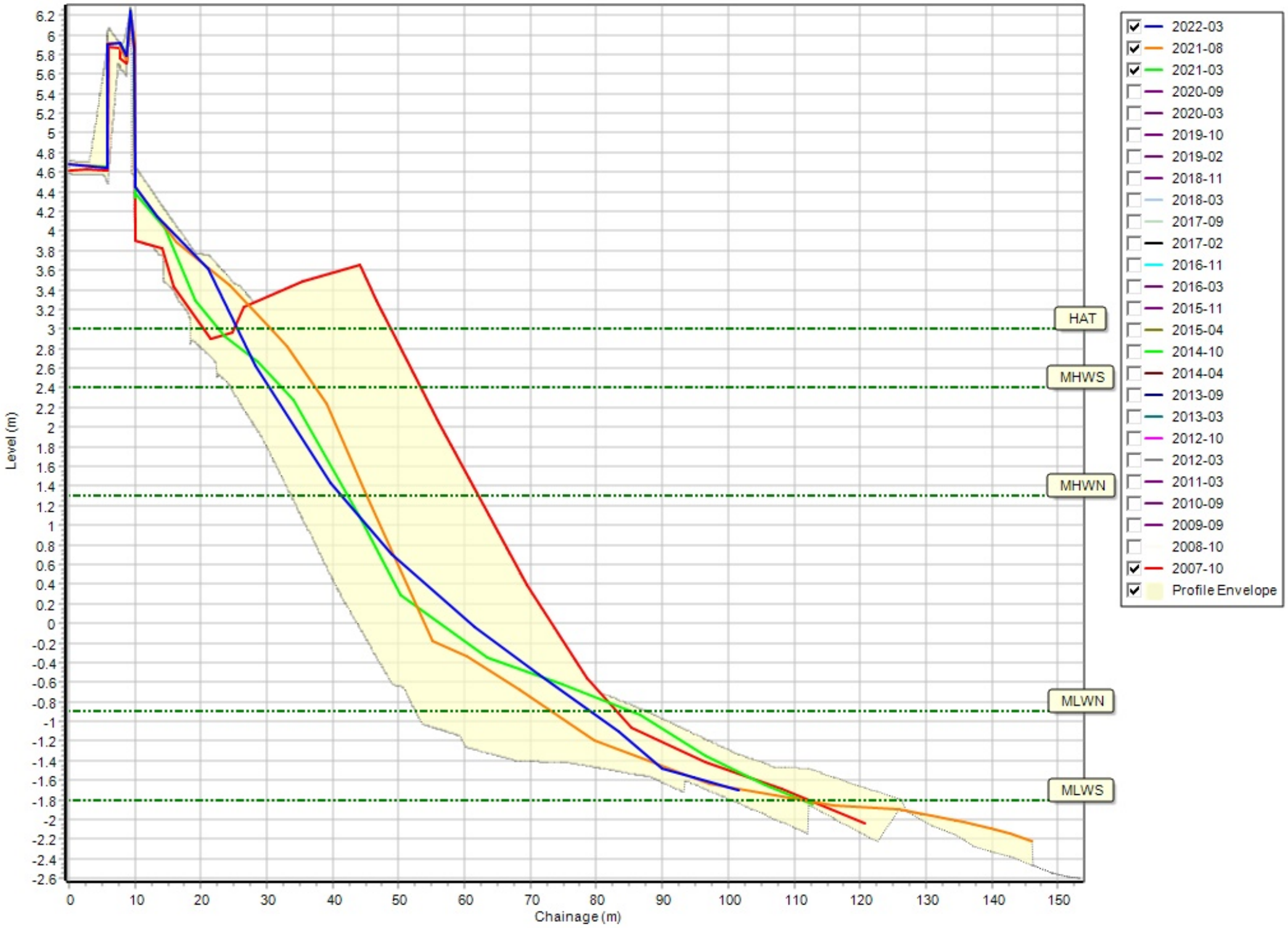
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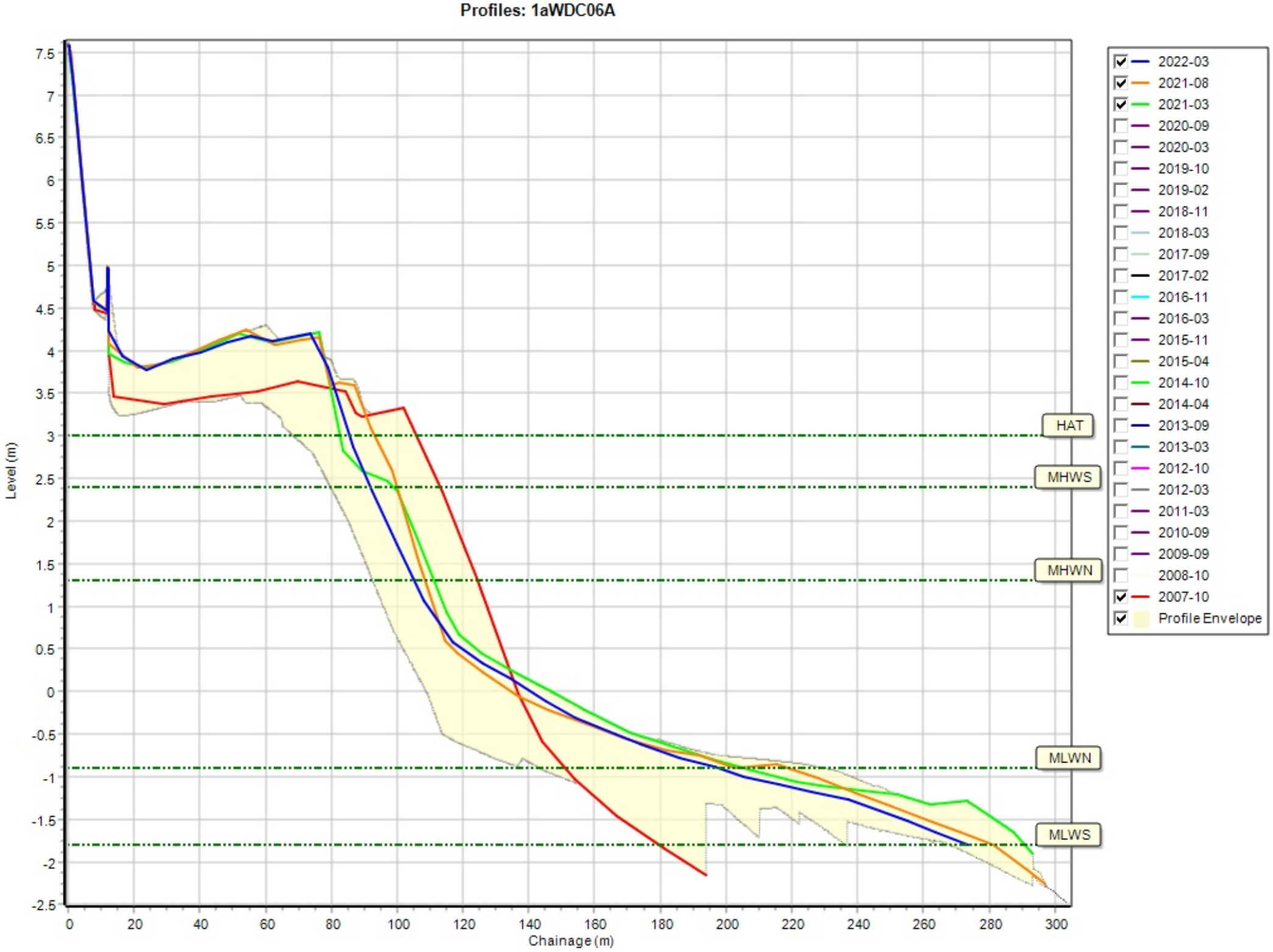
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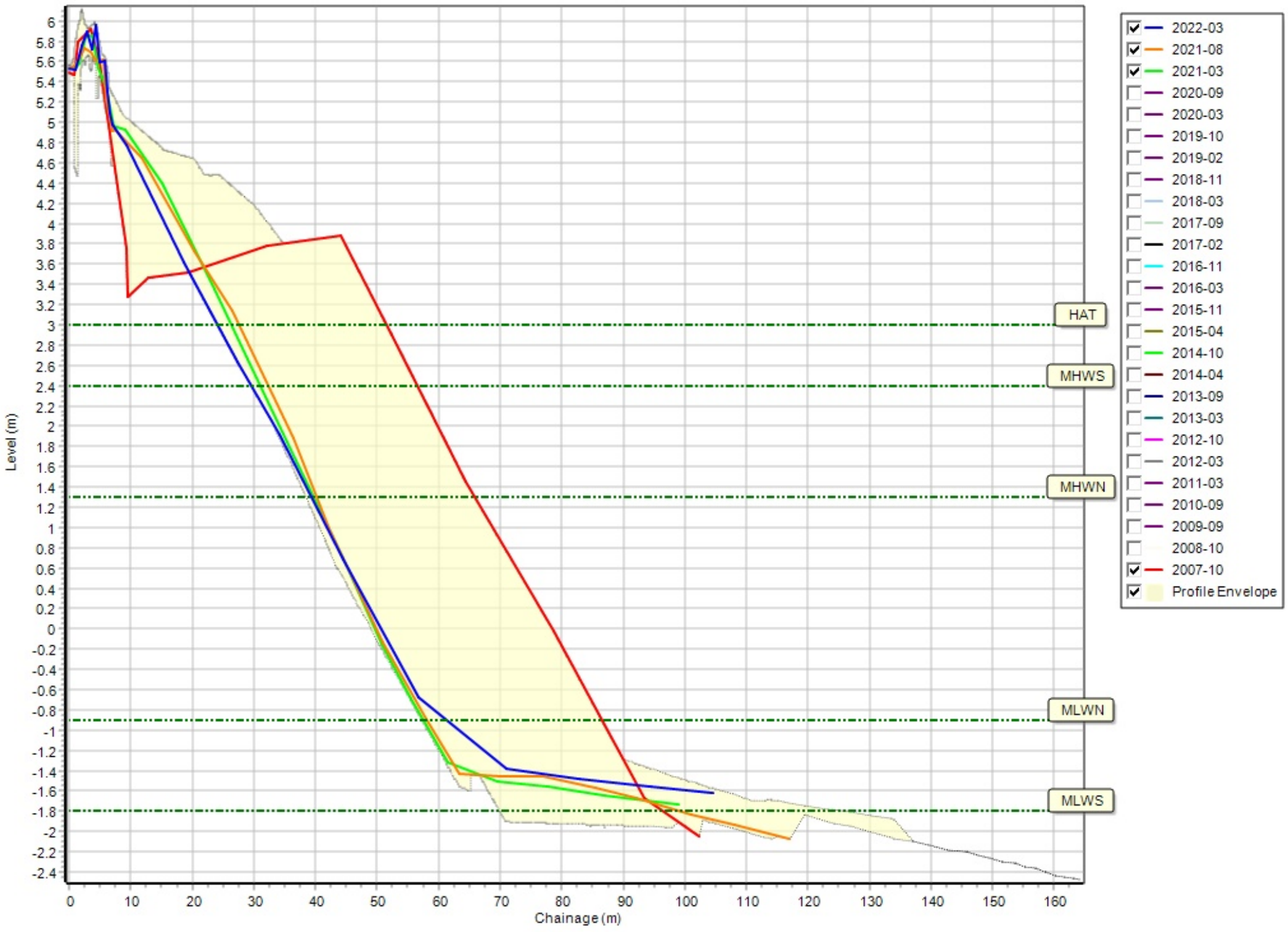
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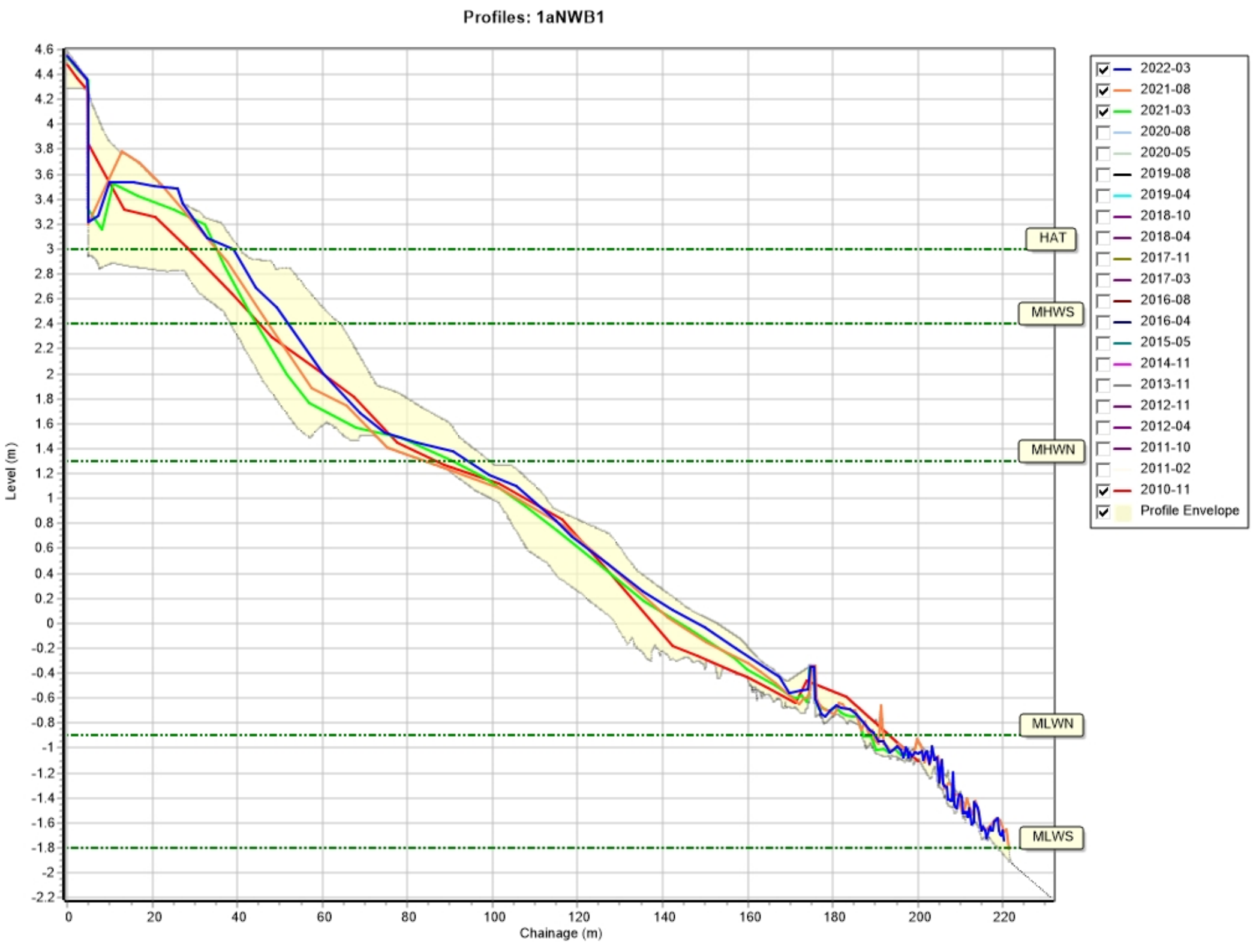
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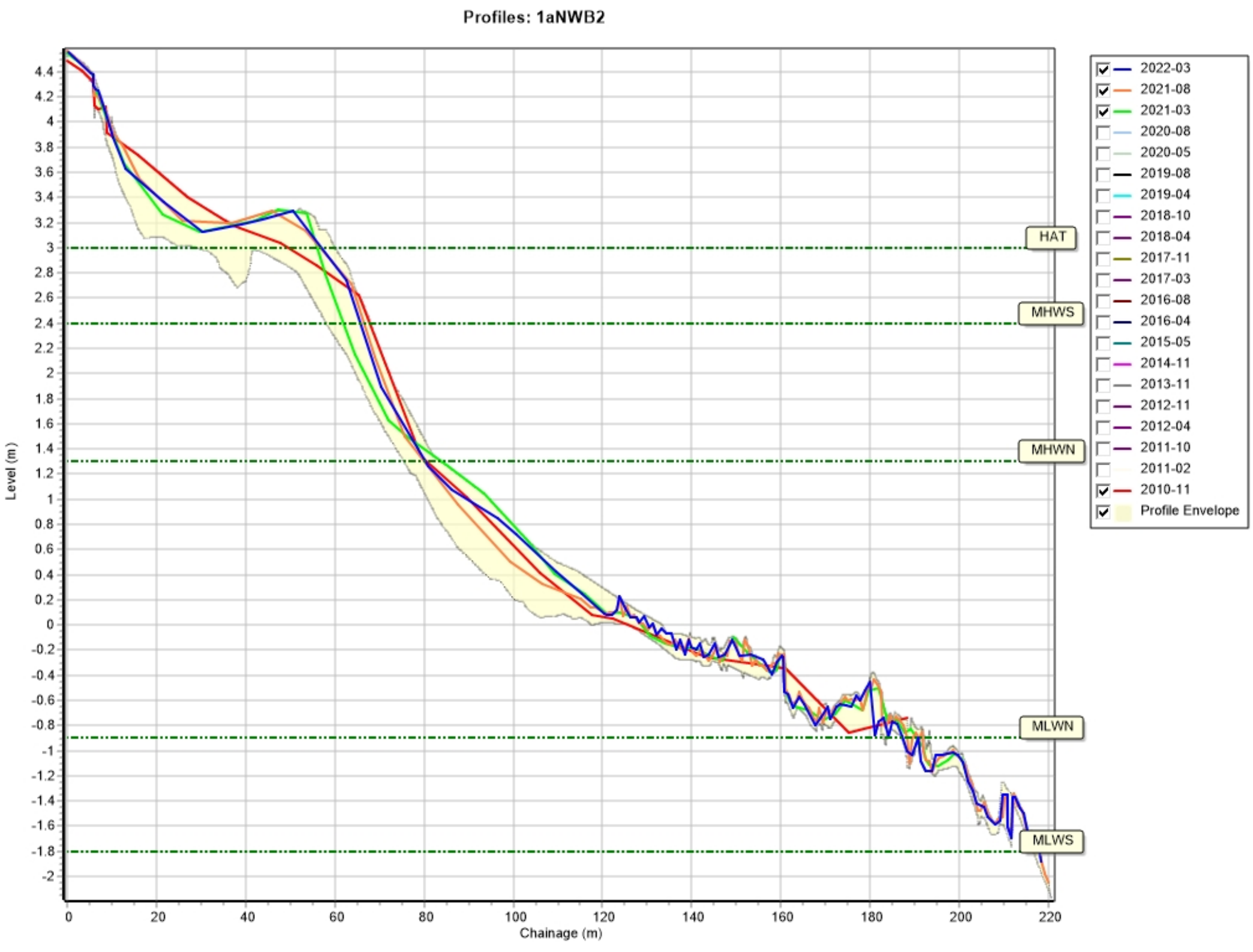
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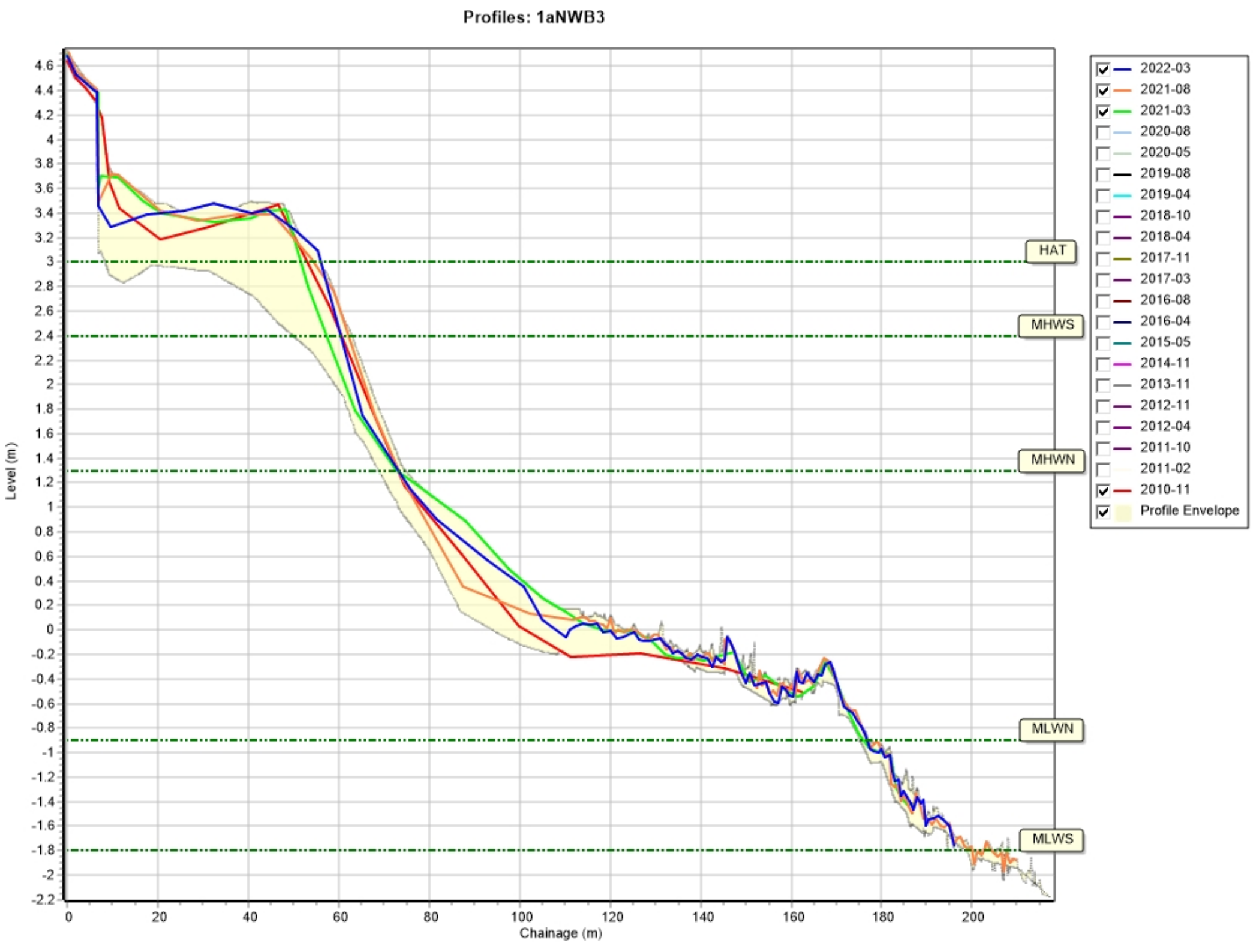
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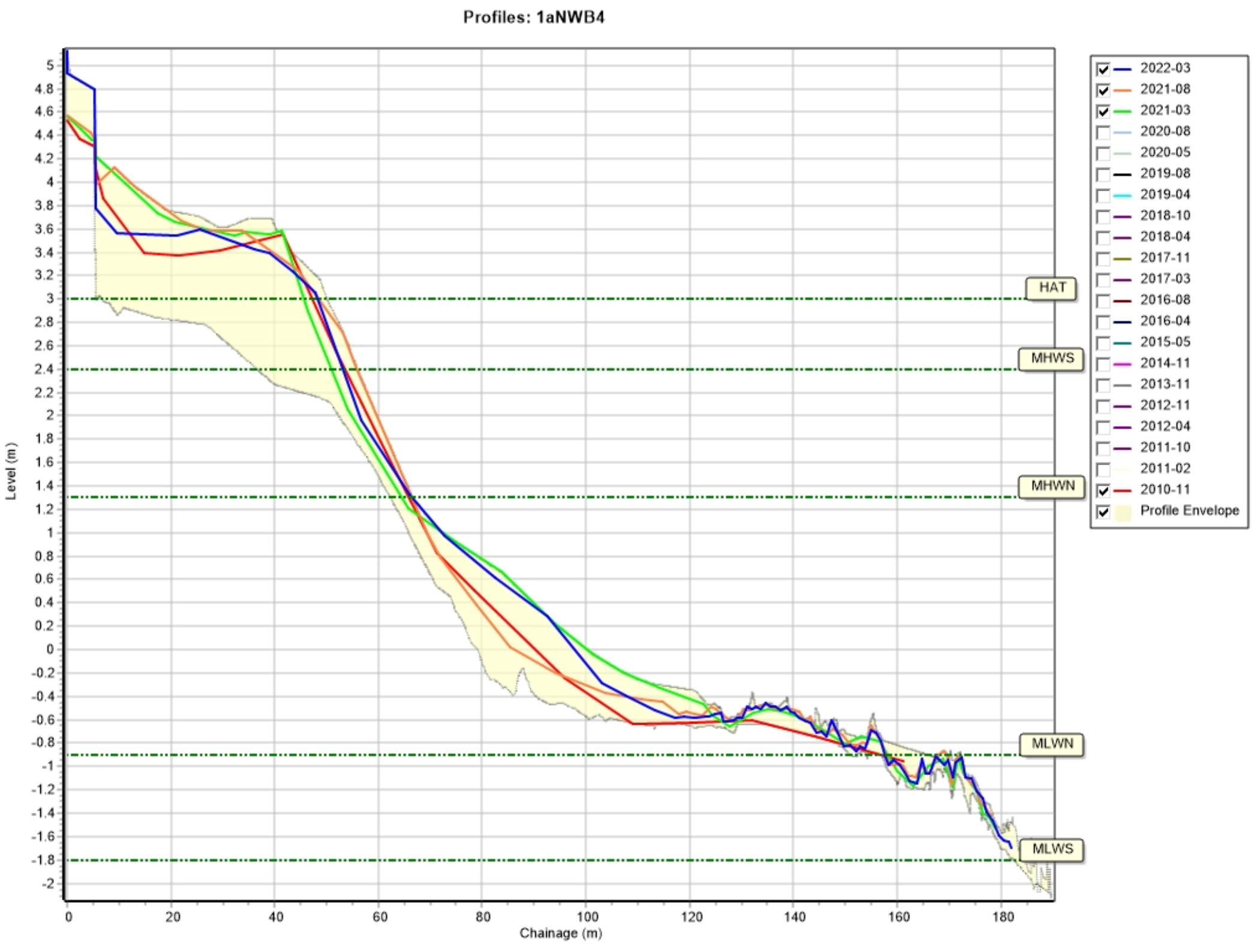
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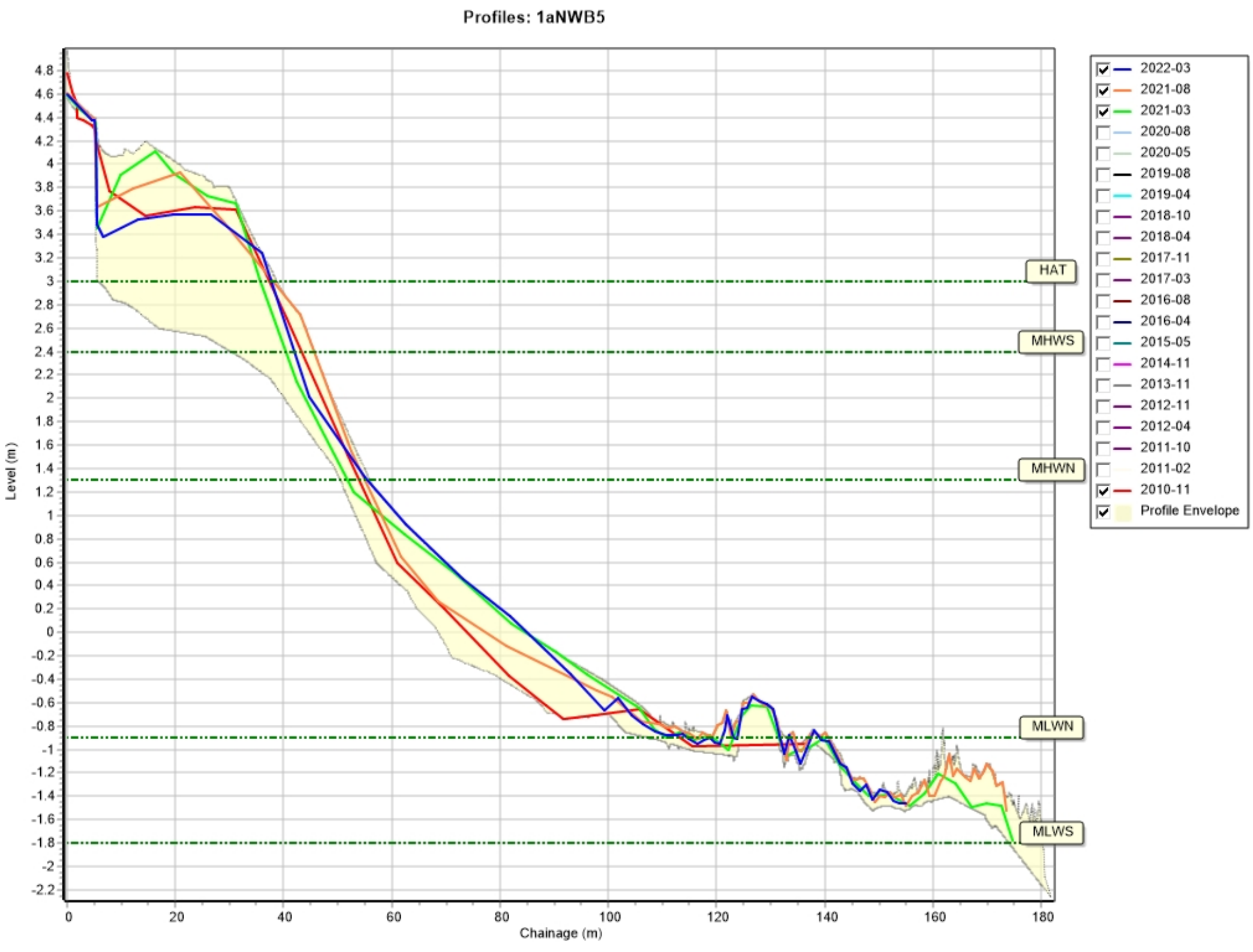
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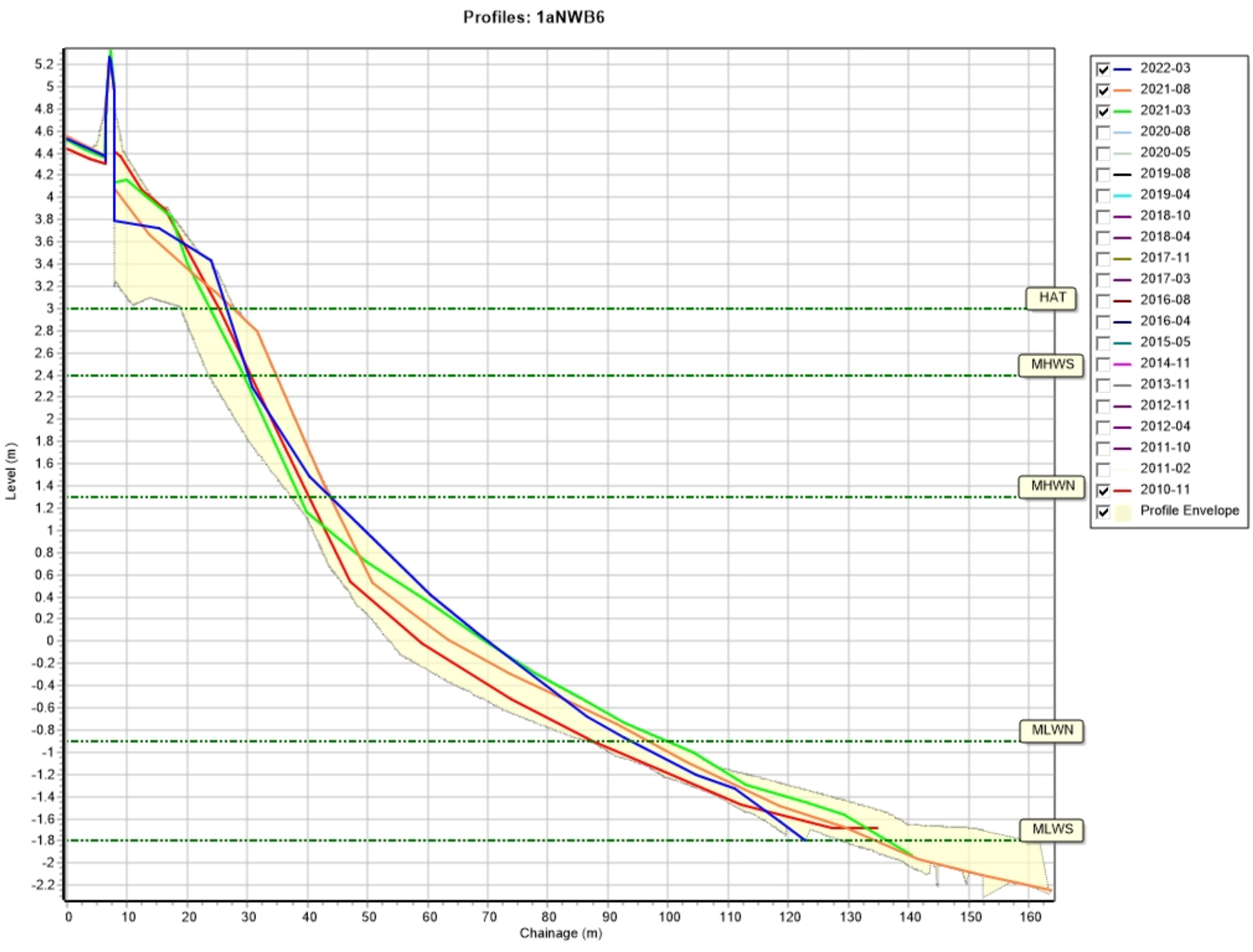
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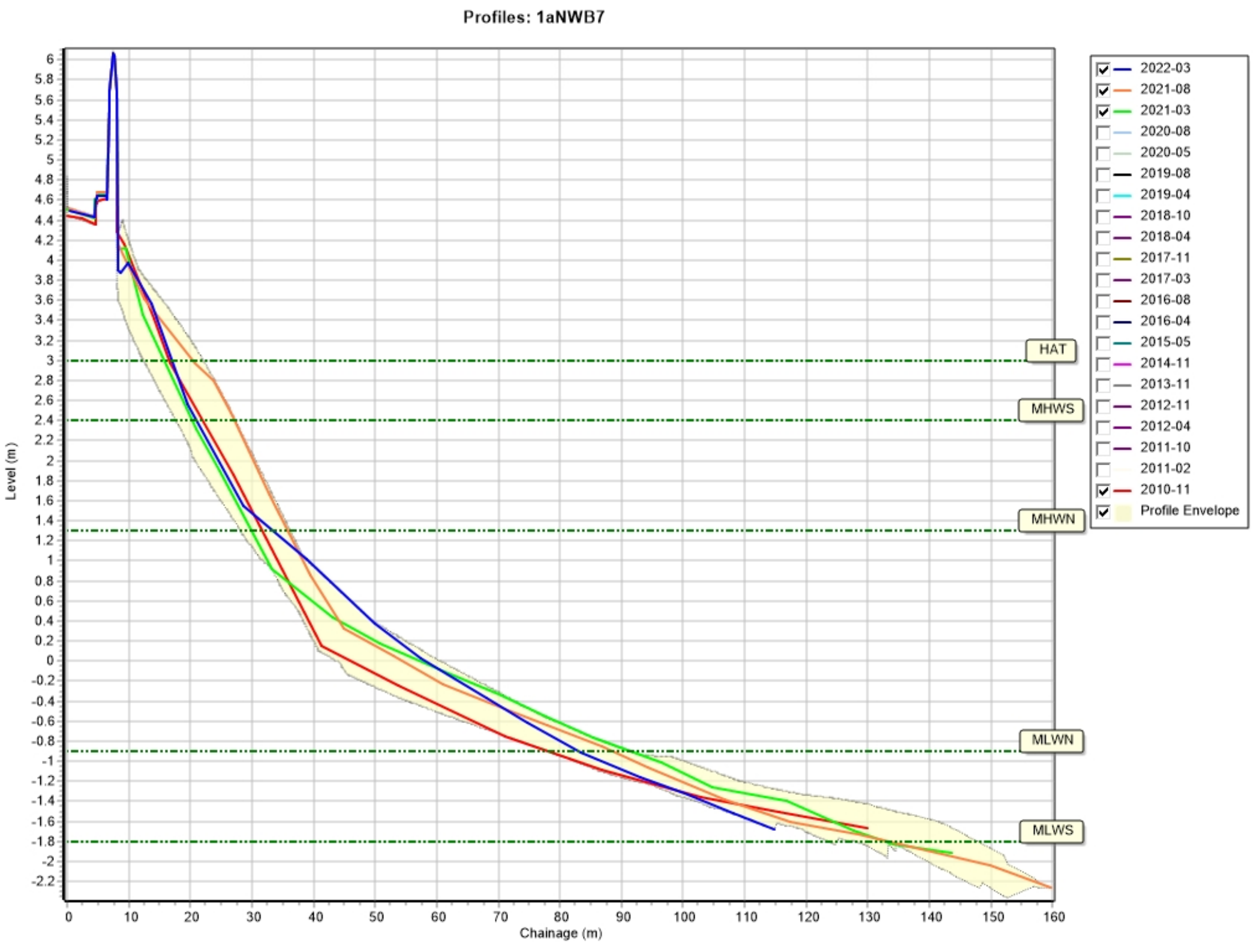
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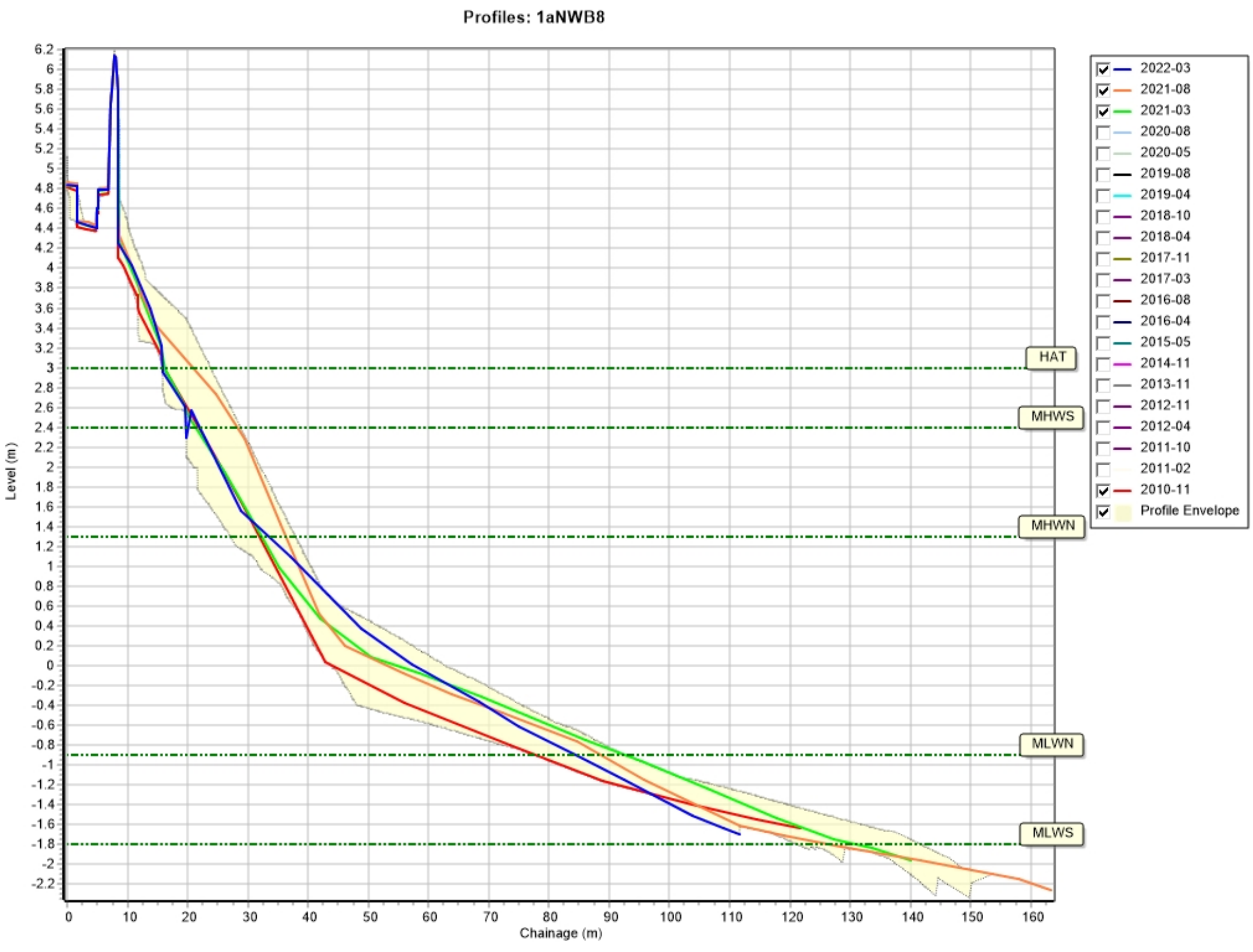
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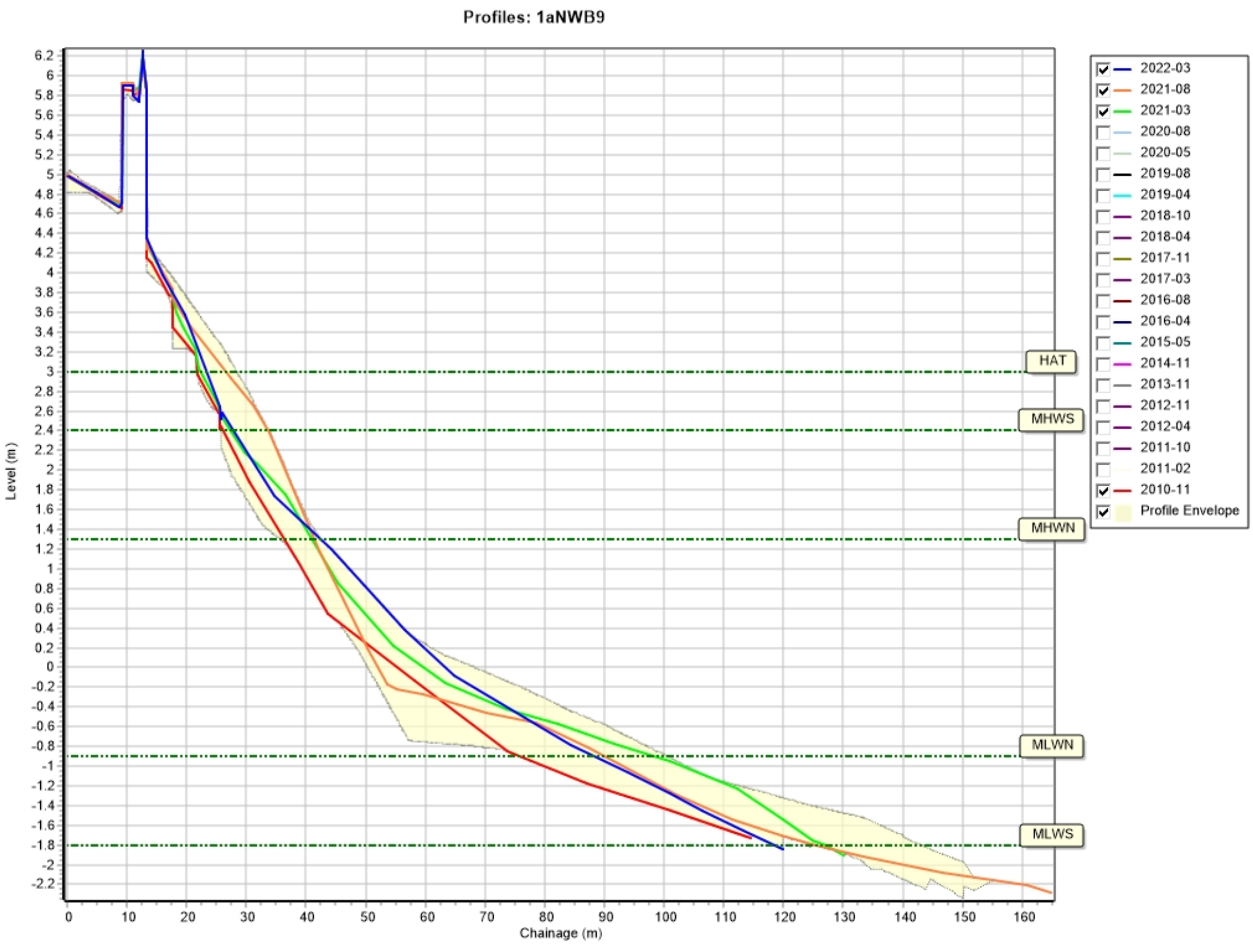
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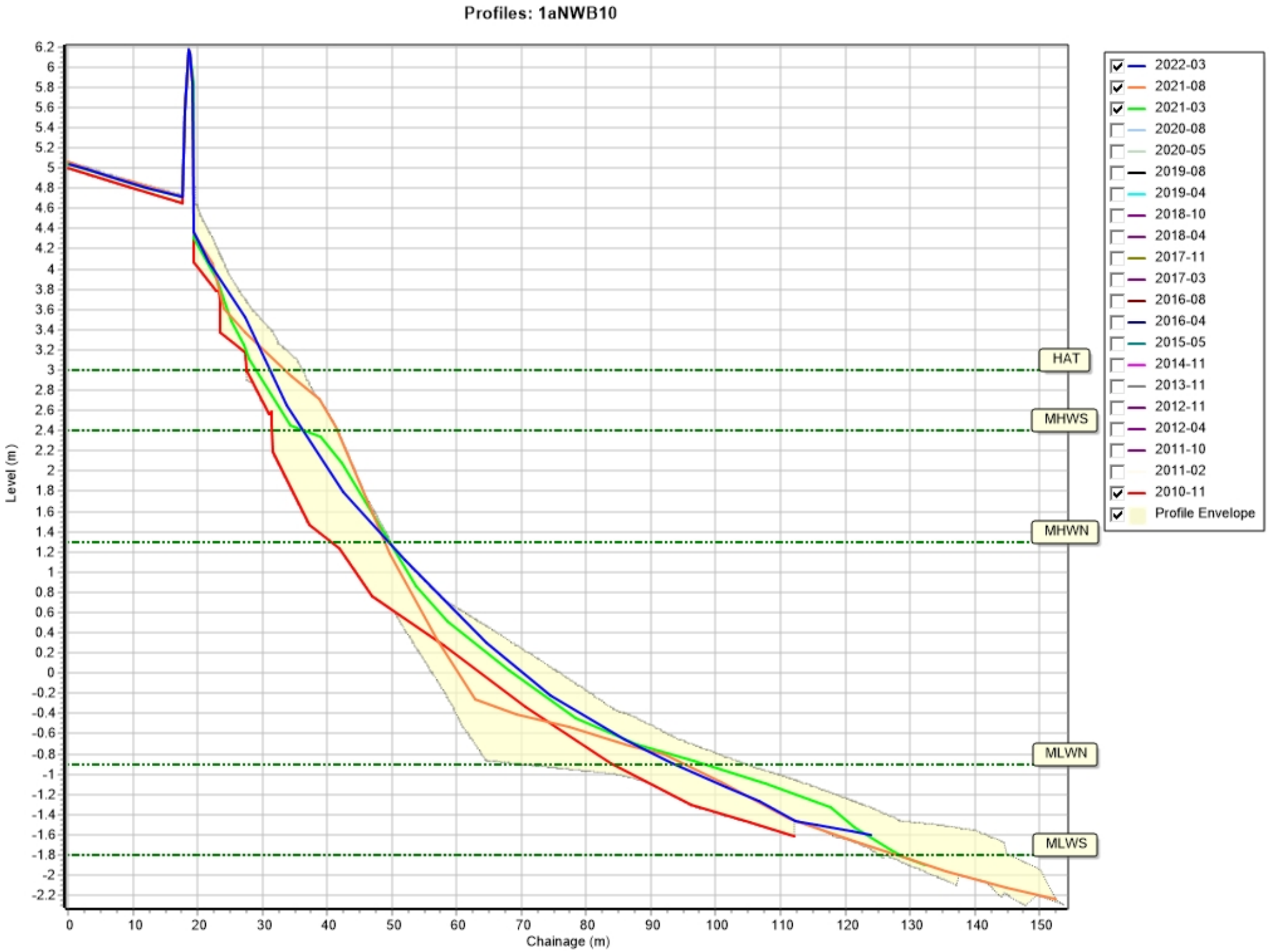
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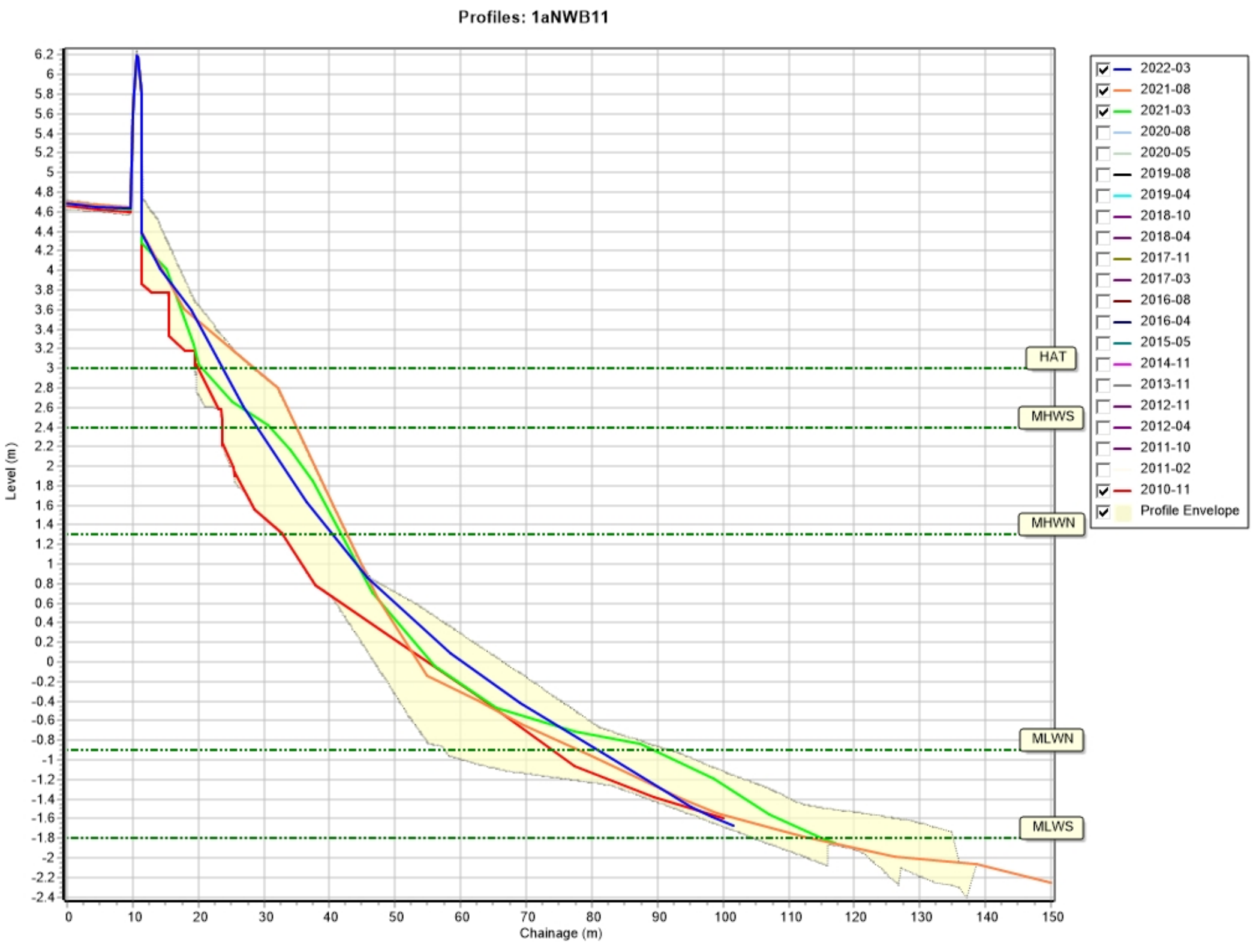
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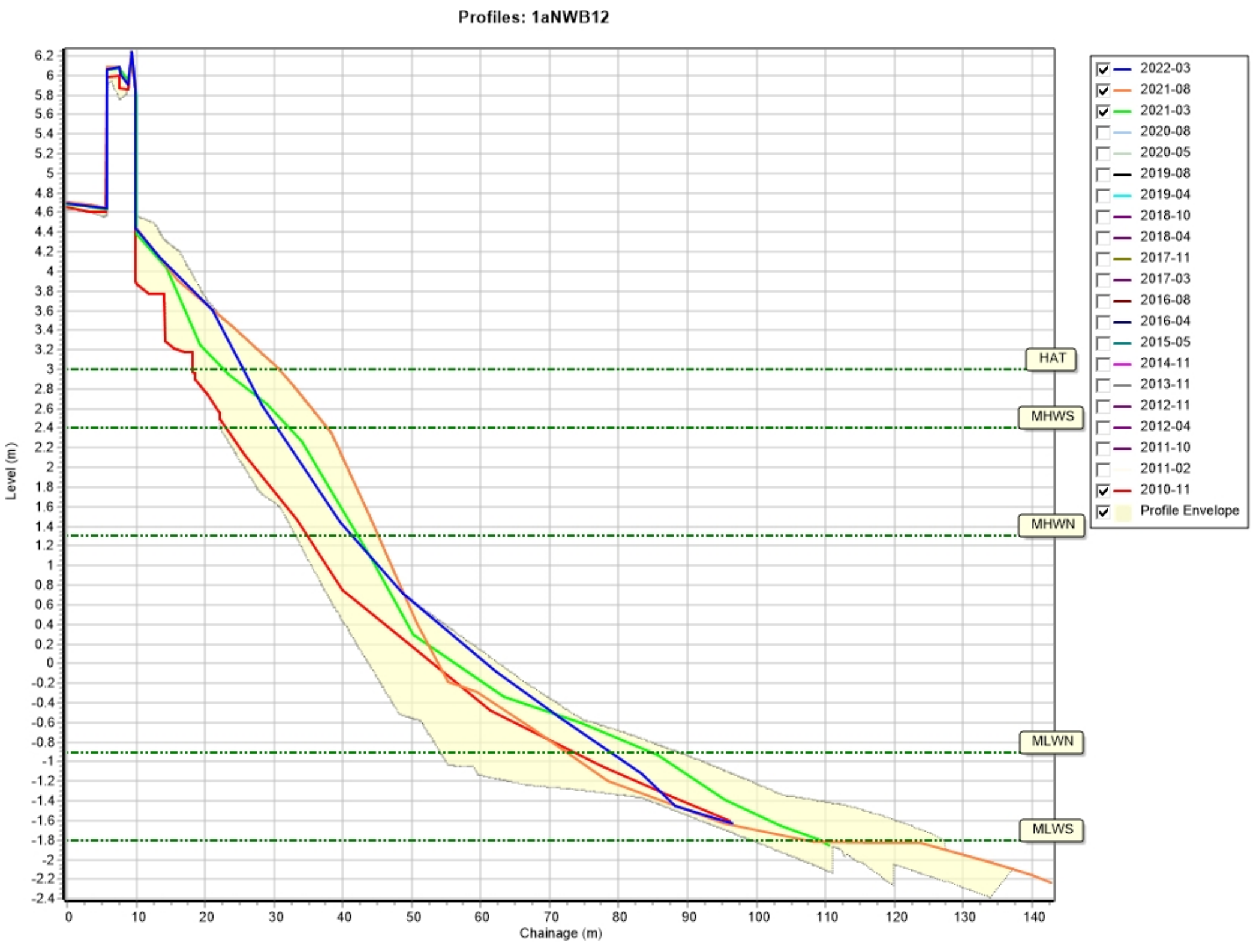
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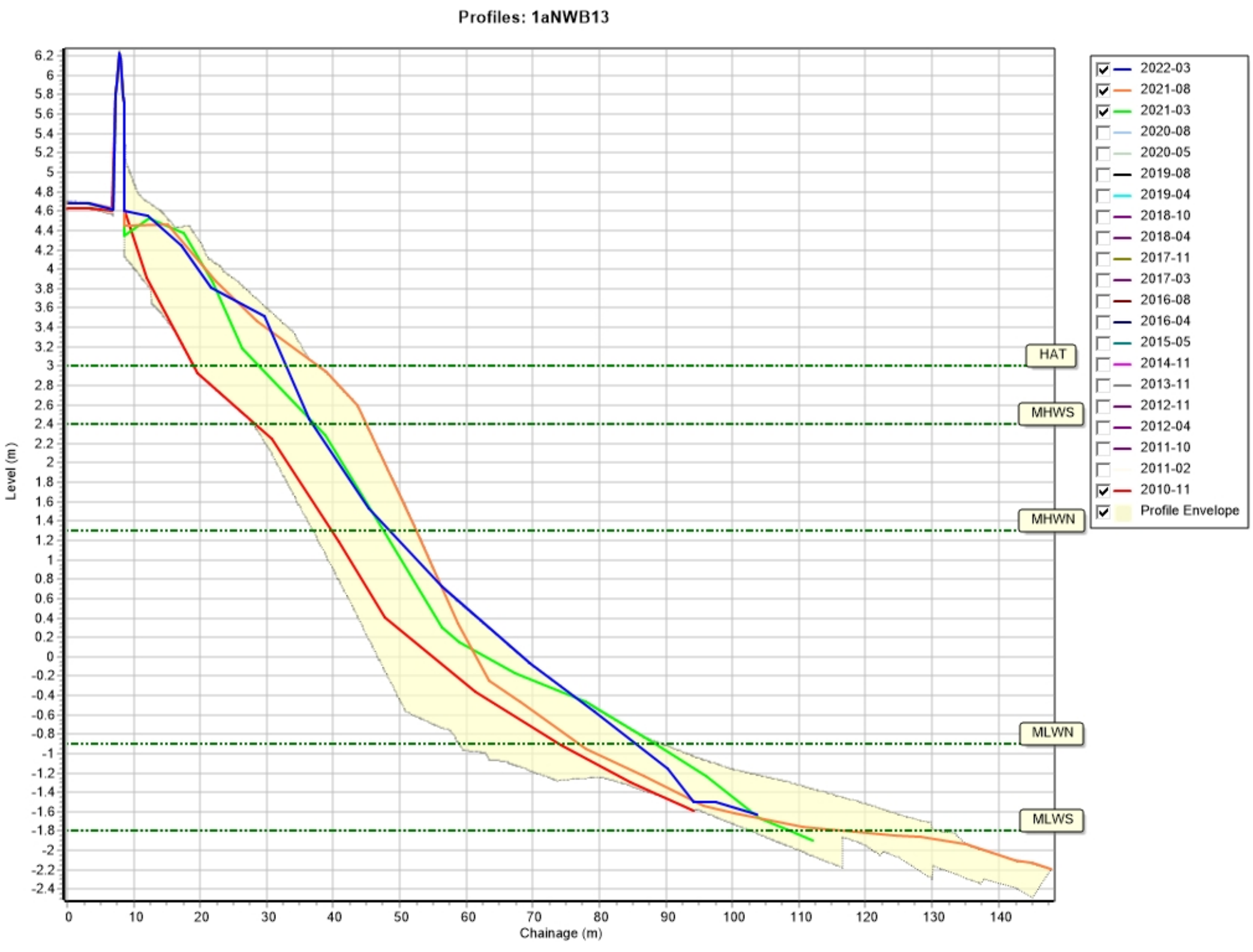
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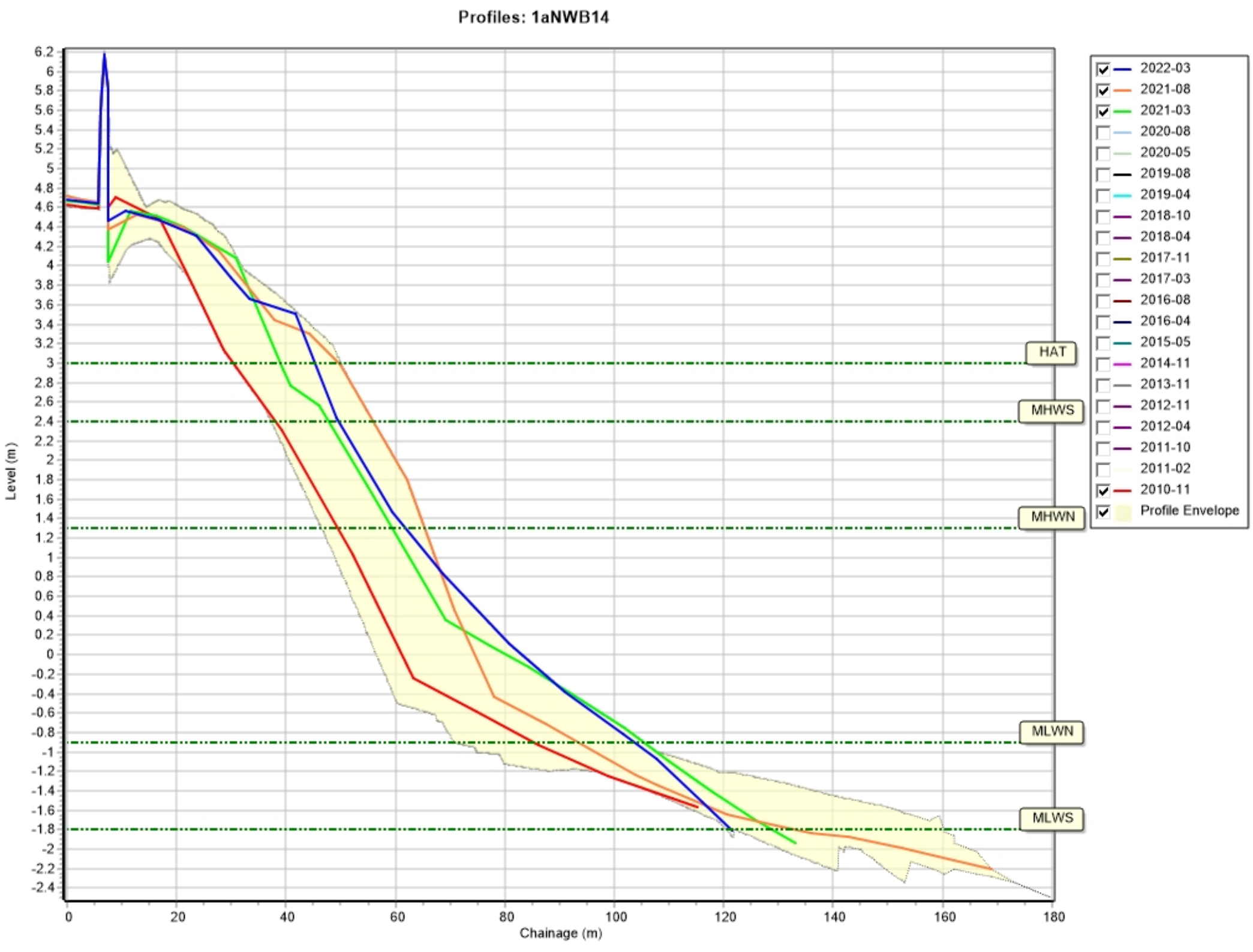
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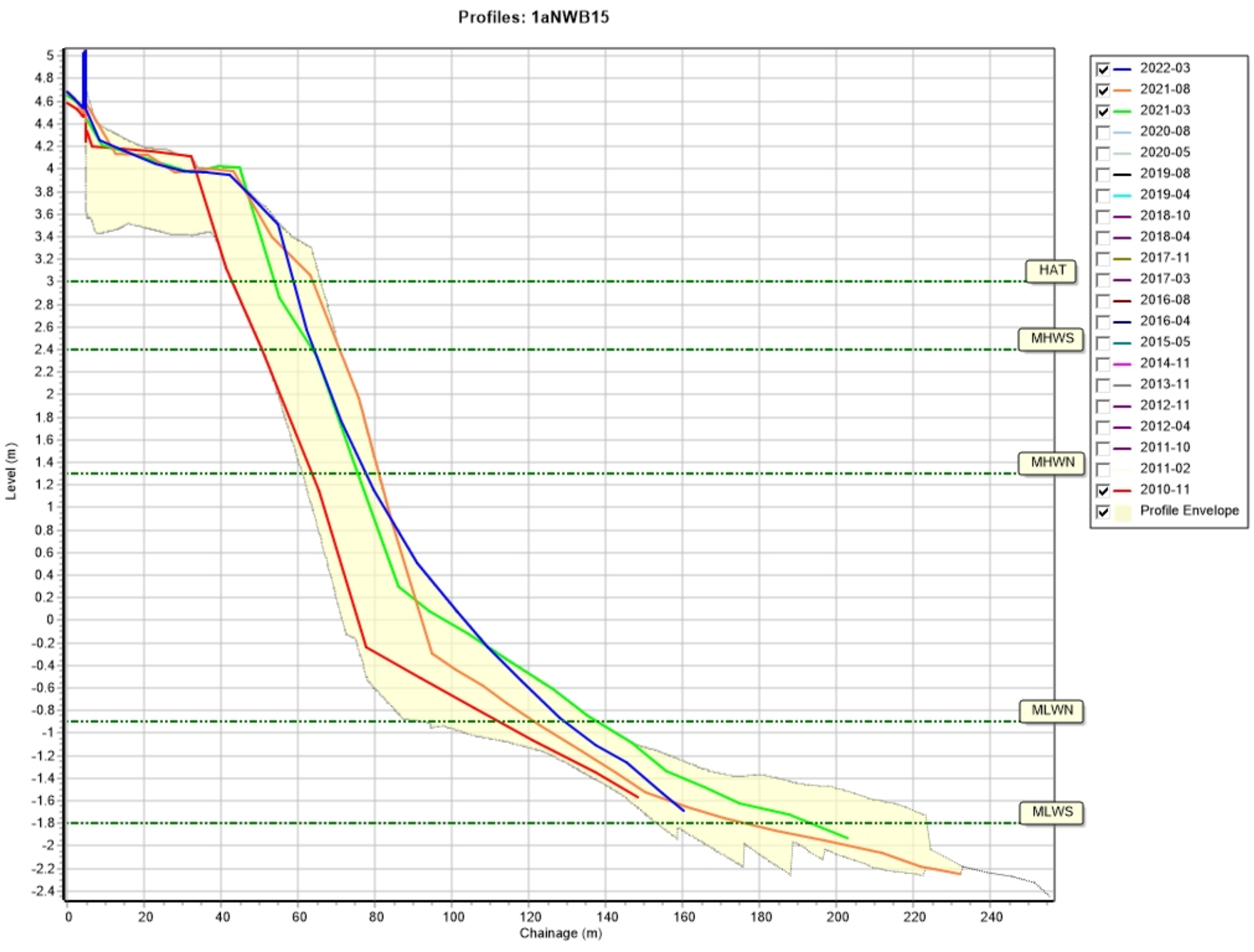
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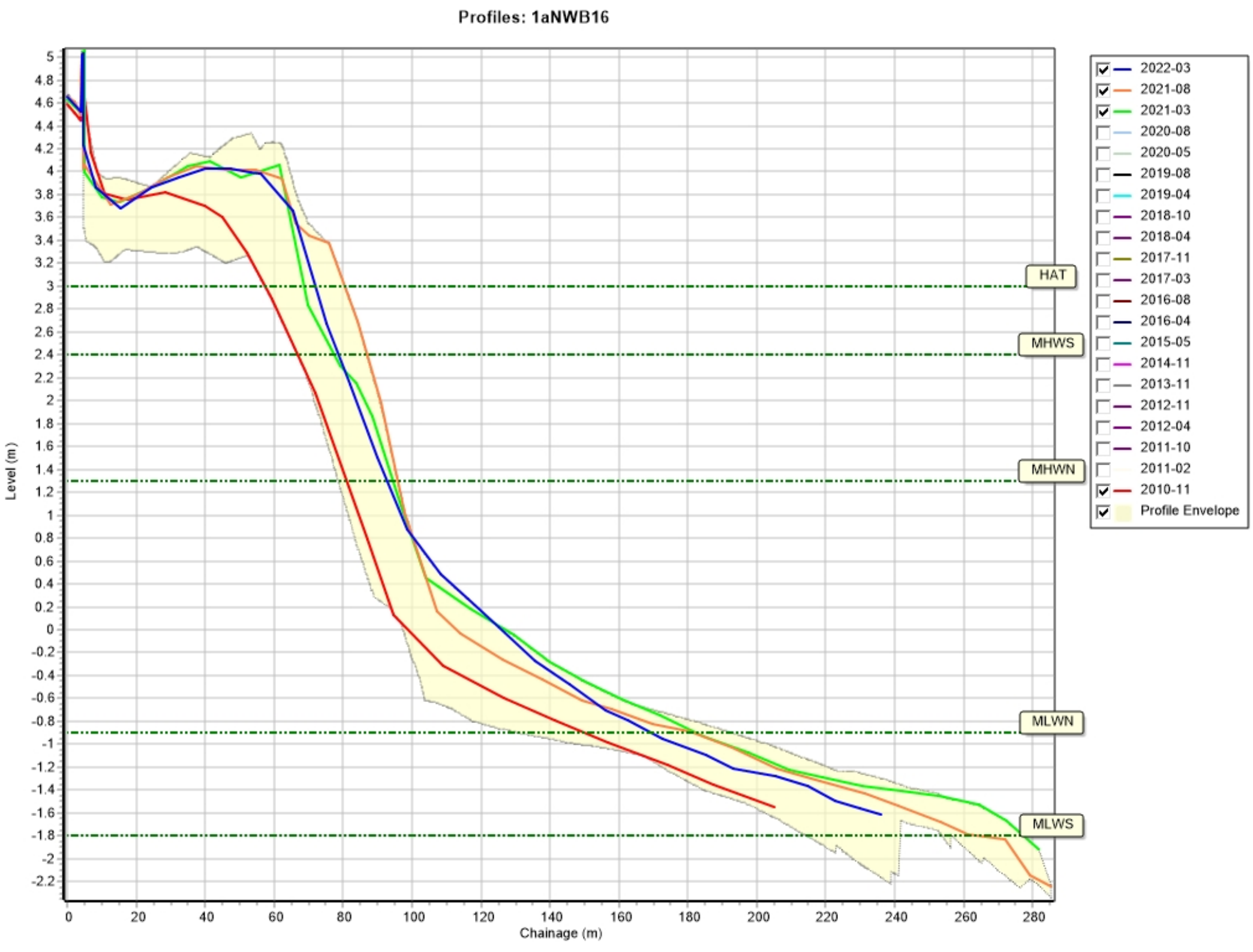
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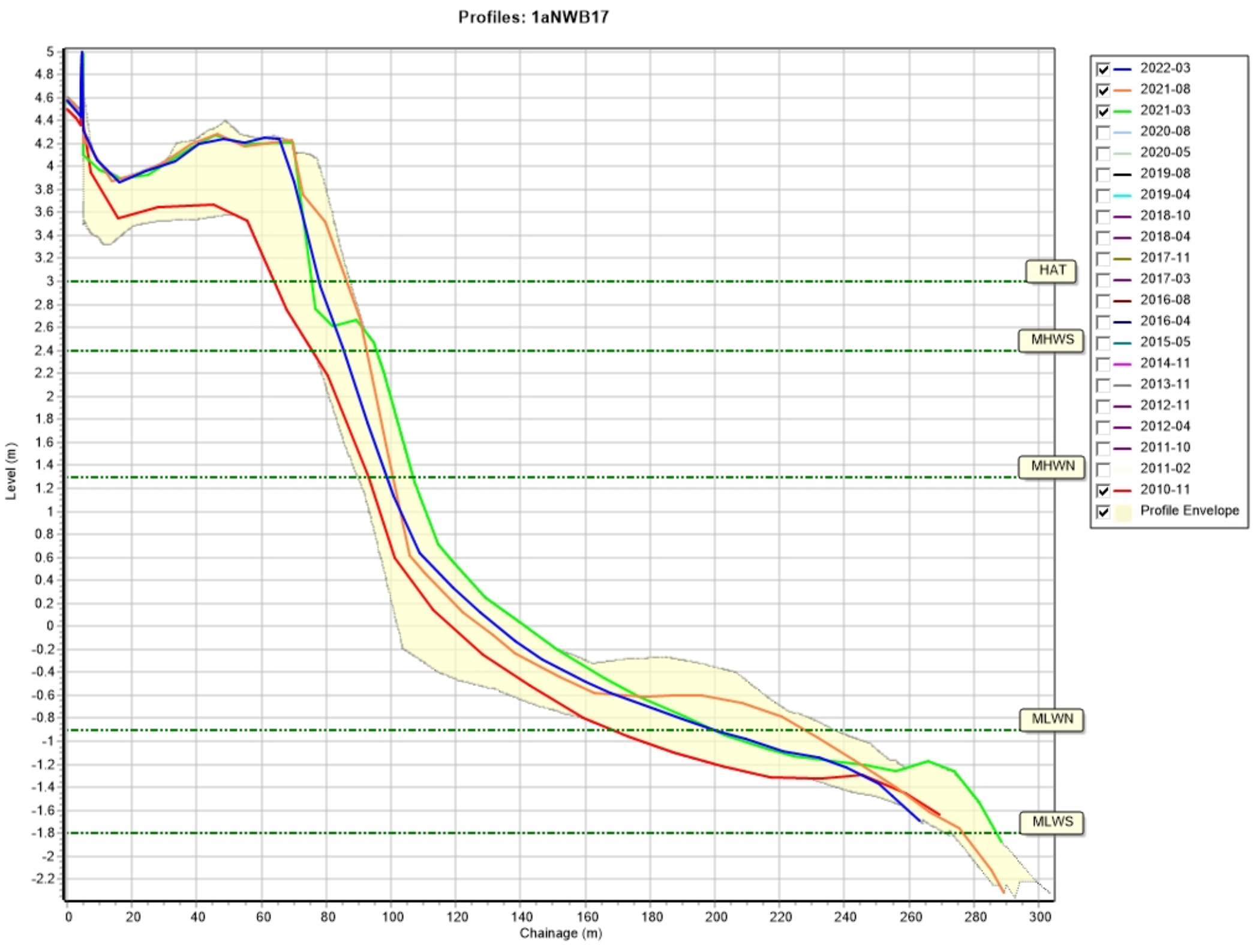
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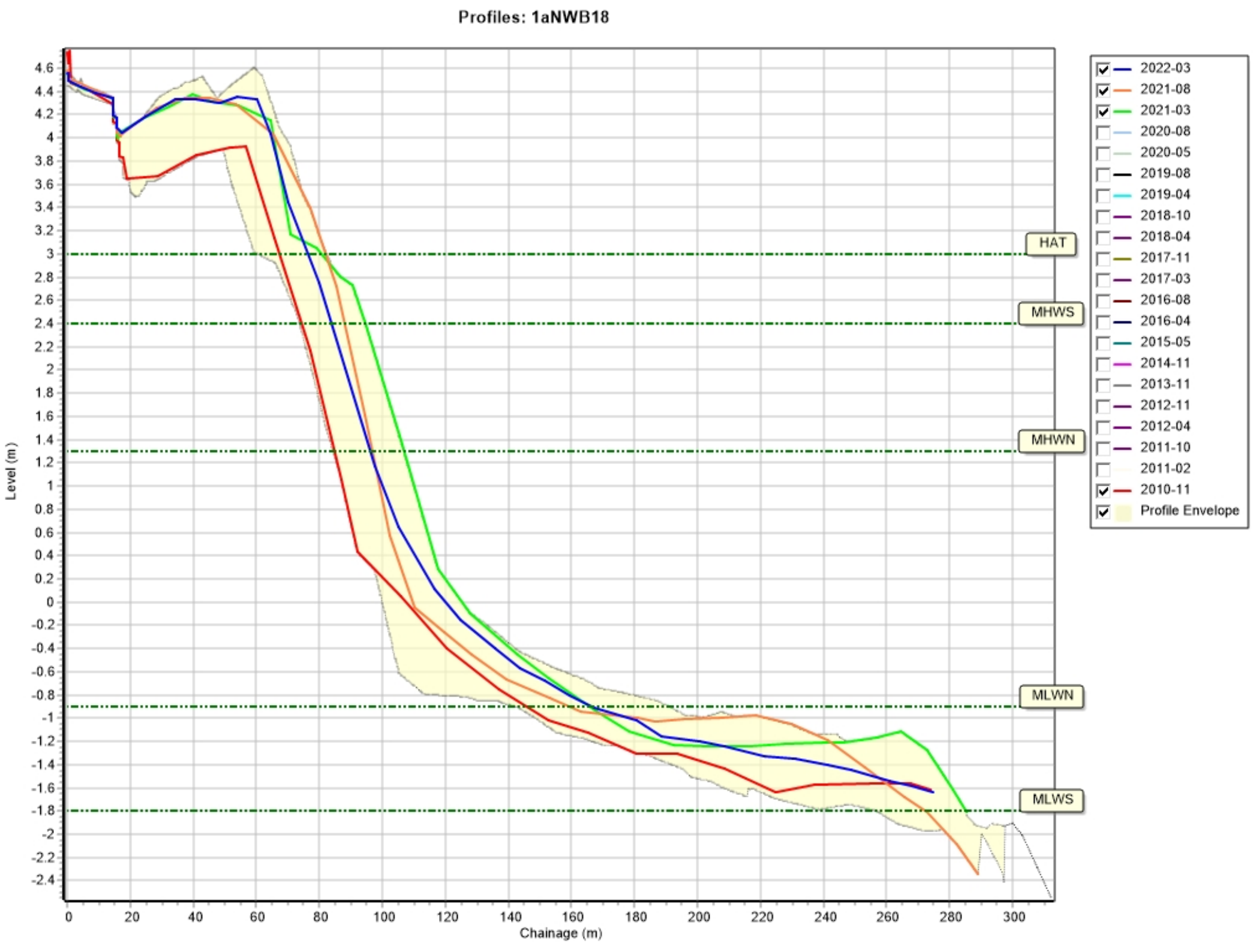
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2021-03
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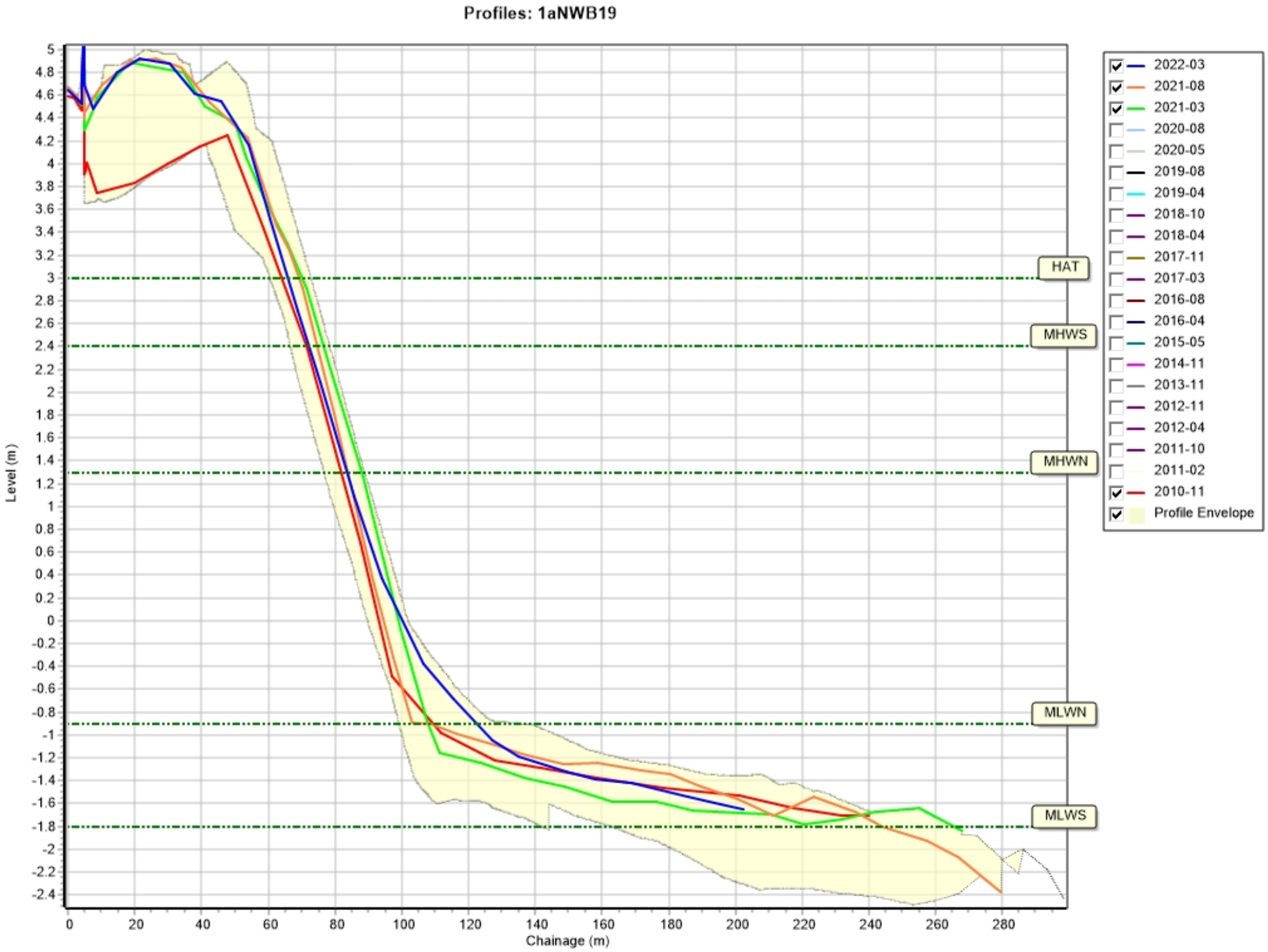
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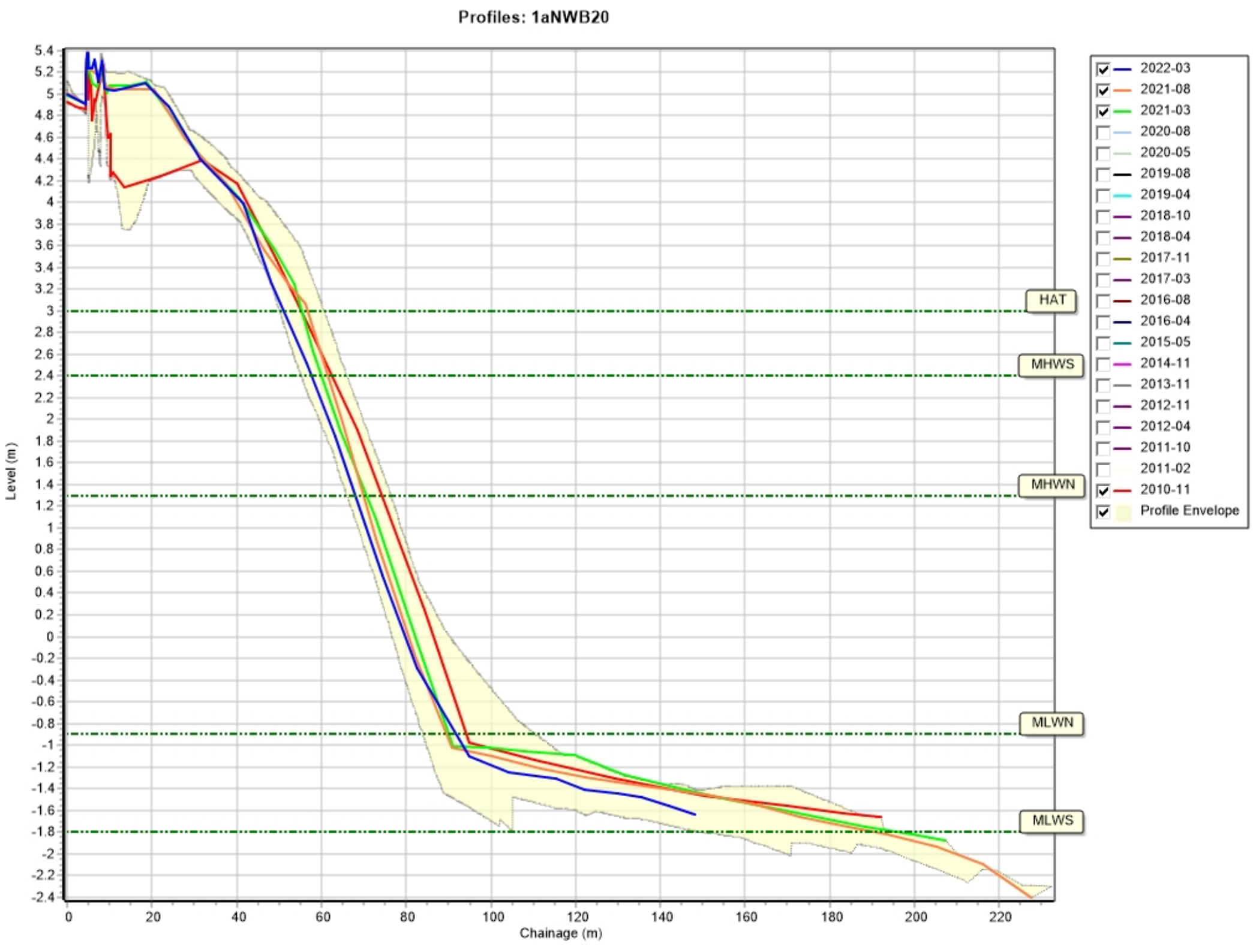
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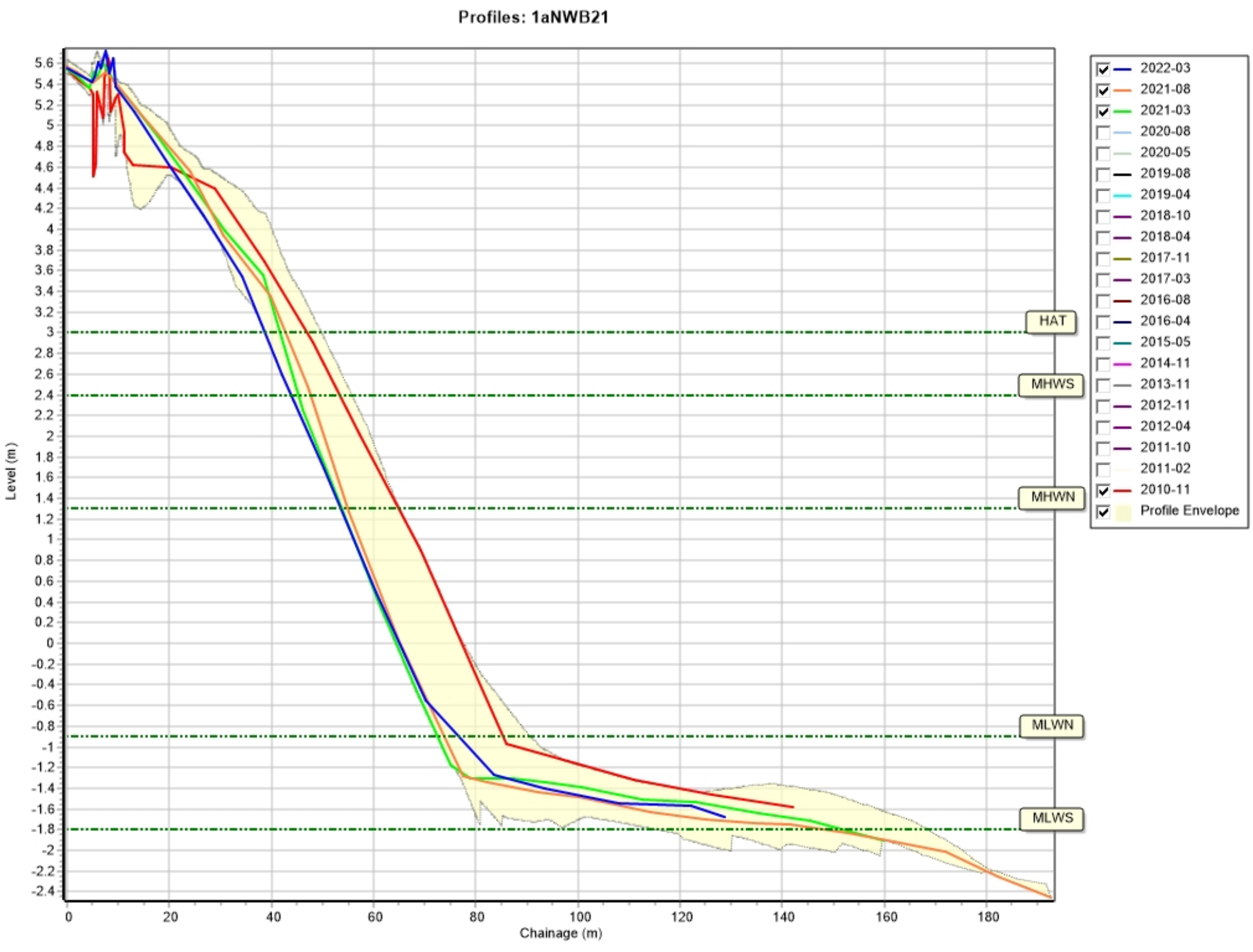
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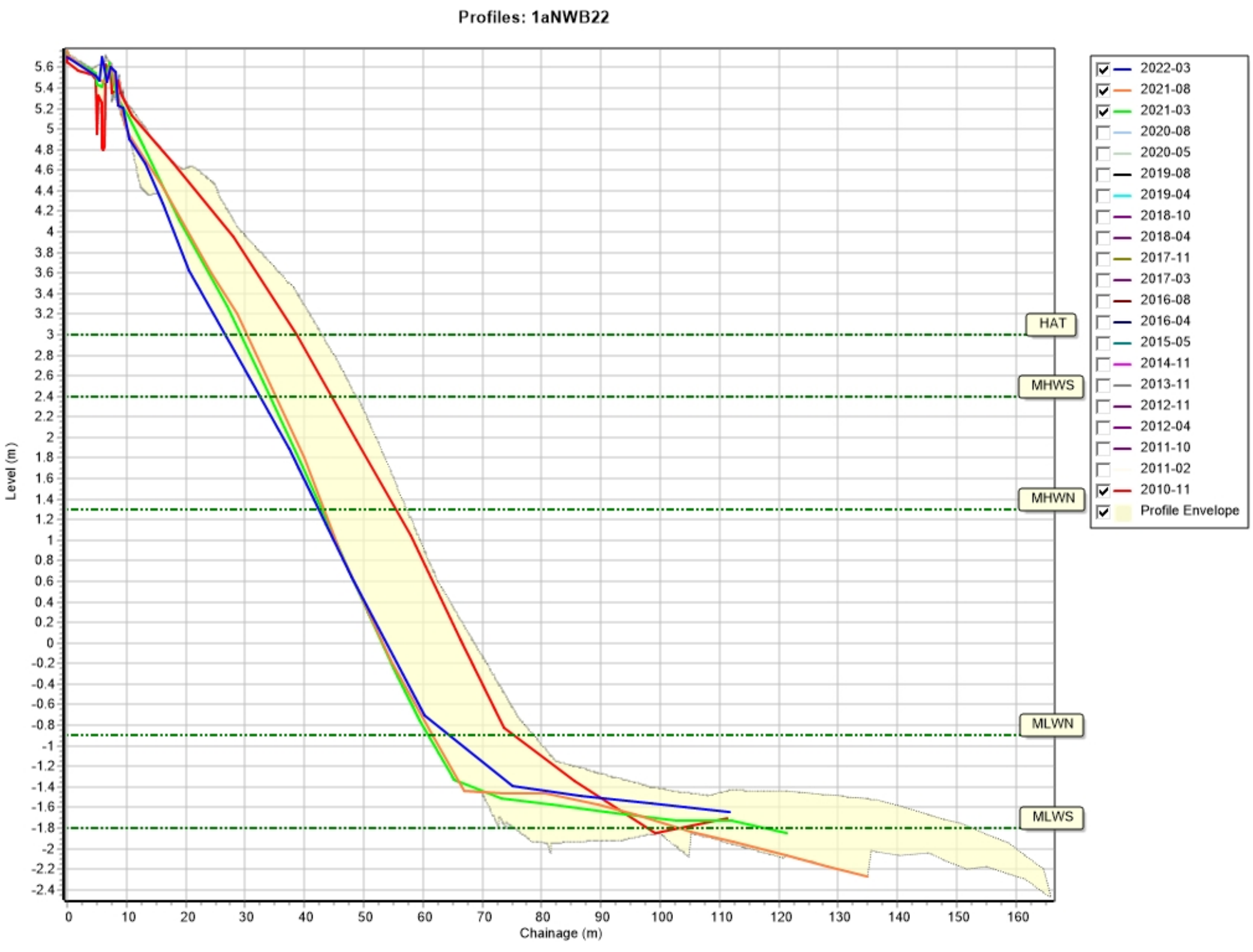
Profile Envelope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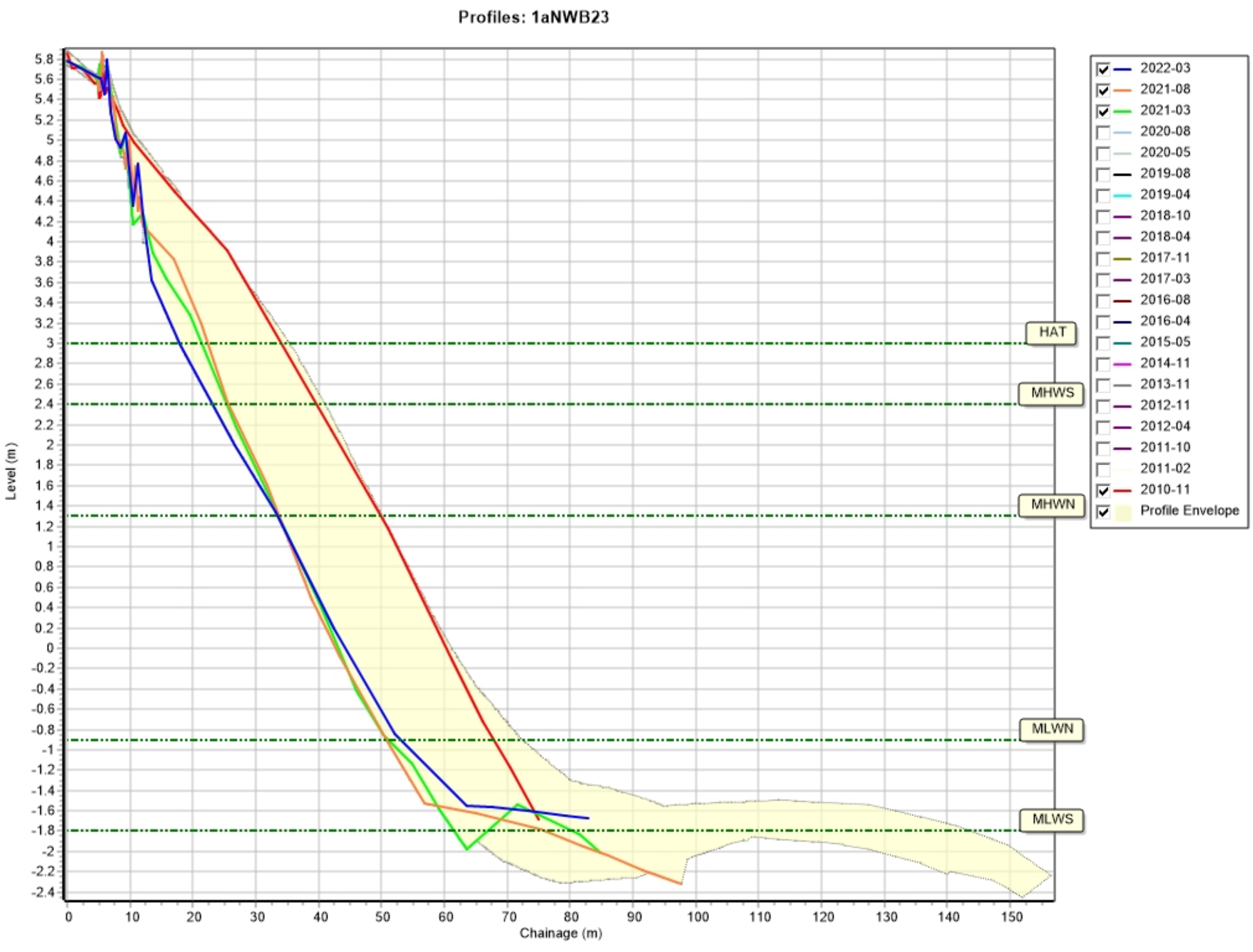
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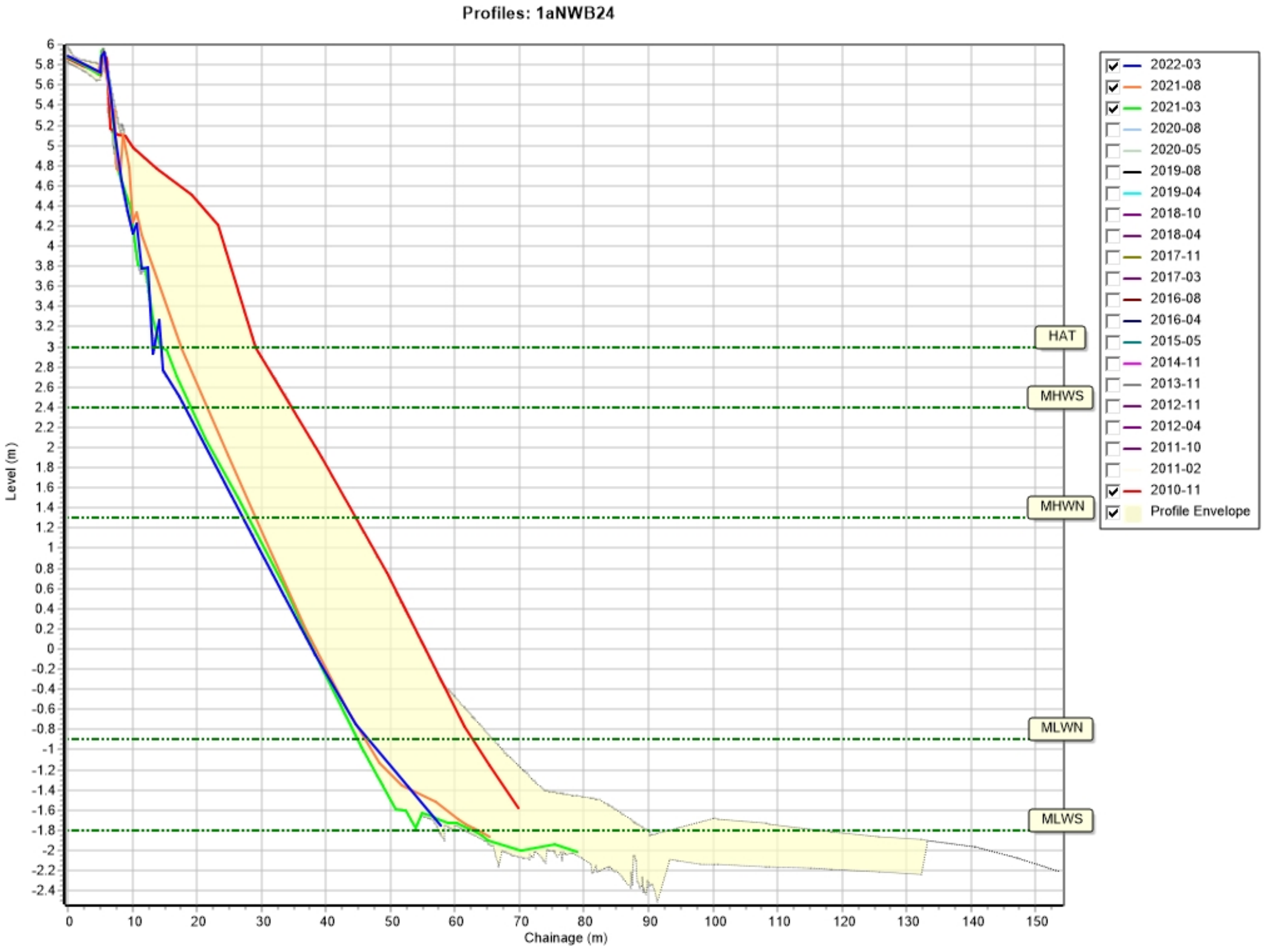
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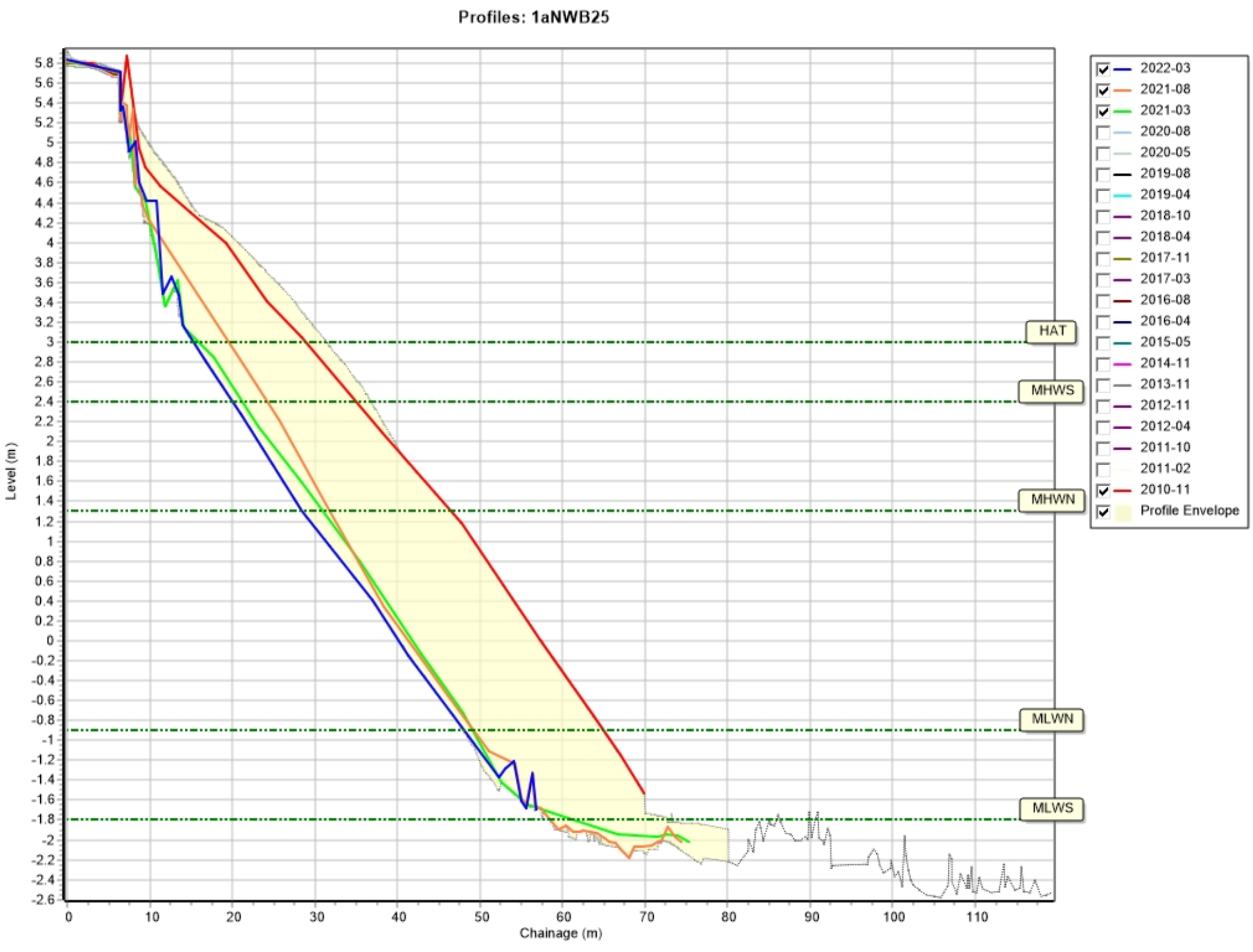
Profile Envelope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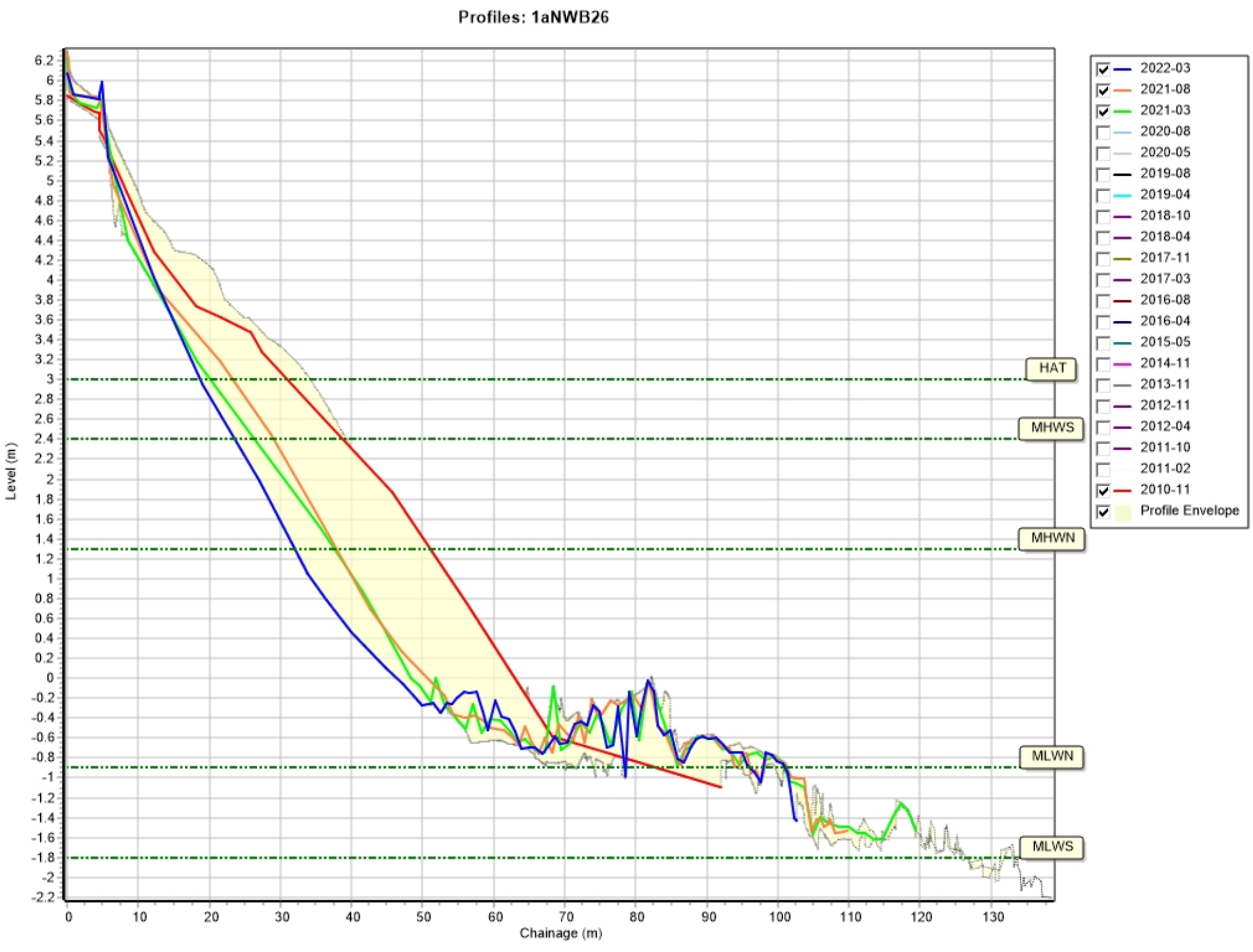
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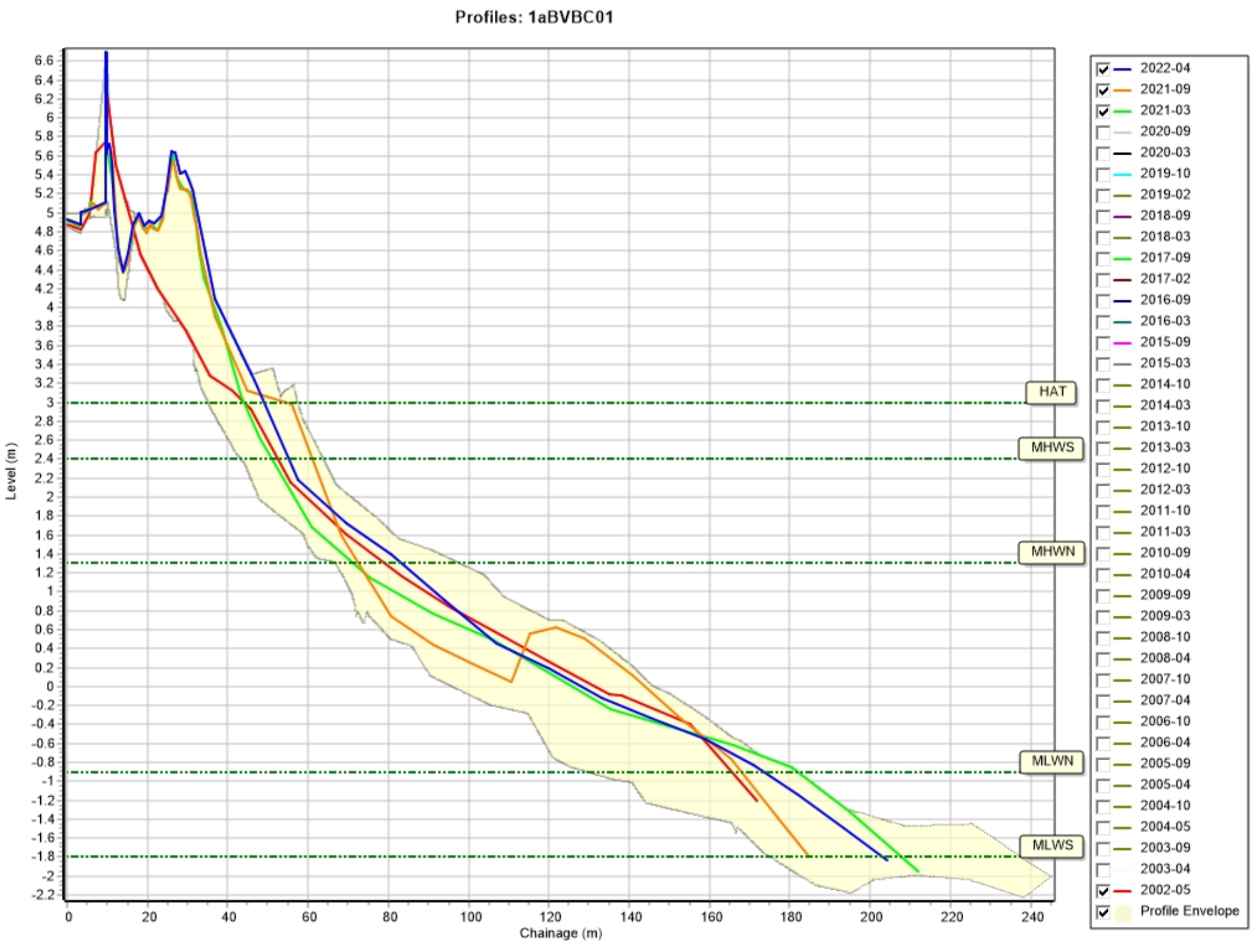
Profile Envelope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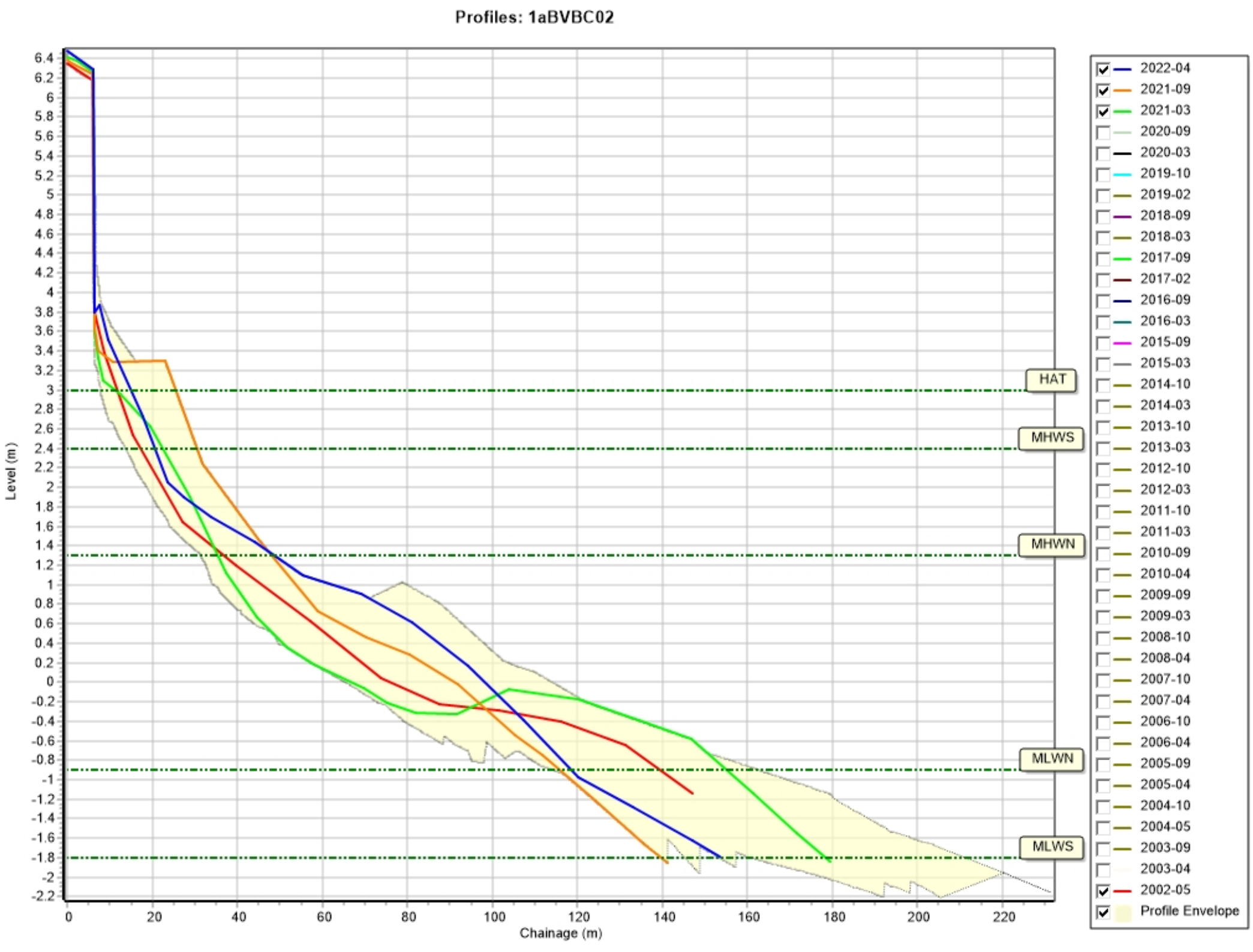
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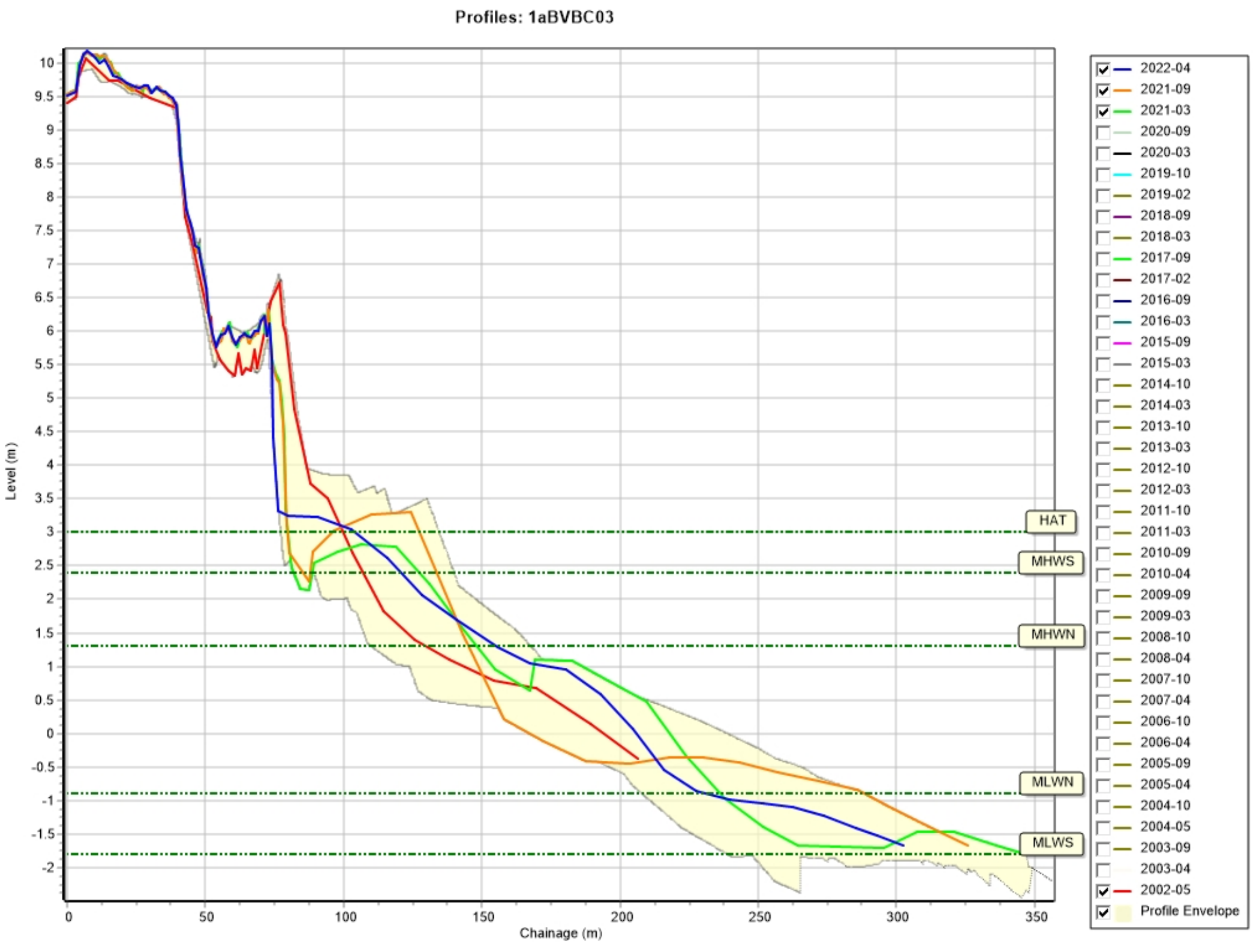
Profile Envelope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MLWS
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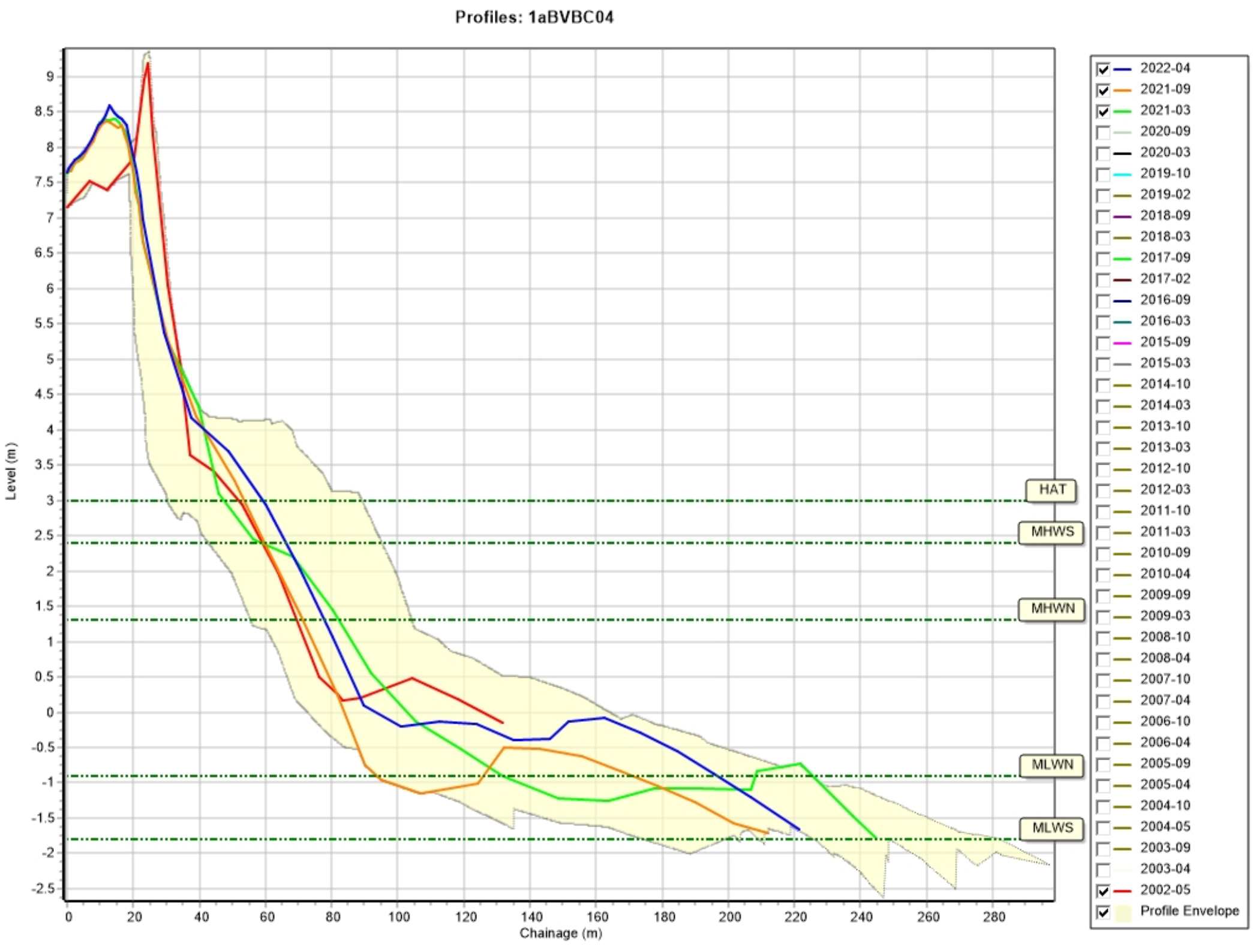
Profiles: 1aBVBC04
Level (m)
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MLWS
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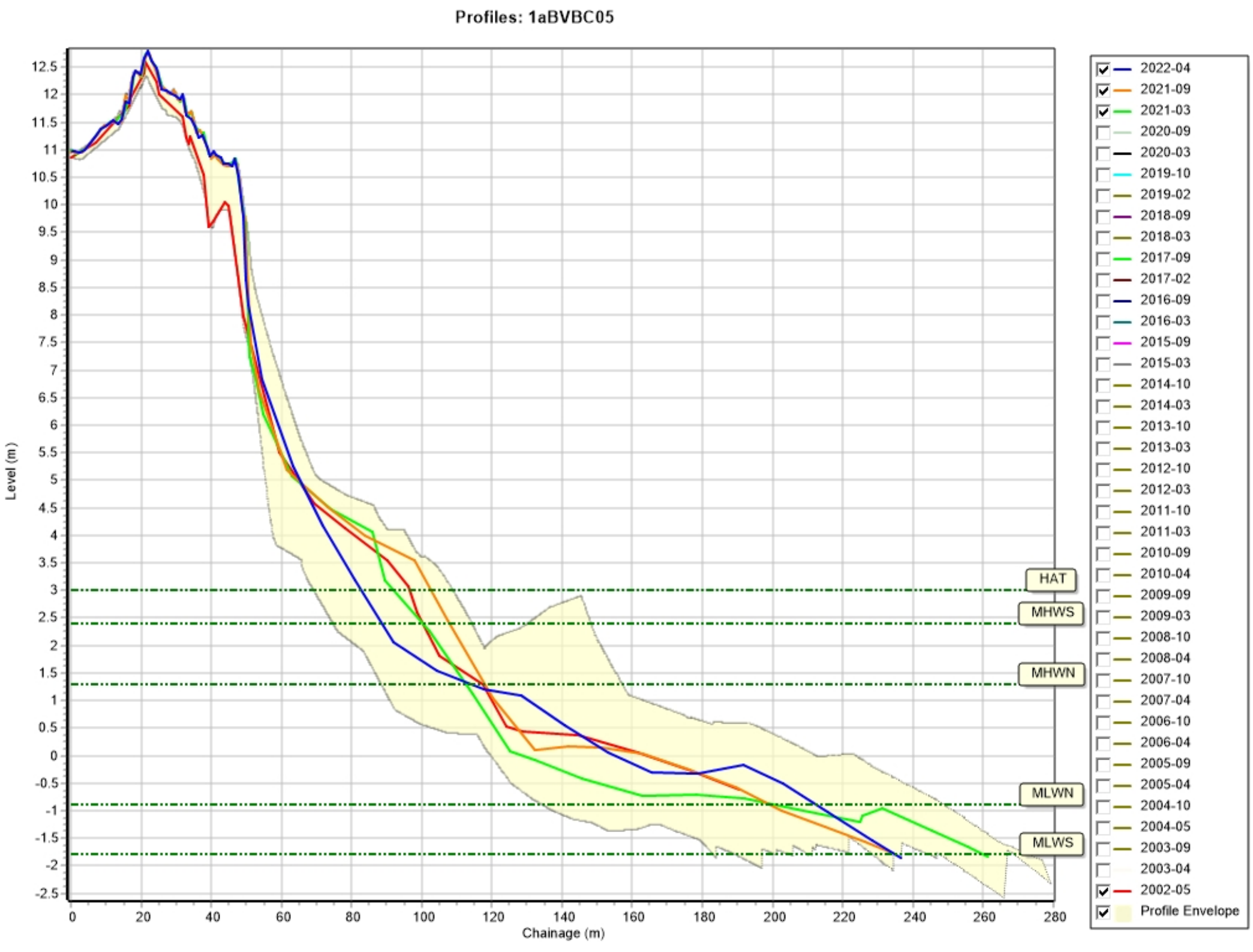
Profiles: 1aBVBC05
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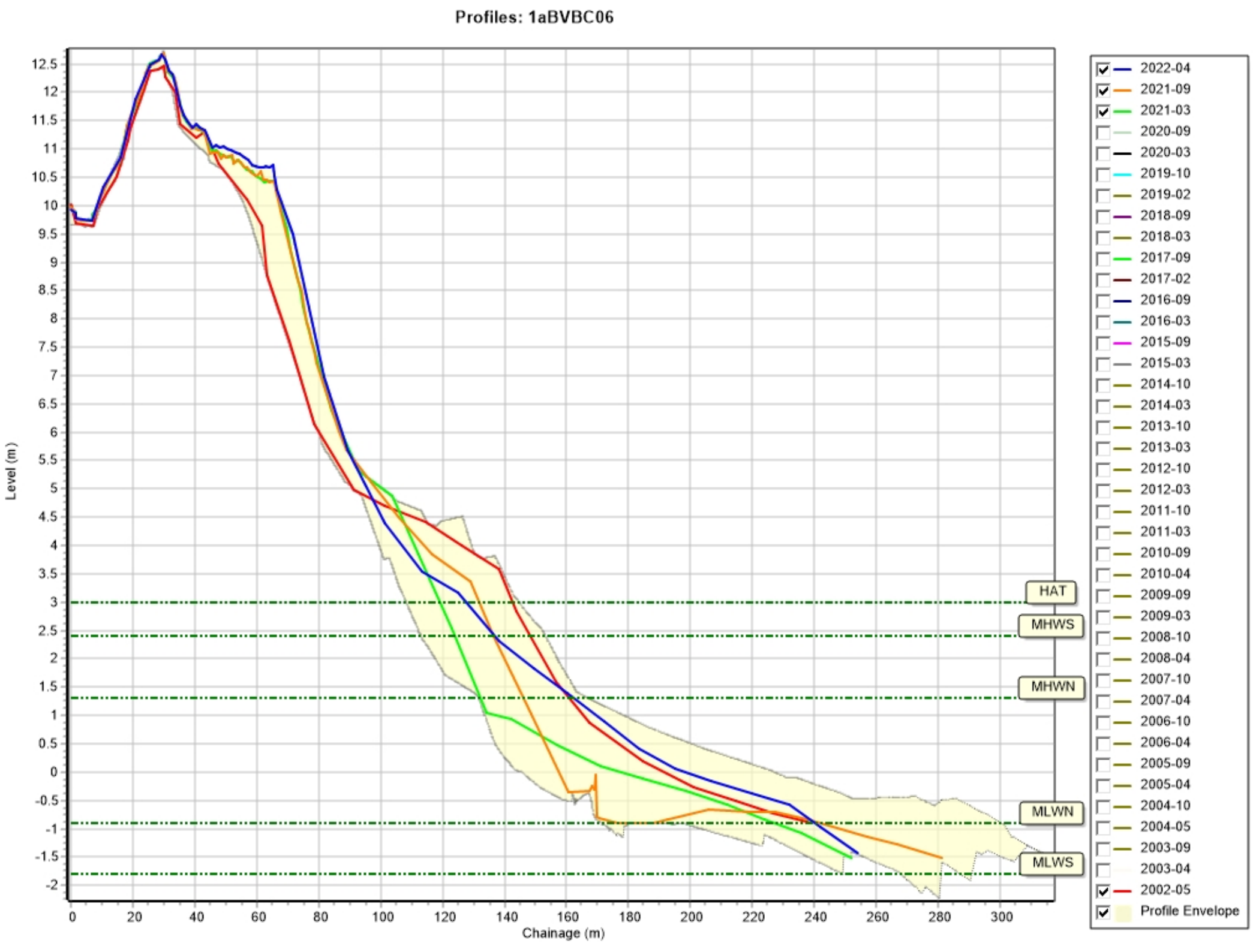
Profile Envelope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Level (m)
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2003-09
2003-04
2002-05
Profile Envelope

Appendix B

Topographic Survey

400400 400800

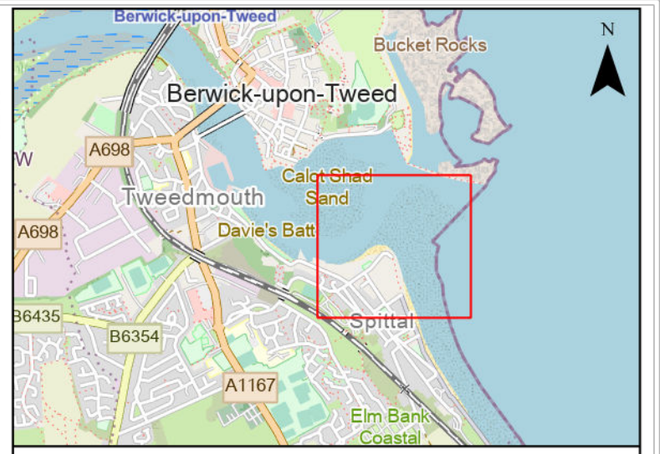
652400 652000

River Tweed River Tweed River Tweed

Dock Road Sandstell Road

Berwick United Reform Church

West Street Middle Street



TOPOGRAPHIC SURVEY (March 2022)

Elevation (mOD)

- 4.6 - 5
- 4.1 - 4.5
- 3.6 - 4
- 3.1 - 3.5
- 2.6 - 3
- 2.1 - 2.5
- 1.6 - 2
- 1.1 - 1.5
- 0.6 - 1
- 0.1 - 0.5
- -0.4 - 0
- -0.9 - -0.5
- -1.4 - -1
- -1.9 - -1.5
- -1.9 - -2

Contours (mOD)*

- 1.0m interval
- 0.25m interval

* Contours only cover sandy beach areas.

0 200 Metres

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

Title:

Appendix B - Map 1

Spittal A and B

Northumberland County Council Frontage

Report:

Update Report
'Partial Measures' Survey 2022

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	09/06/2022	TC	NJC	A3	1:3,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

North East Coastal Observatory

424400 424800 425200 425600

611200 610800 610400

N

River Aln

Alnmouth

B1338

Northumberland Street

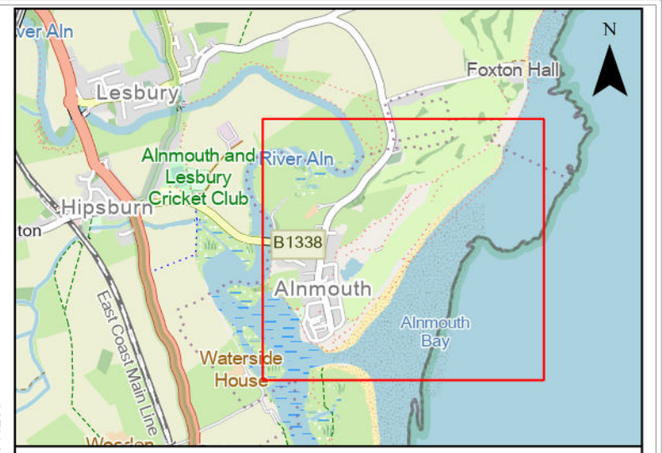
Marine Road

River Aln

River Aln

River Aln

0 300 Metres



TOPOGRAPHIC SURVEY (March 2022)

Elevation (mOD)

- 7.6 - 8
- 7.1 - 7.5
- 6.6 - 7
- 6.1 - 6.5
- 5.6 - 6
- 5.1 - 5.5
- 4.6 - 5
- 4.1 - 4.5
- 3.6 - 4
- 3.1 - 3.5
- 2.6 - 3
- 2.1 - 2.5
- 1.6 - 2
- 1.1 - 1.5
- 0.6 - 1
- 0.1 - 0.5
- -0.4 - 0
- -0.9 - -0.5
- -1.4 - -1
- -1.8 - -1.5

Contours (mOD)*

- 1.0m interval
- 0.25m interval

* Contours only cover sandy beach areas.

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

Title:

Appendix B - Map 2

Alnmouth Bay

Northumberland County Council Frontage

Report:

Update Report
'Partial Measures' Survey 2022

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	09/06/2022	TC	NJC	A3	1:5,500

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

North East Coastal Observatory

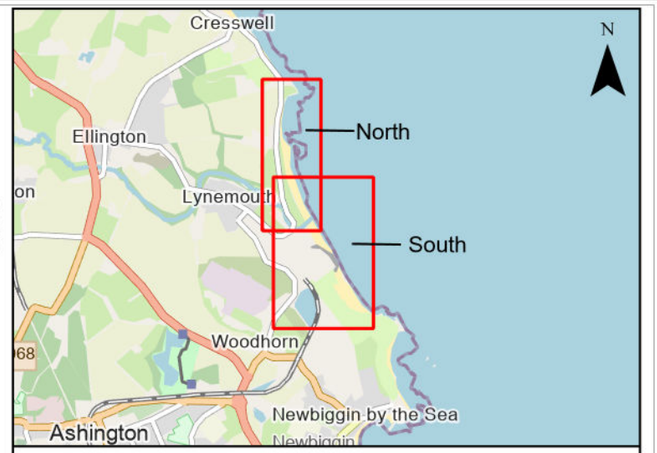
NORTH

SOUTH

River Lyne

Lynemouth Power Station

0 500 Metres



TOPOGRAPHIC SURVEY (March 2022)

Elevation (mOD)

- 6.01 - 6.5
- 5.51 - 6
- 5.01 - 5.5
- 4.51 - 5
- 4.01 - 4.5
- 3.51 - 4
- 3.01 - 3.5
- 2.51 - 3
- 2.01 - 2.5
- 1.51 - 2
- 1.01 - 1.5
- 0.51 - 1
- 0.01 - 0.5
- -0.49 - 0
- -0.99 - -0.5
- -1.49 - -1
- -1.95 - -1.5

Contours (mOD)*

- 1.0m interval
- 0.5m interval

* Contours only cover sandy beach areas.

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

Title:

Appendix B - Map 3

LYNEMOUTH

Northumberland County Council Frontage

Report:

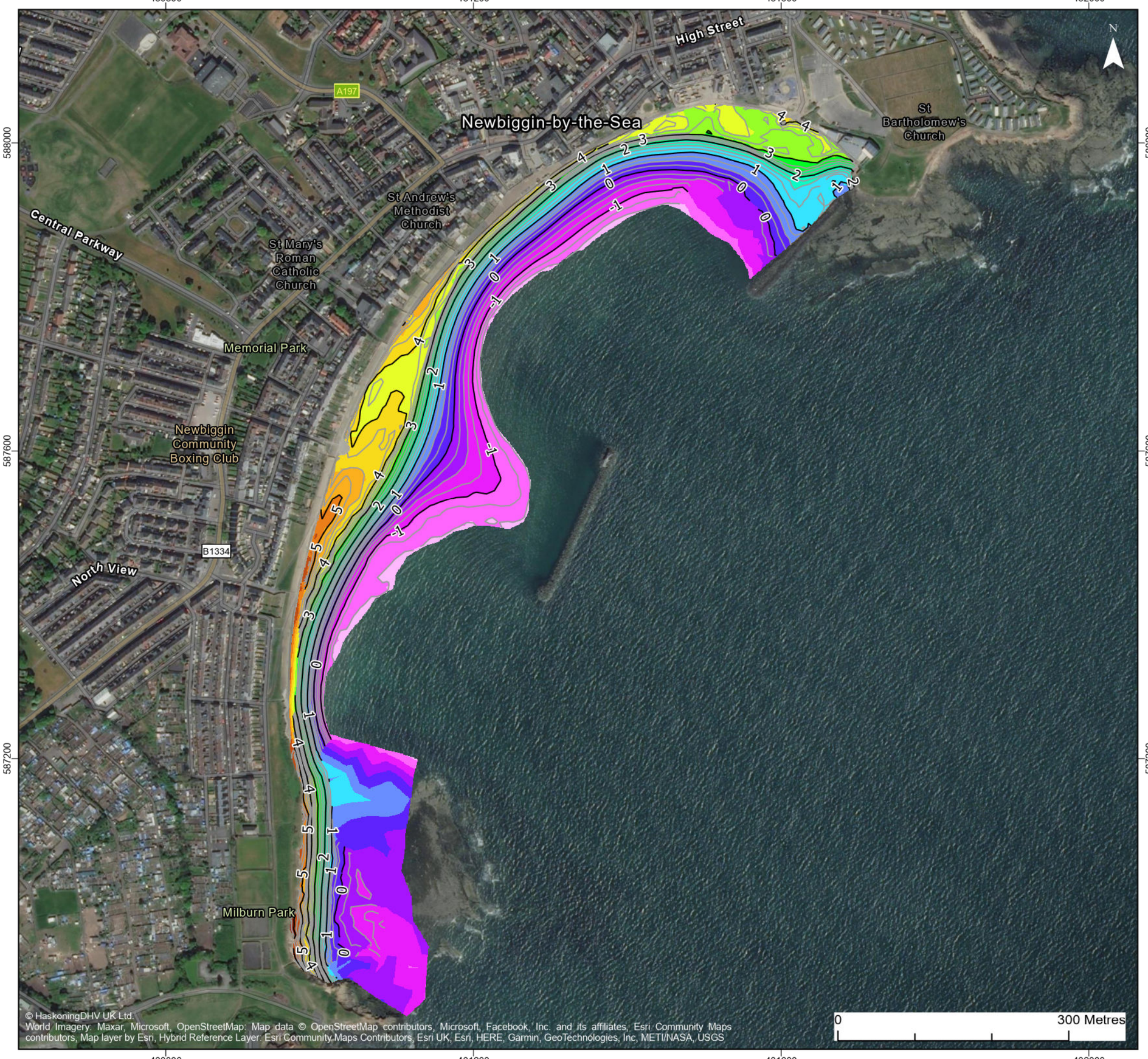
Update Report
'Partial Measures' Survey 2022

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	09/06/2022	TC	NJC	A3	1:8,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

North East Coastal Observatory



TOPOGRAPHIC SURVEY (March 2022)

Elevation (mOD)

- 6.1 - 6.5
- 5.6 - 6
- 5.1 - 5.5
- 4.6 - 5
- 4.1 - 4.5
- 3.6 - 4
- 3.1 - 3.5
- 2.6 - 3
- 2.1 - 2.5
- 1.6 - 2
- 1.1 - 1.5
- 0.6 - 1
- 0.1 - 0.5
- -0.4 - 0
- -0.9 - -0.5
- -1.4 - -1
- -1.9 - -1.5
- -2.4 - -2

Contours (mOD)*

- 1.0m interval
- 0.25m interval

* Contours only cover sandy beach areas.

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

Title:

Appendix B - Map 4

Newbiggin Bay

Northumberland County Council Frontage

Report:

Update Report
'Partial Measures' Survey 2022

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	09/06/2022	TC	NJC	A3	1:5,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

North East Coastal Observatory

400400

400800

652400

652000

River Tweed

River Tweed

River Tweed

N

Dock Road

Sandstell Road

Berwick United Reform Church

West Street

Middle Street

0

200 Metres

Difference between topographic surveys
(Aug 2021 to Mar 2022)
Change in Elevation (mOD)

Gain	>2.0
	1.75 - 2
	1.5 - 1.75
	1.25 - 1.5
	1 - 1.25
	0.75 - 1
	0.5 - 0.75
	0.25 - 0.5
	0.1 - 0.25
Change +/- 0.1m	0 - 0.1
	-0.1 - 0
Loss	-0.25 - -0.1
	-0.5 - -0.25
	-0.75 - -0.5
	-1 - -0.75
	-1.25 - -1
	-1.5 - -1.25
	-1.75 - -1.5
	-2 - -1.75
	<-2

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Title:

Appendix B - Map 5

Spittal A and B

Northumberland County Council Frontage

Report: Update Report 'Partial Measures' Survey 2022

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	09/06/2022	TC	NJC	A3	1:3,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

North East Coastal Observatory

424400 424800 425200 425600

611200 610800 610400

N

River Aln

B1338

Alnmouth

B1338

Northumberland Street

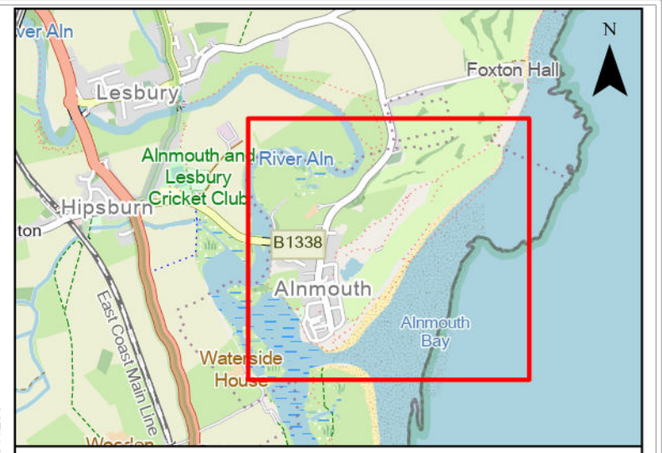
Marine Road

River Aln

River Aln

River Aln

0 200 Metres



Difference between topographic surveys
(Sep 2021 to Mar 2022)
Change in Elevation (mOD)

Gain	>2.0
	1.75 - 2
	1.5 - 1.75
	1.25 - 1.5
	1 - 1.25
	0.75 - 1
	0.5 - 0.75
	0.25 - 0.5
	0.1 - 0.25
Change +/- 0.1m	0 - 0.1
	-0.1 - 0
Loss	-0.25 - -0.1
	-0.5 - -0.25
	-0.75 - -0.5
	-1 - -0.75
	-1.25 - -1
	-1.5 - -1.25
	-1.75 - -1.5
	-2 - -1.75
	<-2

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

Title:

Appendix B - Map 6

Alnmouth Bay

Northumberland County Council Frontage

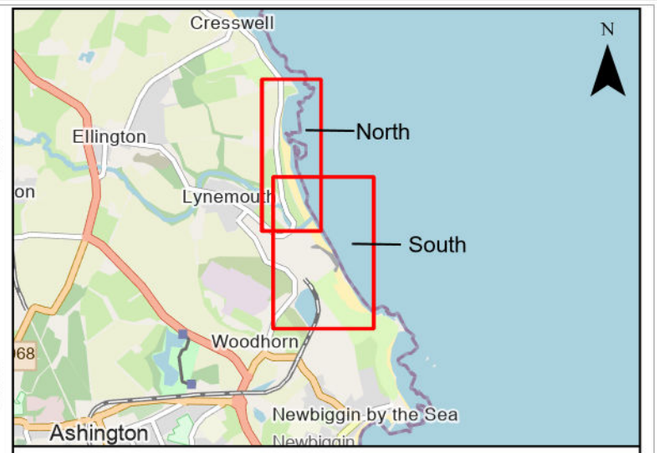
Report:
Update Report
'Partial Measures' Survey 2022

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	09/06/2022	TC	NJC	A3	1:5,500

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

North East Coastal Observatory



Difference between topographic surveys
(Oct 2021 to Mar 2022)
Change in Elevation (mOD)

Gain	>2.0
	1.75 - 2
	1.5 - 1.75
	1.25 - 1.5
	1 - 1.25
	0.75 - 1
	0.5 - 0.75
	0.25 - 0.5
	0.1 - 0.25
Change +/- 0.1m	0 - 0.1
	-0.1 - 0
Loss	-0.25 - -0.1
	-0.5 - -0.25
	-0.75 - -0.5
	-1 - -0.75
	-1.25 - -1
	-1.5 - -1.25
	-1.75 - -1.5
	-2 - -1.75
	<-2

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

Title:

Appendix B - Map 7

LYNEMOUTH

Northumberland County Council Frontage

Report:
Update Report
'Partial Measures' Survey 2022

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	09/06/2022	TC	NJC	A3	1:8,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

North East Coastal Observatory

Difference between topographic surveys
(Aug 2021 to Mar 2022)
Change in Elevation (mOD)

Gain	>2.0
	1.75 - 2
	1.5 - 1.75
	1.25 - 1.5
	1 - 1.25
	0.75 - 1
	0.5 - 0.75
	0.25 - 0.5
	0.1 - 0.25
Change +/- 0.1m	0 - 0.1
	-0.1 - 0
Loss	-0.25 - -0.1
	-0.5 - -0.25
	-0.75 - -0.5
	-1 - -0.75
	-1.25 - -1
	-1.5 - -1.25
	-1.75 - -1.5
	-2 - -1.75
	<-2

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

Title:

Appendix B - Map 8

Newbiggin Bay

Northumberland County Council Frontage

Report: Update Report 'Partial Measures' Survey 2022

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	09/06/2022	TC	NJC	A3	1:5,000

Co-ordinate system: British National Grid

Royal HaskoningDHV
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Appendix C

Sand Extent Survey

SAND EXTENT

- Spring 2022
- Autumn 2021
- Spring 2021
- Autumn 2020
- Spring 2020
- Autumn 2019
- Spring 2019
- Autumn 2018
- Spring 2018
- Autumn 2017
- Spring 2017
- Autumn 2016
- Spring 2016
- Autumn 2015
- Spring 2015
- Autumn 2014
- Spring 2014
- Autumn 2013
- Spring 2013
- Autumn 2012
- Spring 2012
- Autumn 2011

Site of Special Scientific Interest (SSSI)

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

Title:

Appendix C - Map 1

Newbiggin-by-the-Sea Sand Extent

Northumberland County Council Frontage

Report:

Update Report
'Partial Measures' Survey 2022

Revision:	Date:	Drawn:	Checked:	Size:	Scale:
0	16/03/2022	TC	NJC	A3	1:1,500

Co-ordinate system: British National Grid

Royal HaskoningDHV
Enhancing Society Together

North East Coastal Observatory