

Technical Memorandum

03 March 2023

To	Norbert Woerns	Project No.	010978-MEM-298
Copy to	JART, Kevin Mitchell (CRH), Brian Zeman (MHBC), Ellen Ferris (MHBC), Anthony Goodban (GEC)		
From	Kyle Fritz, Richard Murphy		
Project Name	Dufferin Aggregates Milton Quarry East Extension (MQEE)		
Subject	Cumulative Dewatering Influence in the MQEE Area		

1. Introduction

GHD has prepared this memorandum on behalf of Dufferin Aggregates in further response to JART comments requesting additional clarification of the cumulative effects of the permitted dewatering for the existing approved Milton Quarry cells (Main Quarry, North Quarry, Extension Quarry – West Cell and East Cell) in the area of the proposed East Extension. Related JART comments include GWRA Comments: 2, 18, 23, 29, 32, and possibly others. Responses to these comments were provided in table format on January 25, 2023 and discussed at the JART meeting on February 3, 2023.

During the course of the meeting on February 3, 2023 it was discussed that the GWRA Report (GHD, December 2021) and the responses to comments presented data illustrating the influence of the existing approved quarry on groundwater levels and described the likely existing impact on water resources – i.e., Wetland U1 and Wetland W36, as well as Wetland V2 in the East Cell Licence Area prior to its mitigation enhancement. Our discussions revealed that there was agreement on these matters; however, JART requested that clearer quantification of the degree of dewatering influence be provided along with associated statements of the past dewatering influence evidenced by the available monitoring data (i.e., water level hydrographs as included in the GWRA).

This memorandum provides the additional clarification as requested.

2. Available Water Level Data

Water level data is available for a number of monitoring wells in the MQEE area. These wells were installed at various points in time for a number of different studies and purposes. Water level data has also been collected at the various locations at different times based on the purpose of studies and the availability of access. All water level data that is available is presented in the GWRA (refer to Appendix D in tabular and graphical form). Relevant data are reproduced in the hydrographs attached to this memorandum along with data collected since the GWRA was prepared. The attached Figure 3.3 from the GWRA shows all the monitoring locations, although not all locations have data relevant or useful for this exercise.

The general commencement of monitoring data that is useful for this analysis includes monitoring wells installed circa 1979/80 in the MQEE area for studies by prior landowners and monitoring wells installed circa 1990 and 1999 by Dufferin. These sets of older monitoring wells provide the ability to compare contemporary groundwater levels to prior periods when there was little or no influence from quarry dewatering in the MQEE area. Subsequent series of monitoring wells were installed in 2007 and later years; however, these more recent installations are less relevant to this analysis as it is clear that the influence of the existing quarry dewatering in the MQEE area was appreciable by 1999 as described in the GWRA and the Response to JART GWRA Comments (e.g., Comment #24).

The following monitoring wells from the older time periods are available and considered in this analysis:

- ~1979/80: OW2-80, OW3-80, OW11-80
- ~1990: MW4
- ~1999: BH64, BH65, BH66, BH71, OW3-x Series represented by OW3-2-II
- 2008: OW69-08

Updated hydrographs (including data through 2022) are provided in the Attachments. Some other wells are not presented herein as they have more limited datasets and/or do not add useful information to the analysis – e.g., OW10-80, TW1-80, OW3-1, and OW3-3).

The historic surface water data available for this analysis is limited to staff gauges installed in Wetland W36 (SG5 and historic SW5-80A/B) and Wetland W41 (SG6 and SWDP6) installed in 1999. Updated hydrographs for these staff gauges are shown on revised versions of GWRA Figure 6.10 (Wetland U1) and Figure 6.11 (Wetland W36) in the Attachments. A copy of the hydrograph for SW5-80A/B from the GWRA is also included for convenience; however, no measurements have occurred at this location since 1982 (it has been observed to be dry).

3. Analysis of Dewatering Influence

The hydrograph for each of the relevant monitoring wells (as above) were reviewed to develop an estimate of the drawdown evident at each location. The estimate of drawdown is necessarily an approximation due to the limitations of the available data (varying time periods, collection frequency, etc.), seasonal effects, and climatic variations from year to year. While the estimated quantity of drawdown may vary depending on exactly how the results are interpreted, the overall scale and nature of the dewatering influence is evident from this analysis as described below.

Location	Data Commencement	Estimated Drawdown [metres]	Comments
OW2-80	1980	4+	Shallow well has gone dry. Early groundwater levels appear suspect. If measured levels are correct drawdown would be 8+ metres
OW3-80	1979	4-8	Recent dry climate conditions obscure dewatering effect. Range reflects recent spring peak-fall low levels relative to early data
OW11-80/ OW3-2-II	1980/ 1998	2-5	Refer to combined hydrograph. Range of spring-fall
MW4 (series)	1990	12-14	Approximately 10 m occurred in 1997. Range of spring-fall
BH64	1999	0 (since 1999)	Some influence likely occurred prior to 1999 based on observations at MW4 and SW5-80A/B

Location	Data Commencement	Estimated Drawdown [metres]	Comments
BH65	1999	0	No influence is evident
BH66	1999	0	No influence is evident
BH71	1999	0	No drawdown influence is evident. Recent data indicates some increase in groundwater level due to groundwater recharge operations
OW69-08	2008	0	No influence is evident

Wetland U1

Based on the drawdown values at the various monitoring well locations presented above, it appears that in the area of Wetland U1 the approved existing quarry resulted in a drawdown that may be in the range of 2-5 m seasonally (drawdown effects are less in the spring and early summer, and greater in the fall and early winter). This conclusion is supported by the drawdown observed in the area northeast of Wetland U1 (monitoring wells OW11-80, OW3-x Series, and OW3-80) and at monitoring well location MW4.

On the basis of groundwater levels being 2-5 m higher than present in the area of Wetland U1 prior to the dewatering influence of the existing approved quarry, Wetland U1 was historically supported by groundwater and would have had a hydroperiod that persisted for a substantial portion of the year, at least in typical-to-wetter years.

Wetland W36

Groundwater level data relevant to Wetland W36 is limited to monitoring well MW4 and monitoring well BH64. BH64 was not installed until 1999, which is after extraction had already occurred in the adjacent area of the Main Quarry. The water level data from monitoring well BH64 does not indicate any drawdown in groundwater levels in this area following its installation in 1999.

It is interpreted that prior to 1999, groundwater levels were higher at BH64 and the area between Wetland W36 and the Main Quarry. This is also supported by observations of surface water present in Wetland W36 at the unopened road allowance on the east side of the Main Quarry (historic monitoring location SW5-80A/B) at all times of each of the year when observations were made in 1980, 1981, and 1982 – notably including observations in August (refer to attached hydrograph, Figure C.12 from GWRA).

On this basis it can be concluded that prior to the permitted dewatering of the existing quarry, groundwater levels would have been suitable to support groundwater discharge/support to Wetland W36 in the area of monitoring well BH64, as well as to the east and west, prior to the late 1990s.

Other Wetlands

Other wetlands in the MQEE area include Wetland W41, Wetland W46, and Wetland W56. The available groundwater level monitoring data for the area (BH65, BH66, BH71, and OW69-08) do not indicate any drawdown extending to the area of these wetlands (it is noted that groundwater level monitoring was not available prior to 1999 in these areas). This is a reasonable conclusion based on the distance of these features from the existing extraction areas and the intervening wetland features (Wetland U1 and Wetland W36) that would have buffered the extent of any drawdown further to the east.

4. Conclusion

This analysis of cumulative effect of dewatering influence from the Existing Quarry on the MQEE area, clearly demonstrates that groundwater lowering has occurred and can be reasonably interpreted to have resulted in

lower groundwater levels in the area of Wetland U1 and Wetland W36 as indicated in the GWRA and in the Natural Environment Technical Report (NETR) and Environmental Impact Assessment (EIA) (Goodban Ecological Consulting Inc. [GEC] 2021), and responses to comments by JART. There is no indication of a dewatering influence extending to the more distant locations of Wetland W41, Wetland W46, and Wetland W56.

The proposed MQEE includes extension of the existing approved (and operating) water management system which will prevent drawdown influences extending from the MQEE to surrounding water resources such as Wetland W41, Wetland W46, and Wetland W52 and beyond. The proposed mitigation measures will also enhance the wetland conditions in Wetland U1 and Wetland W36 while providing further safeguards for the protection of the more distant wetlands through the Supplemental Monitoring program included in the AMP Addendum.

Therefore, it is clear that the proposed MQEE will not result in any negative cumulative effect and will actually result in enhancement of water resources conditions in the MQEE area.

Regards,



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A handwritten signature in blue ink, appearing to read "J. Richard Murphy".

J. Richard Murphy, P.Eng.
richard.murphy@ghd.com

Attachments: Figure 3.3 Rev (including well locations installed in 2022)
Select MQEE Groundwater hydrographs (as listed in Table)
GWRA Surface water hydrographs for SW5-80A/B
Figure 6.10 Rev (updated data)
Figure 6.11 Rev (updated data)

Attachments

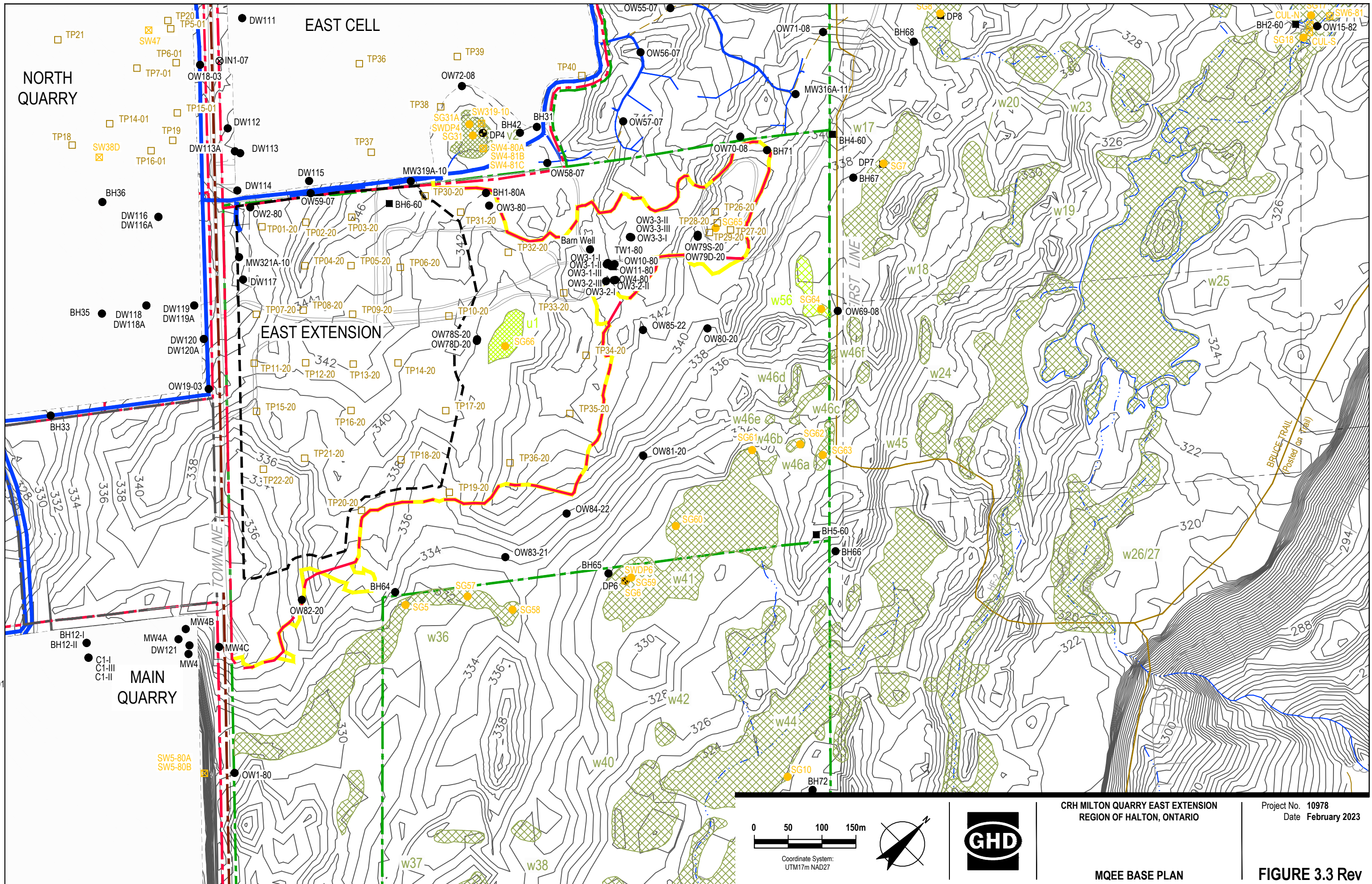
GWRA Figure 3.3 Rev

Select MQEE Groundwater Hydrographs

GWRA Surface Water Hydrograph SW5-80

GWRA Figure 6.10 Rev

GWRA Figure 6.11 Rev



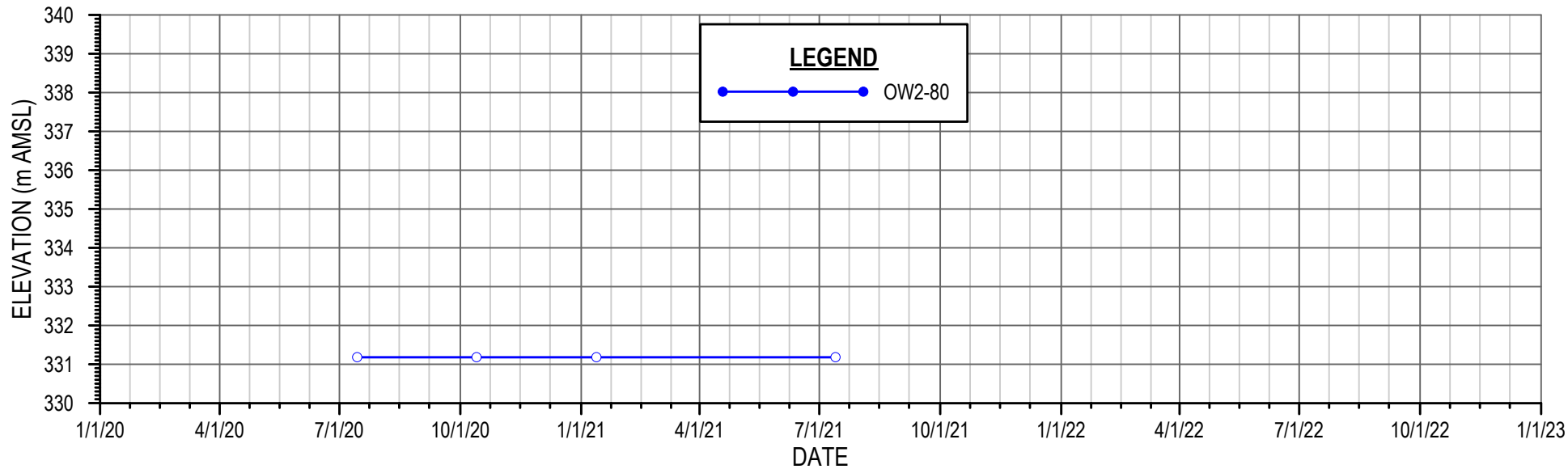
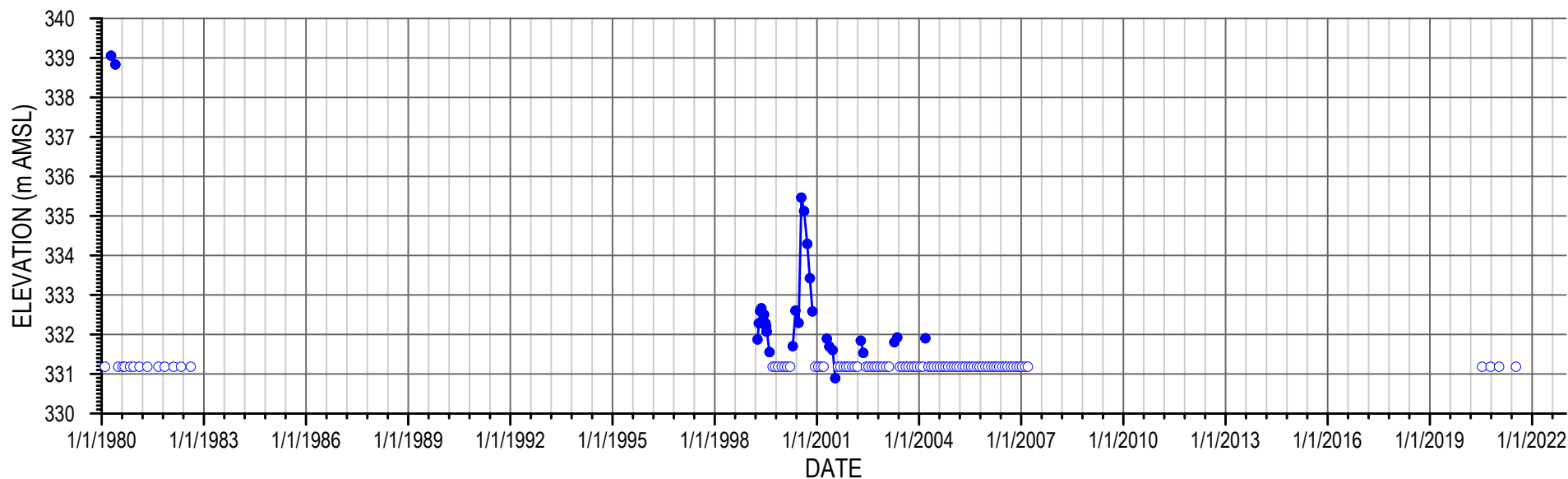
CRH MILTON QUARRY EAST EXTENSION
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MQEE BASE PLAN

FIGURE 3.3 Rev

Filename: \\ghdnet\ghd\CA\Waterloo\Projects\662\010978\Digital_Design\ACAD\Figures\MEM298\010978-GHD-00-00-MEM-EN-D101_WA-298.dwg
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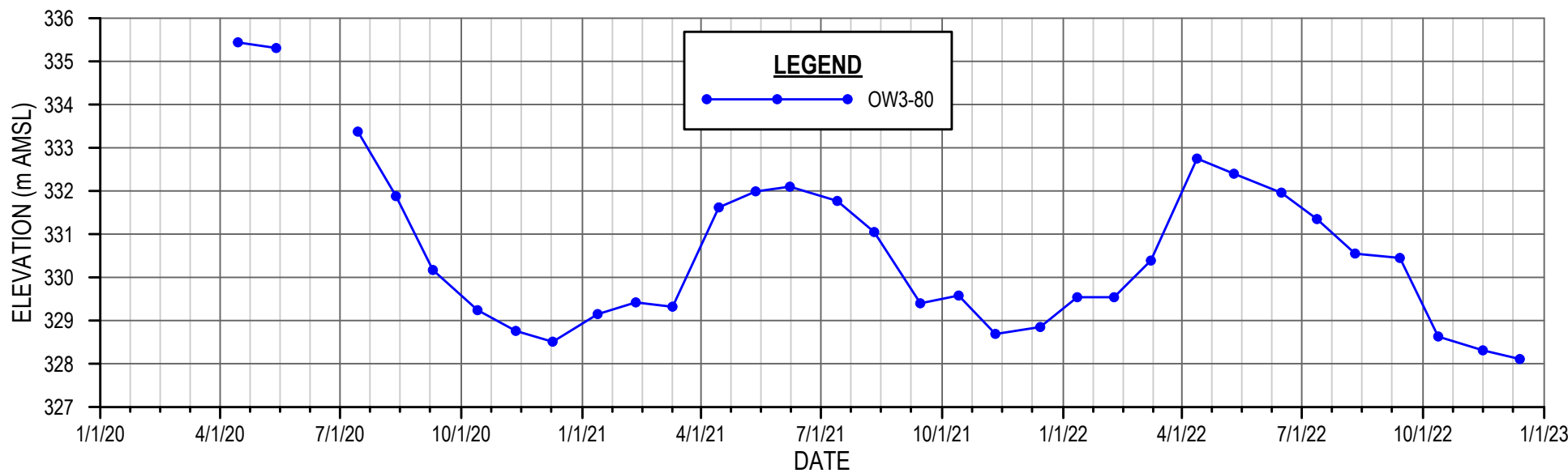
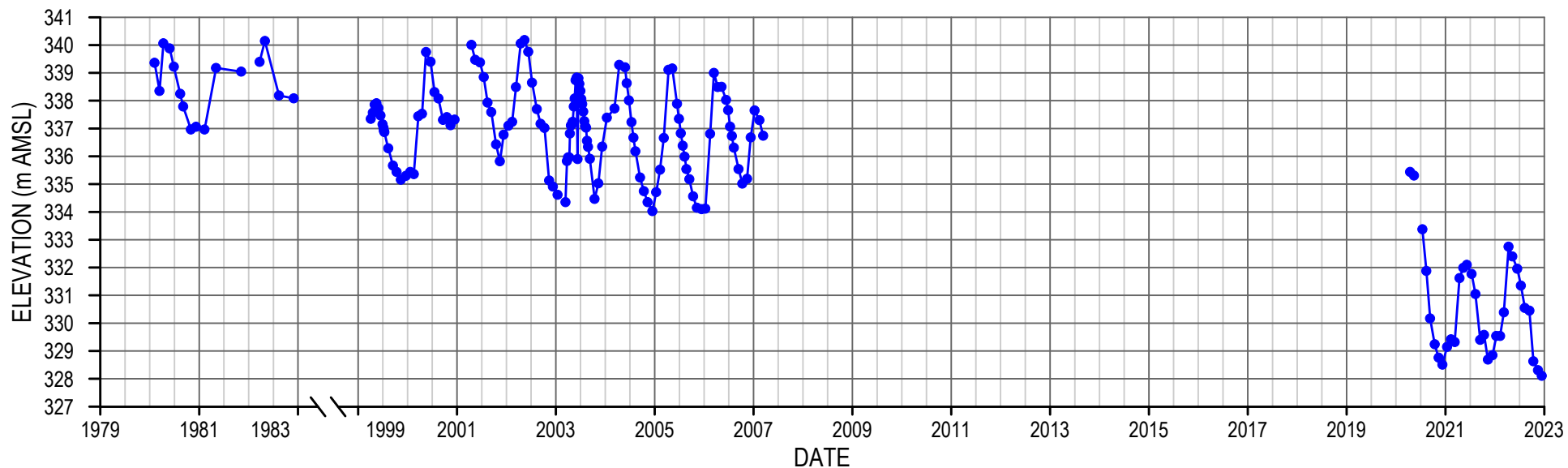
Note: Historical dry measurements may indicate a well obstruction.



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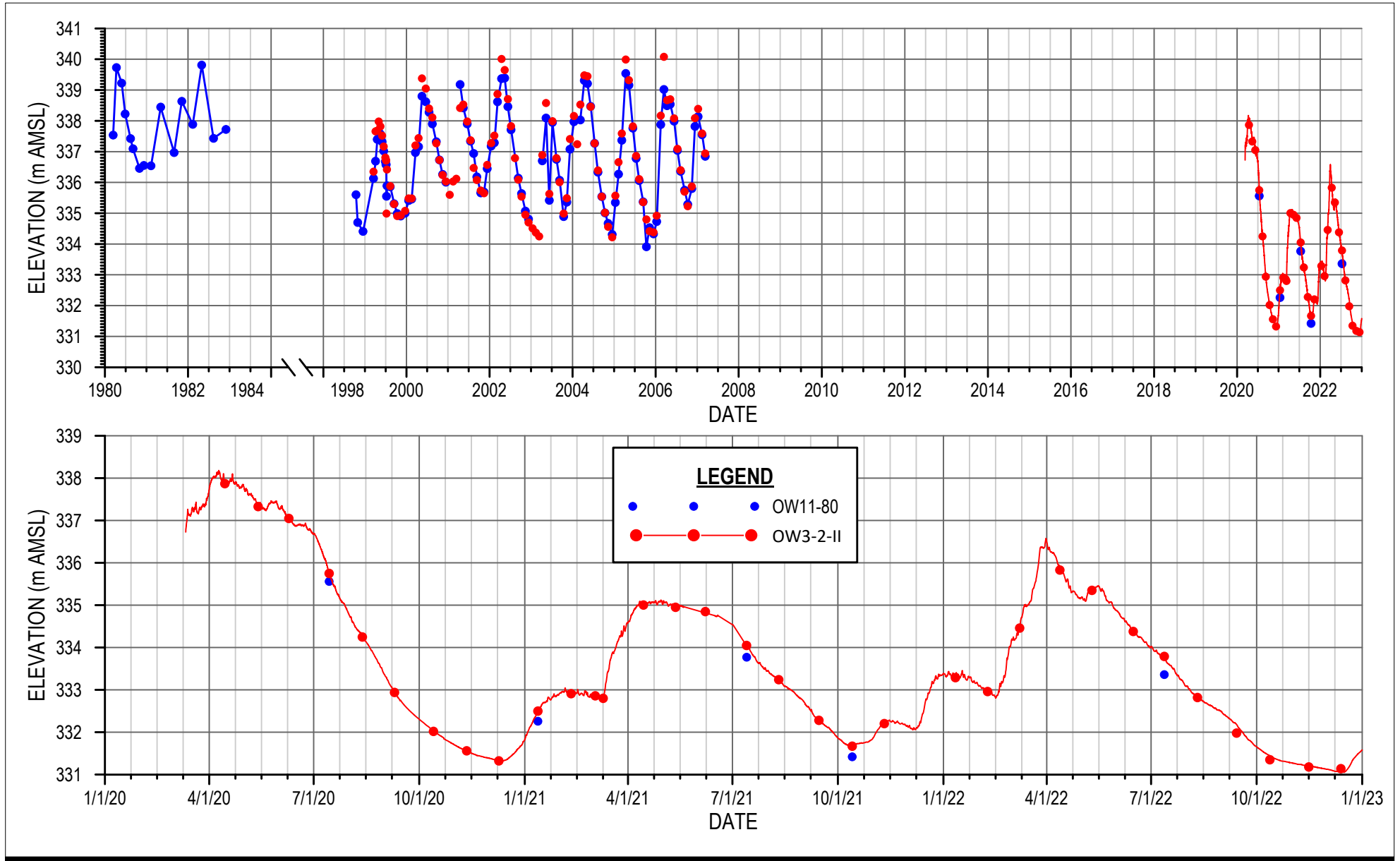
HYDROGRAPH - OW2-80



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HYDROGRAPH - OW3-80

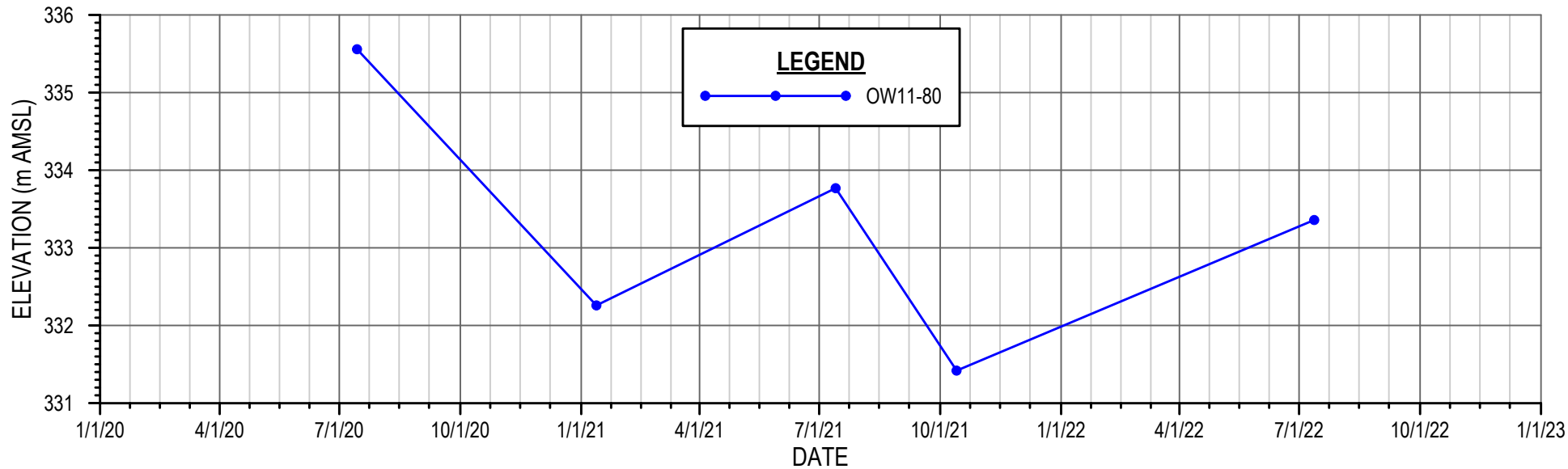
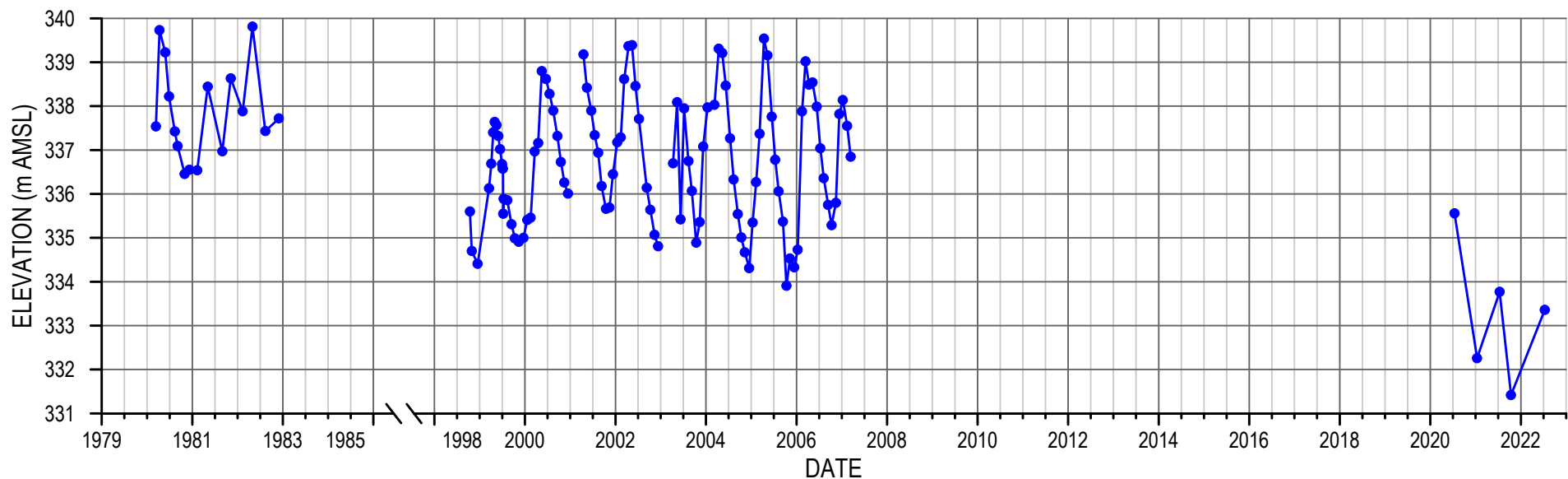


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HYDROGRAPH - OW11-80, OW3-2-II

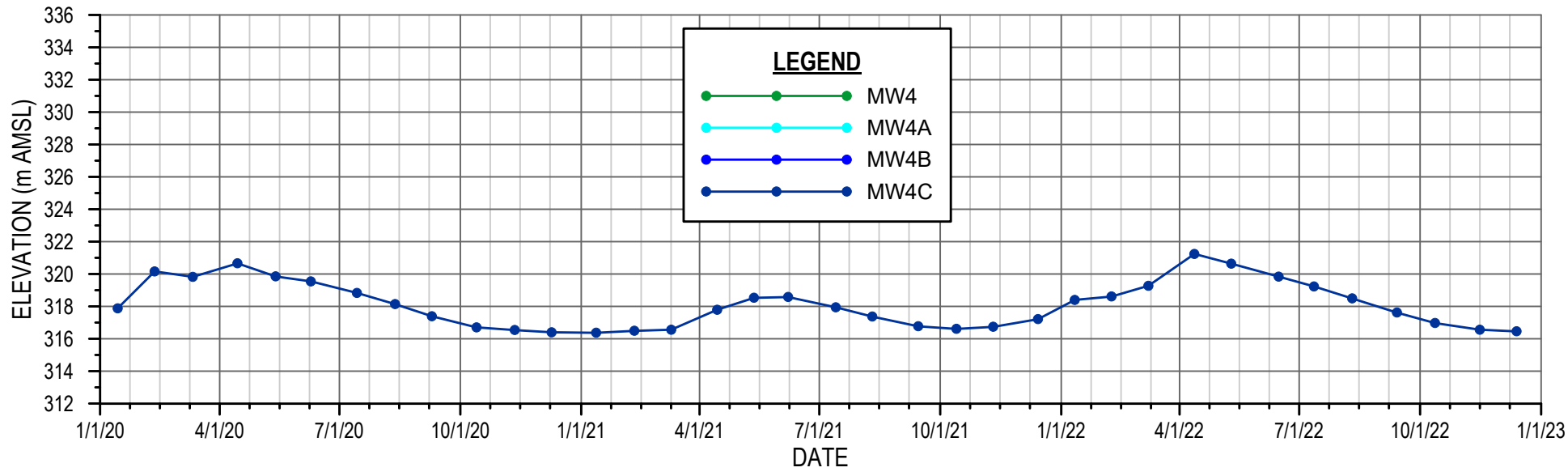
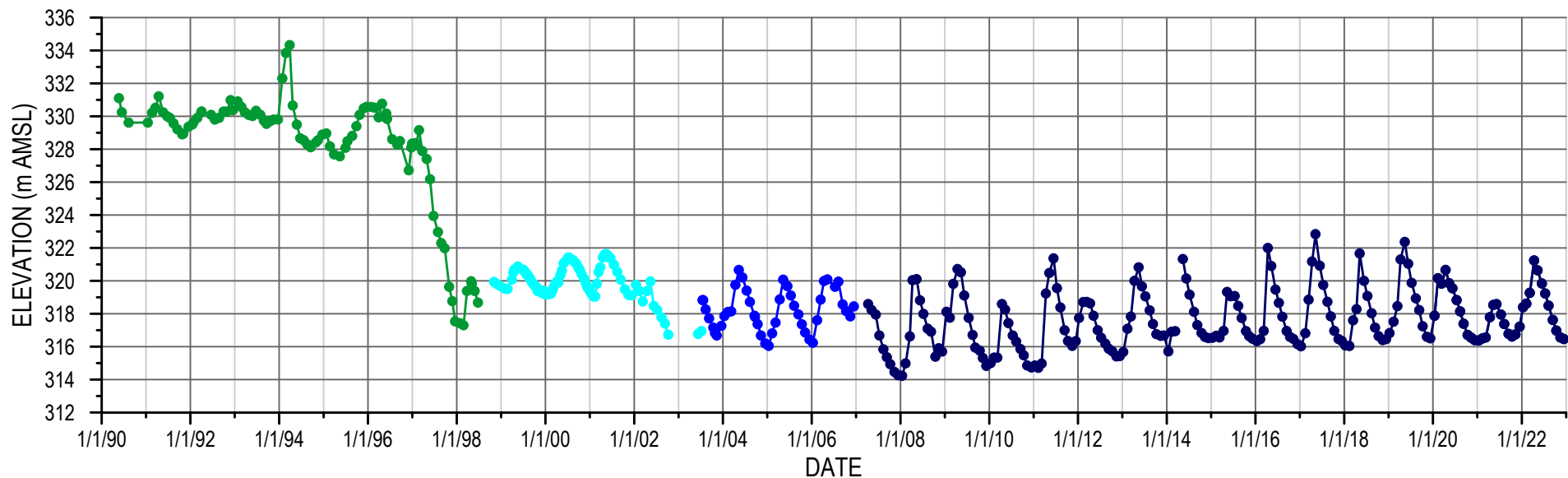
FIGURE



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HYDROGRAPH - OW11-80



LEGEND

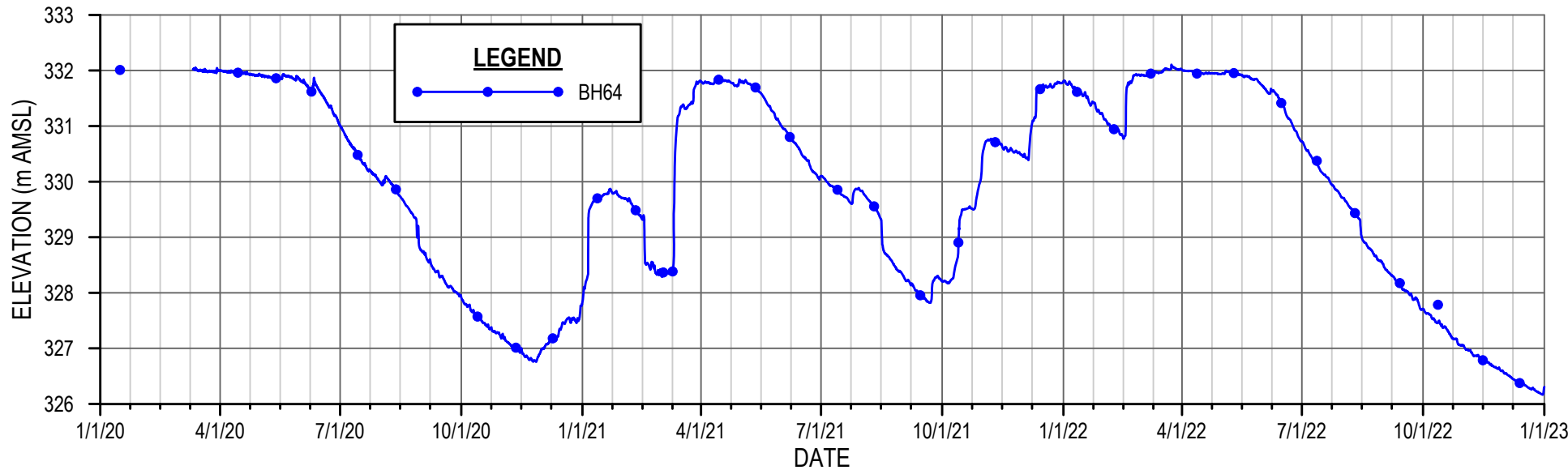
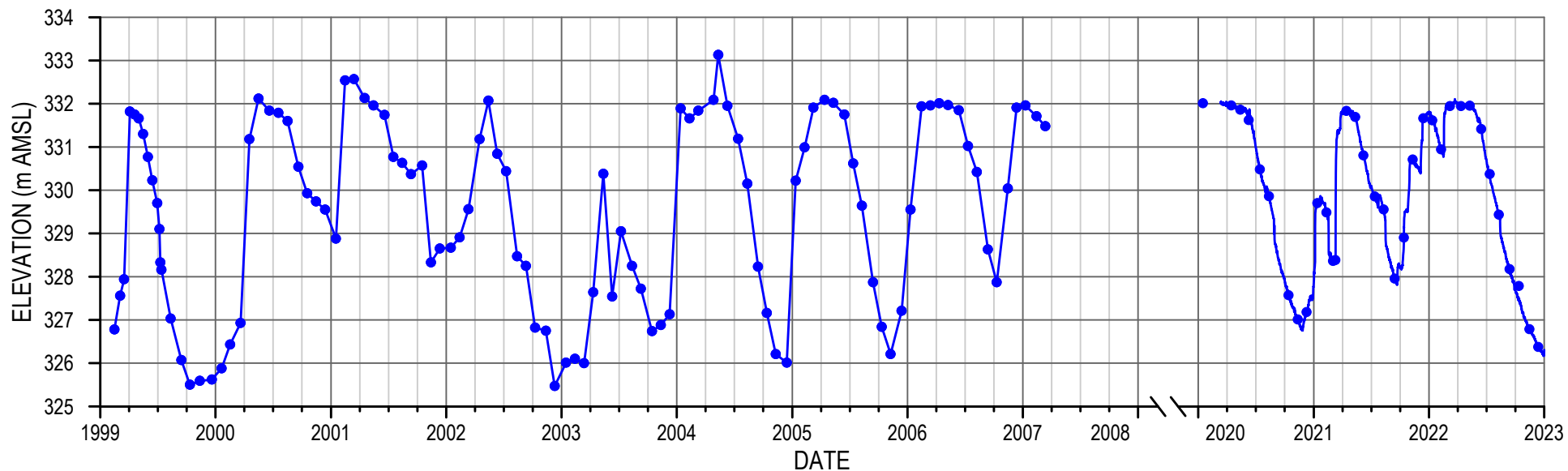
- MW4
- MW4A
- MW4B
- MW4C



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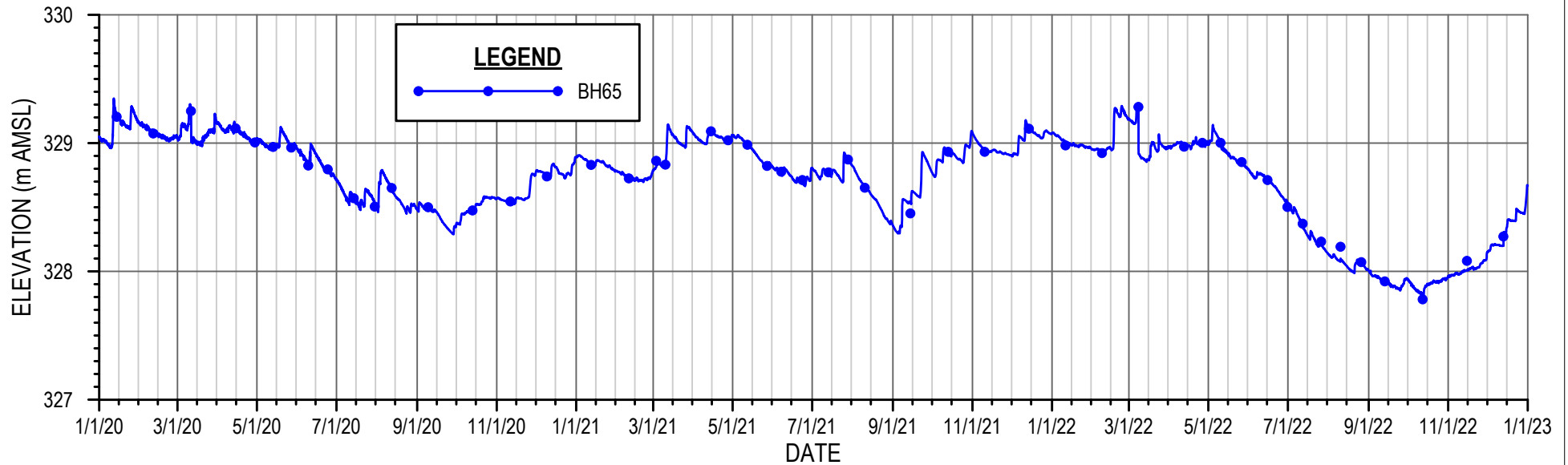
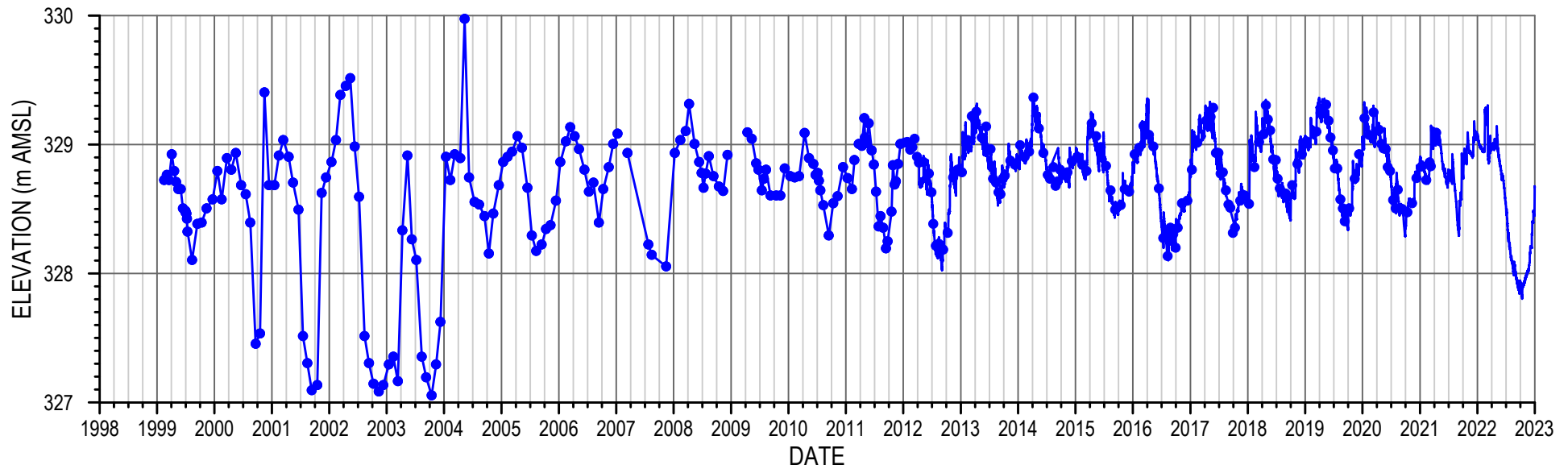
HYDROGRAPH - MW4 SERIES



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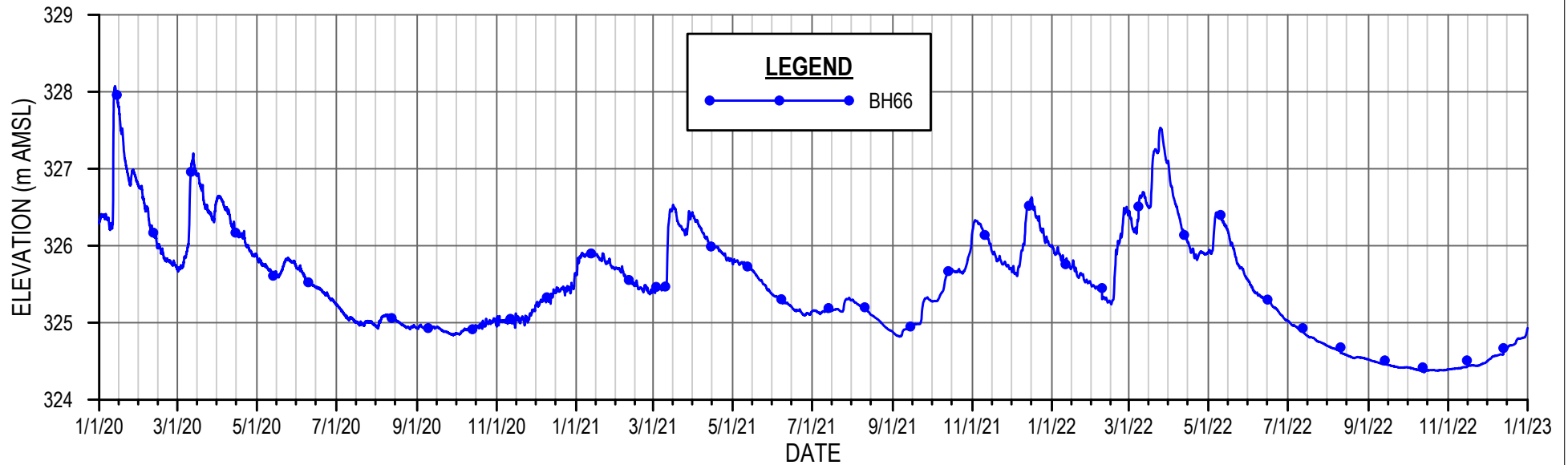
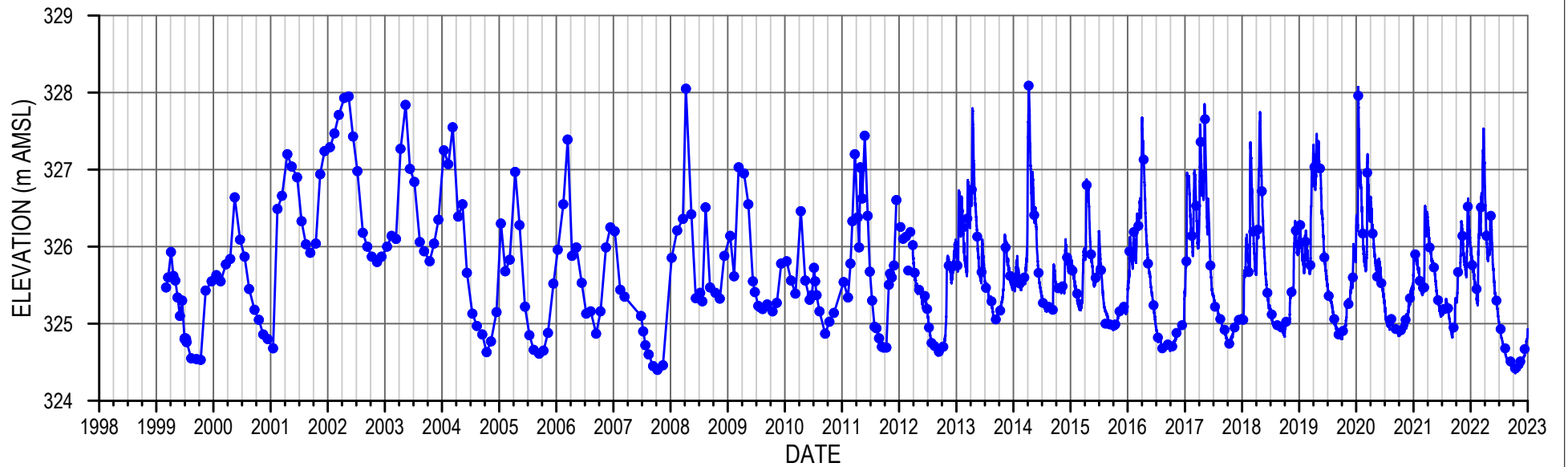
HYDROGRAPH - BH64



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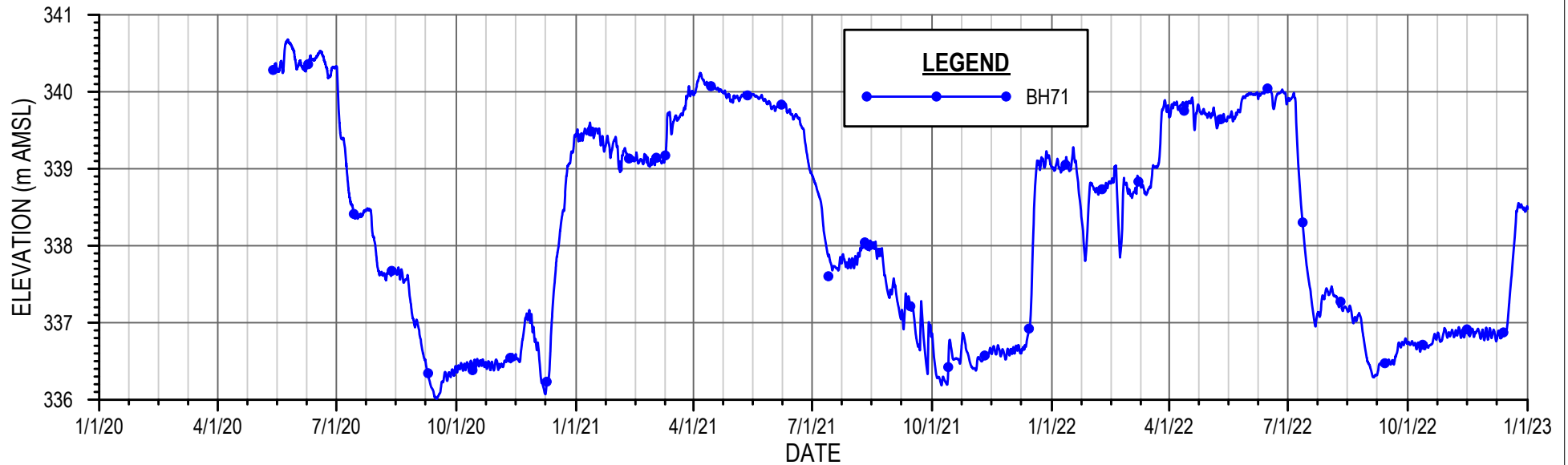
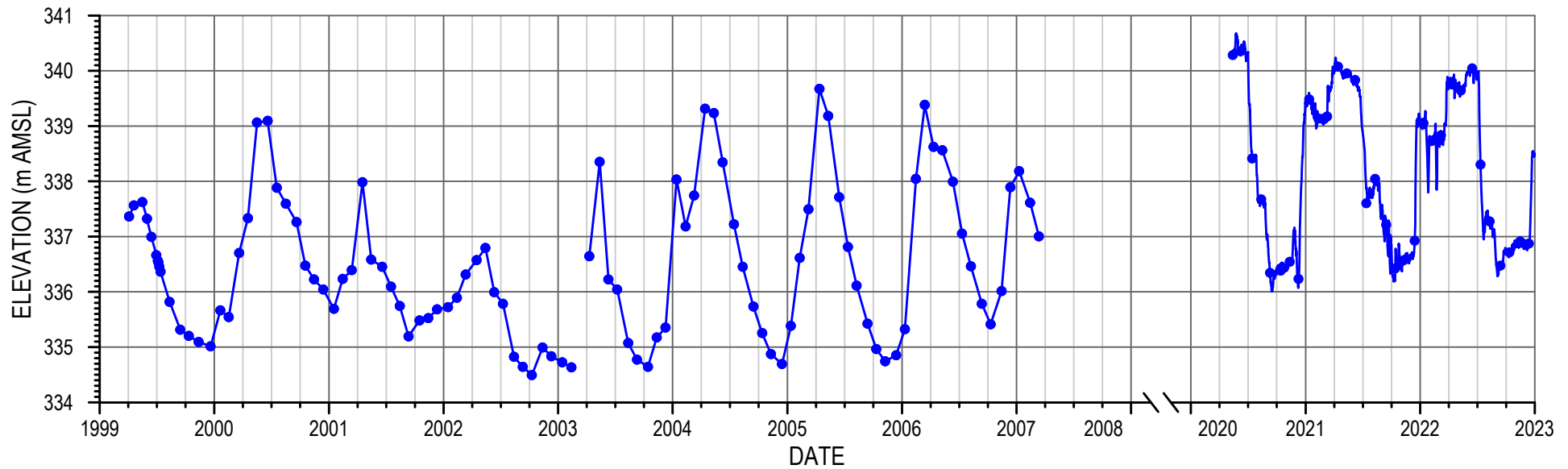
HYDROGRAPH - BH65



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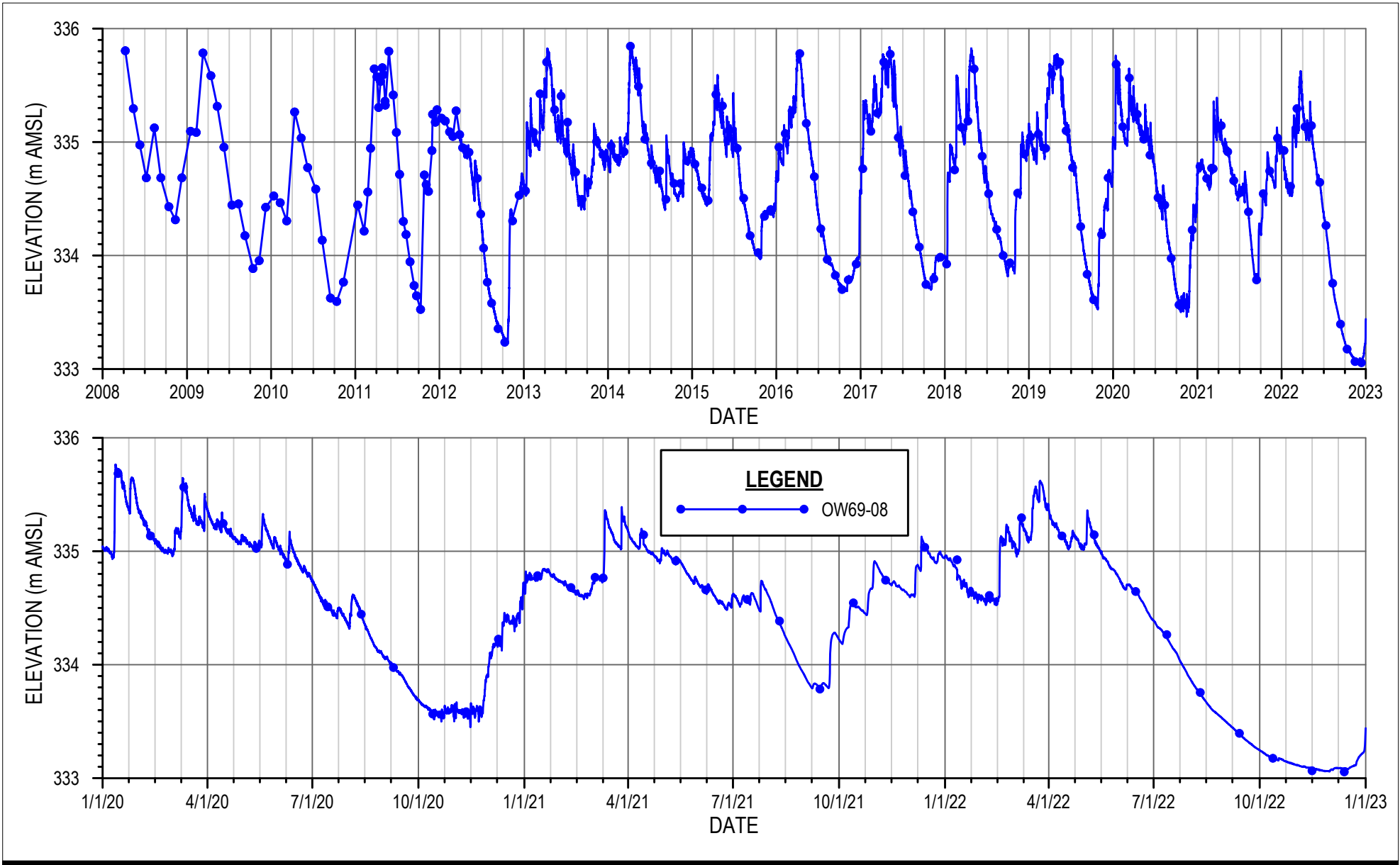
HYDROGRAPH - BH66



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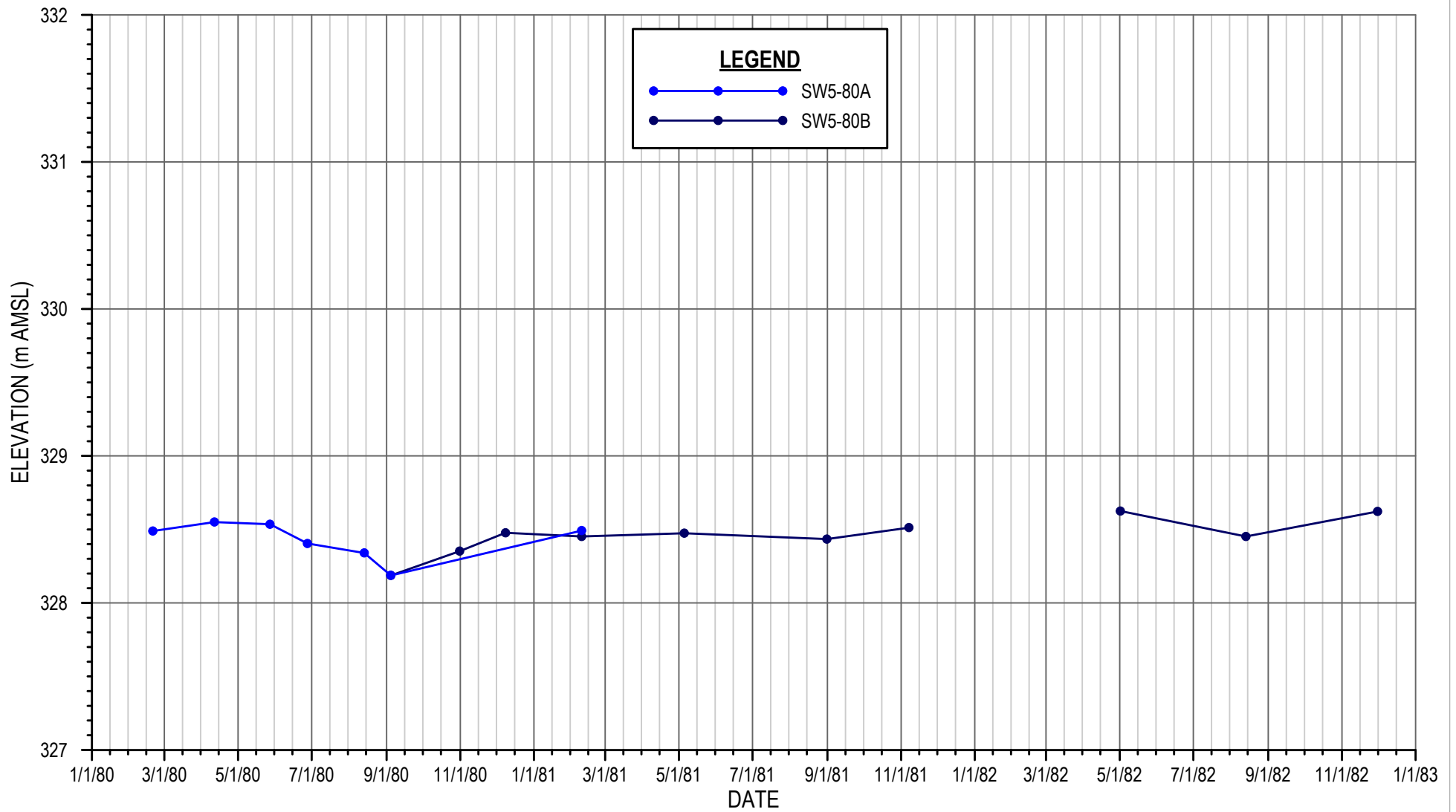
HYDROGRAPH - BH71



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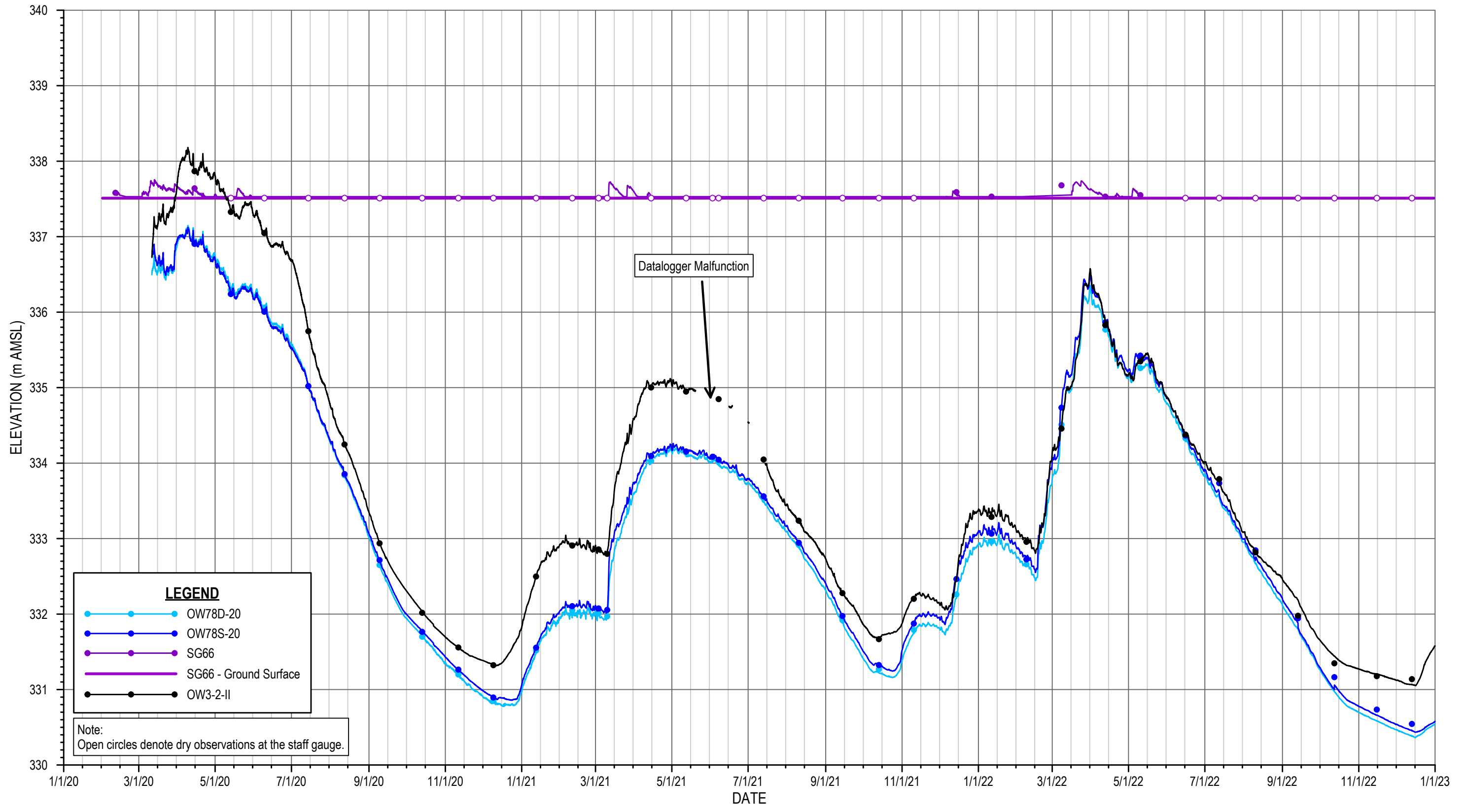
HYDROGRAPH - OW69-08



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HYDROGRAPH - SW5-80A/B

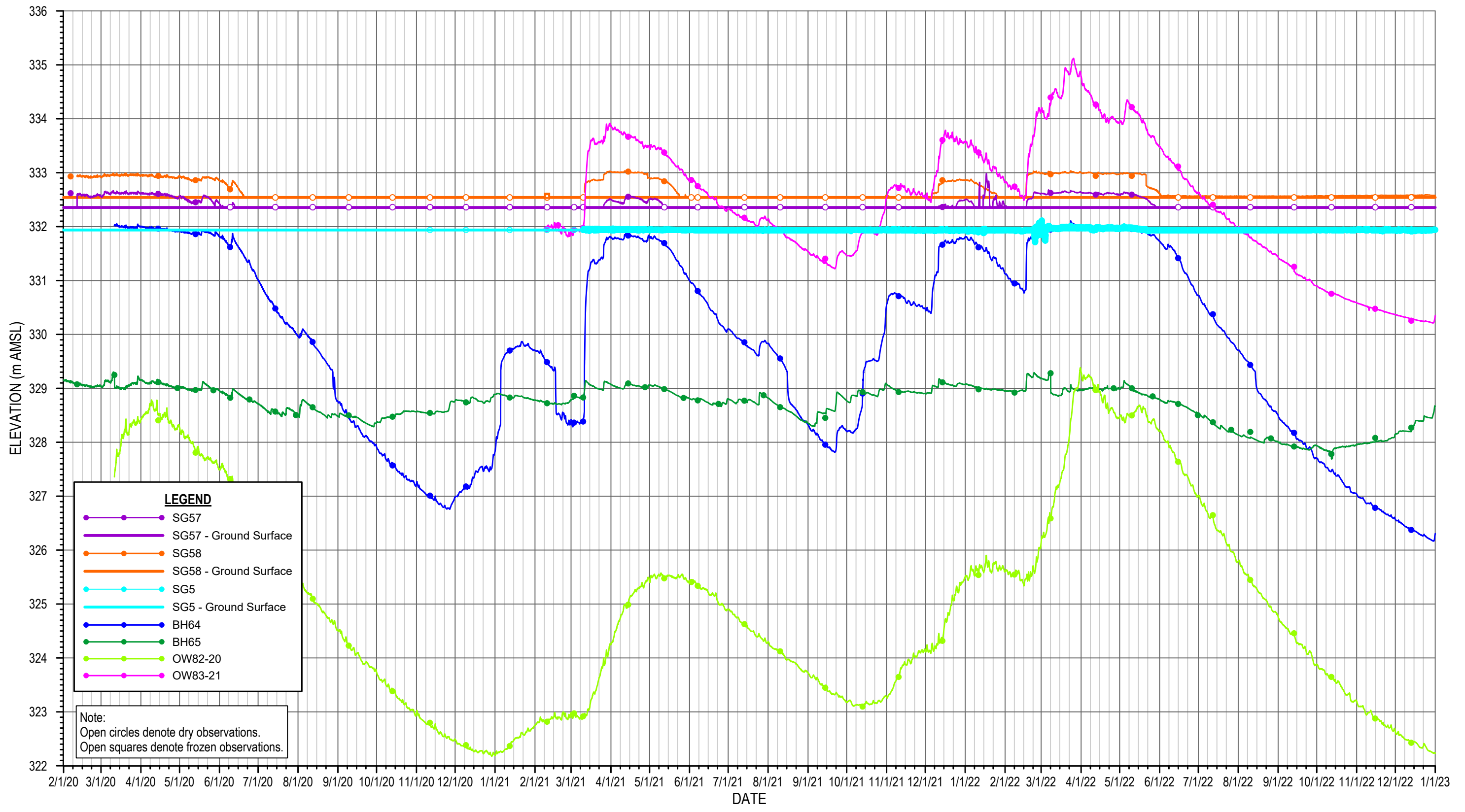


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HYDROGRAPH - WETLAND U1

FIGURE 6.10 Rev



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HYDROGRAPH - WETLAND W36

FIGURE 6.11 Rev