



ANNUAL GROUNDWATER REPORT

2022 - 2023

US GYPSUM, IMPERIAL COUNTY

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1. INTRODUCTION

In 1999, US Gypsum (USG) began an expansion of their Plaster City Plant, located outside of Ocotillo, California. This expansion replaced the production line from 1956 with a more modern and efficient gypsum wallboard manufacturing facility. An environmental impact report and study (EIR/EIS) of the expansion was approved in 2008. This EIR/EIS showed that groundwater levels were declining in the Coyote Wells Valley Basin (**Figure 1**) prior to the Plaster City Plant expansion, and it suggested that the Plant expansion and operations could exacerbate the groundwater level declines. In 2015, USG developed a Groundwater Monitoring Program in response to the EIR/EIS (Todd, 2015). This plan was updated in 2018 following a settlement agreement with the Sierra Club (Imperial County Superior Court, 2018). As detailed in the Monitoring Program, annual reports are submitted to Imperial County by the first business day of October.

This annual report details groundwater conditions in the Coyote Wells Valley Basin and documents changes that occurred between Spring 2022 through Spring 2023. It analyzes and summarizes groundwater levels and groundwater quality measurements collected by the United States Geologic Survey (USGS) each spring, as well as additional groundwater level and groundwater quality data collected by USG.

In Spring 2023, the USGS monitored groundwater levels in 22 wells throughout the basin and sampled groundwater quality from 16 wells. USG also measured daily water levels in five of these wells and additional groundwater contaminants in three of the wells. One well showed groundwater level declines over 4 years. Because this well constitutes less than ten percent of all monitored wells, this does not exceed the threshold for regional water decline. No significant adverse trends that indicate regional groundwater level decline or groundwater quality degradation were observed. Production well USG-4 was inoperable for most of the Spring 2022 to 2023, and production at wells USG-5 and USG-6 increased in response. This shift in production did not cause a significant change in water levels observed in surrounding monitoring wells.

2. PHYSICAL SETTING

2.1. DESCRIPTION OF GROUNDWATER BASIN

The Coyote Wells Groundwater Basin is located in the Yuha Desert, west of Imperial Valley, California (**Figure 1**). This Basin, DWR Groundwater Basin No. 7-29 (DWR, 2003), has an area of 64,400 acres (100 square miles). It is bounded by impermeable rocks to the north, west, and southwest, while its southern and eastern borders are political, as opposed to geologic, boundaries. **Appendix A** contains a more detailed description of the Basin's hydrogeology. Groundwater from this Basin is pumped for the Plaster City Plant, the community of Ocotillo, domestic wells, and, recently, dewatering of a construction project by US Customs and Border Protection that has since been abandoned.

2.2. HYDROLOGY

The Coyote Wells Valley Basin has an arid climate. Over the period of record from 1933-2023, the average spring to spring rainfall at the El Centro precipitation station (Western Regional Climate Center, 2022) is 2.6 inches (**Figure 2**). Annual rainfall ranges from 0.05 inches in 2001-2002 water year to 7.3 inches during the 1982-1983 water year. Annual precipitation was about average, 2.65 inches from April 2022 through March 2023. Sixty percent of the annual precipitation (1.59 inches) occurred during September 2022. The Basin receives limited natural recharge.

2.3. GROUNDWATER PUMPING

The Plaster City Plant pumps groundwater from the Coyote Wells Valley Basin for primarily industrial use. Its three production wells (USG- 4, 5, and 6) located near the center of the Basin (**Figure 3**). Monitoring wells, shown in **Figure 3**, observe groundwater conditions throughout the Basin. **Figure 4** provides a closer view of well locations near Ocotillo.

Figure 5 shows annual USG production, by calendar year, from 1970 to 2022. Annual production totals by well for the 2005 through 2022 calendar years are tabulated in **Table 1**. The total groundwater production reported by USG in the 2022 calendar year was 355-acre feet (AF). This is a slight increase from the 351 AF of production in calendar year 2021.

The total water pumped by USG during the time covered by this Annual Report, from the end of Spring 2022 (Q3 and Q4 2022) through Spring 2023 (Q1 and Q2 2023), was 347 AF. **Table 2** shows pumping during this period, as well as during the first two quarters of 2022. Quarterly production between 2022 Q3 and 2023 Q2 ranged from 78 AF (2023 Q1) to 94 AF (2022 Q3). The totalizer at USG-4 broke in May 2022. However, USG collects weekly data from the water meter, which provides data to the totalizer. The water meter readings at USG-4 were used to complete the total production log from May 2022 through the end of Q2. In July 2022, USG-4 was shut down due to electrical issues. In response, production increased in USG-5 and USG-6.

2.4. PUMPING FROM OTHER SOURCES

Groundwater pumping from the Basin has traditionally been for residential and industrial uses. There are no publicly available data for the annual pumping from the two mutual water companies and domestic wells in the Basin. However, a previous study estimated production from these sources to be 127 AFY as of 2004 (Todd, 2007).

3. MONITORING PROGRAM

The USGS measures water levels and water quality semi-annually and reports results publicly on the National Water Information System (NWIS) at <https://waterdata.usgs.gov/>. USG monitors water levels in the three production wells (USG-4, USG-5, and USG-6) and for two nearby monitoring wells (36A1/MW-2B and 36A2/ MW-2A). **Table 3** identifies all recently monitored wells within and just east of the Basin. In Spring 2023, USGS monitored quarterly water levels in 22 wells and USG monitored daily water levels in five of these wells. Six wells that were recently monitored but were not monitored in Spring 2023 are listed at the bottom of **Table 3**. When applicable, the reason why they were not monitored is also shown in **Table 3**. Staff at USGS were alerted that these wells should continue to be monitored. Well 28D1 was dry in Spring 2023. Its screened interval depths were requested. In September 2020, USG received a grant from the BLM to utilize land to install two additional monitoring wells. USG is currently in the process of assembling quotes for the well installation.

The USGS monitored water quality in 16 wells during March 2023. USG monitored additional contaminants, including organic constituents, in the three USG production wells. Samples were not collected by the USGS from USG-4 in 2023 because it was inoperable.

Figure 3 shows recently monitored wells in and surrounding the Coyote Wells Valley Basin, and **Figure 4** shows monitoring wells, zoomed in on Ocotillo. In these figures blue indicates wells that have both water level (WL) and water quality (WQ) data from 2023, yellow indicates wells with water level data only and green indicates water quality data only. Wells that have been monitored recently but were not monitored in 2023 are shown with a transparent symbol.

Water level measurements in the three production wells may not be representative of regional water levels because the water level fluctuates significantly due to pumping. When the well is pumped, the groundwater levels in and near the well decline. The resultant drawdown is dependent on several variables, including the pumping rate, well efficiency, and the type of pump. Hydrographs for all wells are found in **Appendix B**, and fluctuations in the production wells due to pumping are evident in these hydrographs.

3.1. WATER LEVELS

Appendix B contains hydrographs for all monitoring wells. The hydrographs are presented in two sets. The first set shows hydrographs for all active wells with the same scale for easy comparison. The second set shows the same water levels and wells, but with a vertical range of 25 feet (ft) to highlight subtle changes in the water levels.

Several key wells, shown with their hydrographs in **Figure 6**, were selected to show trends across the groundwater basin. These wells were chosen as key wells because they have relatively complete water level histories and locations representative of the groundwater basin. For easy comparison, the hydrographs in **Figure 6** all use the same vertical scale (40 ft). In Spring 2023, water levels were not measured in two of the six key wells (16J1 and 31B1).

Drawdown from pumping in the USG wells is observed in the nearby monitoring Wells 31B1 and 36D2 from the 1990s through 2008. These wells show slight decreasing trends during this time, and then slight increases in response to lower pumping rates in 2008-2015. Well 36D2 shows a slight decreasing trend from 2015-2023, likely due to recent increases in USG production. Well 31B1 shows a slight decreasing trend from 2015-2022 (water levels were not measured in Spring 2023).

Wells further away from the USG wells do not show a clear response to USG pumping rates. For example, Well 24D1, north of the USG wells, shows steadily decreasing water levels over the past 30 years while water levels in Well 16J1 have steadily increased during this time period. Towards the eastern edge of the Basin, Well 42L1 reflects seasonal variations and shows sharp increases after peak precipitation events in 1993 and 1997. Well 42L1 has shown a declining trend since 2013.

Table 4 lists 19 dedicated monitoring wells that were monitored in both Spring 2022 and Spring 2023 and the annual change in average water level. USG-4, 5, and 6 are excluded from trend analysis because the trend may be more reflective of recent pumping. For the monitoring wells 36A1 (MW-2B) and 36A2 (MW-2A), which are monitored by both the USGS and USG, the Spring USGS measurements were used for trend analysis to maintain consistent methodology.

Of the 19 wells analyzed, thirteen wells showed declining water levels from Spring 2022 to Spring 2023. Six of these wells had water levels decline by greater than 0.1875 during this period. The wells with notable groundwater level declines are not concentrated within a single portion of the Basin. The maximum water level decline was 0.54 ft at well 42L1, located in the southeastern portion of the Basin, seven miles away from the USG production wells.

Six wells show increasing groundwater levels over the past year. Four of these wells showed increases by greater than 0.1875 ft from Spring 2022 to Spring 2023. The three wells with the largest groundwater level increases are clustered in the southern portion of the Basin, near Yuha Estates. The maximum water level increase was 0.60 ft at well 11G1 in Yuha Estates.

The stop in production at USG-4 and the responding increase in production at USG-5 and USG-6 did not appear to affect water levels in surrounding monitoring wells. Monitoring wells 36A2 (MW-2A) and 36A1 (MW-2B), shown in **Figure 4**, are the closest monitoring wells to the USG production wells. **Table 4** shows that 36A2 (MW-2A) showed a water level increase (0.19 inches) between 2022 and 2023 while 36A1 (MW-2B) showed a water level decrease (0.22 inches) during that period.

The groundwater contours and flow direction near Ocotillo are shown in **Figure 7**. Like previous years, the groundwater flows, in general, from west to east. A pumping depression on the west is likely due to recent pumping in one or more private, non-USG wells.

3.2. ASSESSMENT OF GROUNDWATER LEVEL DECLINES

Groundwater level declines in the Coyote Wells Valley Basin have been previously characterized as either short-term or long-term declines. Short-term drawdowns correspond to nearby pumping and quickly recover after nearby pumping has ceased. Production wells have alternating periods where the well is on and off. When the well pump is operating, groundwater levels in and around the pumping well will decline. As shown in hydrographs for the production wells USG-4, USG-5, and USG-6 (**Appendix B**), water levels vary significantly while the wells are pumping, but levels recover within days.

Short-term declines in water levels can adversely affect surrounding wells. This drawdown is called well interference. The monitoring program developed for USG addresses well interference with the following performance standard:

*Well interference is defined as the combined pumping from all USG pumping wells so as **not to exceed 5 feet of drawdown at the nearest water-supply well.***

No private wells have reported well interference issues due to USG pumping thus far. Long-term declines do not quickly recover, and long-term declines are exacerbated by additional pumping. Several wells in the Coyote Wells Valley Basin exhibit long-term declines. The performance standard to evaluate long-term regional decline in the Coyote Wells Valley Basin is as following:

*Water level decline is defined as four consecutive **annual** groundwater measurements (**spring only**) declining at a rate that is greater **than 0.1875 feet per year**, occurring at more than **10 percent of wells** in the regional monitoring program.*

Spring measurements are used to calculate the rate of decline to avoid seasonal effects on groundwater levels, and USGS measurements are used to maintain consistent methodology. The calculated rate of decline for the period of record (2010-2023), is listed by well in **Table 4**. Declines greater than 0.1875 feet in a year are highlighted. Well 42L1 is the only well in the monitoring program to show water level declines over at least four consecutive years since annual reporting began. This well reported a water level decrease of 0.54 ft from 2022 to 2023 and a decline of greater than 0.1875 feet per year for the past six years. The average decline was 0.45 ft during this seven-year period. Well 42L1 is the only well in the

monitoring program to show water level declines over at least four consecutive years since annual reporting began.

The groundwater level data shown in **Table 4** and **Figure 6** indicate that the pattern and rates of groundwater level changes in Well 42L1 differ from that of other monitoring wells in the Basin, including wells closer to USG wells. This suggests that local factors may be affecting water level declines in addition to regional decline. The hydrographs in **Figure 6** shows that historical water level trends in the Basin vary by location. Comparison between the Well 42L1 hydrograph on **Figure 6** and the annual rainfall amounts on **Figure 2** show that high rainfall years correspond with short-term increases in groundwater levels at Well 42L1. This well is located along Yuha Wash, which concentrates and percolates rainfall-induced runoff from surrounding uplands and may make this well's water levels susceptible to precipitation trends, despite the arid environment. This well may be particularly vulnerable to shifting precipitation trends due to climate change.

Despite declines at a rate greater than 0.1875 feet per year for six years, Well 42L1 represents less than 10 percent of the total wells monitored (excluding USG production wells). The performance standard for assessing long-term regional decline has not been exceeded.

In subsequent annual reports, attention should be given to Well 31B1. Water levels in this well have decreased for the past five years. For three consecutive years, the groundwater levels decreased by more than 0.1875 ft, followed by a decrease of 0.17 ft from 2020-2021 and 0.14 ft from 2021-2022. This well was not sampled in 2023. Because the most recent annual groundwater level decrease was less than 0.1875 ft, this well does not meet the criteria for groundwater level decline. Well 31B1 is located near the USG production wells, and local water level decreases may be linked to USG production. Even if water levels in Well 31B1 had decreased by 0.1875 feet for five consecutive years, Wells 31B1 and 42L1 would still constitute less than 10 percent of all monitored wells.

4. WATER QUALITY

4.1. GROUNDWATER QUALITY

The EIR/EIS indicated that increased groundwater production can lead to groundwater quality degradation. Tertiary marine sediments have been identified in outcrops in the Ocotillo area as well as in the No Mirage area in the eastern portion of the groundwater basin. These sediments are present beneath the alluvial aquifer. Groundwater stored in these sediments has a higher natural salinity level. Increases in groundwater production could increase groundwater salinity in the Coyote Wells Valley Basin through two processes:

- lateral migration of saline water from near-surface Tertiary marine sediments
- vertical migration of saline water from the Tertiary marine sediments present at depth below the alluvial aquifer.

The monitoring program is designed to detect changes in total dissolved solids (TDS) concentrations due to increased pumping by USG wells. TDS is used as an indicator for

general mineral groundwater quality. Tracking TDS changes is a simplified, but widely accepted, method to detect changes in general water quality.

4.2. POTENTIAL WATER QUALITY DEGRADATION

Table 5 shows TDS concentrations for the active USGS monitoring wells, and tables of other constituents are presented in **Appendix C**. The water quality data shows clear spatial trends in the Basin, with little change over recent years. While higher TDS concentrations exist in the eastern portion of the Basin, the stable TDS concentrations throughout the Basin suggest that saline eastern water is most likely not migrating west.

The following performance standard has been developed as an early warning of changing conditions from USG pumping and its potential effect on water quality:

*A significant increasing trend in **total dissolved solids (TDS)** concentrations is defined as TDS concentrations in groundwater from any well in the groundwater basin whereby **four consecutive annual samples (collected each spring)** show a cumulative increase greater than **20 percent of the long-term average** for that well.*

No wells show increasing TDS concentrations, as defined by the updated 2018 USG performance standard listed above. Eight wells reported increases in TDS concentrations from 2022 to 2023. The most significant increases were observed in Well 24D1 (316 to 437 mg/L) and in USG-5 (300 to 329 mg/L). However, in Well 24D1, the 2023 value was lower than the long-term average and in USG 5 the 2023 value was only 9 mg/L greater than the long-term average. Eight wells measured lower TDS concentrations in Spring 2023 compared to Spring 2022. This report also includes TDS concentrations for Spring 2022 for wells 25M2, 26F1, and 36A1 (MW-2B). Concentrations at these wells were not available in the 2022 Annual Report due to USGS reporting delays.

Figures 8A and **8B** show springtime TDS concentrations. **Figure 8A** shows every well with a scale of 0 to 1,600 mg/L. All active wells in the monitoring network have satisfied the performance standard for TDS, meaning that cumulative 4-year increases in TDS concentrations (if any) have been less than 20 percent of the well's average TDS concentration. **Figure 8B** shows Well 31B1, a key well that has shown salinity fluctuations over the past several years. In March 2023, the TDS measurement at Figure 8A was 289 mg/L, a slight increase from the March 2022 TDS measurement of 278 mg/L.

Figure 9 shows TDS concentrations within the groundwater basin for Spring 2023. Groundwater quality data for other major constituents are provided in **Appendix C**. Although the maximum TDS concentration is used as the metric for reporting TDS concentrations, every well in the monitoring network only had TDS concentrations measured once in Spring 2023. As documented in **Table 5**, one well with previously high TDS concentrations (42A8) showed a decline from a high of 1,220 mg/L in April 2011 to 551 mg/L in March 2023. Well 24B1, located north of Ocotillo, had the highest March 2023 TDS concentration at 1,250 mg/L, the lowest concentration observed at this well since 2013.

5. SUSTAINABLE GROUNDWATER MANAGEMENT ACT (SGMA)

Pursuant to the Sustainable Groundwater Management Act (SGMA), Imperial County assumed the role of Groundwater Sustainability Agency (GSA) for all groundwater basins and sub-basins within the county. Consequently, the County has been deemed the exclusive GSA for the Coyote Wells Valley Basin.

The County has continued to work cooperatively with local agencies, water providers, and other interested stakeholders within the Basin in this role. DWR has determined Coyote Wells Valley Basin to be very low priority basin and is therefore not required to prepare a Groundwater Sustainability Plan (GSP). Should the County choose to prepare a GSP for the Basin, the County will consider the interests of all beneficial uses and users of groundwater, as directed by California Water Code section 10723.2. USG is a beneficial user of groundwater and should remain aware of and participate in any GSP process; groundwater management may change how groundwater is monitored, reported, or allocated in the Basin.

As of September 2023, there is no initial notification for a GSP of Coyote Wells Valley Basin and there are no other indications that the County is moving ahead in the process (DWR, 2023).

6. CONCLUSIONS

The USG monitoring program meets every objective established in the EIR/EIS. Continued data collection by the USGS is crucial for maintaining monitoring. The current monitoring network and program is sufficient to identify the occurrence of regional water level declines and identify regional water level declines related to the Plaster City Plant production. This annual report identified one well that has shown declining water levels over the past five years. However, this well represents less than 10 percent of the actively monitored wells in the monitoring network.

The current monitoring program meets the objectives set forth in EIR/EIS, noting the importance of continued USGS data collection. The water level data collected are sufficient to identify increases in the rate of water-level decline and for potential water quality degradation. In summary, none of the performance standards have been exceeded, and no significant adverse trends have been identified.

US Gypsum will prepare the next Annual Report due to the County of Imperial by the first business day in October 2024.

7. REFERENCES

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TABLES

Table 1. Annual USG Pumping by Well (AFY)

Calendar Year Pumping	Well #4	Well #5	Well #6	Total
2005	226	199	149	575
2006	199	188	162	549
2007	192	174	135	501
2008	140	136	125	400
2009	75	84	78	237
2010	78	82	79	239
2011	81	83	82	247
2012	69	109	70	248
2013	106	66	78	250
2014	98	59	82	239
2015	87	93	91	271
2016	115	118	106	339
2017	93	148	121	362
2018	154	127	92	374
2019	145	101	141	388
2020	109	108	130	347
2021	94	121	137	351
2022	59	139	157	355

Table 2. Quarterly USG Pumping by Well (AF per quarter)

Year	Quarter	#4	#5	#6	TOTAL	Annual Distribution
2022	Q1	29	21	29	79	--
2022	Q2 ¹	17	30	41	88	--
2022	Q3 ²	13	43	38	94	27.2%
2022	Q4	0	45	48	93	26.9%
2023	Q1	0	45	33	78	22.6%
2023	Q2	0	38	43	81	23.4%

1. Well 4 totalizer broke in May 2022. Subsequent pumping data from water meter.

2. Well 4 stopped operations due to electrical issues

Table 3. List of Actively Monitored Wells and Available Data for 2023

Well Name	Short Name	Active WL Network	Active WQ Network	First WL Measurement	First WQ Measurement	Agency
17S11E22E2	22E2	Y		1975	1975	USGS
17S10E11B1	11B1	Y		1975	*	USGS
17S10E11G1	11G1	Y		1967	1967	USGS
17S10E11G4	11G4	Y		1978	*	USGS
17S10E11H3	11H3		Y	1987	1987	USGS
16S11E23B1	23B1	Y		1974	1964	USGS
16S9E24B1	24B1	Y	Y	1976	1977	USGS
16S9E24D1	24D1	Y	Y	1976	1977	USGS
16S9E25K2	25K2	Y	Y	1972	1972	USGS
16S9E25M2	25M2			1991	1971	USGS
16S9E26F1	26F1	Y	Y	1998	2013	USGS
16S11E27F1	27F1	Y		1975	*	USGS
16S10E27R1	27R1	Y		1975	1975	USGS
16S10E29H1	29H1	Y		1975	1975	USGS
16S10E20R1	30R1		Y	1959	1959	USGS
16S10E31B1	31B1		Y	1993	2013	USGS
16S01E32N1	32N1		Y	2018	2018	USGS
16S10E32P2	32P2	Y		2017	*	USGS
16S01E32P3	32P3		Y	2016	2016	USGS
15S11E32R1	32R1	Y		1974	1964	USGS
16S9E34B1	34B1		Y	1998	1997	USGS
16S9E35M1	35M1	Y		1962	1962	USGS
16S9E36A1	36A1(MW-2B)	Y	Y	2012	2013	USGS, USG
16S9E36A2	36A2 (MW-2A)	Y	Y	2012	2013	USGS, USG
16S9E36B1	36B1 / USG-6	Y	Y	1969	1963	USGS, USG
16S9E36C2	36C2		Y	1975	1961	USGS
16S9E36D2	36D2	Y		1975	1975	USGS
16S9E36G3	36G3 / USG-4	Y		1969	1963	USGS, USG
16S9E36H2	36H2 / USG-5	Y	Y	1954	1963	USGS, USG
16S10E42A8	42A8		Y	1994	1994	USGS
16S11E42L1	42L1	Y		1975	1975	USGS

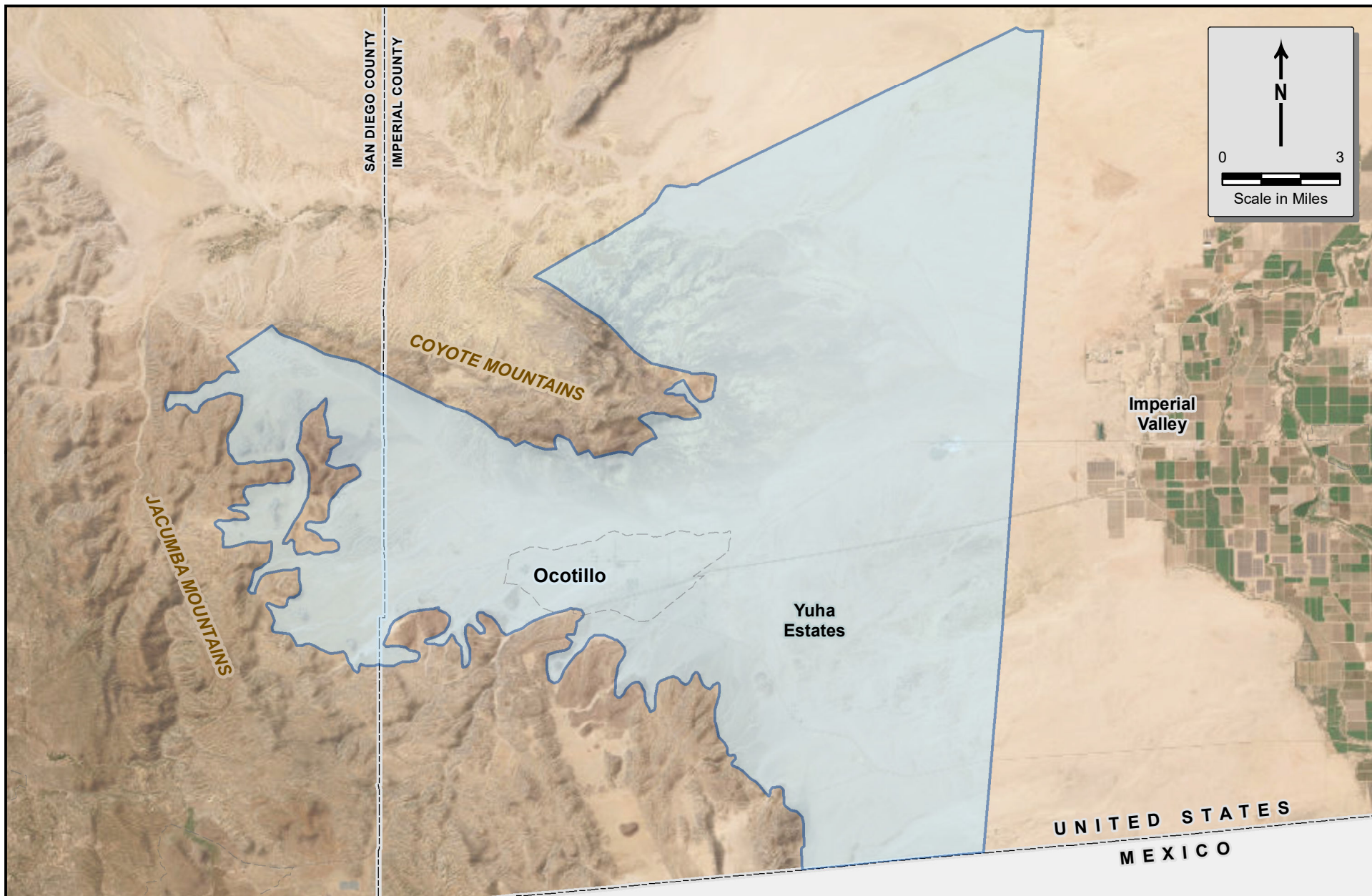
Wells Not Monitored in 2023 that were recently active


Well Name	Short Name	Agency	Reason
16S10E28D1	28D1	USGS	Well is dry -- screened interval unknown
16S10E32P1	32P1	USGS	No reason given by USGS, Last monitored 2017
17S10E11H3	11H3	USGS	Well currently inaccessible
17S11E16J1	16J1	USGS	Water level measured in 2023, but reading was not approved
16S9E25M2	25M2	USGS	Well destroyed
16S10E31B1	31B1	USGS	No reason given by USGS, Last monitored 2022

Table 5: Total Dissolved Solids Concentrations (mg/L)

Date	Chem	11H3	24B1	24D1	25K2	25M2	26F1	30R1	31B1	32N1	32P3	34B1	36A1 (MW-2B)	36A2 (MW-2A)	36C2	36D3	42A8	USG-4	USG-5	USG-6
Mar-09	Total Dissolved Solids	287	1210		335			517				302			359	365	910		305	
Mar-10	Total Dissolved Solids	307	1200		306			498				300			349	346	1100		304	
Apr-11	Total Dissolved Solids	280	1220		325			525				298			485	359	1220		306	
Mar-12	Total Dissolved Solids	315	1210	486				511				303			359		886		320	
Feb-13	Total Dissolved Solids	284	1220	497	302			530	299			306					739			
Apr-14	Total Dissolved Solids	292	1290	499	309			543	284			314			360		728		327	
Mar-15	Total Dissolved Solids	297	1350	492					298			315								
Mar-16	Total Dissolved Solids	280	1350	484	291		356	559	271			303	298	399	362		654	362	334	309
May-17	Total Dissolved Solids	298	1350	495	323		353	567	283			300	303	412	357		594		328	314
Mar-18	Total Dissolved Solids	288	1310	439	304	352	342	565	274	469	612	305	291	396	350		564	343	323	
Mar-19	Total Dissolved Solids	322	1310	503	309	373	365	583	273	477	621	322	307	423	368		575	361	331	317
Mar-20	Total Dissolved Solids	289	1280	431	296	367	366	572	288	474		305	303	420	369		555	372	324	309
Mar-21	Total Dissolved Solids	310	1280	464	304	359	358	598	293	472	618	319	308	409	369		556	350	335	314
Mar-22	Total Dissolved Solids	287	1275	416	297	346	352	600	278	474	566	310	279	420	353		535	337	300	302
Mar-23	Total Dissolved Solids	283	1250	437	295		346	601	289	460	550	315	296	416	349		551		329	305
	Average	295	1,274	470	307	359	355	555	285	471	593	308	298	412	368	357	726	354	320	310
	One Year Change (2022-2023)	(4)	(25)	21	(2)		(6)	1	11	(14)	(16)	5	17	(4)	(4)	-	16		29	3
	Four Year Change (2019-2023)	39	60	66	14		19	(18)	(16)	17	71	7	11	7	19	-	24		2	12
	20 percent of average	59	255	94	61	72	71	111	57	94	119	62	60	82	74	71	145	71	64	62

FIGURES



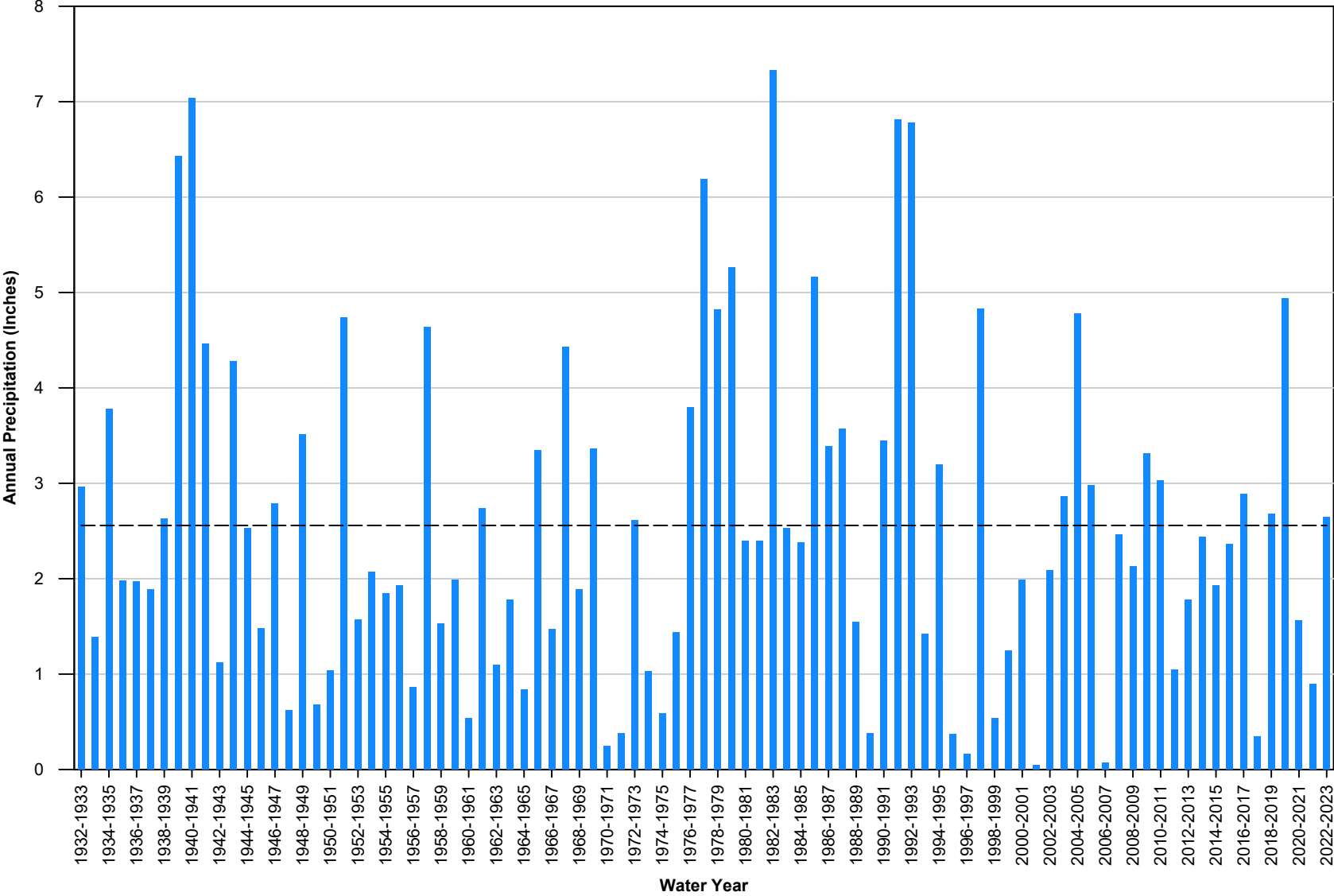
 Coyote Wells Groundwater Basin

August 2023



Figure 1
Groundwater Basin
Boundary

Precipitation



Average Annual Precipitation
2.6 inches

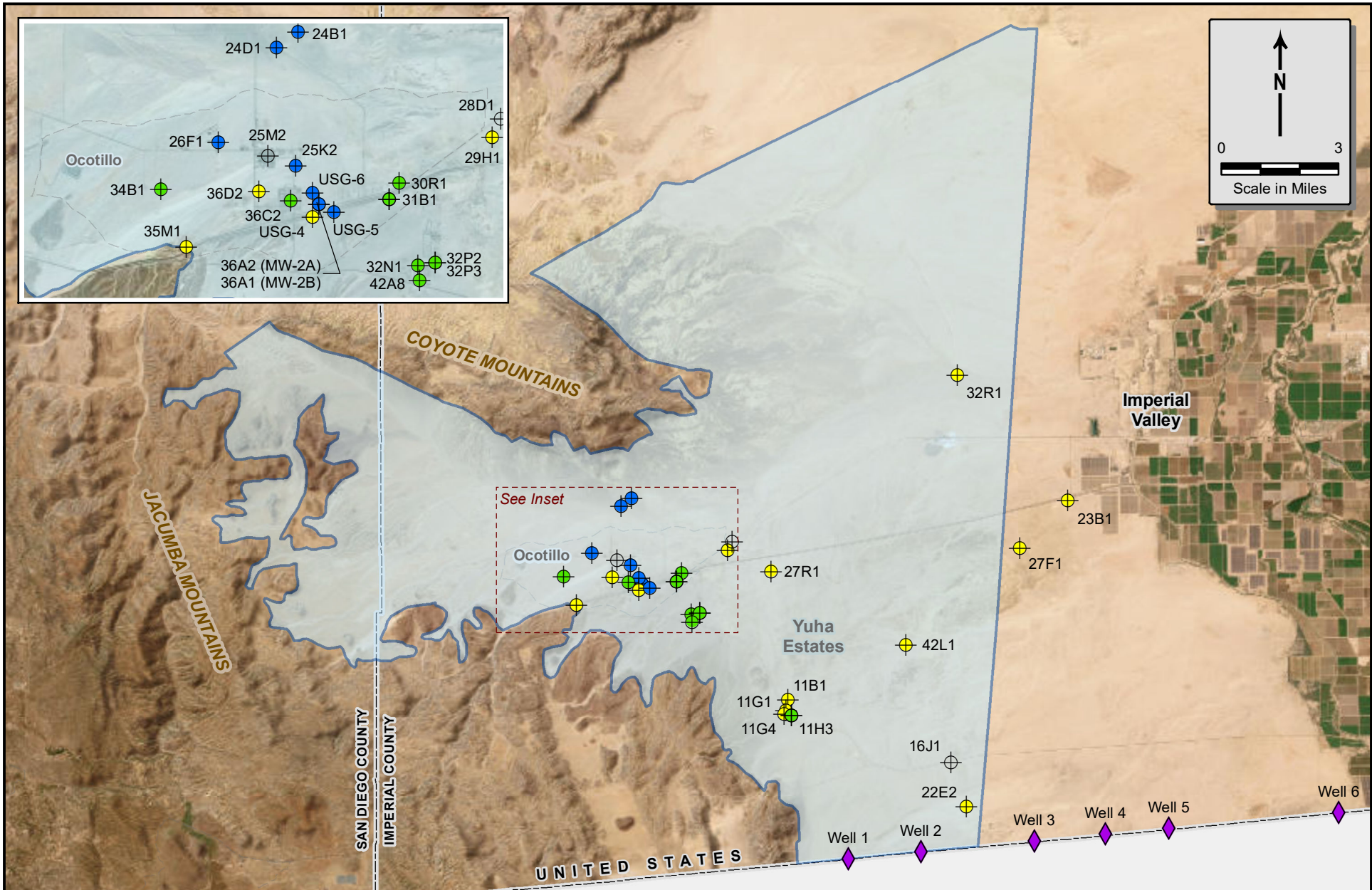
--- Average Annual Precipitation (2.6")
■ Precipitation

August 2023

TODD
GROUNDWATER

Figure 2
Annual Precipitation
at El Centro Station

Path: T:\Projects\US_Coysum_Annual_7420\GGRAPHICS\2023\Figure 2 Annual Precipitation at El Centro Station.grf

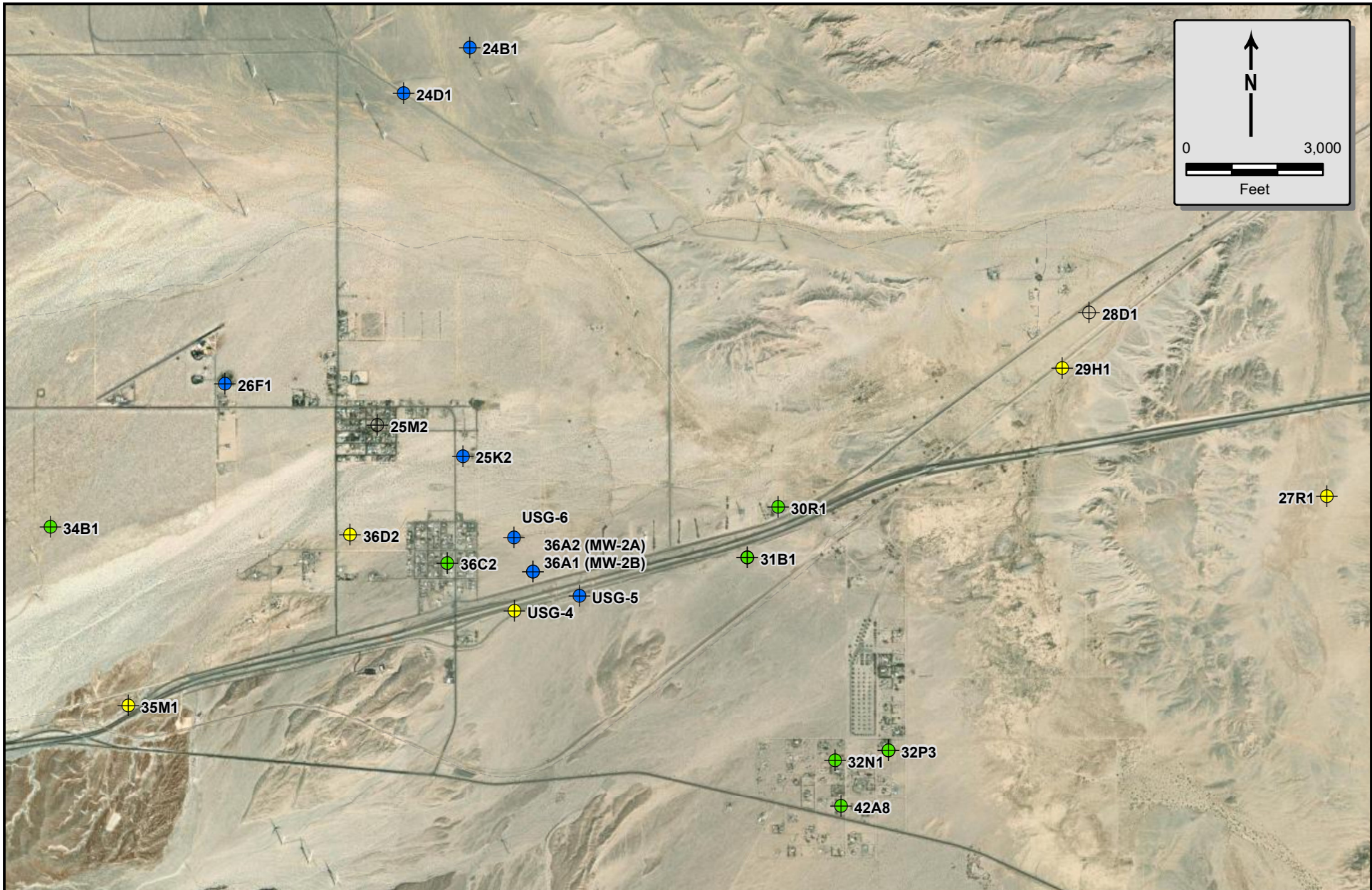


- Monitoring Well - Water Level Only
- Monitoring Well - Water Level and Water Quality
- Monitoring Well - Water Quality Only
- ⊕ Active Wells not Sampled in 2023
- ◆ USBorderWells
- Coyote Wells Groundwater Basin

August 2023

TODD **GROUNDWATER**

Figure 3
Active Monitoring Wells



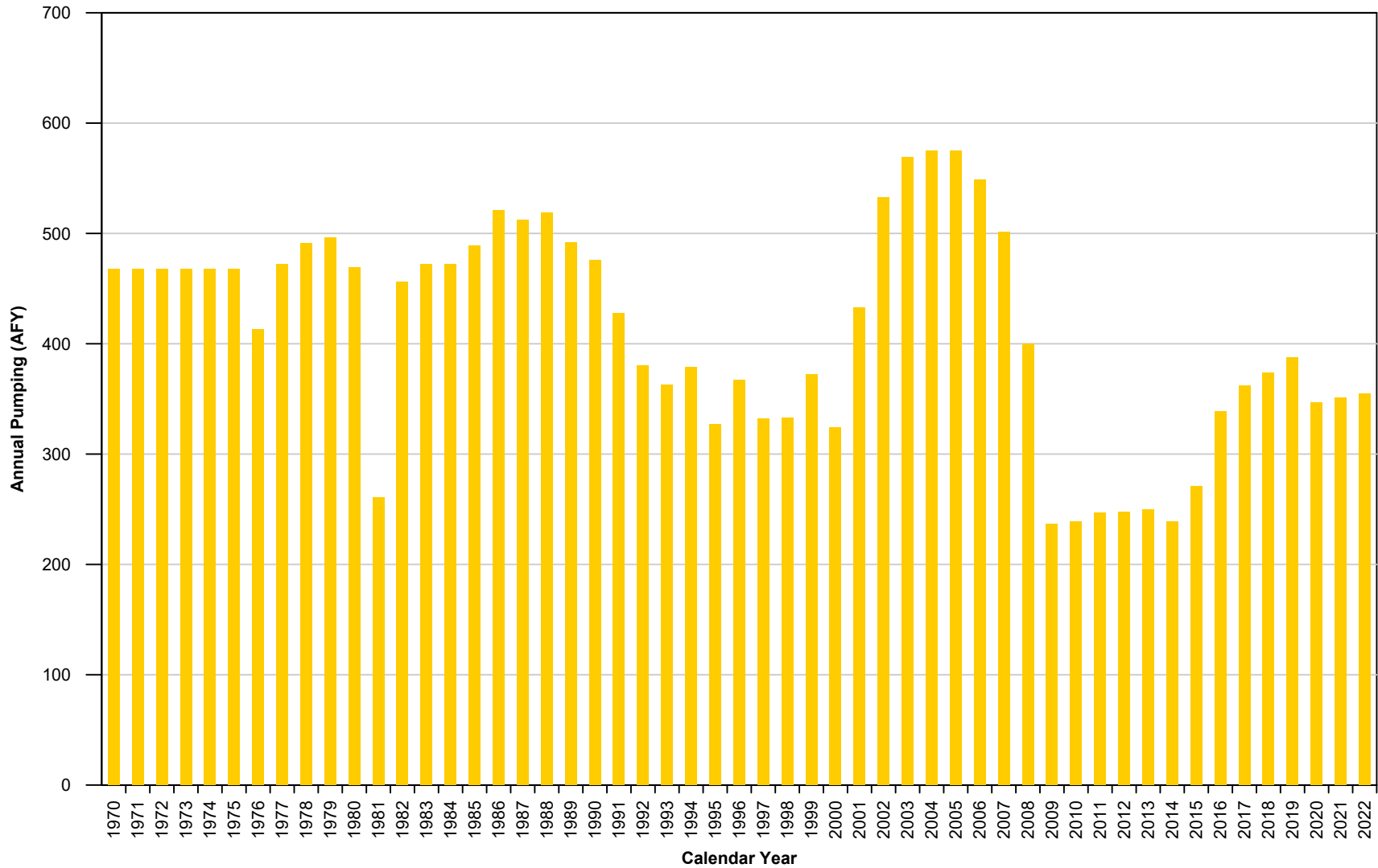
- Monitoring Well - Water Level Only
- Monitoring Well - Water Level and Water Quality
- Monitoring Well - Water Quality Only
- Active Wells not Sampled in 2023

August 2023



Figure 4
Monitoring Wells
Near Ocotillo

USG Annual Pumping

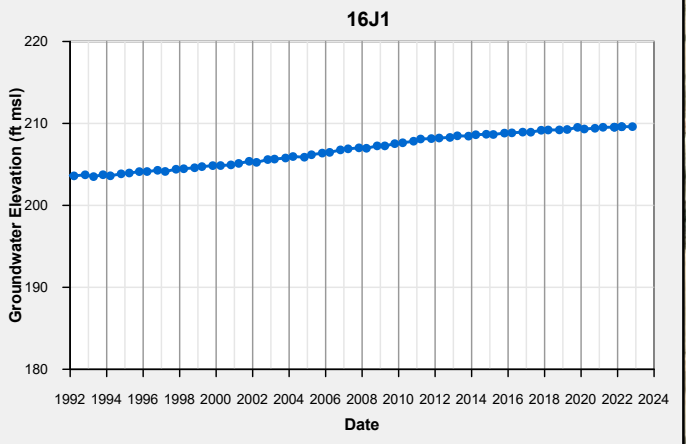
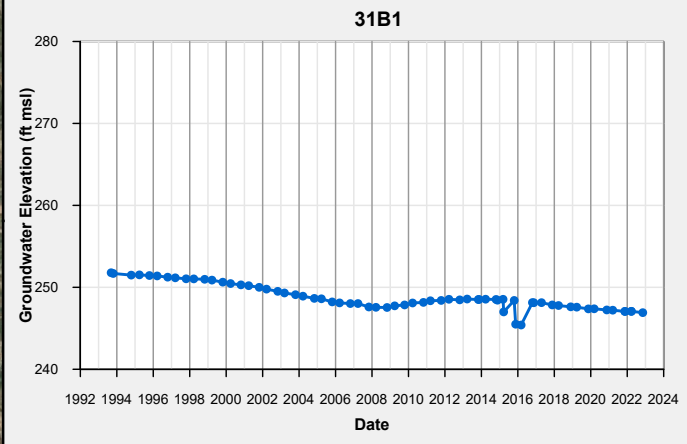
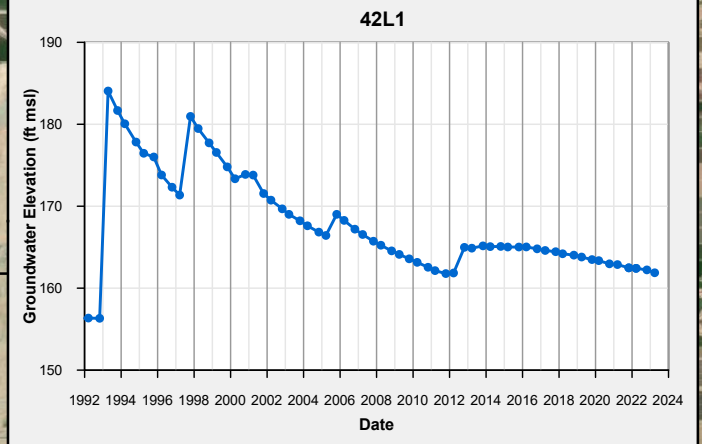
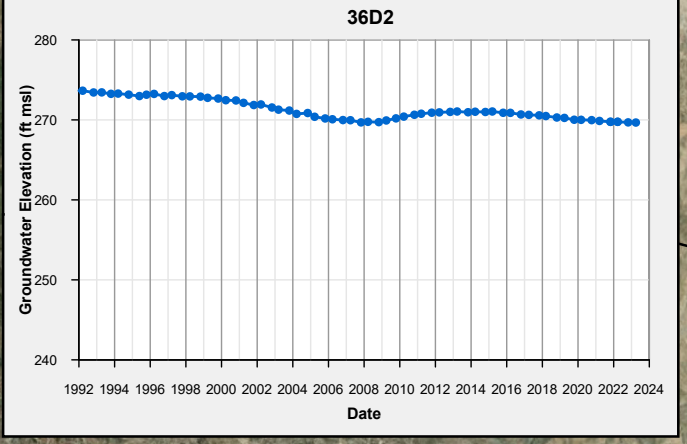
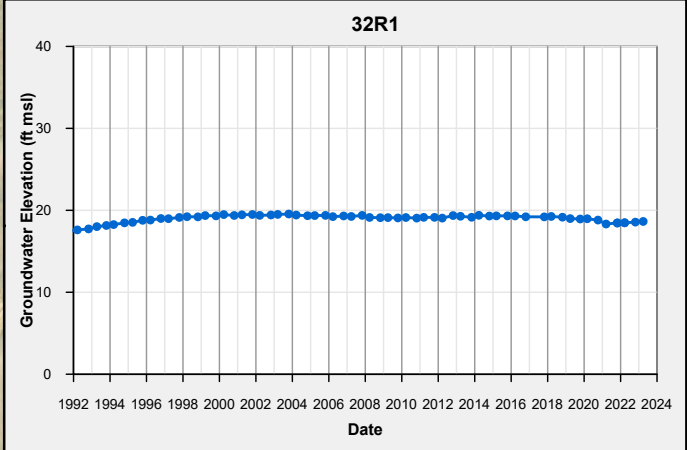
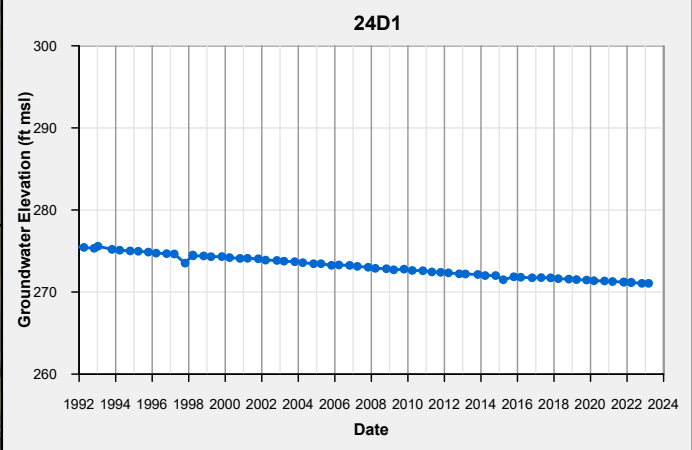
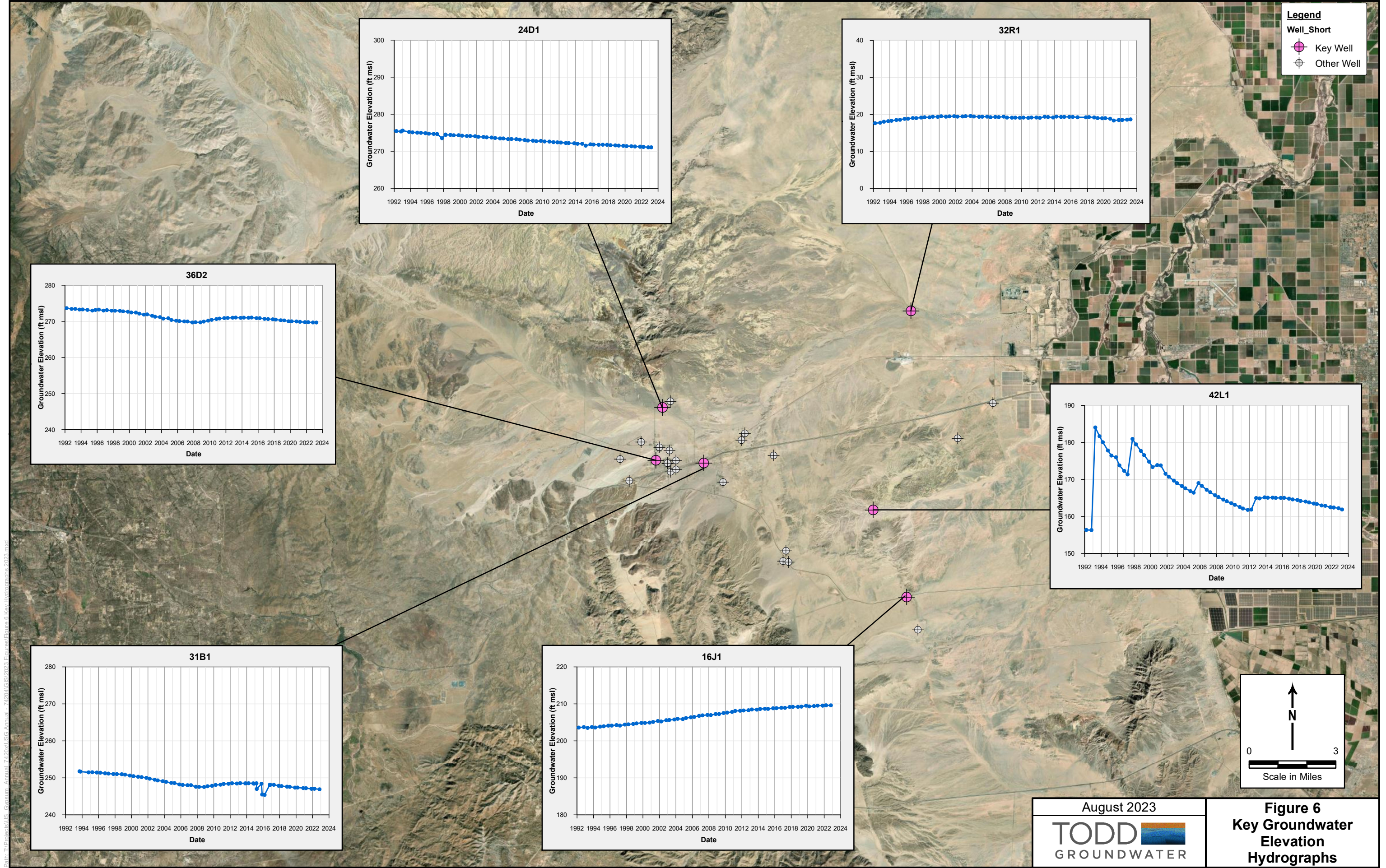


 Pumping (AFY)

August 2023



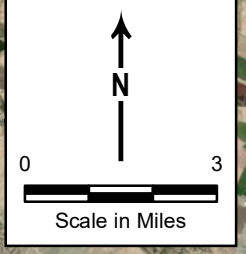
Figure 5
USG Annual Pumping



Legend

Well_Short

- Key Well
- Other Well

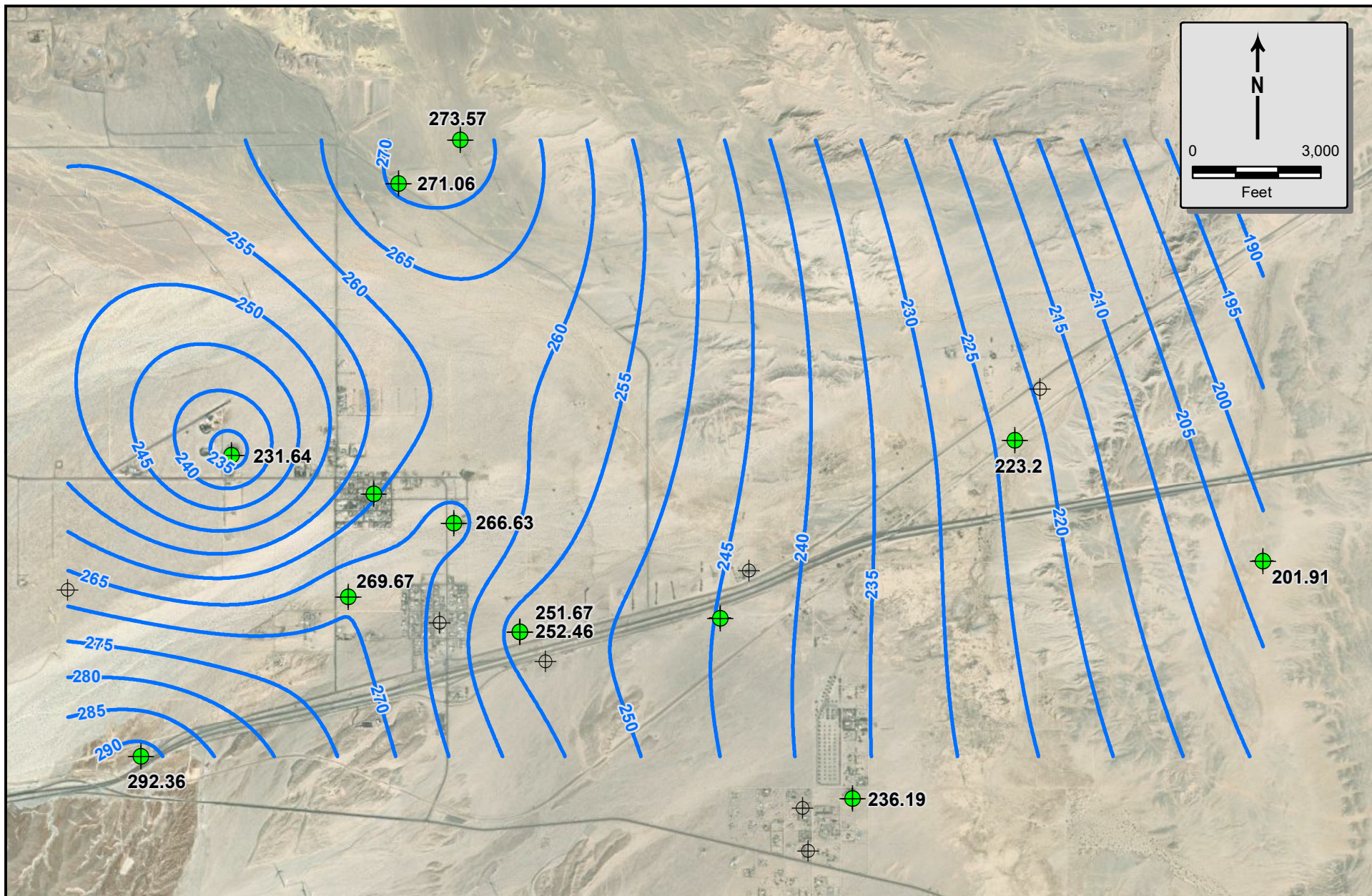


August 2023

TODD GROUNDWATER

Figure 6
Key Groundwater
Elevation
Hydrographs

Path: \\Projects\US - Gopaini - Annual - 7420X\USG - Annual - 7420X\GIS\2023 - Figures\Figure 6 - Key Hydrographs_2023.mxd

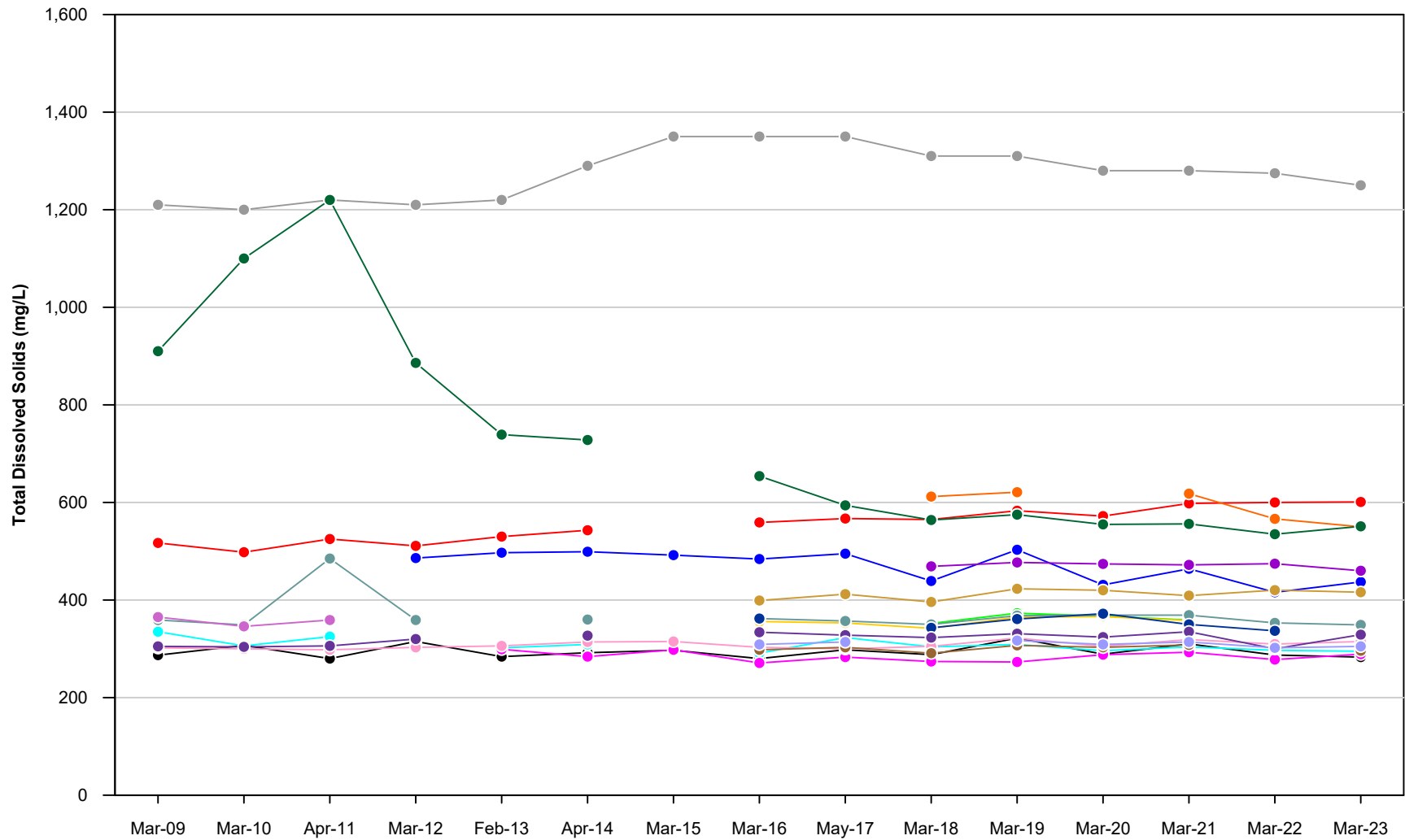


-  Monitoring Well
-  Not Monitored
-  Spring 2023 Groundwater Contour (feet msl)

August 2023

TODD 
GROUNDWATER

Figure 7
Groundwater Contours
and Flow Direction
Spring 2023

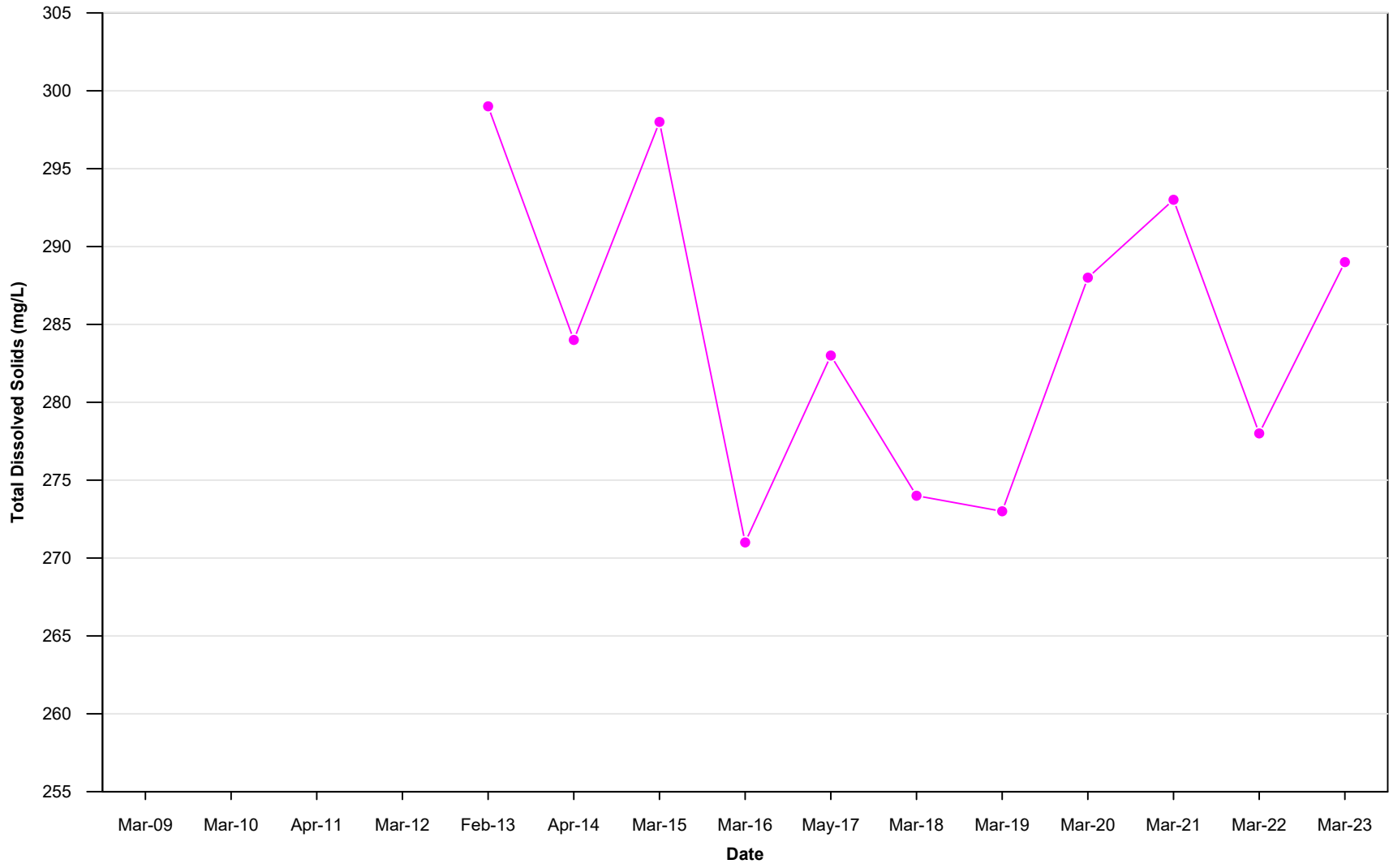


- 11H3 ● 25M2 ● 32N01S ● 36-A2 (MW-2A) ● 42A8
- 24B1 ● 26F1 ● 32P03S ● 36C2 ● USG-4
- 24D1 ● 30R1 ● 34B1 ● 36D3 ● USG-5
- 25K2 ● 31B1 ● 36-A1 (MW-2B) ● 36H1/36H2 ● USG-6

August 2023

TODD
GROUNDWATER

Figure 8A
Total Dissolved Solids
Concentrations



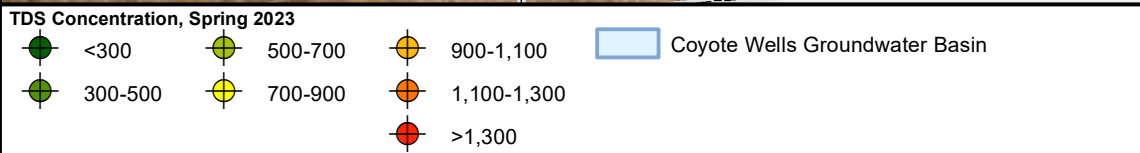
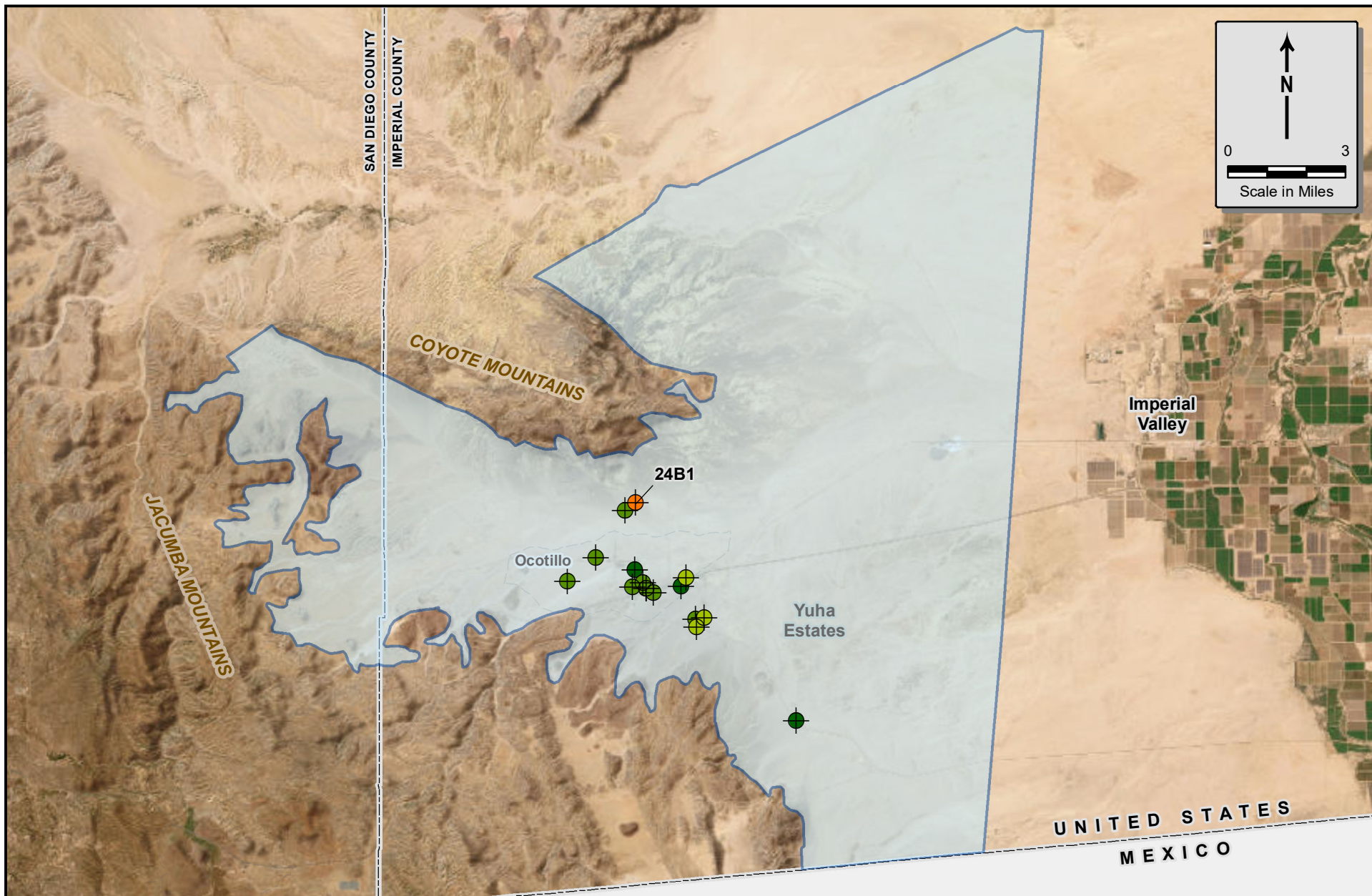
● 31B1

August 2023



TODD
GROUNDWATER

Figure 8B
Total Dissolved Solids
Concentrations in
Well 31B1



August 2023

TODD 
GROUNDWATER

Figure 9
Total Dissolved Solids Concentrations in Groundwater

APPENDIX A

BASIN DESCRIPTION AND HYDROGEOLOGY

Basin Description

Groundwater for the Plaster City Plant, community of Ocotillo, and local domestic wells is pumped from the Coyote Wells Valley Groundwater Basin (No. 7-29), as defined by the California Department of Water Resources (DWR, 2003)¹. DWR generally defines groundwater basins based on the extent of alluvial deposits. As depicted in **Figure A-1**, the Basin encompasses 64,000 acres (100 square miles) in the Yuha desert west of Imperial Valley, California. It is located mostly in Imperial County, with the western edge extending into San Diego County. The Basin is bounded by the Coyote Mountains to the north and the Jacumba Mountains to the west and southwest. These boundaries correspond to the geologic contacts between alluvium and less permeable geologic formations as mapped by DWR. The southern basin boundary is the United States-Mexico border and the eastern boundary is a roughly north-south line from Superstition Mountain on the north to the international border. Part of the northeastern boundary is a surface drainage divide connecting the Coyote Mountains with Superstition Mountain.

HYDROGEOLOGY

Figure A-2 shows the surficial geology within the Coyote Wells Valley Groundwater Basin, as mapped by the USGS (Loeltz, 1975). The groundwater basin boundaries on the north, west, and southwest generally coincide with the low-permeability formations of the mountain ranges; some discrepancies reflect the scale and interpretation of geologic mapping. The main water-bearing units of the Basin are the Quaternary alluvial deposits forming the Basin floor. In many areas, alluvium and lake deposits overlie older Quaternary/Tertiary formations including the Palm Springs and Imperial formations. As shown in **Figure A-2**, these crop out to the west and east.

Figure A-3 is a general cross-section illustrating the major formations in the basin. This cross-section is reproduced from the Final EIR/EIS and shows two layers defined for groundwater flow modeling. The upper layer (Layer 1) consists of alluvial deposits (Qa/Qof) and the lower layer (Layer 2) is composed of the Palm Springs and Imperial formations (QTp/QTi), which have been uplifted in the area east of Ocotillo and are relatively near the ground surface. The water-bearing alluvial deposits (Layer 1) are primarily restricted to the center of the Basin, with thickness of 550 feet or greater in the Ocotillo area. As shown, the alluvium was previously indicated to be 650 feet thick; however, monitoring wells recently drilled near USG pumping encountered alluvium to a depth of 800 feet. The alluvial deposits thin toward the margins of the Basin where they become unsaturated. Along the Basin margins, the saturated zones occur in the Palm Springs and Imperial formations.

In brief, the alluvial Layer 1 aquifer near Ocotillo is generally characterized by relatively high permeability, good water quality, and rapid recovery from pumping. The less permeable Layer 2 (Palm Springs/Imperial formations) east of Ocotillo and in the Yuha Estates area is characterized by relatively poor water quality and greater, more persistent impacts from pumping. In the Ocotillo area, groundwater levels in Layer 1 have been indicated to be higher than those in Layer 2. However, continued groundwater level declines in Layer 1—at more rapid rates than those in Layer 2—present the potential for significant change in that

¹ The EIR/EIS refers to the area as the Ocotillo/Coyote Wells Groundwater Basin as defined by USGS.

vertical gradient. In that case, relatively poor groundwater from Layer 2 could migrate into Layer 1, resulting in water quality deterioration in Layer 1.

Geologic units in the Ocotillo/Coyote Wells Groundwater Basin can be grouped as follows:

- Quaternary Alluvium (Layer 1), composed of poorly consolidated older alluvial fan deposits and sand, underlies much of the basin floor and extends locally into large canyons of the surrounding mountains. Lake deposits also are mapped by USGS. Most wells drilled in the Ocotillo area are completed within the alluvium. The alluvial wells are noted for high yields and relatively good water quality.
- The Palm Springs Formation (in Layer 2) is composed of fluvial and deltaic sand, silt, and clay deposits deposited by the ancestral Colorado River during the early Pleistocene. Thicknesses can range up to several thousand feet. No pumping test data were found for the Palm Springs Formation, but the aquifer properties (e.g., transmissivity and specific yield) are likely similar to those of the Imperial Formation.
- The Late Miocene to Pliocene Imperial Formation (in Layer 2) is generally described as interbedded claystone and sandstone of dominantly marine origin. The Imperial Formation has an exposed thickness of over 1,500 feet in the Yuha area. Wells drilled into the Imperial Formation typically have low yields and produce poor quality water.

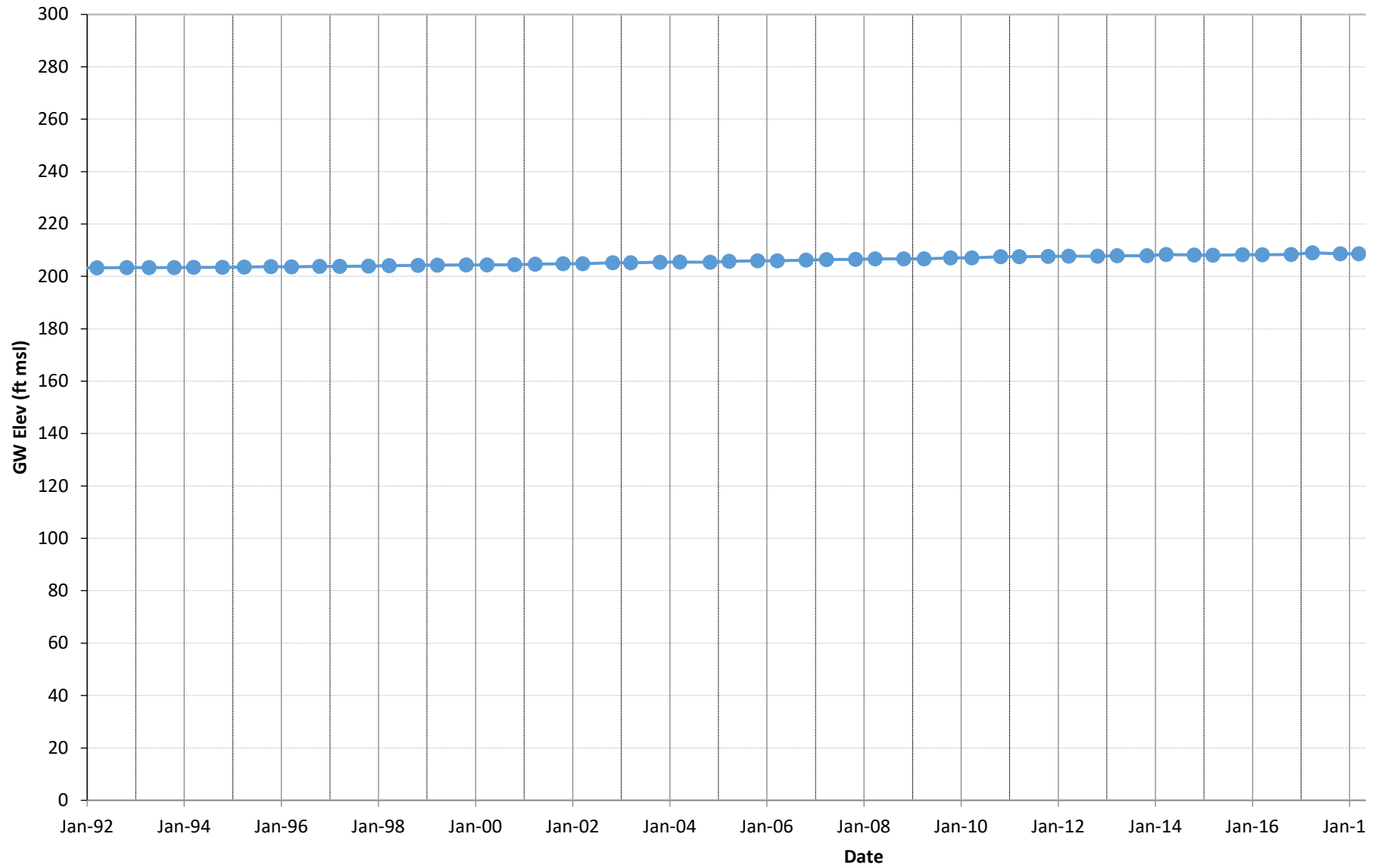
Significant differences have been noted in the hydrogeologic properties, water levels, and water quality between the area around the community of Ocotillo and areas to the east. Near Ocotillo, transmissivities (aquifer properties describing the ease with which groundwater flows through the aquifer) have been noted as significantly higher than those to the east. Transmissivities have been measured in the range of 5,800 to 6,700 ft²/day near Ocotillo, whereas transmissivities of 34 to 957 ft²/day have been noted in the eastern areas. These variations are reflected in groundwater gradients: shallower (flatter) hydraulic gradients have been mapped in the Ocotillo area and steeper hydrologic gradients have been mapped in the area east of Ocotillo.

While there is an occurrence of unconfined groundwater in other parts of the basin, water quality these areas are generally poor, with existing wells drilled in confined groundwater showing improved water quality. Groundwater generally flows southeast through the basin, with the principal recharge derived from percolation from precipitation and ephemeral runoff from the surrounding mountains (Skriver, 1977).

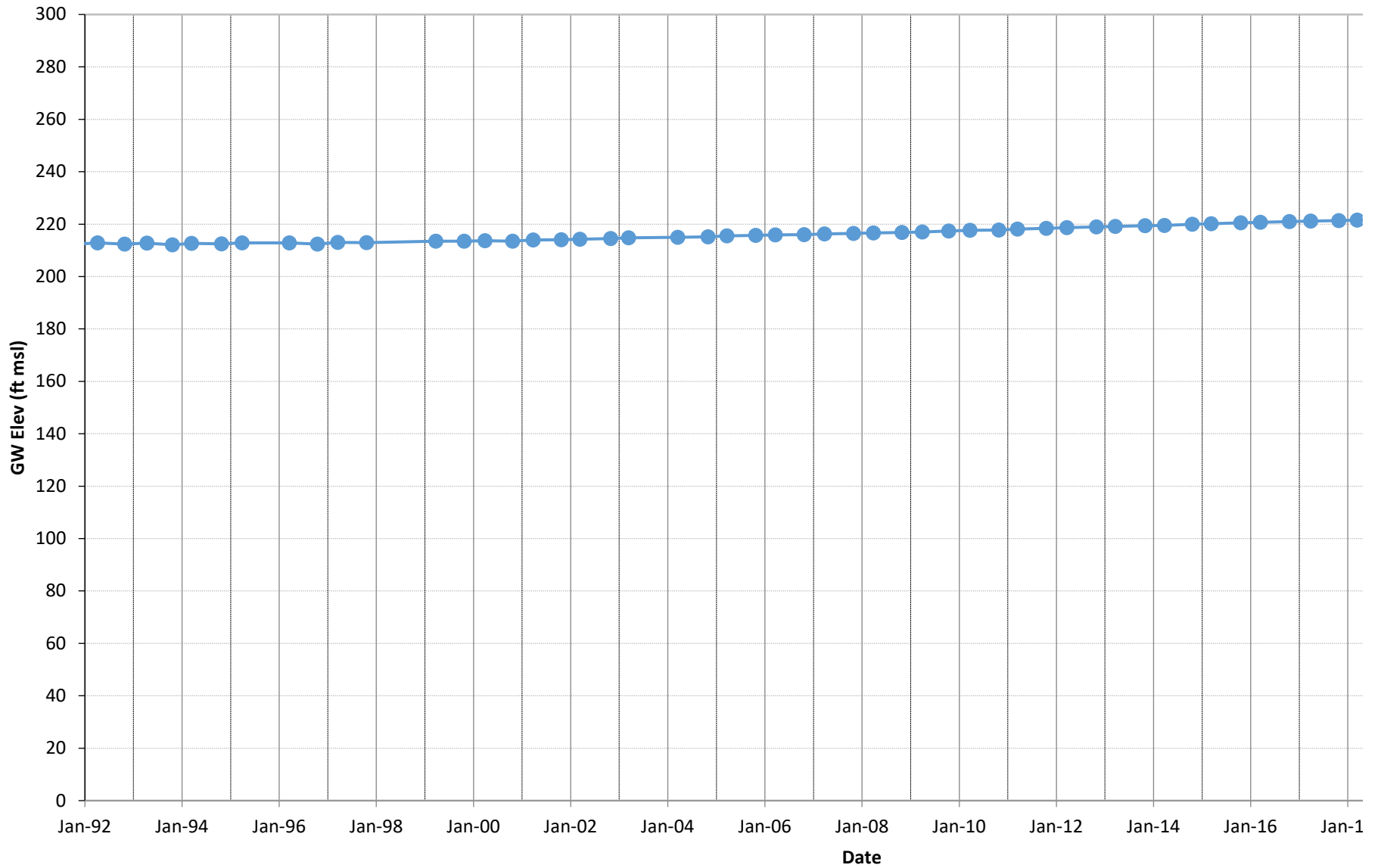
APPENDIX B

GROUNDWATER ELEVATION HYDROGRAPHS

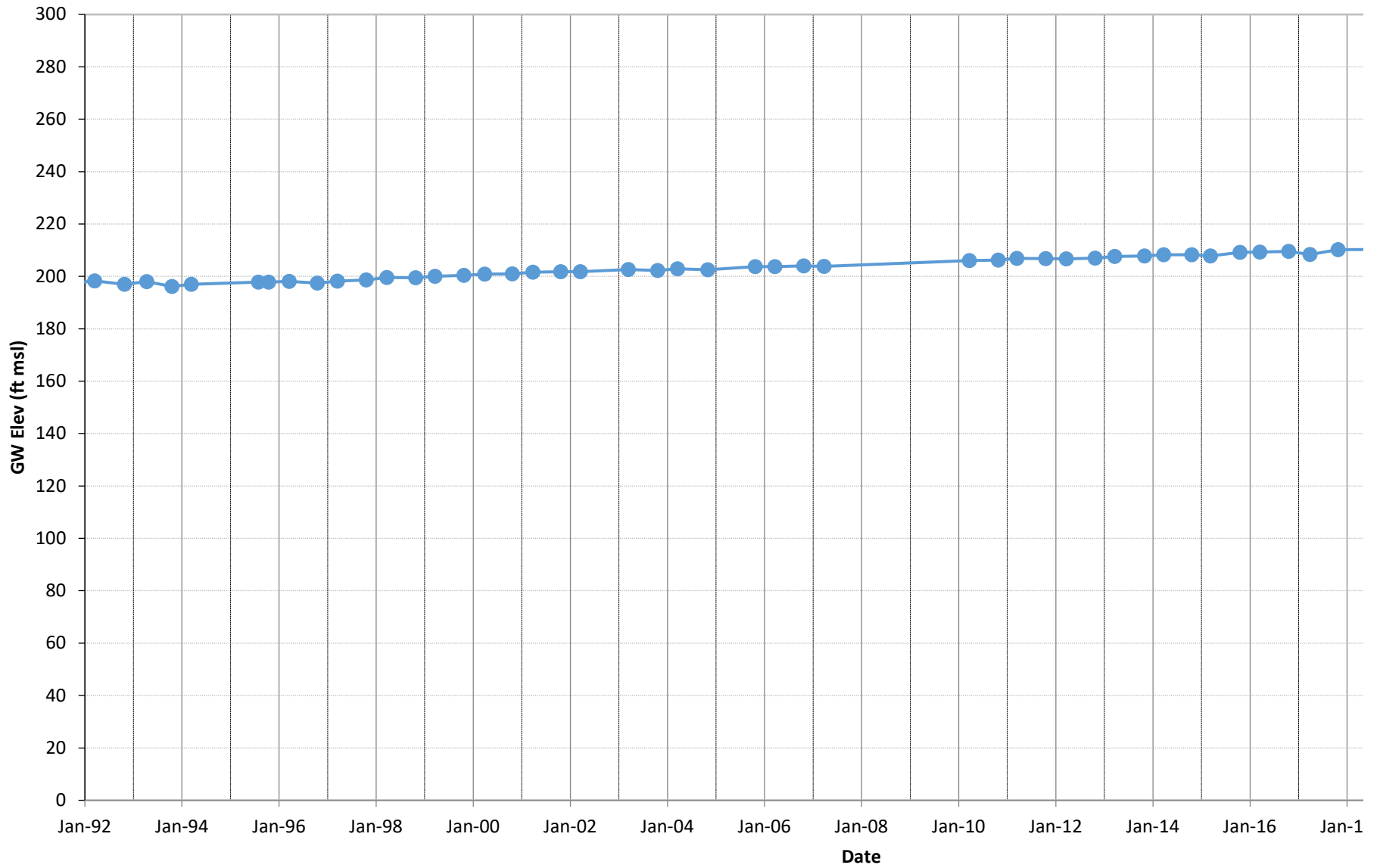
22E2



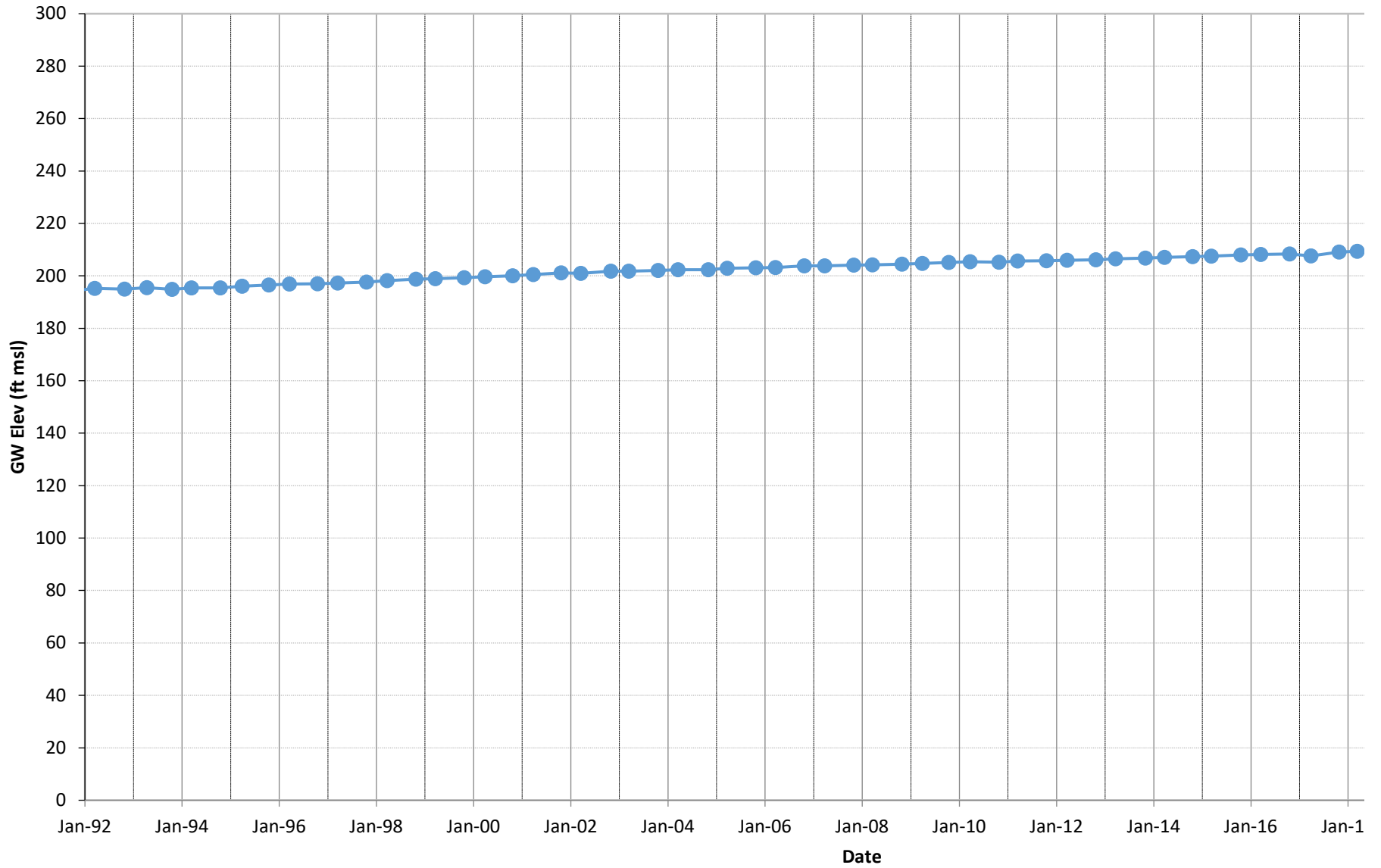
11B1



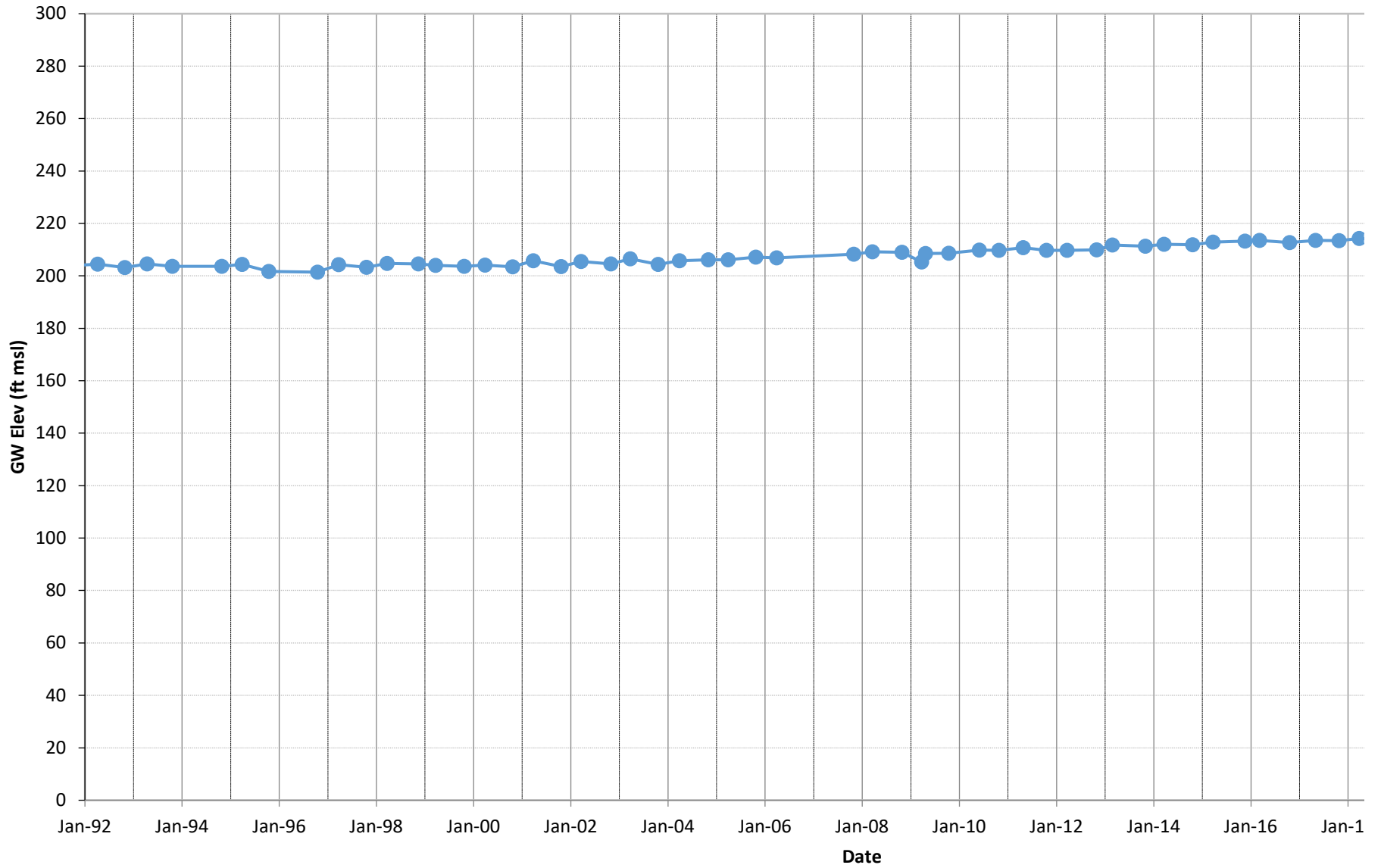
11G1



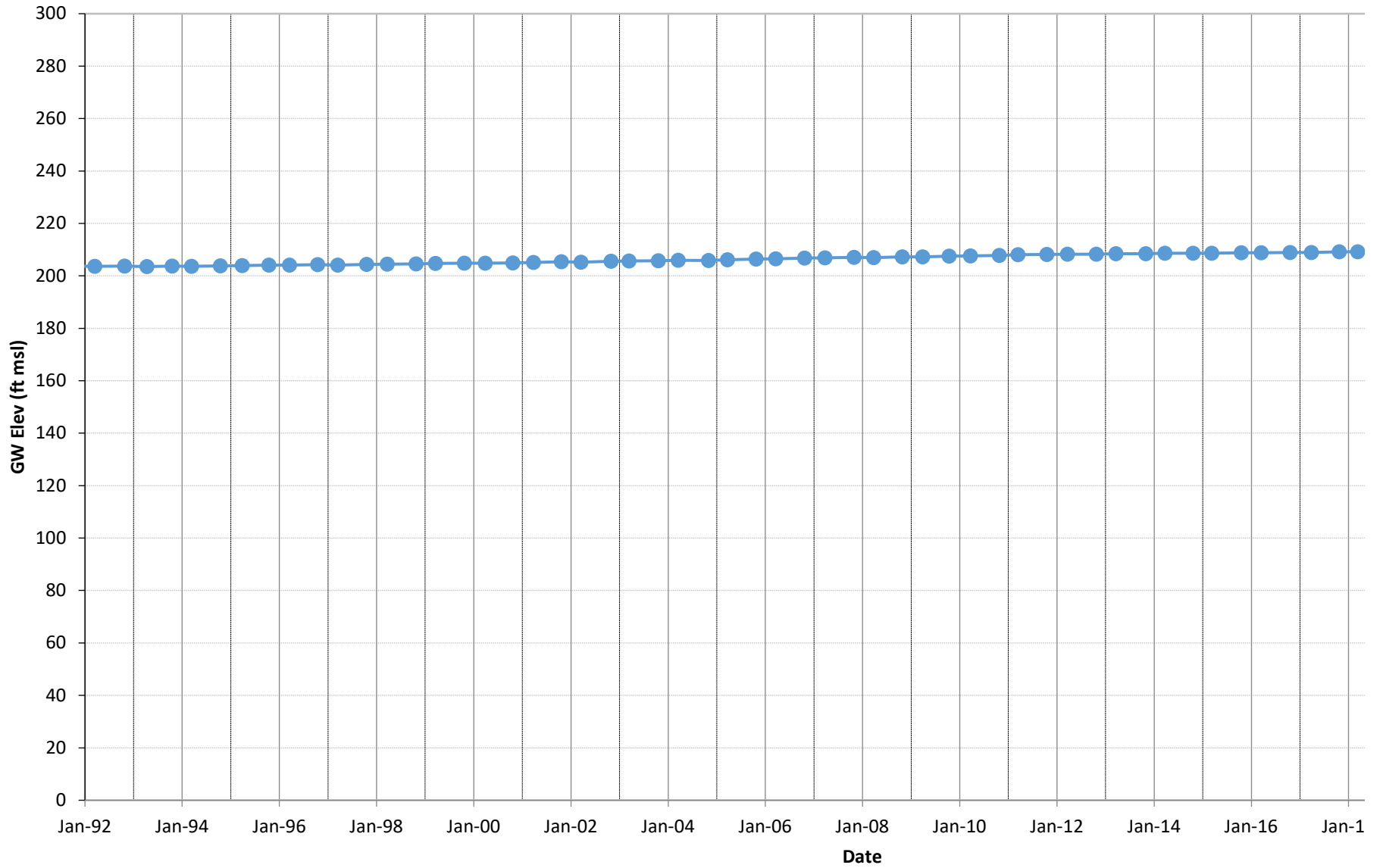
11G4



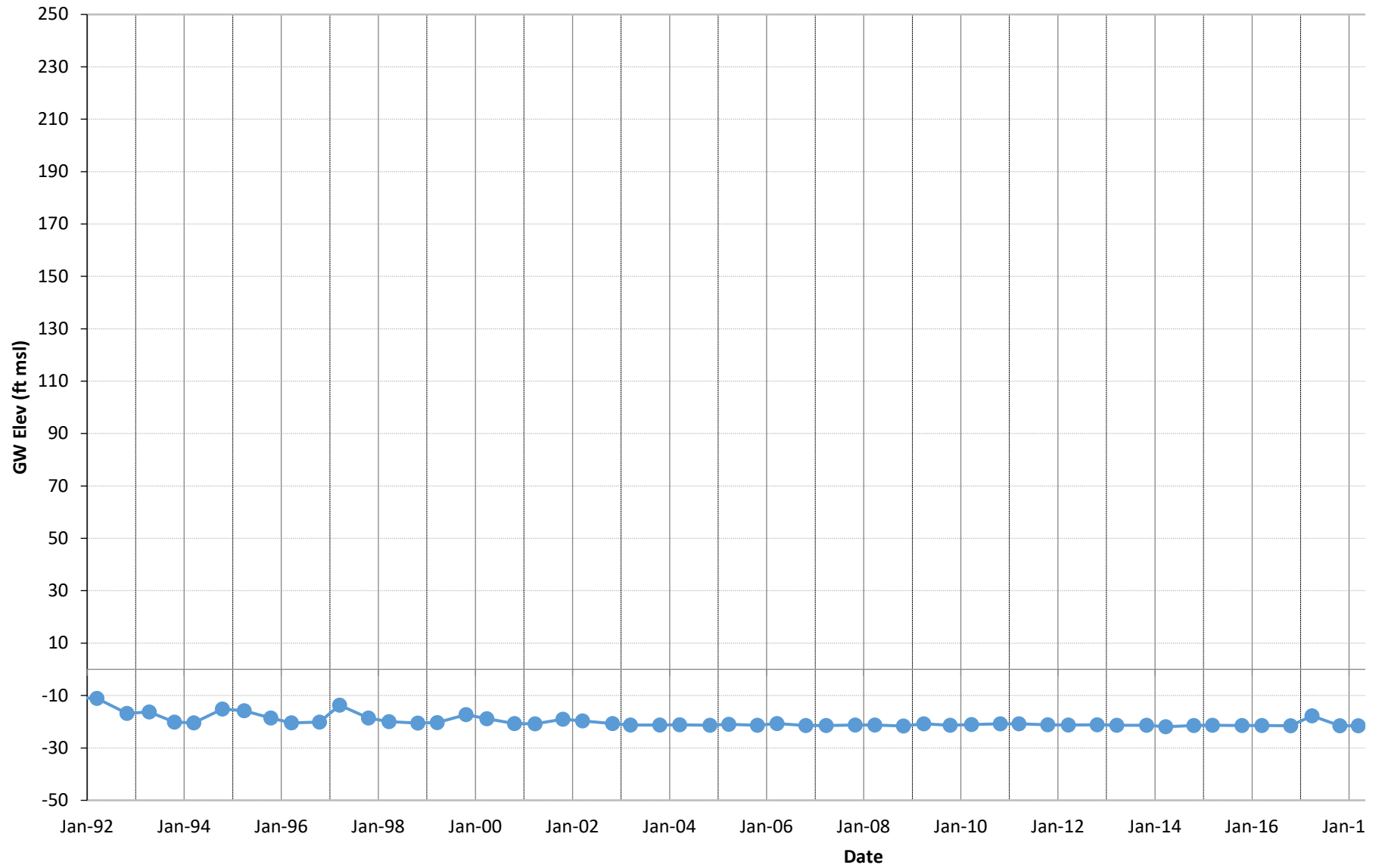
11H3



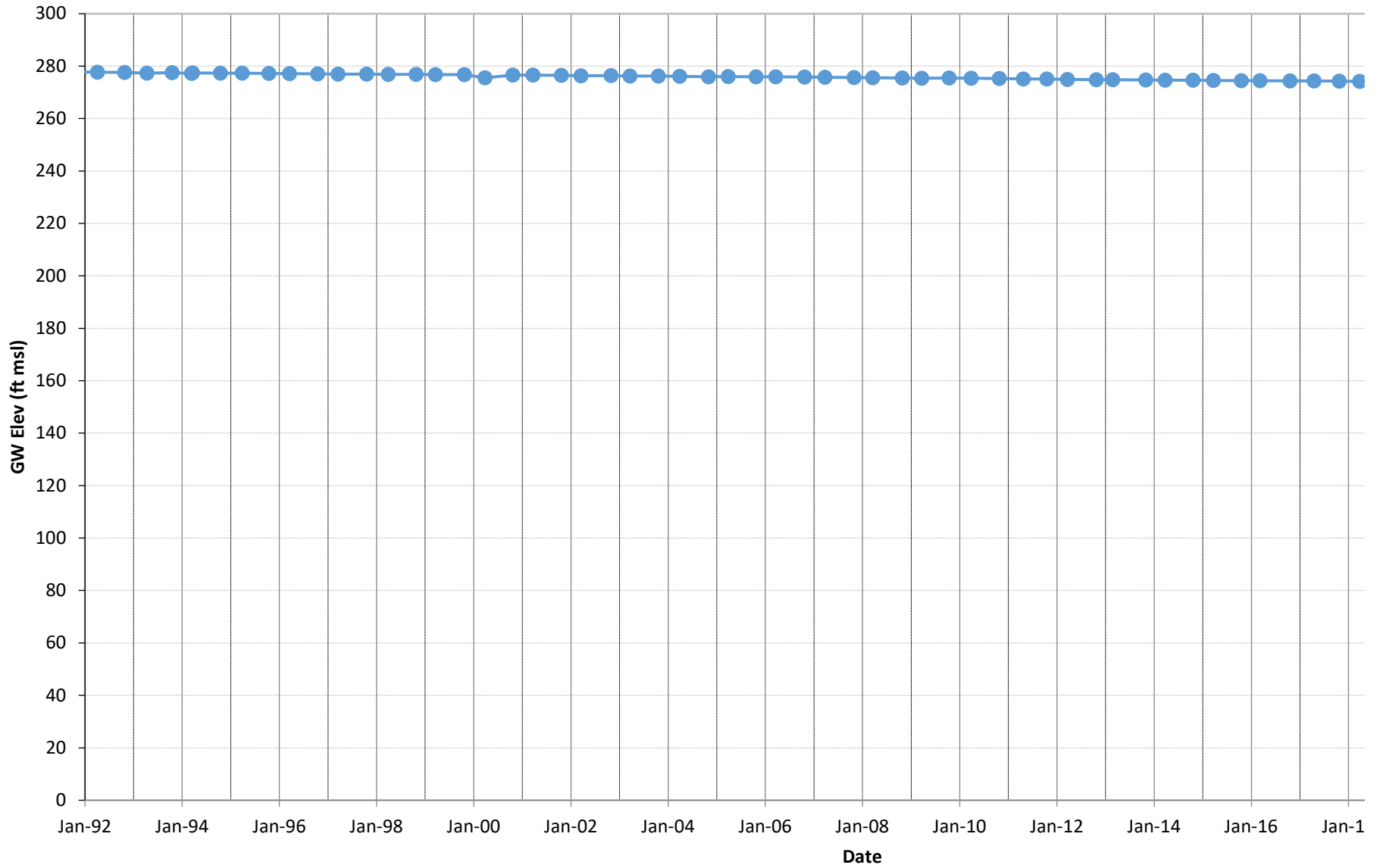
16J1



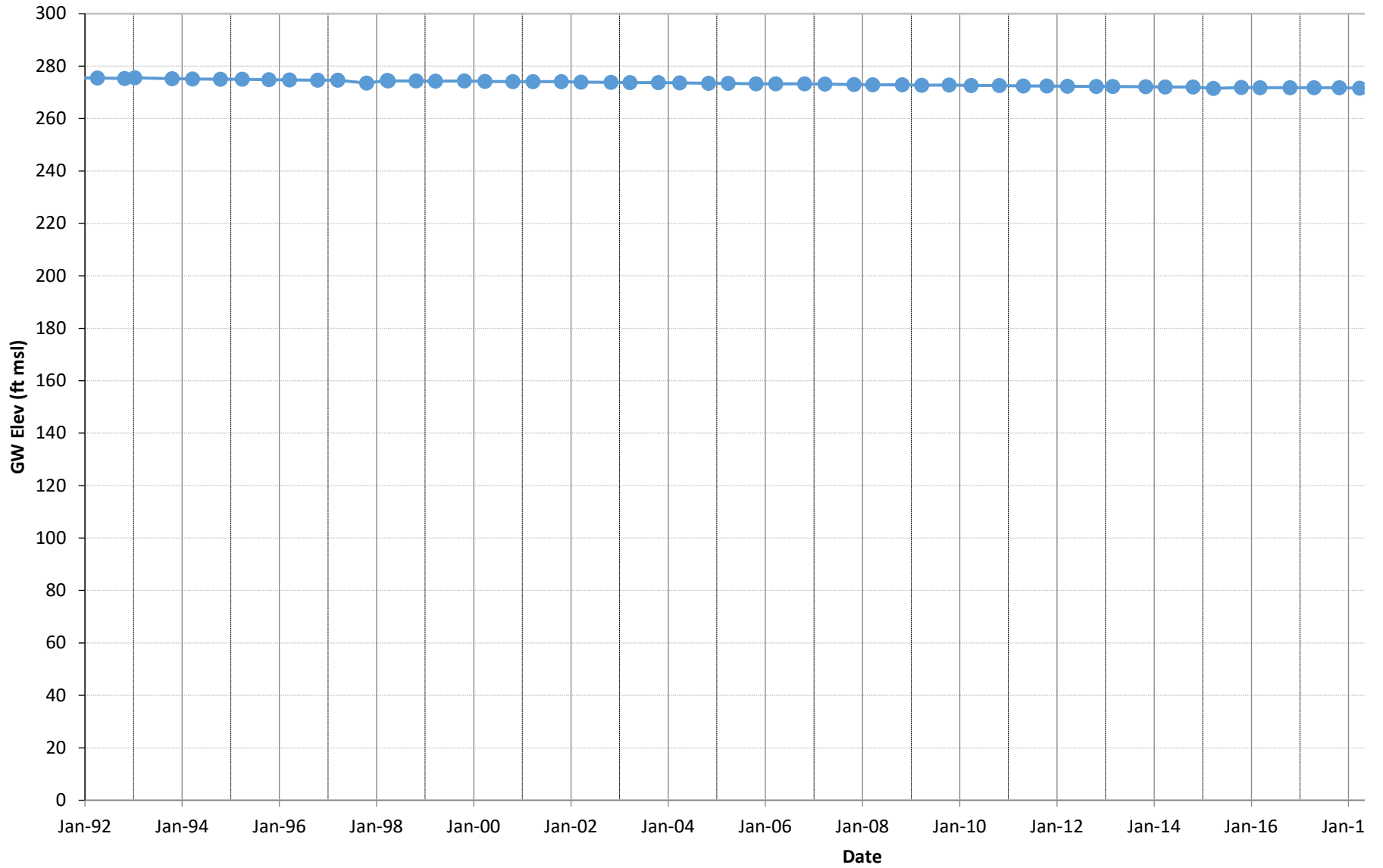
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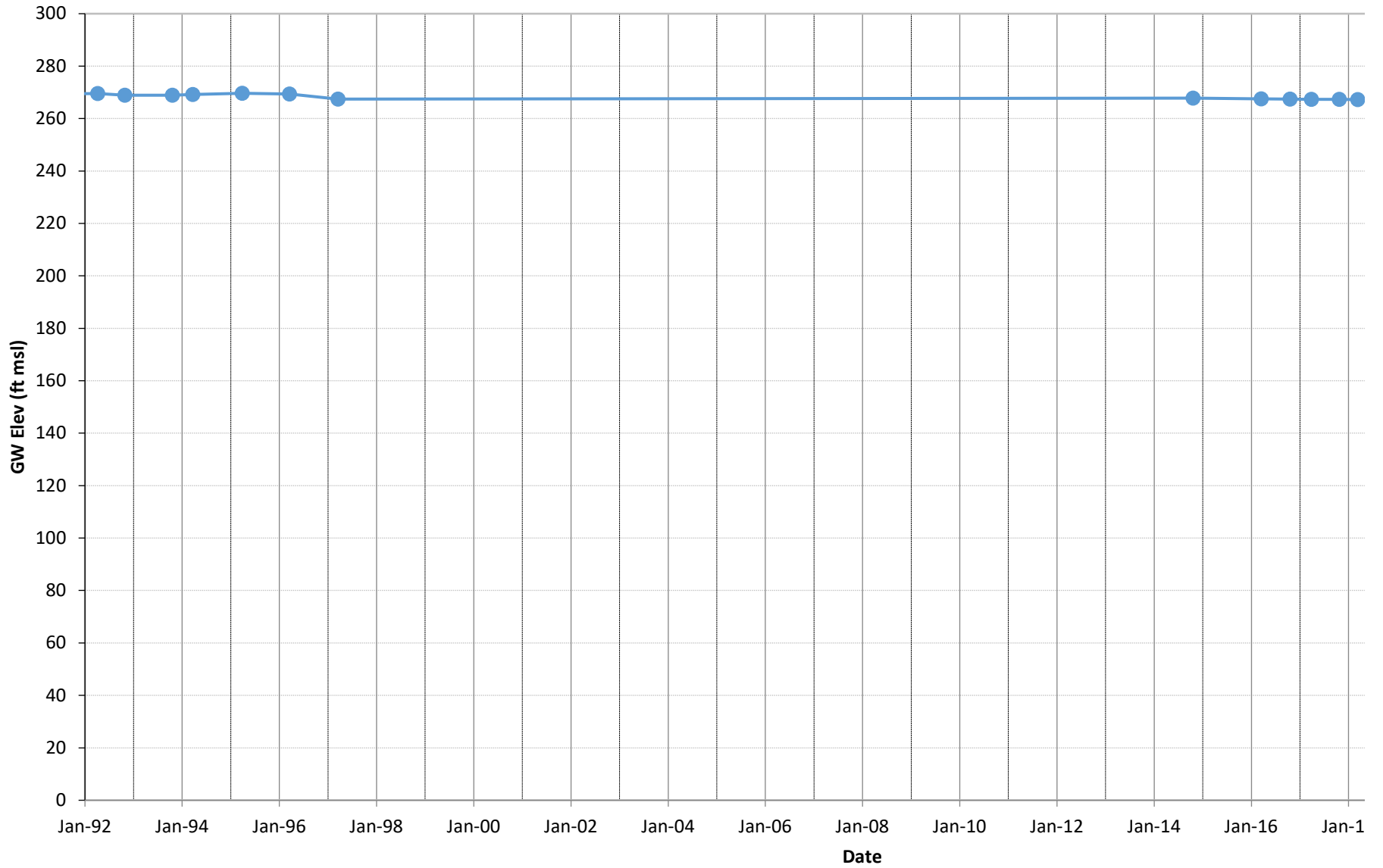
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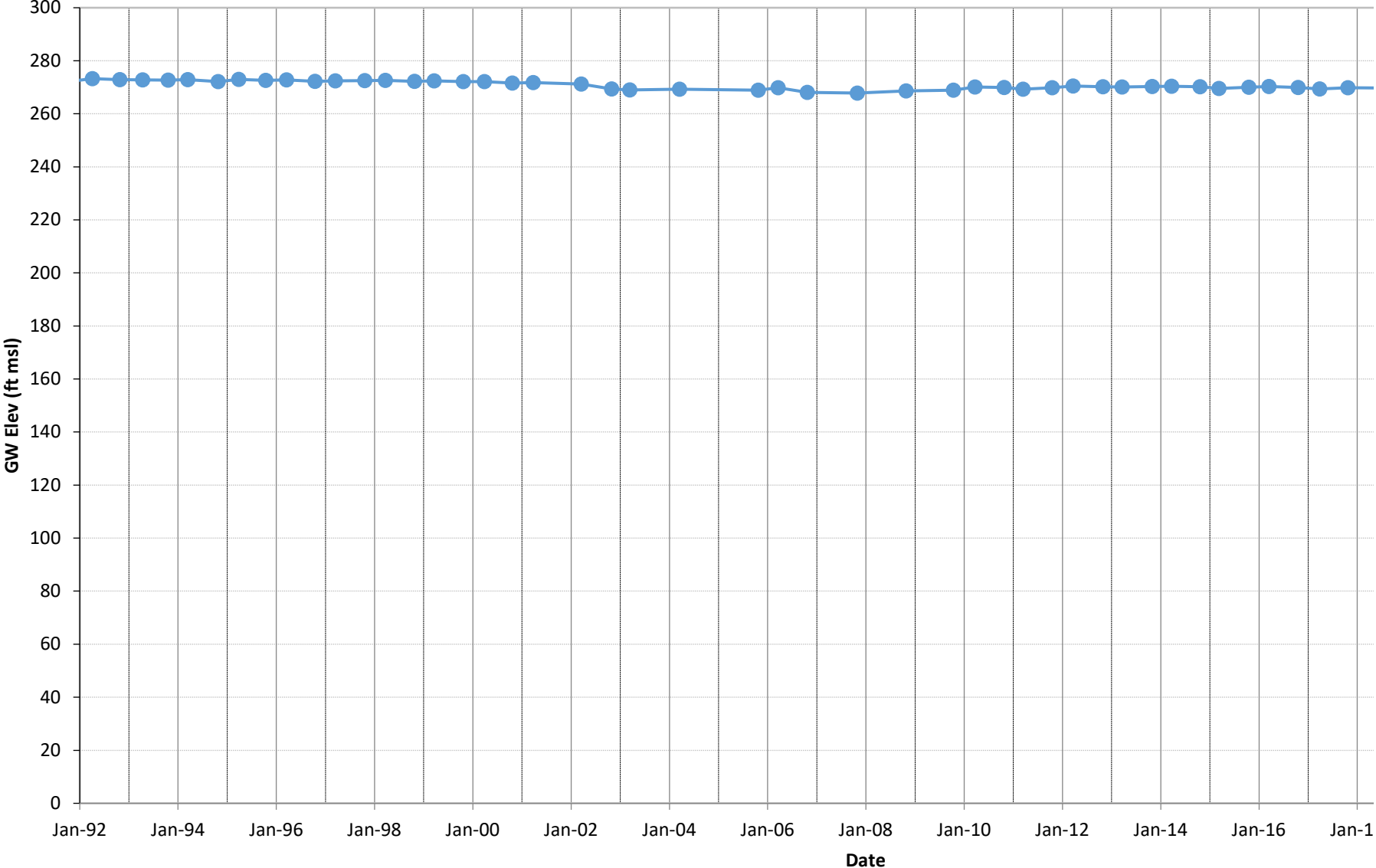
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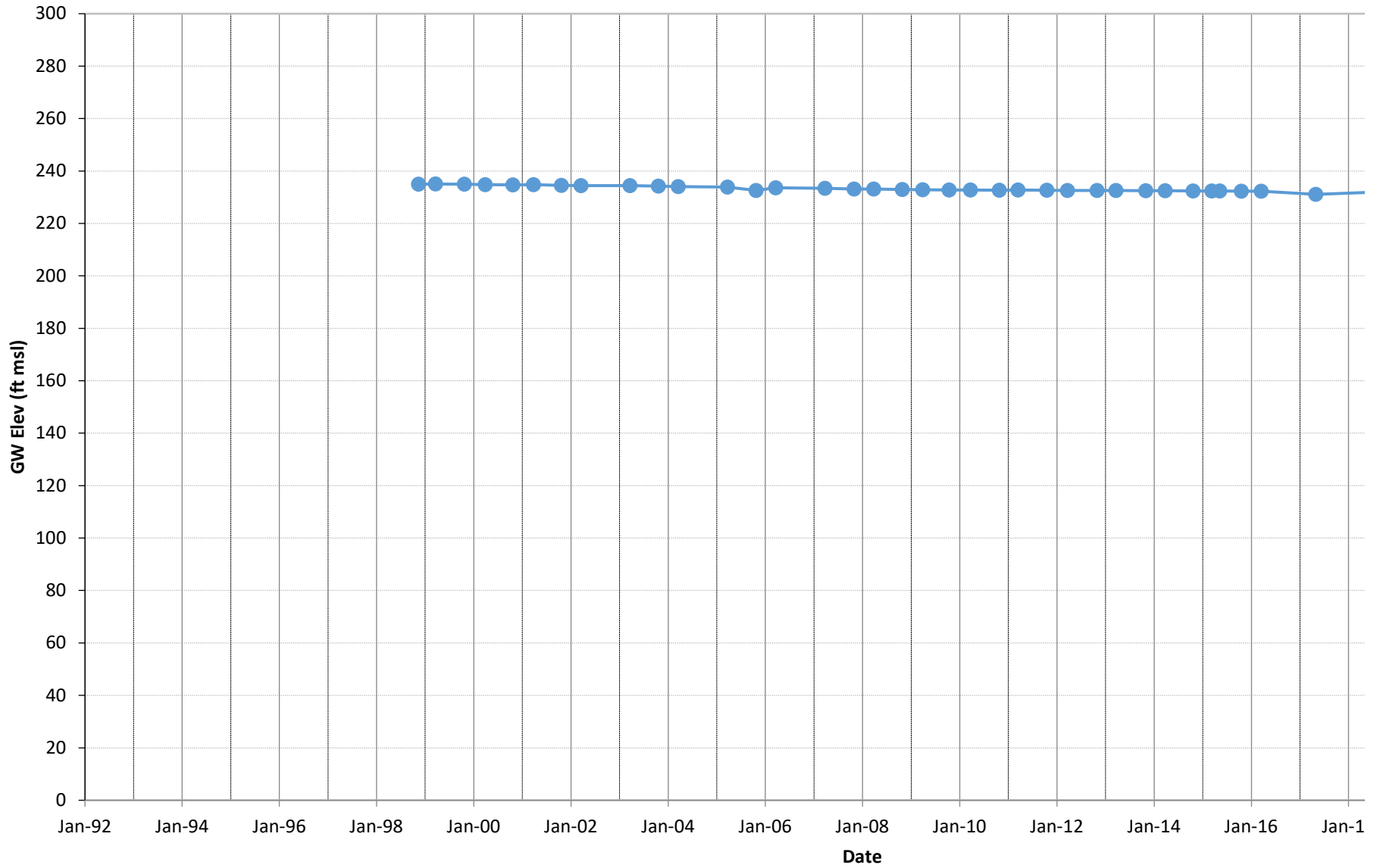
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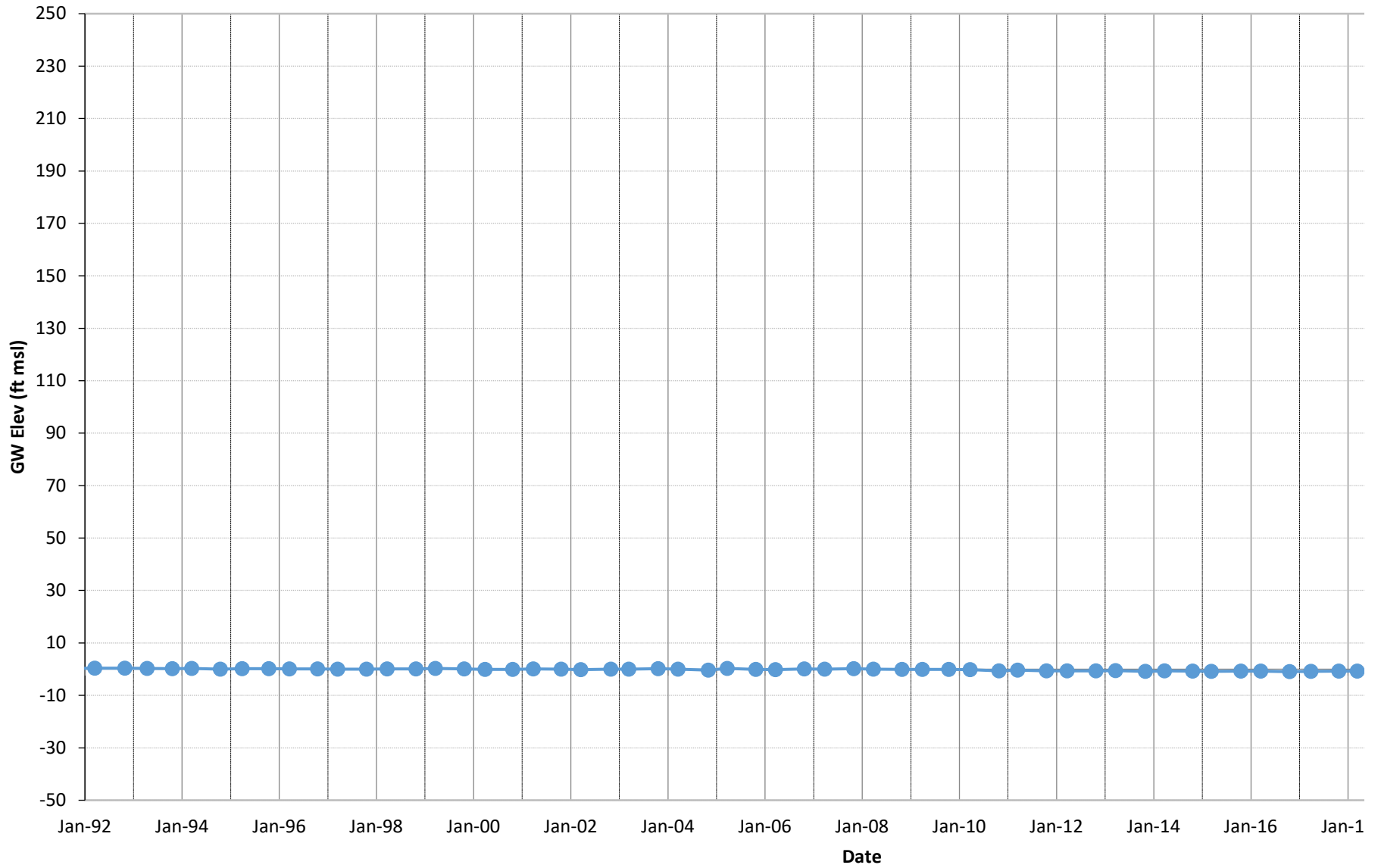
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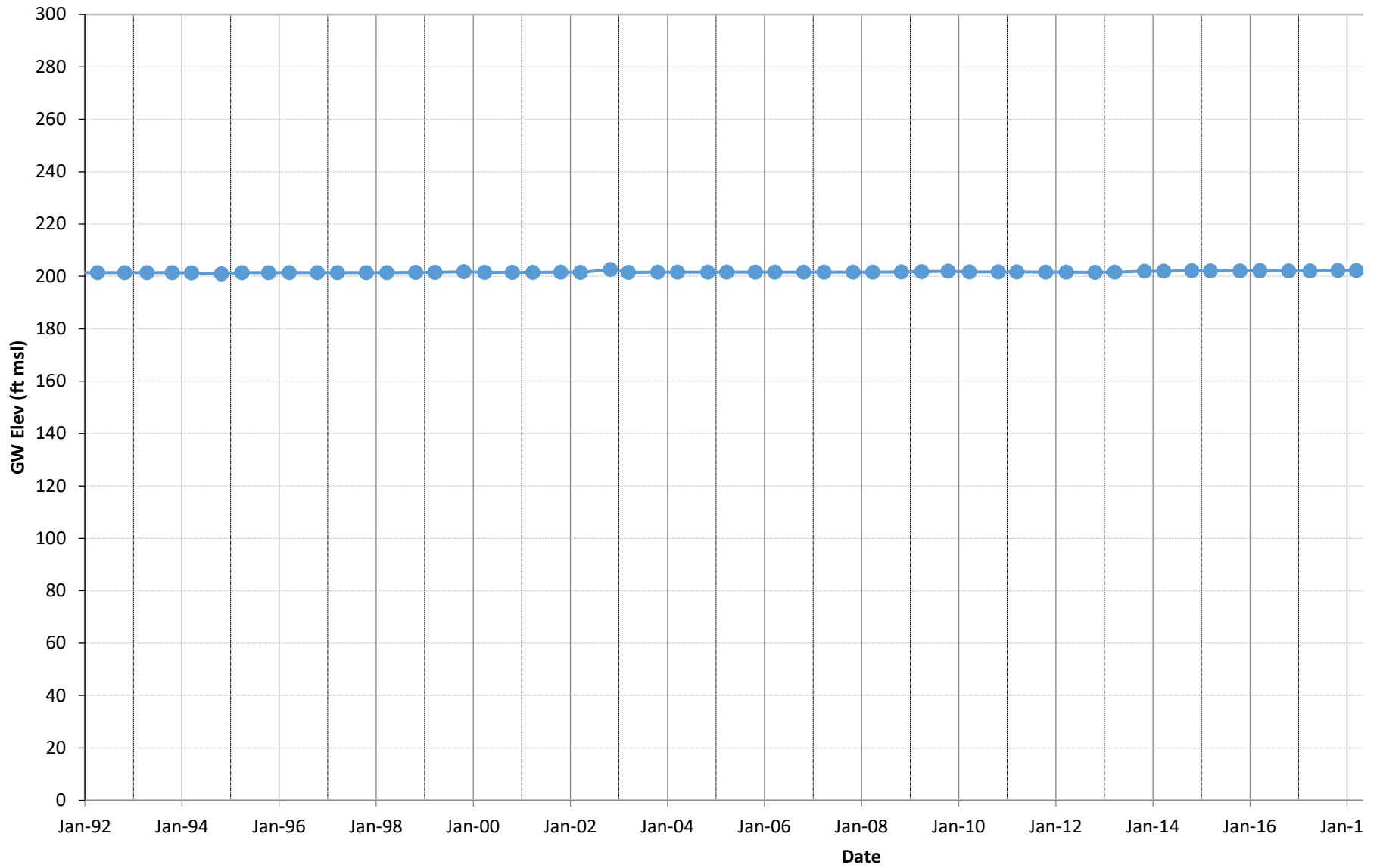
26F1



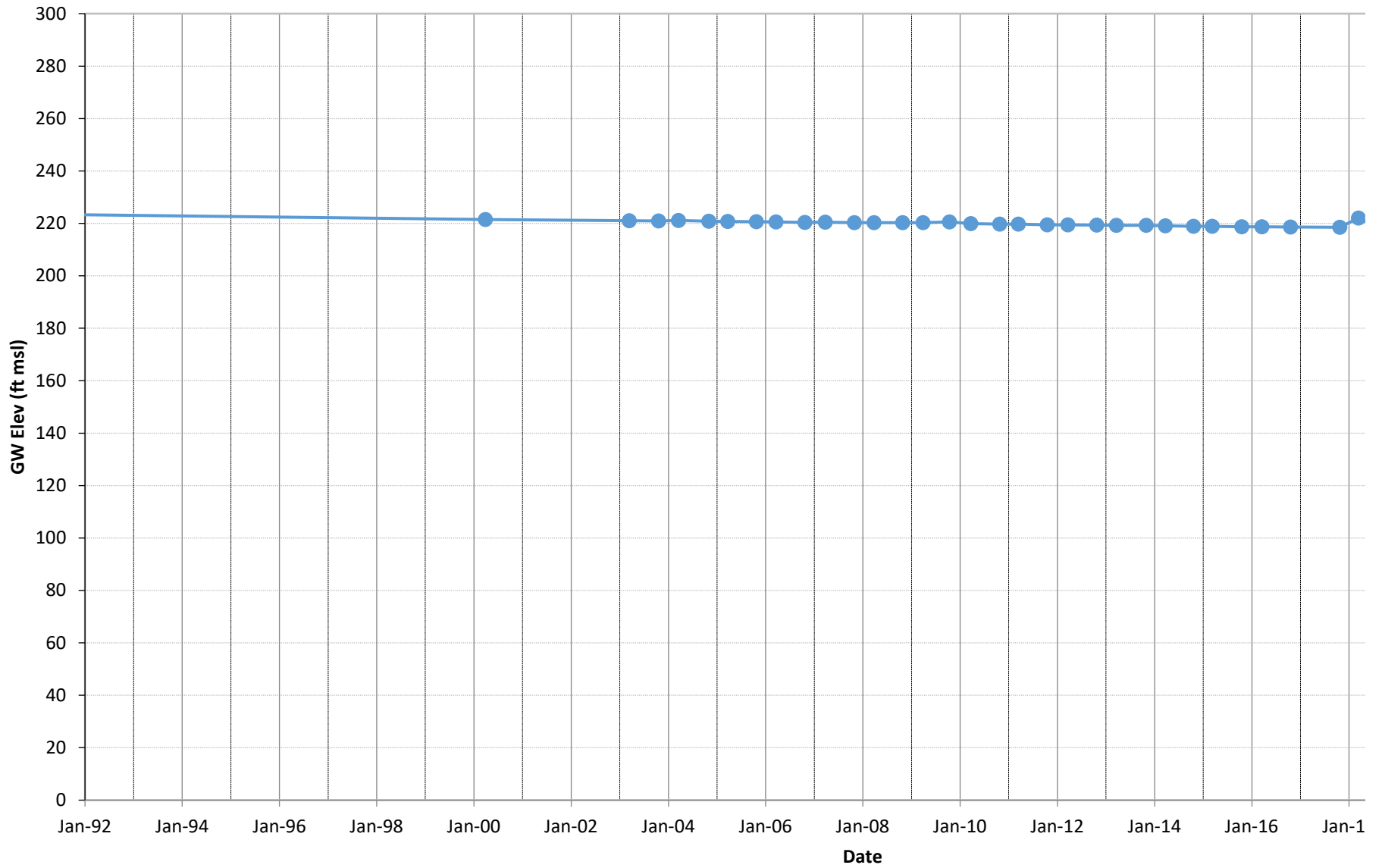
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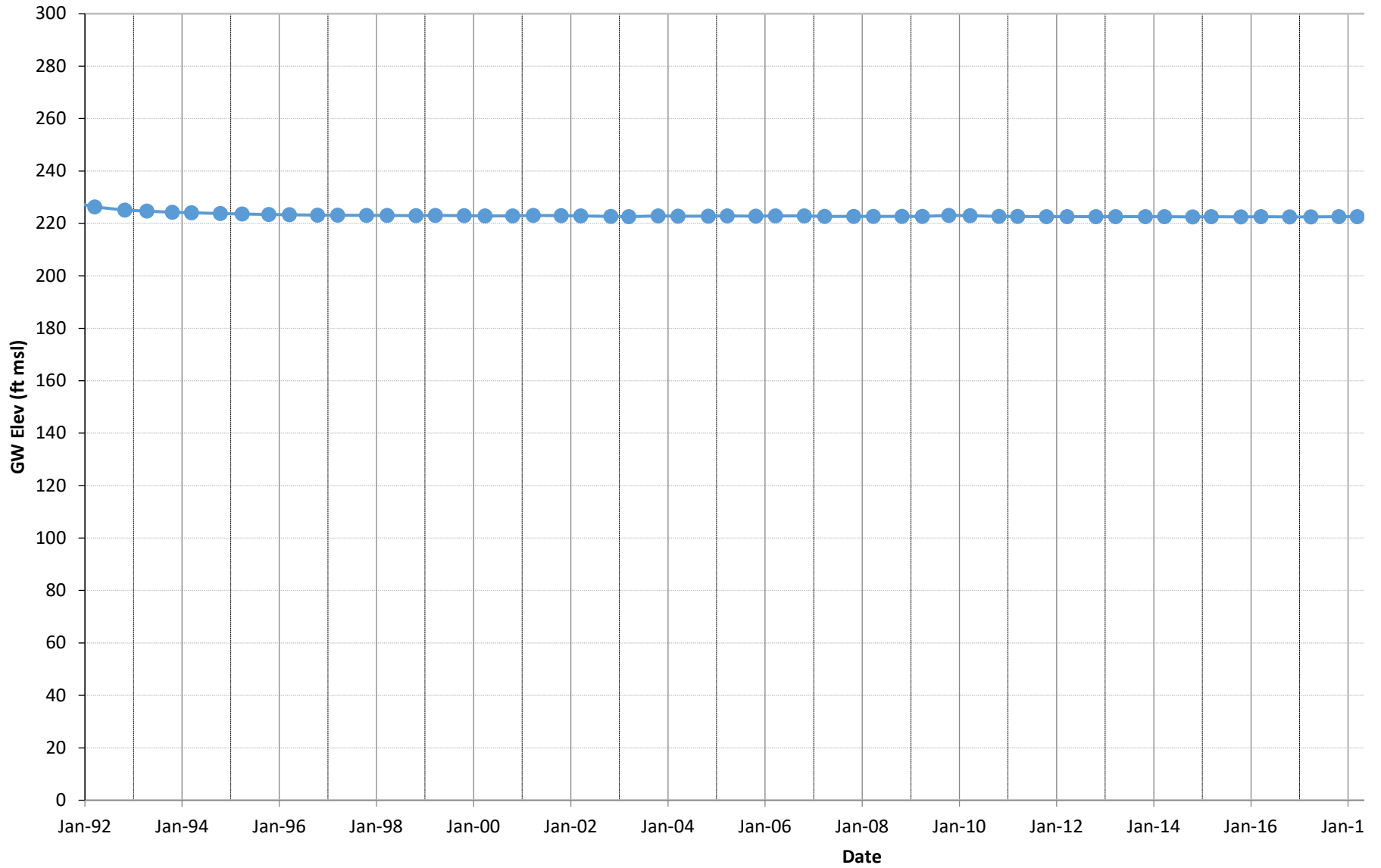
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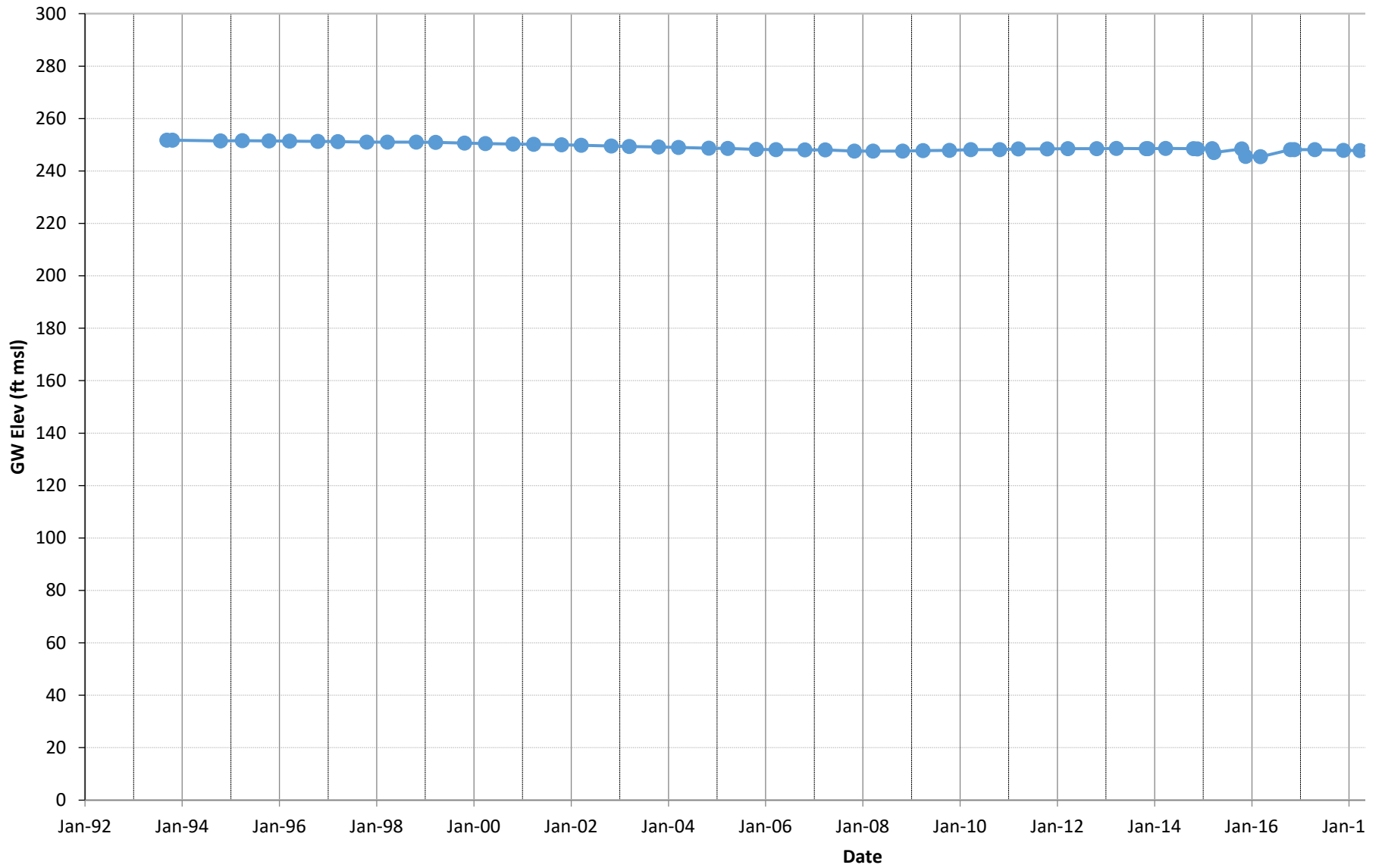
28D1



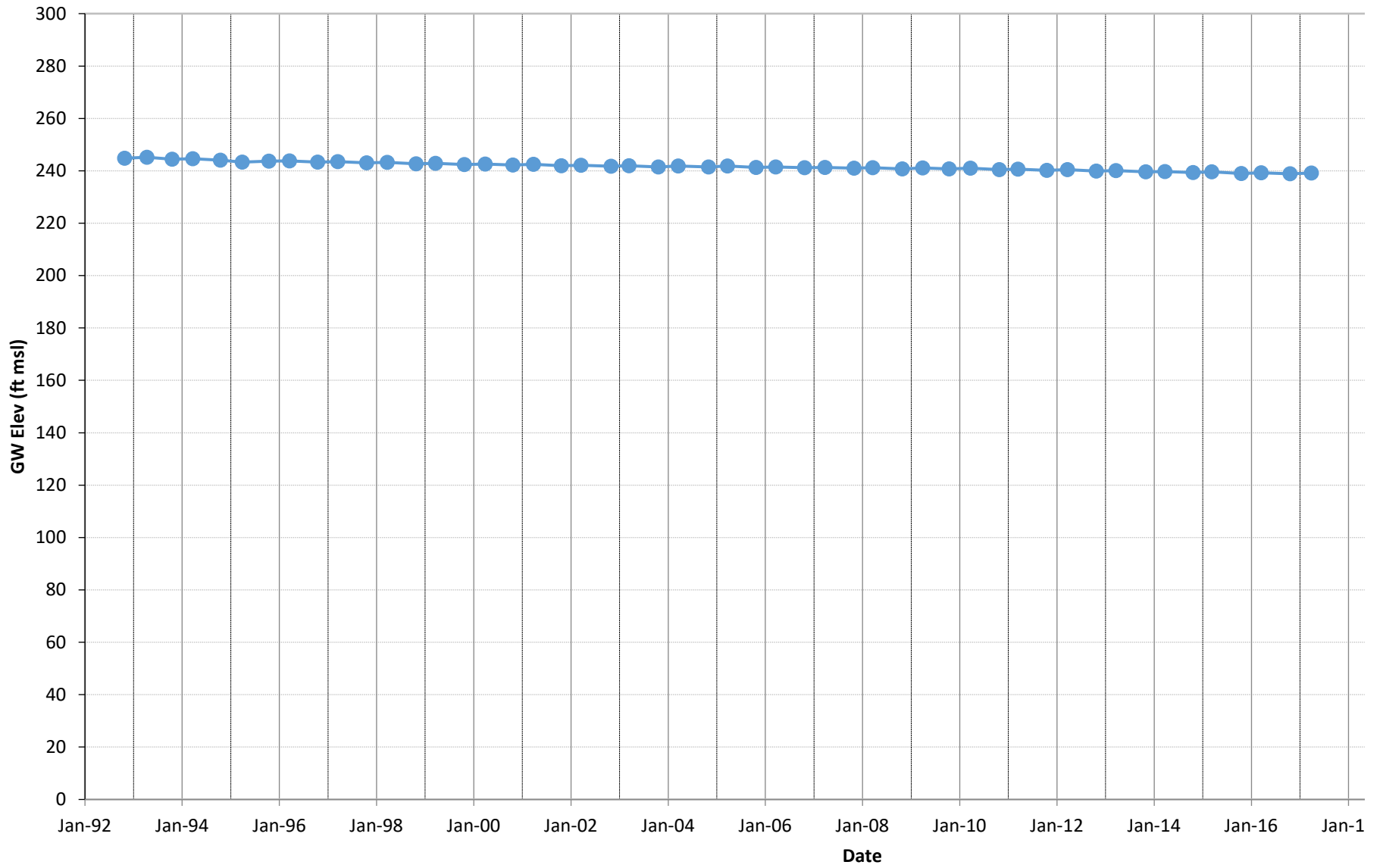
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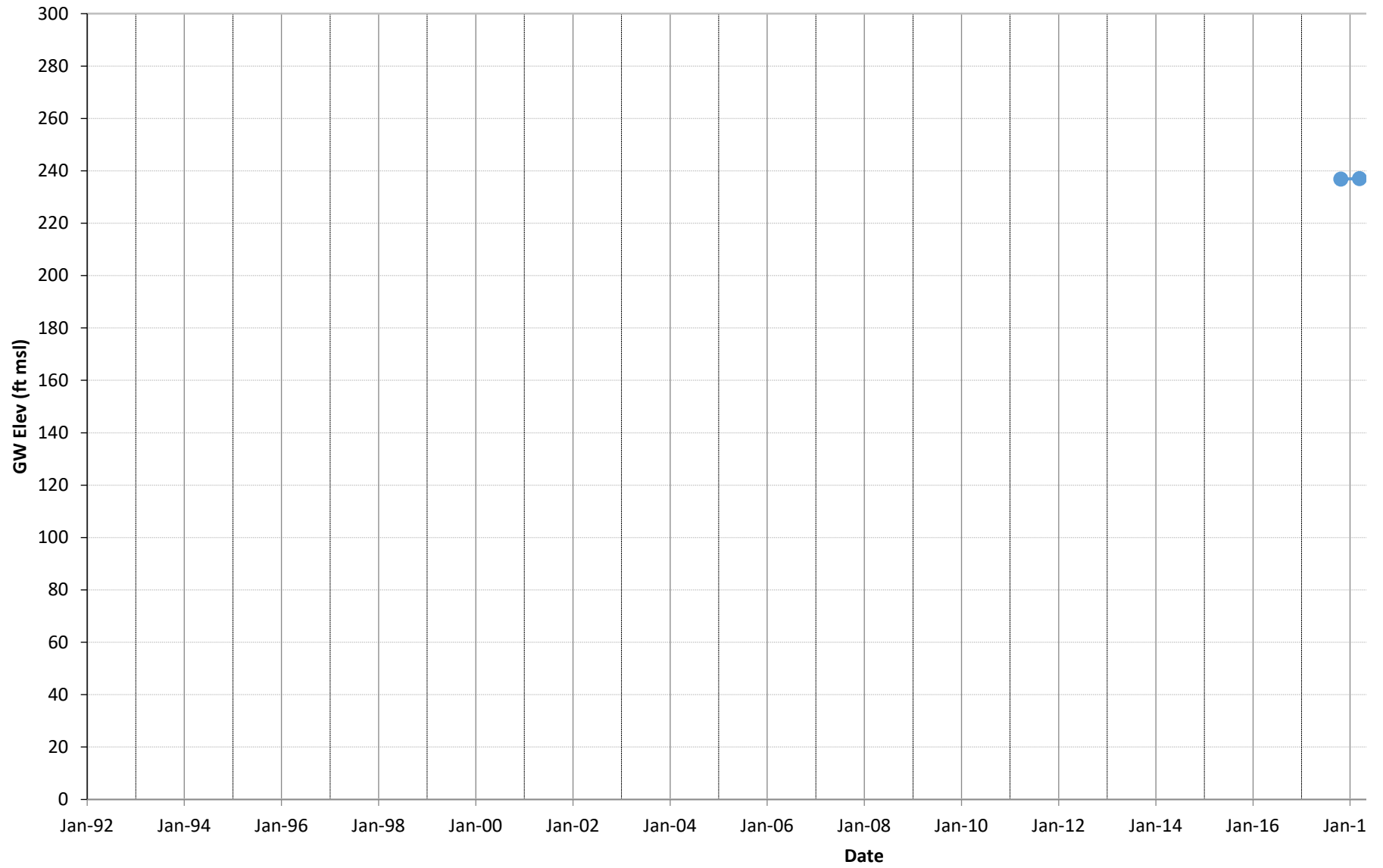
31B1



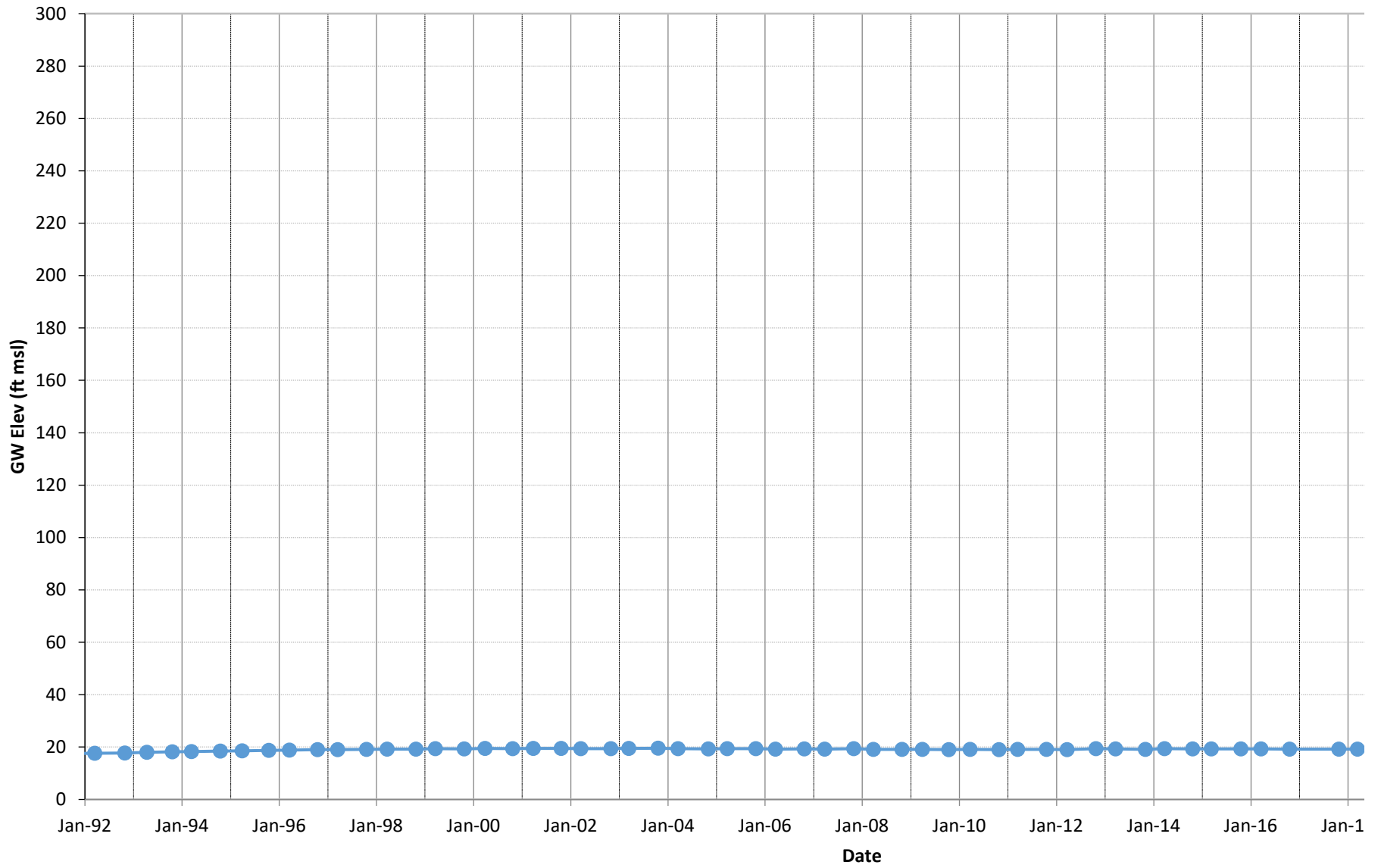
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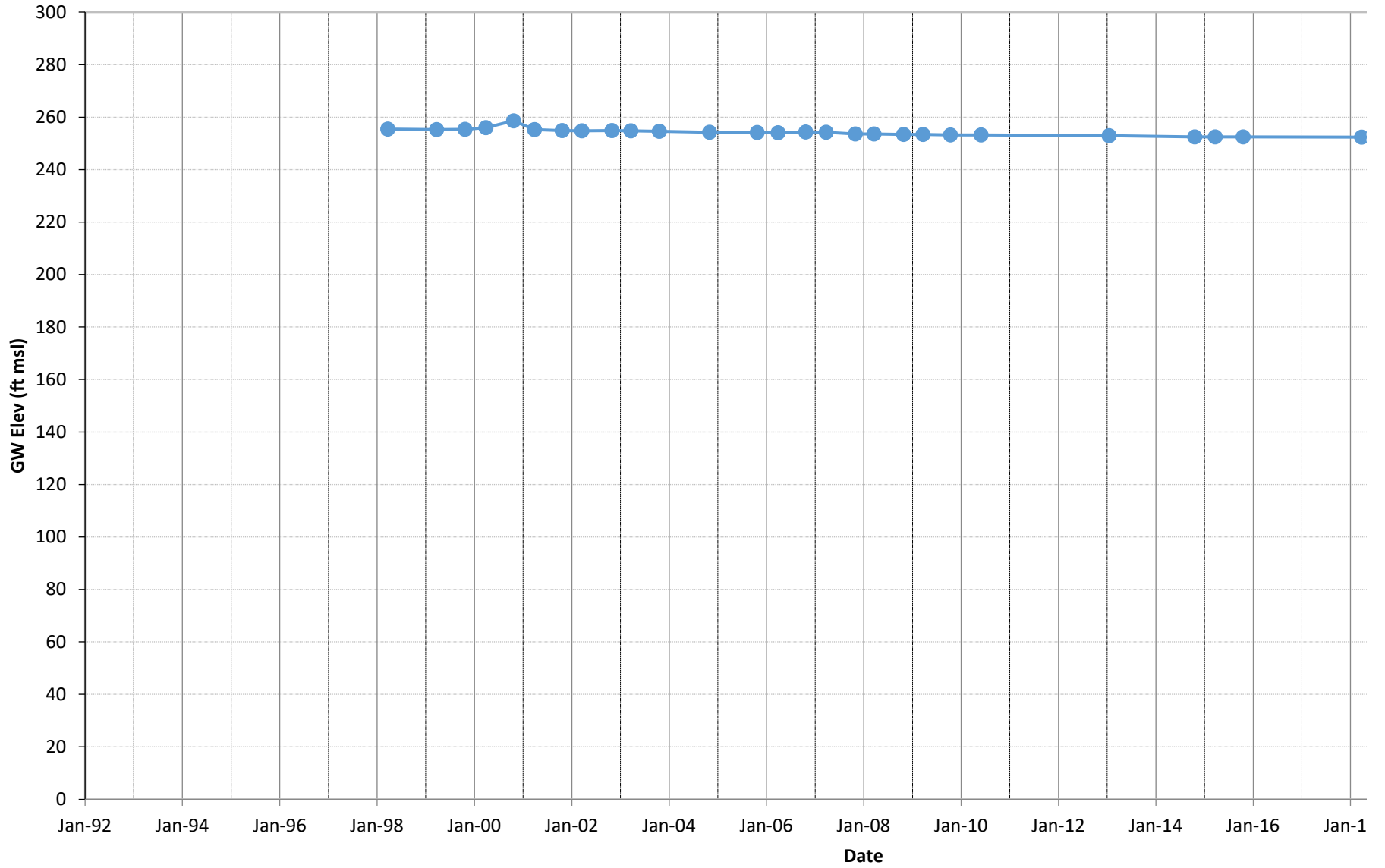
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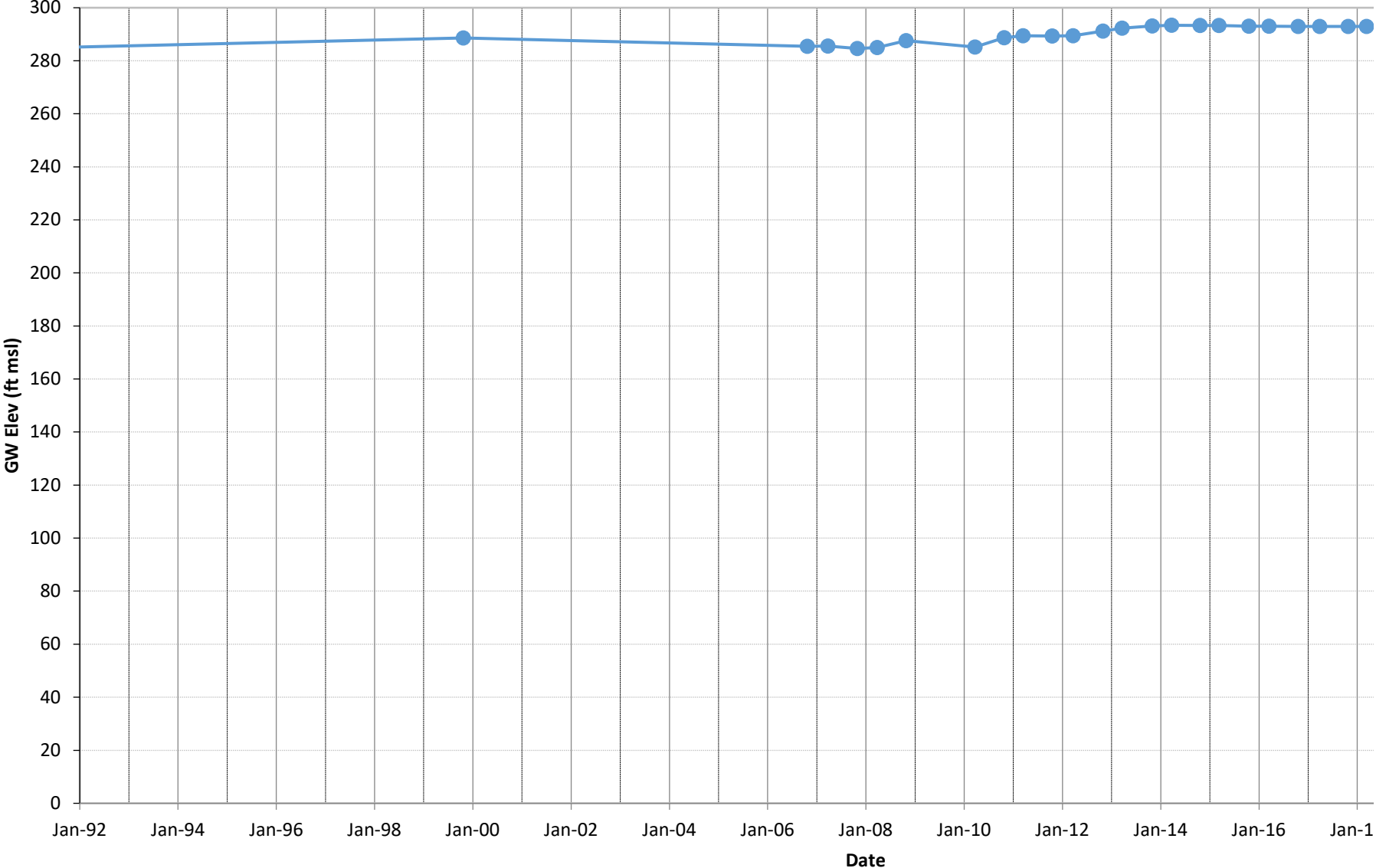
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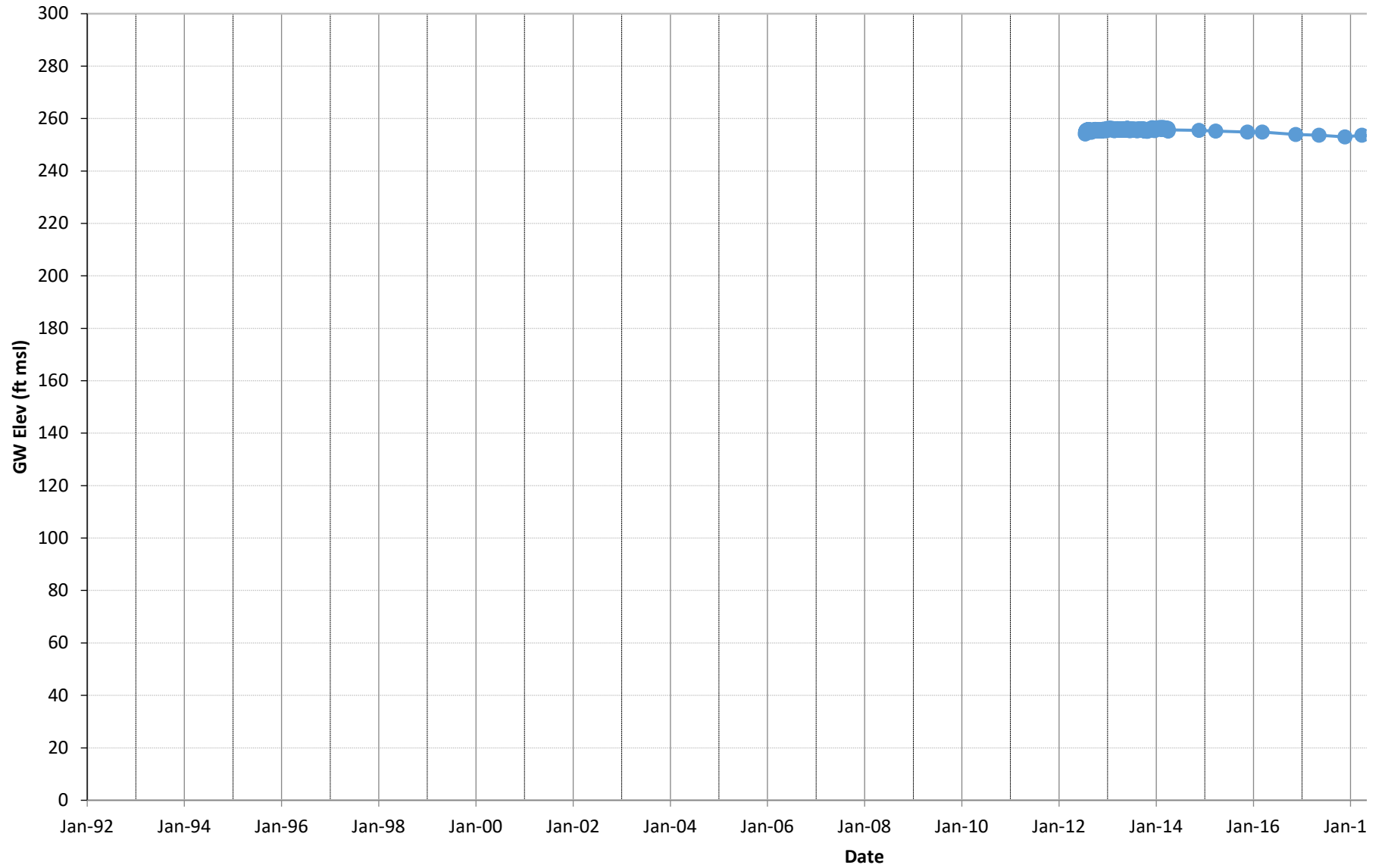
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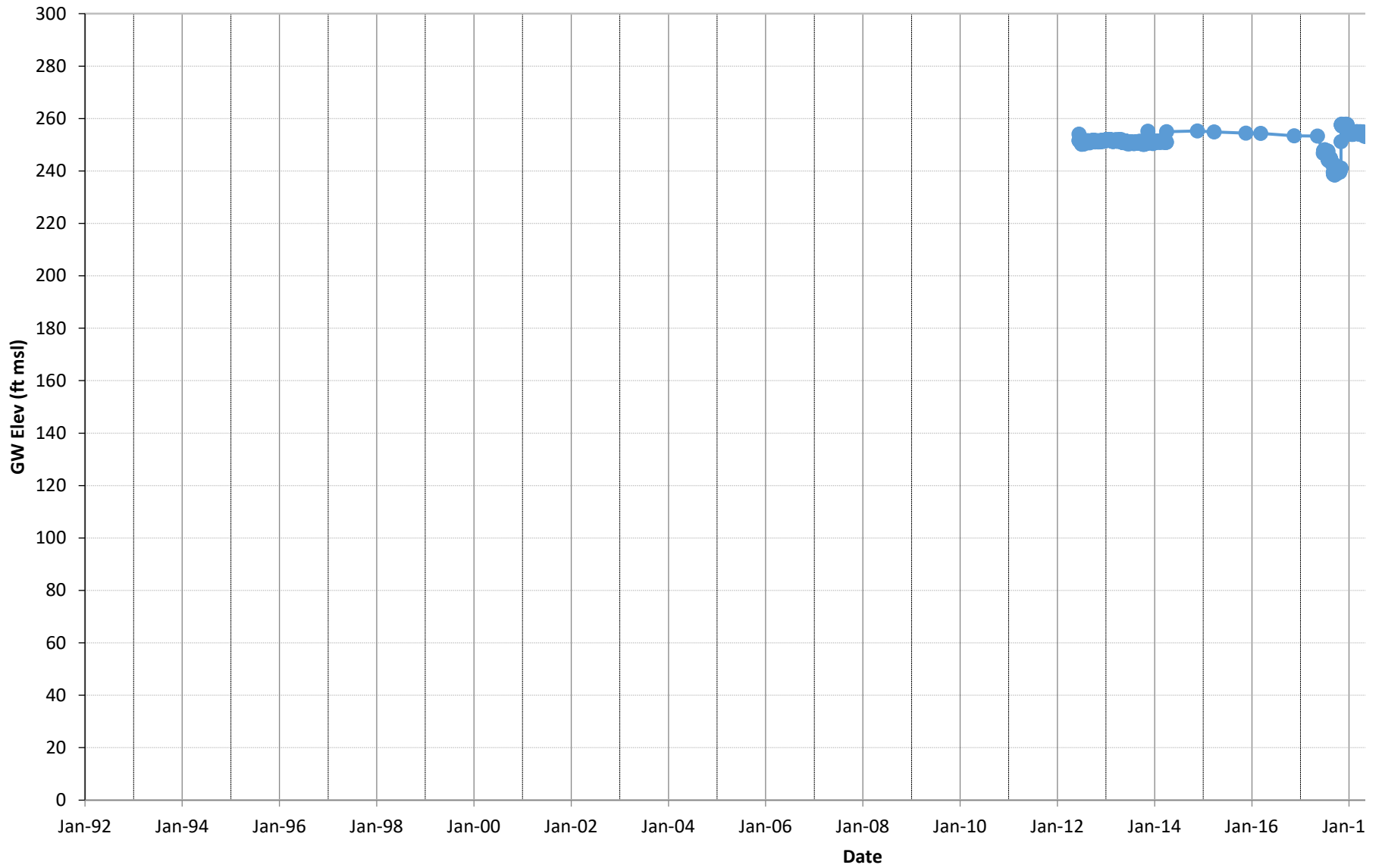
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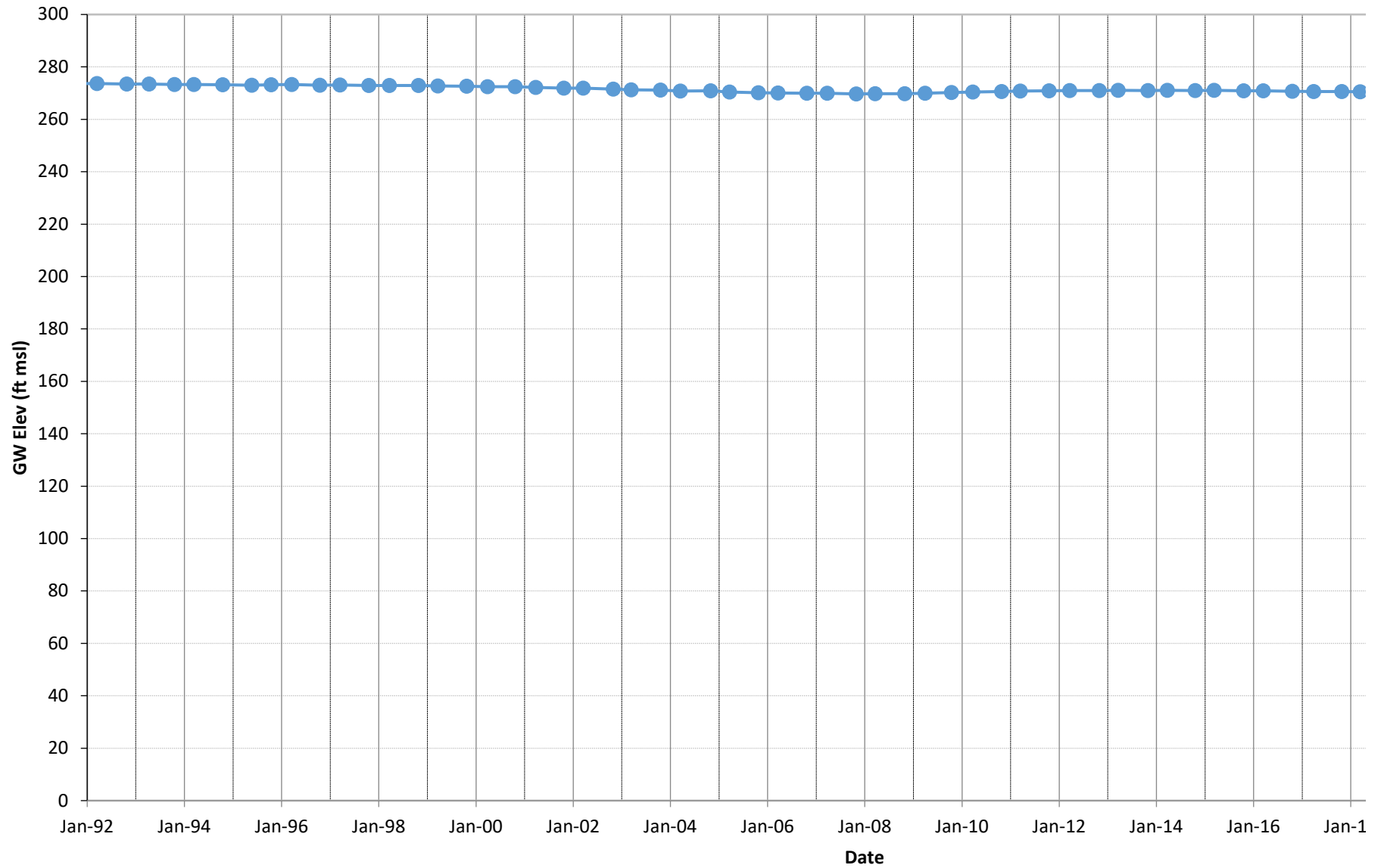
36A1(MW-2B)



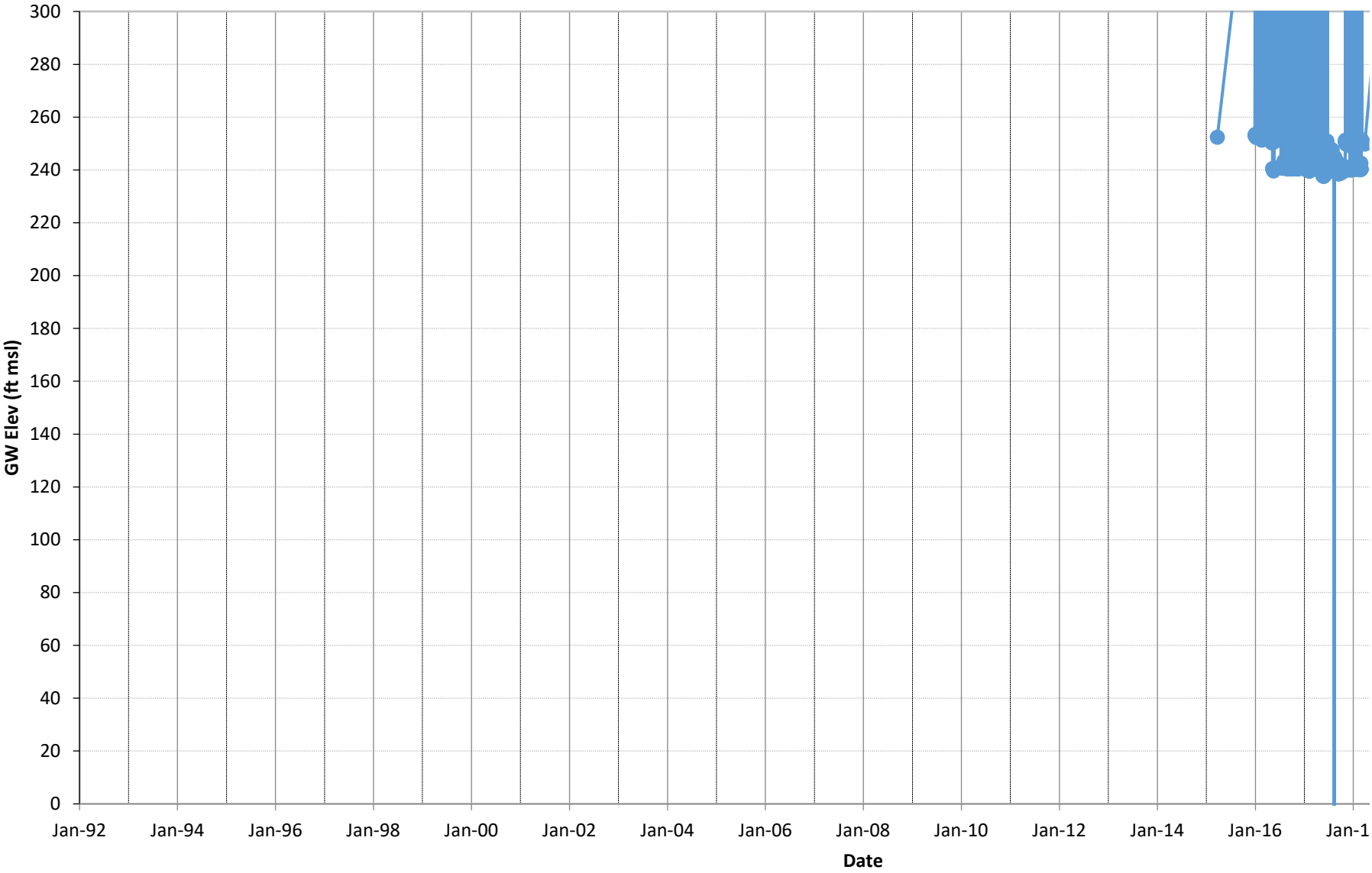
36A2 (MW-2A)



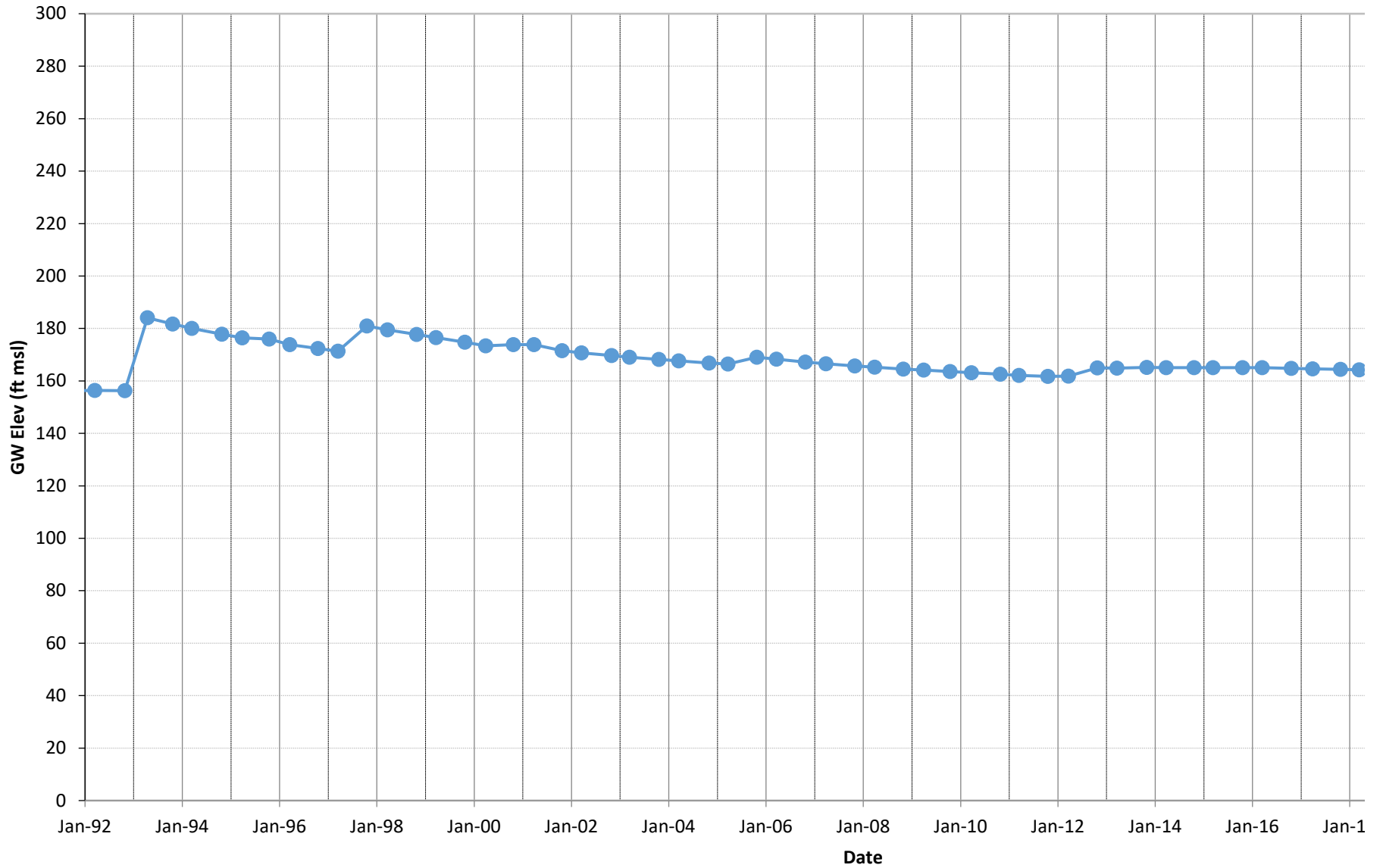
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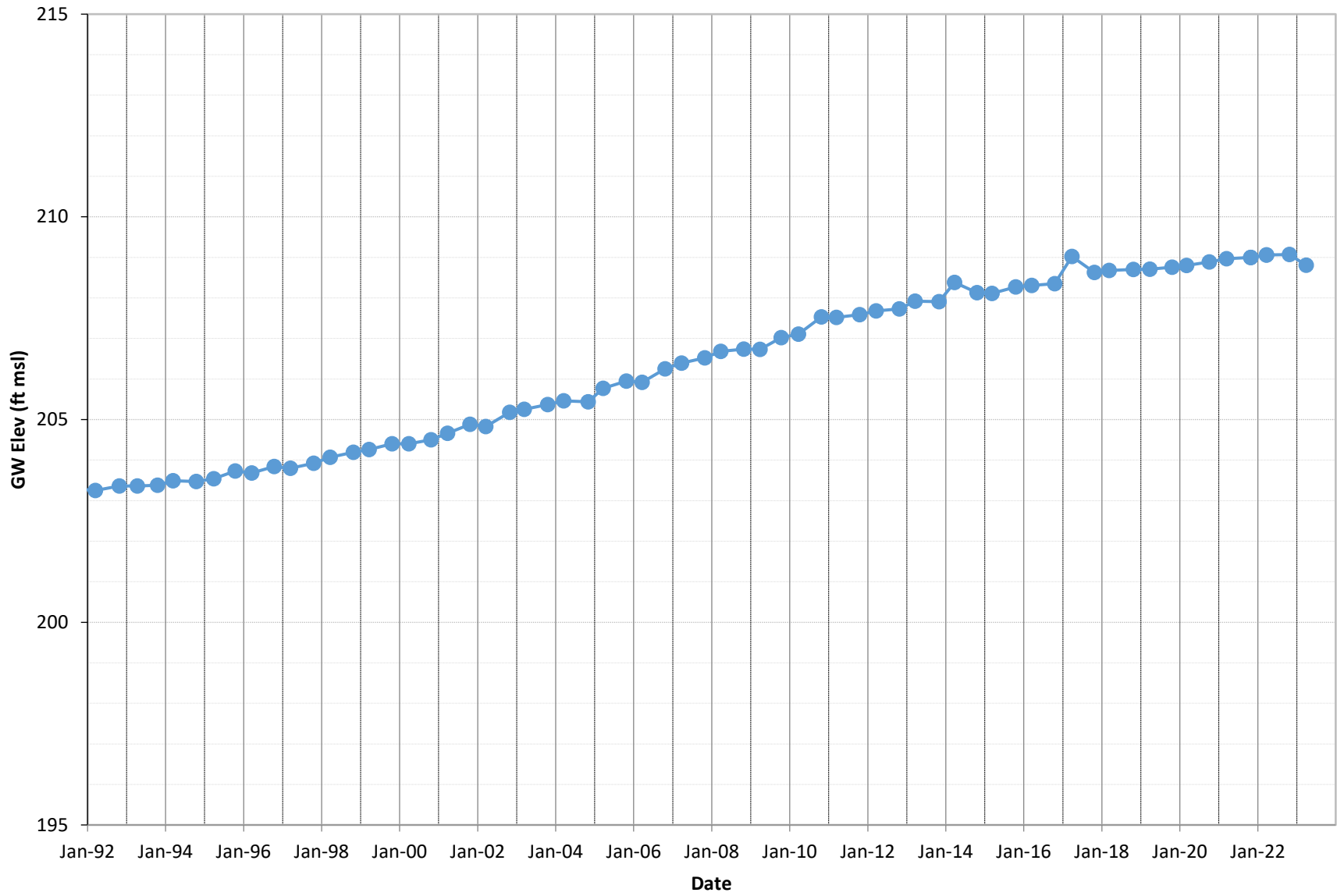
36H2 (New USG 5)



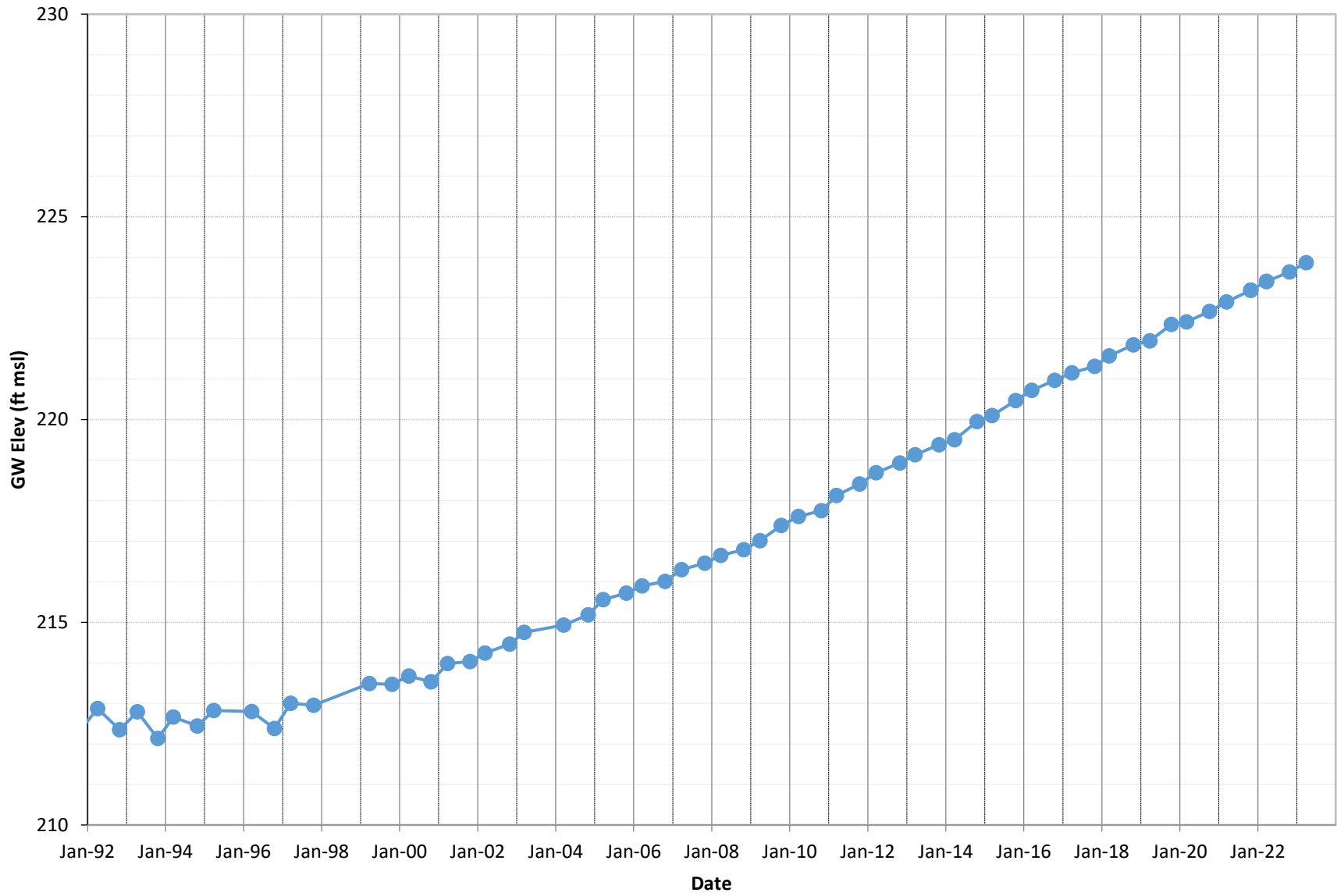
42L1



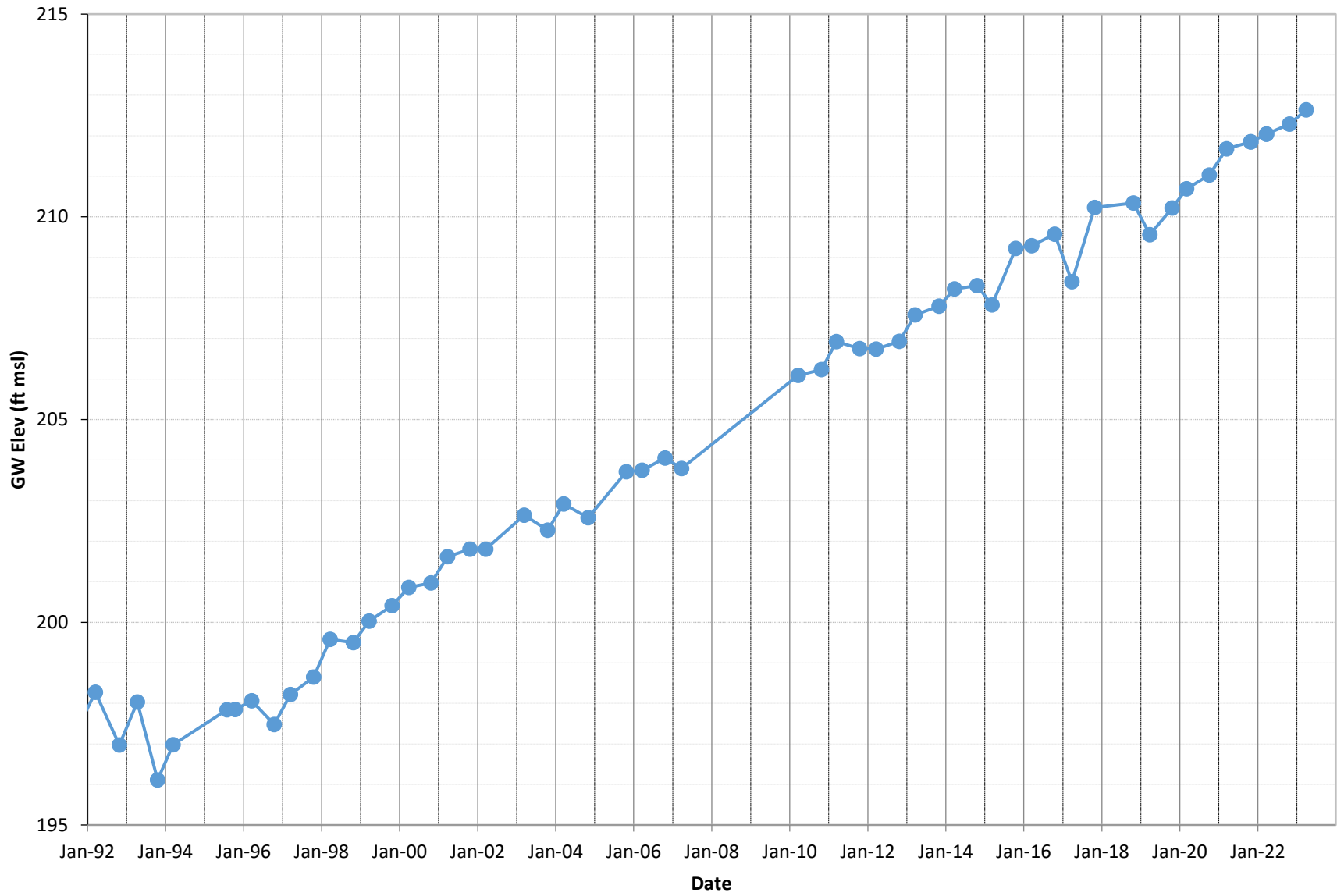
22E2



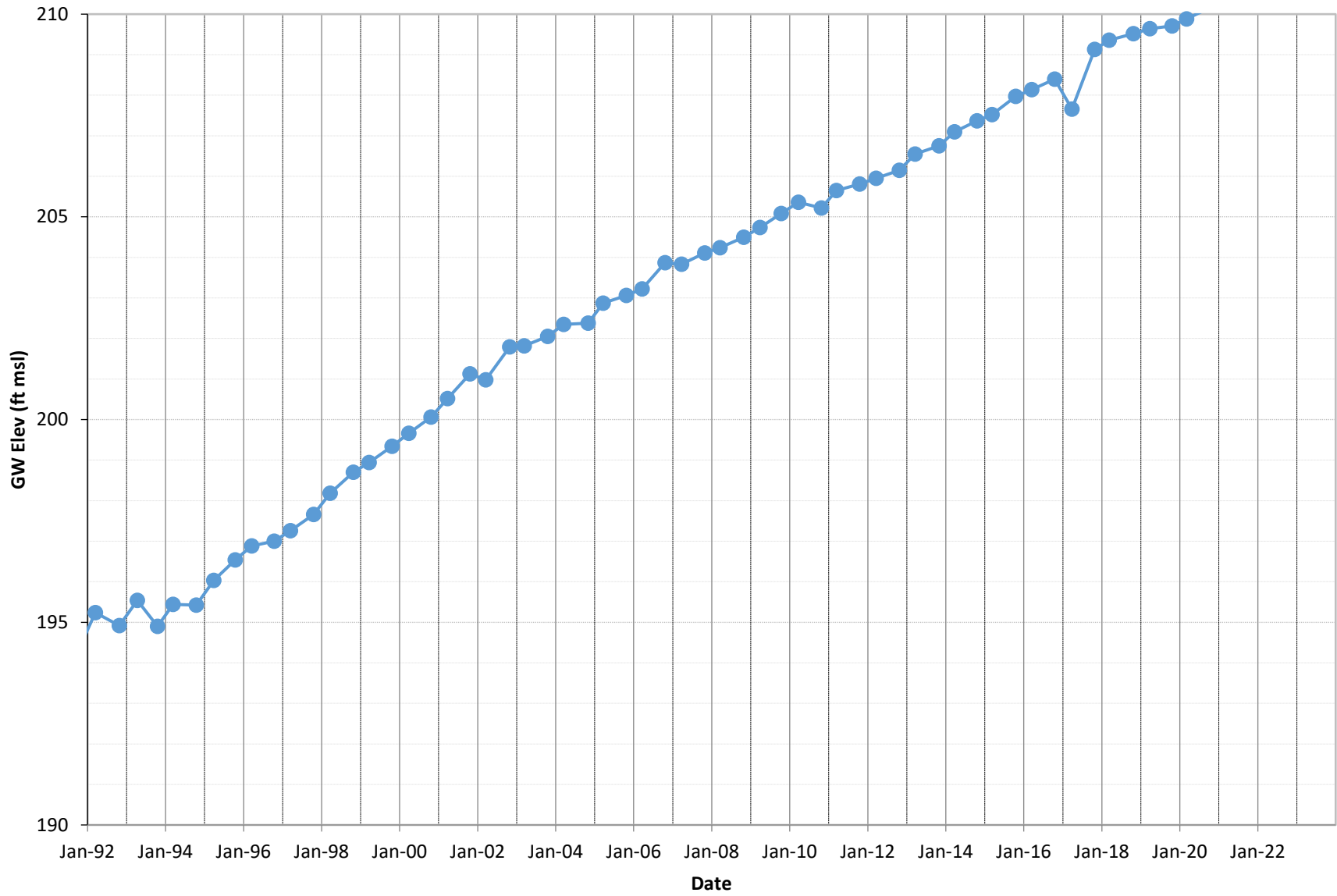
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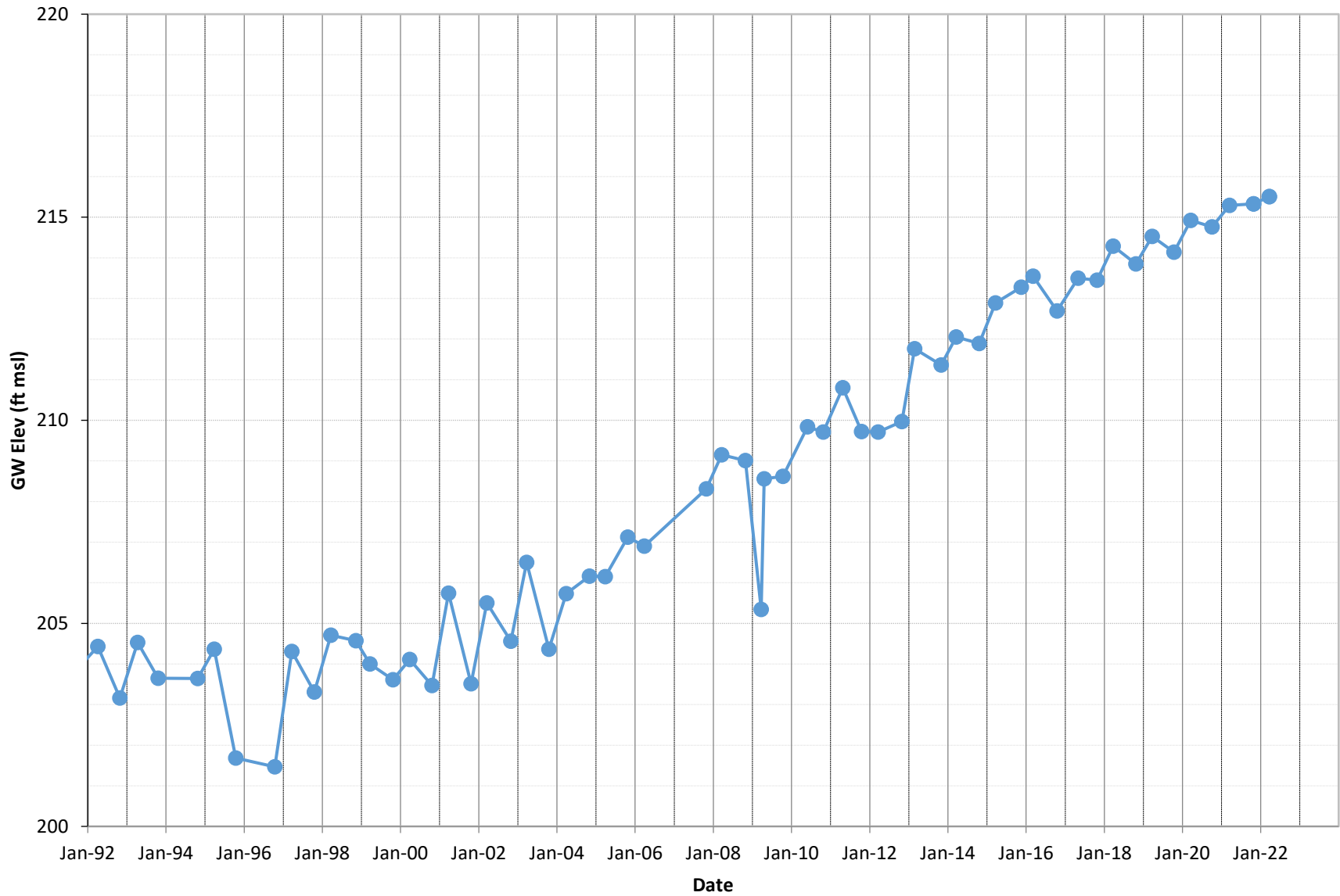
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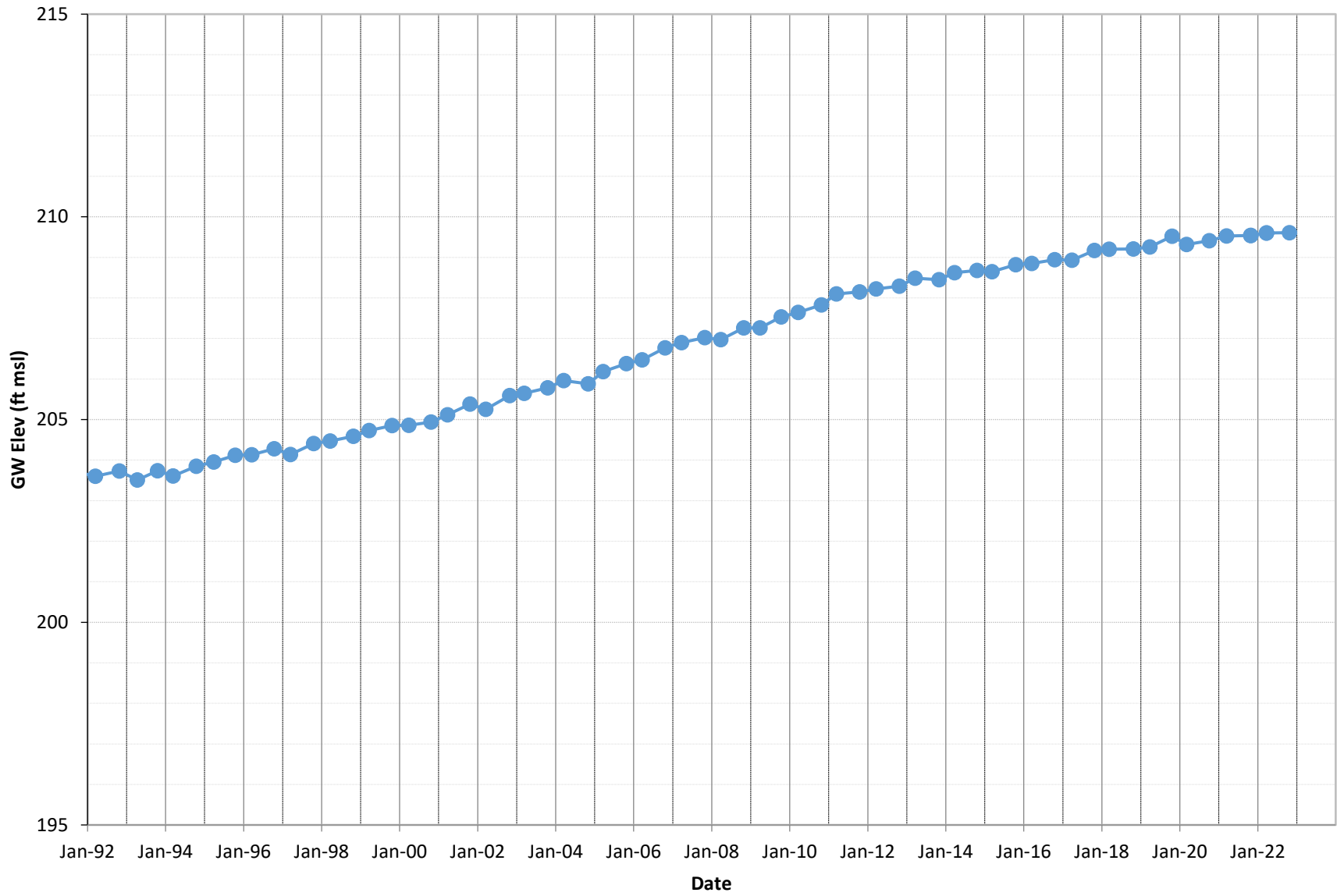
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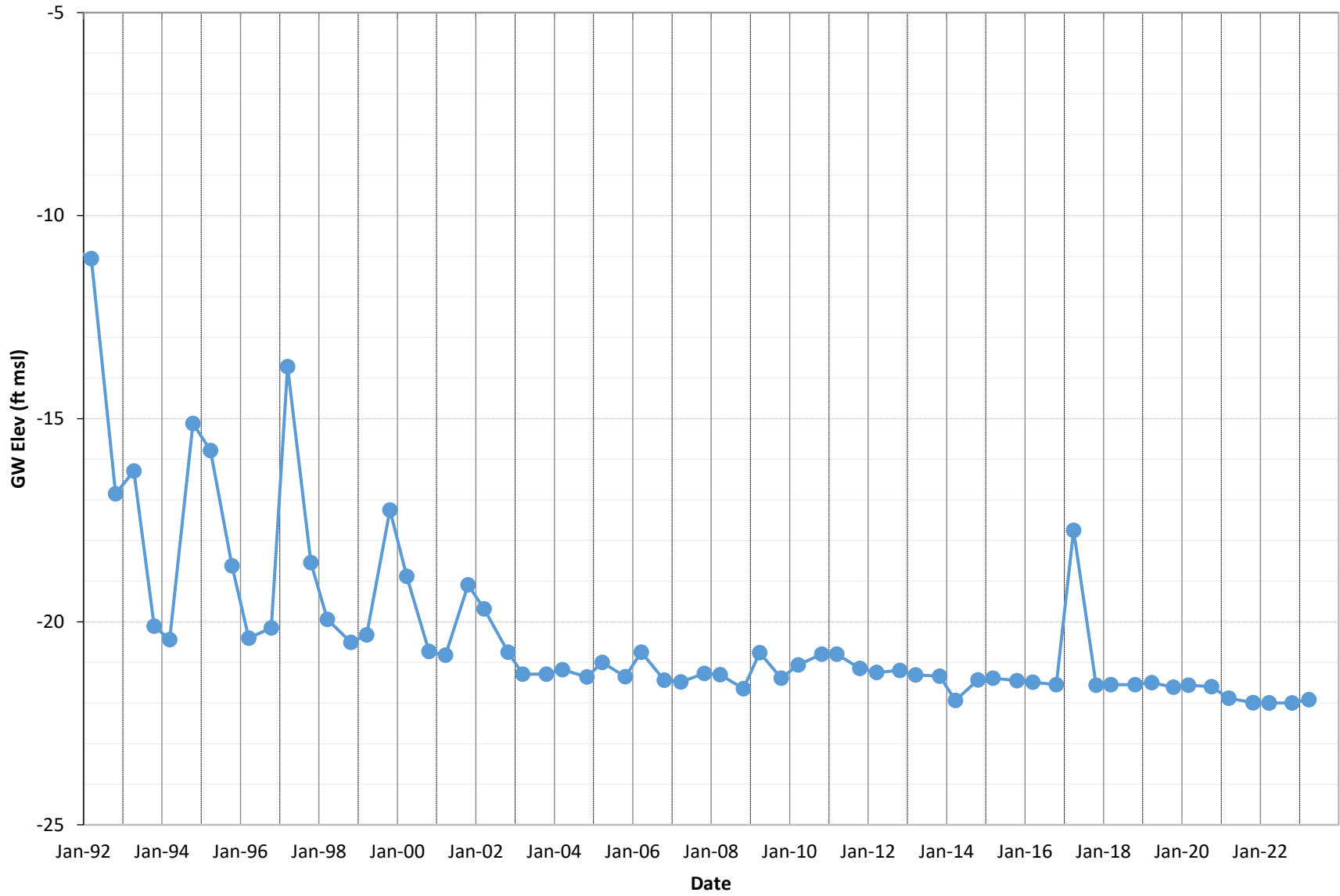
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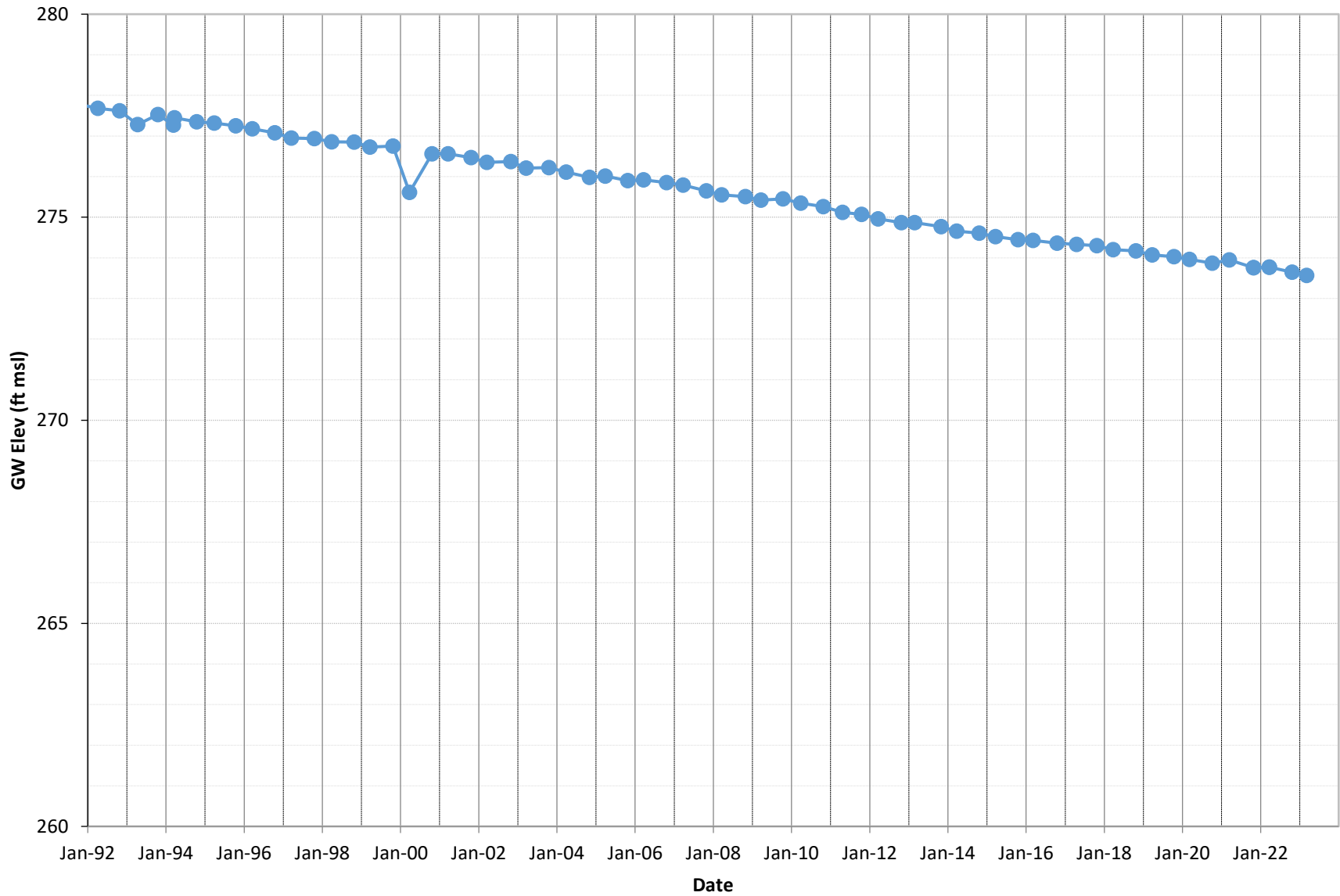
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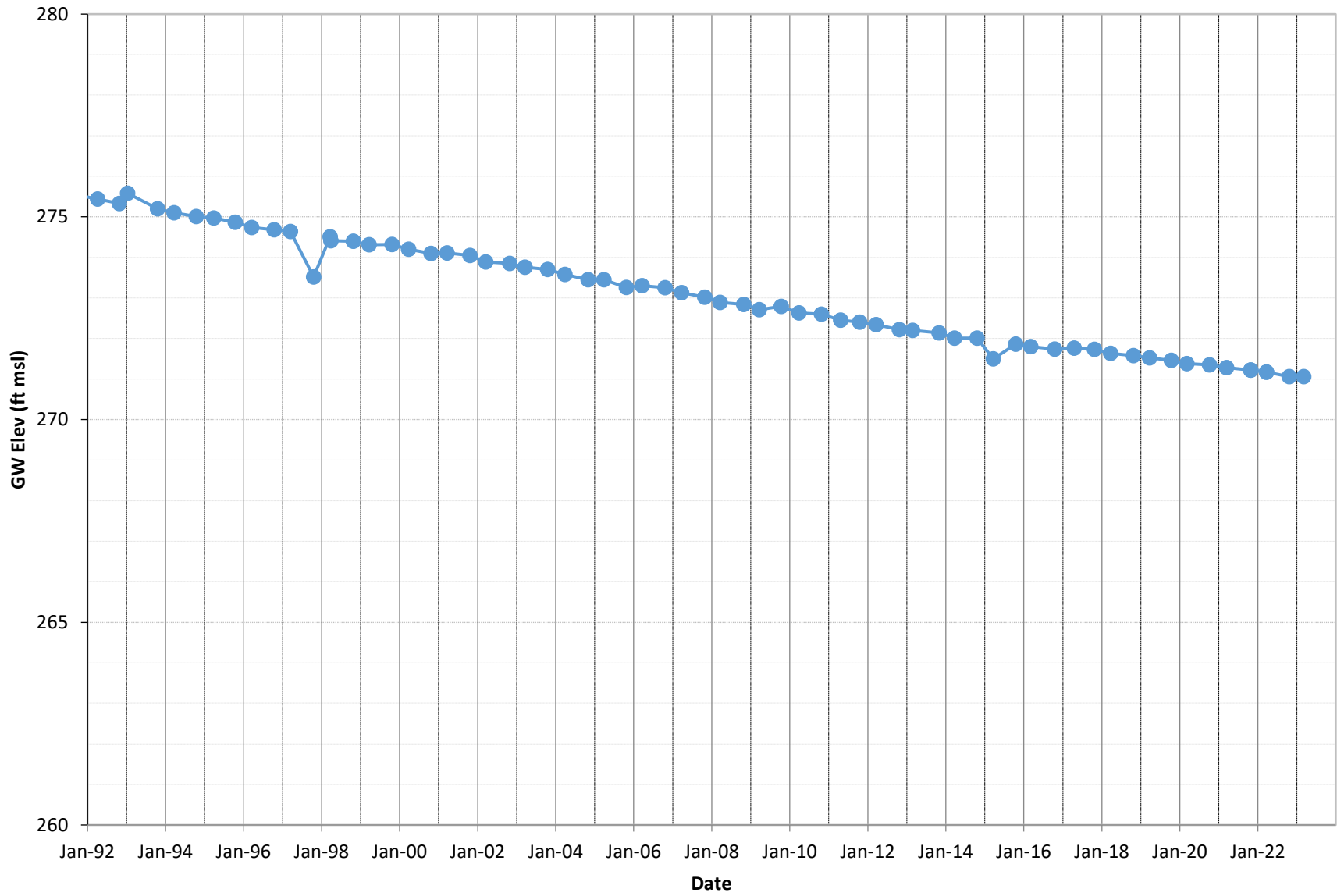
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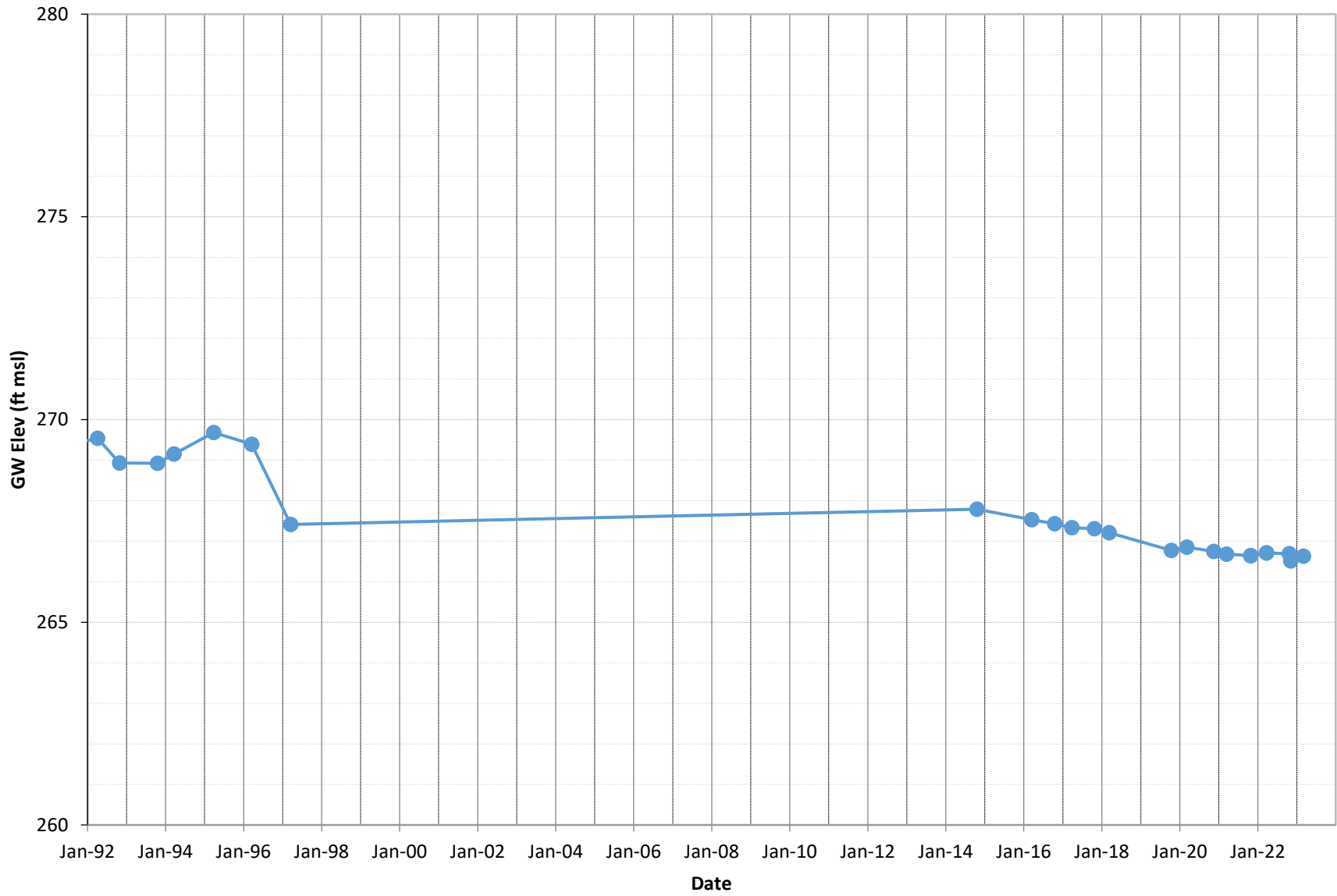
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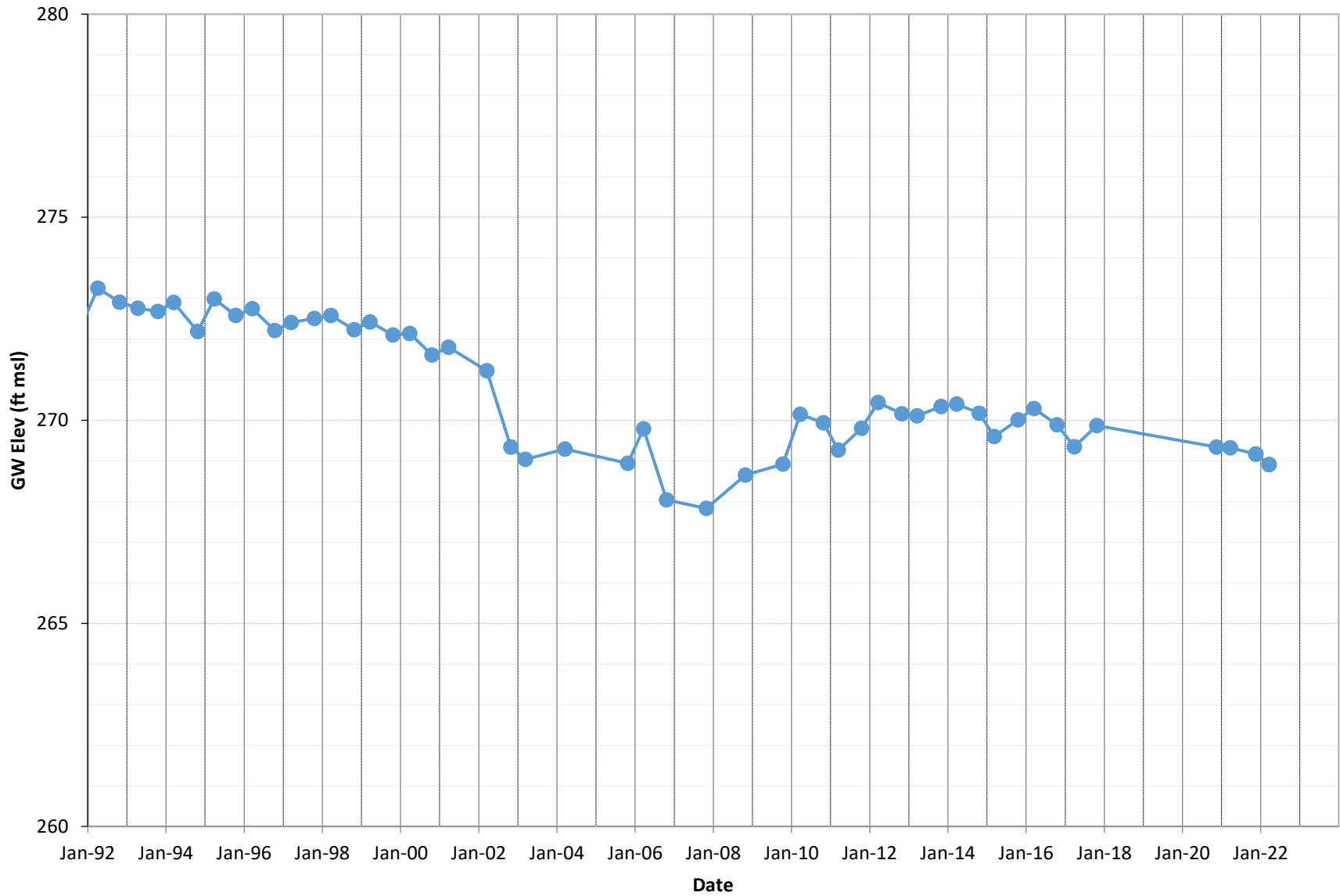
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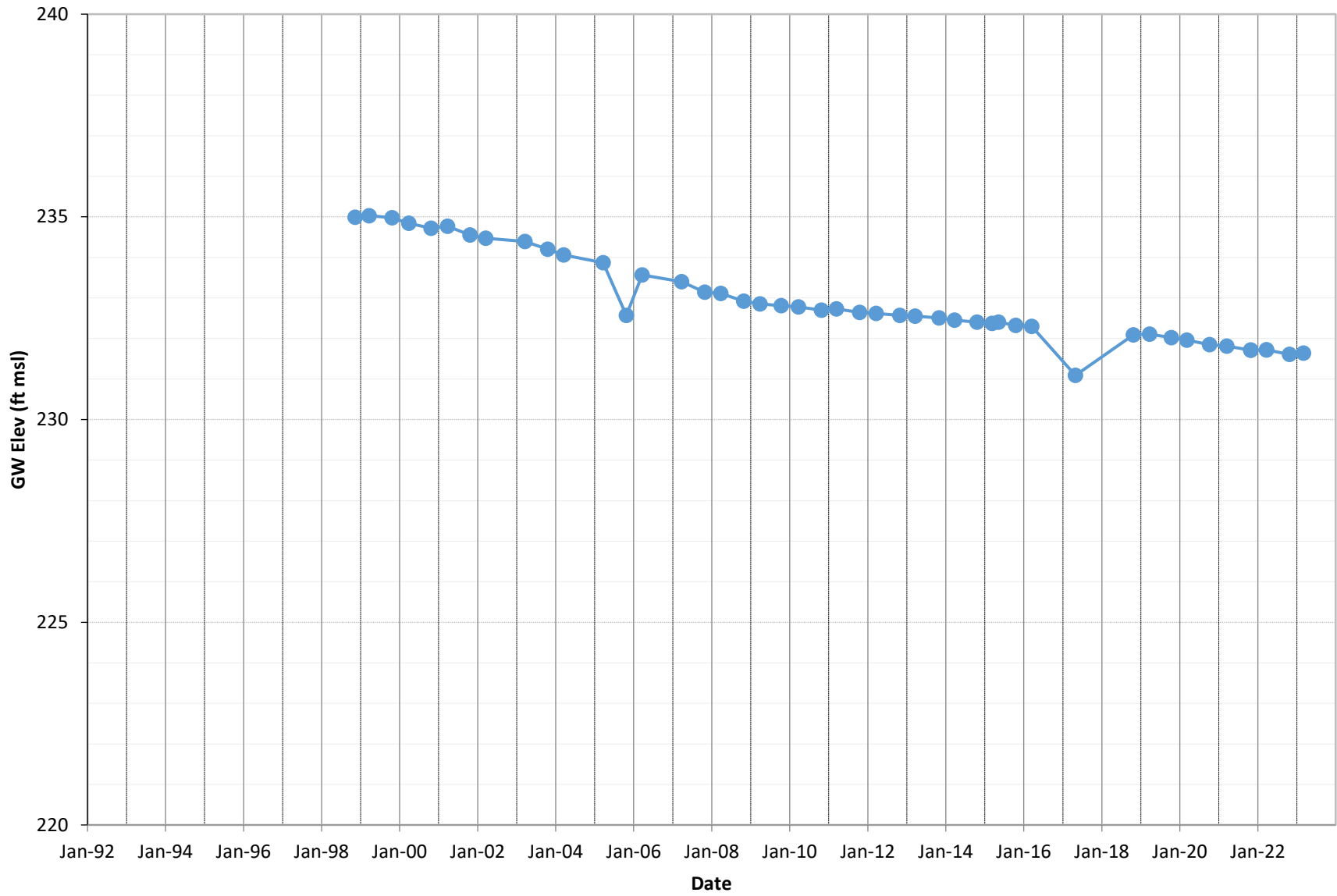
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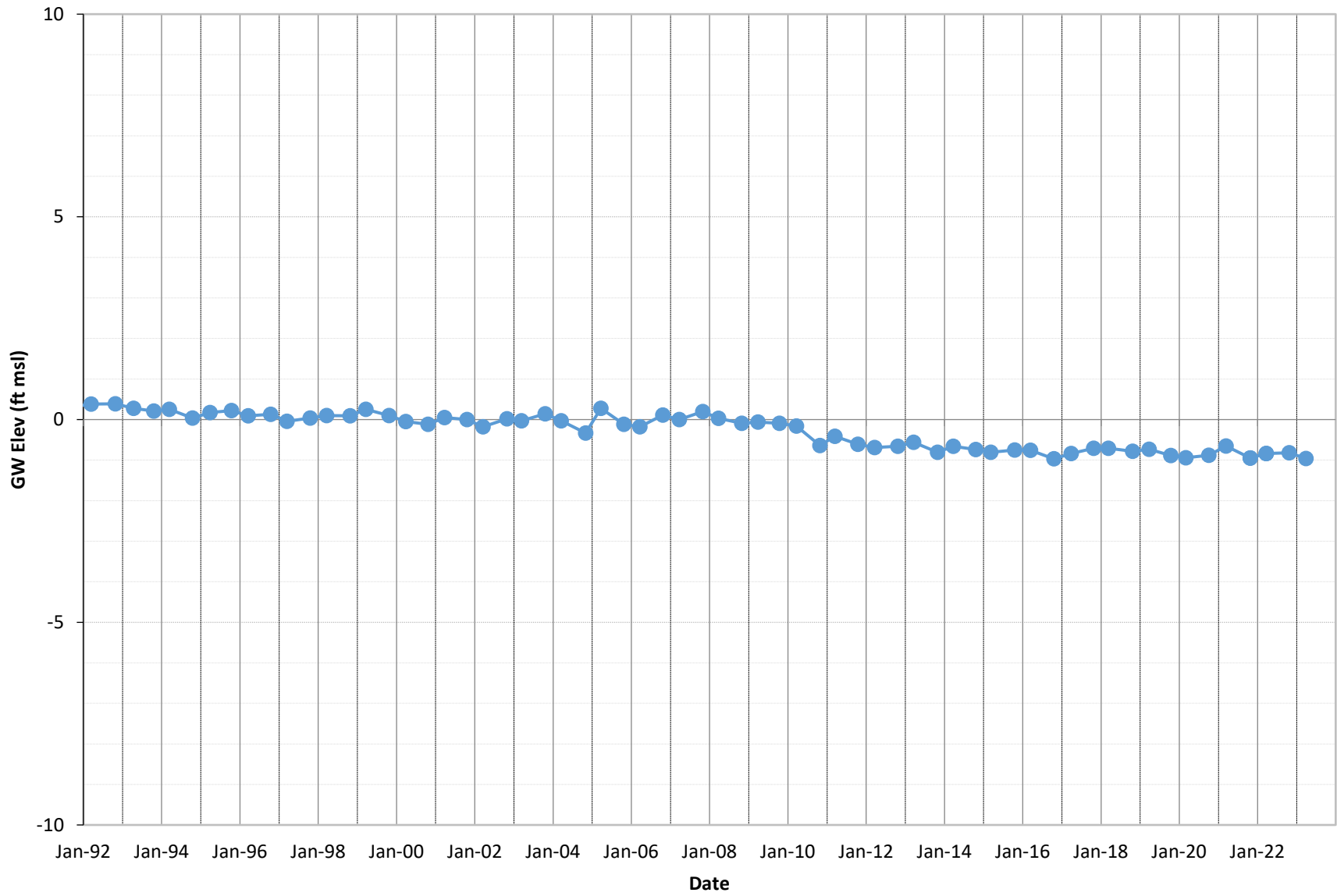
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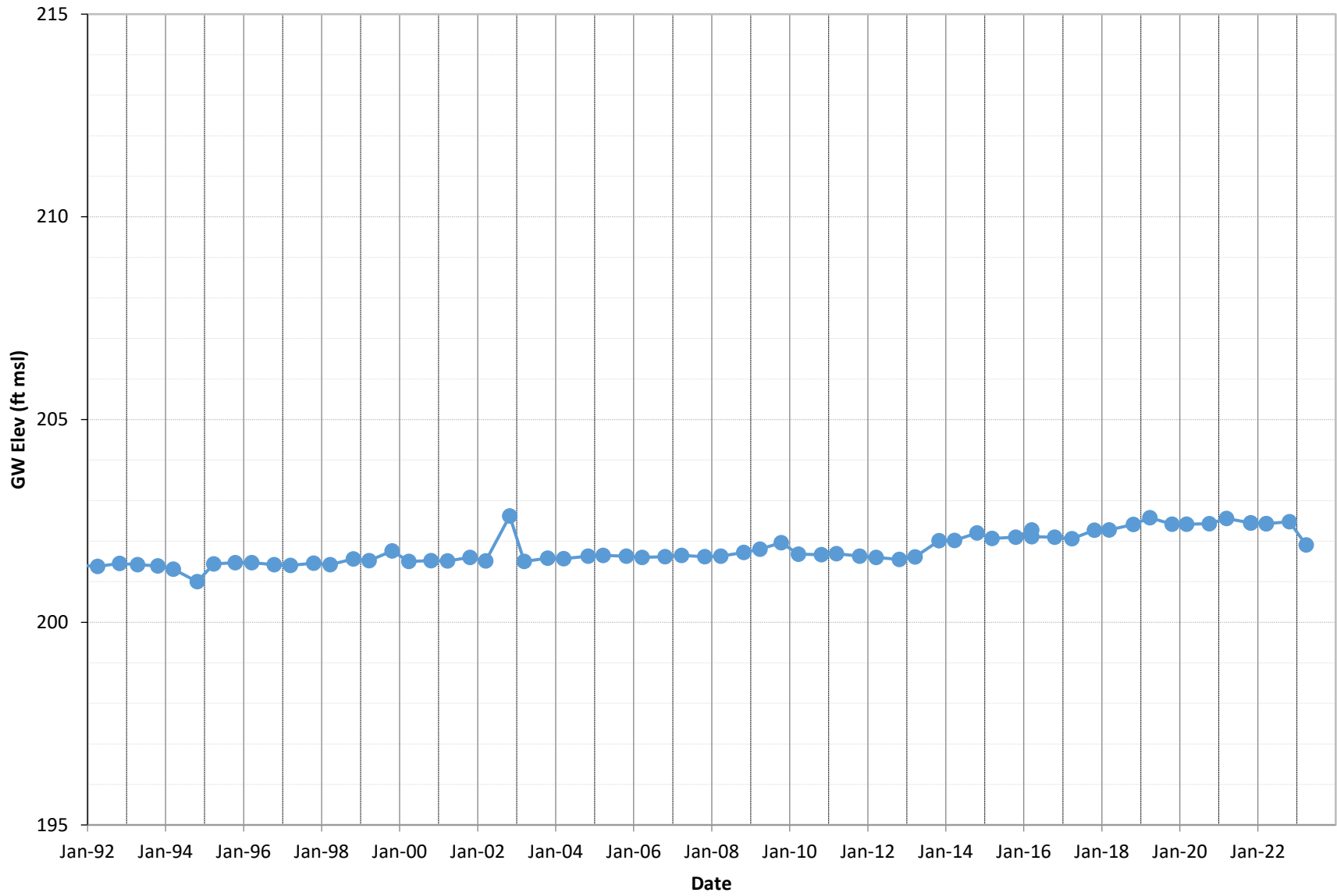
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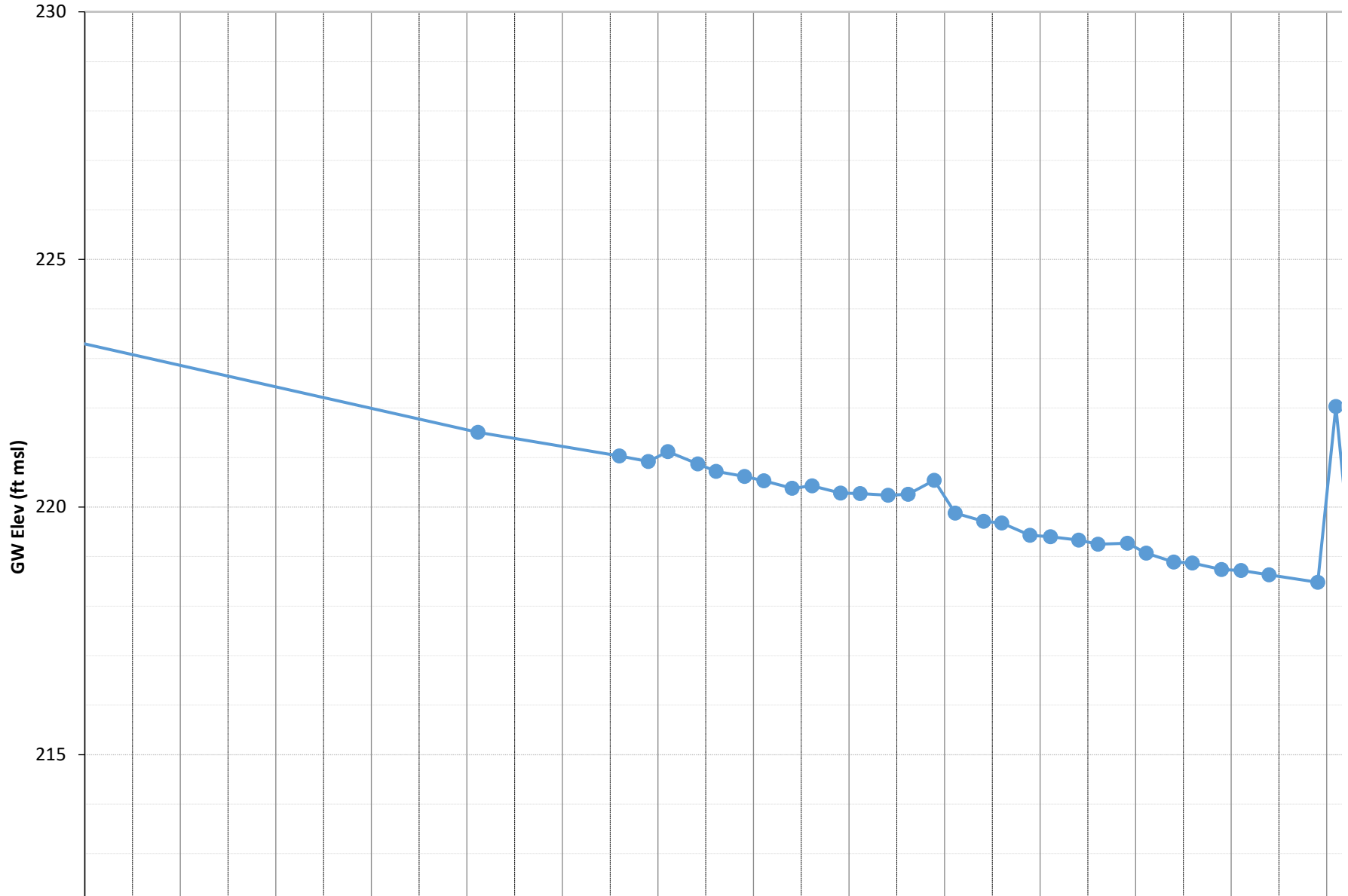
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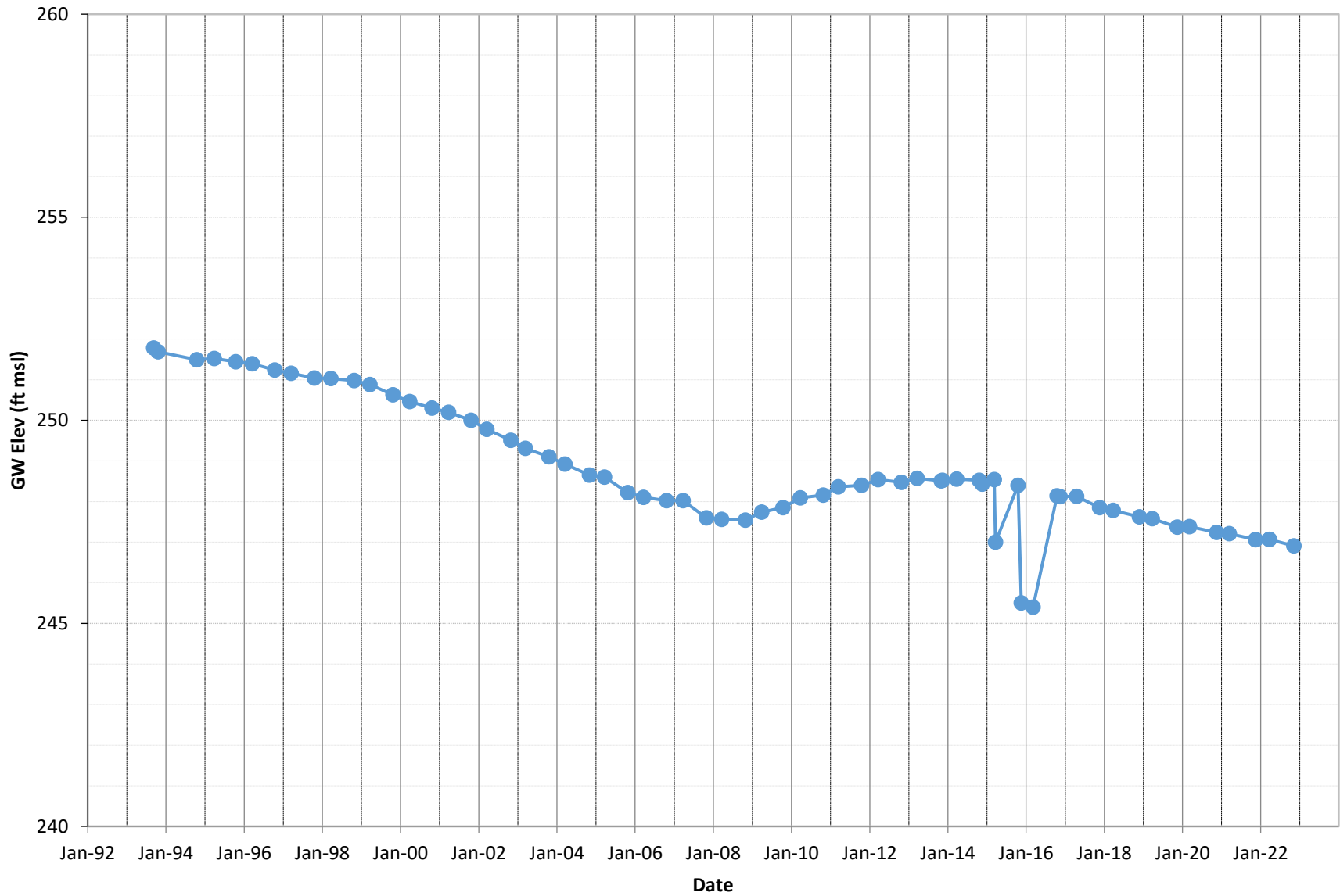
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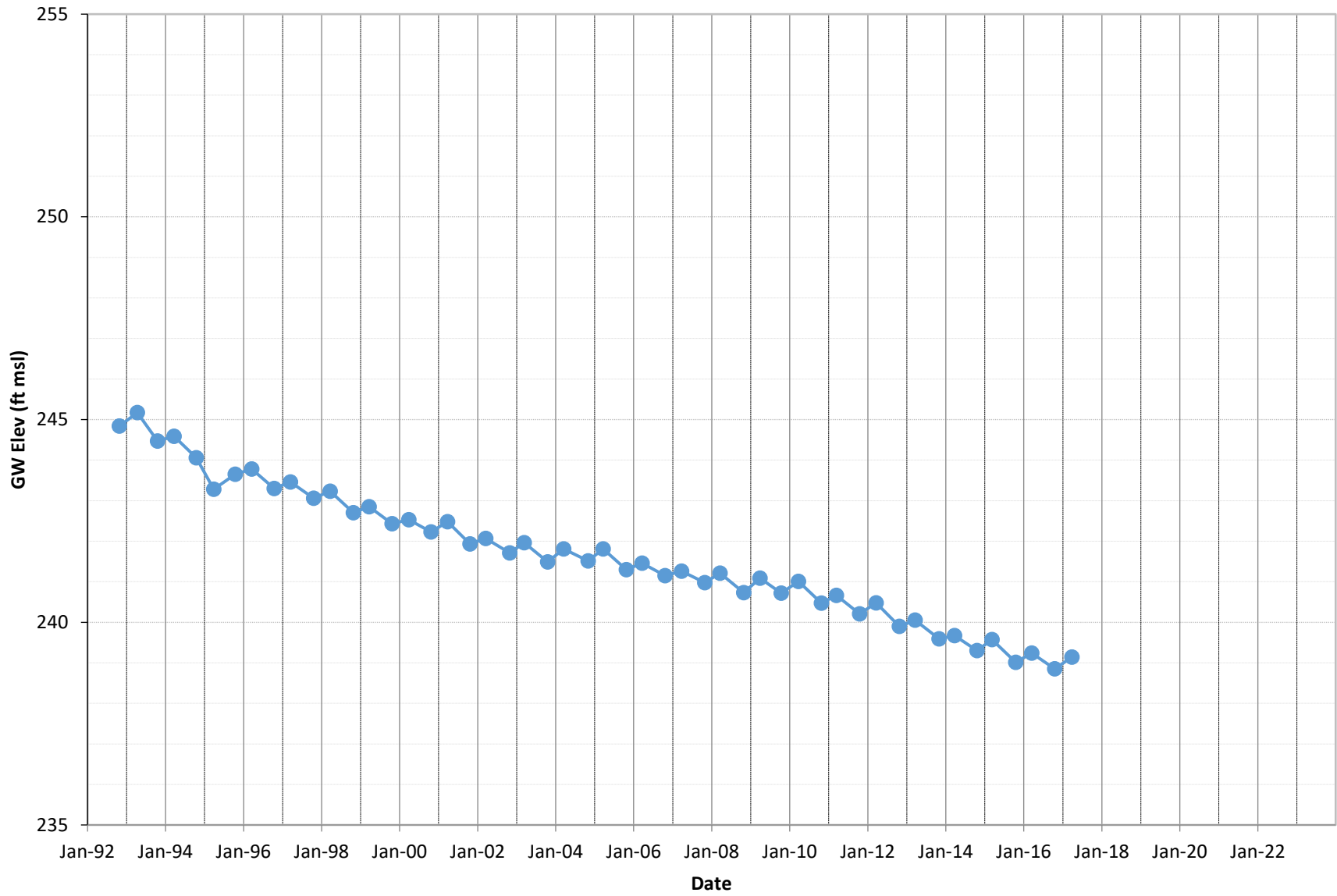
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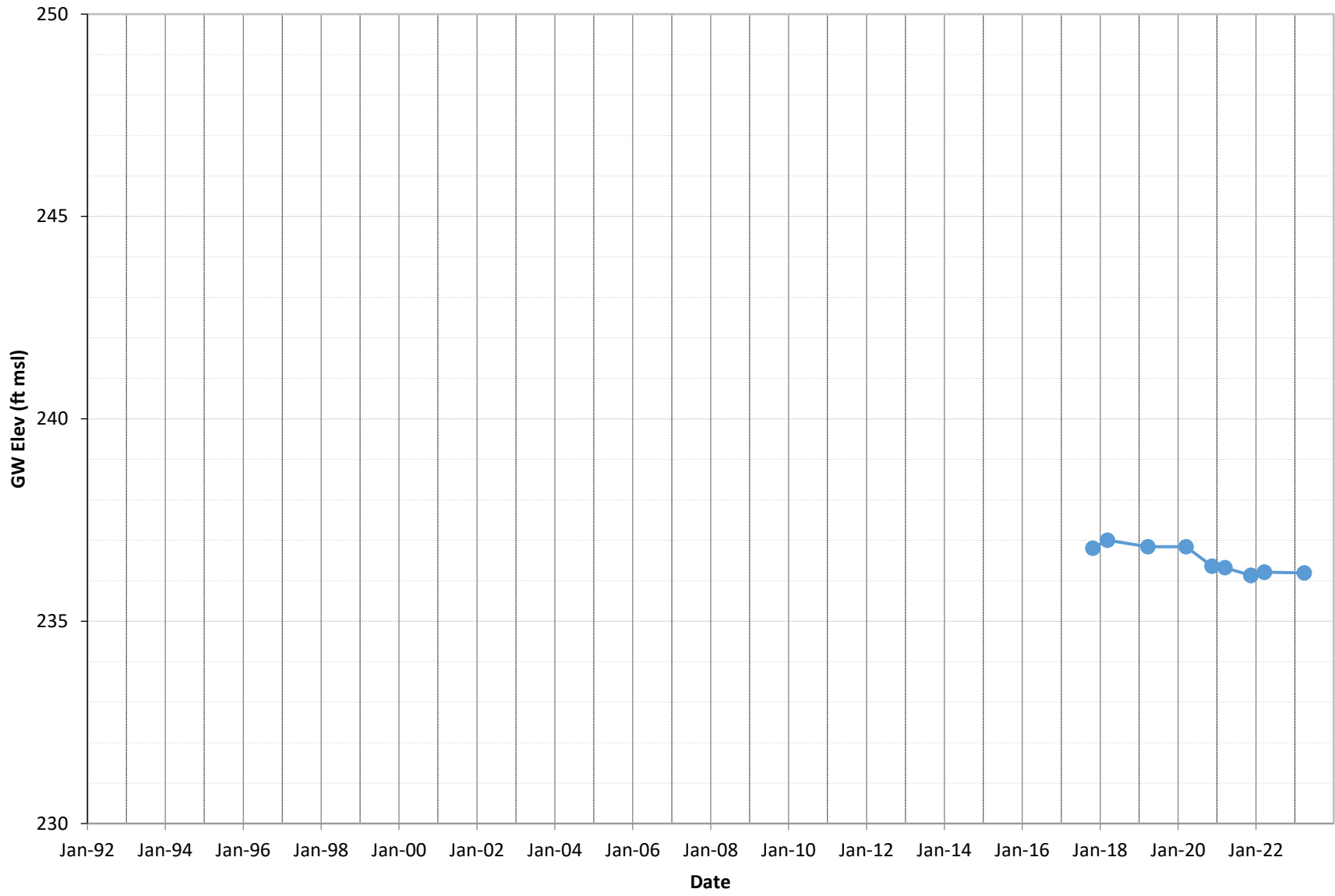
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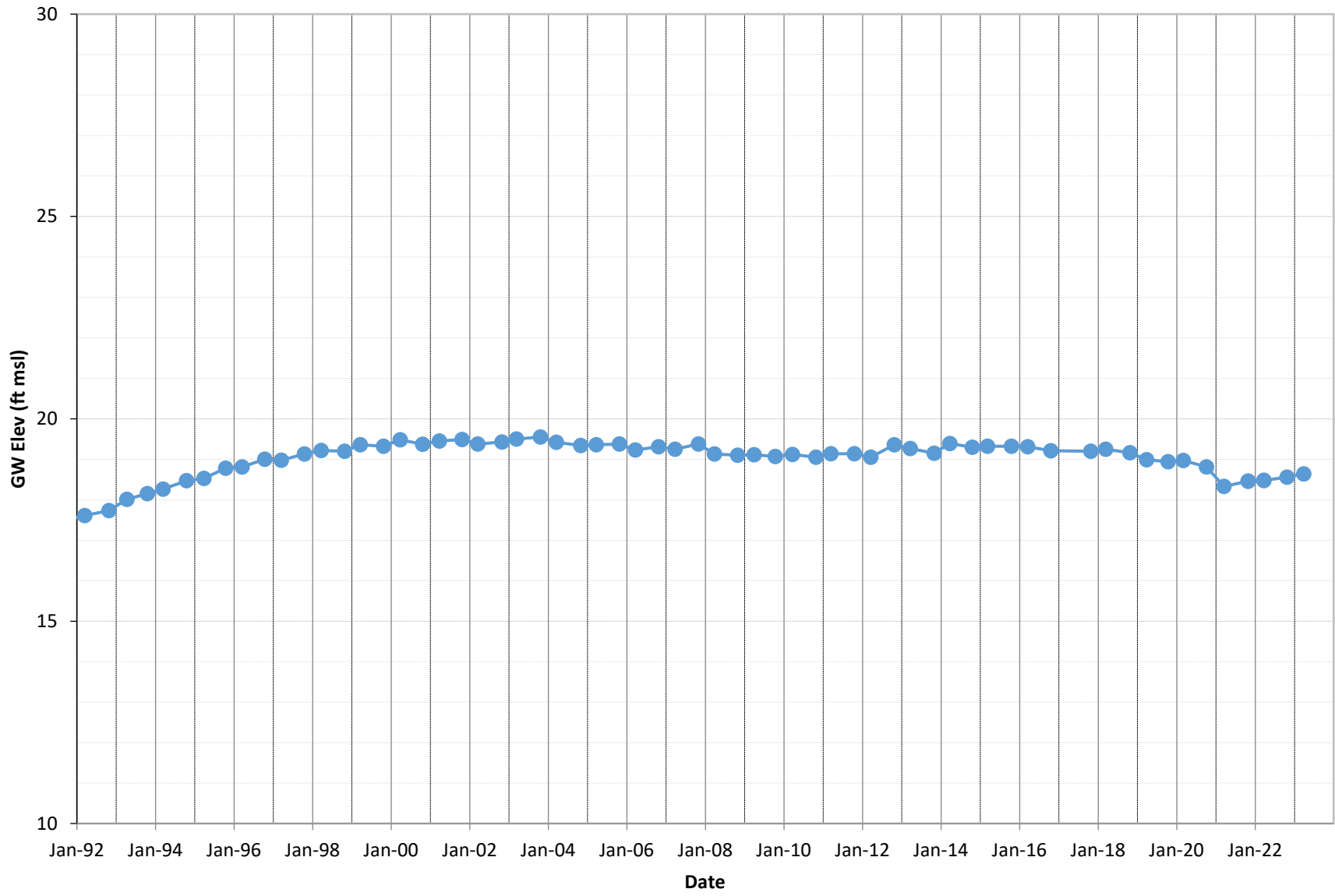
32P1



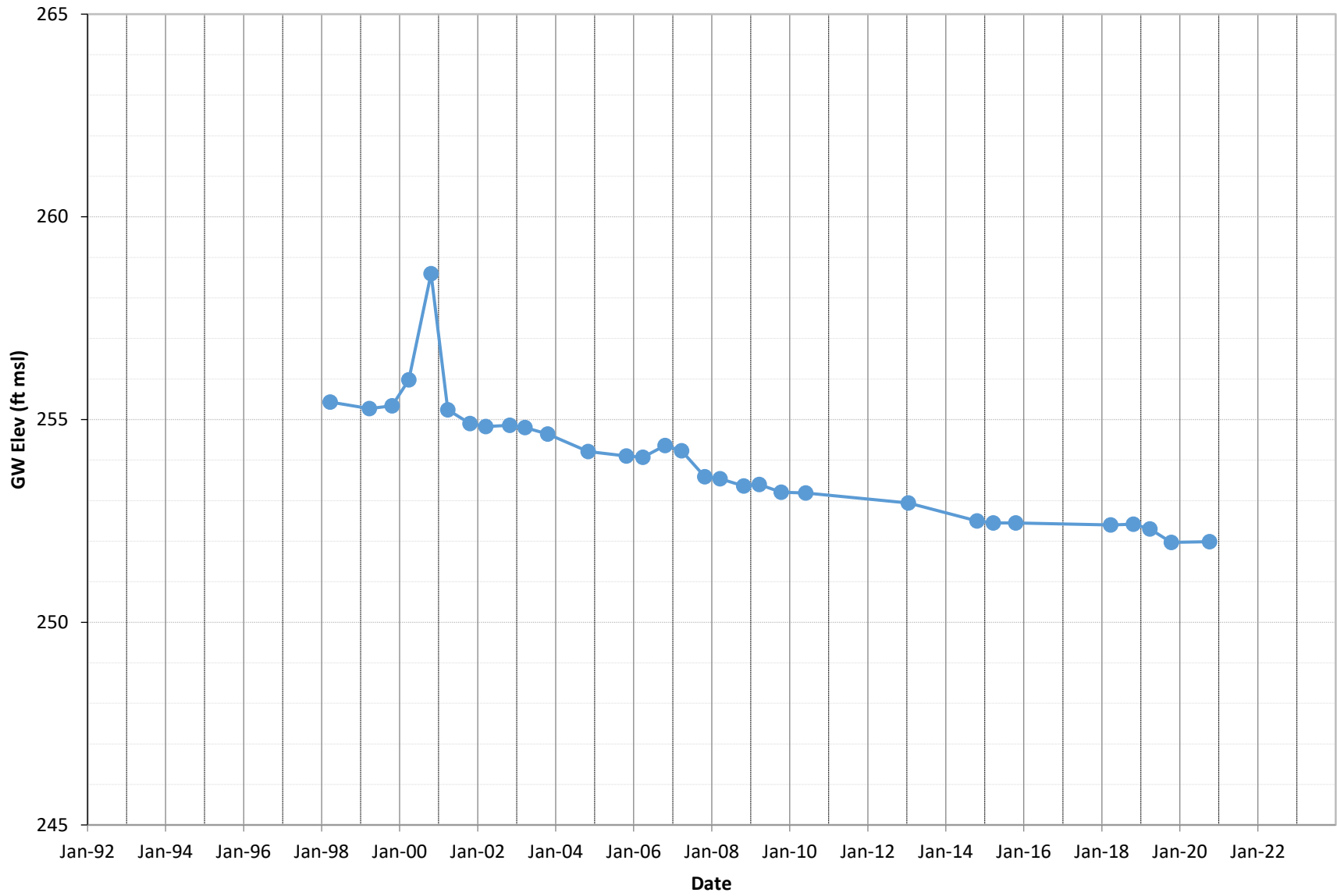
32P2



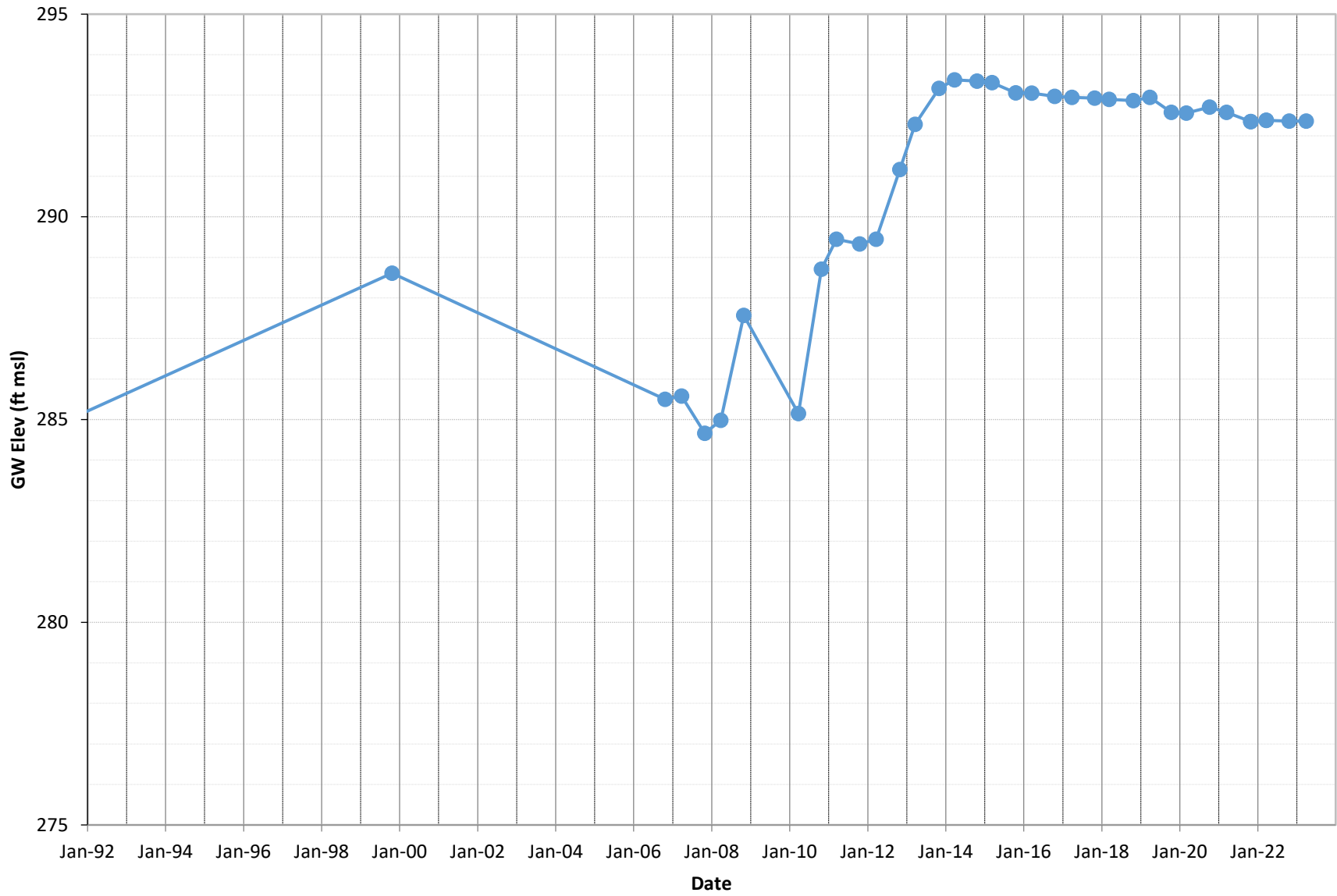
32R1



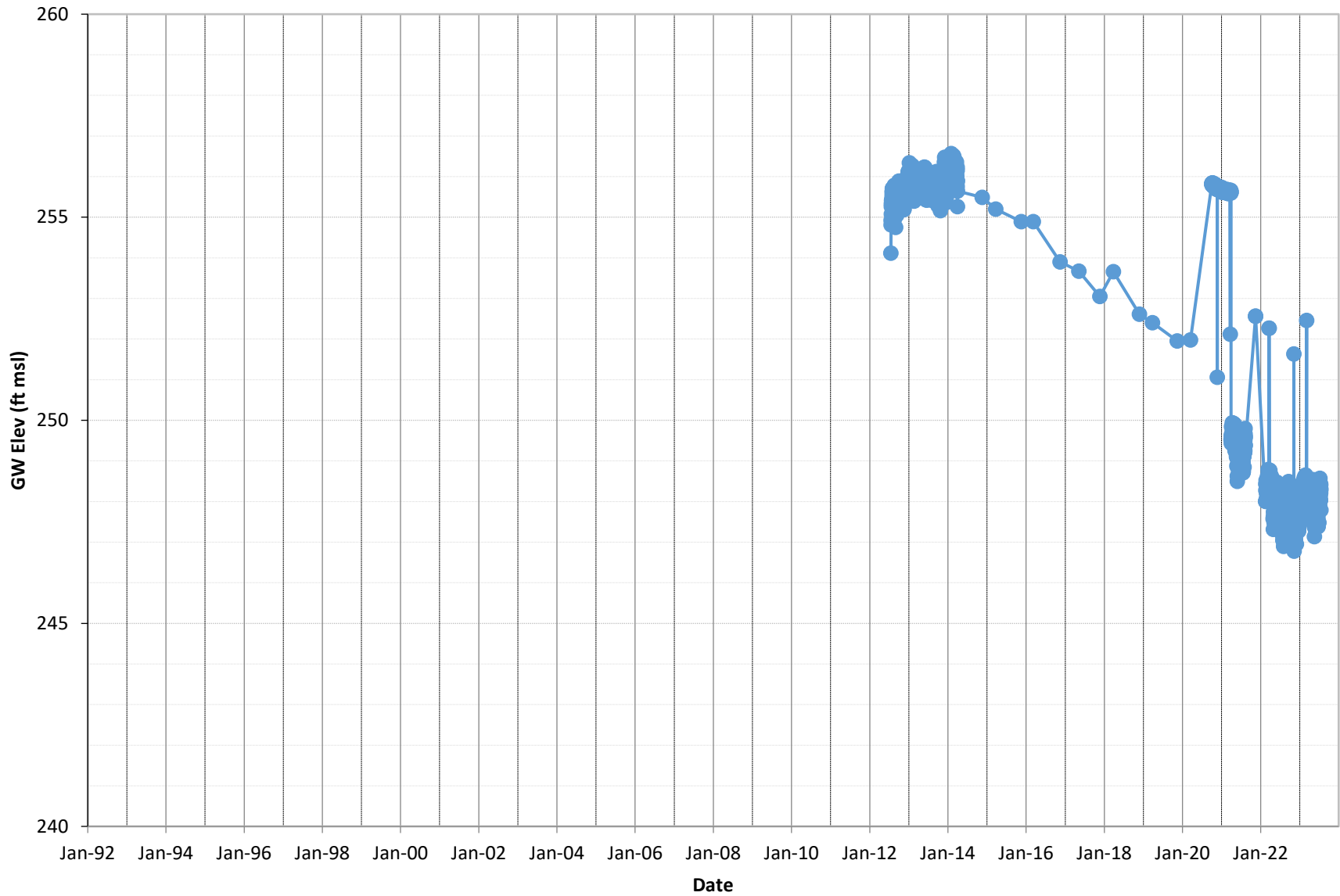
34B1



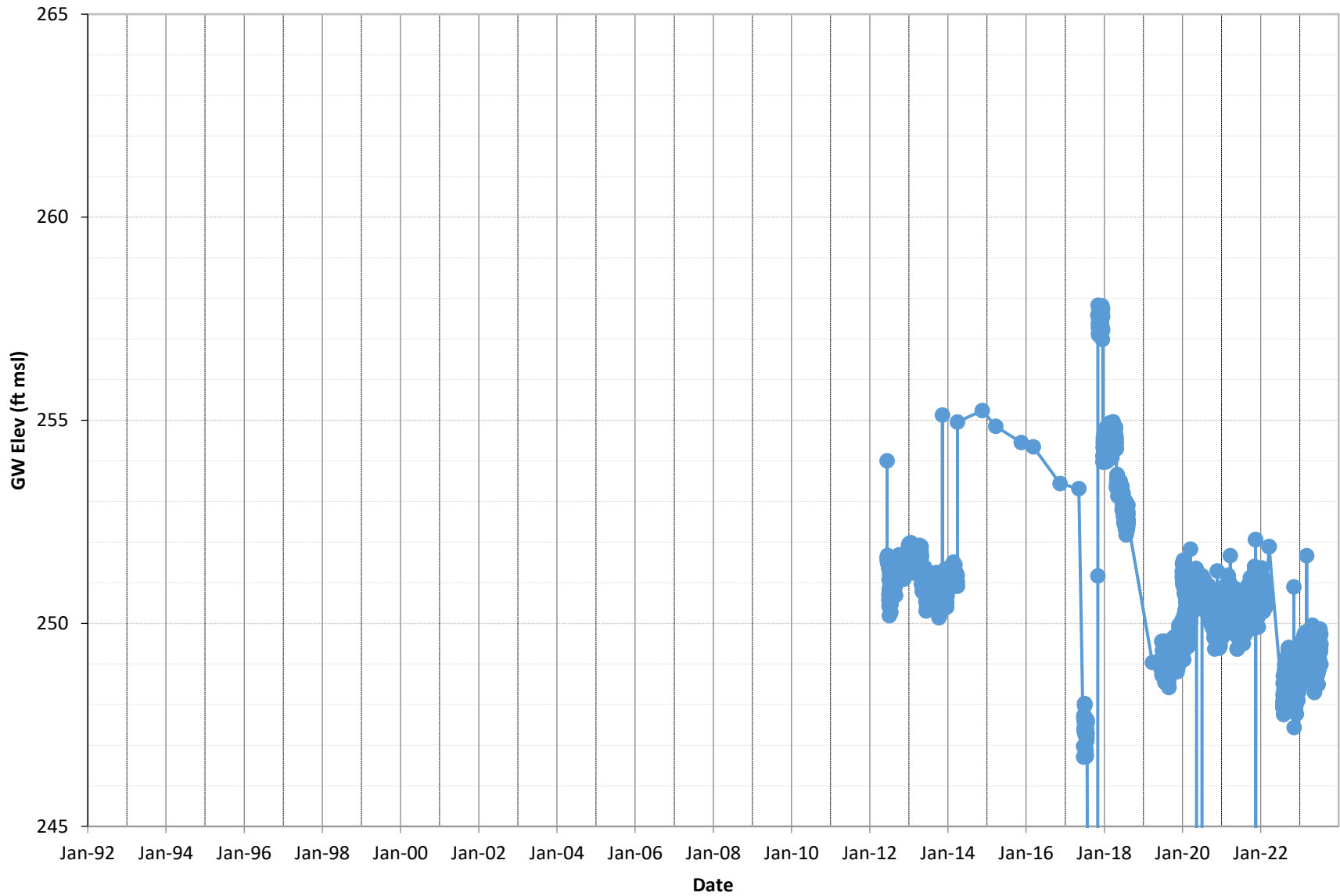
35M1



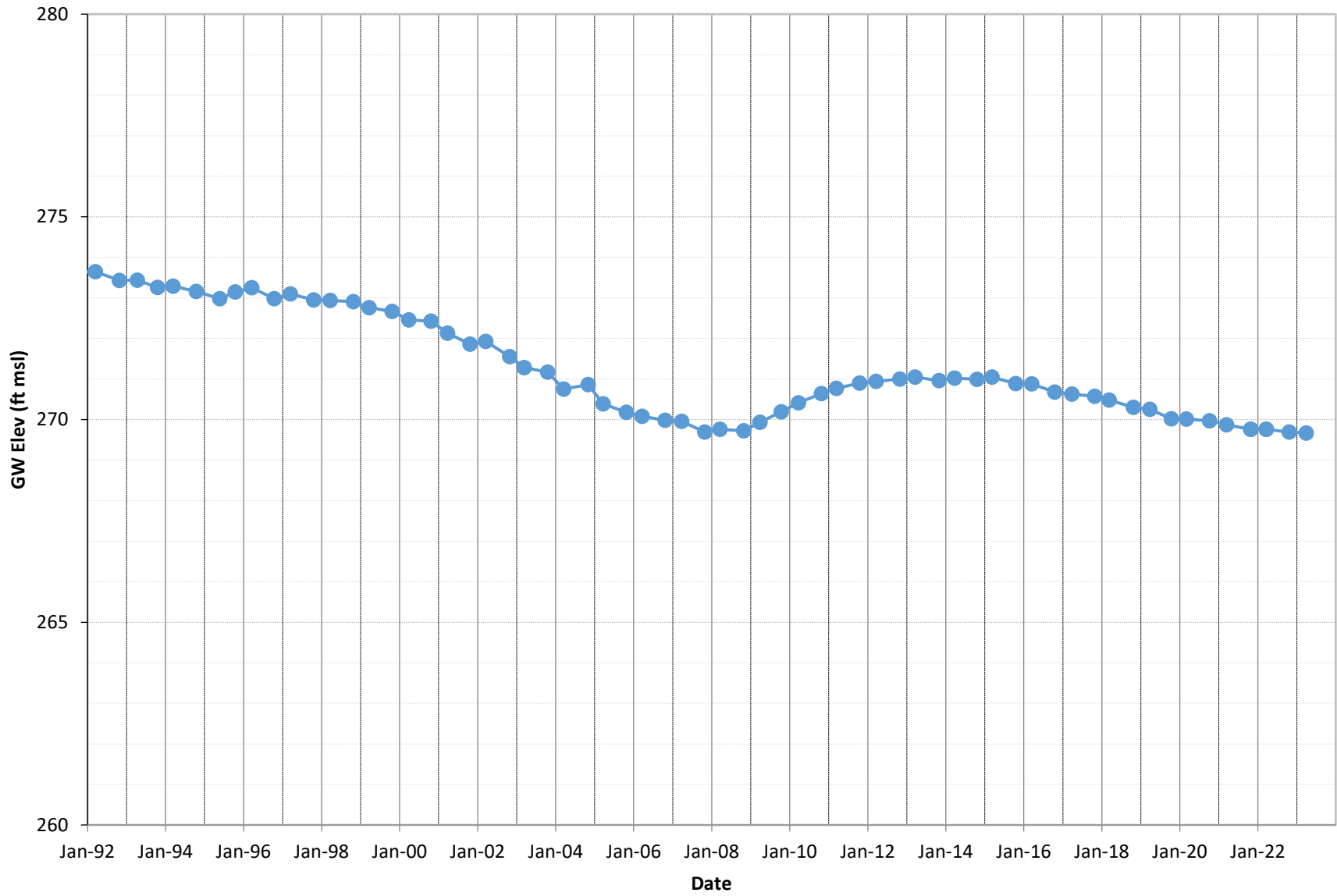
36A1(MW-2B)



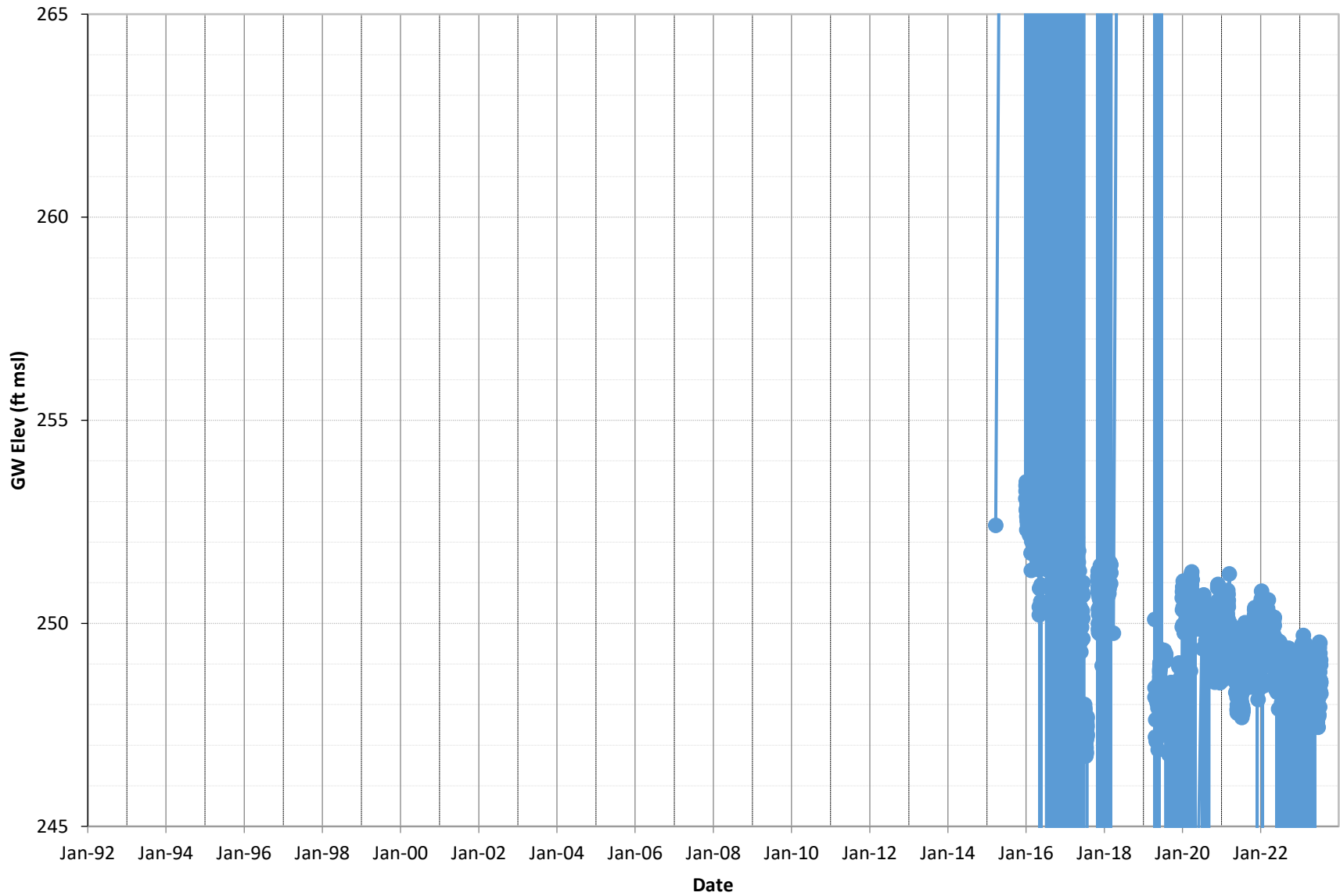
36A2 (MW-2A)



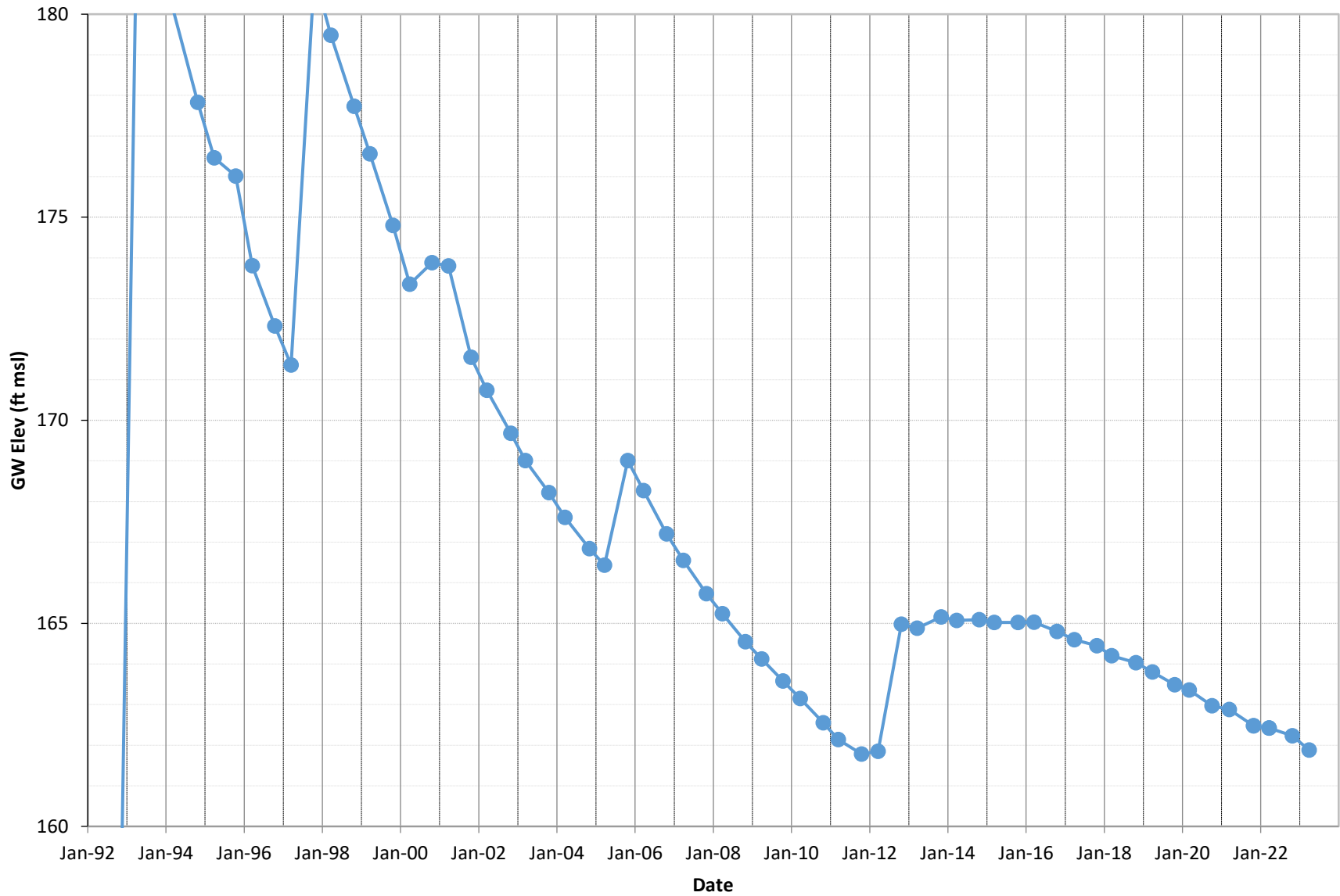
36D2



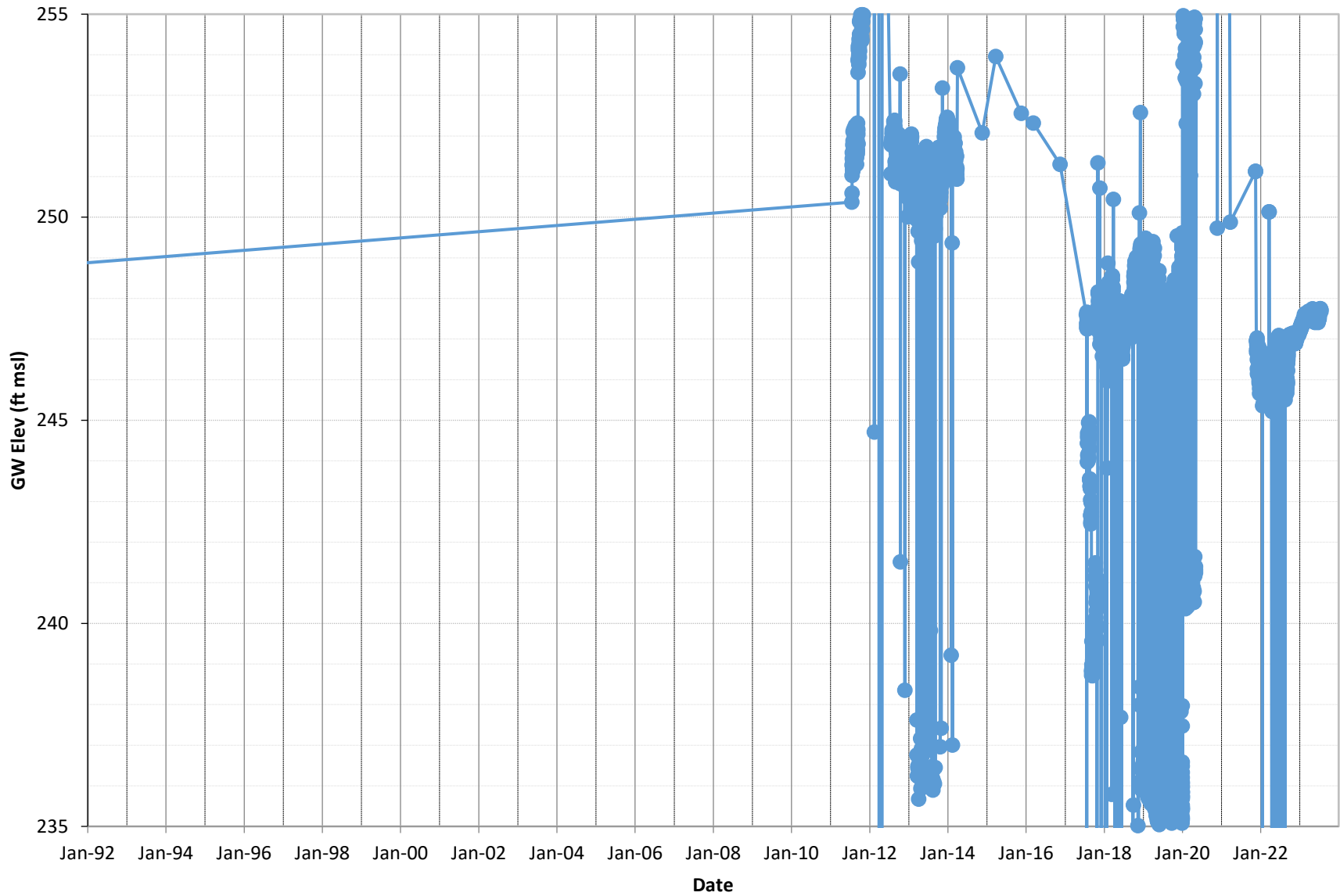
36H2 (New USG 5)



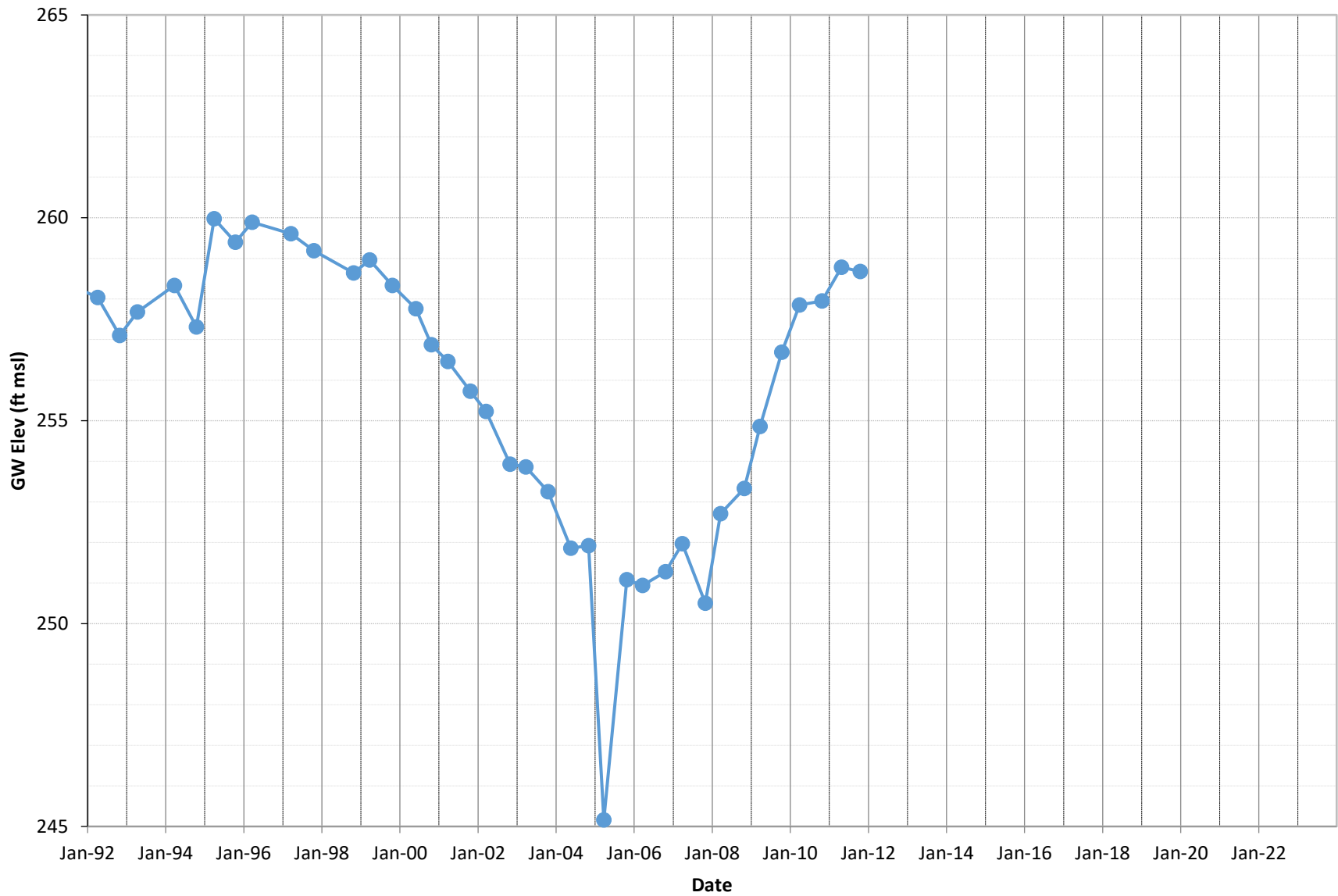
42L1



USG-4



USG-5 Old



APPENDIX C

WATER QUALITY RESULTS AND STATISTICAL ANALYSES

APPENDIX D

Pumping Data 2022-2023

Appendix D

	Total Wells	#4 Well	#5 Well	#6 Well
12/27/2021		12823188	15616450	301815504
1/3/2022		13313872	16080434	302323066
Acreft/wk	4.5	1.5	1.4	1.6
1/10/2022		14134025	16427542	303160178
Acreft/wk	6.2	2.5	1.1	2.6
1/17/2022		14934025	16427542	303913082
Acreft/wk	4.8	2.5	0.0	2.3
1/24/2022		15823757	16427542	304808215
Acreft/wk	5.5	2.7	0.0	2.7
1/31/2022		16569248	17116754	305569810
Acreft/wk	6.7	2.3	2.1	2.3
2/7/2022		17372768	17764190	306306414
Acreft/wk	6.7	2.5	2.0	2.3
2/14/2022		18123765	18451871	307099636
Acreft/wk	6.8	2.3	2.1	2.4
2/21/2022		18903763	19169196	307861193
Acreft/wk	6.9	2.4	2.2	2.3
2/28/2022		19448980	19693673	308465816
Acreft/wk	5.1	1.7	1.6	1.9
3/7/2022		20001226	20236560	309045397
Acreft/wk	5.1	1.7	1.7	1.8
3/14/2022		20804730	21072746	309831944
Acreft/wk	7.4	2.5	2.6	2.4
3/21/2022		21411236	21660430	310448710
Acreft/wk	5.6	1.9	1.8	1.9
3/28/2022		22218463	22548723	311247050
Acreft/wk	7.7	2.5	2.7	2.5
4/4/2022		22892969	23236849	311883918
Acreft/wk	6.1	2.1	2.1	2.0
4/11/2022		23599360	23896112	312603315
Acreft/wk	6.4	2.2	2.0	2.2
4/18/2022		24381700	24668805	313501755
Acreft/wk	7.5	2.4	2.4	2.8
4/25/2022		24935820	25041886	315096010
Acreft/wk	7.7	1.7	1.1	4.9
5/2/2022		25729460	25041886	316705374
Acreft/wk	7.4	2.4	0.0	4.9
5/9/2022		25729460*	25994048	317696434
Acreft/wk	6.0	0.0	2.9	3.0
5/16/2022		25760460*	26788473	318579123
Acreft/wk	5.2	0.1	2.4	2.7
5/23/2022		26164460*	27631808	319501117
Acreft/wk	6.7	1.2	2.6	2.8
5/30/2022		26641460*	28577572	320669668
Acreft/wk	8.0	1.5	2.9	3.6

6/6/2022		26643460*	29445236	321590187
Acreft/wk	5.5	0.0	2.7	2.8
6/13/2022		26654460*	30658945	322936563
Acreft/wk	7.9	0.0	3.7	4.1
6/20/2022		26654460*	31417238	323739806
Acreft/wk	4.8	0.0	2.3	2.5
6/27/2022		27809460*	32258265	324658011
Acreft/wk	8.9	3.5	2.6	2.8
7/4/2022		28232460*	33113875	325538197
Acreft/wk	6.6	1.3	2.6	2.7
7/11/2022		28290460*	34439485	327011543
Acreft/wk	8.8	0.2	4.1	4.5
7/18/2022		28290460*	35699995	328426829
Acreft/wk	8.2	0.0	3.9	4.3
7/25/2022		28290460*	36980095	330126829
Acreft/wk	9.1	0.0	3.9	5.2
8/1/2022		28290460*	38222976	331313668
Acreft/wk	7.5	0.0	3.8	3.6
8/8/2022		29217460*	38528850	331603170
Acreft/wk	4.7	2.8	0.9	0.9
8/15/2022		30093460*	41084080	331618933
Acreft/wk	10.6	2.7	7.8	0.0
8/22/2022		30813460*	42037903	332455218
Acreft/wk	7.7	2.2	2.9	2.6
8/29/2022		31605460*	42744081	333287688
Acreft/wk	7.2	2.4	2.2	2.6
9/5/2022		32039460*	43312215	333824849
Acreft/wk	3.4	0.0	1.7	1.6
9/12/2022		32039460**	43985791	334482863
Acreft/wk	4.1	0.0	2.1	2.0
9/19/2022		32039460**	45018265	335496596
Acreft/wk	6.3	0.0	3.2	3.1
9/26/2022		32039460**	46323840	337076966
Acreft/wk	8.9	0.0	4.0	4.9
10/3/2022		32039460**	47578121	338335090
Acreft/wk	7.7	0.0	3.8	3.9
10/10/2022		32039460**	48580317	339495267
Acreft/wk	6.6	0.0	3.1	3.6
10/17/2022		32039460**	49896270	340910637
Acreft/wk	8.4	0.0	4.0	4.3
10/24/2022		32039460**	51239698	342251984
Acreft/wk	8.2	0.0	4.1	4.1
10/31/2022		32039460**	52476830	343564386
Acreft/wk	7.8	0.0	3.8	4.0
11/7/2022		32039460**	53801456	345033993
Acreft/wk	8.6	0.0	4.1	4.5
11/14/2022		32039460**	55127643	346434411

Acreft/wk	8.4	0.0	4.1	4.3
11/21/2022		32039460**	55767435	347091398
Acreft/wk	4.0	0.0	2.0	2.0
11/28/2022		32039460**	56868649	348478836
Acreft/wk	7.6	0.0	3.4	4.3
12/5/2022		32039460**	57746594	349345230
Acreft/wk	5.4	0.0	2.7	2.7
12/12/2022		32039460**	58978724	350695488
Acreft/wk	7.9	0.0	3.8	4.1
12/19/2022		32039460**	59972412	351793980
Acreft/wk	6.4	0.0	3.0	3.4
12/26/2022		32039460**	60920301	352828224
Acreft/wk	6.1	0.0	2.9	3.2
1/2/2023		32039460**	61753596	353737264
Acreft/wk	5.3	0.0	2.6	2.8
1/9/2023		32039460**	62618756	354674636
Acreft/wk	5.5	0.0	2.7	2.9
1/16/2023		32039460**	63504819	355619258
Acreft/wk	5.6	0.0	2.7	2.9
1/23/2023		32039460**	64341721	356367260
Acreft/wk	4.9	0.0	2.6	2.3
1/30/2023		32039460**	65169101	357421531
Acreft/wk	5.8	0.0	2.5	3.2
2/6/2023		32039460**	66275323	358366290
Acreft/wk	6.3	0.0	3.4	2.9
2/13/2023		32039460**	67167595	359472804
Acreft/wk	6.1	0.0	2.7	3.4
2/20/2023		32039460**	68801086	359540393
Acreft/wk	5.2	0.0	5.0	0.2
2/27/2023		32039460**	69957970	360873169
Acreft/wk	7.6	0.0	3.6	4.1
3/6/2023		32039460**	70999368	361995564
Acreft/wk	6.6	0.0	3.2	3.4
3/13/2023		32039460**	72673620	362432100
Acreft/wk	6.5	0.0	5.1	1.3
3/20/2023		32039460**	74521040	362446601
Acreft/wk	5.7	0.0	5.7	0.0
3/27/2023		32039460**	75596176	363648099
Acreft/wk	7.0	0.0	3.3	3.7
4/3/2023		32039460**	76494352	364503928
Acreft/wk	5.4	0.0	2.8	2.6
4/10/2023		32039460**	77375739	365512201
Acreft/wk	5.8	0.0	2.7	3.1
4/17/2023		32039460**	78342536	366461740
Acreft/wk	5.9	0.0	3.0	2.9
4/24/2023		32039460**	79150351	367206934
Acreft/wk	4.8	0.0	2.5	2.3

5/1/2023		32039460**	80138902	368356901
Acreft/wk	6.6	0.0	3.0	3.5
5/8/2023		32039460**	81328574	369821112
Acreft/wk	8.1	0.0	3.7	4.5
5/15/2023		32039460**	82375266	371383575
Acreft/wk	8.0	0.0	3.2	4.8
5/22/2023		32039460**	83245956	372353272
Acreft/wk	5.6	0.0	2.7	3.0
5/29/2023		32039460**	84229765	373393672
Acreft/wk	6.2	0.0	3.0	3.2
6/5/2023		32039460**	85308174	374489980
Acreft/wk	6.7	0.0	3.3	3.4
6/12/2023		32039460**	86296255	375576719
Acreft/wk	6.4	0.0	3.0	3.3
6/19/2023		32039460**	87194608	376611155
Acreft/wk	5.9	0.0	2.8	3.2
6/26/2023		32039460**	88110955	377576796
Acreft/wk	5.8	0.0	2.8	3.0
7/3/2023		32039460**	88727663	378216074
Acreft/wk	3.9	0.0	1.9	2.0
7/10/2023		32039460**	89689456	379261035
Acreft/wk	6.2	0.0	3.0	3.2

* Totalizer amounts caculated from weekly water meter readings

**Well down due to electrical issues