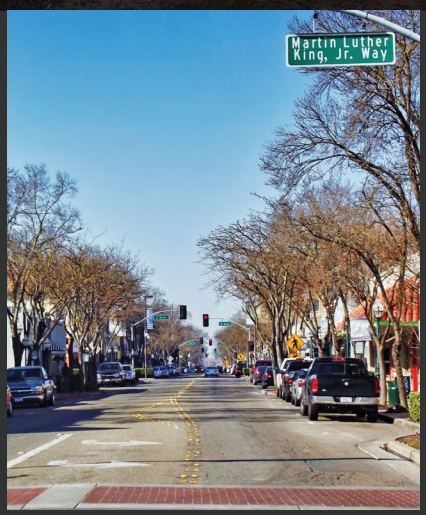
MERCED SGMA

Merced Groundwater Subbasin

GROUNDWATER SUSTAINABILITY PLAN

Water Year 2023 Annual Report

Image courtesy: Veronica Adrover/UC Merced



March 2024

MERCED GROUNDWATER SUBBASIN GROUNDWATER SUSTAINABILITY PLAN:

WATER YEAR 2023 ANNUAL REPORT

March 2024

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ACRONYMS

Acronym	Definition
AFY	Acre-Feet per Year
AWMP	Agricultural Water Management Plan
BHMWC	Buchanan Hollow Mutual Water Company
CCR	California Code of Regulations
CDEC	California Data Exchange Center
CEQA	California Environmental Quality Act
CFS	cubic feet per second
CWC	California Water Code
CWD	Chowchilla Water District
DDW	Division of Drinking Water
DPR	Department of Pesticide Regulation
DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources
ESJWQC	East San Joaquin Water Quality Coalition
GAMA	Groundwater Ambient Monitoring and Assessment
GDE	groundwater dependent ecosystems
GICIMA	Groundwater Elevation Monitoring Groundwater Information Center Interactive Mapping Application
GPS	global positioning system
GQTMP	Groundwater Quality Trend Monitoring Program
GRAT	Groundwater Recharge Assessment Tool
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
ILRP	Irrigated Lands Regulatory Program
IQR	interquartile range
IRWM	Integrated Regional Water Management
IWFM	Integrated Water Flow Model
LGAWD	Le Grand Athlone Water District
LIDAR	Light Detection and Ranging
LPMWC	La Paloma Mutual Water Company
MAF	million acre-feet
MAR	managed aquifer recharge
MCL	Maximum Contaminant Level
MCWD	Merquin County Water District
MercedMAR	Merced Subbasin Integrated Managed Aquifer Recharge Evaluation Tool
MID	Merced Irrigation District
MIUGSA	Merced Irrigation-Urban Groundwater Sustainability
MSGSA	Merced Subbasin Groundwater Sustainability Agency
NASA	National Aeronautics and Space Administration
NRCS	National Agricultural Statistics Service
PRISM	Precipitation-Elevation Regressions on Independent Slopes Model
PVC	polyvinyl chloride
SAGBI	Soil Agricultural Groundwater Banking Index

SDAC	Severely Disadvantaged Community
SGC	Stakeholder Guidance Committee
SGM	Sustainable Groundwater Management
SGMA	Sustainable Groundwater Management Act
SMCL	secondary maximum contaminant level
SWD	Stevinson Water District
TAF	thousand acre-feet
TIWD	Turner Island Water District
TIWD GSA-1	Turner Island Water District Groundwater Sustainability Agency #1
USBR	United States Bureau of Reclamation
USGS	United States Geological Survey
WY	water year

EXECUTIVE SUMMARY

The Merced Groundwater Subbasin (Subbasin) Groundwater Sustainability Plan (GSP) was adopted in late 2019 by the three Groundwater Sustainability Agencies (GSAs) that were formed in accordance with the Sustainable Groundwater Management Act (SGMA) to coordinate, develop, and implement a GSP for the Subbasin: Merced Irrigation-Urban Groundwater Sustainability Agency (MIUGSA), Merced Subbasin Groundwater Sustainability Agency (MSGSA), and Turner Island Water District Groundwater Sustainability Agency #1 (TIWD GSA-1) (MIUGSA, MSGSA, & TIWD GSA-1, 2019). The GSP was initially submitted to the California Department of Water Resources (DWR) in January 2020, ahead of the January 31, 2020 regulatory deadline for submission of GSPs for critically overdrafted subbasins.

On January 28, 2022, DWR completed its review and evaluation of the Merced Subbasin GSP and made a determination that it was "incomplete." The three GSAs worked collaboratively to respond to DWR's comments and engage stakeholders and members of the public to address three identified deficiencies from February through June 2022. A revised GSP was adopted and submitted to DWR in July 2022 with updates in key places to address DWR's recommendations. This Annual Report compares recent observations against the published sustainable management criteria from the 2022 revised GSP.

On August 4, 2023, DWR formally approved the 2022 revised GSP, but provided a set of recommended corrective actions to further assist the GSAs with implementation of the GSP and achieving Subbasin sustainability goals (DWR, 2023). In calendar year 2024, the GSAs are engaged in a process of completing a GSP periodic evaluation and associated GSP update, which includes consideration of the recommended corrective actions.

California Water Code (CWC) §356.2 requires the submission of an annual report to DWR by April 1 of each year following the adoption of the GSP. This is the fifth annual report.

CWC §356.2 requires annual reports to include information about groundwater elevations (contour maps and hydrographs), groundwater extraction, surface water supply, changes in groundwater storage, and a description of progress towards implementation of the GSP since the previous annual report. Table ES-1 provides a summary of the definition of undesirable results and summary of compliance with the sustainability management criteria.

For WY 2023, the San Joaquin Valley Water Year Type Index was 6.40, classified as a Wet year type. The value of 6.40 is 197% of average (DWR, 2024b). Given the heavy storms in WY 2023, the Subbasin experienced increased precipitation within the basin, higher streamflows, more abundant surface water supplies, and lower demands for applied water during periods of precipitation. Together, these factors contributed to improvement in groundwater levels and groundwater storage.

Table ES-1-1: Summary of Sustainable Management Criteria

Sustainability Indicator	Minimum Threshold (MT)	Interim Milestone (IM)	Measurable Objective (MO)	Undesirable Result	WY 2023 Annual Report Status
Groundwater Levels	Fall 2015 groundwater elevation	Based on range of projected values that account for hydrologic uncertainty	November or October 2011 groundwater elevation (measured, or estimation if historical record not available)	Greater than 25% of representative wells fall below MT in 2 consecutive years	12/19 wells (63%) fell below MT. 18 of 19 wells fell below MO. 18/19 are above 2025 IM. 2 wells not measured.
Groundwater Storage	Not applicable - not present and not likely to occur in the Subbasin due to the significant volumes of freshwater in storage All sites showed positive elevation change.				
Seawater Intrusion	Not applicable - not present and not likely to occur due to the distance between the Subbasin and the Pacific Ocean (and Sacramento-San Joaquin Delta)				
Degraded Water Quality	1,000 mg/L TDS	1,000 mg/L TDS	500 mg/L TDS	At least 25% representative wells exceed MT for 2 consecutive years	No wells exceeded MT. 3 wells exceeded MO.
Land Subsidence	0 ft/year, subject to uncertainty of +/-0.16 ft/year	2025: -0.75 ft/year 2030: -0.5 ft/year 2035: -0.25 ft/year	0 ft/year	Exceedance of MT at 3 or more representative sites for 2 consecutive years	All sites showed positive elevation change.
Depletions of Interconnected Surface Waters	Groundwater levels used as a proxy for this sustainability indicator				

Groundwater Levels

Generally, groundwater level increases were observed in WY 2023. Based on data from 12 Monitoring Network Wells in the Above Corcoran Clay Principal Aquifer, average groundwater level change was +6.3 ft from fall 2022 to fall 2023. Based on data from 16 wells in the Below Corcoran Clay Principal Aquifer, average groundwater level change was +19.1 ft from fall 2022 to fall 2023. Based on data from 15 wells in the Outside Corcoran Clay Principal Aquifer, average groundwater level change was+2.0 ft from fall 2022 to fall 2023. Hydrographs and contour maps of groundwater elevation can be found in **Appendix A** and **Appendix B**, respectively.

WY 2023 is the second year in which the revised undesirable result threshold has been in place (greater than 25% of representative wells fall below MT in two consecutive years). While the last two years of

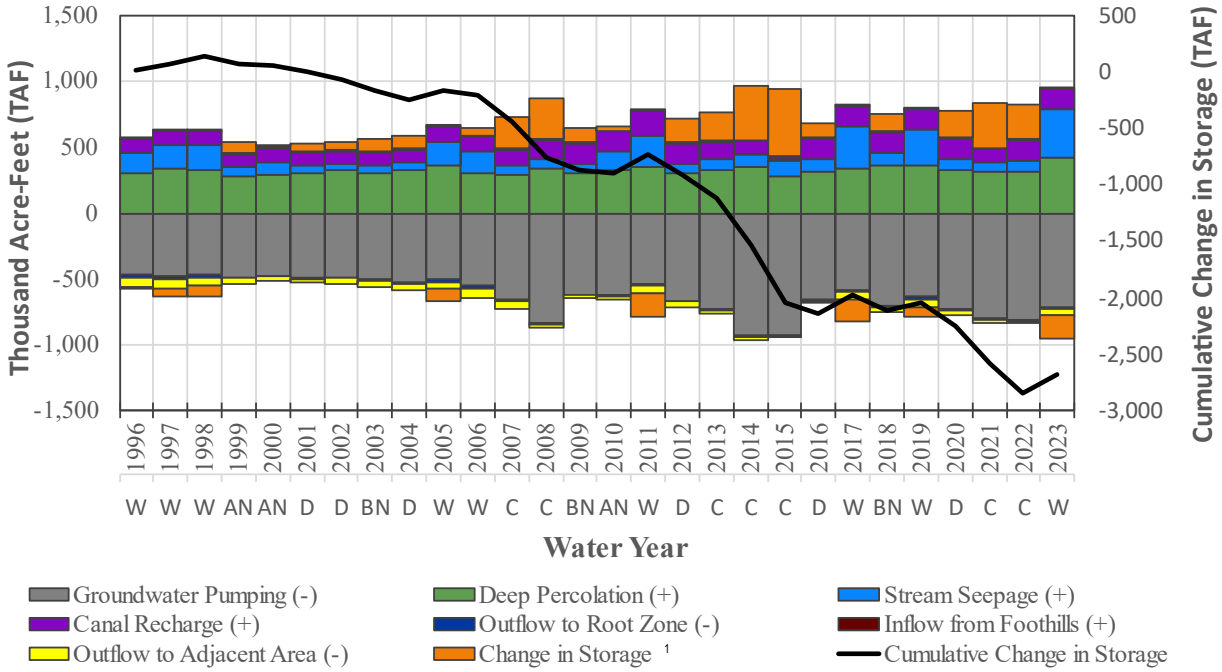
monitoring data meet the criteria for undesirable results, groundwater levels remain largely above the interim milestones and thus do not represent undesirable results. Per DWR's draft Best Management Practice guidance document for sustainability management criteria, "Avoidance of the defined undesirable results must be achieved within 20 years of GSP implementation…Some basins may experience undesirable results within the 20-year period, particularly if the basin has existing undesirable results as of January 1, 2015. The occurrence of one or more undesirable results within the initial 20-year period does not, by itself, necessarily indicate that a basin is not being managed sustainably, or that it will not achieve sustainability within the 20-year period" (DWR, 2017). All groundwater level measurements except for one are above the 2025 IM. IMs were established to facilitate the Subbasin reaching its measurable objectives for groundwater levels. The GSAs expect some level of continued groundwater level decline in much of the Subbasin (as was observed during critically dry conditions in prior WY 2022) while projects and management actions are developed and implemented, and due to hydrologic uncertainty. Many representative monitoring wells were below their MT when the sustainable management criteria were revised in July 2022. Thus, the IMs for groundwater levels allow for temporary groundwater level decline below the MT.

Groundwater Storage

The Merced Water Resources Model (MercedWRM) was updated with recent hydrologic and Subbasin operation information from WY 2023 to estimate the change in storage trends in the Merced Subbasin. The cumulative change in storage during water years 2006-2023 was estimated as -2.52 million acre-feet (MAF), or an average reduction of 140 thousand acre-feet (TAF) per year. During WY 2023, the cumulative change in storage was estimated as an increase of 177 TAF. Note that the average annual reduction of 192 TAF per year established in the GSP using the hydrologically balanced period of WYs 2006-2015 remains the current estimate of long-term overdraft in the Subbasin.

Figure ES-1-1 shows the cumulative change in storage together with annual groundwater uses developed in the water budget and water year type. On the figure, cumulative change in storage (WYs 1996-2023) is shown as a black line with values indicated on the right vertical axis and the annual groundwater budget uses are shown as bar charts with values indicated on the left vertical axis.

Figure ES-1-1: Historical Annual Water Budget and Cumulative Change in Storage



Notes:
"Change in Storage" is placed on the chart to balance the water budget. For instance, if annual outflows (-) are greater than inflows (+), there is a decrease in storage, and this is shown on the positive side of the bar chart to balance out the increased outflows on the negative side of the bar chart.
Water year types based on San Joaquin Valley Water Year Index (DWR, 2024a).

Land Subsidence

Subsidence remains an ongoing concern in the Subbasin. Subsidence is measured at static GPS control points throughout the San Joaquin Valley monitored by the United States Bureau of Reclamation (USBR) as part of the San Joaquin River Restoration Program. Measurements have been recorded semiannually in July and December of each year to monitor ongoing subsidence since 2011. Subsidence values in the last year (December 2022 to December 2023) were positive (i.e. slight land surface elevation increase), likely due to the impact of a very wet winter in late 2022/early 2023. Subsidence is a gradual process that takes time to develop and time to halt. Despite temporarily wet conditions, some level of future subsidence is likely to be underway already and will not be able to be prevented.

Groundwater Quality

The GSAs established a minimum threshold of 1,000 milligrams per liter (mg/L) of total dissolved solids (TDS) at representative monitoring sites for the degraded water quality sustainability indicator. The measurable objective and all interim milestones were set at 500 mg/L TDS. The GSAs are using electrical conductivity (EC) to estimate TDS where not sampled. Out of the ten TDS measurements (direct or estimated) in WY 2023, none exceeded the MT and three exceeded the MO.

In addition to monitoring for TDS, the GSAs are conducting water quality coordination activities for other water quality constituents. These activities include review of monitoring reports published by other

monitoring programs as well as compiling data submitted by Department of Pesticide Regulation (DPR), Division of Drinking Water (DDW), and Department of Toxic Substances Control (DTSC) to the Groundwater Ambient Monitoring and Assessment (GAMA) database. The purpose of these reviews is to monitor the status of constituent concentrations throughout the Subbasin with respect to typical indicators such as applicable maximum contaminant level (MCL) or secondary maximum contaminant levels (SMCL). The GSAs have collected information from GAMA and will use this information to document regional groundwater quality and to assess whether there is a need for changes to existing sustainable management criteria or developing additional sustainable management criteria for water quality as part of the GSP periodic evaluation.

Plan Implementation Progress

The GSAs made meaningful progress in GSP implementation in 2023.

Implementation of Projects

GSP projects are included in the Merced Integrated Regional Water Management (MercedIRWM) Opti project tracker, which, along with the GSP, is viewed by the GSAs as a "living" document. The GSAs have added numerous projects to the Opti project tracker in addition to the original 12 priority projects identified in the GSP. Updates to specific projects are described in Section 3.2 of this annual report. Future updates to the Opti project tracker will be incorporated into subsequent annual reports.

Implementation of Management Actions

The Merced Subbasin GSP includes four Management Actions. For the **water allocation framework**, an Ad Hoc Working Group was previously established with GSA staff and representatives to conduct discussions on an initial framework. Currently, the GSAs are continuing to work individually within their own jurisdictions to develop GSA-specific demand reduction and water allocation programs. A formal allocation agreement between the GSAs for the Subbasin as a whole has not been developed and is not scheduled for the upcoming water year.

The **MSGSA Demand Reduction Program** has begun implementation and continues to develop in recognition of the need to reduce groundwater pumping in the Subbasin. The MSGSA approved an objective that by WY 2025 the consumption of groundwater within the MSGSA will be reduced by a minimum of 15,000 AF annually, with this minimum to be increased annually thereafter. MSGSA has adopted a Two Phased GSP Implementation Approach, focusing on land repurposing as a near-term option to achieve the WY 2025 objective, combined with importing surface water in the GSA (flood waters or purchased water). In 2023, the MSGSA implemented the second year of a locally funded Land Repurposing Program, as part of the Phase 1 GSP Implementation. The MSGSA signed Agreements with landowners to repurpose additional lands saving approximately 8,440 AF of groundwater consumption over the next four years. Additionally, the MSGSA has continued to develop an Allocation Policy to be implemented in Phase 2, with an established Strategic Planning Ad Hoc Committee making step-wise policy recommendations to the MSGSA Board with the expectation of adopting the Allocation Policy in July 2024 and implementing an enforced allocation approach in 2026. MSGSA intends to develop and adopt the associated fees and penalties for enforcing the Allocation Policy in 2025.

The Revised GSP includes a **Domestic Well Mitigation Plan** that involves the planned development of a domestic well mitigation program to respond to potential adverse impacts experienced by domestic well

users where regional overdraft conditions occurring after 2015 may cause declining groundwater levels that interfere with groundwater production or quality. In WY 2022, as part of its Proposition 218 compliant funding mechanism for Phase 1, the MSGSA established a Domestic Well Mitigation Program Fund from which to address qualified mitigation efforts from the to-be-developed program and continue to collect funds for the program.

The Revised GSP also includes a management action for **Above Corcoran Sustainable Management Criteria Adjustment Consideration** which would consider an adjustment to the groundwater level sustainable management criteria for all or a portion of the Above Corcoran Clay Principal Aquifer. Monitoring wells installed in WY2023 will provide much-needed supporting data for development of this management action. No action has been taken on this management action at this time.

Additional Implementation Support Activities

In addition to projects and management actions, the GSAs undertook a number of activities to support GSP implementation. This included updating the MercedWRM model with the most recent monitoring data, installing new monitoring wells, working to instrument existing wells to add them to the monitoring network, holding several interbasin coordination meetings, completing development of a remote-sensing decision support tool, and exploration of a groundwater accounting software platform in collaboration with Environmental Defense Fund and Water Data Consortium.

The MIUGSA Board adopted a three year groundwater allocation for the period of April 1, 2023-December 31, 2025 of 3.3 AF/acre over three years (1.1 AF/acre per year on average), and anticipates updating the allocation on a regular basis at the end of the current allocation period. The MIUGSA Board also adopted a well registration program for all production wells within its boundaries. Additionally, MIUGSA and MSGSA continued working as pilot partners with Environmental Defense Fund and Water Data Consortium on the Groundwater Accounting Platform as a key component of monitoring and enforcing the groundwater allocation within the GSAs' boundaries. The Groundwater Accounting Platform is an open-source platform that can be scaled for use by GSAs throughout the state. MIUGSA made significant progress implementing the well registration policy adopted in October 2022. In 2023, MIUGSA finalized and adopted comprehensive Rules, Regulations, and a Groundwater Management Implementation Plan that establish the framework for measuring, monitoring, and enforcing the groundwater allocation.

Activities Anticipated for the Coming Year

The three GSAs intend to continue activities necessary to implement the GSP and put the Subbasin on a path toward sustainable management. Activities anticipated for 2024 include initiation of numerous grant-funded projects, continued implementation of the Data Gaps Plan (e.g., incorporating additional wells into the monitoring network and installing new wells), and making progress on internal GSA-specific plans for pumping reductions and water allocation frameworks. The majority of WY 2024 will involve the development of the GSP periodic evaluation and associated GSP update, which will be submitted to DWR in January 2025.

1. INTRODUCTION

The Merced Groundwater Subbasin (Subbasin) Groundwater Sustainability Plan (GSP) was initially adopted in late 2019 by the three Groundwater Sustainability Agencies (GSAs) that were formed in accordance with the Sustainable Groundwater Management Act (SGMA) to coordinate, develop, and implement the GSP: Merced Irrigation-Urban Groundwater Sustainability Agency (MIUGSA), Merced Subbasin Groundwater Sustainability Agency (MSGSA), and Turner Island Water District Groundwater Sustainability Agency #1 (TIWD GSA-1) (MIUGSA, MSGSA, & TIWD GSA-1, 2019). The GSP was initially submitted to the California Department of Water Resources (DWR) in January 2020, ahead of the January 31, 2020 regulatory deadline for submission of GSPs for critically overdrafted subbasins.

On January 28, 2022, DWR completed its review and evaluation of the Merced Subbasin GSP and made a determination that it was "incomplete." The three GSAs worked collaboratively to respond to DWR's comments and engage stakeholders and members of the public to address three identified deficiencies from February through June 2022. A revised GSP was adopted and submitted to DWR in July 2022 with updates in key places to address DWR's recommendations. This Annual Report compares recent observations against the published sustainable management criteria from the 2022 revised GSP.

On August 4, 2023, DWR formally approved the 2022 revised GSP, but provided a set of recommended corrective actions to further assist the GSAs with implementation of the GSP and achieving Subbasin sustainability goals (DWR, 2023). In calendar year 2024, the GSAs are engaged in a process of completing a GSP periodic evaluation and associated GSP update which includes consideration of the recommended corrective actions.

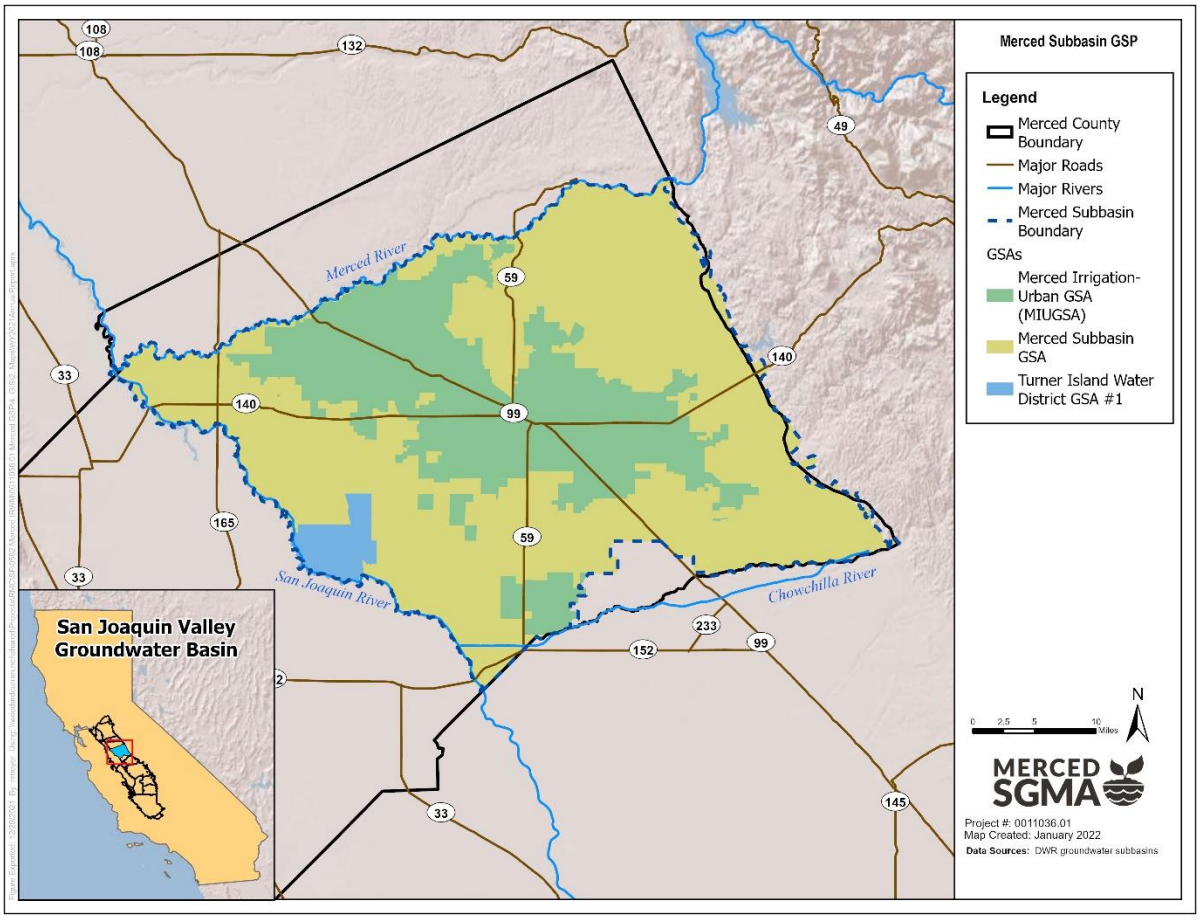
California Water Code (CWC) §356.2 requires the submission of an annual report to DWR by April 1 of each year following the adoption of the GSP. This is the fifth annual report.

CWC §356.2 requires annual reports to include information about groundwater elevations (contour maps and hydrographs), groundwater extraction, surface water supply, changes in groundwater storage, and a description of progress towards implementation of the GSP since the previous annual report.

The annual report is organized into two primary sections: Basin Settings and Plan Implementation. The Basin Settings section provides updates to water budgets and other Subbasin-wide information for WY 2023. The Plan Implementation section discusses progress on implementation of the GSP since the last Annual Report was submitted, with a focus on updates on the status of projects and management actions identified in the GSP and later added via the living project list described further in Section 3.

Figure 1-1 shows a map of the Merced Subbasin and the extent of the three GSAs. An inset map shows the location of the Merced Subbasin within the larger San Joaquin Valley Groundwater Basin located in the Central Valley of California. A more detailed description of the Merced Subbasin can be found in the GSP's Section 1.2 (Plan Area) and Section 2.1 (Hydrogeologic Conceptual Model).

Figure 1-1: Location Map



2. BASIN SETTING

2.1 Hydrology

While groundwater management is critical for long-term sustainability, hydrology remains a critical driver on shorter time frames, such as WY 2023 covered by this annual report.

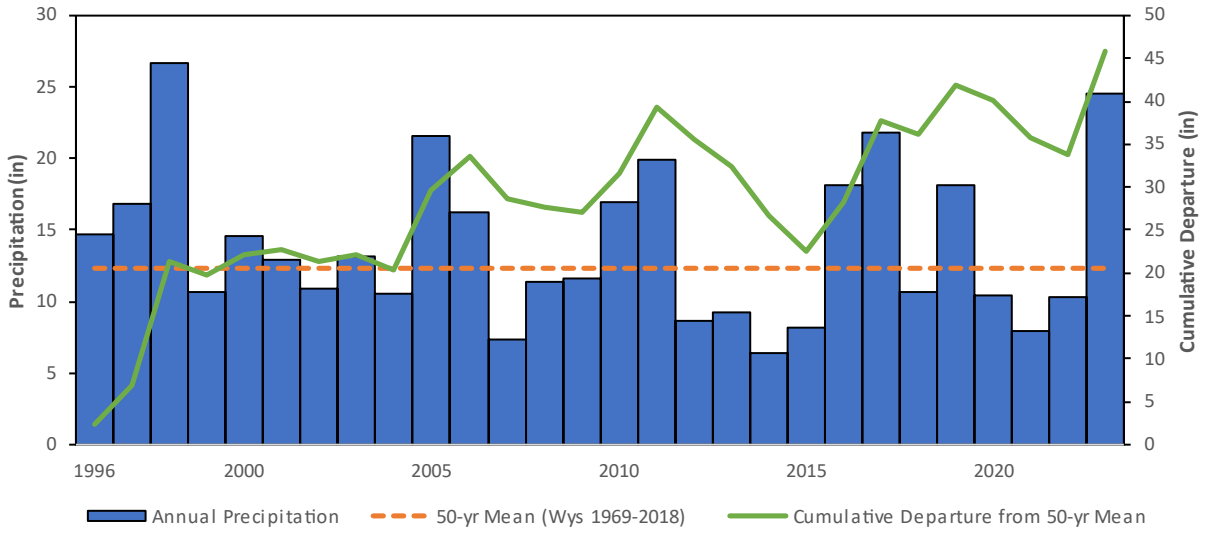
WY 2023 has been classified by DWR's San Joaquin Valley Water Year Index as wet year, the "wettest" of the year type classifications (DWR, 2024a). This contrasts with the previous two water years, 2021 and 2022, which were both classified as critically dry years, the "driest" of the year type classifications. Figure 2-1 shows the cumulative departure from mean precipitation[1] for WY 1996 through WY 2023, showing the substantially above average precipitation in WY 2023 following three years of below average precipitation. In addition to precipitation, streamflow, driven substantially by winter snowpack, is also important to shorter-term groundwater conditions. Streamflow in the Merced River in WY 2023 averaged 1,881 cubic feet per second (CFS), which is over 14 times higher than average for the prior critically dry WY 2022.[2]

These hydrologic trends should be considered when reviewing trends in sustainability indicators and using those trends to assess overall effectiveness of overall groundwater management.

[1] Under this method, the long-term average precipitation is subtracted from annual precipitation within each water year to develop the departure from mean precipitation for each water year. Wet years have a positive departure and dry years have a negative departure; a year with exactly average precipitation would have zero departure. Starting at the first year analyzed, the departures are added cumulatively for each year. So, if the departure for Year 1 is 5 inches and the departure for Year 2 is -2 inches, the cumulative departure would be 5 inches for Year 1 and 3 inches (5 plus -2) for Year 2. A chart is used to graphically illustrate the cumulative departure from mean precipitation. The chart includes bars displaying annual precipitation for each water year starting in 1996, with a horizontal line representing the mean precipitation of 12.3 inches (1969-2018, from GSP). The cumulative departure from mean precipitation is displayed as a line that starts at zero and highlights wet periods with upward slopes and dry periods with downward slopes. More severe events are shown by steeper slopes and greater changes. Thus, the period from 2012 to 2015 illustrates a short period with dry conditions (16.8-inch decline in cumulative departure over 4 years).

[2] Source: CDEC for Station ID MBN (MERCED R AT SHAFFER BRIDGE NR CRESSY).

Figure 2-1: Cumulative Departure from Mean Precipitation, Merced, California



2.2 Groundwater Elevations

Groundwater levels generally increased during WY 2023 for all three principal aquifers. Out of 21 representative monitoring wells, 12 had November 2023 elevations below the MT, 18 had November 2023 elevations below the MO, and 2 wells were not measured. The revised 2022 GSP defines undesirable results as "during GSP implementation when November groundwater levels at greater than 25 percent of representative monitoring wells (at least 6 of 21) fall below their minimum thresholds for two consecutive years" (MIUGSA, MSGSA, & TIWD GSA-1, 2022). WY 2023 is the second year in which the revised undesirable result threshold has been in place. While meeting the undesirable results definition according to the revised threshold, conditions are not considered undesirable results due to compliance with the interim milestones, as described below.

Per DWR's draft Best Management Practice guidance document for sustainable management criteria, "Avoidance of the defined undesirable results must be achieved within 20 years of GSP implementation…Some basins may experience undesirable results within the 20-year period, particularly if the basin has existing undesirable results as of January 1, 2015. The occurrence of one or more undesirable results within the initial 20-year period does not, by itself, necessarily indicate that a basin is not being managed sustainably, or that it will not achieve sustainability within the 20-year period" (DWR, 2017). Note that all measurements except for one (Station ID 8604) are above the 2025 IM. IMs were established to facilitate the Subbasin reaching its measurable objectives for groundwater levels. The GSAs expect some level of continued groundwater level decline in much of the Subbasin (as was observed during critically dry conditions in prior WY 2022) while projects and management actions are developed and implemented, and due to hydrologic uncertainty. Many representative monitoring wells were below their MT when the sustainable management criteria were revised in July 2022. Thus, the IMs for groundwater levels allow for temporary groundwater level decline below the MT.

Based on data from 12 Monitoring Network Wells in the Above Corcoran Clay Principal Aquifer, average groundwater level change was +6.3 ft from fall 2022 to fall 2023. Based on data from 16 wells in the Below

Corcoran Clay Principal Aquifer, average groundwater level change was +19.1 ft from fall 2022 to fall 2023. Based on data from 15 wells in the Outside Corcoran Clay Principal Aquifer, average groundwater level change was+2.0 ft from fall 2022 to fall 2023. These values do not consider that monitoring wells are not evenly distributed throughout the Subbasin, but the overall values still function to provide an overview of trends based on available data. Figure 2-2 shows the location of the wells in the Merced Subbasin GSP monitoring network for groundwater levels. Individual hydrographs for these wells can be found in **Appendix A**. All available data are shown, except for measurements flagged for quality control reasons. Hydrographs for representative monitoring wells also display the minimum threshold, measurable objective, and 2025 interim milestone, that were developed in Chapter 3 (Sustainability Indicators) of the GSP, last revised in the July 2022 GSP Update. The hydrographs also show a water year type indicator according to the San Joaquin Valley Water Year Hydrologic Classification Index. As previously stated, WY 2023 has been categorized as a wet year, the wettest category of the San Joaquin Valley Water Year Hydrologic Classification (DWR, 2024b). Monitoring network data have been uploaded to the SGMA Portal and are displayed in the Merced Opti data management system (https://opti.woodardcurran.com/merced).

The following monitoring wells have officially been added to the monitoring network:

- Well "Michael Road", located near Highway 59, south of the City of Merced, and completed within the Above Corcoran Clay Principal Aquifer.
- Wells HR1-S (Harmon Rd Shallow) and HR1-D (Harmon Rd Deep), located on Hardmon Rd, southwest of El Nido, with dual completions in both the Above Corcoran Clay and Below Corcoran Clay Principal Aquifers. Measurements will be included in future Annual Reports.

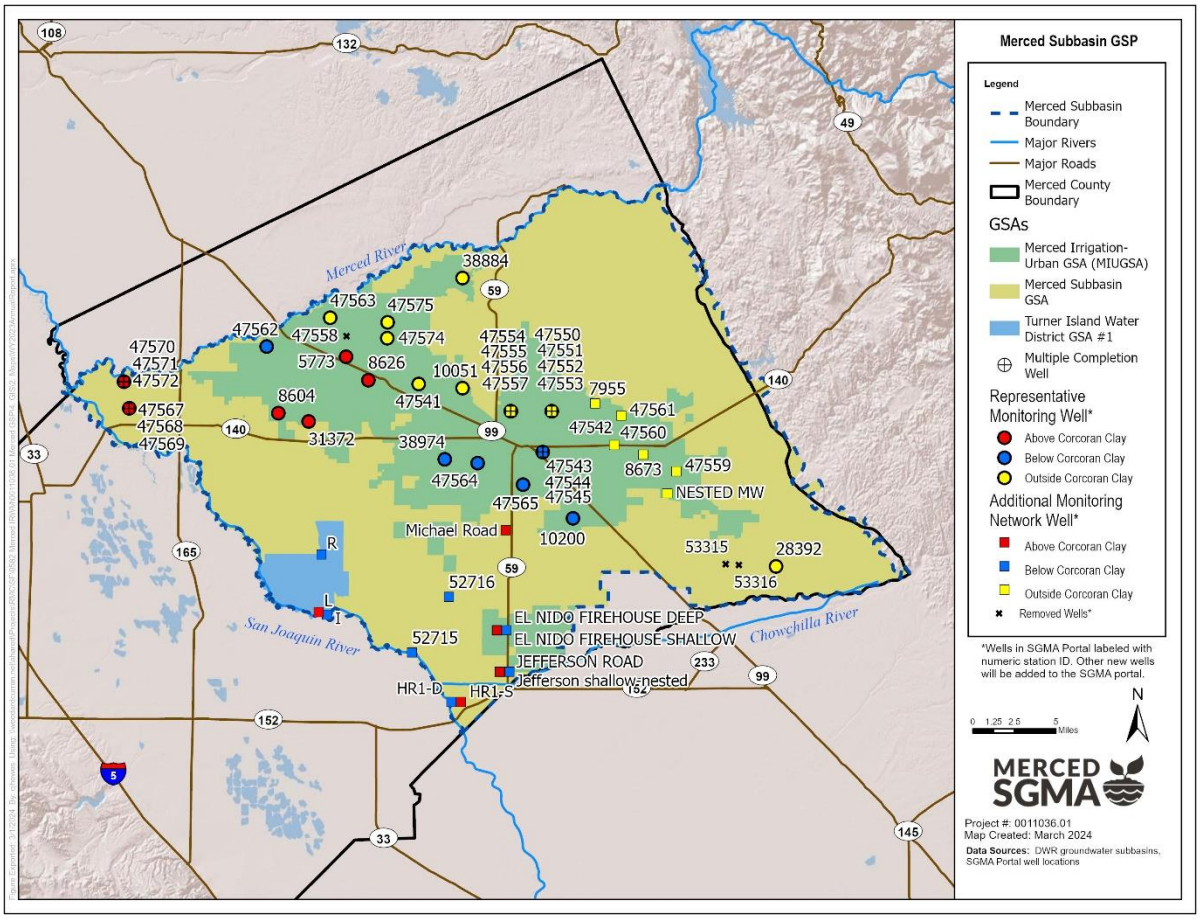
As of the WY 2021 report, the following wells located in TIWD GSA-1 were anticipated to be added to the groundwater level monitoring network, pending site visit reviews to confirm well accessibility for ongoing future monitoring. Their status remains the same while TIWD GSA-1 continues to evaluate these wells.

- Well "R", located in the northern portion of TIWD GSA-1 and completed within the Below Corcoran Clay Principal Aquifer.
- Well "I", located along the southern edge of TIWD GSA-1 and completed within the Below Corcoran Clay Principal Aquifer.
- Well "L", located along the southern edge of TIWD GSA-1 and completed within the Above Corcoran Clay Principal Aquifer.

The following monitoring wells were removed from the monitoring network (shown in Figure 2-2 with "x" symbols):

- Well 47558, located east of the City of Livingston, and completed within the Outside Corcoran Clay Principal Aquifer, has not been successfully measured since 2013. Fortunately, it is located in close proximity to other network wells that do have regular, successful measurements.
- Wells 53315 and 53316, located in the southern end of the Outside Corcoran Clay Principal Aquifer have not been measured since 2019 due to various site challenges.

Figure 2-2: Groundwater Level Monitoring Network



Appendix B shows contour maps of seasonal high (spring) and seasonal low (fall) groundwater elevations for each of the three principal aquifers for fall 2022, spring 2023, and fall 2023. Groundwater level data were obtained from the SGMA Data Viewer and the GSP monitoring network for groundwater levels[3]. Groundwater levels reported by both monitoring network wells and other voluntary and representative wells in the Merced, Turlock, Delta-Mendota, Chowchilla, and Madera Subbasins were used to develop contours. Measurements from neighboring subbasins were included to provide spatial coverage for contoured groundwater levels along the edges of the Merced Subbasin. The contour maps for the Above Corcoran Clay and Outside Corcoran Clay Principal Aquifers show hatched areas labeled "Area of increased uncertainty due to data limitations" which indicate regions with a relatively lower density of monitoring wells. Contours were developed based on available surrounding data, but the change in groundwater levels are considered to have a higher level of uncertainty in this area due to the data limitations. The GSP identifies

[3] TIWD GSA-1 also provided additional static water level measurements for wells within the GSA boundary that are not part of the SGMA Data Viewer system. Monitoring data from relatively new monitoring wells in the El Nido and Planada regions have not yet been uploaded to the SGMA Data Viewer but were used in the development of this Annual Report. MIUGSA plans to upload ongoing collected data from the El Nido and Planada sites to the SGMA Data Viewer starting in WY 2023.

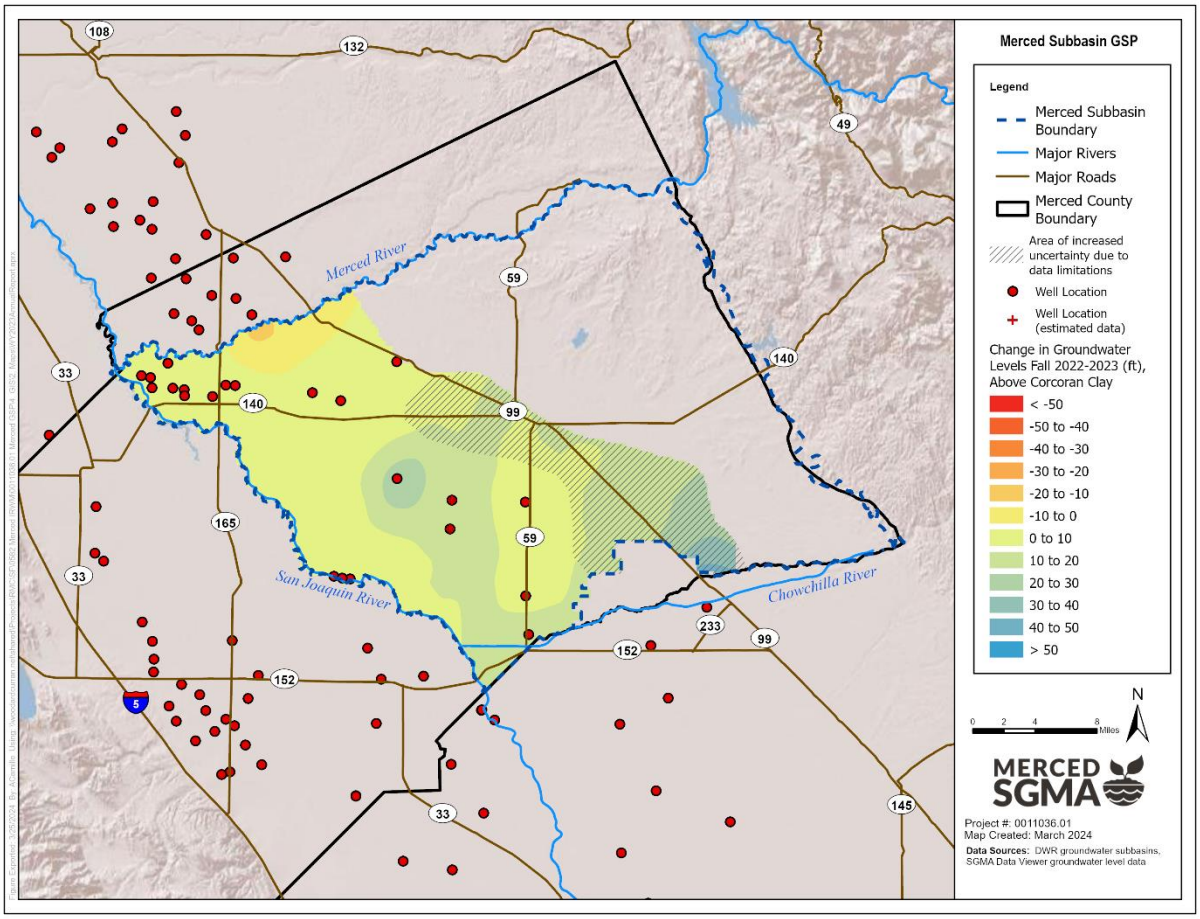
this as a data gap and the GSAs are in the process of implementing recommendations from a recently completed Data Gaps Plan to address critical data gaps in the Subbasin.

Groundwater level contours at 20-foot intervals were developed using the inverse distance weighting interpolation method, with local averaging performed to generate smoother contour lines. Groundwater level measurements were classified as spring if they were recorded in the month of March (± 5 days) and classified as fall if they were recorded in the month of November, or October if November not available (± 5 days). Contour maps for each season and principal aquifer can be found in **Appendix B**.

Many voluntary wells do not consistently report groundwater elevations each spring and fall. In some cases, measurements for monitoring network wells were not used in contouring due to nearby pumping or another data quality flag. A multiple linear regression tool was applied to estimate groundwater elevations for wells with missing seasonal data located within the Merced Subbasin. The estimate is necessary to provide consistent results between time periods, despite variability in available data. The multiple linear regression was applied separately at each well for fall and spring measurements where there were several years of historical data for each respective season. The multiple linear regression methodology makes use of historical observed data at the well being analyzed, and other observations such as water storage changes from the NASA Gravity Recovery and Climate Experiment, soil moisture from the Global Land Data Assimilation System, or the Palmer Hydrologic Drought Index, based on the methodology developed by the BYU Hydroinformatics Laboratory (n.d.). The methodology also uses inputs from up to five best correlated wells located within the same aquifer. Wells at which groundwater elevations were estimated for the purpose of developing contours are identified in the contour maps in **Appendix B**. All other data points use observed data.

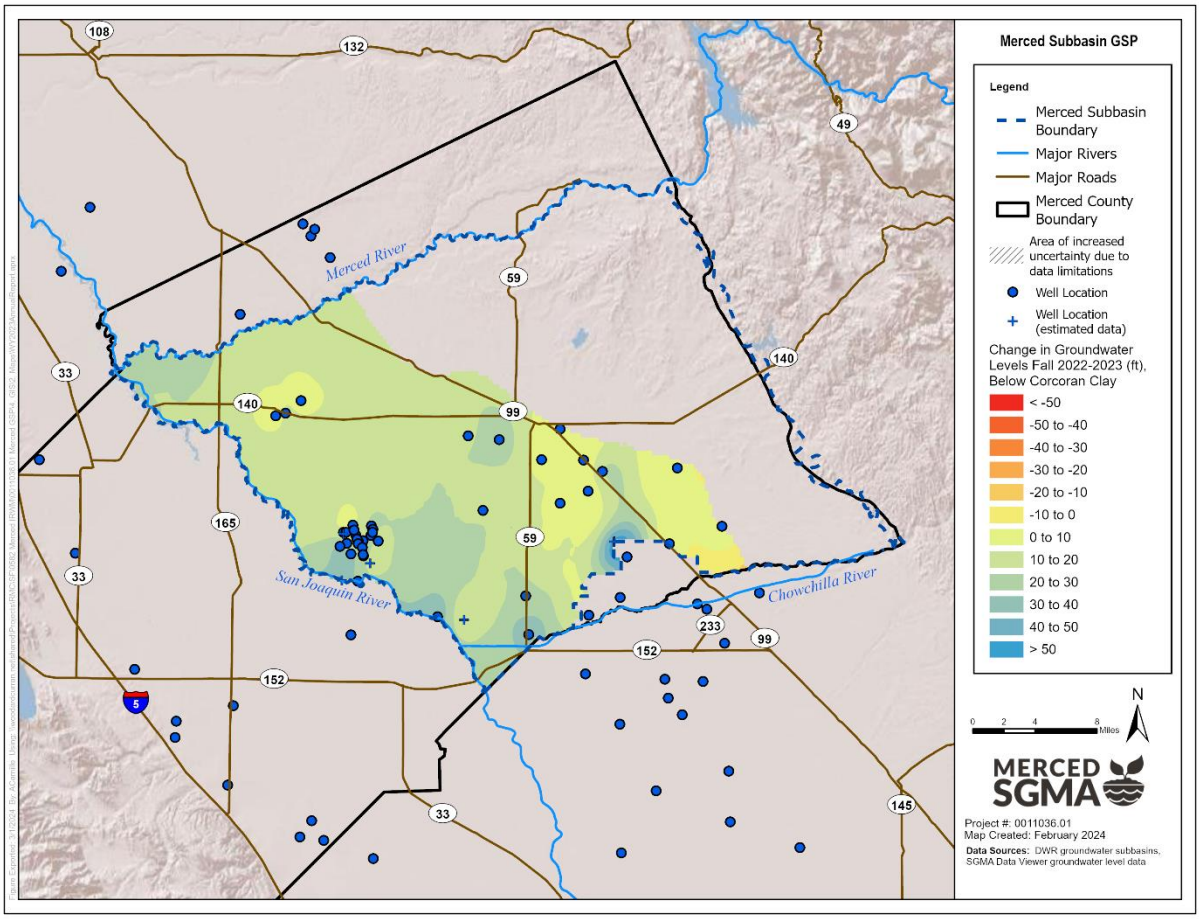
Figure 2-3 through Figure 2-5 show the total change in groundwater levels between fall 2022 and fall 2023 for each principal aquifer, based on comparing the interpolated groundwater level surfaces. The Above Corcoran Clay Principal Aquifer generally shows a slight net increase in groundwater levels throughout most of the aquifer. In the Below Corcoran Clay and Outside Corcoran Clay Principal Aquifers, groundwater levels were found to increase across most of the aquifer, with pockets of decrease.

Figure 2-3: Total Change in Groundwater Levels Fall 2022 to Fall 2023, Above Corcoran Clay



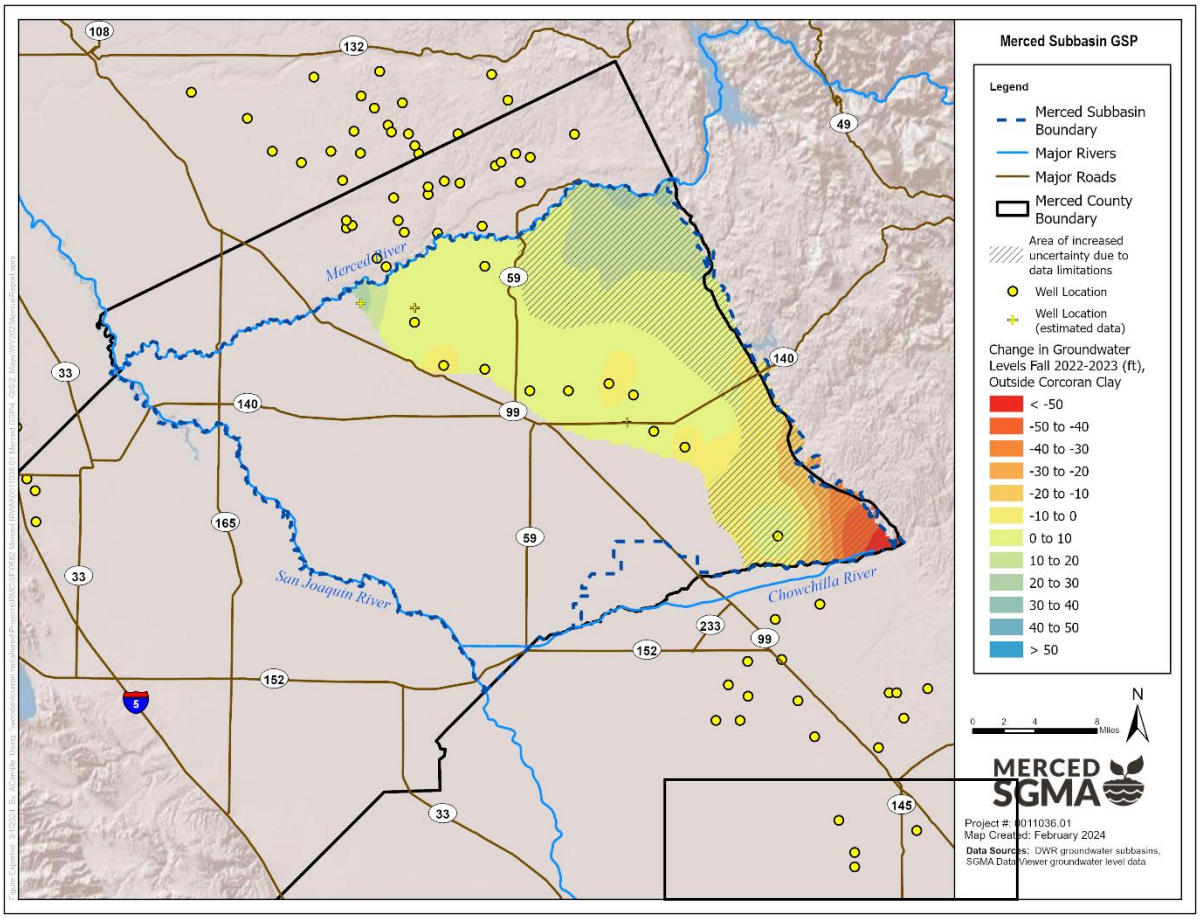
1. *For additional details on change in groundwater levels in specific areas, please refer to contour maps for each season developed in* ***Appendix B****.*
2. *The hatched area labeled "Area of increased uncertainty due to data limitations" indicates a region with a relatively lower density of monitoring wells. Contours were developed based on available surrounding data, but the change in groundwater levels are considered to have a higher level of uncertainty in this area due to the data limitations. The GSP identifies this as a data gap; the GSAs developed a Data Gaps Plan in 2021 and are in the process of implementing the plan.*

Figure 2-4: Total Change in Groundwater Levels Fall 2022 to Fall 2023, Below Corcoran Clay



1. *For additional details on change in groundwater levels in specific areas, please refer to contour maps for each season developed in* ***Appendix B****.*

Figure 2-5: Total Change in Groundwater Levels Fall 2022 to Fall 2023, Outside Corcoran Clay



1. *For additional details on change in groundwater levels in specific areas, please refer to contour maps for each season developed in* ***Appendix B****.*
2. *The hatched area labeled "Area of increased uncertainty due to data limitations" indicates a region with a relatively lower density of monitoring wells. Contours were developed based on available surrounding data, but the change in groundwater levels are considered to have a higher level of uncertainty in this area due to the data limitations. The GSP identifies this as a data gap; the GSAs developed a Data Gaps Plan in 2021 and are in the process of implementing the plan.*

Table 2-1 lists the representative monitoring wells for the chronic lowering of groundwater levels sustainability indicator , comparing fall 2023 groundwater elevations with minimum threshold, measurable objective, and interim milestone 2025 elevations. The sustainable management criteria are updated as of the July 2022 GSP.

Table 2-1: Groundwater Elevation at Representative Monitoring Wells

State Well ID	Site Code	Station ID	Principal Aquifer	Fall 2023 GW Elevation[1]	Minimum Threshold Elevation[1]	Measurable Objective Elevation[1]	Interim Milestone 2025[1]
06S12E33D001M	373732N1206679W001	5773	Above	39.5	46.5	73.8	26.8
07S11E15H001M	373243N1207424W001	8604	Above	55.0	59.0	67.0	55.9
07S12E03F001M	373532N1206432W001	8626	Above	48.5	48.9	78.0	15.5
07S11E24A001M	373166N1207091W001	31372	Above	49.2	50.8	75.6	33.9
07S10E17D003M	373278N1209054W002	47569	Above	68.1	61.2	68.2	59.4
07S10E06K002M	373510N1209113W001	47571	Above	66.4	56.8	66.3	53.8
08S14E15R002M	372335N1204199W001	10200	Below	66.7	67.2	145.2	11.5
07S13E32H001M	372838N1205602W001	38974	Below	95.4	73.9	104.4	61.8
07S14E35E001M	372904N1204207W001	47542	Below	65.4	73.7	112.6	38.3
06S11E27F001M	373821N1207551W001	47562	Below	74.8[3]	58.8	75.3	48.8
07S13E34G001M	372806N1205241W001	47564	Below	81.7	70.2	108.7	53.5
08S14E06G001M	372617N1204747W001	47565	Below	56.2	55.9	100.9	28.5
07S13E09A001M	373457N1205429W001	10051	Outside	56.7[3]	73.7	92.6	48.1
08S16E34J001M	371902N1201985W001	28392	Outside	-88.9	-94.5	47.5	-169.7
06S13E04H001M	374421N1205407W001	38884	Outside	62.0	70.7	100.4	40.4
07S12E07C001M	373496N1205890W001	47541	Outside	32.1	56.1	66.4	29.9
07S14E16F004M	373260N1204432W004	47553	Outside	72.5	87.4	118.1	56.8
07S13E13H004M	373260N1204880W004	47557	Outside	61.6	62.4	102.1	37.4
06S12E17M001M	374074N1206859W001	47563	Outside	N/A[2]	50.5	81.0	33.1
06S12E23P001M	370000N1200000W001	47574	Outside	46.6	56.0	80.0	40.0
06S12E23C001M	370000N1200000W002	47575	Outside	N/A[2]	45.0	89.0	26.1

1. *All elevations reported in feet above sea level, datum NAVD88.*
2. *Station IDs 47563 and 47575 were not measured in fall 2023 (last available measurement was spring 2023).*
3. *In previous years, Station IDs 47562, 10051, and 47563 have had a QA flag of "Oil or foreign substance in casing". While they were not flagged for this issue this year, it is likely the issue persists. Oil layer depths were not measured and thus an adjusted water surface elevation cannot be estimated.*

2.3 Groundwater Extractions

Table 2-2 summarizes monthly groundwater extractions for WY 2023 by water use sector and method of measurement. An annual comparison of groundwater pumping by sector for Water Years 2016-2023 (the

period of time over which annual reports have been developed) is shown in Table 2-3. Groundwater extraction data were requested from groundwater-related entities located in the Merced Subbasin, listed below:

- City of Atwater
- City of Livingston
- City of Merced
- Merced Irrigation District (MID)
- Turner Island Water District GSA #1
- Stevinson Water District
- Merquin County Water District
- Planada Community Services District
- Lone Tree Mutual Water Company
- California American Water, Meadowbrook
- Winton Water and Sanitary District
- Le Grand Community Services District
- Merced National Wildlife Refuge

All reported values from these entities were directly measured. Data are a mixture of metered data and some data from pump tests using run time data. Quantitative estimates of accuracy of measurement (e.g., by percentage or +/- AF) were requested from each agency but not provided by all. Directly measured data are expected to have a qualitative high level of accuracy.

Groundwater extractions from private irrigators and domestic wells are estimated by the Merced Water Resources Model (MercedWRM) based on factors including land use, evapotranspiration, and population. Details about the MercedWRM can be found in the GSP, while recent updates to the model can be found in Section 3.5.1 of this annual report. A map illustrating the general location and volume of groundwater extractions as estimated by the MercedWRM for WY 2023 can be found in Figure 2-6. These estimated data are expected to have a qualitative medium level of accuracy.

Table 2-2: Monthly Groundwater Extractions (in AF), Water Year 2023

Month	Sector						Total
	Agriculture		Urban		Habitat[4]		
	Entity Pumping[1]	Private Pumping[2]	Entity Pumping[1]	Private Pumping[3]	Direct[4]	Estimated[4]	
Oct-2022	4,512	52,460	3,206	666	1,798	0	62,642
Nov-2022	2,336	0	2,336	544	1,818	0	7,035
Dec-2022	0	0	1,987	452	1,304	0	3,743
Jan-2023	93	0	1,853	410	182	0	2,538
Feb-2023	55	0	1,782	412	673	412	3,333
Mar-2023	201	17,780	1,896	441	0	200	20,518
Apr-2023	208	84,815	2,652	631	1	324	88,632
May-2023	706	61,654	3,559	865	0	120	66,904
Jun-2023	635	117,863	4,101	990	54	83	123,727
Jul-2023	891	116,551	4,690	1,110	2	0	123,244
Aug-2023	4,710	105,368	4,508	1,069	0	0	115,655
Sep-2023	2,096	81,879	3,776	906	89	0	88,746
TOTAL	**16,444**	**638,370**	**36,347**	**8,496**	**5,921**	**1,139**	**706,717**

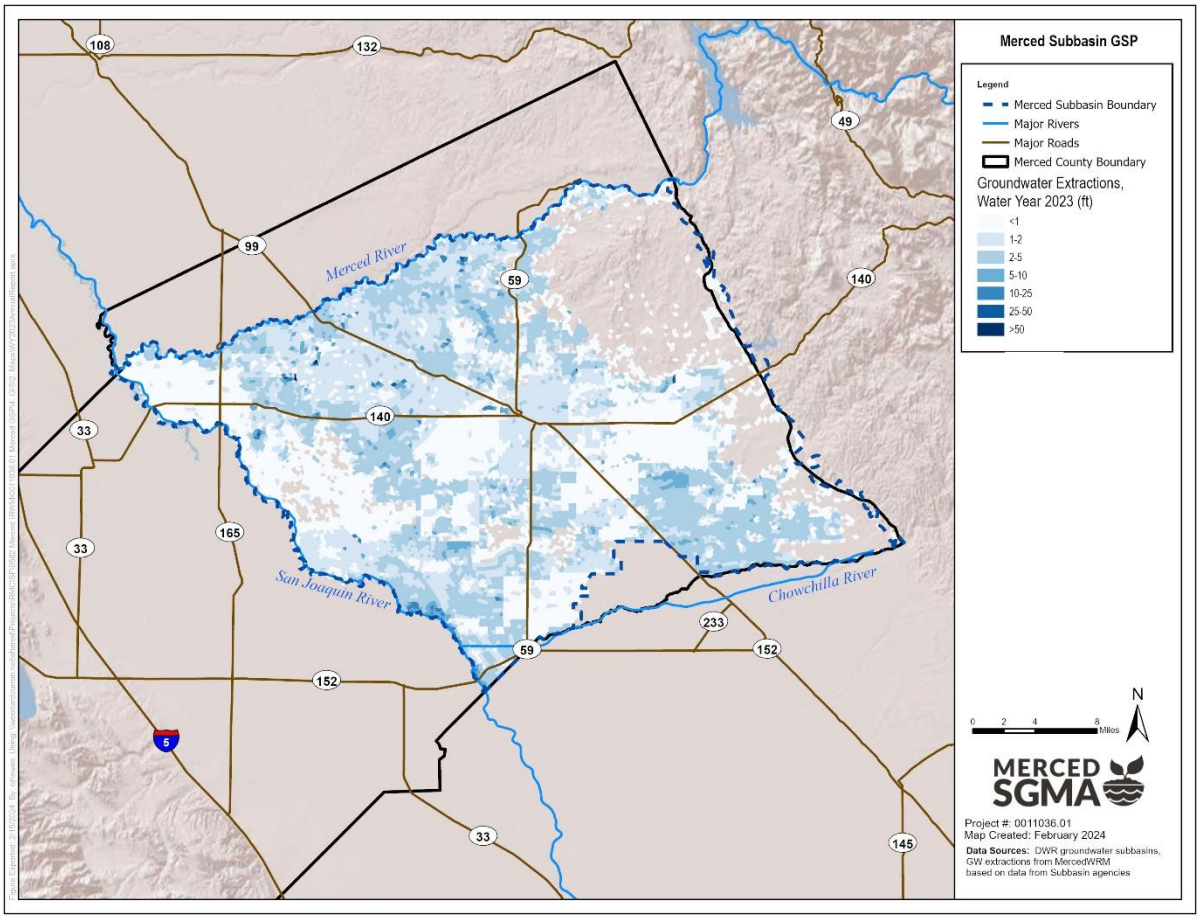
1. *"Entity Pumping" indicates direct measurements of volumes of pumped groundwater reported by agricultural purveyors and urban water suppliers. Directly measured data are expected to have a qualitative high level of accuracy.*
2. *"Private Pumping" for the agricultural sector is estimated by the MercedWRM based on land use and evapotranspiration data. See Section 3.5.2 - MercedWRM Update (Water Year 2023). These estimated data are expected to have a qualitative medium level of accuracy.*
3. *"Private Pumping" for the urban sector (primarily from domestic wells in rural regions) is estimated by the MercedWRM based on census data for population multiplied by a volumetric water use factor averaged from the urban regions. See Section 3.5.2 - MercedWRM Update (Water Year 2023). These estimated data are expected to have a qualitative medium level of accuracy.*
4. *The "Habitat" sector includes directly measured volumes of groundwater extractions at Merced National Wildlife Refuge within the Merced Unit of the refuge. Directly measured data are expected to have a qualitative high level of accuracy. The Merced National Wildlife Refuge also provided some estimated groundwater extractions from the Arena Plains and Snobird Units of the refuge. These estimated data are expected to have a qualitative medium level of accuracy. Groundwater pumping for other wetland/habitat areas are included in the "Agriculture" sector due to a lack of information for demands from these wetlands/habitat areas. Demands were estimated based on DWR land use categorizations of native vegetation or agricultural land.*

Table 2-3: Annual Groundwater Extractions (in AF), Water Years 2016-2023

Water Year	Sector						Total
	Agriculture		Urban		Habitat[4]		
	Entity Pumping[1]	Private Pumping[2]	Entity Pumping[1]	Private Pumping[3]	Direct[4]	Estimated[4]	
2016	23,310	580,083	33,364	10,661	9,060	0	656,477
2017	15,215	516,103	33,441	11,072	7,611	0	583,442
2018	25,994	611,986	33,528	15,057	12,065	0	698,630
2019	17,321	559,521	34,313	14,154	12,495	0	637,804
2020	59,505	575,499	41,074	10,422	14,891	0	701,391
2021	88,937	645,337	41,491	9,172	13,290	2,527	800,754
2022	105,225	715,297	38,189	13,389[5]	7,773	2,527	882,399[5]
2023	16,444	638,370	36,347	8,496	5,921	1,139	706,717

1. *"Entity Pumping" indicates direct measurements of volumes of pumped groundwater reported by agricultural purveyors and urban water suppliers. Directly measured data are expected to have a qualitative high level of accuracy.*
2. *"Private Pumping" for the agricultural sector is estimated by the MercedWRM based on land use and evapotranspiration data. These estimated data are expected to have a qualitative medium level of accuracy.*
3. *"Private Pumping" for the urban sector (primarily from domestic wells in rural regions) is estimated by the MercedWRM based on census data for population multiplied by a volumetric water use factor averaged from the urban regions. These estimated data are expected to have a qualitative medium level of accuracy.*
4. *The "Habitat" sector includes directly measured volumes of groundwater extractions at Merced National Wildlife Refuge within the Merced Unit of the refuge. Directly measured data are expected to have a qualitative high level of accuracy. The Merced National Wildlife Refuge also provides some estimated groundwater extractions which are expected to have a qualitative medium level of accuracy. Groundwater pumping for other wetland/habitat areas are included in the "Agriculture" sector due to a lack of information for demands from these wetlands/habitat areas. Demands were estimated based on DWR land use categorizations of native vegetation or agricultural land.*
5. *Urban Private Pumping was previously reported in error as 51,578 AF in WY 2022. After correcting the value to 13,389 AF, the "Total" column reduced from 920,588 AF to 822,399 AF.*

Figure 2-6: Map of Groundwater Extractions (Water Year 2023)



2.4 Surface Water Supply

SGMA requires that the GSP annual report tabulate "*Surface water supply used or available for use…*" (emphasis added, CCR §356.2 [b] [3]). Table 2-4 summarizes total monthly surface water available for use for WY 2023, broken down by method of measurement. These tables report total surface water diversions and not surface water used, which is difficult to parse out by sector. Direct measurements were provided by MID, Stevinson Water District, TIWD, and Lone Tree Mutual Water Company. Directly measured data are expected to have a qualitative high level of accuracy. Note that MID diversions include surface water ultimately used by Stevinson Water District, Merquin County Water District, Merced National Wildlife Refuge, Le Grand-Athlone Water District, and Lone Tree Mutual Water Company, which fall under both the agricultural and habitat sectors. Diversions made by Lone Tree Mutual Water Company are exclusively flood flow diversions.

Note also that there are several riparian diverters in the Subbasin whose diversions have not been captured for the purpose of the annual. It is anticipated that some of these data will be incorporated into future reports, as data will become available as a result of implementation of Senate Bill 88 (2015).

Table 2-4: Monthly Surface Water Available for Use (in AF), Water Year 2023

Month	Method of Measurement[1]	Total
	Direct	
Oct-2022	28,974	28,974
Nov-2022	1,920	1,920
Dec-2022	1,456	1,456
Jan-2023	2,131	2,131
Feb-2023	2,387	2,387
Mar-2023	12,510	12,510
Apr-2023	41,976	41,976
May-2023	76,221	76,221
Jun-2023	103,703	103,703
Jul-2023	118,651	118,651
Aug-2023	106,493	106,493
Sep-2023	68,713	68,713
TOTAL	**565,134**	**565,134**

1. *This table reports total surface water diversions and not surface water used due to data limitations. Both surface diversions and surface water used are difficult to parse out by sector as well. Note that MID diversions include surface water ultimately used by Stevinson Water District, Merquin County Water District, Merced National Wildlife Refuge, Le Grand-Athlone Water District, and Lone Tree Mutual Water Company, which fall under the agriculture and habitat sectors.*

2.5 Total Water Use

Per SGMA requirement, Table 2-5 summarizes monthly combined groundwater use (Table 2-2) and surface water available for use (Table 2-4) for WY 2023 by water use sector and method of measurement. The same qualifications for method of measurement and sector of use apply from Table 2-2 and Table 2-4.

Table 2-5: Monthly Total Water Use, Water Year 2023

Month	Sector						Total
	Agriculture		Urban		Habitat		
	Direct[1]	Estimate[2]	Direct	Estimate[2]	Direct	Estimate	
Oct-2022	33,486	52,460	3,206	666	1,798	0	91,616
Nov-2022	4,256	0	2,336	544	1,818	0	8,954
Dec-2022	1,456	0	1,987	452	1,304	0	5,199
Jan-2023	2,224	0	1,853	410	182	0	4,669
Feb-2023	2,442	0	1,782	412	673	412	5,720
Mar-2023	12,711	17,780	1,896	441	0	200	33,028
Apr-2023	42,183	84,815	2,652	631	1	324	130,608
May-2023	76,927	61,654	3,559	865	0	120	143,125
Jun-2023	104,338	117,863	4,101	990	54	83	227,429
Jul-2023	119,542	116,551	4,690	1,110	2	0	241,895
Aug-2023	111,203	105,368	4,508	1,069	0	0	222,148
Sep-2023	70,809	81,879	3,776	906	89	0	157,458
TOTAL	**581,577**	**638,370**	**36,347**	**8,496**	**5,921**	**1,139**	**1,271,850**

1. *Surface water diversions have been reported under the category of Agriculture, Direct. As described in Table 2-4, this includes total surface water diversions and not surface water used, and cannot be accurately measured between the agriculture and habitat sectors. Surface water diversions account for approximately 98% of this column.*
2. *See Table 2-2 for more detailed notes on groundwater pumping estimates.*

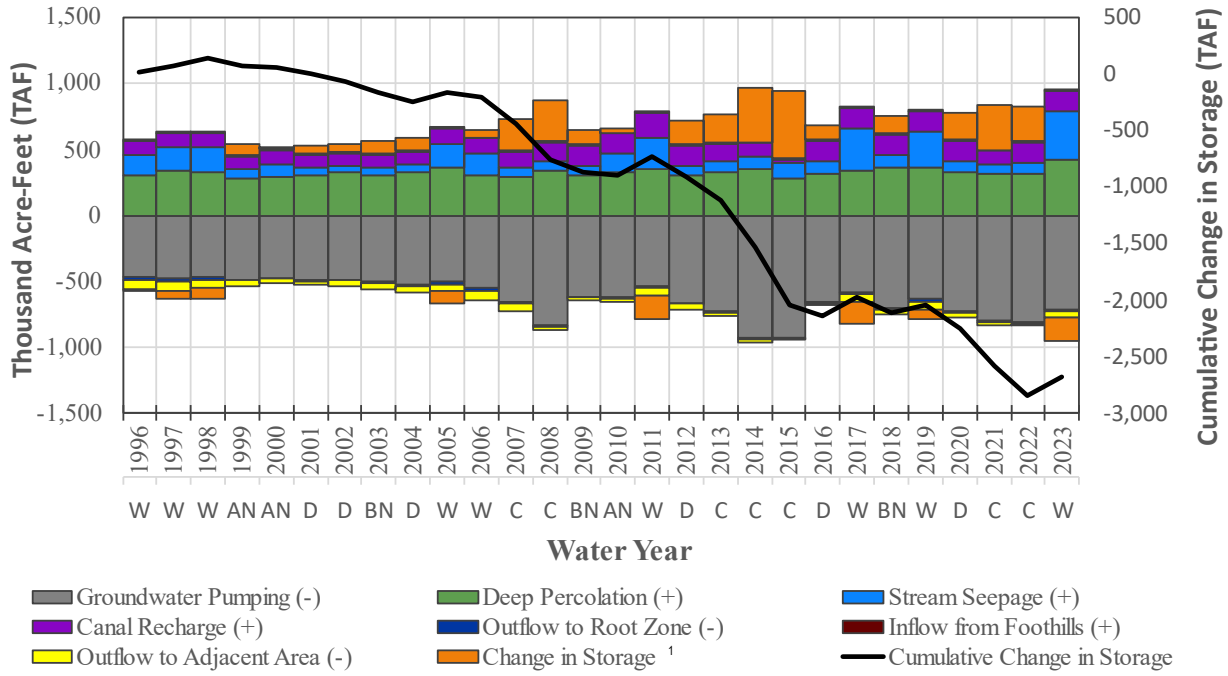
2.6 Change in Groundwater Storage

The MercedWRM was used to estimate historical change in groundwater storage in the Merced Subbasin from water years 1996-2021 for the Merced GSP and subsequent annual reports and then extended through WY 2023 to support quantification of storage change for this annual report. See Section 3.5.1 for more information about the recent model update for this annual report. Note that the time period of 2006-2015 was originally selected as the historical water budget time period reported in the Merced GSP as representative of average precipitation and capturing recent Subbasin operations.

After extending the historical water budget through WY 2023, the current (2023) total fresh groundwater storage was estimated as 46.9 MAF and the cumulative change in storage from WYs 2006-2023 was estimated as -2.52 MAF, or an average reduction of 140 TAF per year. During WY 2023, the change in storage was estimated as an increase of 177 TAF. Note that the average annual reduction of 192 TAF per year established in the GSP using the hydrologically balanced period of WYs 2006-2015 remains the current estimate of long-term overdraft in the Subbasin.

Figure 2-7 shows the cumulative change in storage for WYs 1996-2023 against groundwater uses developed in the water budget and water year type.

Figure 2-7: Historical Annual Water Budget – Groundwater System, Merced Subbasin



1. *"Change in Storage" is placed on the chart to balance the water budget. For example, if annual outflows (-) are greater than inflows (+), there is a decrease in storage, and this is shown on the positive side of the bar chart to balance out the increased outflows on the negative side of the bar chart.*
Source: Water year types based on San Joaquin Valley Water Year Index (DWR, 2024a).

Sustainable management criteria were not developed for this sustainability indicator because significant and unreasonable reduction of groundwater storage is not present and not likely to occur in the Subbasin.

The 2006-2023 cumulative change in storage described above, which includes both representative dry and wet years, reflects a rate of overdraft of approximately 0.2 percent of total freshwater storage per year. It is not reasonable to expect that the available groundwater in storage would be exhausted, noting that issues related to accessibility of groundwater to beneficial users are addressed through the groundwater level and depletions sustainability indicators.

Figure 2-8 through Figure 2-10 show the total change in groundwater storage by principal aquifer for WY 2023 in a spatial format as estimated by outputs from the MercedWRM. The change in storage is shown in units of feet. The MercedWRM calculates a change in volume per area of each model element. Since the model elements vary in size, visually displaying a map of volume change per model element is not spatially intuitive, so the results have been normalized to show change in depth by dividing the volume by area per model element.

Change in groundwater storage is a function of changes in groundwater levels and physical properties of the aquifer. As such, it would be expected that areas with increases in groundwater storage would also have increases in groundwater levels in Figures 2-2 through 2-4 and that areas with decreases in groundwater storage would also have decreases in groundwater levels. While this is true in many cases, it is not true in all cases due to uncertainties in the underlying data. Uncertainties in the change in groundwater storage are associated with the MercedWRM, while uncertainties in the change in groundwater levels are associated with limited data points and individual data points that may be impacted by nearby pumping, screen depths, or otherwise provide non-representative values. It is useful to look at these figures together to better understand patterns of change in groundwater levels and storage.

Subbasin storage increased during WY 2023 and the figures below primarily show corresponding areas of relative increase in storage (associated with increasing groundwater levels; shown in blue shades). The Above Corcoran Clay shows several areas of moderate increase in storage, with remaining areas primarily showing little change. The eastern portion of the Below Corcoran Clay shows some increase in storage, with the remainder showing negligible change. The Outside Corcoran Clay shows moderate declines through the central portion of the aquifer, some increases in storage along portions of the Merced River, and negligible change throughout the remainder.

Figure 2-8: Change in Storage Water Year 2023 (feet), Above Corcoran Clay

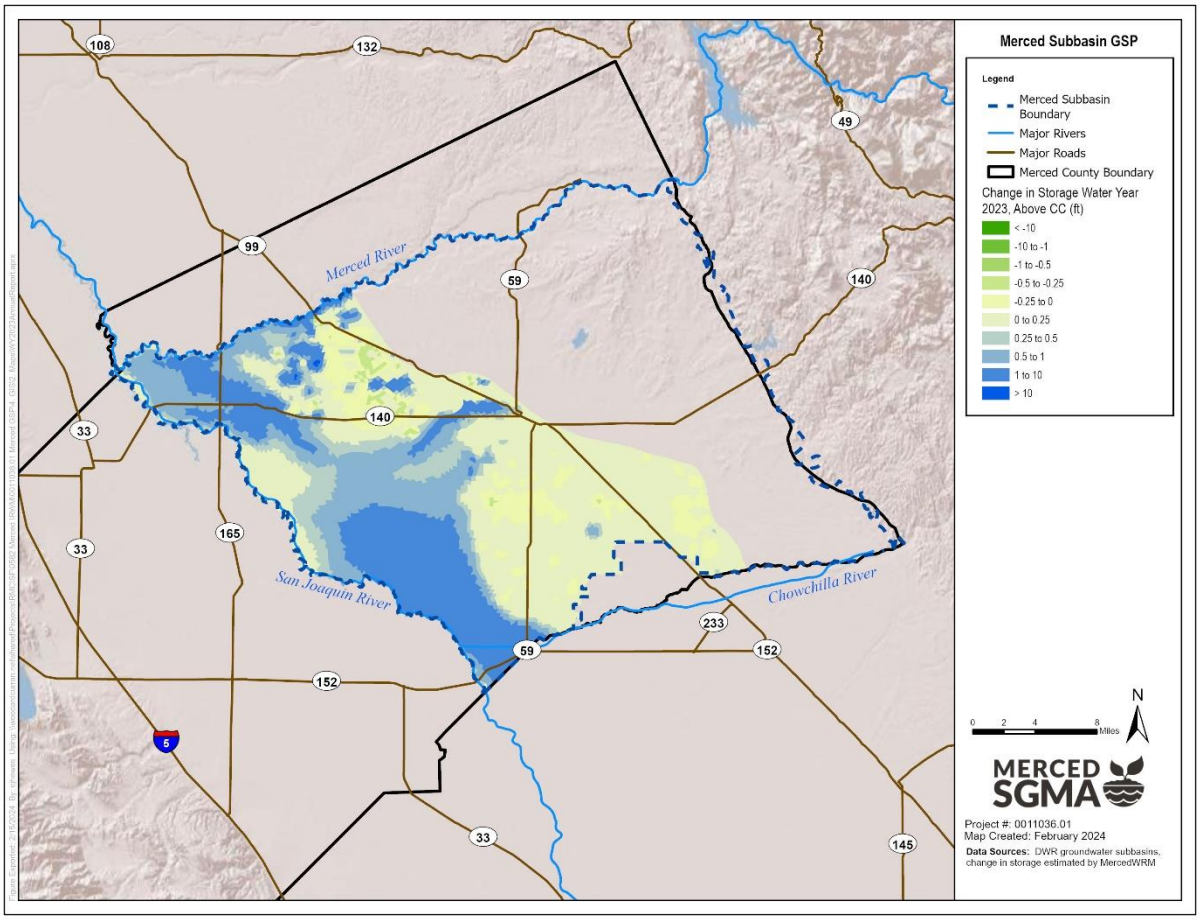


Figure 2-9: Change in Storage Water Year 2023 (feet), Below Corcoran Clay

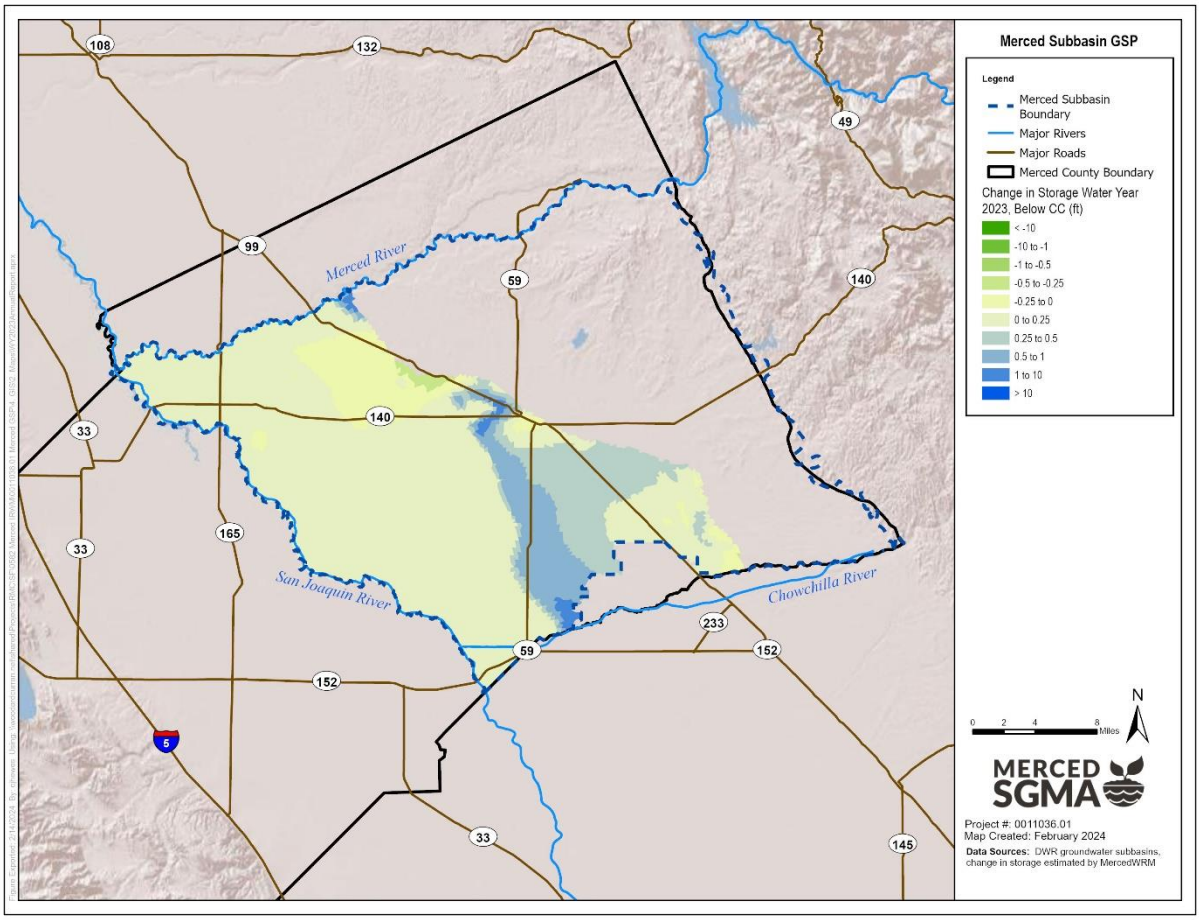
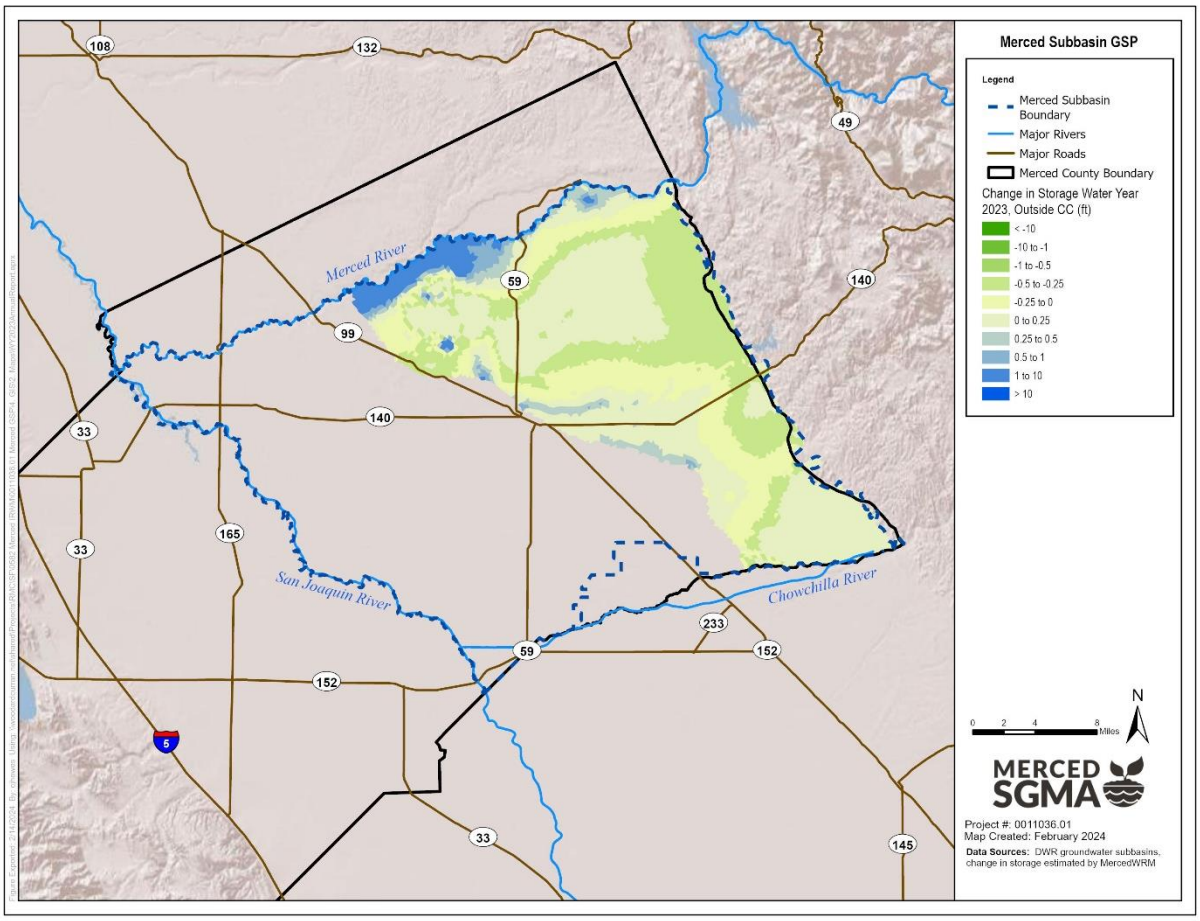


Figure 2-10: Change in Storage Water Year 2023 (feet), Outside Corcoran Clay



1. *The eastern portion of the Outside Corcoran Clay Principal Aquifer is a region with a relatively lower density of monitoring wells and thus higher level of uncertainty due to the data limitations. The GSP identifies this as a data gap; the GSAs developed a Data Gaps Plan in 2021 and are in the process of implementing the plan.*

2.7 Land Subsidence

This section provides maps of the most recent subsidence measurements taken in and around the Subbasin and compares them to the GSP's sustainable management criteria. Subsidence is measured at static GPS control points throughout the San Joaquin Valley monitored by the US Bureau of Reclamation (USBR) as part of the San Joaquin River Restoration Program. Measurements have been recorded semiannually in July and December of each year to monitor ongoing subsidence since 2011. Figure 2-11 shows the total subsidence occurring from December 2022 to December 2023. Figure 2-12 shows the average subsidence occurring from December 2015 through December 2023.

Figure 2-11: Total Subsidence December 2022 to December 2023

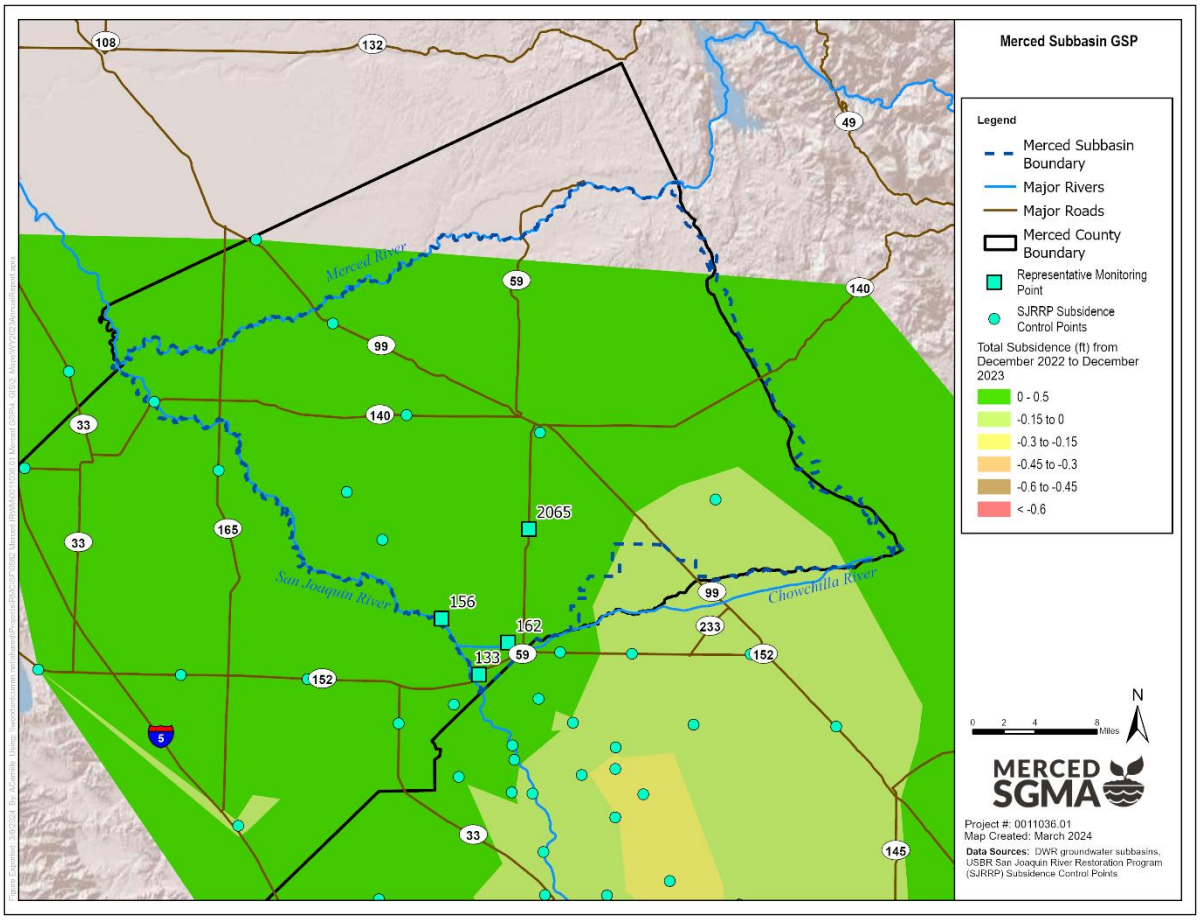
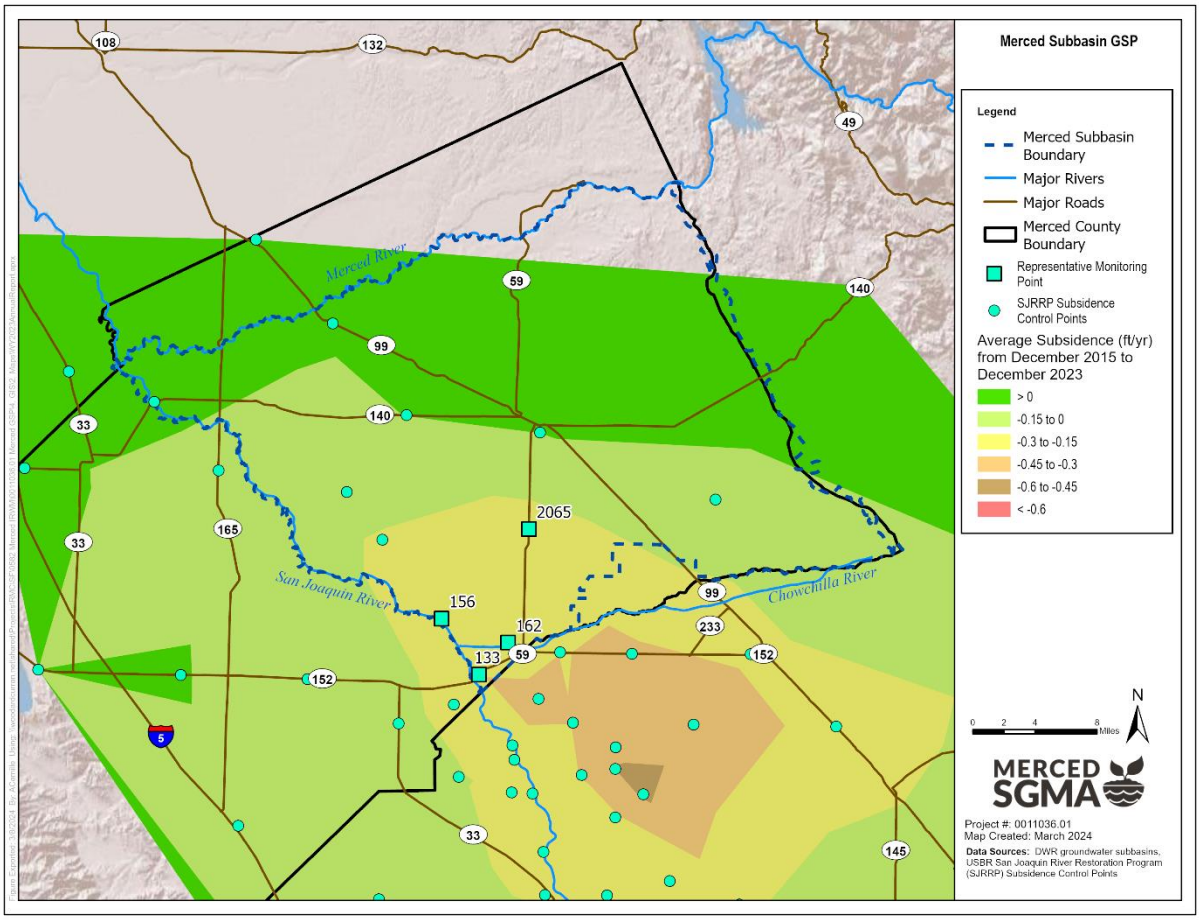


Figure 2-12: Average Subsidence Rate December 2015 to December 2023



In the 2022 revised GSP, the GSAs established a minimum threshold of 0 ft/year (subject to uncertainty of ±0.16 ft/year) at four representative monitoring stations. The measurable objective is also 0 ft/year, with interim milestones of -0.75 ft/year (2025), -0.50 ft/year (2030), and -0.25 ft/year (2035) of subsidence. The GSP identifies undesirable results for subsidence as "exceedances of minimum threshold rates of land subsidence at three or more monitoring sites out of four for two consecutive years" (MIUGSA, MSGSA, & TIWD GSA-1, 2022).

As shown in Table 2-6, subsidence has consistently been observed (e.g. greater magnitude than the MT and MO of 0 ft/yr) at the representative monitoring sites from 2015 to 2022. Through that period, the rate of subsidence has consistently been less than the 2025 IM of 0.75 ft/yr. However, land surface elevation change between December 2022 – December 2023 was positive, likely due to the impact of a very wet winter in late 2022/early 2023.

Work is currently underway to better understand how to stabilize subsidence in the Subbasin. Subsidence is a gradual process that takes time to develop and time to halt. As a result, some level of future subsidence, likely at rates similar to those experienced 2015 to 2022, is likely to be underway already and will not be able to be prevented.

Table 2-6: Subsidence at Representative Monitoring Stations

	Point ID	133	162	2065	156
	Station Name	H 1235 RESET	RBF 1057	W 938 RESET	W 990 CADWR
Subsidence (ft)	Dec 2015-Dec 2016	-0.44	-0.25	-0.16	-0.29
	Dec 2016-Dec 2017	-0.18	-0.07	-0.16	0.01
	Dec 2017-Dec 2018	-0.30	-0.17	-0.17	-0.32
	Dec 2018-Dec 2019	-0.24	-0.10	-0.14	-0.07
	Dec 2019-Dec 2020	-0.39	-0.26	-0.30	-0.28
	Dec 2020-Dec 2021	-0.33	-0.19	-0.35	-0.23
	Dec 2021-Dec 2022	-0.46	-0.34	-0.52	-0.35
	Dec 2022-Dec 2023	+0.02	+0.13	+0.08	+0.16
Minimum Threshold (ft/yr)		0 ± 0.16	0 ± 0.16	0 ± 0.16	0 ± 0.16
Measurable Objective (ft/yr)		0	0	0	0
2025 Interim Milestone (ft/yr)		-0.75	-0.75	-0.75	-0.75

2.8 Groundwater Quality

In addition to comparing water quality monitoring to the GSP's interim milestones and other sustainable management criteria, this section provides a summary of ongoing water quality coordination activities being conducted by the GSAs.

2.8.1 Representative Monitoring

In the GSP, the GSAs established a minimum threshold of 1,000 mg/L of Total Dissolved Solids (TDS) at representative monitoring sites for the degraded water quality sustainability indicator. The measurable objective and all interim milestones were set at 500 mg/L TDS. Undesirable results are defined in the GSP as "during GSP implementation when at least 25% of representative monitoring wells (6 of 22 sites) exceed the minimum threshold for degraded water quality for two consecutive years" (MIUGSA, MSGSA, & TIWD GSA-1, 2022).[4]

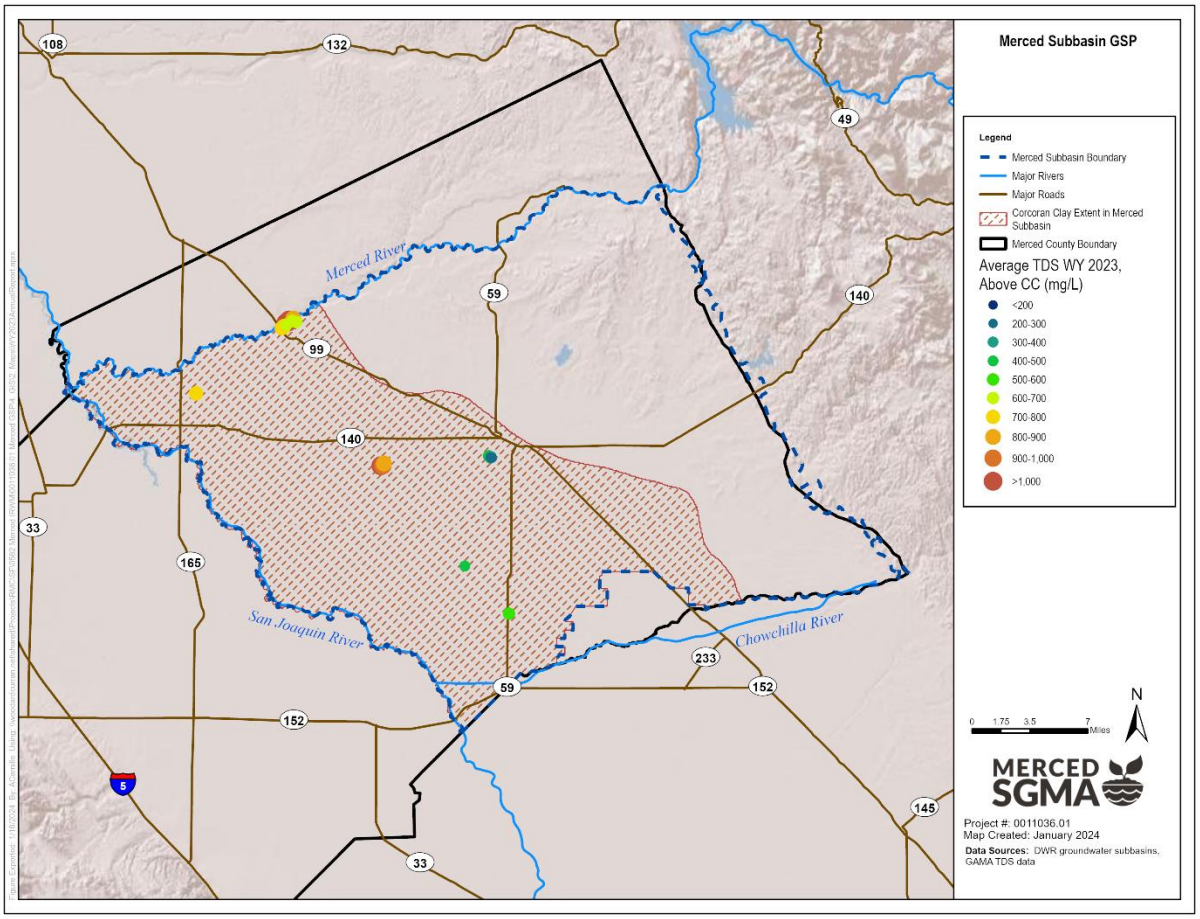
[4] The total count of representative monitoring wells is now 23 as of this annual report and will be reflected in the upcoming updated GSP 2025.

Figure 2-13 through Figure 2-15 show the spatial distribution of TDS concentration measurements in the three principal aquifers based on TDS and electrical conductivity (EC) data reported in the Groundwater Ambient Monitoring & Assessment (GAMA) database within WY 2023 for wells in the Merced Subbasin monitoring network (including more than just representative wells).[5] EC measurements were converted to estimates of TDS only if TDS samples were not measured directly during WY 2023. Figure 2-16 shows concentrations for which the principal aquifer is unknown due to a lack of well construction data (e.g., lacking total well depth or screened interval). The GSP monitoring network includes both designated representative wells as well as any public water supply wells that report data to the Division of Drinking Water (DDW).

While elevated TDS (actual and/or estimated from EC) concentrations (greater than 1,000 mg/L) were observed in monitoring data for WY 2023, they were confirmed to be at six locations where samples were collected at environmental monitoring wells monitored by regulated facilities. The Merced GSP describes that there are pockets of the Subbasin known to have such elevated concentrations and water use behaviors have already shifted to accommodate these concentrations. For example, agriculture has focused on more salt-tolerant crops, and more saline water supplies are blended with less saline water supplies. As a result, TDS concentrations in excess of 1,000 mg/L where currently experienced are not unexpected. There is, however, a desire on the part of Subbasin stakeholders to limit increases in salinity in parts of the Subbasin where TDS is below 1,000 mg/L to prevent undesirable results such as requirements to change cropping, blending supplies, etc.

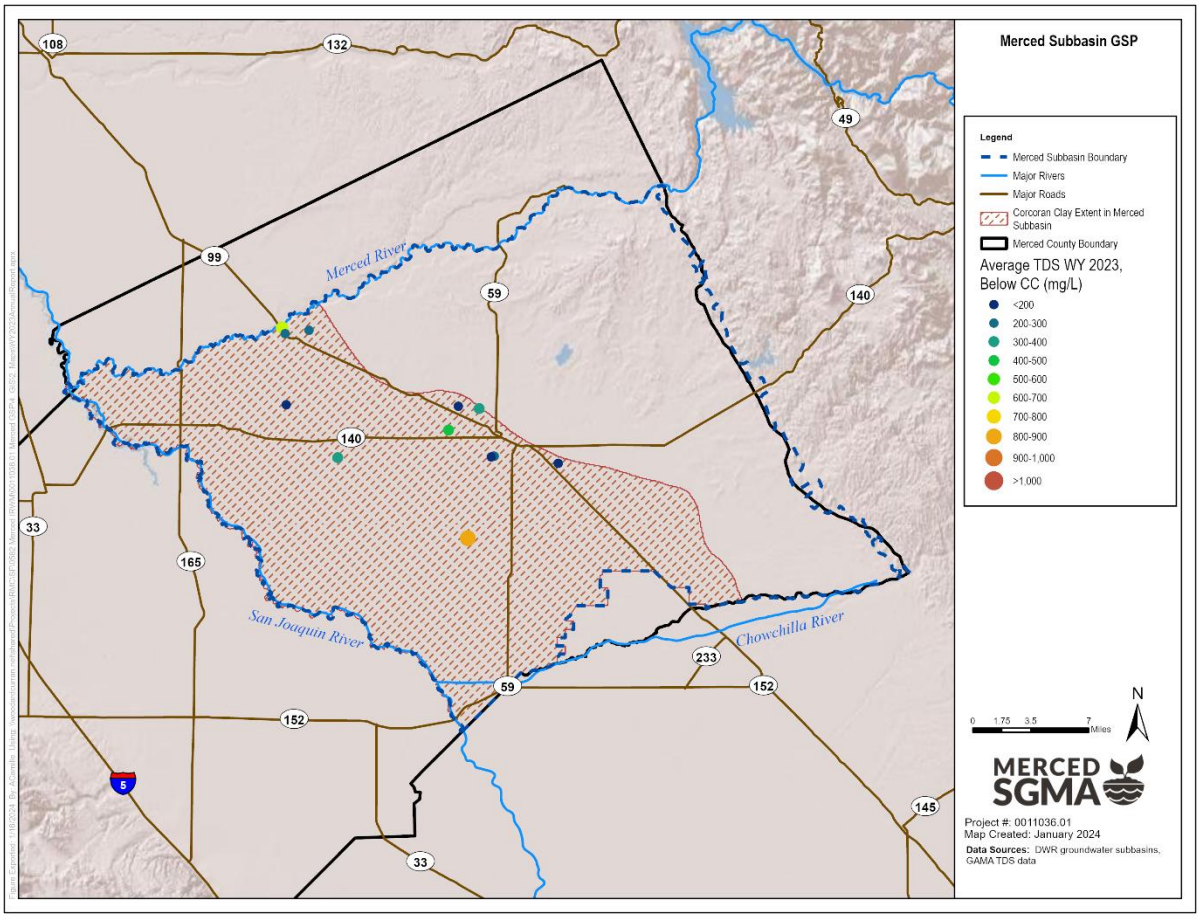
[5] TDS concentration was estimated using the estimation formula of TDS (mg/L) ≈ EC (µS/cm) * 0.640, described later in this section.

Figure 2-13: Average TDS Concentration Water Year 2023, Above Corcoran Clay Principal Aquifer



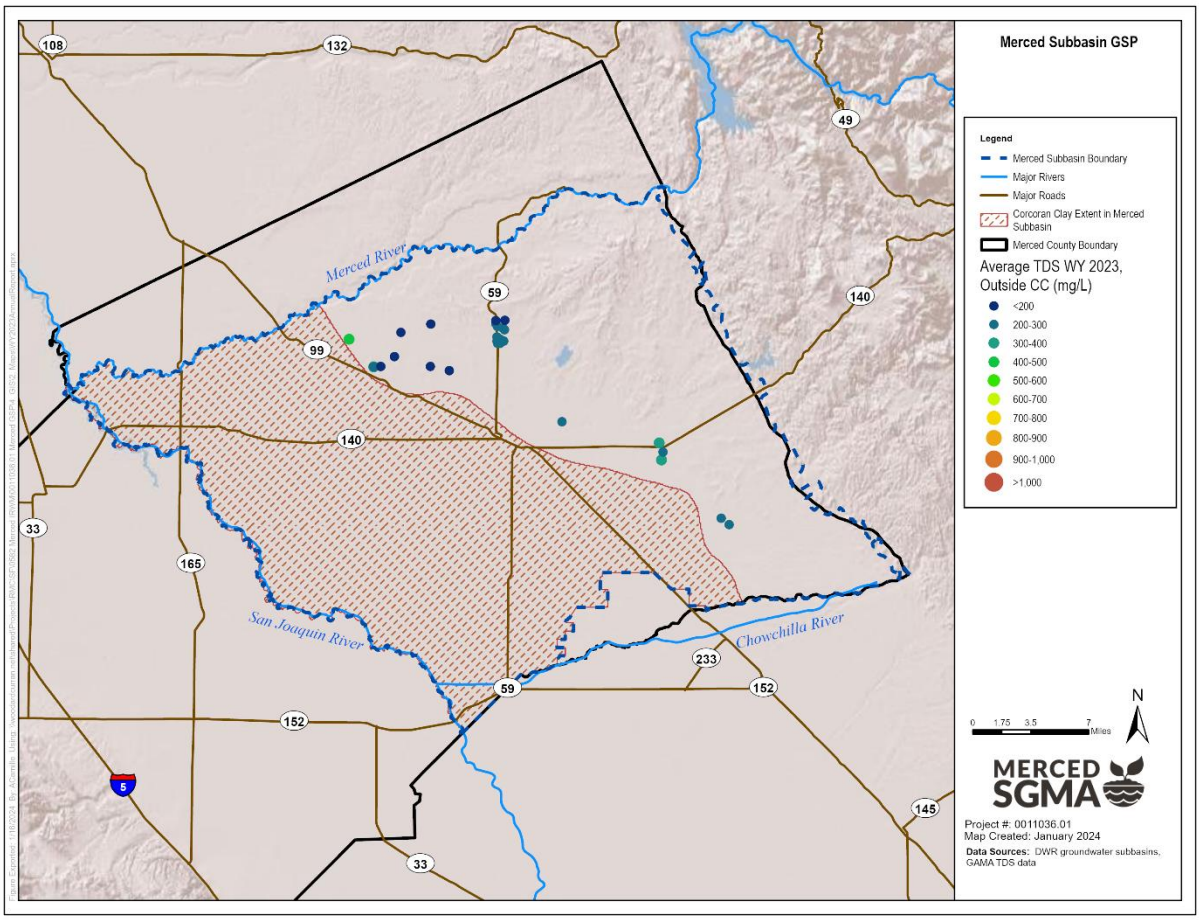
1. *Some TDS values are estimated based on EC measurements.*

Figure 2-14: Average TDS Concentration Water Year 2023, Below Corcoran Clay Principal Aquifer



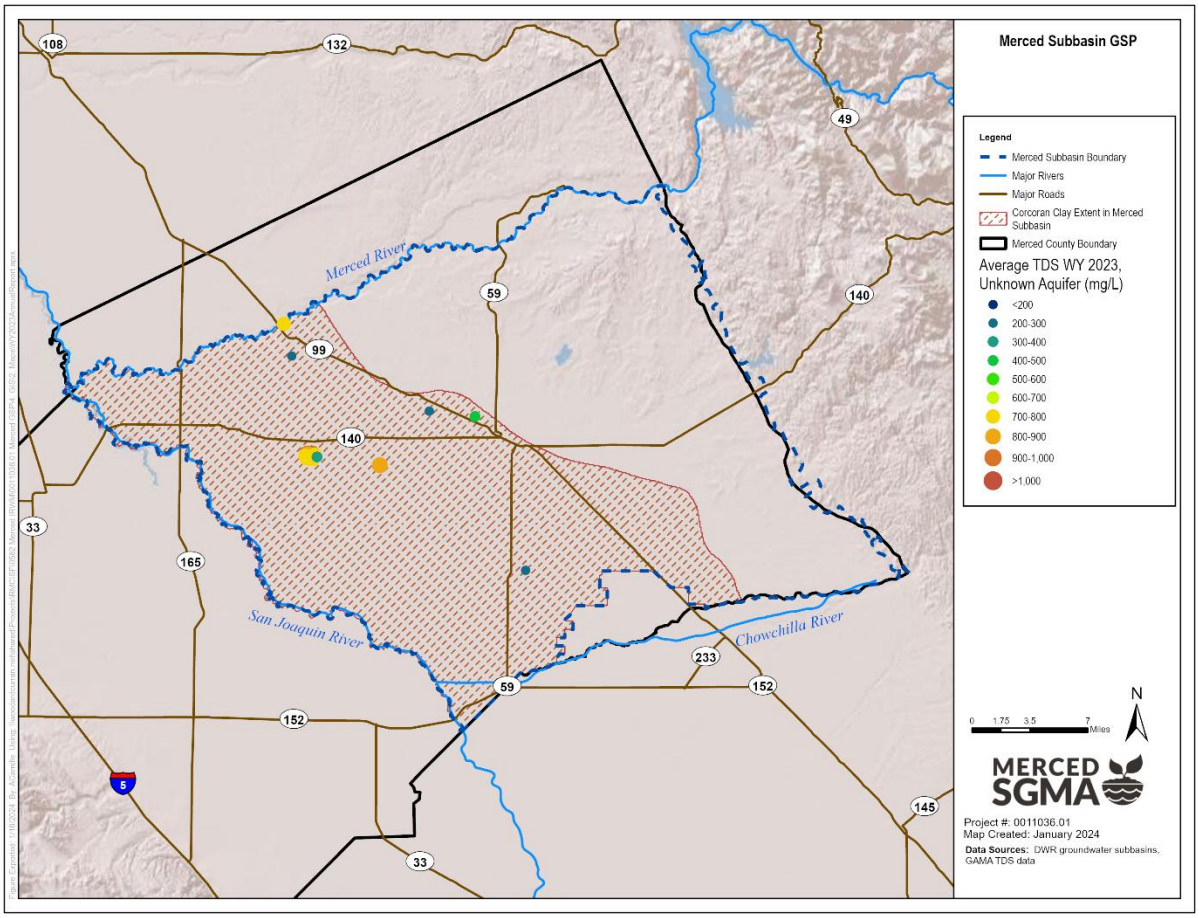
1. *Some TDS values are estimated based on EC measurements.*

Figure 2-15: Average TDS Concentration Water Year 2023, Outside Corcoran Clay Principal Aquifer



1. Some TDS values are estimated based on EC measurements.

Figure 2-16: Average TDS Concentration Water Year 2023, Unknown Principal Aquifer



1. *Some TDS values are estimated based on EC measurements.*

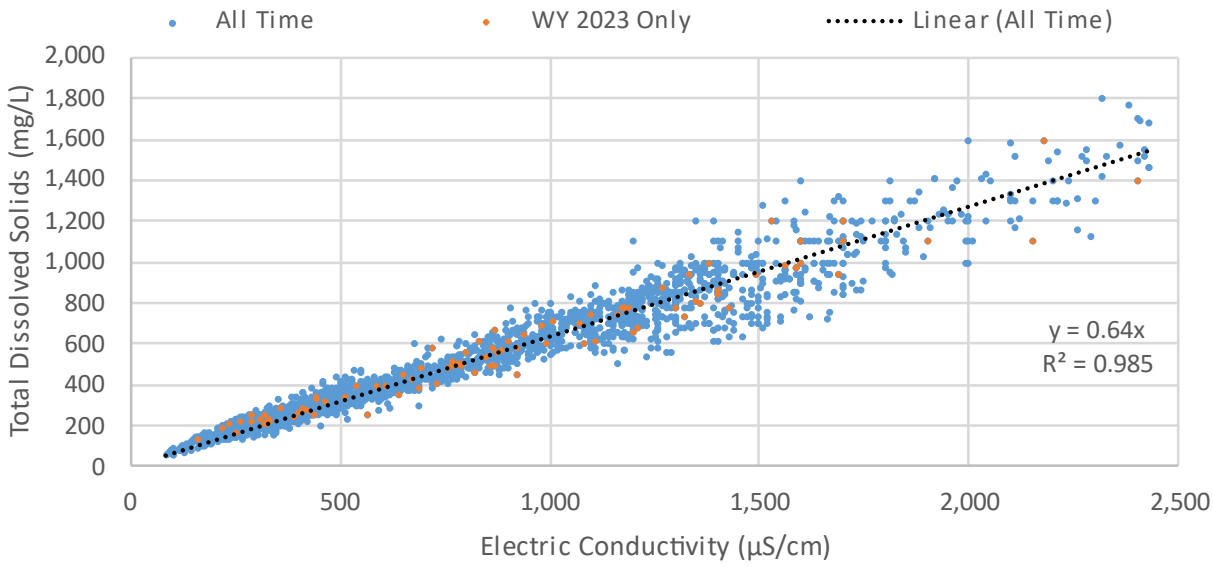
The East San Joaquin Water Quality Coalition (ESJWQC) is a group of agricultural interests and growers formed to represent dischargers who own or operate irrigated lands east of the San Joaquin River within Madera, Merced, Stanislaus, Tuolumne, and Mariposa Counties, as well as portions of Calaveras County. The ESJWQC has developed a Groundwater Quality Trend Monitoring Program (GQTMP) as part of the Irrigated Lands Regulatory Program (ILRP), which includes a targeted set of domestic wells (denoted as principal wells) supplemented by public water system wells (denoted as complementary wells) (ESJWQC, 2018). There are currently nine principal wells and 14 complementary wells in the Merced Subbasin that are designated as representative monitoring wells in the Merced GSP at which sustainable management criteria are established for groundwater quality (shown in Table 2-7). Data collected by ESJWQC are submitted to GAMA annually.

Note that since the last annual report, GQTMP Well ID ESJQC00043, located just northwest of the City of Atwater, was added to the GQTMP monitoring network and thus also added as a representative monitoring network well to the Merced GSP, bringing the total number of representative monitoring wells to 23.

ESJWQC monitors EC, pH, dissolved oxygen, temperature, and nitrate as nitrogen (as N) annually. TDS and other constituents are monitored every five years. TDS was recorded in July 2023 for one of the nine principal monitoring wells in the GQTMP that are located in the Merced Subbasin (ESJQC00043, which is new to the network). Wells are on a five-year cycle for direct measurement of TDS, with most having been last recorded directly in 2022. For the remaining eight sites, the most recent EC field measurements collected by the ESJWQC were used to estimate TDS. The most recent TDS observations (whether direct or estimated) for Merced GSP representative wells are summarized in Table 2-7. None of the wells with reported data have measured or estimated TDS concentrations above the MT. Three wells show a TDS concentration that is above the MO and IM. Note that for the 14 complementary wells (identified with GQTMP Well ID beginning with "C"), three had TDS or EC data reported in GAMA for the reporting period.

There is a relationship between EC and TDS (SWRCB, 2004), with a typical acceptable ratio of TDS to EC ranging from 0.55 to 0.7 (American Public Health Association, American Water Works Association, and Water Environment Foundation, 1999). TDS is measured by ESJWQC every five years, though the definition of undesirable results in the Merced GSP is based on the assumption that measurements will be recorded annually. Because ESJWQC is already measuring EC annually, the GSAs use EC measurements to estimate TDS in years where TDS is not sampled. The ratio used for conversion is 0.64 (where TDS [mg/L] ≈ EC [µS/cm] * 0.64). This is based on an analysis of paired EC and TDS measurements recorded in Merced County, as shown in Figure 2-17. Each paired EC/TDS measurement was recorded on the same day at the same site. The line of best fit has a slope of 0.64 (the ratio), with a strong level of correlation based on the coefficient of determination (R^2) value of 0.985 out of 1.

Figure 2-17: Relationship Between Electrical Conductivity & Total Dissolved Solids



a. *This graph is based on 2,771 measurements of EC and TDS recorded on the same day at monitoring sites throughout Merced County from 1925-2023.*

b. *Outliers were identified by calculating the interquartile (IQR) range of EC measurements (75th percentile value minus 25th percentile value). Measurement pairs (EC with TDS) were flagged as outliers and excluded from the analysis if they had an EC measurement that was higher than: (75th percentile EC value) + 1.5 * IQR, or 2,485 µS/cm. A second-step outlier analysis using the same methodology was performed on a small handful of remaining measurement pairs where the ratio between TDS and EC was outside of the range 0.43 – 0.93 ([25th percentile ratio – 1.5 IQR] to [75th percentile ratio + 1.5 IQR]). Overall, 217 outliers were excluded out of 2,988 measurement pairs.*

Table 2-7: TDS Concentrations at Representative Monitoring Wells

GQTMP Well ID	GAMA Well ID	EC (µS/cm)	TDS (mg/L)	Date of Measurement [b]	Minimum Threshold (mg/L TDS)	Measurable Objective and Interim Milestones (mg/L TDS)	Principal Aquifer
P06	AGC10001233 1-ESJQC00006	307	196[a]	8/5/2020	1,000	500	Outside Corcoran Clay
P07	AGC10001233 1-ESJQC00007	297	190[a]	7/25/2023	1,000	500	Below Corcoran Clay
P08	AGC10001233 1-ESJQC00008	457	292[a]	7/24/2023	1,000	500	Outside Corcoran Clay
P09	AGC10001233 1-ESJQC00009	645	413[a]	7/25/2023	1,000	500	Below Corcoran Clay
P10	AGC10001233 1-ESJQC00010	1,312	840[a]	7/24/2023	1,000	500	Below Corcoran Clay

GQTMP Well ID	GAMA Well ID	EC (µS/cm)	TDS (mg/L)	Date of Measurement [b]	Minimum Threshold (mg/L TDS)	Measurable Objective and Interim Milestones (mg/L TDS)	Principal Aquifer
ESJQC00019	AGC100012331-ESJQC00019	1,146	733 [a]	7/25/2023	1,000	500	Below Corcoran Clay
ESJQC00022	AGC100012331-ESJQC00022	849	543 [a]	7/24/2023	1,000	500	Above Corcoran Clay
ESJQC00030	AGC100012331-ESJQC00030	769	492 [a]	7/27/2021	1,000	500	Below Corcoran Clay
ESJQC00043	AGC100012331-ESJQC00043		333	7/25/2023	1,000	500	Outside Corcoran Clay
C35	CA2400172_001_001		362	1/22/2009	1,000	500	Above Corcoran Clay
C41	CA2400220_001_001	710	454 [a]	5/5/2016	1,000	500	Above Corcoran Clay
C45	CA2400089_001_001		N/A[c]		1,000	500	Above Corcoran Clay
C38	CA2410004_011_011		270	6/27/2023	1,000	500	Below Corcoran Clay
C44	CA2400218_001_001	460	294 [a]	6/22/2021	1,000	500	Below Corcoran Clay
C40	CA2410001_006_006		290	3/16/2006	1,000	500	Outside Corcoran Clay
C42	CA2400046_002_002		320	8/11/2022	1,000	500	Outside Corcoran Clay
C43	CA2410007_005_005	420	269 [a]	5/2/2023	1,000	500	Outside Corcoran Clay
C46	CA2410007_002_002		209	1/31/1991	1,000	500	Outside Corcoran Clay
C47	CA2400194_001_001		N/A[c]		1,000	500	Outside Corcoran Clay
C39	CA2400119_001_001		N/A[c]		1,000	500	Outside Corcoran Clay
C48	CA2410011_005_005		220	10/18/2022	1,000	500	Outside Corcoran Clay
C49	CA2400172_012_012		300	12/16/2020	1,000	500	Unknown
C50	CA2400079_001_001	320	205 [a]	11/2/2020	1,000	500	Unknown

*a. TDS concentration was estimated using the formula TDS (mg/L) ≈ EC (µS/cm) * 0.640.*

b. All WY 2023 data are shown. If no data for WY 2023 are available, the most recent measurement of TDS (or TDS estimated from EC) is shown.

c. No data reported for EC or TDS in GAMA.

2.8.2 Water Quality Coordination Activities

In addition to monitoring for TDS (see Section 2.8.1 - Representative Monitoring), the GSAs are conducting water quality coordination activities to address other water quality constituents. These activities include review of monitoring reports published by other monitoring programs as well as compiling data submitted by Department of Pesticide Regulation (DPR), Division of Drinking Water (DDW), and Department of Toxic Substances Control (DTSC) to the GAMA database. The purpose of these reviews is to evaluate the status of constituent concentrations throughout the Subbasin with respect to typical indicators such as applicable maximum contaminant level (MCL)[6] or secondary maximum contaminant levels (SMCL)[7] associated with drinking water.

Established in 2000, the GAMA Program monitors groundwater quality throughout California. GAMA is intended to create a comprehensive groundwater monitoring program throughout the state and increase public availability and access to groundwater quality and contamination information. Agencies submit data from monitoring wells for 244 constituents. GAMA data for the Merced Subbasin contains wells monitored or regulated by the DDW, DPR, DWR, USGS, and environmental monitoring wells monitored by regulated facilities. The GSAs have collected information from GAMA and use this information to document regional groundwater quality and to assess whether there is a need for changes to existing sustainable management criteria or developing additional sustainable management criteria for water quality as part of GSP updates.

[6] MCLs are drinking water standards that are adopted as regulations and describe the highest level of a contaminant allowed in drinking water, based on health risks and also detectability, treatability, as well as the costs of treatment.

[7] Secondary MCLs are established by the USEPA and then adopted by the SWRCB. The secondary MCL is a Secondary Drinking Water Standard that is established for aesthetic reasons such as taste, odor, and color and is not based on public health concerns.

3. PLAN IMPLEMENTATION PROGRESS

This section of the Annual Report provides updates on:

- Interim Milestones (Section 3.1)
- Projects (Section 3.2)
- Management actions (Section 3.3)
- Progress made on addressing recommended corrective actions (Section 3.4)
- Other implementation support activities (Section 3.5)
- Anticipated upcoming activities (Section 3.6)

This Annual Report provides a snapshot of projects and management actions (PMAs) and their respective implementation status. The PMAs are also included in the Merced Integrated Regional Water Management (MercedIRWM) Opti project tracker (https://opti.woodardcurran.com/irwm/merced/), which, along with the GSP, is viewed by the Merced Subbasin GSAs as a "living" document. The list of PMAs maintained in the MercedIRWM Opti system will be revised periodically and reflects, at any time in the future, the list of PMAs associated with the GSP. When revised, the PMA list will be approved by the Merced Subbasin Coordination Committee or other body, as appropriate, following updating, and will be made available via the MercedIRWM Opti system. As such, the list of PMAs maintained in the MercedIRWM Opti system is considered to be the official Merced Subbasin GSP PMA list; no formal GSP adoption will be required for PMA list updating.

3.1 Interim Milestones

Interim Milestones were identified in Chapter 3 (Sustainable Management Criteria) of the GSP for all Sustainability Indicators and provided in tabular form for Groundwater Elevations and Groundwater Quality Sustainability Indicators (see Tables 3-1 and 3-2 in GSP). These Interim Milestones are anticipated to be achieved over the course of GSP implementation in increments of five years, pursuant to the CCR definition "*Target values representing measurable groundwater conditions, in increments of five years, set by an Agency as part of a Plan*" [CCR Title 23, Division 2, §351(q)]. Progress toward achieving Interim Milestones since submitting the original 2019 and revised 2022 GSP are provided in Sections 2.2 (Groundwater Elevations), 2.7 (Land Subsidence), and 2.8 (Groundwater Quality). Further updates are expected in the first Five Year Assessment for the Merced Subbasin GSP, with status checks provided in future annual reporting.

3.2 Implementation of Projects

Since the initial publishing of the GSP in 2020, various projects have been started, completed, and new projects have been added. The different sources of projects are described in the subsections below, after which Table 3-1 describes completed projects and Table 3-2 describes projects in progress.

Original GSP Projects

The GSP originally identified twelve priority projects. These original projects were selected for inclusion in the GSP based on their ability to address a list of priorities identified by the Stakeholder Advisory and

Coordination Committee members and the public. Eight of the twelve priority projects are considered complete (see Table 3-1). Table 3-2 provides a summary of updated project information for the four ongoing priority projects since the previous annual report, as provided by project proponents.

Proposition 68 SGM Grant Program Planning Grant

The Merced Subbasin was awarded a Proposition 68 SGM Grant Program Planning Grant which was contracted with DWR in May 2020. The grant funded a GSP Development Project for Addressing Critical Data Gaps which consists of developing a Data Gaps Plan, upgrading & incorporating existing wells into the monitoring network, installing new well(s) in critical locations, and stakeholder outreach. It also funded the development of a remote-sensing decision support tool. These projects are shown in Table 3-2 under Project Source "Proposition 68 SGM Grant Program Planning Grant".

Proposition 68 SGM Grant Program Implementation Grant

The Merced Subbasin received Proposition 68 SGM Grant Program Implementation Grant in 2021 for two projects described in Table 3-2 under Project Source "Proposition 68 SGM Grant Program Implementation Grant".

Round 1 Sustainable Groundwater Management Implementation Planning and Projects Grant

At the end of February 2022, the GSAs submitted an application and spending plan to DWR for a cumulative approximately $13.7 million of grant funding for 18 projects and received $7.6 million of funding for 15 of those projects. These projects are shown in Table 3-2 as Project Source "Projects Funded by the SGM Implementation Grant Round 1".

Round 2 Sustainable Groundwater Management Implementation Planning and Projects Grant

In December 2022, the GSAs submitted an application and spending plan to DWR for a cumulative approximately $18.4 million of grant funding for 7 projects and received $3.4 million of funding for 2 of those projects. These projects are shown in Table 3-2 as Project Source "Projects Funded by the SGM Implementation Grant Found 2".

Table 3-1: Completed Projects

Project Name	Project Update Description
Project 1: Planada Groundwater Recharge Basin Pilot Project	Cone Penetration Tests did not show favorable geologic conditions for a recharge basin; a dry well recharge facility was installed as an alternative to a traditional recharge basin. Pre-filtration methods designed for the pilot were insufficient; alternative approaches to filtration are being considered and evaluated. Proposed permanent monitoring well installed in September 2020. This well has been added to the Merced Subbasin's Monitoring Network.
Project 2: El Nido Groundwater Monitoring Wells	All planned well site installations have been completed. These wells have been added to the Merced Subbasin's Monitoring Network.
Project 3: Meadowbrook Water System Intertie Feasibility Study	Study completed in January 2021.
Project 5: Merced Irrigation District to Lone Tree Mutual Water Company Conveyance Canal	Completed fall 2022 and currently in operation.
Project 8: Merced Groundwater Subbasin LIDAR	Funding for this project was awarded under the Proposition 1 Round 1 IRWM Implementation Grant in 2020. LIDAR data was collected in December 2020 and will be used in conjunction with weather forecast data to predict local stormflows from rainfall events.
Project 9: Study for Potential Water System Intertie Facilities from MID to LGAWD and CWD	The study has been completed. The GSAs received Proposition 68 Implementation Grant funding for the phase 1 portion of this work in 2021. An additional, separate phase 2 of work has been funded as part of the SGM Implementation Grant Round 1. Further, LGAWD has adopted an assessment with the intention of fully funding the remaining portion of the cost estimate, which is approximately $25,000,000.
Project 11: Mini-Big Conveyance Project	Combined with Project 9 Study for Potential Water System Intertie Facilities from MID to LGAWD and CWD due to substantial overlap in scope.
Project 12: Streamlining Permitting for Replacing SubCorcoran Wells	The study has been completed and has been used by Merced County to support well permitting from below to above the Corcoran Clay in the subsidence area.
Merced Subbasin GSP Development Project for Addressing Critical Data Gaps	Develop Remove Sensing Decision Support Tool for Subbasin - The tool was completed in spring 2023. Funded via Proposition 68 SGM Grant Program Planning Grant.
El Nido Conveyance System Improvements Project	Provides conveyance improvements at four existing siphons/pipelines in MID's El Nido Conveyance System to allow more surface water to be diverted from the Mariposa Creek to the

	El Nido area, an Underrepresented Community[1] suffering from declining groundwater levels and subsidence. Construction concluded in March 2022. Funded via Proposition 68 SGM Grant Program Implementation Grant.

1. *The following projects were reported previously but are no longer being pursued:*
    a. *GSP "Project 4: Merquin County Water District Recharge Basin" because MCWD is not currently pursuing this project.*
    b. *"Merquin County Water District (MCWD) Sustainable Yield Management Plan and Plan Implementation" because MCWD has withdrawn this project from the SGM Implementation Grant Round 1 grant agreement.*

[1] Underrepresented Communities are defined by the SGM Grant Program as a DAC, SDAC, or EDA; Tribal Lands/Tribes; California Communities Environmental Health Screening Tool Classified DACs (EnvDACs); and Fringe Communities.

Table 3-2: Description of Project Implementation Updates

Project Source	Project Name	Project Update Description
Original GSP Project	Project 6: Merced IRWM Region Climate Change Modeling	No update of information in 2022 revised GSP to report at this time.
	Project 7: Merced Region Water Use Efficiency Program	No update of information in 2022 revised GSP to report at this time.
	Project 10: Vander Woude Dairy Offstream Temporary Storage	This project was approved for funding in May 2022 as part of the Round 1 Sustainable Groundwater Management Implementation Planning and Projects Grant ("Vander Woude Storage Reservoir") and reflects some minor modifications to what was initially proposed in the GSP. The project will build a 30-acre storage reservoir with a capacity of 250 AF. The project will divert flood water from Mariposa and Owens Creeks and store it for later use to meet crop demand. It's estimated the reservoir would be filled 3 times per year for an estimated yield of 750 AFY. In addition, the project will permanently fallow 30-acres of productive farmland that has a crop demand of 150 AFY. The total project yield is 900 AFY. Environmental review is complete, and the design is 95% complete. The project is expected to go out to bid in summer 2024.
Proposition 68 SGM Grant Program Planning Grant	Merced Subbasin GSP Development Project for Addressing Critical Data Gaps	The "Addressing GSP Gaps" component has multiple sub-components: • The Data Gaps Plan document was completed in July 2021 and provides tools to prioritize filling the data gaps and identifies implementation procedures necessary to fill such gaps. The Data Gaps Plan does not attempt to completely fill all identified gaps, but rather acts as a starting point and guidance framework for ongoing efforts to do so. • Upgrade and Incorporate Existing Wells into Monitoring Network – MIUGSA and MSGSA have identified existing candidate wells for potential incorporation into the monitoring network and instrumented several of those wells for monitoring. In early- to mid-2024, the GSAs are completing remaining work to investigate, through video logs, site visits, and well completion reports, then instrument and incorporate the appropriate wells.

Project Source	Project Name	Project Update Description
		• Install New Monitoring Well(s) in Critical Locations – new dual completion (2 casings) monitoring well was previously installed in the southwest corner of the Subbasin.
Proposition 68 SGM Grant Program Implementation Grant	LeGrand-Athlone Water District Intertie and Recharge Project (Phase 1)	Note that Phase 2 of the project is described in the row below. The Intertie project an approximately 2-mile canal to connect MID's Booster Lateral 3 to Dutchman Creek. The environmental review and design of Phase I is complete and the construction contract has been awarded to McElvaney Construction. Construction is expected to begin March 2024.
Projects Funded by the SGM Implementation Grant Round 1[1]	LeGrand-Athlone Water District Intertie Canal (Phase 2)	The design of Phase 2 is complete, and the environmental review and easement acquisition are underway. Construction is expected to begin in spring 2025.
	Merced Subbasin Integrated Managed Aquifer Recharge Evaluation Tool (MercedMAR)	The project began in mid-2023 and is ongoing.
	Vander Dussen Subsidence Priority Area Flood-MAR Project	Construction is complete, with the exception of PG&E power.
	Vander Woude Storage Reservoir	Environmental review is complete, and the design is 95% complete. The project is expected to go out to bid in summer 2024.
	Filling Data Gaps Identified in Data Gaps Plan	Planning work is ongoing.
	Amsterdam Water District Surface Water Conveyance and Recharge Project	This project will result in a Groundwater Recharge Feasibility Study in fall 2024. A precursor to the Study is a geotechnical investigation, which includes drilling boreholes and taking soil samples to depths of 50 feet. The soil permeability and other laboratory results are due in spring 2024.
	GSP Project 31: Crocker Dam Modification	Project Planning and Design is fully funded and underway.
	G Ranch Groundwater Recharge, Habitat Enhancement & Floodplain Expansion Project – Planning	La Paloma Mutual Water Company has partnered with River Partners and Ducks Unlimited for this Planning and Implementation project. The Project will provide both wildlife and groundwater recharge benefits by re-establishing flood plains. Environmental planning is complete and the project is in the design phase. Construction is expected to begin in spring 2025.

Project Source	Project Name	Project Update Description
	G Ranch Groundwater Recharge, Habitat Enhancement & Floodplain Expansion Project - Implementation	See project update in row above.
	Purdy Project (E. Purdy, W. Purdy, and Kevin Recharge Basins) (Project No. 38)	Project has not proceeded due to a policy conflict that has rendered the project infeasible for the applicant to pursue.
	Purdy Project (East Pike Recharge Basin) (Project No. 37)	Project has not proceeded due to a policy conflict that has rendered the project infeasible for the applicant to pursue.
	Buchanan Hollow Mutual Water Company Floodwater Recharge Project	This project will result in a Groundwater Recharge Feasibility Study in fall 2024. A precursor to the Study is a geotechnical investigation, which includes drilling boreholes and taking soil samples to depths of 50 feet. The soil permeability and other laboratory results are due in spring 2024.
	Turner Island Water District (TIWD) Water Conservation	Project is funded and has been initiated by the project team. Initial studies have been completed to determine which projects are feasible and allow for maximum conservation of water. The next steps are to develop a project plan for CEQA purposes and continue project development.
	TIWD Shallow Well Drilling	Project is funded and has been initiated. A hydrogeologic study was completed to determine the best locations for future wells. The next step is for wells to be designed and for CEQA analysis to proceed, which is likely to be completed in tandem with TIWD's Water Conservation Project.
Projects Funded by the SGM Implementation Grant Found 2[2]	La Paloma Mutual Water Company G Ranch Groundwater Recharge, Habitat Enhancement, and Floodplain Expansion – Phase II (Construction)	Project is funded, but pending grant agreement drafting and execution.
	La Paloma Mutual Water Company Bear Creek Ranch Groundwater Recharge, Habitat Enhancement, and Floodplain Expansion – Phase I (Planning)	Project is funded, but pending grant agreement drafting and execution.

Notes:

1. *Three projects from the SGM Implementation Grant Round 1 were not funded:*
    a. *MIUGSA Groundwater Extraction Measurement Program*
    b. *Deadman Creek Canal Off Stream Storage and Recharge*
    c. *Tri City's Water Recharge/Underground Storage Feasibility*
2. *Several additional projects from the SGM Implementation Grant Round 2 (not listed) were not funded. The application process was particularly competitive, with over $780 million in grant funds available and $187 million awarded.*

3.3 Implementation of Management Actions

The July 2022 updated Merced Subbasin GSP includes four Management Actions:

- Management Action 1: Water Allocation Framework
- Management Action 2: MSGSA Demand Reduction Program
- Management Action 3: Domestic Well Mitigation Program
- Management Action 4: Above Corcoran Sustainable Management Criteria Adjustment Consideration

Water Allocation Framework: An Ad Hoc Coordination Committee Working Group, supported by GSA staff, was previously established to conduct discussions on an initial framework. Currently, the GSAs are working individually within their own jurisdictions to develop GSA-specific demand reduction and water allocation programs, described immediately below for MSGSA and in Section 3.5.1 for MIUGSA. A formal allocation agreement between the GSAs for the Subbasin as a whole has not been developed and is not scheduled for the upcoming water year.

MSGSA Demand Reduction Program: The MSGSA has initiated a demand reduction program in recognition of the need to reduce groundwater pumping in the subbasin. On July 8, 2021, the MSGSA Board approved Resolution 2021-01 which described an objective that by WY 2025 the consumptive use of groundwater within the MSGSA will be reduced by a minimum of 15,000 AF annually, with this minimum to be increased annually thereafter.

The MSGSA has adopted a Two Phased GSP Implementation Approach, with Phase 1 focusing on land repurposing as a near-term option to achieve the WY 2025 objective, combined with importing surface water in the GSA (flood waters or purchased water). Phase 2 will involve increasing to substantially greater reductions by 2040.

Phase 1's voluntary land repurposing program was designed and launched in WY 2022 to encourage landowner participation through the use of an incentive payment system driven by landowner applications. A second round of applications were solicited and selected in WY 2023. Program metrics are summarized in the bullets below:

- First round of applications accepted in November 2022 and the MSGSA approved 16 applications, totaling 2,353 acres, in December 2022, which will begin land repurposing in WY 2023. These efforts are anticipated to reduce consumptive use of groundwater by 3,755 AF annually for 3 to 5 years.
- Second round of applications accepted in July 2023, and the MSGSA approved four applications, total 1,622 acres, in August 2023, which will begin land repurposing in WY 2024. These efforts are anticipated to reduce consumptive use of groundwater by 2,713 AF annually for 3 to 4 years.
- A third and final round of applications will be solicited and selected in 2024 for the remaining funding and authorized years of the program.

MSGSA is on track to adopt an Allocation Policy in July 2024, which is intended to be implemented and enforced starting in 2026. MSGSA expects to implement the allocation policy in combination with the

continued land repurposing/fallowing, including implementing an $8.89 million Department of Conservation Multibenefit Land Repurposing Program grant, and imported surface water. Development and implementation of this program is still ongoing: the GSA will continue to conduct analyses, develop policies, adopt procedures, establish monitoring and reporting tools, and conduct outreach.

Domestic Well Mitigation Plan: The July 2022 Revised GSP includes this new management action that involves the planned development of a domestic well mitigation program to respond to adverse impacts experienced by domestic well users where regional overdraft conditions occurring after 2015 are causing declining groundwater levels that interfere with groundwater production or quality. In WY 2022, as part of its Proposition 218 compliant funding mechanism for Phase 1, the MSGSA established a Domestic Well Mitigation Program Fund from which to address qualified mitigation efforts from the to-be-developed program and continues to collect funding for the Program.

No action has been taken since the prior WY 2022 on this management action.

Above Corcoran Sustainable Management Criteria Adjustment Consideration: The July 2022 Revised GSP includes this new management action which would consider an adjustment to the groundwater level sustainable management criteria for all or a portion of the Above Corcoran Clay Principal Aquifer. The Above Corcoran Clay Principal Aquifer has traditionally seen lower levels of use for water supply. As a result, minimum thresholds in this area are likely to be relatively high, as they are based on fall 2015 levels. A large component of the selection of fall 2015 as the minimum threshold was to limit impacts to domestic well users and to limit impacts of subsidence. Much of the Above Corcoran Clay Principal Aquifer has few domestic wells, and the Above Corcoran Clay Principal Aquifer is not thought to contribute to subsidence.

No action has been taken since the prior WY 2022 on this management action.

3.4 Progress Made on Addressing Recommended Corrective Actions

DWR's August 2023 GSP determination letter included nine recommended corrective actions (DWR, 2023). The GSAs anticipate responding to all recommended corrective actions in the 5-year GSP Update which is projected to be completed in January 2025. A high-level summary of the recommended corrective actions is provided in the bullets below. Note that DWR's determination letter includes more details on several of the recommended corrective actions; the list is intended to be a high-level summary only.

1. Implement the Domestic Well Mitigation Program and evaluate impacts to water quality because of continued overdraft during GSP implementation before the sustainability goal is achieved.

2. Evaluate potential impacts to domestic wells because of continued overdraft during GSP implementation before the sustainability goal is achieved.

3. Identify total cumulative subsidence tolerable by critical infrastructure and revise how the level of uncertainty is accounted for in the definition of sustainable management criteria of land subsidence.

4. Investigate wells pumping from below the bottom of the basin.

5. Establish sustainable management criteria for groundwater storage.

6. Explain and justify the selection of the sustainable management criteria for degradation of water quality, particularly with respect to constituents of concern and undesirable results and minimum thresholds.

7. Work towards establishing sustainable management criteria for the interconnected surface water sustainability indicator.

8. Fill data gaps within the groundwater levels monitoring network.

9. Provide an explanation of how the timing and quantified benefits of project and management actions will be conducted to reach sustainability by 2040.

3.5 Additional Implementation Support Activities

Additional activities have taken place within or just after the Annual Reporting period that contribute to the overall GSP implementation progress. These are described below in Section 3.5.1, while Section 3.5.2 includes the MercedWRM update for WY 2023.

3.5.1 Other Implementation Activities

Interbasin Coordination: The GSAs continued interbasin coordination efforts including a May 2023 meeting with the Chowchilla Subbasin to discuss the Merced GSP's approach to Interim Milestones. The GSAs also met with the Delta-Mendota Subbasin in August 2023 to coordinate on future monitoring well locations along the San Joaquin River, with a focus on the interconnected surface water sustainability indicator.

MIUGSA Development of Guidelines for GSP Implementation: In June 2021, MIUGSA published a Public Involvement Plan and formed a Stakeholder Guidance Committee (SGC) to "facilitate communication, provide for the dissemination of information and involvement" (MIUGSA, 2021) between the SGC and the MIUGSA Board during the implementation of the GSP. The SGC met 10/12/21, 3/9/22, and 5/4/22 in WY 2022 to provide input on draft water management actions, such as methods to monitor groundwater use, a water use accounting system for tracking water use and trading water, water allocation approaches and rules, and enforcement and penalties for overuse.

In May 2022, the MIUGSA Board adopted a groundwater allocation considered consistent with the GSP's sustainable yield, in effect from April 2023 through December 2025, of 3.3 AF/acre over three years (1.1 AF/acre per year on average). On October 12, 2022, a well registration program was also adopted, with a goal of establishing an online platform and procedure to register all wells in the GSA prior to December 31, 2025. Significant progress was made in WY 2023 to register wells; registration is ongoing.

In October 2023, MIUGSA finalized and adopted comprehensive Rules, Regulations, and a Groundwater Management Implementation Plan that establish the framework for measuring, monitoring, and enforcing the groundwater allocation. MIUGSA will continue working with stakeholders to analyze and vet policies for the future use of flow meters. Until then, initial groundwater use measurements will be made using remote sensing technology (satellite imagery). MIUGSA intends to make groundwater use measurements available to individual users within the GSA to better track and understand their water usage (MIUGSA, 2022).

3.5.2 MercedWRM Update (Water Year 2023)

The MercedWRM was originally developed and calibrated to model historical groundwater storage from water years (WY) 1996-2015, updated with WY 2015-2019 data in the 2020 annual report, and updated yearly for each following annual report. The model was updated for the current annual report to reflect more recent data. Data from WY 2023 were collected from the same public and private sources that had provided the historical data through WY 2020 used in the GSP and previous annual reports. The historical water budget was extended through WY 2023, including an updated estimate of the change in groundwater storage reflecting the latest data.

The WY 2023 continuation of the historical water budget is intended to further evaluate the aquifer system under a variety of hydrological and anthropogenic conditions. The full annual groundwater budget for WY 1996-2023 is shown earlier in Figure 2-7.

Data Sources

Data were requested and received from the following entities in the Subbasin to complete the MercedWRM update:

Agricultural and Environmental Water Purveyors

- Merced Irrigation District
- Stevinson Water District
- Merquin County Water District
- Turner Island Water District
- Lone Tree Mutual Water Company
- Merced National Wildlife Refuge

Urban Water Purveyors

- City of Merced
- City of Atwater
- City of Livingston
- Le Grand Community Services District
- Planada Community Services District
- Winton Water and Sanitary District
- California American Water, Meadowbrook

Additional publicly available data were downloaded to complete the MercedWRM update:

State

- DWR SGMA Data Viewer
- DWR California Data Exchange Center (CDEC)

Federal

- United States Department of Agriculture, Natural Resources Conservation Service, National Agricultural Statistics Service (NRCS): CropScape
- United States Geological Survey (USGS) National Water Information System

- United States Census Bureau

Other

- Precipitation-Elevation Regressions on Independent Slopes Model (PRISM) Climate Group, Oregon State University

Updated Components

The above data sources provided the necessary data to allow the historical model run to reflect the most recent conditions. The following components of the model were updated for the annual report.

Surface Water Diversions and Deliveries: Monthly surface water diversions and deliveries were provided for October 2022 through September 2023 by MID, TIWD, Stevinson Water District, Merquin County Water District, and Lone Tree Mutual Water Company. MID deliveries were aggregated at the subregional level for both in- and out-of-district sales, whereas the other water agencies were summarized within their boundaries.

Groundwater Pumping: Groundwater extractions from October 2022 to September 2023 were provided by all agricultural and urban water purveyors listed in Section 2.3. Agency pumping by MID and TIWD were simulated using measured data at each production well whereas other entities have pumping aggregated evenly across their institutional boundaries based on aggregate reported data. Pumping estimates were made for private agriculture and domestic wells based on land use type and population.

Population: The City of Merced's population was based on a summary generated by the city based on California Department of Finance data. For the City of Atwater and the City of Livingston, populations were updated based on data publicly available from the US Census online database (2021 actual and 2022 estimate prepared by US Census Bureau). Rural population updates for previous model updates have typically been extracted from census block data. However, at the time of the model update these had not yet been updated based on the most recent 2020 census data, thus populations were projected based on historical trends.

Land Use: Each element within the MercedWRM is comprised of some fraction of 14 land uses, including 11 agricultural crop categories, native vegetation, riparian vegetation, and urban. For the 2023 update, the model utilizes annual data based on the NRCS CropScape program which provides data throughout the model domain on a gridded resolution of 30 meters.

Precipitation: Monthly precipitation into the Subbasin and its watersheds was derived on a four-kilometer grid using the Precipitation-Elevation Regressions on Independent Slopes Model (PRISM) dataset available online from Oregon State University through a partnership the NRCS National Water and Climate Center.

Streamflow: Monthly inflow to the Merced Subbasin was downloaded for the San Joaquin River from the USGS and from CDEC for Merced River, Bear Creek, Owens Creek, and Mariposa Creek. Chowchilla River flows were estimated based on similar months and water year types from historical USGS gauge data. Non-gauged tributaries into the Subbasin were estimated internally by the model using the Integrated Water Flow Model (IWFM) small-watershed package.

Boundary Conditions: Groundwater elevation contours were downloaded from DWR's SGMA Data Viewer for fall 2022 and spring 2023 and used to update the assumed groundwater elevation boundary conditions

in the model. As groundwater level contours are only available in semiannual intervals, intermediary months were estimated though linear interpolation.

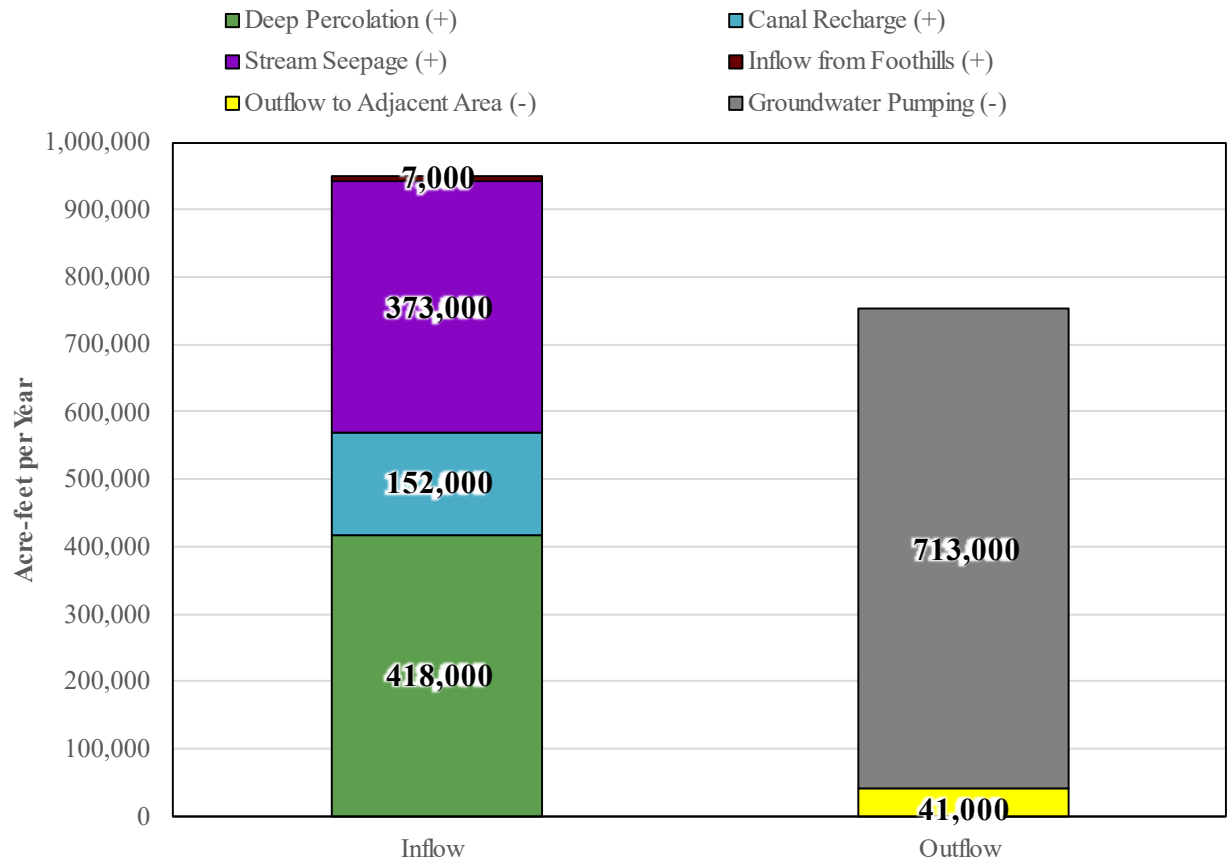
Canal Recharge: The MercedWRM estimates MID canal recharge based on historical monthly diversions and the water year index. An in-depth analysis of MID operational water budgets was developed as part of MID's 2020 Agricultural Water Management Plan (AWMP) (MID, 2021). As a result, the MercedWRM may be updated with further refined datasets in the future. SWD and TIWD have also estimated seepage from unlined canals due to their conveyance of developed supply as described in the GSP Section 6.2.

Interbasin Flows: The MercedWRM simulates groundwater flow between the Merced Subbasin and the neighboring subbasins to the north (Turlock), west (Delta-Mendota) and south (Chowchilla). The rate and direction of this interbasin subsurface flow depends on the groundwater operations and levels during the historical and projected periods on both sides of the boundary. The MercedWRM has been calibrated using limited available data for areas in the vicinity of the boundaries in neighboring subbasins. During the development of the Merced Subbasin GSP, there was no information on the projected conditions from the neighboring subbasins. Modeling for the Merced GSP shows net flows from the Merced Subbasin to the Turlock Subbasin. All neighboring subbasins have now completed their GSP or have relatively recently completed their GSP; thus, it is expected that additional data and/or assumptions on the groundwater operations will be available from the neighboring subbasins for future updates of the model and assessments of the Merced Subbasin sustainability conditions. Interbasin coordination meetings have been held with all three surrounding subbasins, and coordination agreements have been put in place with the Turlock and Chowchilla Subbasins to facilitate such exchange of data and information. Additionally, the GSAs have received grant funding (from the Round 1 Sustainable Groundwater Management Implementation Planning and Projects Grant) for a Merced Subbasin Integrated Managed Aquifer Recharge (MAR) Evaluation Tool (MercedMAR) which will involve MercedWRM enhancements that update subsurface flows to/from Turlock, Delta Mendota, and Chowchilla subbasins. Work began in 2023.

Results

Evaluation of WY 2023 (Figure 3-1) shows that the Merced Subbasin experienced net 950,000 AF of inflows and 772,000 AF of outflow. Net-recharge from the stream and canal systems (525,000 AFY = 373,000 AFY streams + 152,000 AFY canals) is the largest contributor of groundwater inflow, followed by deep percolation from rainfall and irrigation applied water (418,000 AFY) and net-subsurface inflows from local subbasins and the Sierra Nevada foothills (7,000 AFY). Groundwater production (713,000 AFY) accounts for the greatest outflow from the Merced Subbasin, followed by outflow to adjacent areas (41,000 AFY) and outflow to root zone (18,000 AFY).

Figure 3-1: Annual Estimated Groundwater Budget 2023, Merced Subbasin



3.6 Activities Anticipated for the Coming Year

The Merced GSAs intend to continue activities necessary to implement the GSP and put the Subbasin on a path toward sustainable management through the activities described in the subsections below. The majority of WY 2024 will involve the GSP periodic evaluation and update which will be submitted to DWR in January 2025.

Project Implementation

Implementation continues for various grant-funded activities described in more detail in Section 3.2, including numerous projects to increase recharge and to improve the understanding of the groundwater system.

Water Allocation & Demand Reduction

All three GSAs plan to continue making progress on internal GSA plans for pumping reductions and GSA-specific water allocation frameworks.

The MSGSA will continue developing the Demand Reduction Program, by conducting analyses, developing additional policies, adopting procedures, establishing monitoring and reporting tools, and conducting

outreach. The MSGSA will focus on implementing the Two Phased GSP Implementation Approach which was adopted via resolution in November 2021. Phase 1 activities include the continued implementation of the Land Repurposing Program and making parcel-based water budgets available to growers through the Groundwater Accounting Platform. Phase 2 will kick off with the anticipated adoption of the Allocation Policy in July 2024 and adoption of fees and penalties in 2025, in order to fully implement and enforce an Allocation Policy in 2026. Additionally, MSGSA will continue to implement land repurposing through the recently awarded $8.89 million Multibenefit Land Repurposing Program grant from the California Department of Conservation.

It is anticipated that MIUGSA will actively monitor and enforce the allocation and registration policies that were adopted in WY 2022 and will continue to develop and adopt additional Rules and Regulations, and various policies for implementation of the Merced GSP within MIUGSA's boundaries during WY 2024.

4. REFERENCES

American Public Health Association, American Water Works Association, and Water Environment Foundation. (1999). Standard Methods for the Examination of Water and Wastewater. Retrieved Feb 15, 2022, from https://beta-static.fishersci.com/content/dam/fishersci/en_US/documents/programs/scientific/technical-documents/white-papers/apha-water-testing-standard-methods-introduction-white-paper.pdf

BYU Hydroinformatics Laboratory. (n.d.). *Groundwater Data Mapping Application*. Retrieved February 24, 2022, from http://hydroinf.groups.et.byu.net/servir-wa/gwdm/index.php

Central Valley Groundwater Monitoring Collaboriatve. (2021). *Five-Year Assessment Report*.

DWR. (2017). *Best Management Practices for the Sustainable Management of Groundwater: Sustainable Management Criteria (DRAFT).* Retrieved from https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-6-Sustainable-Management-Criteria-DRAFT_ay_19.pdf

DWR. (2021). *SGM Grant Program SGMA Implementation Proposal Solicitation Package.* Retrieved from https://water.ca.gov/-/media/DWR-Website/Web-Pages/Work-With-Us/Grants-And-Loans/Sustainable-Groundwater/Files/2021-SGMA-Imp-General-Funds/sgma-implementation_final-psp_dec2021.pdf

DWR. (2023). Approved Determined of the Revised Groundwater Sustainability Plan Submitted for the San Joaquin Valley - Merced Subbasin. Sacramento, CA. Retrieved from https://sgma.water.ca.gov/portal/service/gspdocument/download/9583

DWR. (2024a). *Chronological Reconstructed Sacramento and San Joaquin Valley Water Year Hydrologic Classifications Indices.* Retrieved February 2023, from http://cdec.water.ca.gov/reportapp/javareports?name=WSIHIST

DWR. (2024b). *Water Supply Index (WSI) Forecasts: 2024 Water Year Hydrologic Classification Indicies.* Retrieved February 2023, from http://cdec.water.ca.gov/reportapp/javareports?name=WSI

ESJWQC. (2018, February). Groundwater Quality Trend Monitoring Workplan: Phase III. *Specific Network Wells*. East San Joaquin Water Quality Coalition. Retrieved from https://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/water_quality/coalitions_submittals/east_sanjoaquin/ground_water/2018_0302_esj_gqtmp_ph3.pdf

ESJWQC. (2020). *Annual Groundwater Quality Trend Monitoring Report.*

MID. (2021). *2020 Agricultural Water Management Plan.* Retrieved from http://www.mercedid.com/default/assets/File/2020%20Merced%20ID%20AWMP_Public%20Final.pdf

MIUGSA. (2021). *Public Involvement Plan to Support Implementatino of the Merced Subbasin Groundwater Sustainability Plan.* Retrieved from https://www.miugsa.org/s/Public-Involvement-Plan.pdf

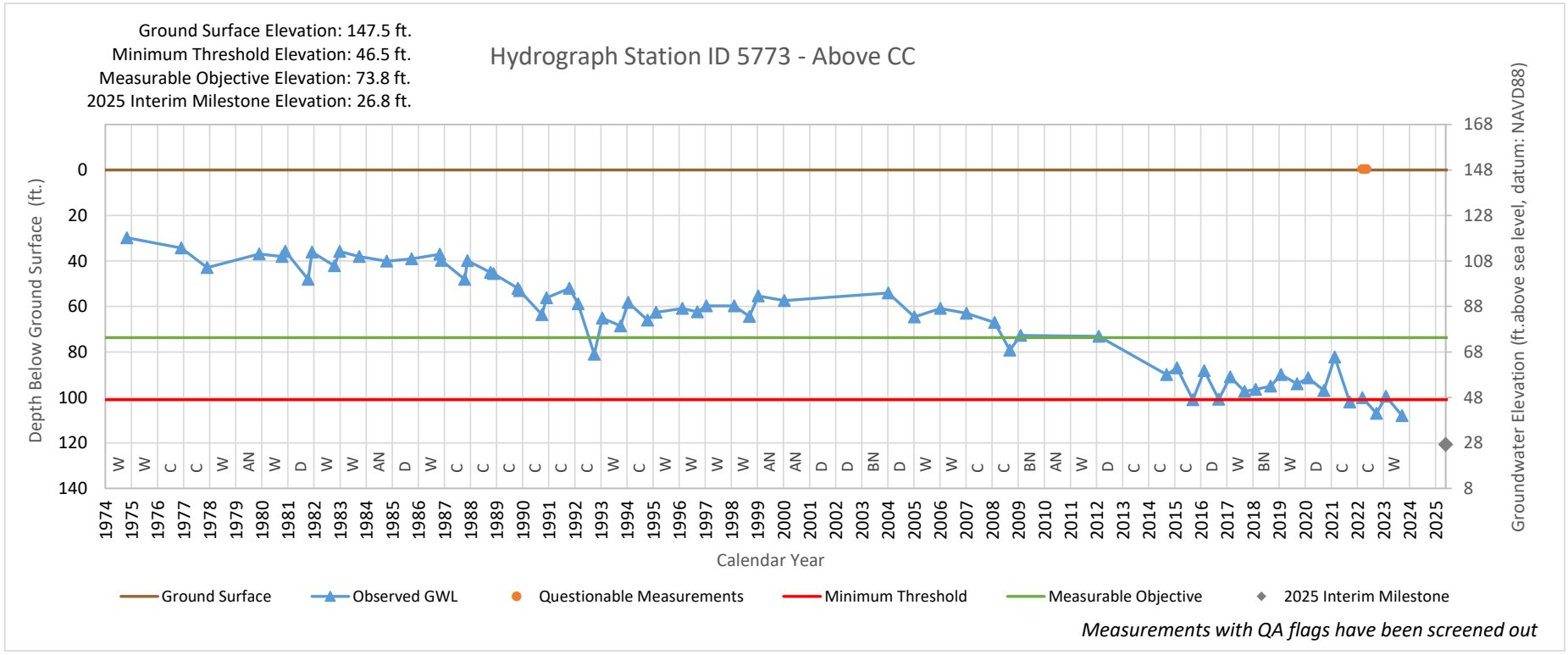
MIUGSA. (2022). Merced Irrigation-Urban GSA Sets New Agriculture Pumping Regulations. Retrieved Feb 22, 2023, from https://www.miugsa.org/s/Fall2022_FinalNewsletter_web.pdf

MIUGSA, MSGSA, & TIWD GSA-1. (2019). *Merced Groundwater Subbasin Groundwater Sustainability Plan.*

MIUGSA, MSGSA, & TIWD GSA-1. (2022). Merced Groundwater Subbasin Groundwater Sustainability Plan. Retrieved from http://www.mercedsgma.org/assets/pdf/gsp-sections/revised/Merced-Subbasin-GSP_July-2022-Update_without-appendices.pdf

SWRCB. (2004, Apr 27). DQM Information Paper 3.1.3: Conductivity/Salinity Measurement Principles and Methods. *The Clean Water Team Guidance Compendium for Watershed Monitoring and Assessment*. Sacramento, CA. Retrieved Feb 15, 2022, from https://www.waterboards.ca.gov/water_issues/programs/swamp/docs/cwt/guidance/313.pdf

APPENDIX A: HYDROGRAPHS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Minimum Threshold
Measurable Objective
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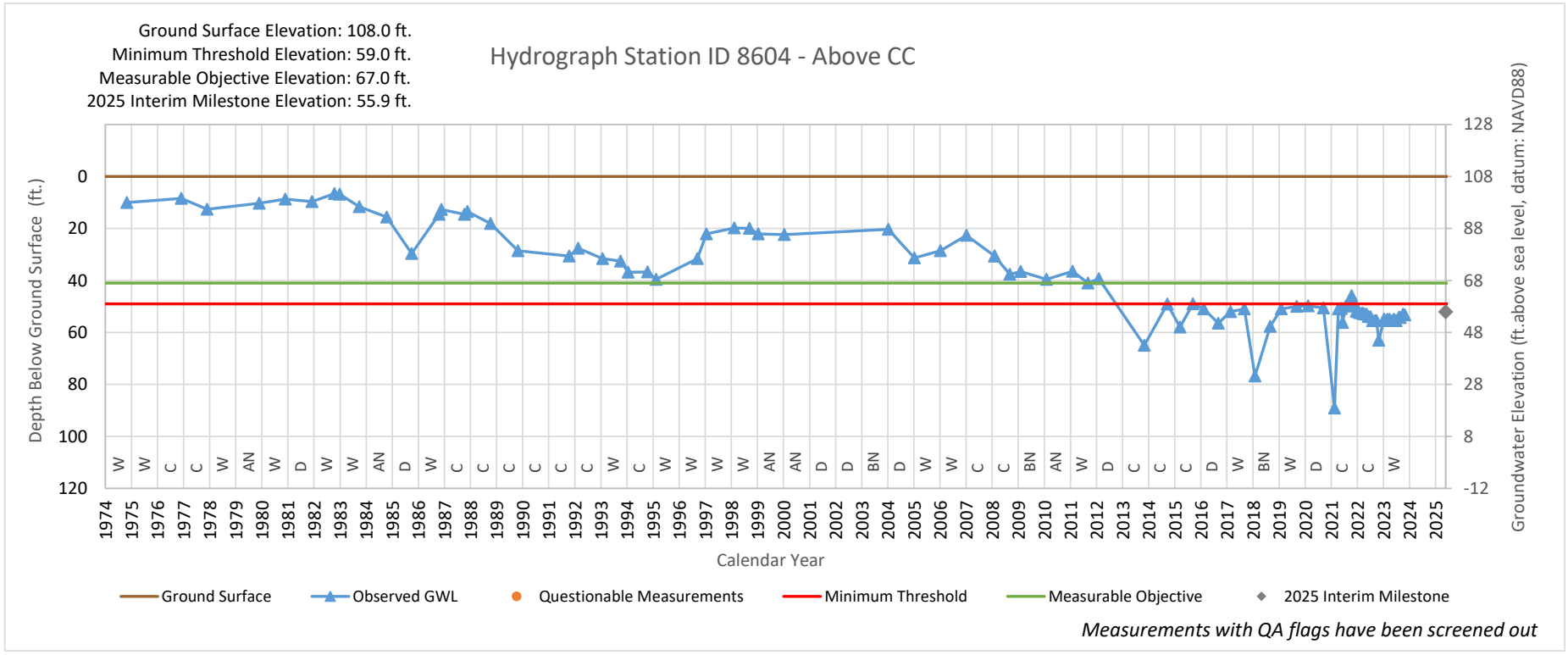
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Groundwater Elevation (ft.above sea level, datum: NAVD88)
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Observed GWL
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Minimum Threshold
Measurable Objective
2025 Interim Milestone
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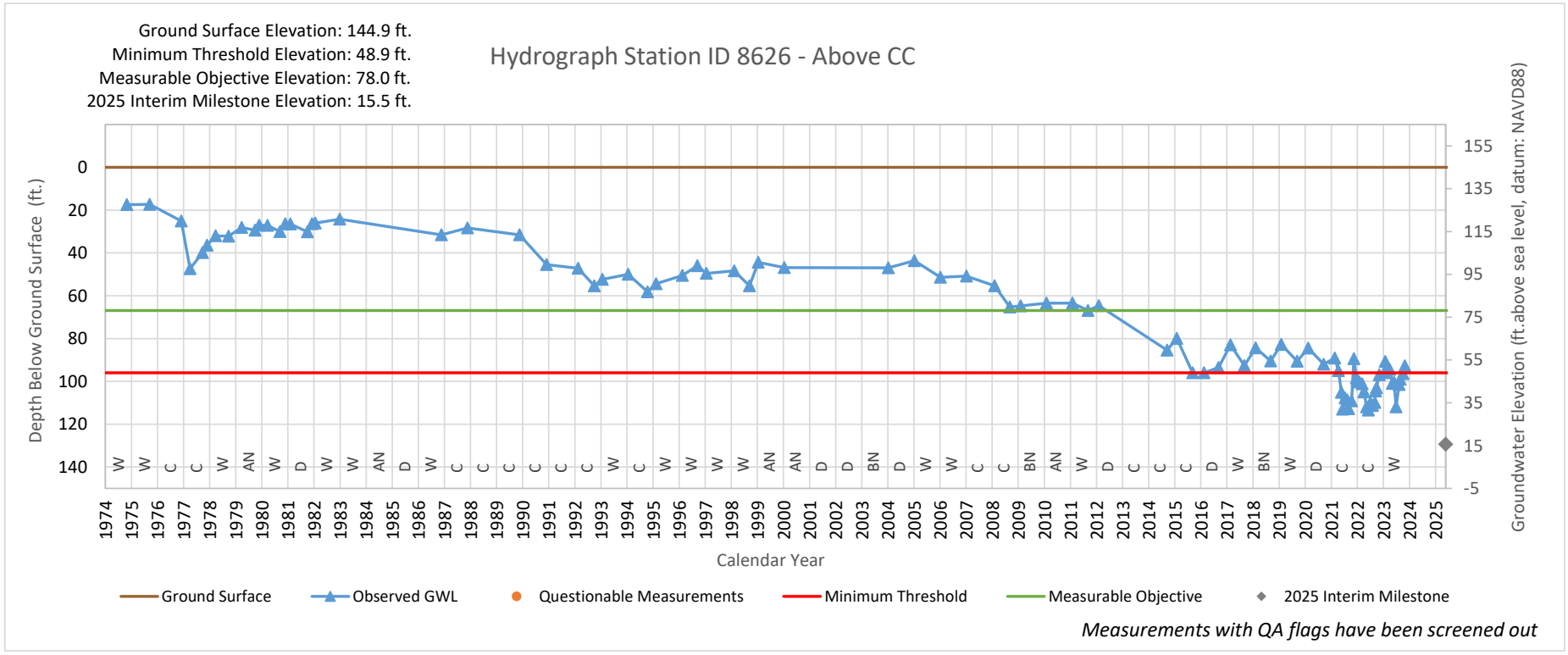
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Ground Surface
Observed GWL
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Minimum Threshold
Measurable Objective
2025 Interim Milestone
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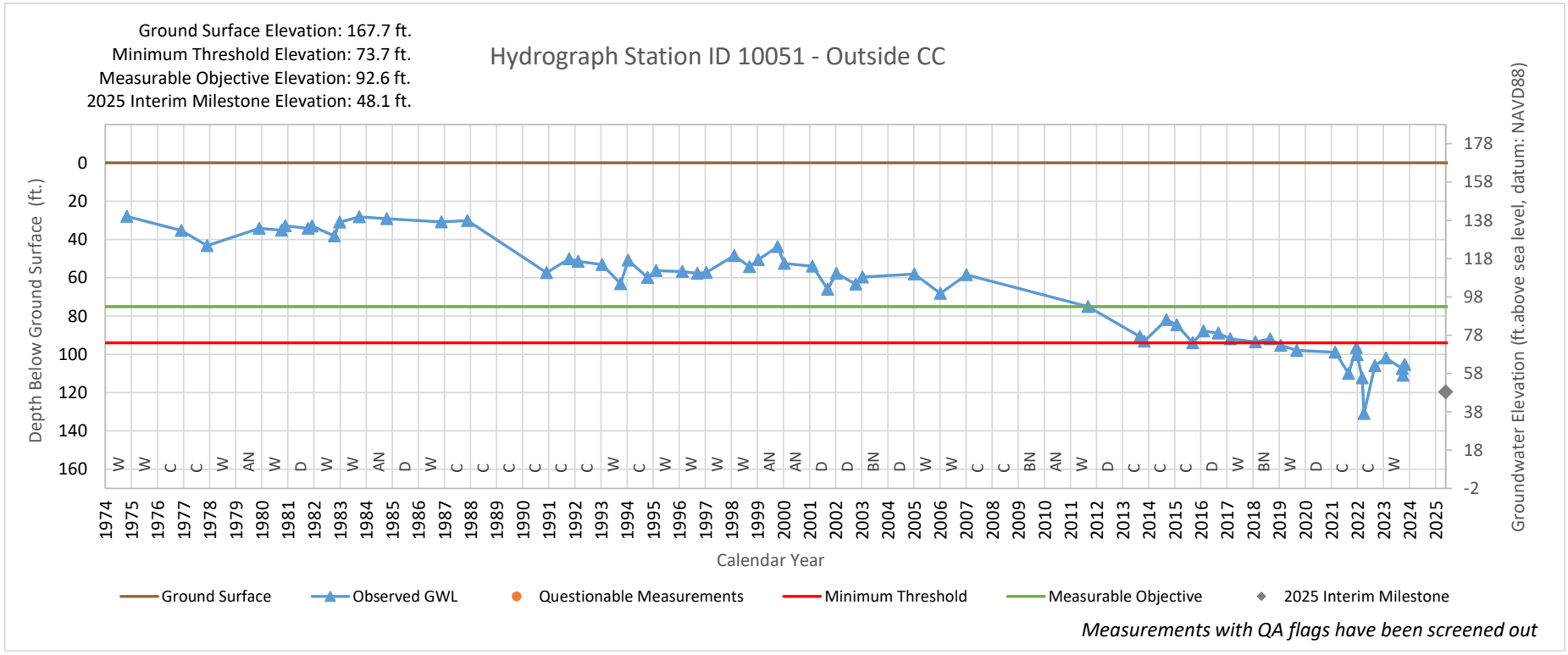
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Groundwater Elevation (ft.above sea level, datum: NAVD88)
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Observed GWL
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Minimum Threshold
Measurable Objective
2025 Interim Milestone
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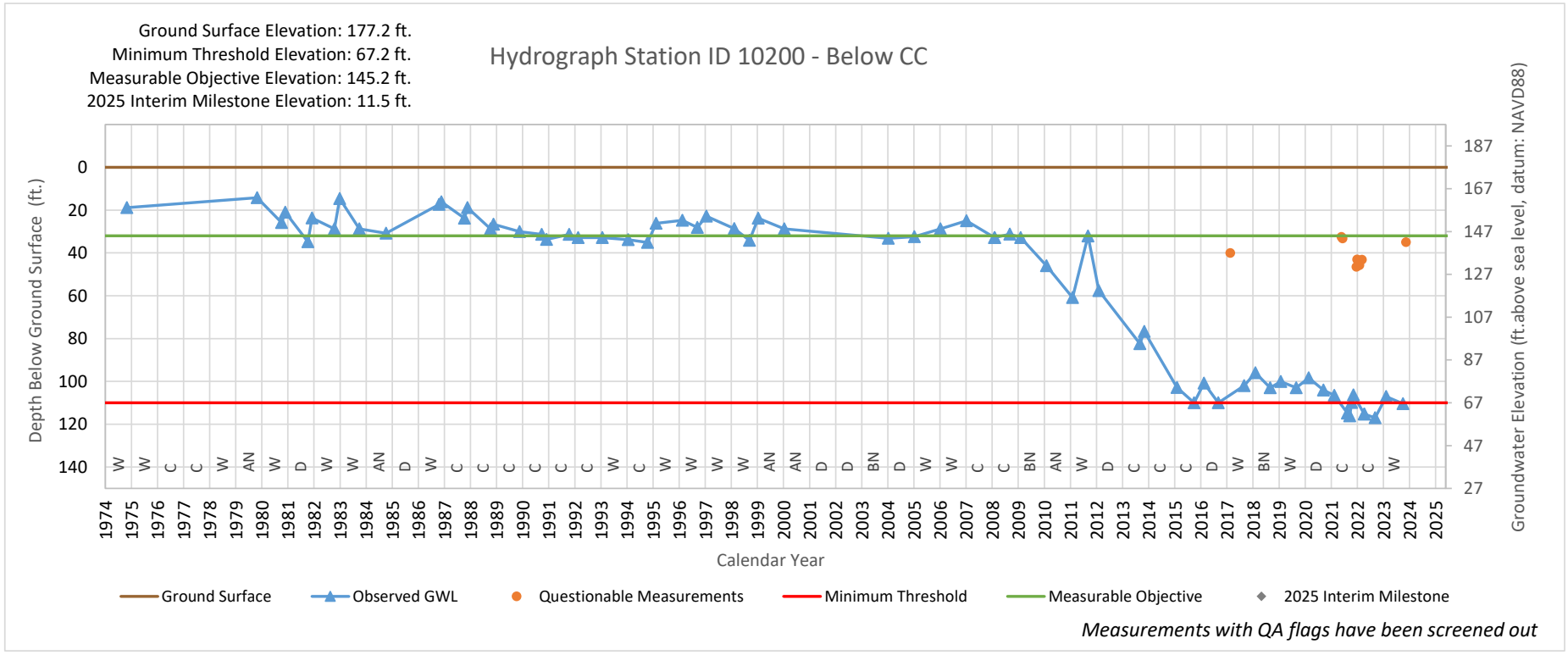
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Groundwater Elevation (ft.above sea level, datum: NAVD88)
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Observed GWL
Questionable Measurements
Minimum Threshold
Measurable Objective
2025 Interim Milestone
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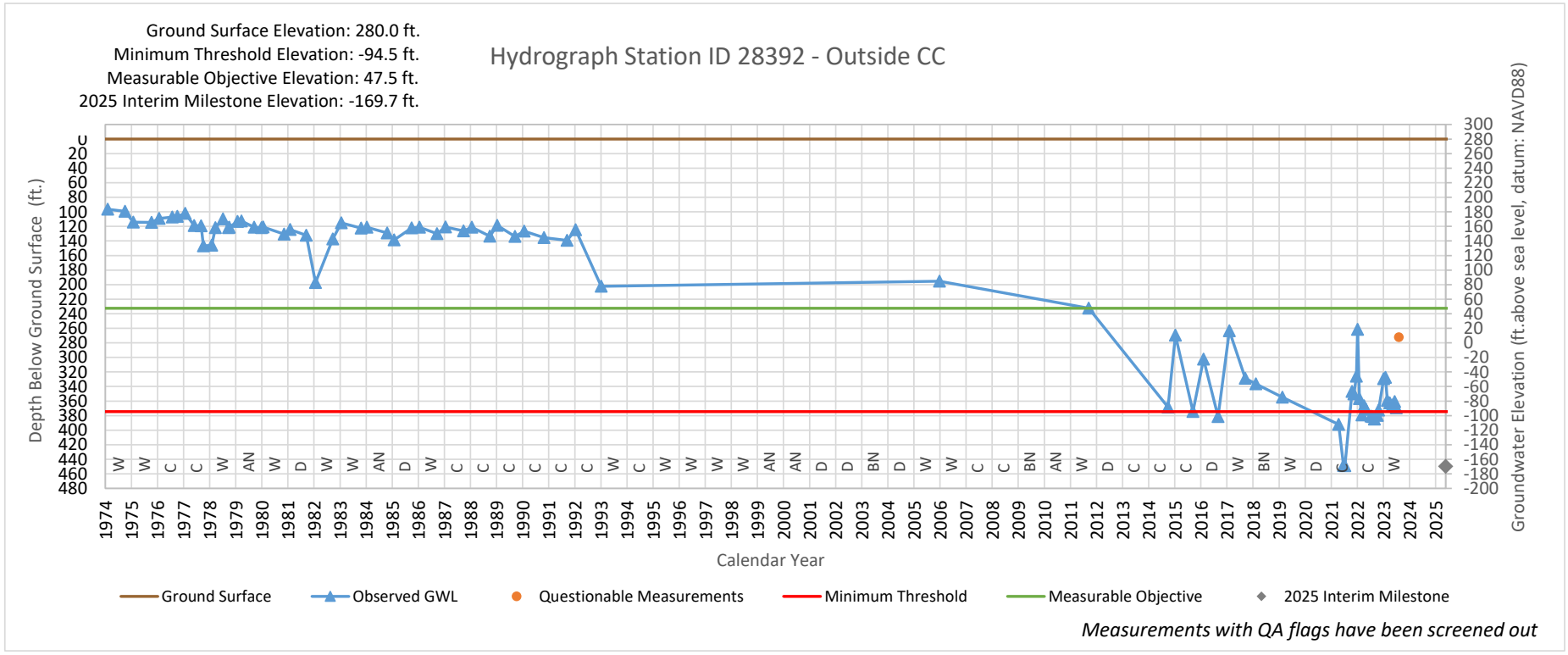
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Ground Surface
Observed GWL
Questionable Measurements
Minimum Threshold
Measurable Objective
2025 Interim Milestone
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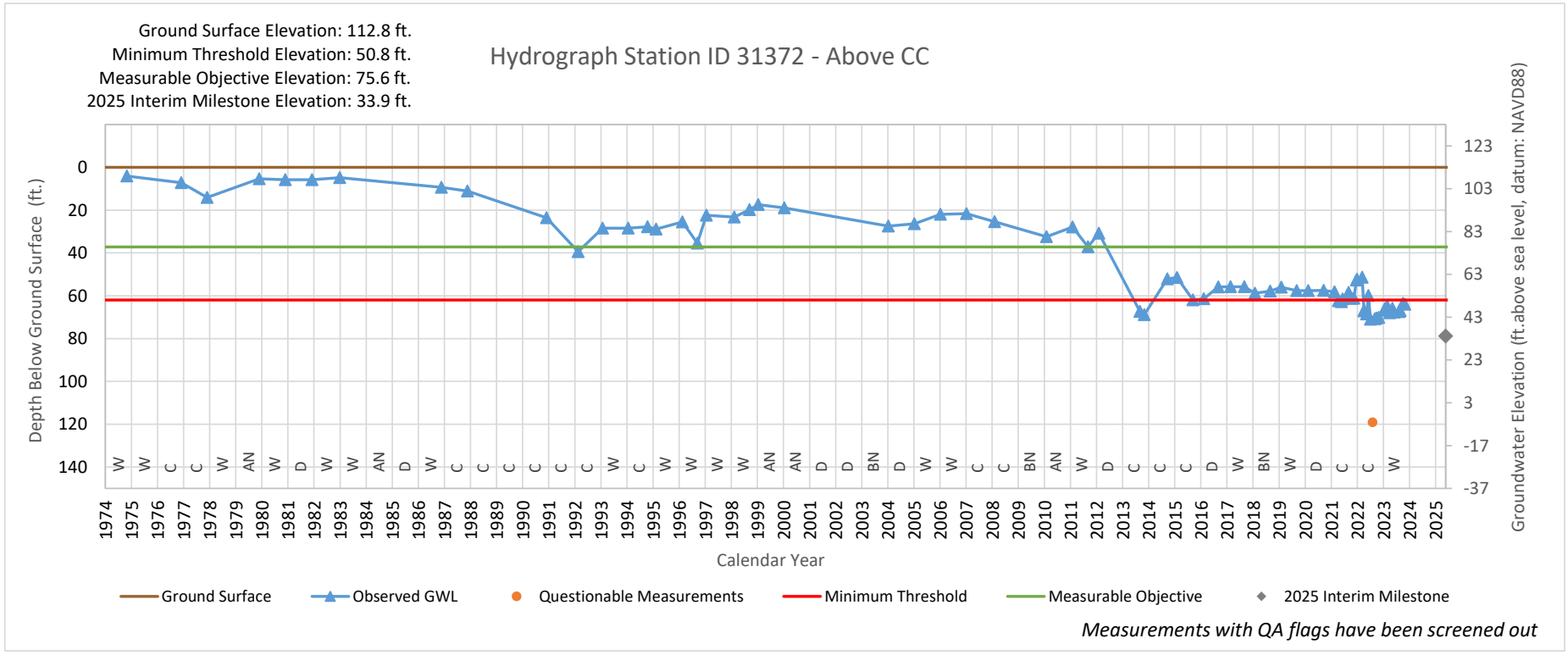
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Groundwater Elevation (ft.above sea level, datum: NAVD88)
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Ground Surface
Observed GWL
Questionable Measurements
Minimum Threshold
Measurable Objective
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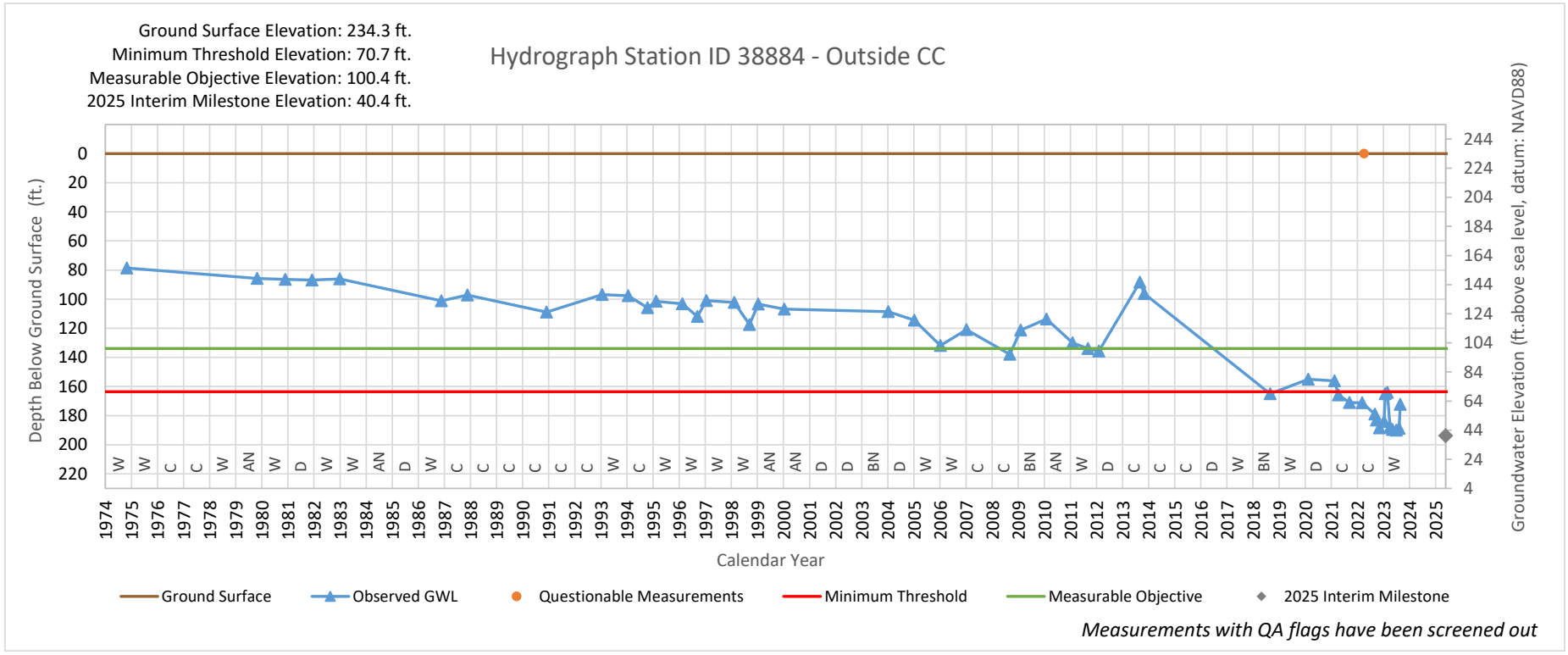
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Ground Surface
Observed GWL
Questionable Measurements
Minimum Threshold
Measurable Objective
2025 Interim Milestone
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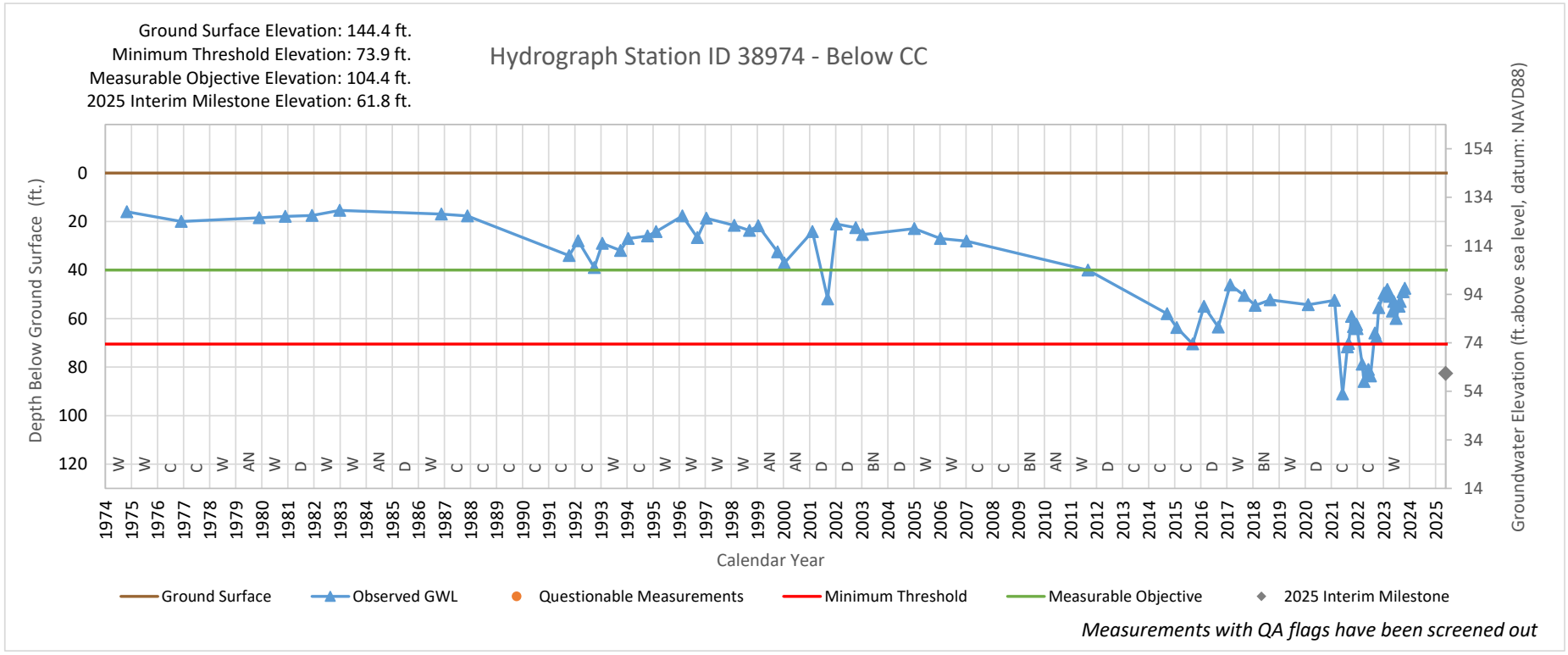
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Observed GWL
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Minimum Threshold
Measurable Objective
2025 Interim Milestone
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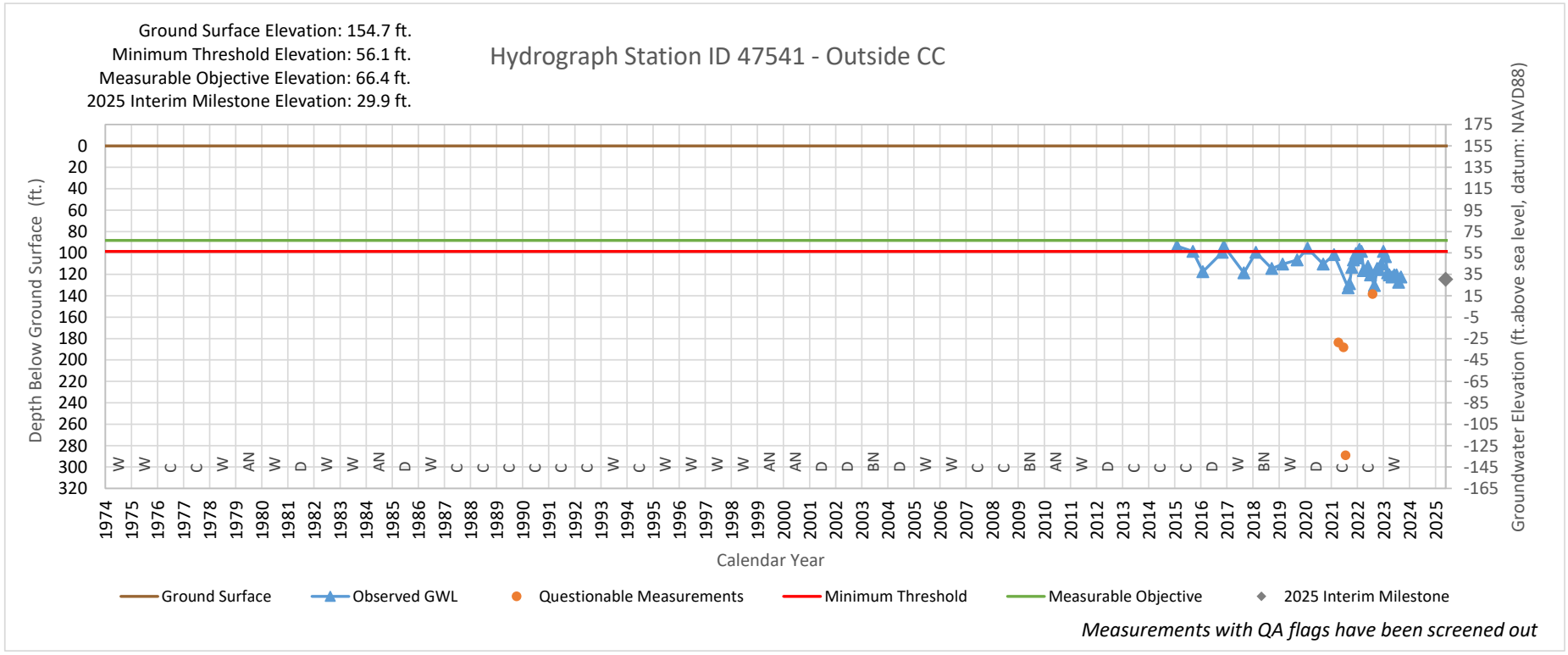
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Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Minimum Threshold
Measurable Objective
2025 Interim Milestone
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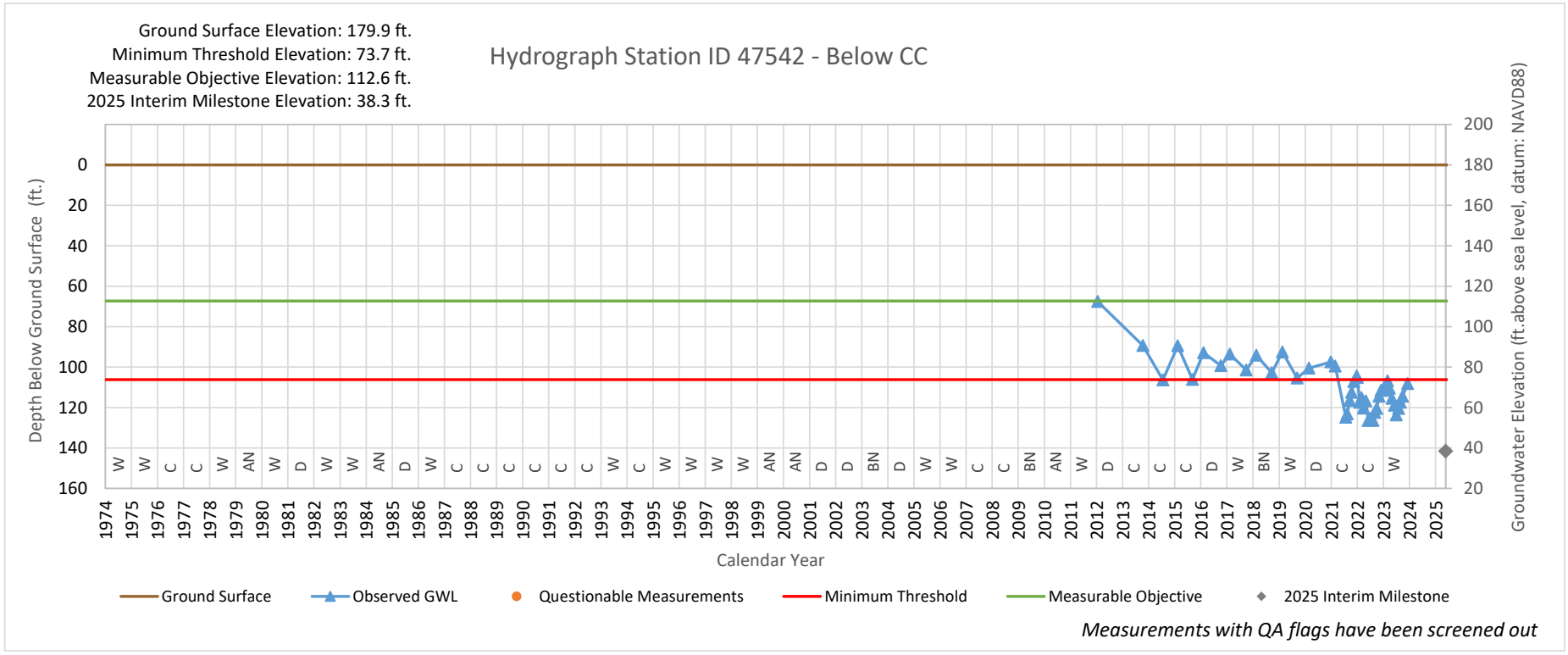
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Groundwater Elevation (ft.above sea level, datum: NAVD88)
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Minimum Threshold
Measurable Objective
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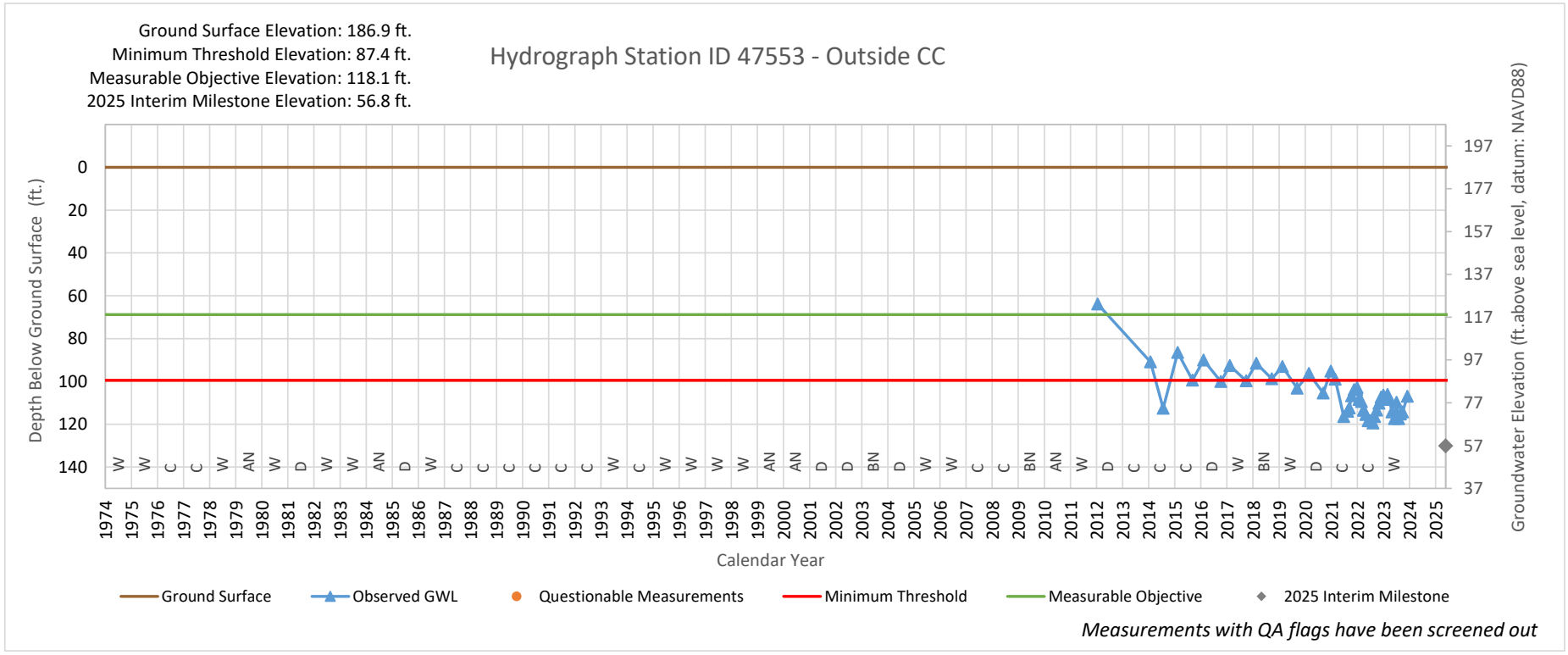
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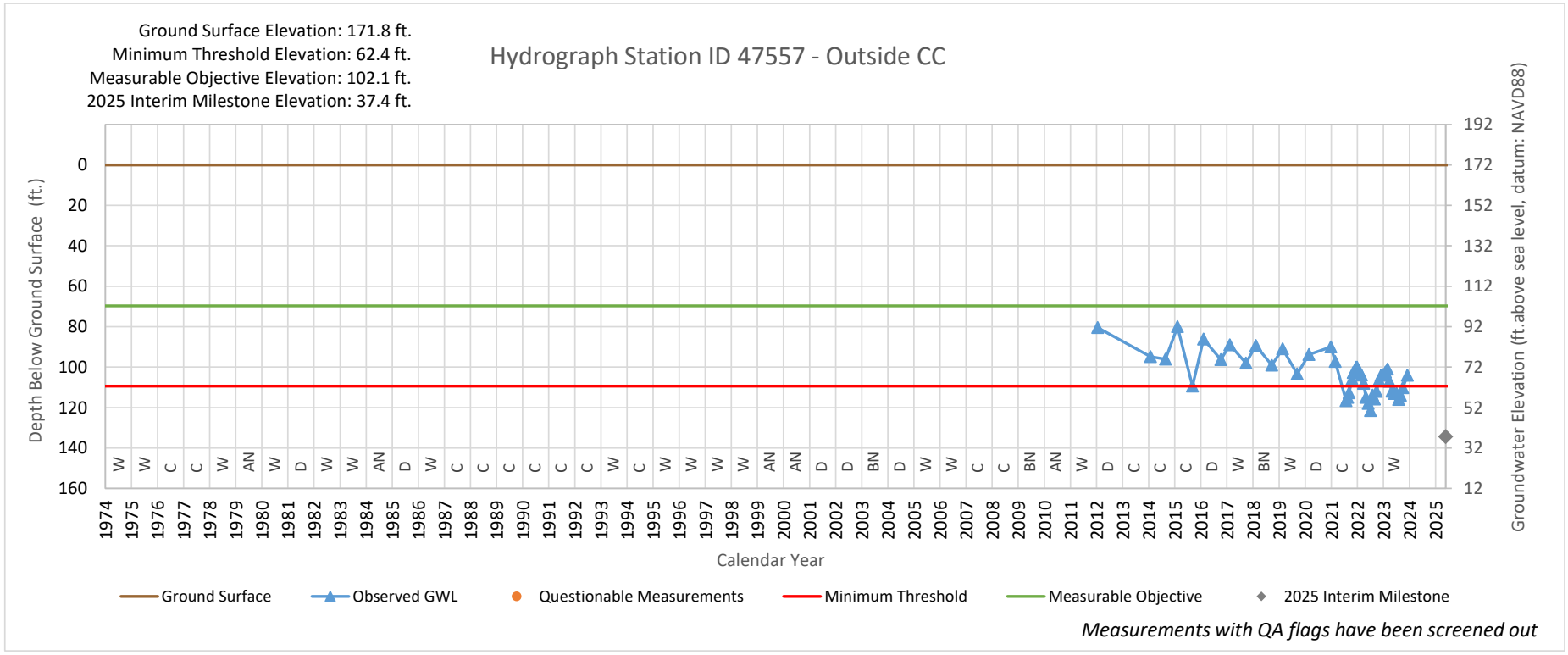
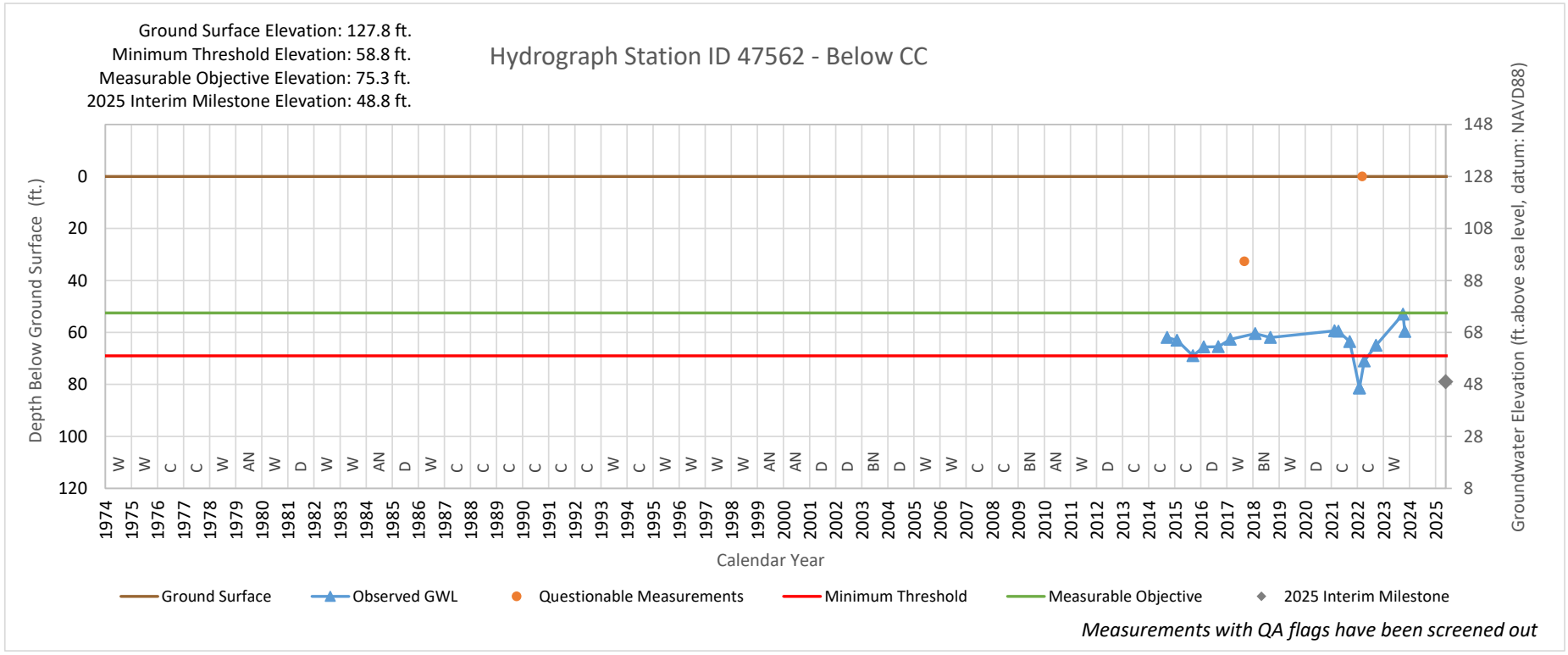
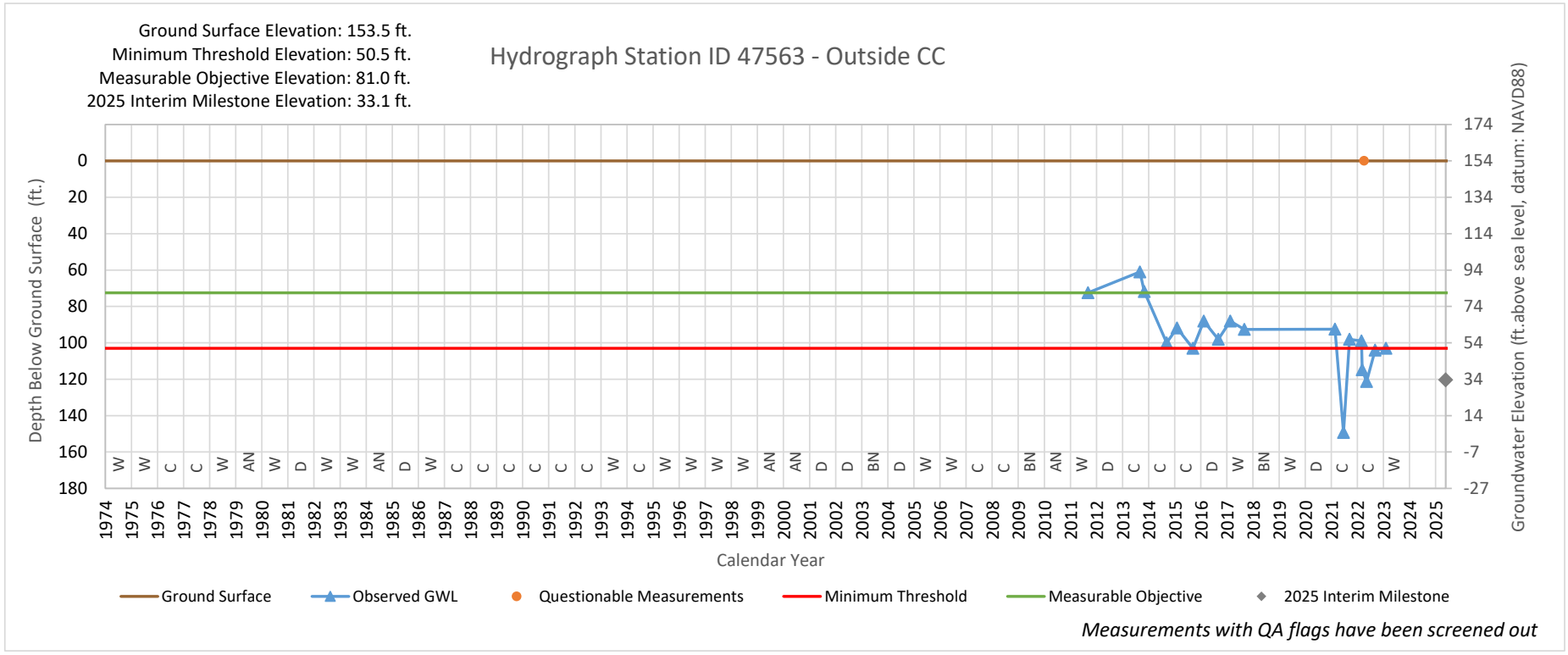
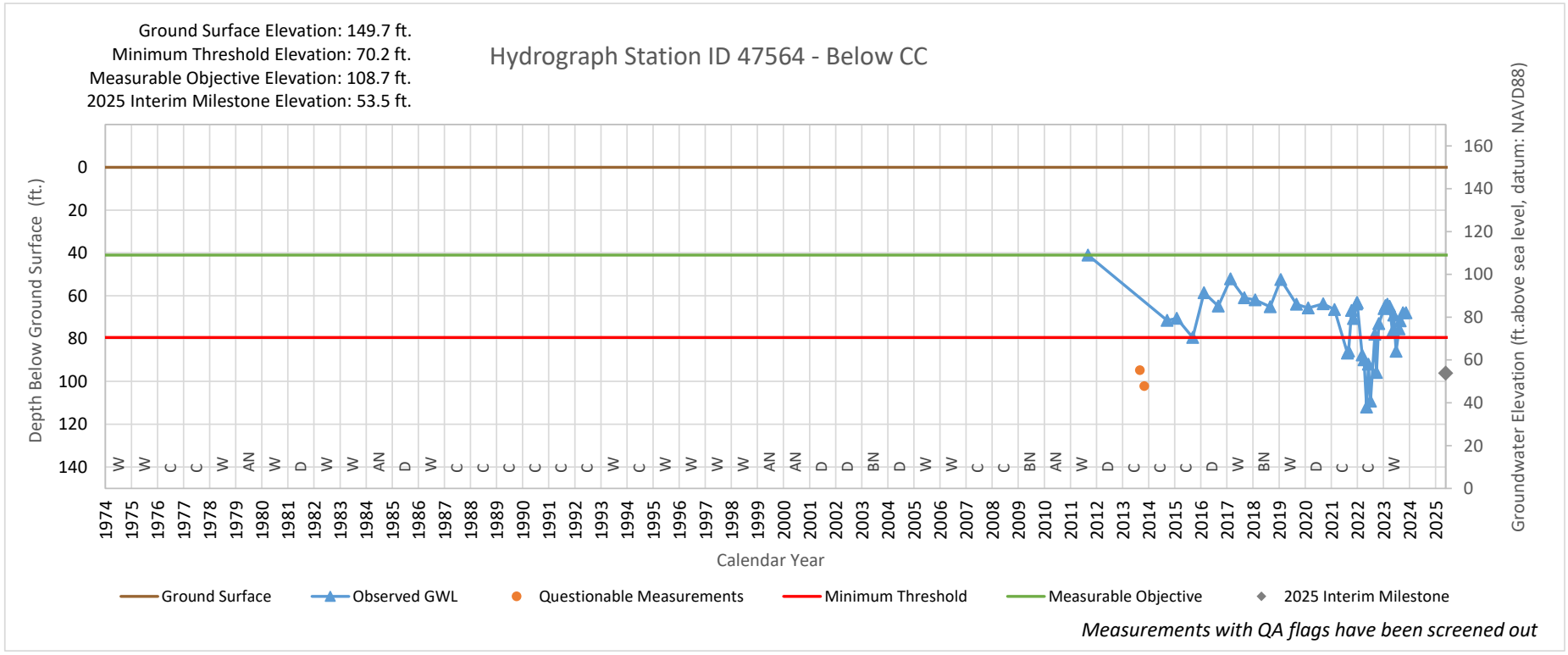
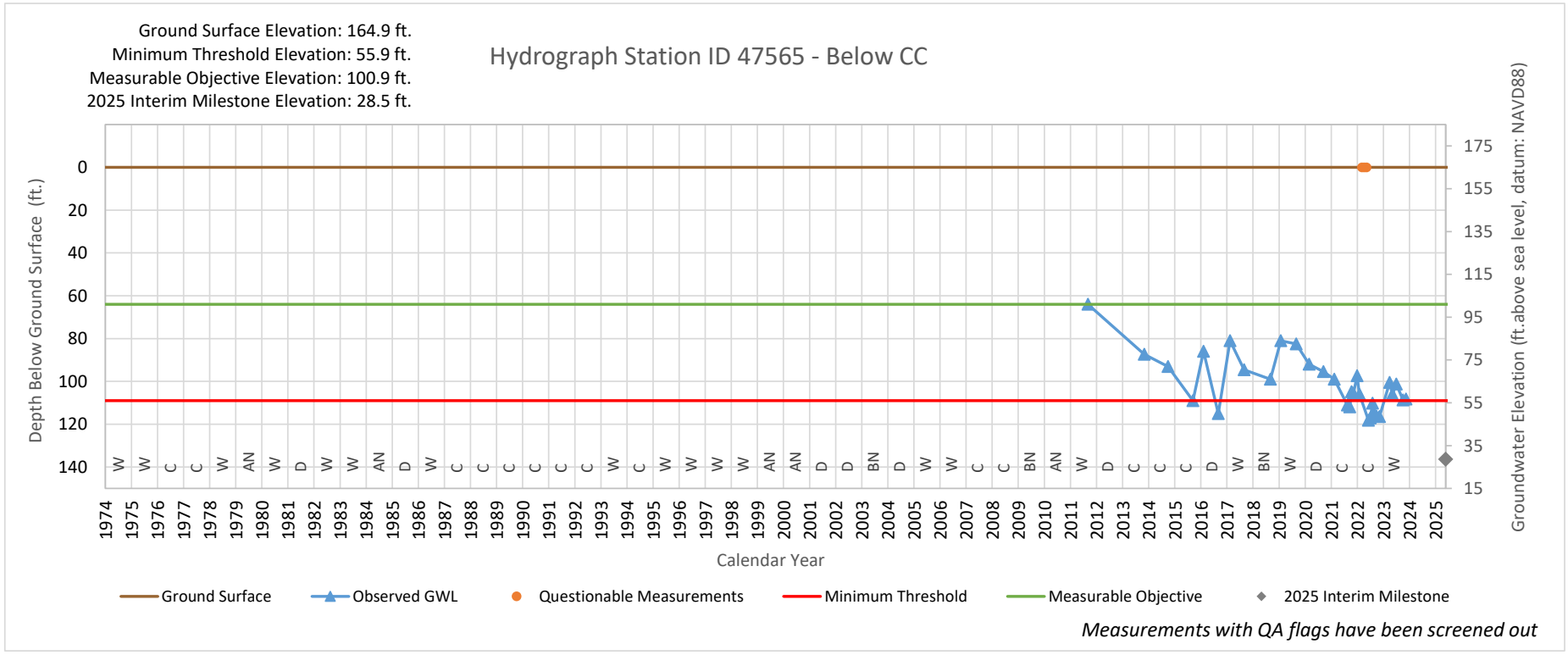
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Minimum Threshold
Measurable Objective
2025 Interim Milestone
Measurements with QA flags have been screened out

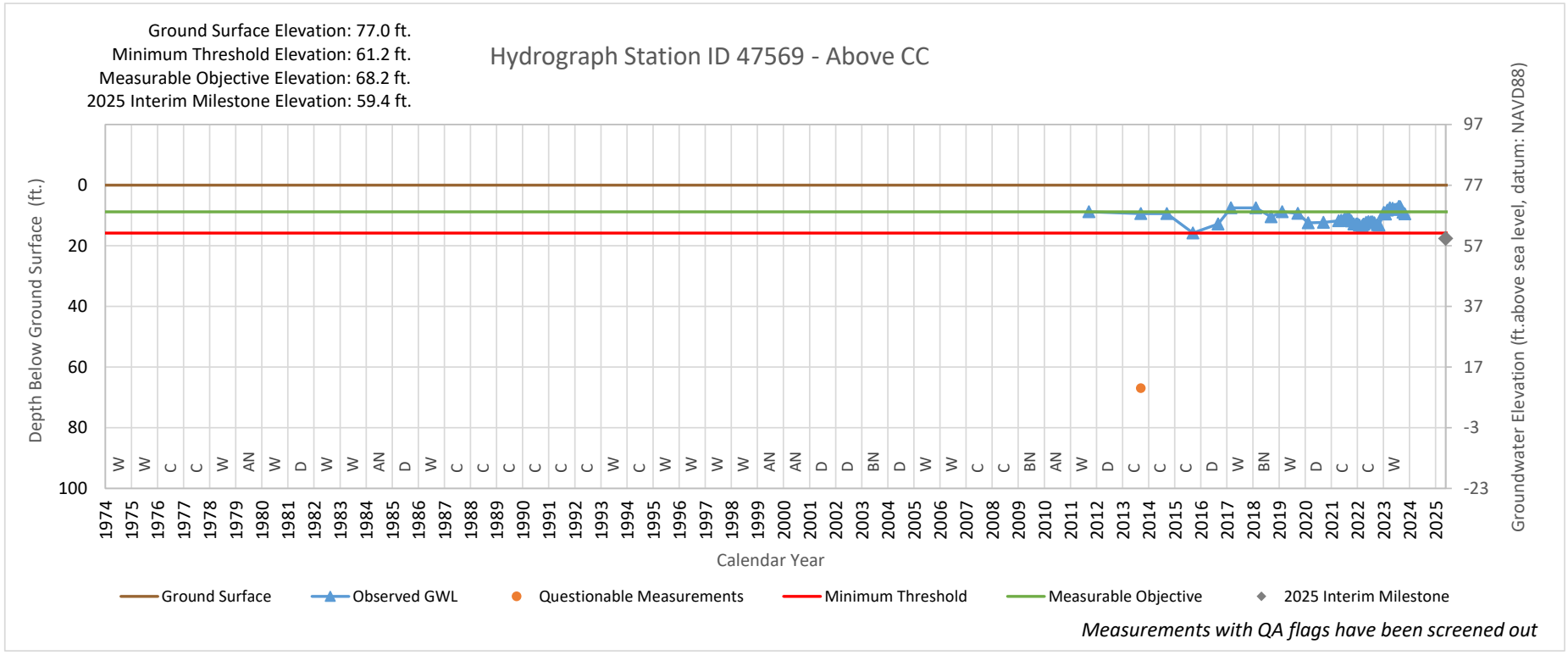

Ground Surface Elevation: 171.8 ft.
Minimum Threshold Elevation: 62.4 ft.
Measurable Objective Elevation: 102.1 ft.
2025 Interim Milestone Elevation: 37.4 ft.
Hydrograph Station ID 47557 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Minimum Threshold
Measurable Objective
2025 Interim Milestone
Measurements with QA flags have been screened out

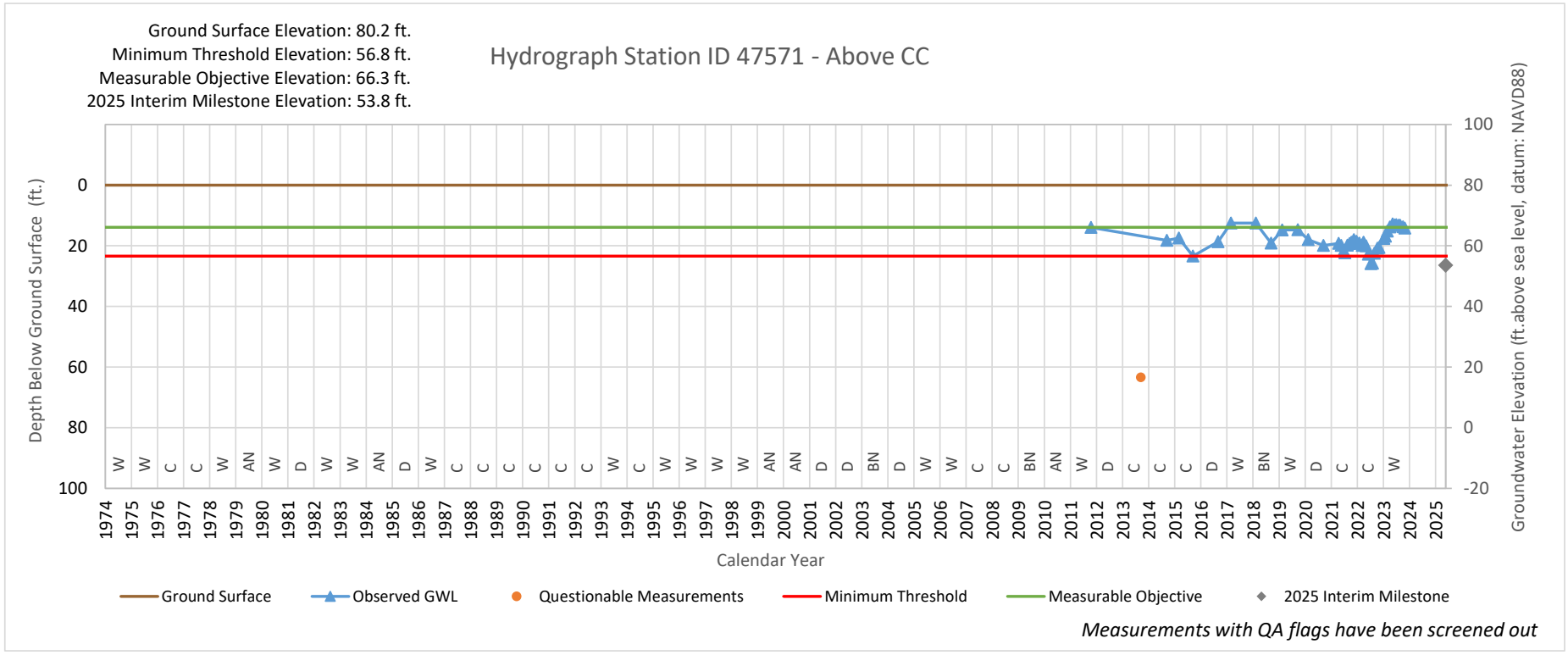

Ground Surface Elevation: 127.8 ft.
Minimum Threshold Elevation: 58.8 ft.
Measurable Objective Elevation: 75.3 ft.
2025 Interim Milestone Elevation: 48.8 ft.
Hydrograph Station ID 47562 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Minimum Threshold
Measurable Objective
2025 Interim Milestone
Measurements with QA flags have been screened out

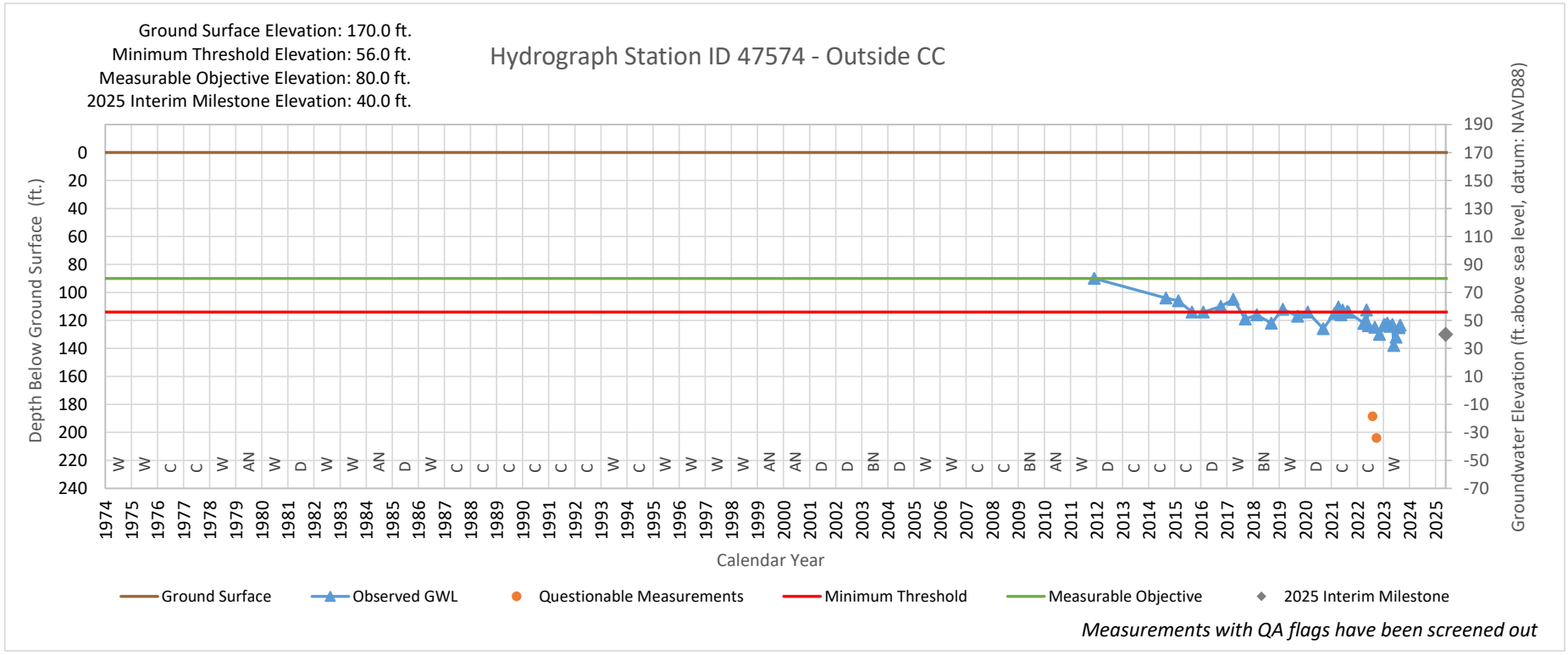

Ground Surface Elevation: 153.5 ft.
Minimum Threshold Elevation: 50.5 ft.
Measurable Objective Elevation: 81.0 ft.
2025 Interim Milestone Elevation: 33.1 ft.
Hydrograph Station ID 47563 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Minimum Threshold
Measurable Objective
2025 Interim Milestone
Measurements with QA flags have been screened out

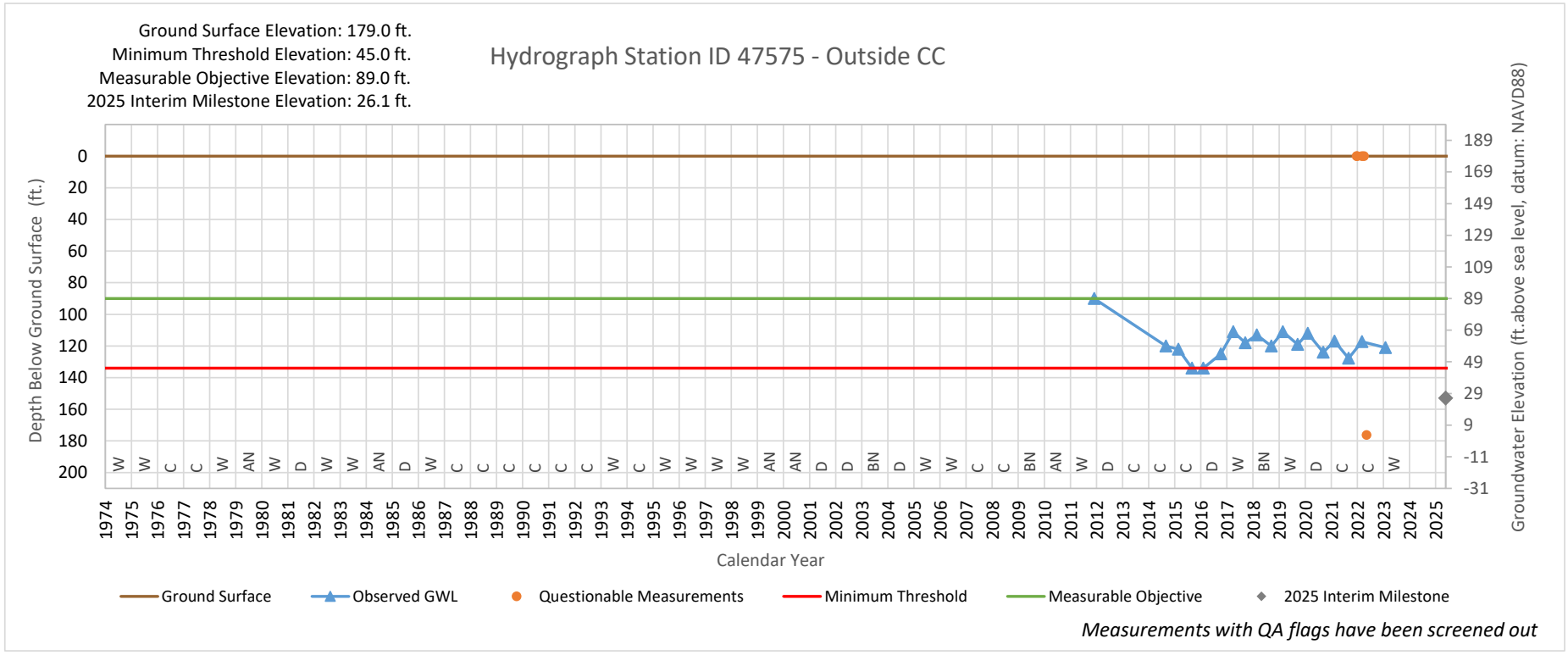

Ground Surface Elevation: 149.7 ft.
Minimum Threshold Elevation: 70.2 ft.
Measurable Objective Elevation: 108.7 ft.
2025 Interim Milestone Elevation: 53.5 ft.
Hydrograph Station ID 47564 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Minimum Threshold
Measurable Objective
2025 Interim Milestone
Measurements with QA flags have been screened out

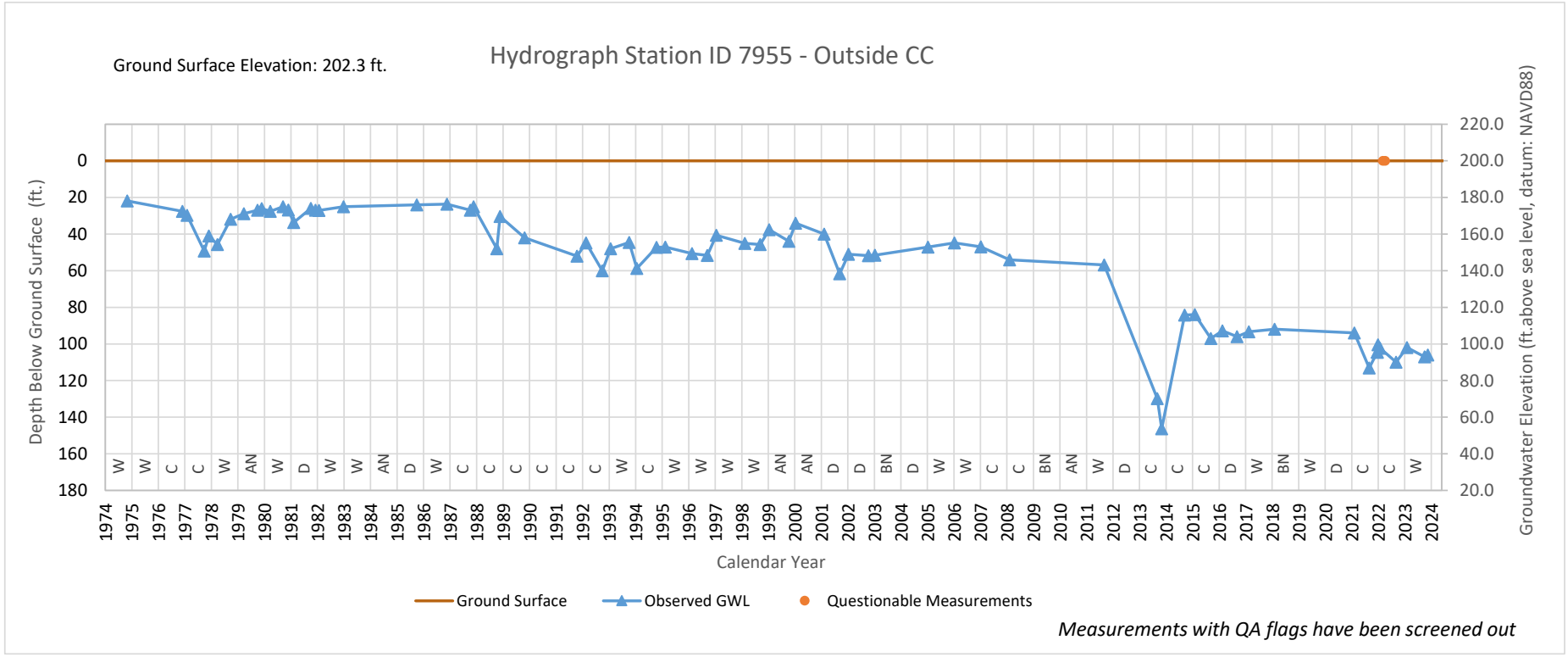

Ground Surface Elevation: 164.9 ft.
Minimum Threshold Elevation: 55.9 ft.
Measurable Objective Elevation: 100.9 ft.
2025 Interim Milestone Elevation: 28.5 ft.
Hydrograph Station ID 47565 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Minimum Threshold
Measurable Objective
2025 Interim Milestone
Measurements with QA flags have been screened out

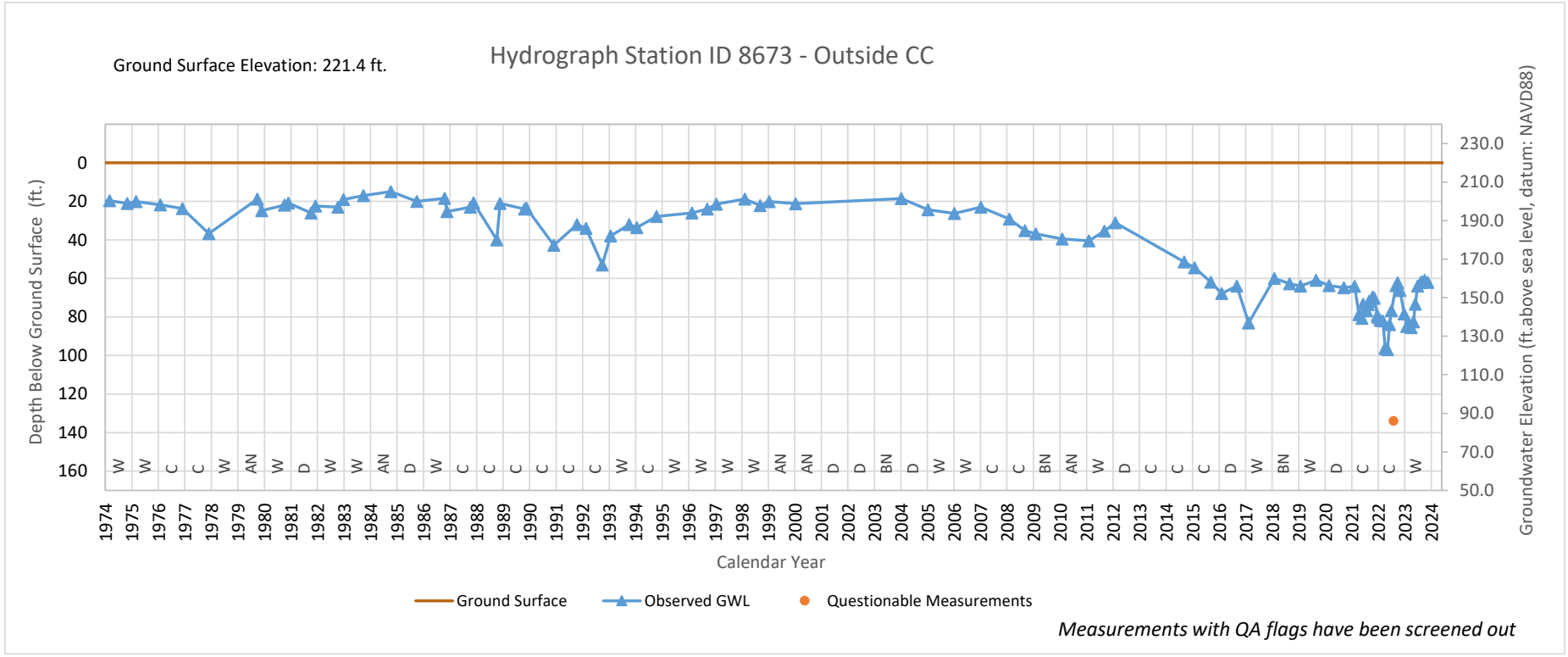

Ground Surface Elevation: 77.0 ft.
Minimum Threshold Elevation: 61.2 ft.
Measurable Objective Elevation: 68.2 ft.
2025 Interim Milestone Elevation: 59.4 ft.
Hydrograph Station ID 47569 - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Minimum Threshold
Measurable Objective
2025 Interim Milestone
Measurements with QA flags have been screened out

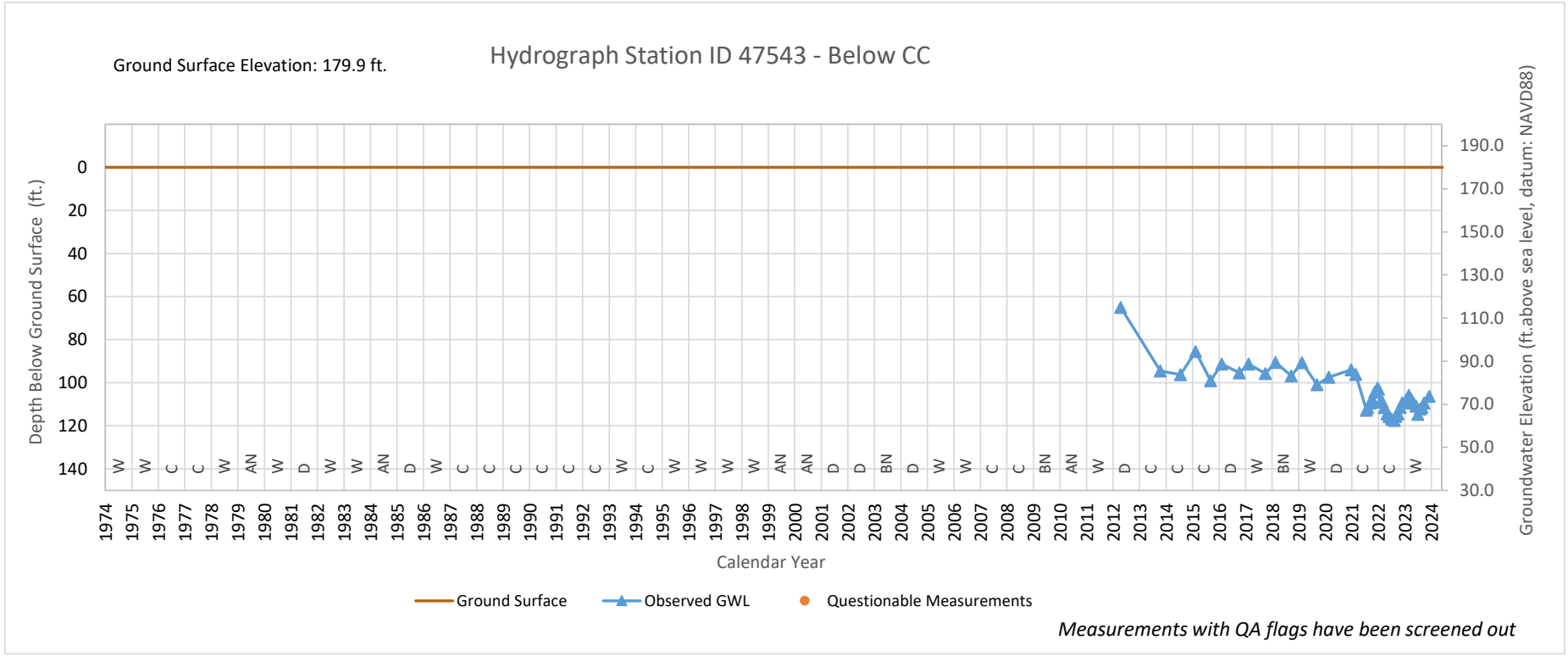

Ground Surface Elevation: 80.2 ft.
Minimum Threshold Elevation: 56.8 ft.
Measurable Objective Elevation: 66.3 ft.
2025 Interim Milestone Elevation: 53.8 ft.
Hydrograph Station ID 47571 - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Minimum Threshold
Measurable Objective
2025 Interim Milestone
Measurements with QA flags have been screened out

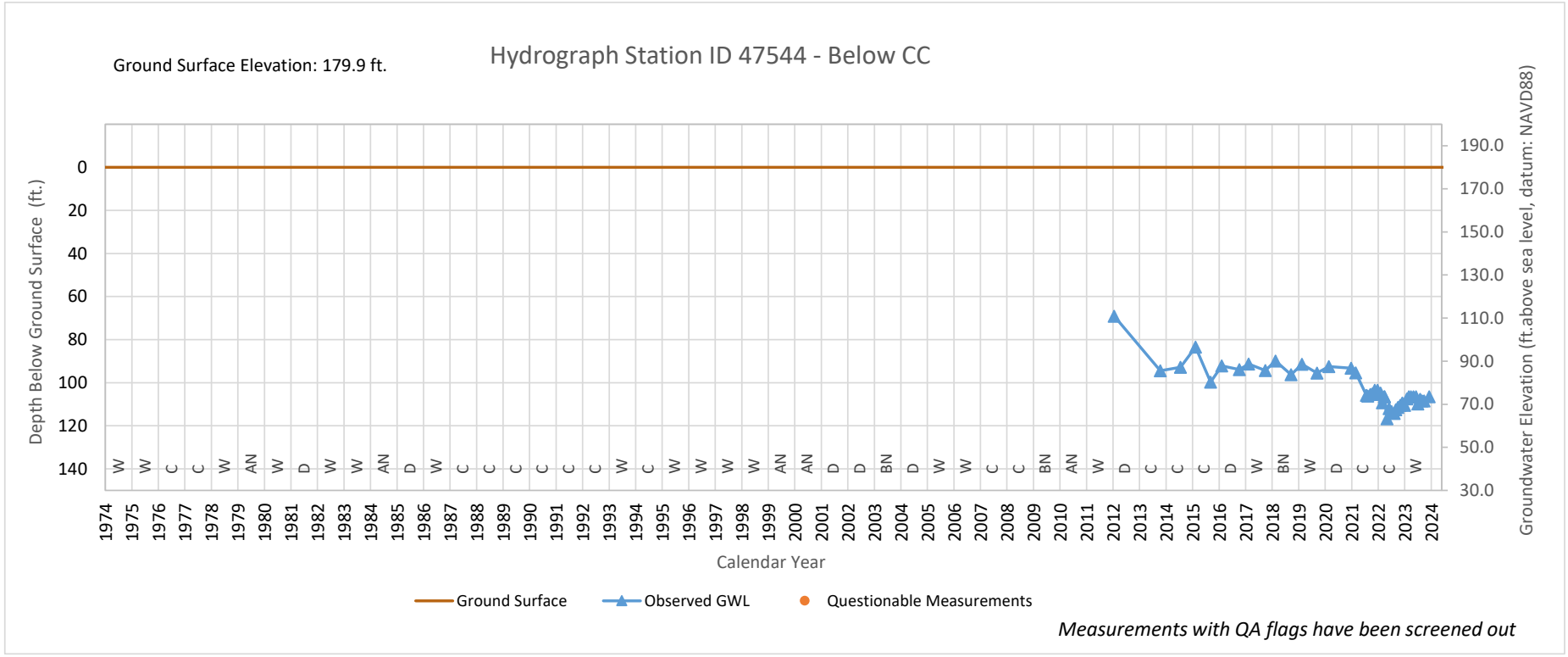

Ground Surface Elevation: 170.0 ft.
Minimum Threshold Elevation: 56.0 ft.
Measurable Objective Elevation: 80.0 ft.
2025 Interim Milestone Elevation: 40.0 ft.
Hydrograph Station ID 47574 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Minimum Threshold
Measurable Objective
2025 Interim Milestone
Measurements with QA flags have been screened out


Ground Surface Elevation: 179.0 ft.
Minimum Threshold Elevation: 45.0 ft.
Measurable Objective Elevation: 89.0 ft.
2025 Interim Milestone Elevation: 26.1 ft.
Hydrograph Station ID 47575 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Minimum Threshold
Measurable Objective
2025 Interim Milestone
Measurements with QA flags have been screened out


Ground Surface Elevation: 202.3 ft.
Hydrograph Station ID 7955 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 221.4 ft.
Hydrograph Station ID 8673 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
0
20
40
60
80
100
120
140
160
230.0
210.0
190.0
170.0
150.0
130.0
110.0
90.0
70.0
50.0
W W C C W AN W D W W AN D W C C C C C C W C W W W W AN AN D D BN D W W C C BN AN W D C C C D W BN W D C C W
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 179.9 ft.
Hydrograph Station ID 47543 - Below CC
Depth Below Ground Surface (ft.)
0
20
40
60
80
100
120
140
Groundwater Elevation (ft.above sea level, datum: NAVD88)
190.0
170.0
150.0
130.0
110.0
90.0
70.0
50.0
30.0
W W C C W AN W D W W AN D W C C C C C C W C W W W W AN AN D D BN D W W C C BN AN W D C C C D W BN W D C C W
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 179.9 ft.
Hydrograph Station ID 47544 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
0
20
40
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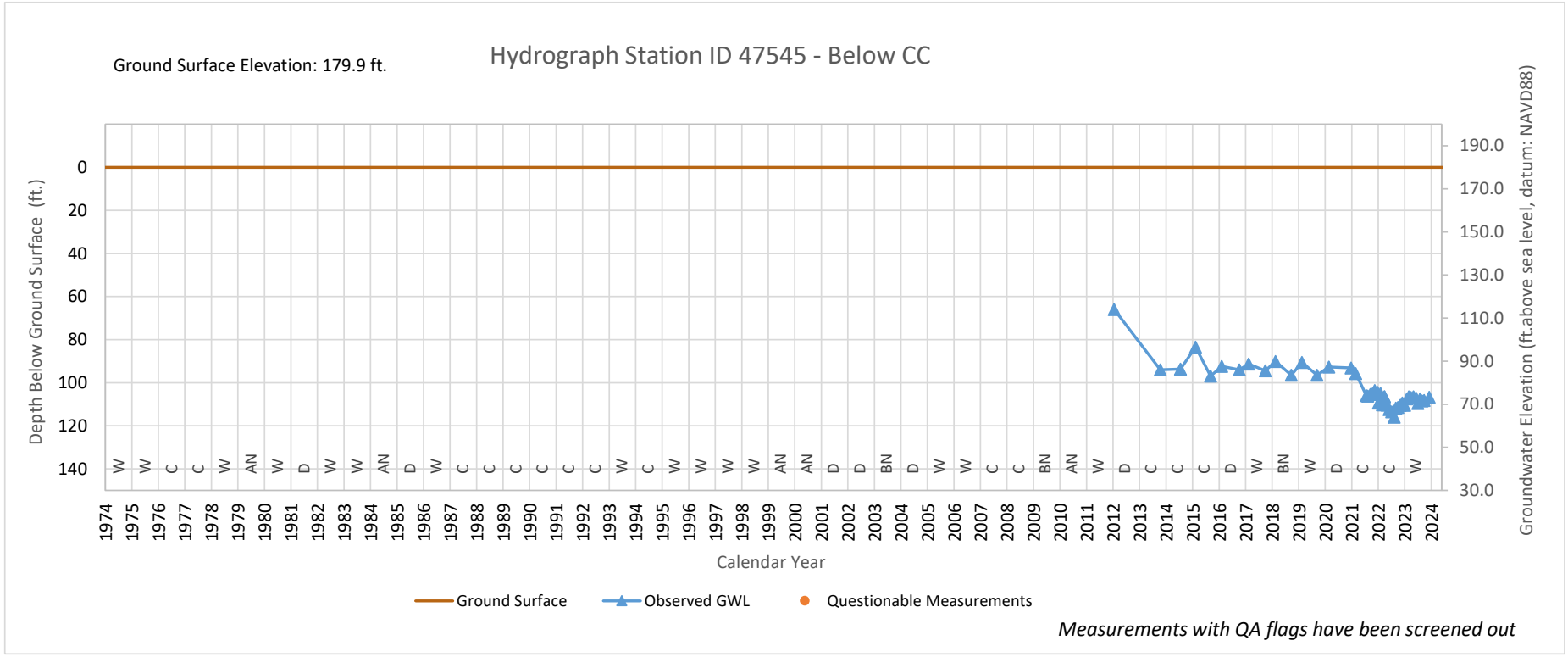
120
140
190.0
170.0
150.0
130.0
110.0
90.0
70.0
50.0
30.0
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 179.9 ft.
Hydrograph Station ID 47545 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
0
20
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190.0
170.0
150.0
130.0
110.0
90.0
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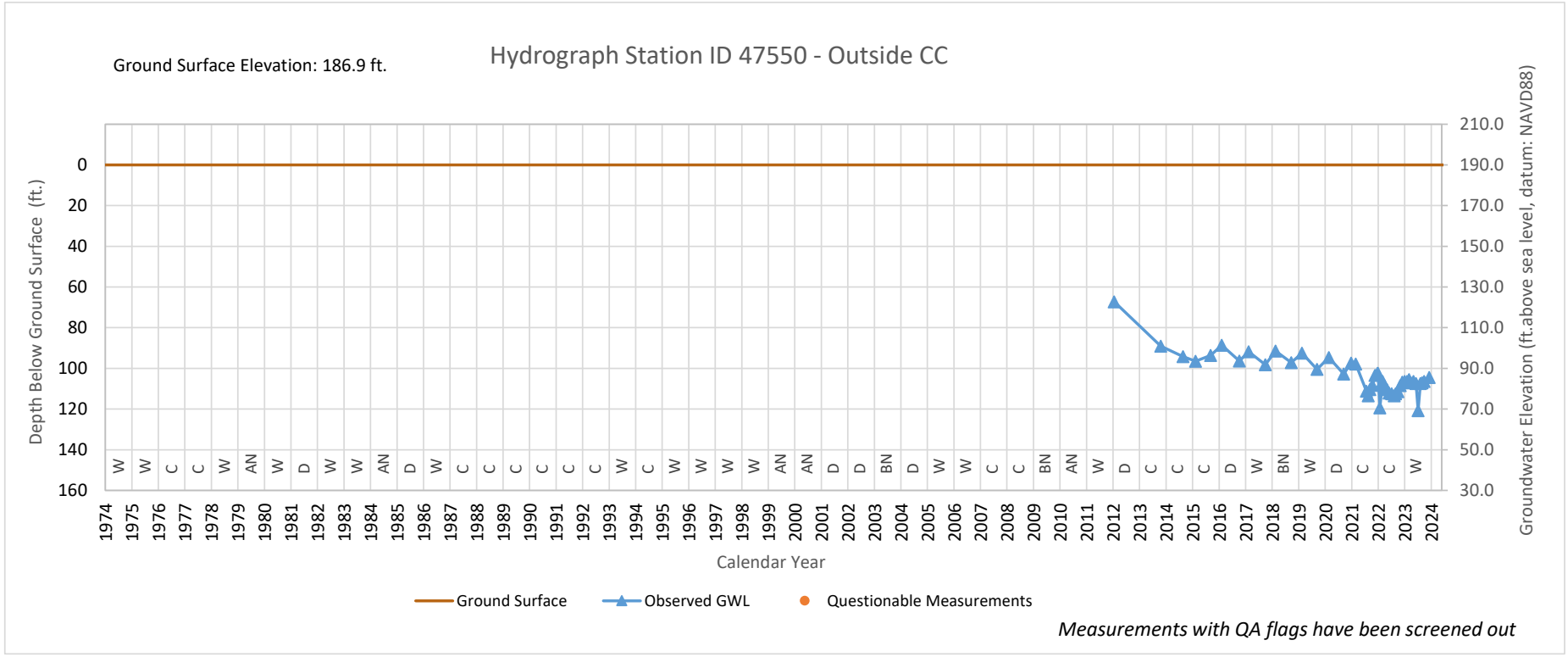
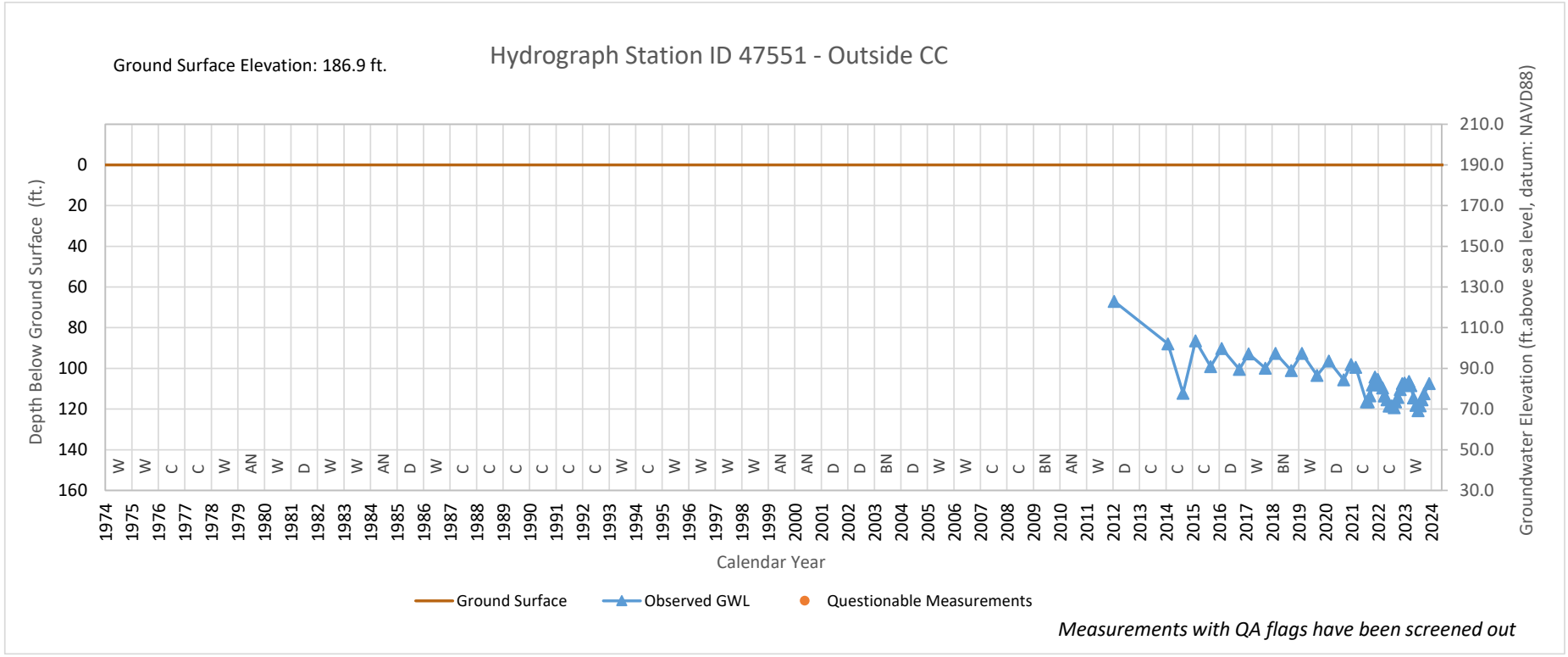
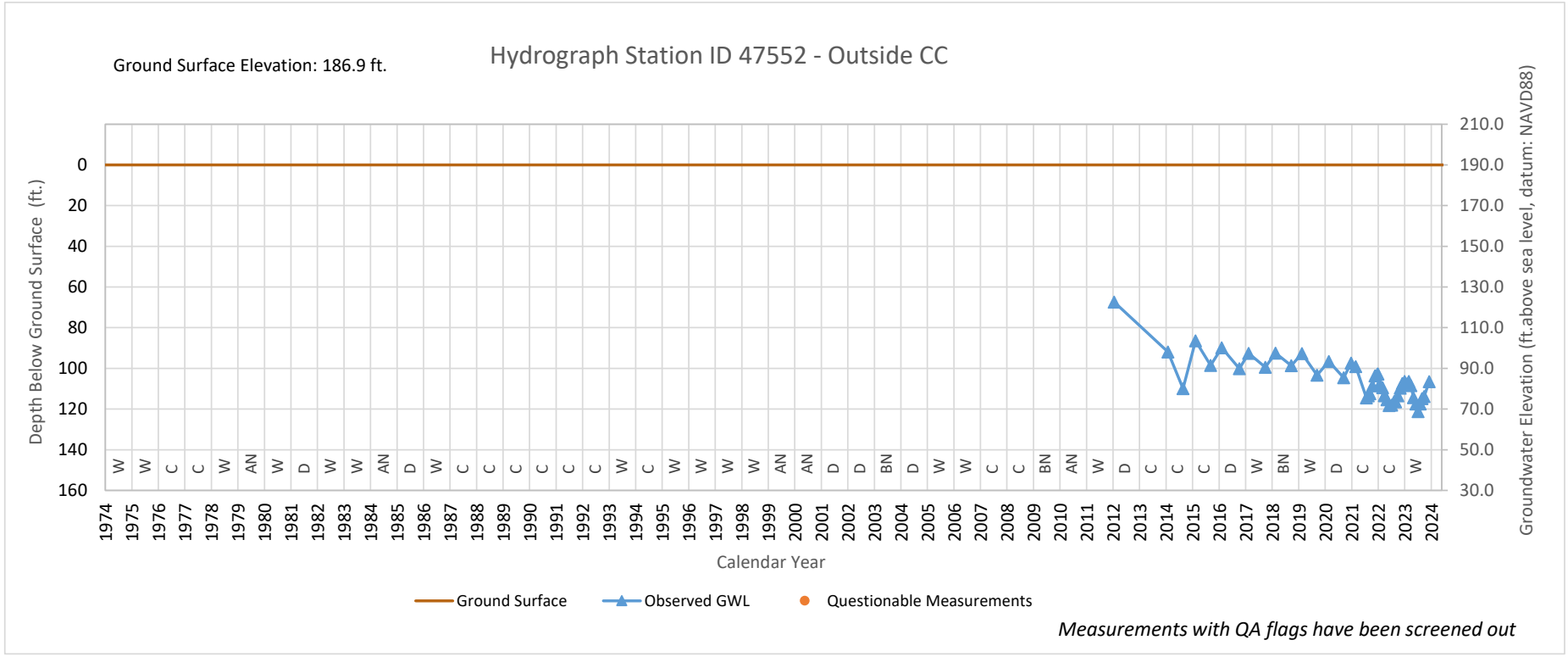
50.0
30.0
W W C C W AN W D W W AN D W C C C C C C W C W W W W AN AN D D BN D W W C C BN AN W D C C C D W BN W D C C W
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 186.9 ft.
Hydrograph Station ID 47550 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
0
20
40
60
80
100
120
140
160
210.0
190.0
170.0
150.0
130.0
110.0
90.0
70.0
50.0
30.0
W W C C W AN W D W W AN D W C C C C C C W C W W W W AN AN D D BN D W W C C BN AN W D C C C D W BN W D C C W
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 186.9 ft.
Hydrograph Station ID 47551 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
0
20
40
60
80
100
120
140
160
210.0
190.0
170.0
150.0
130.0
110.0
90.0
70.0
50.0
30.0
W W C C W AN W D W W AN D W C C C C C C W C W W W W AN AN D D BN D W W C C BN AN W D C C C D W BN W D C C W
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 186.9 ft.
Hydrograph Station ID 47552 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
0
20
40
60
80
100
120
140
160
210.0
190.0
170.0
150.0
130.0
110.0
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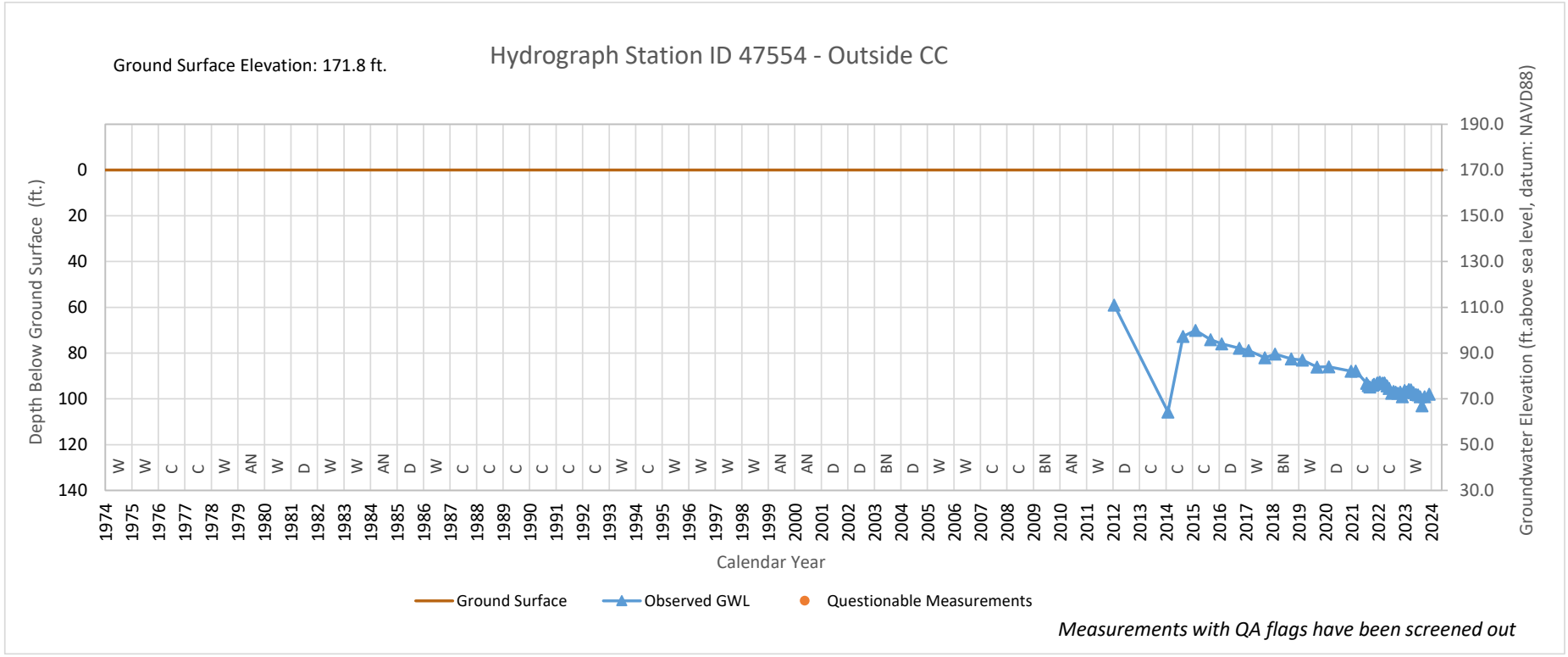
30.0
W W C C W AN W D W W AN D W C C C C C C W C W W W W AN AN D D BN D W W C C BN AN W D C C C D W BN W D C C W
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 171.8 ft.
Hydrograph Station ID 47554 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
0
20
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190.0
170.0
150.0
130.0
110.0
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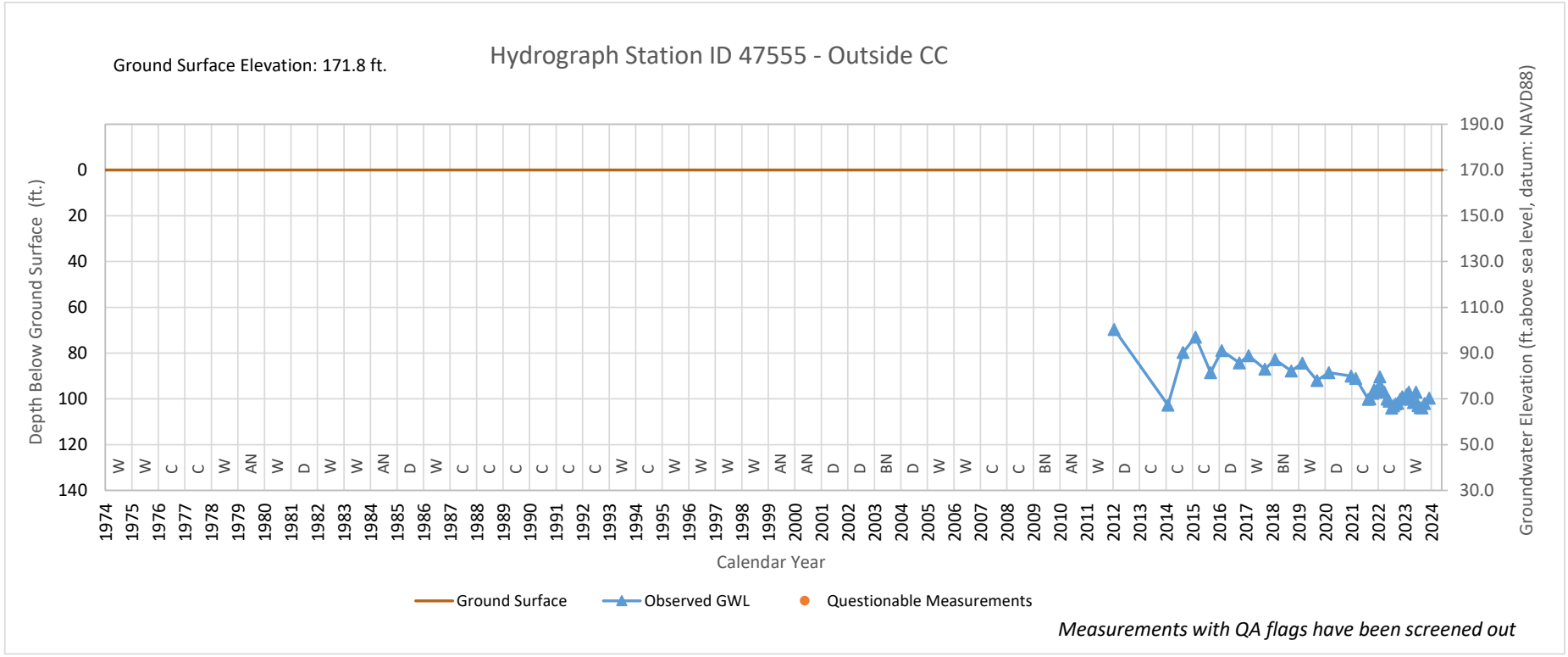
W W C C W AN W D W W AN D W C C C C C C W C W W W W AN AN D D BN D W W C C BN AN W D C C C D W BN W D C C W
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 171.8 ft.
Hydrograph Station ID 47555 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
0
20
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100
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140
190.0
170.0
150.0
130.0
110.0
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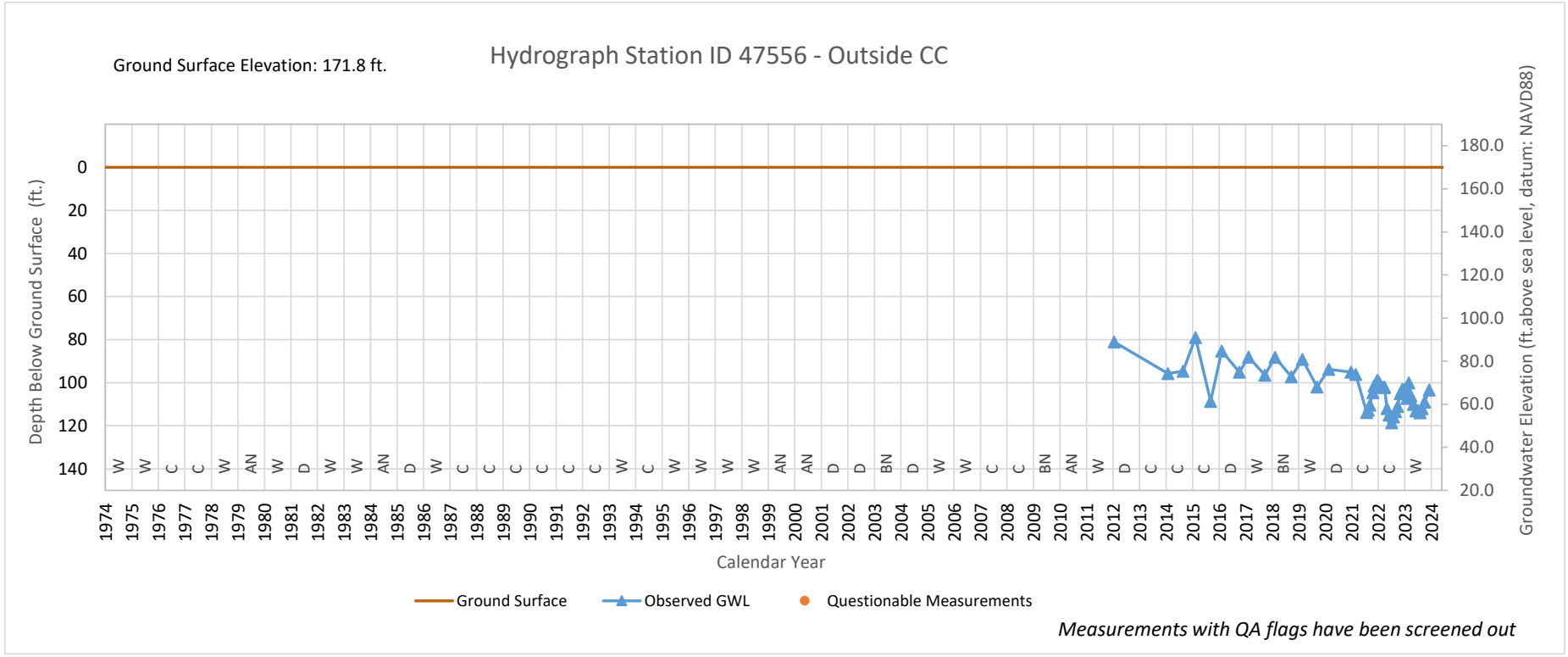
30.0
W W C C W AN W D W W AN D W C C C C C C W C W W W W AN AN D D BN D W W C C BN AN W D C C C D W BN W D C C W
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 171.8 ft.
Hydrograph Station ID 47556 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
0
20
40
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120
140
180.0
160.0
140.0
120.0
100.0
80.0
60.0
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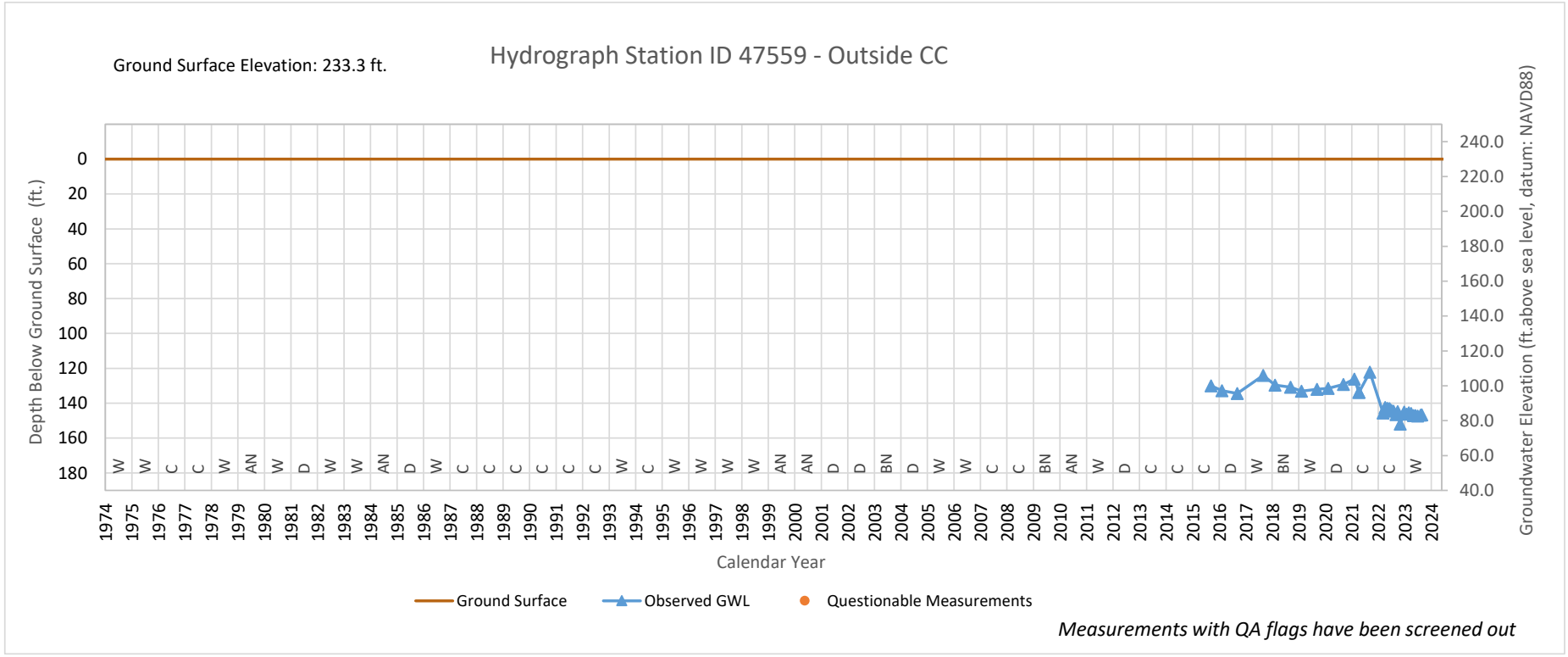
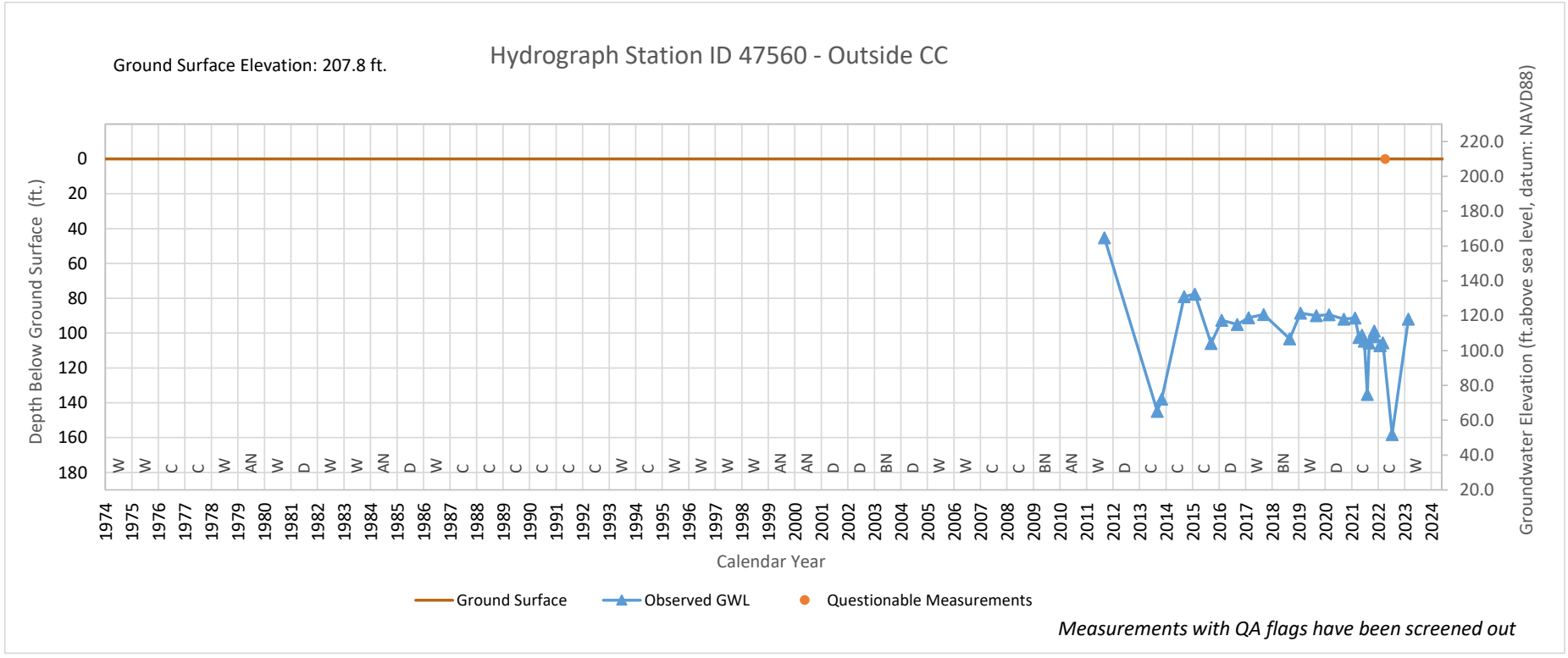
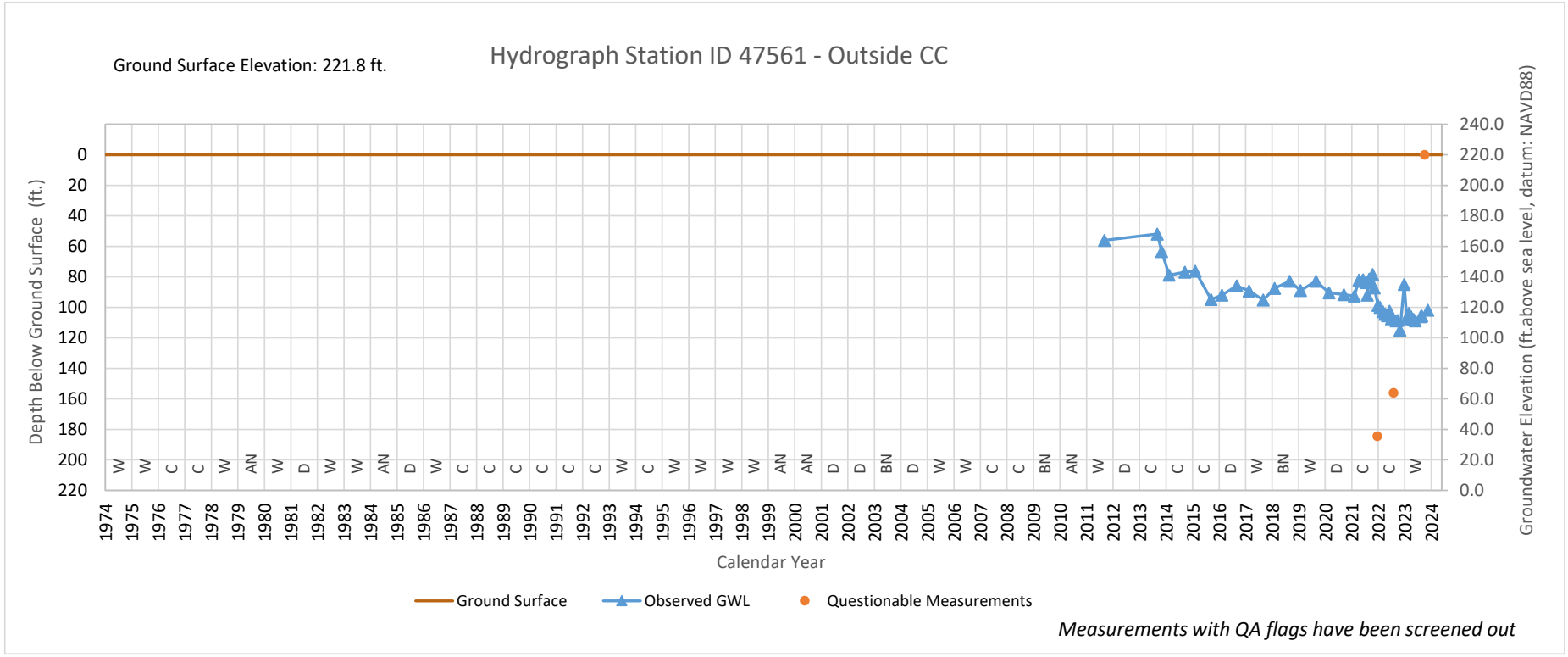
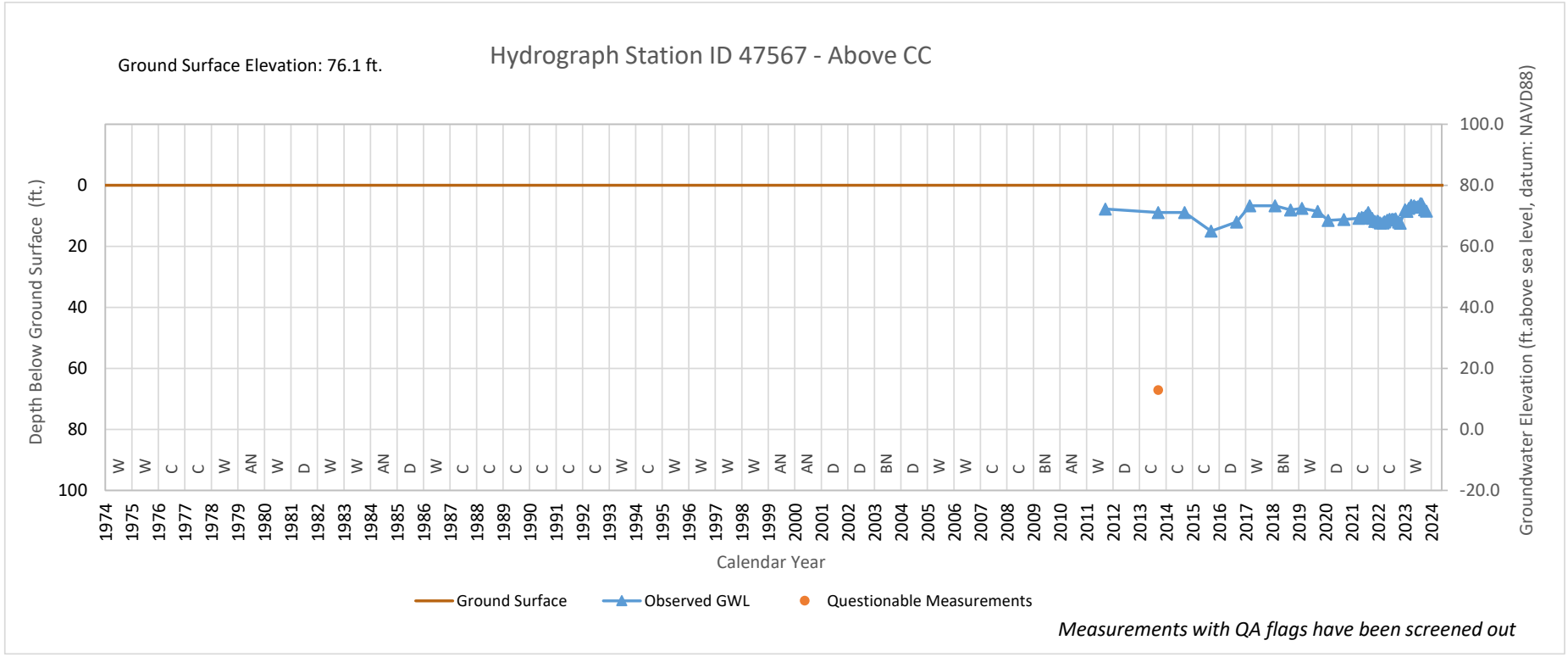
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
W W C C W AN W D W W AN D W C C C C C C W C W W W W AN AN D D BN D W W C C BN AN W D C C C D W BN W D C C W
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 233.3 ft.
Hydrograph Station ID 47559 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 207.8 ft.
Hydrograph Station ID 47560 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 221.8 ft.
Hydrograph Station ID 47561 - Outside CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 76.1 ft.
Hydrograph Station ID 47567 - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
0
20
40
60
80
100
100.0
80.0
60.0
40.0
20.0
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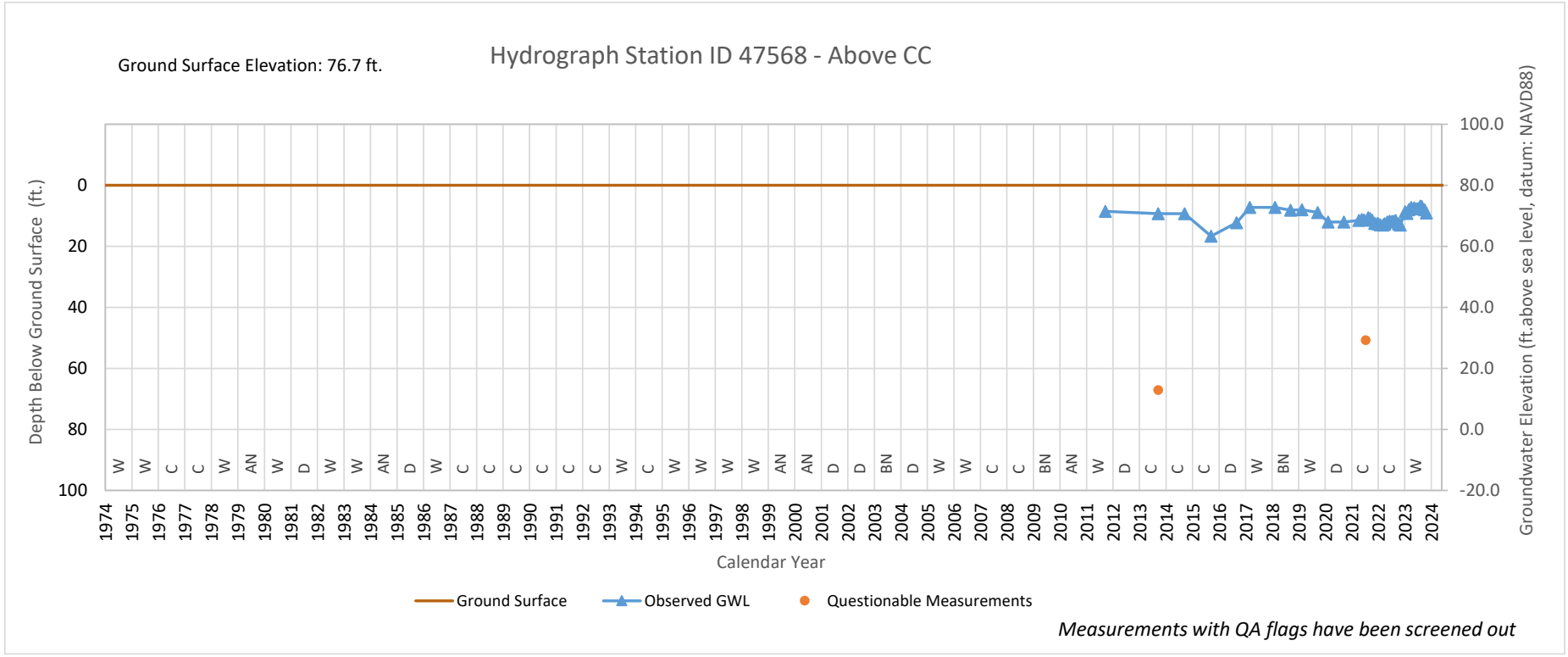
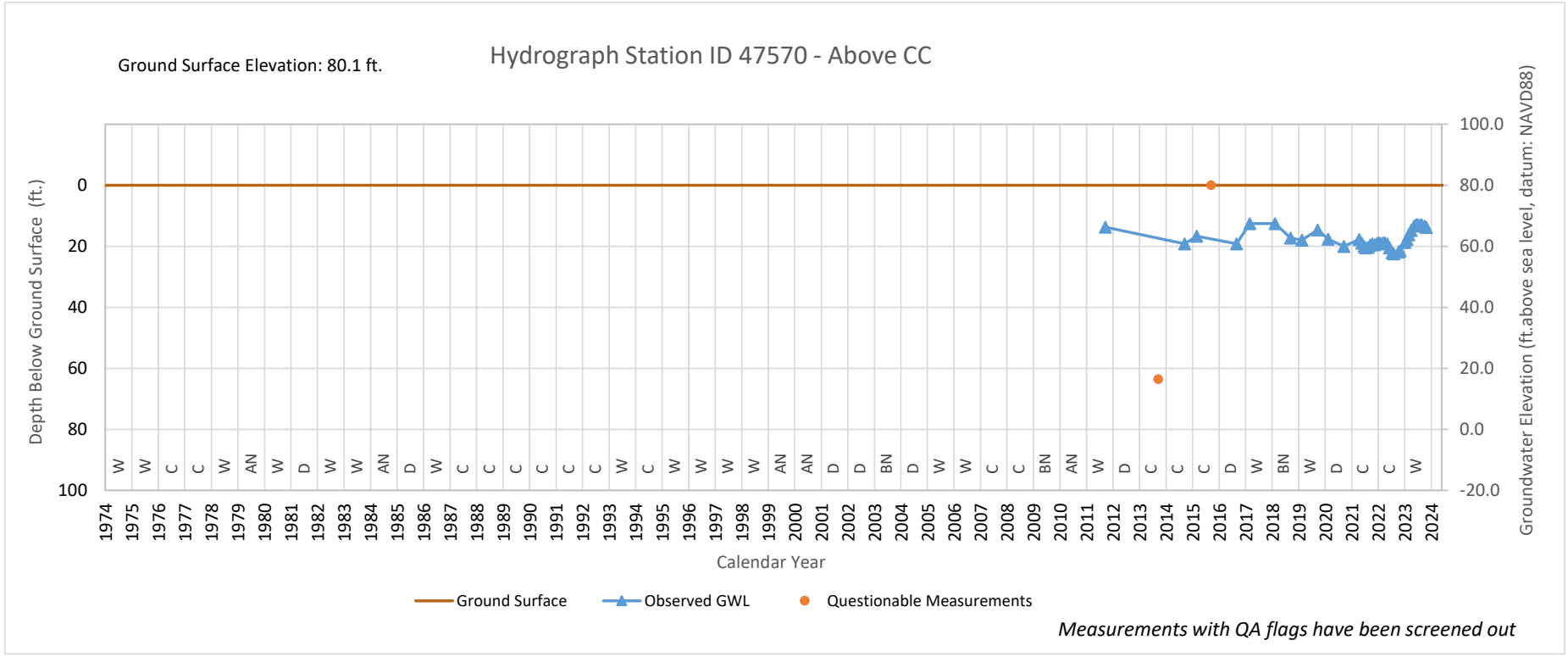
-20.0
W W C C W AN W D W W AN D W C C C C C C W C W W W W AN AN D D BN D W W C C BN AN W D C C C D W BN W D C C W
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 76.7 ft.
Hydrograph Station ID 47568 - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 80.1 ft.
Hydrograph Station ID 47570 - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
0
20
40
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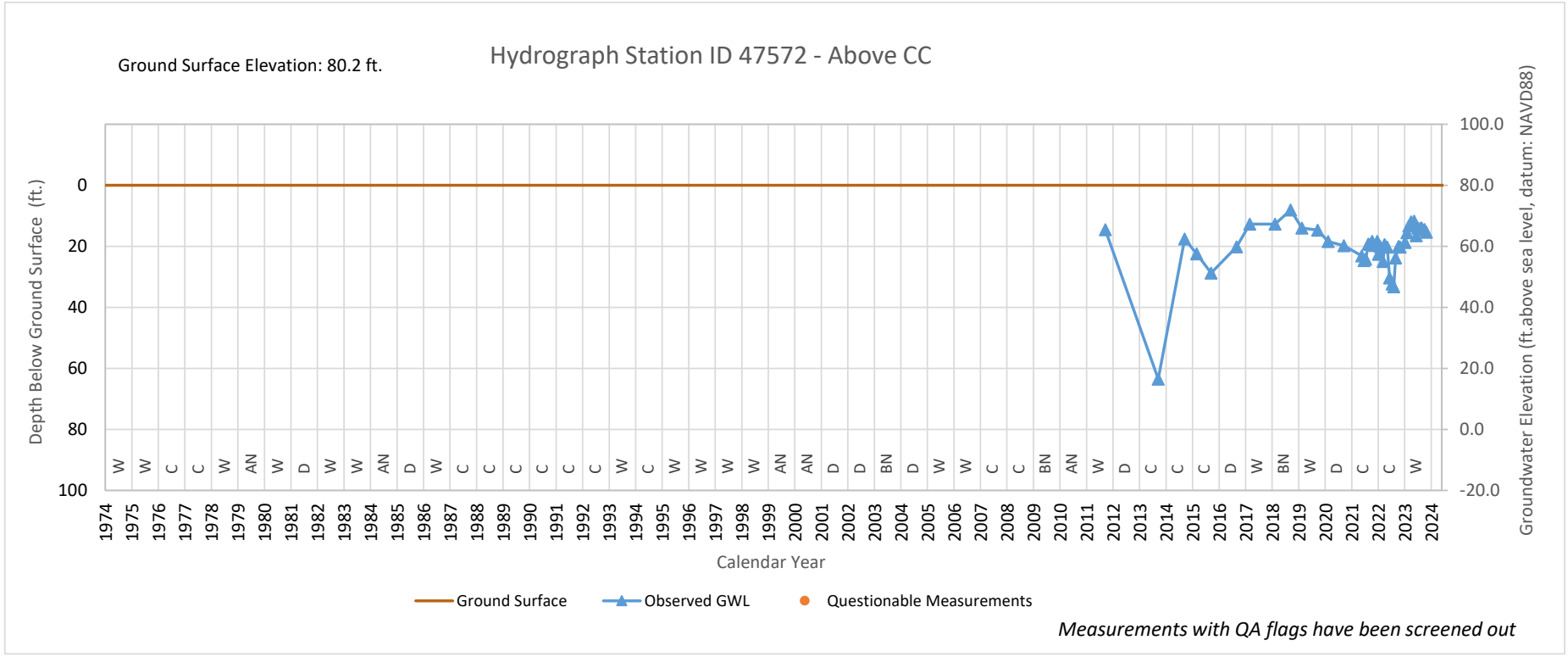
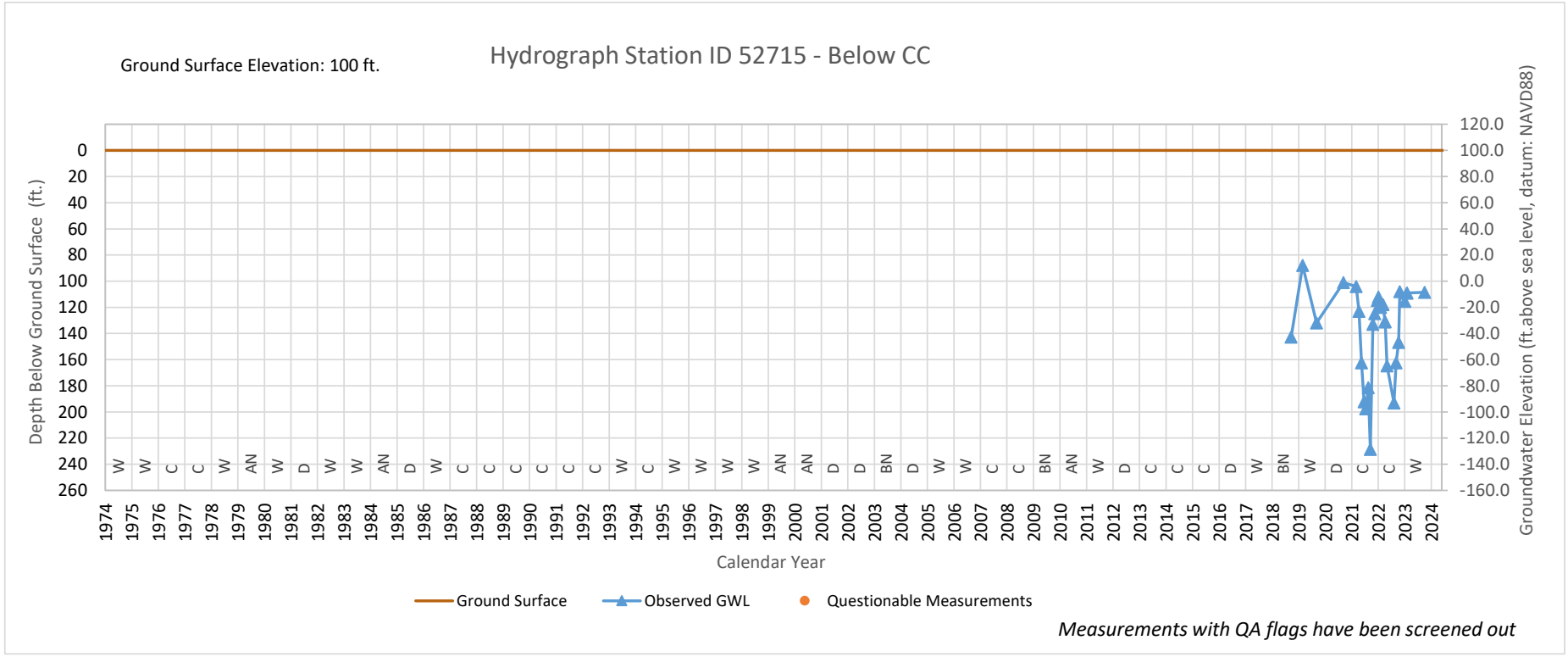
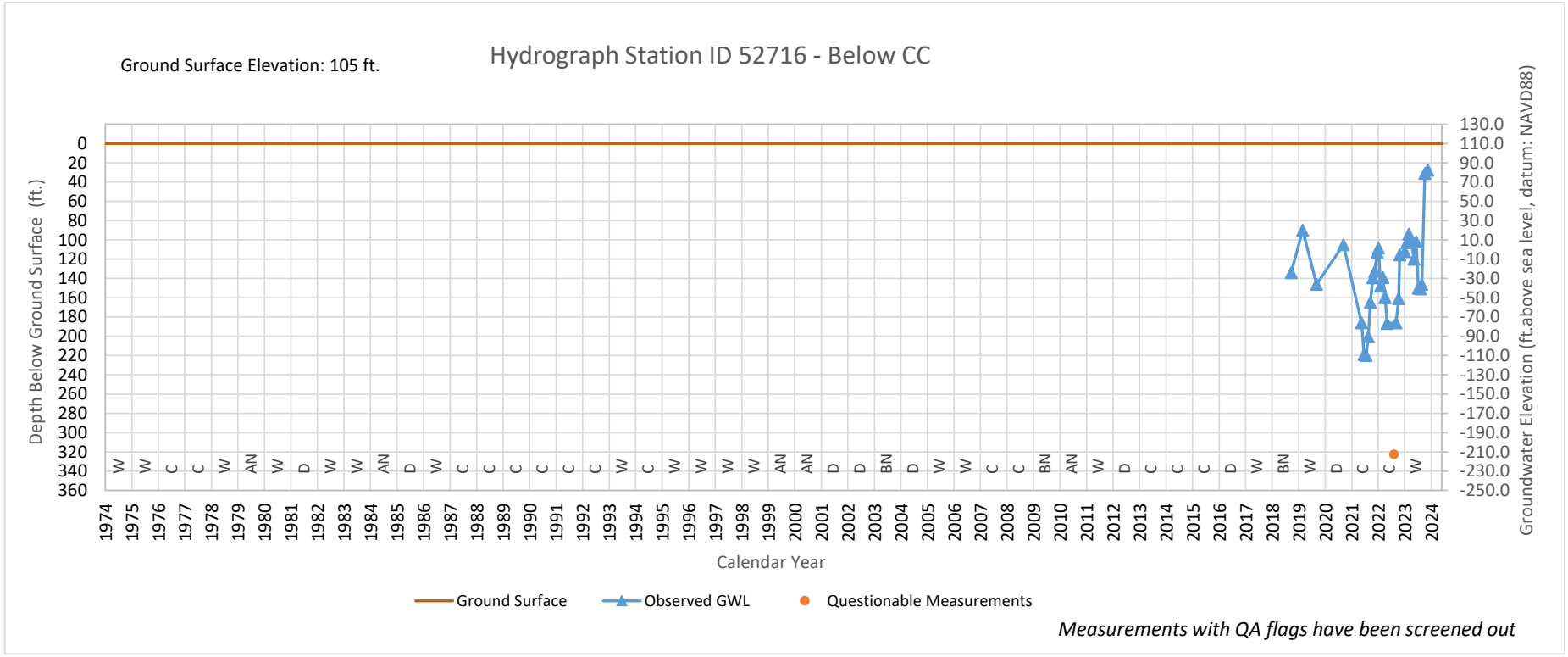
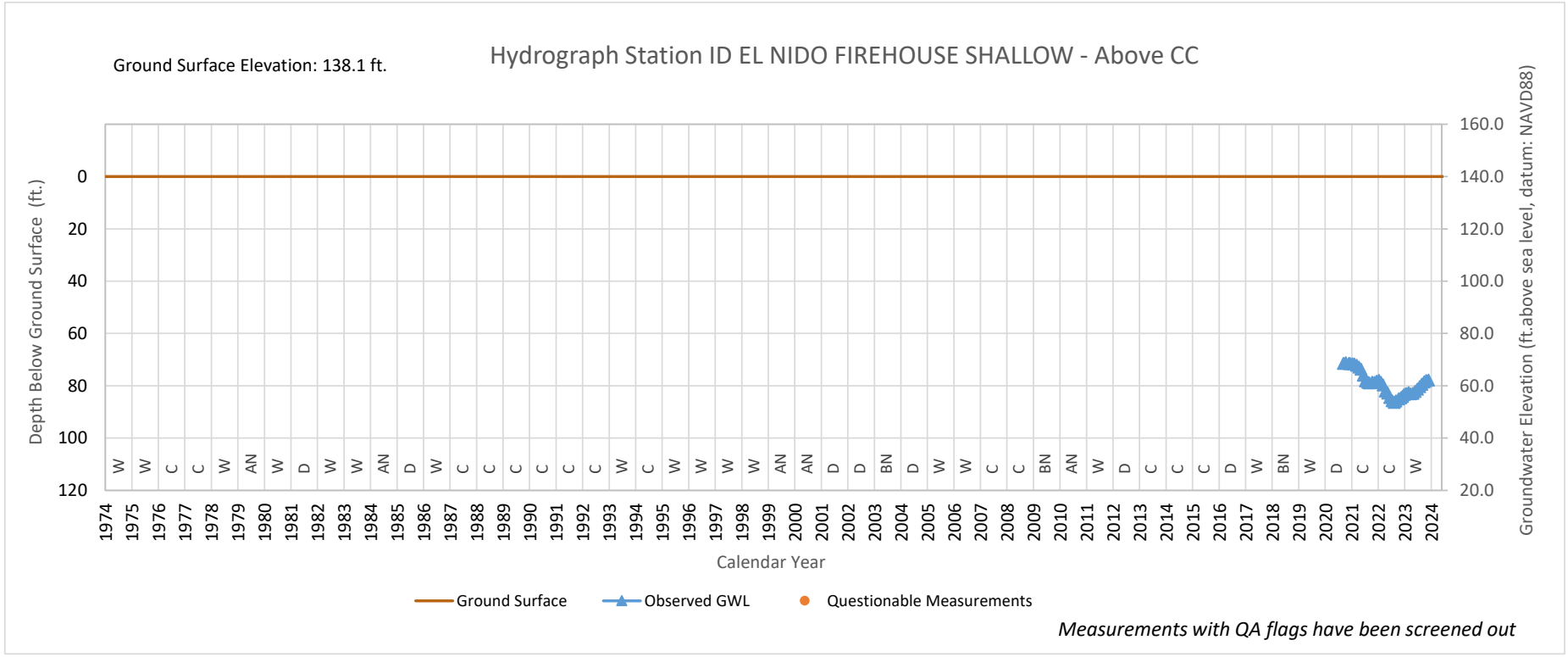
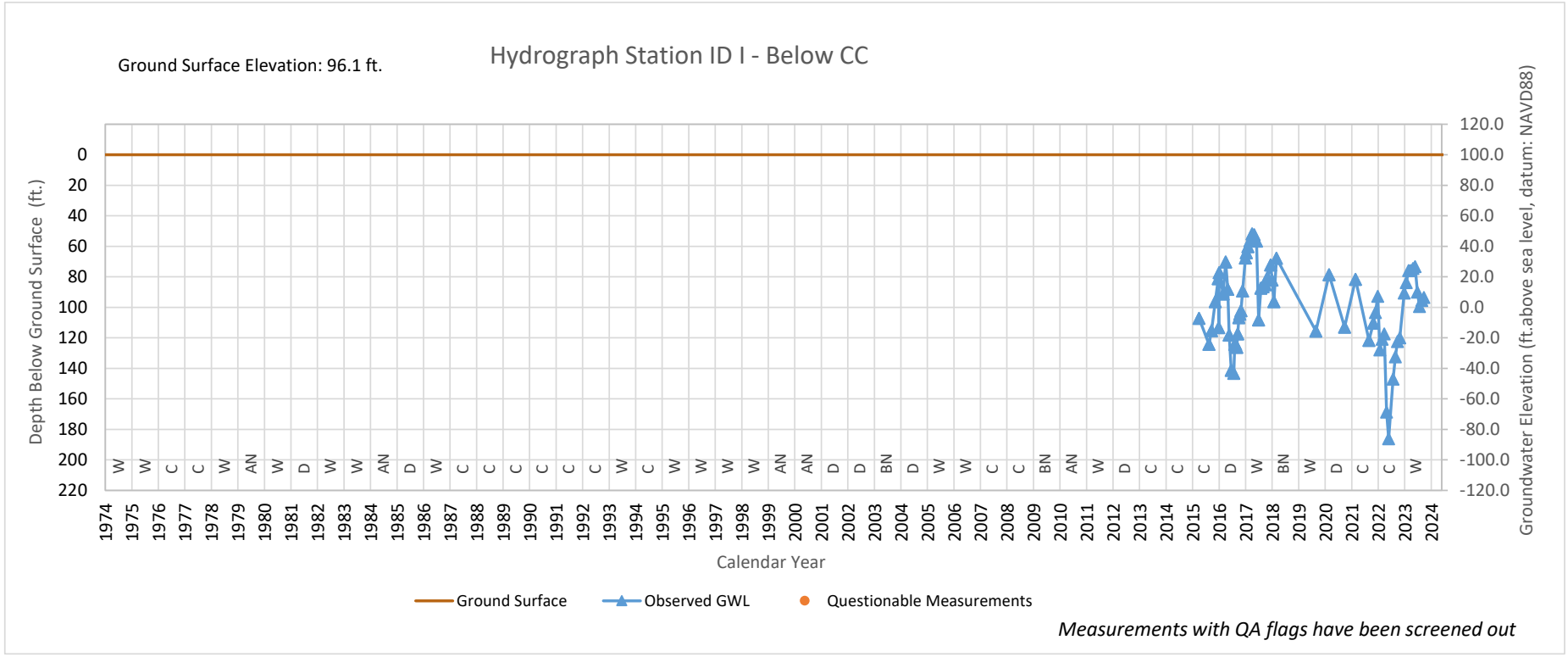
100.0
80.0
60.0
40.0
20.0
0.0
-20.0
W W C C W AN W D W W AN D W C C C C C C W C W W W W AN AN D D BN D W W C C BN AN W D C C C D W BN W D C C W
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out

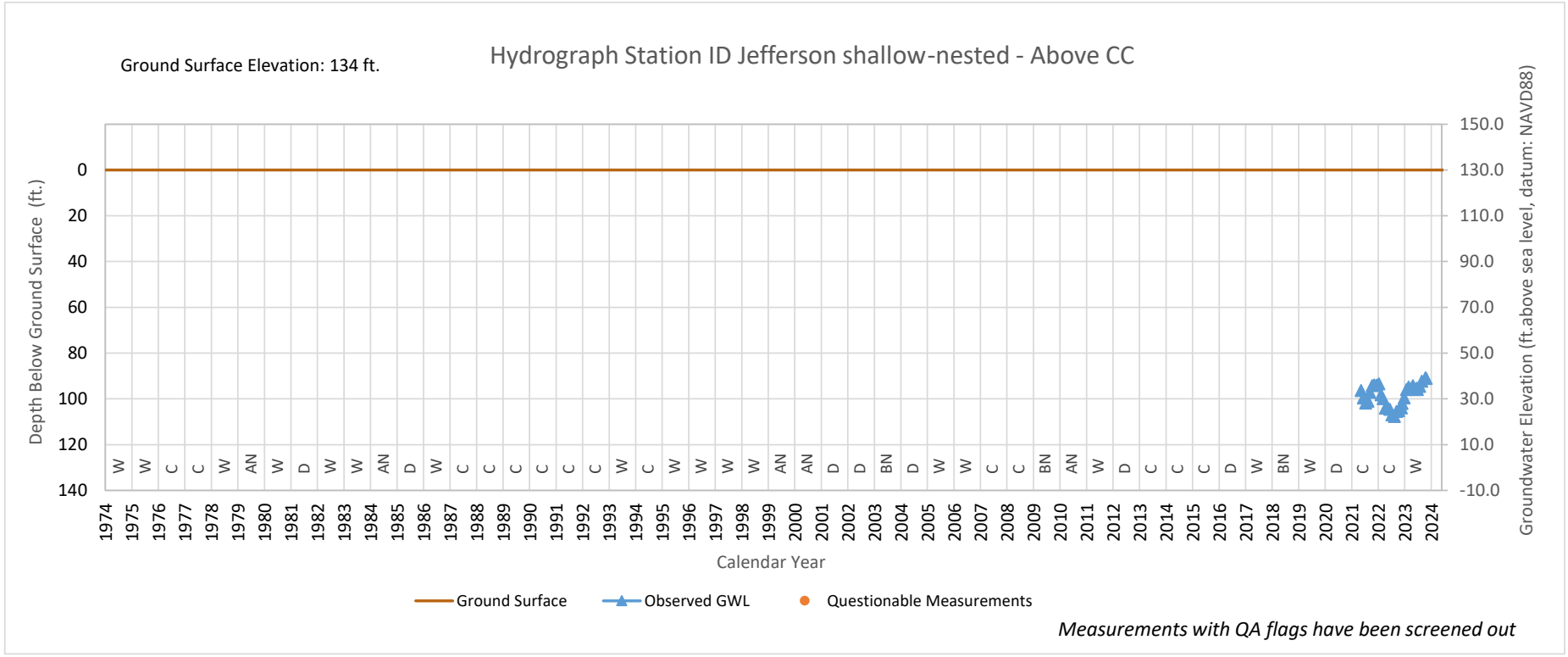

Ground Surface Elevation: 80.2 ft.
Hydrograph Station ID 47572 - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
0
20
40
60
80
100
100.0
80.0
60.0
40.0
20.0
0.0
-20.0
W W C C W AN W D W W AN D W C C C C C C W C W W W W AN AN D D BN D W W C C BN AN W D C C C D W BN W D C C W
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out

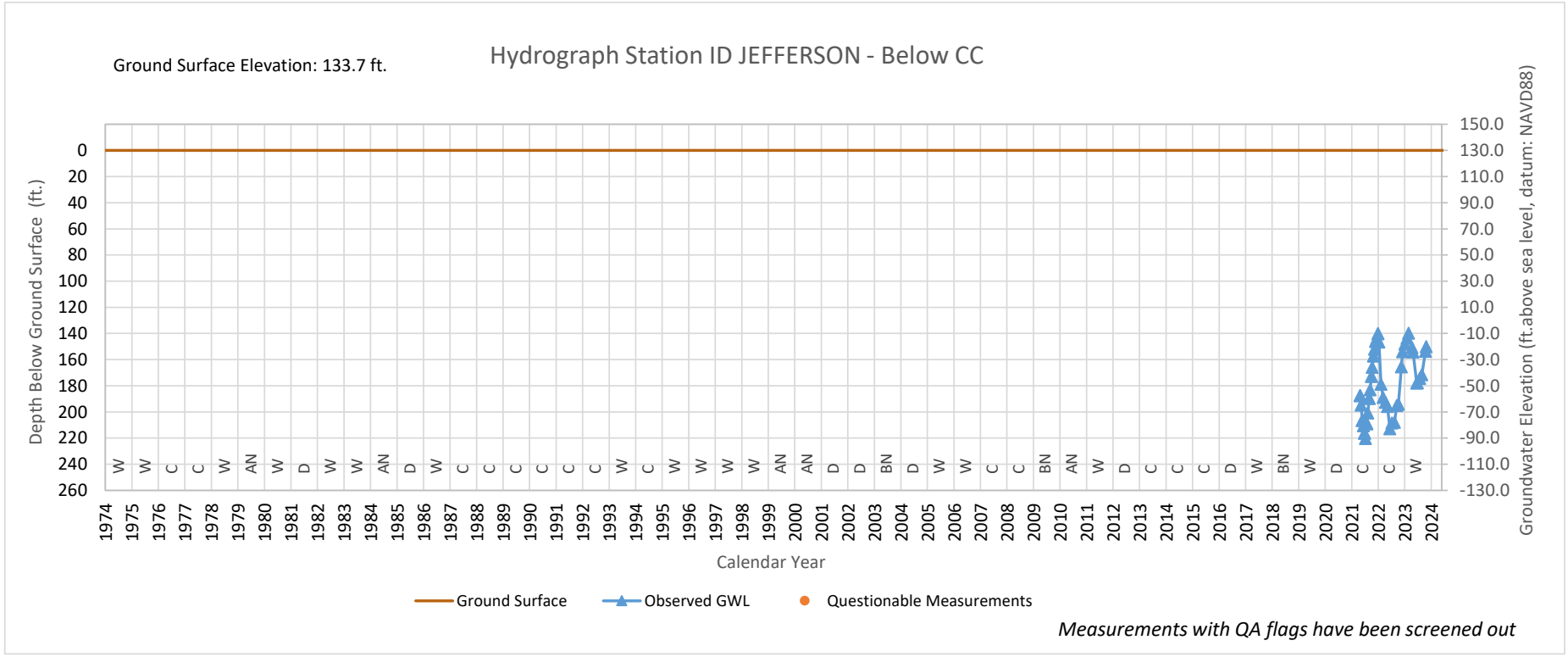

Ground Surface Elevation: 100 ft.
Hydrograph Station ID 52715 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out

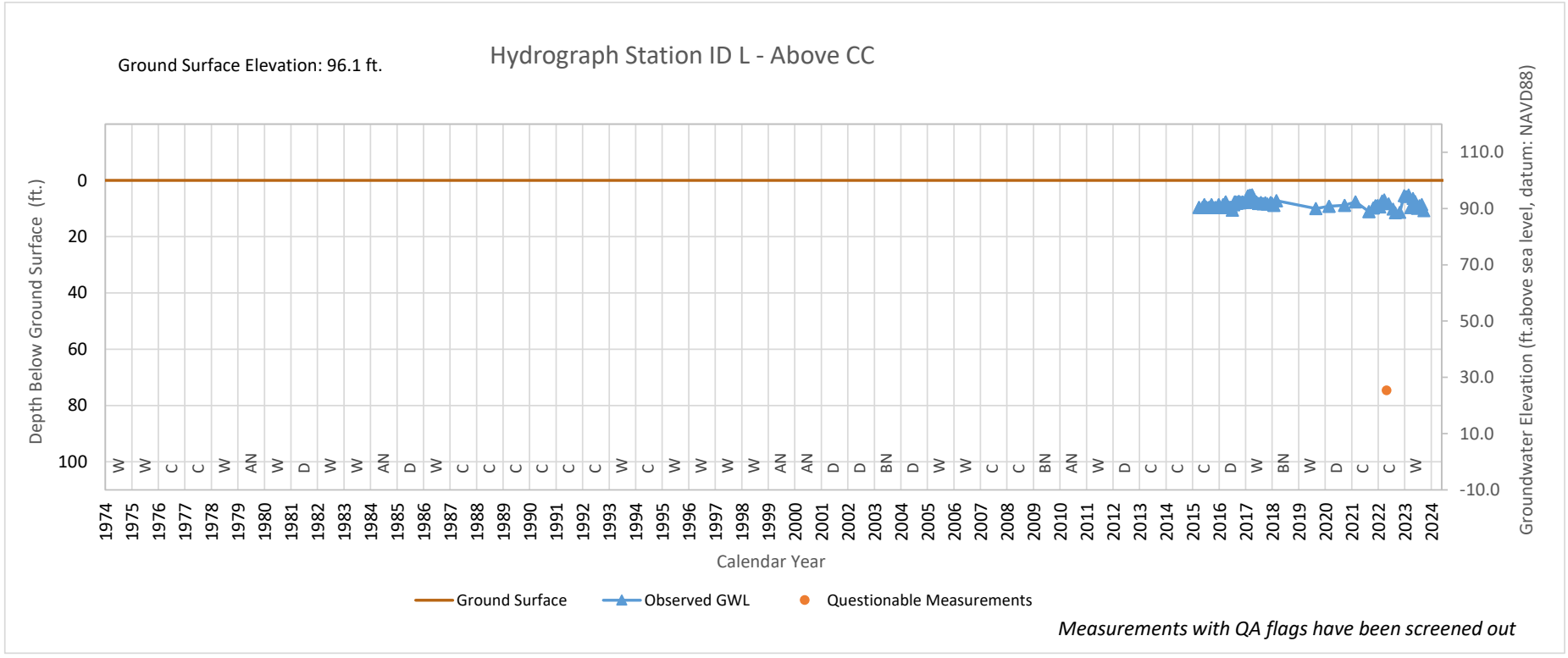

Ground Surface Elevation: 105 ft.
Hydrograph Station ID 52716 - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out

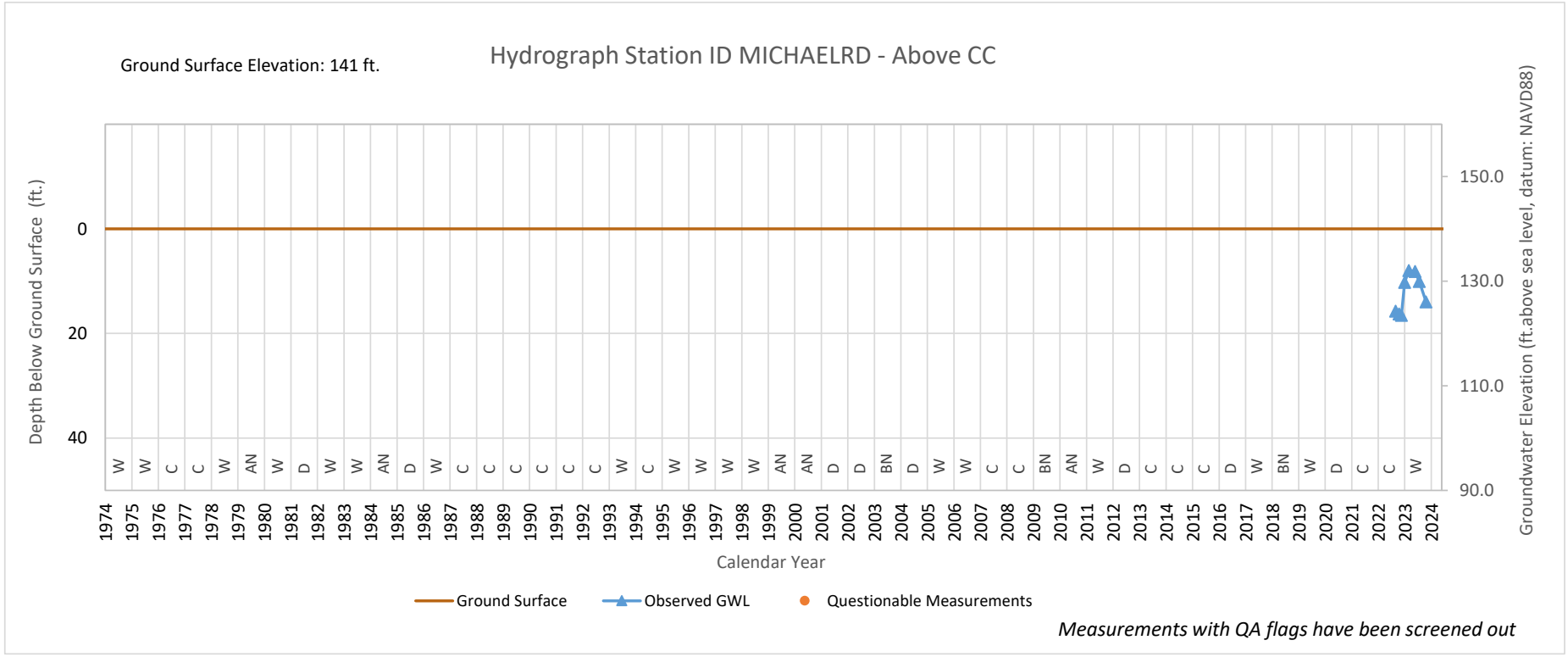

Ground Surface Elevation: 138.1 ft.
Hydrograph Station ID EL NIDO FIREHOUSE SHALLOW - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
0
20
40
60
80
100
120
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
W W C C W AN W D W W AN D W C C C C C C W C W W W W AN AN D D BN D W W C C BN AN W D C C C D W BN W D C C W
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out

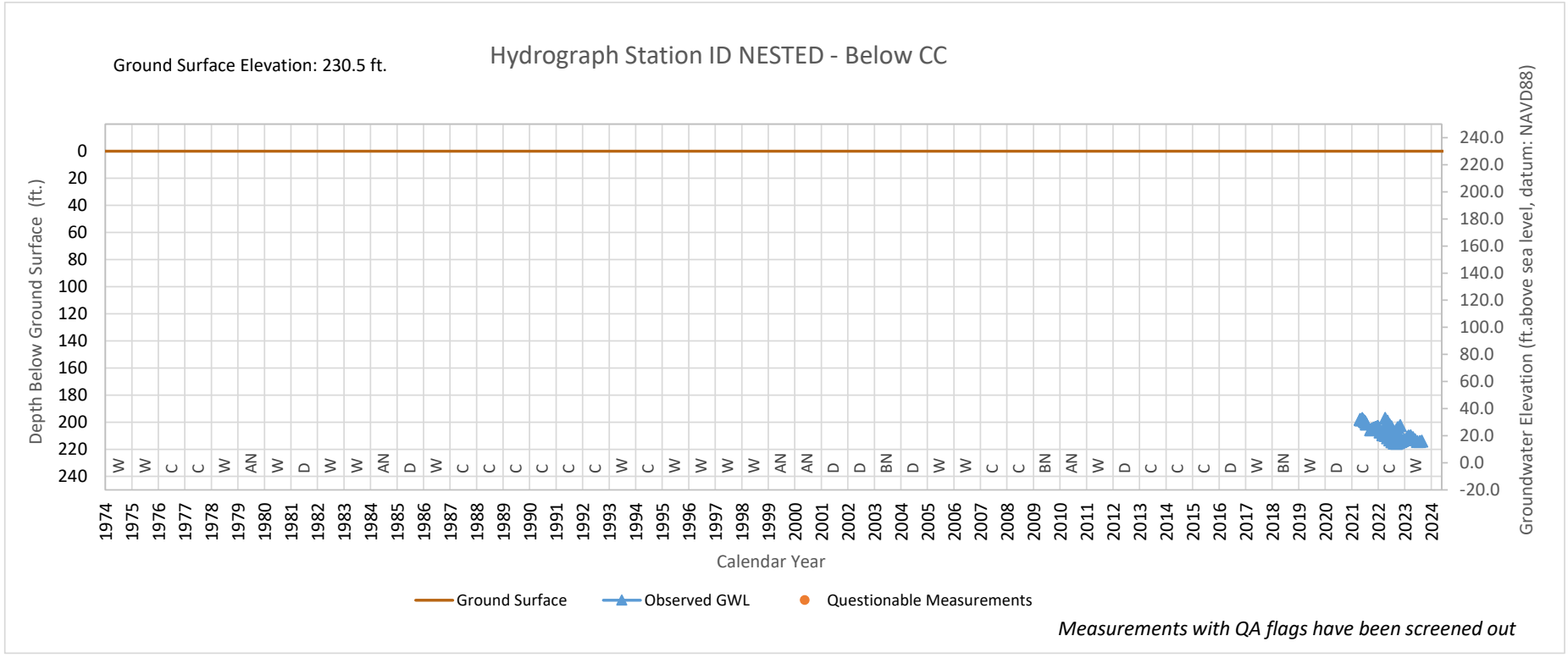

Ground Surface Elevation: 96.1 ft.
Hydrograph Station ID I - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out

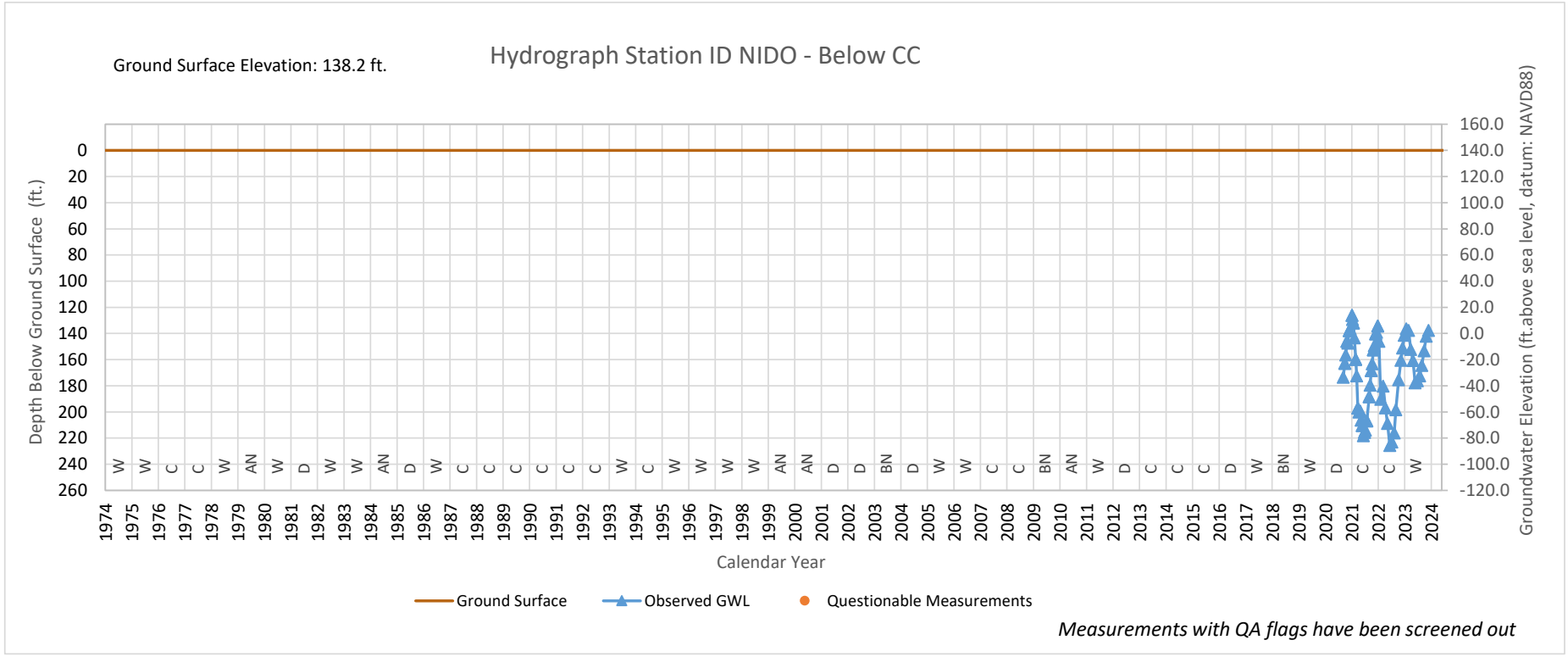

Ground Surface Elevation: 134 ft.
Hydrograph Station ID Jefferson shallow-nested - Above CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
0
20
40
60
80
100
120
140
150.0
130.0
110.0
90.0
70.0
50.0
30.0
10.0
-10.0
W W C C W AN W D W W AN D W C C C C C C W C W W W W AN AN D D BN D W W C C BN AN W D C C C D W BN W D C C W
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out

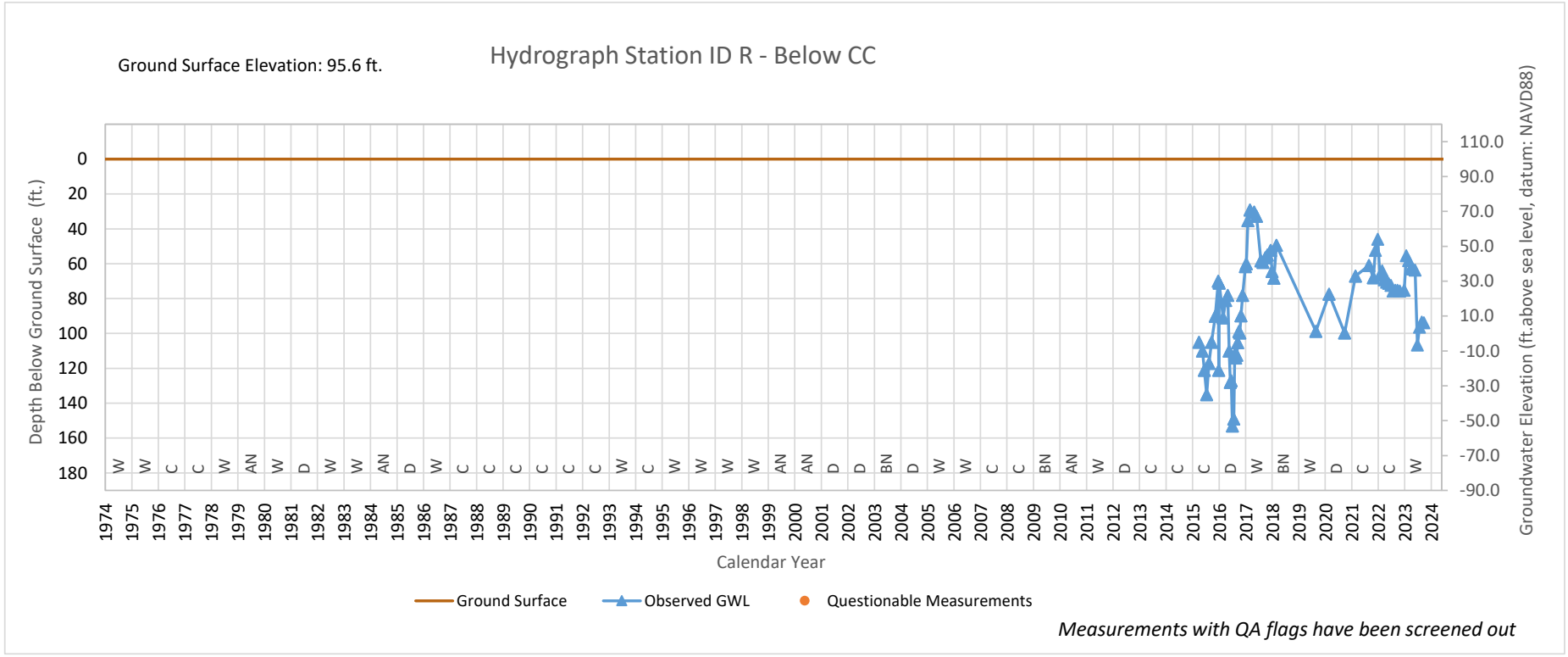

Ground Surface Elevation: 133.7 ft.
Hydrograph Station ID JEFFERSON - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 96.1 ft.
Hydrograph Station ID L - Above CC
Depth Below Ground Surface (ft.)
0
20
40
60
80
100
110.0
90.0
70.0
50.0
30.0
10.0
-10.0
Groundwater Elevation (ft.above sea level, datum: NAVD88)
W W C C W AN W D W W AN D W C C C C C C W C W W W W AN AN D D BN D W W C C BN AN W D C C C D W BN W D C C W
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out

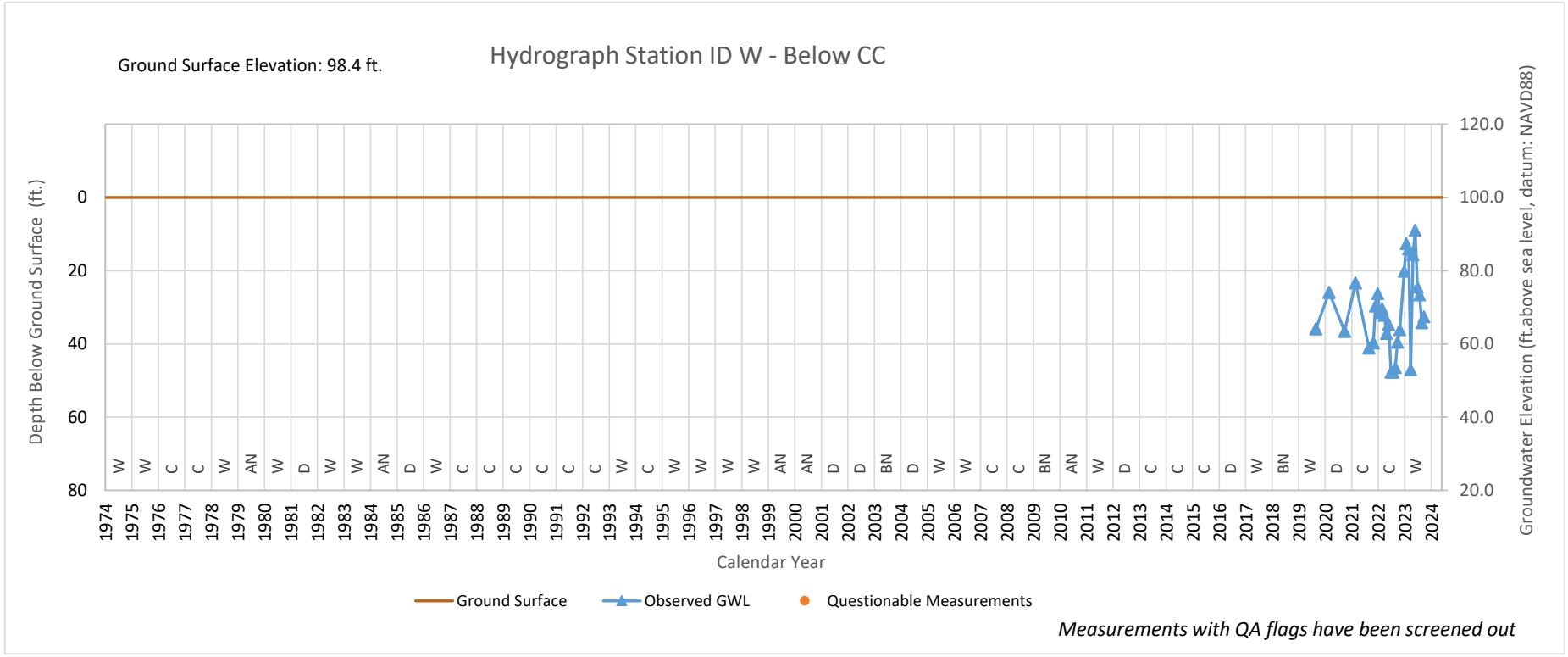

Ground Surface Elevation: 141 ft.
Hydrograph Station ID MICHAELRD - Above CC
Depth Below Ground Surface (ft.)
0
20
40
150.0
130.0
110.0
90.0
Groundwater Elevation (ft.above sea level, datum: NAVD88)
W W C C W AN W D W W AN D W C C C C C C W C W W W W AN AN D D BN D W W C C BN AN W D C C C D W BN W D C C W
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out


Ground Surface Elevation: 230.5 ft.
Hydrograph Station ID NESTED - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out

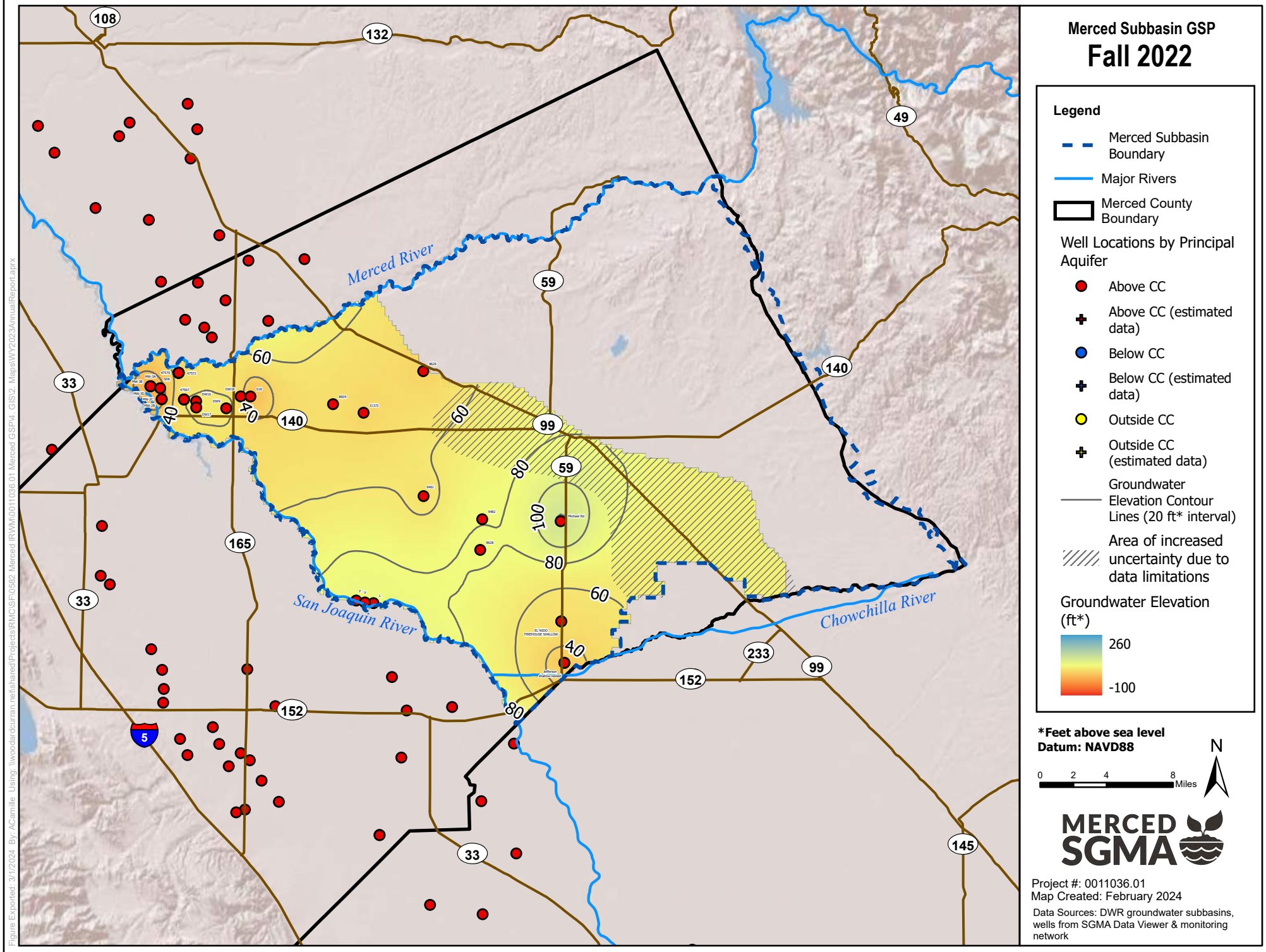

Ground Surface Elevation: 138.2 ft.
Hydrograph Station ID NIDO - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out

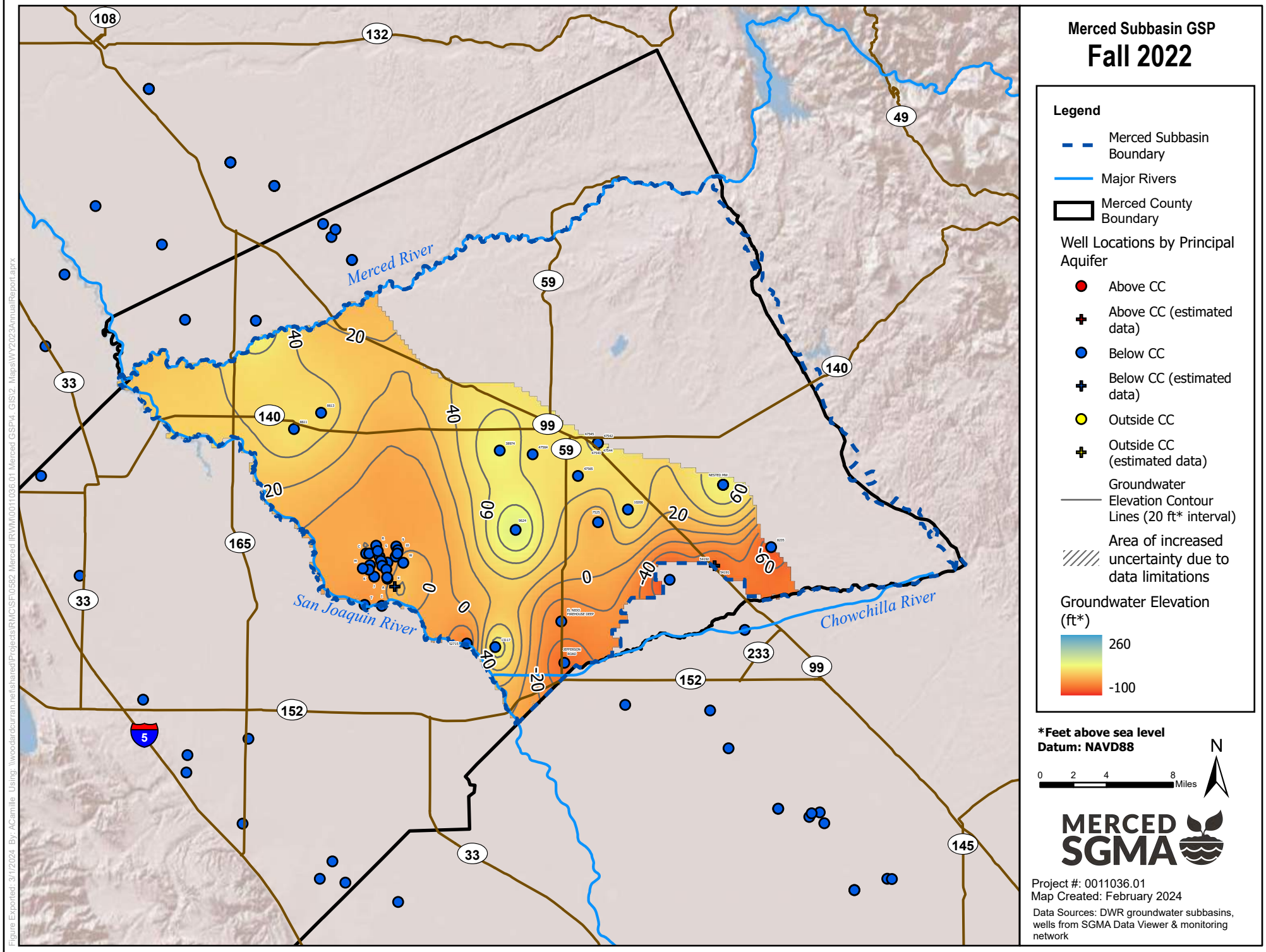


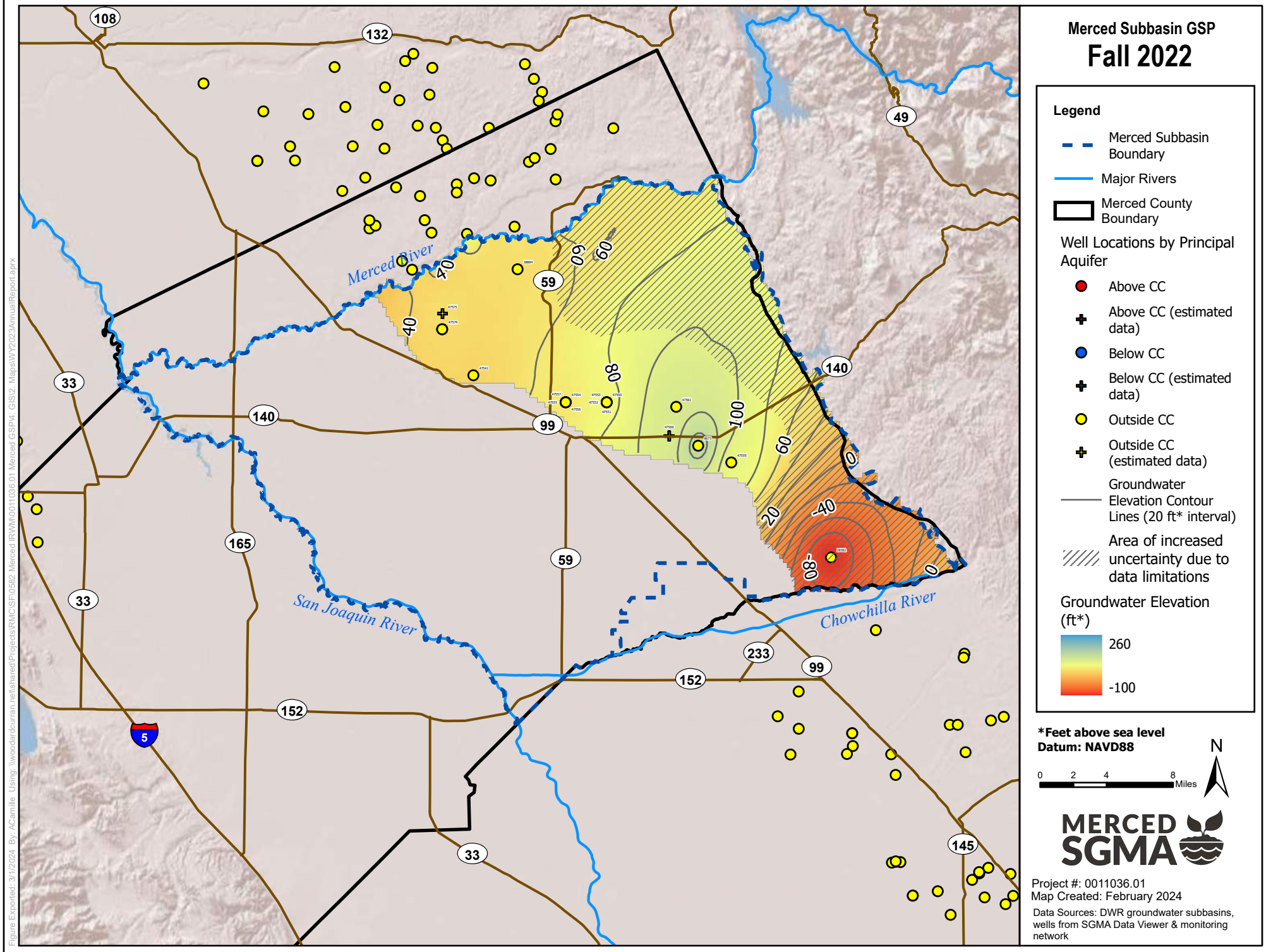
Measurements with QA flags have been screened out


Ground Surface Elevation: 98.4 ft.
Hydrograph Station ID W - Below CC
Depth Below Ground Surface (ft.)
Groundwater Elevation (ft.above sea level, datum: NAVD88)
0
20
40
60
80
120.0
100.0
80.0
60.0
40.0
20.0
W W C C W AN W D W W AN D W C C C C C C W C W W W W AN AN D D BN D W W C C BN AN W D C C C D W BN W D C C W
1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024
Calendar Year
Ground Surface
Observed GWL
Questionable Measurements
Measurements with QA flags have been screened out

APPENDIX B: GROUNDWATER LEVEL CONTOUR MAPS


Merced Subbasin GSP
Fall 2022
Legend
Merced Subbasin Boundary
Major Rivers
Merced County Boundary
Well Locations by Principal Aquifer
Above CC
Above CC (estimated data)
Below CC
Below CC (estimated data)
Outside CC
Outside CC (estimated data)
Groundwater Elevation Contour Lines (20 ft* interval)
Area of increased uncertainty due to data limitations
Groundwater Elevation (ft*)
260
-100
*Feet above sea level
Datum: NAVD88
N
0 2 4 8 Miles
MERCED SGMA
Project #: 0011036.01
Map Created: February 2024
Data Sources: DWR groundwater subbasins, wells from SGMA Data Viewer & monitoring network
Merced River
San Joaquin River
Chowchilla River
108
132
49
59
140
33
99
165
152
233
145
5
60
40
80
100


Merced Subbasin GSP
Fall 2022
Legend
Merced Subbasin Boundary
Major Rivers
Merced County Boundary
Well Locations by Principal Aquifer
Above CC
Above CC (estimated data)
Below CC
Below CC (estimated data)
Outside CC
Outside CC (estimated data)
Groundwater Elevation Contour Lines (20 ft* interval)
Area of increased uncertainty due to data limitations
Groundwater Elevation (ft*)
260
-100
*Feet above sea level
Datum: NAVD88
N
0 2 4 8 Miles
MERCED SGMA
Project #: 0011036.01
Map Created: February 2024
Data Sources: DWR groundwater subbasins, wells from SGMA Data Viewer & monitoring network
Merced River
San Joaquin River
Chowchilla River
108
132
49
59
140
33
99
165
152
233
5
145
Figure Exported: 3/1/2024 By: ACamille Using: \\woodardcurran.net\shared\Projects\RMCSF\0582 Merced IRWM\0011036.01 Merced GSP4. GIS\2. Maps\WY2023AnnualReport.aprx


Merced Subbasin GSP
Fall 2022
Legend
Merced Subbasin Boundary
Major Rivers
Merced County Boundary
Well Locations by Principal Aquifer
Above CC
Above CC (estimated data)
Below CC
Below CC (estimated data)
Outside CC
Outside CC (estimated data)
Groundwater Elevation Contour Lines (20 ft* interval)
Area of increased uncertainty due to data limitations
Groundwater Elevation (ft*)
260
-100
*Feet above sea level
Datum: NAVD88
N
0 2 4 8 Miles
MERCED SGMA
Project #: 0011036.01
Map Created: February 2024
Data Sources: DWR groundwater subbasins, wells from SGMA Data Viewer & monitoring network
Merced River
San Joaquin River
Chowchilla River
108
132
49
59
140
33
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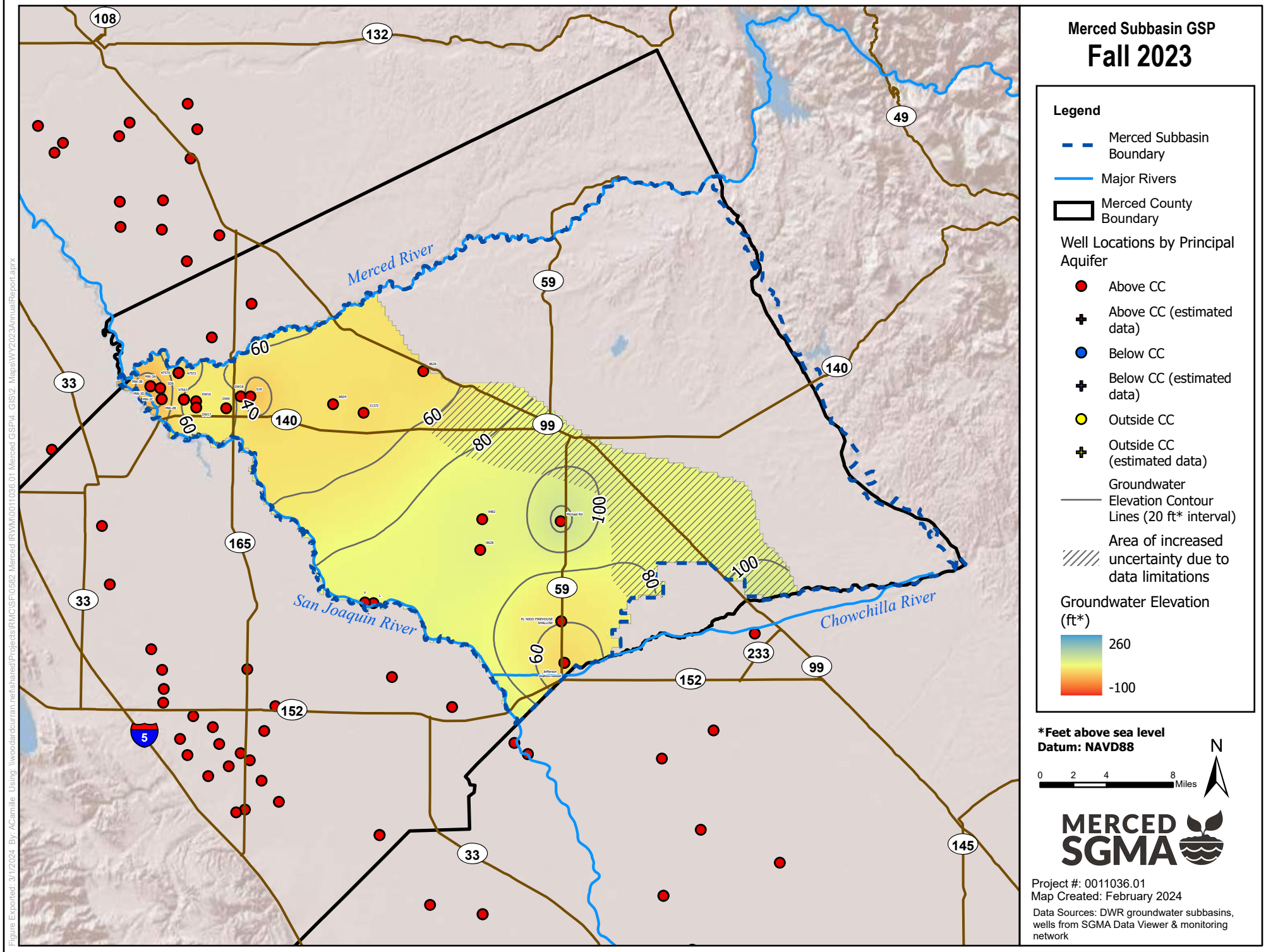
165
152
5
233
145



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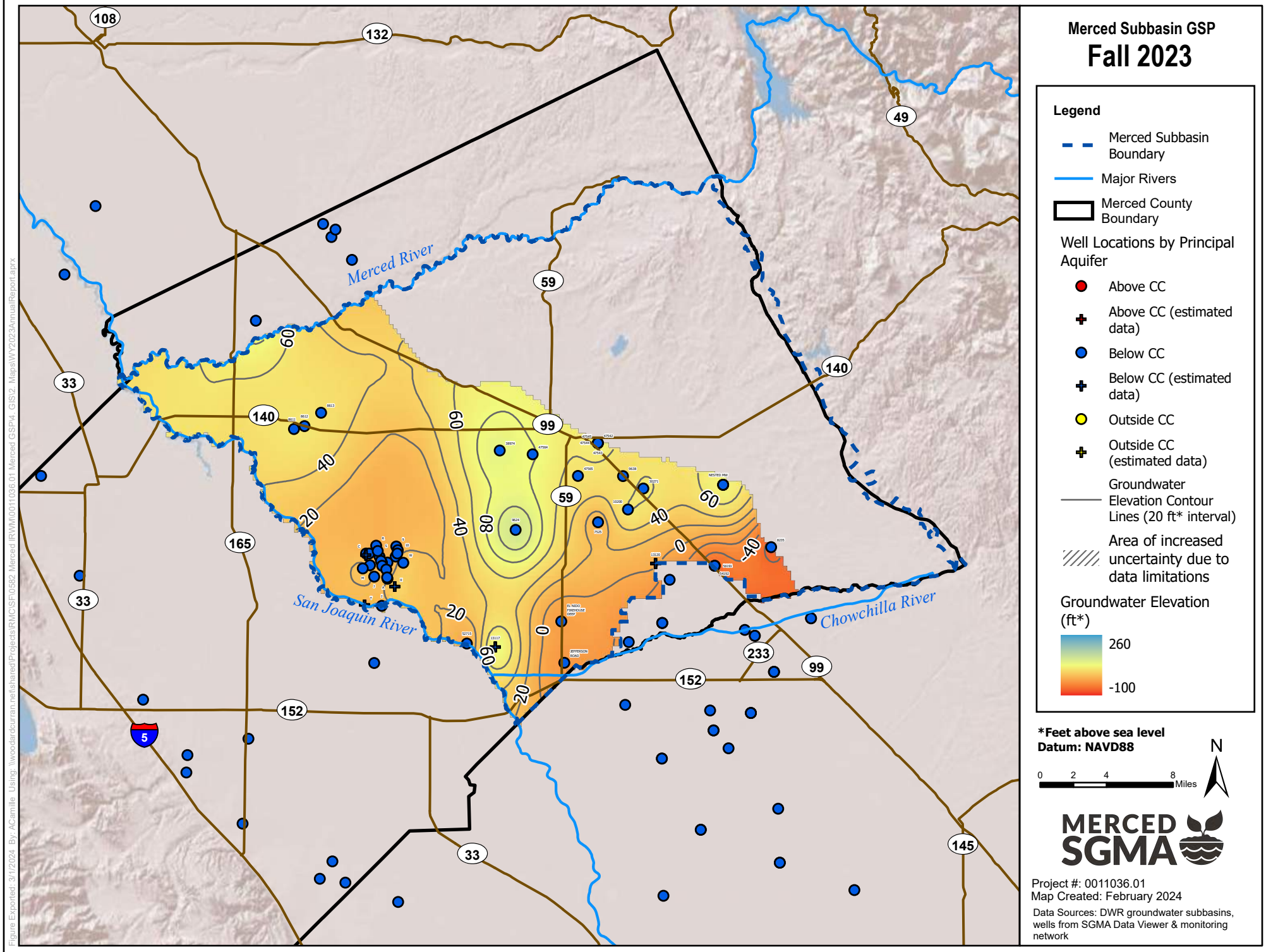
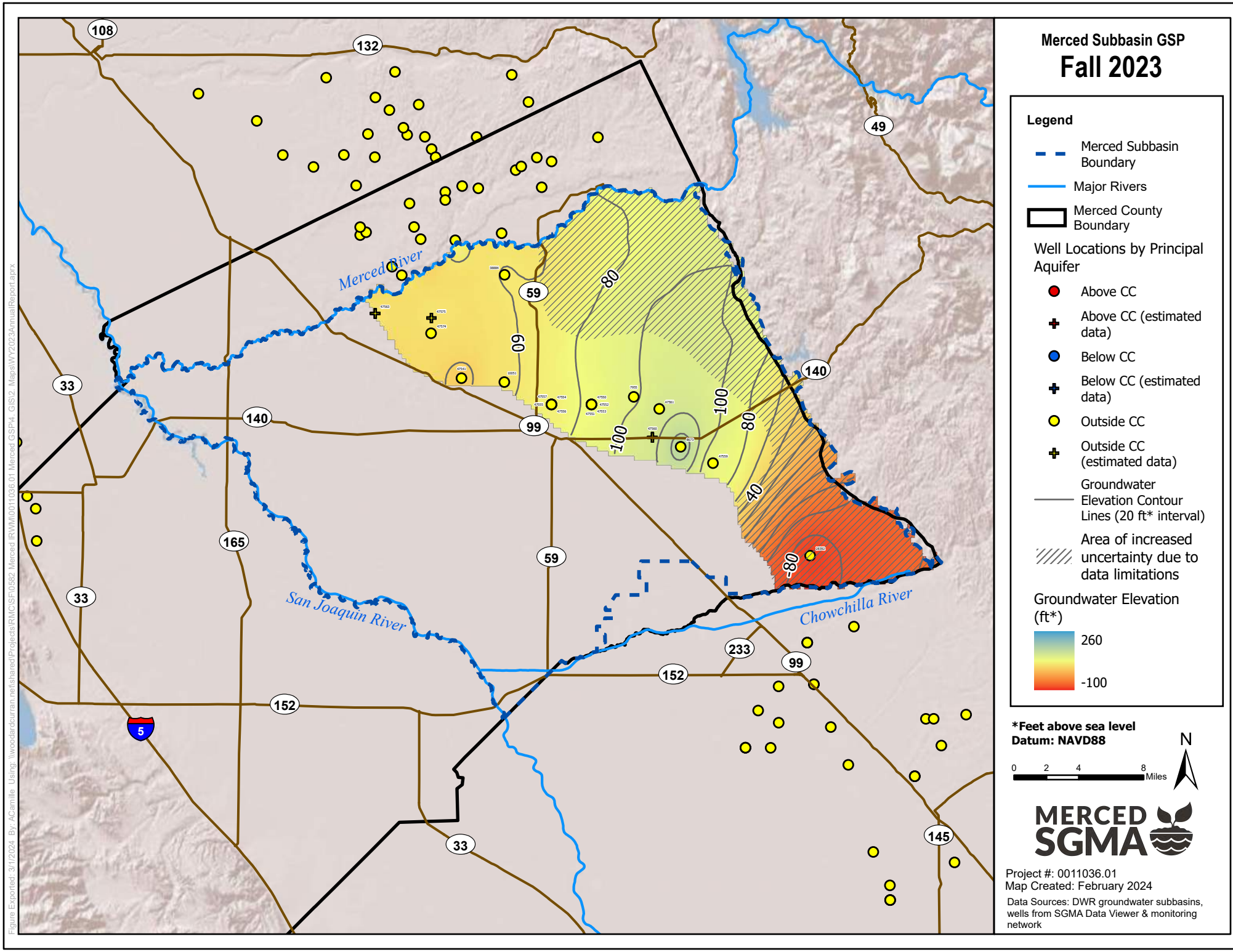

Merced Subbasin GSP
Fall 2023
Legend
Merced Subbasin Boundary
Major Rivers
Merced County Boundary
Well Locations by Principal Aquifer
Above CC
Above CC (estimated data)
Below CC
Below CC (estimated data)
Outside CC
Outside CC (estimated data)
Groundwater Elevation Contour Lines (20 ft* interval)
Area of increased uncertainty due to data limitations
Groundwater Elevation (ft*)
260
-100
*Feet above sea level
Datum: NAVD88
N
0 2 4 8 Miles
MERCED SGMA
Project #: 0011036.01
Map Created: February 2024
Data Sources: DWR groundwater subbasins, wells from SGMA Data Viewer & monitoring network
Merced River
San Joaquin River
Chowchilla River
108
132
49
59
140
33
99
165
152
5
233
145
60
40
20
80
0
-40


Merced Subbasin GSP
Fall 2023
Legend
Merced Subbasin Boundary
Major Rivers
Merced County Boundary
Well Locations by Principal Aquifer
Above CC
Above CC (estimated data)
Below CC
Below CC (estimated data)
Outside CC
Outside CC (estimated data)
Groundwater Elevation Contour Lines (20 ft* interval)
Area of increased uncertainty due to data limitations
Groundwater Elevation (ft*)
260
-100
*Feet above sea level
Datum: NAVD88
N
0 2 4 8 Miles
MERCED SGMA
Project #: 0011036.01
Map Created: February 2024
Data Sources: DWR groundwater subbasins, wells from SGMA Data Viewer & monitoring network
Merced River
San Joaquin River
Chowchilla River
108
132
49
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140
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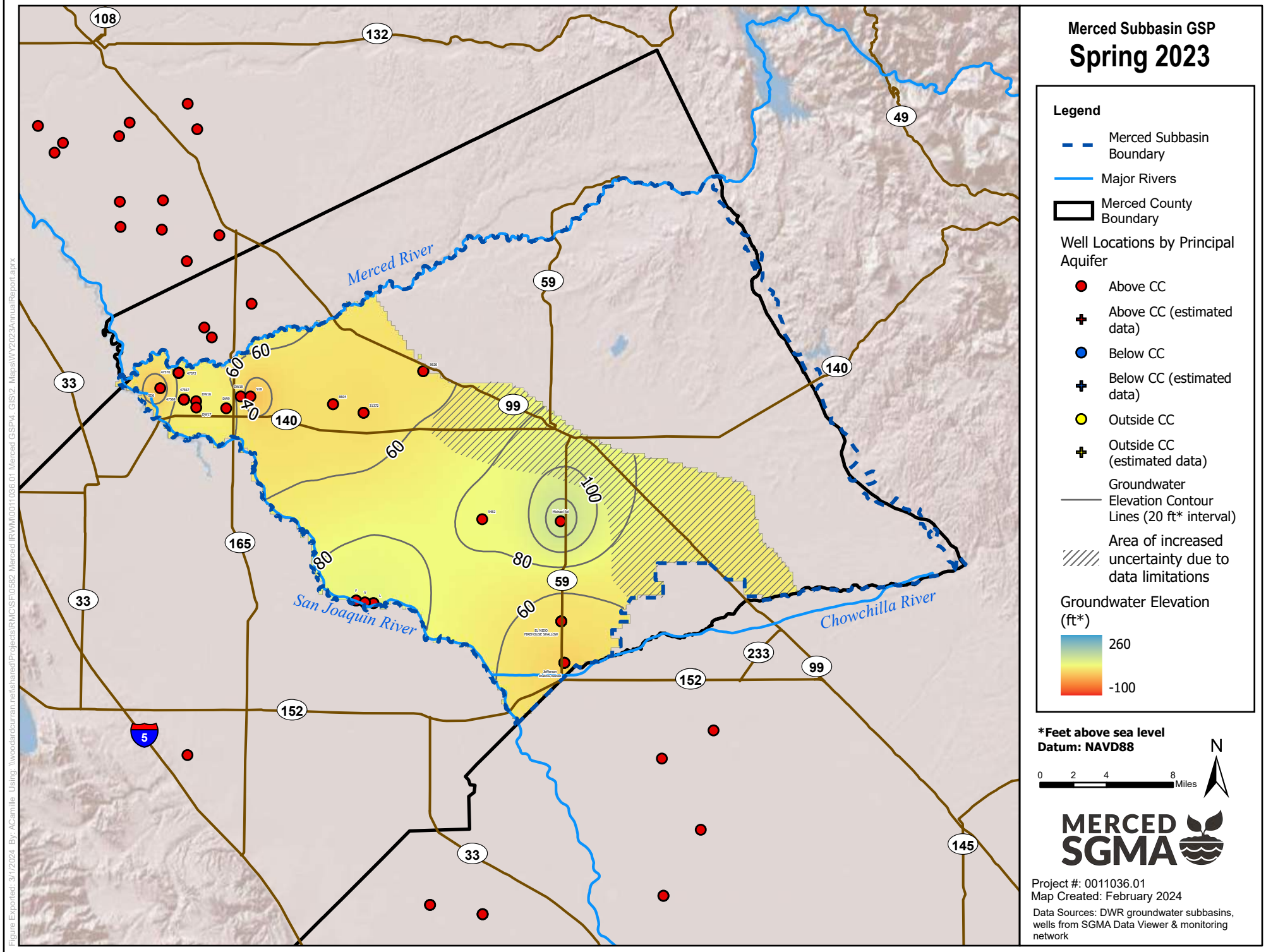
165
152
233
145
5
80
60
100
40
-80
-100


Merced Subbasin GSP
Spring 2023
Legend
Merced Subbasin Boundary
Major Rivers
Merced County Boundary
Well Locations by Principal Aquifer
Above CC
Above CC (estimated data)
Below CC
Below CC (estimated data)
Outside CC
Outside CC (estimated data)
Groundwater Elevation Contour Lines (20 ft* interval)
Area of increased uncertainty due to data limitations
Groundwater Elevation (ft*)
260
-100
*Feet above sea level
Datum: NAVD88
N
0 2 4 8 Miles
MERCED SGMA
Project #: 0011036.01
Map Created: February 2024
Data Sources: DWR groundwater subbasins, wells from SGMA Data Viewer & monitoring network
Merced River
San Joaquin River
Chowchilla River
108
132
49
59
140
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33
165
152
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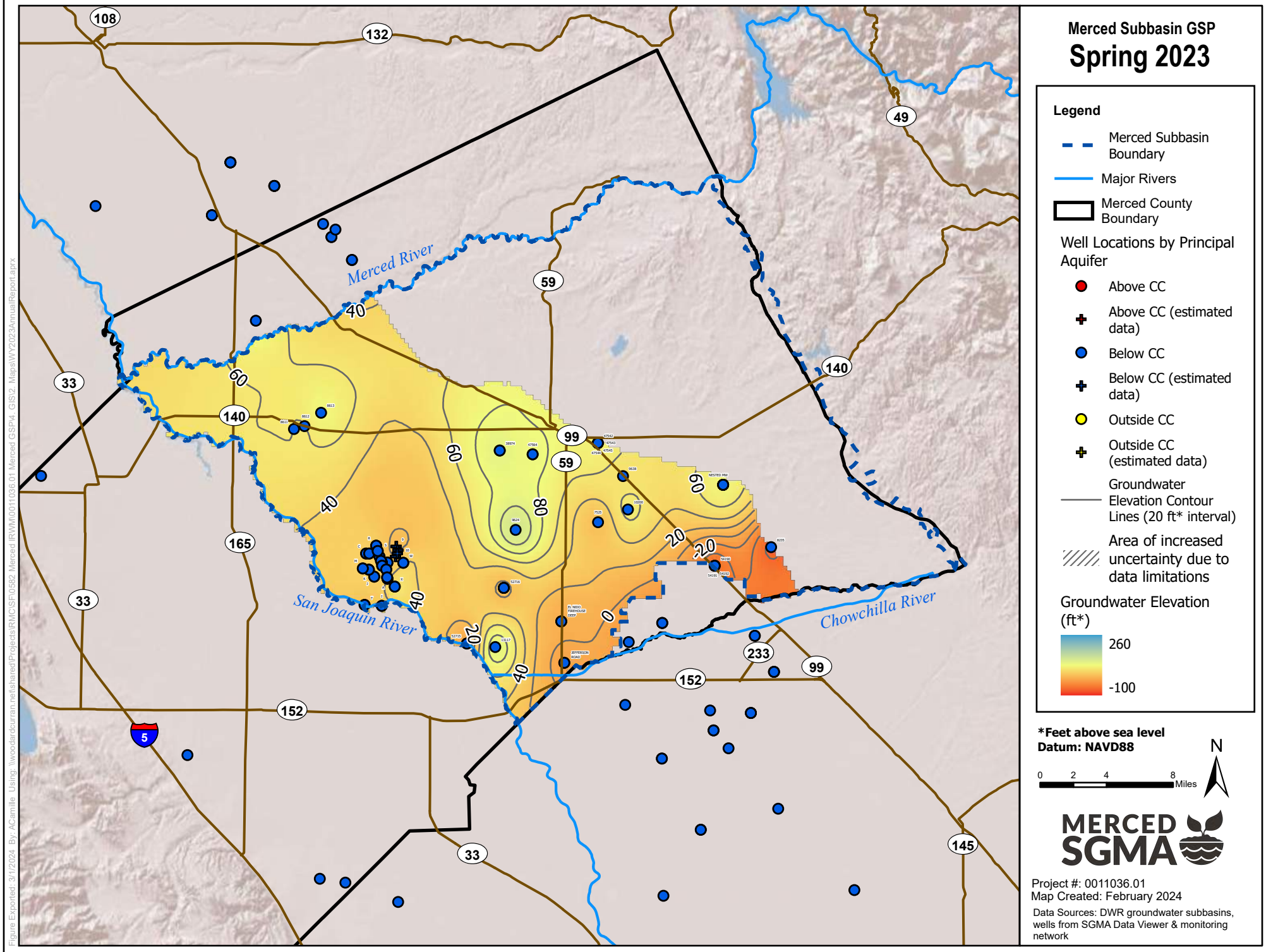
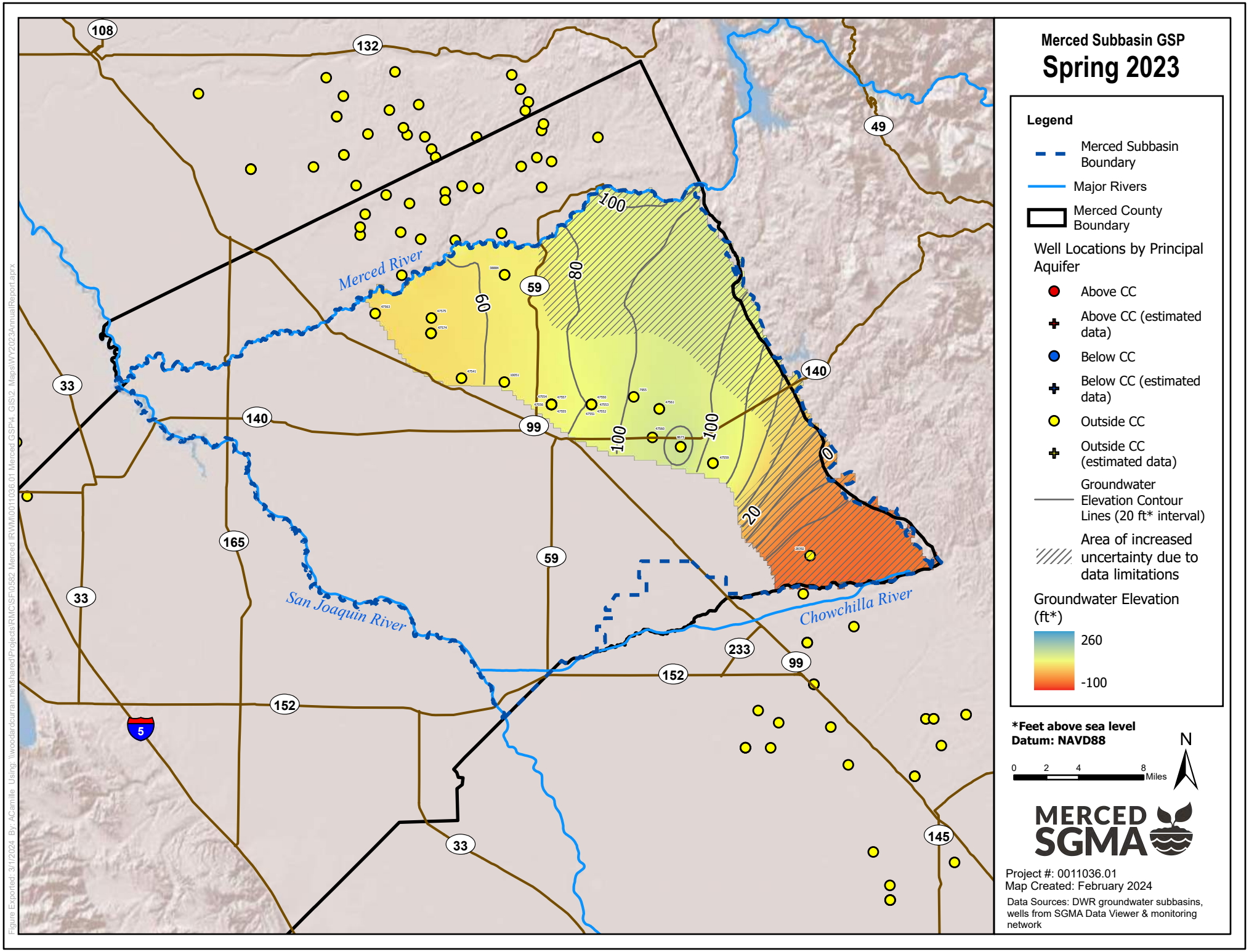
60
40
80
100


Merced Subbasin GSP
Spring 2023
Legend
Merced Subbasin Boundary
Major Rivers
Merced County Boundary
Well Locations by Principal Aquifer
Above CC
Above CC (estimated data)
Below CC
Below CC (estimated data)
Outside CC
Outside CC (estimated data)
Groundwater Elevation Contour Lines (20 ft* interval)
Area of increased uncertainty due to data limitations
Groundwater Elevation (ft*)
260
-100
*Feet above sea level
Datum: NAVD88
N
0 2 4 8 Miles
MERCED SGMA
Project #: 0011036.01
Map Created: February 2024
Data Sources: DWR groundwater subbasins, wells from SGMA Data Viewer & monitoring network
Merced River
San Joaquin River
Chowchilla River
Figure Exported: 3/1/2024 By: ACamille Using: \\woodardcurran.net\shared\Projects\RMCSF\0582 Merced IRWM\0011036.01 Merced GSP4. GIS\2. Maps\WY2023AnnualReport.aprx


Merced Subbasin GSP
Spring 2023
Legend
Merced Subbasin Boundary
Major Rivers
Merced County Boundary
Well Locations by Principal Aquifer
Above CC
Above CC (estimated data)
Below CC
Below CC (estimated data)
Outside CC
Outside CC (estimated data)
Groundwater Elevation Contour Lines (20 ft* interval)
Area of increased uncertainty due to data limitations
Groundwater Elevation (ft*)
260
-100
*Feet above sea level
Datum: NAVD88
N
0 2 4 8 Miles
MERCED SGMA
Project #: 0011036.01
Map Created: February 2024
Data Sources: DWR groundwater subbasins, wells from SGMA Data Viewer & monitoring network
Merced River
San Joaquin River
Chowchilla River
100
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-100
108
132
49
140
33
99
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165
152
233
145
5

Woodard & Curran

woodardcurran.com

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916.999.8700

Image courtesy: Veronica Adrover/UC Merced