



# **R-Area Groundwater (NBN) Biennial Effectiveness Monitoring Report in Support of R-Area Operable Unit (U)**

**January 2021 through December 2022**

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## LIST OF ABBREVIATIONS AND ACRONYMS

~	approximately
<	less than
cDCE	cis-1,2-dichloroethylene
cm	centimeter
EMP	Effectiveness Monitoring Plan
EMR	Effectiveness Monitoring Report
ft	feet
in	inch
ISD	<i>In situ</i> decommissioning
J	Result between Method Detection Limit and Practical Quantitation Limit, indicating it was detected but the actual concentration is of higher uncertainty.
L	liter
LAZ	lower aquifer zone
LUCs	land use controls
m	meters
MAZ	middle aquifer zone
MCL	maximum contaminant level
MDL	method detection limit
µg	microgram
mL	milliliter
MNA	monitored natural attenuation
amsl	above mean sea level
NA	not applicable
pCi	picocurie
PQL	practical quantitation limit
PRG	preliminary remedial goal
RAOU	R-Area Operable Unit
RAGW	R-Area Groundwater
RBC	R-Reactor Building Complex (105-R)
RCOC	refined contaminants of concern
ROD	Record of Decision
SRNS	Savannah River Nuclear Solutions, LLC
SRS	Savannah River Site
TCE	trichloroethylene
TCCZ	Tan Clay Confining Zone
TZ	Transmissive Zone
UAZ	upper aquifer zone
UTM	universal transverse mercator
UTRA	Upper Three Runs Aquifer
VC	vinyl chloride
VOC	volatile organic compound
yr	year

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## **1.0 INTRODUCTION**

This Effectiveness Monitoring Report (EMR) documents and summarizes R-Area Groundwater (RAGW) monitoring well and surface water data collected from January 2021 through December 2022 in compliance with the Effectiveness Monitoring Plan (EMP) for the R-Area Operable Unit (RAOU) and subsequent agreements. The primary goal of the RAGW EMR for the RAOU is to evaluate groundwater and surface water monitoring data supporting the Monitored Natural Attenuation (MNA) of tritium and volatile organic compound (VOC) groundwater plumes (SRNS 2011).

## **2.0 OPERABLE UNIT DESCRIPTION AND HISTORY**

R Area is located in the east central area of the Savannah River Site (SRS) (Figure 1). R-Reactor achieved criticality in December 1953 and was shut down in 1964 due to reduced requirements for defense-related products. During R-Reactor operations, releases of tritium and VOCs contaminated the groundwater in R Area.

The RAGW is a subunit of the RAOU and encompasses three tritium plumes and one VOC groundwater plume that resulted from past activities within R Area. MNA was selected as the remedial action for the groundwater in R Area (SRNS 2010a). Historical groundwater data collected from 2007 through 2010 was used to estimate the extent of the four groundwater plumes (Figure 2).

As stated in the Record of Decision (ROD) (SRNS 2010a), the final remedial action for the RAOU consists of Land Use Controls (LUCs) for the entire RAOU and MNA for the RAGW Subunit. The MNA portion of the remedy includes both groundwater and surface water monitoring as described in the EMP (SRNS 2011) in order to evaluate the effectiveness of the MNA remedy.

The long-term remedial action objective for the RAGW Subunit of the RAOU is to restore contaminated groundwater in the Upper Three Runs Aquifer (UTRA) to below regulatory limits. Based on a conservative estimate for the source concentrations, and not taking credit for dilution,

dispersion, and diffusion, estimates to reach below maximum contaminant levels (MCLs) in the four plumes ranged from 26 to 124 years (SRNS 2010b).

### **3.0 MONITORING**

#### **3.1 RAGW Monitoring**

The groundwater monitoring network currently includes 28 wells, 4 seepage locations, and 7 surface water locations (Figure 3) (Table 1).

The Floridan aquifer system is the aquifer system of concern within the RAOU boundary. The system is divided into two aquifer units separated by a confining unit. From top to bottom, they are known as the UTRA, the Gordon Confining Unit (GCU), and the Gordon Aquifer (GA). The UTRA occurs between the water table surface and the GCU. The UTRA is divided into three aquifer zones: the Upper Aquifer Zone (UAZ); the Middle Aquifer Zone (MAZ); and the Lower Aquifer Zone (LAZ). The UAZ is comprised of three zones: the A-Horizon; the AA-Horizon; and the Transmissive Zone (TZ). The TZ is a clean sand layer at the bottom of the UAZ. The UAZ and LAZ are divided by an aquitard informally referred to as the Tan Clay Confining Zone (TCCZ). The MAZ resides as a sandy to clayey-sand zone between the Tan Clay Upper Clay (TCUC) and the Tan Clay Lower Clay (TCLC) layers of the TCCZ.

Monitoring wells RAG013 and RAG014 were installed in 2011 to expand the groundwater monitoring network (Figure 3). In 2013, the Core Team (i.e., representatives from the United States Department of Energy [USDOE], United States Environmental Protection Agency [USEPA], and South Carolina Department of Health and Environmental Control [SCDHEC]), determined that a new plume boundary well (RBP011B) should be installed downgradient of well RAG008B. Well RBP011B was installed in September 2014 to monitor the Eastern VOC plume and is co-located with wells RBP 11DL and RBP 11DU (Figure 3). SRS will conduct normal maintenance on the wells as needed. Any maintenance work that changes any of the well information (e.g., reference elevation) will be discussed in the next report.

In accordance with the 2011 EMP, the initial 25 wells were scheduled to be monitored annually for the first five years (SRNS 2011). Any additional wells would be monitored semi-annually for

the first two years, then annually for three years. For this reason, newer wells RAG013 and RAG014 were sampled semi-annually during 2012 and 2013 and sampled annually since 2014. Well RBP011B installed in 2014 was sampled on a semi-annual schedule in 2014 and 2015, and now follows the annual sampling schedule consistent with the other RAGW monitoring wells. Likewise, well RAG008BL installed in 2021 was sampled on a semi-annually in 2021 and 2022 and will now follow the annual sampling schedule in 2023 consistent with the other RAGW monitoring wells. Data collected since monitoring began in 2011, in addition to historical data, has provided sufficient data to establish the refined contaminants of concern (RCOC) concentrations are trending downward at most monitoring stations. A notable exception is the increasing TCE groundwater concentrations at plume definition well RAG008B since 2010. The project team believes the observed decreasing trends warrant reduced monitoring frequency to biennial (two-year) at most wells with agreement from the Core Team. Sampling is performed as described in the most current version of Manual 3Q1, *Environmental Requirements and Program Documents* (SRNS 2010c). The analytical suite for the VOC plume wells includes carbon tetrachloride, chloroform, trichloroethylene (TCE), cis-1,2-dichloroethylene (cDCE), and vinyl chloride (VC). Tritium is the only contaminant sampled and analyzed for in the wells monitoring the RAGW tritium plumes.

Three surface water stations along Joyce Branch (JBSW-01, JBSW-02 and JBSW-03) and two seepage groundwater wells (JBS005A and JBS005B) monitor the Eastern Tritium and VOC plumes (Figure 3) (Table 1). Four surface water stations (MCSW-03 through MCSW-06) and two seepage groundwater wells (MCS002A and MCS002B) monitor the former Northern Tritium plume along Mill Creek. Two surface water locations (PASL-01 and PASL-02) monitoring the former Northern Tritium plume along Pond A were frequently dry (Appendix A) and with Core Team approval in 2019, they have been replaced by monitoring wells RSP 5DL and RAG13 (Figure 3 and Table 1). Surface water stations are used as LUC boundary stations for the Eastern VOC, Eastern Tritium, and former Northern Tritium plumes. The surface water and seepage stations are monitored annually.

The analytical suite for the stations along Joyce Branch includes tritium, carbon tetrachloride, chloroform, TCE, cDCE, and VC. Only tritium is sampled and analyzed for at Mill Creek seepage

and surface water stations. Likewise, only tritium is sampled and analyzed for at the monitoring wells near Pond A. All surface water samples are collected according to Manual 3Q1, Procedure 3001A (SRNS 2010c).

### **3.2 ISD Monitoring**

The *In situ* decommissioning (ISD) remedy for the R-Reactor Building (105-R) Complex (RBC) is designed to significantly reduce contaminant mobility and allow for radioactive decay of contaminants within the structure. The ISD remedy included grouting of all below-grade areas of the building, grouting and stabilization of disassembly basin and reactor vessel contaminants, demolition associated with the disassembly basin above-ground structure and stack, and construction of a cover system over the grouted disassembly basin and reactor vessel.

The ISD monitoring wells were installed to verify the remedial action for the RBC is functioning as designed and the wells are sampled every five years according to the 2011 EMP (SRNS 2011) to demonstrate that the ISD remedy remains effective in preventing impact to groundwater. The ISD monitoring wells are shown in Figure 4 and listed in Table 1.

The ISD monitoring network consists of ten ISD wells and one temporary ISD well (RDB 2D). Well RDB 2D is not one of the original ten wells identified as an ISD monitoring well in the RAOU EMP, but it was added in 2017 to aid ISD monitoring, so it is identified as an temporary ISD monitoring well in this report. If the Core Team determines well RDB 2D needs to be retained as an ISD well the “temporary” designation will be dropped in future reports.

Wells RAG003DU, RAG003DL, RDB 1D, RDB 2D, RDB 3D, RDB005C, RPS004C, RSE032D, and RSE033D are used to monitor the RBC. Two wells (RDB003DU and RPS004DU) were installed in 2011 for additional ISD monitoring of the RBC. ISD monitoring well RPS004DU was observed to have a warped casing in one section and was abandoned per Manual 3Q1 (SRNS 2010c). Replacement well RPS004DUR was installed in 2012 to monitor the RBC and serves as a replacement well for RPS004DU. Well RPS004DUR is sampled every five years per the ISD sampling schedule, and has been sampled in 2012, 2017, and 2022.

In 2017, carbon-14 was detected (141 picocuries per liter [pCi/L]) in the groundwater near the RBC at well RDB 3D, but below the MCL (2,000 pCi/L). SRS notified the Core Team and elected to sample for carbon-14 and tritium annually for five years (2018-2022) at five monitoring wells (RDB 1D, RDB 2D, RDB 3D, RDB003DU, and RDB005C) near the RBC (Figure 5). Well RDB 2D is not one of the 10 wells identified as an ISD monitoring well in the RAOU EMP, so it is identified as a temporary ISD monitoring well in this report.

The ISD wells are sampled once every five years for the three most mobile contaminant migration RCOCs (carbon-14, chlorine-36, and iodine-129) plus tritium. Tritium was not a contaminant migration RCOC, but it is a useful leading indicator of potential contaminant migration. In 2022 ISD sampling was conducted at all 11 wells.

### **3.3 Groundwater Flow Directions**

The 31-year (yr) average (1990 through 2020) for SRS rainfall is 122.6 centimeter per year (cm/yr [48.25 inches per year {in./yr}]), based on data from the SRS 700-A rain gauge (SRNL 2021). In 2021, SRS received 130.25 cm (51.28 in.) of rainfall, based on data from the SRNL Atmospheric Technologies Group 773-A rain gauge. In 2022, SRS received 100.13 cm (39.42 in.) of rainfall, based on data from the SRNL Atmospheric Technologies Group 773-A rain gauge. The average groundwater recharge is estimated at 31.8 cm (12.5 in./yr), while the remainder is lost to evapotranspiration or run-off to surface water (WSRC 2000). Years with greater-than-average rainfall will tend to provide more groundwater recharge, and the water table will tend to rise. Years with lower-than-average rainfall will tend to provide less groundwater recharge, and the water table will tend to fall.

Historic water elevations, extending from 1984 to present, are displayed as hydrographs in Appendix B. The potentiometric surfaces were mapped using fourth quarter 2022 water elevations for the TZ of the UAZ, and the LAZ (Appendix E). The MAZ was not contoured due to the limited number of wells within the aquifer.

Within the RAOU LUC boundary, groundwater in the TZ of the UAZ was demonstrated to flow radially from a local mounded area centered to the northeast of the RBC (Figure 2) (SRNS 2011). In 2022, the water table elevation in this mounded area is approximately (~) 83.78-meters

(m [ $\sim$ 274.8-feet {ft}]) above mean sea level (amsl), and the groundwater flows toward Mill Creek ( $\sim$ 79.3-m [ $\sim$ 260-ft] amsl) to the north, Joyce Branch ( $\sim$ 65.5-m [ $\sim$ 215-ft] amsl) to the west, and Pond 4 ( $\sim$ 73.0-m [ $\sim$ 239.4-ft] amsl) to the south (Figure 2 and Appendix E). Groundwater in the LAZ flows to the northeast toward Joyce Branch (Appendix E).

### **3.4 RAGW Compliance**

Key source area monitoring wells were identified in the EMP (SRNS 2011) for each plume and are sampled annually (Table 1). If observed tritium or TCE concentrations in these wells exceed an MNA Action Limit (i.e., 150% of the observed maximum between 2002 and 2010) (Table 2), then a confirmation sample will be collected, and the frequency of sampling will be increased to quarterly for one year. A best fit line will be applied to the value that exceeded the trigger limit and subsequent data, and if the line has a positive slope, then an increasing trend is present. If an increasing trend is observed, a Core Team meeting will be convened to discuss the results and determine if other remediation alternatives should be considered (SRNS 2011). No source area monitoring wells have exceeded an Action Limit.

LUC boundary stations for the plumes are identified in Table 1. These stations verify tritium and VOC concentrations are below MCLs outside the LUC boundary, and that the plumes are not expanding horizontally or vertically. If the tritium or VOC concentration in any LUC boundary station exceeds an MCL and is verified by a confirmation sample, then the Core Team will convene to discuss necessary actions (e.g., expansion of the LUC boundary or additional monitoring).

Plume boundary wells (vertical and horizontal extent) for all plumes are identified in Table 1. If the tritium or VOC concentration in any plume boundary well sample exceeds an MCL and is verified by a confirmation sample, then an additional well will be installed downgradient of the boundary well if determined necessary by the Core Team. Groundwater samples from plume boundary well RAG008B exceeded the MCL (5 microgram per liter [ $\mu$ g/L]) for TCE. The Core Team determined a new plume boundary well (RBP011B) should be installed in 2014 to monitor horizontal expansion of the VOC plume. Well RAG008B is now a plume definition well. The Core Team determined a deeper well (RAG008BL) should be co-located with plume definition well RAG008B to ensure the VOC plume was bounded vertically. Plume boundary well RAG008BL was installed in 2021, and TCE has been below detection in 2021 and 2022. The

plume definition wells (Table 1) are used to monitor the contaminants within the plume and are expected to exceed MCLs. With the approval of the Core Team, SRS may suspend monitoring on any station with stable or decreasing RCOC concentrations that are below MCLs for six consecutive years (SRNS 2011).

If the MCL for tritium or a VOC is exceeded in a surface water sample, a confirmation sample will be collected. If the exceedance is confirmed, a Core Team meeting will be convened to discuss a path forward.

### **3.5 ISD Compliance**

The original ISD monitoring network consists of ten wells identified in the EMP (SRNS 2011), and they are sampled every five years (Table 1). If observed contaminant concentrations in a monitoring well exceed MCLs/preliminary remediation goals (PRGs), a confirmation sample will be collected for that contaminant. If the confirmation sample concentration also exceeds the MCL/PRG and background levels, then a Core Team meeting will be convened to discuss the results and a path forward.

It is important to note that the 2017 ISD sampling event at well RDB 3D had carbon-14 results above the practical quantitation limit (PQL), but less than the MCL. Well RDB 3D also had elevated tritium results in comparison to historical data. As a result, SRS monitored for carbon-14 and tritium at five of the ISD monitoring wells (RDB 1D, RDB 2D, RDB 3D, RDB003DU, and RDB005C) annually for the past five years (2018 through 2022). Well RDB 2D was added as a temporary ISD monitoring well during this 5-year period, and its continued need will be determined by the ISD monitoring data.

## **4.0 REPORTING**

### **4.1 RAGW Subunit MNA Results**

Appendix A provides the results for RAGW groundwater and surface water sampling during 2021 and 2022. Appendix C provides time-series plots for the RAGW wells. Appendix D contains plume maps for each groundwater plume. Table 2 identifies the maximum concentrations for each

RCOC for each plume during the 2021 and 2022 sampling period. No MNA Action Limits were exceeded in 2021 or 2022.

The RCOCs that exceeded their specific MCLs in 2021 are tritium and TCE (Table 2). There was one result above the PQL for cDCE in the 2021 sampling event, but it did not exceed the MCL (70 µg/L). There was one result above the method detection limit (MDL) for VC during the 2021 sampling period, but it was less than the MCL (2 µg/L). Carbon tetrachloride and chloroform results were below their detection limits in all of the monitoring wells and surface water stations in 2021.

The RCOCs that exceeded their specific MCLs in 2022 are tritium, TCE and VC. There were four results above the PQL for cDCE in the 2022 sampling period, but none of them exceeded the MCL (70 µg/L). There were two results above the MDL for VC during the 2022 sampling period, and one result (2.04 µg/L) at RPS004DUR exceeded the MCL (2 µg/L). All carbon tetrachloride and chloroform results were below their detection limits in all of the monitoring wells and surface water locations during the 2022 sampling period.

#### ***4.1.1 Eastern VOC Plume***

The Eastern VOC plume originates about 280 m (919 ft) from the northeast side of the R-Reactor Building (105-R) and extends east towards Joyce Branch (Figure 3). VOCs are constrained vertically to the UAZ of the UTRA, primarily in the sandy TZ (Figure 8), but TCE results above the MCL (5 µg/L) have been confirmed in the LAZ of the UTRA at plume definition well RAG008B. TCE is the predominant VOC and is used to depict the 2022 Eastern VOC Plume that has decreased in size and concentration relative to the 2010 TCE plume (Figure 3 and Figure 6).

During the 2021 monitoring period three wells (RAG008DL, RAG008B, and RBP 11DL) in the mid-plume area exceeded the TCE MCL (5 µg/L). During the 2022 monitoring period only two wells (RAG008DL and RAG008B) in the mid-plume area exceeded the TCE MCL (5 µg/L). Key source area well RWT003C remained below the MCL for TCE during the 2021 and 2022 sampling events, continues to show a decreasing trend, and the 2022 result was below detection limits.

In the UAZ of the UTRA, well RAG008DL exceeded the TCE MCL (5 µg/L) in 2021 and 2022 but continues to show a decreasing trend for TCE since 2010. Long term (2002 through 2022) results from plume definition well RBP 11DL continue to show a decreasing trend for TCE in the groundwater and concentrations were below the TCE MCL (5 µg/L) for the first time in 2022 (Appendix C, Figure C-32).

In the LAZ, the current TCE concentration (24.2 µg/L) in plume definition well RAG008B reflects an increasing trend since 2010 (Appendix C, Figure C-30). The elevated TCE concentrations detected at well RAG008B are likely due to a higher concentration portion of the groundwater plume migrating from the R-Reactor Building (105-R) toward Joyce Branch. Plume boundary well RBP011B continues to show a steady trend with TCE concentrations near the PQL (1 µg/L) (Appendix C, Figure C-32).

Downgradient seep line samples at wells JBS005A and JBS005B were below the detection limit for TCE during the 2021 and 2022 sampling events.

All three Joyce Branch surface water samples (JBSW-01, JBSW-02, and JBSW-03) remained below the detection limit for TCE during 2021 and 2022.

Plume definition well RPS004C and ISD well RSP004DUR were the only monitoring stations that had detectable VC groundwater concentrations in 2022 (1.64 µg/L and 2.04 µg/L, respectively). ISD monitoring well RPS004DUR was the only monitoring station that had VC groundwater concentrations (2.04 µg/L) above the MCL (2 µg/L) in 2022. Overall, VC concentrations at well RSP004C indicate a decreasing trend since sampling began in 2007 (Appendix C, Figure C-16).

Concentrations of cDCE did not exceed the MCL (70 µg/L) at any monitoring station in 2021 or 2022. Groundwater at well RPS004C had the highest cDCE concentrations (16.7 µg/L and 9.73 µg/L) in 2021 and 2022. The cDCE concentrations in the groundwater at well RPS004C represent an overall decreasing trend since monitoring began in 2007 when the groundwater concentration of cDCE was 29.3 µg/L (Appendix C, Figure C-25). Concentrations of carbon tetrachloride and chloroform were below the detection limits in all wells during the 2021 and 2022 sampling events.

#### ***4.1.2 Eastern Tritium Plume***

The Eastern Tritium plume emanates from the southeast corner of the RBC, near the former location of the moderator distillation columns, and extends east to Joyce Branch (Figure 3). Tritium is primarily constrained vertically to the UAZ of the UTRA, primarily in the sandy TZ (Figure 9); only sporadic results above the PQLs have been observed in the LAZ of the UTRA. The 2022 Eastern Tritium Plume has decreased in size and concentration relative to the 2010 tritium plume (Figure 3 and Figure 7).

In 2021 and 2022, key source area well RPS004C yielded tritium results above the MCL (20 pCi/mL), although concentrations are below the Action Limit (2,610 pCi/mL) for tritium at this well (Table 2). A decreasing trend is evident at well RPS004C, which had a maximum tritium concentration of 1,740 pCi/mL in March 2008 and a tritium concentration of 141 pCi/mL during the 2022 sampling period (Appendix C, Figure C-60). ISD wells RAG003DL and RPS004DUR, had groundwater tritium concentrations of 29 pCi/mL and 376 pCi/mL, respectively, which also exceeded the MCL.

In the UAZ of the UTRA, long term results (2002 through 2022) from plume definition wells RBP 11DL and RBP 11DU continue to indicate decreasing trends for groundwater tritium concentrations (Appendix C, Figure C-50). Plume definition well RCS003C continues to show a stable trend since first sampled in 2007. The tritium concentrations in the groundwater at plume definition well RAM009C initially increased from 2007 to 2015, but groundwater results have been stable to slowly decreasing since 2015, and all tritium results are still below the MCL (20 pCi/mL).

In the LAZ, tritium remains stable and below the detection limit in groundwater during the 2021 and 2022 sampling events at plume definition wells RAG006B, RAG008B, RAG008BL, and RBP011B. Tritium concentrations at plume boundary well RBP011B continue to remain stable, either below the detection limit or less than the PQL during the 2021 and 2022 sampling events. Collectively, these groundwater data indicate the tritium plume is not expanding horizontally or vertically.

Tritium concentrations in downgradient seepage well JBS005A decreased to 0.981 pCi/mL in 2022, relative to the 2012 sample (3.98 pCi/mL). Seepage well JBS005B tritium concentrations remained below the detection limit during the 2021 and 2022 sampling events.

Tritium concentrations for all three Joyce Branch surface water station samples (JBSW-01, JBSW-02, and JBSW-03) were either below the detection limit or less than the PQLs in 2021 and 2022.

#### ***4.1.3 Western Tritium Plume***

The Western Tritium plume emanates from the southwest corner of the RBC and extends south-by-southeast before reaching the R-Area Concrete Lakes (186-R/190-R) (Figure 3). The Western Tritium plume is constrained vertically to the TZ of the UAZ of the UTRA (Figure 10). The 2022 Western Tritium plume has decreased in size and concentration relative to the 2010 tritium plume (Figure 3 and Figure 7).

The key source area well RDB005C tritium concentrations decreased slightly during the 2021 and 2022 sampling events, but still above the MCL (20 pCi/ml) though below the Action Limit (76.8 pCi/mL) for tritium at this well (Appendix C, Figure C-56).

In the TZ, the tritium concentration in groundwater at plume definition well RAG004DL continued to decrease slightly in 2021 to 2.38 pCi/mL and in 2022 to 1.86 pCi/mL. Tritium concentrations in well RAG004DL demonstrate an overall decreasing trend from 19.5 pCi/mL when monitoring began in 2007. Tritium concentrations in groundwater at the plume boundary well RDB004DL remain stable and concentrations are either below the detection limit or less than the PQLs indicating that the plume is not expanding horizontally.

In the LAZ, tritium remains stable and below the detection limit in the groundwater at plume definition well RAG004B, indicating the plume is not expanding vertically.

#### ***4.1.4 Former Northern Tritium Plume***

The former Northern Tritium plume emanated about 300-m (984-ft) northwest of the RBC and extended to the north up to the LUC boundary (Figure 3). In 2021 and 2022, all of the Northern

Tritium plume monitoring stations groundwater tritium concentrations were below the MCL, so this plume is no longer depicted on the figures. To the north and northeast, the tritium is constrained vertically to the UAZ of the UTRA (Figure 11); however in the past, results above the MCL (20 pCi/mL) have been confirmed in the LAZ of the UTRA. The 2022 Northern Tritium Plume has decreased in size and concentration relative to the 2010 tritium plume (Figure 3 and Figure 7). In 2010, the Northern Tritium Plume areal extent was approximately 142,000 m<sup>2</sup> (35.1 acres) with a maximum tritium concentration of 53.7 pCi/mL. In 2022, the Northern Tritium Plume was effectively gone with a maximum tritium concentration of 16.6 pCi/mL at well RSE 10DU, which is below the MCL.

Groundwater tritium concentration at key source area well (RSE 10DU) decreased below the tritium MCL (20 pCi/mL) in 2019 and has remained below the MCL in the three annual sample events (2020, 2021 and 2022) since then. Concentrations in this well have an overall decreasing trend since monitoring began in September 2002 when the tritium concentration was 161 pCi/mL (Appendix C, Figure C-61). The December 2022 groundwater tritium concentration of 16.6 pCi/mL for RSE 10DU is also well below the Action Limit (252 pCi/mL) for this well.

In the UAZ of the UTRA, the groundwater at the northeast plume definition well RAG009DU was 5.66 pCi/mL in 2022. Tritium concentrations in well RAG009DU indicate a decreasing trend since 2019. Concentrations at other monitoring wells (RAG009DL, RAG013, RAG014, RGW 2D, RPC 2D, RSE027C, and RSP 5DL) remain below the MCL (20 pCi/mL) or below detection limits. The highest observed concentration for these wells during the 2021 and 2022 sampling event was a tritium concentration of 2.28 pCi/mL in well RGW 2D in 2021. The tritium concentrations in the groundwater at LUC plume boundary wells MCS002A and MCS002B have remained essentially constant, as the tritium concentrations have been below the detection limit or less than the PQL since 2008.

In the LAZ, all tritium results since 2001 have been below the detection limit at plume boundary well RPC 19C. Likewise, all tritium results have remained very low or less than the detection limit at plume definition wells RGW 2C, RPC 2CU, and RPC 2CL. The highest observed tritium concentration in these LAZ wells during the 2021 and 2022 sampling events was 3.34 pCi/mL in

well RPC 2CU in 2022. These wells indicate the plume is not expanding vertically into the LAZ as it moves northward.

All Mill Creek surface water stations continue to remain well below the MCL, with a maximum observed concentration of 1.68 pCi/mL in well MCSW-04 in October 2022. MCSW-03 was not sampled due to dry conditions in 2022. The two surface water locations PASL-01 and PASL-02 along Pond A were frequently dry (Appendix A). With Core Team Approval, in 2019 and 2020, RAG013 and RSP 5DL replaced PASL-01 and PASL-02 as Plume Boundary Wells, and discontinued monitoring at PASL-01 and PASL-02. RAG013 groundwater tritium concentrations were below detection in both 2021 and 2022. RSP 5DL groundwater tritium concentrations were 1.03 pCi/mL in 2021 and 0.936 pCi/mL in 2022.

## **4.2 ISD Results**

### **4.2.1 2021 and 2022 ISD Results**

Due to elevated tritium and carbon-14 results in well RDB 3D in 2017, SRS began monitoring for carbon-14 and tritium at five ISD monitoring wells (RDB 1D, RDB 2D, RDB 3D, RDB003DU, and RDB005C) annually for five years (2018-2022). During the 2021 and 2022 sampling periods, there were two carbon-14 results (95.0 pCi/L and 35.4 pCi/L, respectively) above the PQL, but they were both less than the MCL (2,000 pCi/L). In 2021 and 2022, the five ISD monitoring wells (RDB 1D, RDB 2D, RDB 3D, RDB003DU, and RDB005C) were sampled for carbon-14 and tritium. In 2022, all 11 ISD wells were sampled and analyzed for the routine suite of analytes (carbon-14, chlorine-36, iodine-129 and tritium) per the five-year schedule.

Tritium concentrations in well RDB 3D decreased to 353 pCi/mL in 2021 and to 109 pCi/mL in 2022, which is down from a maximum of 1,930 pCi/mL in 2017 (Appendix C, Figure C-53). In 2021, tritium groundwater concentrations at well RDB 2D increased to 30.4 pCi/mL, which is above the MCL (20 pCi/mL) but decreased to 6.31 pCi/mL in 2022. Tritium concentrations in all other ISD wells remained relatively stable or decreased in 2021 and 2022.

Carbon-14 concentrations in well RDB 3D also decreased in 2021 to 95.0 pCi/L and to 35.4 pCi/L in 2022 (Appendix A, Table A-1), which is down from a maximum of 225 pCi/L in 2020.

Carbon-14 had an estimated detection result (J 14.1 pCi/L) at well RDB 2D for the first time in 2021, but the 2022 result was below detection limits (U 12.2 pCi/L). Carbon-14 was below detection in the groundwater samples from all other ISD wells during the 2021 and 2022 sampling periods.

In 2017, it was noted that water elevations in RDB 3D were 87.1-m (285.8-ft) amsl, which is ~0.9-m (3-ft) above the average water elevation (86.1-m [282.5-ft] amsl) in this well. Comparatively, the water elevation in 2003 for well RDB 3D reached a height of 285.2 ft amsl which also resulted in an increase in tritium concentrations until 2005 (Figure 12). In 2020, the water elevation in well RDB 3D was 286.1 ft-amsl, which at that time was the historic maximum for RDB 3D, and tritium concentrations again increased at this location (Figure 12). Wells within the vicinity of the well RDB 3D do not show similar increases in tritium concentrations due to the increases in water table elevations. For these reasons, the elevated water levels at RDB 3D may have allowed the detection of a small shallow legacy spill near the R-Reactor Disassembly Basin.

## **5.0 SUMMARY AND RECOMMENDATIONS**

### **5.1 RAGW MNA Summary**

Data from source area monitoring wells in the Eastern VOC, Eastern Tritium, Western Tritium, and Northern Tritium plumes indicate stable or decreasing groundwater concentrations for VOCs and tritium in the source areas (Appendix C) and support the time estimates for the concentrations to be below MCLs. Likewise, the extent of the Eastern VOC, Eastern Tritium, Western Tritium, and Northern Tritium plumes continue to decrease. These data indicate MNA continues to be an effective remedy for the RAGW tritium and VOC plumes and is functioning as designed.

#### **5.1.1 Eastern VOC Plume**

Based on the 2021 and 2022 monitoring data, MNA continues to be an effective remedy for the RAGW Eastern VOC Plume. The key source area well RWT003C and all plume definition wells, except for RAG008B, show decreasing VOC trends (Figure 13). In 2022, the maximum TCE groundwater concentration was 24.2 µg/L at well RAG008B. SRS installed a deeper well (RAG008BL) between the RAG008B screen zone and the top of the Gordon Confining Unit (AKA

“Green Clay”) in 2021 to determine vertical extent of TCE in the RAOU eastern tritium plume. All TCE results for RAG008BL groundwater samples have been below detection limits in 2021 and 2022 and the Eastern VOC plume is bounded vertically and indicates downward migration of TCE is not occurring at this location. The plume boundary well RBP011B had one TCE result below detection (U 1.37 µg/L) in 2021 and one result (1.07 µg/L) just above the PQL in 2022, which are both below the MCL of 5 µg/L, indicating no plume growth towards Joyce Branch. Well cluster RAG008 (-DL, -B, and -BL) and well cluster RBD011 (-DU, -DL, and -B) are now the critical monitoring stations for the Eastern VOC plume, and the data from these wells will continue to be closely evaluated each year. All Joyce Branch surface water station samples remain below the detection limit for TCE.

### ***5.1.2 Eastern Tritium Plume***

Based on the 2021 and 2022 monitoring data, MNA continues to be an effective remedy for the RAGW Eastern Tritium Plume. In 2022, the key source area well (RPS004C) showed a decreasing trend in tritium concentrations (141 pCi/mL) (Figure 14). ISD wells RAG003DL and RPS004DUR are within the Eastern Tritium plume area and groundwater tritium concentrations (29 pCi/mL and 376 pCi/mL, respectively) also exceeded the MCL at these wells. All other wells in the Eastern Tritium Plume area were below the MCL. The plume boundary well (RBP011B) remains below the detection limit (0.46 pCi/mL) and/or less than the PQL (1.01 pCi/mL). The Joyce Branch surface water stations continue to be stable with tritium concentrations less than the PQL.

### ***5.1.3 Western Tritium Plume***

Based on the 2021 and 2022 monitoring data, MNA continues to be an effective remedy for the RAGW Western Tritium Plume. The source area monitoring well (RDB005C) had a slight decrease in tritium concentrations in 2021 to 32.7 pCi/mL, and also slightly decreasing concentrations in 2022 to 30.3 pCi/mL, all other wells in the Western Tritium Plume are below the MCL (Figure 15). The plume definition well RAG004DL indicates a decreasing tritium trend for the Western Tritium Plume from 19.5 pCi/mL in 2007 to 1.86 pCi/mL in 2022 (Figure 15) and supports the time estimate for concentrations to be below MCLs (SRNS 2010b). The plume boundary well RDB004DL remains below the detection limit or less than the PQL.

#### ***5.1.4 Former Northern Tritium Plume***

Based on the 2021 and 2022 monitoring data, MNA continues to be an effective remedy for the RAGW Northern Tritium Plume. All tritium results were below the MCL for all stations in 2021 and 2022. The groundwater at the key source area well RSE 10DU shows an overall decreasing trend for tritium since 2002 (Figure 16). RSE 10DU tritium concentrations have been below the MCL for the past four years (2019-2022), as are tritium concentrations at all the other wells monitoring the Northern Plume. Likewise, there is an overall decreasing trend for tritium at plume definition well RAG009DU since monitoring began in 2010, and groundwater tritium concentrations have been below the MCL since 2015 at well RAG009DU (Figure 16). The data from all northern plume definition and plume boundary wells indicate the tritium plume continues to decrease in concentration and it is contracting in size. The Mill Creek surface water stations continue to remain well below the MCL and indicate decreasing tritium concentrations (Appendix C; Figure C-39).

#### ***5.1.5 ISD***

Tritium concentrations exceeded the MCL and detectable levels of carbon-14 were present at ISD monitoring well RDB 3D in 2021 and 2022, but tritium and carbon-14 concentrations have decreased since 2017 (Appendix C; Figure C-53 and Figure C-4, respectively). In 2021, carbon-14 was detected (J 12.8 pCi/L) in the groundwater at well RDB 2D, but carbon-14 was below detection in 2022. There was also an increase in tritium (31.5 pCi/mL) in 2021 at RDB 2D, which decreased to 6.31 pCi/mL in 2022. The carbon-14 estimated result and tritium above the MCL in 2022 at RDB 2D indicates contamination could be spreading from RDB 3D to RDB 2D and warrants continued monitoring of RDB 2D. All other wells remain stable or have decreasing concentrations of tritium. It appears the 2017 through 2022 increases in tritium and carbon-14 at well RDB 3D may be due to mobilization of a small shallow legacy spill near the disassembly basin, related to the 2017 high-water table levels (Appendix B; Figure B-16). The 2021-2022 data indicate the ISD remedial action implemented, pursuant to the approved RAOU ROD, (i.e., grouting of below-grade areas, grouting and stabilization of disassembly basin and reactor vessel contaminants, demolition of the disassembly basin above-ground structure and stack, and construction of a cover system over the grouted disassembly basin and reactor vessel) for the RBC

is functioning as designed and the ISD remedy remains effective in preventing impact to groundwater.

## **5.2 RAGW Recommendations**

SRS recommends continued annual sampling for carbon-14 and tritium for another two sample events at five monitoring wells (RDB 1D, RDB 2D, RDB 3D, RDB003DU, and RDB005C) near the RBC to track carbon-14 and tritium concentrations.

No MNA Action Limits have been exceeded for the RAOU since monitoring began in 2011, ISD is functioning as designed, and all plumes are slowly decreasing in size and concentration. The remedies for both RRSB OU and RAOU are evaluated in the Five-Year Remedy Review (5YRR) Report of SRS Operable Units with Groundwater Remedies, and the next 5YRR (Rev 0) is due Dec 2024. The project team proposes combining both RRSB OU and RAOU into a letter report in August 2026 and a full report due August 2028 to support the Dec 2029 5YRR submittal. Biennial sampling for the RAOU starting this year 2023, 2025, and 2027 to match the RRSB OU sampling schedule, and would support a combined report for both the RRSB OU and the RAOU. With Core Team approval, the project team recommends all RAOU MNA sampling be conducted biennially to coincide with a combined RRSB OU and RAOU report cycle. RAOU full ISD monitoring would continue on a 5-year sampling period (2022 and 2027) to coincide with the 5-year ROD Review. The proposed schedule is the following:

- 2023: RAOU MNA, RAOU 5 ISD Wells, and RRSB Sampling (4Q23);
- 2024: RAOU and RRSB OU 5YRR;
- 2025: RAOU MNA, RAOU 5 ISD Wells, and RRSB Sampling (4Q25);
- 2026: RAOU and RRSB OU Letter Report (2023-2025 Data);
- 2027: RAOU MNA, RAOU 11 ISD Wells, and RRSB Sampling (4Q27);
- 2028: RAOU and RRSB OU Full Report (2027 Data); and
- 2029: RAOU MNA, RAOU 11 ISD Wells, and RRSB Sampling and 5YRR.

## 6.0 REFERENCES

SRNL, 2021. *Atmospheric Technology Group Meteorological Monthly Monitoring Report, Savannah River Site*, SRNL-L2200-2021-00001, Revision 0, December 2020, Savannah River National Laboratory, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC

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WSRC, 2000. *Groundwater Flow Modeling for C-Area Groundwater Operable Unit (U)*, WSRC-RP-2000-4096, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken, SC

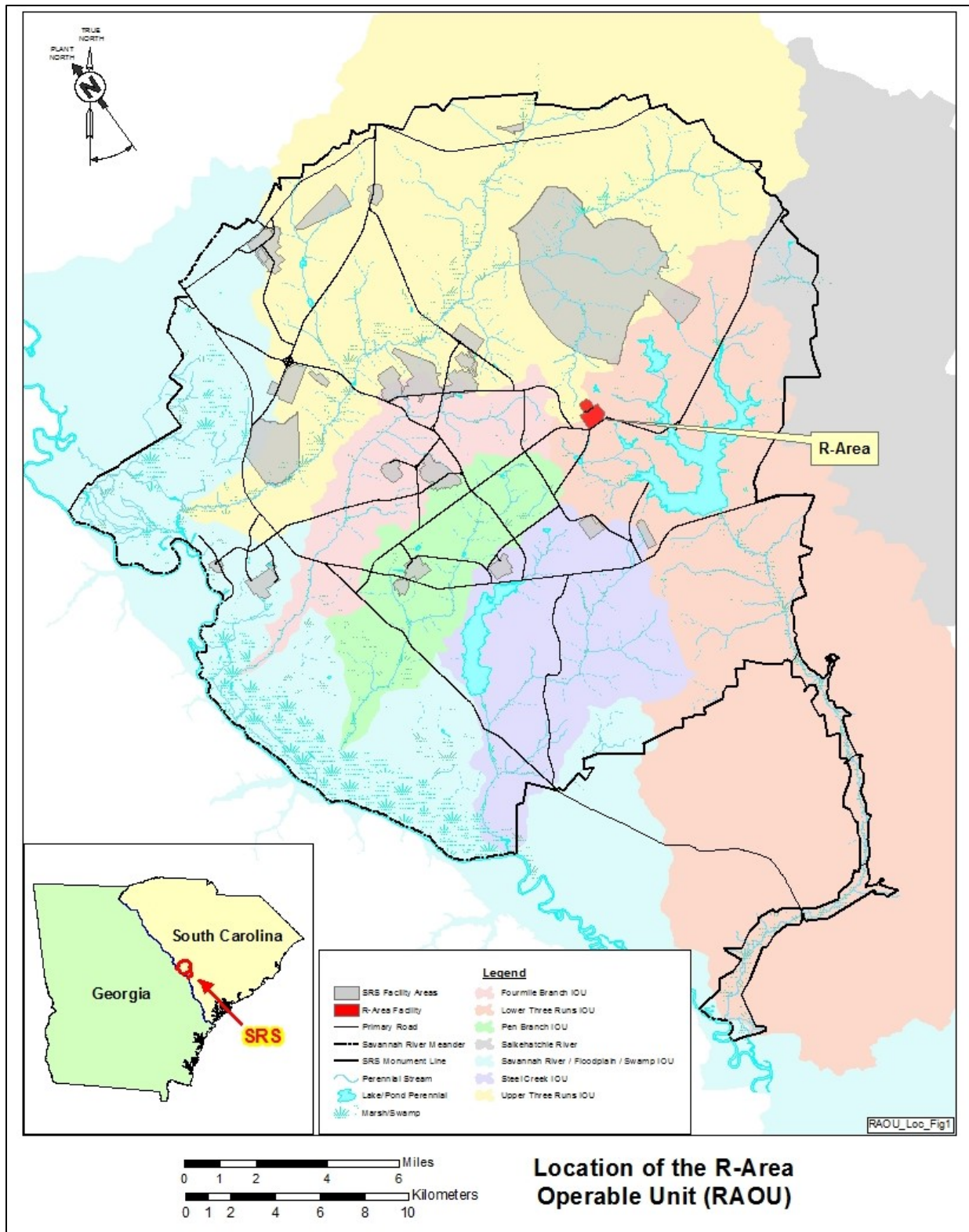


Figure 1. RAOU Location

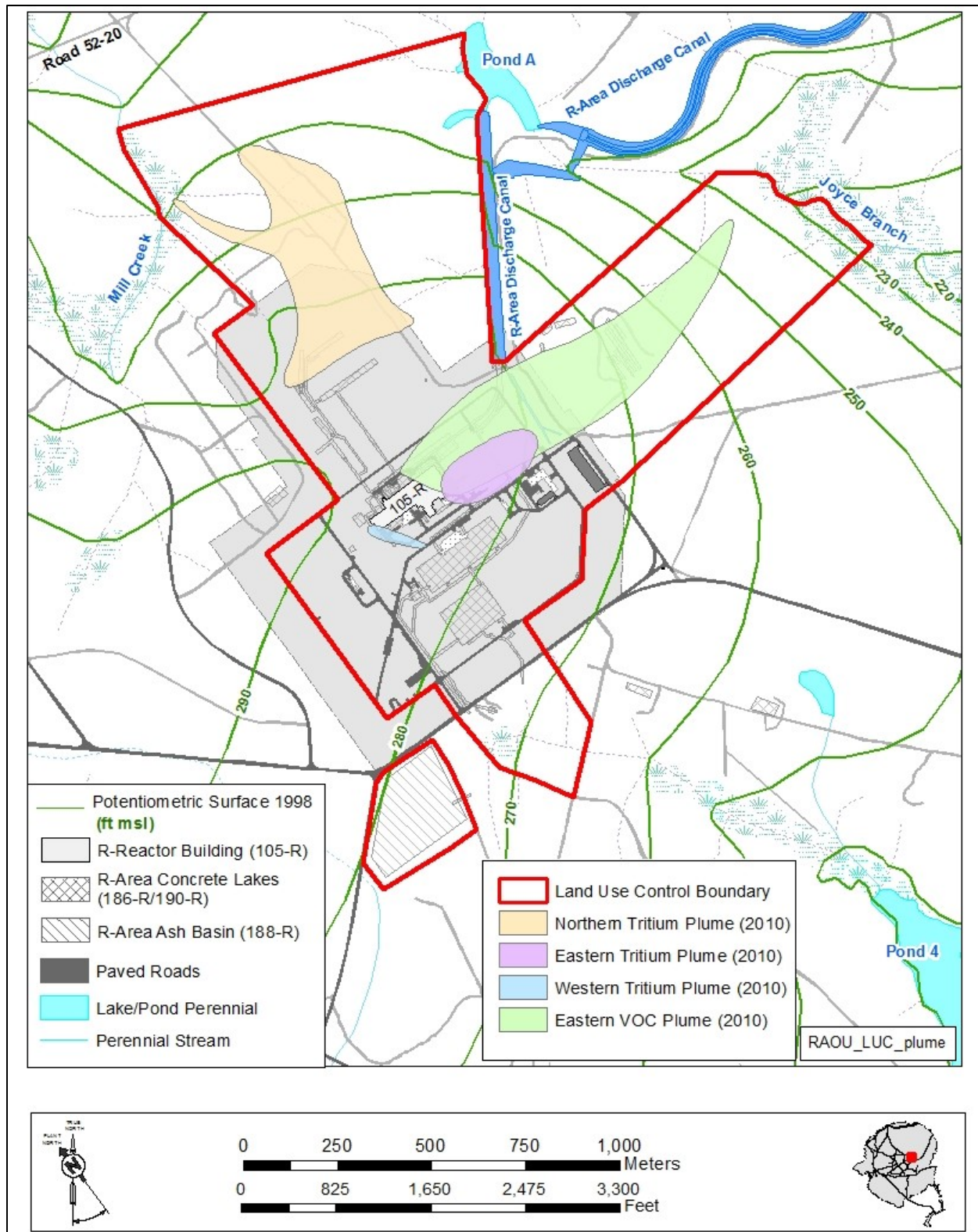


Figure 2. RAGW Groundwater Plumes (2010) and LUC Boundary

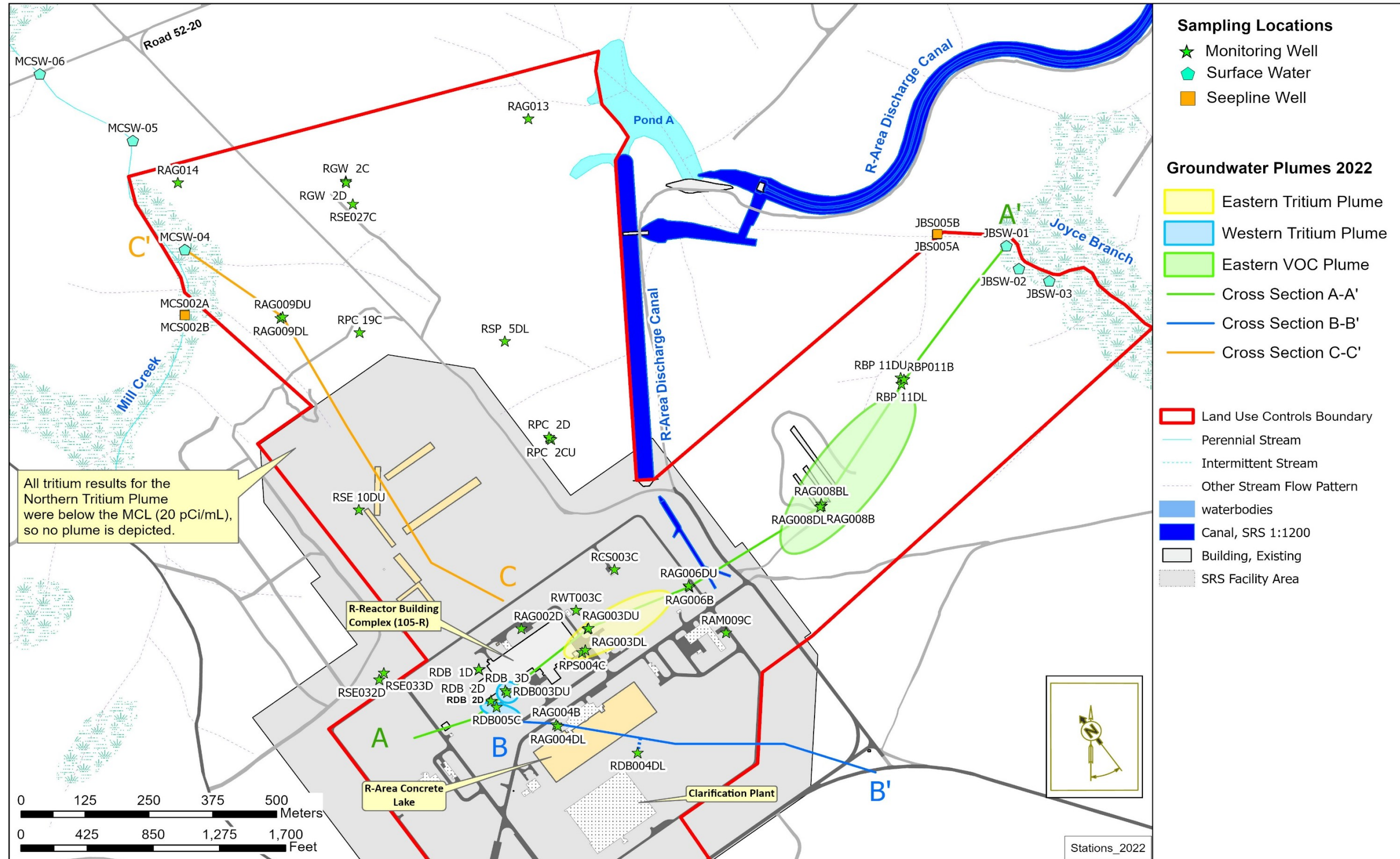


Figure 3. RAGW Monitoring Stations and 2022 Groundwater Plumes

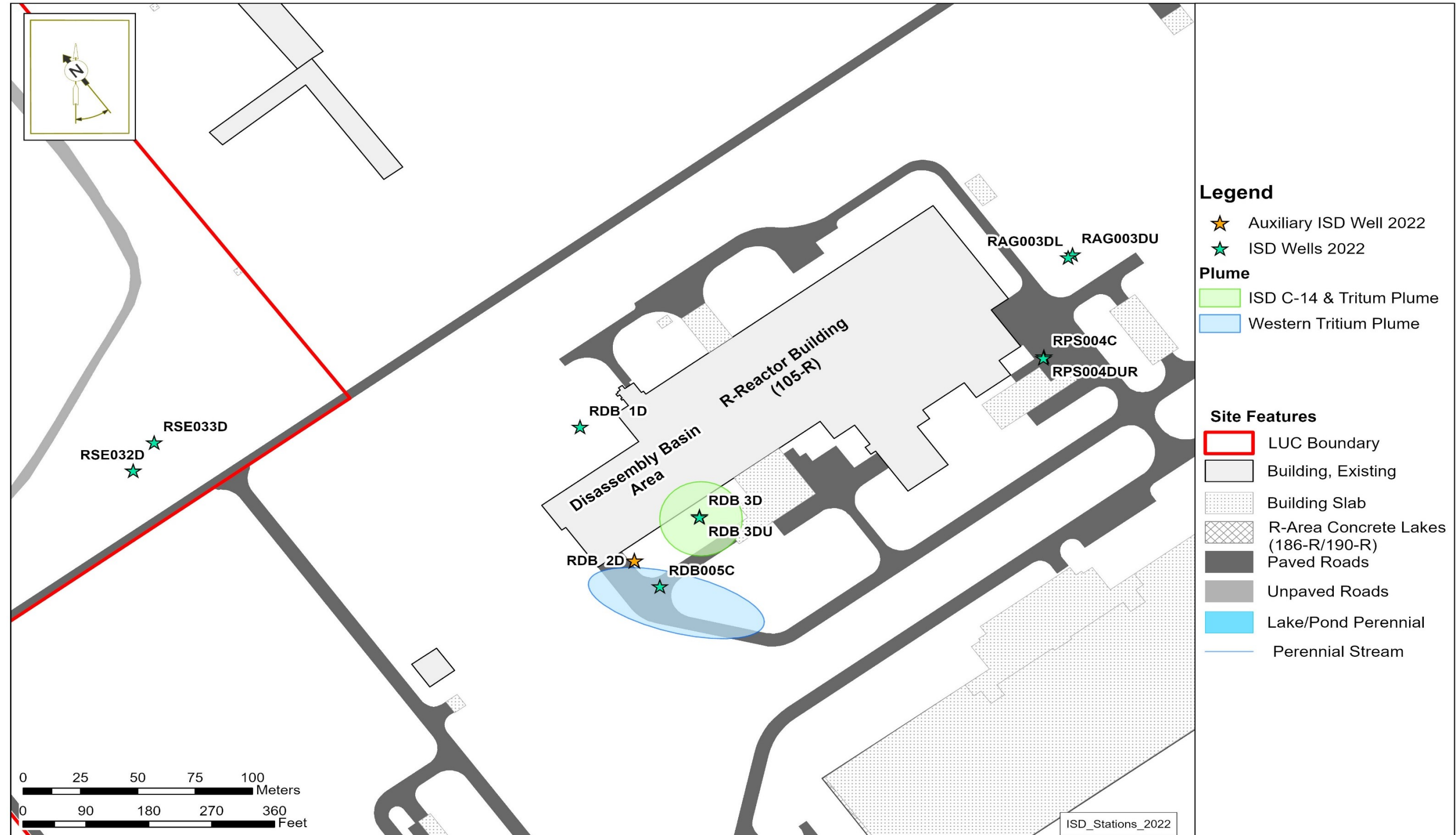


Figure 4. ISD Monitoring Wells (2022)

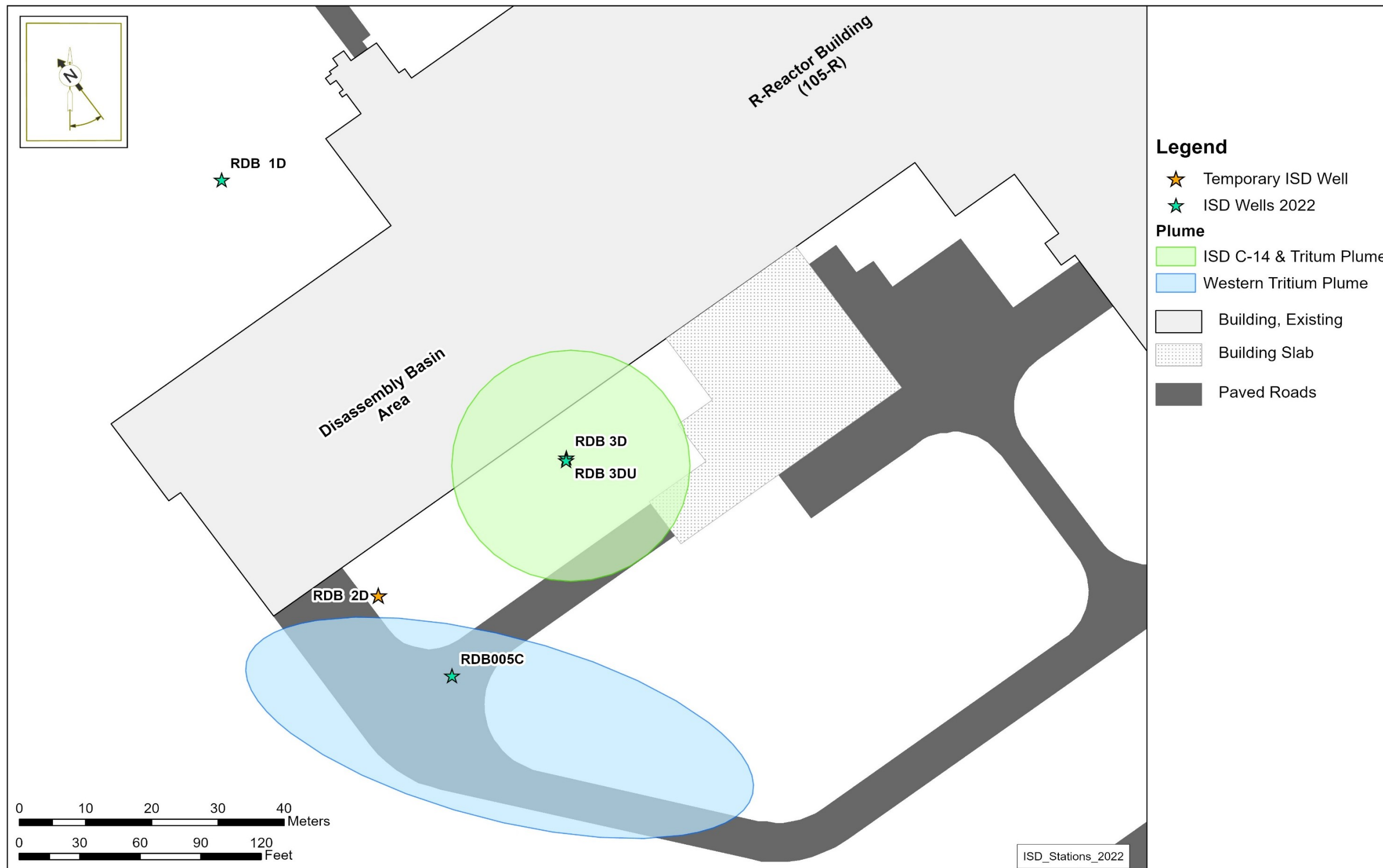


Figure 5. Five ISD Monitoring Wells Sampled Annually (2018 through 2022)

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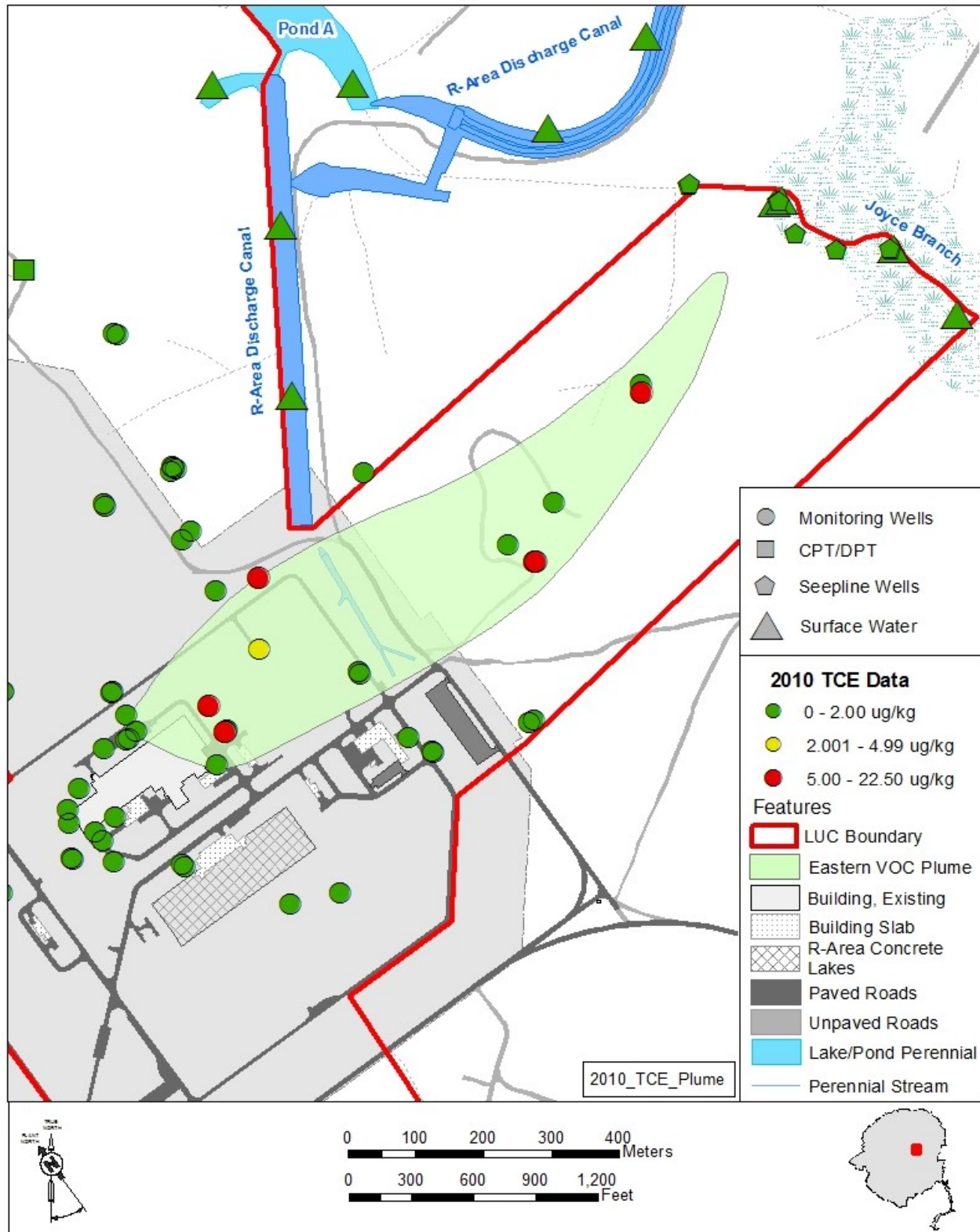


Figure 6. RAGW Eastern VOC Plume 2010 Data

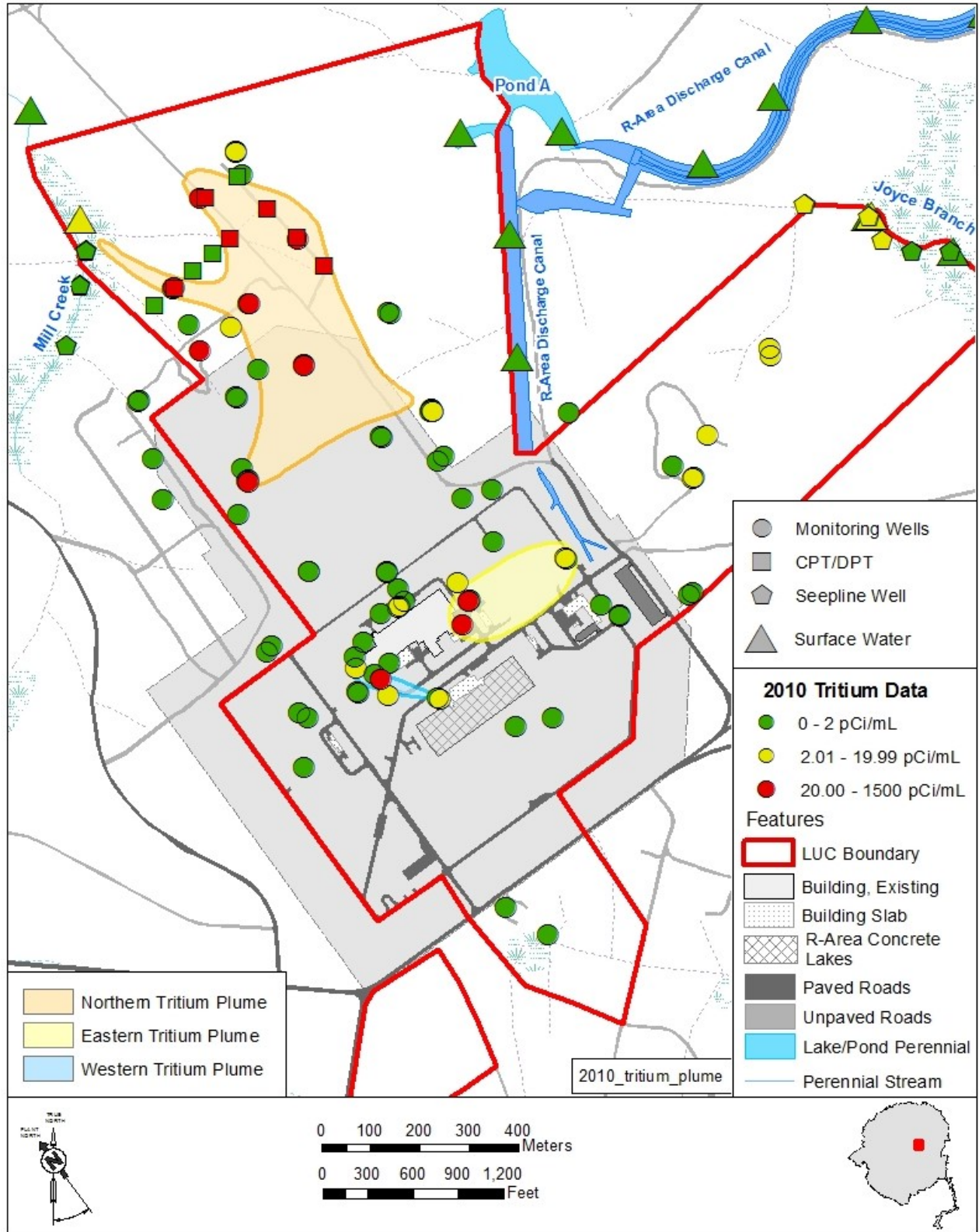


Figure 7. RAGW Tritium Plumes 2010 Data

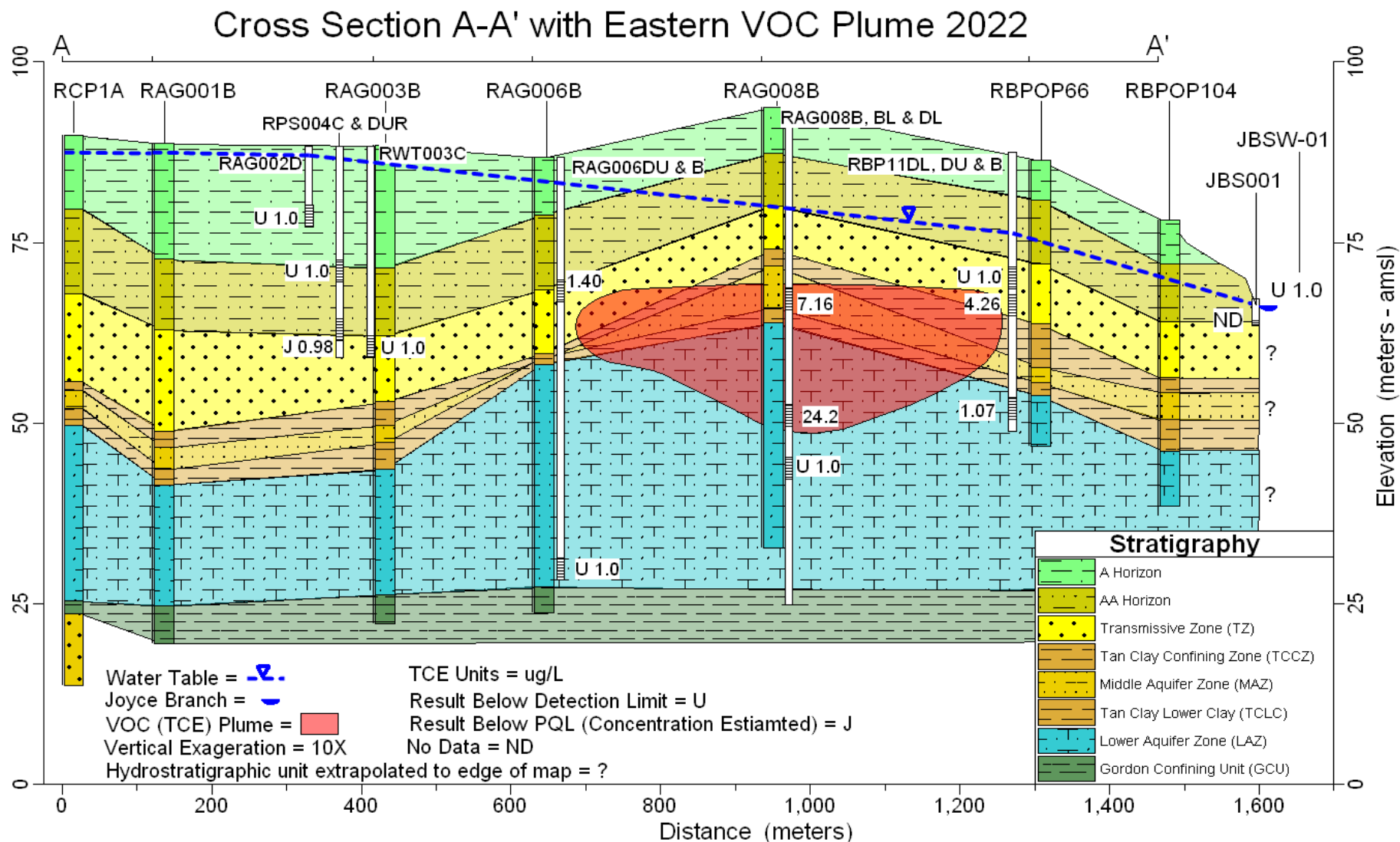
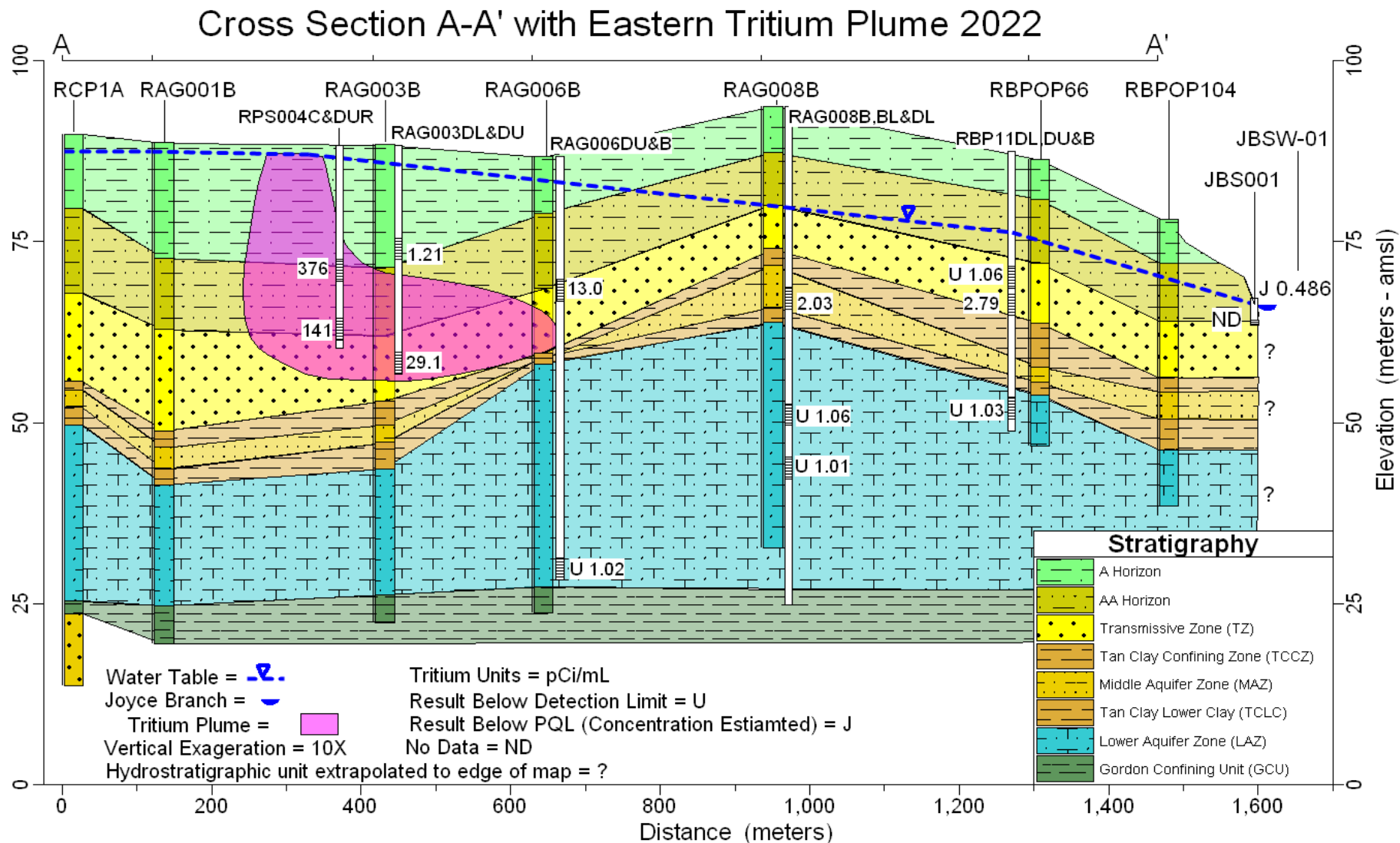


Figure 8. R-Area Cross-Section with RAGW Eastern VOC Plume 2022



**Figure 9. R-Area Cross-Section with RAGW Eastern Tritium Plume 2022**

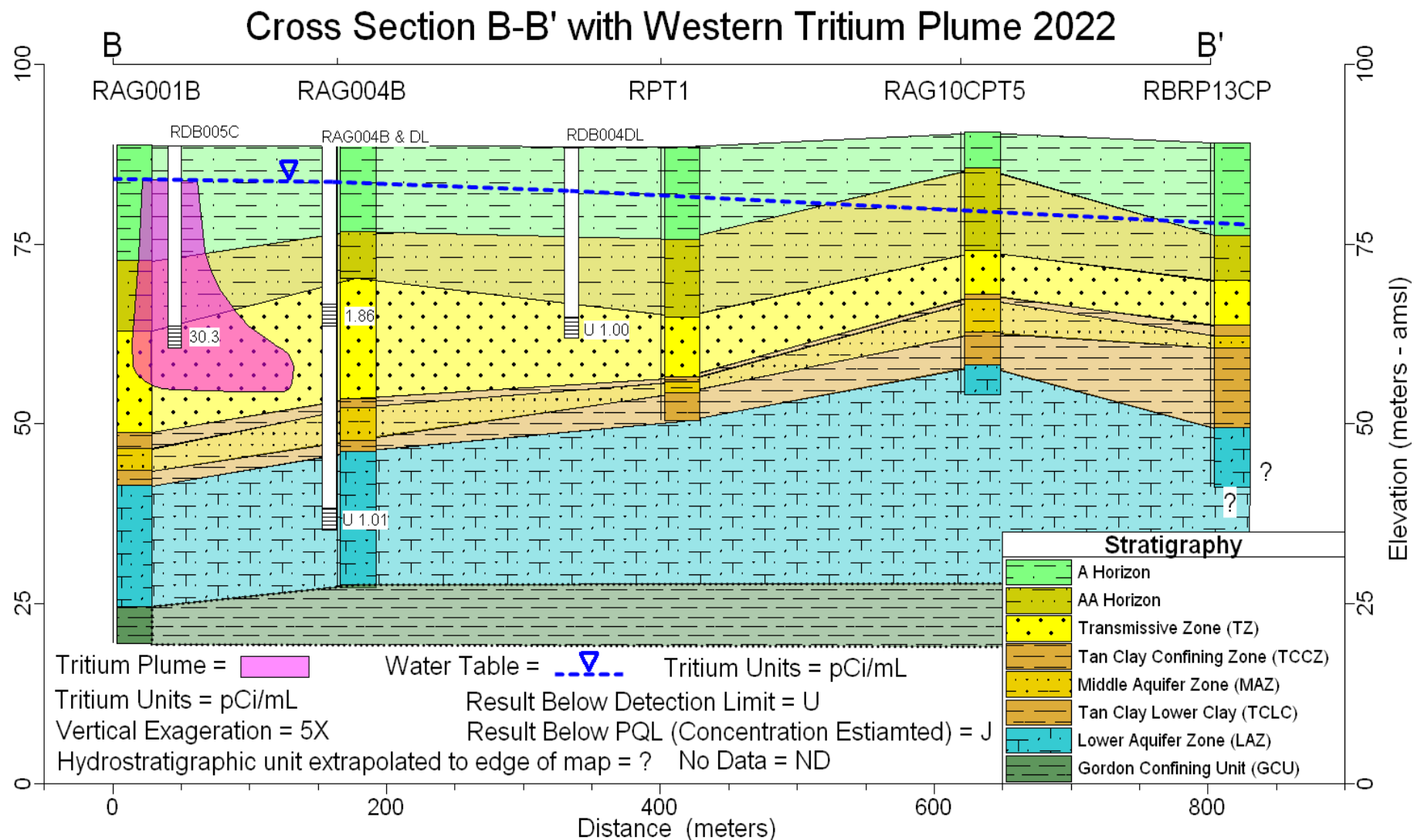


Figure 10. R-Area Cross-Section with RAGW Western Tritium Plume 2022

### Cross Section C-C' with Northern Tritium Plume 2022

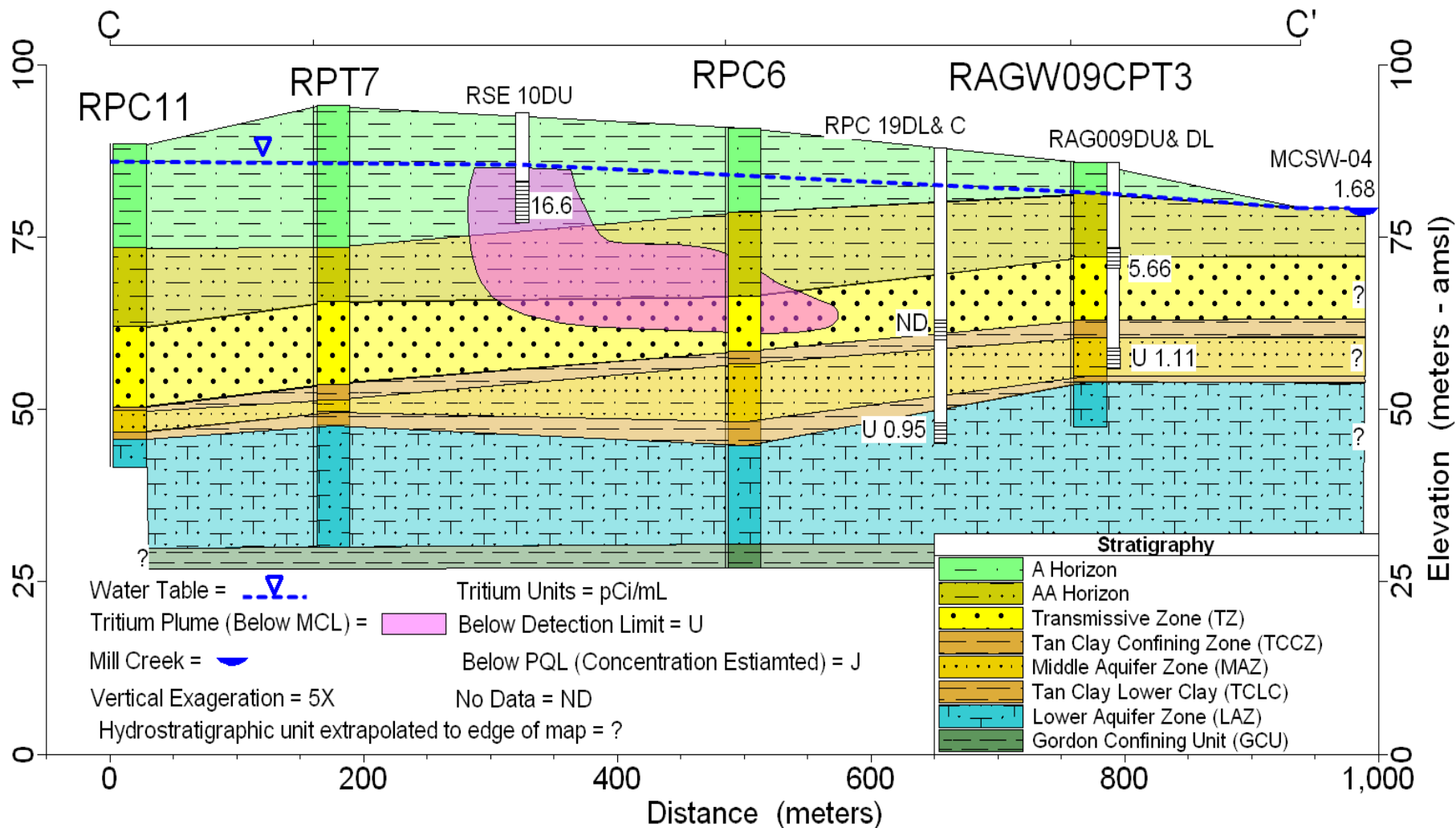


Figure 11. R-Area Cross-Section with RAGW Northern Tritium Plume 2022

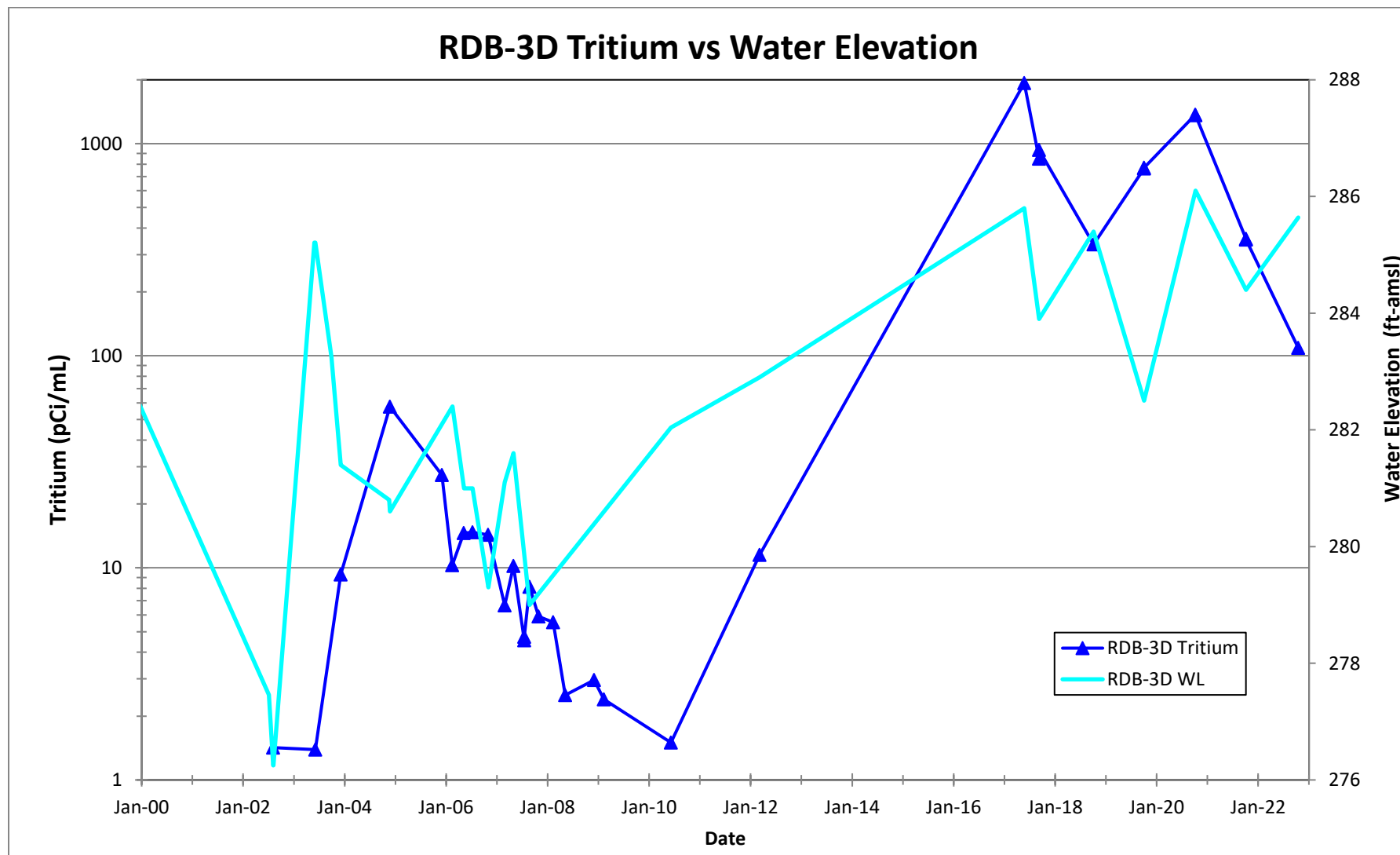


Figure 12. RDB 3D Water Elevation and Tritium Trends

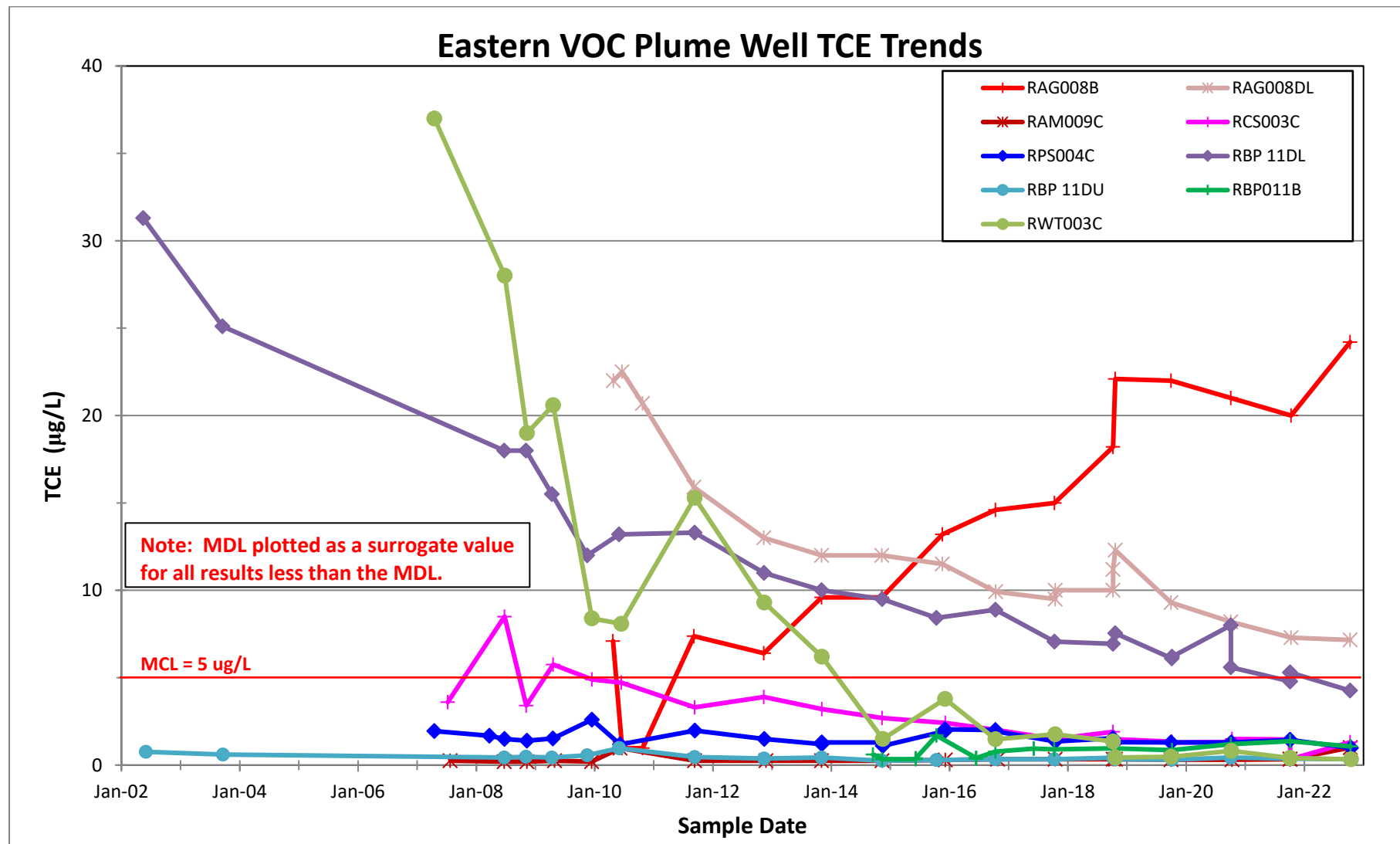


Figure 13. RAGW Eastern VOC Plume Wells

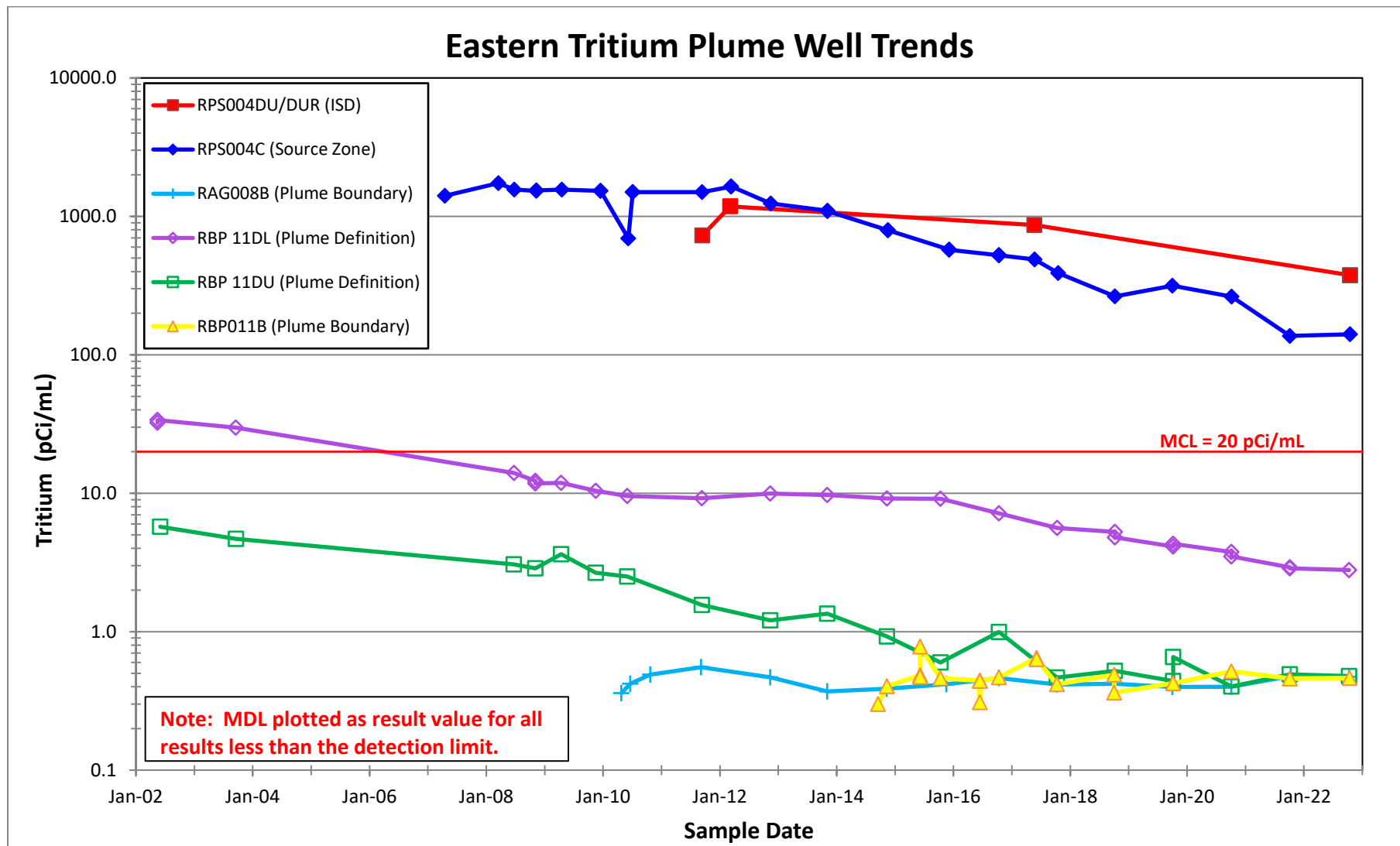


Figure 14. RAGW Eastern Tritium Plume Wells

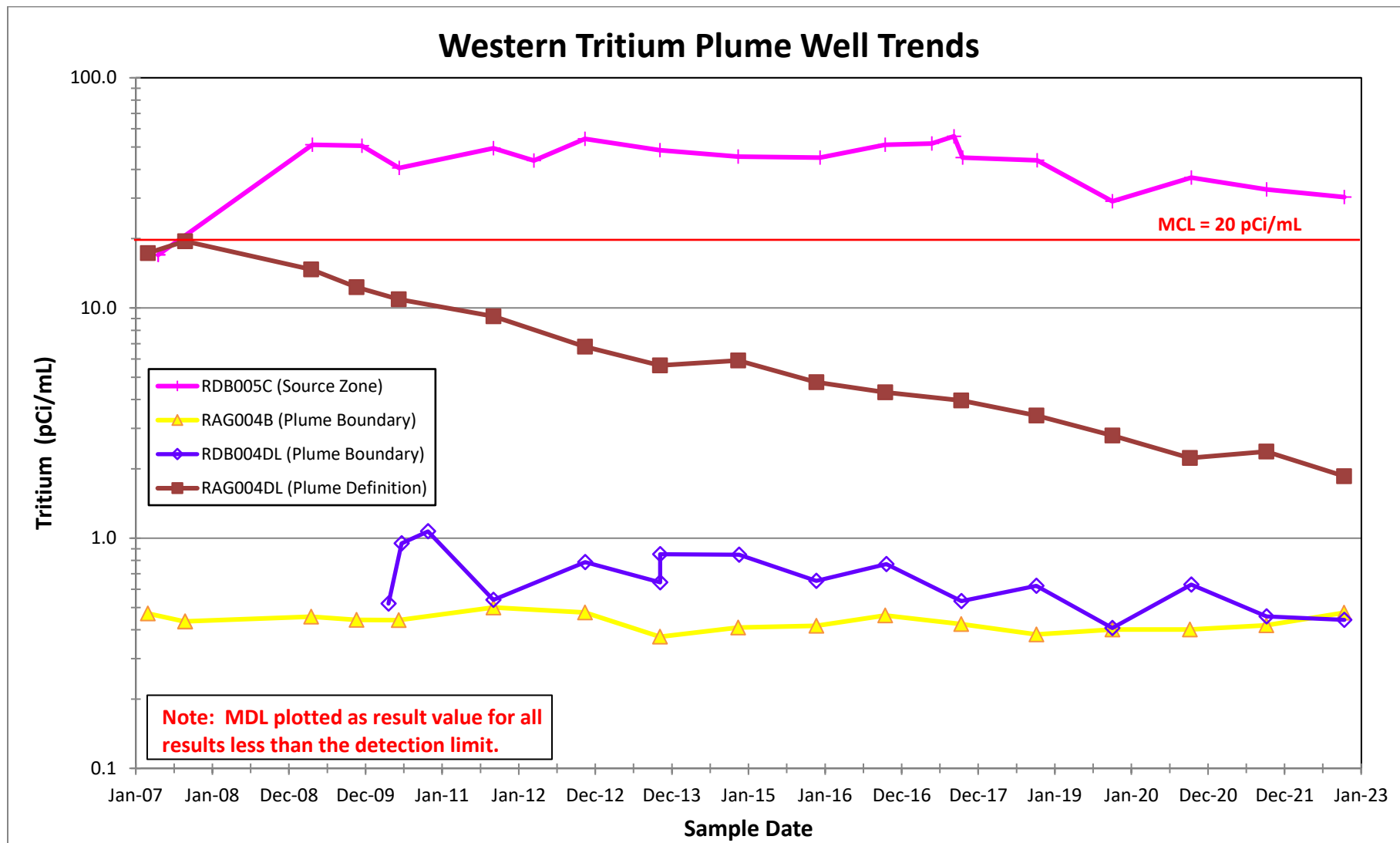


Figure 15. RAGW Western Tritium Plume Wells

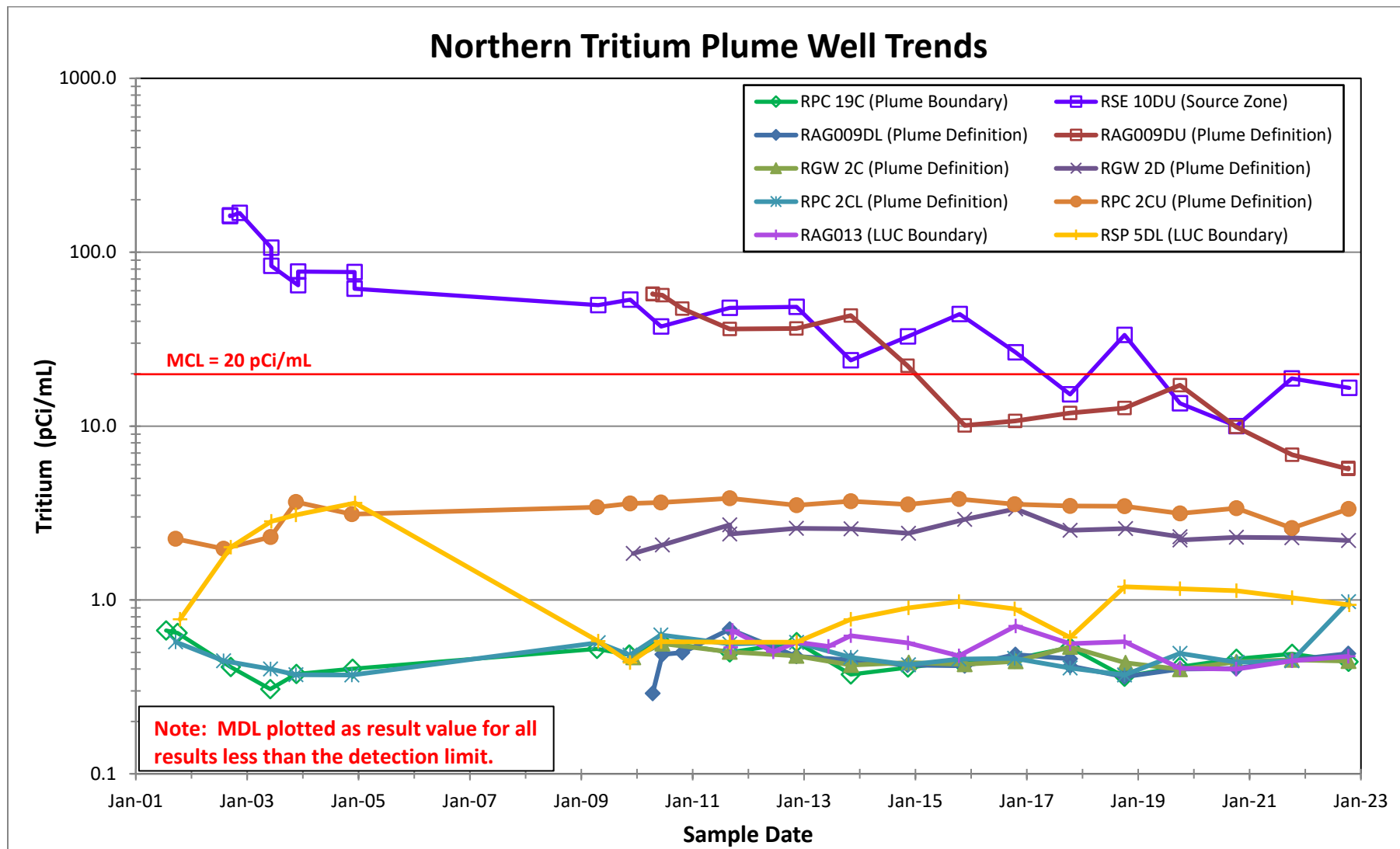


Figure 16. RAGW Northern Tritium Plume Wells

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**Table 1. RAGW Monitoring Stations**

Plume	Station ID	Aquifer Zone	Purpose	UTM-N	UTM-E	Top of Casing	Screen Top Elevation	Screen Bottom Elevation
							<i>(ft amsl)</i>	
Eastern VOC	RAG002D	A/AA	Plume Definition Monitoring Well	3681720.40	446009.30	293.15	263.15	253.15
Eastern VOC	RWT003C	TZ	Source Area Monitoring Well	3681758.00	446116.35	292.46	204.00	194.00
Eastern VOC and Tritium	JBS005A	TZ	LUC Boundary Seepine Well	3682523.90	446822.19	228.80	220.30	217.80
Eastern VOC and Tritium	JBS005B	TZ	LUC Boundary Seepine Well	3682524.90	446823.38	222.70	215.20	212.70
Eastern VOC and Tritium	JBSW-01	NA	LUC Boundary Surface Water	3682501.80	446958.40	NA	NA	NA
Eastern VOC and Tritium	JBSW-02	NA	LUC Boundary Surface Water	3682455.00	446982.80	NA	NA	NA
Eastern VOC and Tritium	JBSW-03	NA	LUC Boundary Surface Water	3682430.00	447042.20	NA	NA	NA
Eastern VOC and Tritium	RAG006B	LAZ	Plume Definition Monitoring Well	3681805.30	446338.11	287.05	102.80	92.80
Eastern VOC and Tritium	RAG008B	LAZ	Plume Definition Monitoring Well	3681970.60	446596.74	309.84	172.83	162.83
Eastern VOC and Tritium	RAG008BL	LAZ	Plume Boundary Monitoring Well	3681975.1	446596.0	310.26	148.74	138.74
Eastern VOC and Tritium	RAG008DL	TZ	Plume Definition Monitoring Well	3681968.80	446594.12	310.08	225.45	215.45
Eastern VOC and Tritium	RAM009C	TZ	Plume Definition Monitoring Well	3681712.18	446409.86	290.67	197.20	187.20
Eastern VOC and Tritium	RBP 11DL	TZ	Plume Definition Monitoring Well	3682219.05	446752.89	290.07	222.59	212.59
Eastern VOC and Tritium	RBP 11DU	A/AA	Plume Definition Monitoring Well	3682232.04	446751.49	289.43	231.87	221.80
Eastern VOC and Tritium	RBP011B	LAZ	Plume Boundary Monitoring Well	3682219.00	446753.00	286.20	175.71	165.70
Eastern VOC and Tritium	RCS003C	TZ	Plume Definition Monitoring Well	3681841.00	446191.38	292.12	202.12	192.12
Eastern VOC and Tritium, and ISD Performance	RPS004C	TZ	Source Area Monitoring Well, ISD Source Well	3681671.76	446128.19	292.90	211.30	201.30
Northern Tritium	MCS002A	A/AA	LUC Boundary Seepine Well	3682360.70	445350.21	263.30	260.30	254.80
Northern Tritium	MCS002B	A/AA	LUC Boundary Seepine Well	3682359.10	445350.70	263.40	255.90	253.40
Northern Tritium	MCSW-03	NA	LUC Boundary Surface Water	3682428.70	445355.00	NA	NA	NA
Northern Tritium	MCSW-04	NA	LUC Boundary Surface Water	3682493.70	445350.70	NA	NA	NA
Northern Tritium	MCSW-05	NA	LUC Boundary Surface Water	3682716.00	445249.00	NA	NA	NA
Northern Tritium	MCSW-06	NA	LUC Boundary Surface Water	3682852.00	445067.00	NA	NA	NA

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**Table 1. RAGW Monitoring Stations (Continued/End)**

Plume	Station ID	Aquifer Zone	Purpose	UTM-N	UTM-E	Top of Casing	Screen Top Elevation	Screen Bottom Elevation
						<i>(ft amsl)</i>		
Northern Tritium	RAG009DL	TZ	Plume Definition Monitoring Well	3682353.32	445538.11	283.72	193.10	183.10
Northern Tritium	RAG009DU	A/AA	Plume Definition Monitoring Well	3682356.13	445542.13	283.66	241.13	231.13
Northern Tritium	RAG013	TZ	LUC Boundary Monitoring Well	3682760.27	446022.85	266.10	202.50	192.50
Northern Tritium	RAG014	TZ	Plume Definition Monitoring Well	3682629.87	445337.18	278.00	201.00	191.00
Northern Tritium	RGW 2C	LAZ	Plume Definition Monitoring Well	3682633.20	445665.82	306.83	151.83	141.83
Northern Tritium	RGW 2D	TZ	Plume Definition Monitoring Well	3682629.97	445666.21	307.48	200.00	190.00
Northern Tritium	RPC 2CL	LAZ	Plume Definition Monitoring Well	3682107.95	446064.67	294.85	107.35	97.35
Northern Tritium	RPC 2CU	LAZ	Plume Definition Monitoring Well	3682106.22	446067.51	294.87	158.67	148.67
Northern Tritium	RPC 2D	A/AA	Plume Definition Monitoring Well	3682111.08	446063.41	294.60	279.39	259.39
Northern Tritium	RPC 19C	LAZ	Plume Boundary Monitoring Well	3682324.35	445692.68	304.22	160.22	150.22
Northern Tritium	RSE 10DU	A/AA	Source Area Monitoring Well	3681962.80	445691.31	283.72	273.10	253.00
Northern Tritium	RSE027C	MAZ	Plume Definition Monitoring Well	3682586.20	445679.59	308.52	178.94	168.94
Northern Tritium	RSP 5DL	TZ	LUC Boundary Monitoring Well	3682306.51	445976.95	296.82	186.52	176.52
Western Tritium	RAG004B	LAZ	Plume Boundary Monitoring Well	3681524.54	446077.40	293.05	125.56	115.56
Western Tritium	RAG004DL	TZ	Plume Definition Monitoring Well	3681521.36	446080.81	293.49	218.80	208.80
Western Tritium	RDB004DL	TZ	Plume Boundary Monitoring Well	3681467.14	446236.70	294.11	213.40	203.40
Western Tritium, ISD Performance	RDB005C	TZ	Source Area Monitoring Well, ISD Source Well	3681560.48	445960.77	293.49	208.60	198.60
ISD Performance	RSE032D	A/AA	ISD Background Well	3681616.50	445731.16	301.9	262.6	252.6
ISD Performance	RSE033D	TZ	ISD Background Well	3681630.20	445740.30	302.5	221.1	211.1
ISD Performance	RAG003DL	TZ	ISD Source Well	3681719.82	446138.79	292.7	195.9	185.9
ISD Performance	RAG003DU	A/AA	ISD Source Well	3681721.20	446140.70	292.5	237.9	227.9
ISD Performance	RDB 1D	A/AA	ISD Source Well	3681637.70	445925.99	292.7	285.5	265.5
ISD Performance	RDB 2D	A/AA	ISD Temporary Well	3681572.94	445949.65	292.9	285.7	265.7
ISD Performance	RDB 3D	A/AA	ISD Source Well	3681594.41	445978.05	293.0	285.8	265.8
ISD Performance	RDB003DU	A/AA	ISD Source Well	3681589.92	445981.24	293.1	238.7	228.7
ISD Performance	RPS004DUR	A/AA	ISD Source Well	3681676.74	446134.42	293.0	238.2	228.2

**Table 2. RCOC Maximum Results for 2021-2022 by Plume**

Station ID	Plume Name	Contaminant of Concern	Maximum Detected Concentration	Action Limit <sup>a</sup>	Units	MCL	Units
RPS004DUR	ISD	Tritium	376	NA	pCi/mL	20	pCi/mL
RPS004DUR	ISD	Vinyl Chloride	2.04	NA	µg/L	2	µg/L
RDB 3D	ISD	Carbon-14	95.0	2,000	pCi/L	2,000	pCi/L
All Stations <sup>b</sup>	ISD	Chlorine-36	U 90.0	700	pCi/L	700	pCi/L
All Stations <sup>b</sup>	ISD	Iodine-129	U 0.50	1	pCi/L	1	pCi/L
RDB005C	Western Tritium	Tritium	32.7	76.8	pCi/mL	20	pCi/mL
RSE 10DU	Northern Tritium	Tritium	18.8	252	pCi/mL	20	pCi/mL
RPS004C	Eastern Tritium	Tritium	141	2610	pCi/mL	20	pCi/mL
RPS004C	Eastern VOC	Trichloroethylene	J 0.98	NA	µg/L	5	µg/L
RPS004C	Eastern VOC	cis-1,2-Dichloroethylene	16.7	NA	µg/L	70	µg/L
RPS004C	Eastern VOC	Vinyl Chloride	1.64	NA	µg/L	2	µg/L
All Stations <sup>b</sup>	Eastern VOC	Carbon Tetrachloride	U 1.00	NA	µg/L	5	µg/L
All Stations <sup>b</sup>	Eastern VOC	Chloroform	U 1.00	NA	µg/L	70	µg/L
All Stations <sup>b</sup>	Eastern VOC	Dichloromethane	U 5.00	NA	µg/L	5	µg/L
RWT003C	Eastern VOC	Trichloroethylene	U 1.00	37	µg/L	5	µg/L
RAG008B	Eastern VOC	Trichloroethylene	24.2	NA	µg/L	5	µg/L

U = Result below method detection limit.

NA = Not Applicable.

a) Action Limits shown for key source area zone monitoring wells for tritium or TCE.

b) There were no results above the detection limit.

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**APPENDIX A**

**RAGW Data 2021 and 2022**

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Table A-1. RAOU EMR Monitoring Wells, 2021 - 2022			Field Data								VOCs					Radionuclides			
			SAMPLE COLLECTION DATE	SPECIFIC CONDUCTANCE	WATER TEMPERATURE	TURBIDITY	SAMPLING EVENT WATER ELEVATION	OXYGEN	OXIDATION- REDUCTION POTENTIAL	FIELD CONDITIONS	CARBON TETRACHLORIDE	CHLOROETHENE (VINYL CHLORIDE)	CHLOROFORM	CIS-1,2- DICHLOROETHYLENE	TRICHLOROETHYLENE (TCE)	CARBON-14	CHLORINE-36	IODINE-129	TRITIUM
			Unit	uS/cm	degC	NTU	ft	mg/L	mV		ug/L	ug/L	ug/L	ug/L	ug/L	pCi/L	pCi/L	pCi/L	pCi/mL
Station	Well Use	Aquifer Zone	GWPS																
RSE032D	ISD Background Well	A UAZ UTRAU	12-Oct-2022	27	19.2	1.5	NS	2.29	277	NC	NR	NR	NR	NR	NR	<EQL (23.7)	<EQL (90)	<EQL (0.5)	[0.344]
RSE033D	ISD Background Well	TZ UAZ UTRAU	12-Oct-2022	28	19.5	1.4	NS	4.06	320	NC	NR	NR	NR	NR	NR	<EQL (24.6)	<EQL (90)	<EQL (0.5)	[0.429]
RDB 2D	ISD Temporary	TZ UAZ UTRAU	06-Oct-2021	239	28.8	9.1	286.56	NR	NR	NC	NR	NR	NR	NR	NR	[14.1]	NR	NR	30.4
			18-Oct-2022	242	24.5	58.8	287.4	2.73	100	NC	NR	NR	NR	NR	NR	<EQL (26.6)	<EQL (90)	<EQL (0.5)	6.31
RAG008BL	Plume Boundary Well	LAZ UTRAU	06-Jul-2021	246	20.1	13.1	226.66	NS	NS	NC	NR	<EQL (1)	NR	<EQL (1)	<EQL (1)	NR	NR	<EQL (2.27)	<EQL (1.43)
			23-Nov-2021	255	18.6	8	225.91	NS	NS	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	NR	<EQL (0.966)
			13-Jun-2022	246	19.6	8.4	225.26	4.3	174	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	NR	<EQL (1.52)
			11-Oct-2022	247	19.3	1.4	225.43	6.78	242	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	NR	[-0.03]
JBS005A	LUC Boundary Seepline Well	TZ UAZ UTRAU	12-Oct-2021	84	18.8	661	219.92	1.66	66	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	NR	[0.813]
			18-Oct-2022	44	18.9	25.3	219.6	4.6	141	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	[0.53]	NR	NR	NR	[0.981]
JBS005B	LUC Boundary Seepline Well	TZ UAZ UTRAU	12-Oct-2021	13	19	12.1	219.76	7.58	155	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	NR	<EQL (1.03)
			18-Oct-2022	13	19	2.3	219.6	4.3	158	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	NR	[0.427]
MCS002A	LUC Boundary Seepline Well	A UAZ UTRAU	12-Oct-2021	33	20.1	644	260.95	NR	NR	NC	NR	NR	NR	NR	NR	NR	NR	NR	<EQL (1.37)
			18-Oct-2022	31	19.1	1000	259.5	4.6	227	NC	NR	NR	NR	NR	NR	NR	NR	NR	[0.249]
MCS002B	LUC Boundary Seepline Well	A UAZ UTRAU	12-Oct-2021	28	20.1	130	261.12	NR	NR	NC	NR	NR	NR	NR	NR	NR	NR	NR	<EQL (1.02)
			18-Oct-2022	18	19.3	320	259.5	4.4	210	NC	NR	NR	NR	NR	NR	NR	NR	NR	[-0.009]
RAG004DL	Plume Boundary Well	TZ UAZ UTRAU	05-Oct-2021	36	20.1	0.5	271.49	3.72	158	NC	NR	NR	NR	NR	NR	NR	NR	NR	2.38
			11-Oct-2022	36	20.1	1.9	269.83	4.19	176	NC	NR	NR	NR	NR	NR	NR	NR	NR	1.86
RAG008B	Plume Definition Well	LAZ UTRAU	12-Oct-2021	218	19.3	3.5	226.62	5.56	163	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	20	NR	NR	NR	<EQL (1.04)
			11-Oct-2022	209	19.3	1	225.5	8.01	230	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	24.2	NR	NR	NR	[0.302]
RPC 19C	Plume Boundary Well	LAZ UTRAU	06-Oct-2021	28	18.8	0.8	255.72	4.6	234	NC	NR	NR	NR	NR	NR	NR	NR	NR	<EQL (1.09)
			12-Oct-2022	27	20.1	1.9	254.64	9.23	282	NC	NR	NR	NR	NR	NR	NR	NR	NR	[-0.011]
RAG002D	Plume Definition Well	A UAZ UTRAU	05-Oct-2021	165	23.2	6.6	283.57	6.23	-58	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	NR	NR
			18-Oct-2022	160	22.4	7.1	283.55	4.8	80	NC	<EQL (1)	<EQL (1)	<EQL (1)	[0.36]	<EQL (1)	NR	NR	NR	NR
RAG004B	Plume Definition Well	LAZ UTRAU	05-Oct-2021	29	20.1	1.7	253.7	4.66	161	NC	NR	NR	NR	NR	NR	NR	NR	NR	<EQL (0.911)
			11-Oct-2022	33	20.1	2	254.64	4.06	151	NC	NR	NR	NR	NR	NR	NR	NR	NR	[-0.079]
RAG006B	Plume Definition Well	LAZ UTRAU	05-Oct-2021	219	19.8	0.6	234.89	6.62	152	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	NR	<EQL (0.896)
			11-Oct-2022	221	19.1	2.3	233.79	3.35	177	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	NR	[0.061]
RAG008DL	Plume Definition Well	MAZ UTRAU	12-Oct-2021	29	20.1	1.1	236.76	3.27	220	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	7.29	NR	NR	NR	1.95
			11-Oct-2022	29	19.1	0.3	234.96	7.04	261	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	7.16	NR	NR	NR	2.03
RAG009DL	Plume Definition Well	TZ UAZ UTRAU	06-Oct-2021	16	18.9	11.9	264.17	3.31	314	NC	NR	NR	NR	NR	NR	NR	NR	NR	<EQL (0.984)
			11-Oct-2022	16	20.1	23.8	264.92	8.3	254	NC	NR	NR	NR	NR	NR	NR	NR	NR	[0.42]
RAG009DU	Plume Definition Well	A UAZ UTRAU	06-Oct-2021	27	18.8	1.6	265.2	3.53	306	NC	NR	NR	NR	NR	NR	NR	NR	NR	6.84
			11-Oct-2022	26	19.8	0.9	266.23	8.68	294	NC	NR	NR	NR	NR	NR	NR	NR	NR	5.66

Table A-1. RAOU EMR Monitoring Wells, 2021 - 2022			Field Data								VOCs					Radionuclides			
			SAMPLE COLLECTION DATE	SPECIFIC CONDUCTANCE	WATER TEMPERATURE	TURBIDITY	SAMPLING EVENT WATER ELEVATION	OXYGEN	OXIDATION- REDUCTION POTENTIAL	FIELD CONDITIONS	CARBON TETRACHLORIDE	CHLOROETHENE (VINYL CHLORIDE)	CHLOROFORM	CIS-1,2- DICHLOROETHYLENE	TRICHLOROETHYLENE (TCE)	CARBON-14	CHLORINE-36	IODINE-129	TRITIUM
			Unit	uS/cm	degC	NTU	ft	mg/L	mV		ug/L	ug/L	ug/L	ug/L	ug/L	pCi/L	pCi/L	pCi/L	pCi/mL
Station	Well Use	Aquifer Zone	GWPS																
RAG013	Plume Definition Well	TZ_UAZ_UTRAU	06-Oct-2021	25	20.7	2.3	256.8	NR	NR	NC	NR	NR	NR	NR	NR	NR	NR	<EQL (1)	
			11-Oct-2022	22	19	6.6	256.11	5.21	161	NC	NR	NR	NR	NR	NR	NR	NR	[0.16]	
RAG014	Plume Definition Well	TZ_UAZ_UTRAU	06-Oct-2021	39	19.4	1.3	253.4	3.77	168	NC	NR	NR	NR	NR	NR	NR	NR	<EQL (1.05)	
			11-Oct-2022	41	18.6	6.3	252.19	5.21	161	NC	NR	NR	NR	NR	NR	NR	NR	[-0.064]	
RAM009C	Plume Definition Well	TZ_UAZ_UTRAU	06-Oct-2021	37	23.1	927	254.94	3.6	94	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	NR	[0.941]	
			12-Oct-2022	32	22.8	1000	248.09	3.6	120	NC	<EQL (1)	<EQL (1)	<EQL (1)	[0.49]	<EQL (1)	NR	NR	2.32	
RBP 11DL	Plume Definition Well	TZ_UAZ_UTRAU	06-Oct-2021	32	19.2	0.4	247.51	4.02	242	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	5.3	NR	NR	2.87	
			11-Oct-2022	37	19.5	2.3	244.22	4.1	253	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	4.26	NR	NR	2.79	
RBP 11DU	Plume Definition Well	A_UAZ_UTRAU	06-Oct-2021	32	19.9	0.2	247.28	4.82	271	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	[0.36]	NR	NR	<EQL (1.11)	
			11-Oct-2022	32	19.3	1.6	243.93	3.9	256	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	[0.249]	
RBP011B	Plume Boundary Well	LAZ_UTRAU	06-Oct-2021	202	19	6.9	NS	5.35	223	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	1.37	NR	NR	<EQL (1.01)	
			11-Oct-2022	198	19.6	13.9	NS	5	165	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	1.07	NR	NR	[0.302]	
RCS003C	Plume Definition Well	TZ_UAZ_UTRAU	06-Oct-2021	25	21.5	56.6	266.68	2.04	204	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	1.5	NR	NR	1.2	
			12-Oct-2022	25	19.1	113	266.67	2.1	206	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	1.31	NR	NR	1.21	
RDB004DL	Plume Definition Well	TZ_UAZ_UTRAU	06-Oct-2021	37	18.4	2.8	268.21	4.32	312	NC	NR	NR	NR	NR	NR	NR	NR	<EQL (1.02)	
			12-Oct-2022	34	19.1	6.9	268.51	5.46	258	NC	NR	NR	NR	NR	NR	NR	NR	[0.365]	
RGW 2C	Plume Definition Well	LAZ_UTRAU	06-Oct-2021	75	19.2	14.9	254.14	6.63	229	NC	NR	NR	NR	NR	NR	NR	NR	<EQL (0.982)	
			12-Oct-2022	76	19.1	5	253.25	7.05	201	NC	NR	NR	NR	NR	NR	NR	NR	[0.108]	
RGW 2D	Plume Definition Well	TZ_UAZ_UTRAU	06-Oct-2021	22	19	10.7	260.62	4.96	251	NC	NR	NR	NR	NR	NR	NR	NR	2.28	
			12-Oct-2022	22	18.9	7.6	260.48	6.7	278	NC	NR	NR	NR	NR	NR	NR	NR	2.2	
RPC 2CL	Plume Definition Well	LAZ_UTRAU	06-Oct-2021	89	19.3	3.1	247.65	4.8	164	NC	NR	NR	NR	NR	NR	NR	NR	[0.446]	
			12-Oct-2022	81	19.9	1.1	247.15	7	23	NC	NR	NR	NR	NR	NR	NR	NR	[0.978]	
RPC 2CU	Plume Definition Well	LAZ_UTRAU	06-Oct-2021	22	19	0.9	256.37	4.4	257	NC	NR	NR	NR	NR	NR	NR	NR	2.59	
			12-Oct-2022	28	19.7	2.1	256.17	6.6	201	NC	NR	NR	NR	NR	NR	NR	NR	3.34	
RPC 2D	Plume Definition Well	TZ_UAZ_UTRAU	06-Oct-2021	20	19.6	3.6	269.5	4.1	203	NC	NR	NR	NR	NR	NR	NR	NR	<EQL (1.3)	
			12-Oct-2022	19	22	37.4	268.73	5.93	128	NC	NR	NR	NR	NR	NR	NR	NR	[0.176]	
RSE027C	Plume Definition Well	MAZ_UTRAU	06-Oct-2021	19	19.6	4.8	NS	4.3	230	NC	NR	NR	NR	NR	NR	NR	NR	<EQL (0.939)	
			12-Oct-2022	19	19.2	4.4	NS	3.83	266	NC	NR	NR	NR	NR	NR	NR	NR	[0.114]	
RSP 5DL	Plume Definition Well	TZ_UAZ_UTRAU	06-Oct-2021	93	19.2	3.4	NS	3.16	112	NC	NR	NR	NR	NR	NR	NR	NR	[1.03]	
			17-Oct-2022	76	23.2	6.6	NS	4.3	80	NC	NR	NR	NR	NR	NR	NR	NR	[0.936]	
RAG003DL	ISD Source Well	TZ_UAZ_UTRAU	18-Oct-2022	71	20.3	9.6	270.17	4.7	159	NC	<EQL (1)	[0.94]	<EQL (1)	2.22	[0.54]	<EQL (37.7)	<EQL (90)	<EQL (0.5)	29.1
RAG003DU	ISD Source Well	A_UAZ_UTRAU	18-Oct-2022	38	20.7	4.1	269.72	4.5	137	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	[0.72]	<EQL (23.9)	<EQL (90)	NR	1.21
RDB 1D	ISD Source Well	A_UAZ_UTRAU	06-Oct-2021	202	26.1	1	287.5	NR	NR	NC	NR	NR	NR	NR	NR	<EQL (23)	NR	NR	<EQL (1.1)
			18-Oct-2022	239	25.2	3.3	286.9	1.88	155	NC	NR	NR	NR	NR	NR	<EQL (25.1)	<EQL (90)	<EQL (0.5)	[0.252]

Table A-1. RAOU EMR Monitoring Wells, 2021 - 2022			Field Data								VOCs					Radionuclides			
			SAMPLE COLLECTION DATE	SPECIFIC CONDUCTANCE	WATER TEMPERATURE	TURBIDITY	SAMPLING EVENT WATER ELEVATION	OXYGEN	OXIDATION- REDUCTION POTENTIAL	FIELD CONDITIONS	CARBON TETRACHLORIDE	CHLOROETHENE (VINYL CHLORIDE)	CHLOROFORM	CIS-1,2- DICHLOROETHYLENE	TRICHLOROETHYLENE (TCE)	CARBON-14	CHLORINE-36	IODINE-129	TRITIUM
			Unit	uS/cm	degC	NTU	ft	mg/L	mV		ug/L	ug/L	ug/L	ug/L	ug/L	pCi/L	pCi/L	pCi/L	pCi/mL
Station	Well Use	Aquifer Zone	GWPS																
RDB 3D	ISD Source Well	A UAZ UTRAU	06-Oct-2021	238	25	14.8	284.4	NR	NR	NC	NR	NR	NR	NR	95	NR	NR	353	
			18-Oct-2022	223	24	13.8	285.64	2.23	110	NC	NR	NR	NR	NR	35.4	<EQL (90)	<EQL (0.5)	109	
RDB003DU	ISD Source Well	A UAZ UTRAU	06-Oct-2021	22	21.6	13.2	276.5	NR	NR	NC	NR	NR	NR	NR	<EQL (28.5)	NR	NR	2.26	
			18-Oct-2022	213	24.2	3.9	277.1	2.39	117	NC	NR	NR	NR	NR	<EQL (24)	<EQL (90)	<EQL (0.5)	2.19	
RDB005C	ISD & Tritium Source Well	TZ UAZ UTRAU	06-Oct-2021	42	23.9	186	273.29	2.5	46	NC	NR	NR	NR	NR	<EQL (23.1)	NR	NR	32.7	
			12-Oct-2022	24	24.4	185	267.61	5.56	226	NC	NR	NR	NR	NR	<EQL (24.9)	<EQL (90)	<EQL (0.5)	30.3	
RPS004C	ISD Source & VOC Well	TZ UAZ UTRAU	06-Oct-2021	74	24.1	12.6	NS	0.1	16	NC	<EQL (1)	1.52	<EQL (1)	16.7	1.44	NR	NR	137	
			18-Oct-2022	72	21.5	14.9	NS	2.77	131	NC	<EQL (1)	1.64	<EQL (1)	9.73	[0.98]	<EQL (23.3)	<EQL (90)	<EQL (0.5)	141
RPS004DUR	ISD Source Well	A UAZ UTRAU	17-Oct-2022	180	22.2	4	NS	1.6	-20	NC	<EQL (1)	2.04	<EQL (1)	1.36	<EQL (1)	<EQL (23.9)	<EQL (90)	<EQL (0.5)	376
RSE 10DU	Source Well	A UAZ UTRAU	05-Oct-2021	46	24.3	4.3	NS	4.86	209	NC	NR	NR	NR	NR	NR	NR	NR	18.8	
			17-Oct-2022	49	25.6	29	NS	4	228	NC	NR	NR	NR	NR	NR	NR	NR	16.6	
RWT003C	Source Well	TZ UAZ UTRAU	06-Oct-2021	26	21.9	20.4	NS	2.2	8	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	[0.41]	NR	NR	NR	
			17-Oct-2022	26	21.2	18.3	NS	2.7	183	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	NR	
JBSW-01	Surface Water	Unknown	12-Oct-2021	26	19	7.9	NA	5.25	104	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	<EQL (1.11)	
			12-Oct-2022	778	17.8	4.7	NA	6.19	186	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	[0.486]	
JBSW-02	Surface Water	Unknown	12-Oct-2021	24	18.9	4	NA	4.97	108	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	<EQL (1.1)	
			12-Oct-2022	760	17.9	4.3	NA	5.99	174	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	[0.425]	
JBSW-03	Surface Water	Unknown	12-Oct-2021	25	19.1	4.5	NA	5.27	116	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	<EQL (1.1)	
			12-Oct-2022	783	17.9	5.1	NA	6.12	179	NC	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	<EQL (1)	NR	NR	[0.437]	
MCSW-03	Surface Water	Unknown	10-Oct-2022	NS	NS	NS	NA	NS	NS	DRY	NR	NR	NR	NR	NR	NR	NR	NS	
MCSW-04	Surface Water	Unknown	11-Oct-2022	71	17.8	2.5	NA	2.41	170	NC	NR	NR	NR	NR	NR	NR	NR	1.68	
MCSW-05	Surface Water	Unknown	12-Oct-2022	22	17.2	7.3	NA	2.55	213	NC	NR	NR	NR	NR	NR	NR	NR	0.567	
MCSW-06	Surface Water	Unknown	13-Oct-2022	19	17.8	2.6	NA	4.22	203	NC	NR	NR	NR	NR	NR	NR	NR	0.689	

Table A-2 Abbreviations and Definitions	
[0.425]	EPA Functional Guideline Code of 'J' was applied to the result, indicating an estimated quantity.
<EQL (1)	Constituent was below detection. The sample-specific Practical Quantitation Limit is in parentheses.
20.4	Result exceeds applicable limit.
REJ	Result Rejected.
	Result is less than the applicable limit and without EPA Functional Guideline qualifiers.
NS	Requested to be sampled but was not. See comments as to why not.
NA	Not Applicable for this station or sample.
NR	Not a required sample analysis.

Table A-2 Field Comments	
C	Continuously pumping well / flowing stream
DRY	Dry well. No sample collected.
NS	Not sampled.
T	High turbidity. Some portions of the sample may not be analyzed.
X	Well pumped dry. Samples collected after well recovered.
N	Field parameters not stable when sample collected.
NC	No comment.

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## **APPENDIX B**

### **Hydrographs**

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Figure B-1.

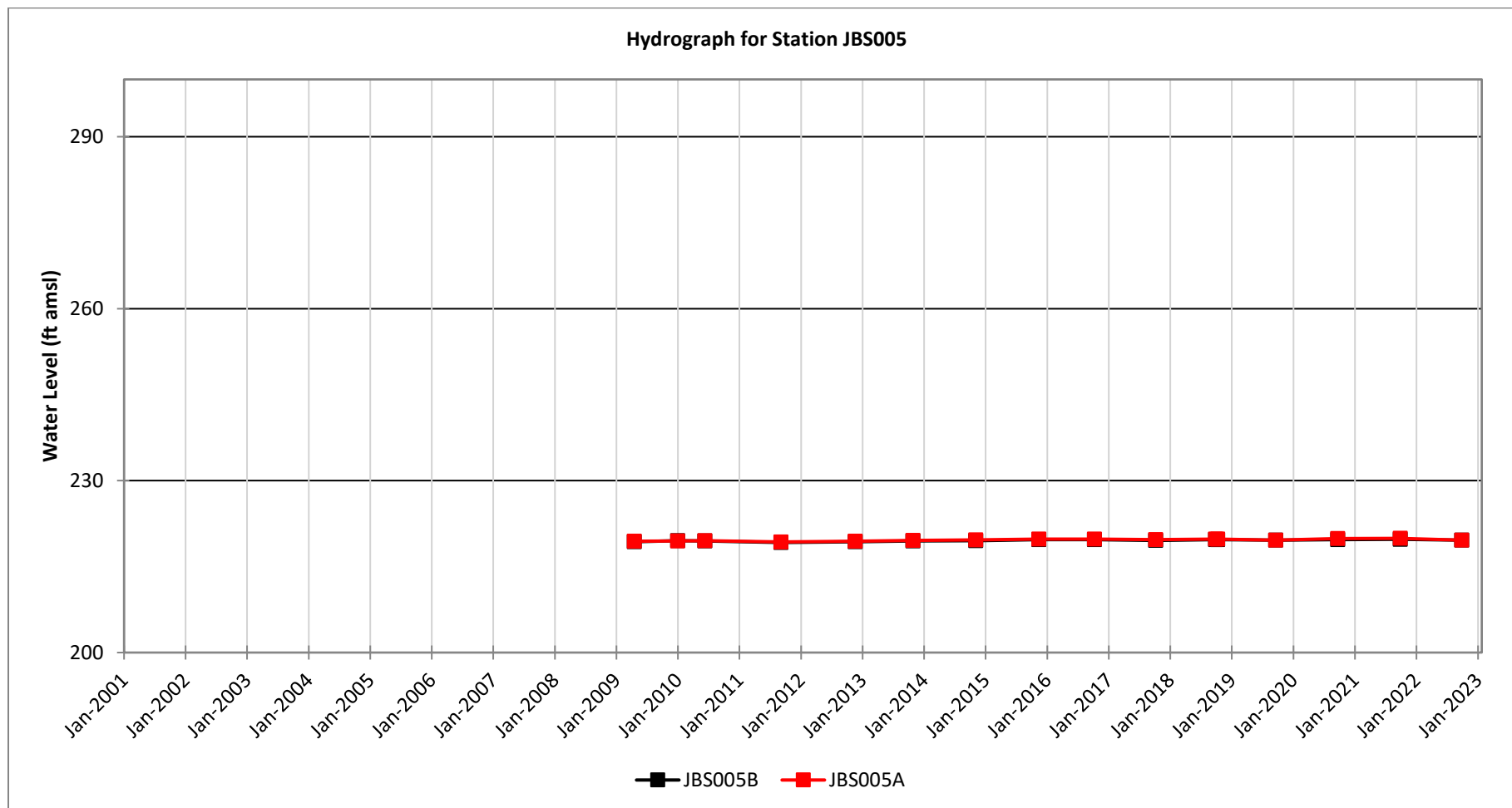


Figure B-2.

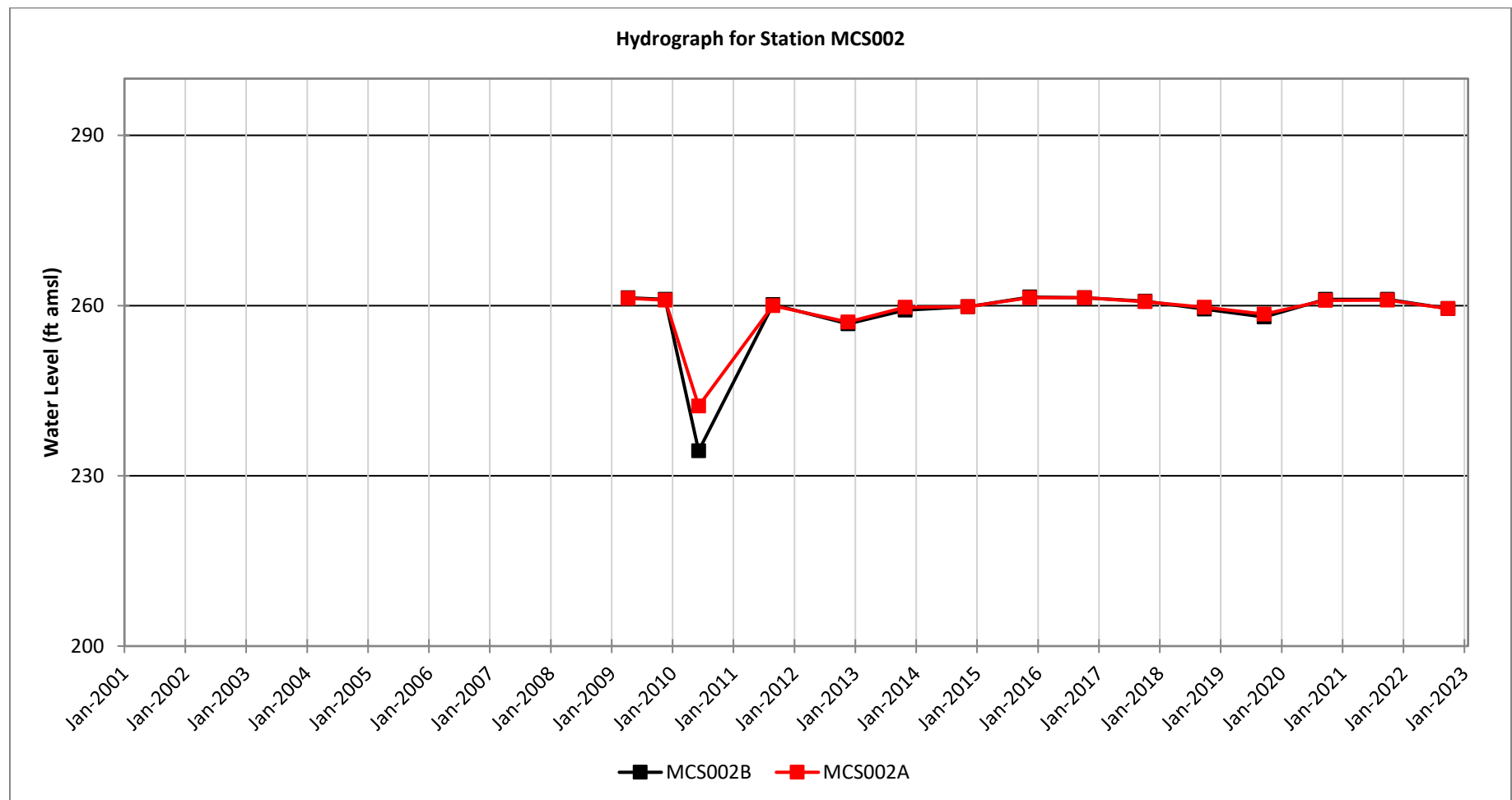


Figure B-3.

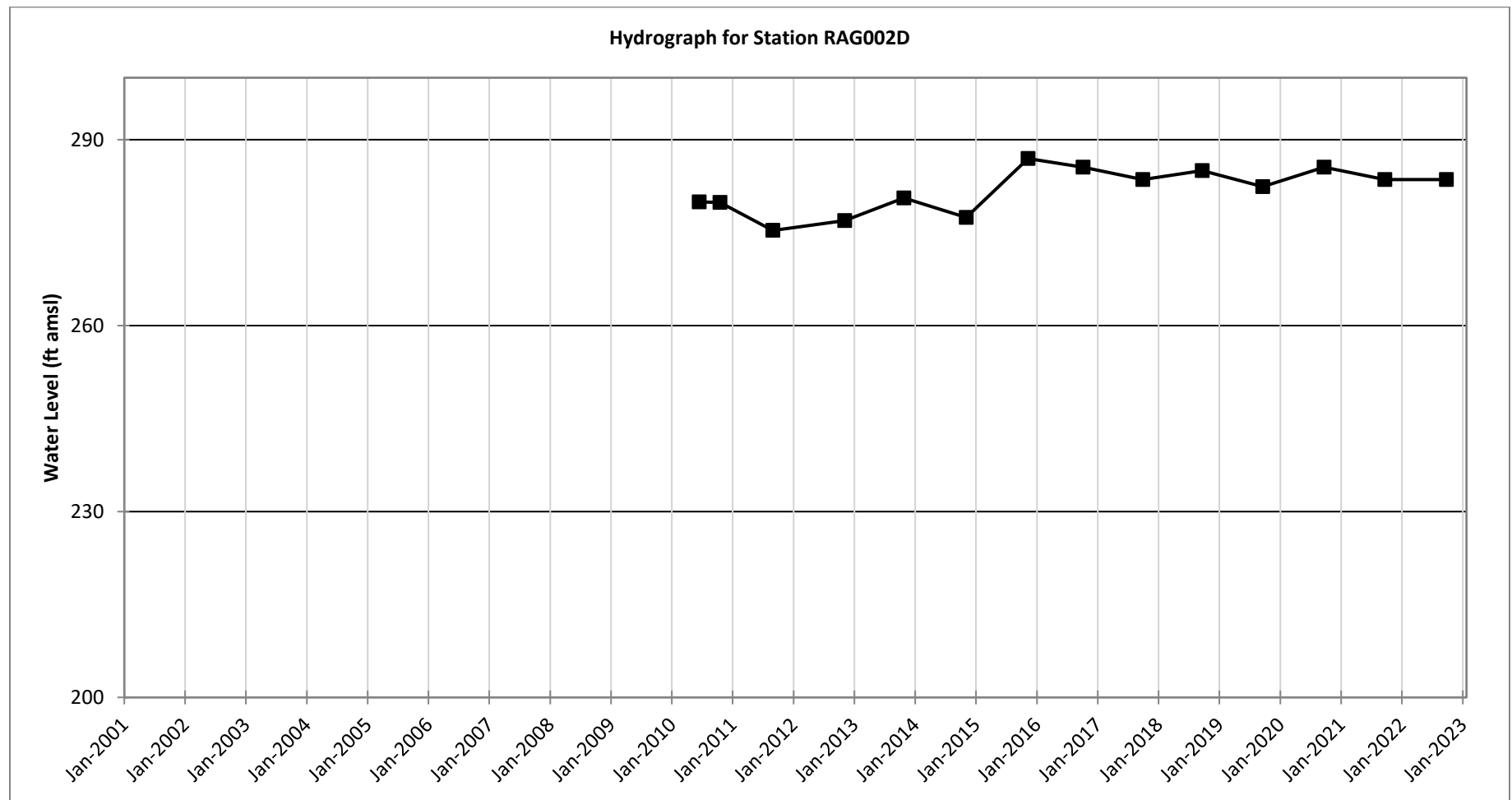


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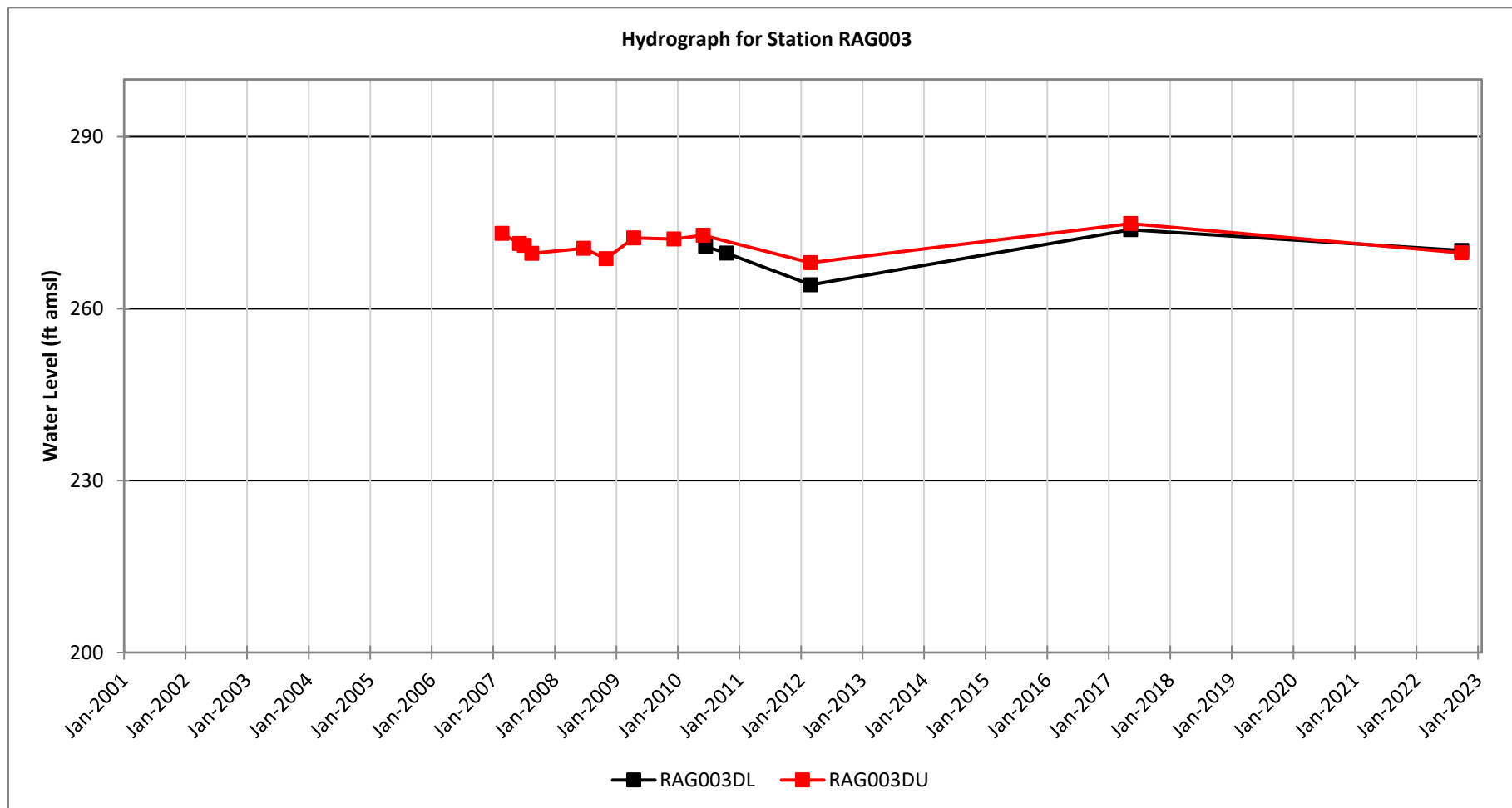


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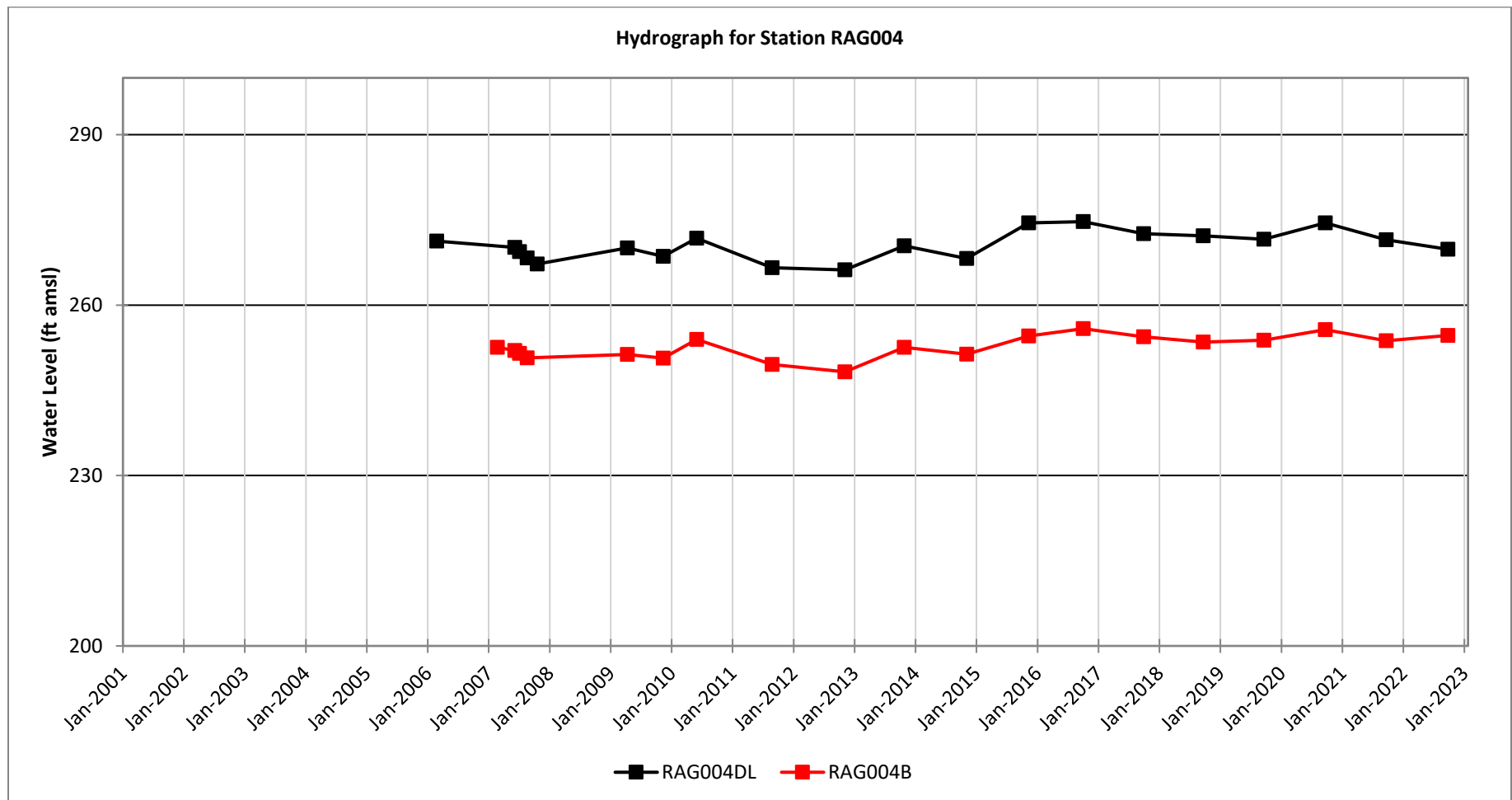


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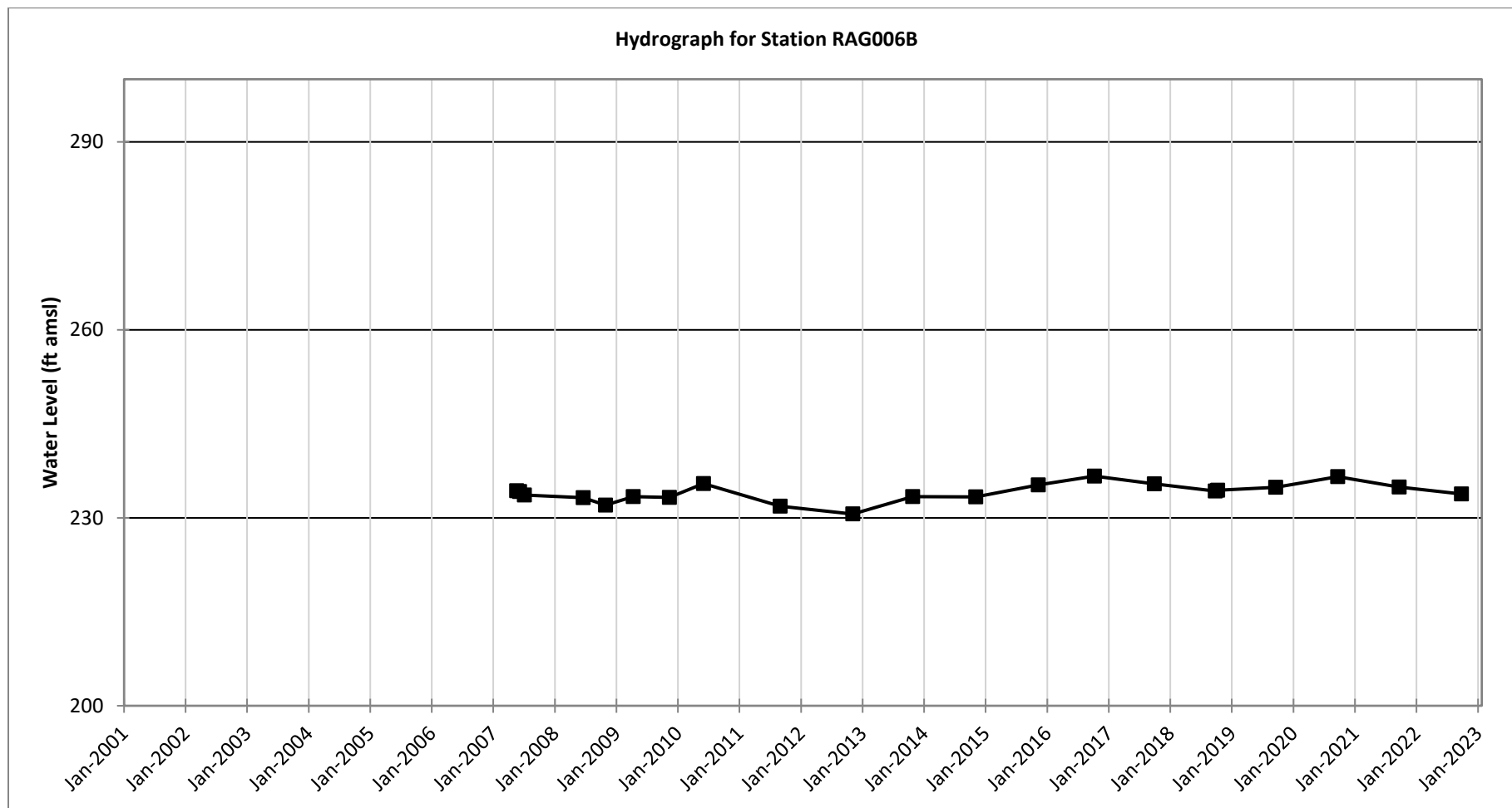


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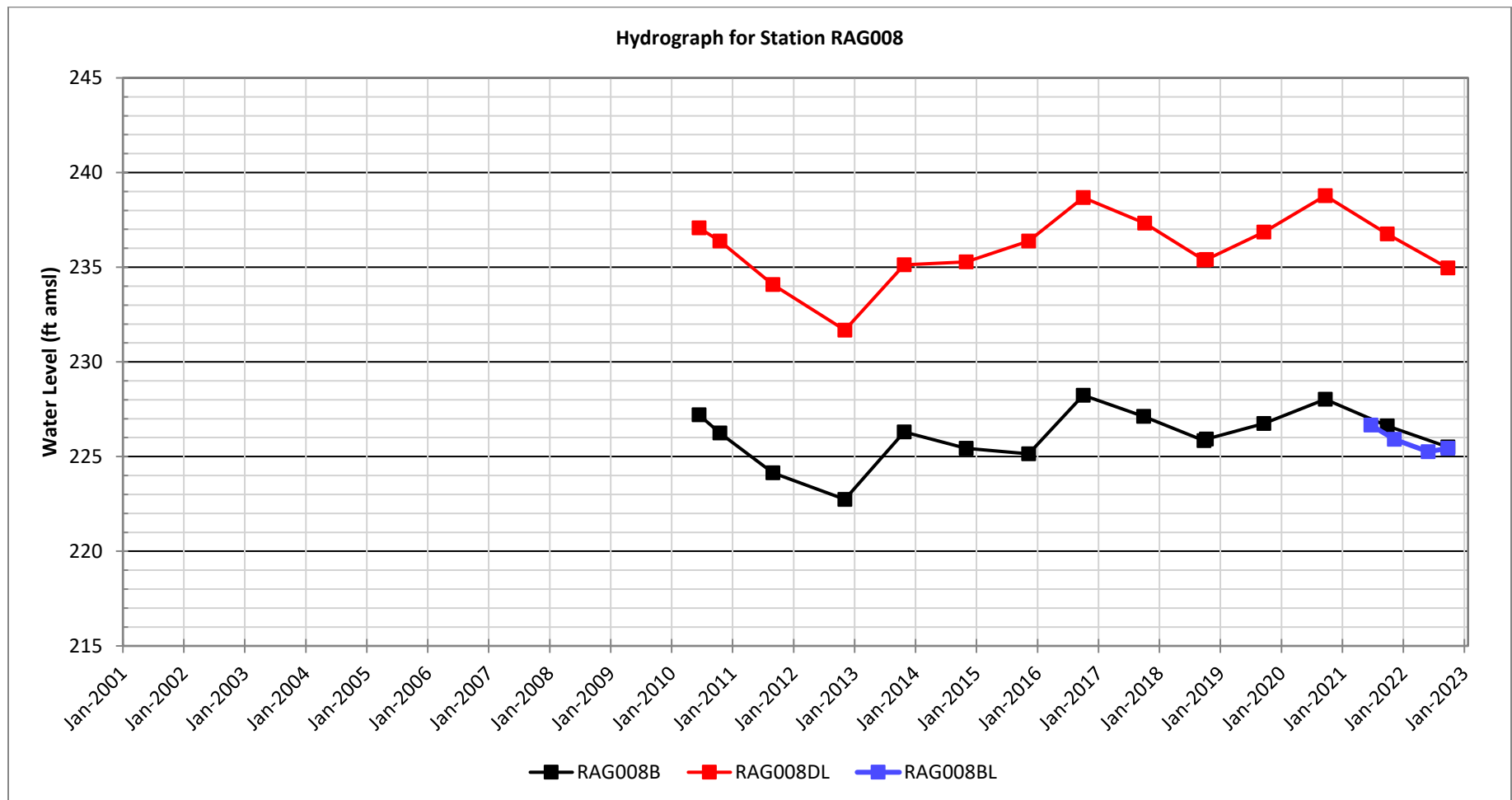


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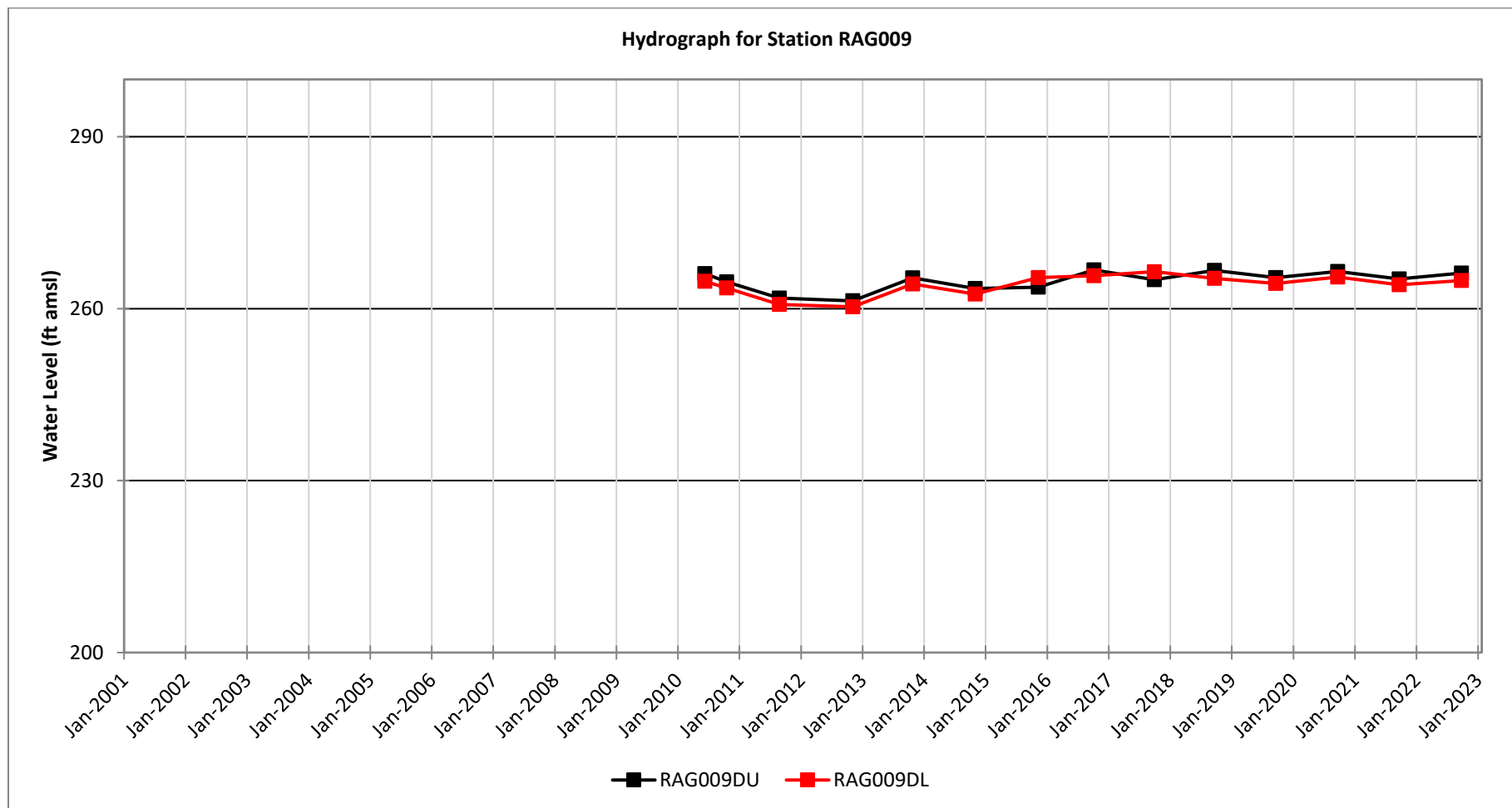


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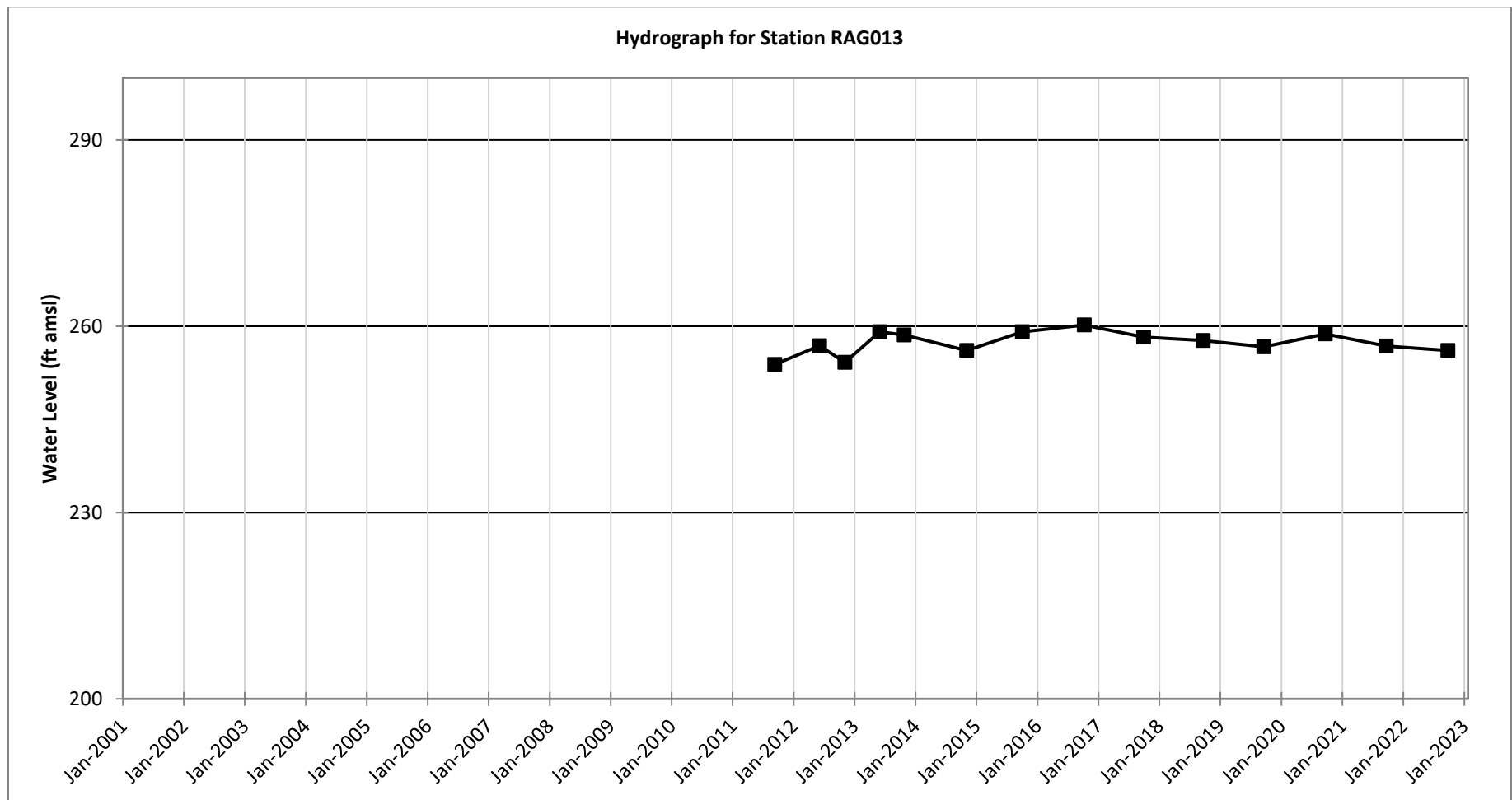


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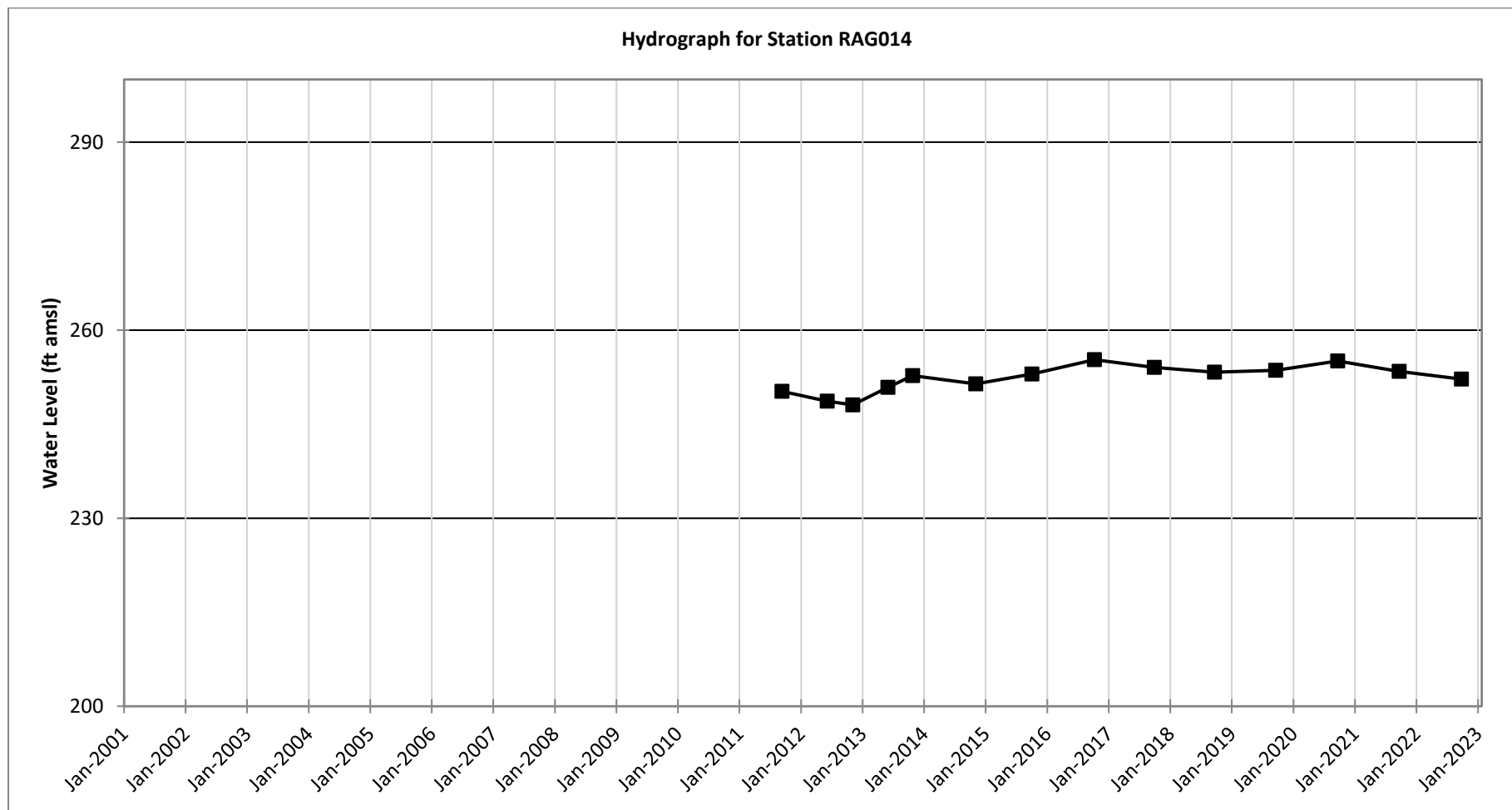


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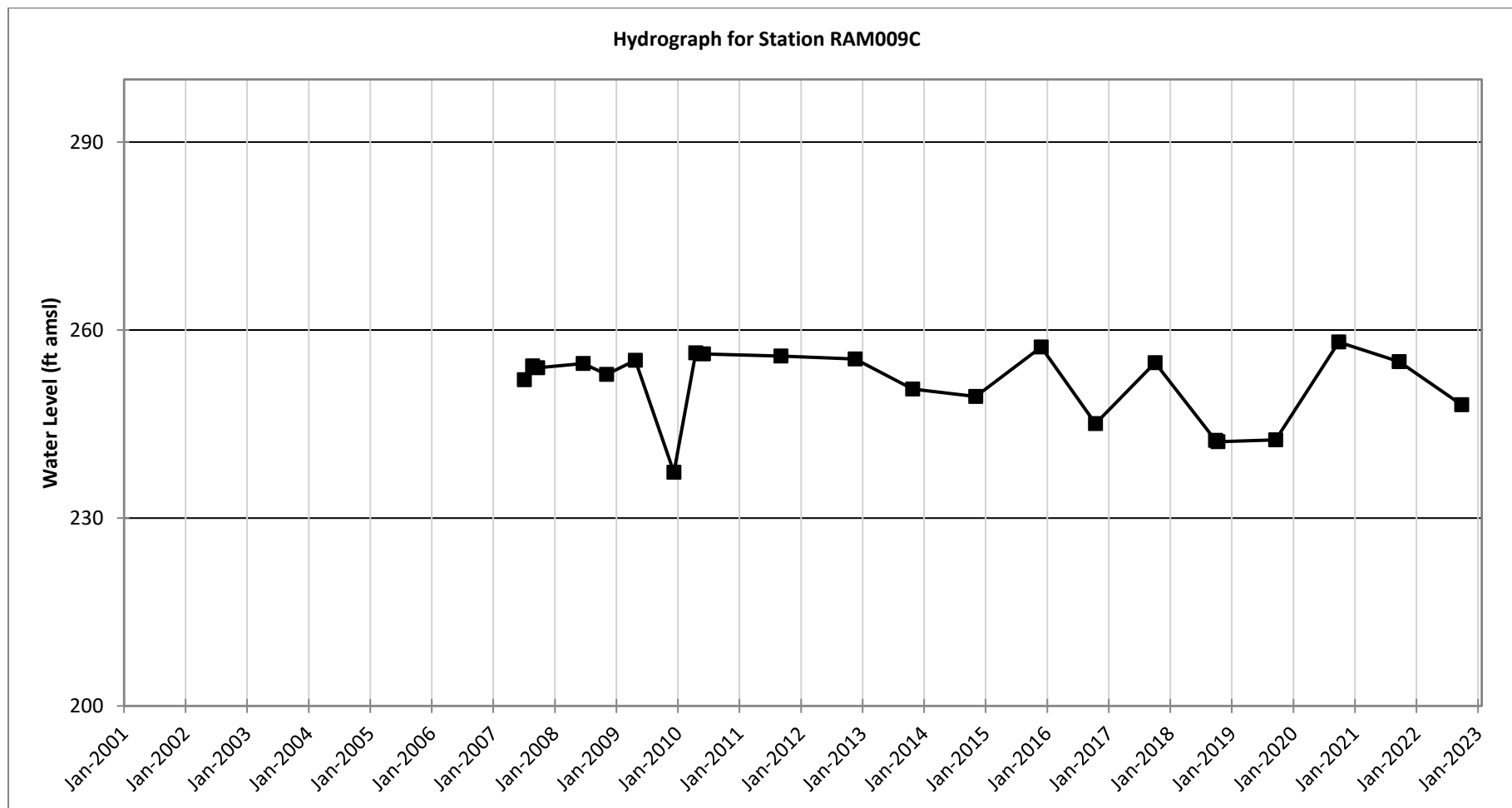


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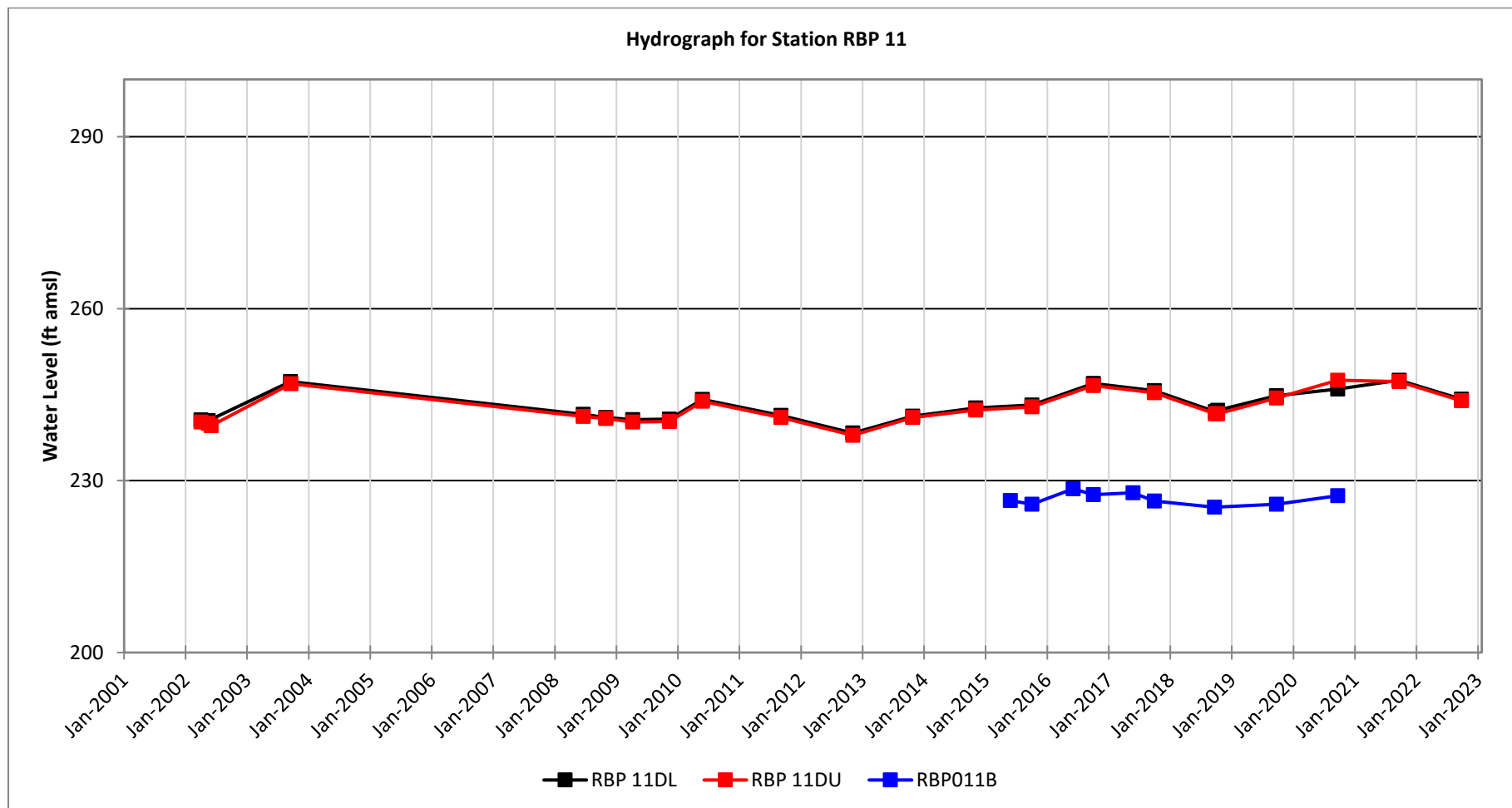


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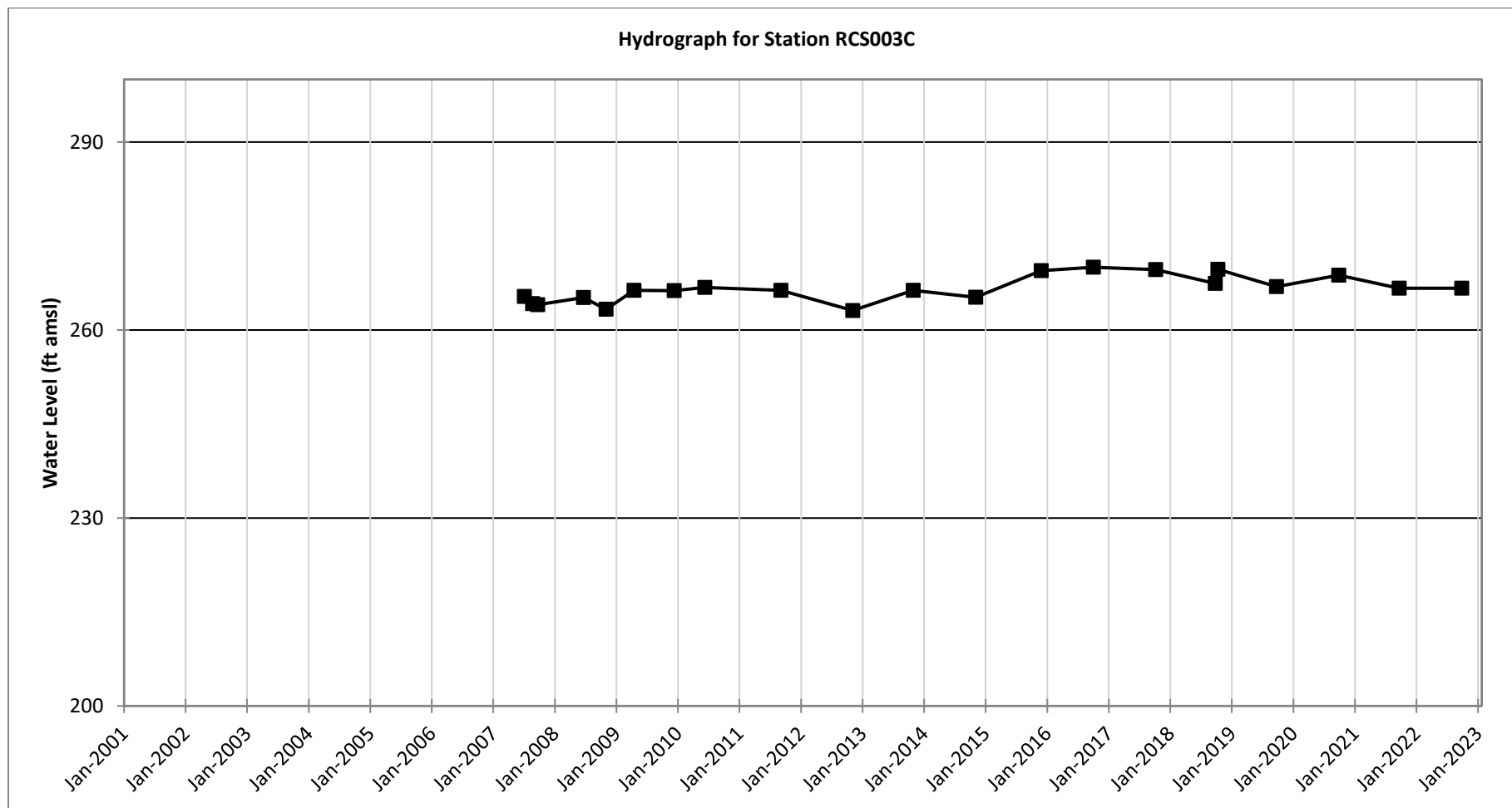


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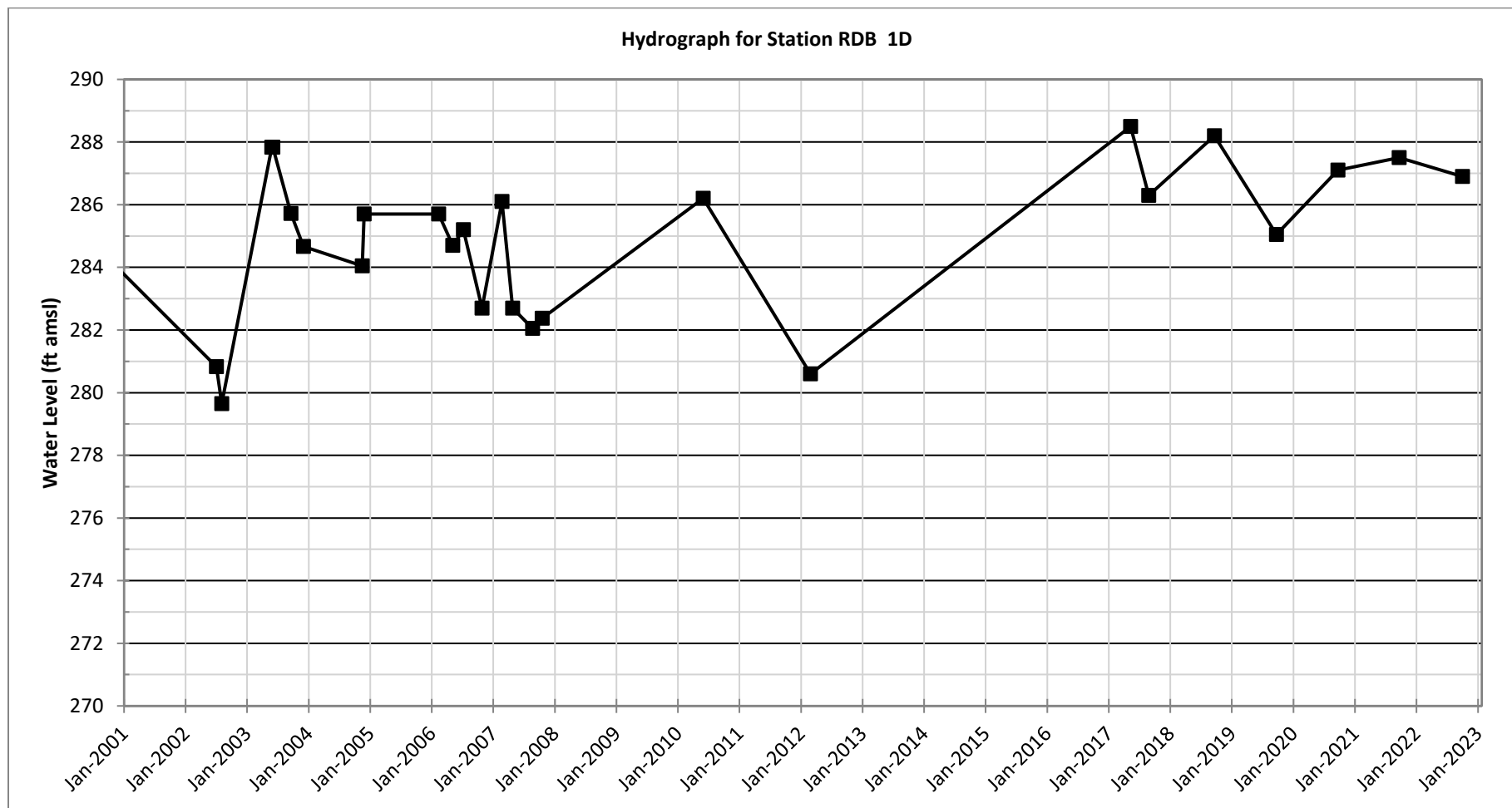


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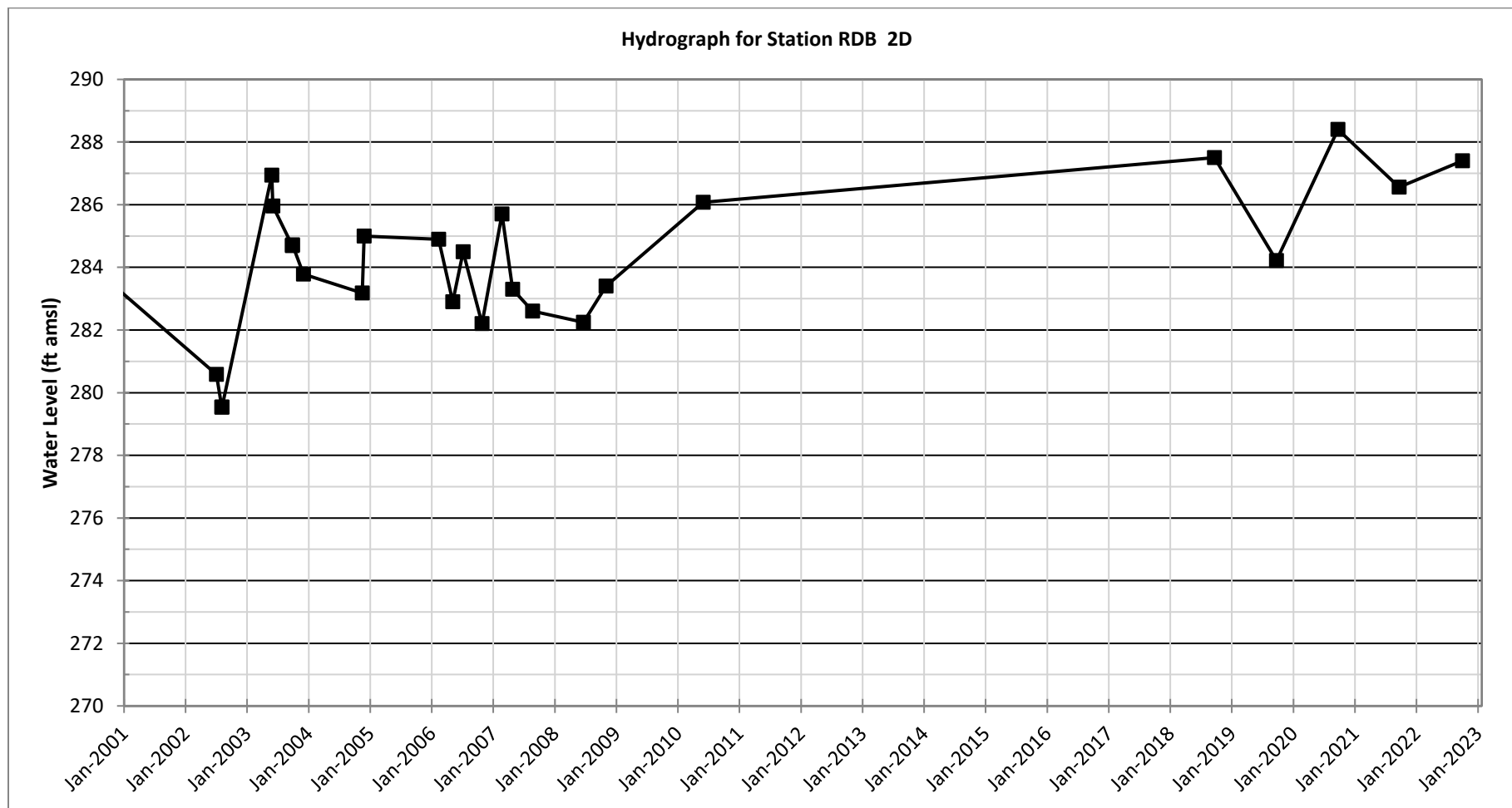


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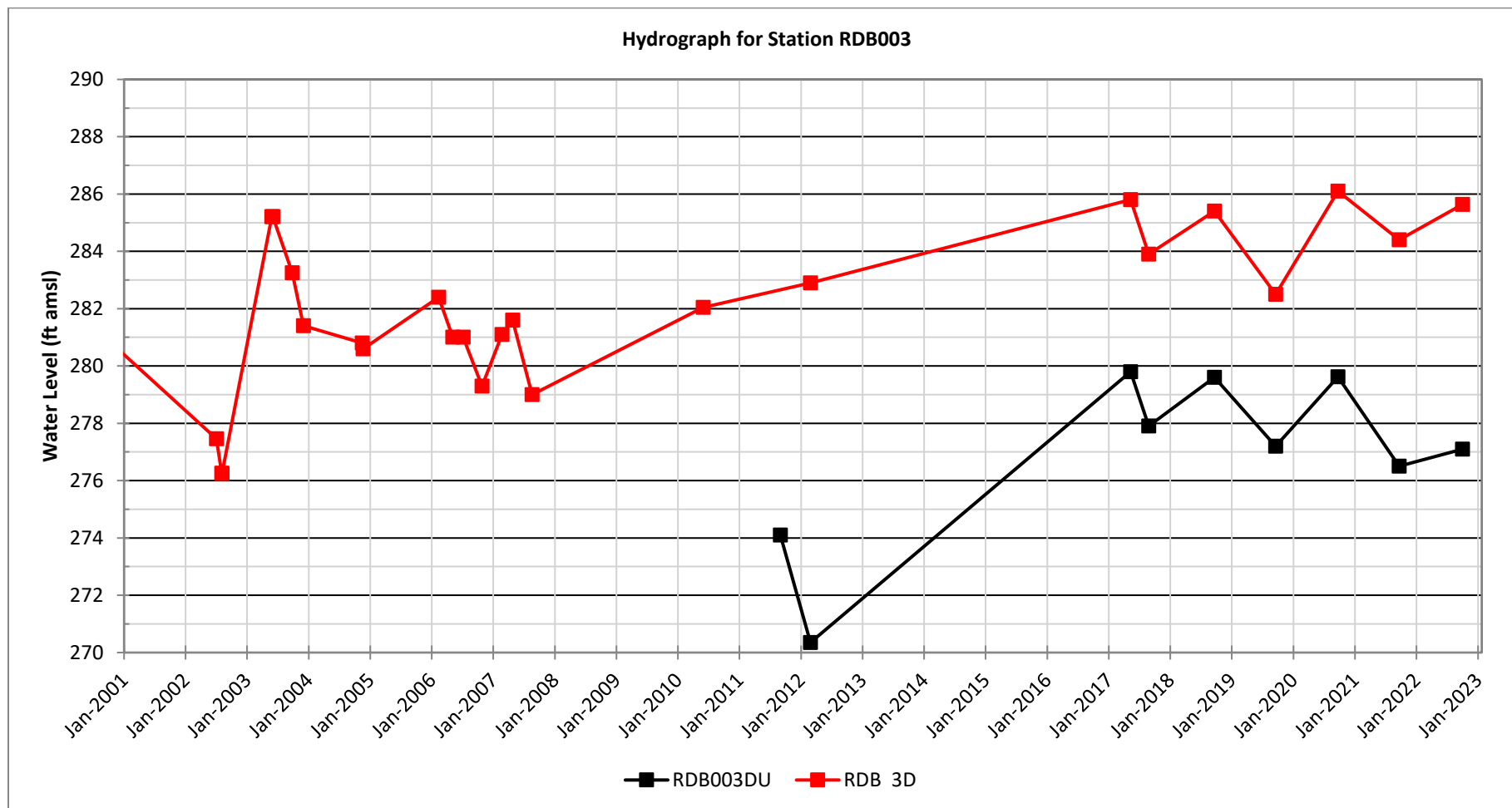


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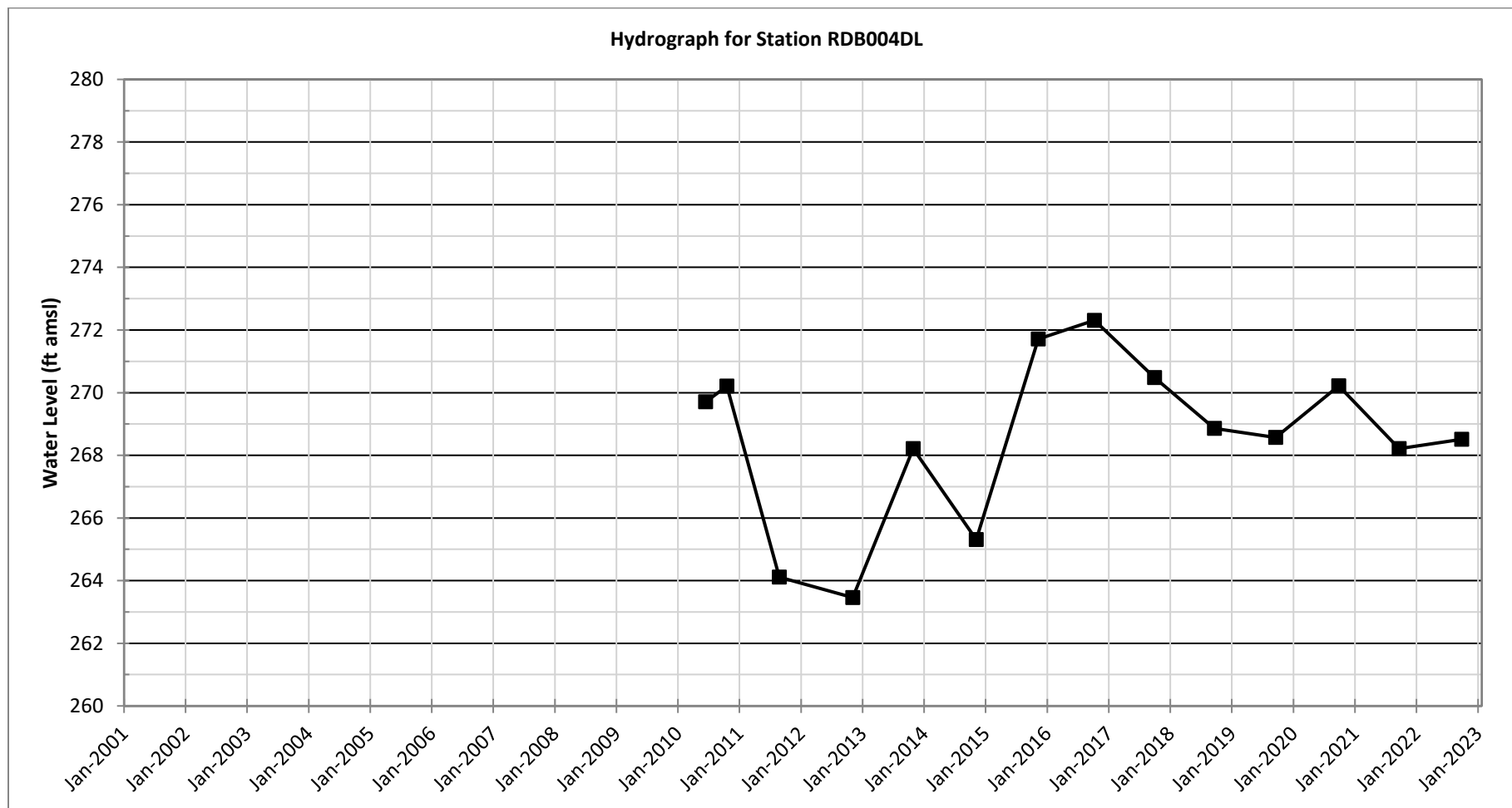


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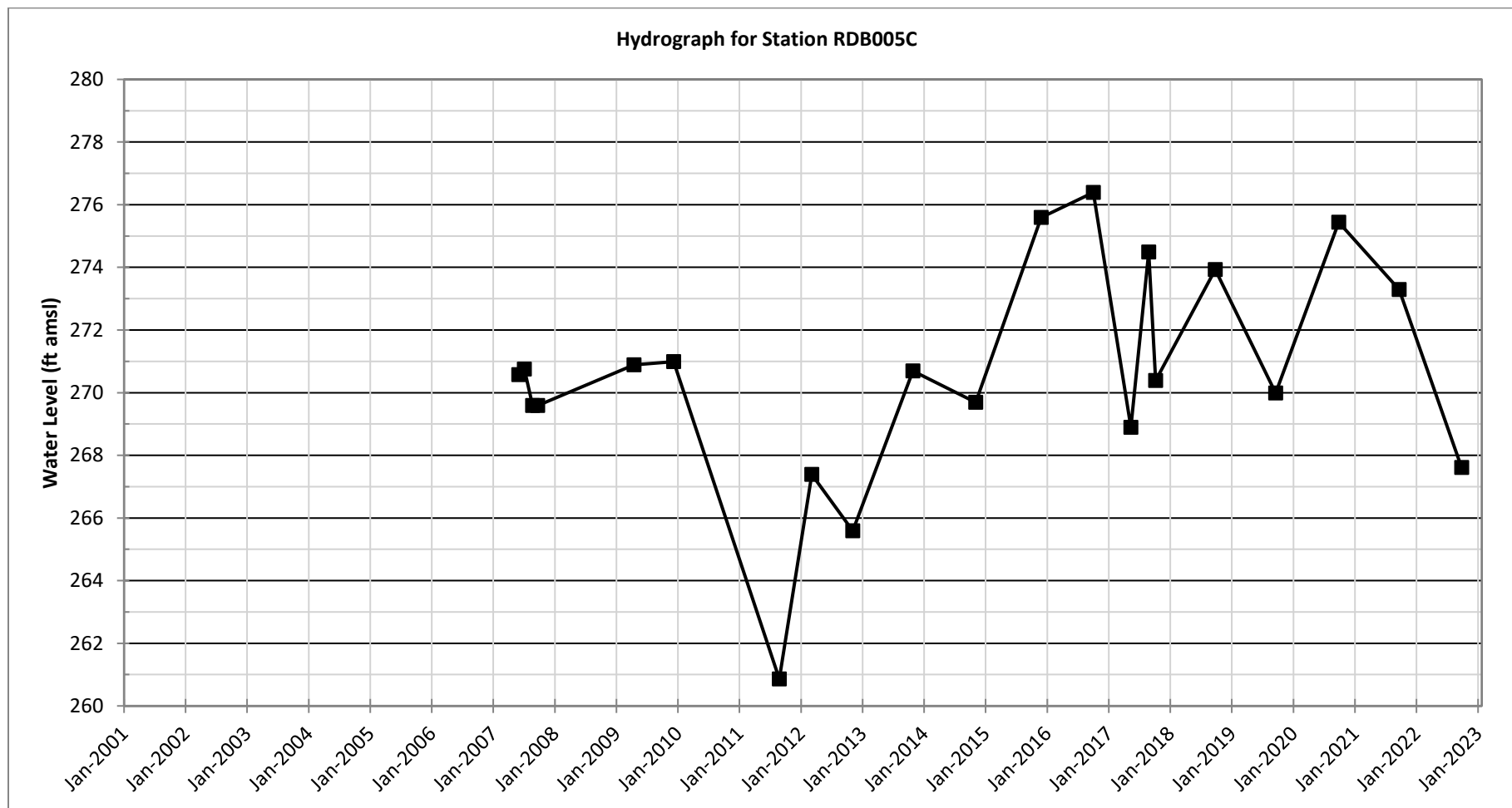


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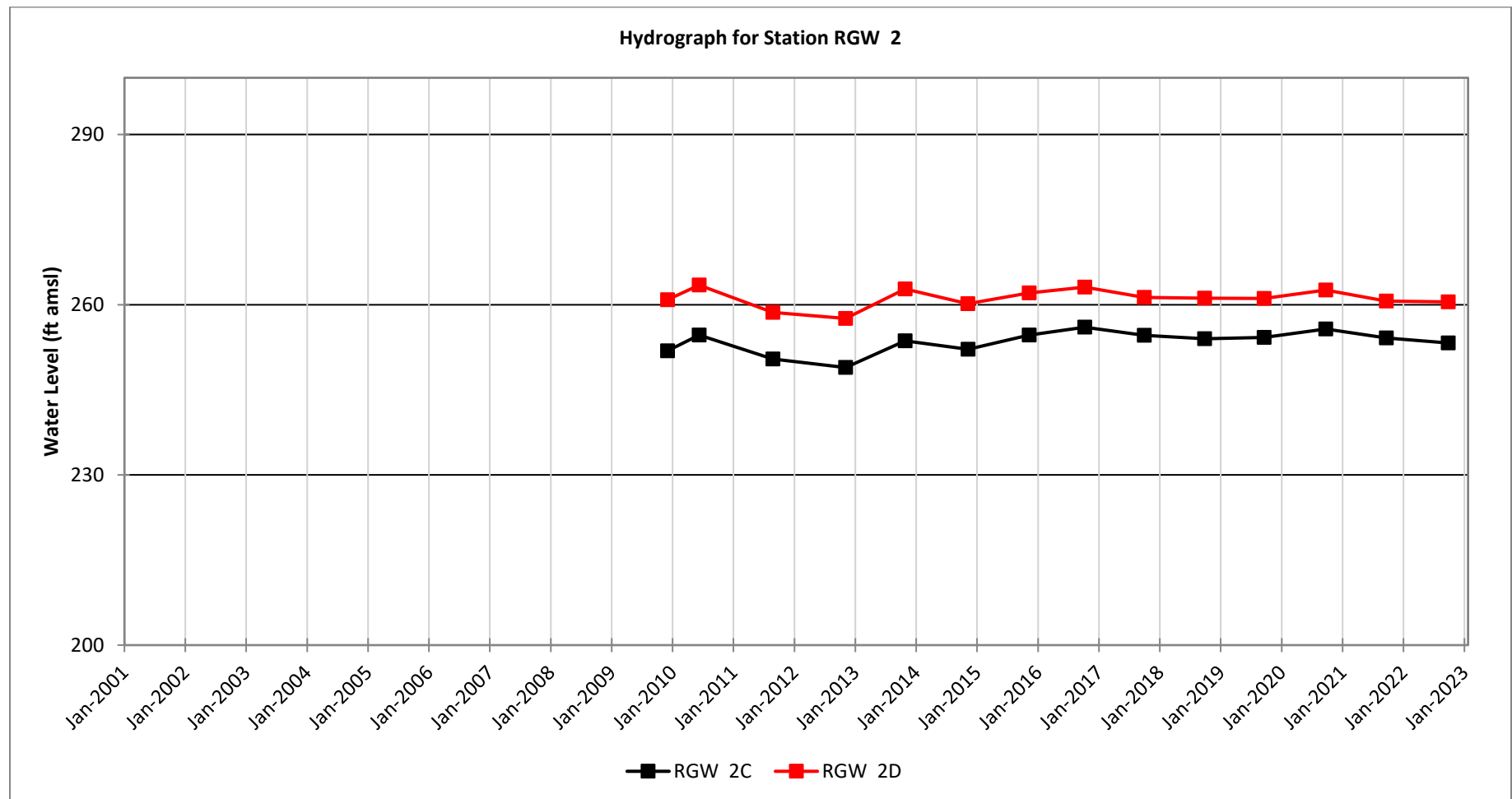


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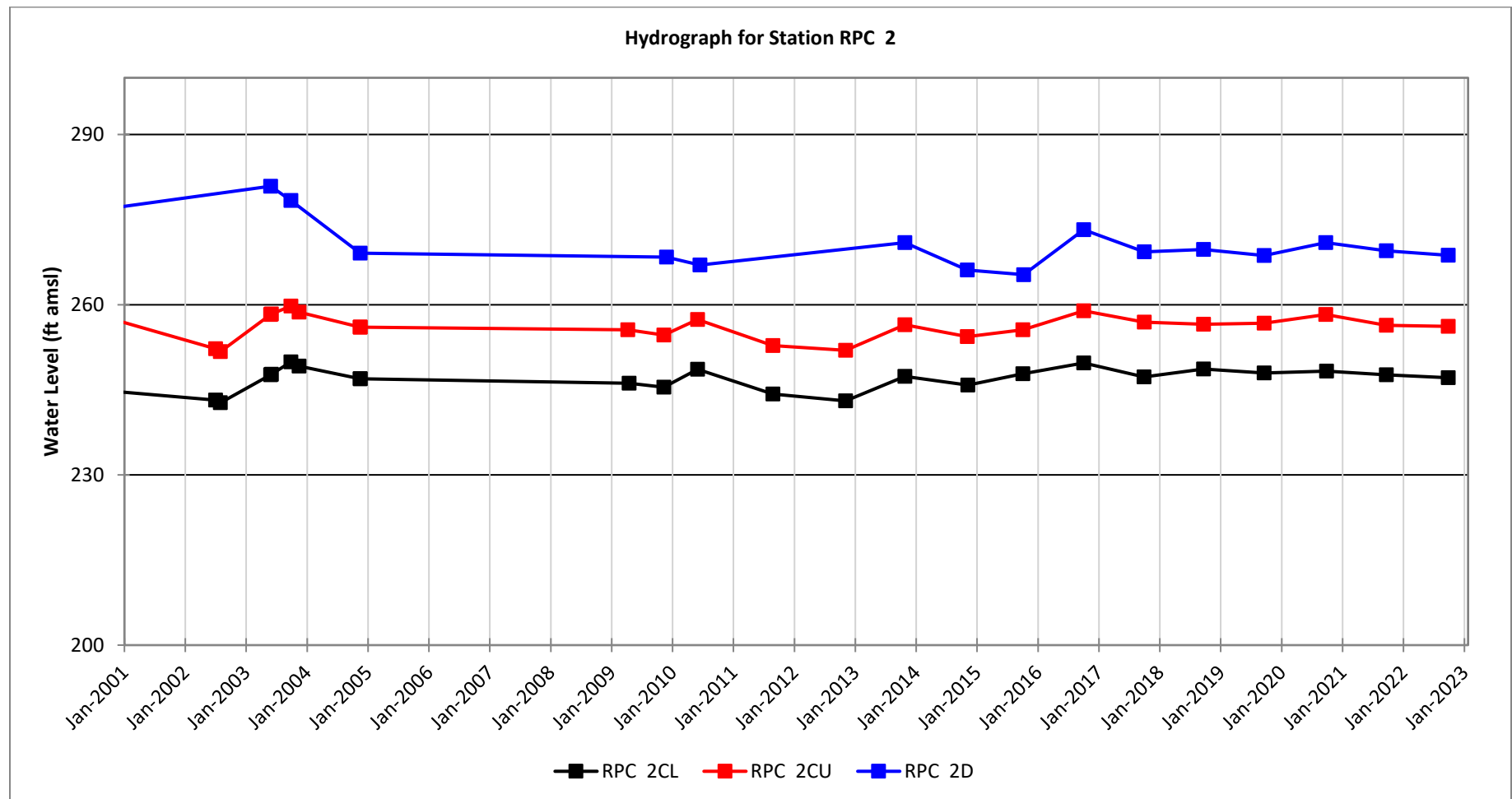


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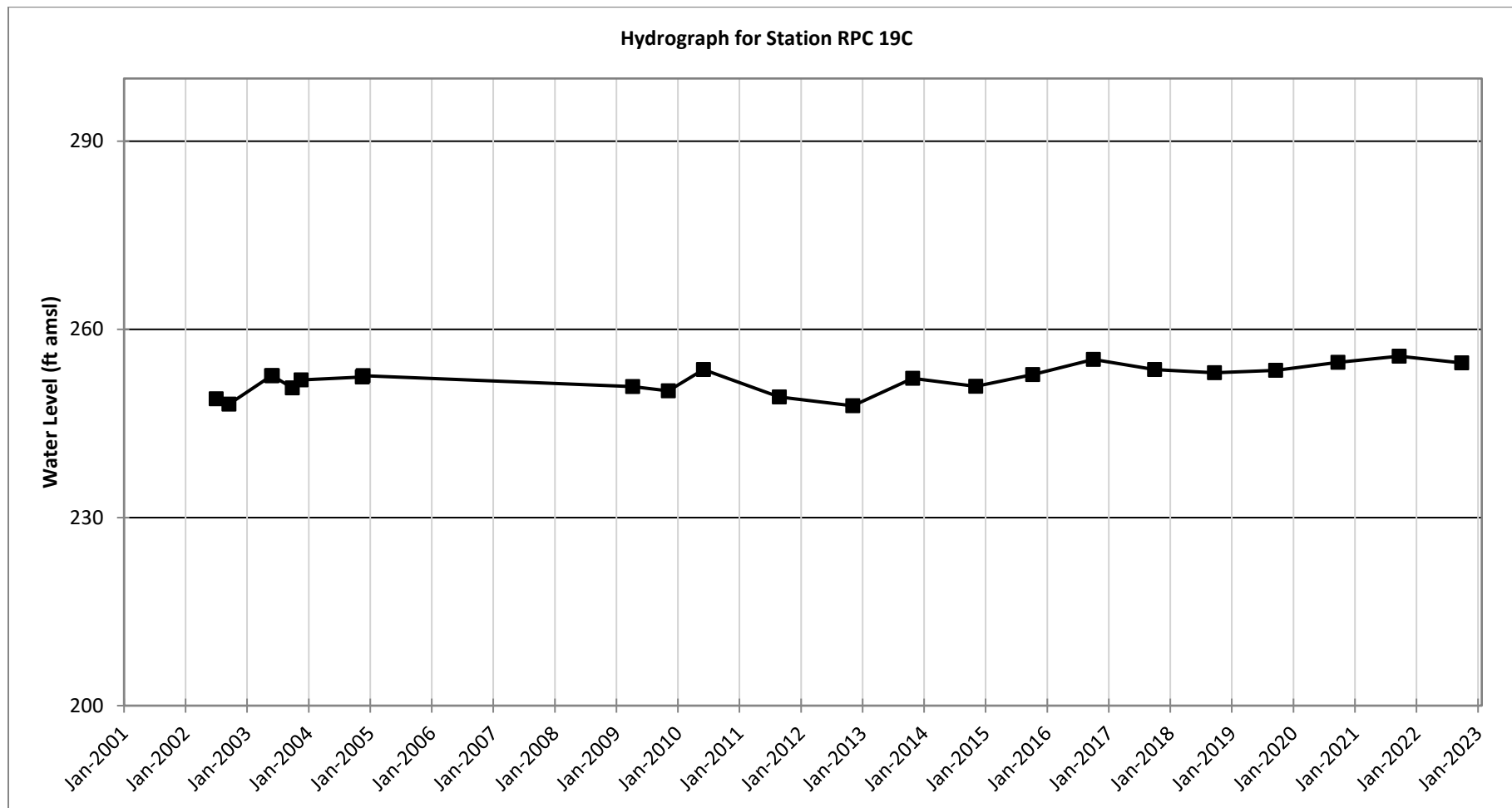


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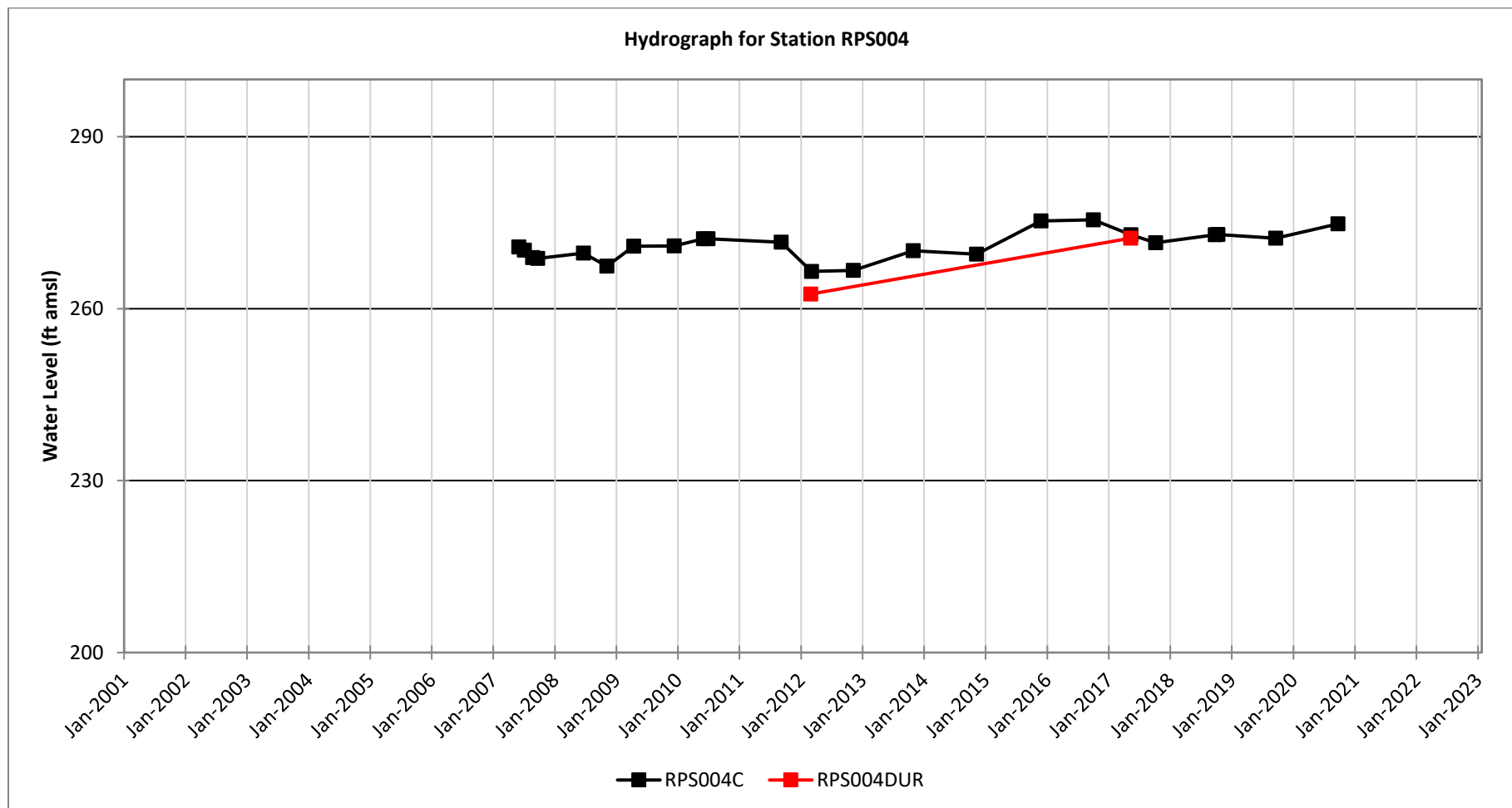


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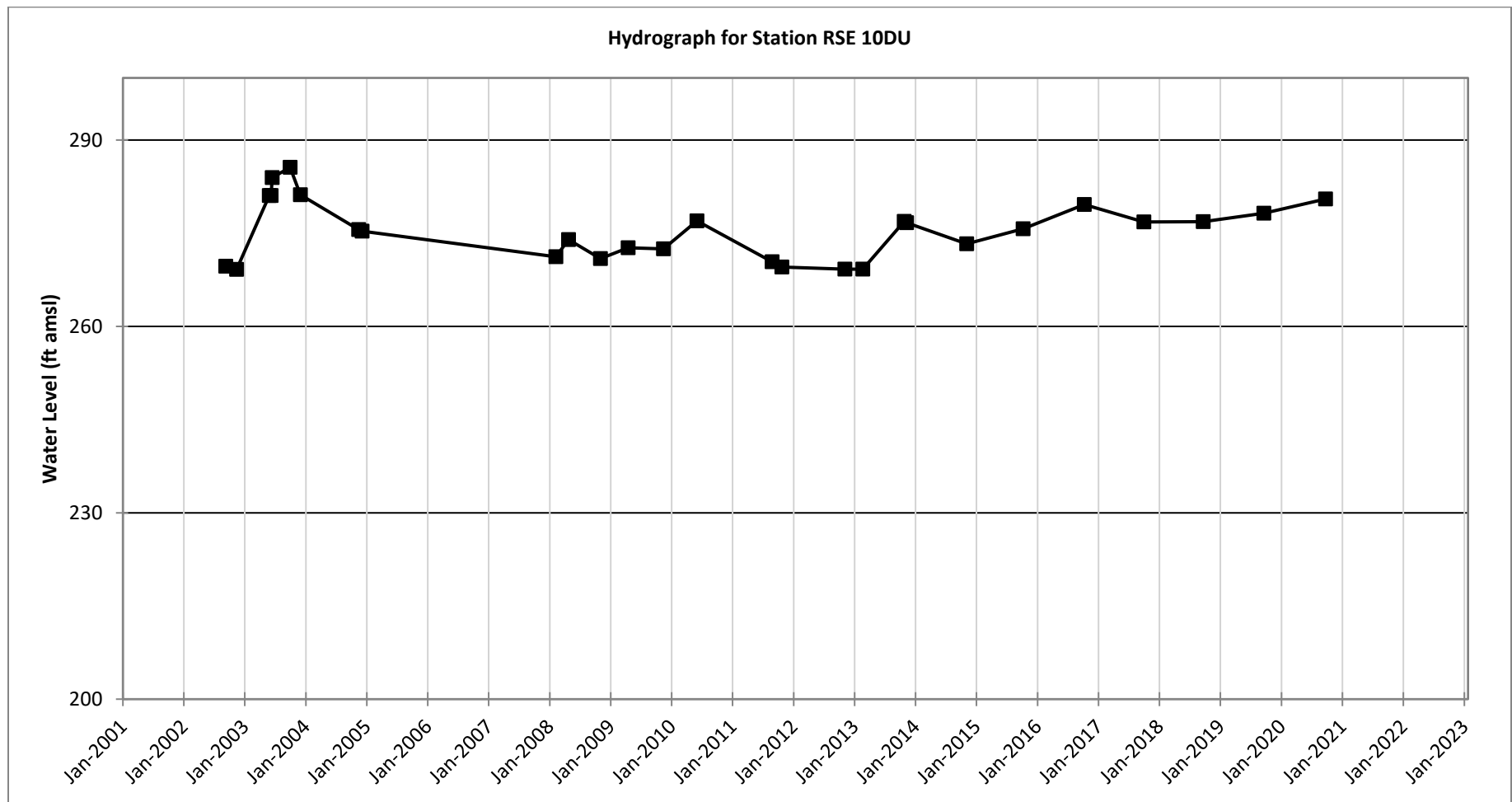


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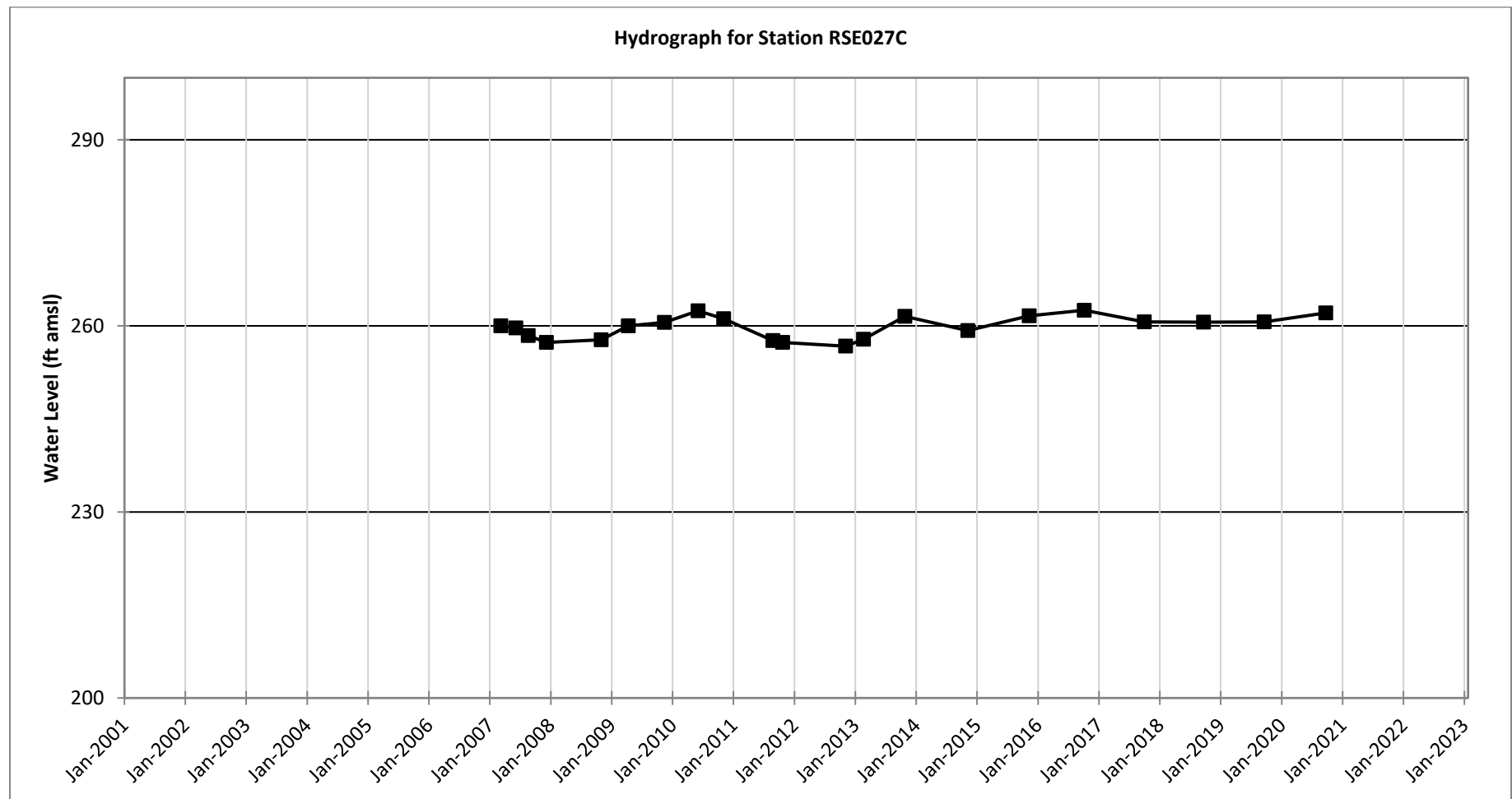


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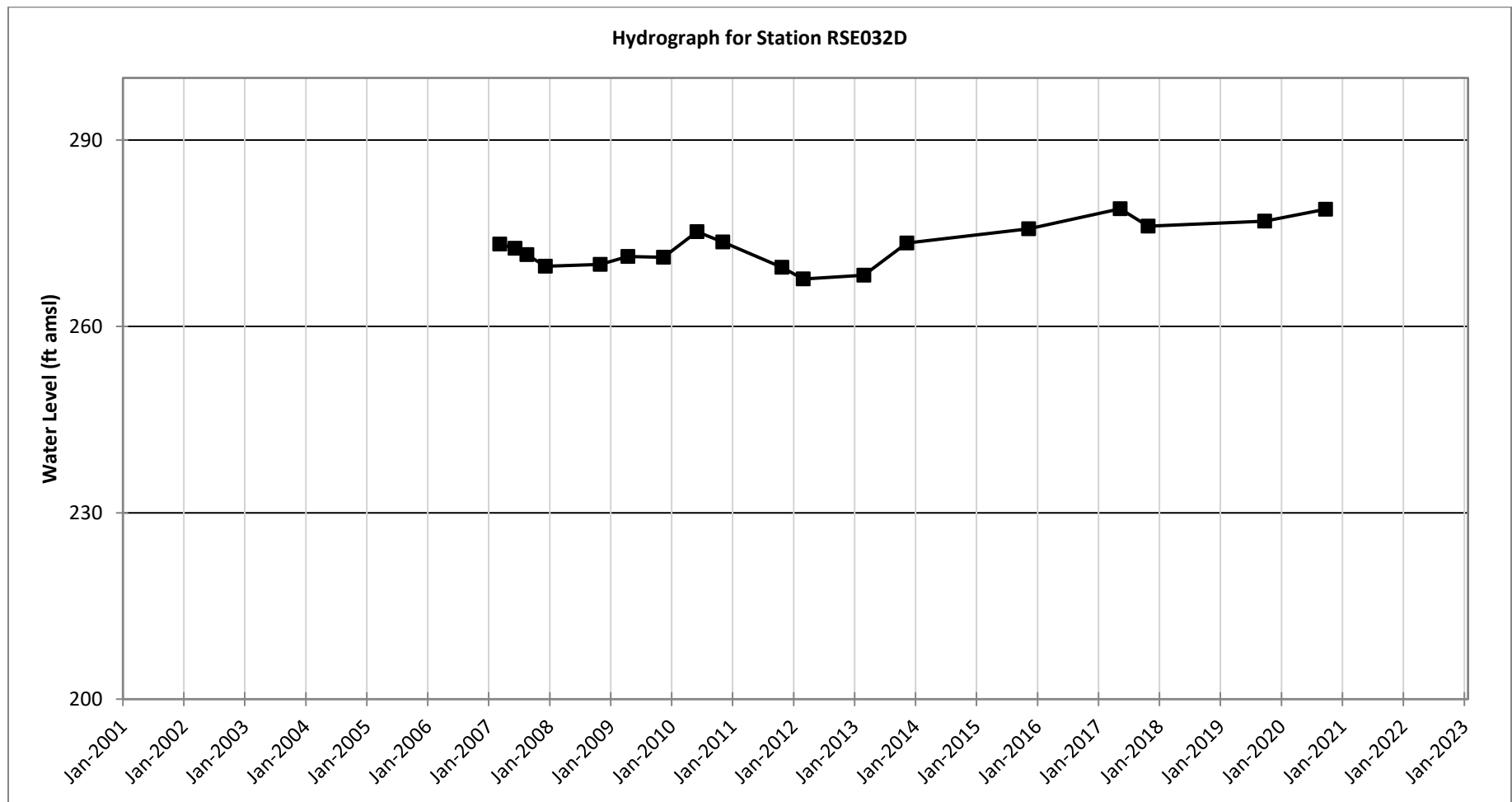


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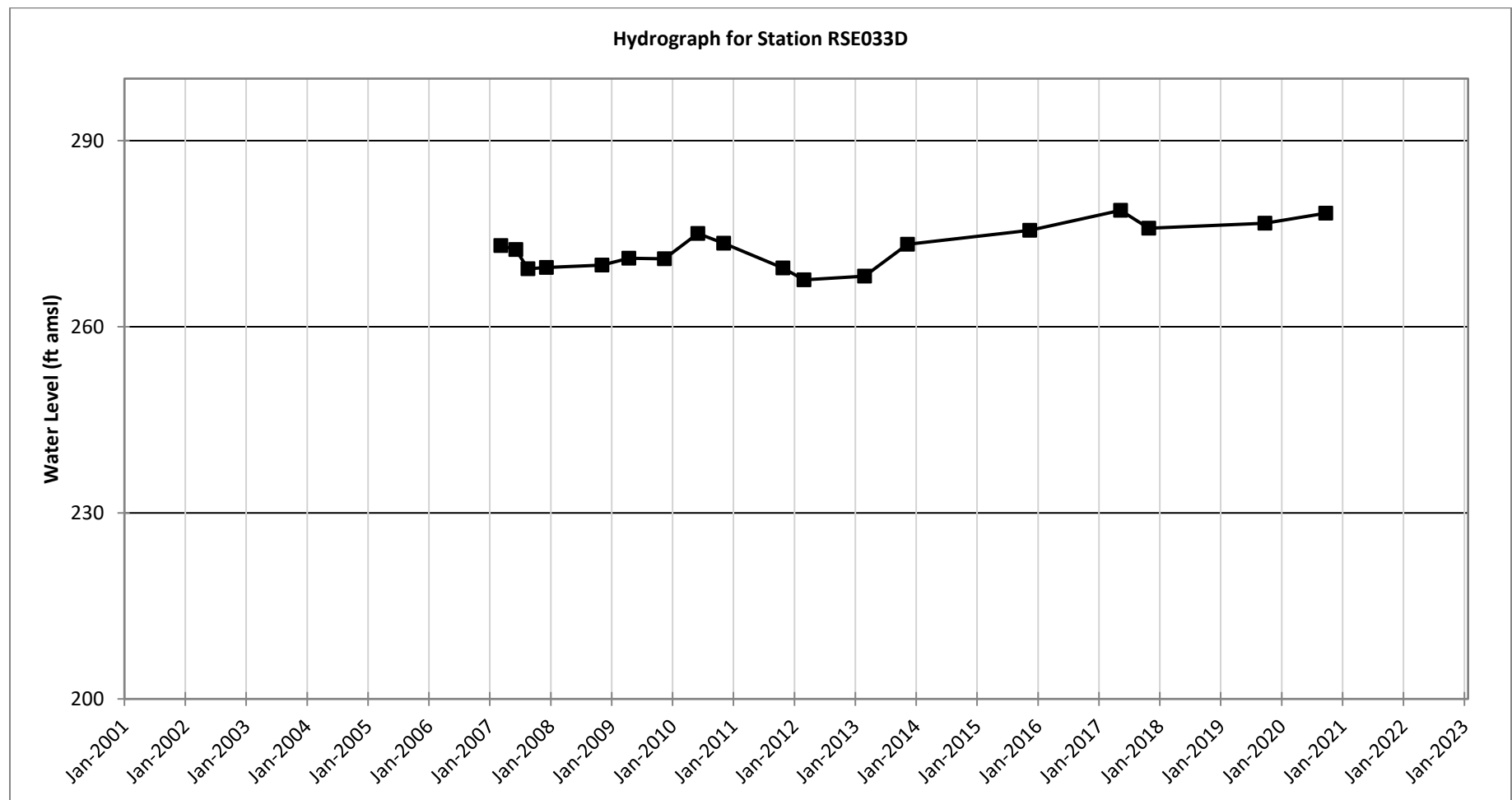


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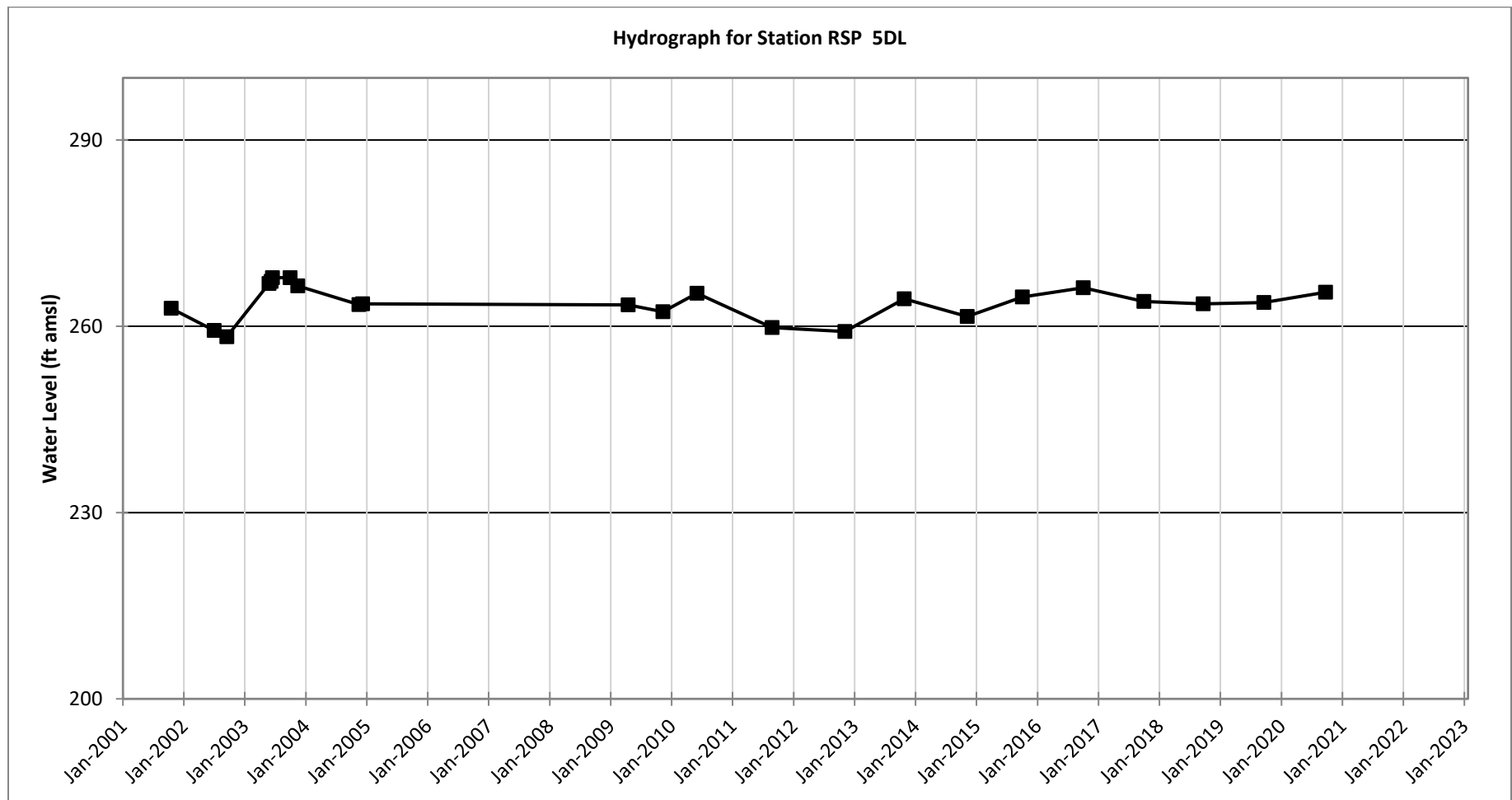
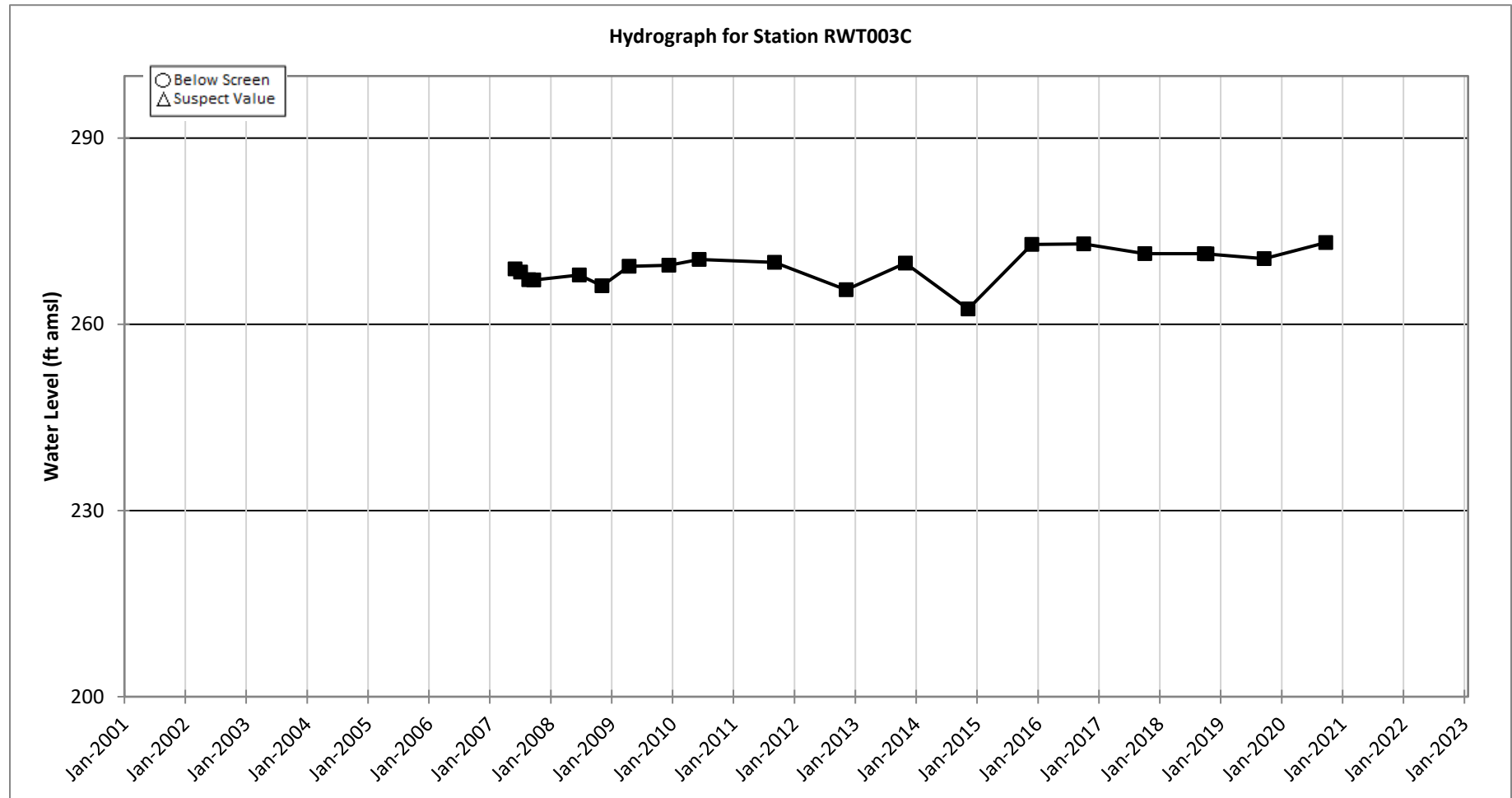


Figure B-28.



## **APPENDIX C**

### **Time Series Plots**

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Figure C-1.

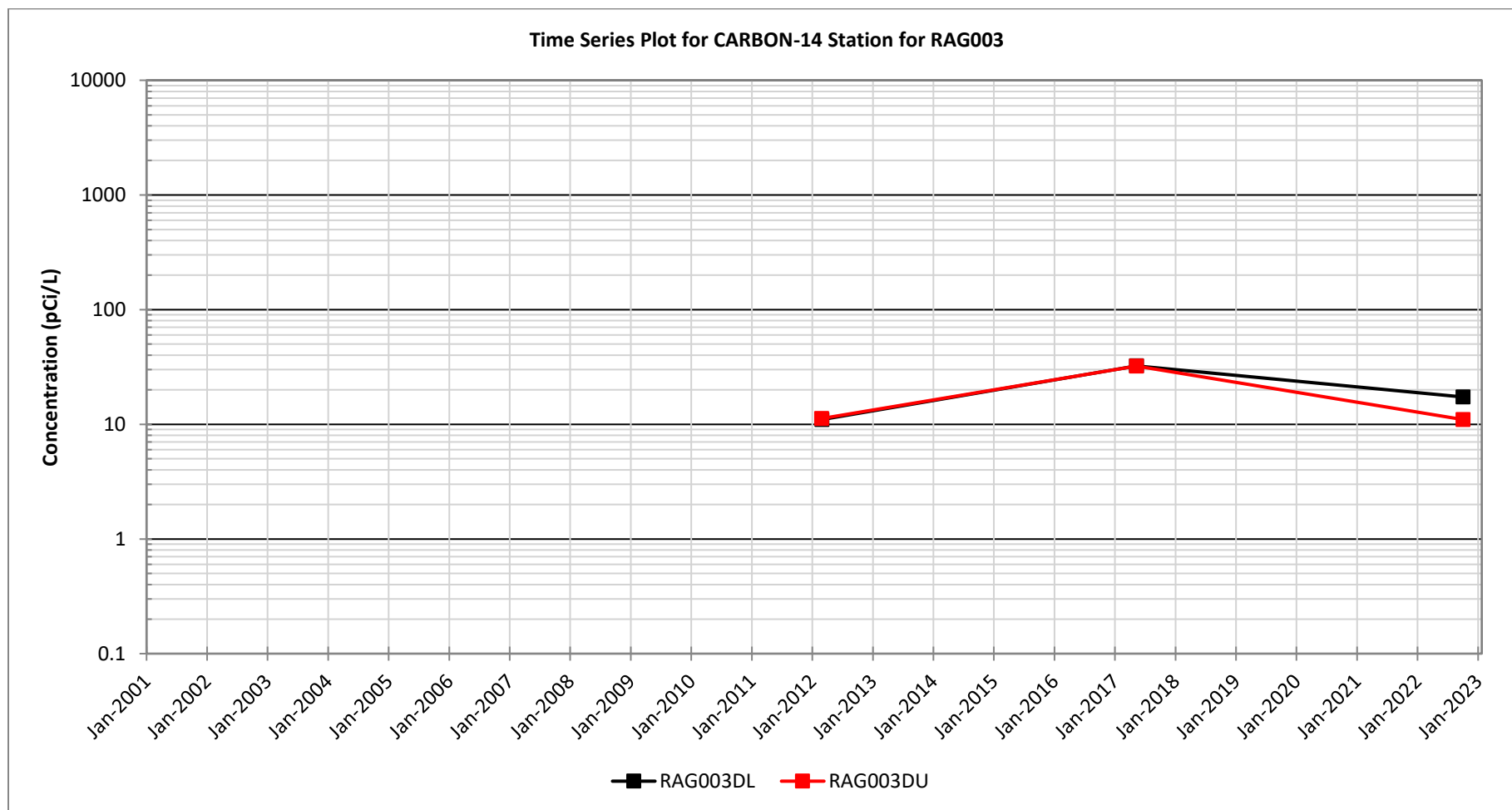


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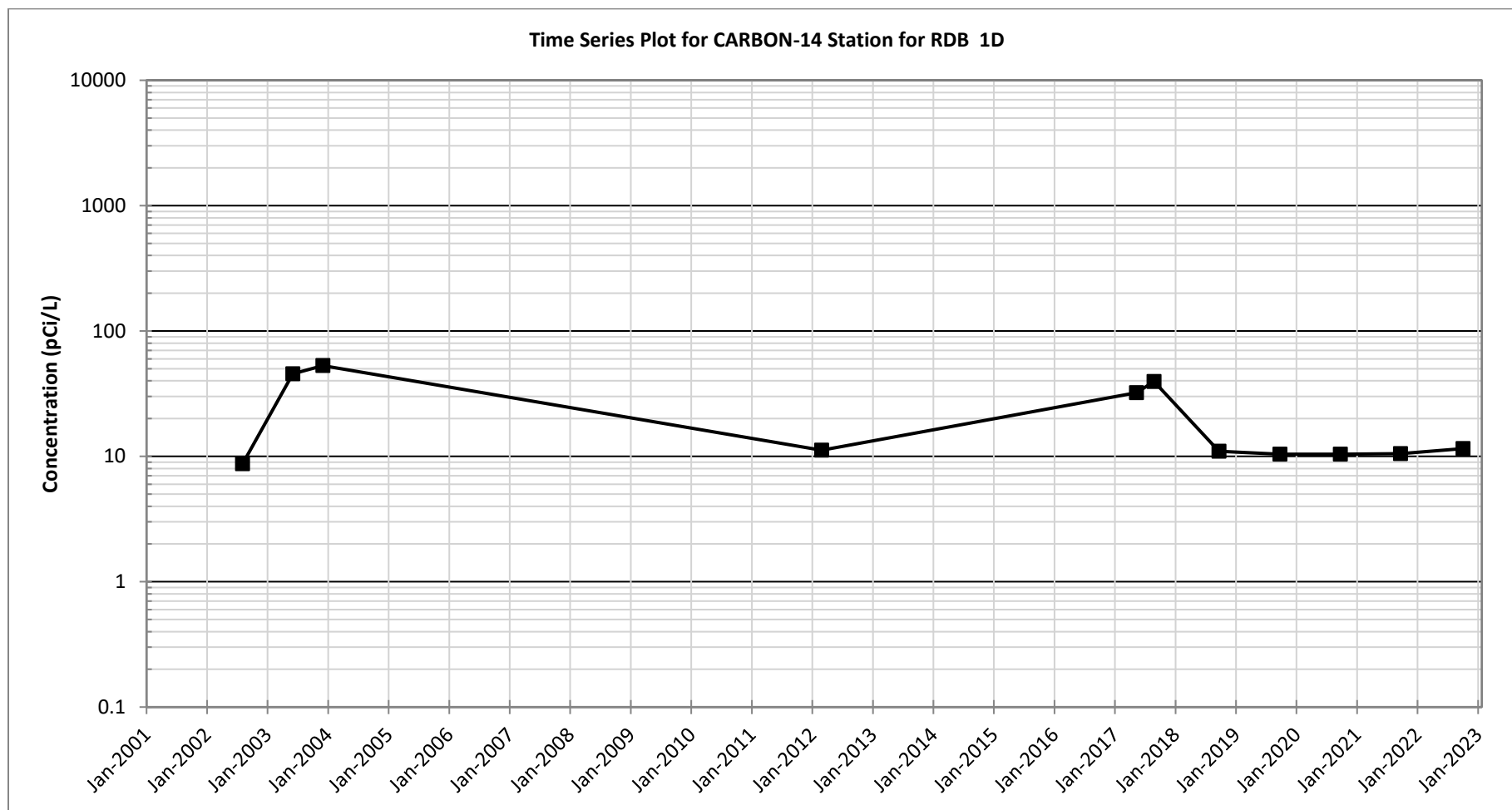


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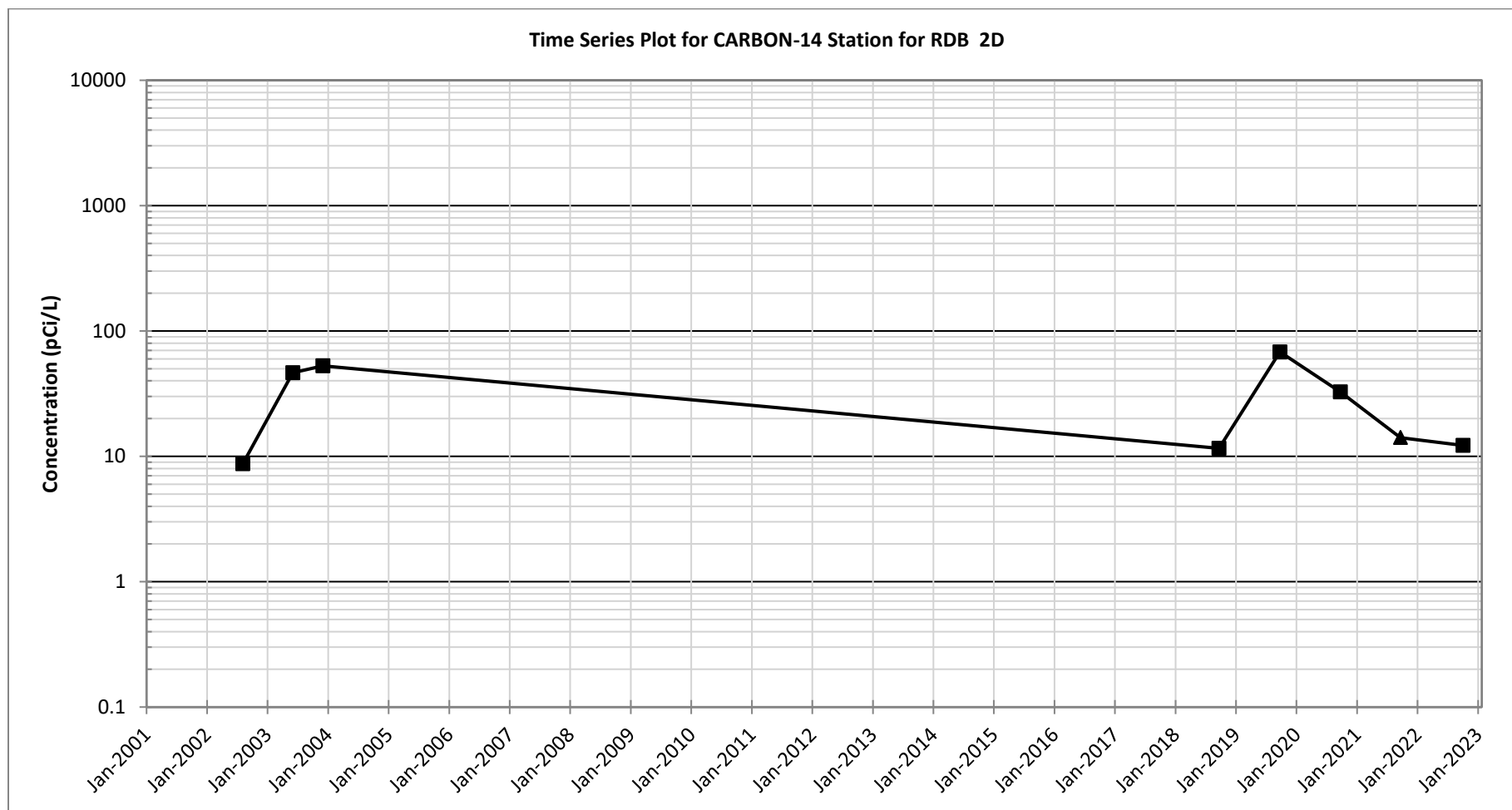


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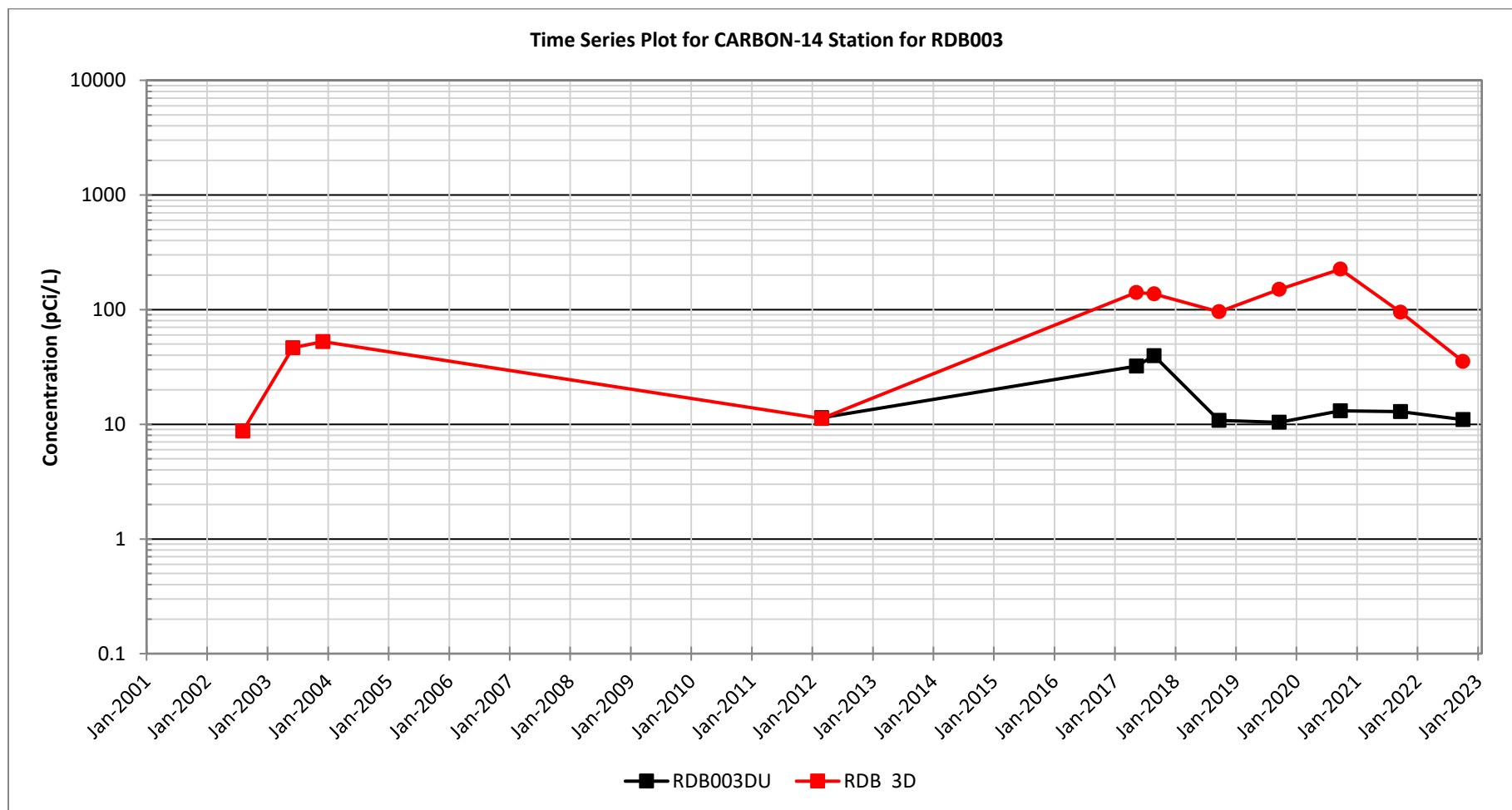


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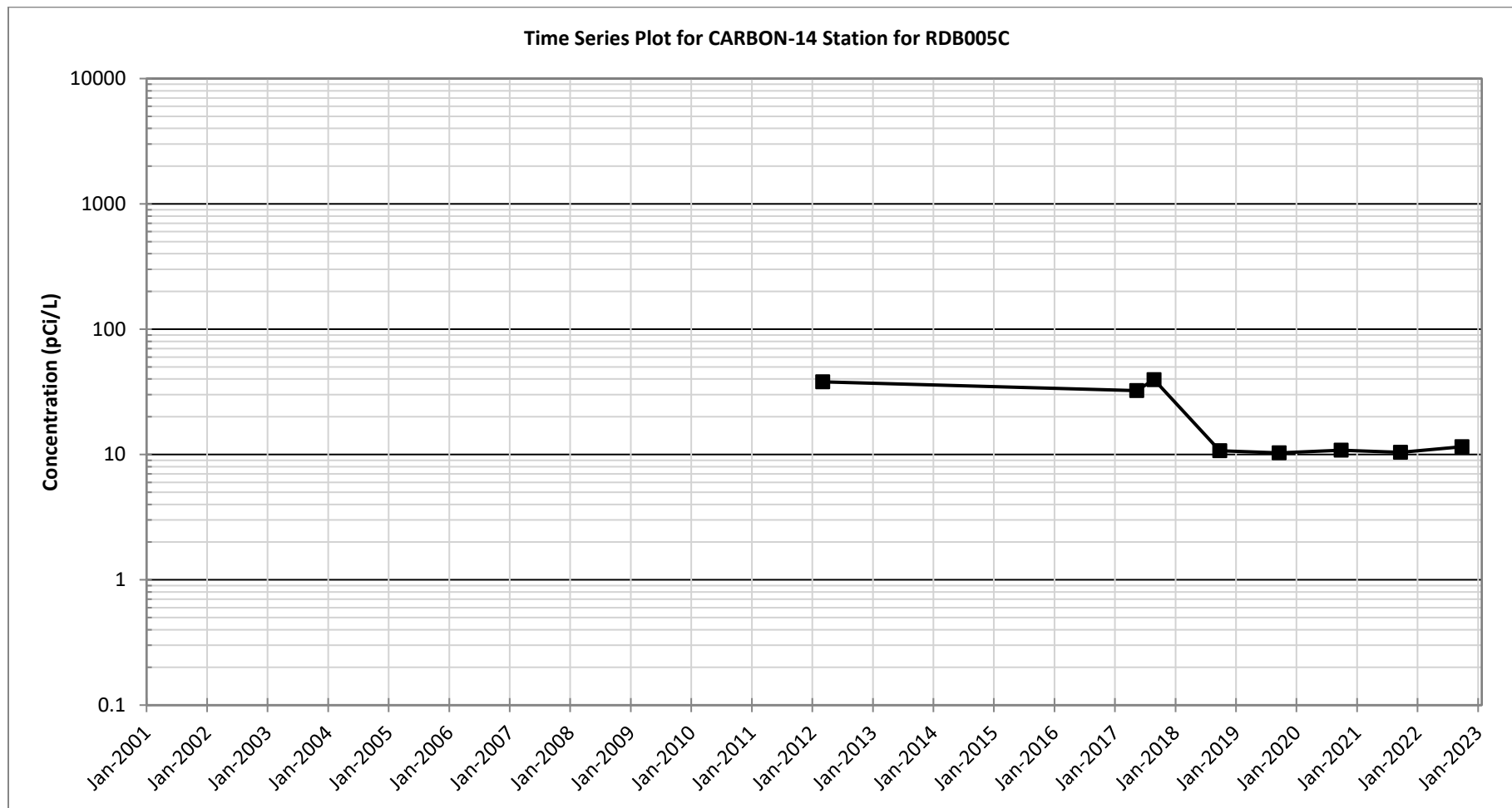


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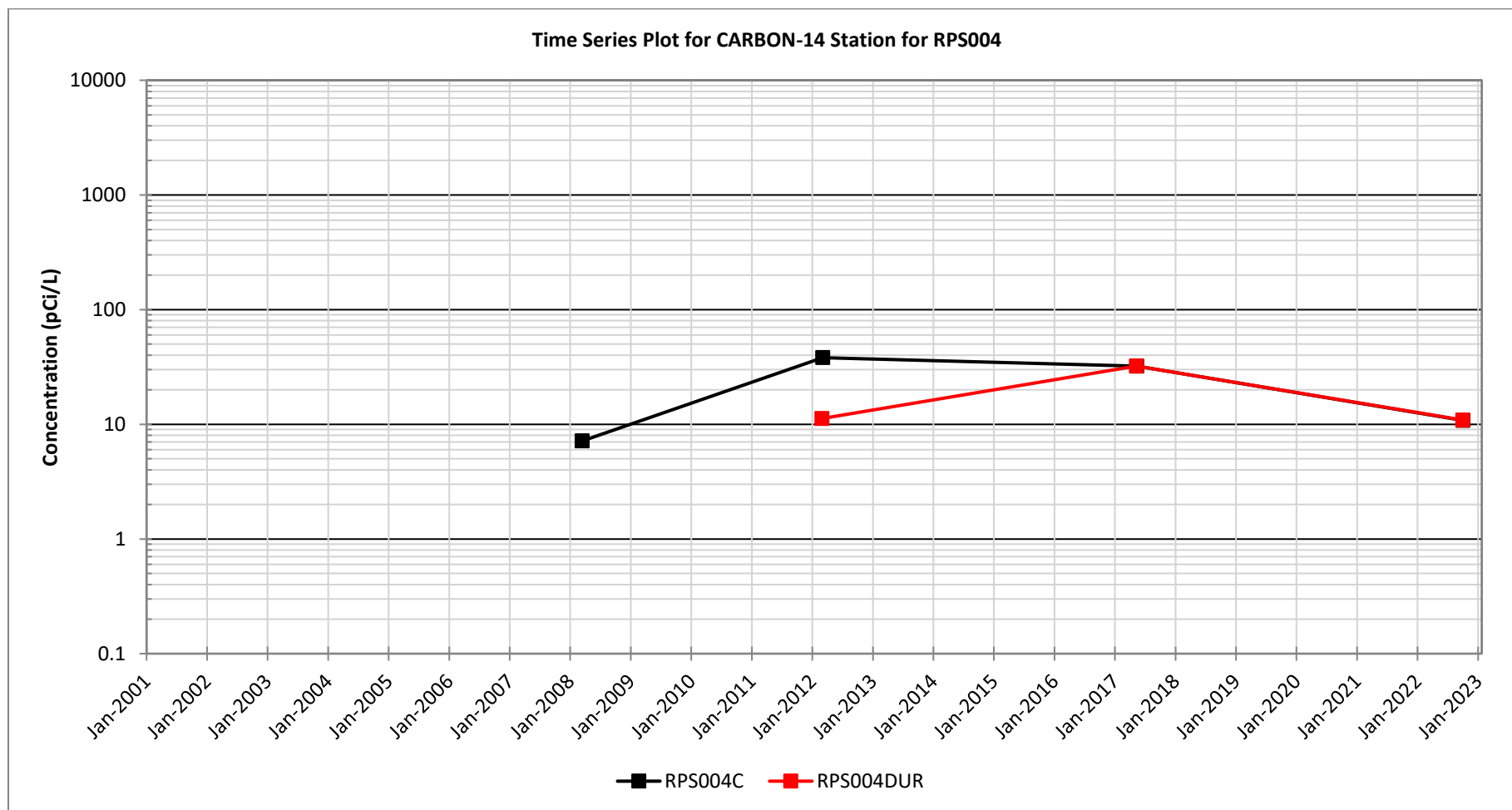


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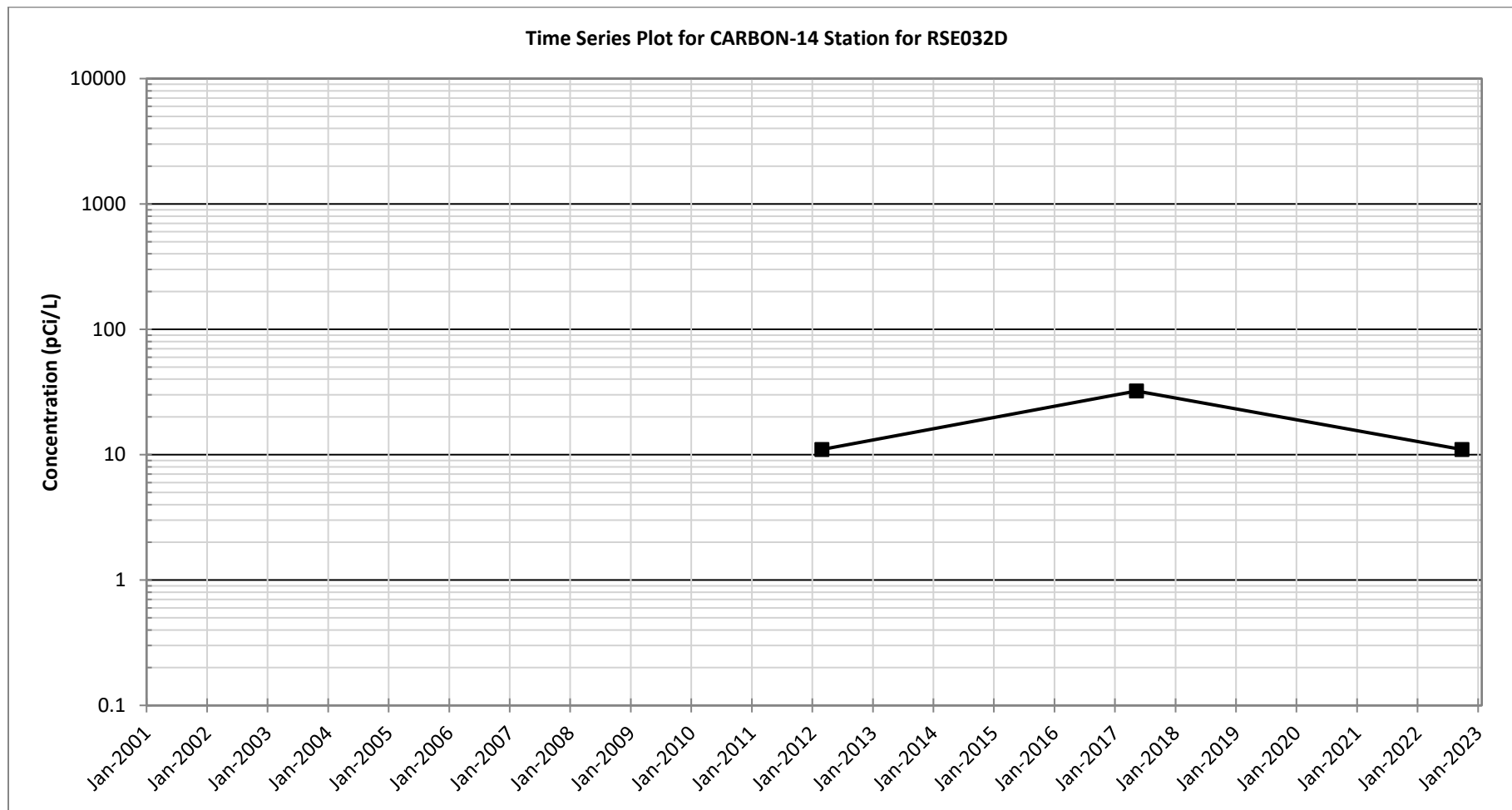


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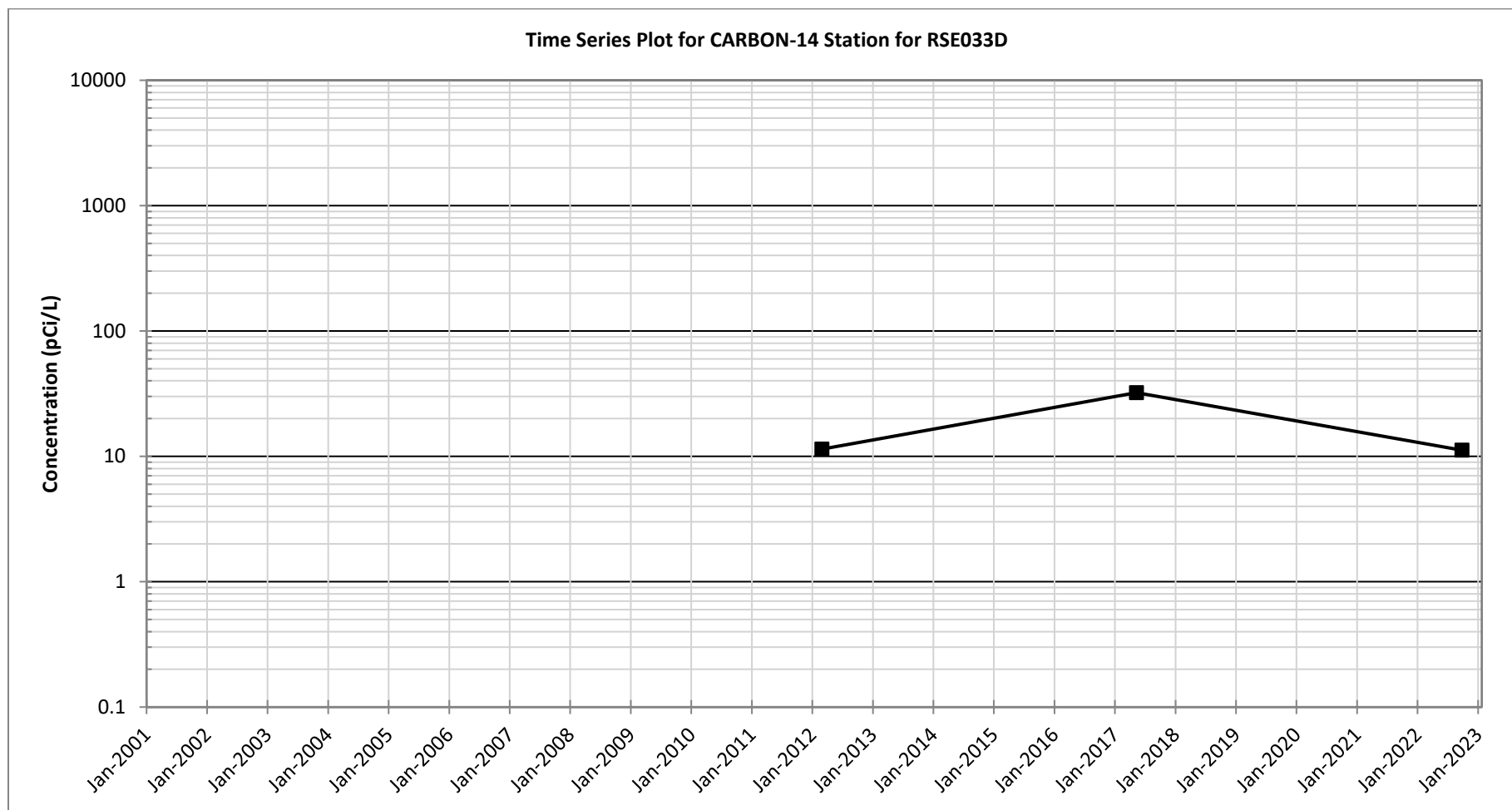


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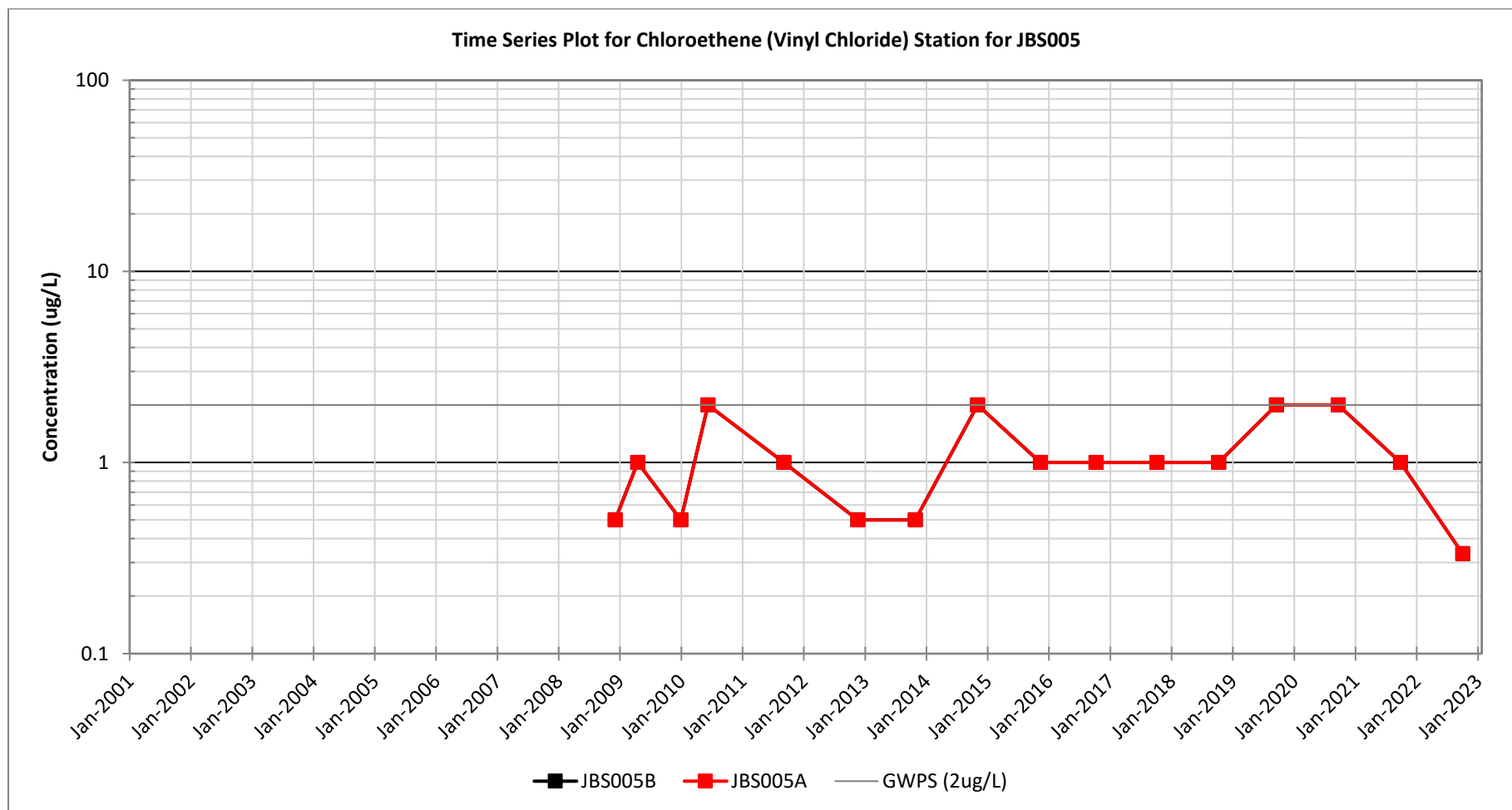


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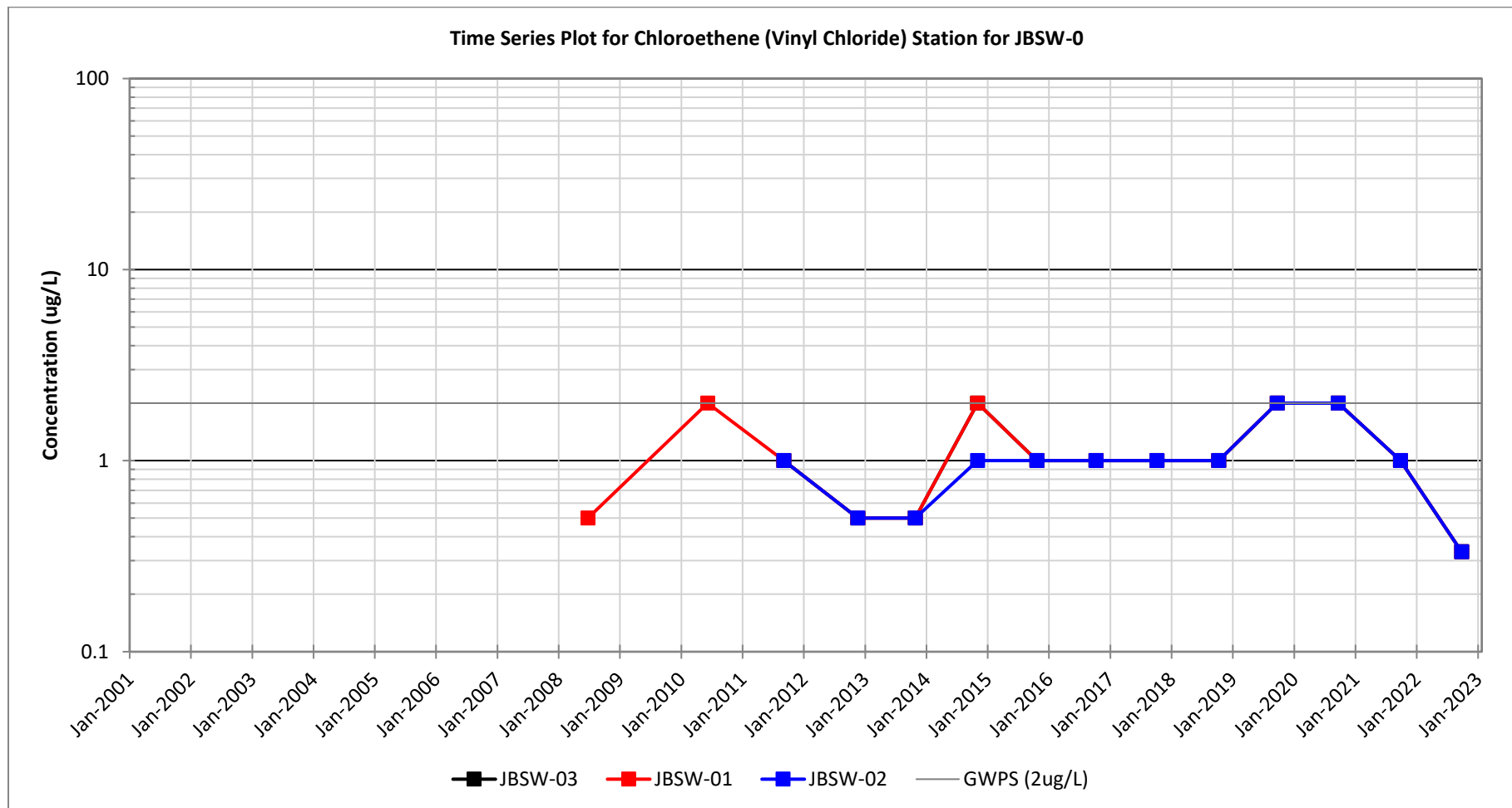


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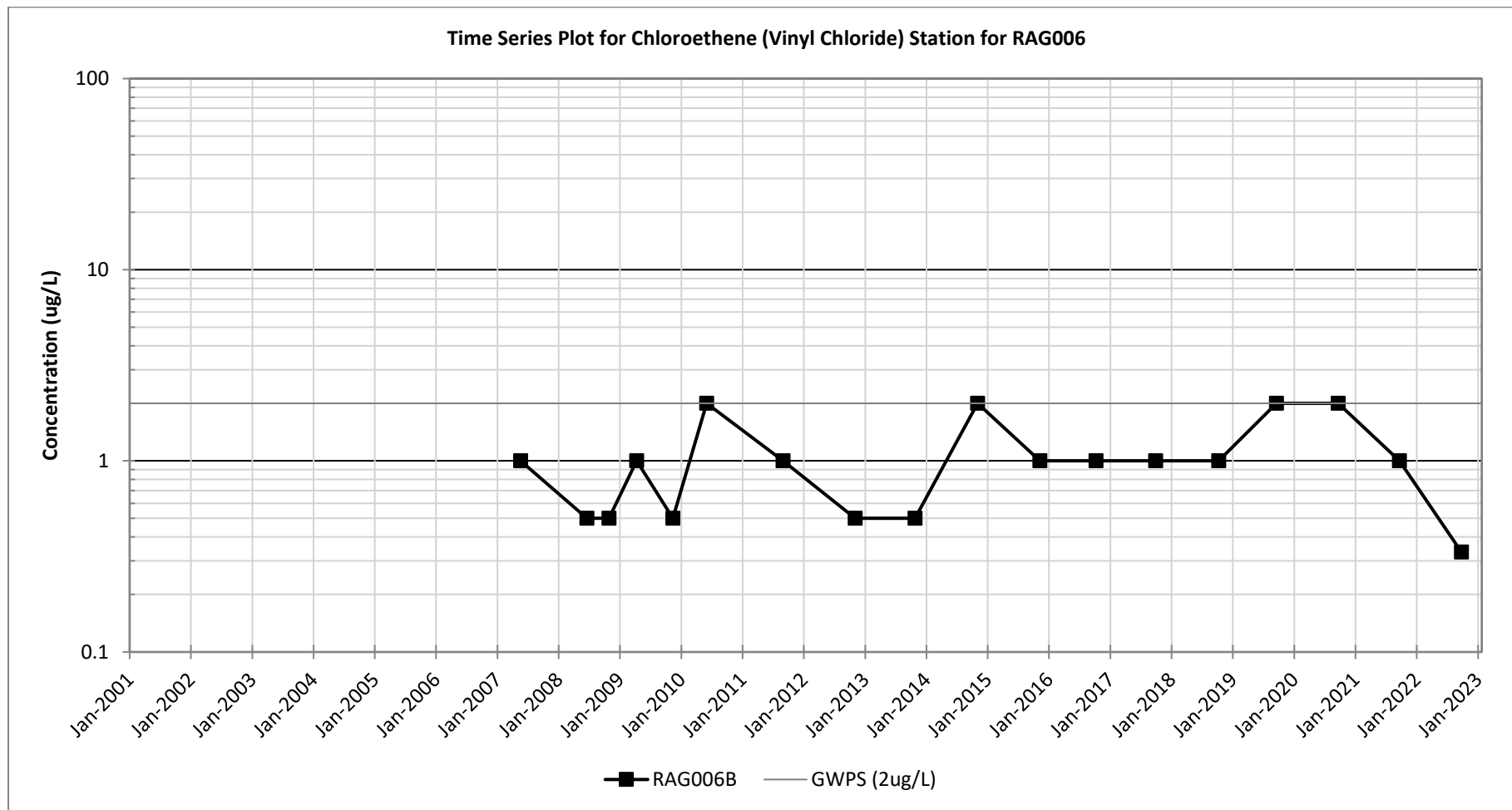


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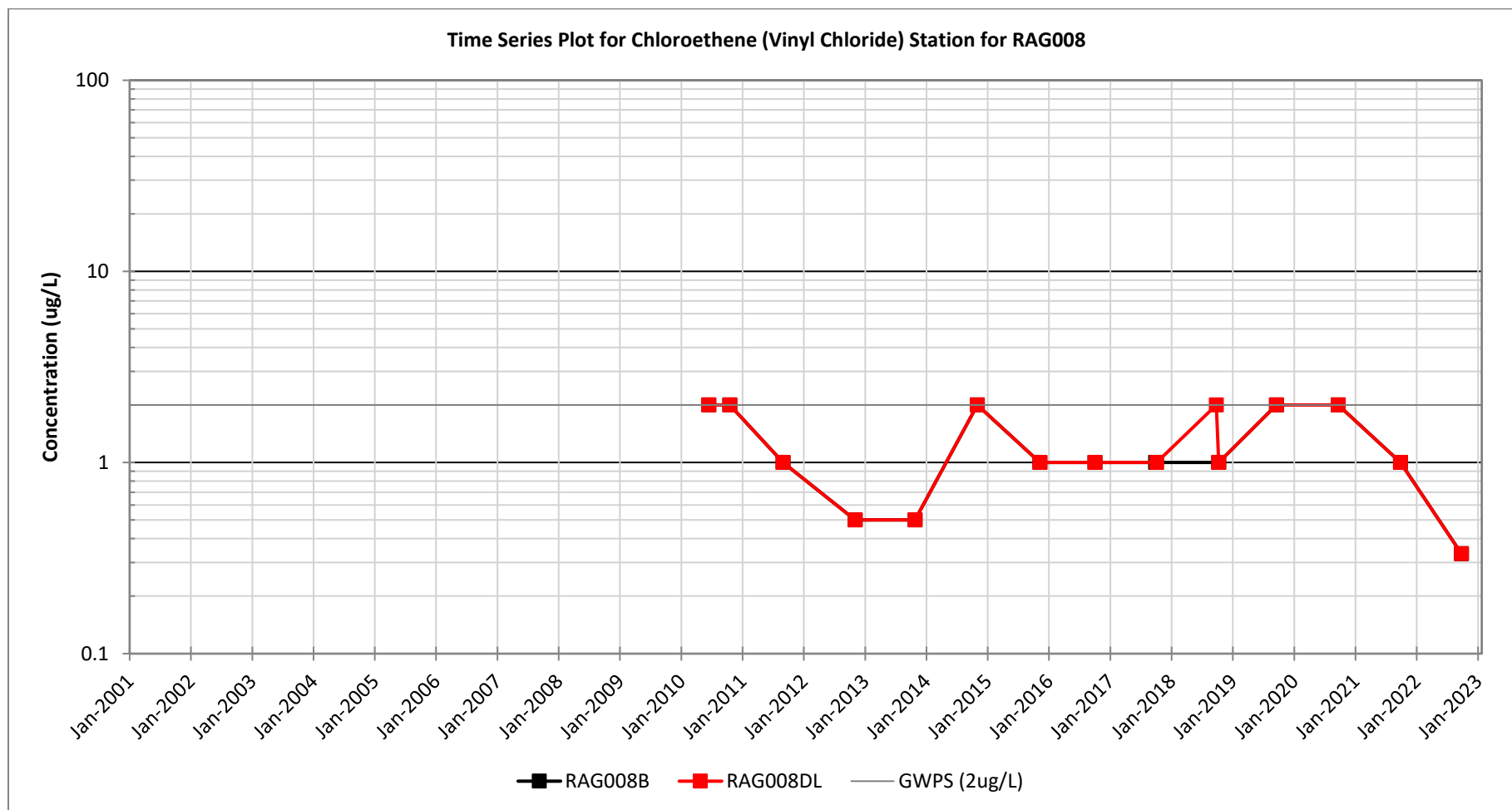


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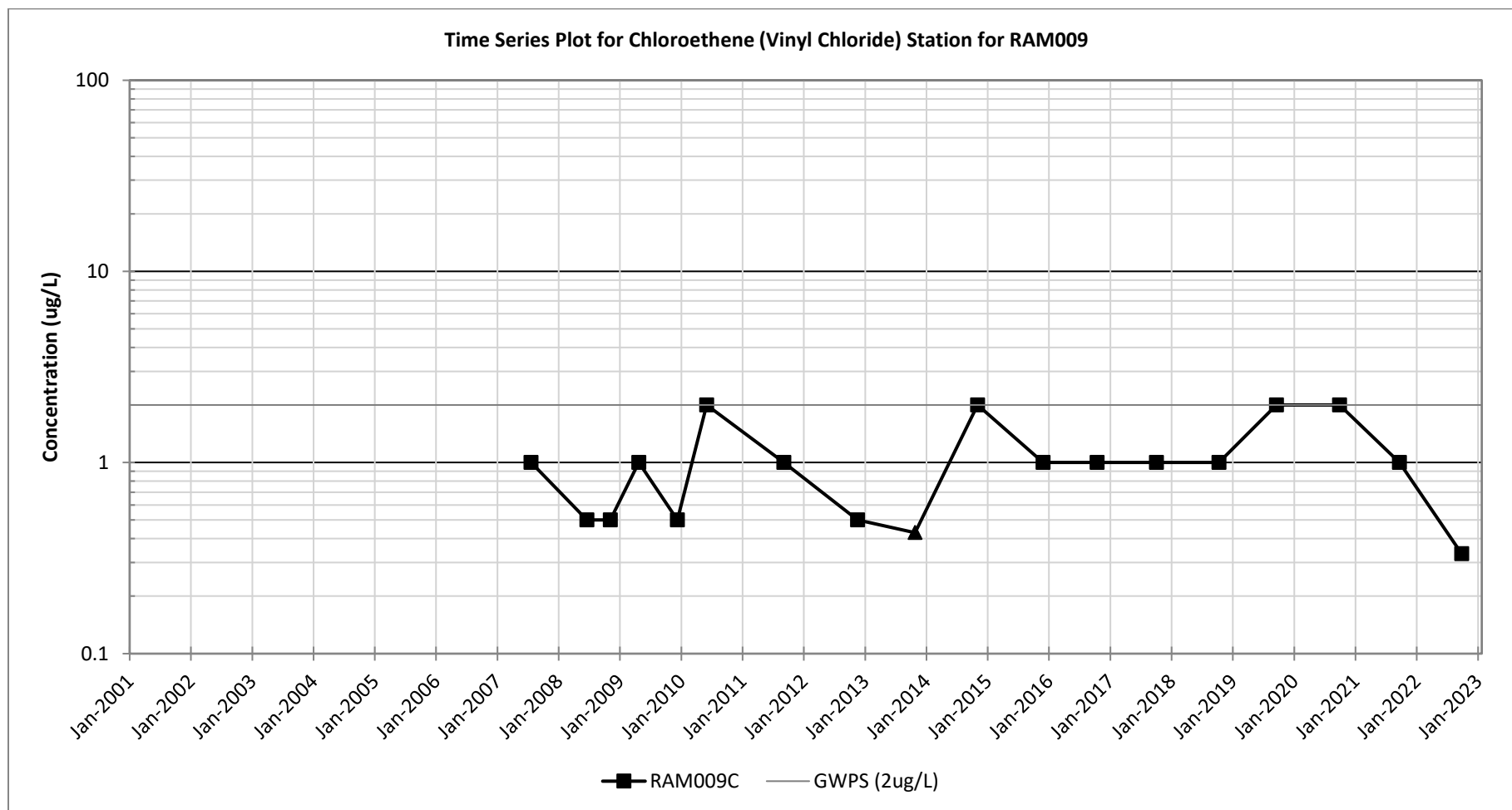


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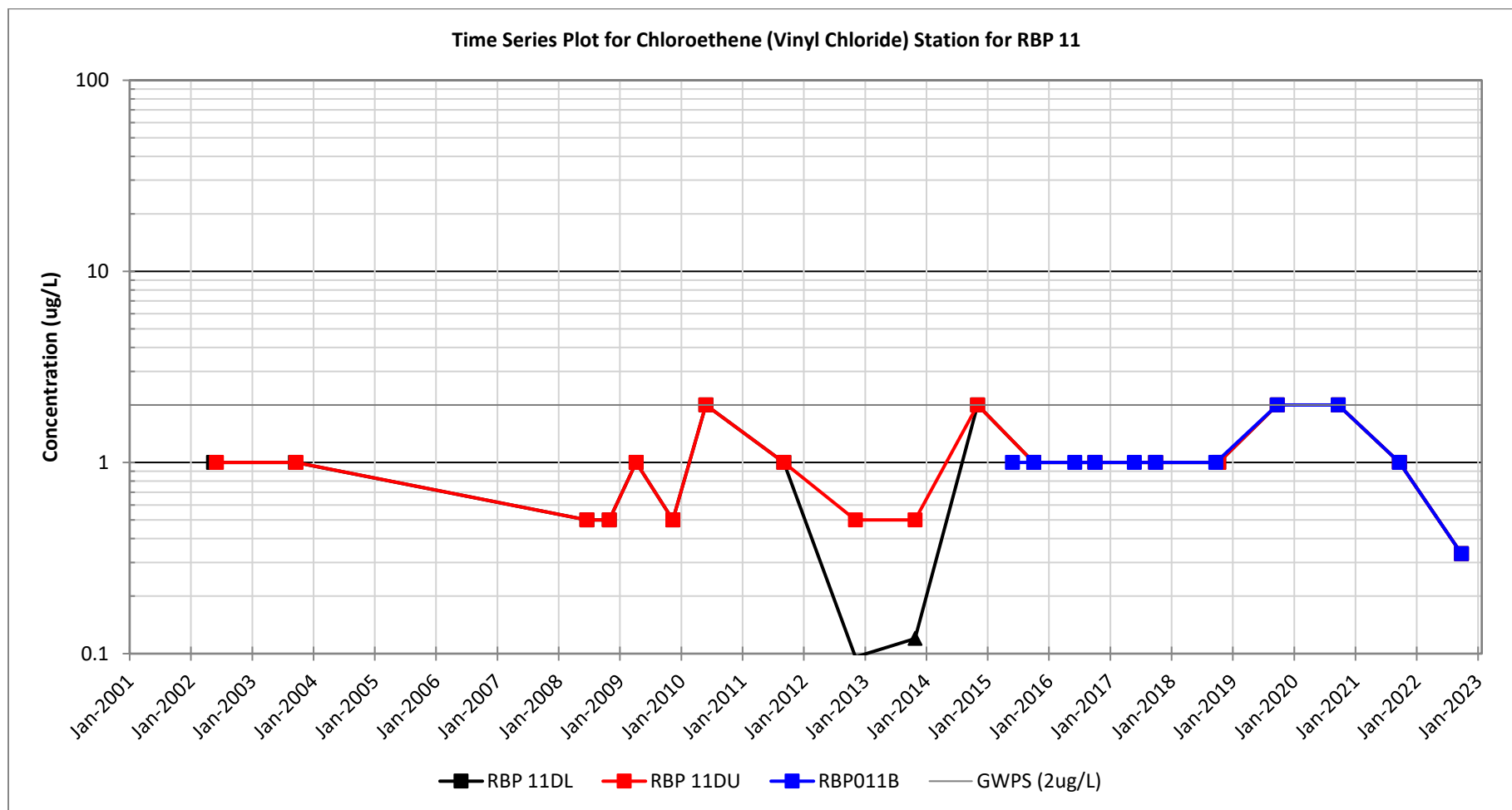


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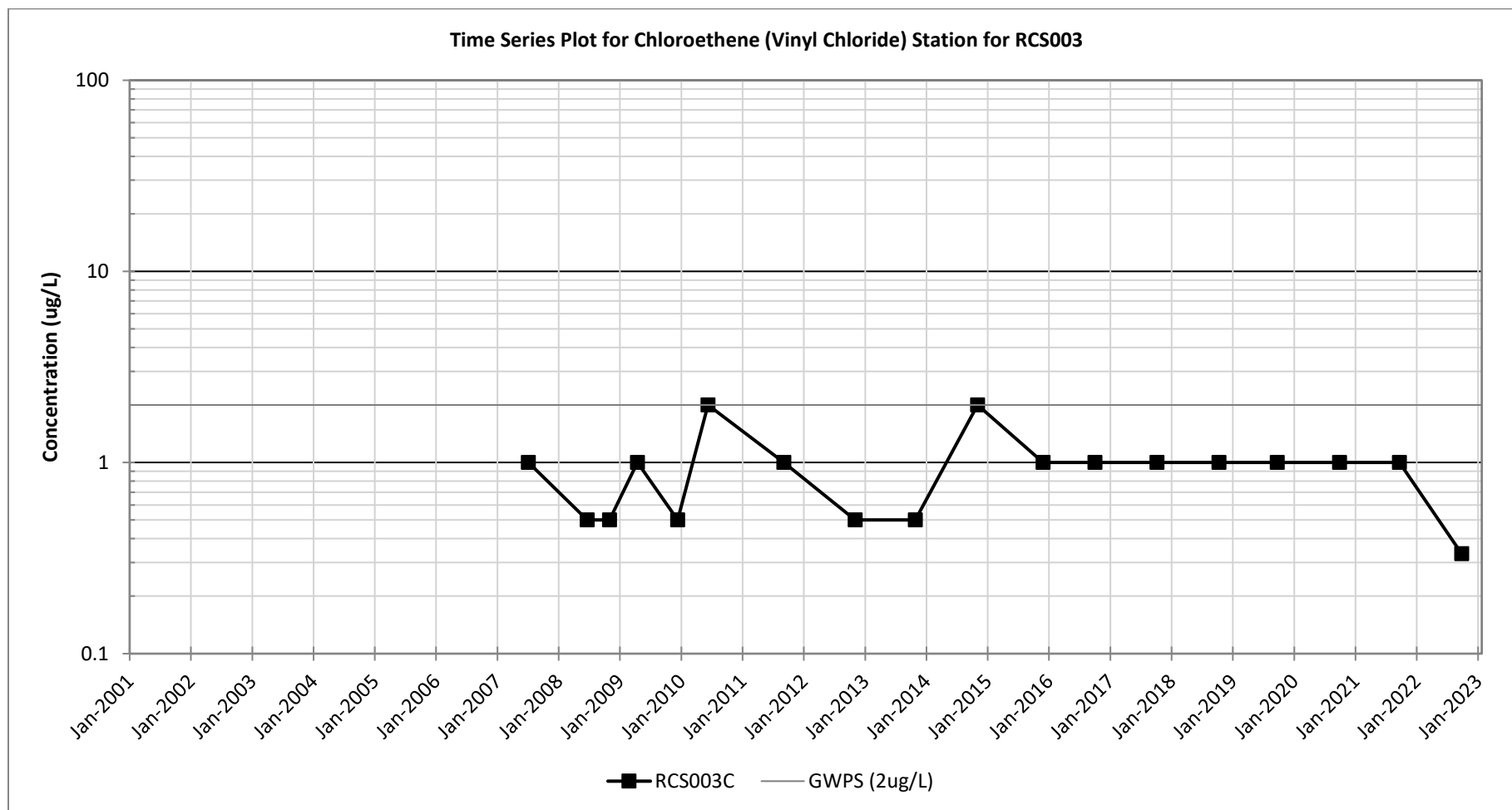


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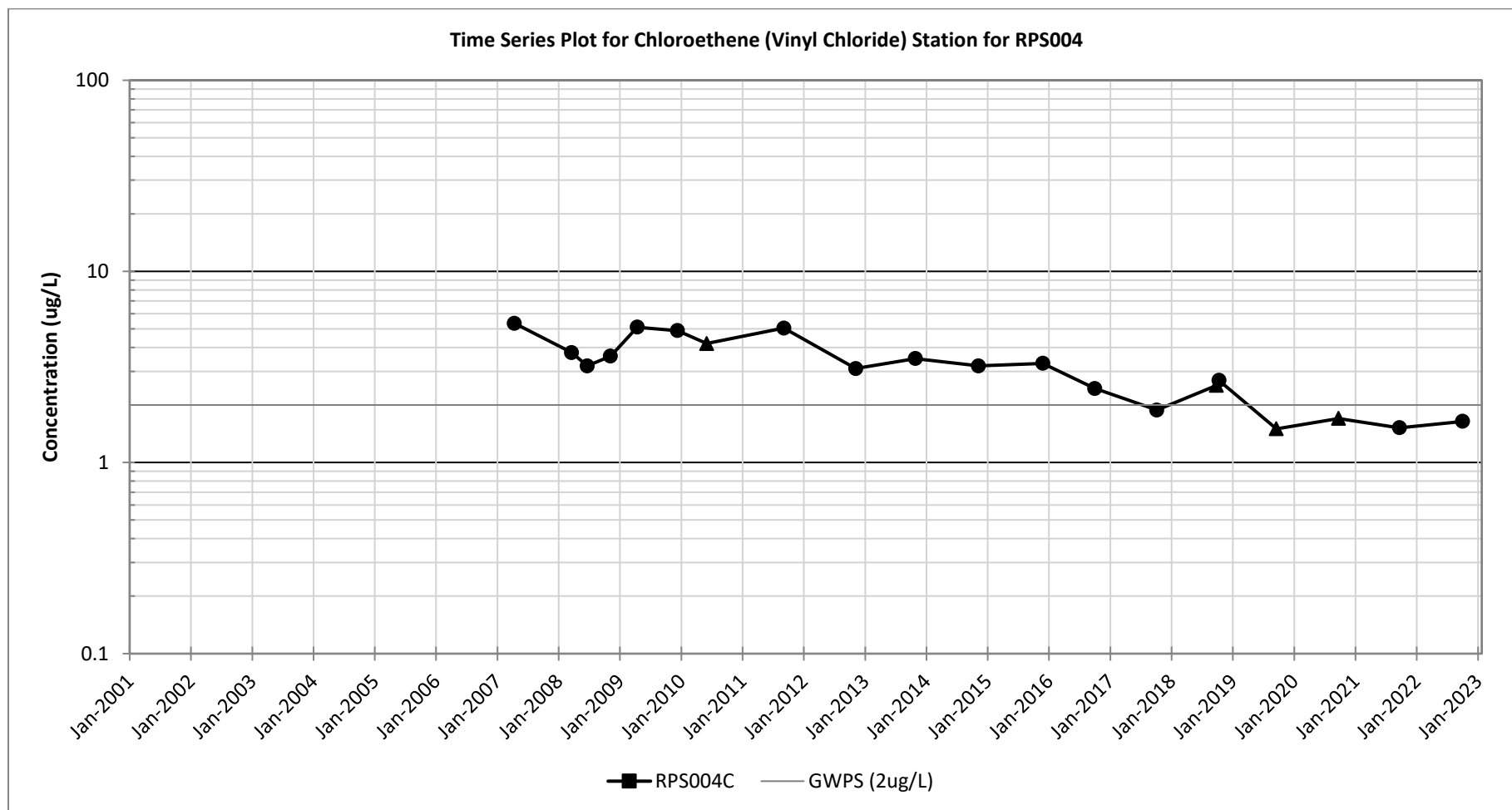


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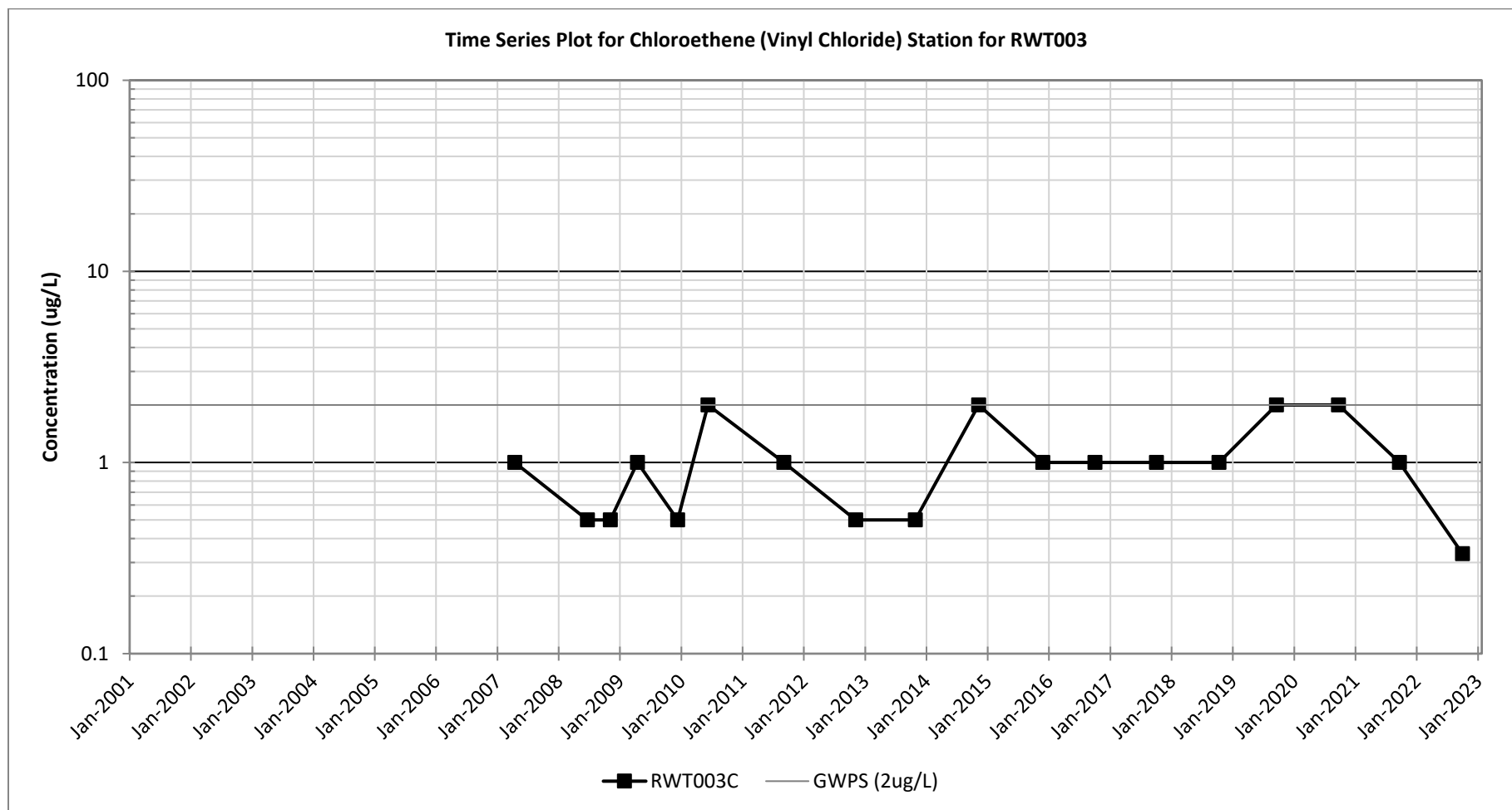


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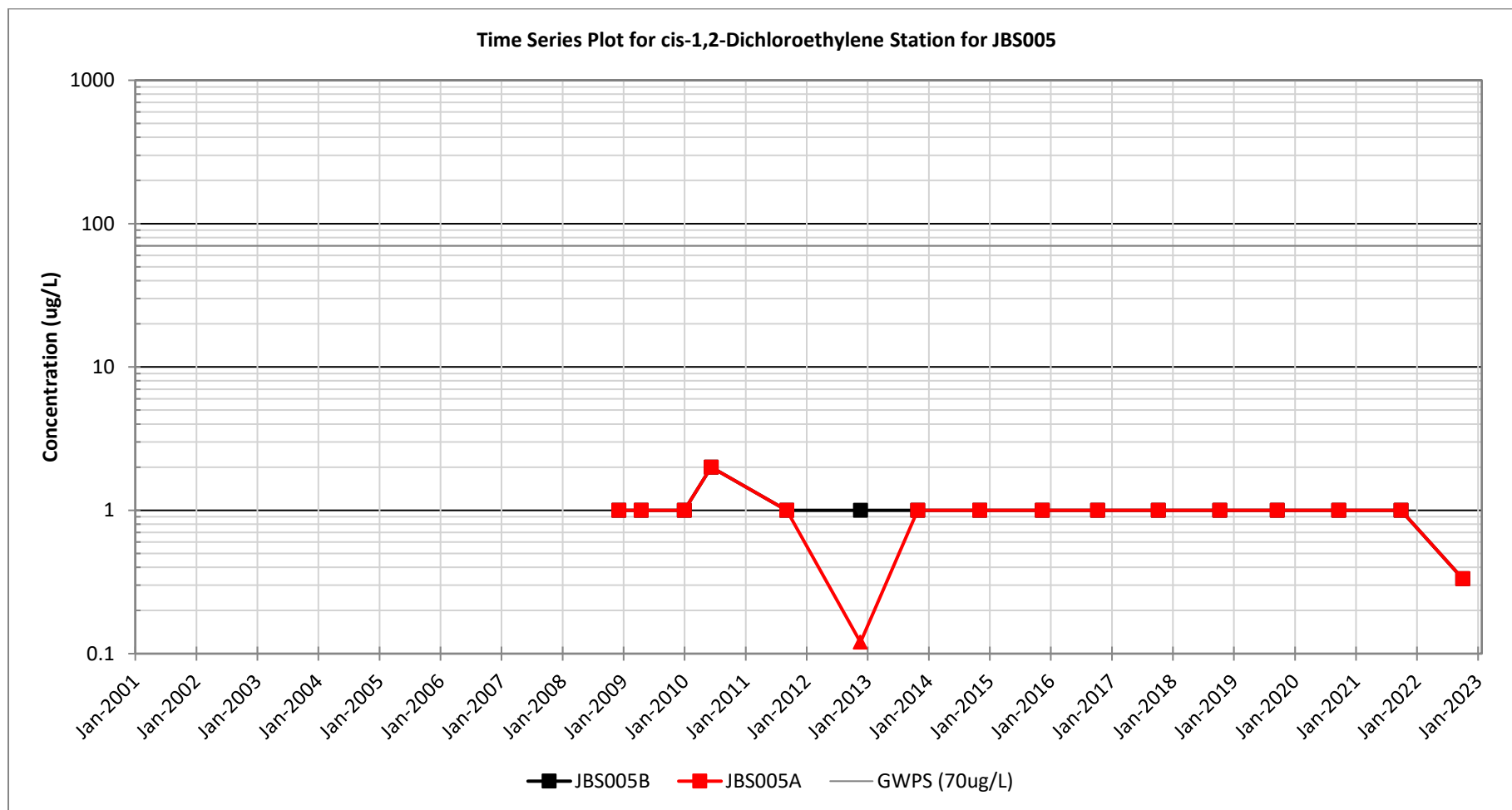


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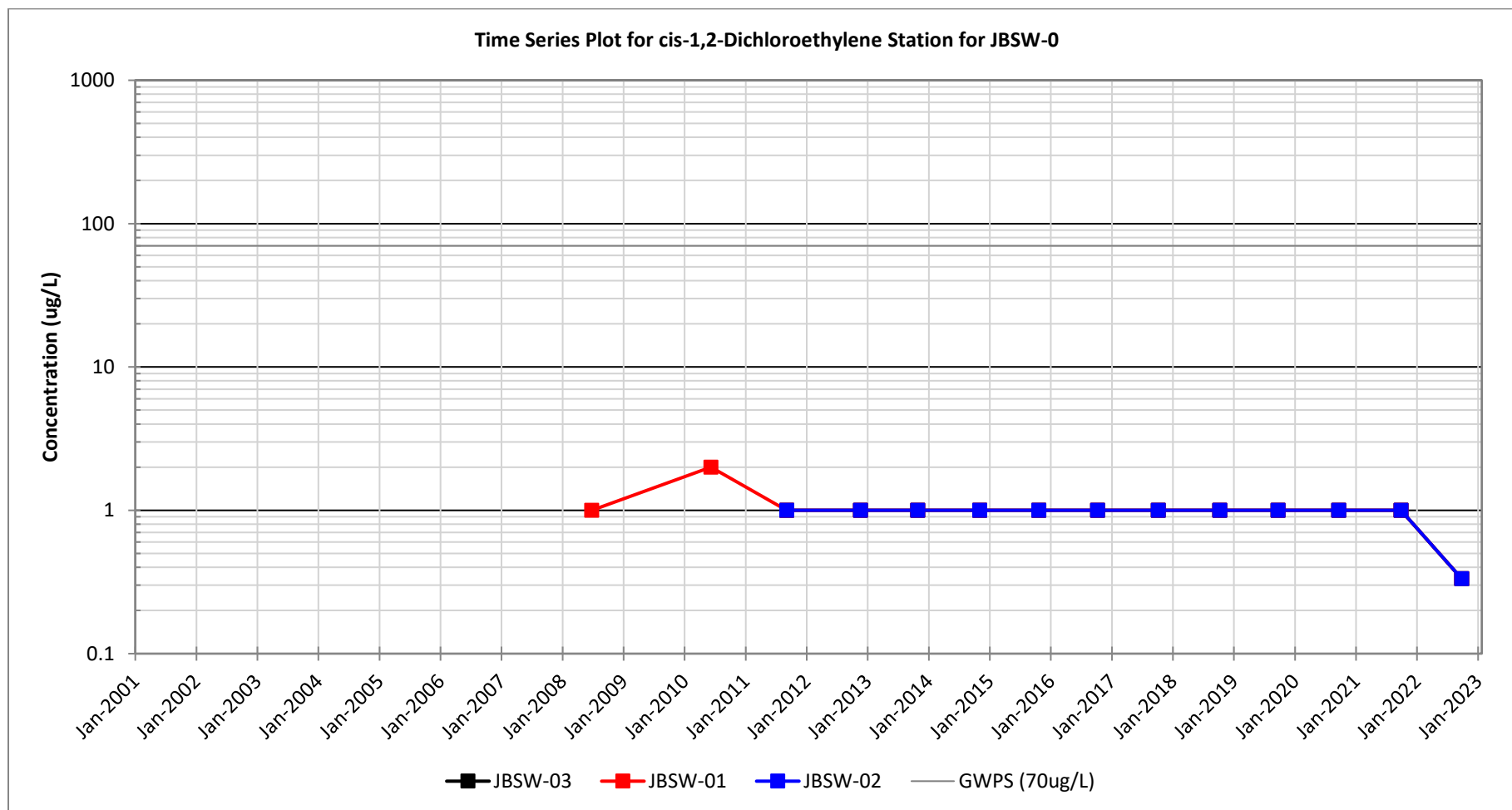


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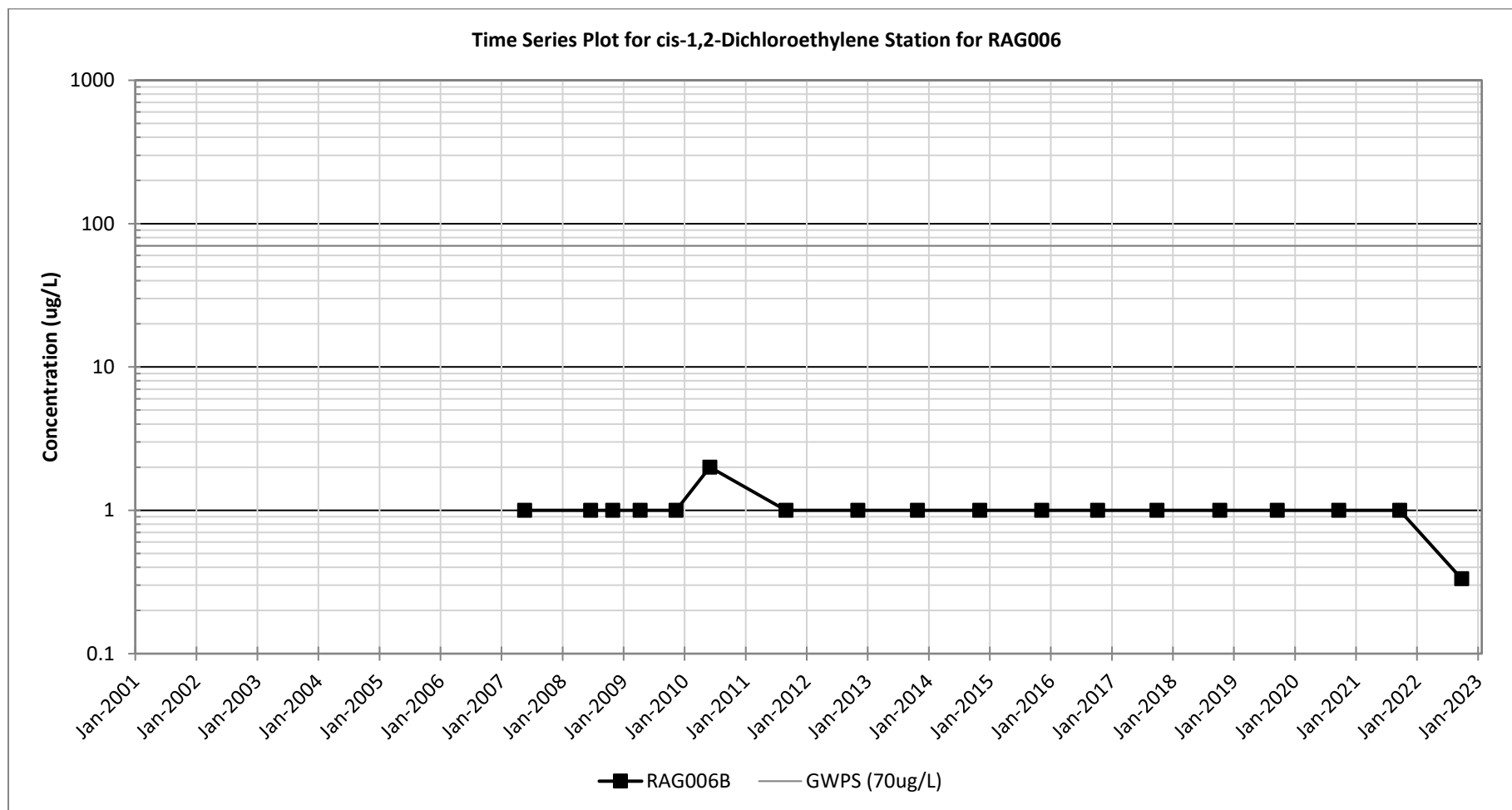


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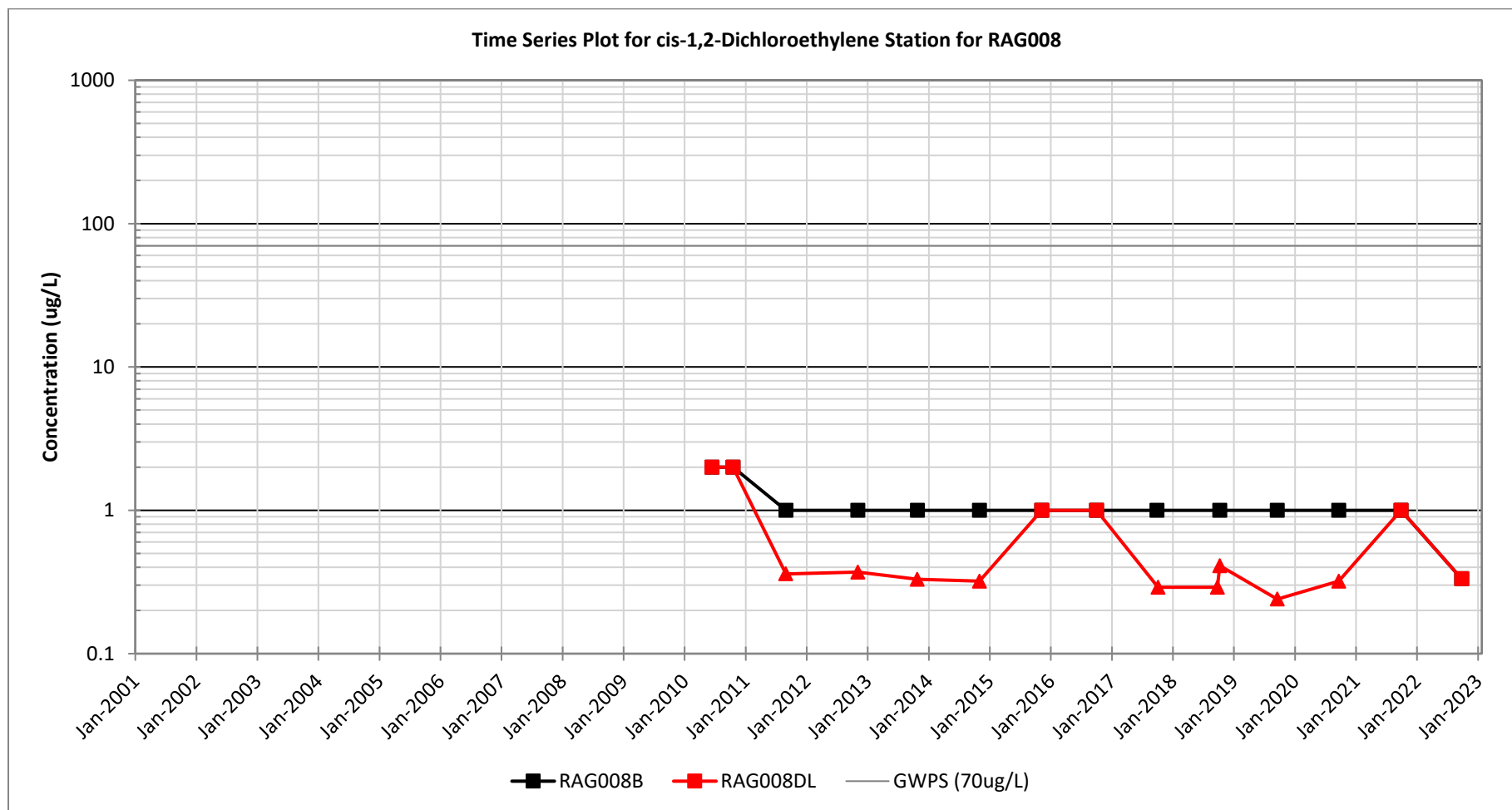


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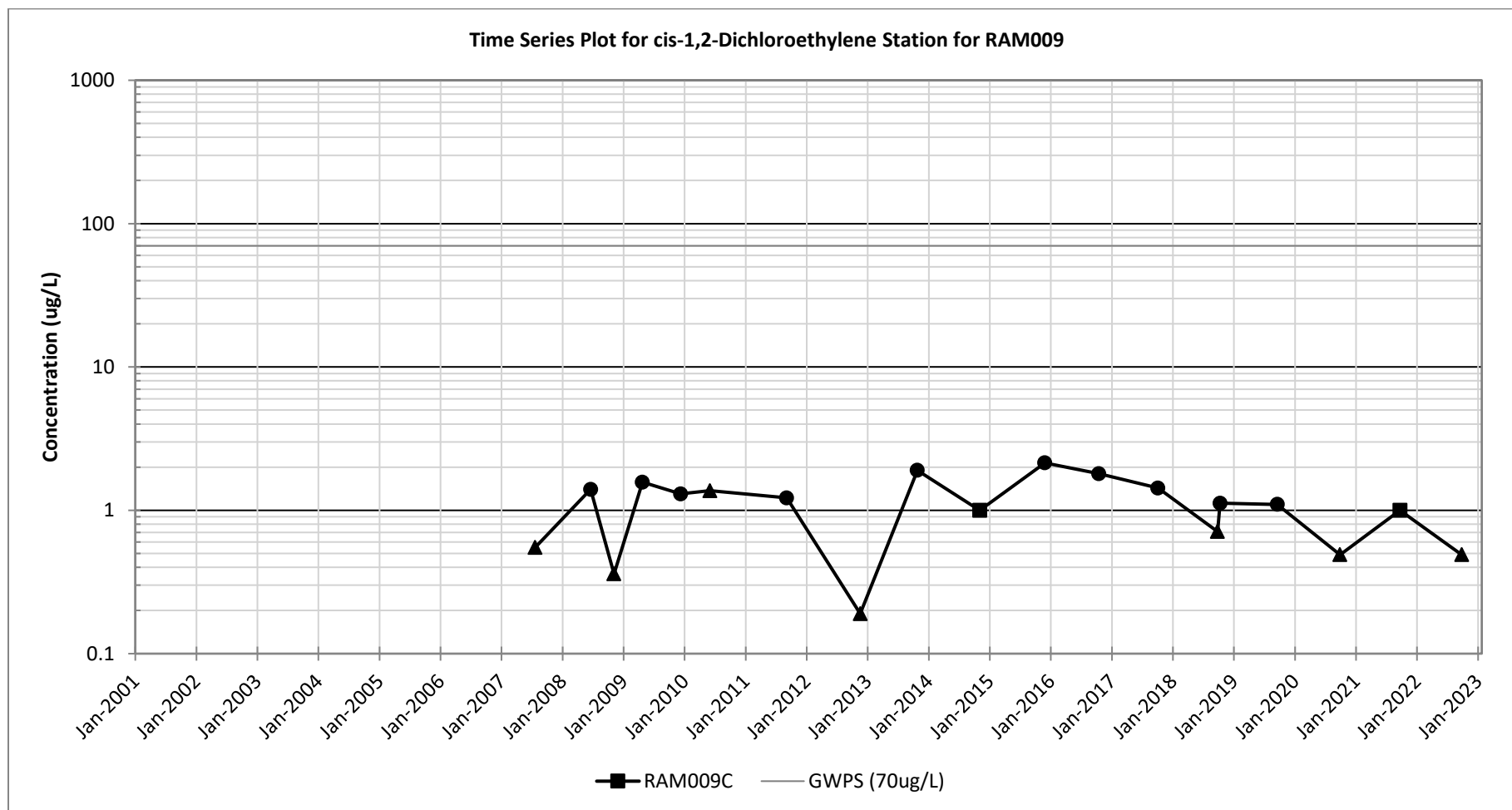


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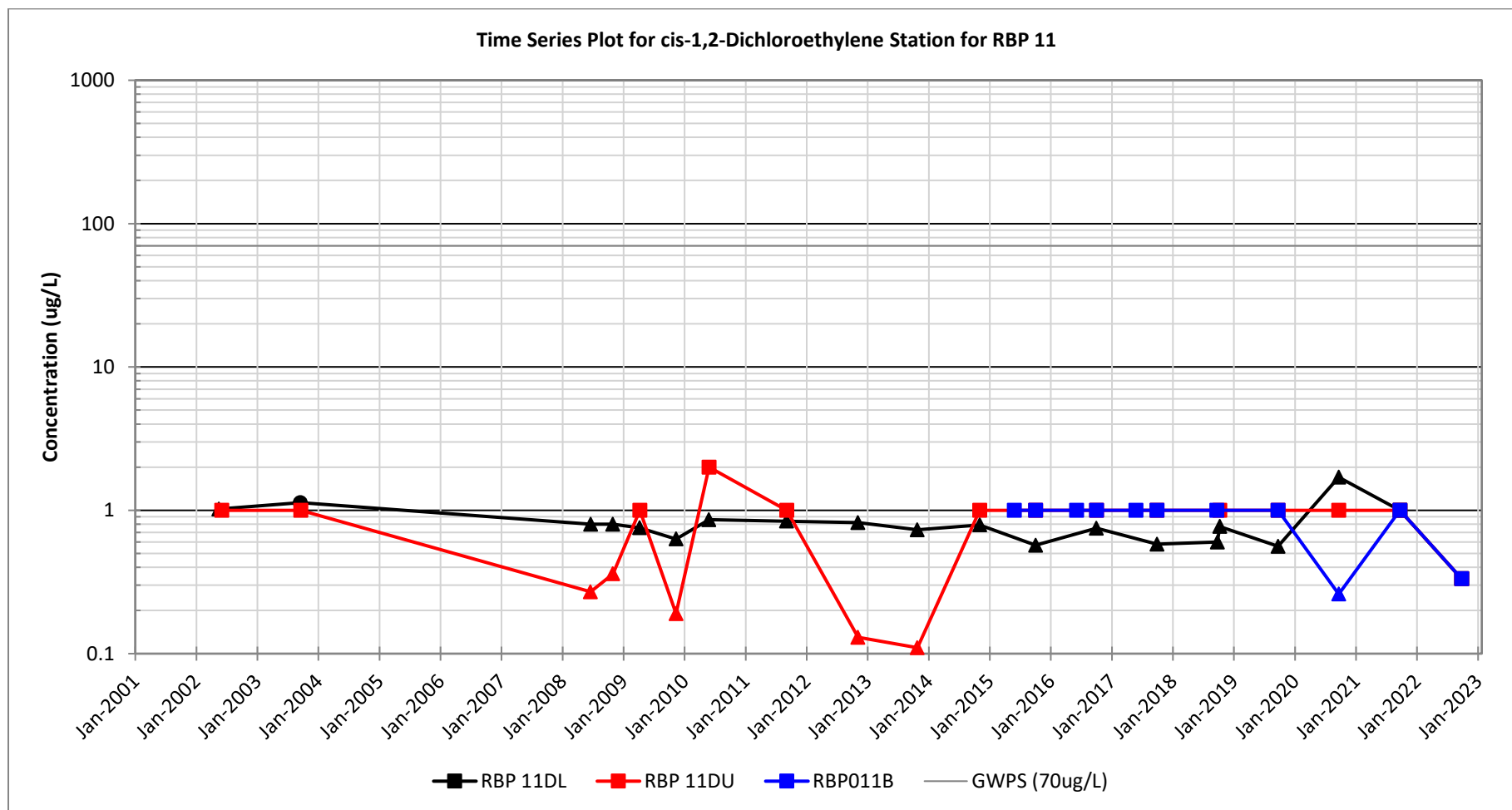


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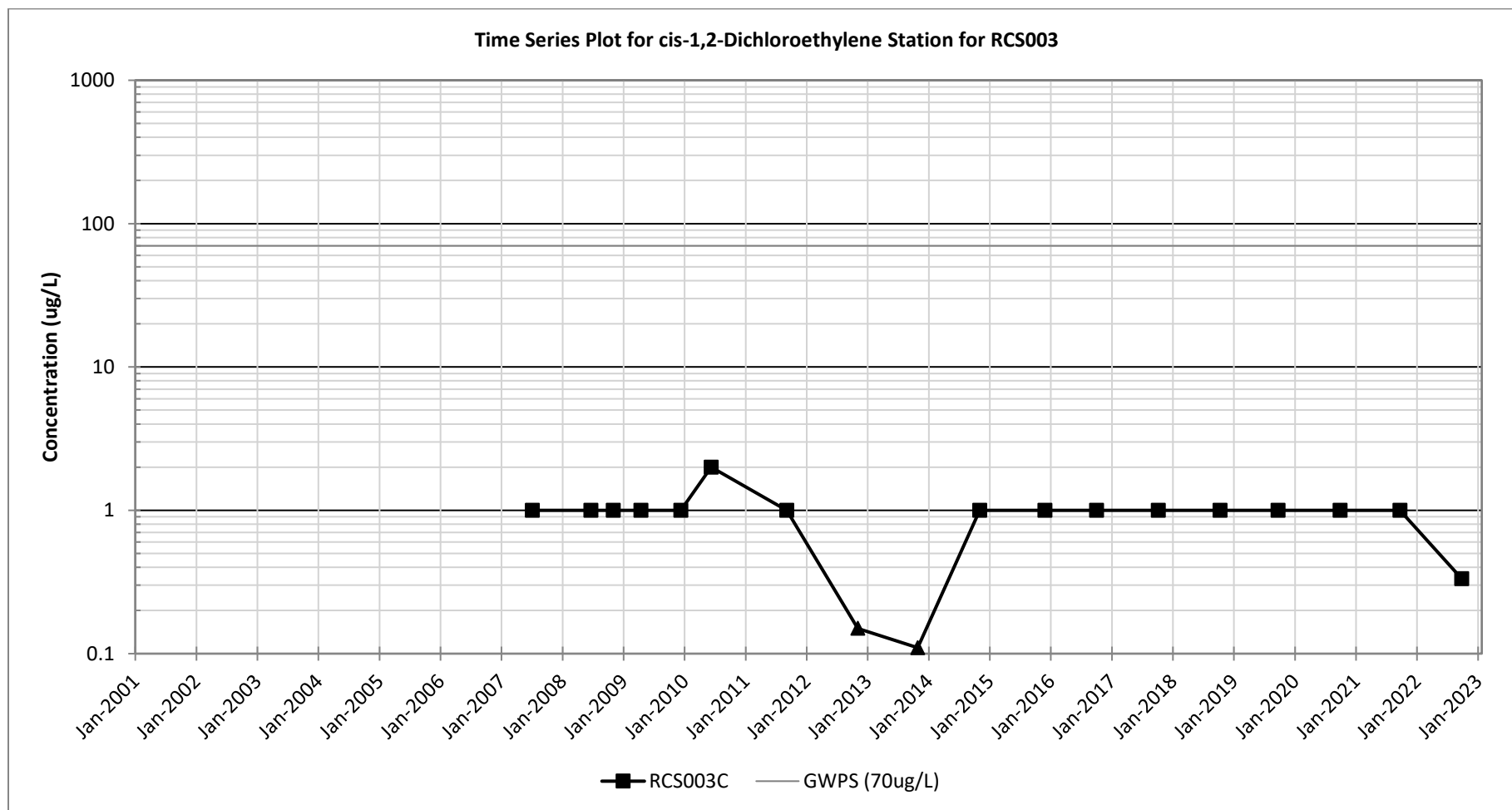


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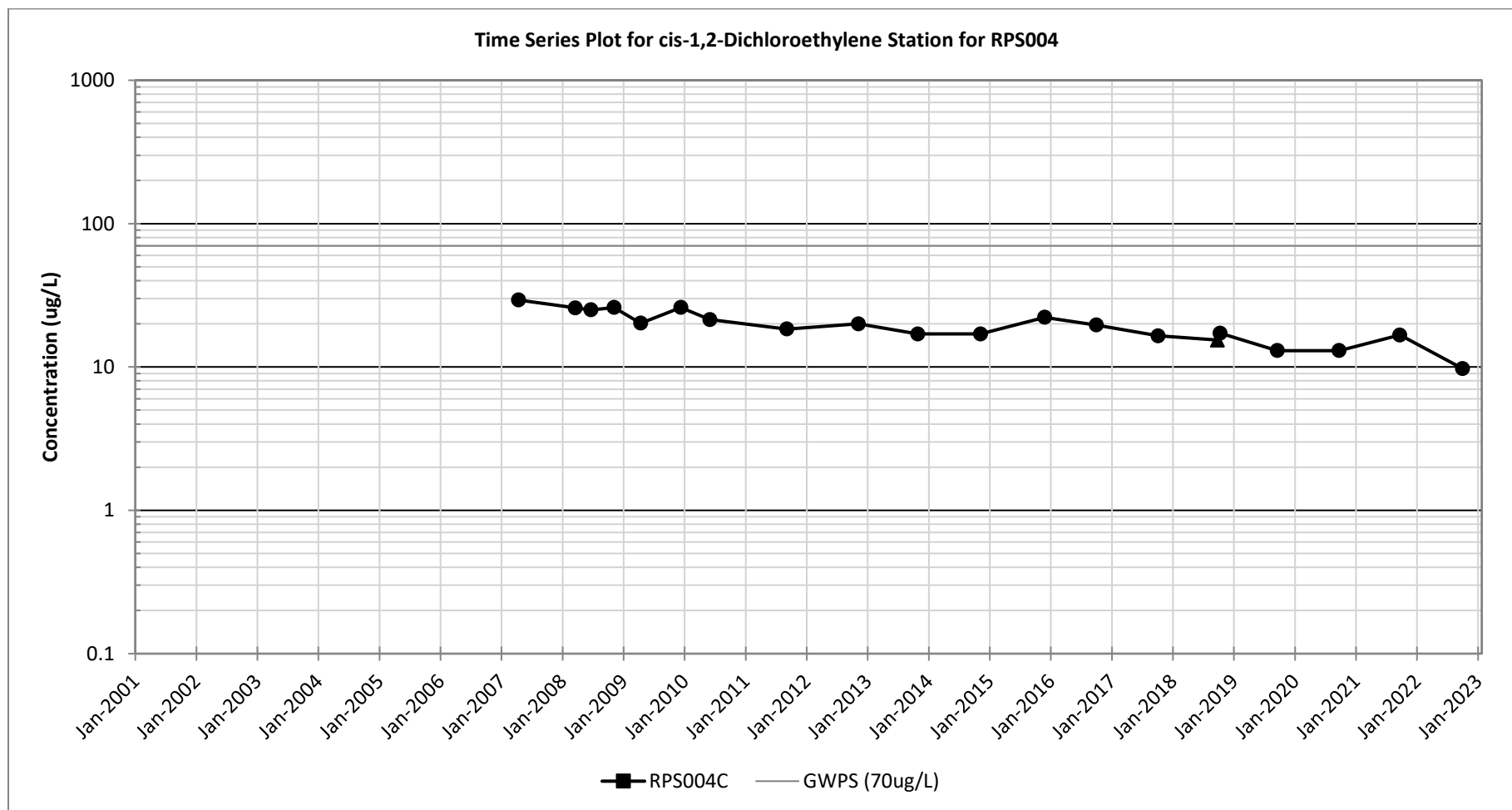


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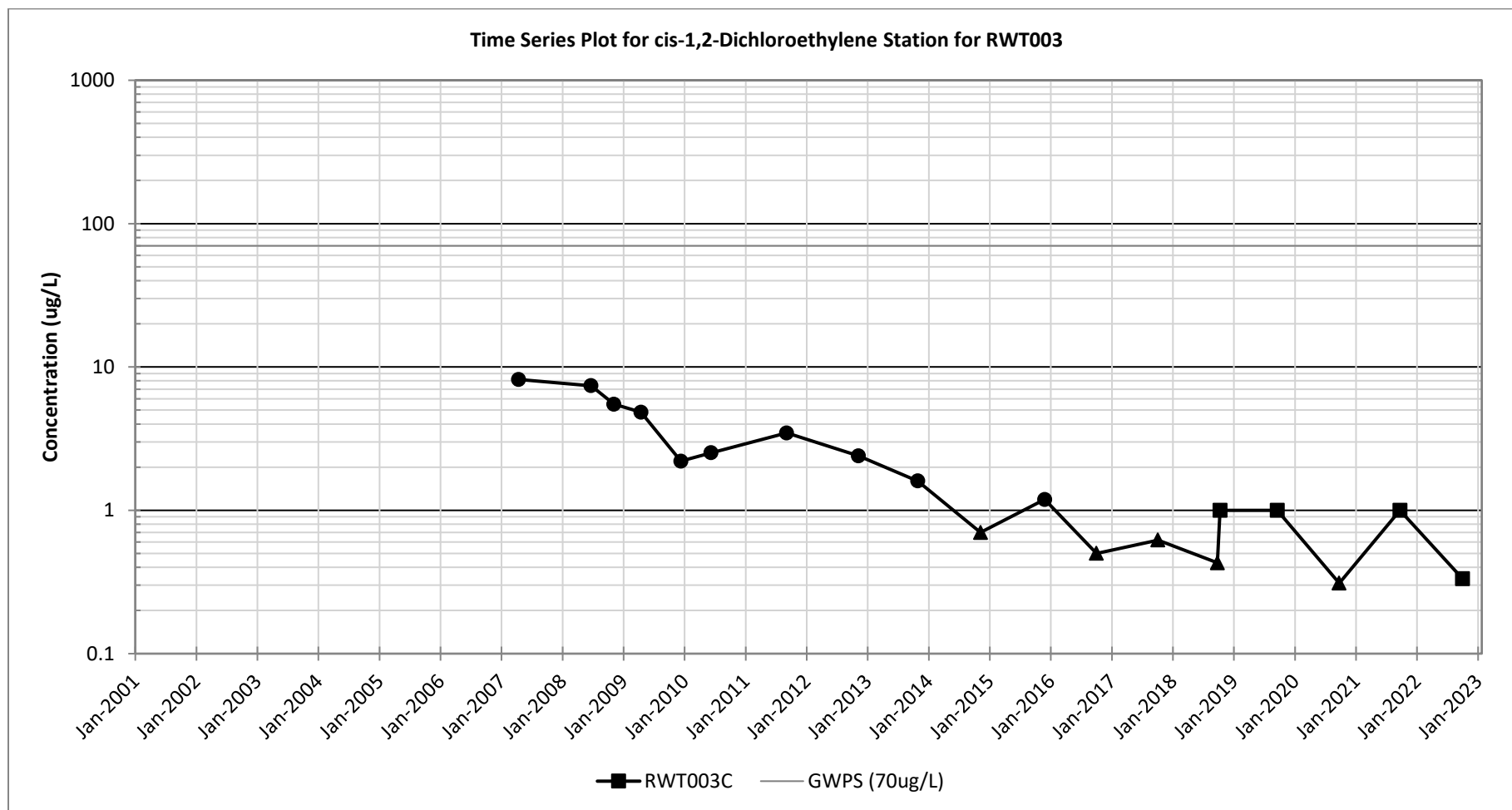


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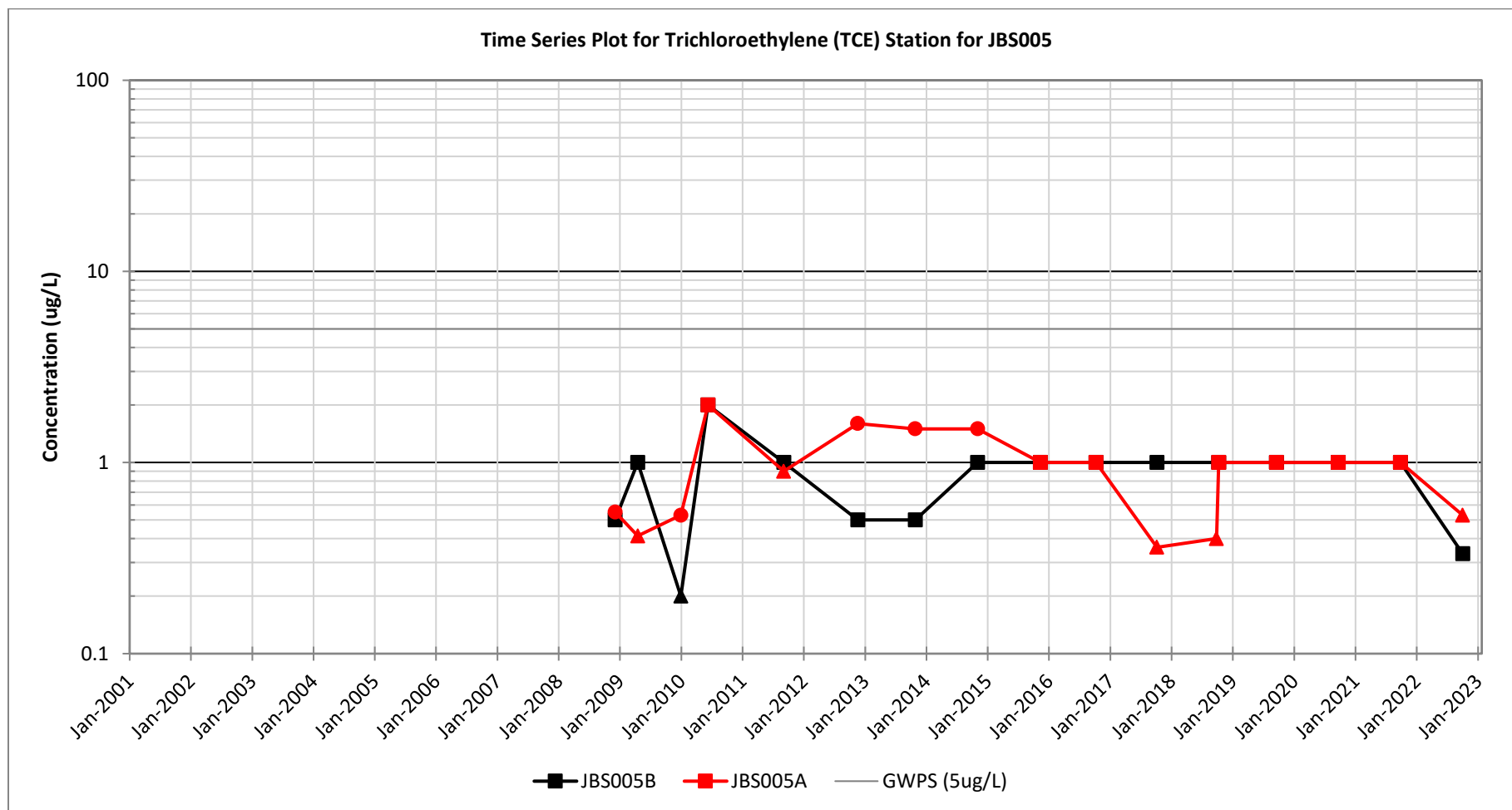


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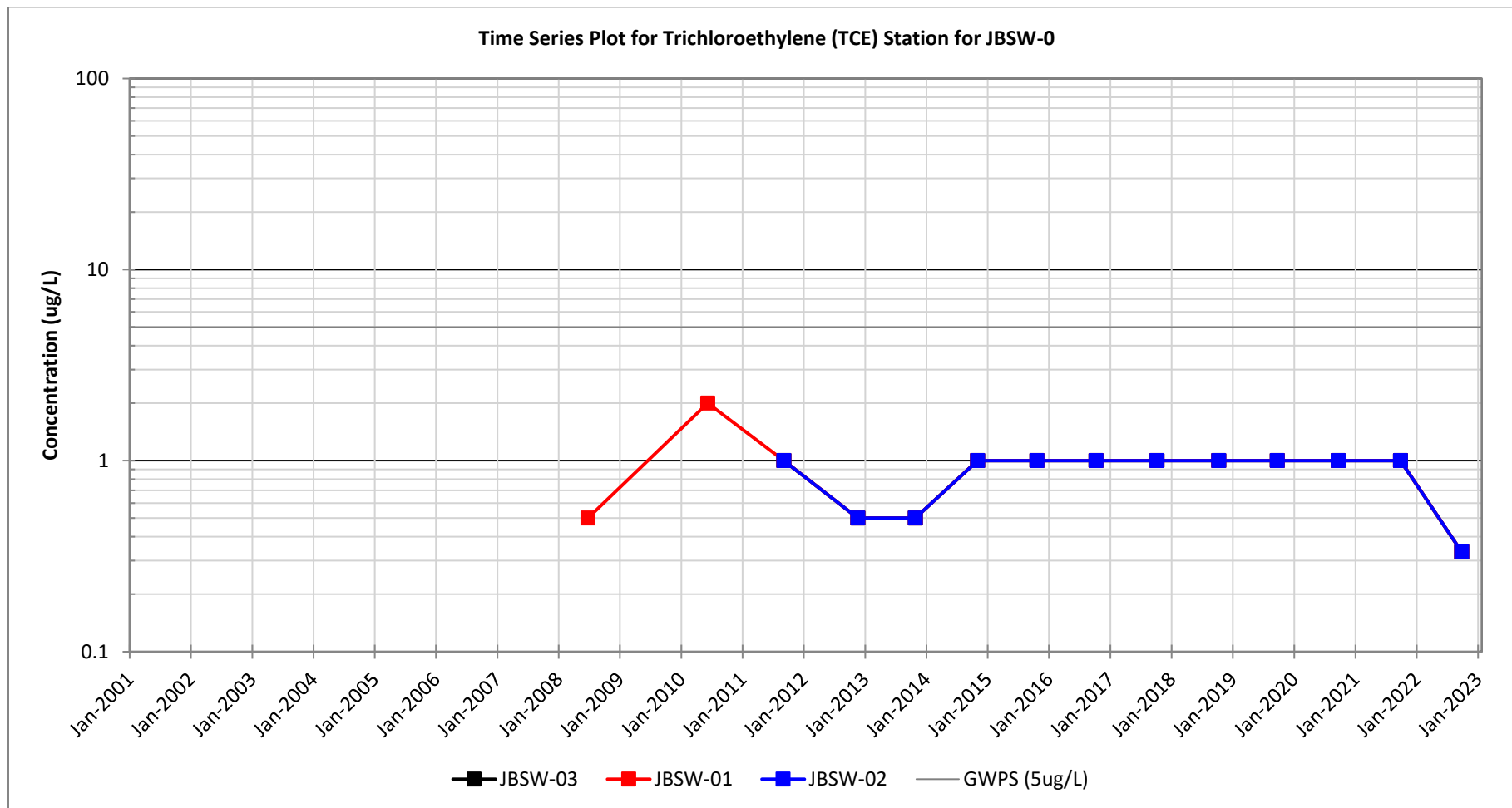


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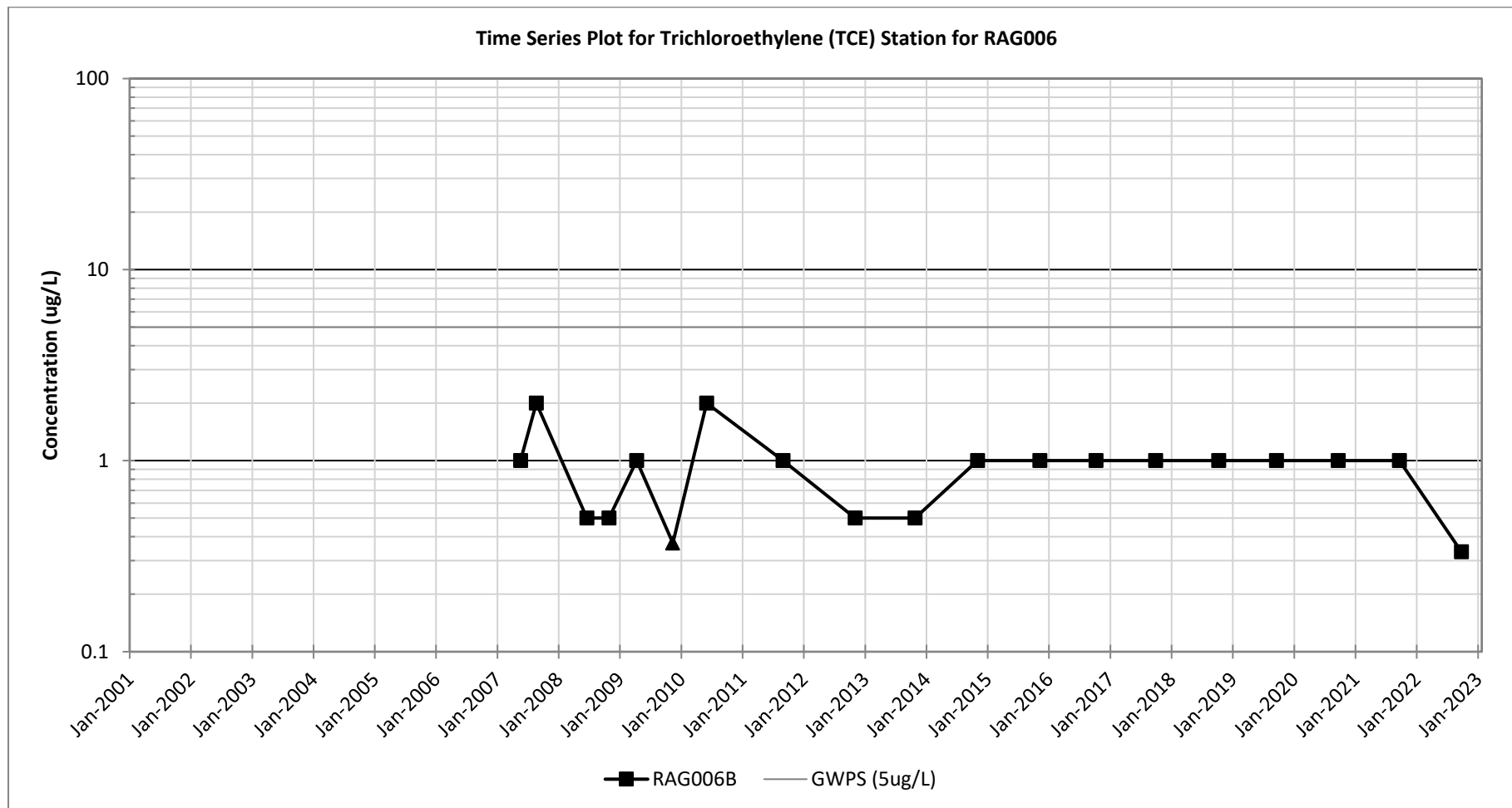


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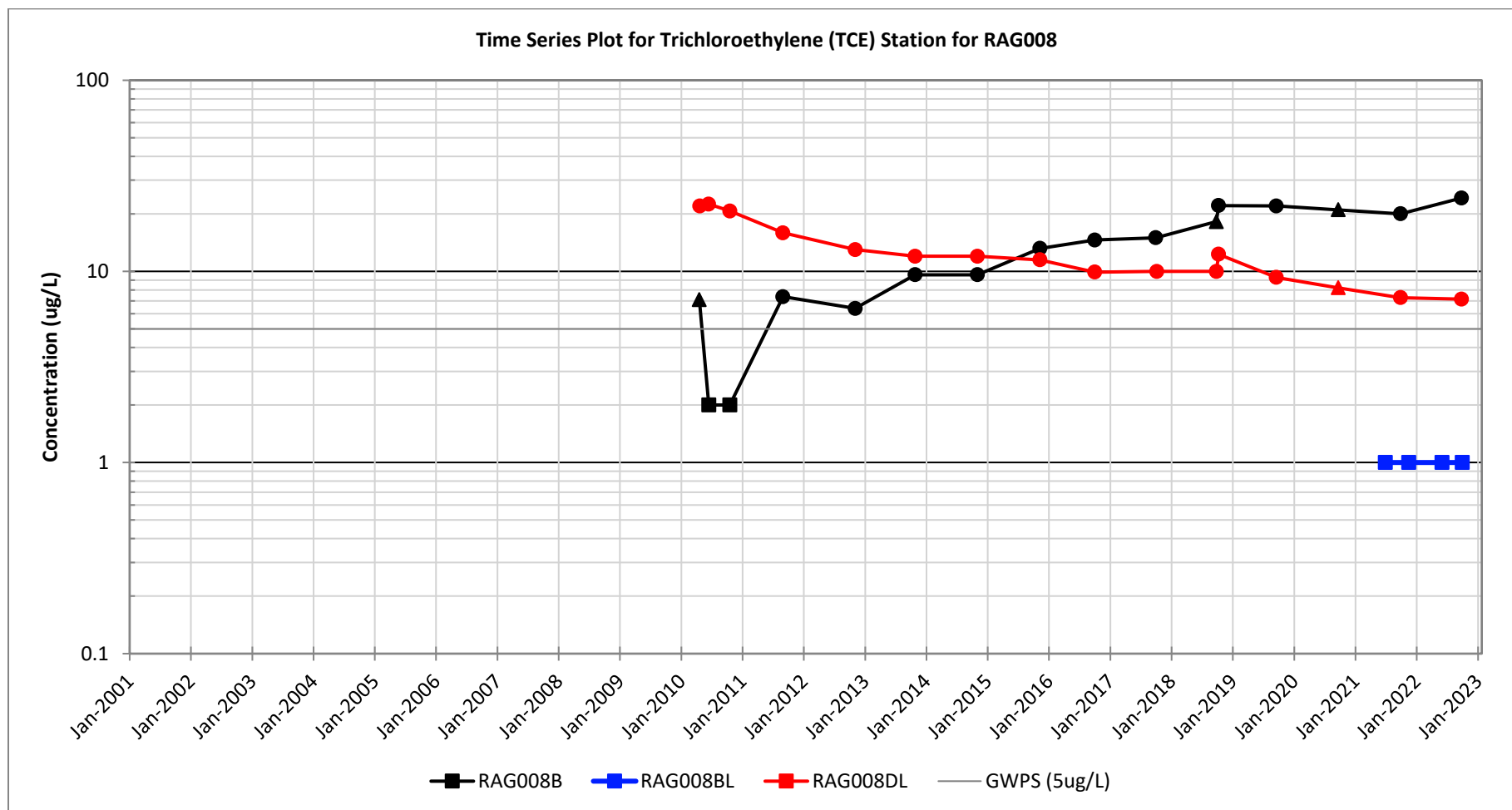


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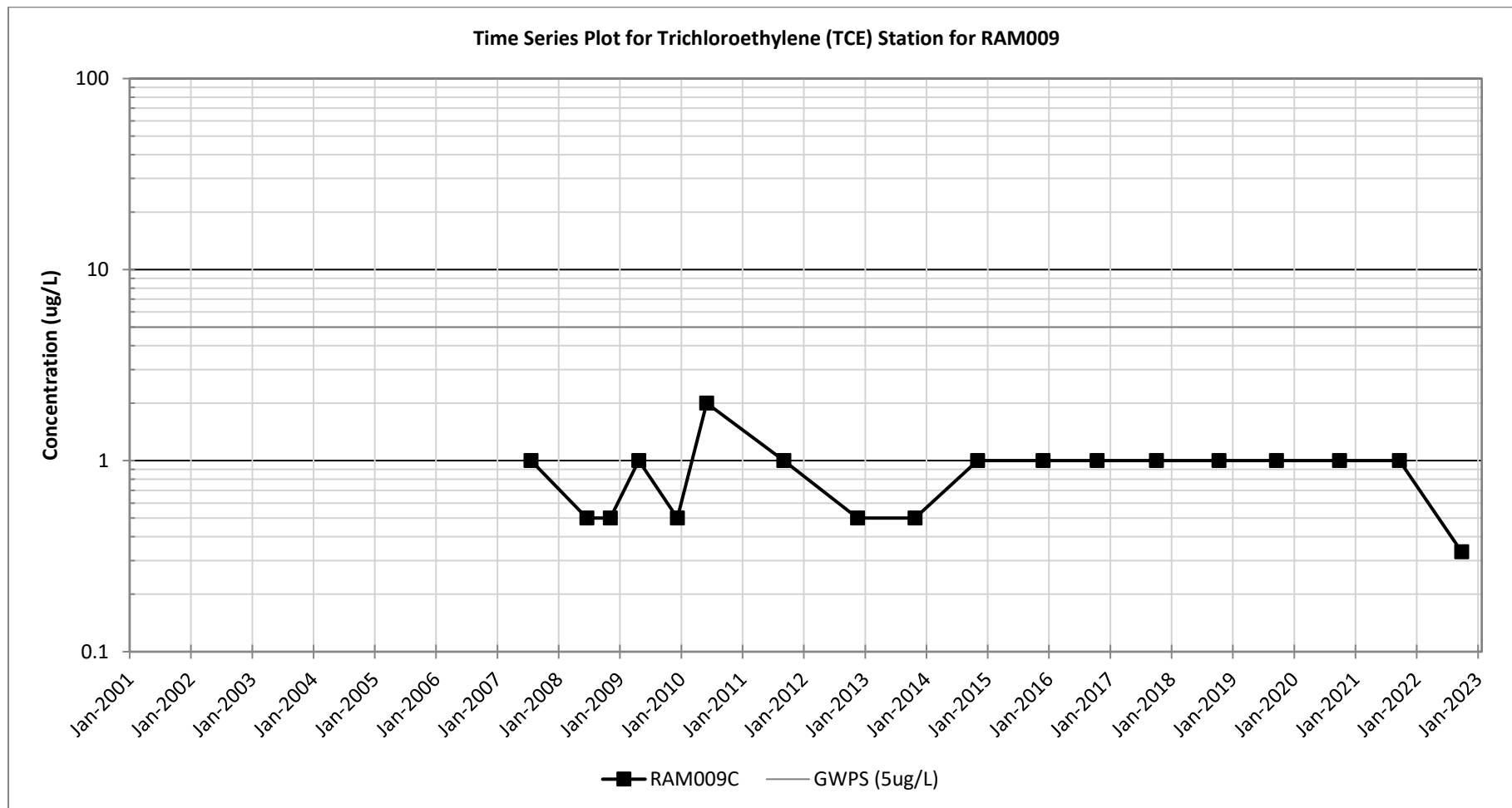


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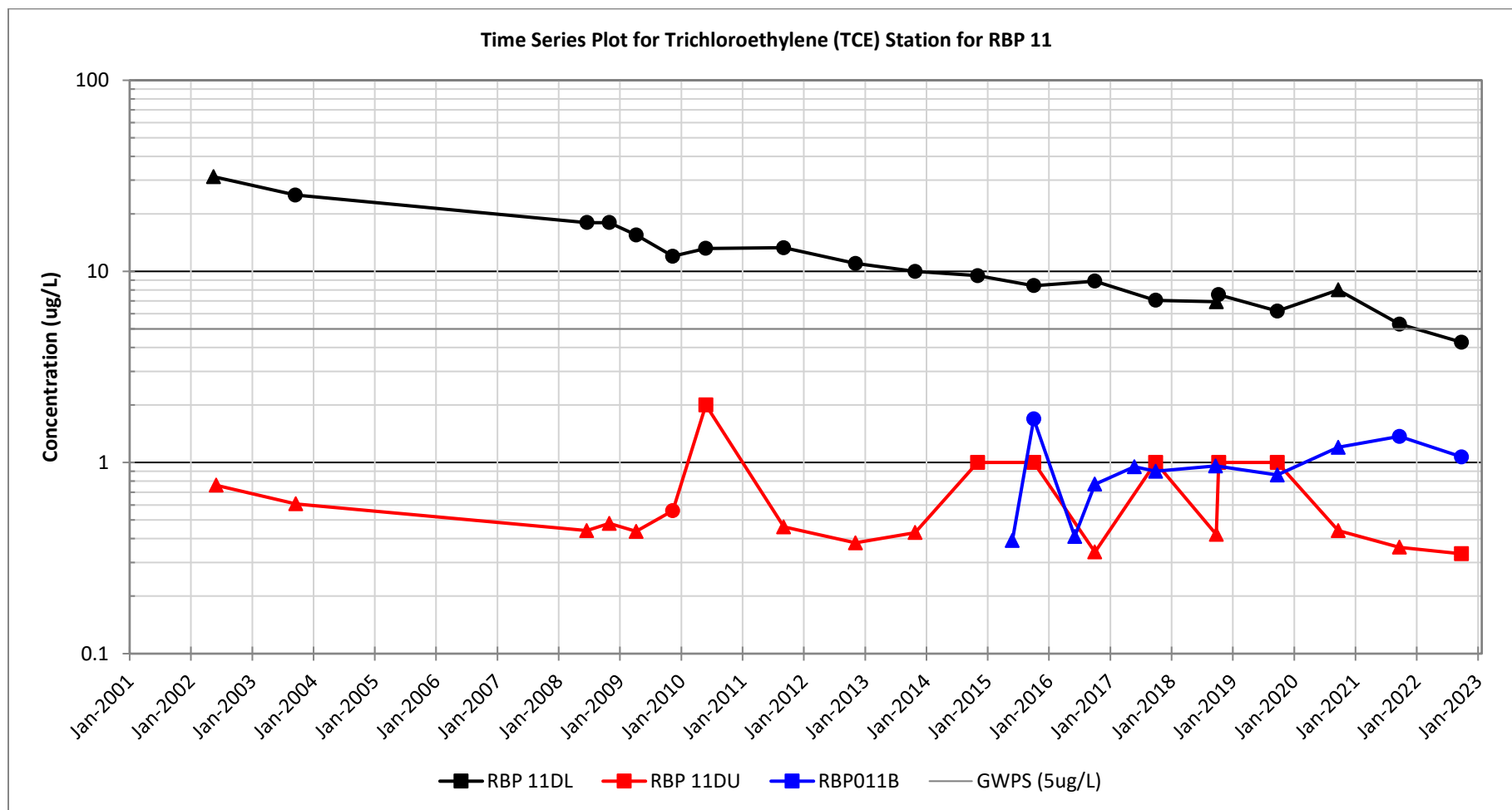


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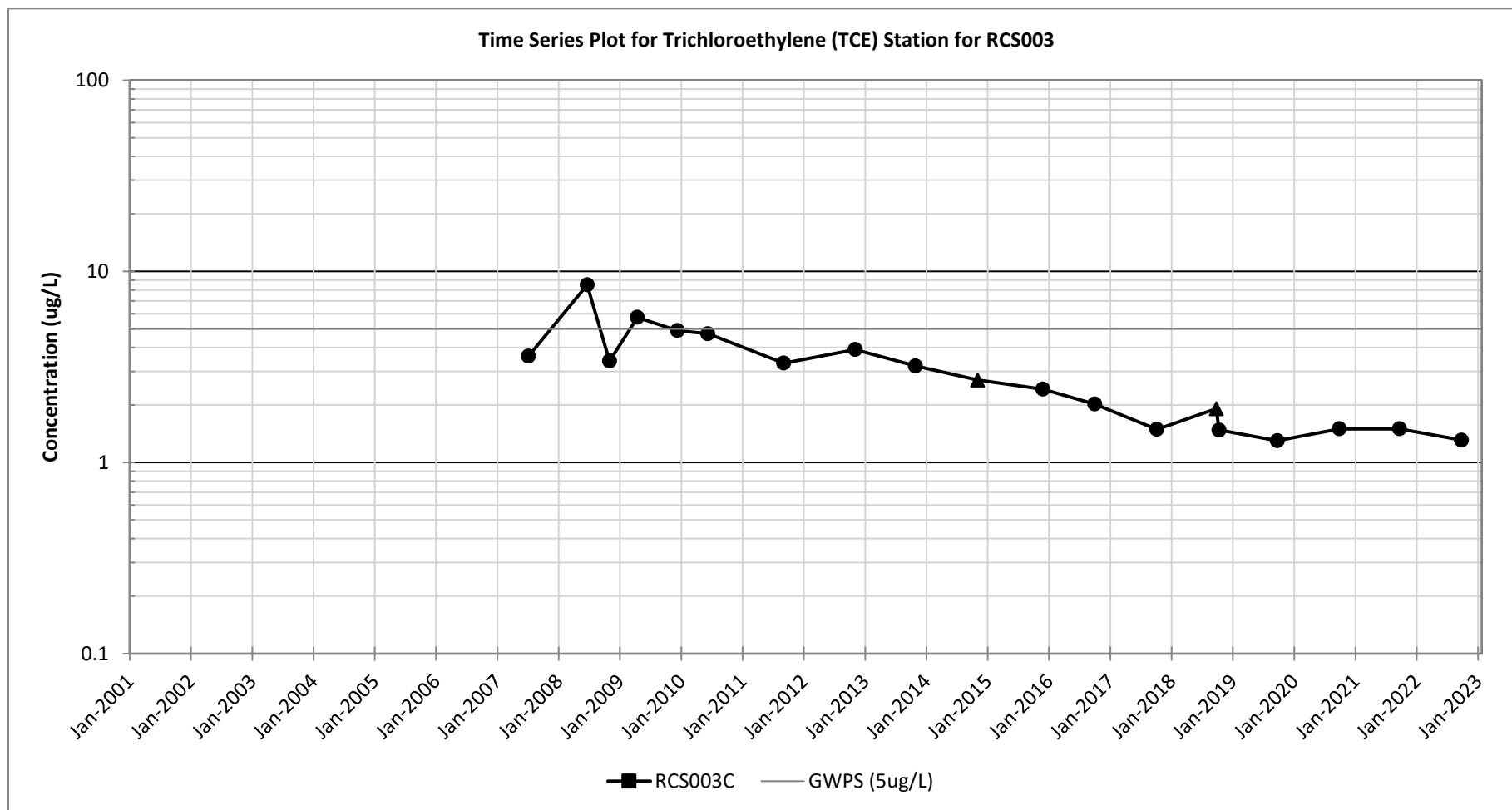


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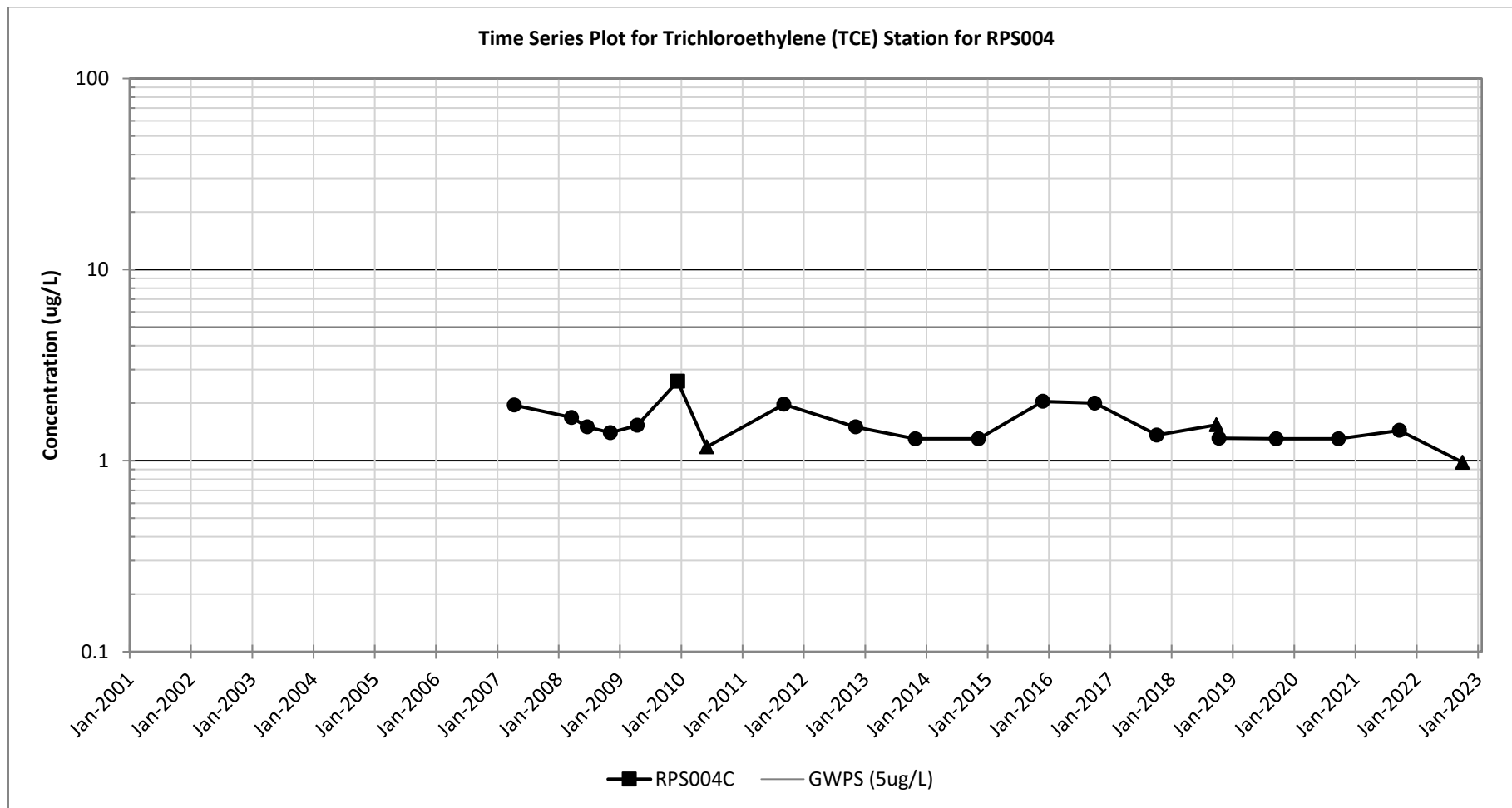


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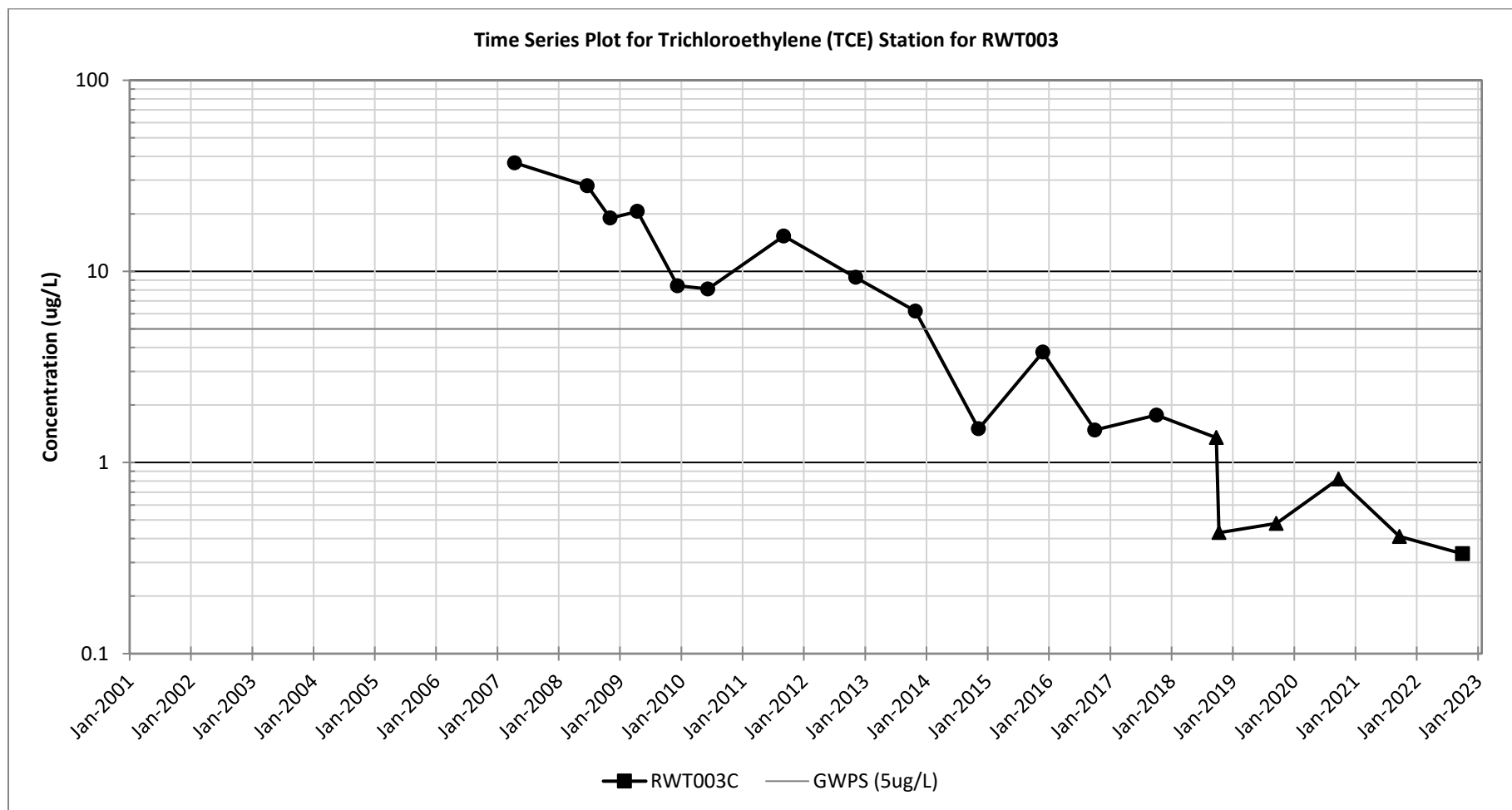


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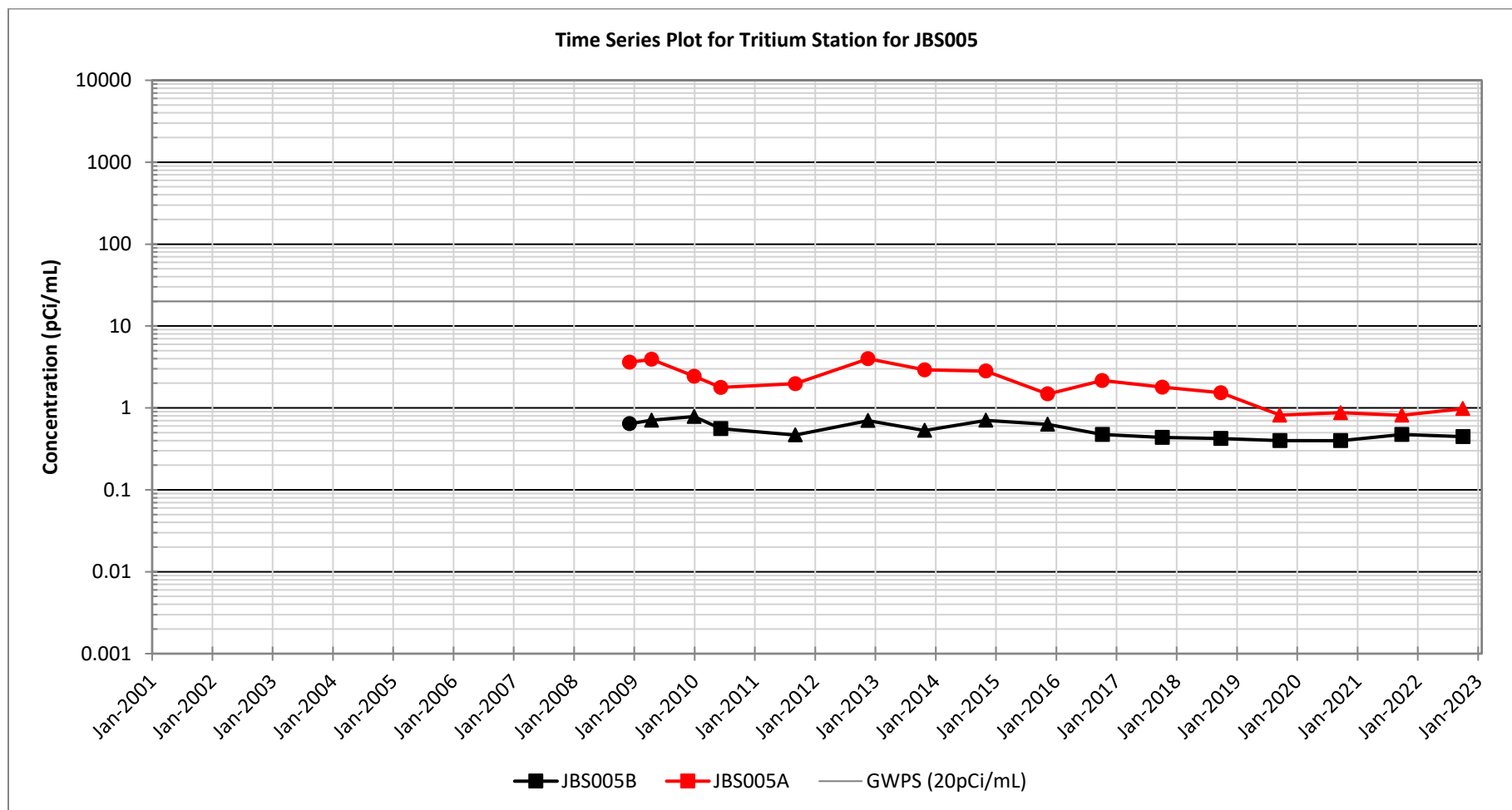


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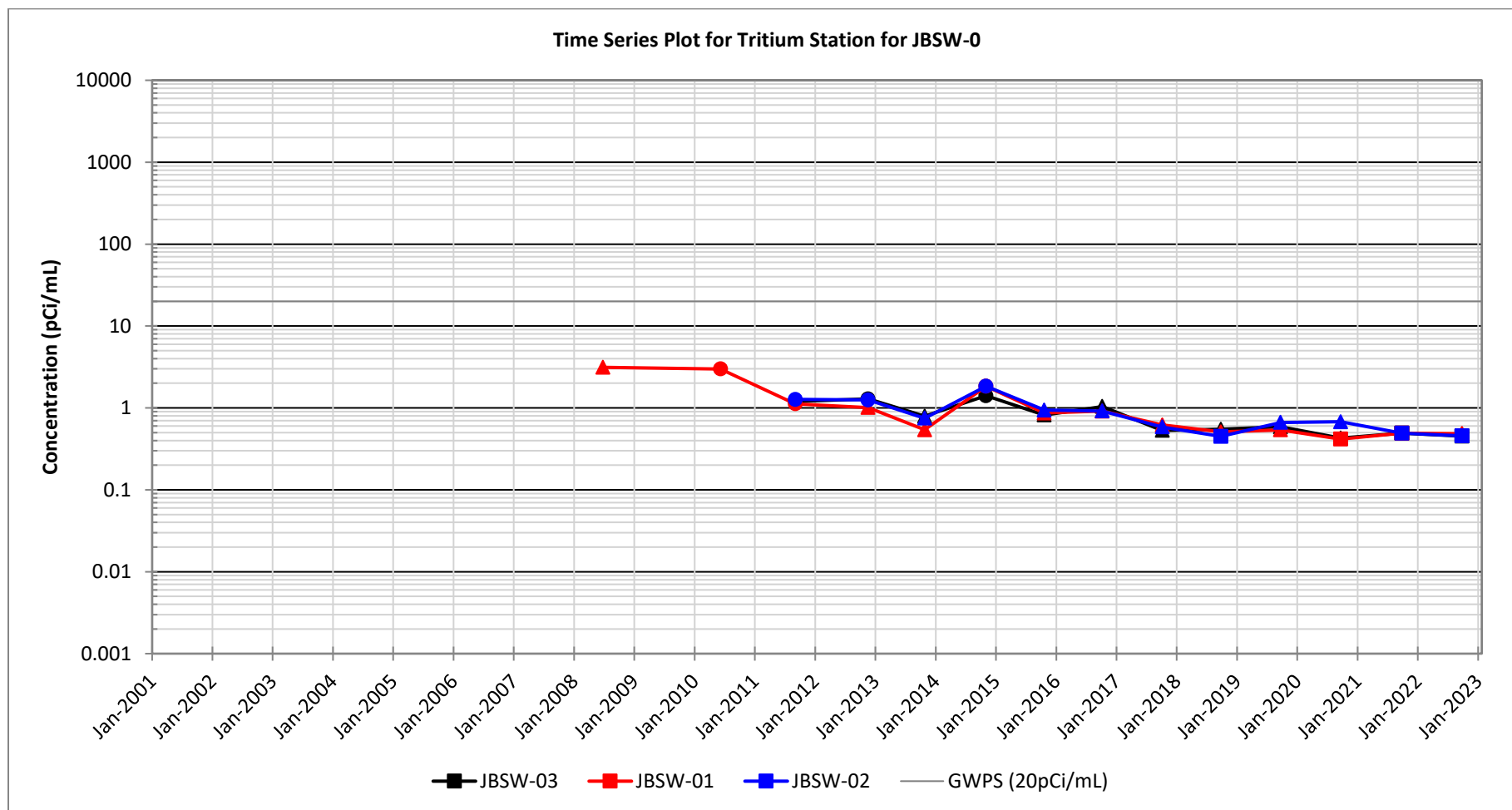


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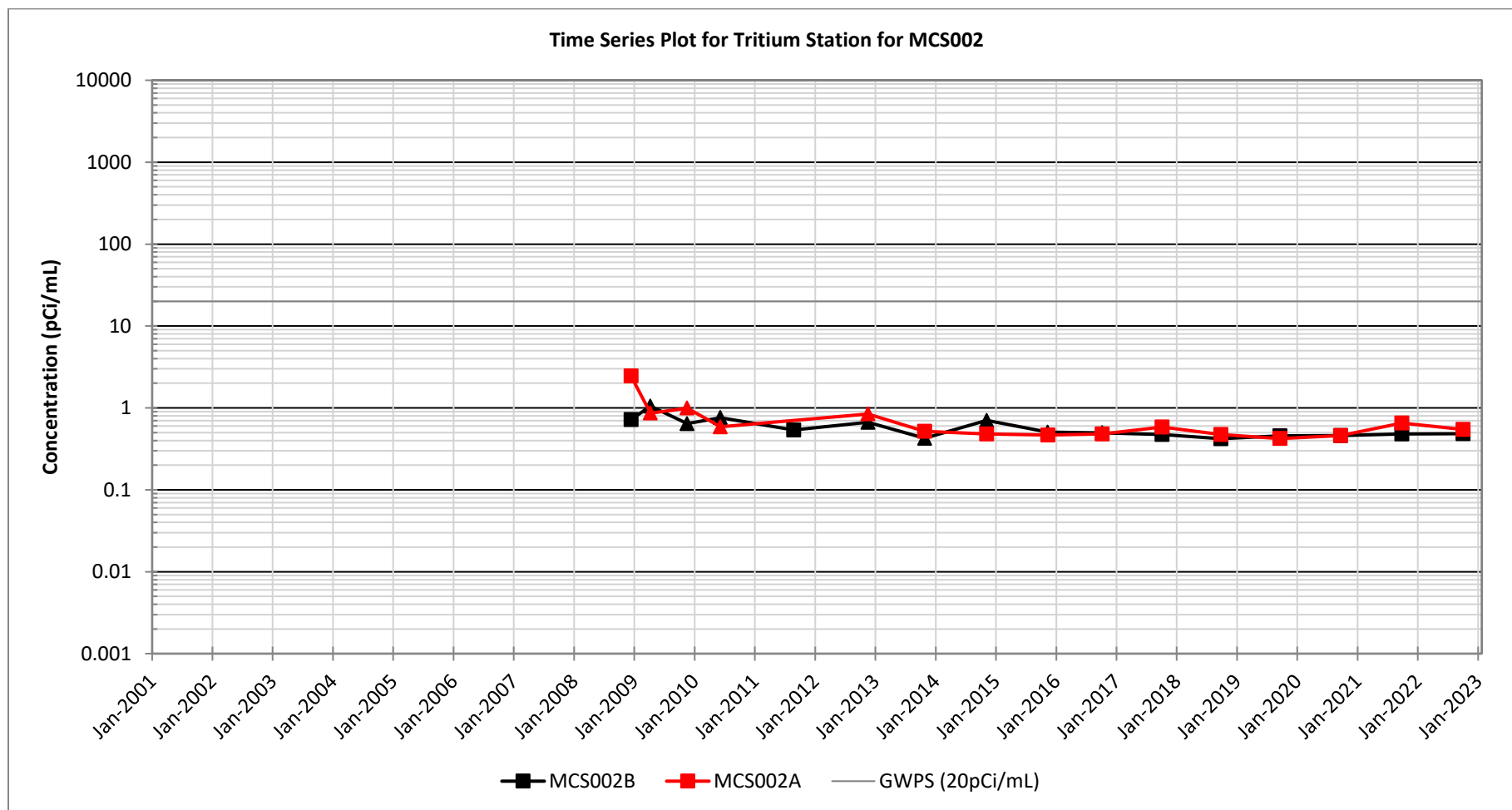


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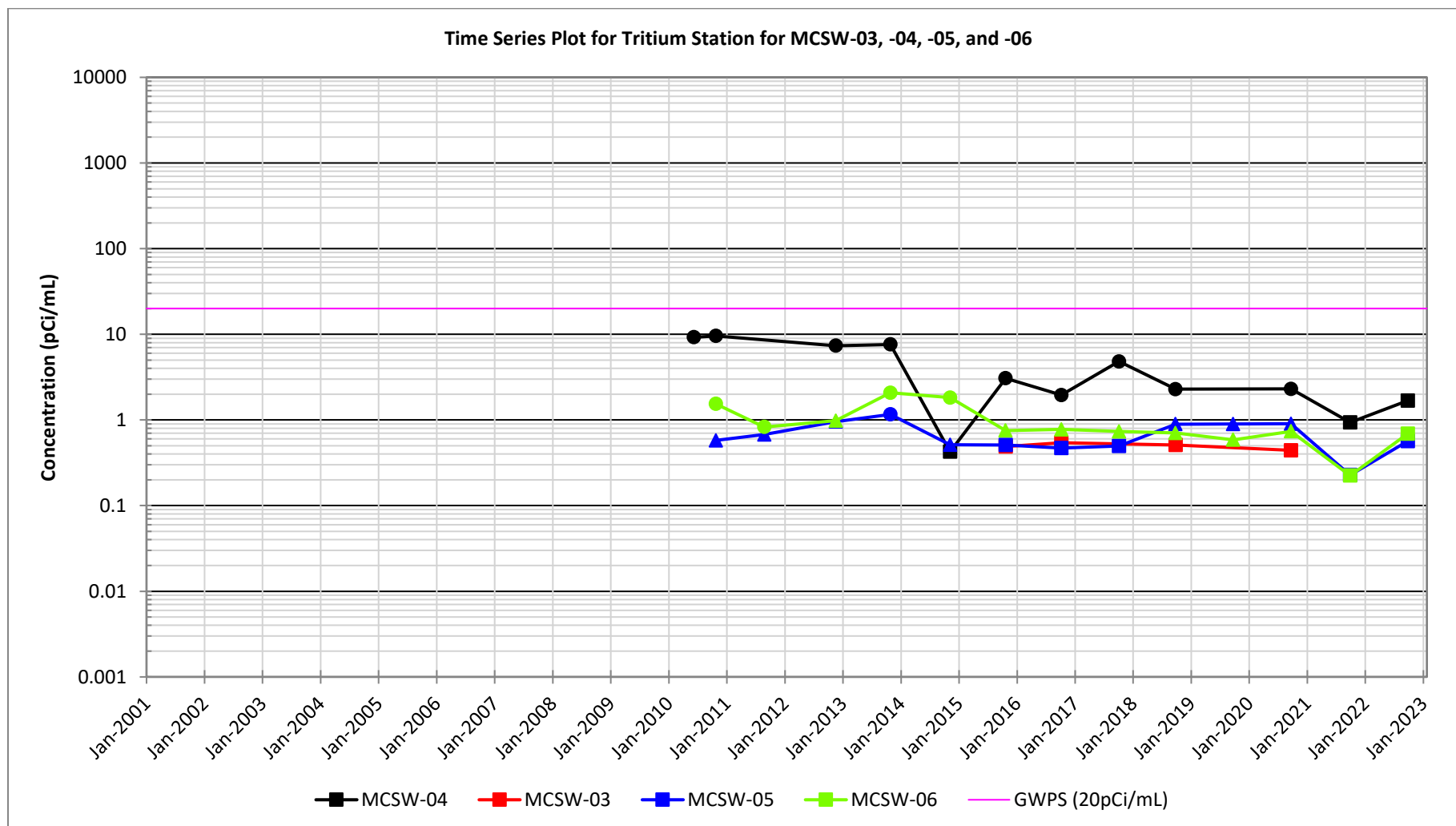


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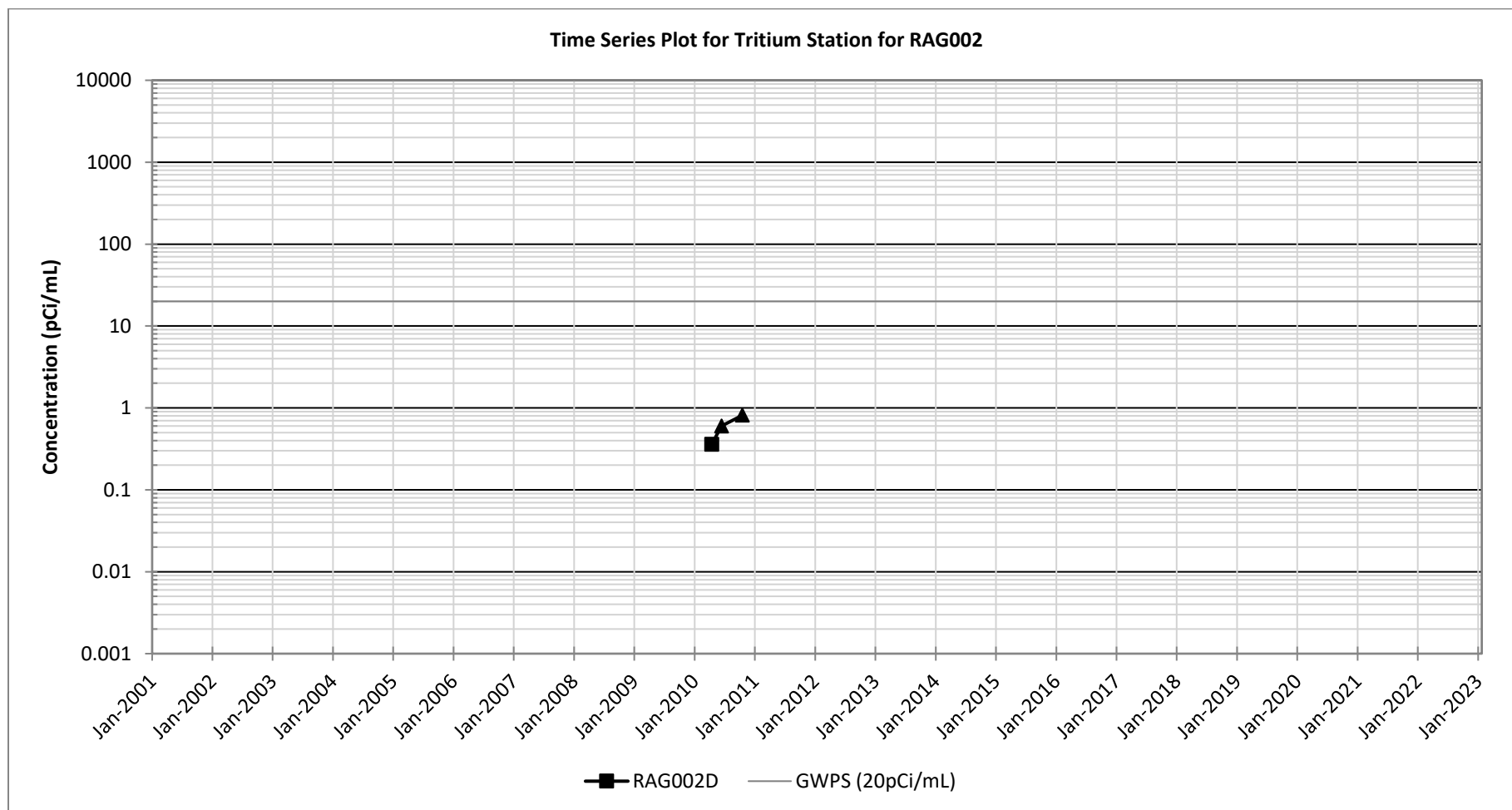


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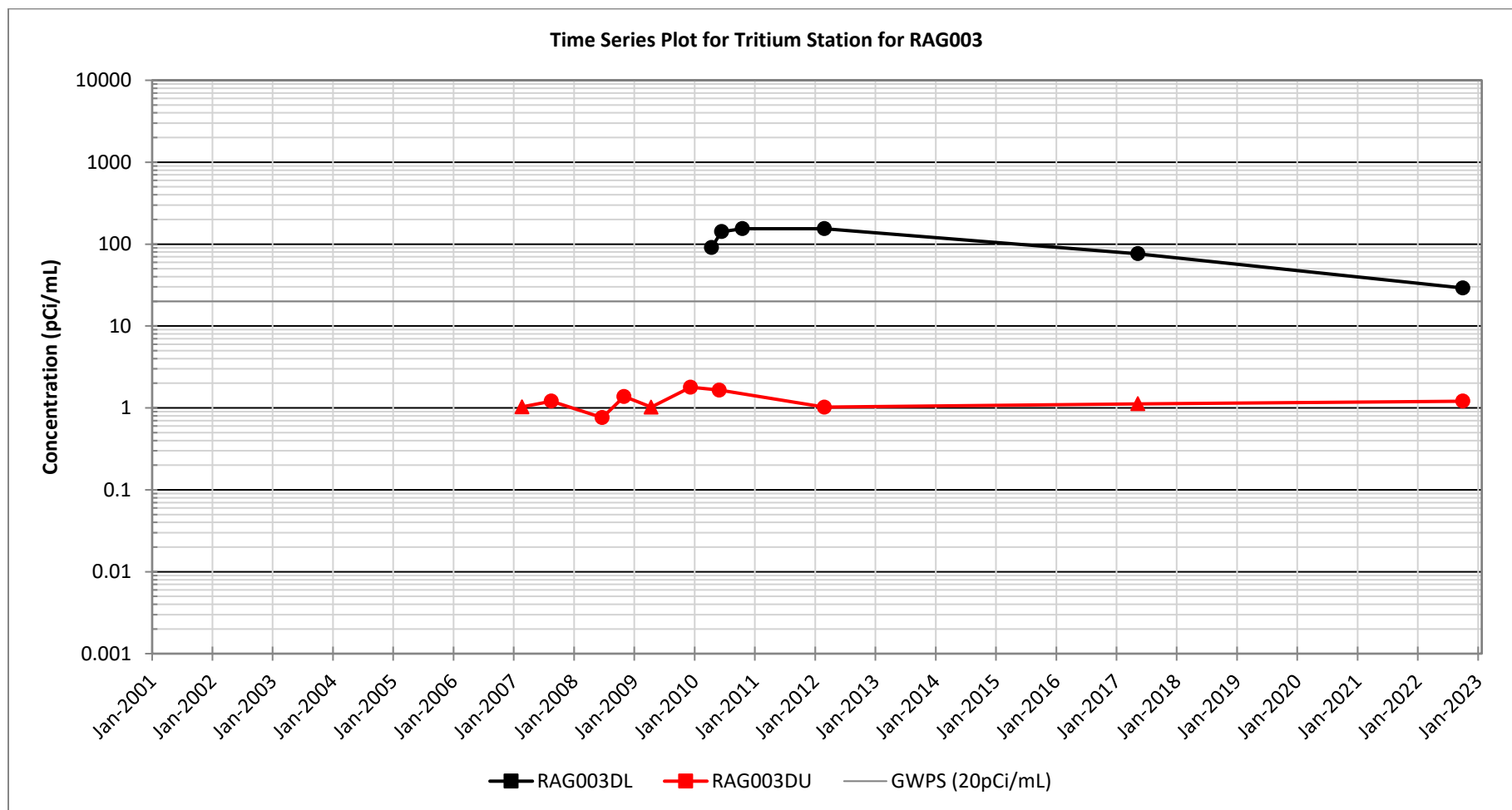


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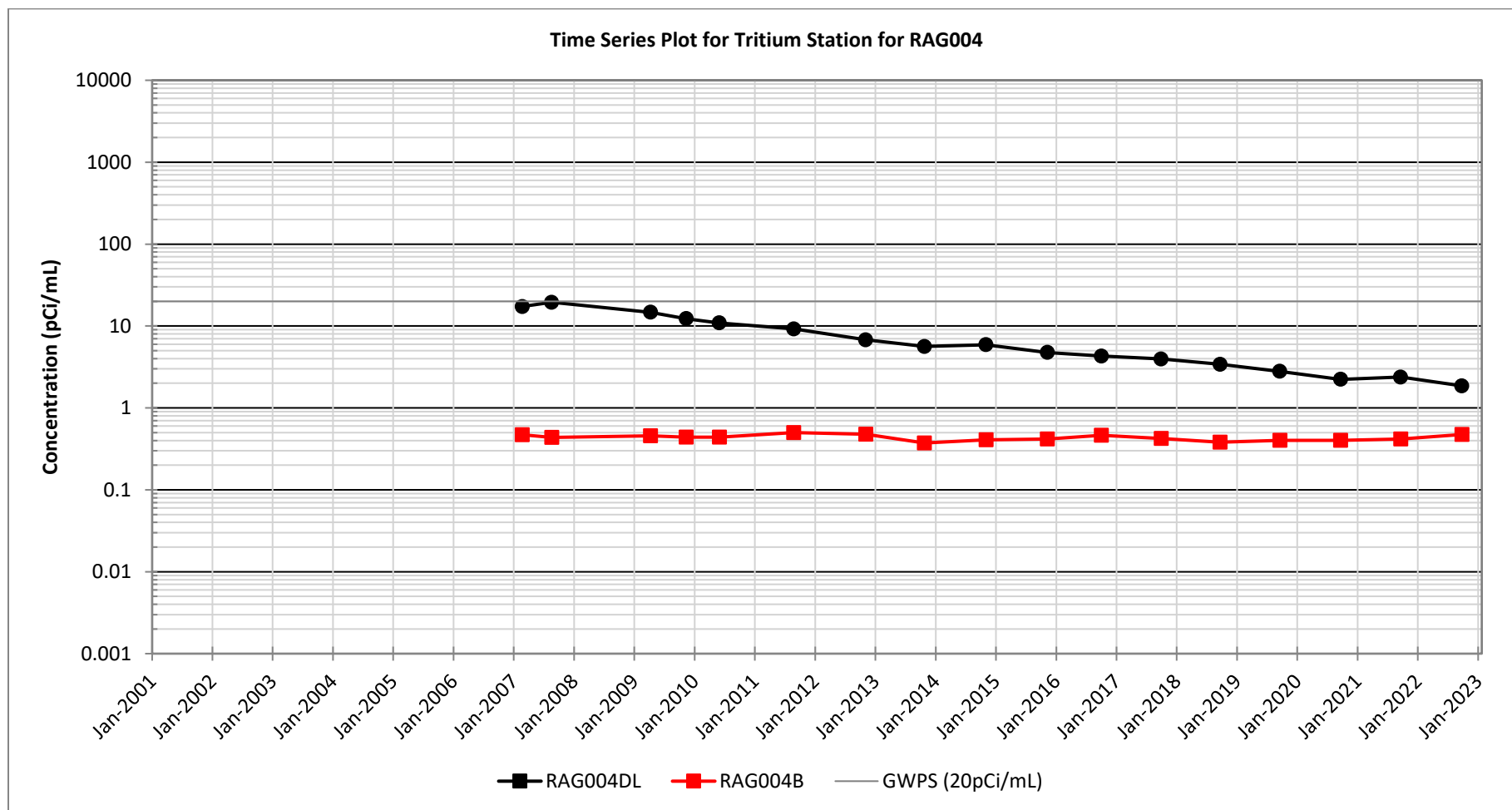


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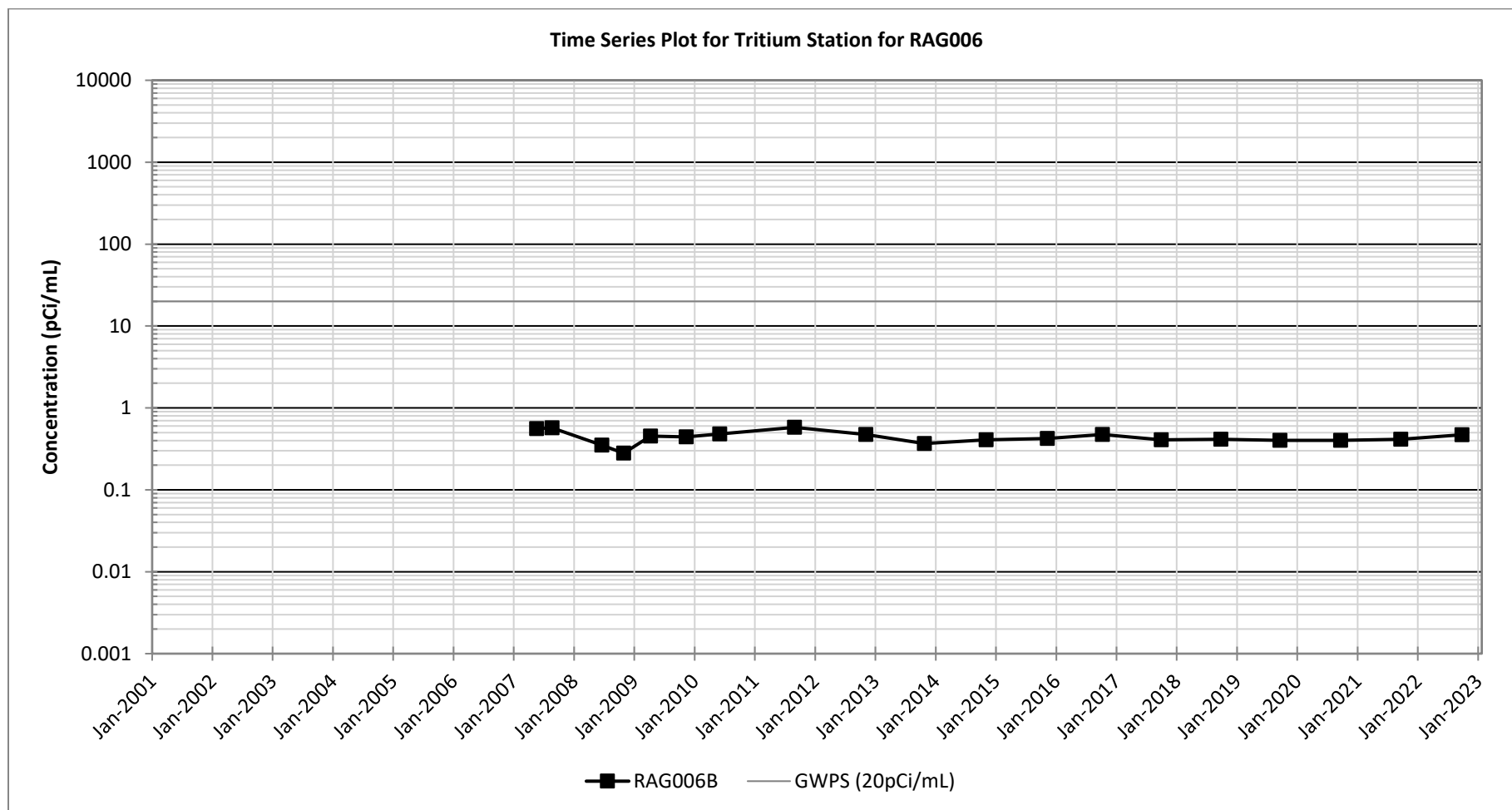


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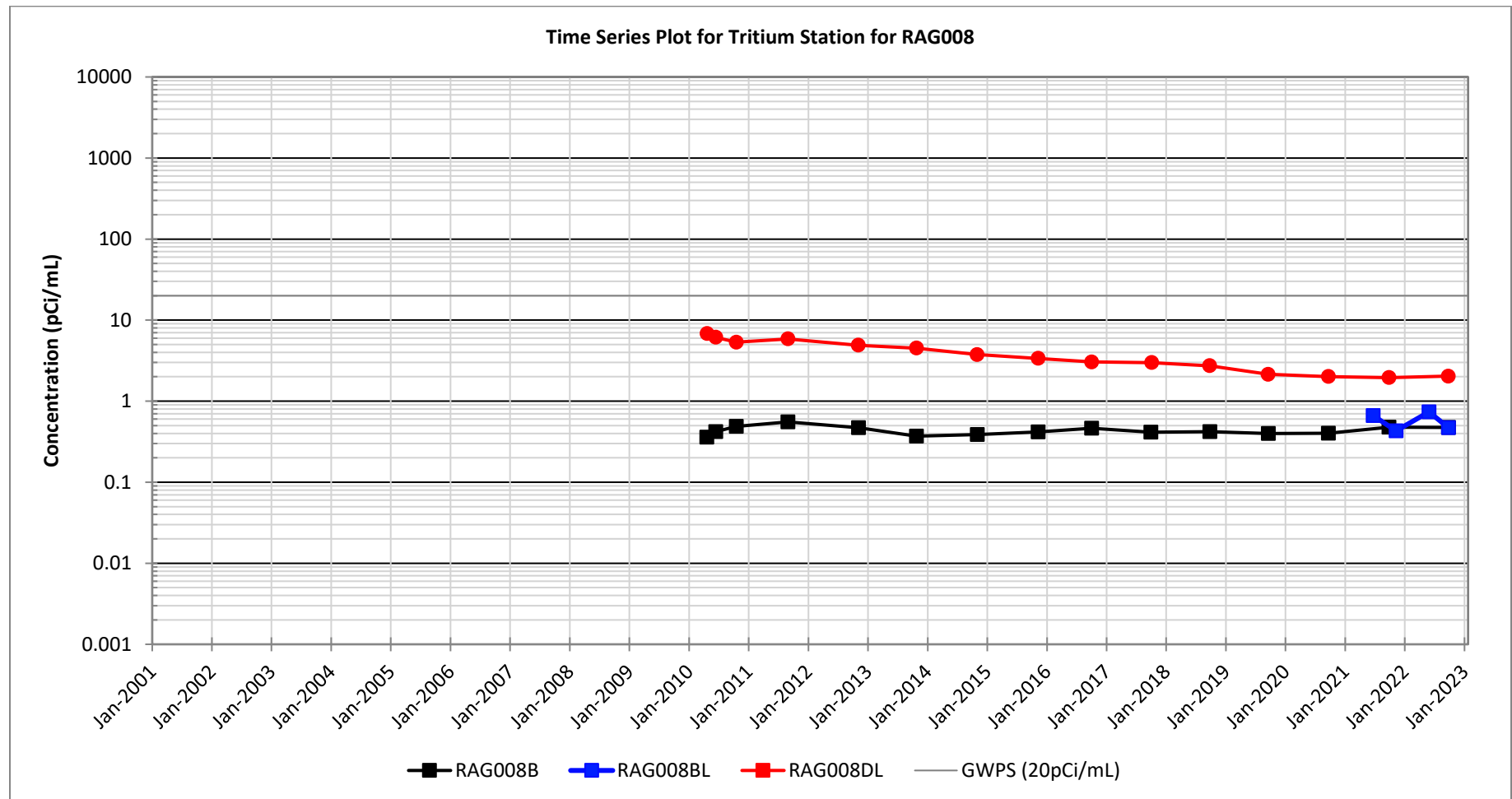


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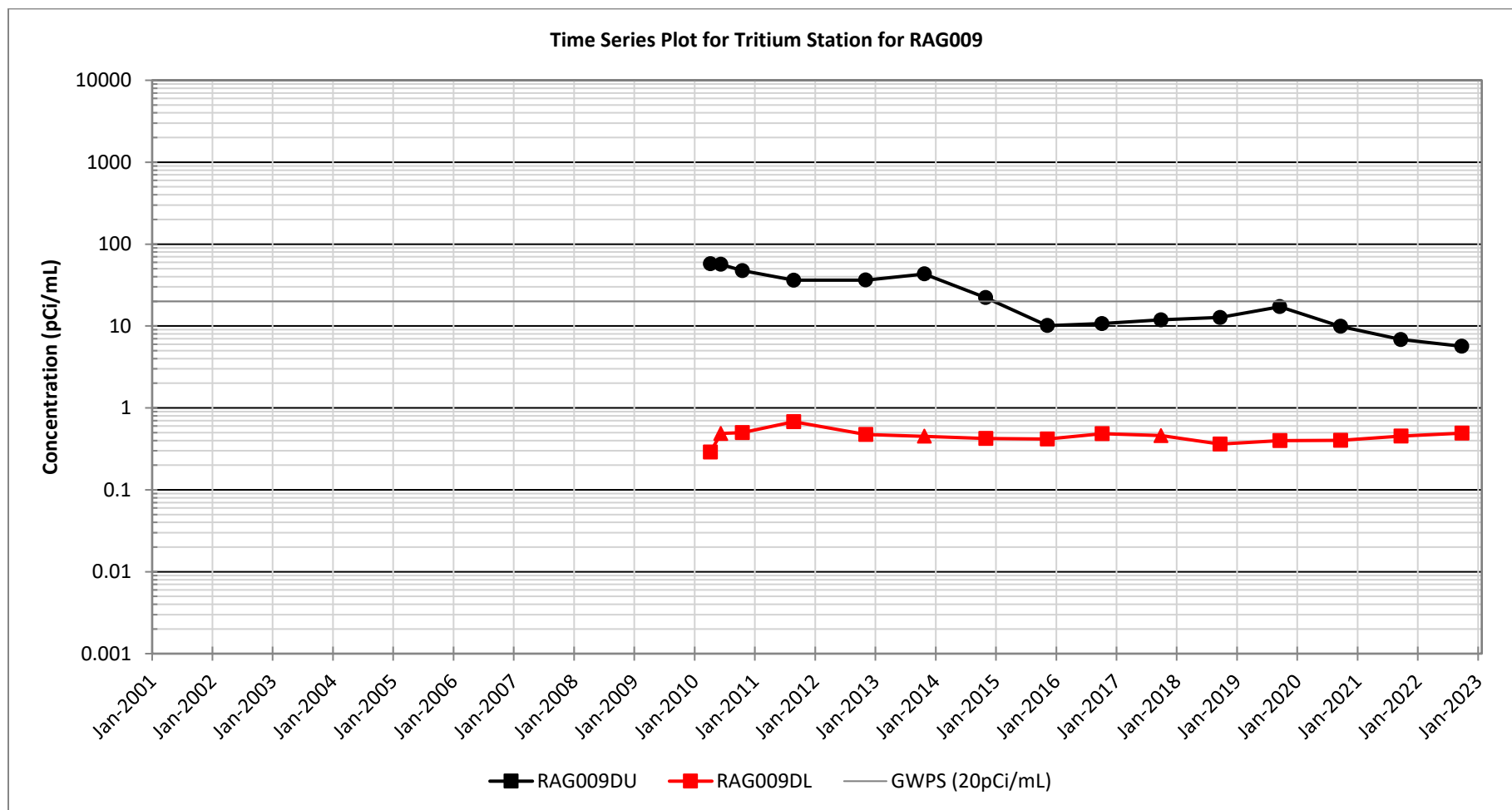


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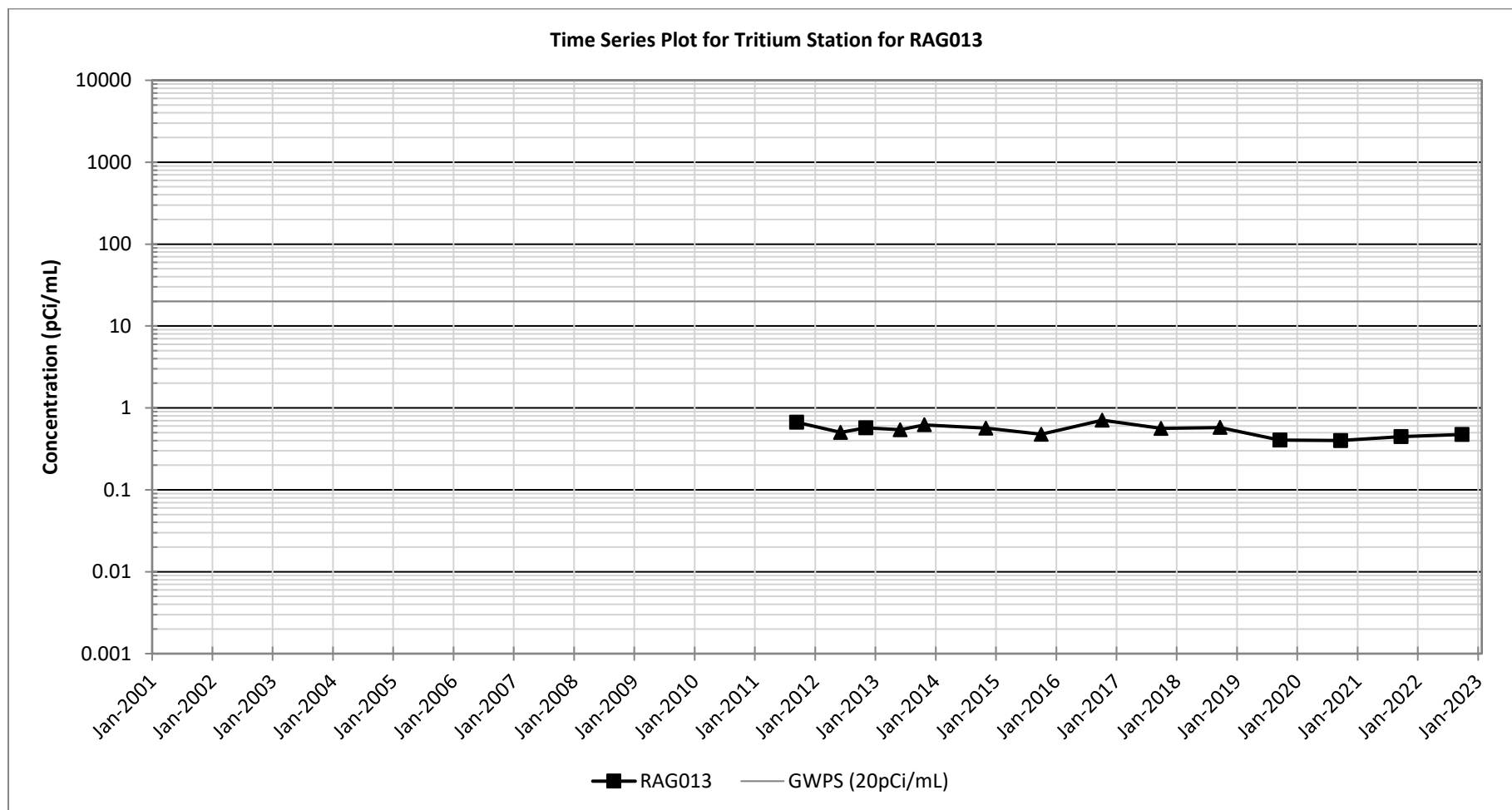


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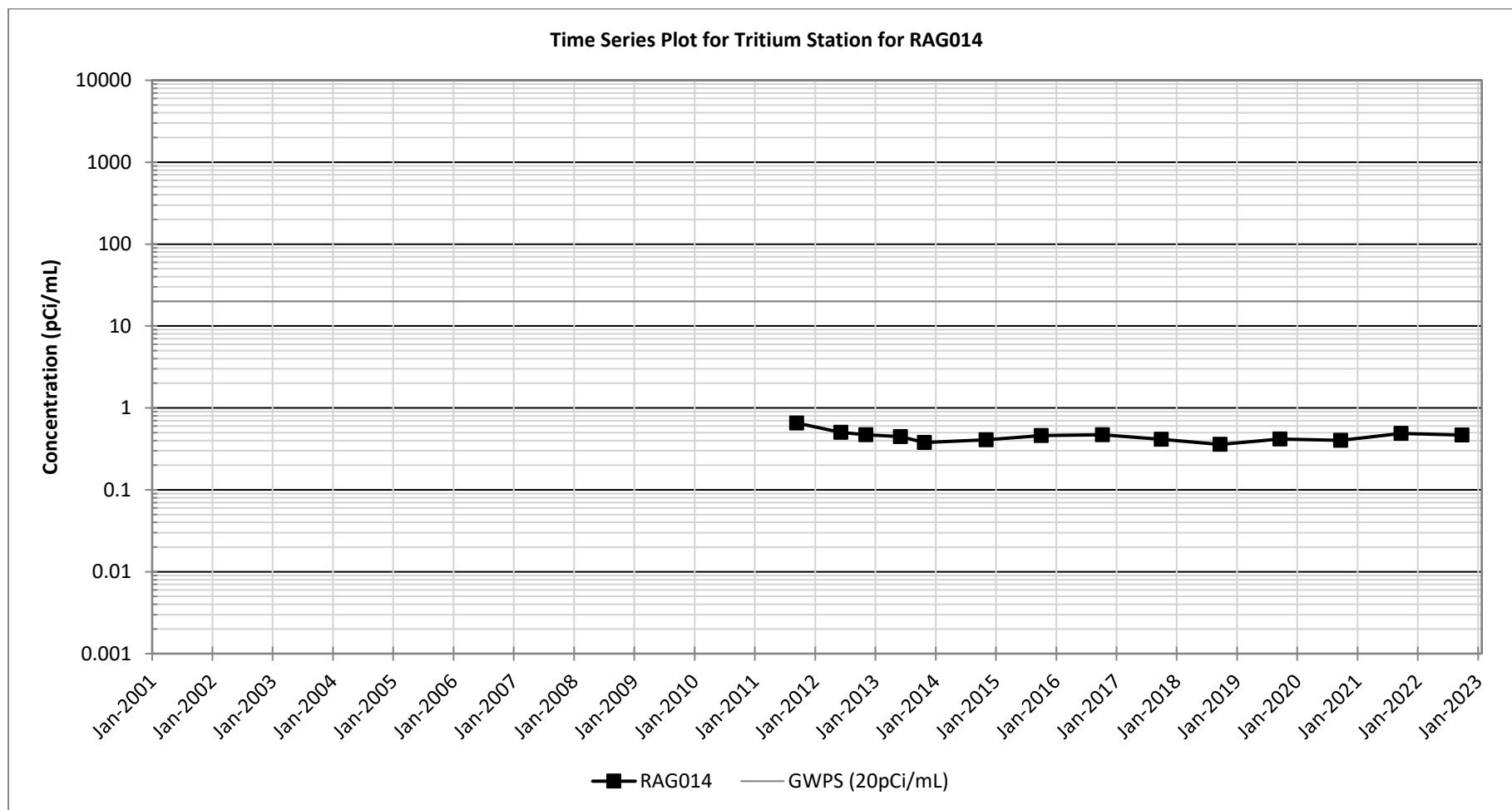


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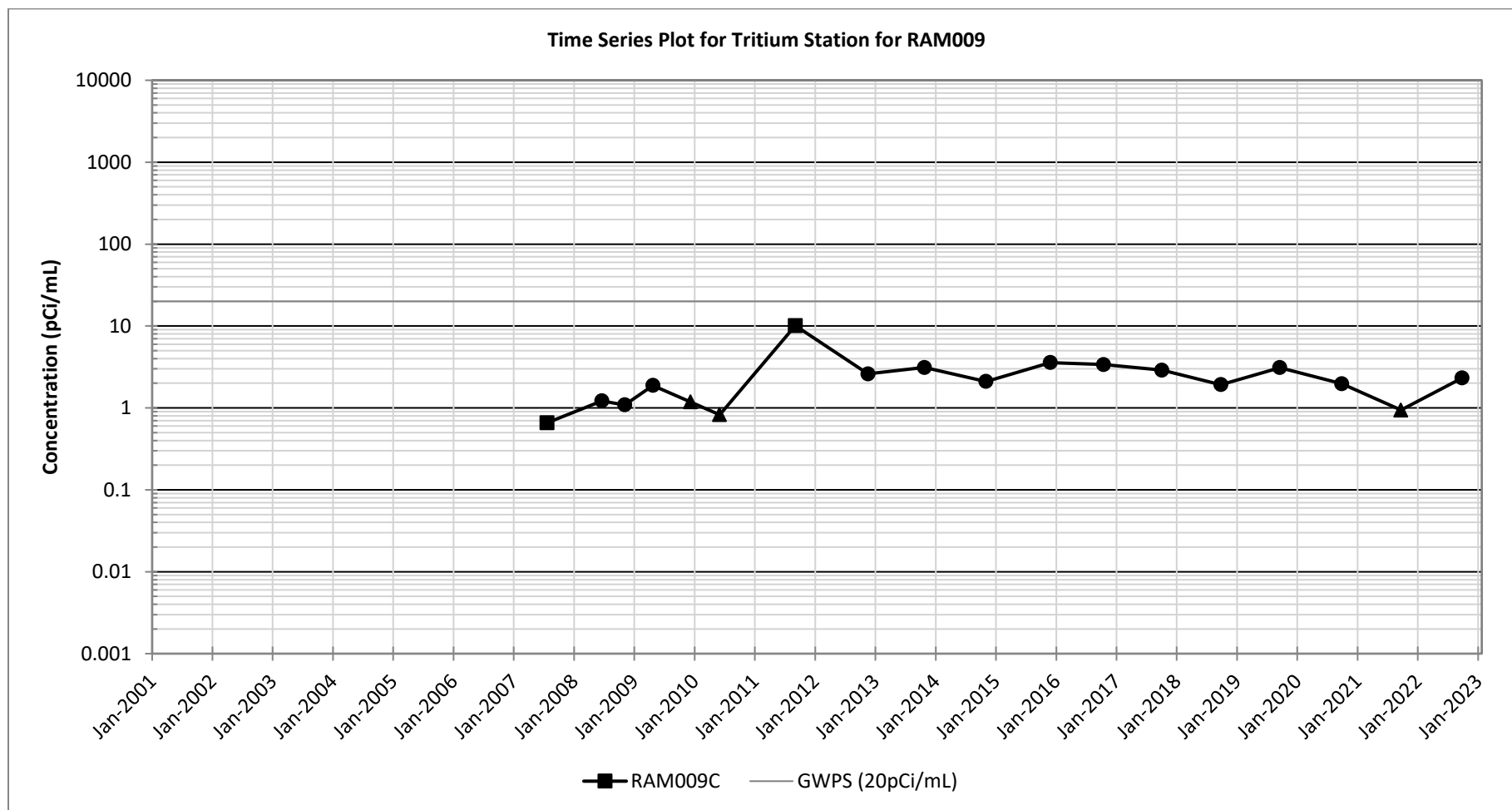


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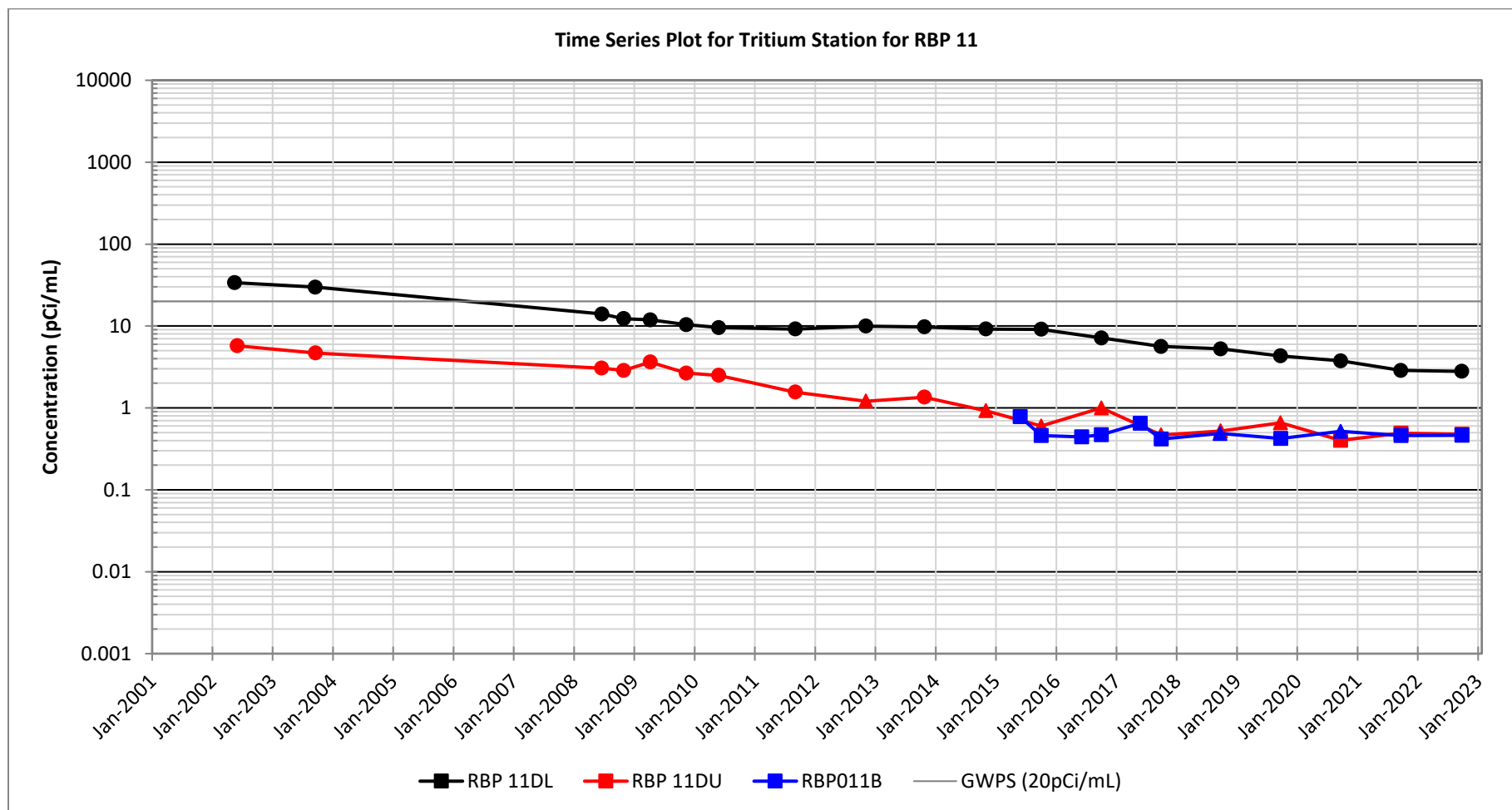


Figure C-50.

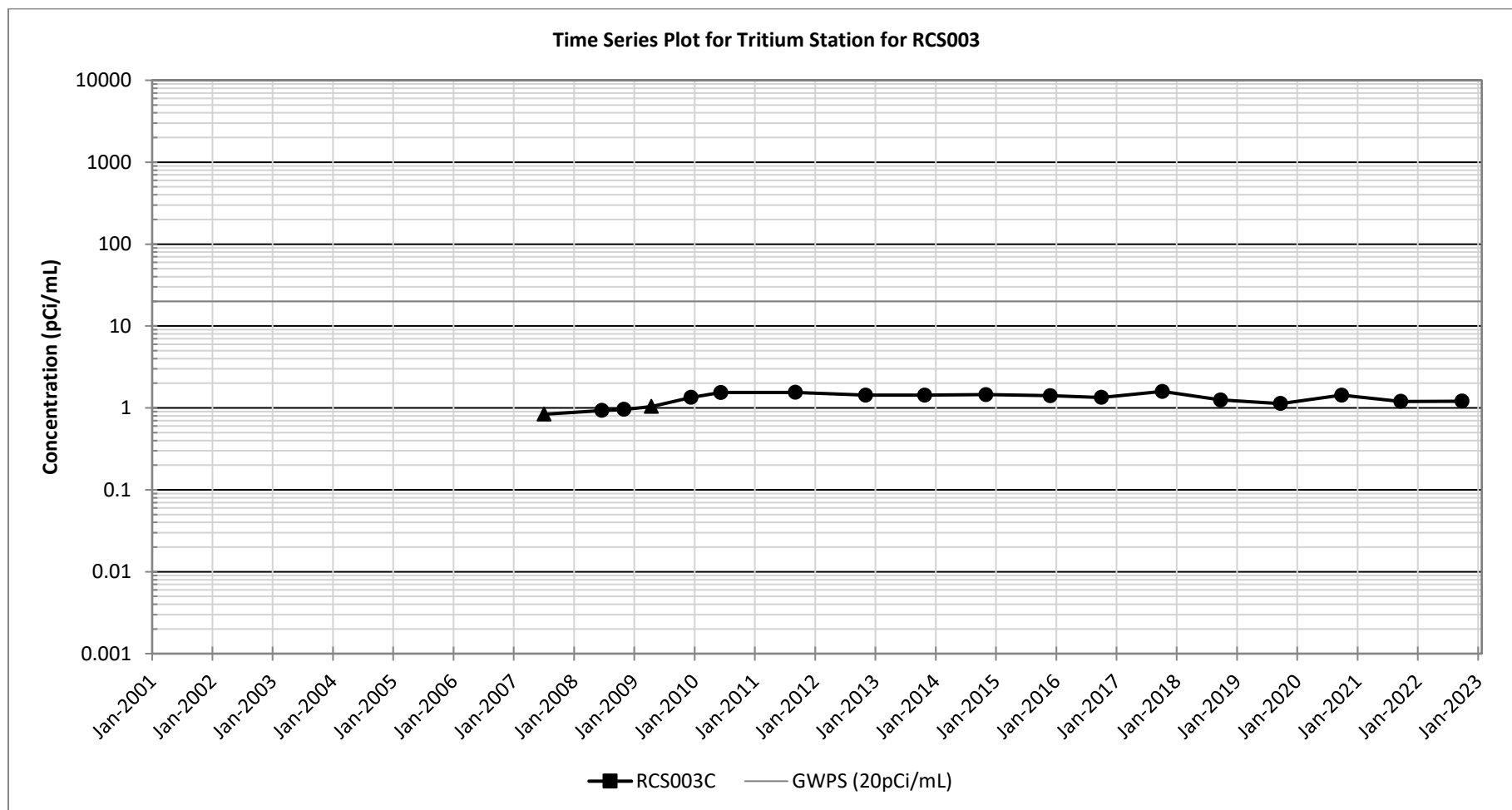


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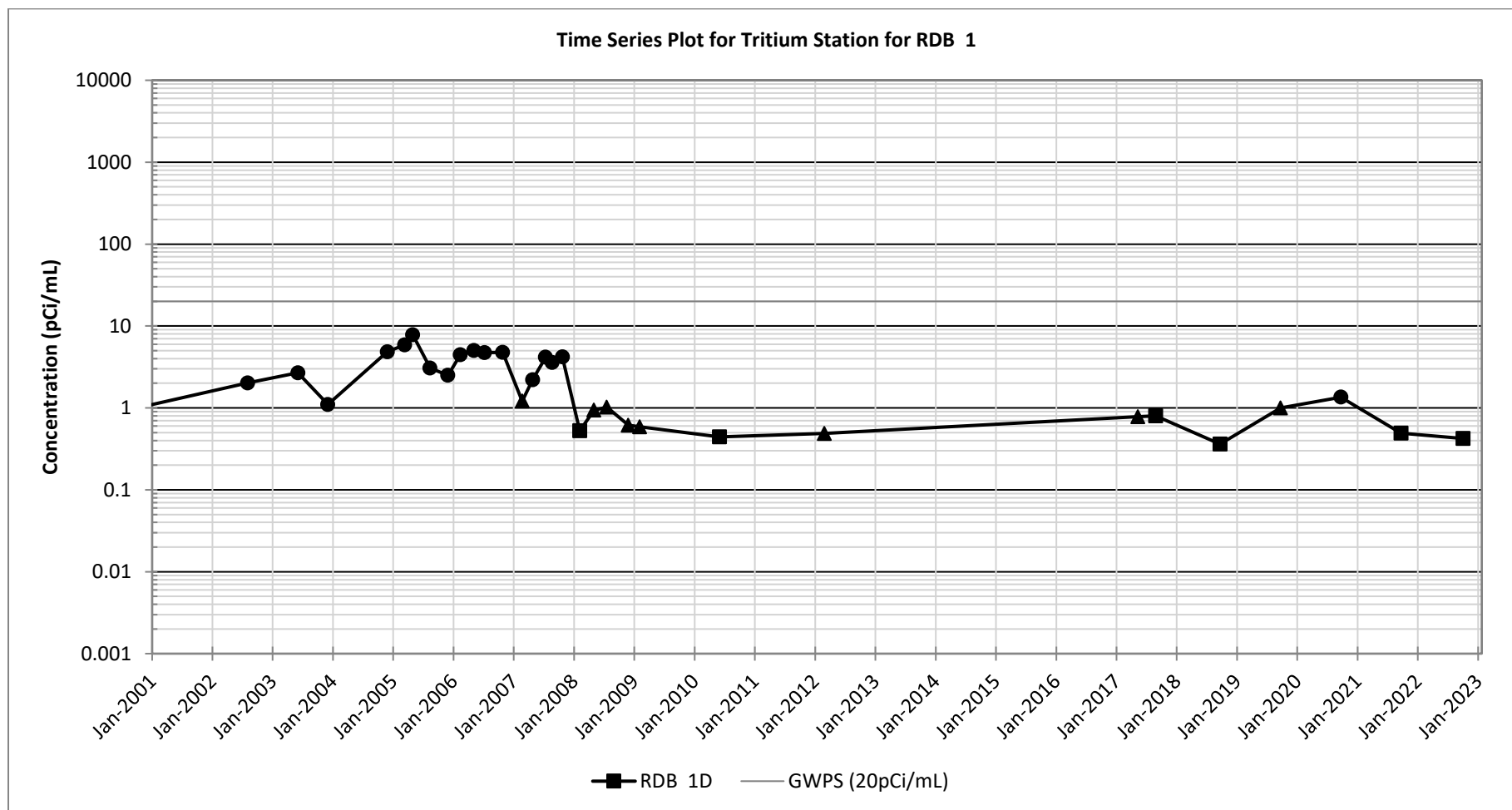


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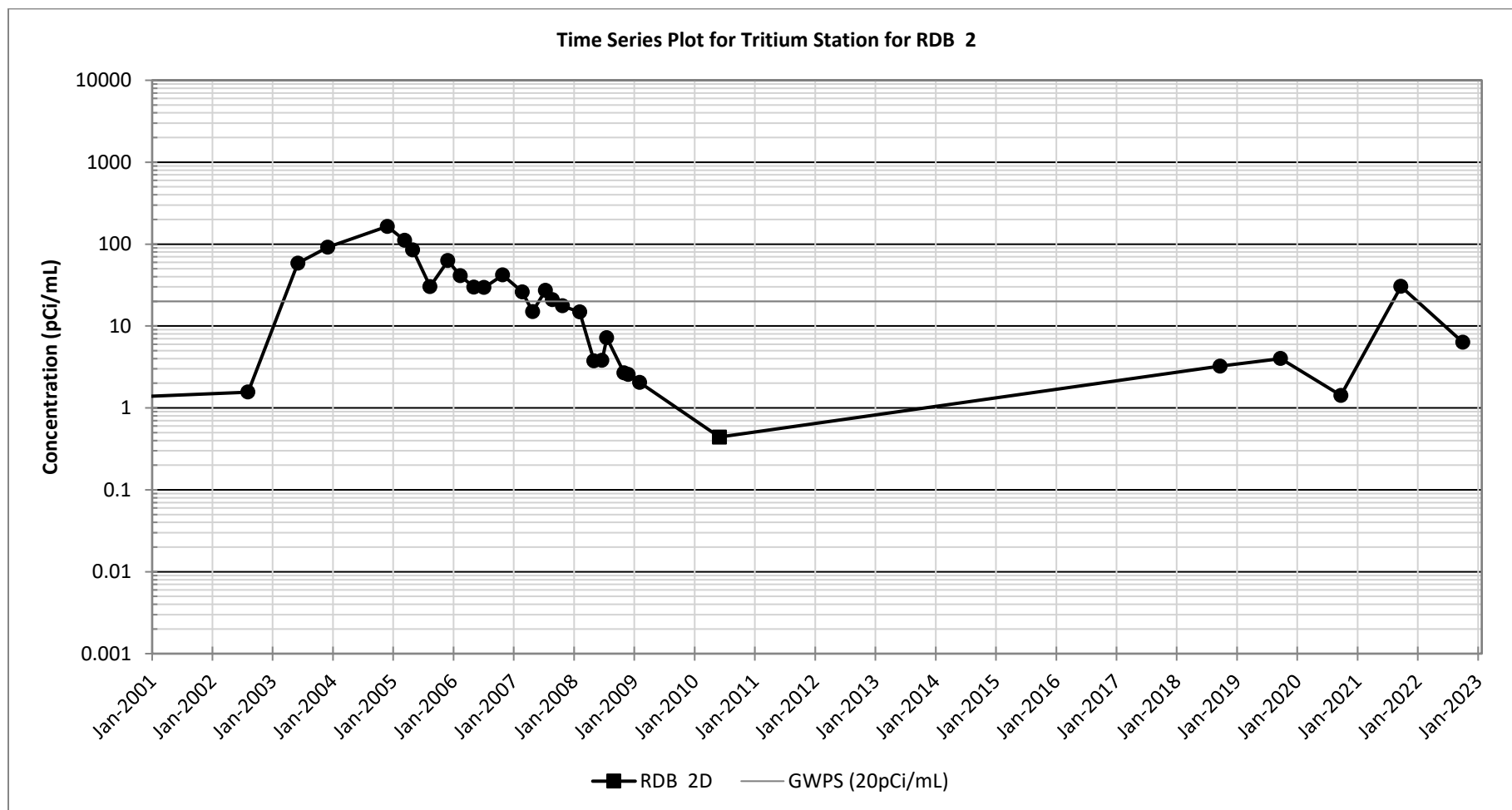


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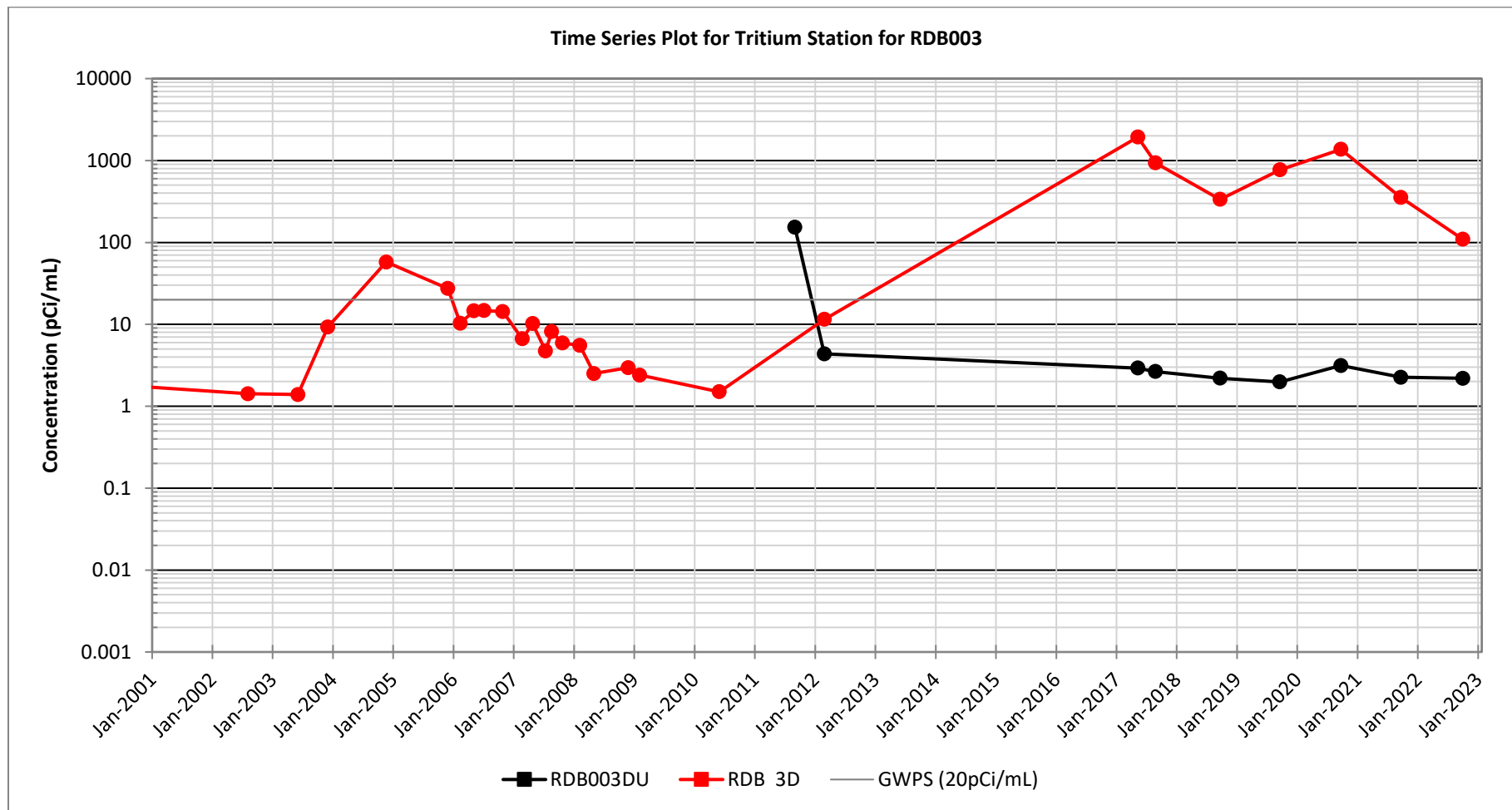


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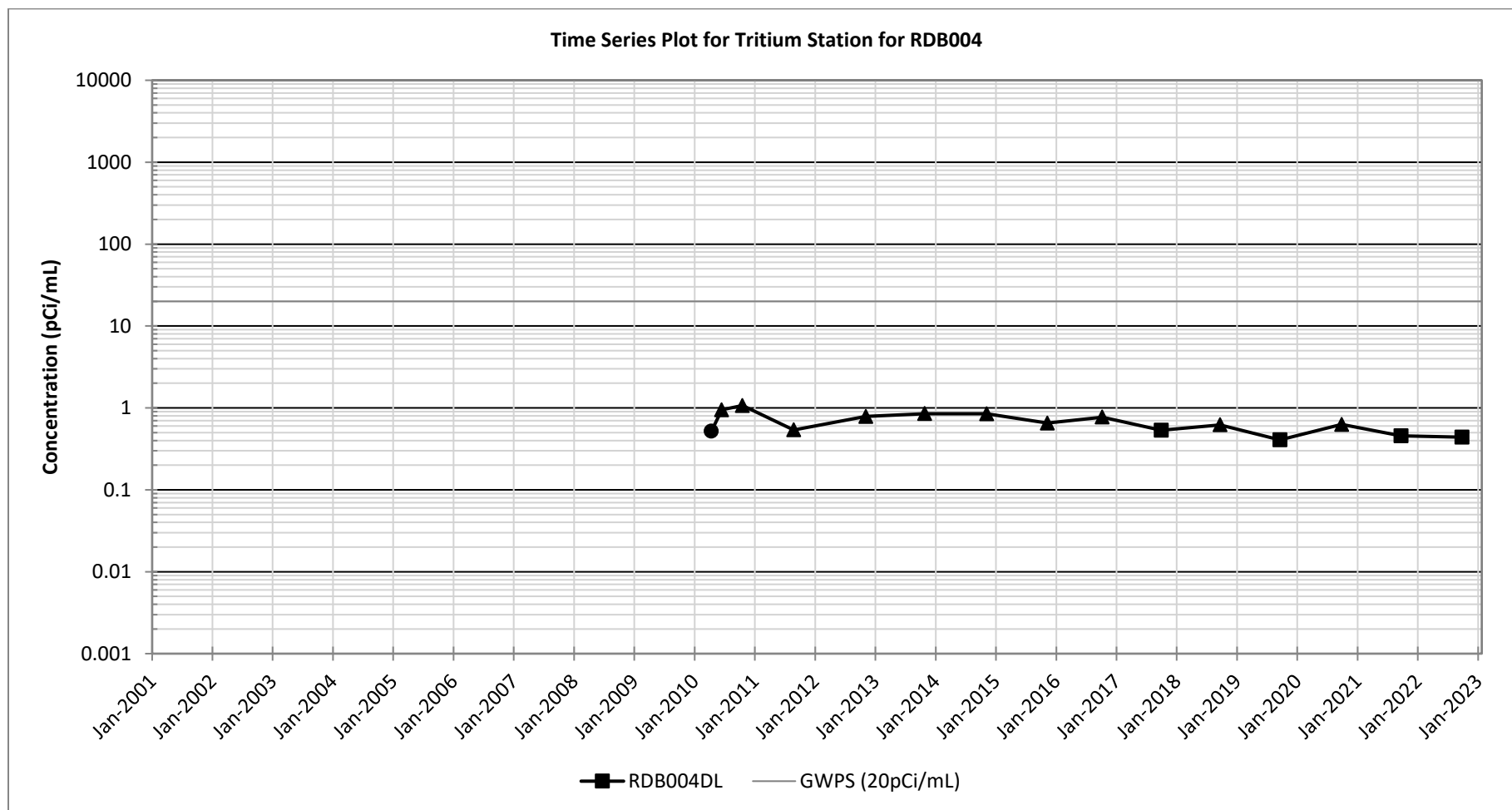


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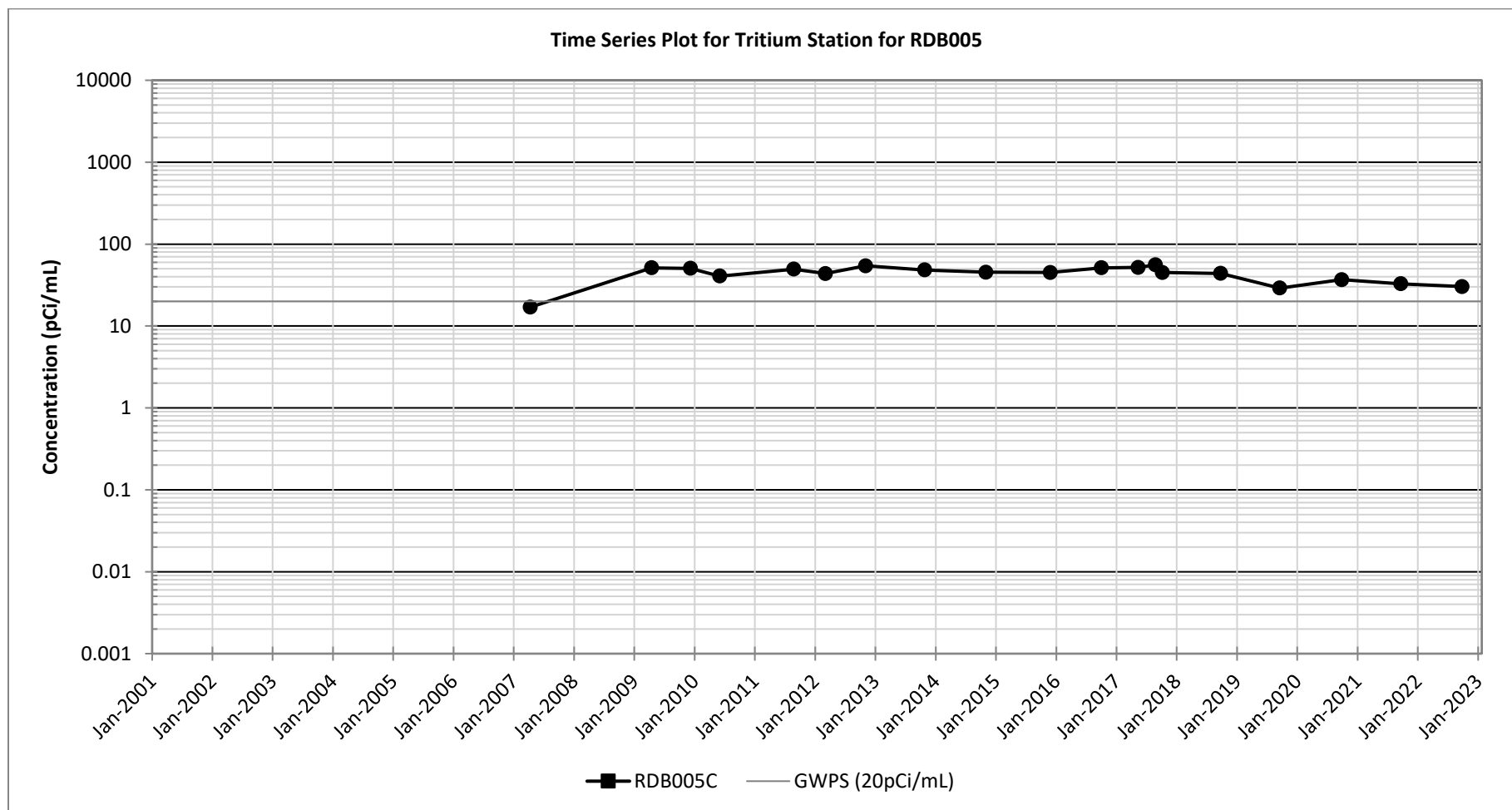


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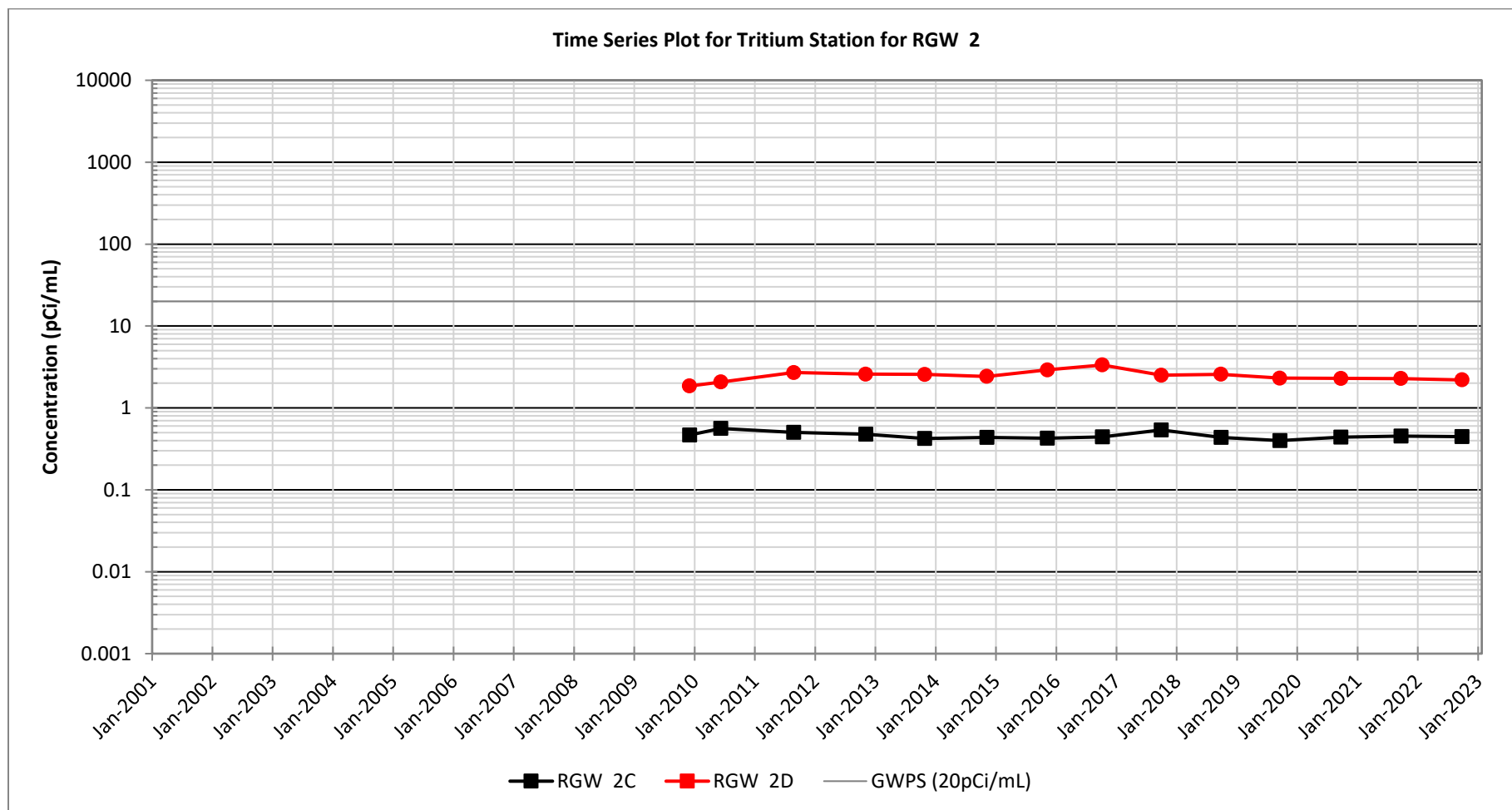


Figure C-57.

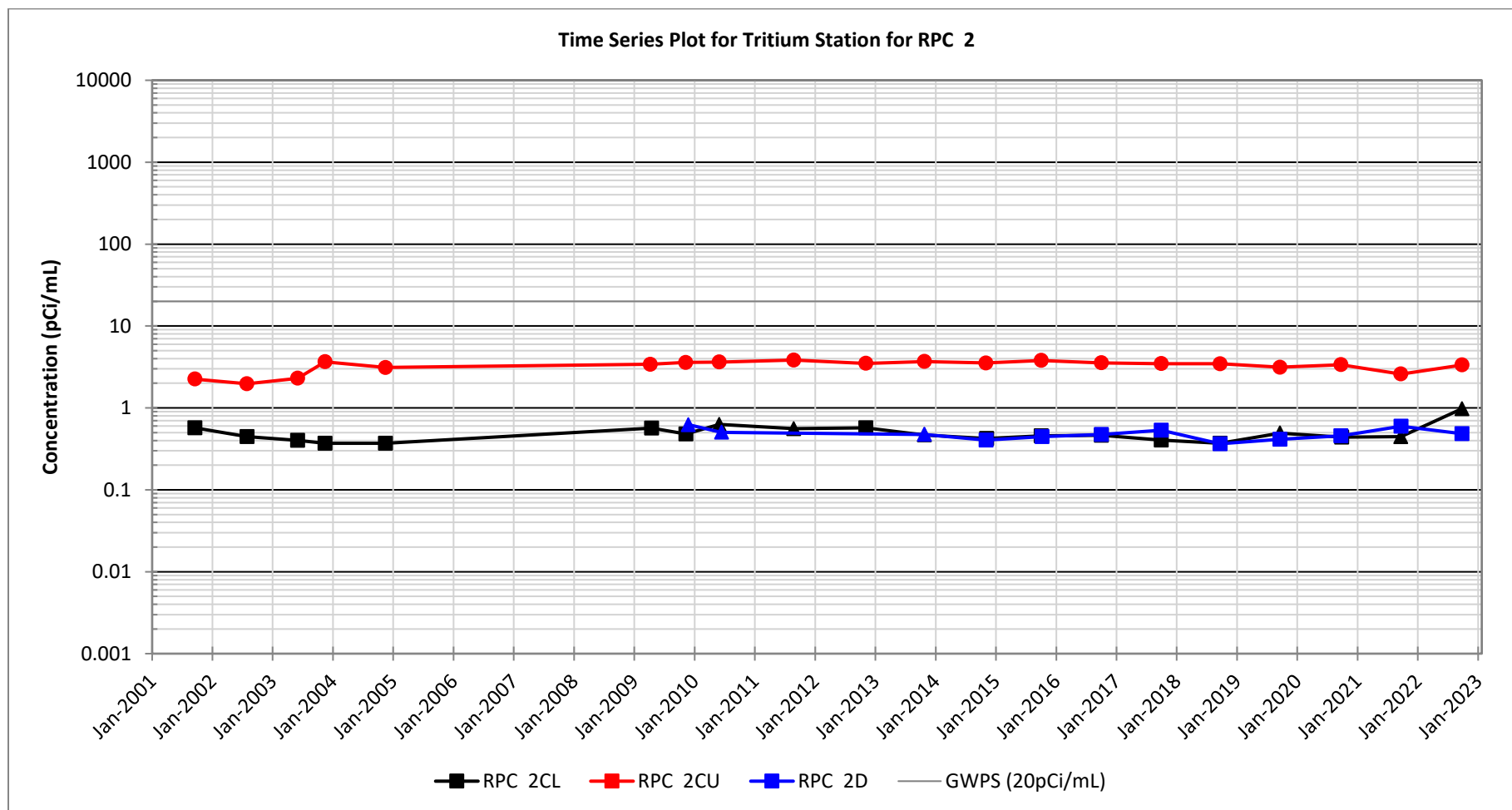


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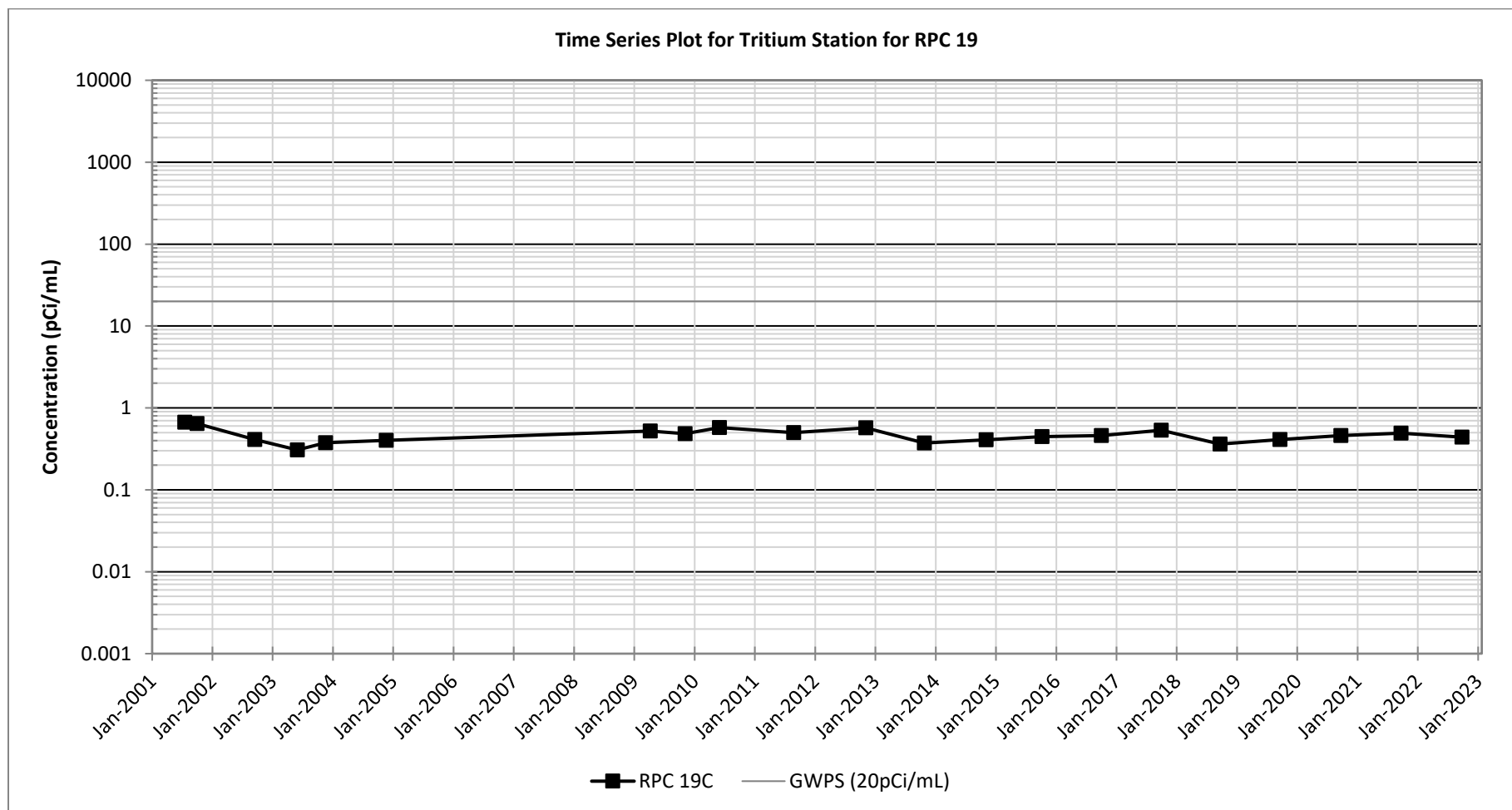


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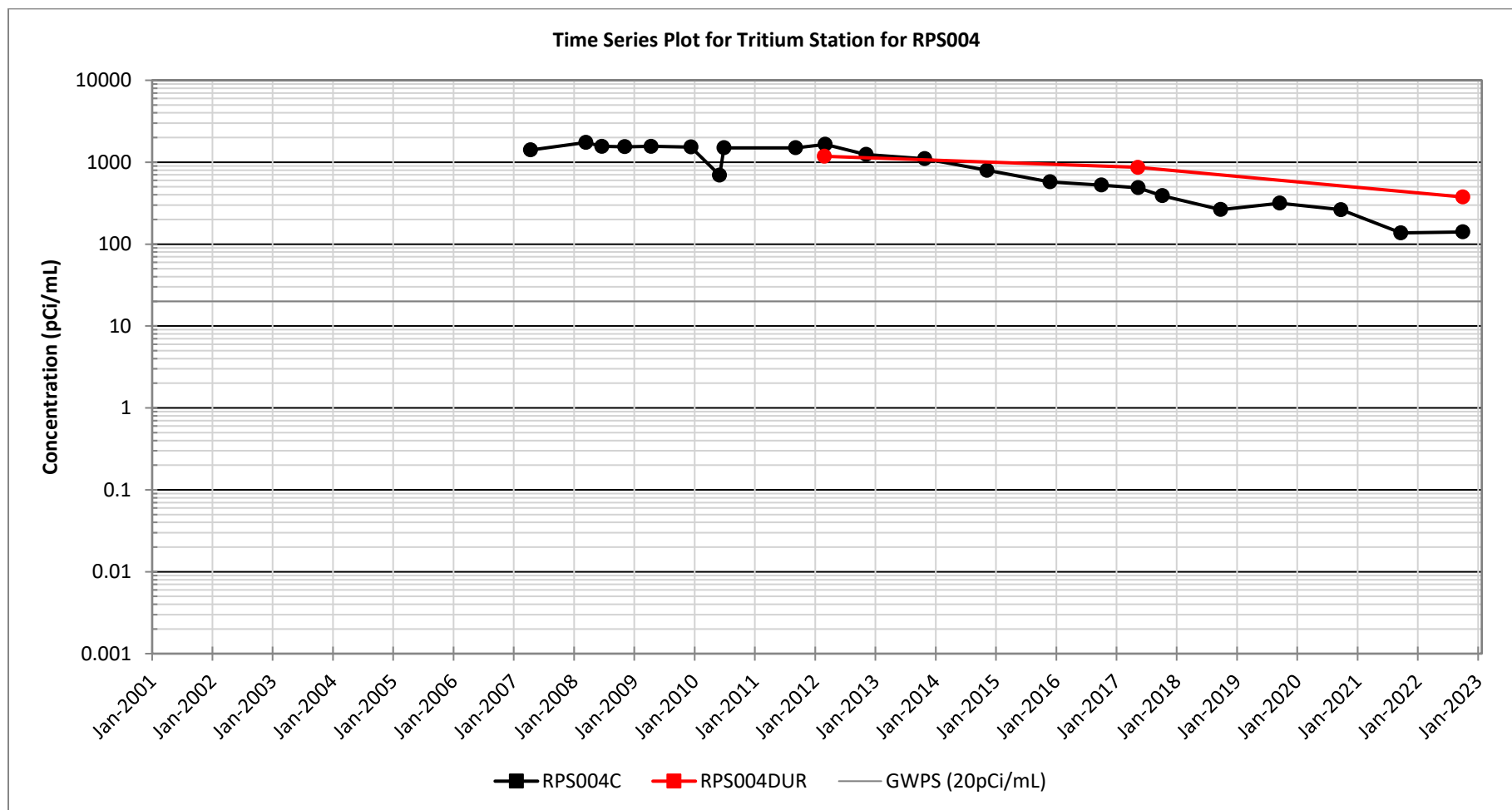


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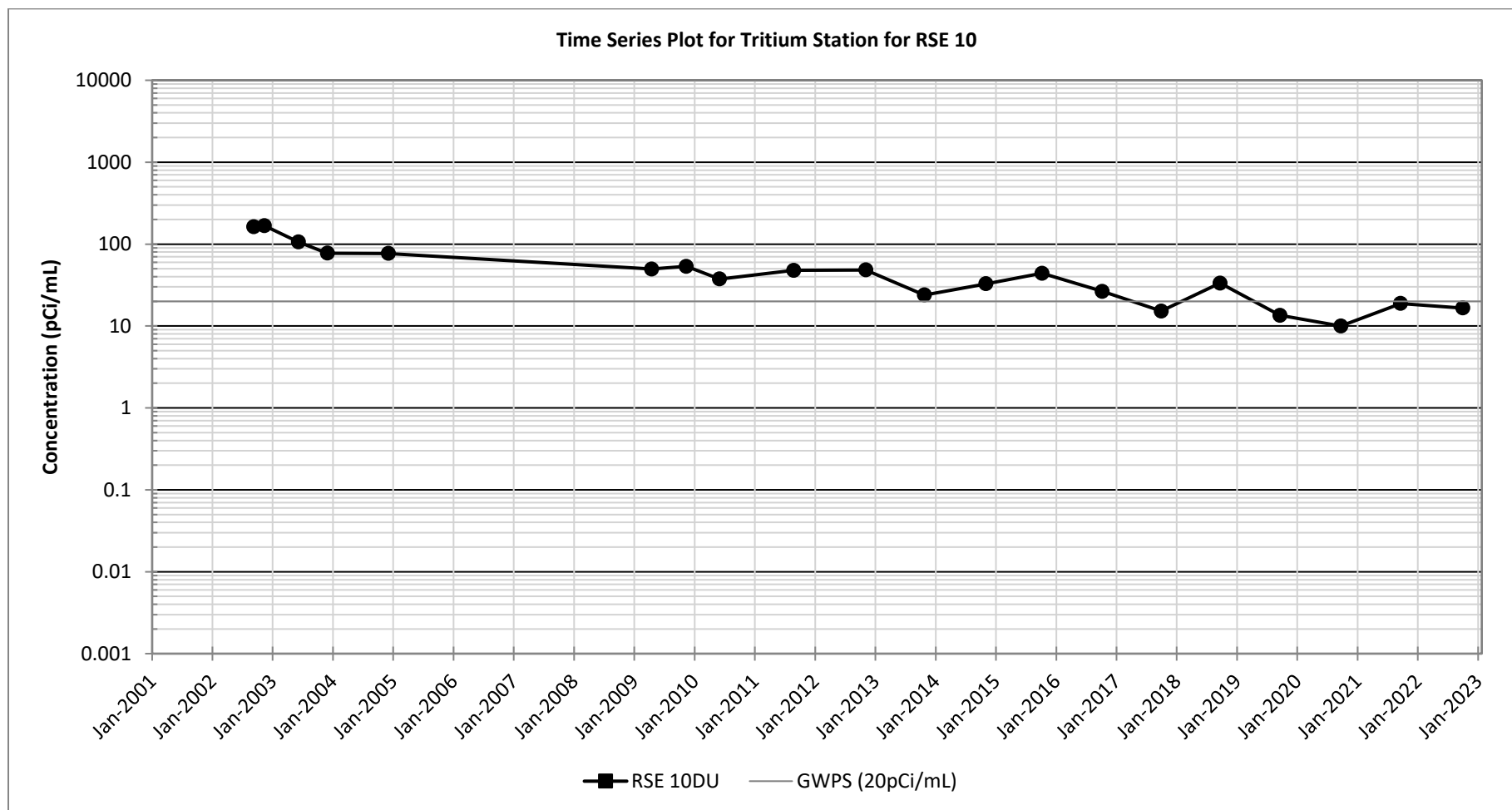


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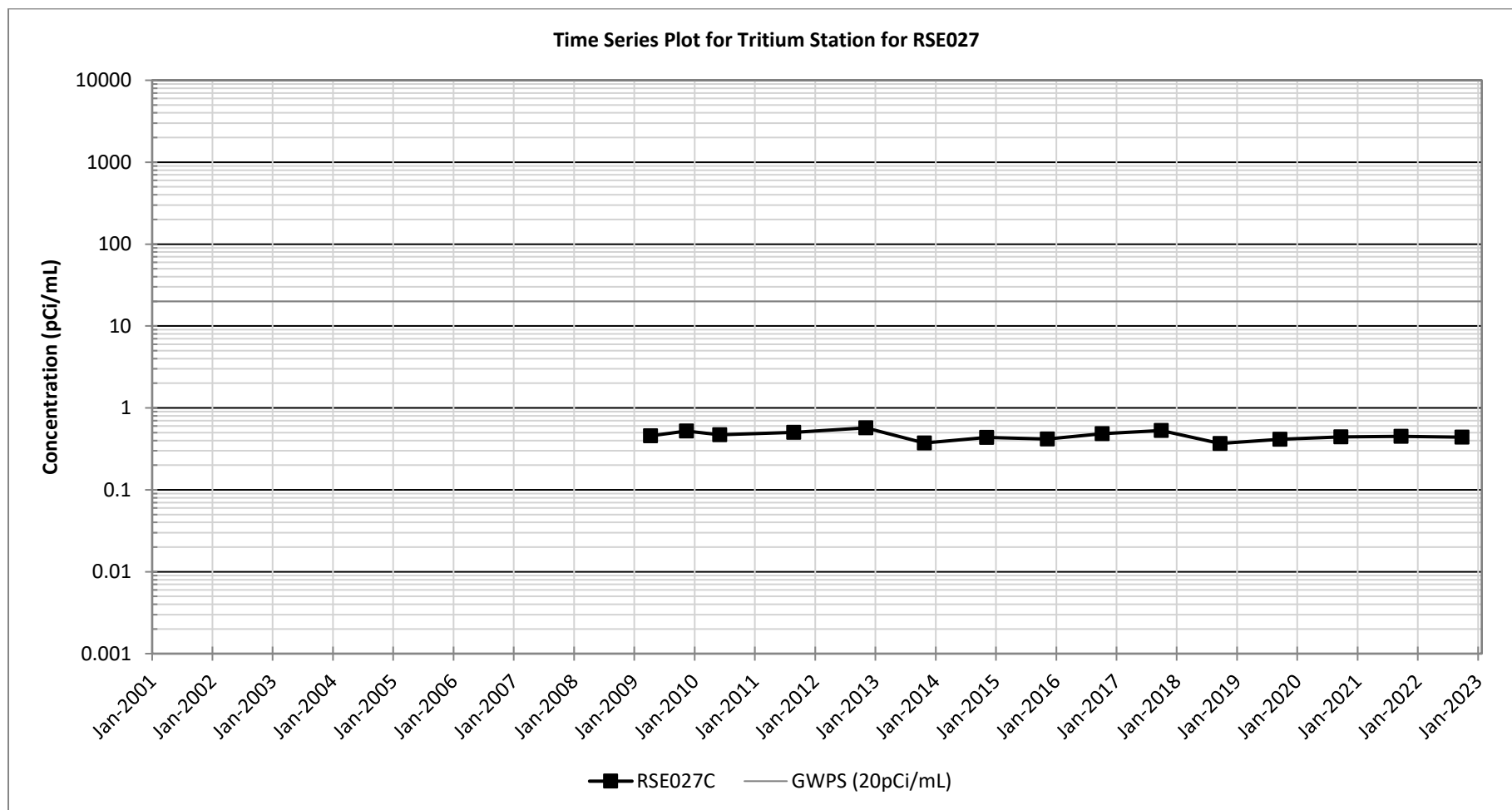


Figure C-62.

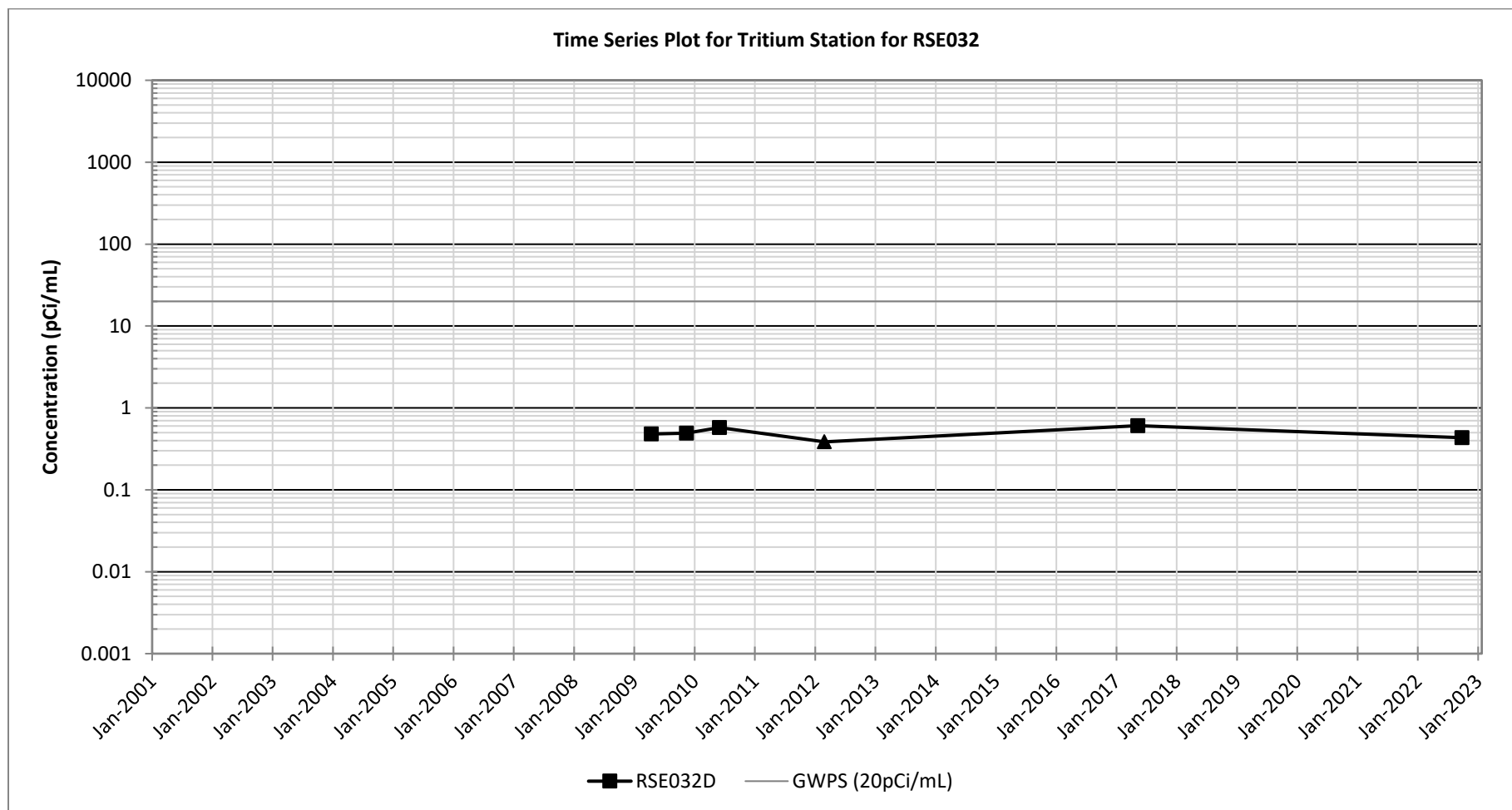


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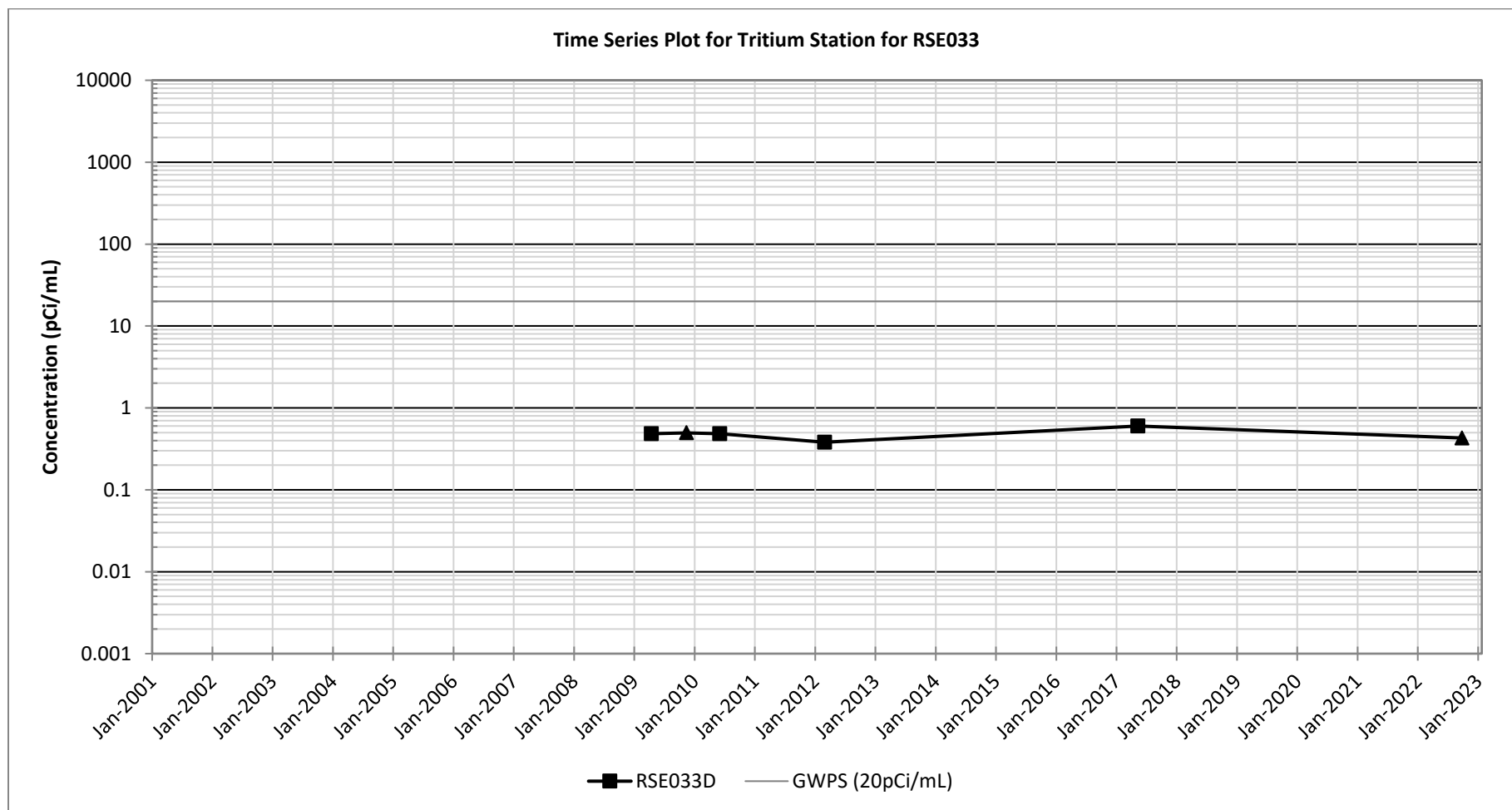
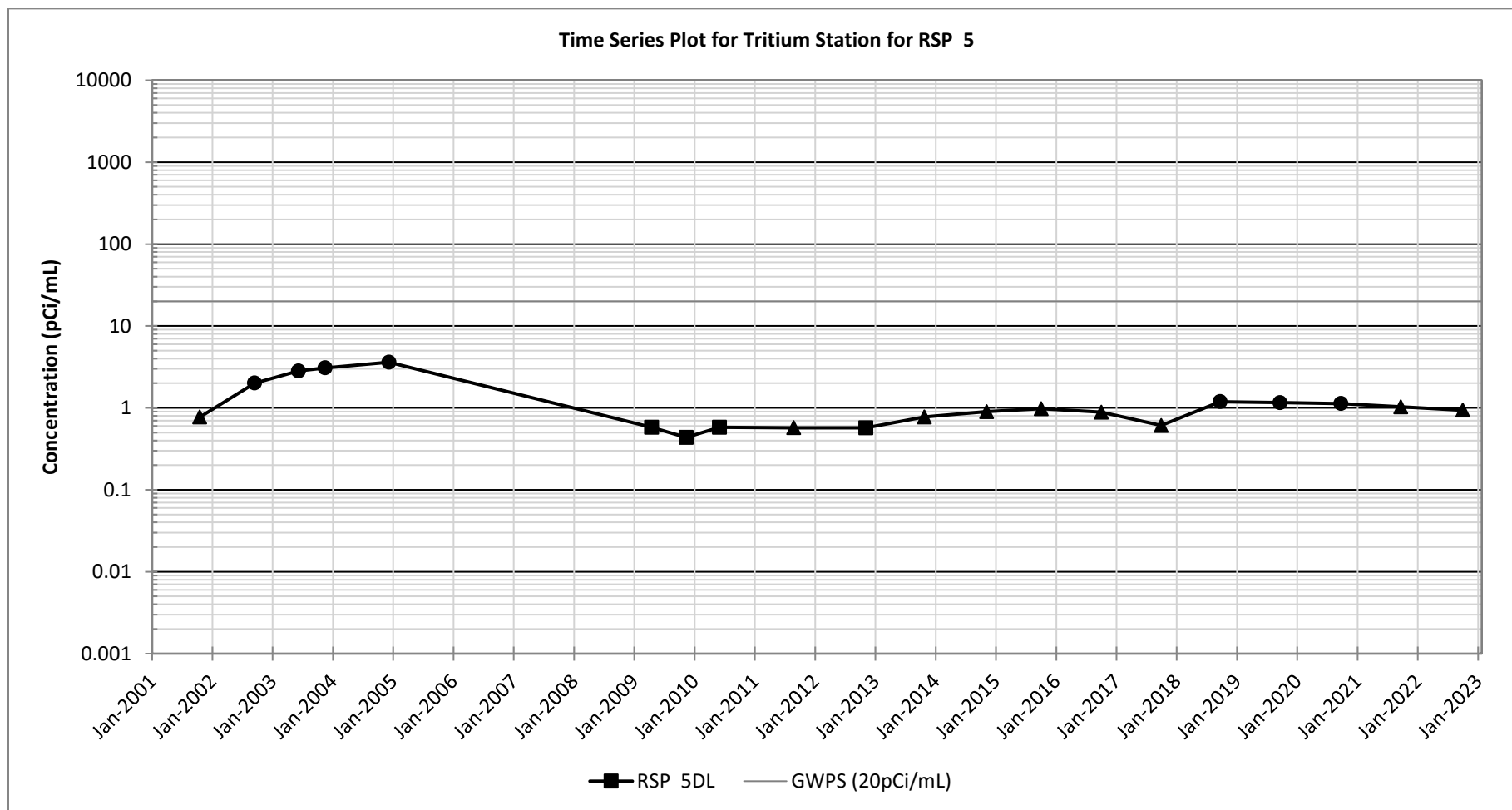


Figure C-64.



**APPENDIX D**

**Tritium and TCE Plume Maps**

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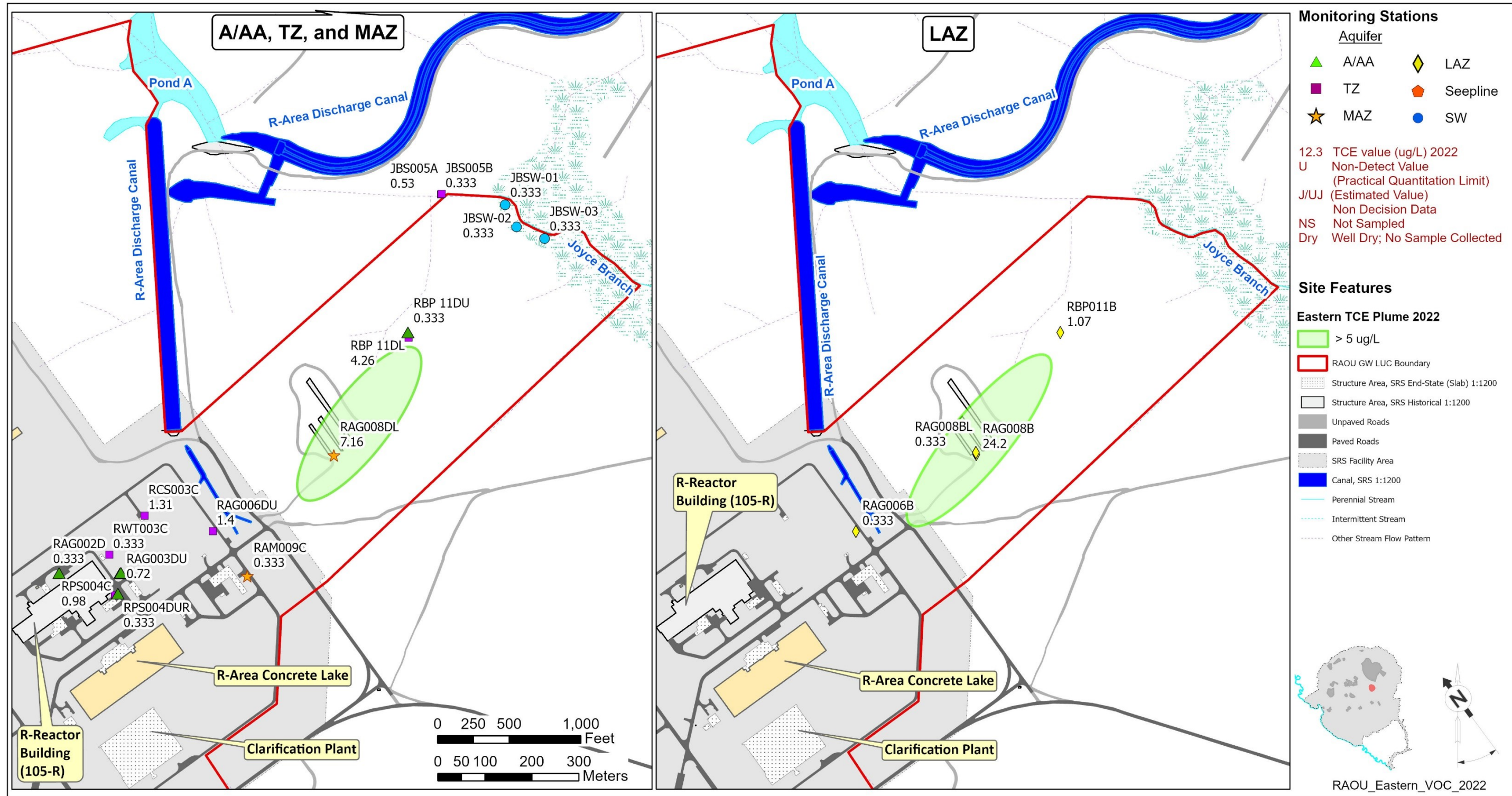


Figure D-1. Eastern VOC Plume 2022

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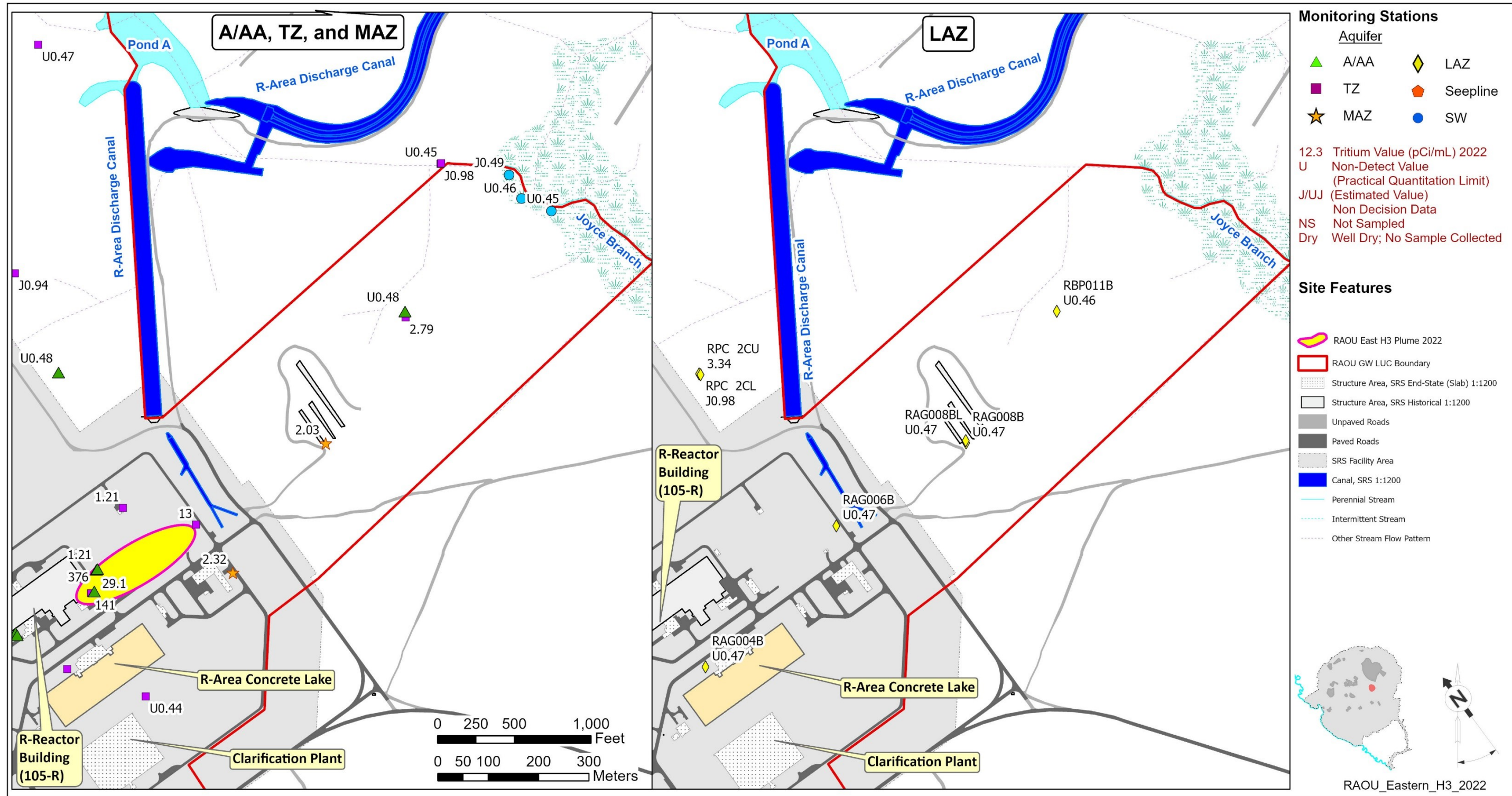


Figure D-2. Eastern Tritium Plume 2022

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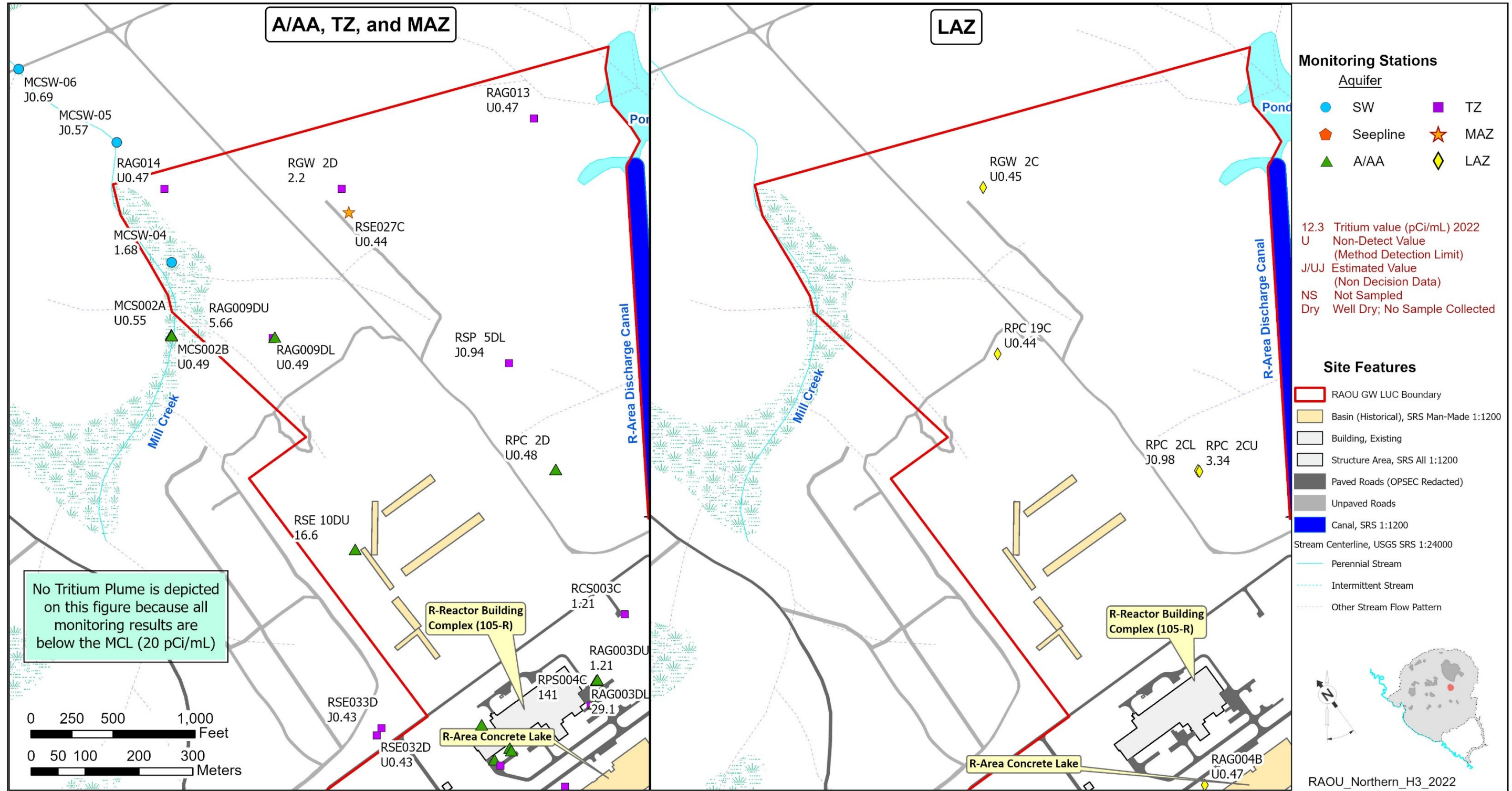


Figure D-3. Northern Tritium Plume 2022

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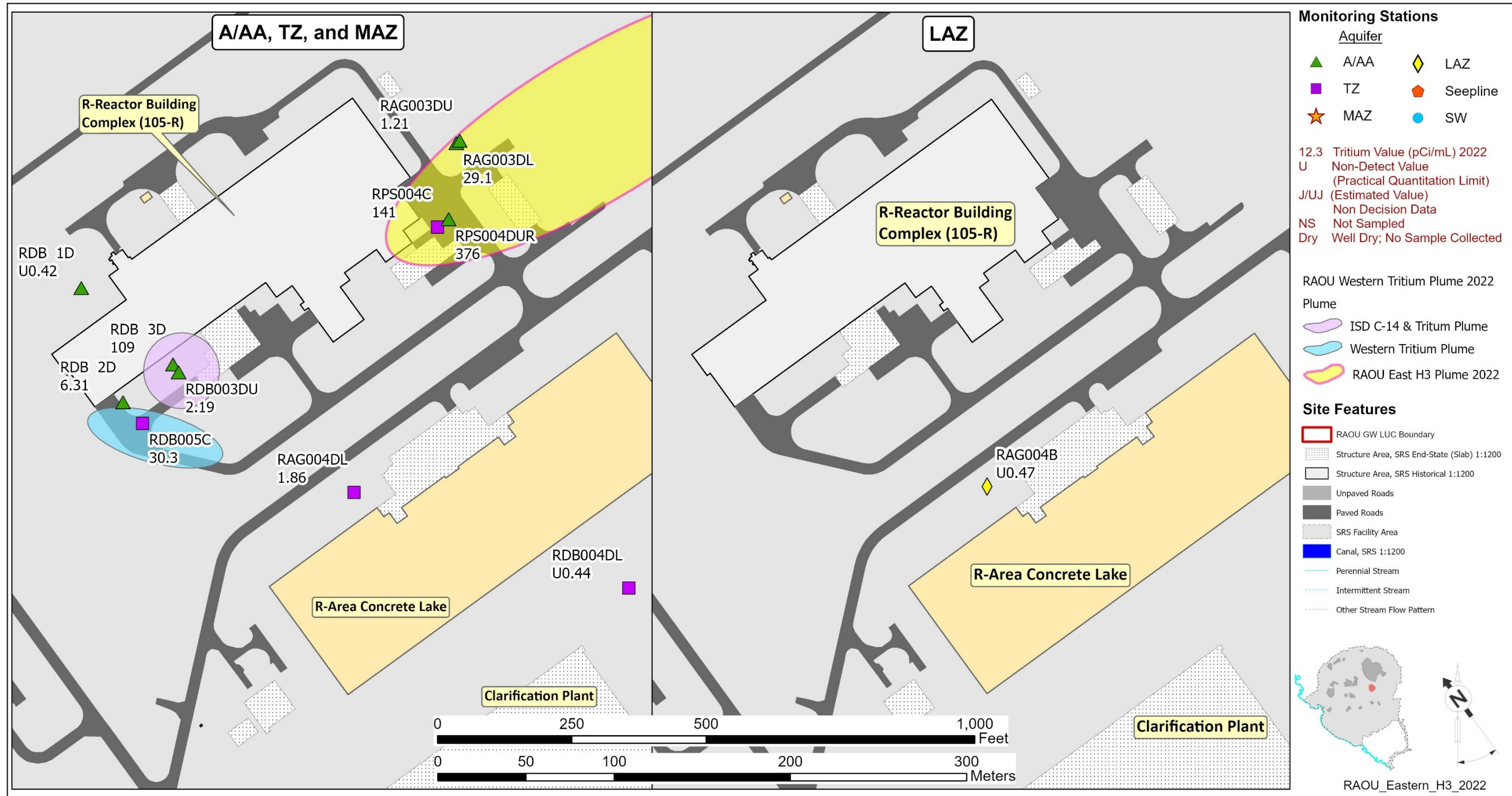


Figure D-4. Western Tritium Plume 2018

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## APPENDIX E

### Potentiometric Surfaces

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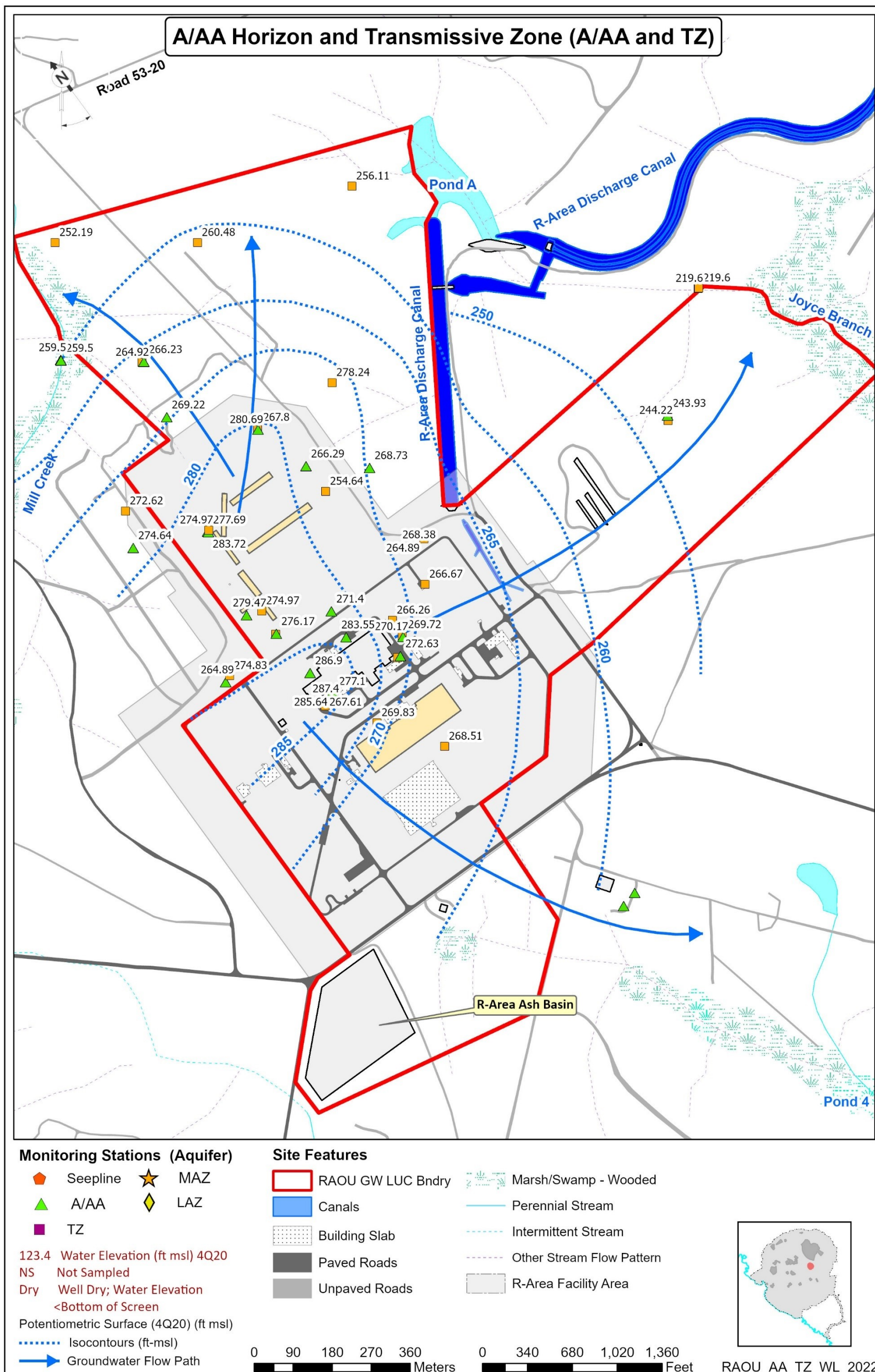


Figure E-1. R-Area TZ Well Water Elevations 2022

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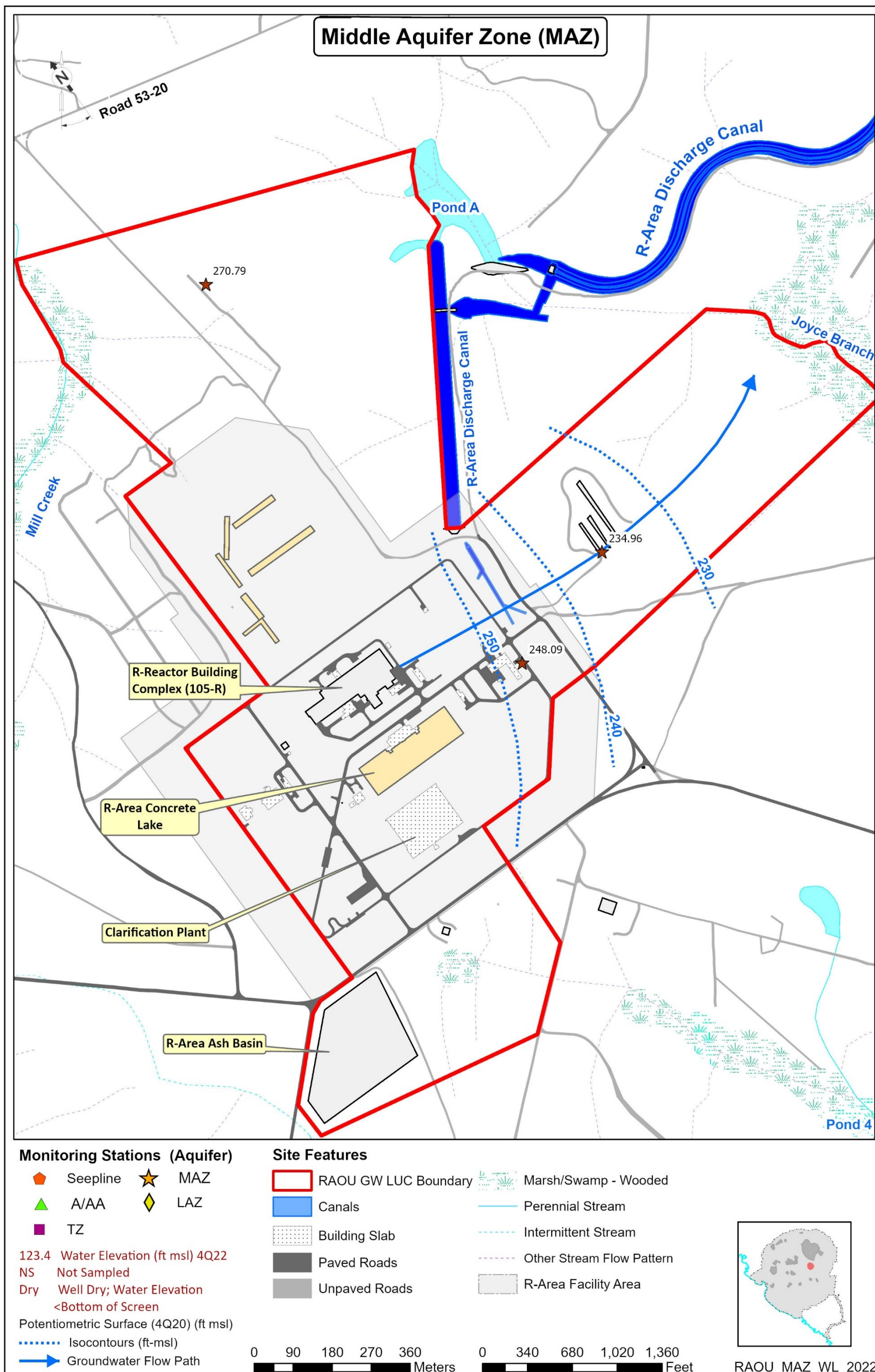


Figure E-2. R-Area MAZ Well Water Elevations 2022

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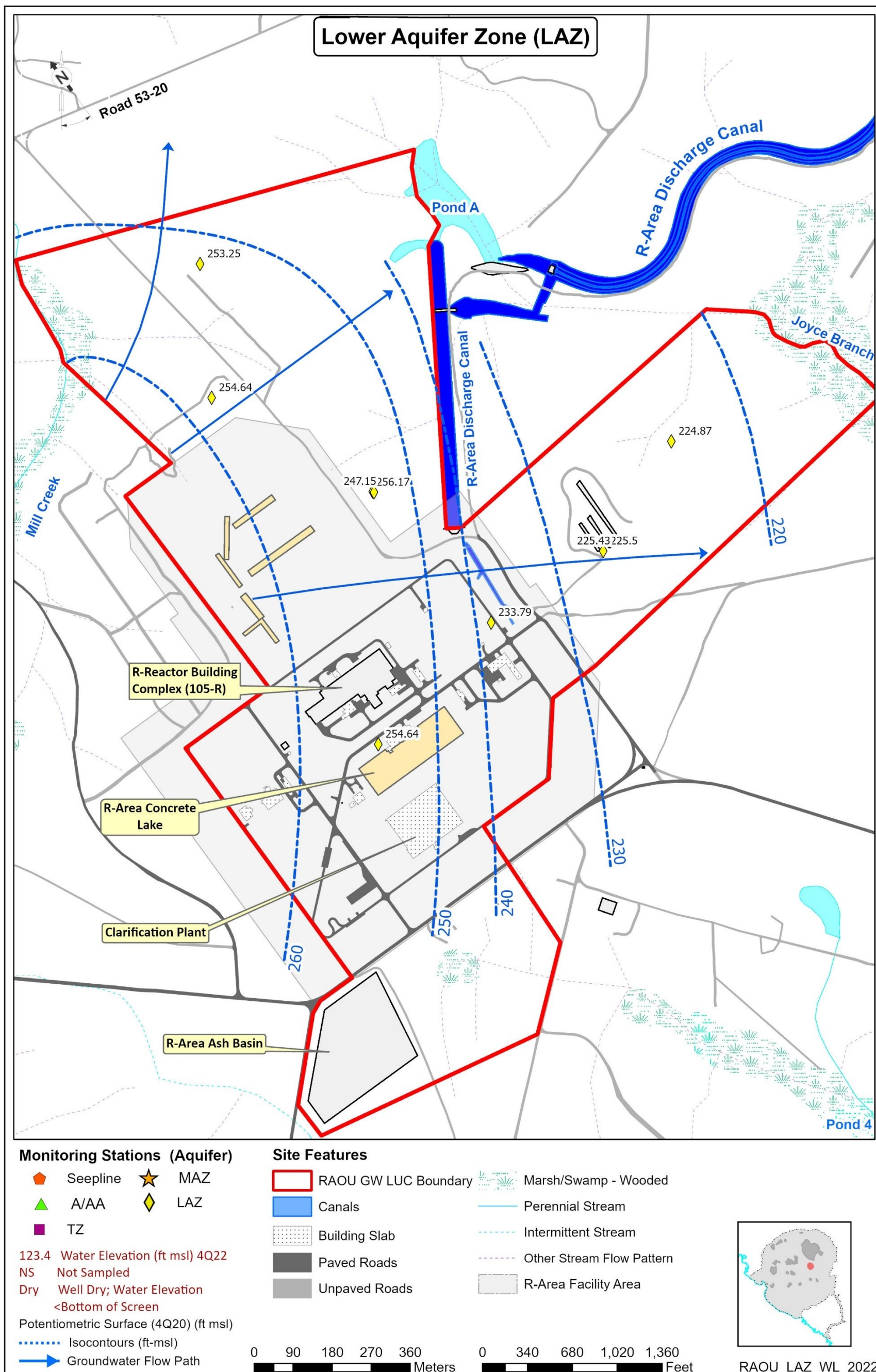


Figure E-3. R-Area LAZ Well Water Elevations 2020

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