Rio Algom Mining LLC

January 29, 2020

Mr. Thomas Lancaster
Nuclear Regulatory Commission
Mail Stop T-A10
Washington, DC 20555-0001

Re: **Ambrosia Lake Facility**
License SUA-1473, Docket No. 40-8905
License Condition #34
Second Half 2019 Groundwater Stability Monitoring Report

Dear Mr. Lancaster:

Pursuant to Condition 34 for License SUA-1473, attached is the Groundwater Stability Monitoring Report for the Second Half of 2019. This report describes the results associated with the groundwater stability monitoring plan established by Amendment #56.

A digital copy of the report is also included in the package.

If you have any questions or need additional information, please call me at (916) 947-7637.

Sincerely,
Rio Algom Mining LLC

Sandra L. Ross, P.G.
Site Manager

Attachment: As stated

cc: NRC – Document Control (certified mail)
NMED, Kurt Vollbrecht (email), Amber Rhuebottom (email)
DOE, Bernadette Tsosie (email)
Mike Schierman, ERG (email)

RIO ALGOM LLC

AMBROSIA LAKE WEST FACILITY

License SUA-1473 Docket 40-8905

Groundwater Stability Monitoring Report

Second Half of 2019

January 29, 2020

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ACRONYMS AND ABBREVIATIONS

ACL	alternate concentration limit
AOD	Assurance of Discontinuance
CAP	corrective action program
EPA	Environmental Protection Agency, United States
ft	foot *or* feet
ft/ft	feet per foot
GPS	groundwater protection standard
gross alpha	gross alpha minus uranium
KD	Dakota Sandstone
License	source material license SUA-1473
LTSM	long-term surveillance and maintenance boundary
mg/L	milligrams per liter
NMED	New Mexico Environment Department
NRC	Nuclear Regulatory Commission
pCi/L	picoCuries per liter
POC	point of compliance
POE	point of exposure
RAML	Rio Algom Mining LLC
Site	Rio Algom Mining LLC – Ambrosia Lake West Facility
TRA	Tres Hermanos A
TRB	Tres Hermanos B

RIO ALGOM MINING LLC
AMBROSIA LAKE WEST FACILITY
GROUNDWATER STABILITY MONITORING REPORT – SECOND HALF 2019

The United States Nuclear Regulatory Commission (NRC) source material license SUA-1473 (the License), Condition 34.D, requires Rio Algom Mining LLC (RAML) to submit semiannual groundwater monitoring reports associated with the facility's groundwater stability monitoring plan established by Amendment 56. Condition 34.D states:

> *Submit, by February 1 and August 1 of each year groundwater monitoring reports to include a minimum of the following: potentiometric surface maps for each aquifer; time vs. concentration plots for all parameters for which ACLs [alternative concentration limits] have been issued, hydrographs for the downgradient most trend well or POE [point of exposure] well in each aquifer, hydraulic gradient calculations, and tabulated analytical data for each ACL parameter for each well.*

1.0 BACKGROUND

RAML's Ambrosia Lake West facility (Site) is located in McKinley County, approximately 24 miles due north of Grants, New Mexico, in the Ambrosia Lake Valley. Uranium milling activities started at the Site in 1957. The waste management structures were Tailings Impoundments 1 and 2, Decantation Pond 3, Evaporation Ponds 4 through 10, and the Section 4 Evaporation Ponds, as shown in **Figure 1**. Tailings Impoundments 1 and 2, along with Pond 3 at the eastern toe of Tailings Impoundment 1, were built in 1958 to accept decanted tailings liquids. Tailings were first produced at the Site in November 1958. In 1976, RAML diverted the natural course of the Arroyo del Puerto east of Ponds 4, 5, and 6, and lined Ponds 9 and 10. The Section 4 Evaporation Ponds were constructed in 1978. The solids fraction of the tailings was disposed of through a slurry transfer system to the tailings impoundments, while the liquids fraction was transferred to the evaporation ponds. Evaporation pond residues were placed in Tailings Impoundments 1 and 2 prior to final reclamation. All the aforementioned tailings impoundments and ponds were unlined, except Ponds 9, 10, and the Section 4 Ponds. Seepage from the tailings impoundments and Evaporation Ponds 3 through 6, along with seepage from unrelated mining and milling operations, saturated and impacted the alluvium of the Arroyo del Puerto. Seepage from the tailings impoundments and Evaporation Ponds 7 and 8 recharged and impacted the Tres Hermanos B sandstone within the Mancos Formation shale, and the Dakota Sandstone (KD), which underlies the Mancos Formation.

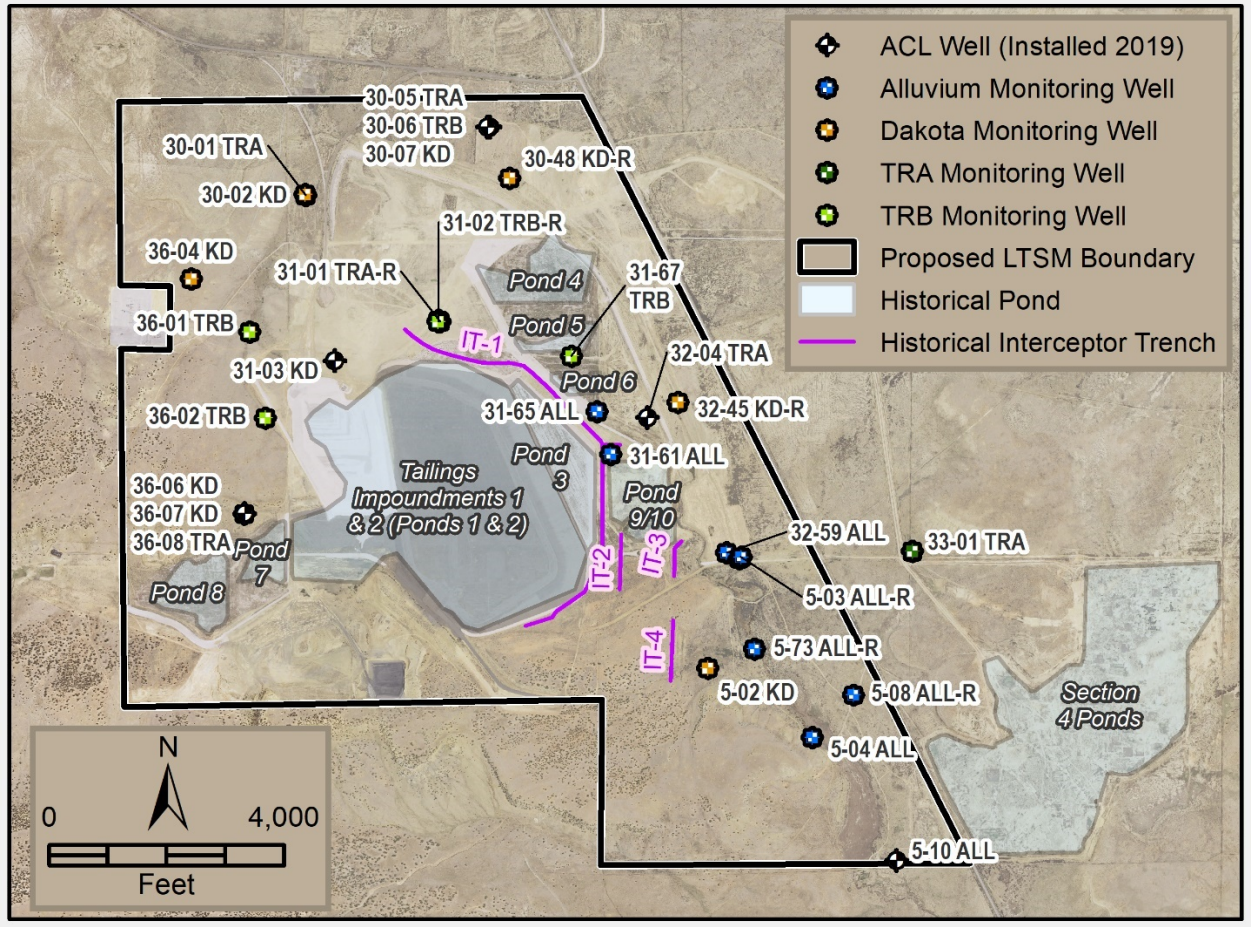


Figure 1. Monitoring Well Network with Historical Site Features.

Consequently, in 1983, RAML entered into an Assurance of Discontinuance (AOD) with the State of New Mexico Environmental Improvement Division (currently the New Mexico Environment Department [NMED]) to minimize the future impact of mill tailings solutions seepage on groundwater. The approved AOD remedial action required the construction and maintenance of interceptor trench IT-1 and the cessation of discharges to unlined Ponds 4 through 8. These ponds were taken out of service in 1983. In the late 1990s, RAML added interceptor trenches IT-2, IT-3, and IT-4 south of Pond 10 to collect seepage potentially missed by IT-1 (**Figure 1**).

In 1986, after the State of New Mexico relinquished its licensing authority over uranium mill activities, the NRC reasserted its jurisdiction at the Site and required that the Site begin a groundwater detection monitoring program. Data from this program were the basis for the groundwater protection standards (GPSs) established for the Site by NRC, and a corrective action program (CAP) for the groundwater was developed based on this information. The CAP required pumping, treating, and discharging treated groundwater into the Arroyo del Puerto. The treated groundwater management was implemented so that this water would sweep through the alluvium, creating a hydraulic barrier between the tailings ponds and the Arroyo del Puerto while flushing

existing impacted groundwater toward the interceptor trench where it was then captured and disposed of into Tailings Impoundment 1. RAML implemented the CAP beginning in the mid-1980s. The CAP and its requirements to pump and treat were removed when the alternate concentration limit (ACL) petition was granted by the NRC in 2006.

Mining and milling operations in the area have had two notable hydrologic effects: (1) creation of a saturated zone in the alluvium and (2) creation of a cone of depression in bedrock aquifers due to dewatering of underground mines. The saturated zone in the alluvium has continued to decrease since the mine dewatering, milling processes, and the CAP were terminated.

2.0 SECOND HALF 2019 ACTIVITIES

Groundwater monitoring and associated activities at the Site during the second half of 2019 were completed in accordance with the requirements of Condition 34 of SUA-1473. The monitoring well network was designed to track and assess groundwater impacts between the tailings impoundment and the point of exposure (POE), which is currently the proposed long-term surveillance and maintenance boundary (LTSM) for the alluvium, Tres Hermanos A, Tres Hermanos B, and the Dakota Sandstone. The current ACLs for the Site are presented in **Table 1** below.

Table 1. Rio Algom Mining – Ambrosia Lake West Operation Alternate Concentration Limits.

Parameter	Dakota Sandstone	Tres Hermanos A	Tres Hermanos B	Alluvium
U-nat (mg/L)	1.6	No ACL	1.6	23
Th-230 (pCi/L)	945	945	945	13,627
Ra-226 and -228 (pCi/L)	218	218	218	3,167
Pb-210 (pCi/L)	88	88	88	1,274
Gross Alpha (pCi/L)	No ACL	No ACL	No ACL	8,402
Molybdenum (mg/L)	No ACL	No ACL	No ACL	176
Nickel (mg/L)	6.8	No ACL	6.8	98
Selenium (mg/L)	No ACL	No ACL	No ACL	49
Chloride (mg/L)	3,200	1,070	2,810	7,110
Nitrate (mg/L)	22.8	9.2	7.7	351
Sulfate (mg/L)	6,480	2,584	4,760	12,000
Total Dissolved Solids (mg/L)	14,100	6,400	11,700	26,100

mg/L = milligrams per liter
pCi/L = picoCuries per liter

Attachments to this report present the following information as outlined in Condition 34.D of SUA-1473: **Appendix 1** contains the analytical data for the Dakota Sandstone, Tres Hermanos A, Tres Hermanos B, and alluvial units for the second half of 2019. **Appendix 2** contains the time versus concentration plots for the ACL parameters for the Dakota Sandstone, Tres Hermanos A, Tres Hermanos B, and alluvial units. **Appendix 3** contains the hydrographs for the most downgradient monitoring well for the Dakota Sandstone, Tres Hermanos A, Tres Hermanos B, and alluvial units.

Appendix 4 contains monitoring well network and potentiometric surface maps for the Dakota Sandstone, Tres Hermanos A, Tres Hermanos B, and alluvial units during the second half of 2019. The monitoring well network is also illustrated on **Figure 1**.

2.1 Improvements to the Monitoring Program

Eight additional monitoring wells (**Figure 1**) were installed between July and November 2019 in accordance with the Data Collection Work Plan in Support of Additional ACLs (INTERA, 2017). Groundwater monitoring of the new wells began in December 2019. RAML will sample the new wells quarterly for eight consecutive quarters, allowing water quality to stabilize before using the data to evaluate potential additions or revisions to the ACLs. RAML will include laboratory and field data from the new wells in a separate appendix in future semiannual reports.

The electric submersible pump in monitoring well 17-01 KD obstructs access to the water column, preventing water level measurements using a water level meter. During the second half of 2019, a pressure transducer was installed in monitoring well 17-01 KD to record water level measurements. Water level measurements for the NRC monitoring wells are included in **Appendix 1**.

As discussed in previous semiannual monitoring reports, the screened intervals in wells 30-02 KD and 30-01 TRA no longer intercept groundwater because of a declining trend in water levels. Therefore, neither well provides meaningful water level or water quality data. RAML will present a justification for removing both wells from the groundwater monitoring program in an upcoming request for a License amendment.

3.0 DATA EVALUATION

As a component of the ACL approval process, NRC not only established ACLs for specific parameters, but also maintained the GPSs for those constituents for which ACLs were not proposed. Data collected during the second half of 2019 were compared to ACLs and GPSs. Notable results are described in detail in the following sections.

3.1 Dakota Sandstone

Analytical results from the Dakota Sandstone groundwater monitoring well network are tabulated in **Appendix 1, page 1-1** and presented in time series plots for the ACL parameters in **Appendix 2, pages 2-1 through 2-24.** A hydrograph for the most downgradient Dakota Sandstone well, 30-02 KD, is included in **Appendix 3, page 3-2**. Dakota Sandstone potentiometric surface elevation is displayed in **Appendix 4, page 4-2** and was used to calculate a hydraulic gradient of 0.028 feet per foot (ft/ft) during the second half of 2019.

Dakota Sandstone monitoring wells 36-06 KD and 32-45 KD-R have been sampled monthly due to exceedances of GPSs for beryllium, cadmium, and gross alpha in 36-06 KD, and molybdenum and gross alpha in monitoring well 32-45 KD-R. The results of monthly sampling are discussed below. Groundwater sampling results from Dakota Sandstone monitoring wells 17-01 KD and 30-48 KD-R did not reveal any exceedances of ACLs or GPSs in the second half of 2019. Monitoring well 30-02 KD did not contain enough water for sample collection.

3.1.1 36-06 KD

Monitoring well 36-06 KD has been sampled monthly for beryllium, cadmium, gross alpha, and uranium. Results are discussed below.

3.1.1.1 Beryllium and Cadmium

Elevated beryllium concentrations were identified in 2006 in Dakota Sandstone point of compliance (POC) monitoring well 36-06 KD. As a result of this condition, RAML submitted a proposed CAP on January 15, 2007, to address the beryllium concentrations present within monitoring well 36-06 KD. This CAP was approved by NRC on April 30, 2007. RAML performed monthly sampling of well 36-06 KD for beryllium so that additional data would be available. Water levels in 36-06 KD appear to correlate with decreasing beryllium concentrations. Beryllium concentrations continue to decrease and have remained below the GPS during the second half of 2019 (**Table 2** and **Figure 2**).

Table 2. Second Half of 2019 Analytical Summary for Beryllium and Cadmium in Monitoring Well 36-06 KD.

Date	Beryllium (mg/L)	Cadmium (mg/L)
GPS (mg/L)	**0.01**	**0.01**
7/22/2019	0.0065	0.0054
8/1/2019	0.00436	0.00314
9/4/2019	0.00561	0.00377
10/21/2019	0.00598	0.0047
11/1/2019	0.00646	0.00474
12/4/2019	0.00676	0.00476

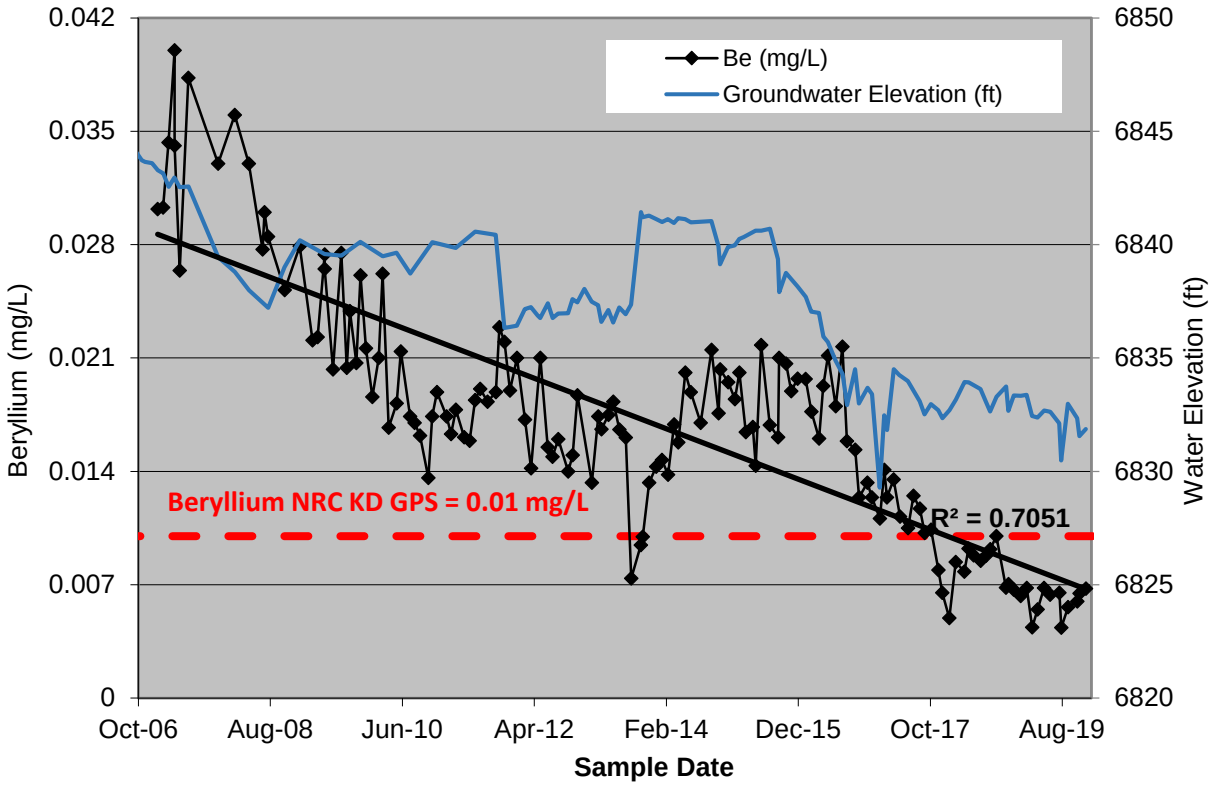


Figure 2. Beryllium Concentrations in Dakota Sandstone Monitoring Well 36-06 KD.

Cadmium concentrations in the samples of groundwater from monitoring well 36-06 KD exceeded the GPS of 0.01 milligrams per liter (mg/L) during several sampling rounds, beginning in November 2007 (**Figure 3**). Cadmium concentrations in monitoring well 36-06 KD follow a pattern that is very similar to both uranium (**Appendix 2**, **page 2-22**) and beryllium (**Figure 2**) concentrations in the same well. Concentrations of these constituents are sensitive to changes in pH and appear to correlate with decreasing water levels. As with uranium and beryllium, cadmium concentrations continue to exhibit an overall decreasing trend. Cadmium concentrations remained below the GPS throughout the second half of 2019 (**Table 2** and **Figure 3**).

Beryllium and cadmium concentrations have remained below their GPSs since 2016 and 2017, respectively (**Figure 2** and **Figure 3**). Therefore, as discussed with NRC, monthly monitoring for beryllium and cadmium is no longer warranted and will be discontinued during the first quarter 2020 (T. Lancaster, personal communication, January 14, 2020). Beryllium and cadmium will continue to be monitored semiannually in accordance with Condition 34 of SUA-1473.

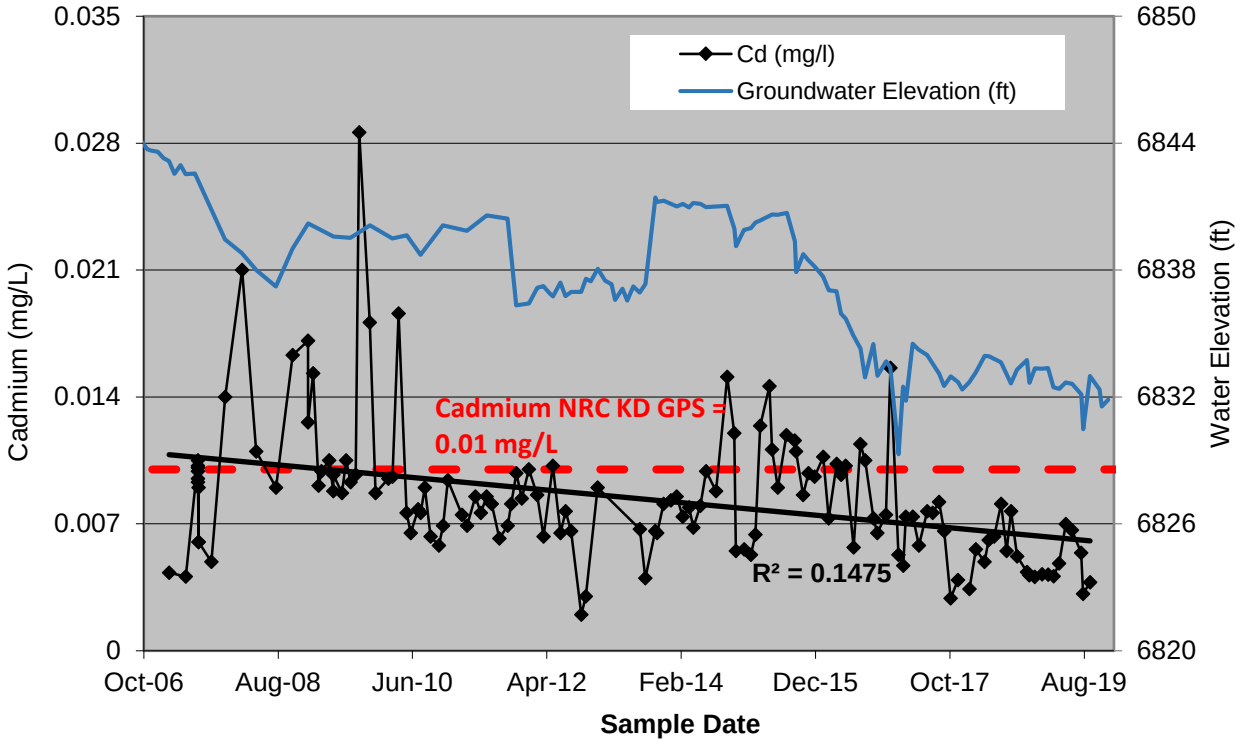


Figure 3. Cadmium Concentrations in Dakota Sandstone Monitoring Well 36-06 KD.

3.1.1.2 Gross Alpha and Uranium

The gross alpha analyses were performed in accordance with United States Environmental Protection Agency (EPA) Method 900.0. This method is a commonly used gross alpha screening method for groundwater; however, there are uncertainties with this method when applied to waters with high dissolved solids. Using EPA Method 600/00-02 does not result in decreased uncertainties; both methods are limited by matrix interferences in monitoring well 36-06 KD samples (detailed in RAML, 2016).

The semiannual sample results from 2014 through present for alpha emitters Ra-226 and Th-230, calculated gross alpha, and corrected gross alpha (which is the measured gross alpha minus uranium [referred to as gross alpha in this report]) are compared to their corresponding ACLs or GPSs as summarized in **Table 3**. It is important to note that individual alpha emitters in the upper bedrock units are subject to ACLs, while gross alpha has a more conservative GPS. The sum of the ACLs for the major alpha emitters (Th-230 and Ra-226) is 1,163 picoCuries per liter (pCi/L), which is 20 times greater than the gross alpha GPS of 56 pCi/L.

Table 3. Summary of Historical Gross Alpha Calculations and Measurements in Monitoring Well 36-06 KD.

Date Sampled	Ra-226 (pCi/L)	Th-230 (pCi/L)	Gross Alpha[A] (Summed Isotopes) (pCi/L)	Gross Alpha (pCi/L)
GPS/ACL	**218 (ACL)**	**945 (ACL)**	**56 (GPS)**	**56 (GPS)**
6/10/2014	9.2	29	38.2	55.5
9/24/2014	10	25	35	-122
11/6/2014	15	13	28	**68.9**
2/11/2015	12	30	42	-39.4
8/26/2015	11	13	24	-66.1
2/11/2016	16	11	27	-18
7/18/2016	19	84	**103**	34
2/15/2017	17	21	38	**180**
8/14/2017	12	23	35	-23
2/12/2018	17	9.7	26.7	**120**
8/6/2018	11	21	32	-90
2/7/2019	7.6	10	17.6	-67
7/22/2019	14	10	24	**130**

*Bold values indicate an exceedance of the KD gross alpha GPS of 56 pCi/L.

[A]Gross alpha (Summed Isotopes) is calculated from the sum of Ra-226 and Th-230 activities. Isotopes selected for the gross alpha summation have long half-lives, are alpha emitters, and are sourced from either U-238 or Th-232, the most abundant isotopes of each element.

Figure 4 shows gross alpha results over time with error bars signifying the range of possible results. This figure illustrates that the estimated analytical uncertainty in the gross alpha results, shown by the error bar for each sample result, is often greater than the GPS of 56 pCi/L.

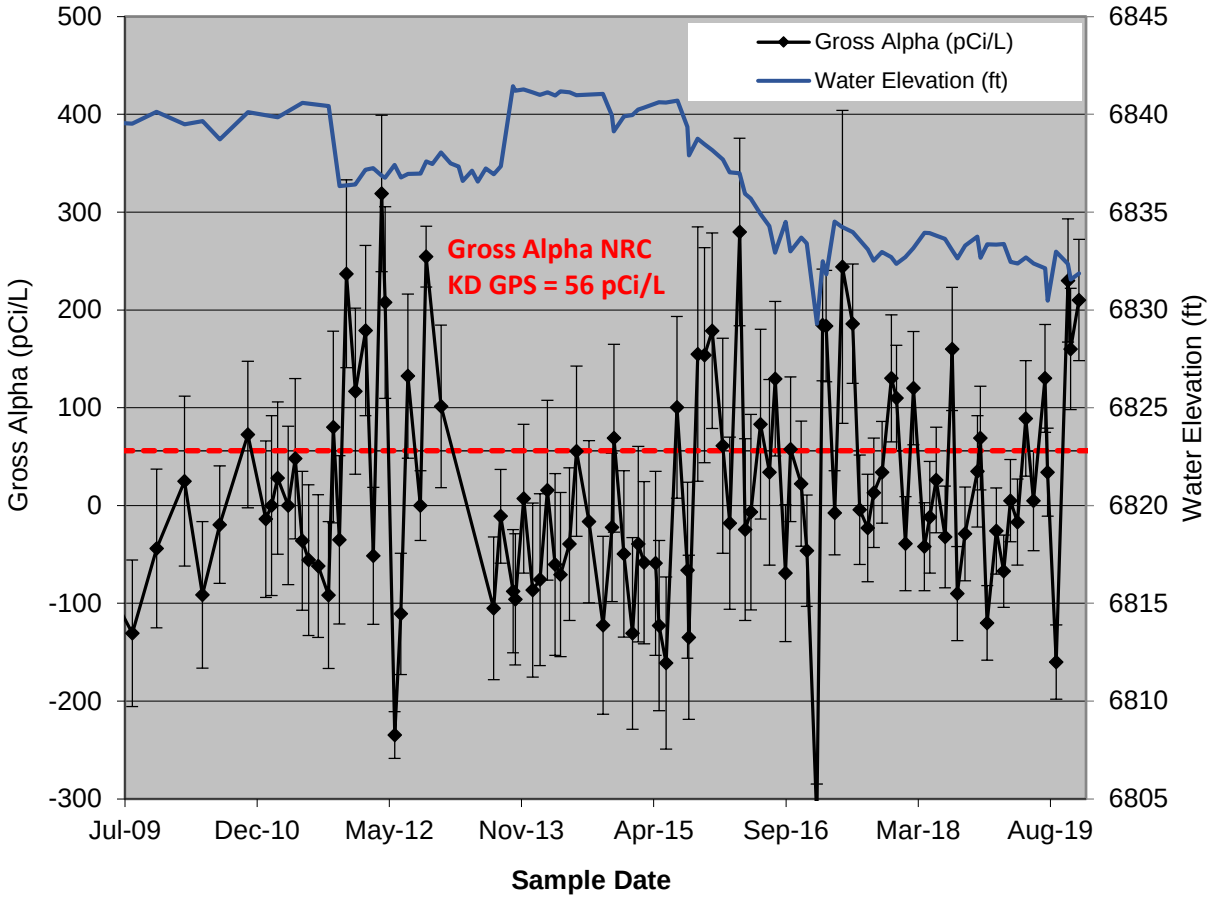


Figure 4. Gross Alpha Activities in Dakota Sandstone Monitoring Well 36-06 KD.

The gross alpha values for the monthly samples collected during the second half of 2019 are presented in **Table 4.** Four out of six gross alpha values were greater than the GPS of 56 pCi/L in the second half of 2019. Uranium concentrations did not exceed the ACL.

Table 4. Second Half of 2019 Monthly Analytical Summary for Gross Alpha and Uranium in Monitoring Well 36-06 KD.

Date	Gross Alpha Value (pCi/L)	Uranium (mg/L)
GPS/ACL	**56 (GPS)**	**1.6 (ACL)**
7/22/2019	**130**	0.415
8/1/2019	34	0.308
9/4/2019	-160	0.443
10/21/2019	**230**	0.357
11/1/2019	**160**	0.424
12/4/2019	**210**	0.333

*Bold values indicate an exceedance of the KD GPS or ACL.

Monthly sampling and analysis will continue for gross alpha and uranium in monitoring well 36-06 KD pending preparation of a License amendment with proposed removal of gross alpha compliance standards for the upper bedrock units.

3.1.2 32-45 KD-R

RAML performs monthly sampling for molybdenum, gross alpha, and uranium at well 32-45 KD-R in response to historical detections above the molybdenum GPS and gross alpha ACL. Analytical results for these constituents at well 32-45 KD-R during the second half of 2019 are discussed below.

3.1.2.1 Molybdenum

Molybdenum in monitoring well 32-45 KD-R reached a maximum concentration of 0.505 mg/L in March of 2015 (**Figure 5**). Although molybdenum concentrations have been decreasing, they continue to exceed the GPS of 0.06 mg/L (**Table 5** and **Figure 5**). Decreasing molybdenum concentrations appear to correlate with the decreasing water levels in monitoring well 32-45 KD-R. **Table 5** presents molybdenum concentrations in monitoring well 32-45 KD-R during the second half of 2019. Recently measured molybdenum concentrations appear to be increasing; however, the time series plot for molybdenum in monitoring well 32-45 KD-R (**Figure 5**) shows that concentrations during the second half of 2019 are part of an overall decreasing trend that appears to be stabilizing near 0.12 mg/L.

Table 5. Second Half of 2019 Analytical Result Summary for Molybdenum in Monitoring Well 32-45 KD-R.

Sample Date	Molybdenum (mg/L)
GPS/ACL	**0.06 (GPS)**
7/22/2019	**0.118**
8/1/2019	**0.115**
9/5/2019	**0.125**
10/22/2019	**0.134**
11/1/2019	**0.112**
12/4/2019	**0.154**

*Bold values indicate an exceedance of the KD GPS or ACL.

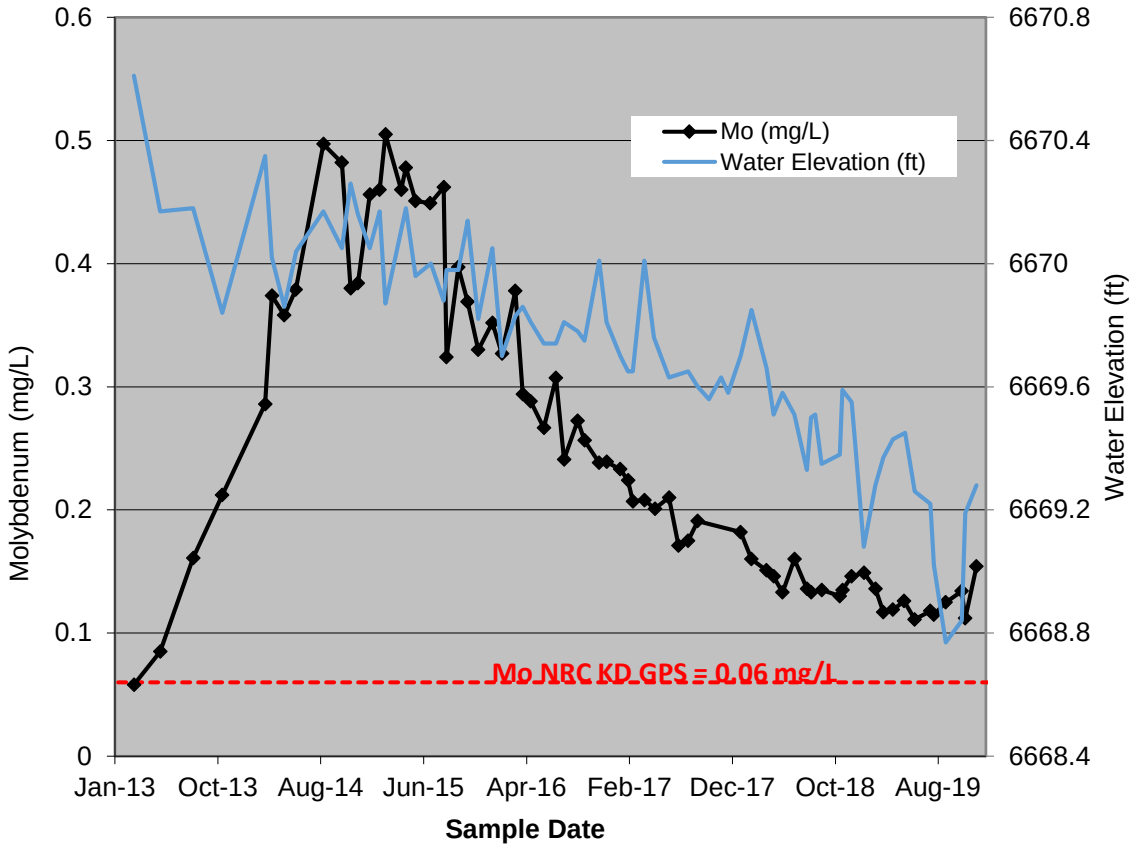


Figure 5. Molybdenum Concentration in Dakota Sandstone Monitoring Well 32-45 KD-R.

Molybdenum is known to occur naturally near uranium deposits (Guilbert and Park, 1986). Molybdenum is not included in primary or secondary EPA Maximum Contaminant Levels for drinking water; however, NMED has a molybdenum standard for irrigation, which is 1.0 mg/L,

and concentrations of molybdenum in groundwater samples from this well do not exceed that standard.

Monthly sampling and analysis for molybdenum will continue pending preparation of a License amendment, which may include a proposed GPS modification or an ACL for molybdenum in the Dakota Sandstone.

3.1.2.2 Gross Alpha and Uranium

The gross alpha values were greater than the GPS of 56 pCi/L, and uranium concentrations in monitoring well 32-45 KD-R did not exceed the ACL during the second half of 2019 (**Table 6** and **Figure 6**). Other alpha emitters contributing to gross alpha remained below their respective ACLs during the second half of 2019 (**Appendix 1, page 1-1**). Gross alpha in monitoring well 32-45 KD-R will continue to be sampled monthly, as reported in the SUA-1473 Reporting of Monthly Sampling Results for First Quarter 2018 (RAML, 2018), pending preparation of a License amendment proposing removal of gross alpha compliance standards for the upper bedrock units.

Table 6. Second Half of 2019 Analytical Result Summary for Gross Alpha and Uranium in Monitoring Well 32-45 KD-R.

Sample Date	Gross Alpha (pCi/L)	Uranium (mg/L)
GPS/ACL	**56 pCi/L (GPS)**	**1.6 mg/L (ACL)**
7/22/2019	**78**	0.0484
8/1/2019	**58**	0.0507
9/5/2019	**86**	0.0502
10/22/2019	**110**	0.0425
11/1/2019	**91**	0.0432
12/4/2019	**89**	0.0467

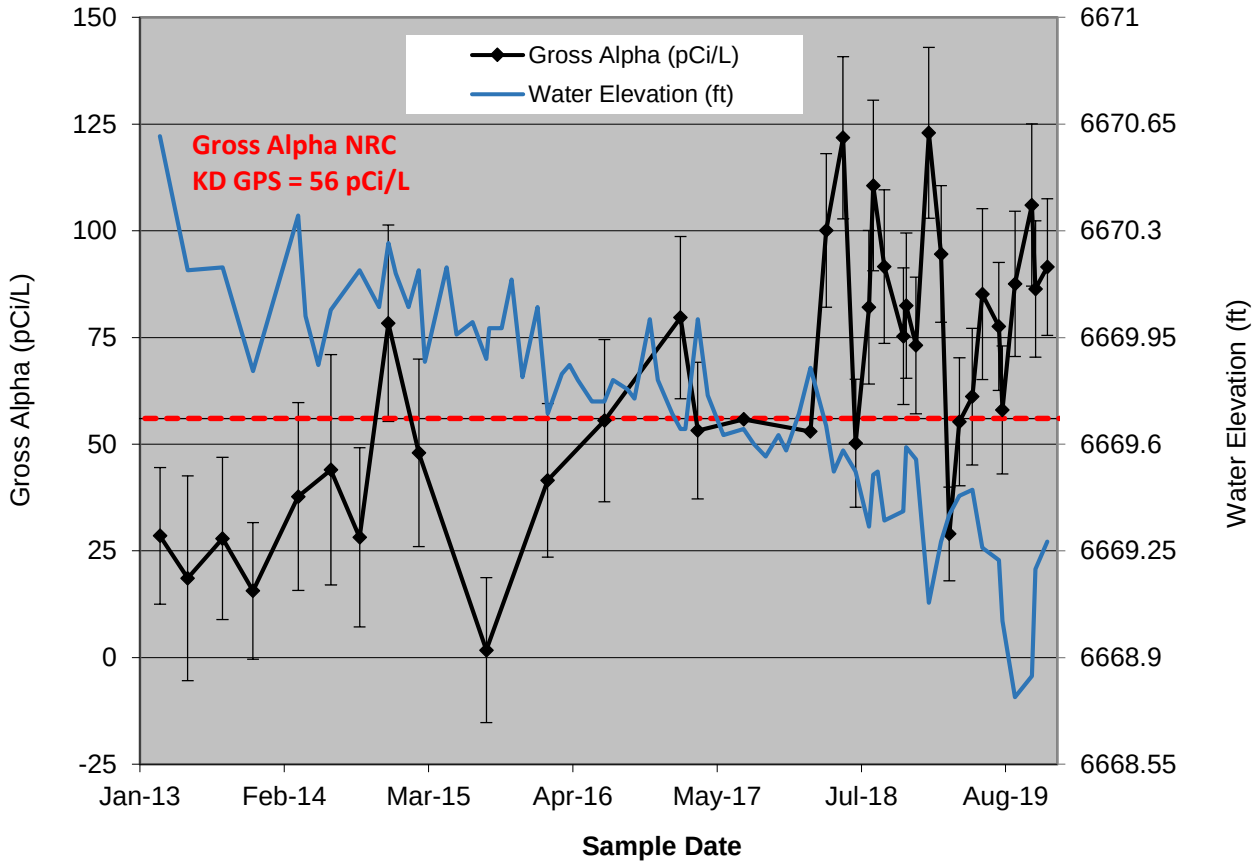


Figure 6. Gross Alpha Activities in Dakota Sandstone Monitoring Well 32-45 KD-R.

3.2 Tres Hermanos A

Analytical results from Tres Hermanos A wells are tabulated in **Appendix 1, page 1-2,** and presented graphically as time series plots in **Appendix 2, pages 2-47 through 2-55**. A hydrograph for the most downgradient Tres Hermanos A well, 30-01 TRA, is included in **Appendix 3, page 3-1**. As displayed graphically in **Appendix 3, page 3-1**, monitoring well 30-01 KD is screened to the bottom of the Tres Hermanos A unit and contains a 20-ft sump below the screen. The only groundwater detected in this well accumulates in the sump over long periods of time; therefore, for practicable purposes, the TRA is dry at this location. Therefore, monitoring wells 31-01 TRA-R and 33-01 TRA are the only available Tres Hermanos A locations with groundwater during this monitoring period; thus, the hydraulic gradient cannot be evaluated for the Tres Hermanos A (**Appendix 4, page 4-3**) for the second half of 2019.

Three additional Tres Hermanos A wells have been installed (**Figure 1**) as outlined in the Data Collection Work Plan in Support of Additional ACLs (INTERA, 2017). Groundwater elevation data from these additional wells will allow for characterization of the potentiometric surface and

calculation of the hydraulic gradient in the Tres Hermanos A and will be used in future groundwater monitoring reports.

Monitoring well 30-01 TRA did not contain enough water to collect a sample. Groundwater samples from monitoring wells 31-01 TRA-R and 33-01 TRA did not exceed License groundwater standards during the second half of 2019.

3.3 Tres Hermanos B

Analytical results from Tres Hermanos B monitoring wells are tabulated in **Appendix 1, page 1-3,** and presented graphically as time series plots in **Appendix 2, pages 2-26 through 2-45**. A hydrograph for the most downgradient Tres Hermanos B monitoring well, 31-67 TRB, is included in **Appendix 3, page 3-3**. Tres Hermanos B potentiometric surface elevation is displayed in **Appendix 4, page 4-4,** and was used to calculate a hydraulic gradient of 0.016 ft/ft for the second half of 2019.

Monitoring well 36-01 TRB was last sampled in 2009 and has not contained enough water for a sample since then. No new exceedances of ACLs or GPSs were observed in groundwater collected from Tres Hermanos B monitoring wells in the second half of 2019.

3.3.1 31-02 TRB-R

Uranium concentrations in groundwater samples collected from former monitoring well 31-02 TRB from July through November of 2011 exceeded the ACL of 1.6 mg/L. RAML continued monthly sampling, and uranium concentrations were observed below the ACL throughout 2012. As part of the site-wide well replacement program, monitoring well 31-02 TRB was identified for replacement; and a new well (31-02 TRB-R) was installed on December 14, 2012. Monthly sampling and analysis for uranium and gross alpha in monitoring well 31-02 TRB-R continued, and results are provided below.

3.3.1.1 Gross Alpha and Uranium

Results from groundwater sampling for the second half of 2019 are presented in **Table 7**. Gross alpha over time is shown in **Figure 7**. There was one exceedance of gross alpha activity measured in samples from monitoring well 31-02 TRB-R during the second half of 2019 (**Table 7**). Uranium concentrations in this replacement well have never exceeded the ACL (**Appendix 2, page 2-31**).

Table 7. Second Half 2019 Analytical Summary for Gross Alpha and Uranium in Monitoring Well 31-02 TRB-R.

Date	Gross Alpha (pCi/L)	Uranium (mg/L)
ACL/GPS	**21 (GPS)**	**1.6 (ACL)**
7/17/2019	-3.5	0.0039
8/1/2019	6.3	0.0046
9/4/2019	13	0.0042
10/22/2019	16	0.0029
11/1/2019	**22**	0.0035
12/4/2019	2.2	0.0028

*Bold values indicate an exceedance of the TRB GPS.

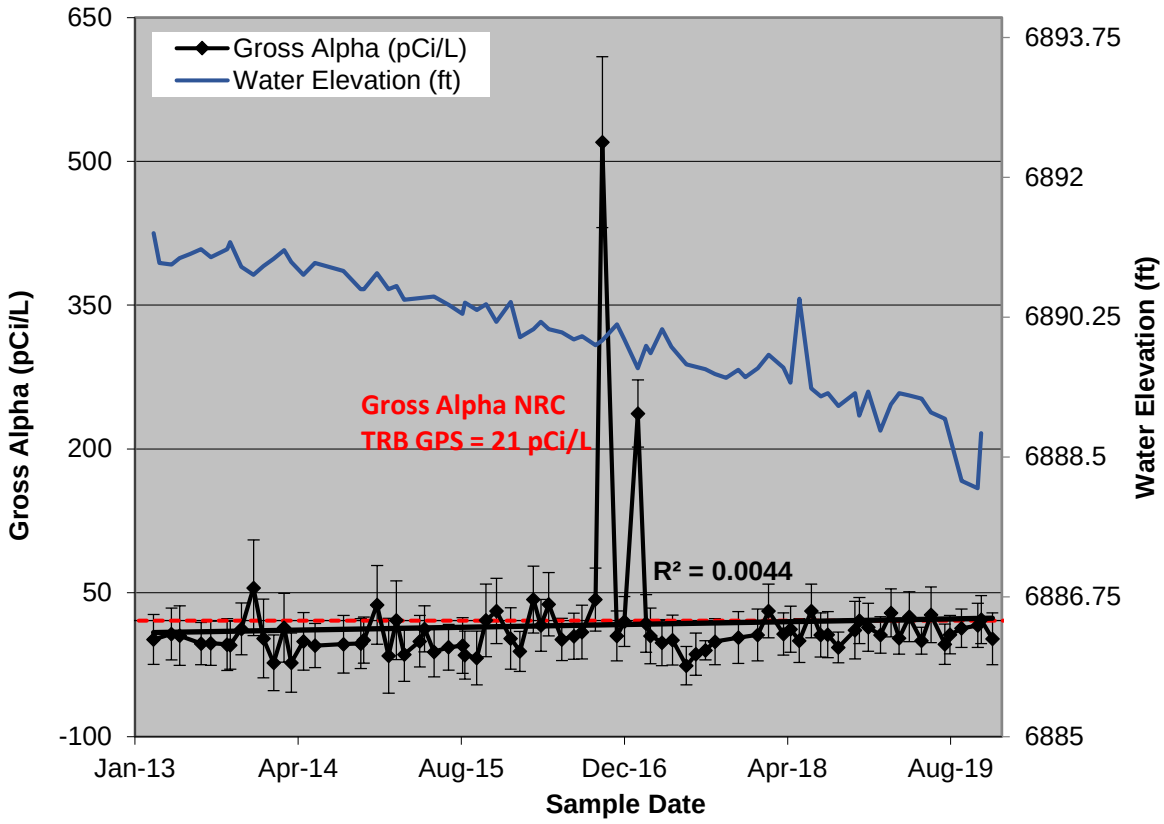


Figure 7. Gross Alpha Activities in Monitoring Well 31-02 TRB-R.

As with the gross alpha results in 36-06 KD described in **Section 3.1.1.2**, the Tres Hermanos B does not have an ACL for gross alpha but does have ACLs for the other alpha emitters. Monthly sampling and analysis will continue for gross alpha and uranium in monitoring well 31-02 TRB-R, pending preparation of a License amendment proposing removal of gross alpha compliance standards for the upper bedrock units.

3.4 Alluvium

Analytical results from the alluvial well network are tabulated in **Appendix 1, page 1-4,** and presented graphically as time series plots in **Appendix 2, pages 2-57 through 2-92**. A hydrograph for the most downgradient alluvial well, MW-24 ALL, is included in **Appendix 3, page 3-4**. Alluvial potentiometric surface elevation is displayed in **Appendix 4, page 4-1,** and was used to calculate a hydraulic gradient of 0.008 ft/ft for the second half of 2019.

Monitoring wells 32-59 ALL and MW-24 ALL did not contain enough water to collect a sample. Groundwater from all other NRC alluvial wells did not exceed ACLs.

4.0 CONCLUSIONS

Table 8 summarizes the notable results from the second half of 2019 groundwater monitoring and provides path forward recommendations.

Table 8. Rio Algom Mining – Ambrosia Lake West
Second Half 2019 Summary and Path Forward.

Well(s)	Summary	Status	Path Forward
36-06 KD	Gross alpha above GPS	Monthly sampling (plus uranium)	Continue monthly sampling until License amendment is made proposing removal of gross alpha compliance standards for upper bedrock units.
36-06 KD	Beryllium, cadmium below GPSs	Monthly sampling	Discontinue monthly sampling for beryllium and cadmium during first quarter 2020.
32-45 KD-R	Molybdenum, gross alpha above GPS	Replacement well stabilizing, monthly sampling	Continue monthly sampling and quarterly reporting for molybdenum until concentrations drop below the GPS; consider revision of GPS or ACLs for molybdenum and removal of gross alpha compliance standards for upper bedrock units in upcoming License amendment.
31-02 TRB-R	Gross alpha above GPS	Replacement well stabilizing; monthly sampling	Continue monthly sampling and quarterly reporting until well stabilizes or License amendment is made proposing removal of gross alpha compliance standards for upper bedrock units.
30-02 KD; 30-01 TRA	Dry; water level below screened interval	Not sampled	Propose removal from monitoring program in upcoming License amendment (See **Section 2**).
36-06 KD; 36-07 KD; 36-08 TRA; 31-03 KD; 5-10 ALL; 30-05 TRA; 30-06 TRB; 30-07 KD	Installed in 2019 (INTERA, 2017)	Quarterly sampling	Quarterly sampling for eight quarters while wells stabilize; RAML will include laboratory and field data from new wells as a separate appendix in future semiannual reports.

RAML proposes to continue monthly sampling of constituents exceeding their GPSs, including the following: gross alpha in monitoring wells 36-06 KD, 32-45 KD-R, and 31-02 TRB-R, and molybdenum in monitoring well 32-45 KD-R. RAML will discontinue monthly sampling of constituents that are below their GPSs, including beryllium and cadmium in monitoring well 36-06 KD. The path forward for constituents with exceedances of GPSs is to develop ACLs and amend the License to include these values as described in RAML's letter to NRC dated April 13,

2017. Wells with construction specifications that allow for collection of samples but may not be representative of formation conditions will be monitored for total depth and depth to water and sampled if the water column volume is sufficient (i.e. if the well contains enough water to operate sampling equipment and/or enough water to fill sample bottles). Monitoring and sampling of the well network is required on a semiannual basis with the exception of the wells involved in accelerated monthly monitoring. RAML will continue to conduct monthly and semiannual monitoring in accordance with the requirements in Condition 34 of the License.

5.0 REFERENCES

Guilbert, J.M. and C.F. Park, 1986. *The Geology of Ore Deposits*. Waveland Press, IL.

INTERA Incorporated (INTERA). 2017. Rio Algom Mining, LLC's Ambrosia Lake Mill Site Data Collection Work Plan in Support of Additional Alternate Concentration Limits. November.

Rio Algom Mining LLC (RAML). 2016. Rio Algom LLC Ambrosia Lake Facility, License SUA-1473 Docket 40-8905, Groundwater Stability Monitoring Report, First Half 2016.

———, 2018. SUA-1473 Docket 40-8905, Reporting of Monthly Sampling Results for First Quarter 2018, Rio Algom Mining LLC, Ambrosia Lake Facility.

APPENDIX 1

Stability Monitoring Plan
Analytical Results

RIO ALGOM MINING LLC
2ND HALF 2019
DAKOTA WELL RESULTS - ACL PARAMETERS

Well	Date	Depth To Water	Total Depth	Specific Conductivity	Temp (°C)	pH s.u.	Chloride (mg/L)	Nitrate (mg/L)	T.D.S. (mg/L)	Sulfate (mg/L)
17-01 KD	7/24/2019	686.02	--	1470	13.18	9.11	11.2	<0.02	1130	766
30-02 KD	7/22/2019	307.90	313.32			Insufficient Water				
30-48 KD-R	7/25/2019	328.45	--	4585	14.5	6.80	489	0.02	4200	2080
32-45 KD-R	7/22/2019	258.18	278.66	1701	14.79	6.98	79.2	0.63	1460	656
36-06 KD	7/22/2019	189.28	--	6440	23.54	4.01	927	<0.02	5980	3050
5-02 KD	7/30/2019	186.85	--	1311	23.54	7.49	9.8	0.41	806	280
ACL							**3,200**	**22.8**	**14,100**	**6,480**

Well	Date	Ni (mg/L)	U-nat (mg/L)	Th-230 (pCi/L)	Pb-210 (pCi/L)	Ra-226+Ra-228 (pCi/L)
17-01 KD	7/24/2019	<0.0004	<0.0001	-0.03	4.8	2.36
30-02 KD	7/22/2019			Insufficient Water		
30-48 KD-R	7/25/2019	<0.002	<0.0005	0.35	3.3	10.0
32-45 KD-R	7/22/2019	0.0021	0.0484	0.02	6.4	3.4
36-06 KD	7/22/2019	0.105	0.415	10	8.7	22.0
5-02 KD	7/30/2019	0.0005	0.0009	0.28	-2	0.20
ACL		**6.8**	**1.6**	**945**	**88**	**218**

Depth to water at 17-01 KD was measured on October 7, 2019 using a pressure transducer
Total depth could not be measured at 17-01 KD, 30-48 KD-R, 36-06 KD,and 5-02 KD
Monitoring well 30-02 KD contained insufficient water for sample collection
< = constituent was not detected above the method detection limit

RIO ALGOM MINING LLC
2ND HALF 2019
TRA WELL RESULTS - ACL PARAMETERS

Well	Date	Depth To Water	Total Depth	Specific Conductivity	Temp (°C)	pH s.u.	Chloride (mg/L)	Nitrate (mg/L)	T.D.S. (mg/L)	Sulfate (mg/L)
30-01 TRA	7/22/2019	203.10	207.27			Insufficient Water				
31-01 TRA-R	7/17/2019	204.69	213.63	1787	14.42	7.23	18.6	0.04	1680	867
33-01 TRA	7/30/2019	118.74	181.30	3406	13.61	7.67	32.3	<0.02	2700	1720
ACL							**1,070**	**9.2**	**6,400**	**2,584**

Well	Date	Th-230 (pCi/L)	Pb-210 (pCi/L)	Ra-226+Ra-228 (pCi/L)
30-01 TRA	7/22/2019	Insufficient Water		
31-01 TRA-R	7/17/2019	-0.05	-2.8	1.30
33-01 TRA	7/30/2019	0.01	2.2	2.4
ACL		**945**	**88**	**218**

< = constituent was not detected above the method detection limit
Well 30-01 TRA contained insufficient water for sample collection

RIO ALGOM MINING LLC
2ND HALF 2019
TRB WELL RESULTS - ACL PARAMETERS

Well	Date	Depth To Water	Total Depth	Specific Conductivity	Temp (°C)	pH s.u.	Chloride (mg/L)	Nitrate (mg/L)	T.D.S. (mg/L)	Sulfate (mg/L)
19-77 TRB	7/30/2019	272.24	289.60	4712	17.15	7.88	15.6	0.33	3520	1900
31-02 TRB-R	7/17/2019	97.77	128.31	7917	13.86	6.45	1100	<0.02	7740	3190
31-67 TRB	7/24/2019	39.02	96.20	7499	13.40	6.40	915	<0.02	7280	3300
36-01 TRB	7/22/2019	Dry	58.39				Dry			
36-02 TRB	7/22/2019	51.83	57.48	9350	17.43	6.61	2000	0.05	7820	2510
ACL							**2,810**	**7.7**	**11,700**	**4,760**

Well	Date	Ni (mg/L)	U-nat (mg/L)	Th-230 (pCi/L)	Pb-210 (pCi/L)	Ra-226+Ra-228 (pCi/L)
19-77 TRB	7/30/2019	0.0018	0.0124	0.02	-2.5	1.6
31-02 TRB-R	7/17/2019	<0.002	0.0039	0.03	4.1	14.2
31-67 TRB	7/24/2019	0.009	0.0126	0.21	0.73	15.3
36-01 TRB	7/22/2019			Dry		
36-02 TRB	7/22/2019	0.005	0.0035	0.09	3	0.73
ACL		**6.8**	**1.6**	**945**	**88**	**218**

< = constituent was not detected above the method detection limit
Monitoring Well 36-01 TRB was dry and therefore not sampled.

RIO ALGOM MINING LLC
2ND HALF 2019
ALLUVIAL WELL RESULTS - ACL PARAMETERS

Well	Date	Depth To Water	Total Depth	Specific Conductivity	Temp (°C)	pH s.u.	Chloride (mg/L)	Nitrate (mg/L)	T.D.S. (mg/L)	Sulfate (mg/L)
5-73 ALL-R	7/29/2019	24.94	35.80	8547	12.20	6.78	1640	2.06	6650	2270
5-03 ALL-R	7/26/2019	30.31	55.82	4880	12.66	7.02	595	0.57	4540	2170
5-04 ALL	7/29/2019	27.08	60	6403	12.61	7.47	970	0.02	5360	2760
5-08 ALL-R	7/25/2019	39.81	76.54	3825	13.15	7.46	125	26.3	3730	2130
31-61 ALL	7/29/2019	18.38	29.32	15520	12.40	6.21	2280	10.8	13900	6640
31-65 ALL	7/24/2019	15.37	41.50	14981	11.32	6.17	2240	<0.02	15100	7840
32-59 ALL	7/26/2019	25.62	--			Insufficient Water				
MW-24 ALL	7/25/2019	50.12	50.32			Insufficient Water				
ACL							**7,110**	**351**	**26,100**	**12,000**

Well	Date	Mo (mg/L)	Ni (mg/L)	Se (mg/L)	U-nat (mg/L)	Th-230 (pCi/L)	Pb-210 (pCi/L)	Ra-226+Ra-228 (pCi/L)	Gross Alpha (pCi/L)
5-73 ALL-R	7/29/2019	0.006	0.013	0.0626	1.92	0.03	1	0.88	-656
5-03 ALL-R	7/26/2019	<0.001	0.002	<0.001	0.107	0.21	6.6	1.51	-6
5-04 ALL	7/29/2019	<0.001	<0.002	0.0025	<0.0005	0.13	3.2	1.75	-7.2
5-08 ALL-R	7/25/2019	0.0047	0.0021	0.0118	0.0258	-0.02	5.7	1.73	10
31-61 ALL	7/29/2019	<0.002	0.055	0.0058	0.668	0.09	5.5	2.75	-58
31-65 ALL	7/24/2019	0.003	0.120	<0.005	0.083	0.33	16	1.58	13
32-59 ALL	7/26/2019				Insufficient Water				
MW-24 ALL	7/25/2019				Insufficient Water				
ACL		**176**	**98**	**49**	**23**	**13,627**	**1,274**	**3,167**	**8,402**

< = constituent was not detected above the method detection limit
Wells MW-24 ALL and 32-59 ALL contained insufficient water for sample collection; total depth (ft) not measured at 32-59 ALL during Q3 2019

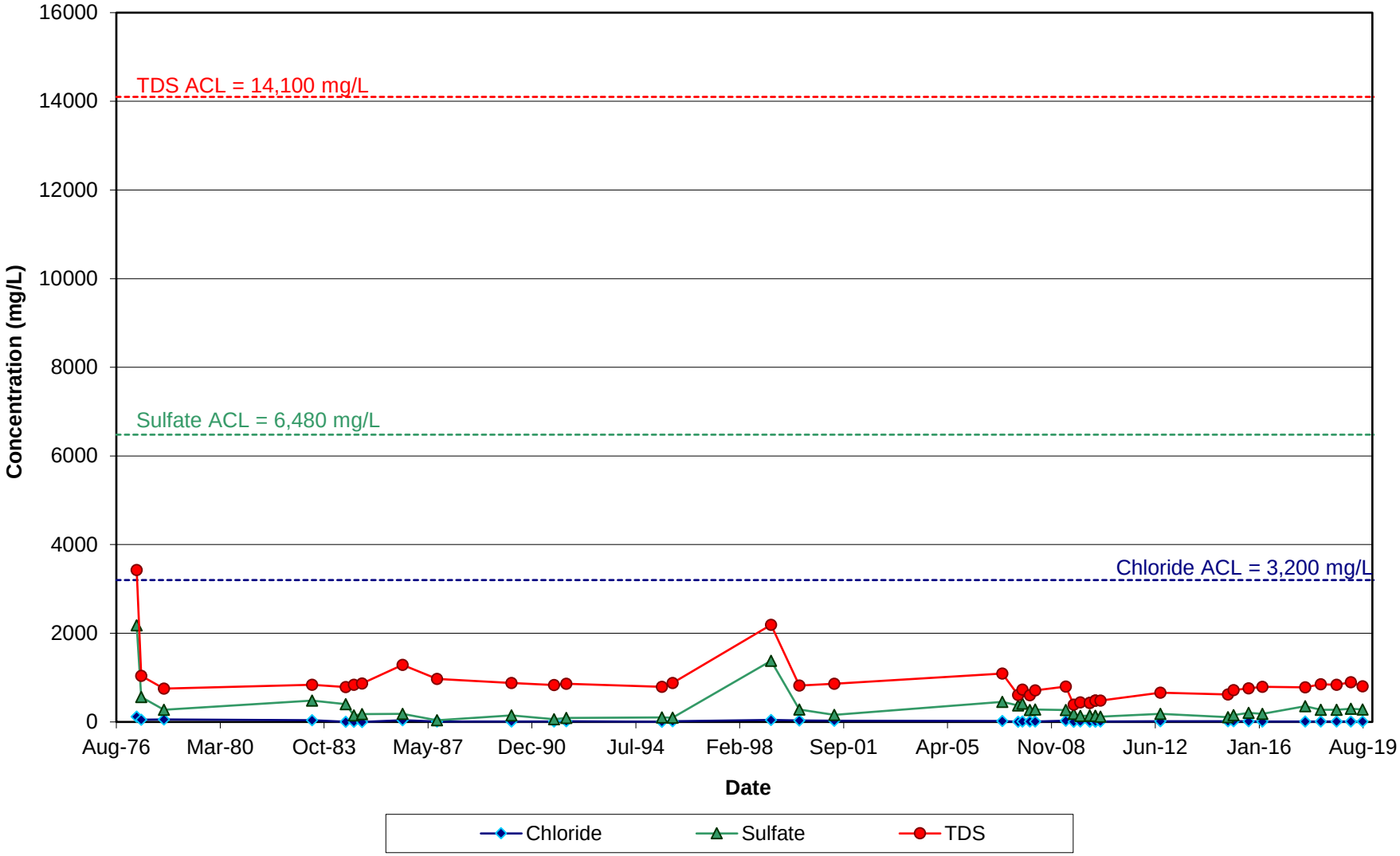
APPENDIX 2

Stability Monitoring Plan
Time Versus Concentration Plots

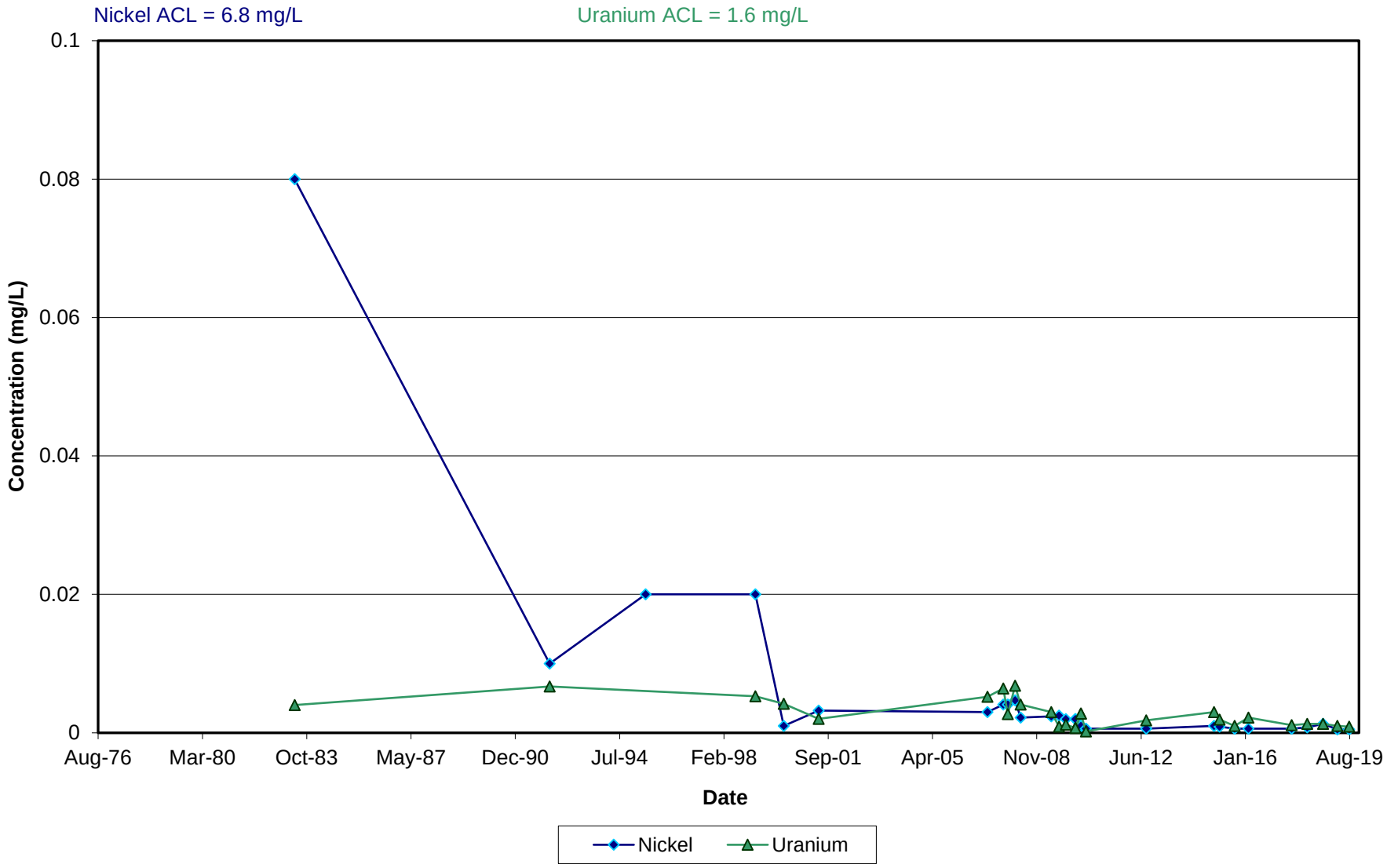
Stability Monitoring Plan
Time Versus Concentration Plots

Dakota Sandstone

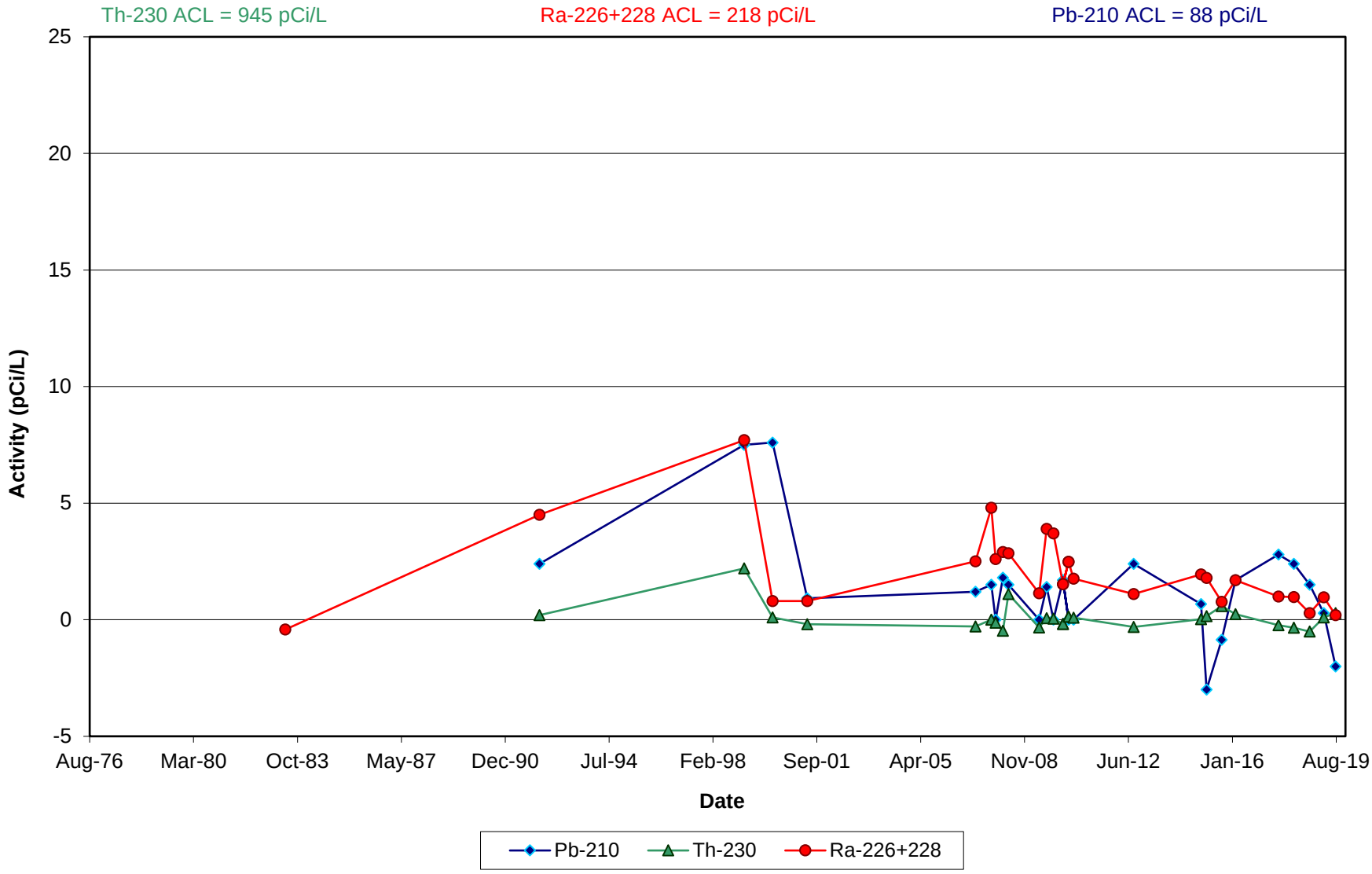
Anions and TDS in Monitoring Well 5-02 KD



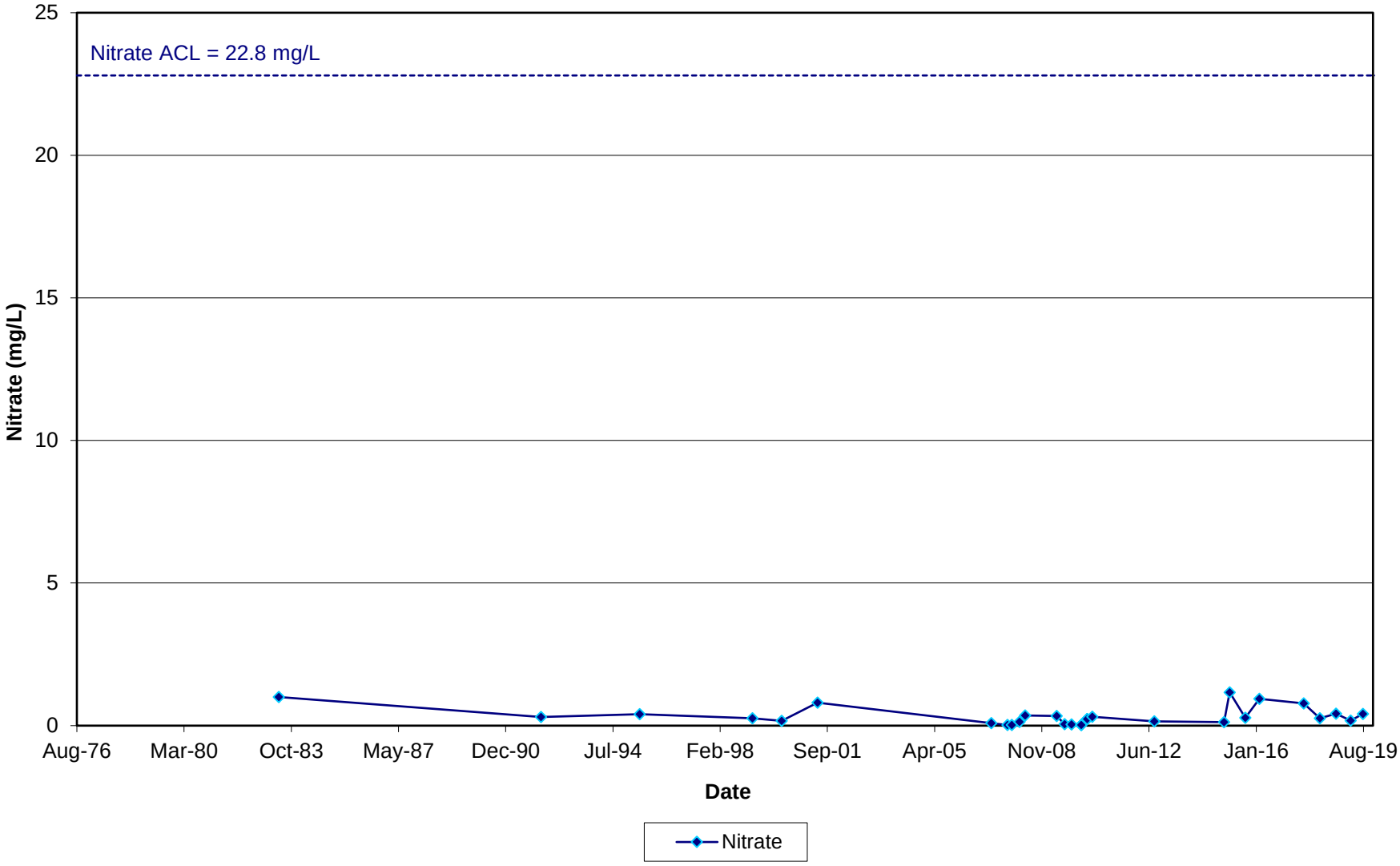
Metals in Monitoring Well 5-02 KD



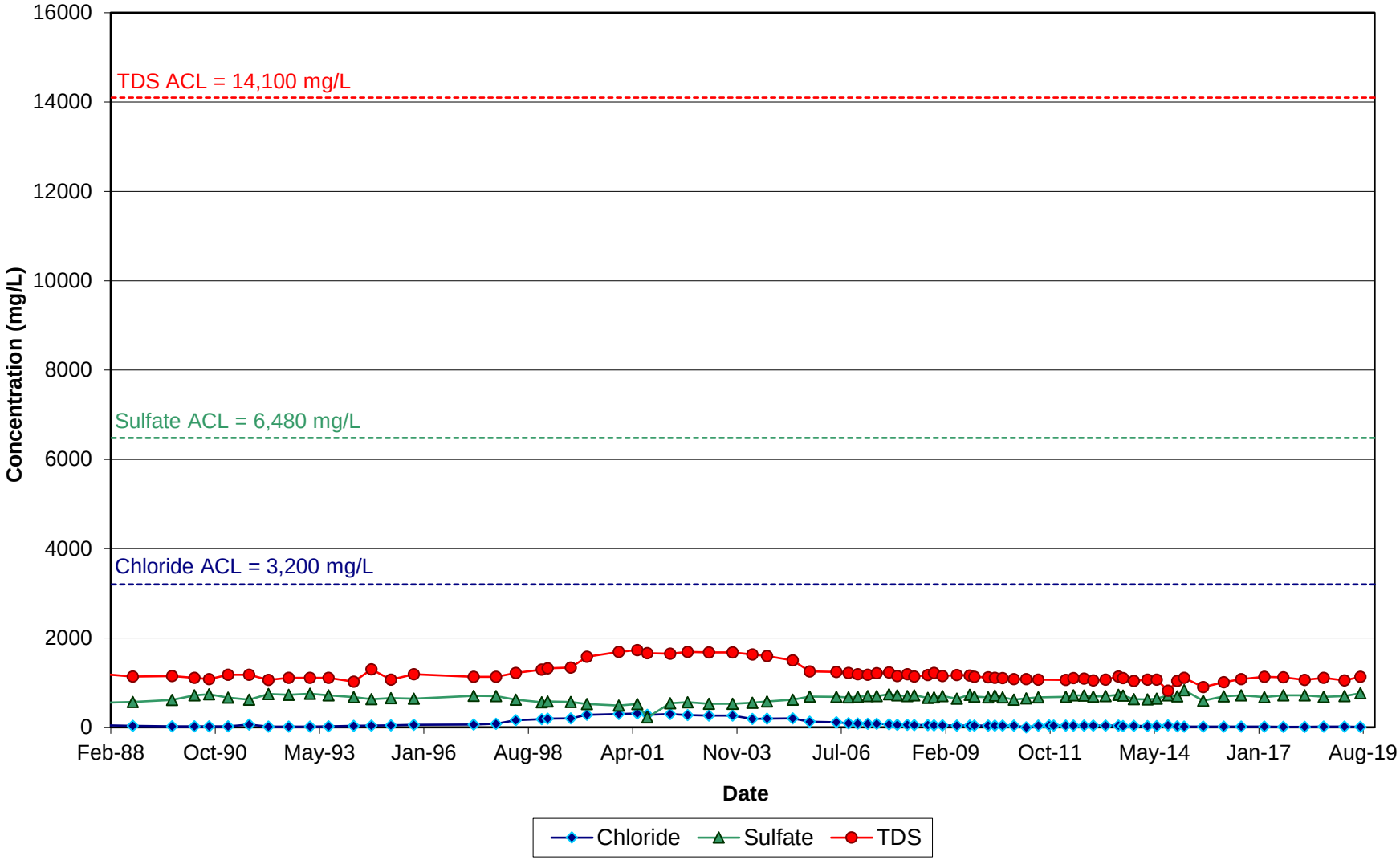
Radionuclides in Monitoring Well 5-02 KD



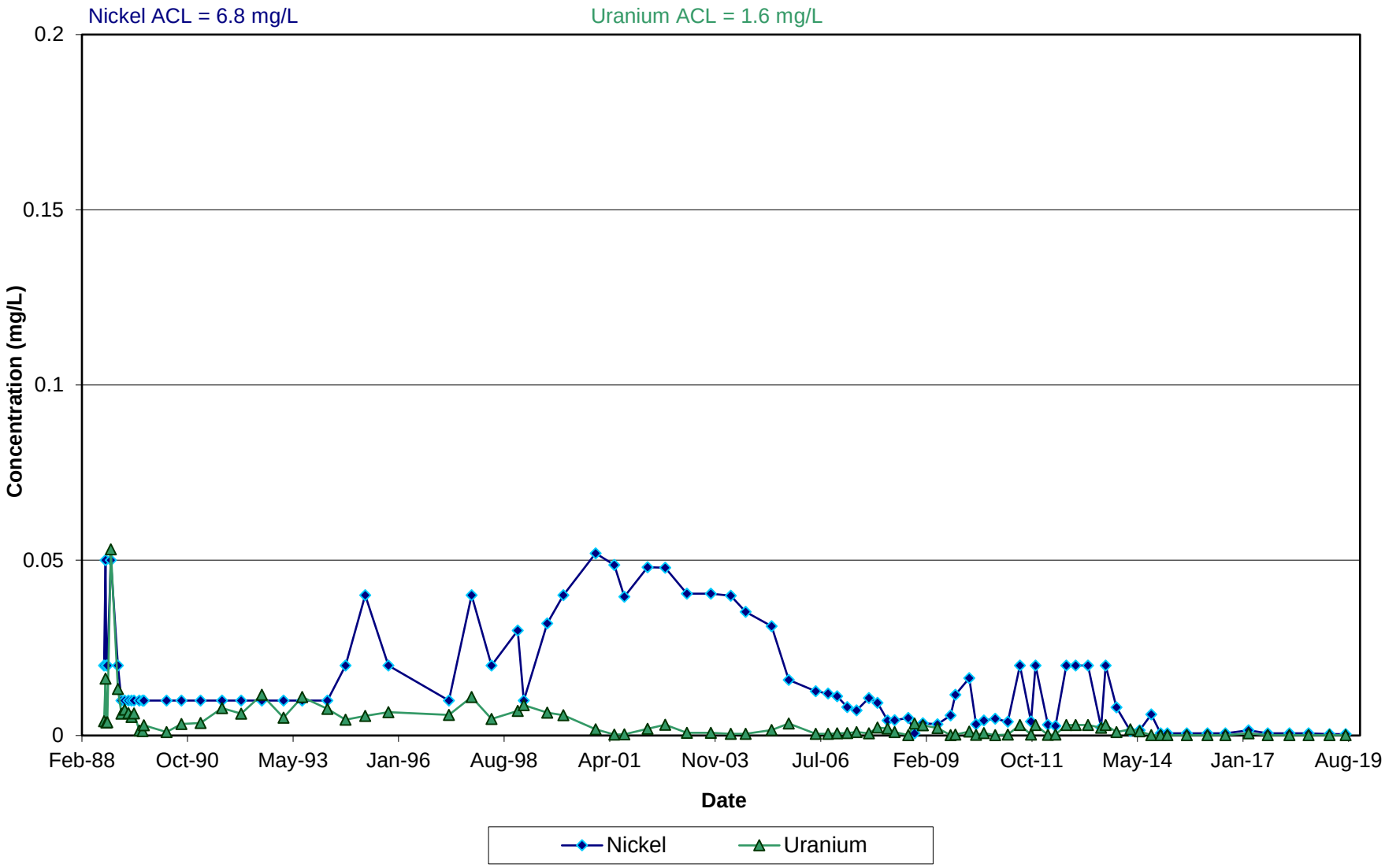
Nitrate in Monitoring Well 5-02 KD



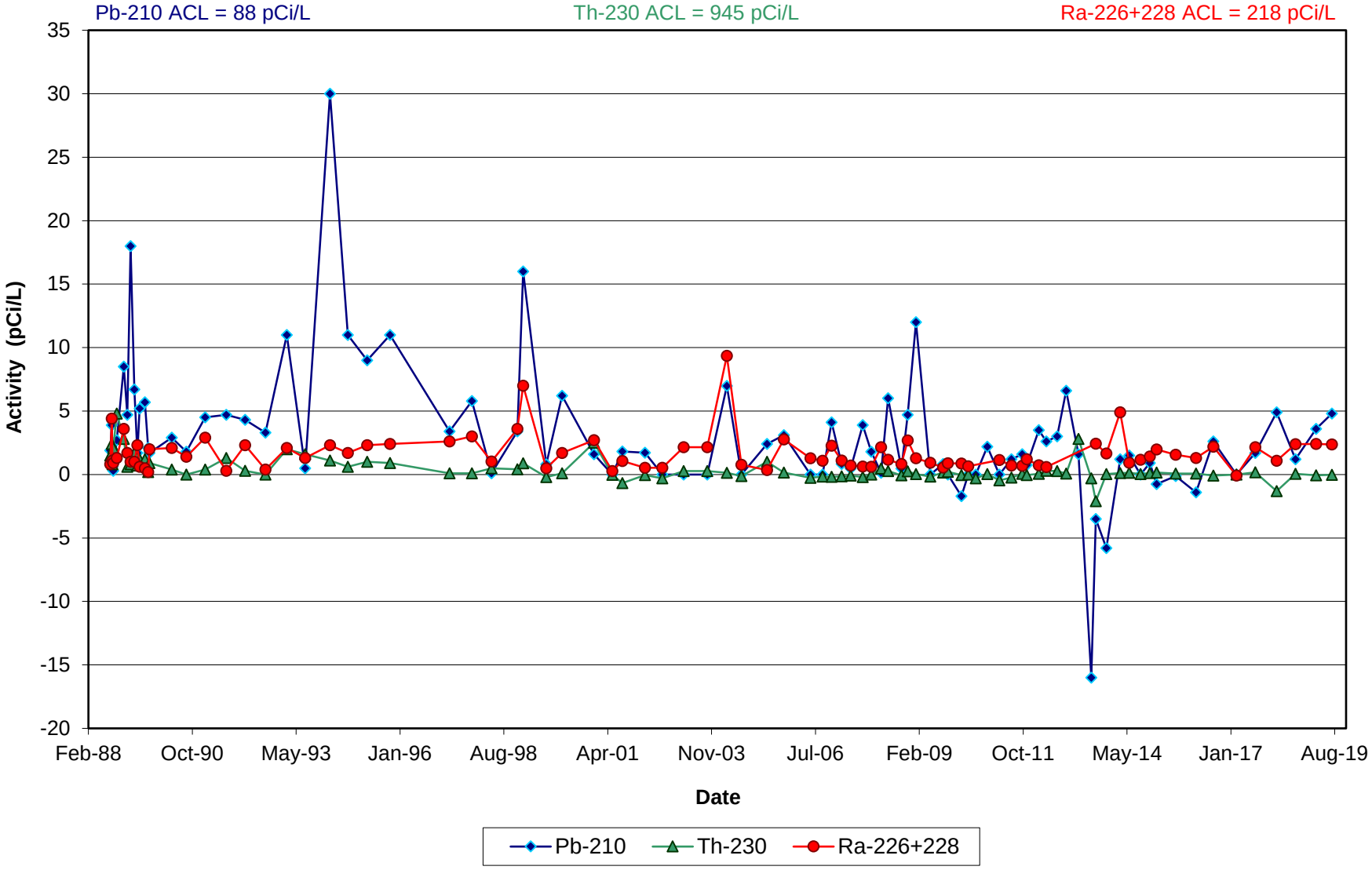
Anions and TDS in Monitoring Well 17-01 KD



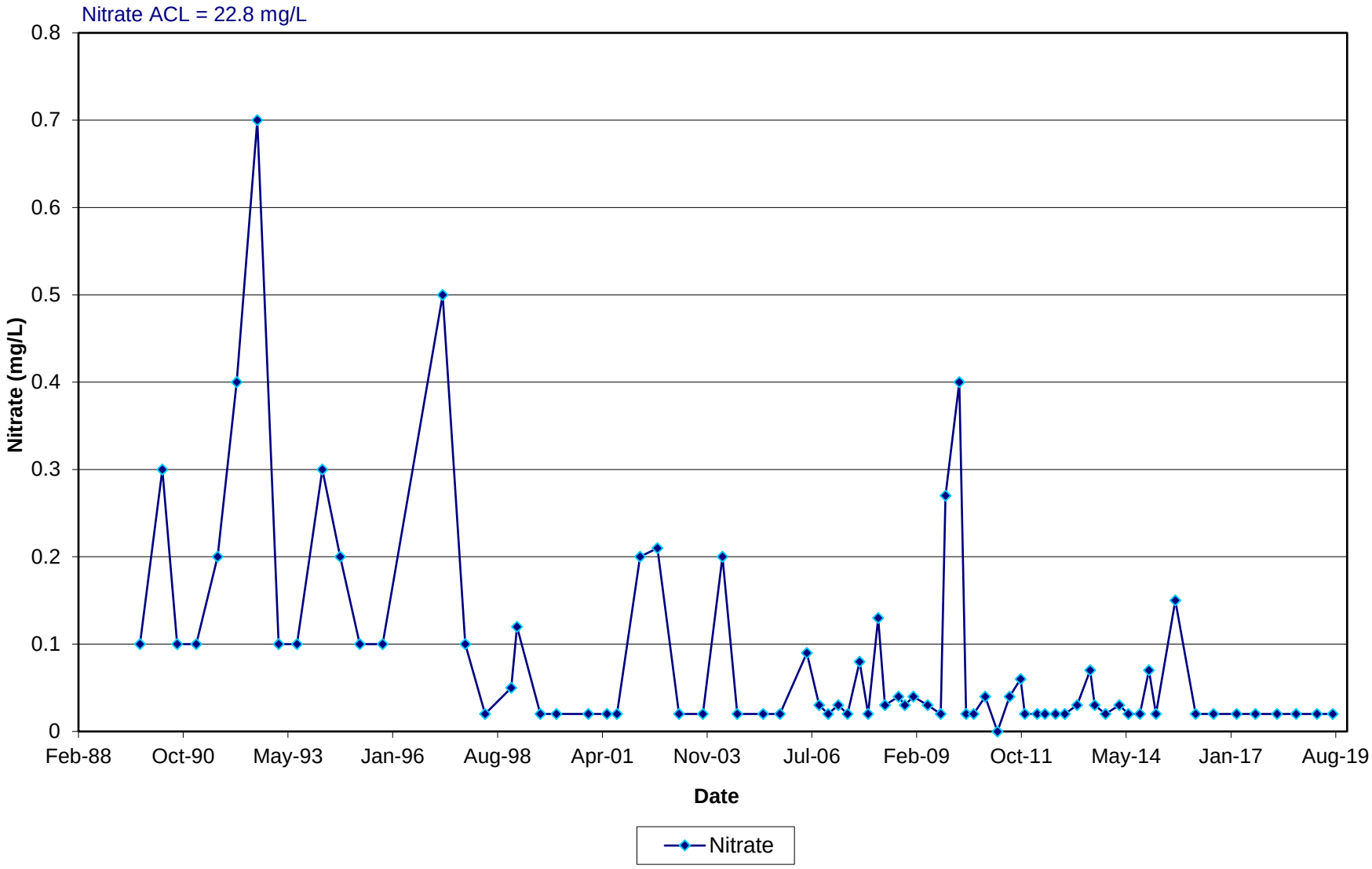
Metals in Monitoring Well 17-01 KD



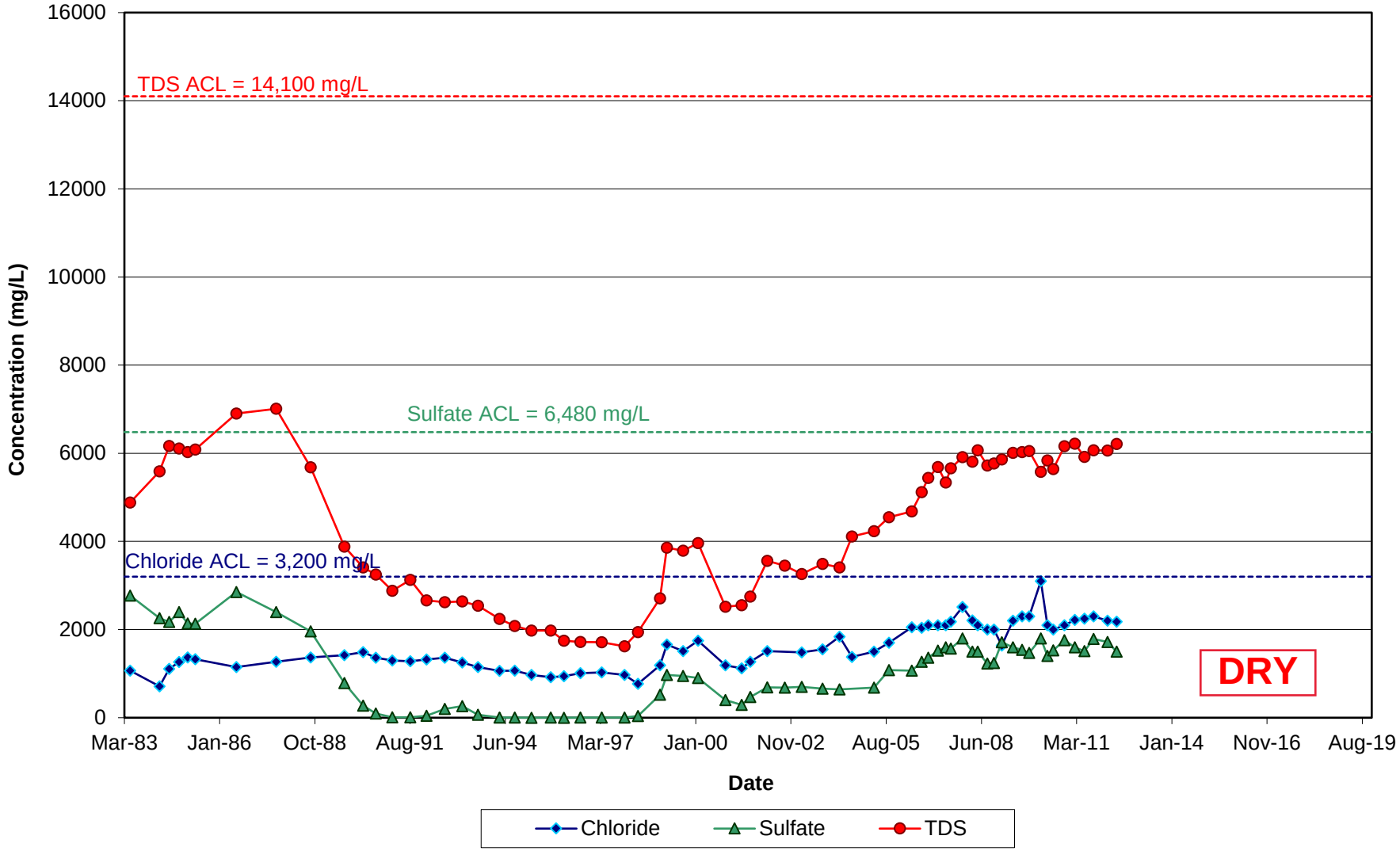
Radionuclides in Monitoring Well 17-01 KD



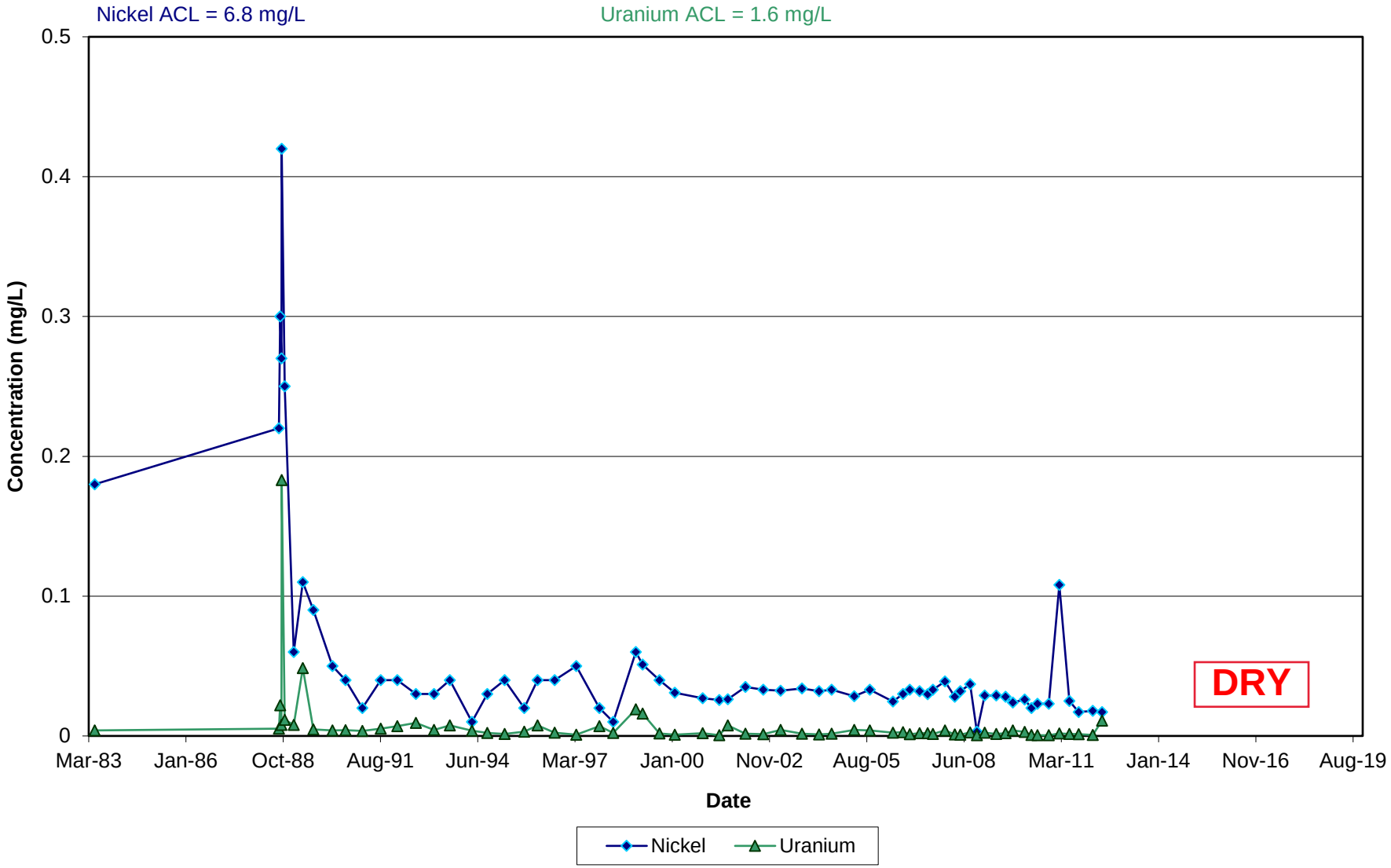
Nitrate in Monitoring Well 17-01 KD

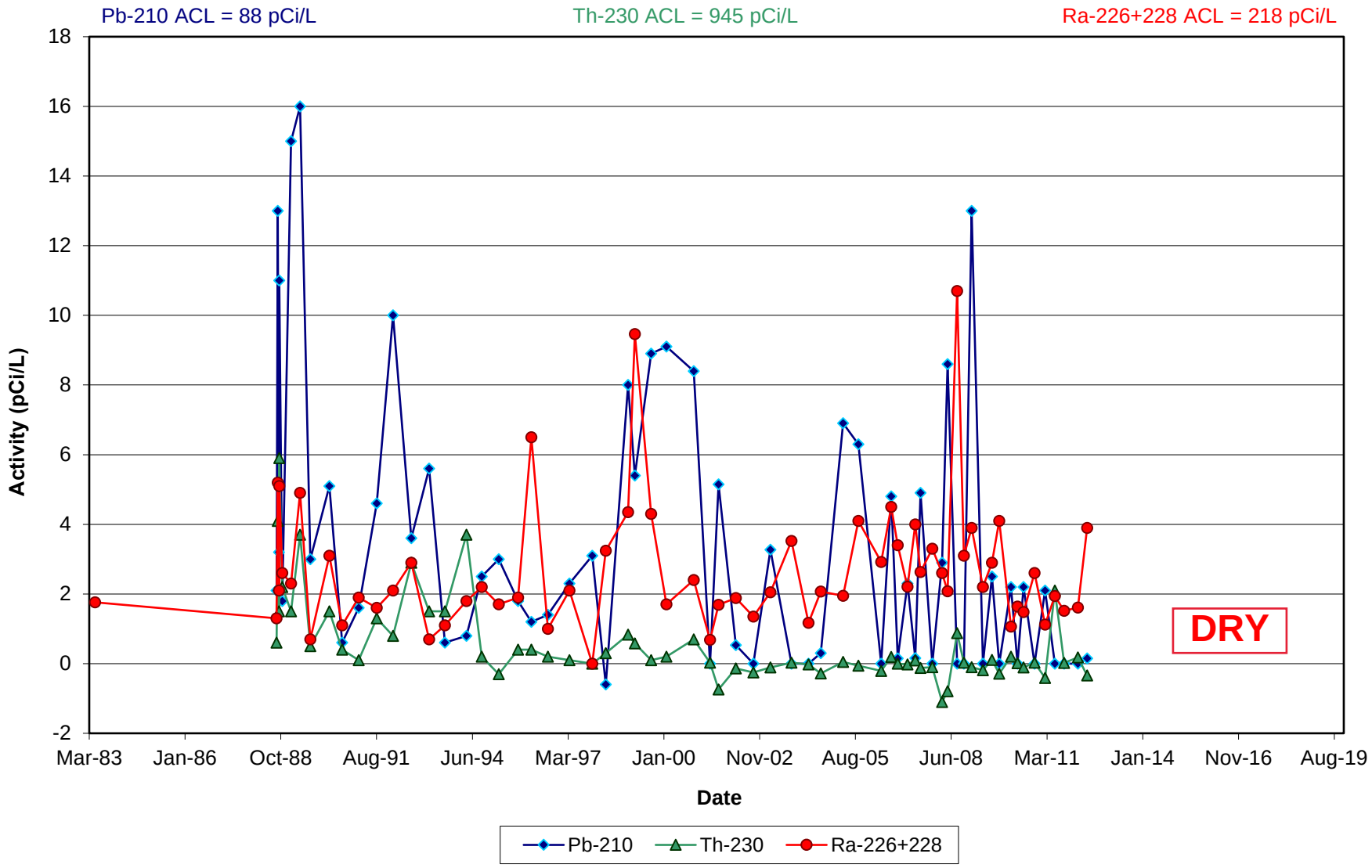


Anions and TDS in Monitoring Well 30-02 KD

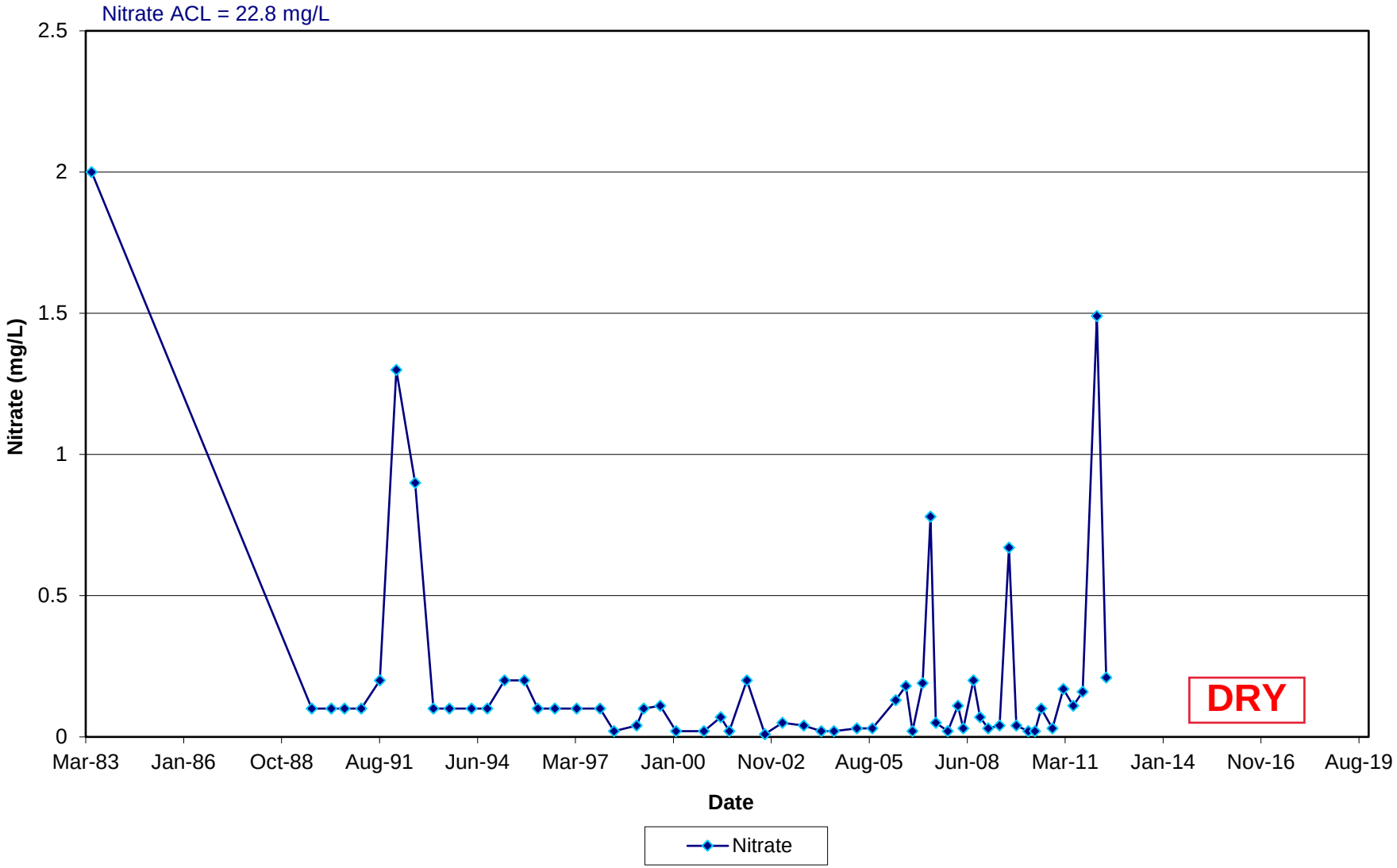


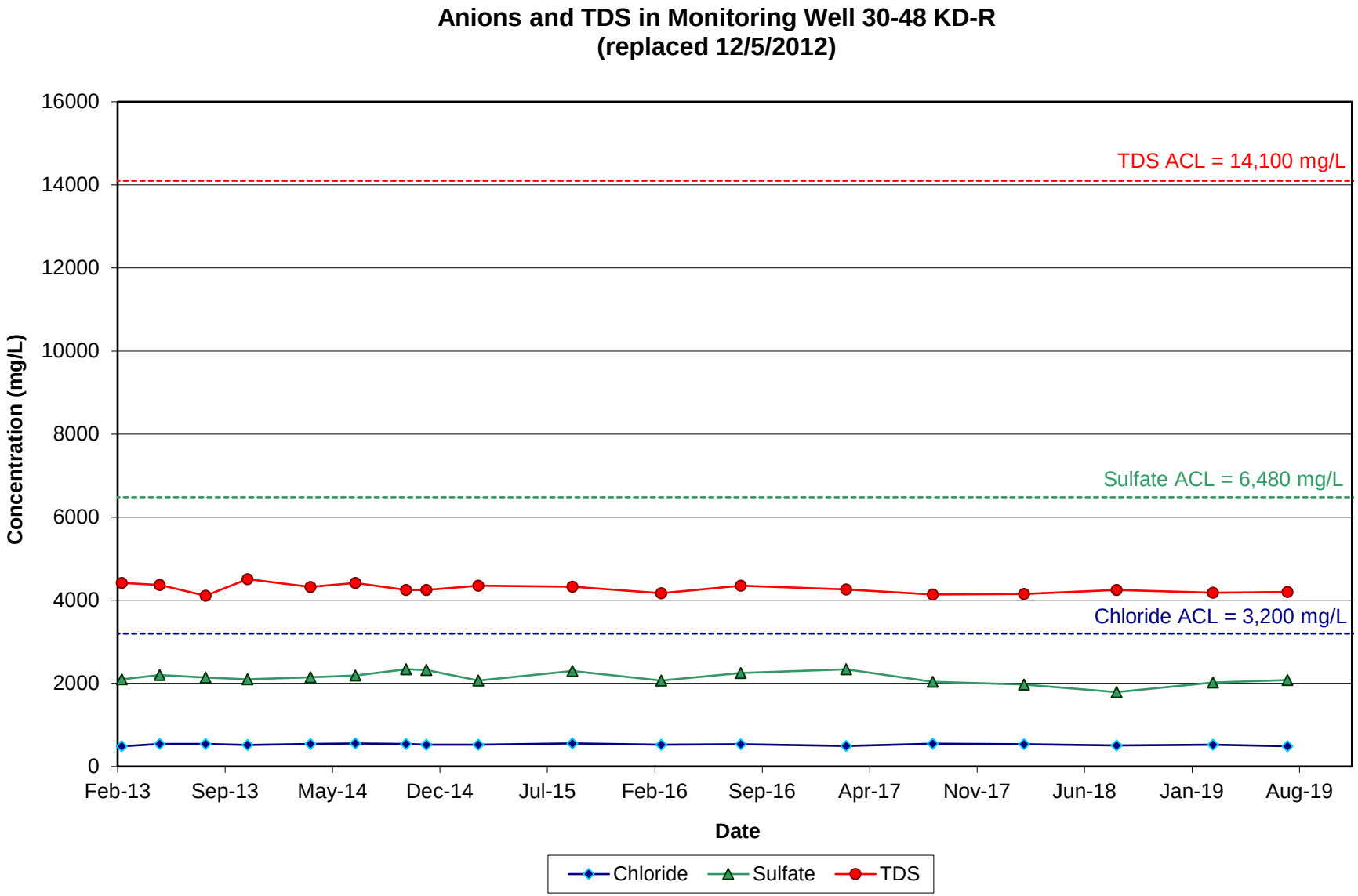
Metals in Monitoring Well 30-02 KD

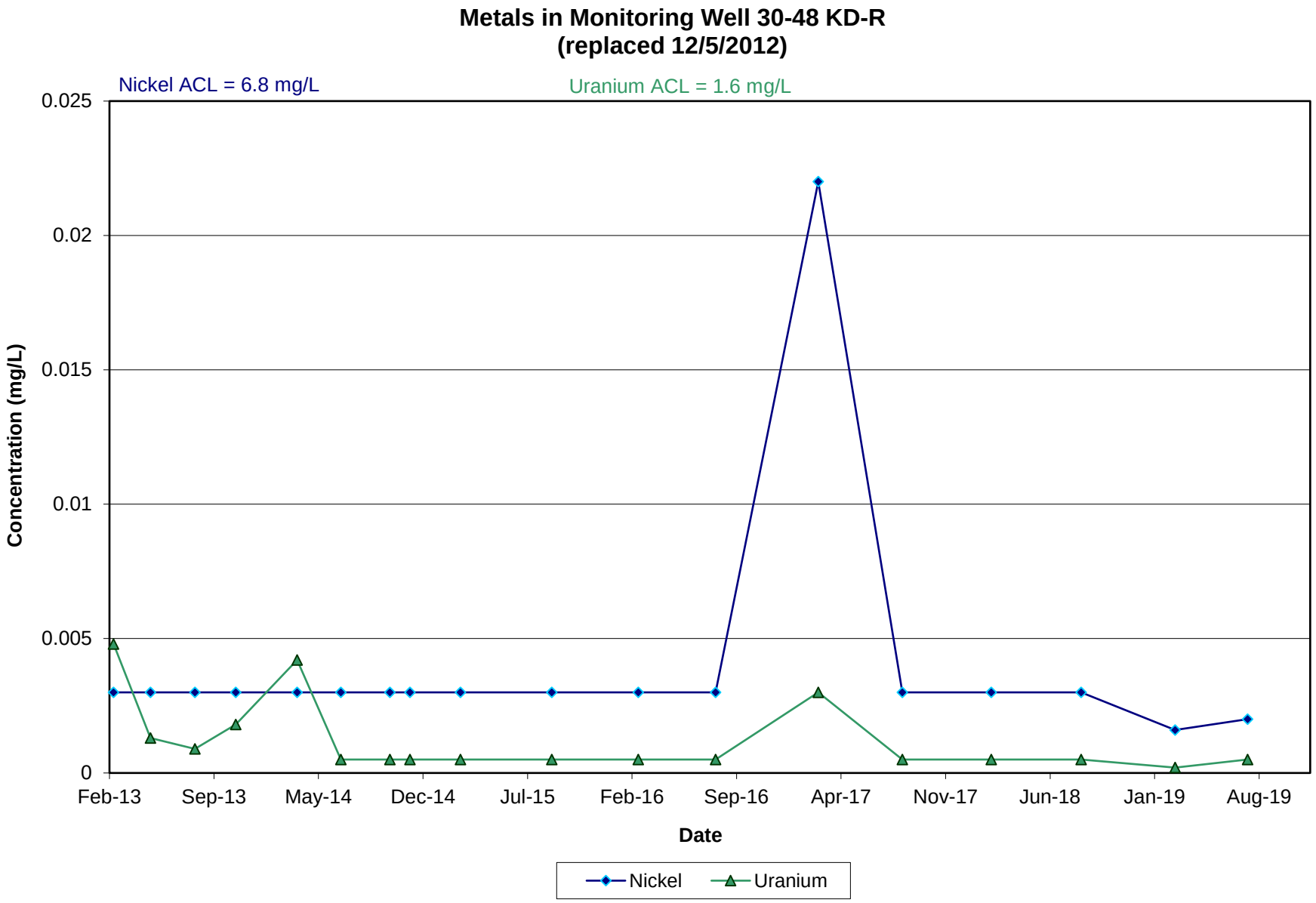


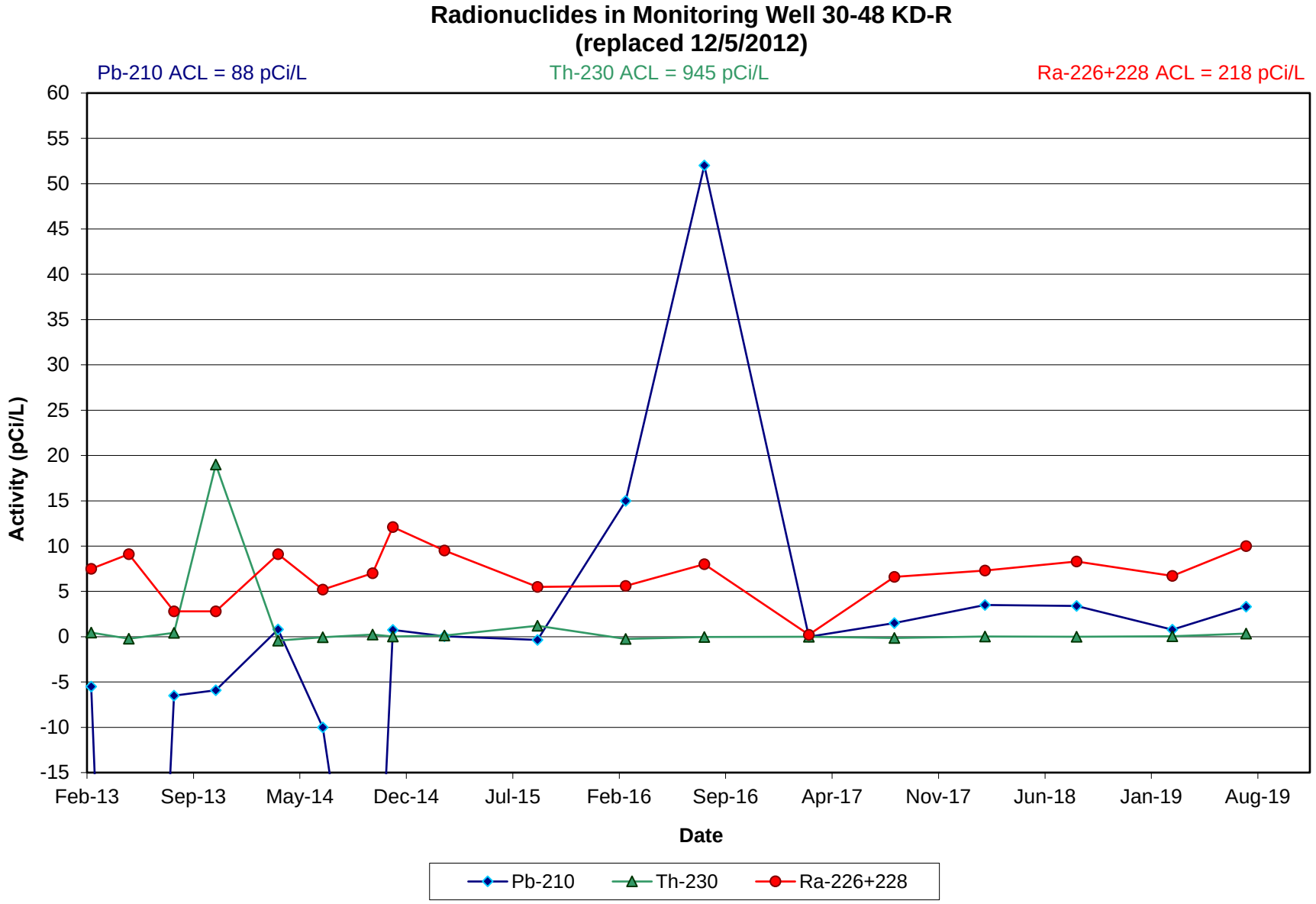

Radionuclides in Monitoring Well 30-02 KD
Pb-210 ACL = 88 pCi/L
Th-230 ACL = 945 pCi/L
Ra-226+228 ACL = 218 pCi/L
Activity (pCi/L)
18
16
14
12
10
8
6
4
2
0
-2
Mar-83
Jan-86
Oct-88
Aug-91
Jun-94
Mar-97
Jan-00
Nov-02
Aug-05
Jun-08
Mar-11
Jan-14
Nov-16
Aug-19
Date
DRY
Pb-210
Th-230
Ra-226+228

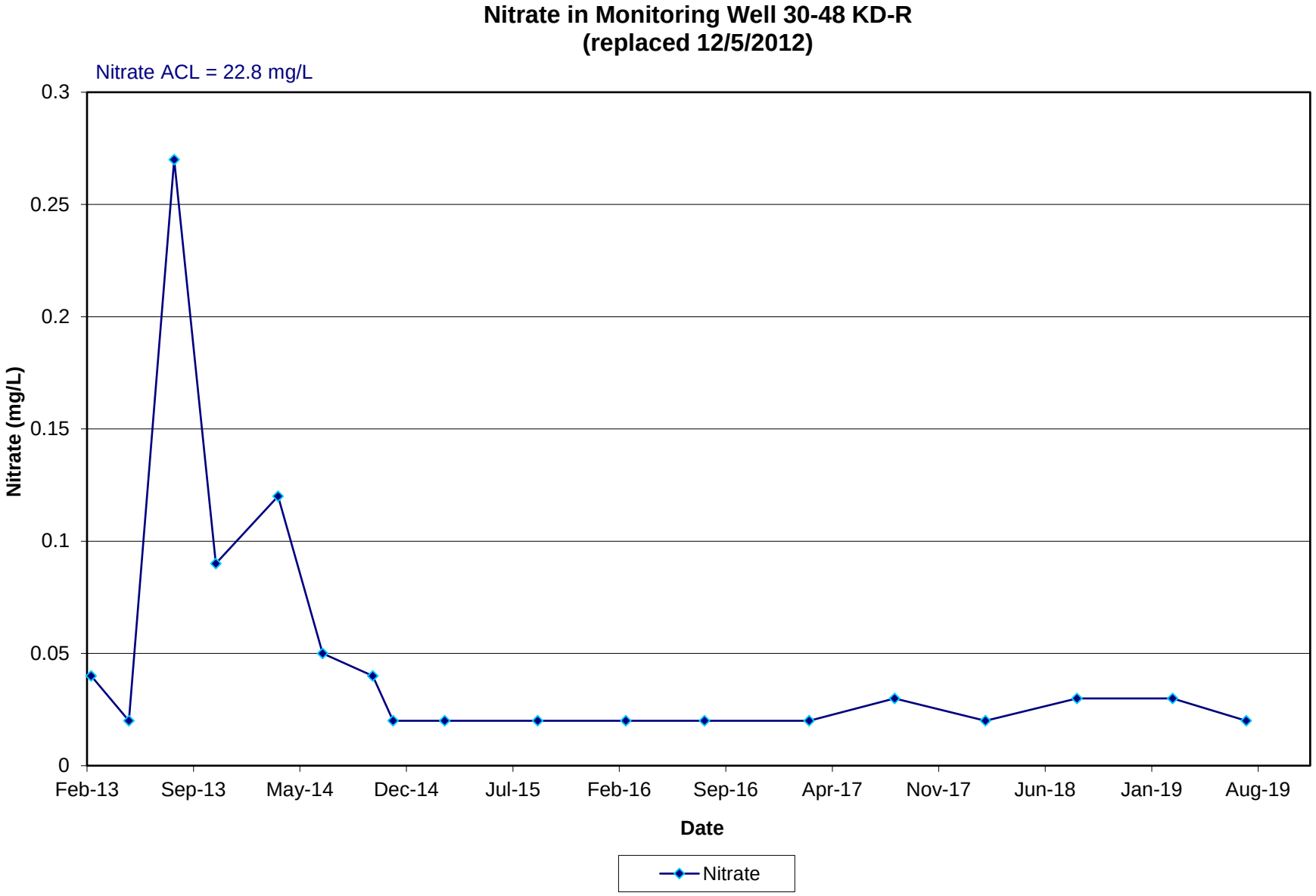
Nitrate in Monitoring Well 30-02 KD

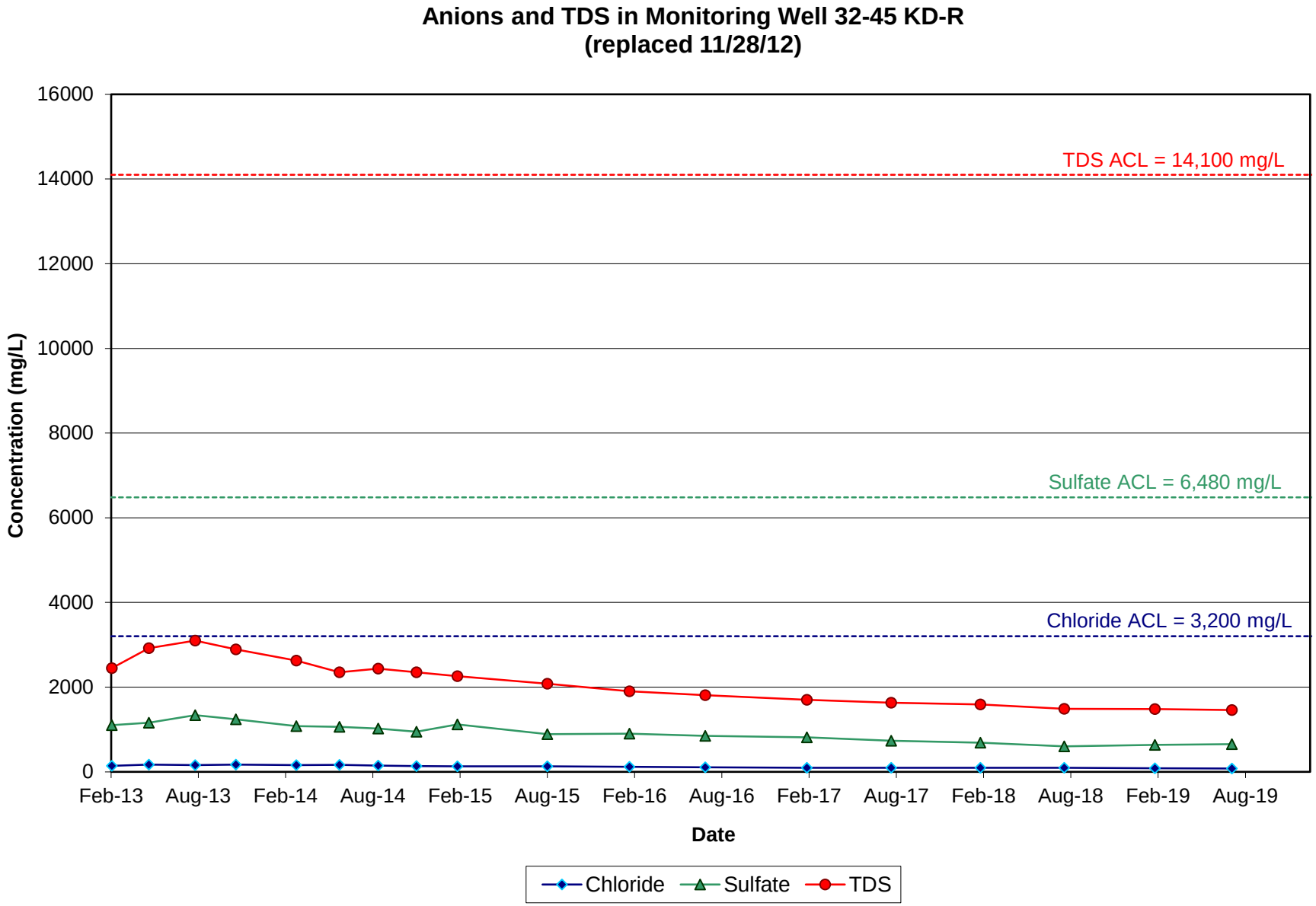


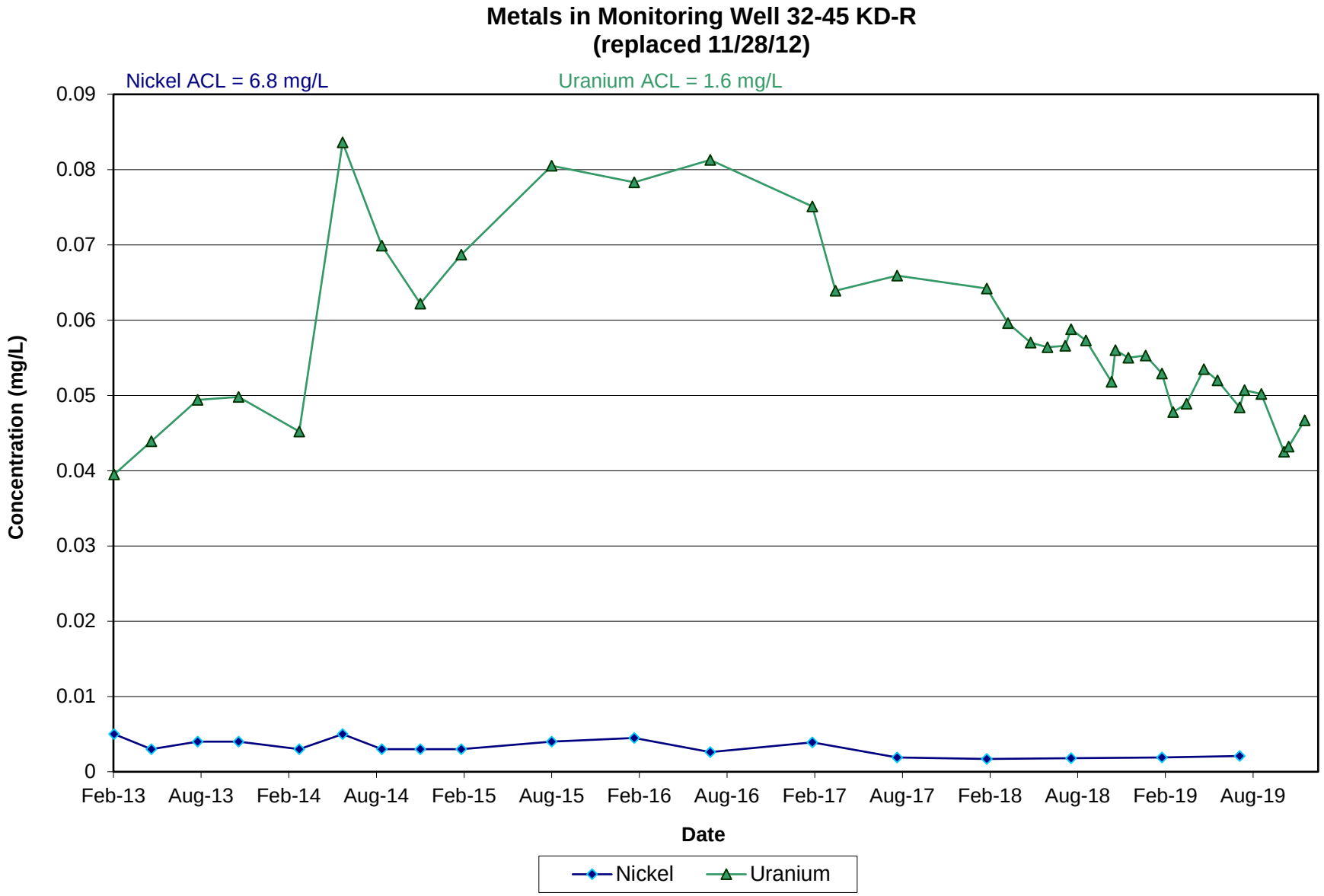

Anions and TDS in Monitoring Well 30-48 KD-R
(replaced 12/5/2012)
16000
14000
12000
10000
8000
6000
4000
2000
0
Concentration (mg/L)
TDS ACL = 14,100 mg/L
Sulfate ACL = 6,480 mg/L
Chloride ACL = 3,200 mg/L
Feb-13
Sep-13
May-14
Dec-14
Jul-15
Feb-16
Sep-16
Apr-17
Nov-17
Jun-18
Jan-19
Aug-19
Date
Chloride
Sulfate
TDS

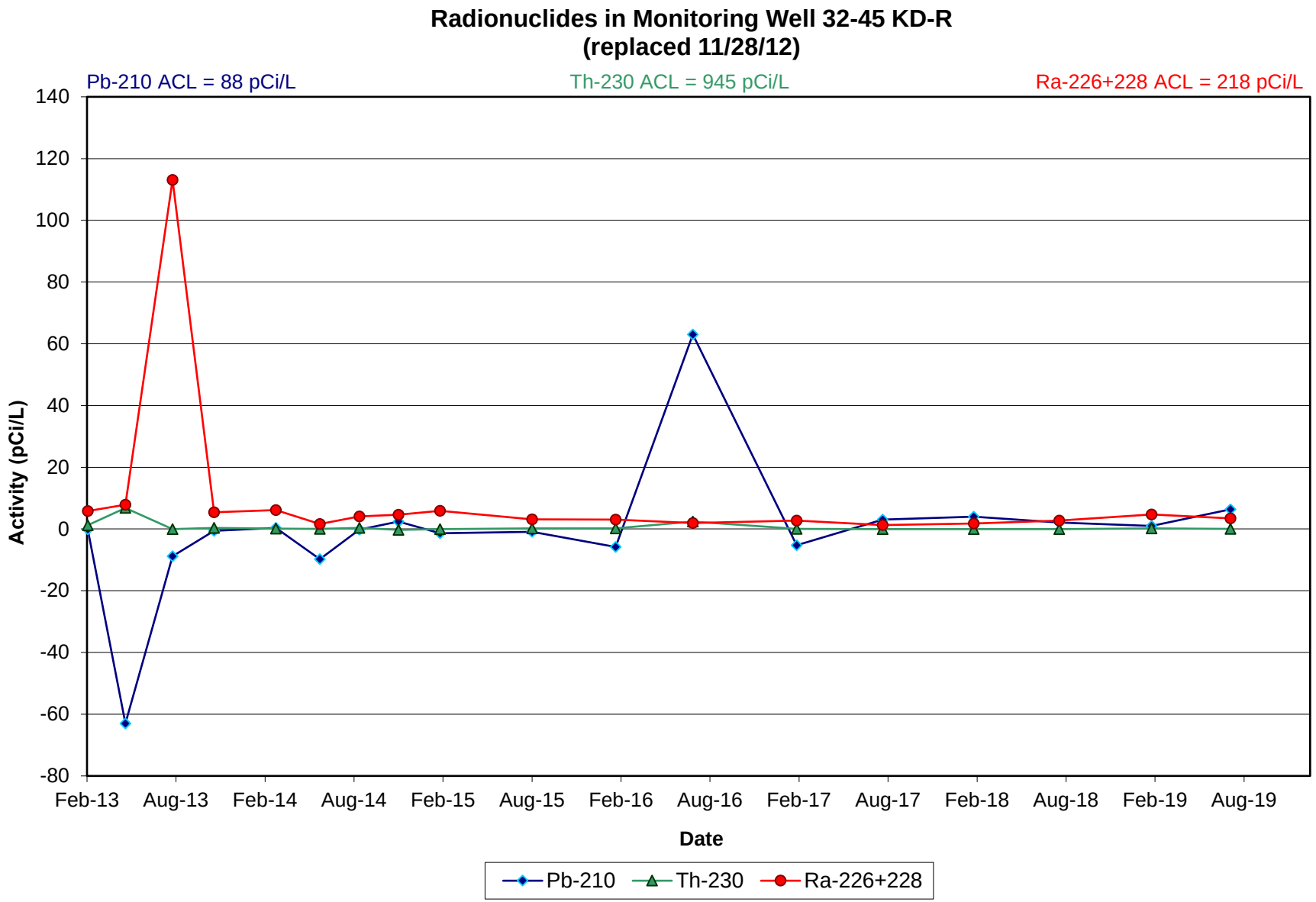

Metals in Monitoring Well 30-48 KD-R
(replaced 12/5/2012)
Nickel ACL = 6.8 mg/L
Uranium ACL = 1.6 mg/L
Concentration (mg/L)
0.025
0.02
0.015
0.01
0.005
0
Feb-13
Sep-13
May-14
Dec-14
Jul-15
Feb-16
Sep-16
Apr-17
Nov-17
Jun-18
Jan-19
Aug-19
Date
Nickel
Uranium

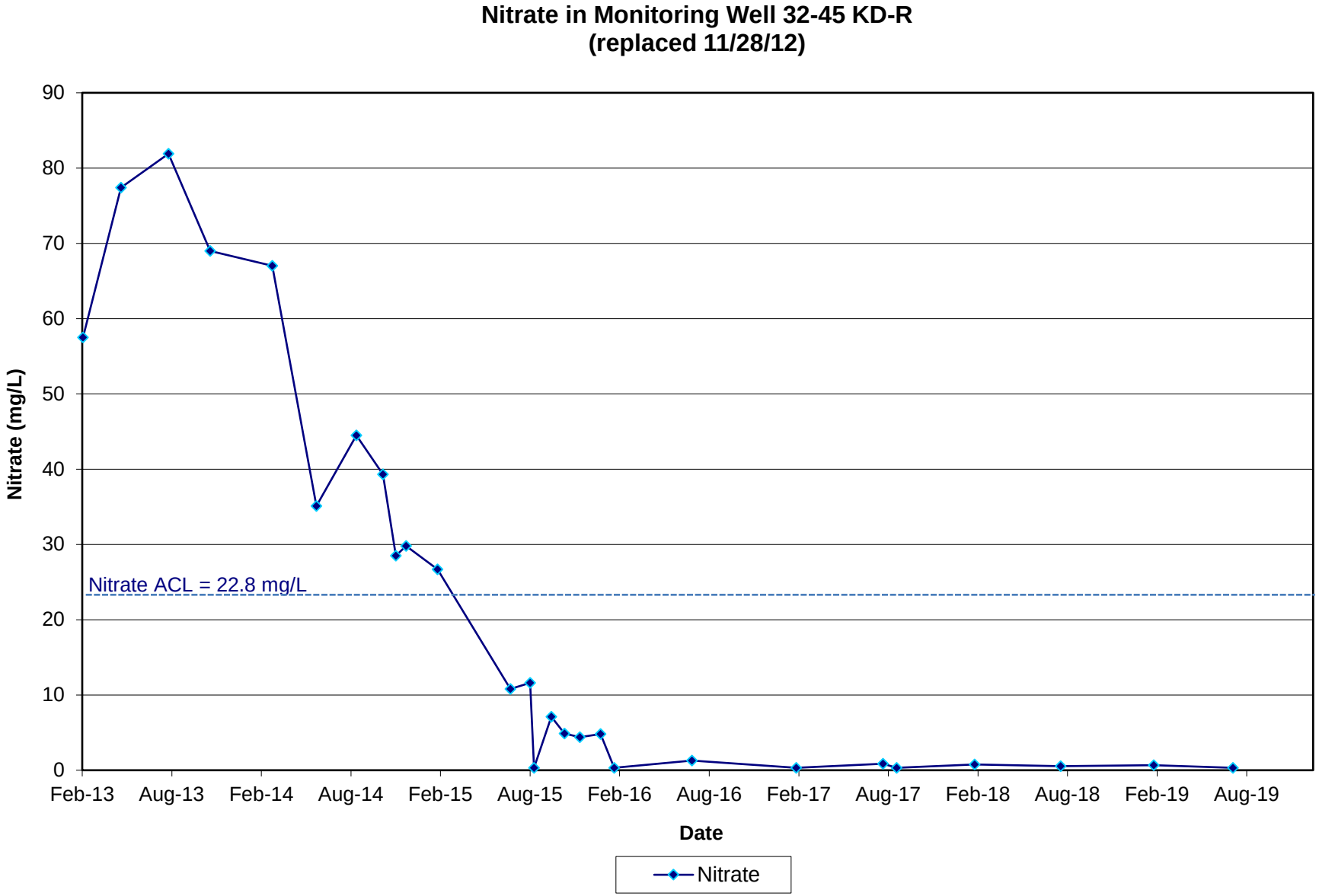

Radionuclides in Monitoring Well 30-48 KD-R
(replaced 12/5/2012)
Pb-210 ACL = 88 pCi/L
Th-230 ACL = 945 pCi/L
Ra-226+228 ACL = 218 pCi/L
Activity (pCi/L)
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
Feb-13
Sep-13
May-14
Dec-14
Jul-15
Feb-16
Sep-16
Apr-17
Nov-17
Jun-18
Jan-19
Aug-19
Date
Pb-210
Th-230
Ra-226+228


Nitrate in Monitoring Well 30-48 KD-R
(replaced 12/5/2012)
Nitrate ACL = 22.8 mg/L
0.3
0.25
0.2
0.15
0.1
0.05
0
Nitrate (mg/L)
Feb-13
Sep-13
May-14
Dec-14
Jul-15
Feb-16
Sep-16
Apr-17
Nov-17
Jun-18
Jan-19
Aug-19
Date
Nitrate

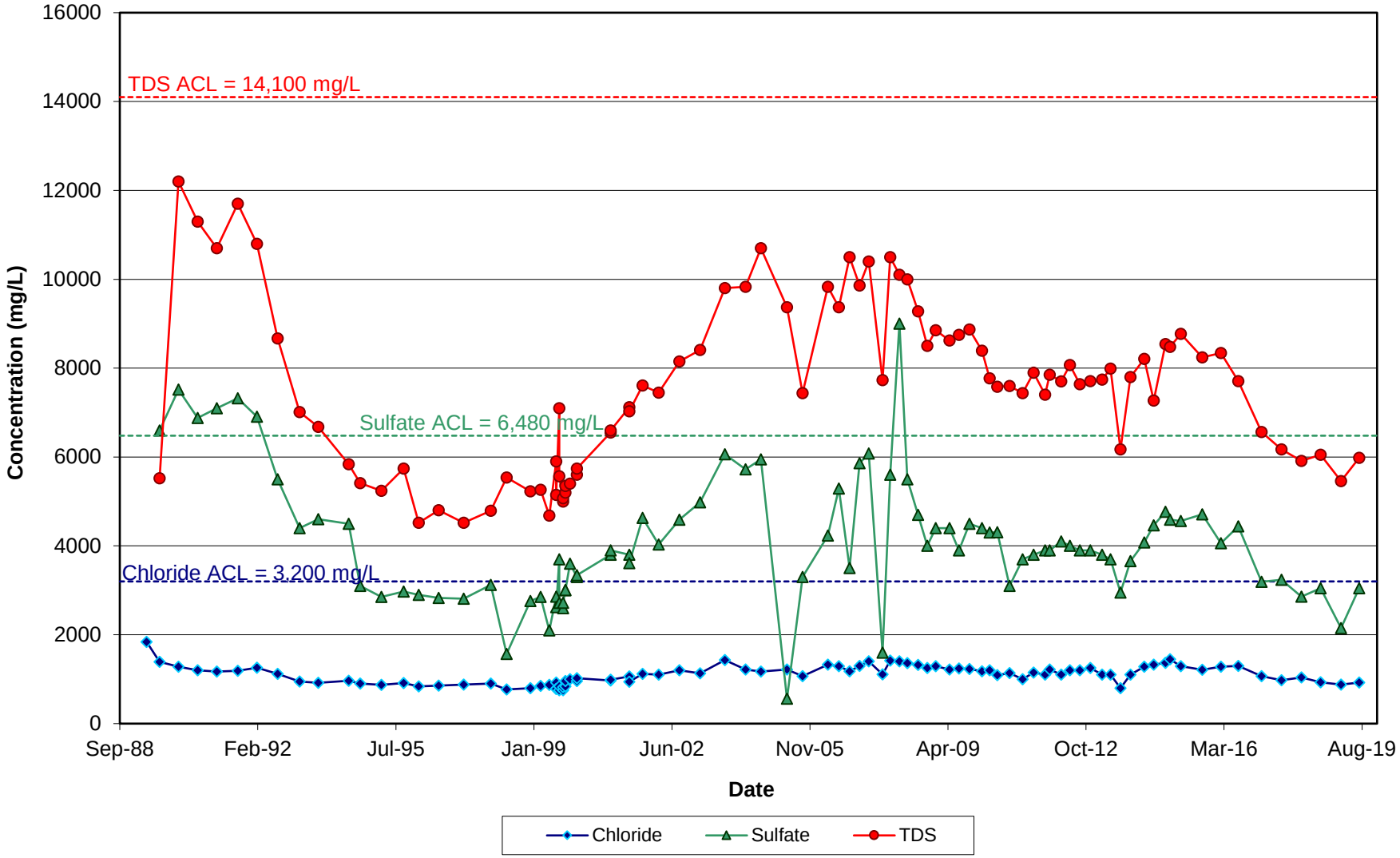

Anions and TDS in Monitoring Well 32-45 KD-R
(replaced 11/28/12)
16000
14000
12000
10000
8000
6000
4000
2000
0
Concentration (mg/L)
TDS ACL = 14,100 mg/L
Sulfate ACL = 6,480 mg/L
Chloride ACL = 3,200 mg/L
Feb-13
Aug-13
Feb-14
Aug-14
Feb-15
Aug-15
Feb-16
Aug-16
Feb-17
Aug-17
Feb-18
Aug-18
Feb-19
Aug-19
Date
Chloride
Sulfate
TDS


Metals in Monitoring Well 32-45 KD-R
(replaced 11/28/12)
Nickel ACL = 6.8 mg/L
Uranium ACL = 1.6 mg/L
Concentration (mg/L)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Feb-13
Aug-13
Feb-14
Aug-14
Feb-15
Aug-15
Feb-16
Aug-16
Feb-17
Aug-17
Feb-18
Aug-18
Feb-19
Aug-19
Date
Nickel
Uranium

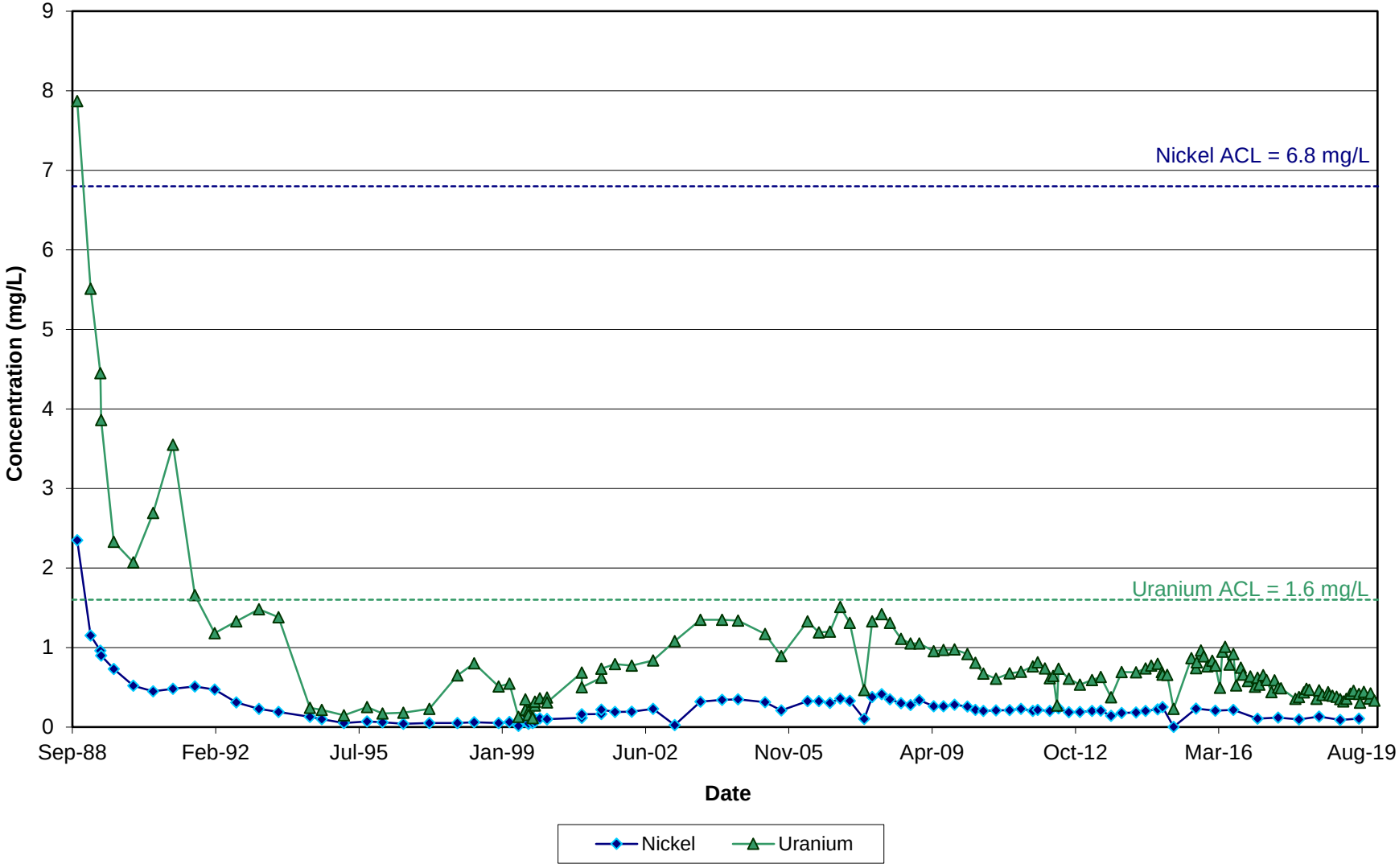

Radionuclides in Monitoring Well 32-45 KD-R
(replaced 11/28/12)
Pb-210 ACL = 88 pCi/L
Th-230 ACL = 945 pCi/L
Ra-226+228 ACL = 218 pCi/L
Activity (pCi/L)
140
120
100
80
60
40
20
0
-20
-40
-60
-80
Feb-13
Aug-13
Feb-14
Aug-14
Feb-15
Aug-15
Feb-16
Aug-16
Feb-17
Aug-17
Feb-18
Aug-18
Feb-19
Aug-19
Date
Pb-210
Th-230
Ra-226+228


Nitrate in Monitoring Well 32-45 KD-R
(replaced 11/28/12)
Nitrate (mg/L)
90
80
70
60
50
40
30
20
10
0
Nitrate ACL = 22.8 mg/L
Feb-13
Aug-13
Feb-14
Aug-14
Feb-15
Aug-15
Feb-16
Aug-16
Feb-17
Aug-17
Feb-18
Aug-18
Feb-19
Aug-19
Date
Nitrate

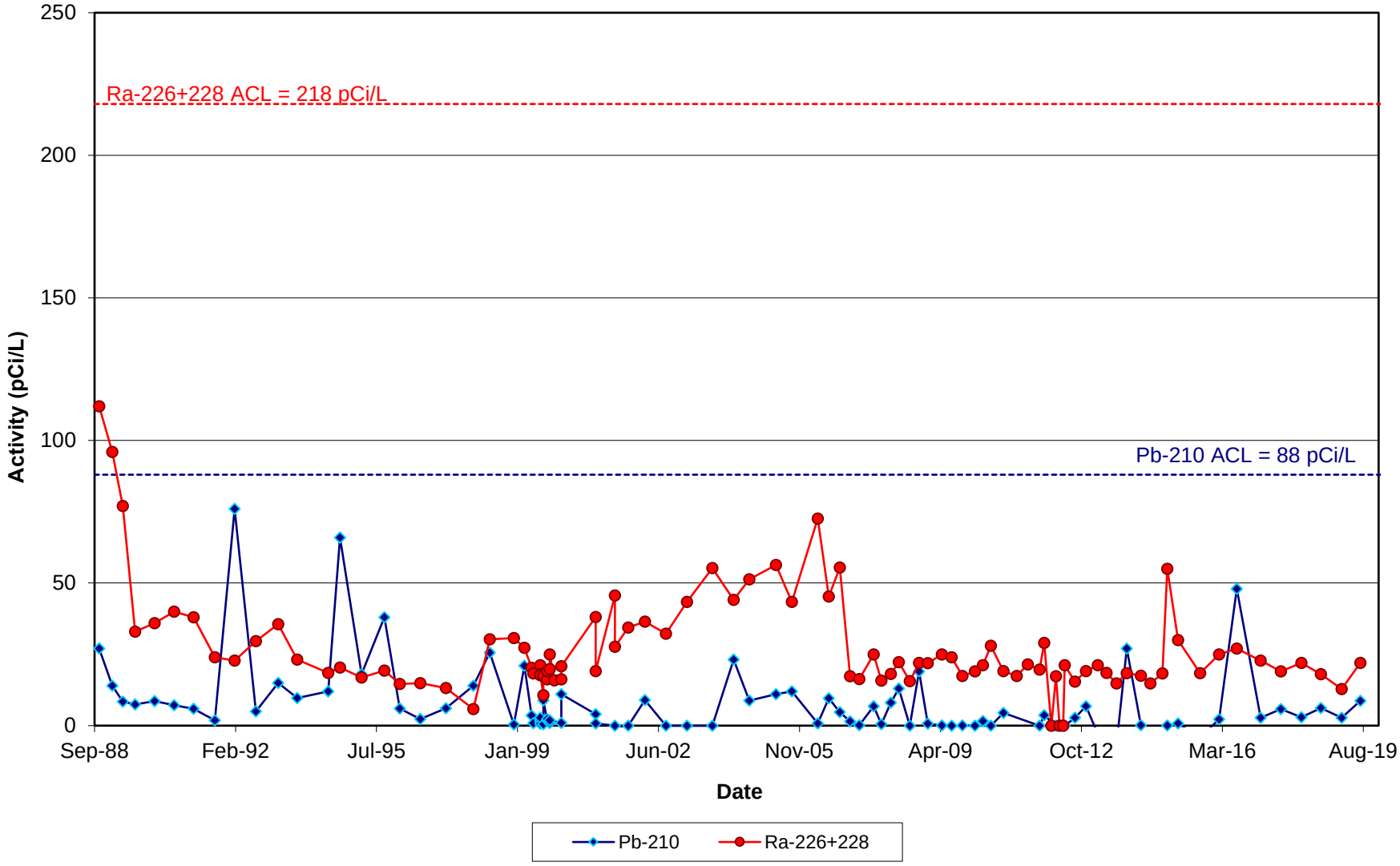
Anions and TDS Well 36-06 KD



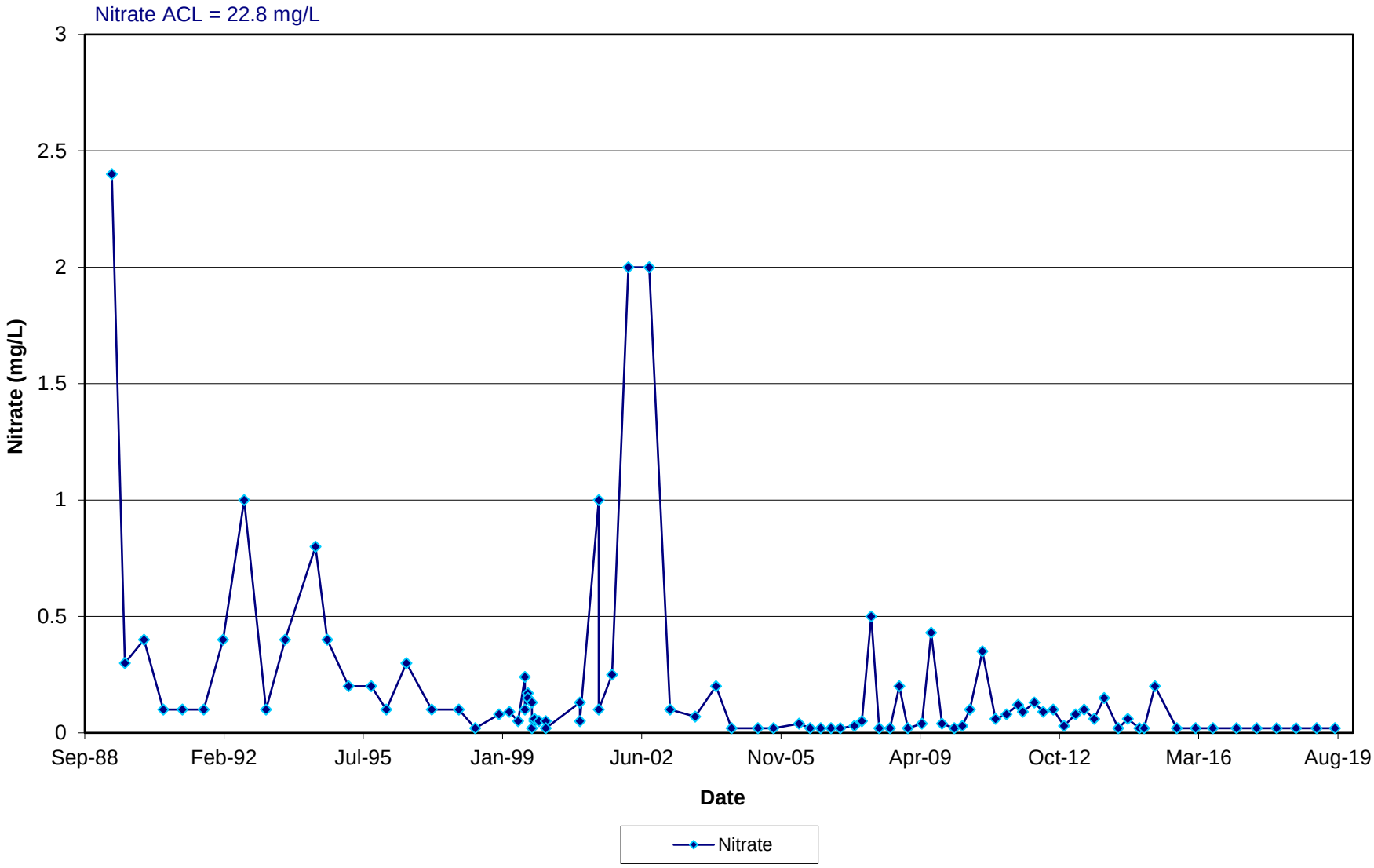
Metals in Monitoring Well 36-06 KD



Radionuclides in Monitoring Well 36-06 KD



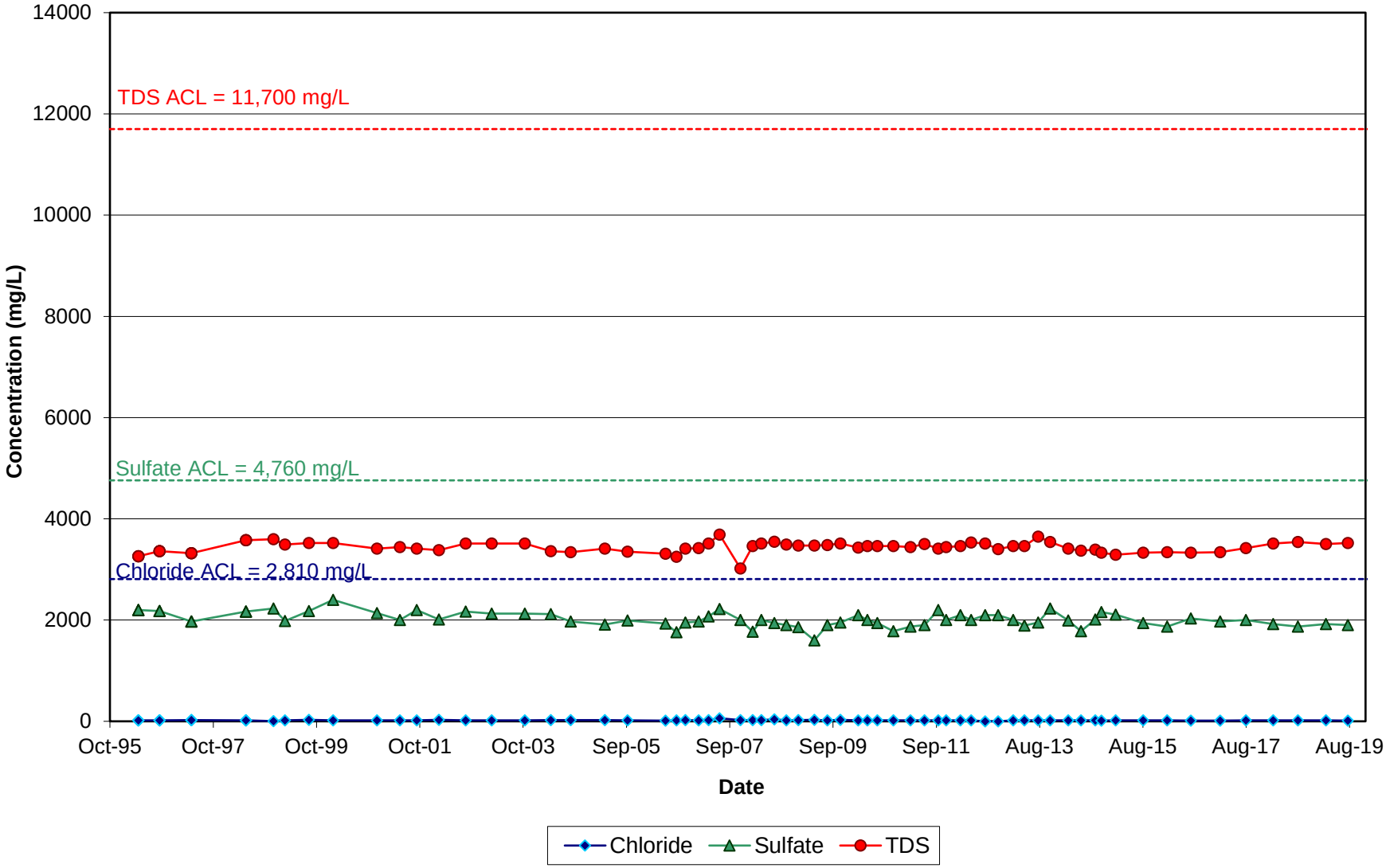
Nitrate in Monitoring Well 36-06 KD



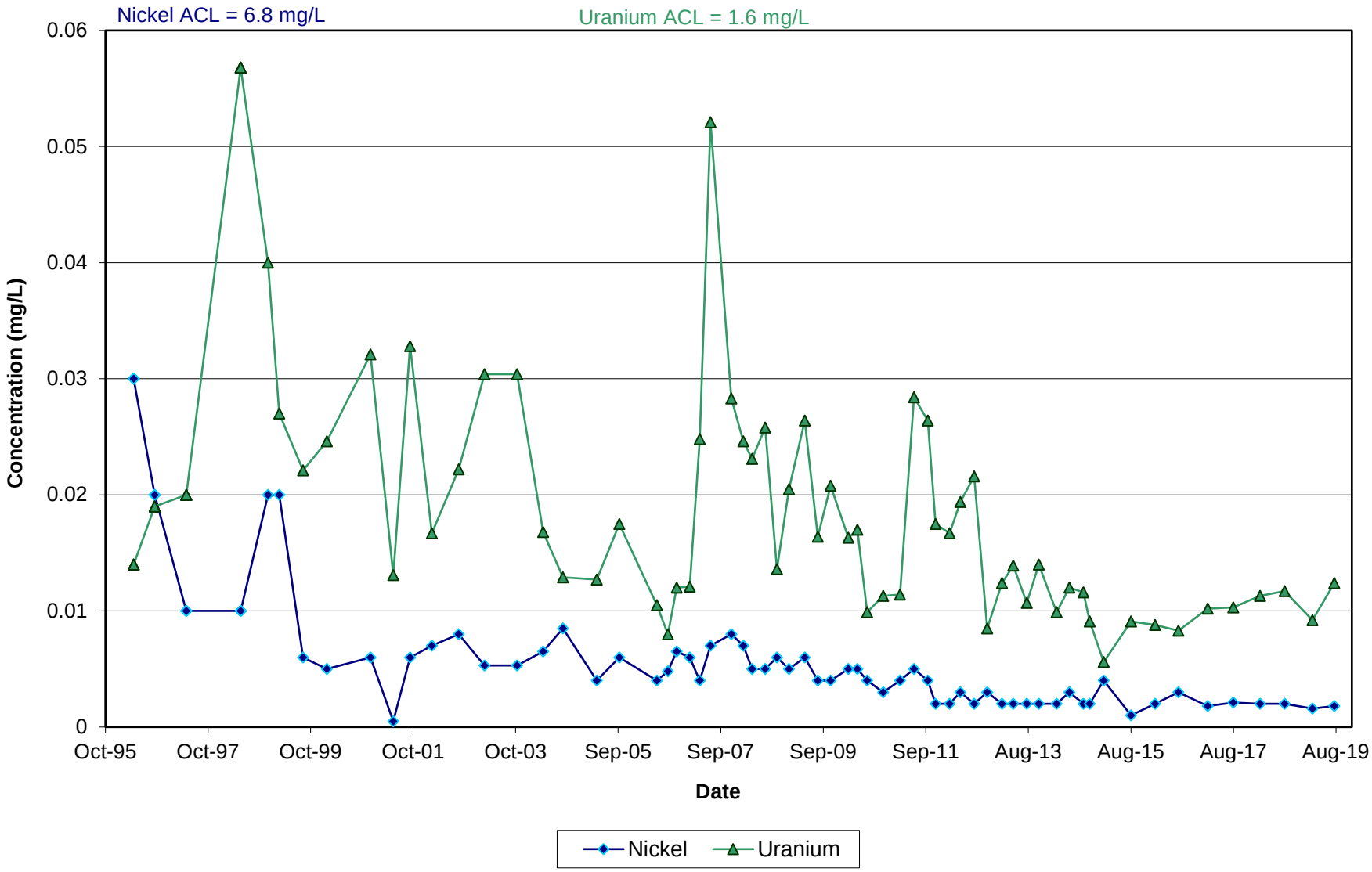
Stability Monitoring Plan
Time Versus Concentration Plots

Tres Hermanos B

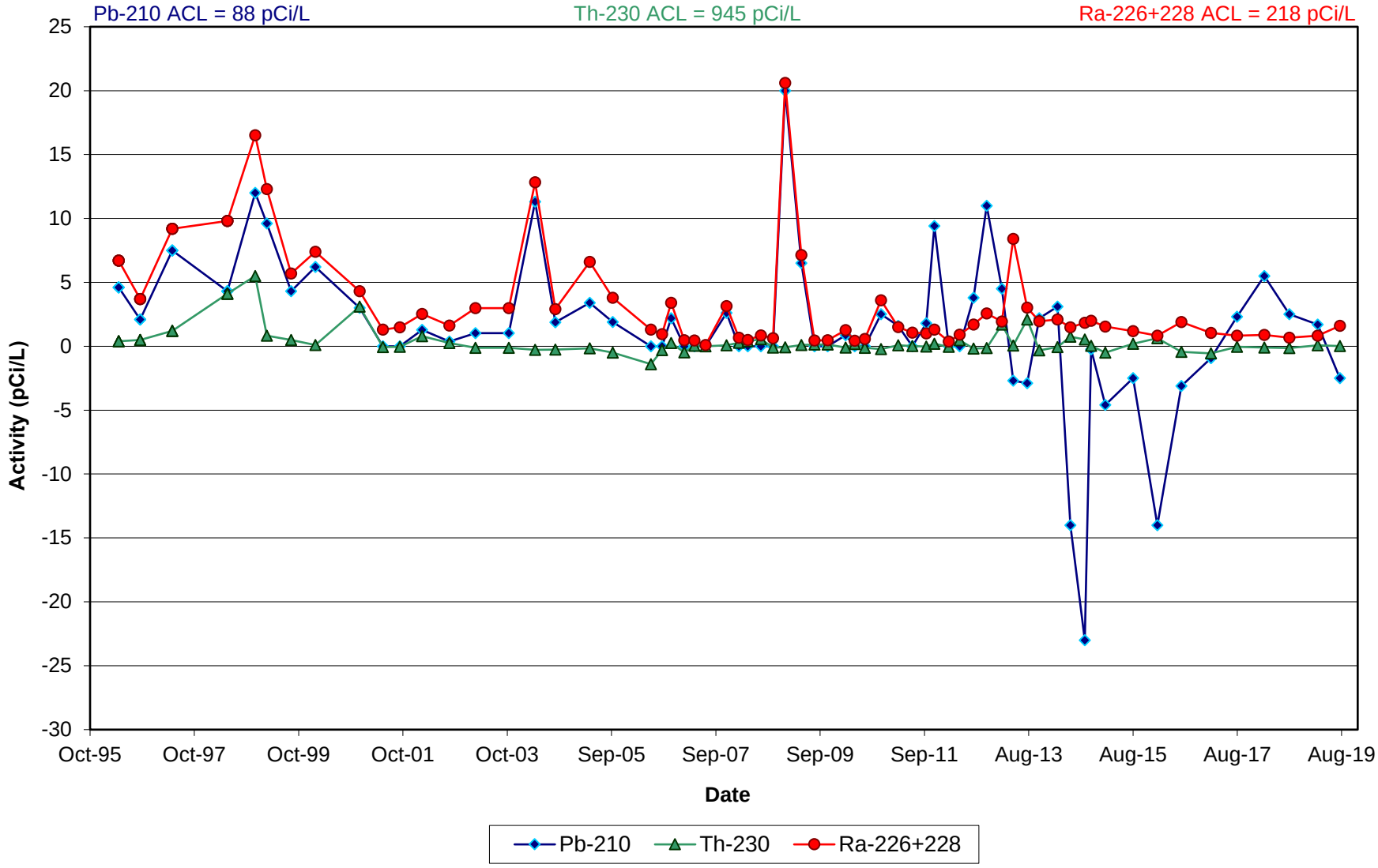
Anions and TDS in Monitoring Well 19-77 TRB



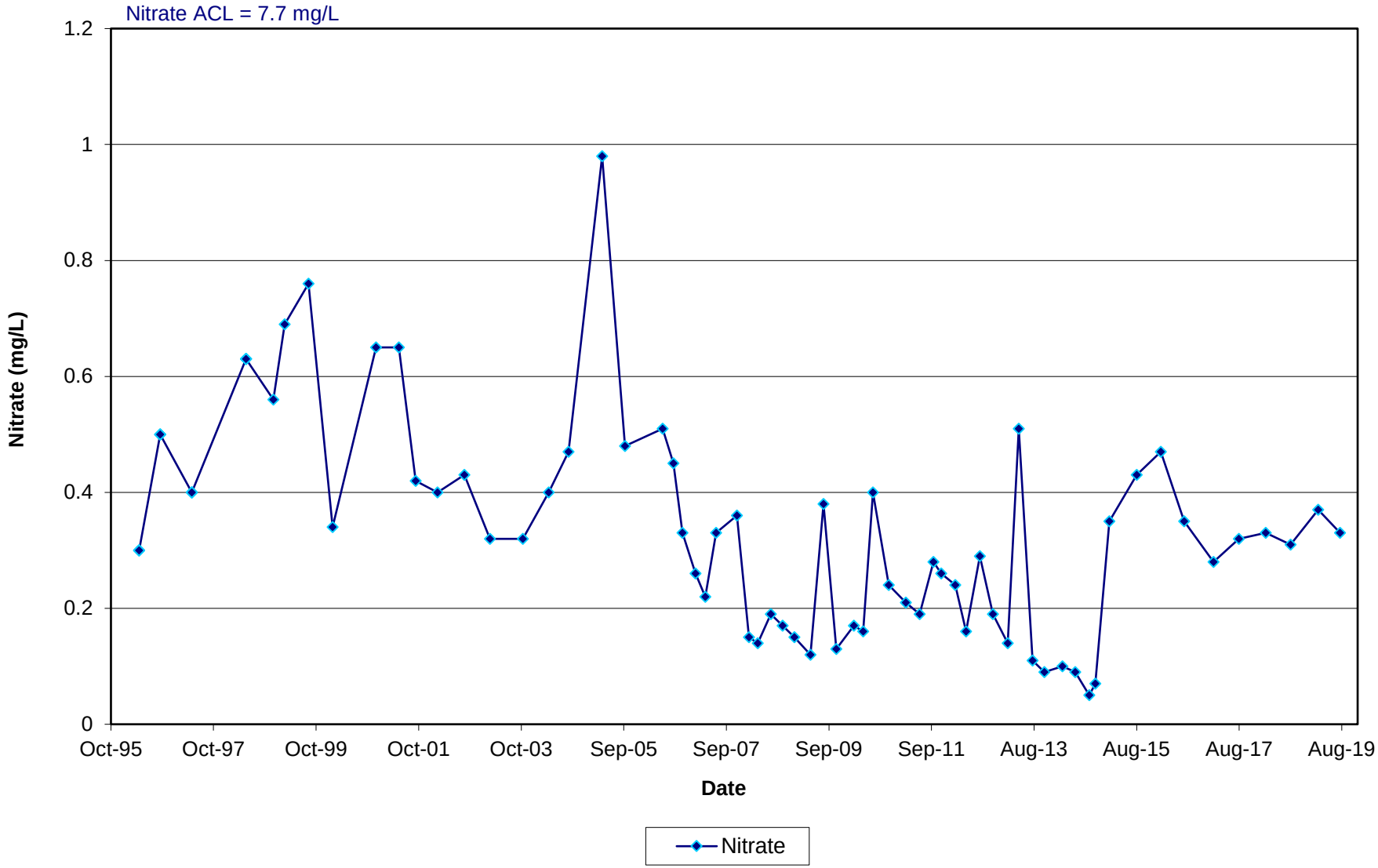
Metals in Monitoring Well 19-77 TRB

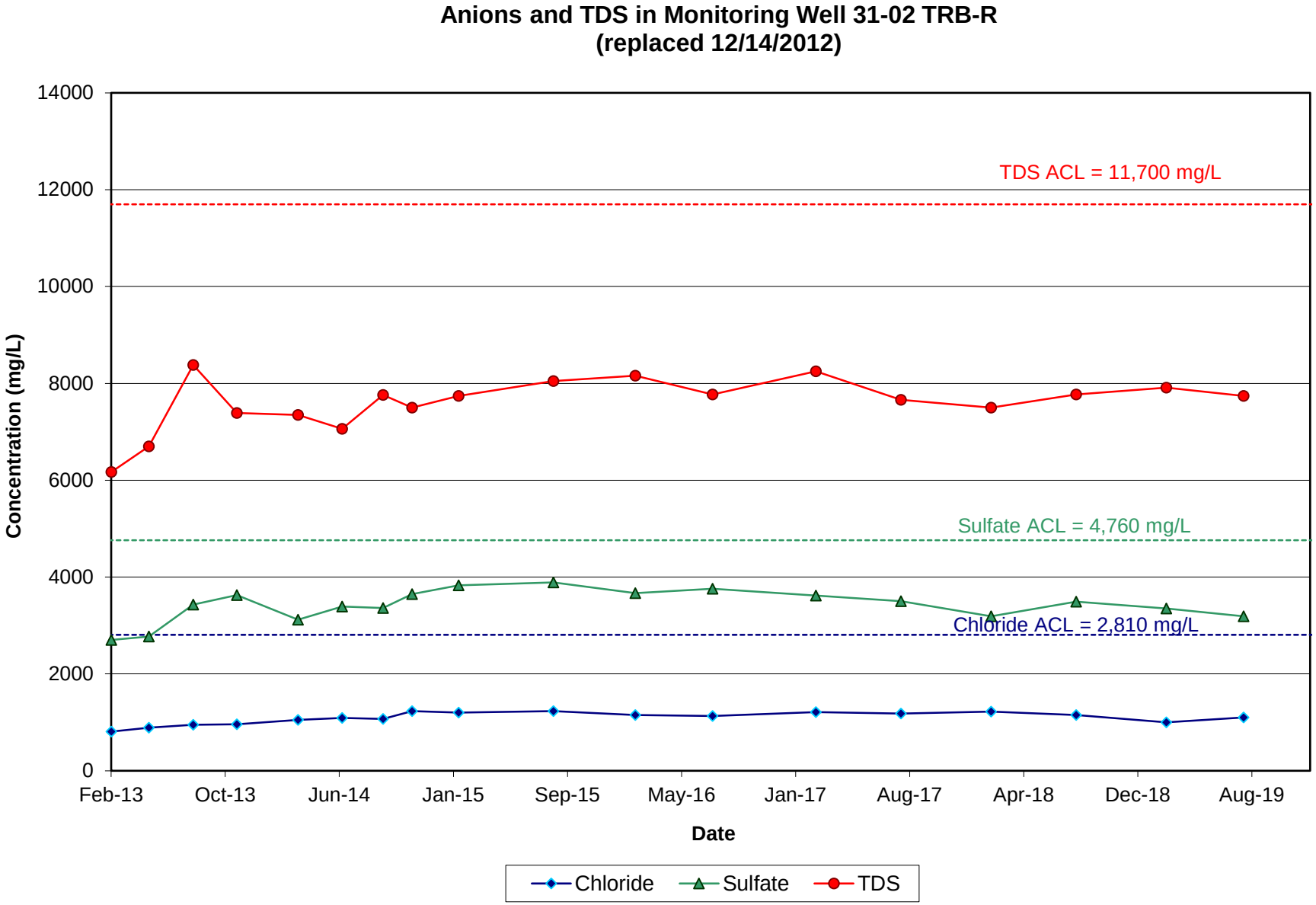


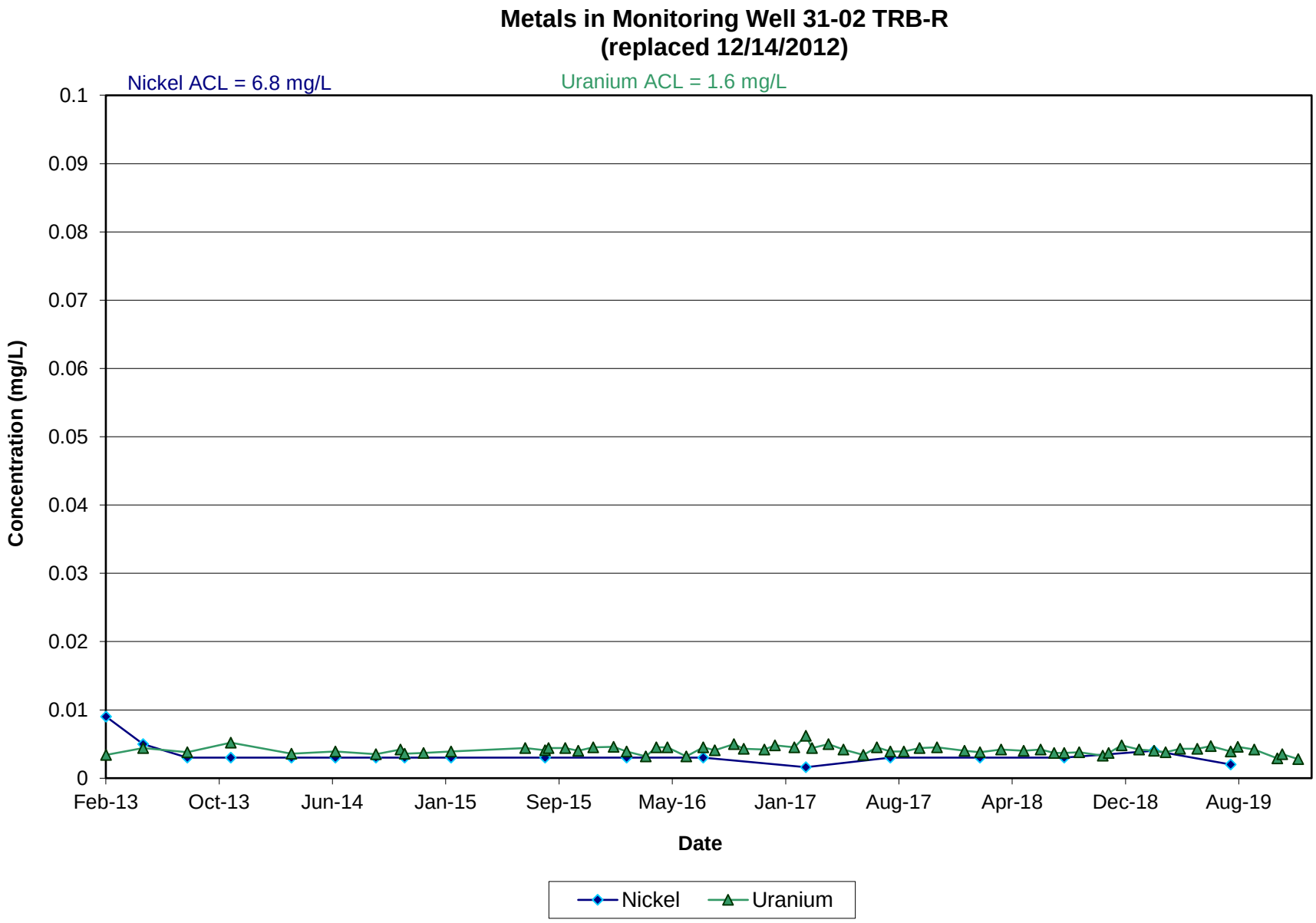
Radionuclides in Monitoring Well 19-77 TRB

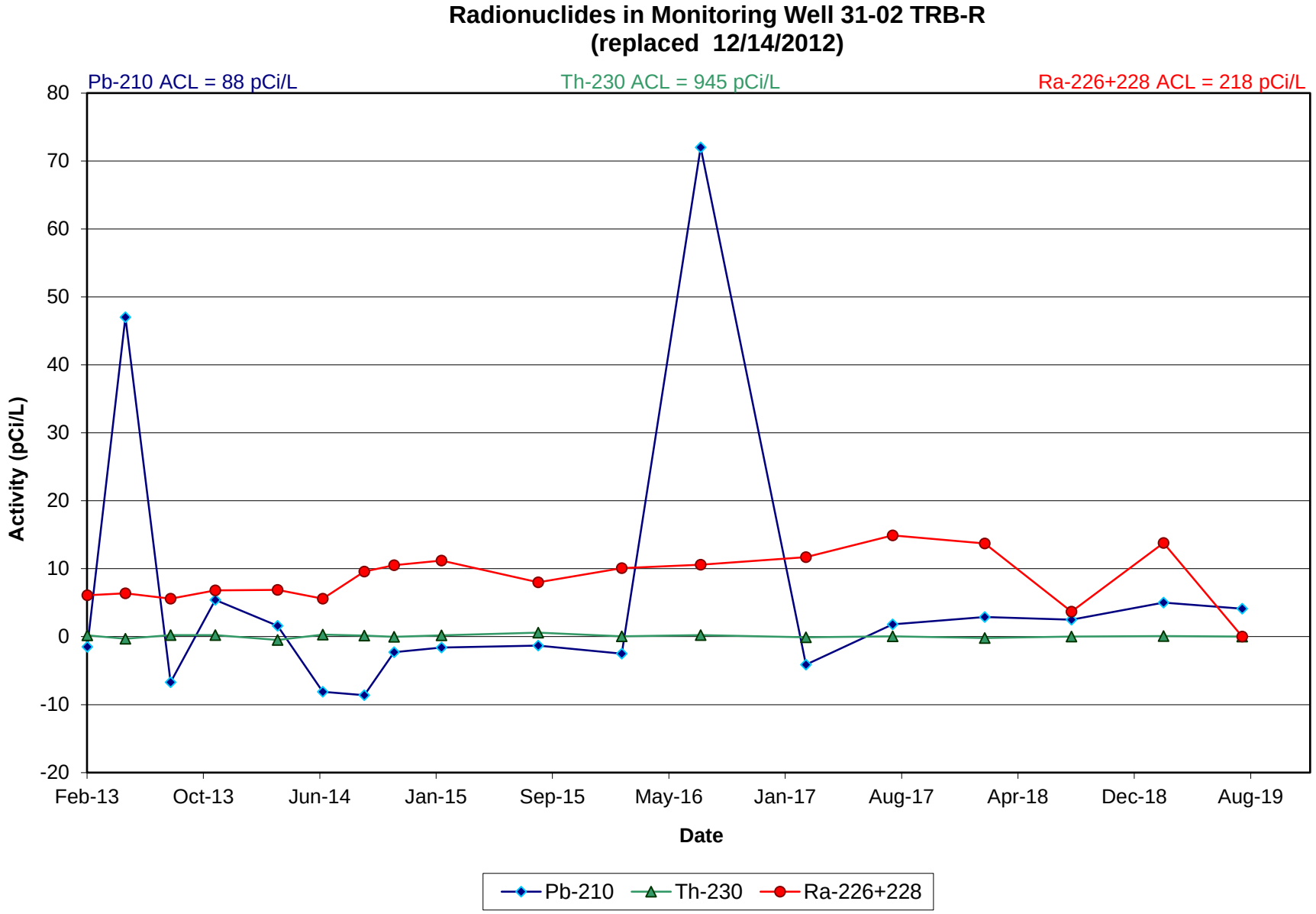


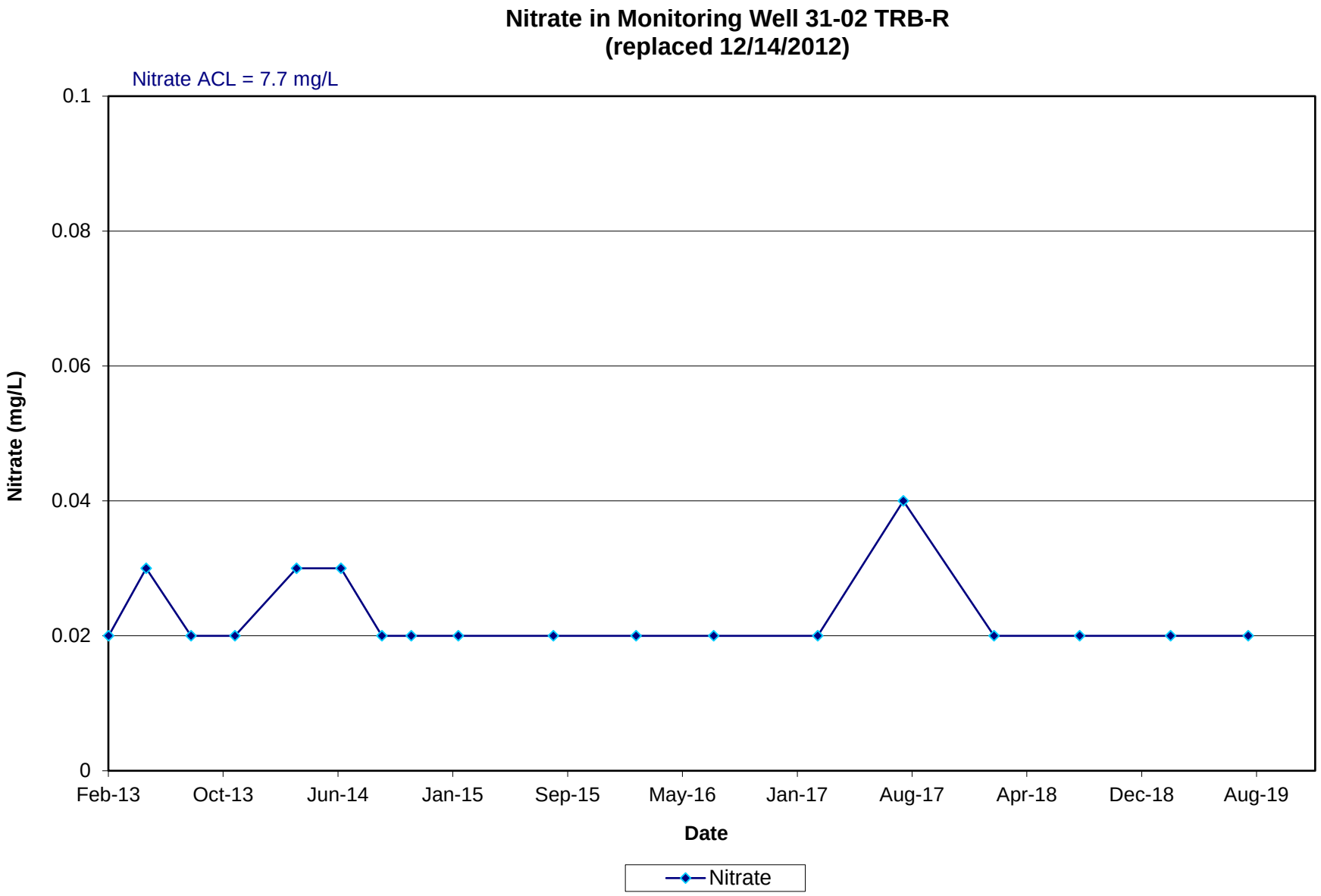
Nitrate in Monitoring Well 19-77 TRB



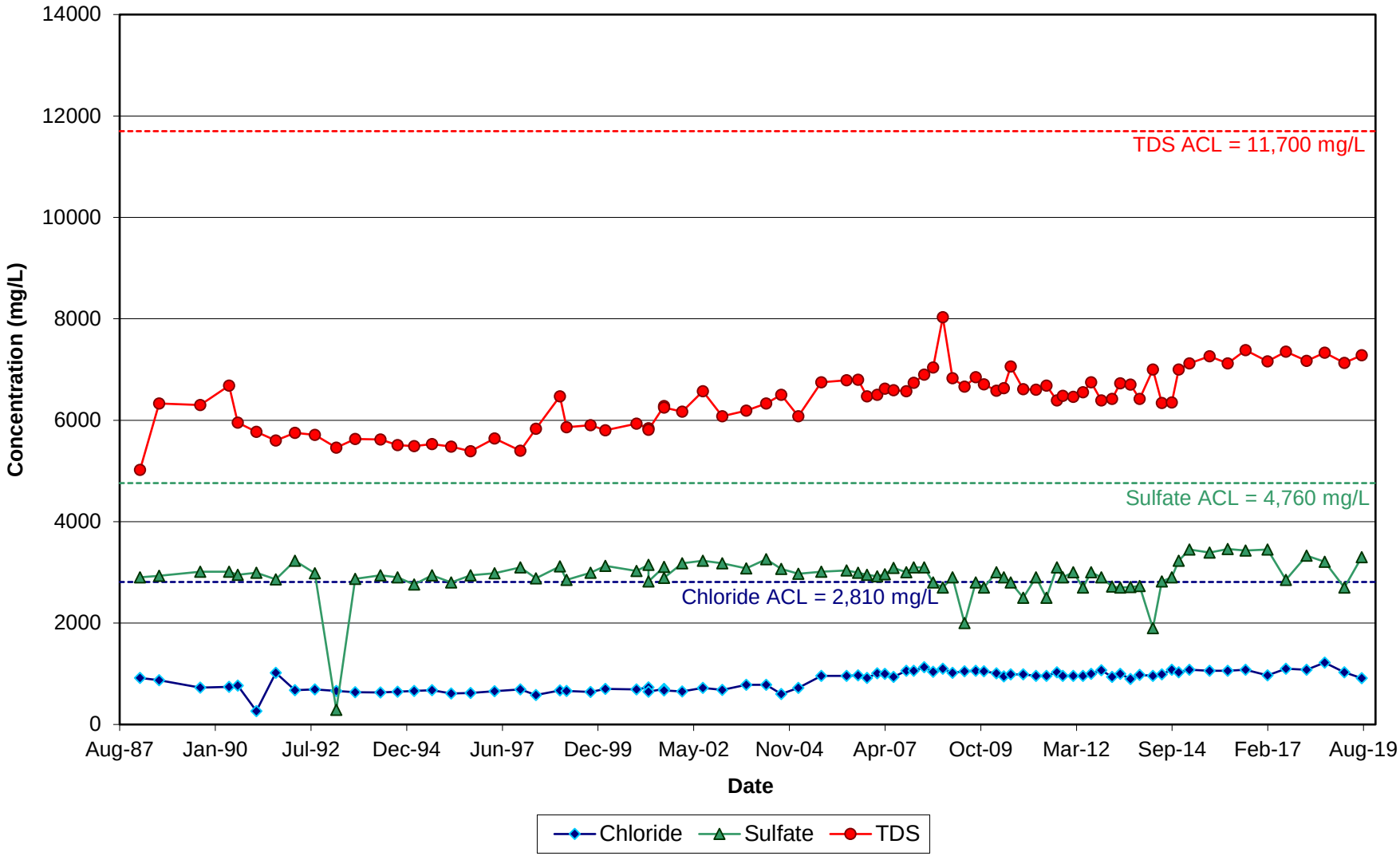

Anions and TDS in Monitoring Well 31-02 TRB-R
(replaced 12/14/2012)
14000
12000
10000
8000
6000
4000
2000
0
Concentration (mg/L)
TDS ACL = 11,700 mg/L
Sulfate ACL = 4,760 mg/L
Chloride ACL = 2,810 mg/L
Feb-13
Oct-13
Jun-14
Jan-15
Sep-15
May-16
Jan-17
Aug-17
Apr-18
Dec-18
Aug-19
Date
Chloride
Sulfate
TDS


Metals in Monitoring Well 31-02 TRB-R
(replaced 12/14/2012)
Nickel ACL = 6.8 mg/L
Uranium ACL = 1.6 mg/L
Concentration (mg/L)
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Feb-13
Oct-13
Jun-14
Jan-15
Sep-15
May-16
Jan-17
Aug-17
Apr-18
Dec-18
Aug-19
Date
Nickel
Uranium

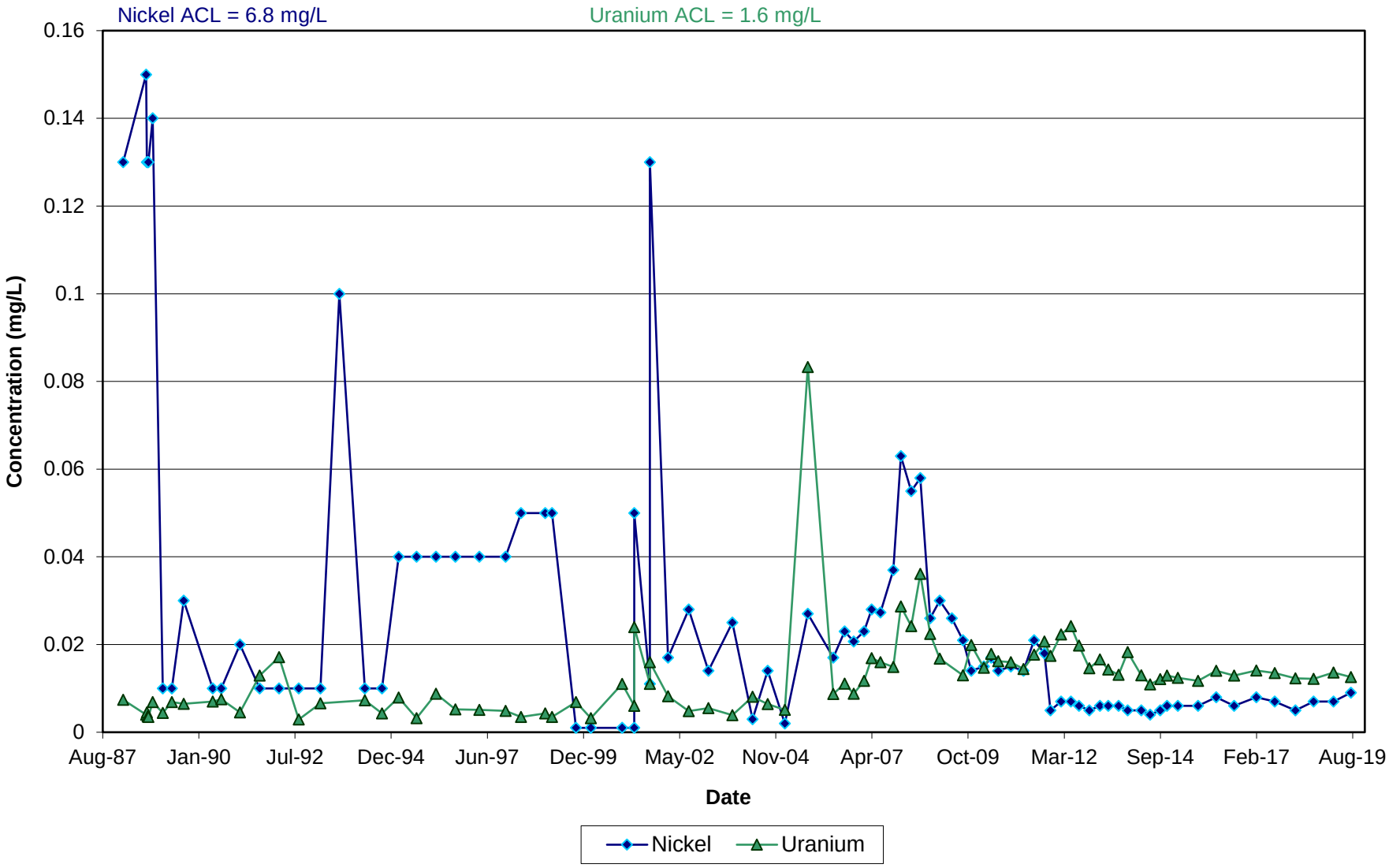

Radionuclides in Monitoring Well 31-02 TRB-R
(replaced 12/14/2012)
Pb-210 ACL = 88 pCi/L
Th-230 ACL = 945 pCi/L
Ra-226+228 ACL = 218 pCi/L
Activity (pCi/L)
80
70
60
50
40
30
20
10
0
-10
-20
Feb-13
Oct-13
Jun-14
Jan-15
Sep-15
May-16
Jan-17
Aug-17
Apr-18
Dec-18
Aug-19
Date
Pb-210
Th-230
Ra-226+228


Nitrate in Monitoring Well 31-02 TRB-R
(replaced 12/14/2012)
Nitrate ACL = 7.7 mg/L
0.1
0.08
0.06
0.04
0.02
0
Nitrate (mg/L)
Feb-13
Oct-13
Jun-14
Jan-15
Sep-15
May-16
Jan-17
Aug-17
Apr-18
Dec-18
Aug-19
Date
Nitrate

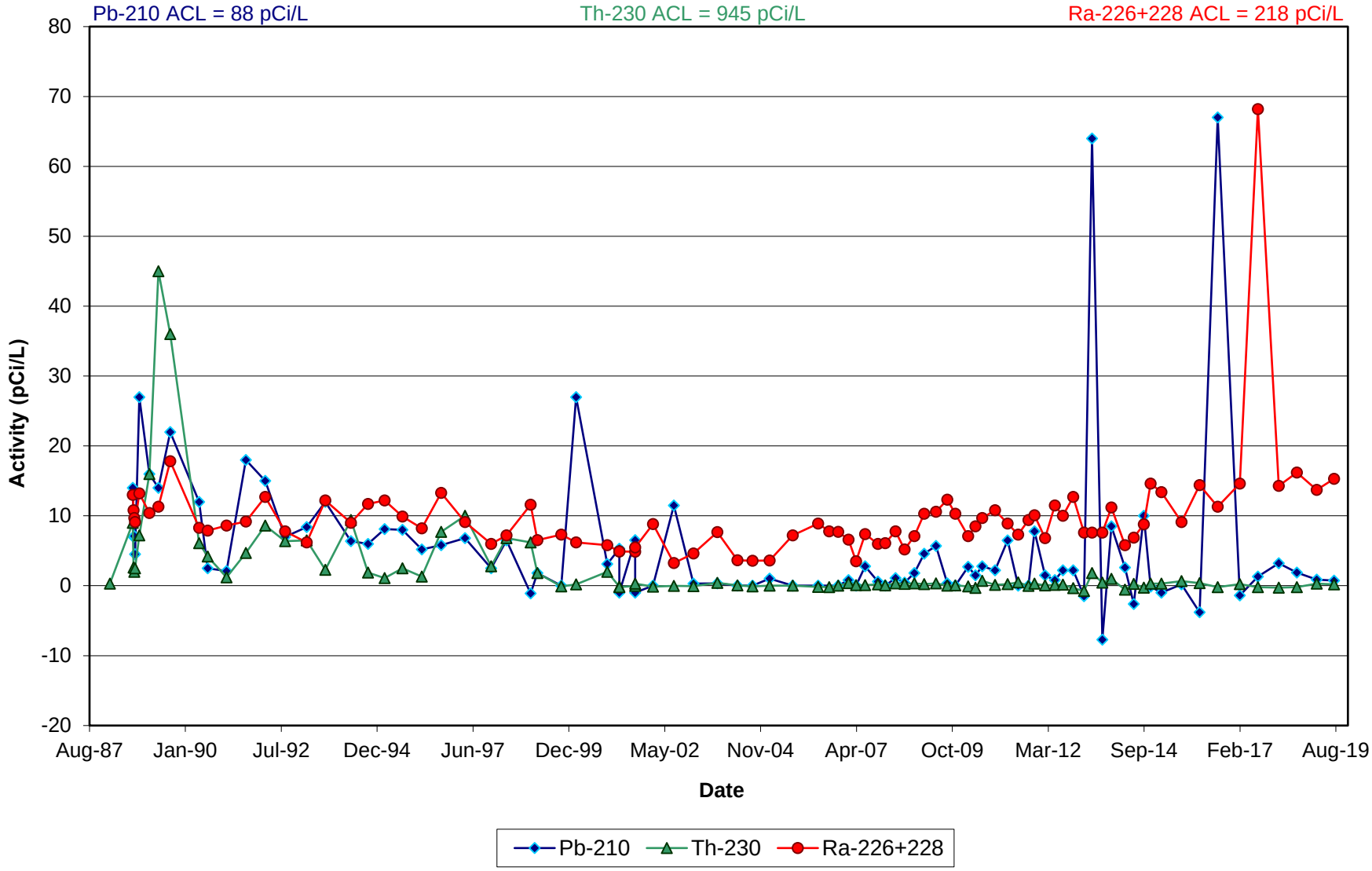
Anions and TDS in Monitoring Well 31-67 TRB



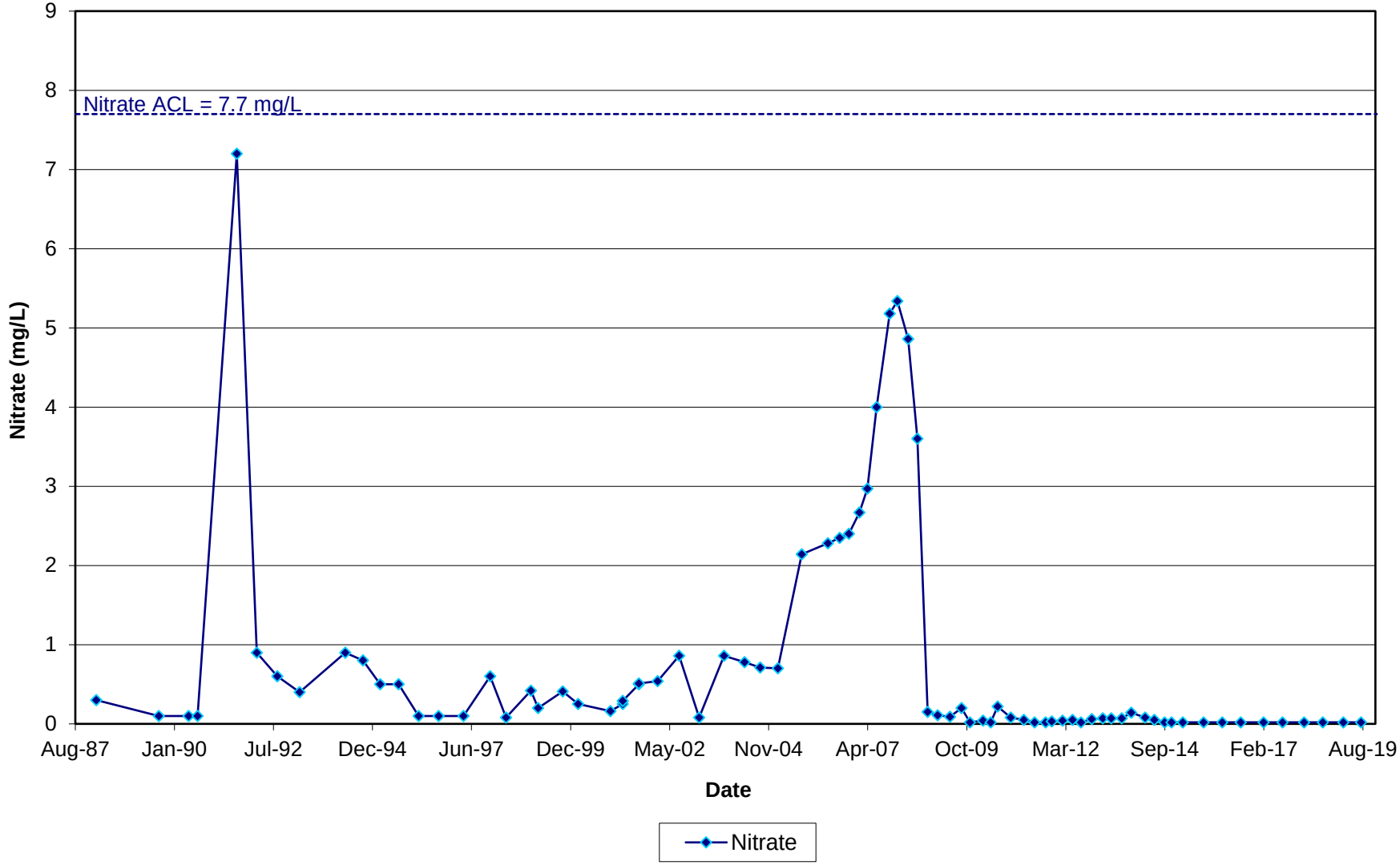
Metals in Monitoring Well 31-67 TRB



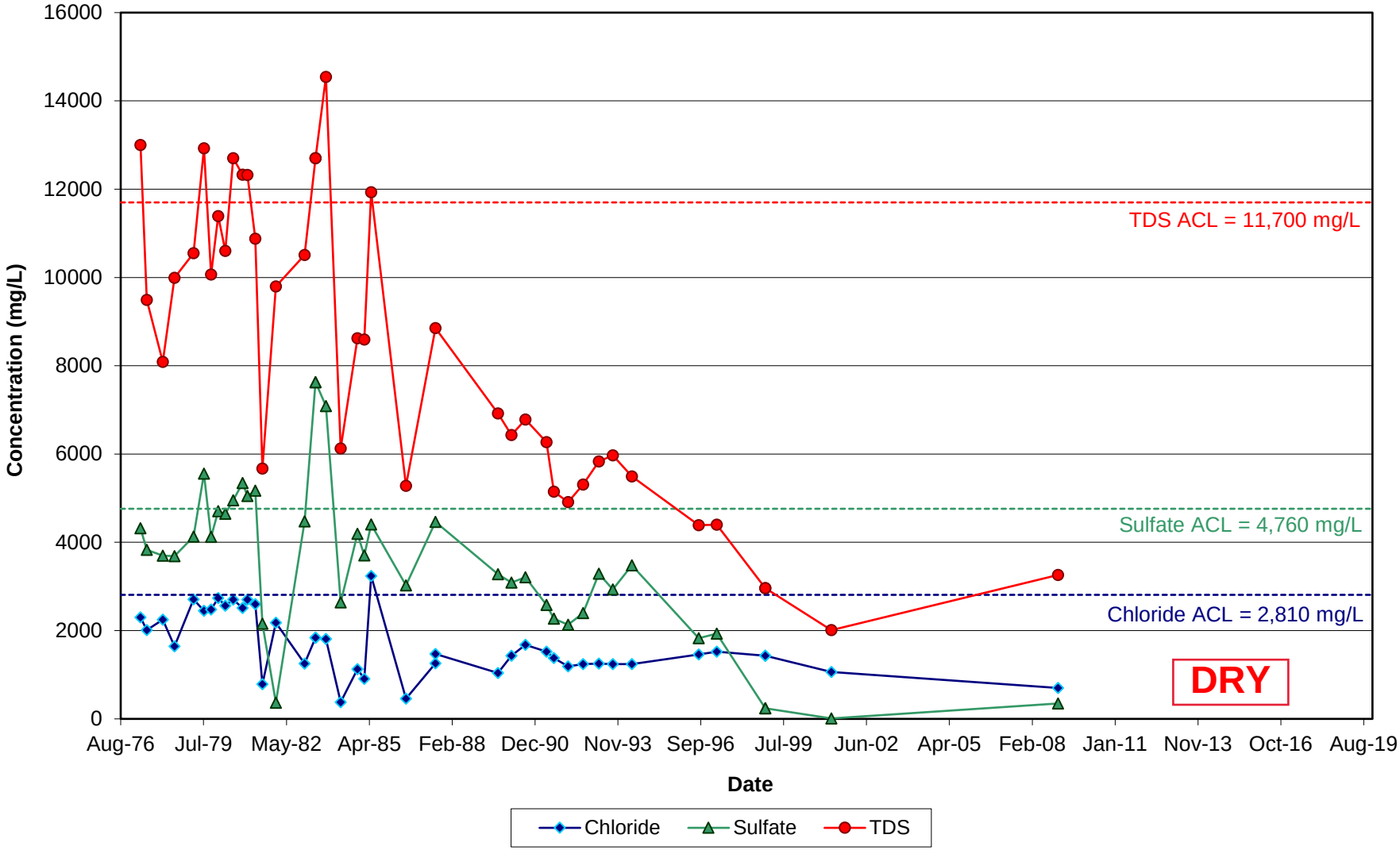
Radionuclides in Monitoring Well 31-67 TRB



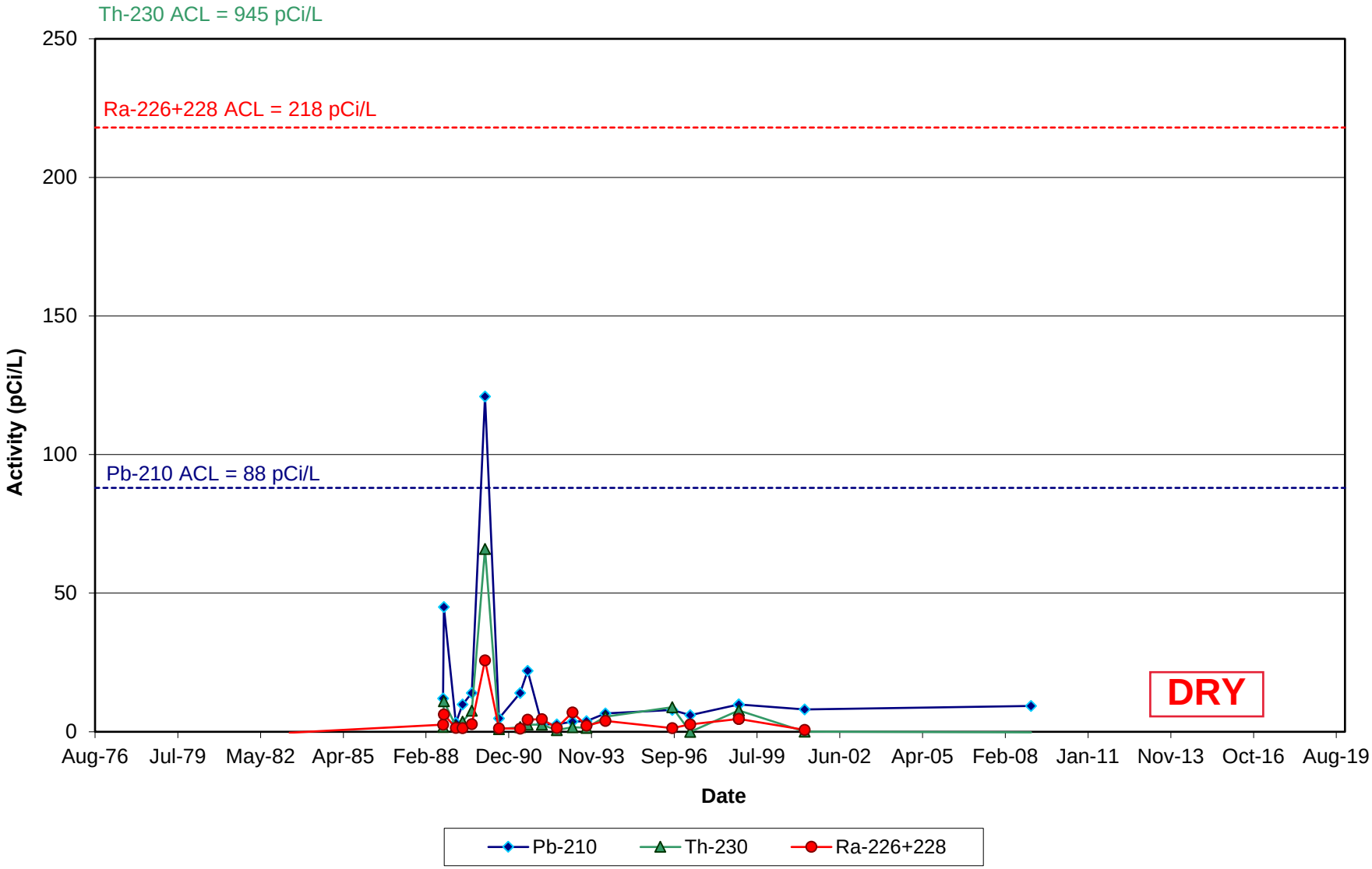
Nitrate in Monitoring Well 31-67 TRB



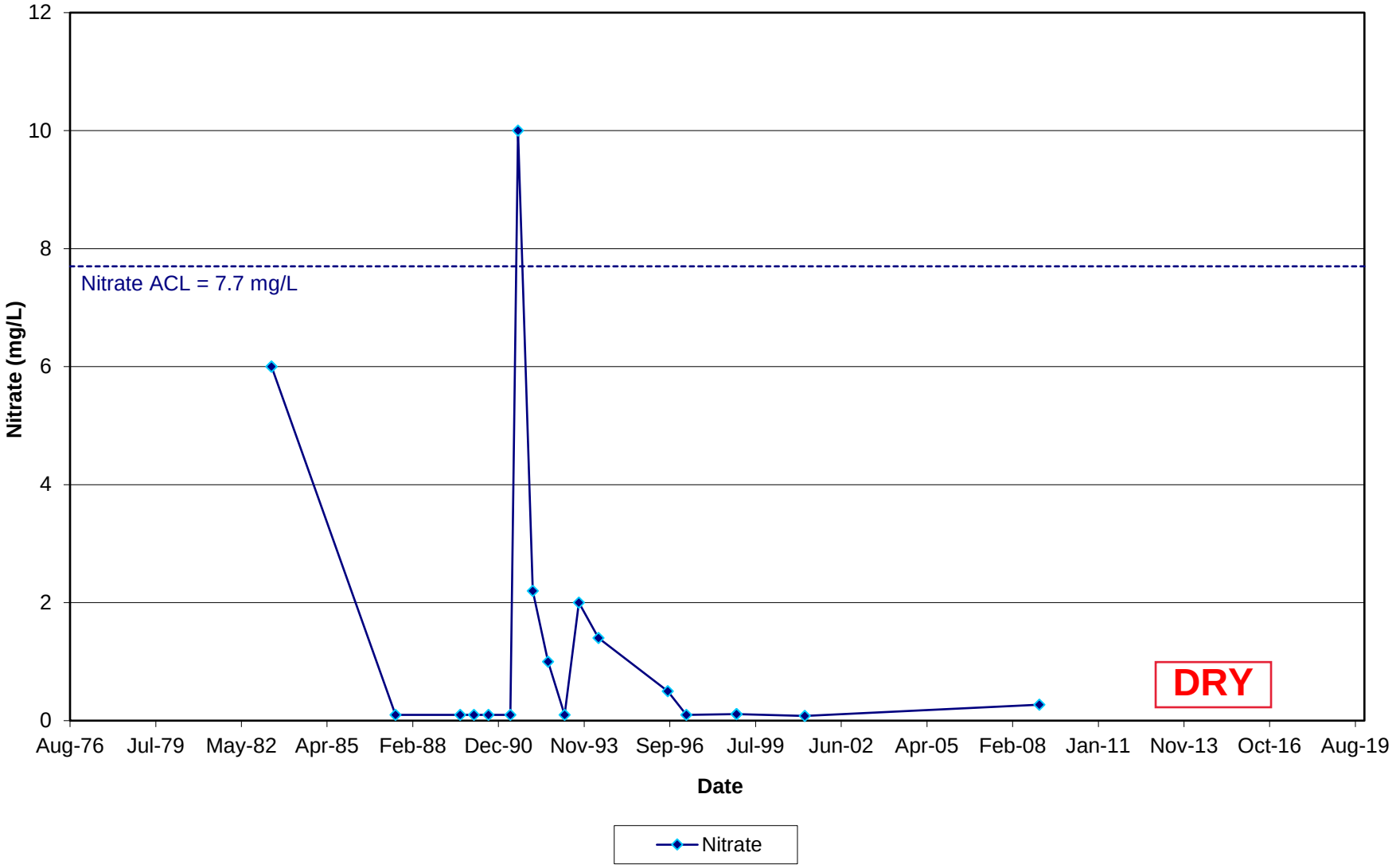
Anions and TDS in Monitoring Well 36-01 TRB



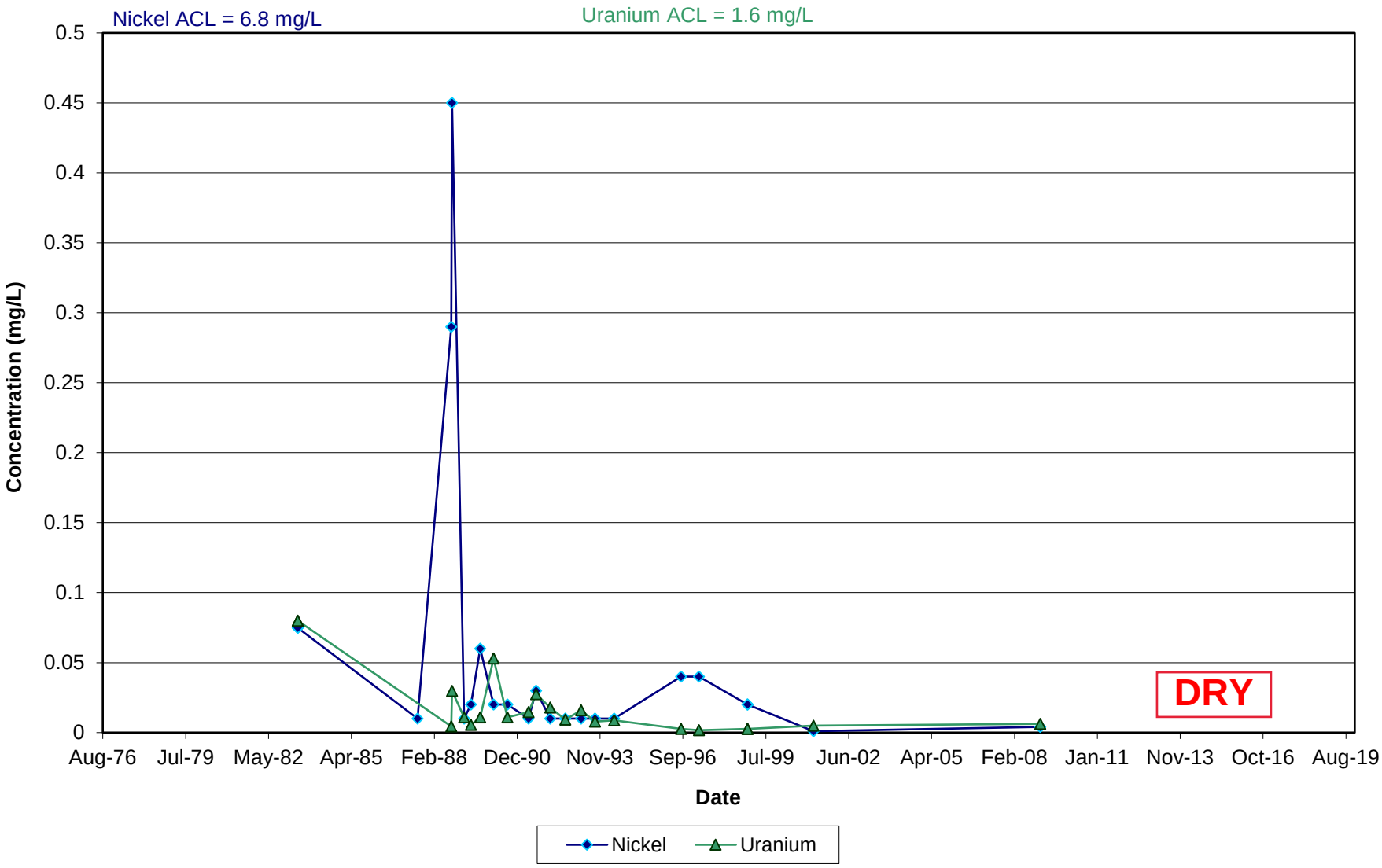
Radionuclides in Monitoring Well 36-01 TRB



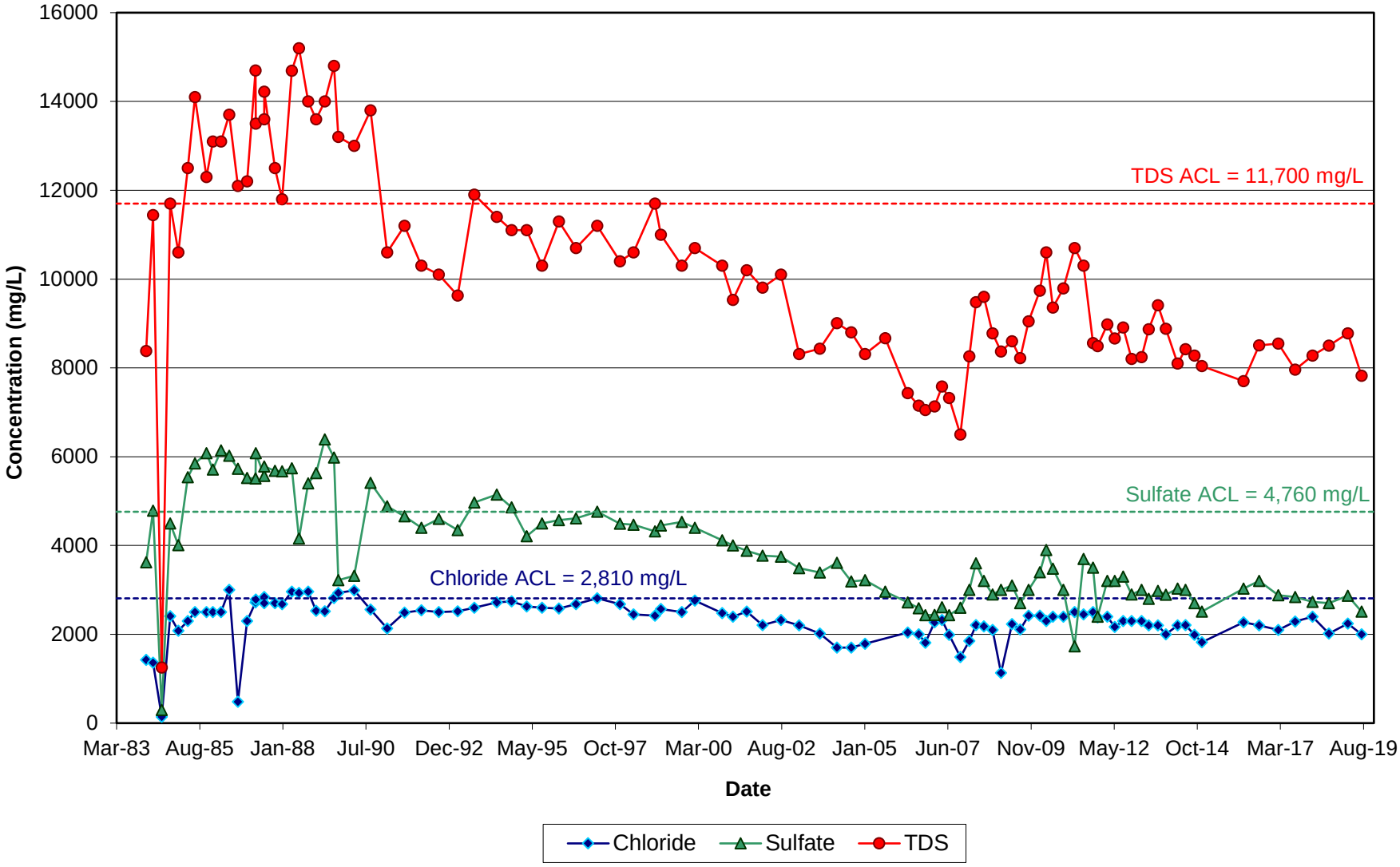
Nitrate in Monitoring Well 36-01 TRB



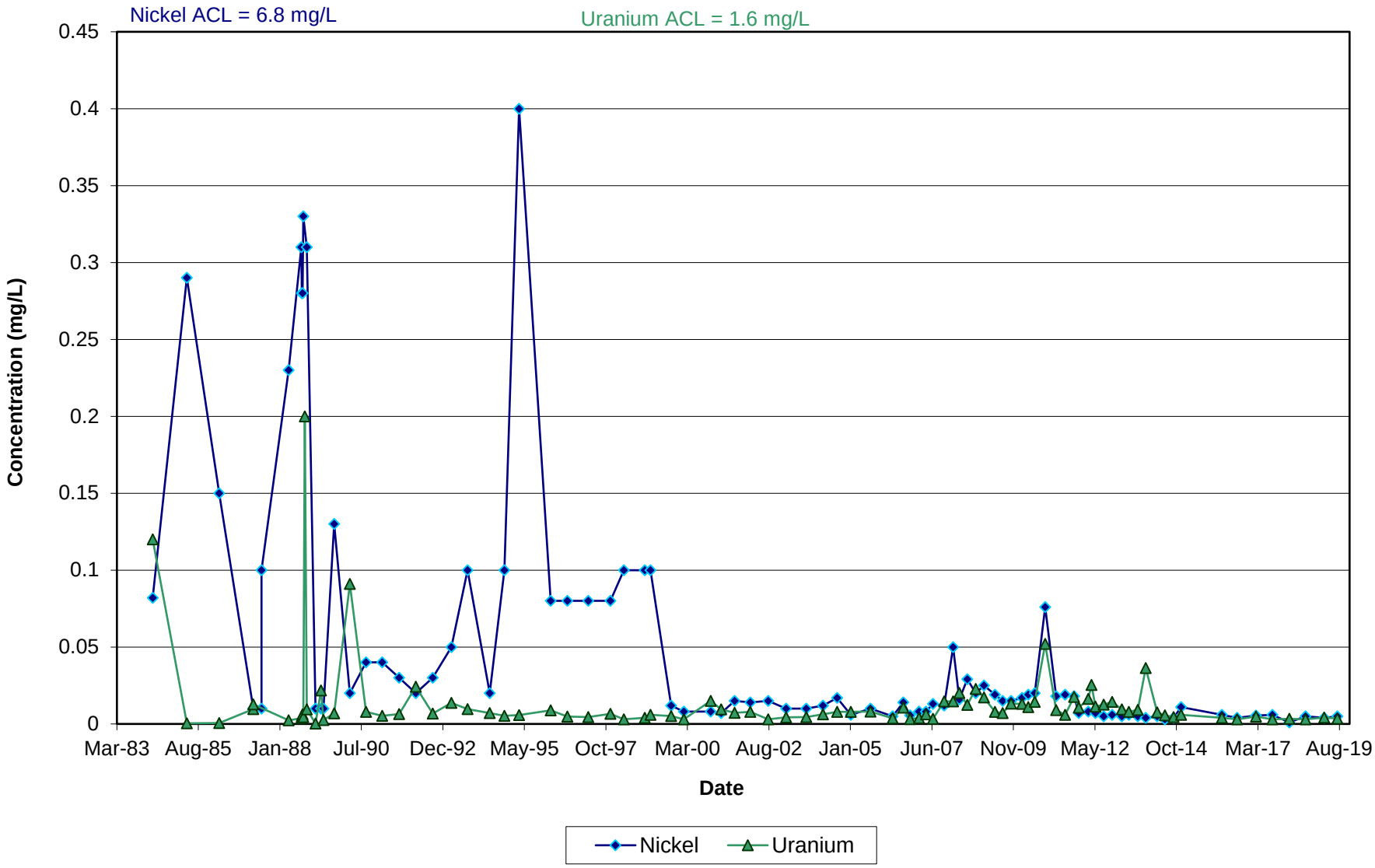
Metals in Monitoring Well 36-01 TRB



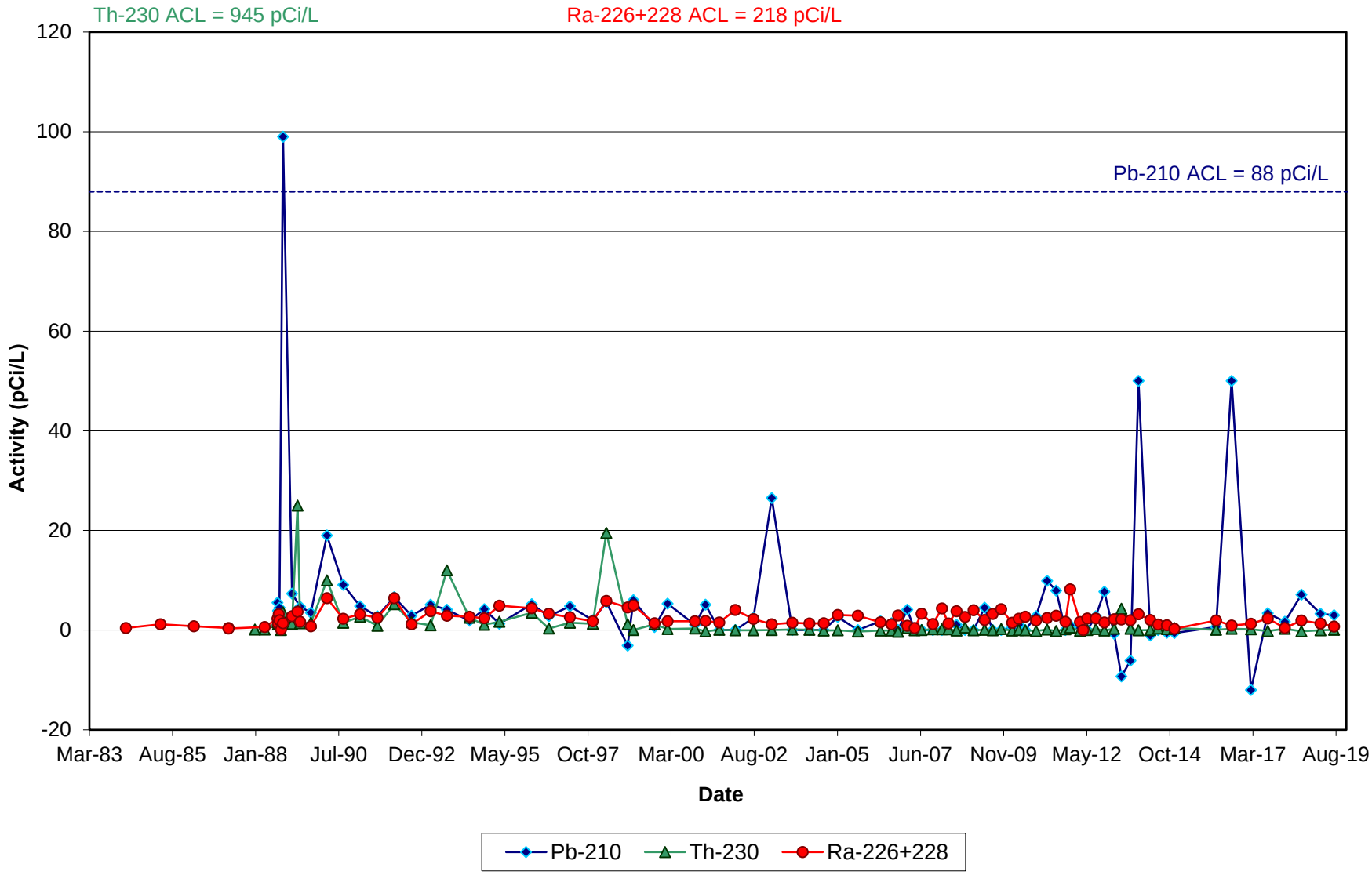
Anions and TDS in Monitoring Well 36-02 TRB



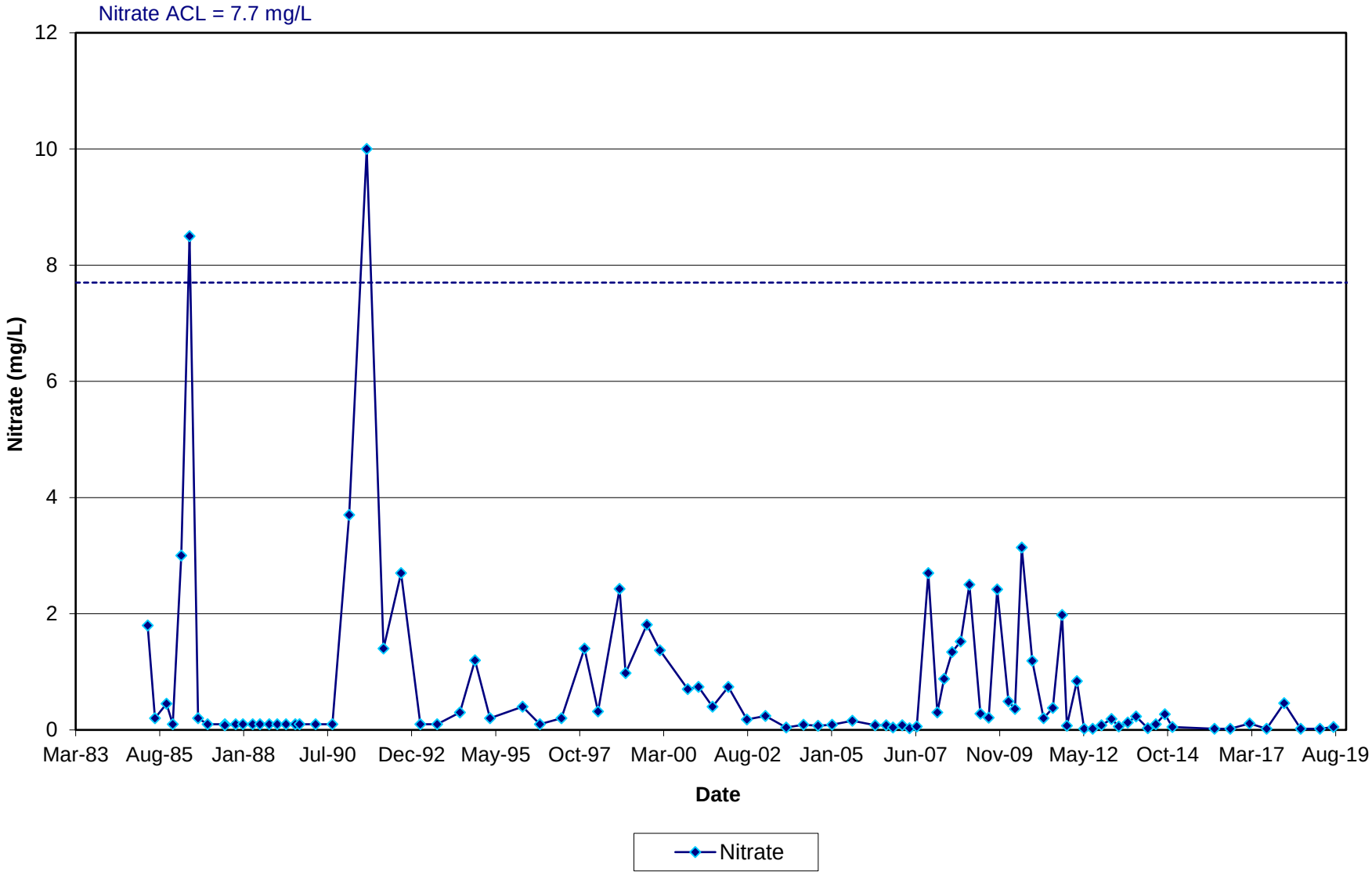
Metals in Monitoring Well 36-02 TRB



Radionuclides in Monitoring Well 36-02 TRB



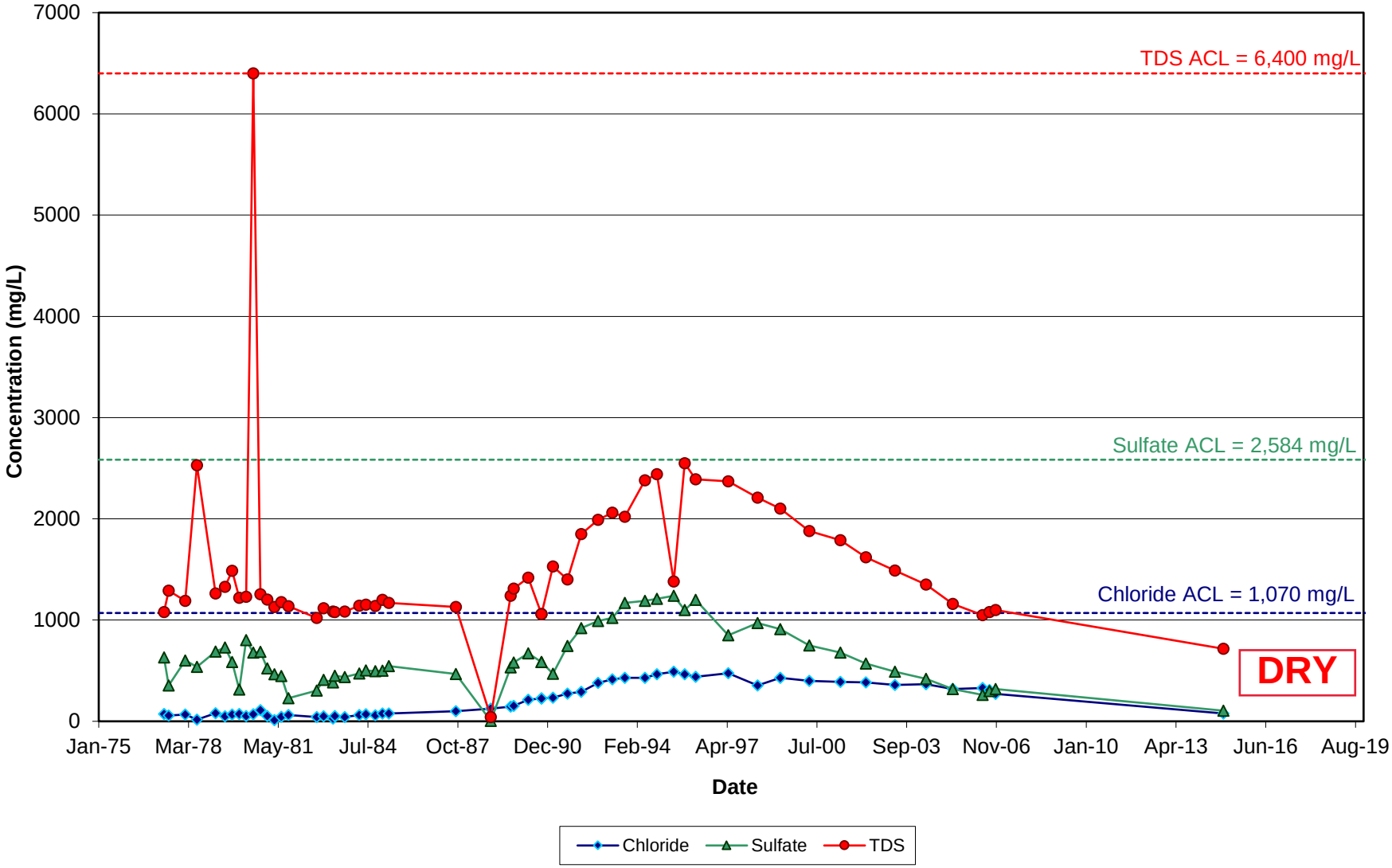
Nitrate in Monitoring Well 36-02 TRB



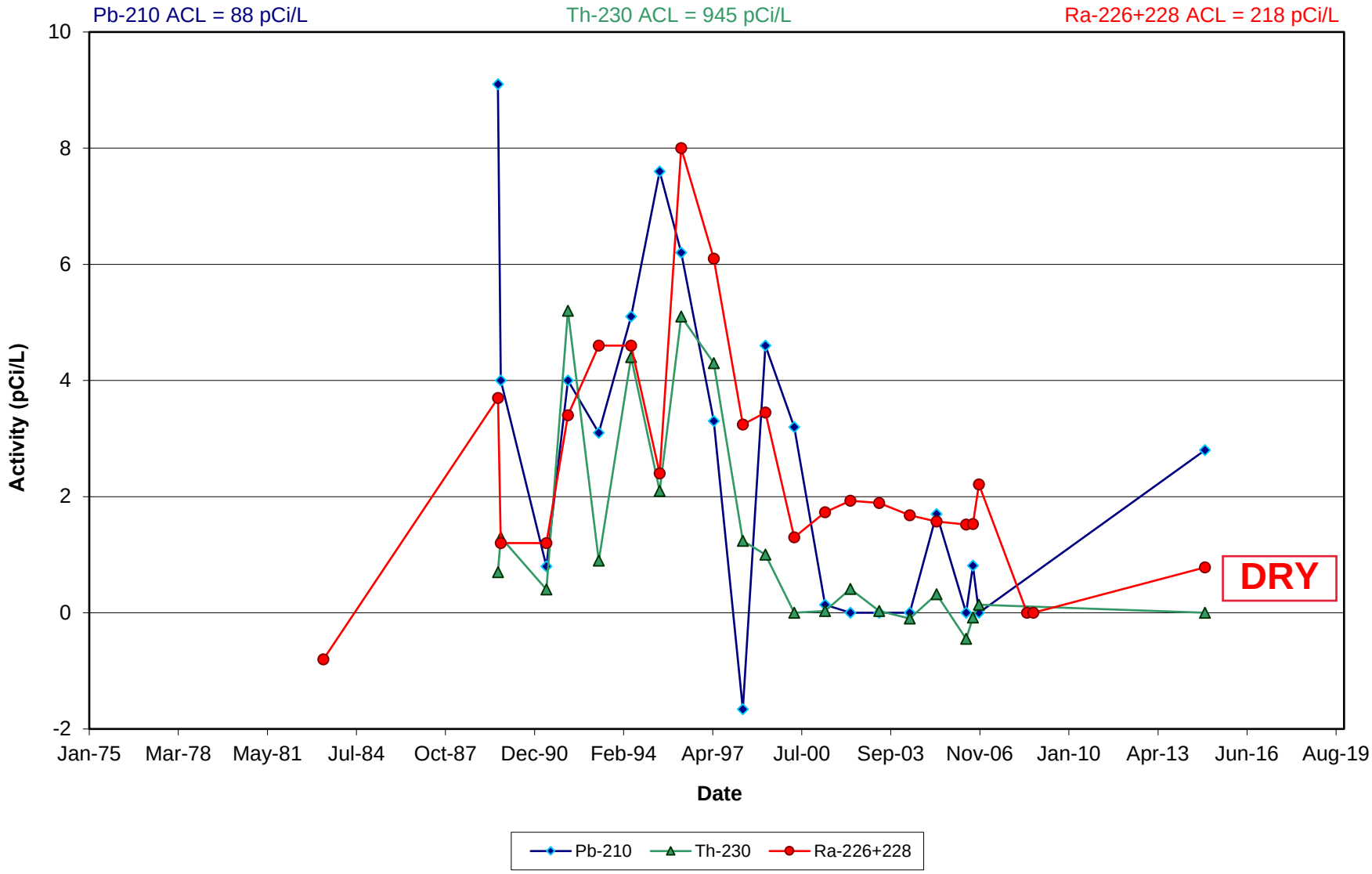
Stability Monitoring Plan
Time Versus Concentration Plots

Tres Hermanos A

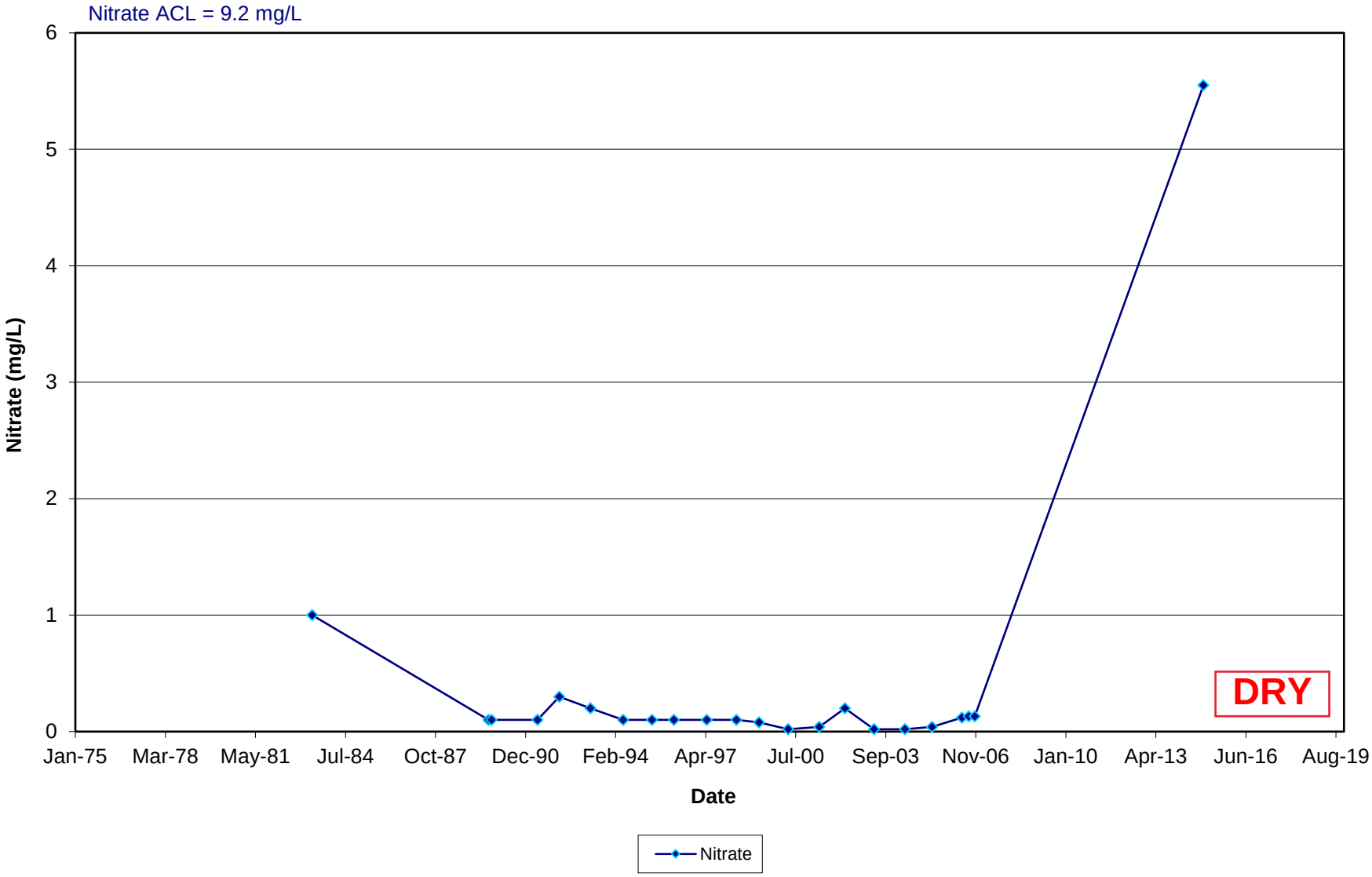
Anions and TDS in Monitoring Well 30-01 TRA

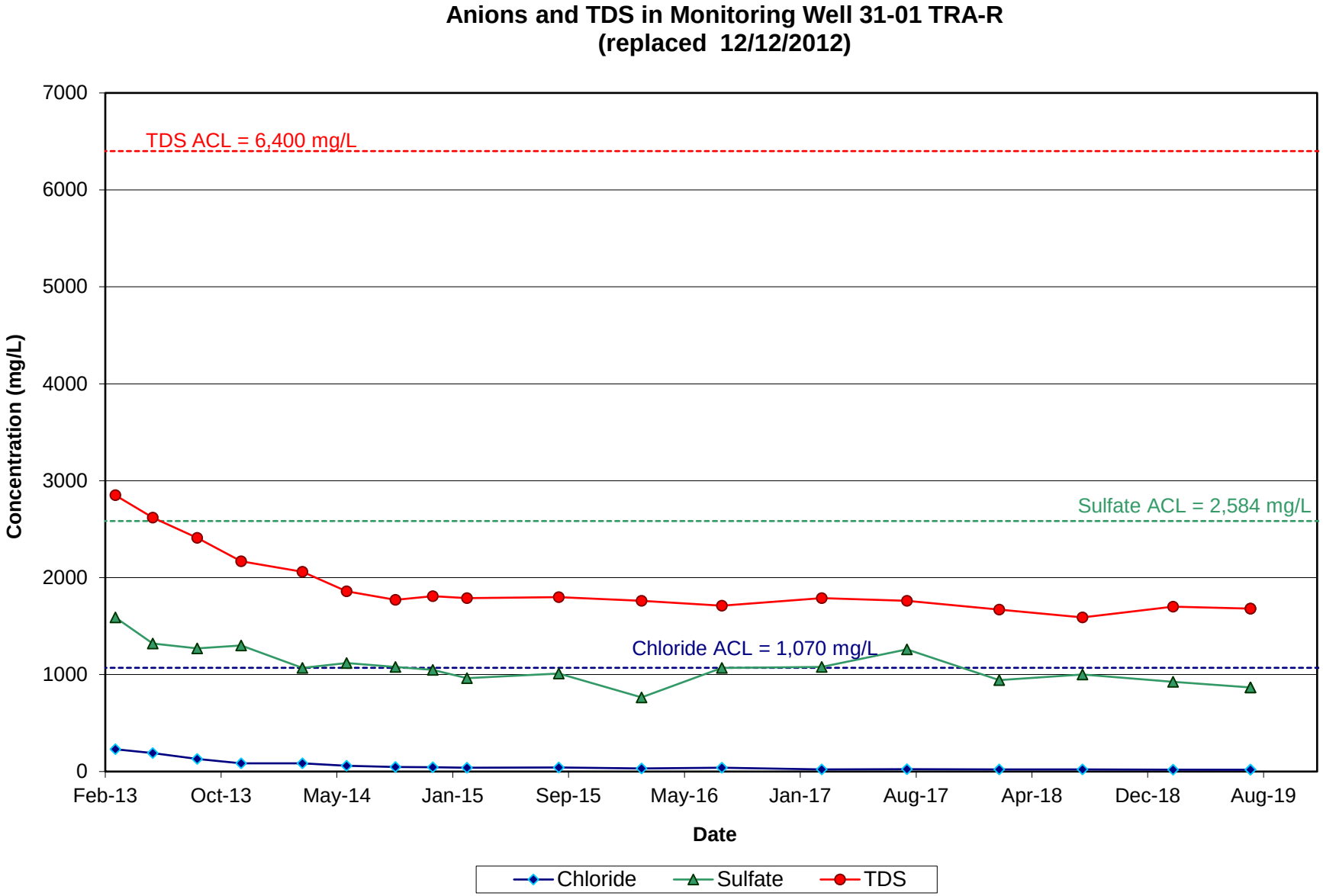


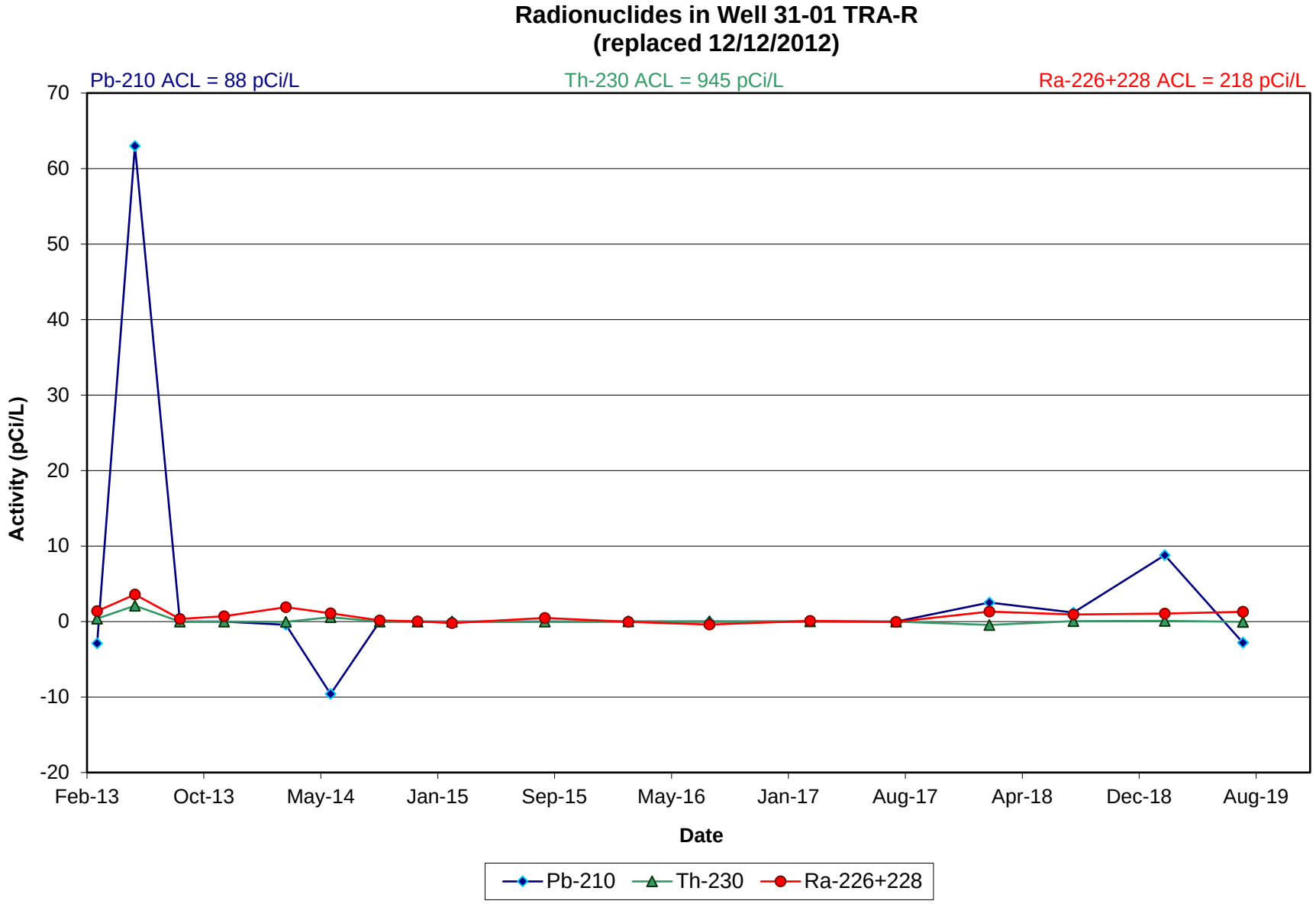
Radionuclides in Monitoring Well 30-01 TRA

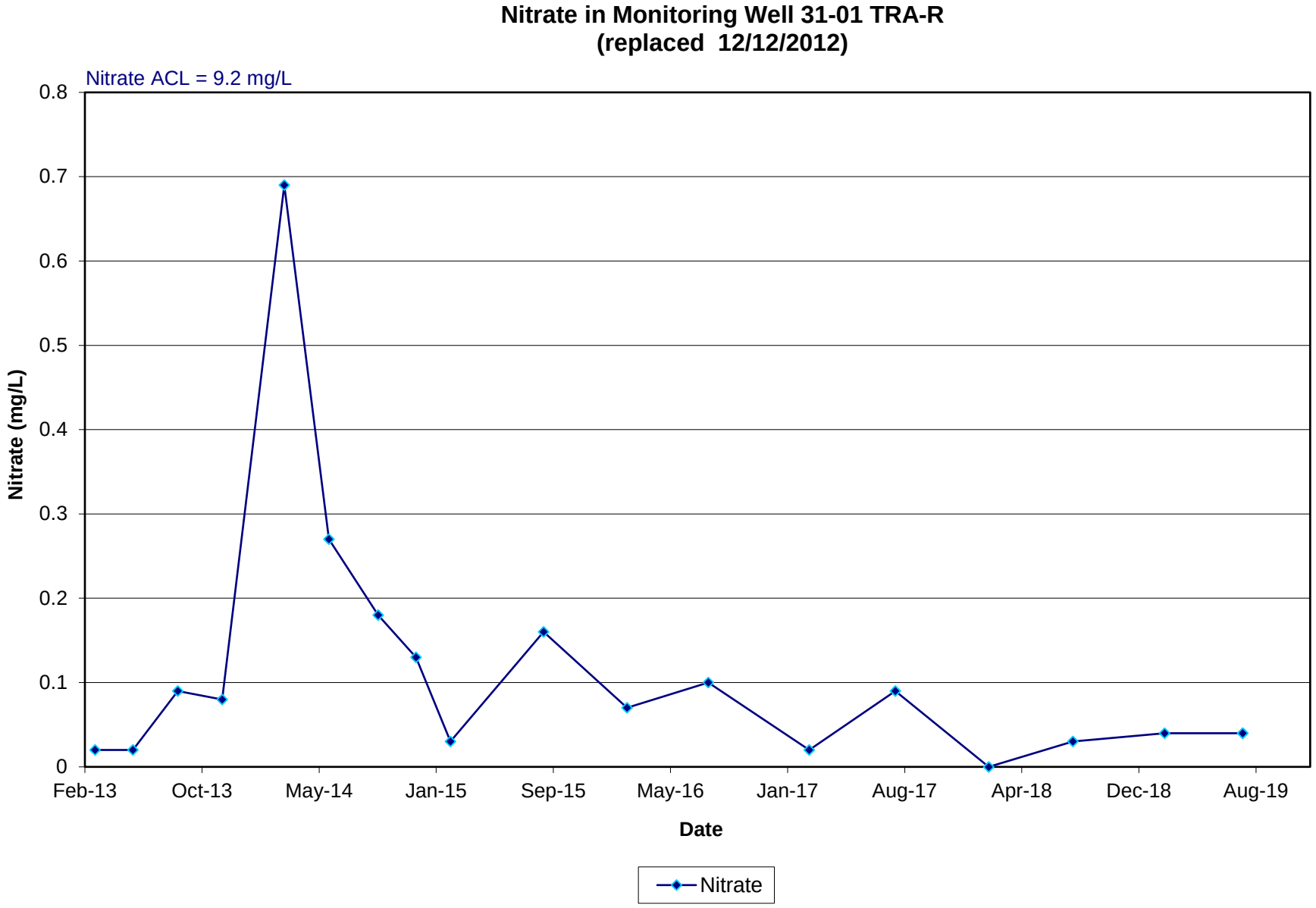


Nitrate in Monitoring Well 30-01 TRA

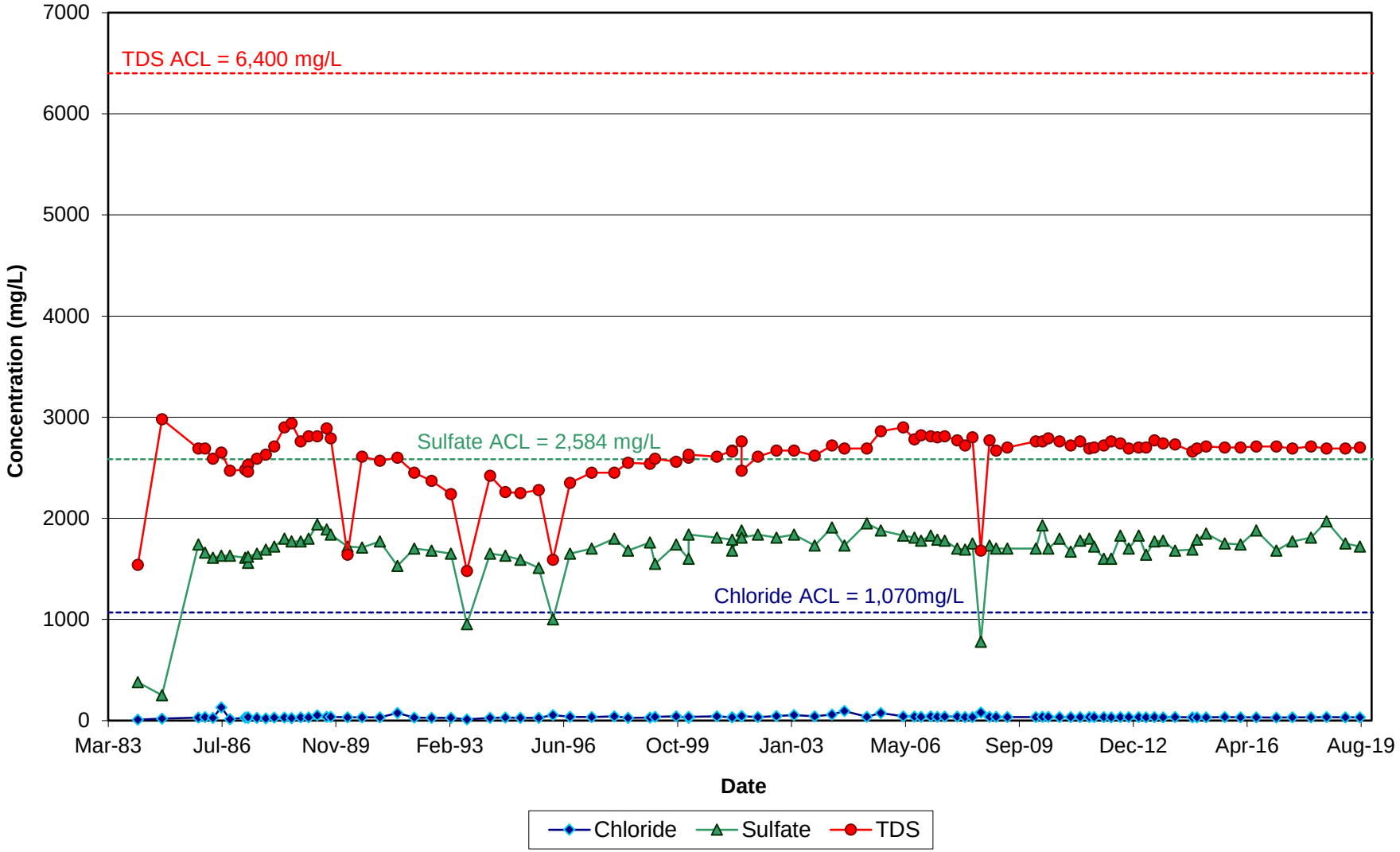



Anions and TDS in Monitoring Well 31-01 TRA-R
(replaced 12/12/2012)
7000
6000
5000
4000
3000
2000
1000
0
Concentration (mg/L)
TDS ACL = 6,400 mg/L
Sulfate ACL = 2,584 mg/L
Chloride ACL = 1,070 mg/L
Feb-13
Oct-13
May-14
Jan-15
Sep-15
May-16
Jan-17
Aug-17
Apr-18
Dec-18
Aug-19
Date
Chloride
Sulfate
TDS

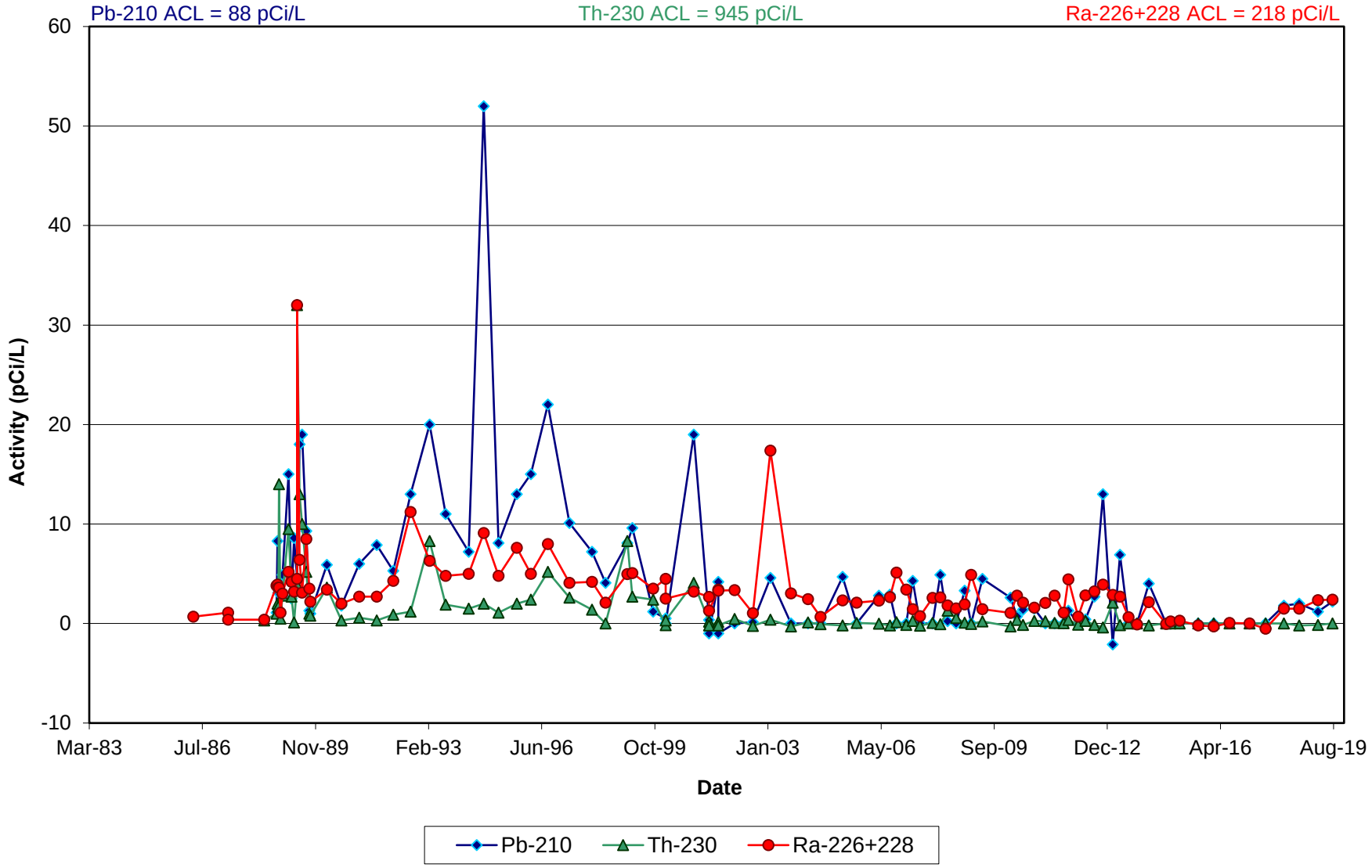

Radionuclides in Well 31-01 TRA-R
(replaced 12/12/2012)
Pb-210 ACL = 88 pCi/L
Th-230 ACL = 945 pCi/L
Ra-226+228 ACL = 218 pCi/L
Activity (pCi/L)
70
60
50
40
30
20
10
0
-10
-20
Feb-13
Oct-13
May-14
Jan-15
Sep-15
May-16
Jan-17
Aug-17
Apr-18
Dec-18
Aug-19
Date
Pb-210
Th-230
Ra-226+228


Nitrate in Monitoring Well 31-01 TRA-R
(replaced 12/12/2012)
Nitrate ACL = 9.2 mg/L
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Nitrate (mg/L)
Feb-13
Oct-13
May-14
Jan-15
Sep-15
May-16
Jan-17
Aug-17
Apr-18
Dec-18
Aug-19
Date
Nitrate

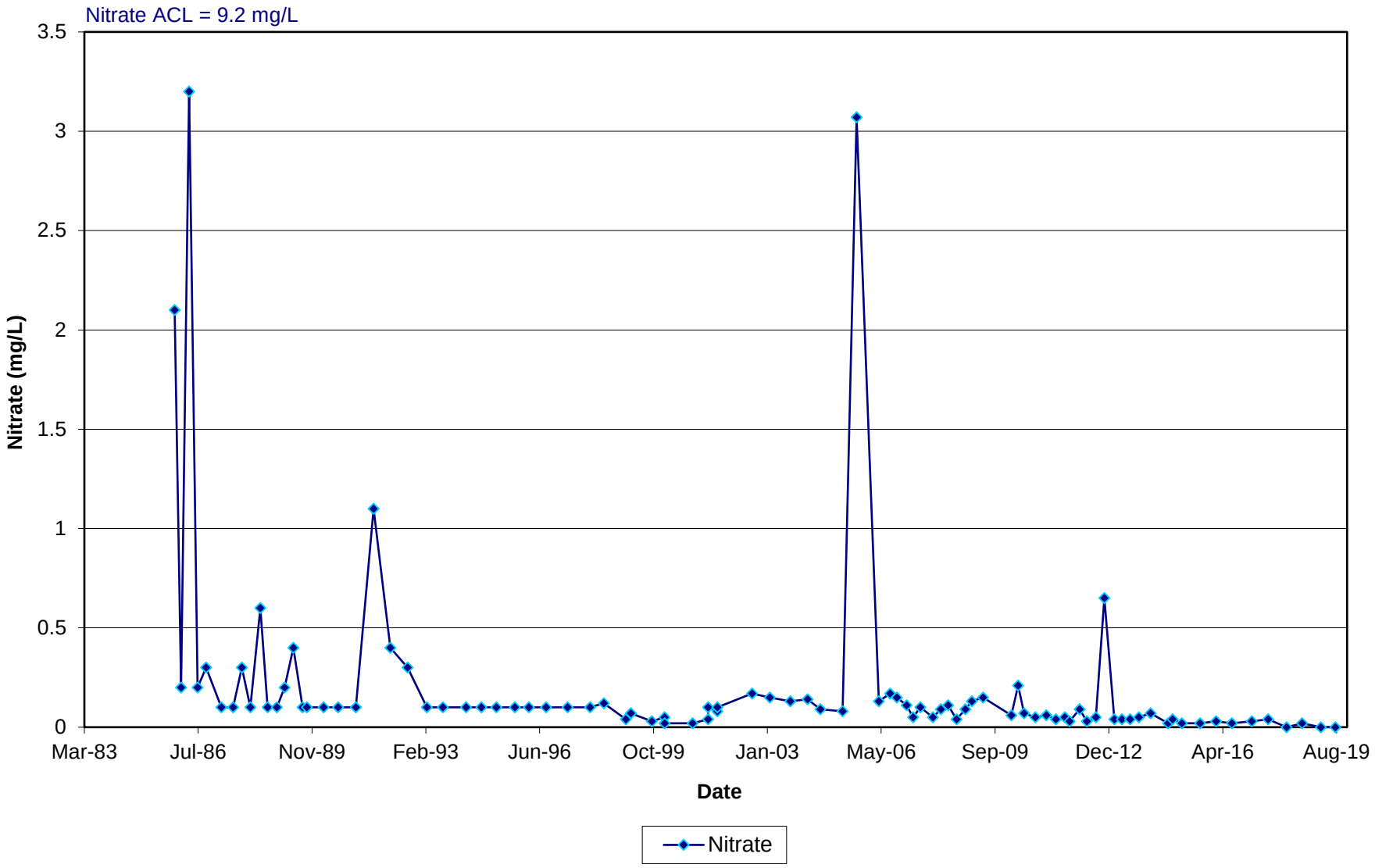
Anions and TDS in Monitoring Well 33-01 TRA



Radionuclides in Monitoring Well 33-01 TRA

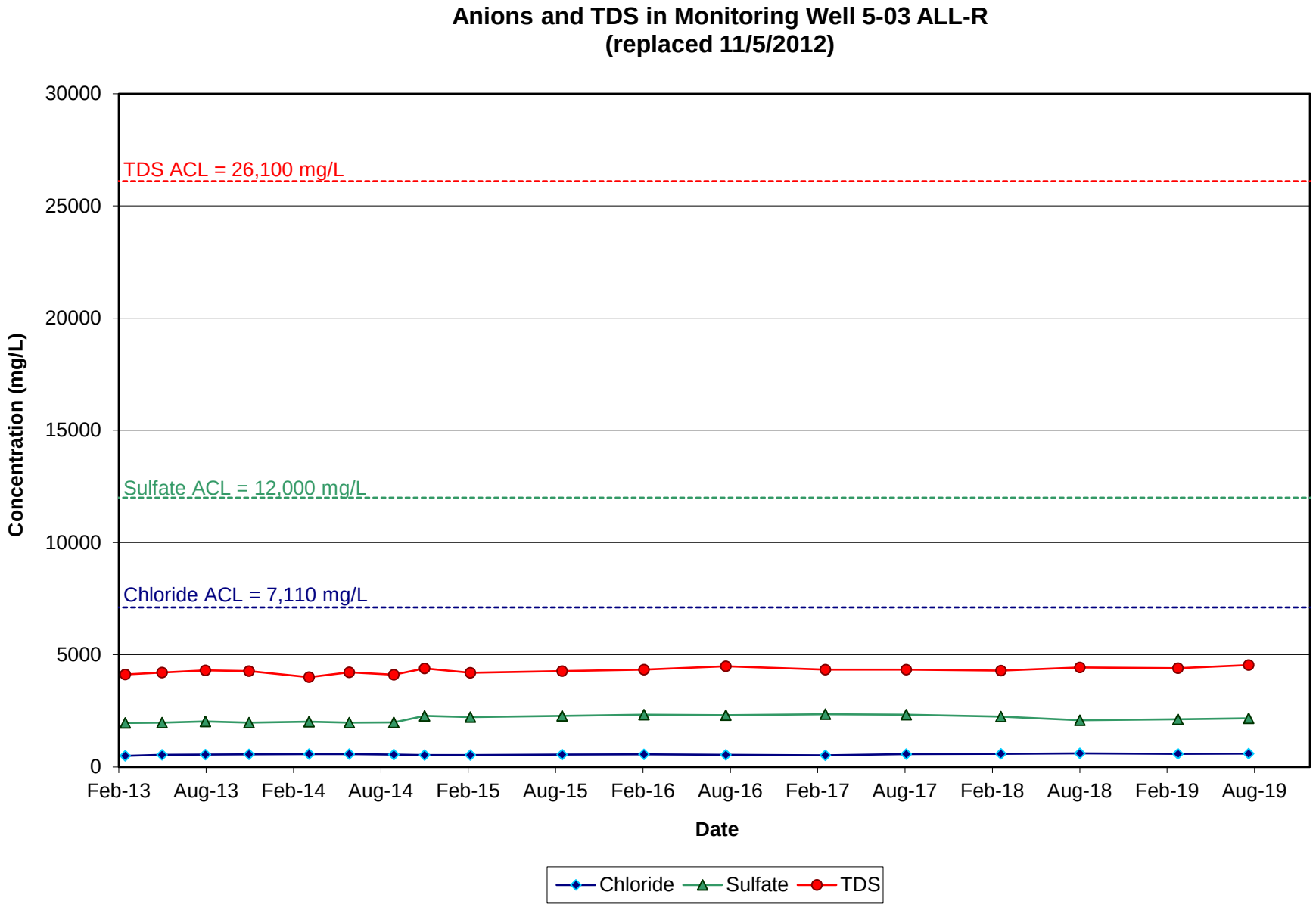


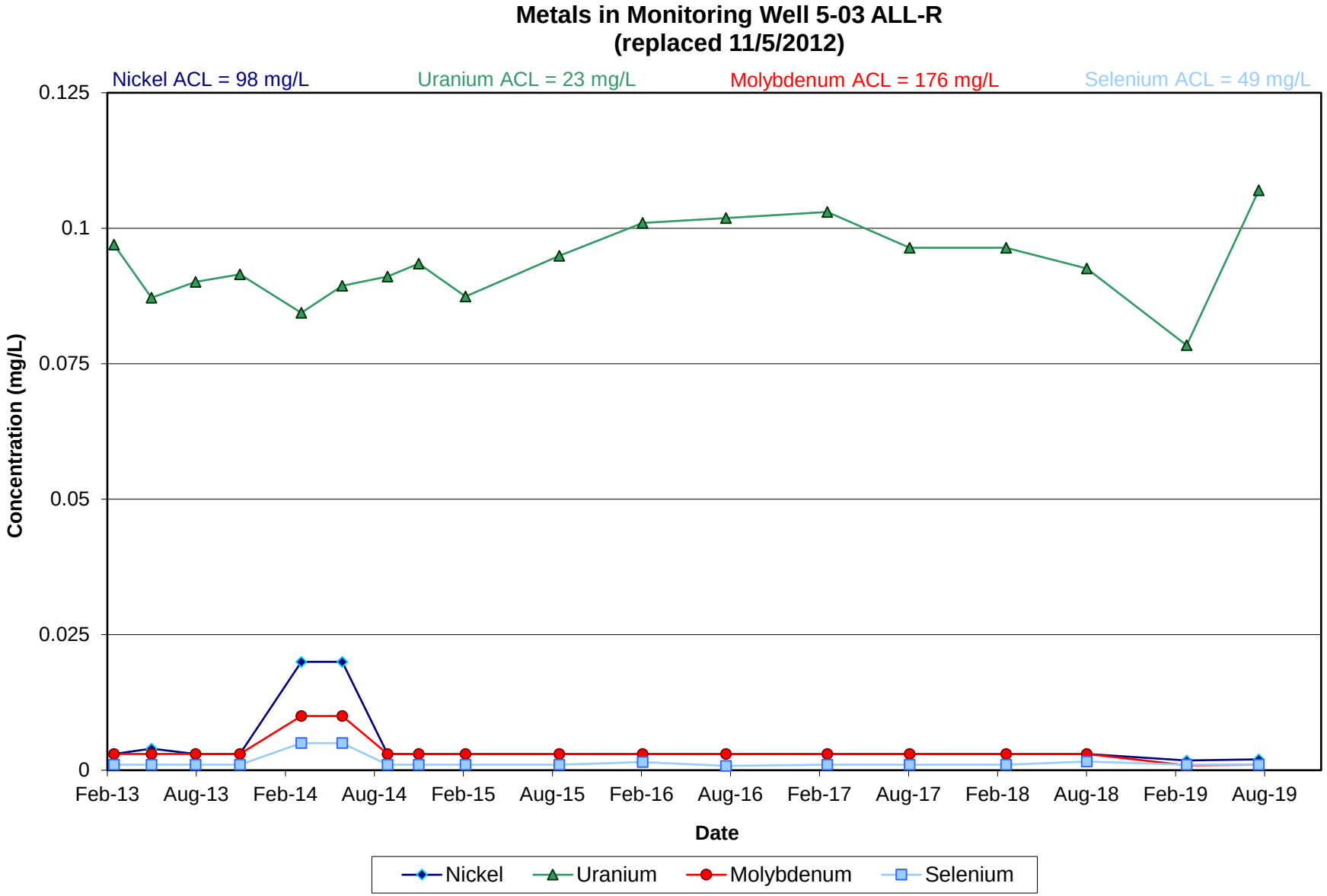
Nitrate in Monitoring Well 33-01 TRA

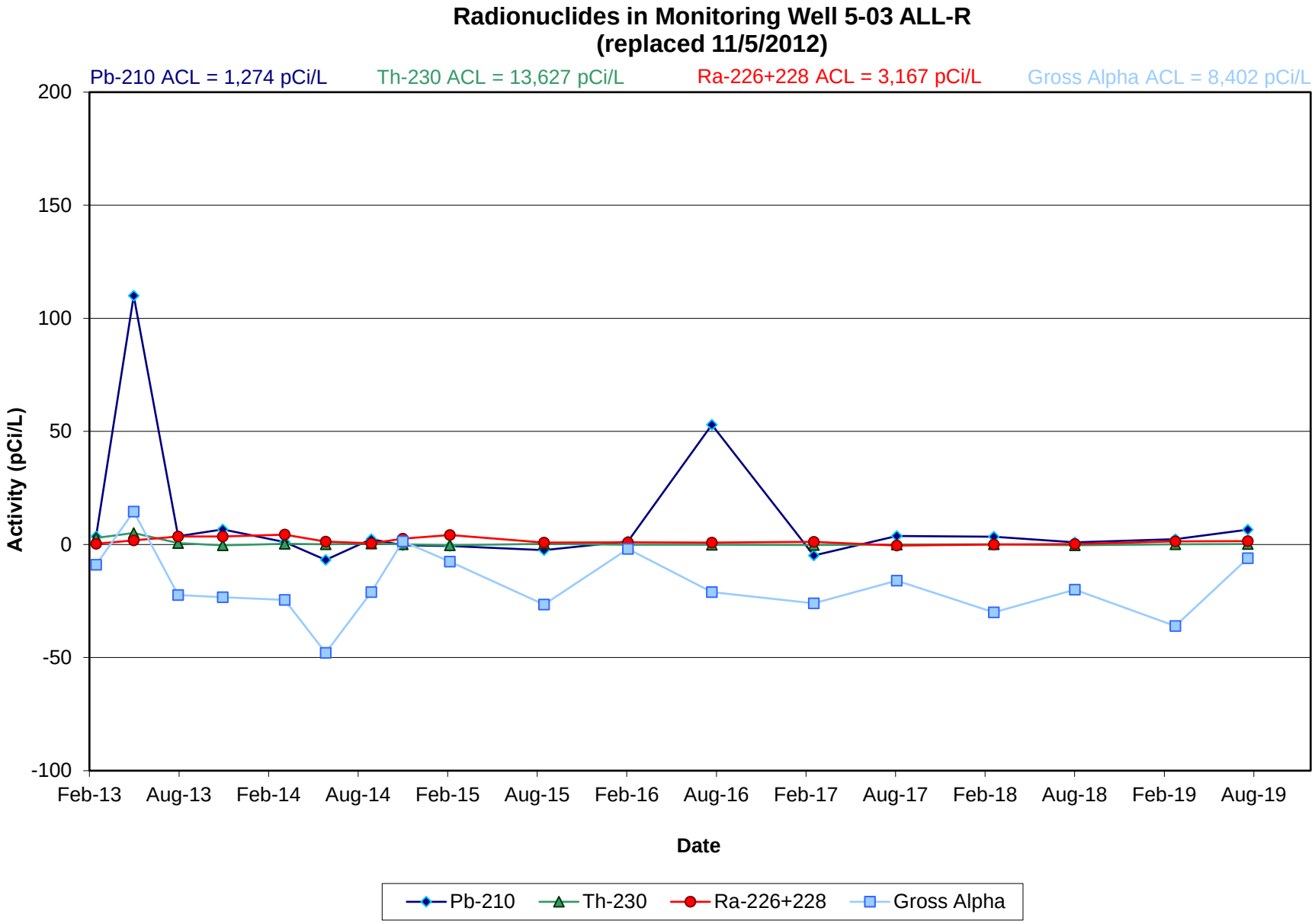


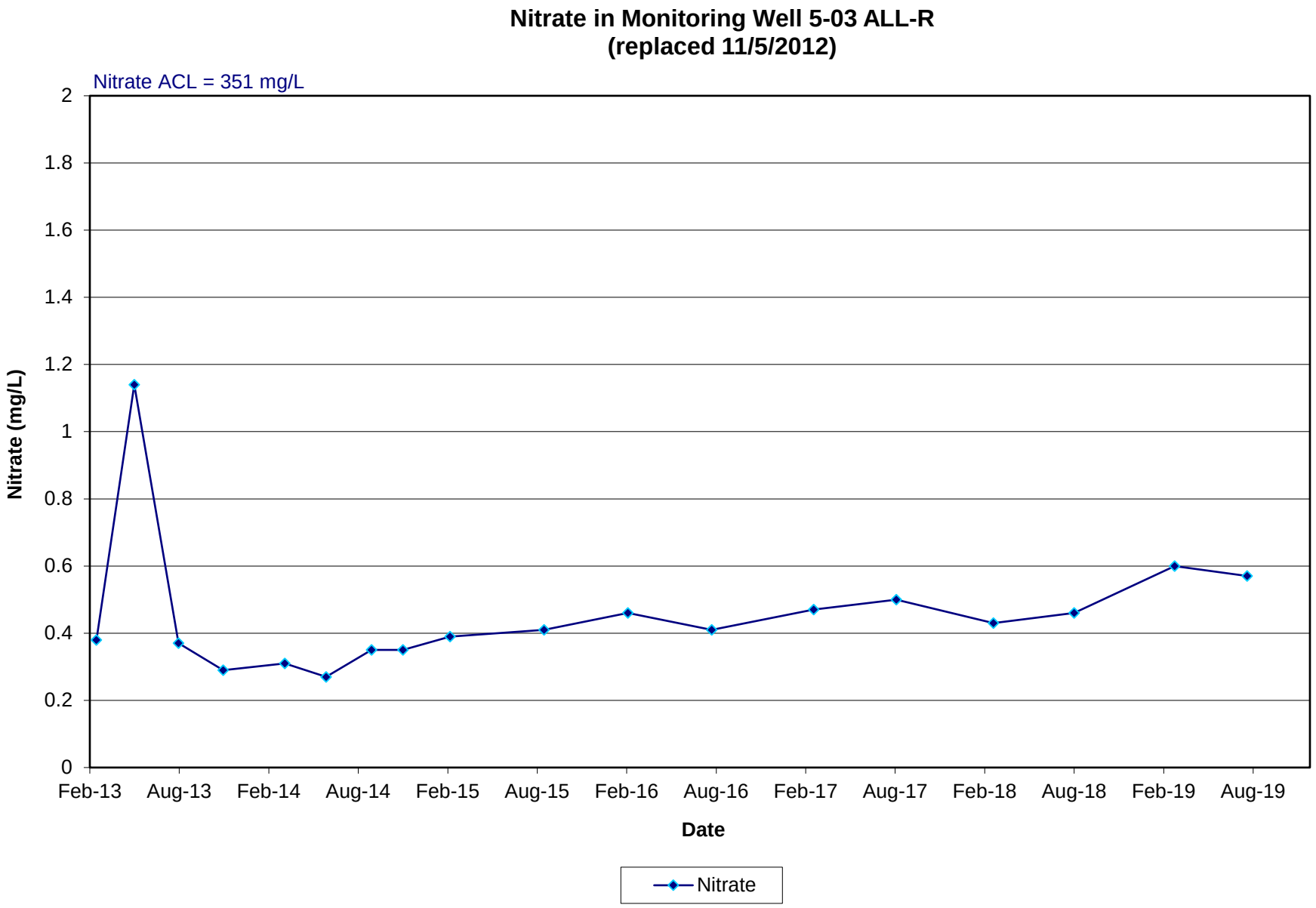
Stability Monitoring Plan
Time Versus Concentration Plots

Alluvium

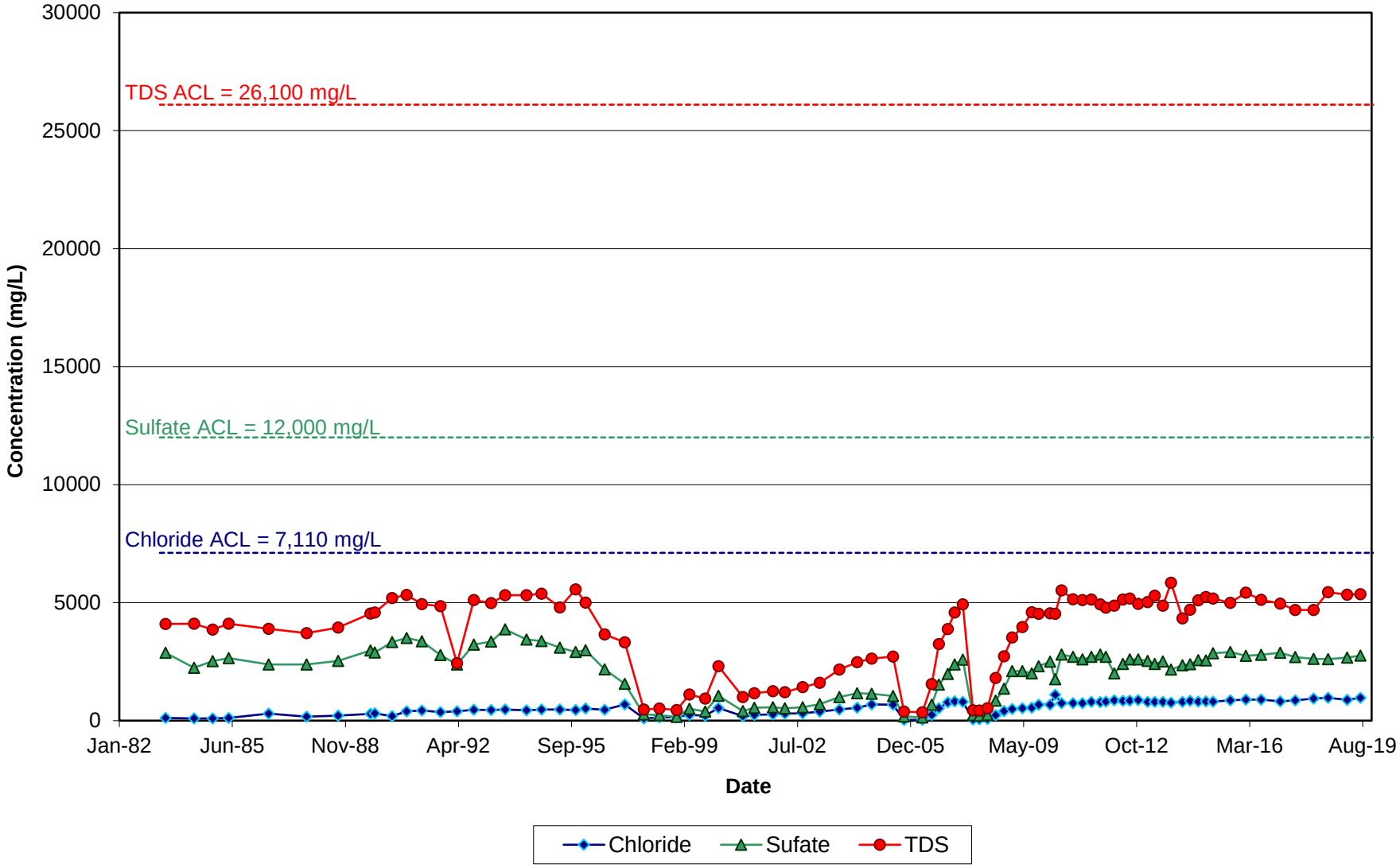

Anions and TDS in Monitoring Well 5-03 ALL-R
(replaced 11/5/2012)
30000
25000
20000
15000
10000
5000
0
Concentration (mg/L)
TDS ACL = 26,100 mg/L
Sulfate ACL = 12,000 mg/L
Chloride ACL = 7,110 mg/L
Feb-13
Aug-13
Feb-14
Aug-14
Feb-15
Aug-15
Feb-16
Aug-16
Feb-17
Aug-17
Feb-18
Aug-18
Feb-19
Aug-19
Date
Chloride
Sulfate
TDS

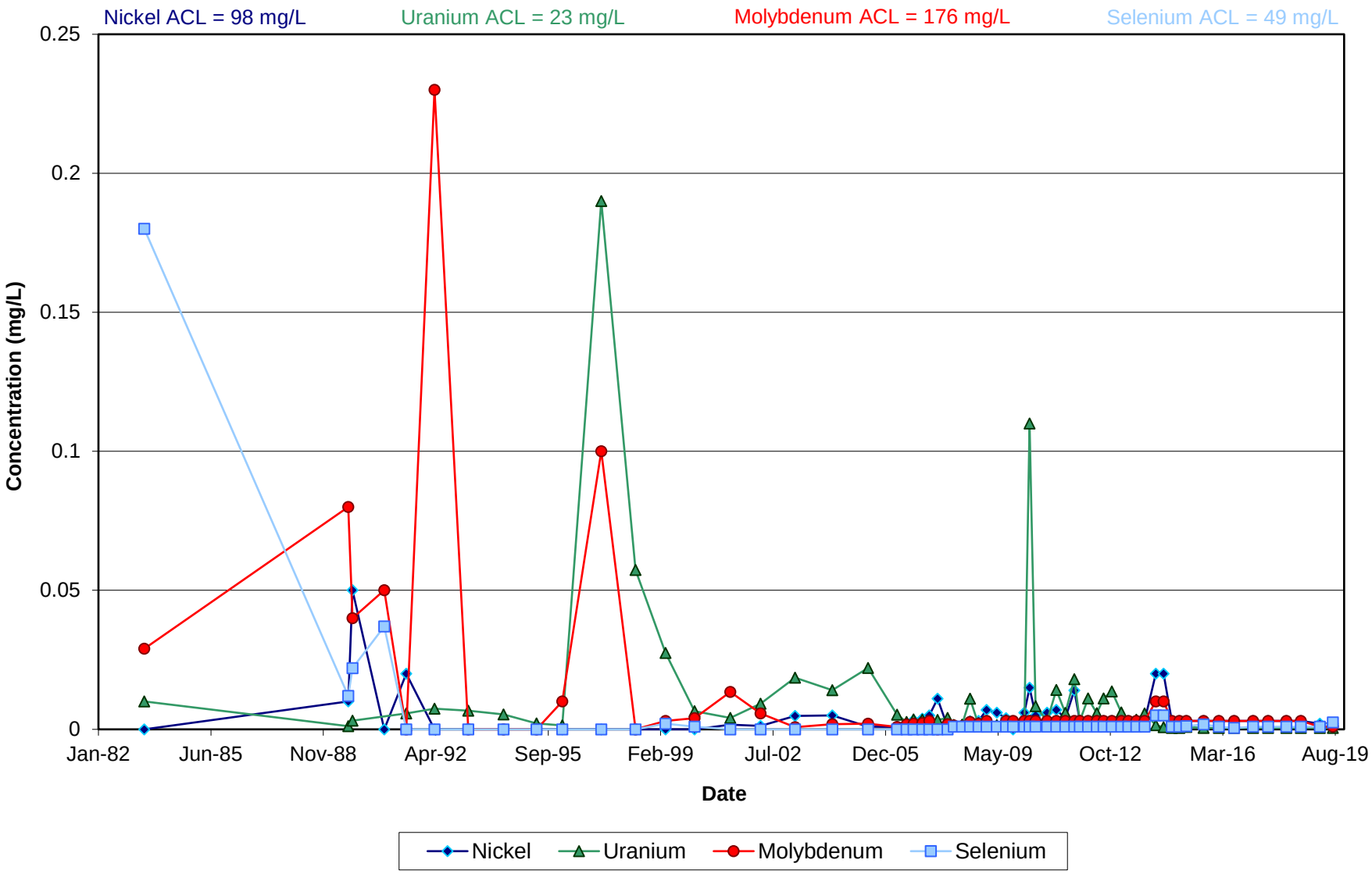

Metals in Monitoring Well 5-03 ALL-R
(replaced 11/5/2012)
Nickel ACL = 98 mg/L
Uranium ACL = 23 mg/L
Molybdenum ACL = 176 mg/L
Selenium ACL = 49 mg/L
0.125
0.1
0.075
0.05
0.025
0
Concentration (mg/L)
Feb-13
Aug-13
Feb-14
Aug-14
Feb-15
Aug-15
Feb-16
Aug-16
Feb-17
Aug-17
Feb-18
Aug-18
Feb-19
Aug-19
Date
Nickel
Uranium
Molybdenum
Selenium


Radionuclides in Monitoring Well 5-03 ALL-R
(replaced 11/5/2012)
Pb-210 ACL = 1,274 pCi/L
Th-230 ACL = 13,627 pCi/L
Ra-226+228 ACL = 3,167 pCi/L
Gross Alpha ACL = 8,402 pCi/L
Activity (pCi/L)
200
150
100
50
0
-50
-100
Feb-13
Aug-13
Feb-14
Aug-14
Feb-15
Aug-15
Feb-16
Aug-16
Feb-17
Aug-17
Feb-18
Aug-18
Feb-19
Aug-19
Date
Pb-210
Th-230
Ra-226+228
Gross Alpha

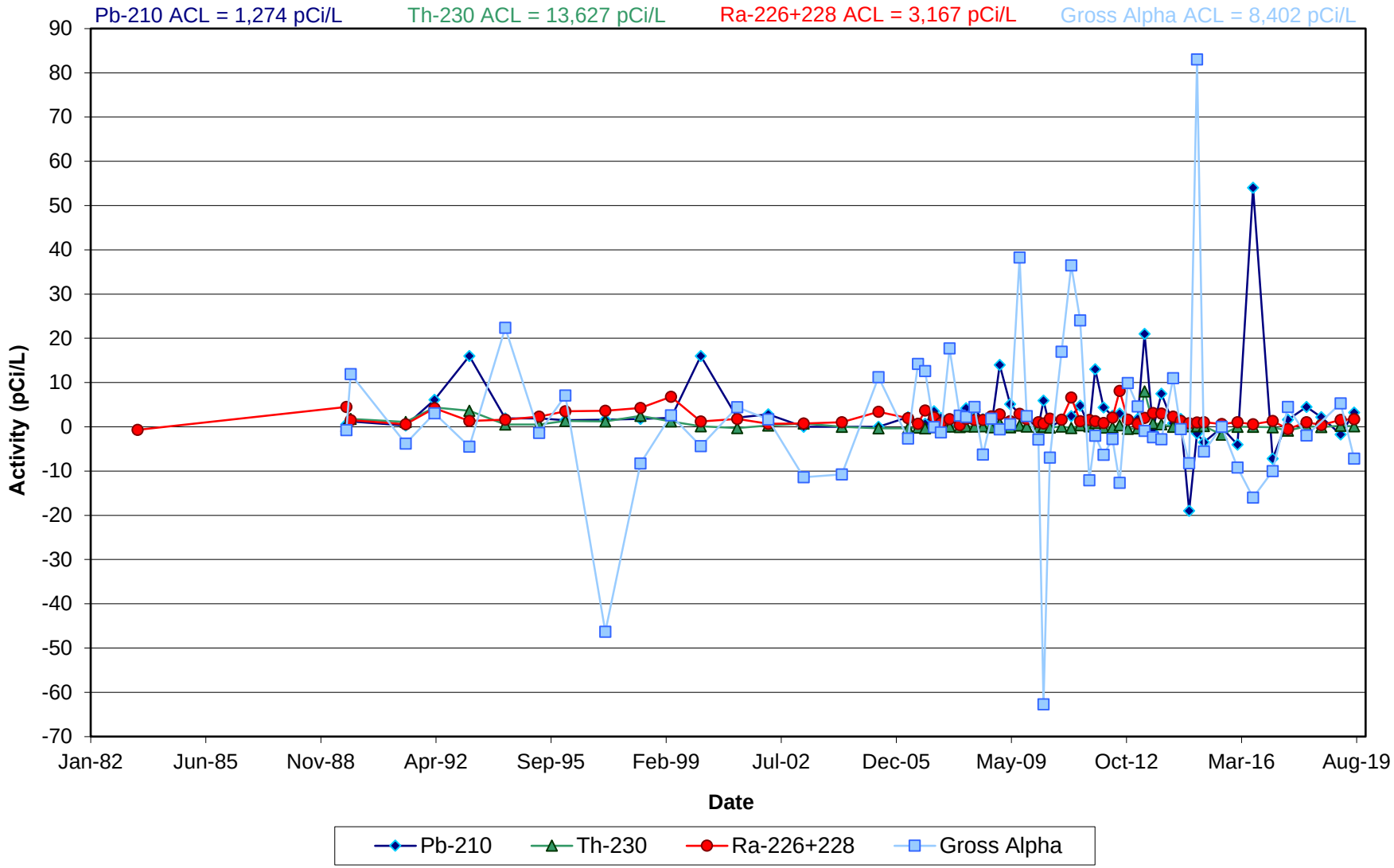

Nitrate in Monitoring Well 5-03 ALL-R
(replaced 11/5/2012)
Nitrate ACL = 351 mg/L
Nitrate (mg/L)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Feb-13
Aug-13
Feb-14
Aug-14
Feb-15
Aug-15
Feb-16
Aug-16
Feb-17
Aug-17
Feb-18
Aug-18
Feb-19
Aug-19
Date
Nitrate

Anions and TDS in Monitoring Well 5-04 ALL

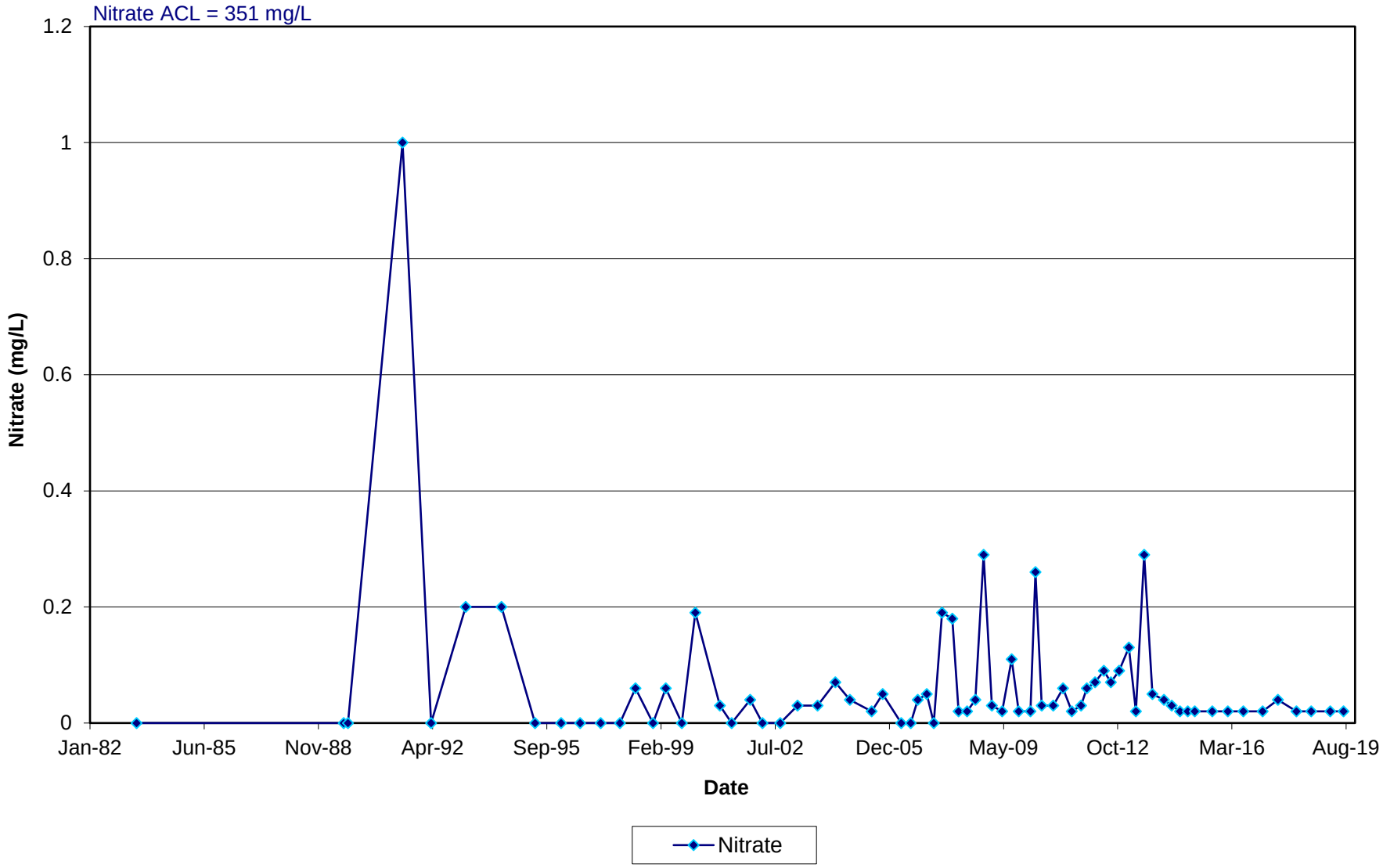



Metals in Monitoring Well 5-04 ALL
Nickel ACL = 98 mg/L
Uranium ACL = 23 mg/L
Molybdenum ACL = 176 mg/L
Selenium ACL = 49 mg/L
Concentration (mg/L)
0.25
0.2
0.15
0.1
0.05
0
Jan-82
Jun-85
Nov-88
Apr-92
Sep-95
Feb-99
Jul-02
Dec-05
May-09
Oct-12
Mar-16
Aug-19
Date
Nickel
Uranium
Molybdenum
Selenium

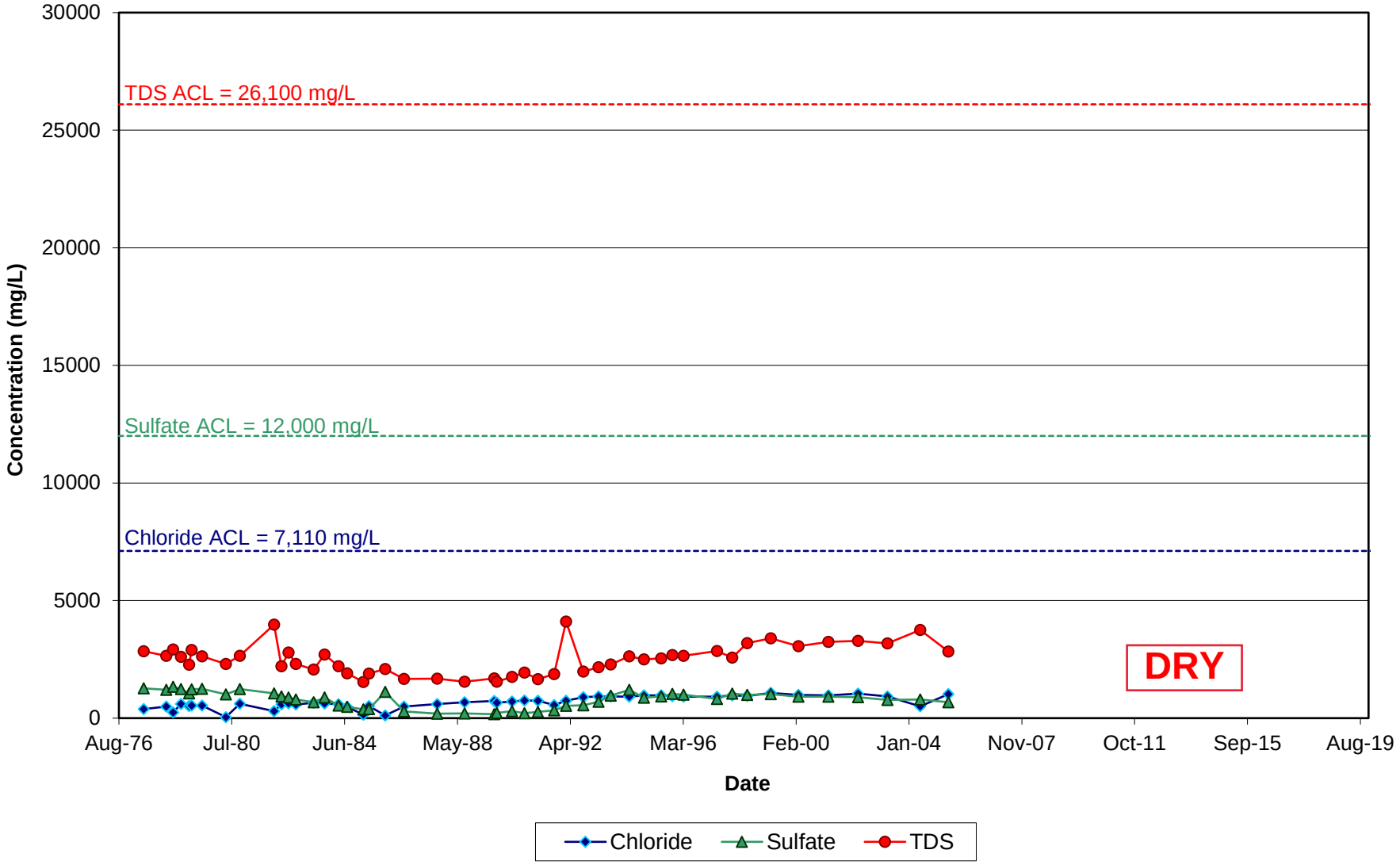
Radionuclides in Monitoring Well 5-04 ALL



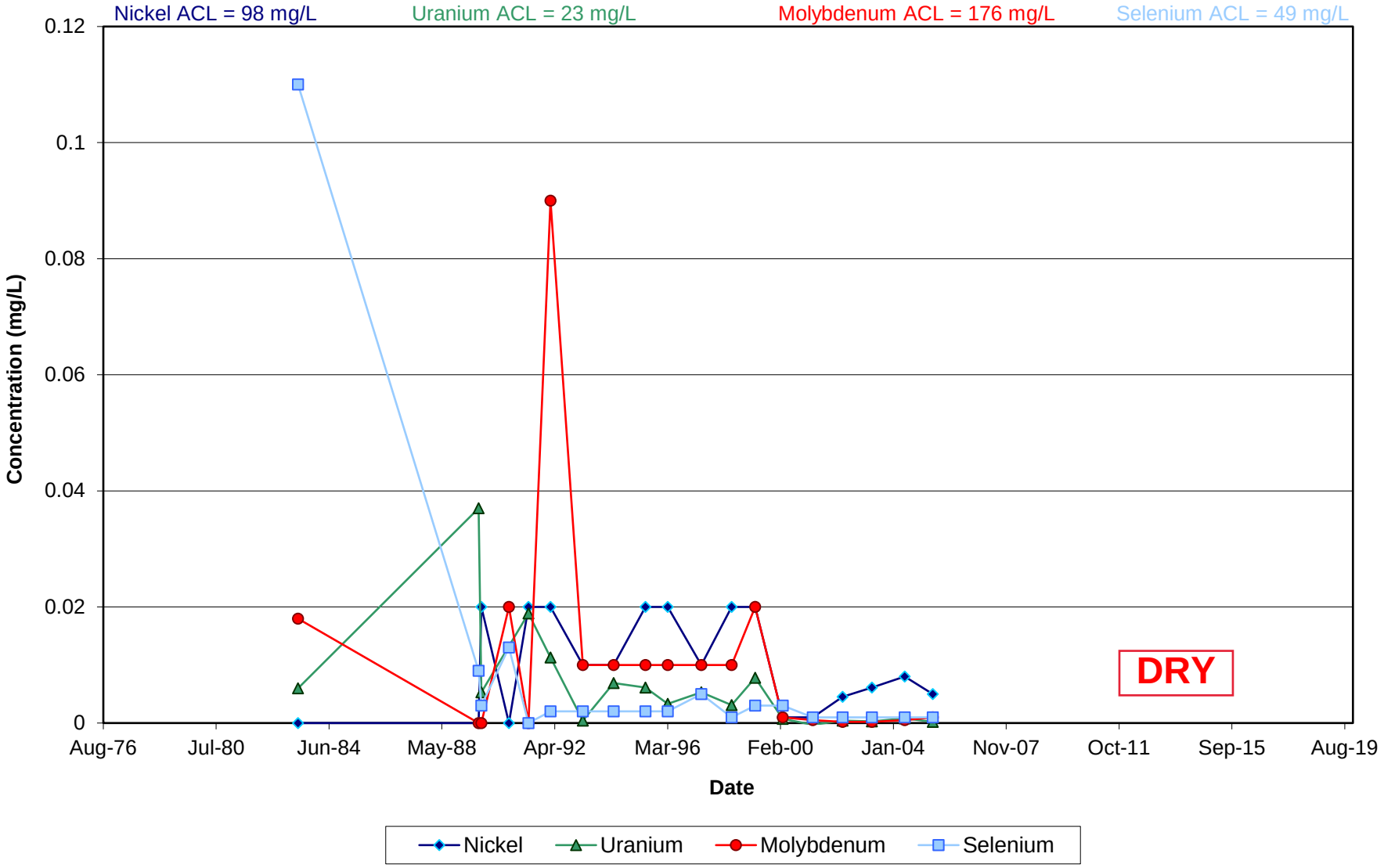
Nitrate in Monitoring Well 5-04 ALL



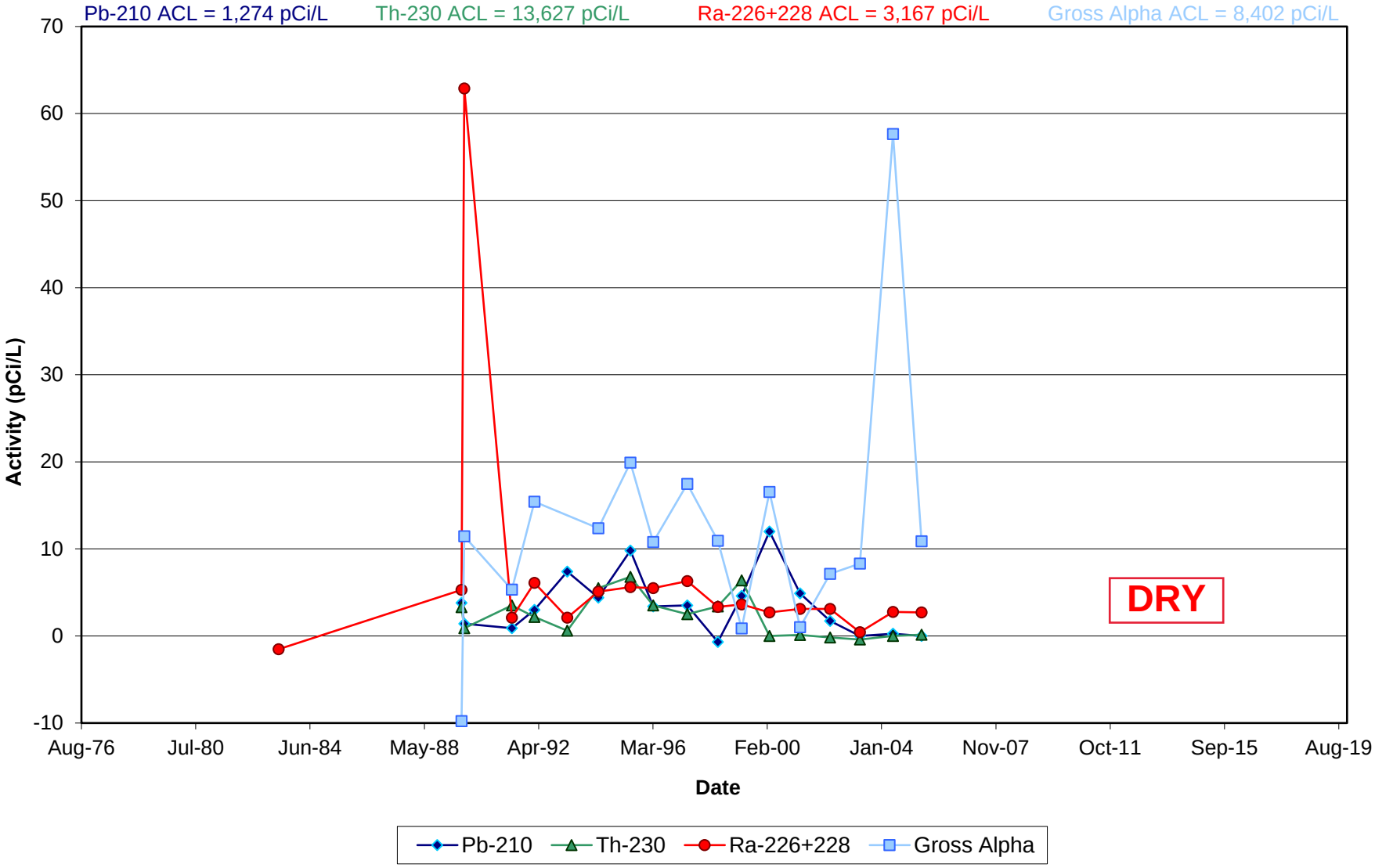
Anions and TDS in Monitoring Well 5-05



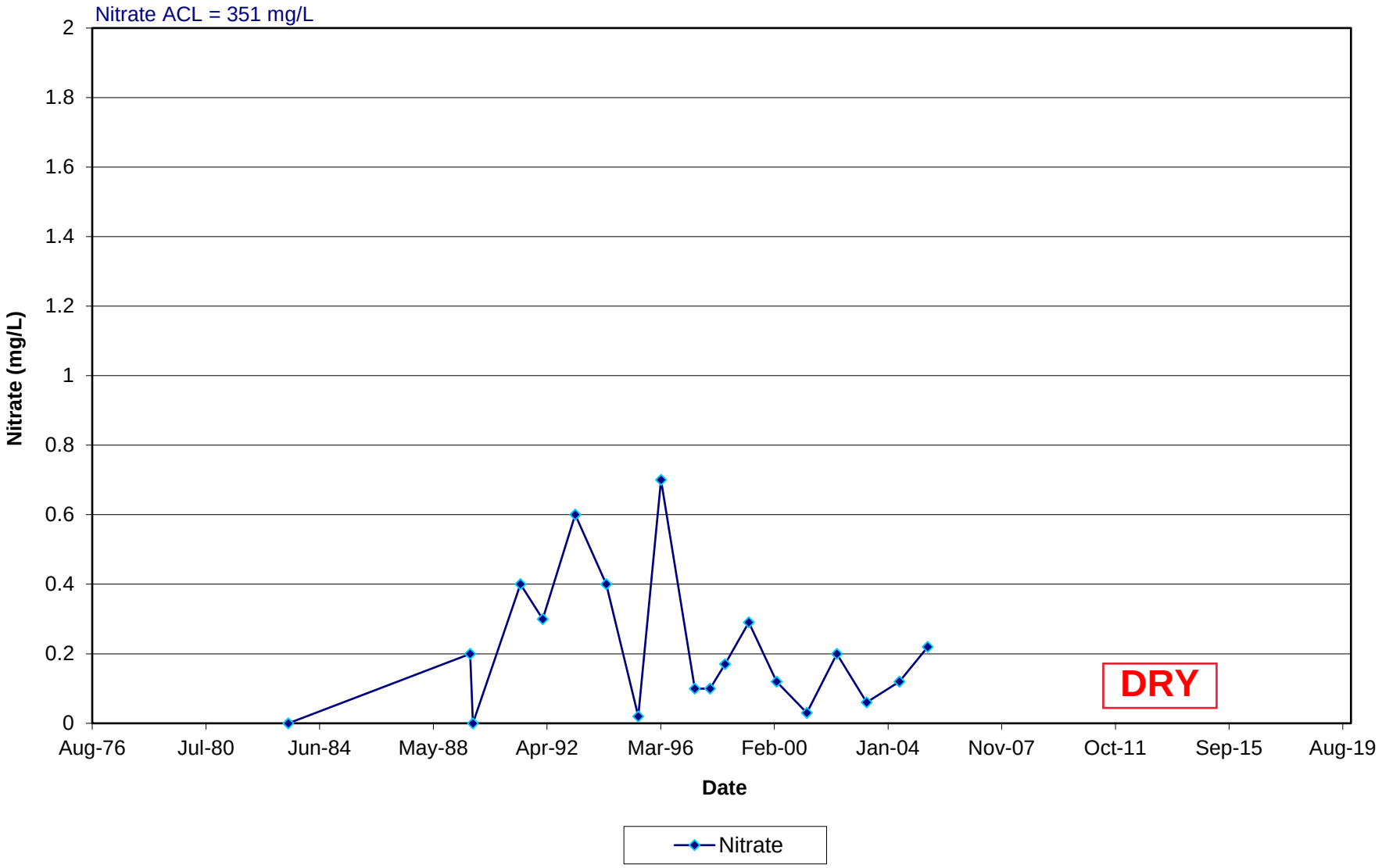
Metals in Monitoring Well 5-05

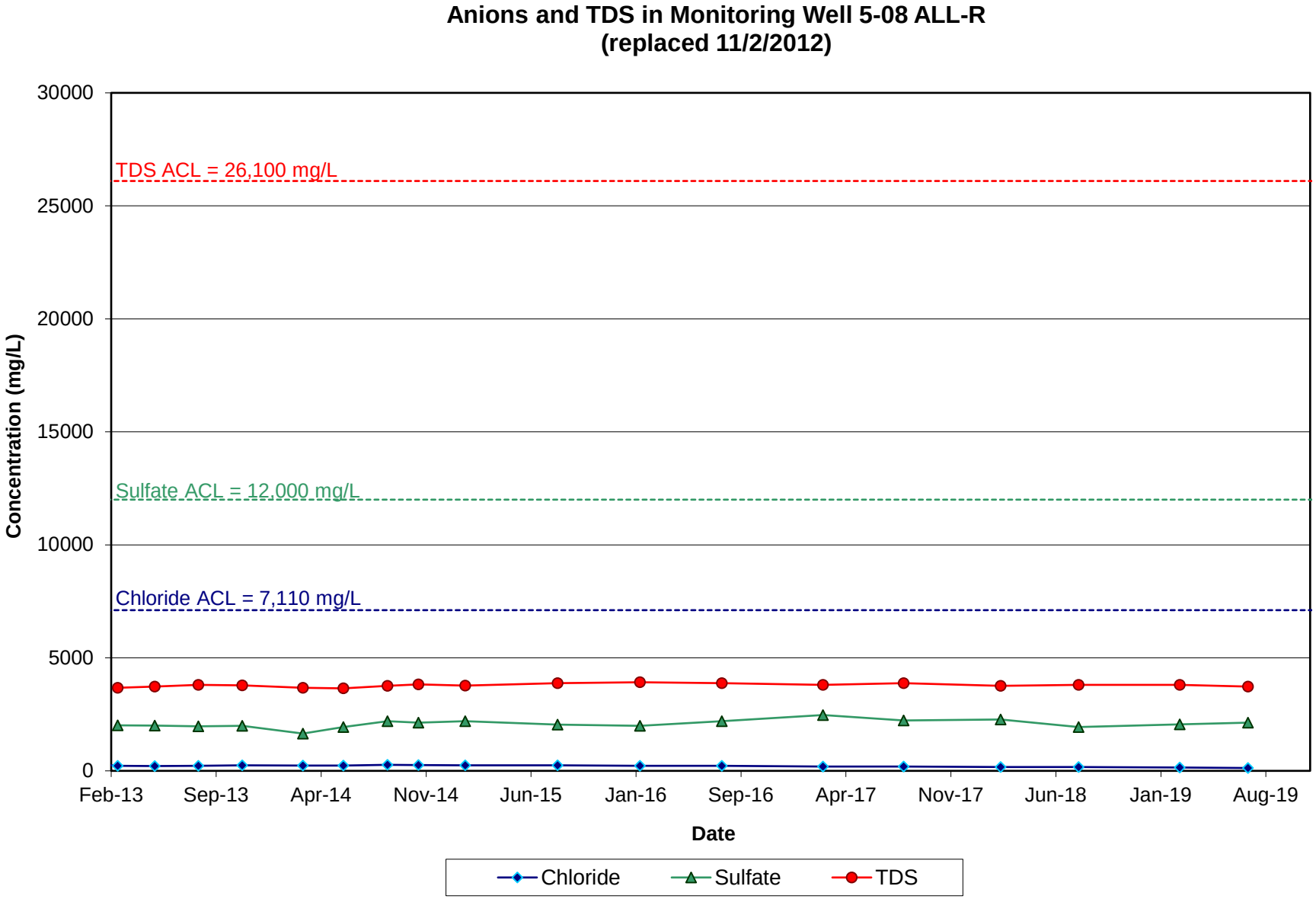


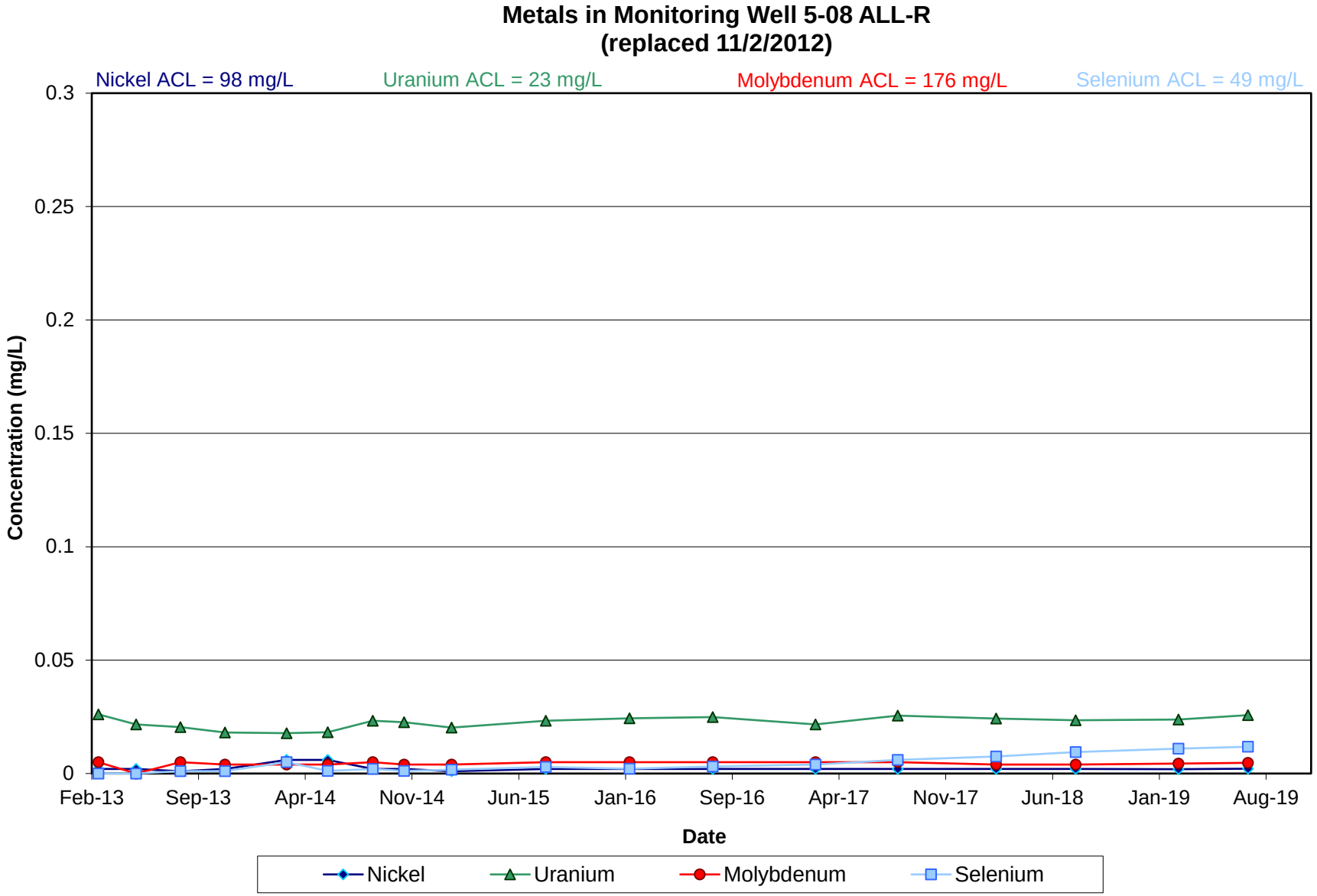
Radionuclides in Monitoring Well 5-05

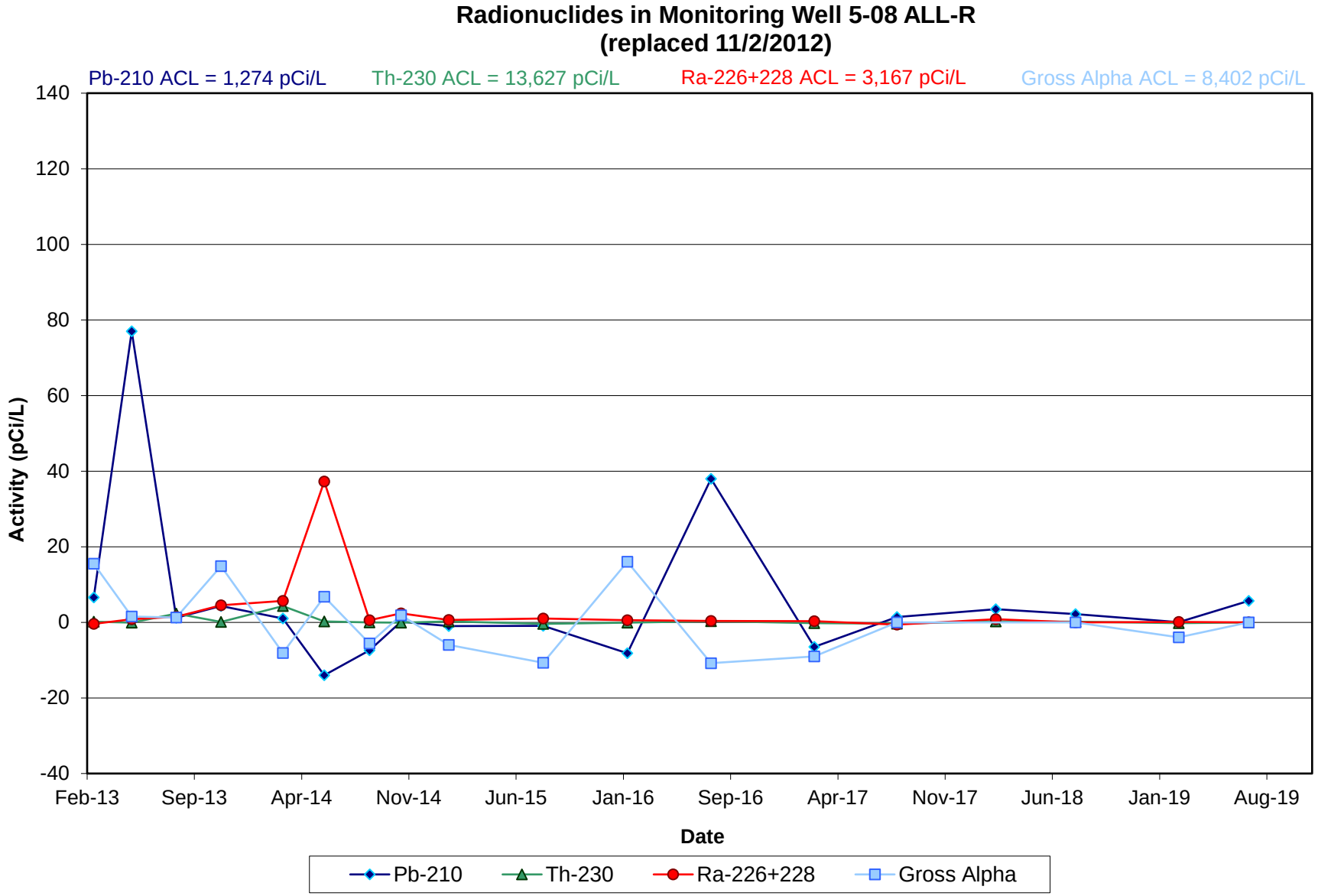


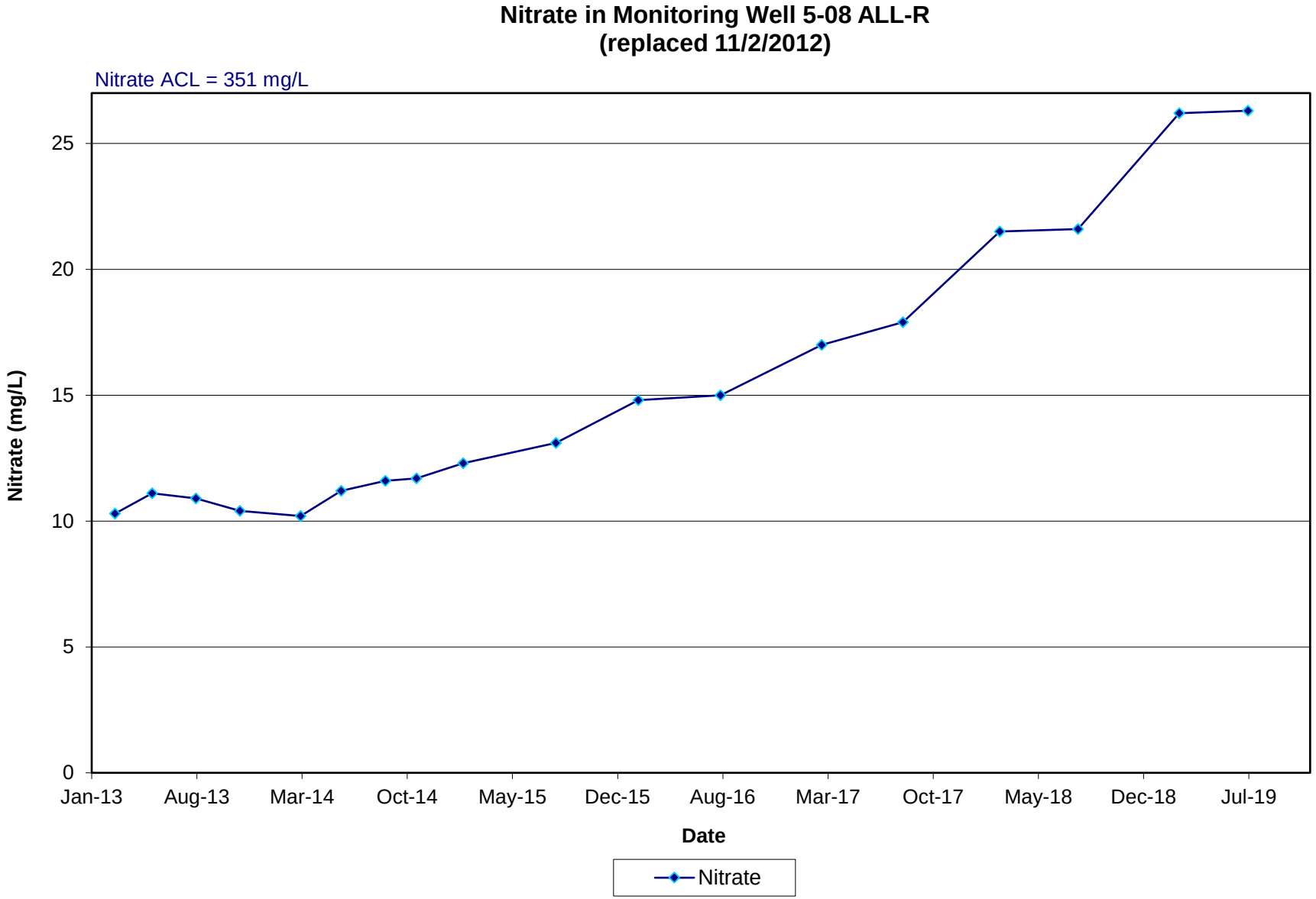
Nitrate in Monitoring Well 5-05

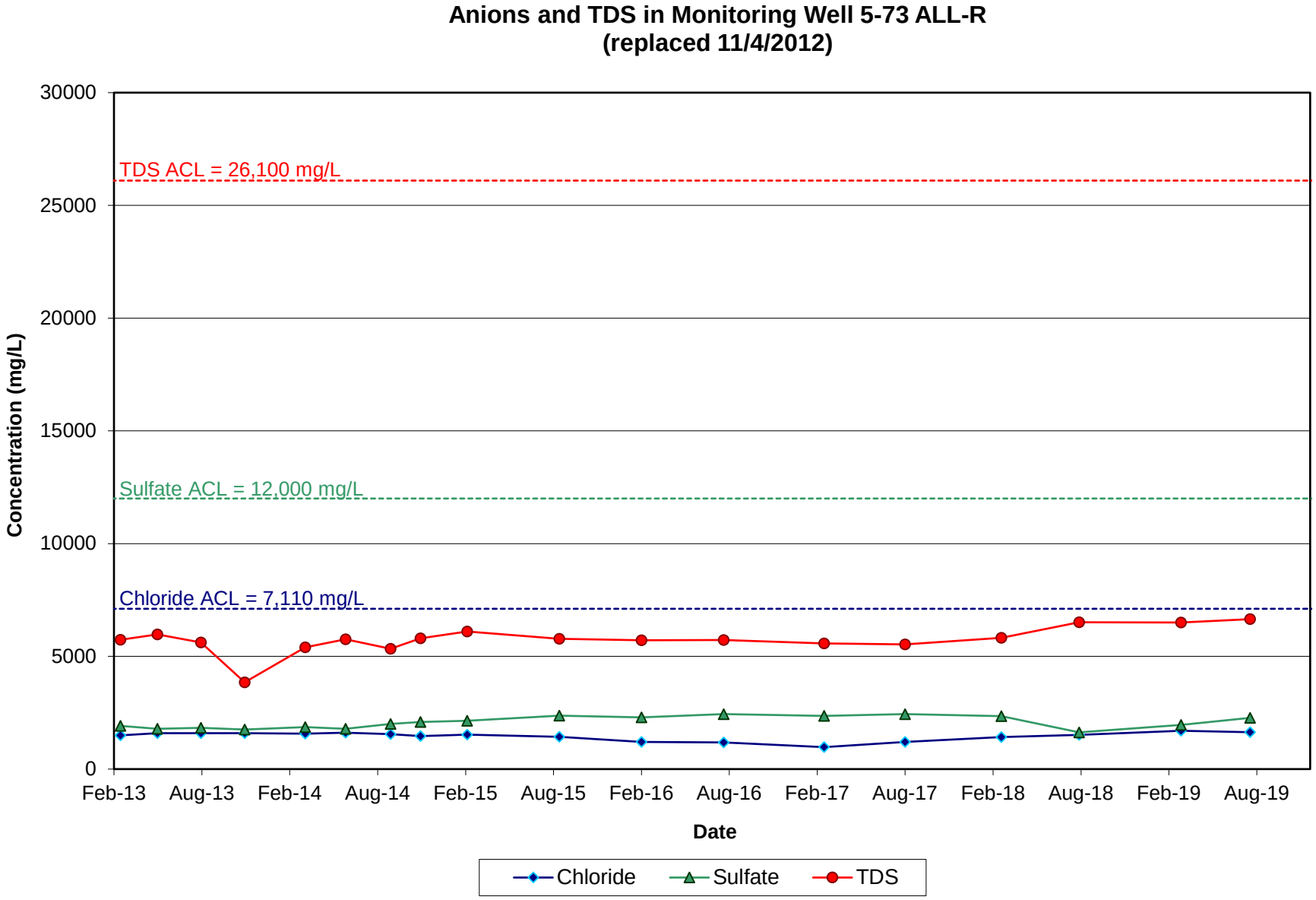


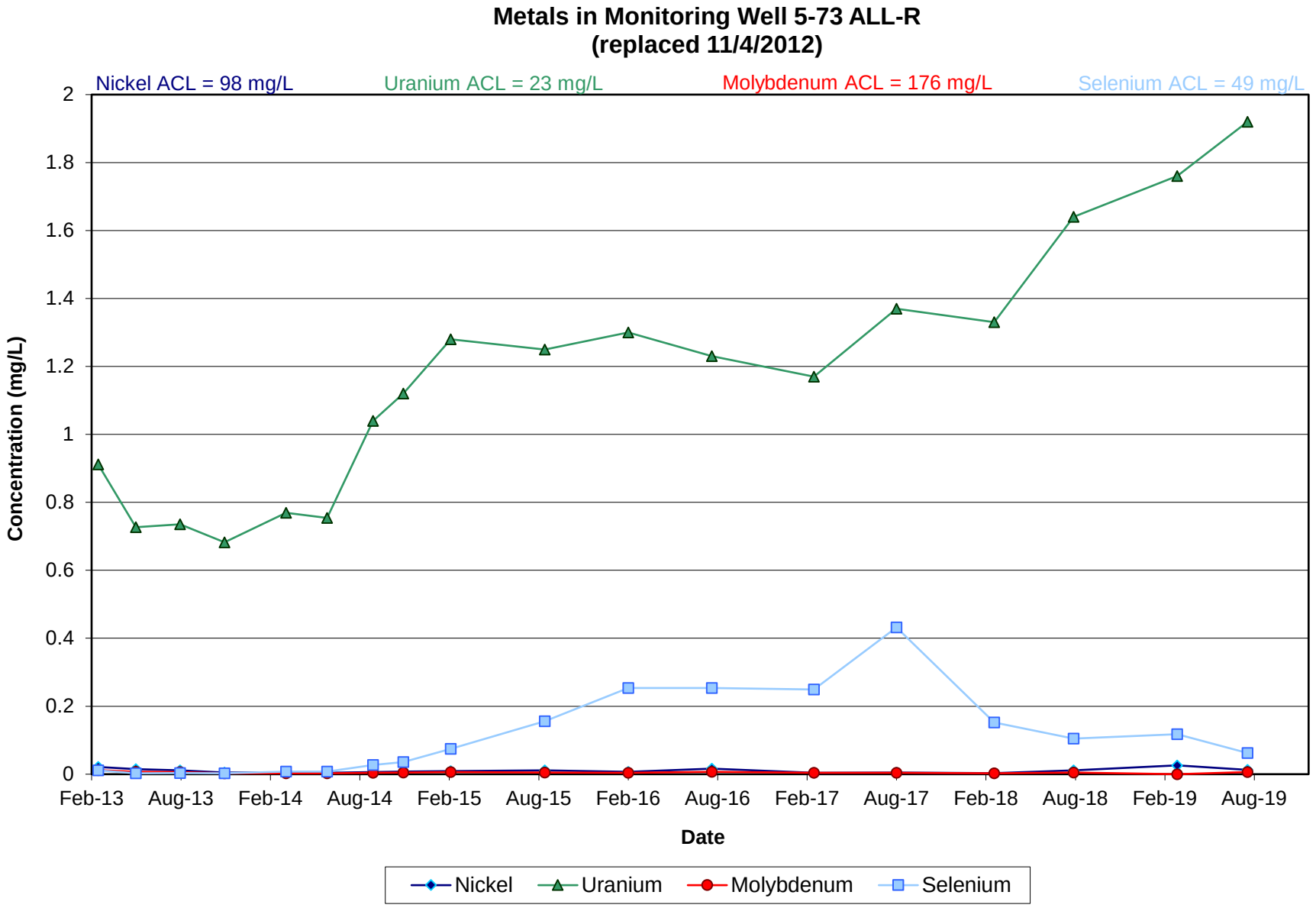

Anions and TDS in Monitoring Well 5-08 ALL-R
(replaced 11/2/2012)
30000
25000
20000
15000
10000
5000
0
Concentration (mg/L)
TDS ACL = 26,100 mg/L
Sulfate ACL = 12,000 mg/L
Chloride ACL = 7,110 mg/L
Feb-13
Sep-13
Apr-14
Nov-14
Jun-15
Jan-16
Sep-16
Apr-17
Nov-17
Jun-18
Jan-19
Aug-19
Date
Chloride
Sulfate
TDS

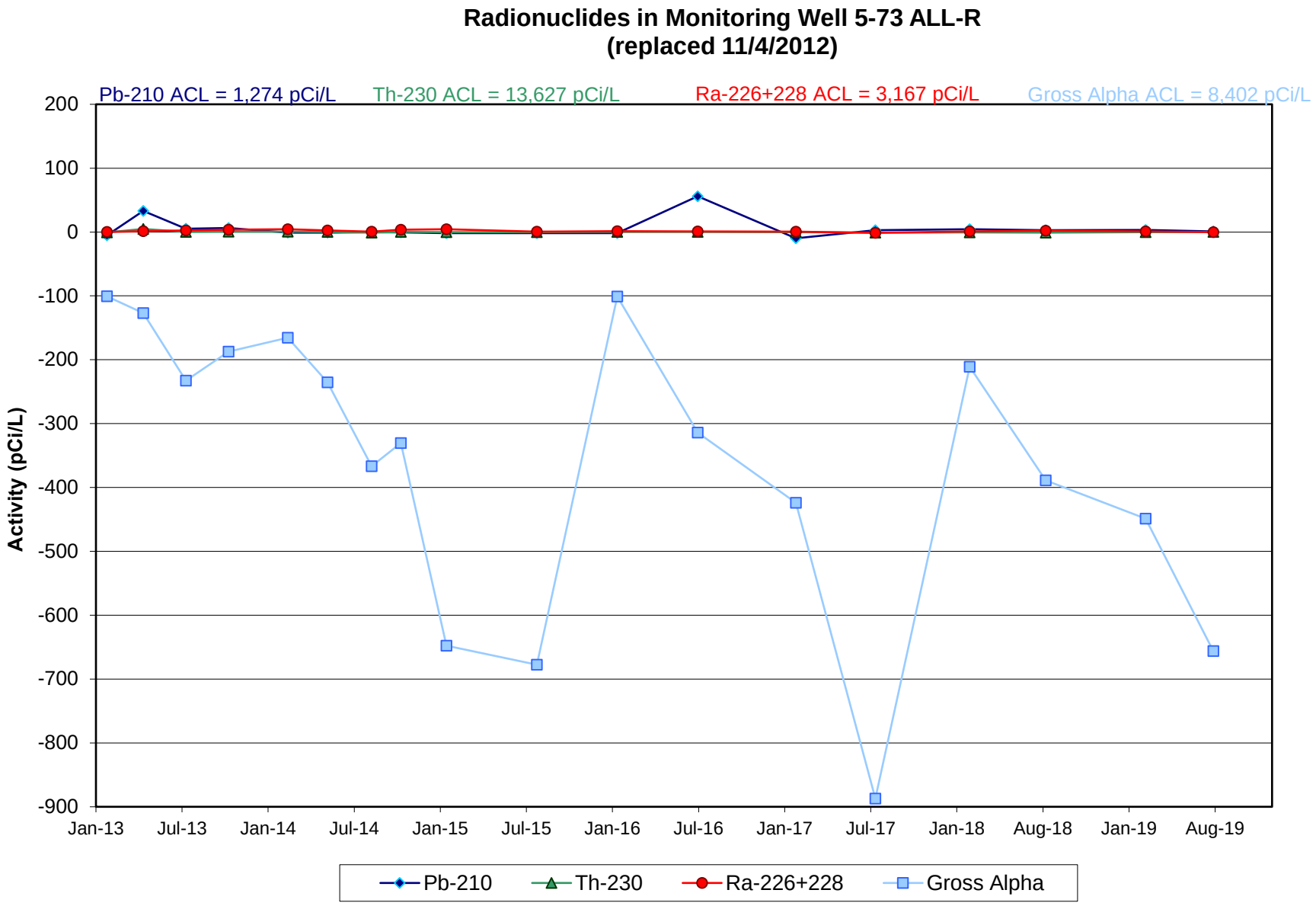

Metals in Monitoring Well 5-08 ALL-R
(replaced 11/2/2012)
Nickel ACL = 98 mg/L
Uranium ACL = 23 mg/L
Molybdenum ACL = 176 mg/L
Selenium ACL = 49 mg/L
Concentration (mg/L)
0.3
0.25
0.2
0.15
0.1
0.05
0
Feb-13
Sep-13
Apr-14
Nov-14
Jun-15
Jan-16
Sep-16
Apr-17
Nov-17
Jun-18
Jan-19
Aug-19
Date
Nickel
Uranium
Molybdenum
Selenium

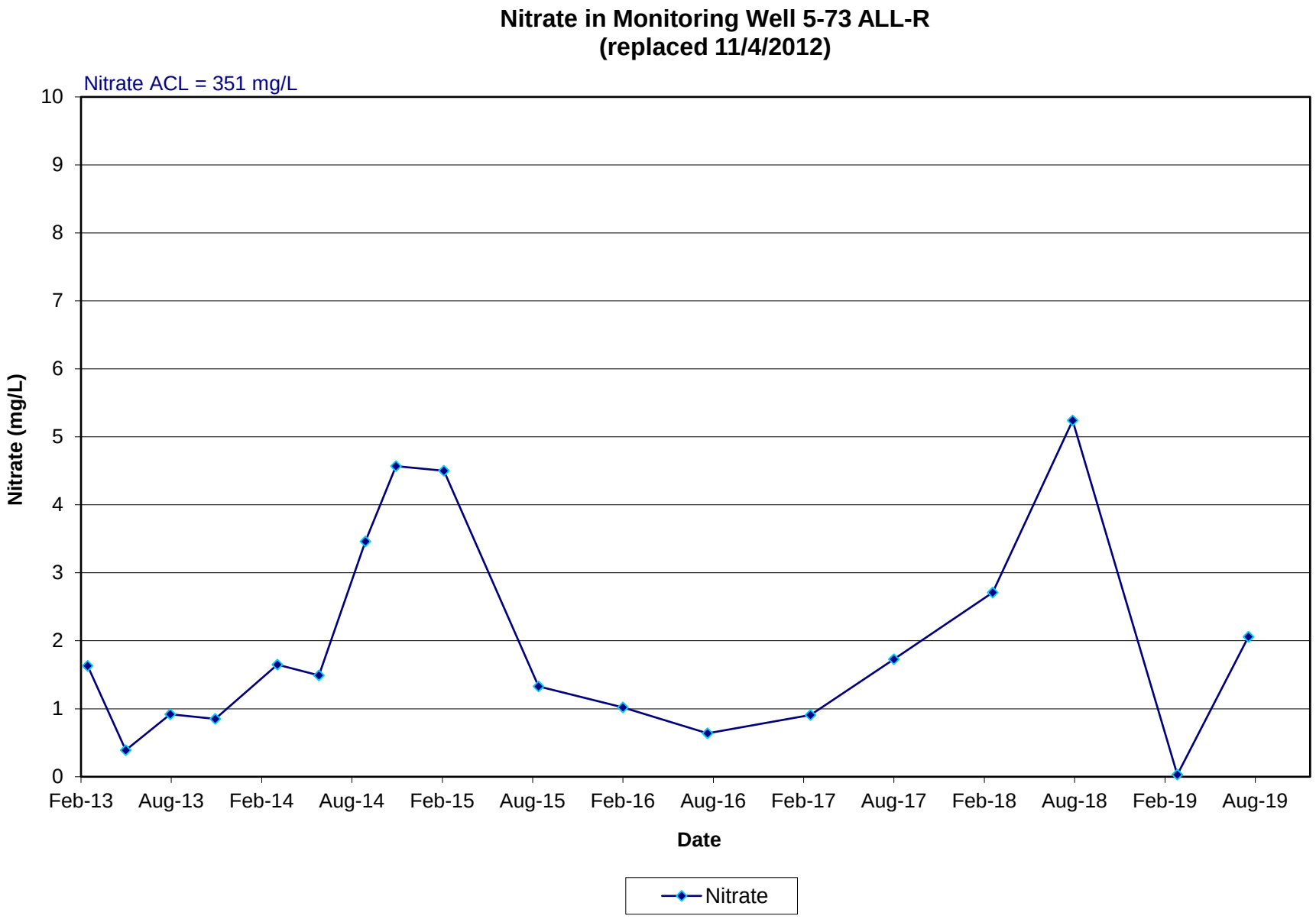

Radionuclides in Monitoring Well 5-08 ALL-R
(replaced 11/2/2012)
Pb-210 ACL = 1,274 pCi/L
Th-230 ACL = 13,627 pCi/L
Ra-226+228 ACL = 3,167 pCi/L
Gross Alpha ACL = 8,402 pCi/L
Activity (pCi/L)
140
120
100
80
60
40
20
0
-20
-40
Feb-13
Sep-13
Apr-14
Nov-14
Jun-15
Jan-16
Sep-16
Apr-17
Nov-17
Jun-18
Jan-19
Aug-19
Date
Pb-210
Th-230
Ra-226+228
Gross Alpha


Nitrate in Monitoring Well 5-08 ALL-R
(replaced 11/2/2012)
Nitrate ACL = 351 mg/L
Nitrate (mg/L)
0
5
10
15
20
25
Jan-13
Aug-13
Mar-14
Oct-14
May-15
Dec-15
Aug-16
Mar-17
Oct-17
May-18
Dec-18
Jul-19
Date
Nitrate

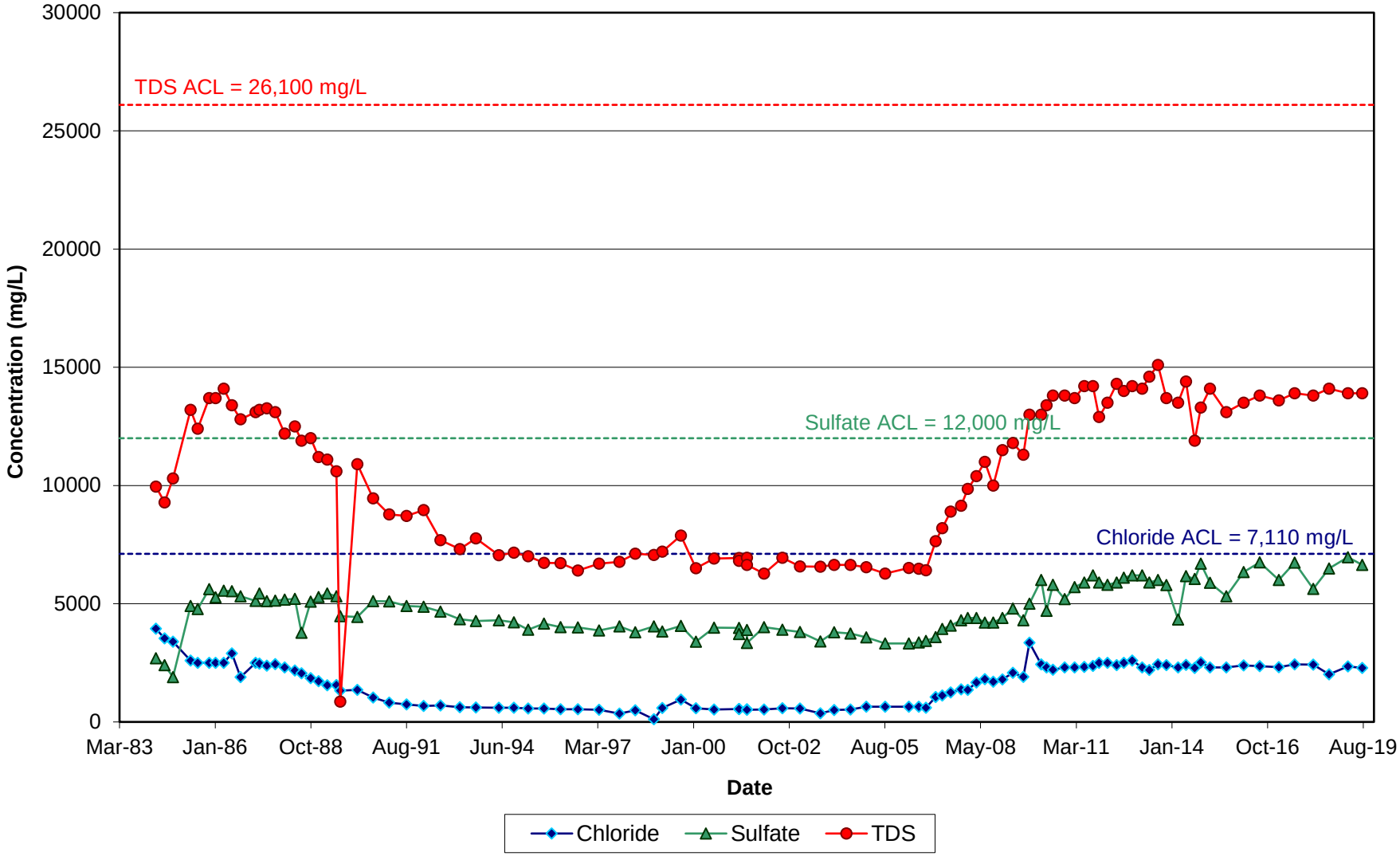

Anions and TDS in Monitoring Well 5-73 ALL-R
(replaced 11/4/2012)
30000
25000
20000
15000
10000
5000
0
Concentration (mg/L)
TDS ACL = 26,100 mg/L
Sulfate ACL = 12,000 mg/L
Chloride ACL = 7,110 mg/L
Feb-13
Aug-13
Feb-14
Aug-14
Feb-15
Aug-15
Feb-16
Aug-16
Feb-17
Aug-17
Feb-18
Aug-18
Feb-19
Aug-19
Date
Chloride
Sulfate
TDS


Metals in Monitoring Well 5-73 ALL-R
(replaced 11/4/2012)
Nickel ACL = 98 mg/L
Uranium ACL = 23 mg/L
Molybdenum ACL = 176 mg/L
Selenium ACL = 49 mg/L
Concentration (mg/L)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Feb-13
Aug-13
Feb-14
Aug-14
Feb-15
Aug-15
Feb-16
Aug-16
Feb-17
Aug-17
Feb-18
Aug-18
Feb-19
Aug-19
Date
Nickel
Uranium
Molybdenum
Selenium

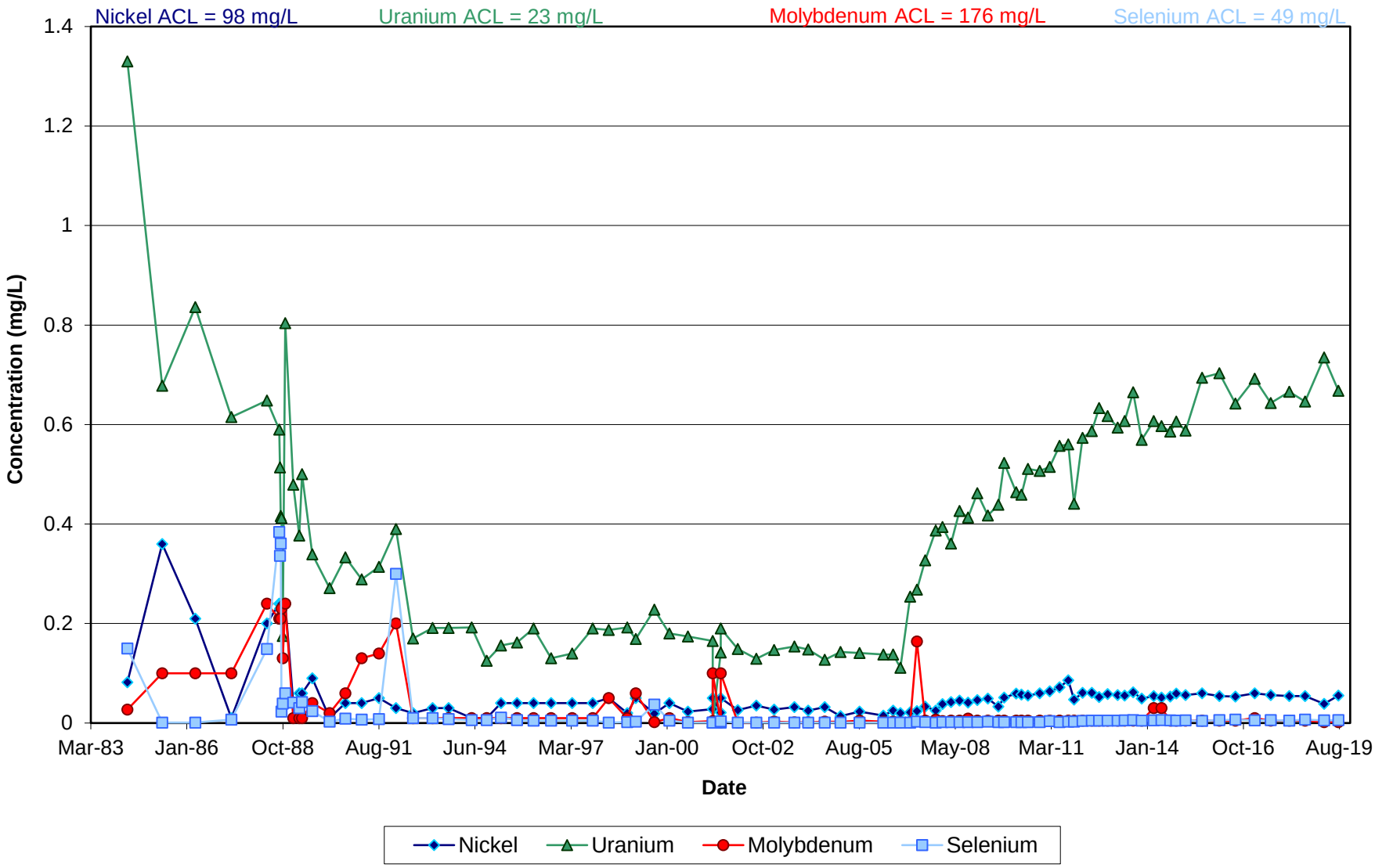

Radionuclides in Monitoring Well 5-73 ALL-R
(replaced 11/4/2012)
Pb-210 ACL = 1,274 pCi/L
Th-230 ACL = 13,627 pCi/L
Ra-226+228 ACL = 3,167 pCi/L
Gross Alpha ACL = 8,402 pCi/L
Activity (pCi/L)
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18
Aug-18
Jan-19
Aug-19
Pb-210
Th-230
Ra-226+228
Gross Alpha


Nitrate in Monitoring Well 5-73 ALL-R
(replaced 11/4/2012)
Nitrate ACL = 351 mg/L
Nitrate (mg/L)
10
9
8
7
6
5
4
3
2
1
0
Feb-13
Aug-13
Feb-14
Aug-14
Feb-15
Aug-15
Feb-16
Aug-16
Feb-17
Aug-17
Feb-18
Aug-18
Feb-19
Aug-19
Date
Nitrate

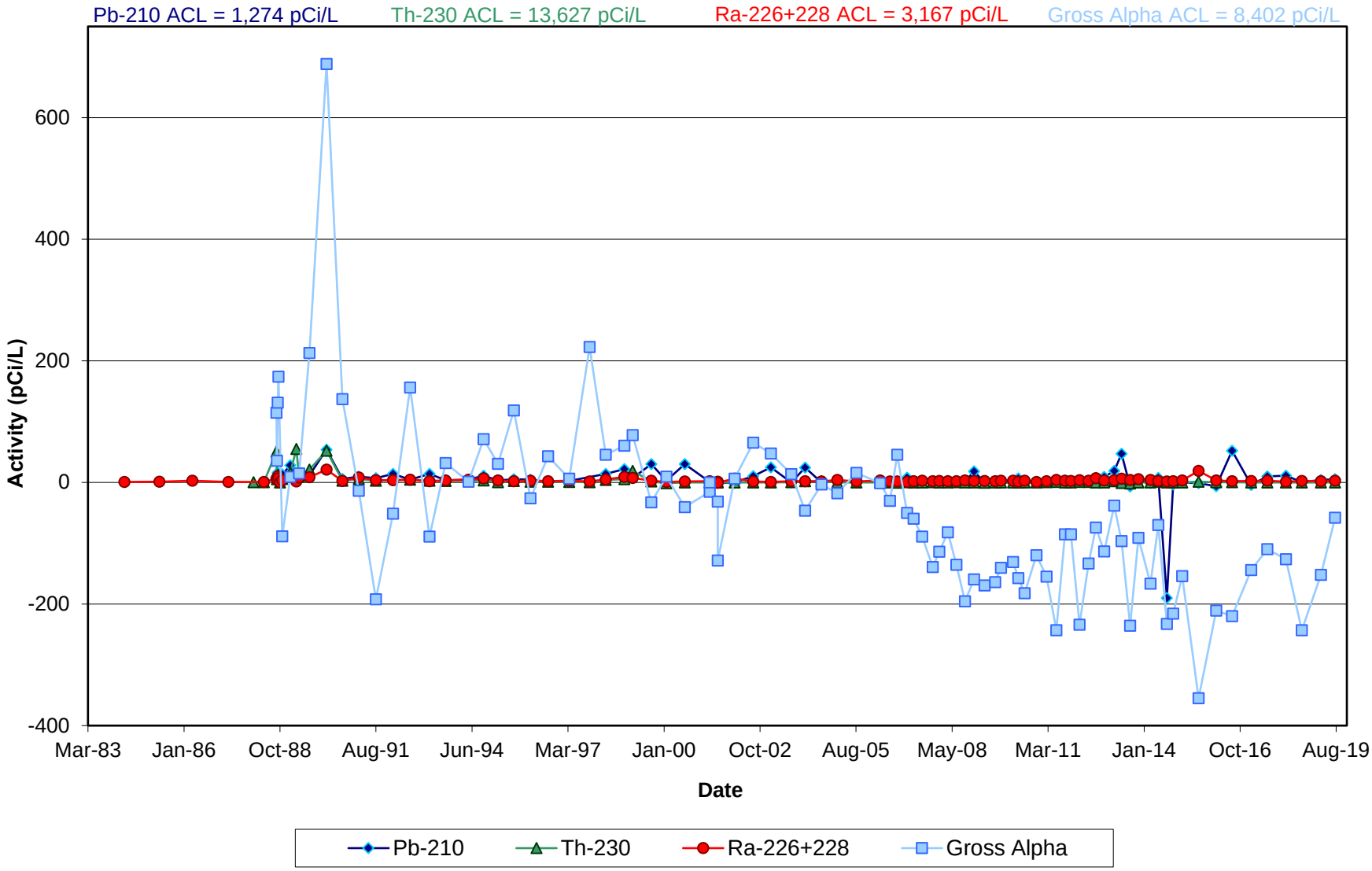
Anions and TDS in Monitoring Well 31-61 ALL



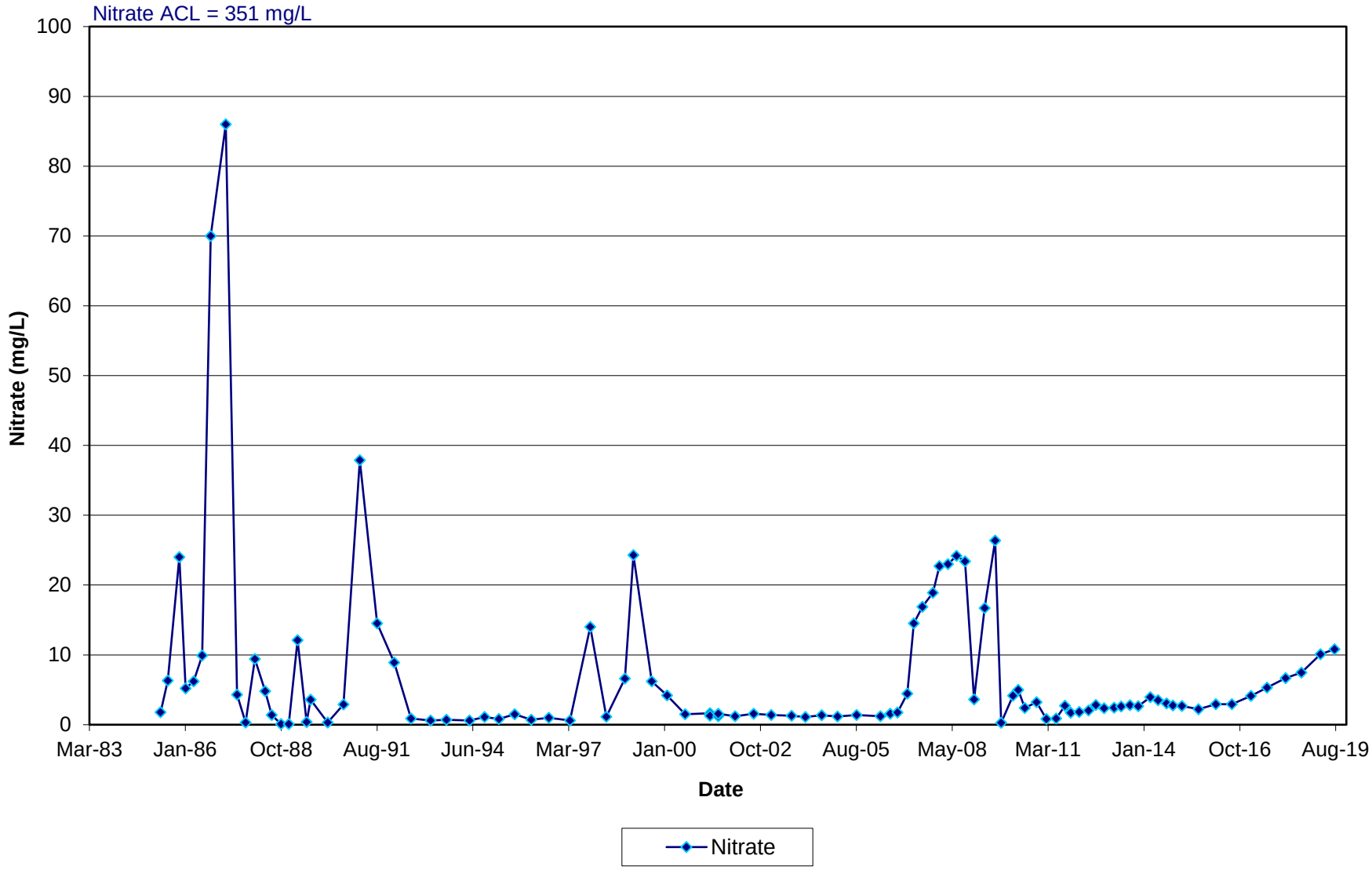
Metals in Monitoring Well 31-61 ALL



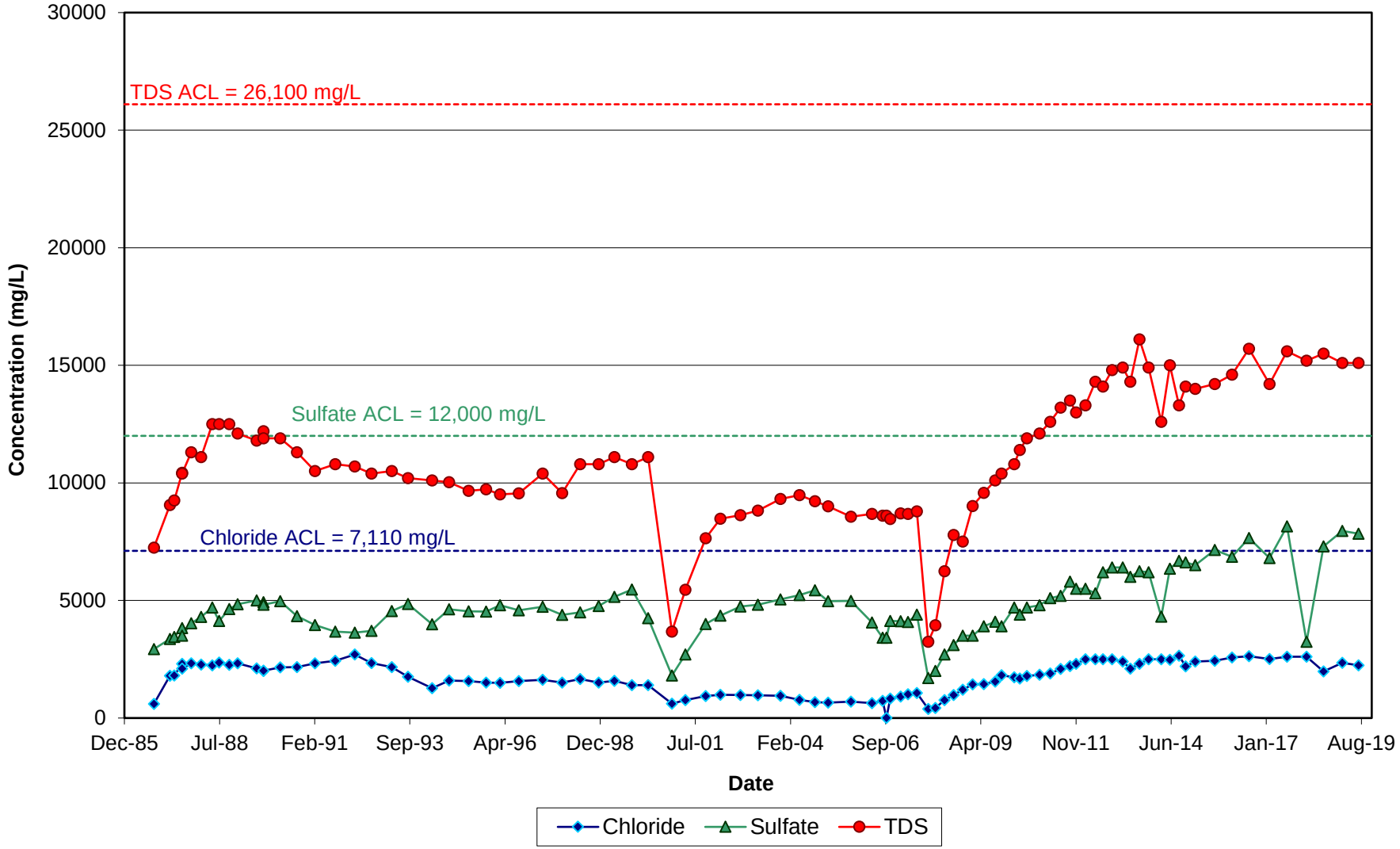
Radionuclides in Monitoring Well 31-61 ALL



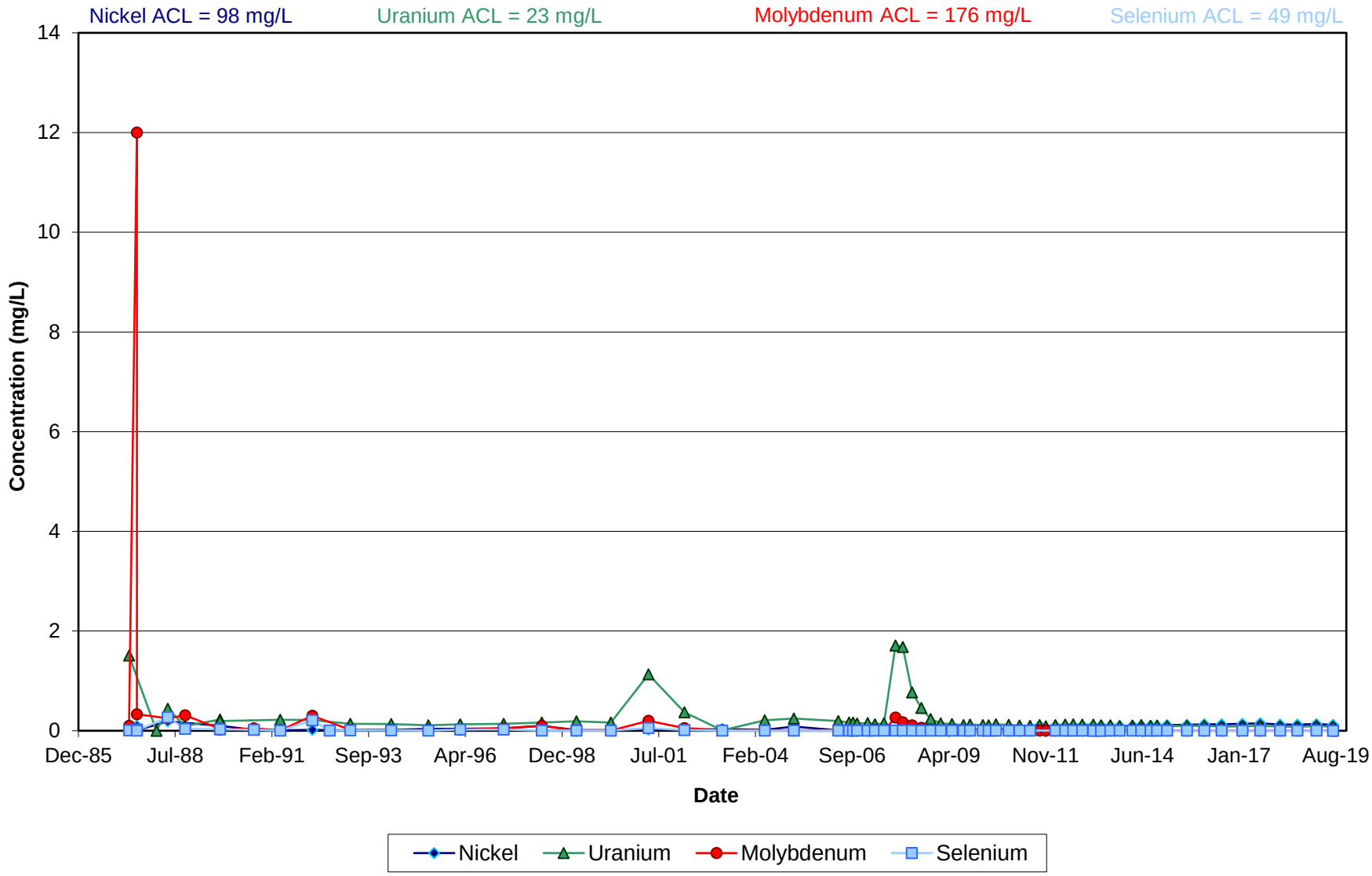
Nitrate in Monitoring Well 31-61 ALL



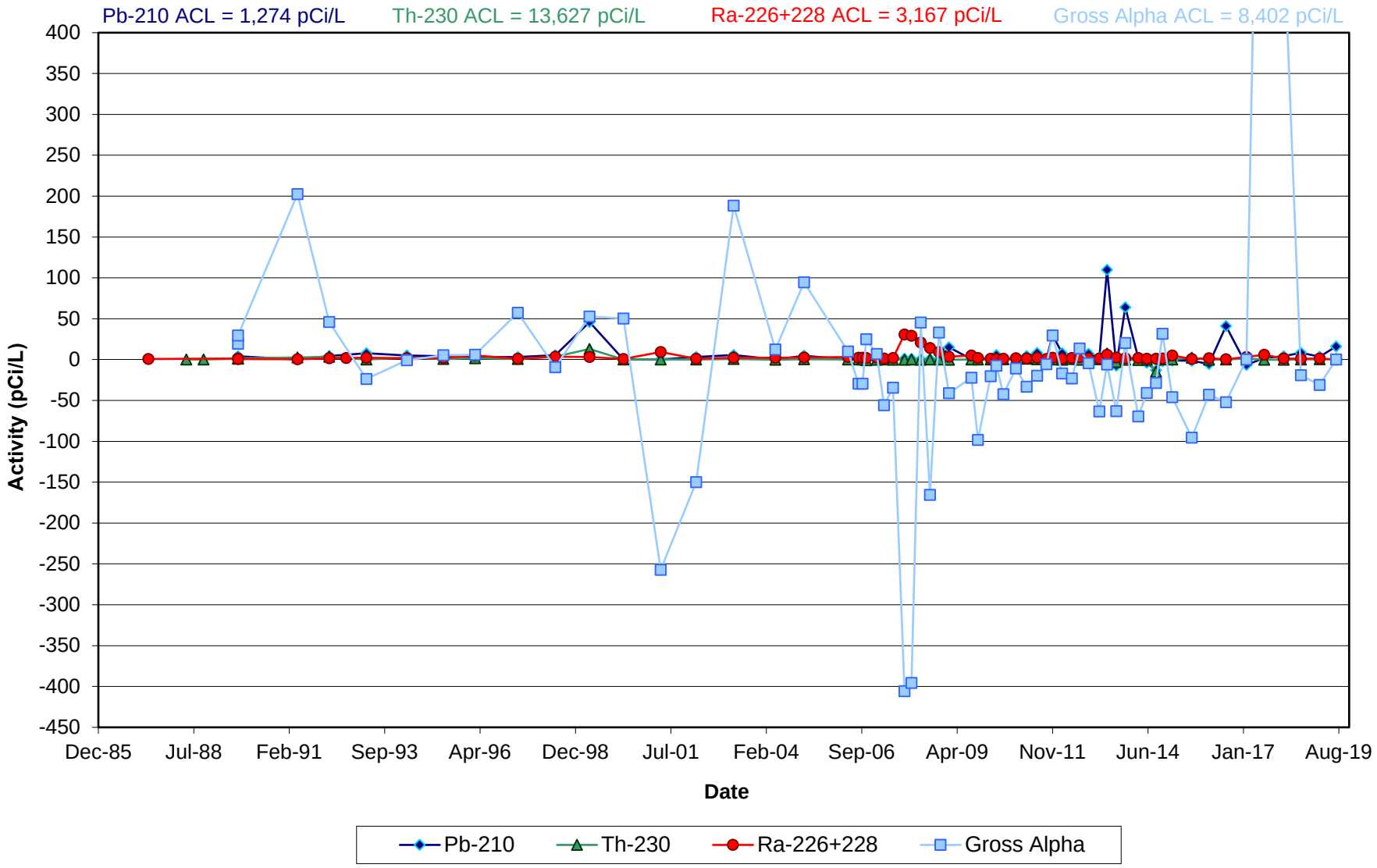
Anions and TDS in Monitoring Well 31-65 ALL



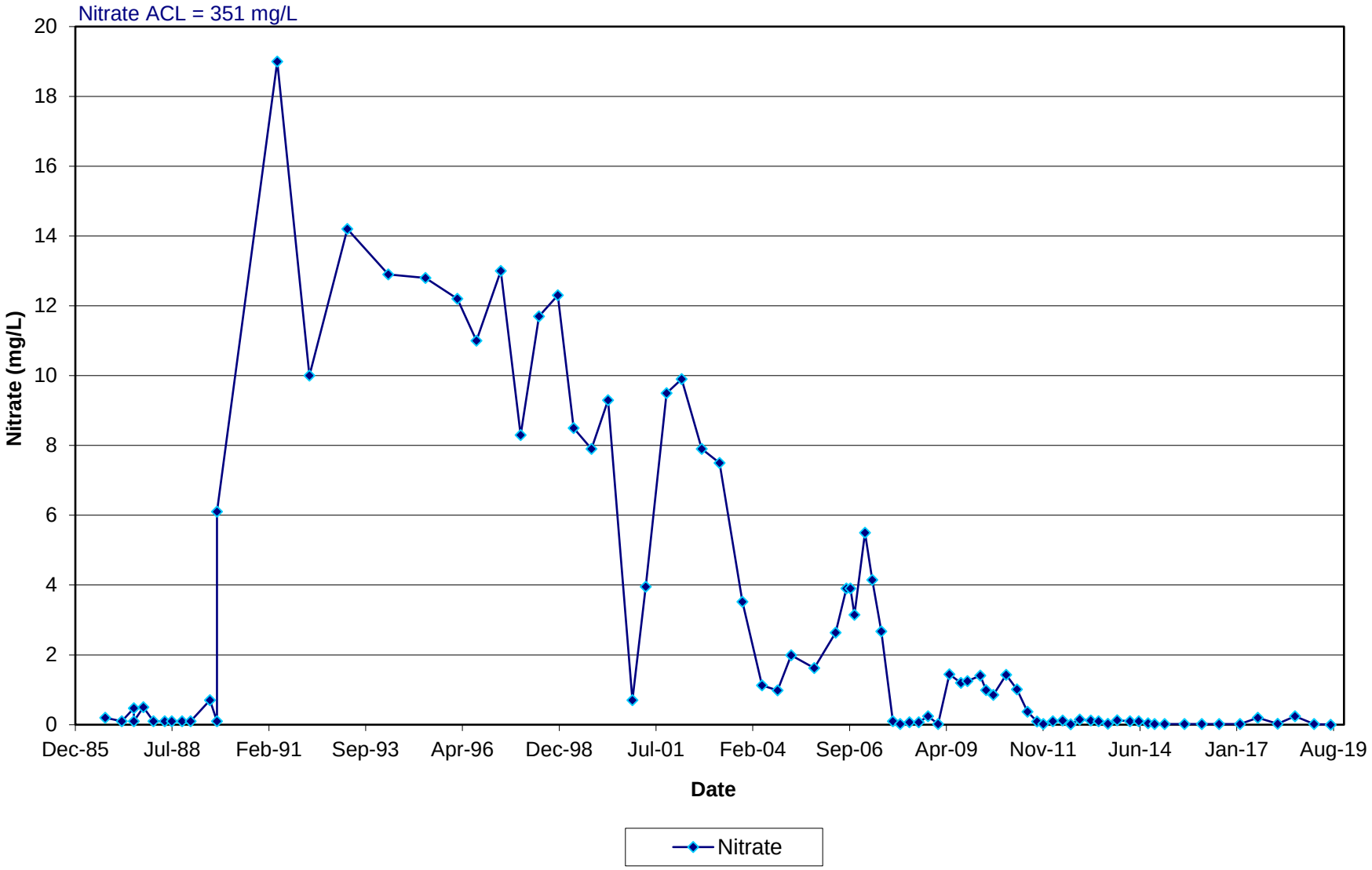
Metals in Monitoring Well 31-65 ALL



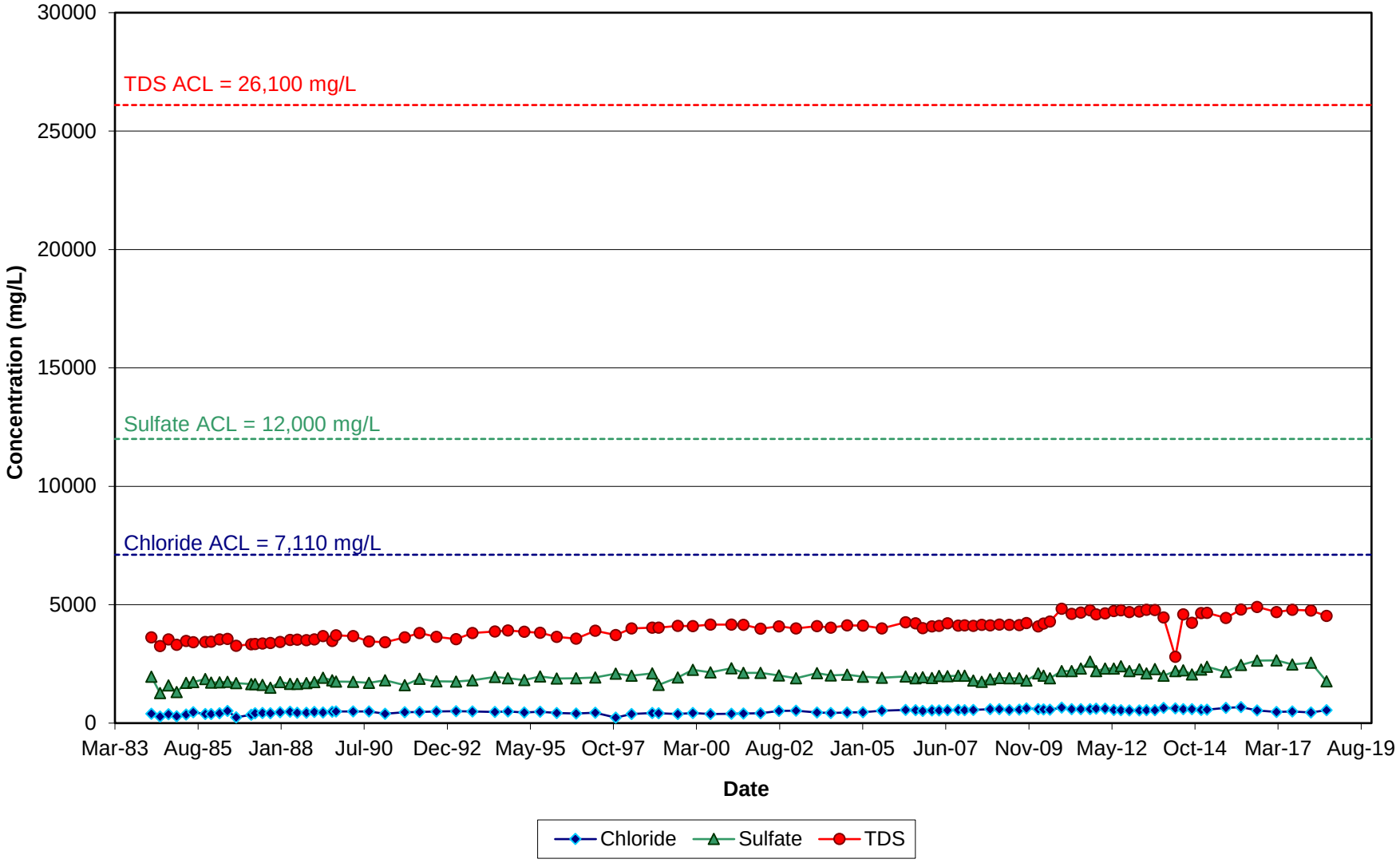
Radionuclides in Monitoring Well 31-65 ALL



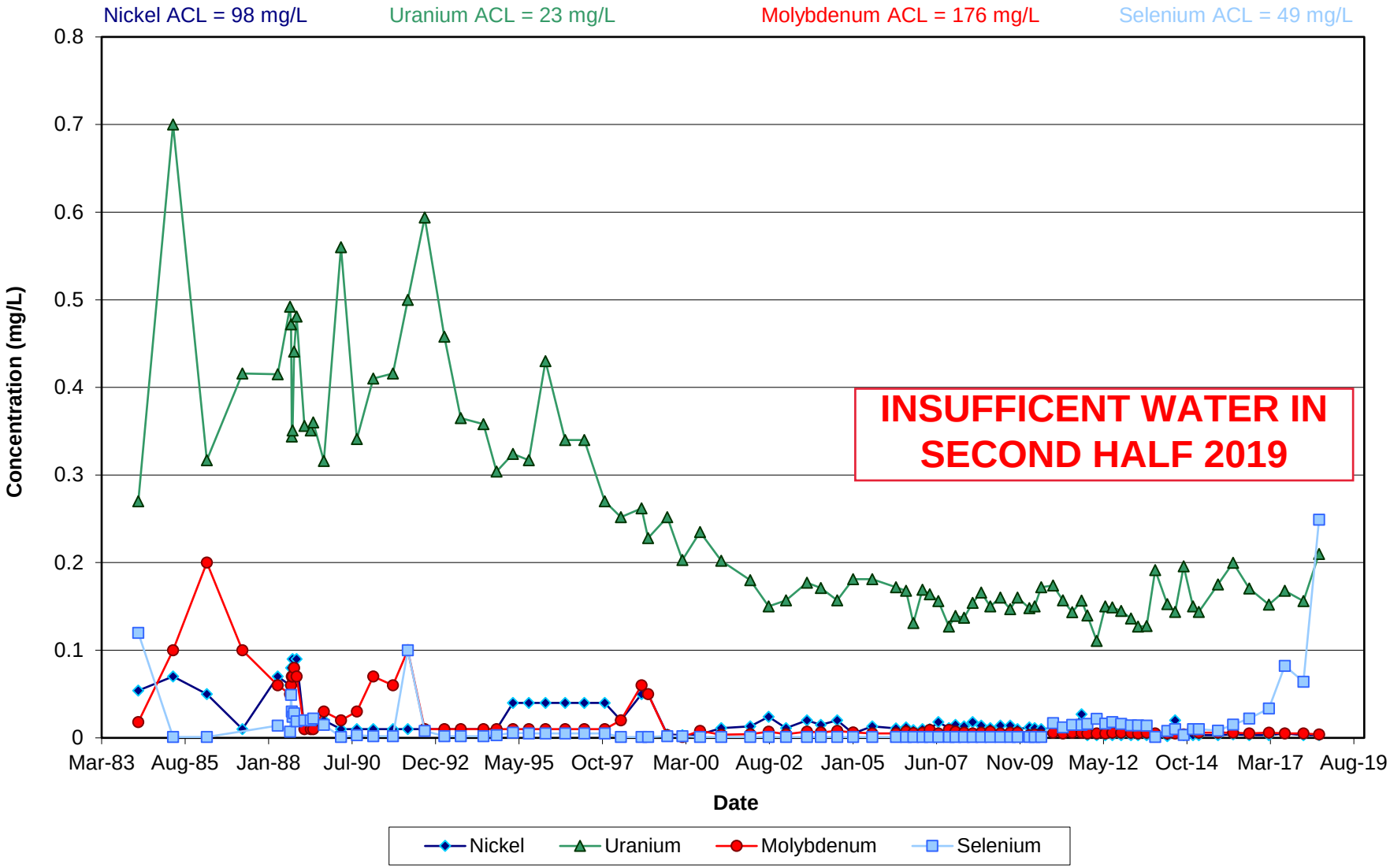
Nitrate in Monitoring Well 31-65 ALL

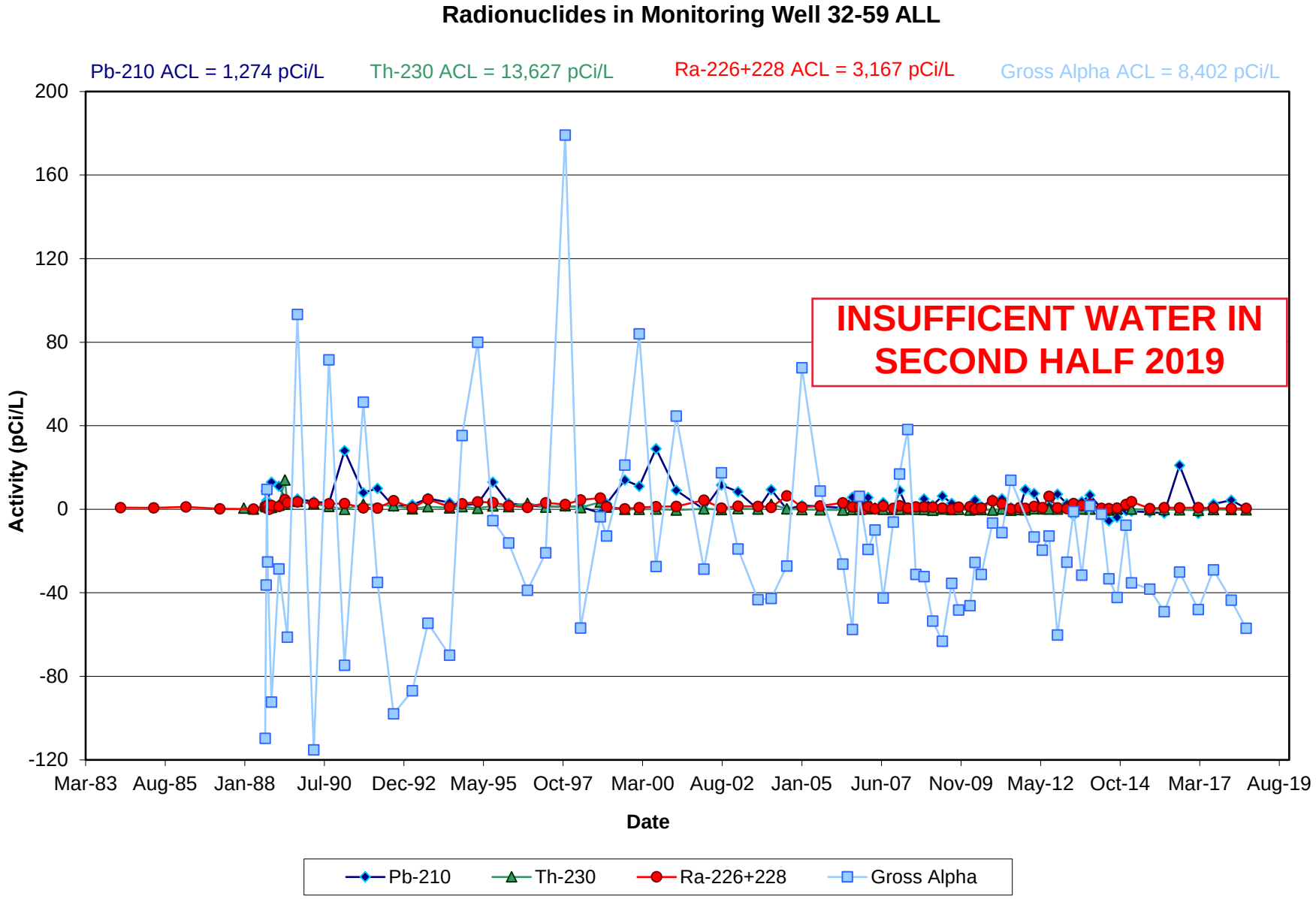


Anions and TDS in Monitoring Well 32-59 ALL

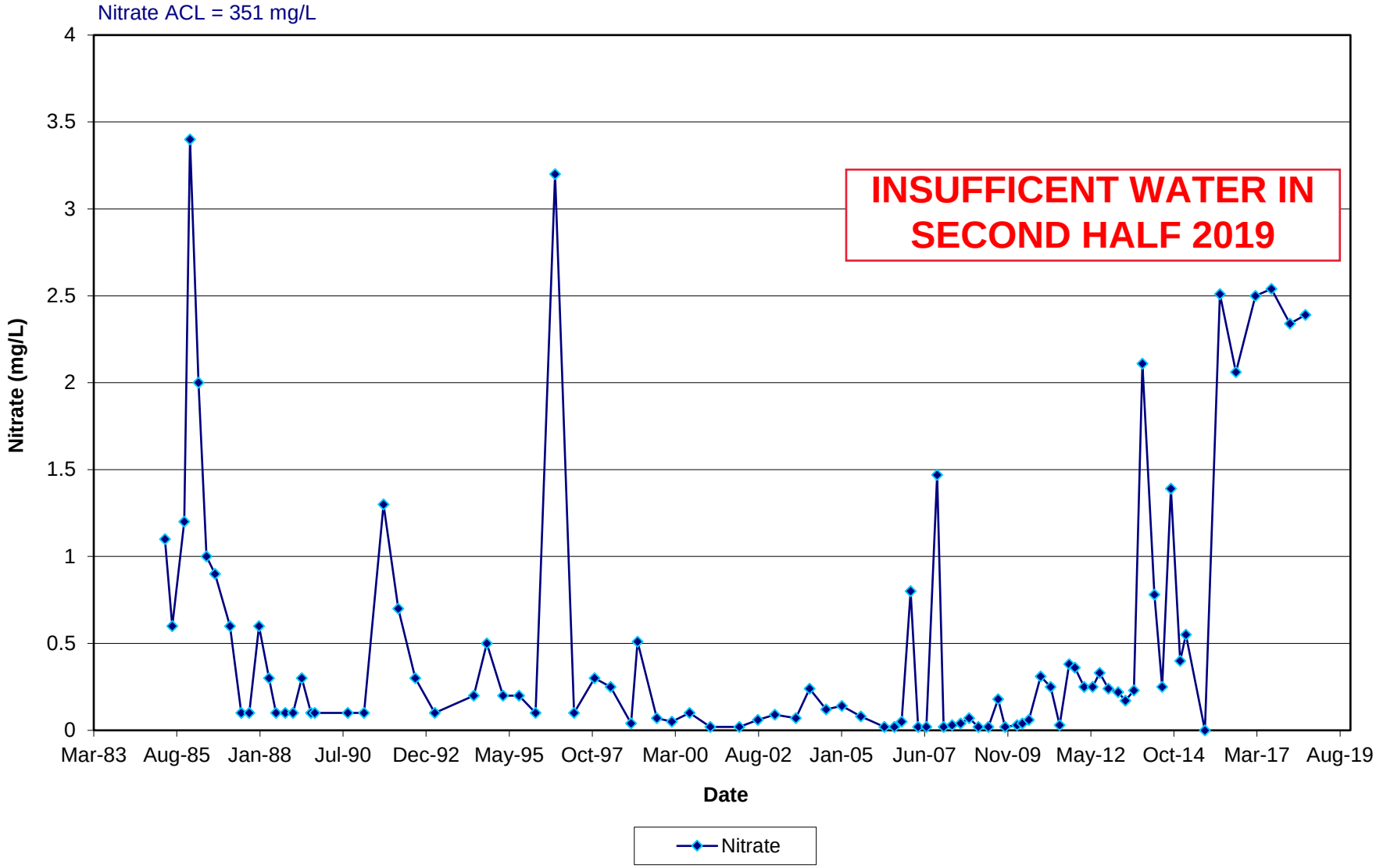


Metals in Monitoring Well 32-59 ALL

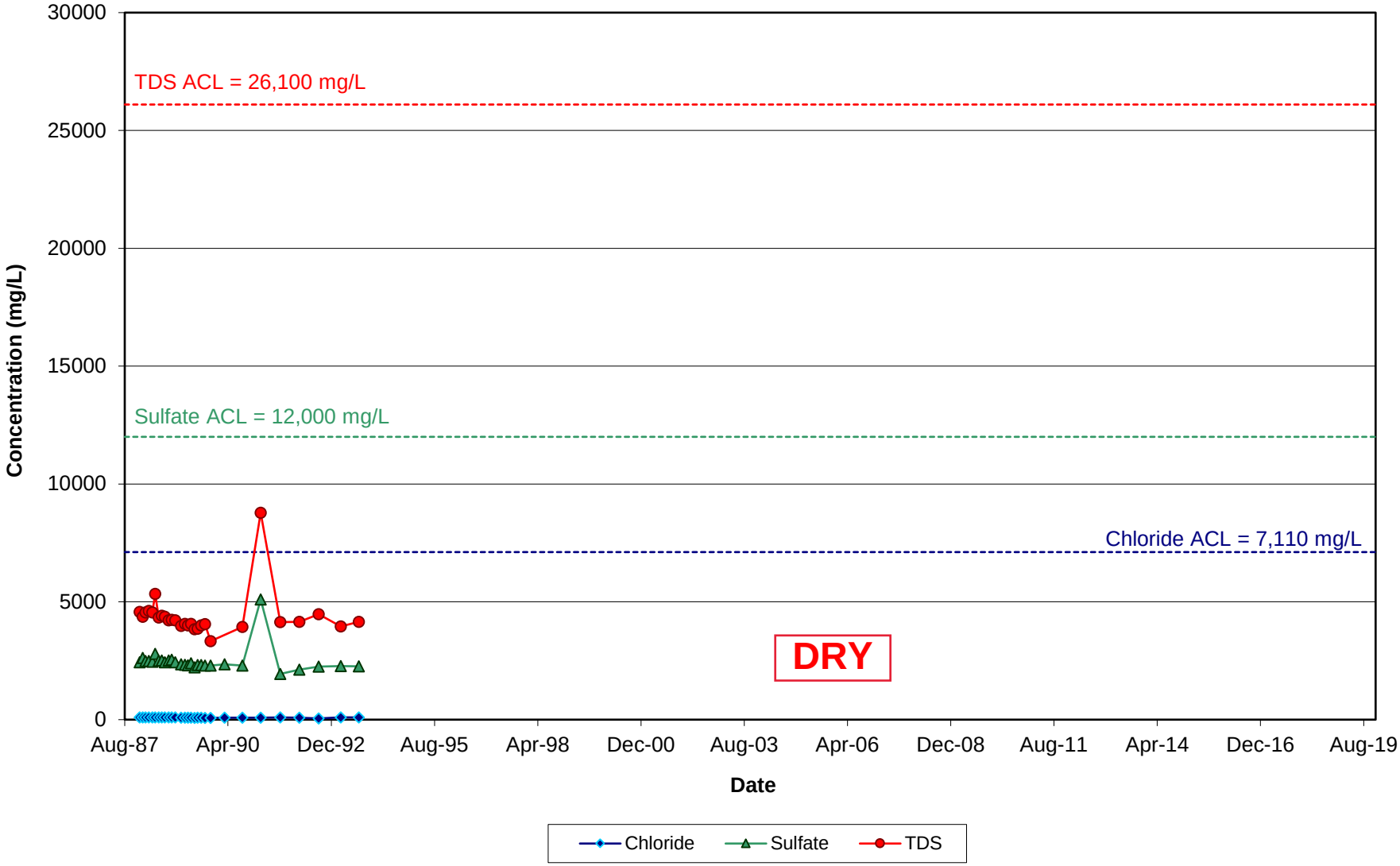


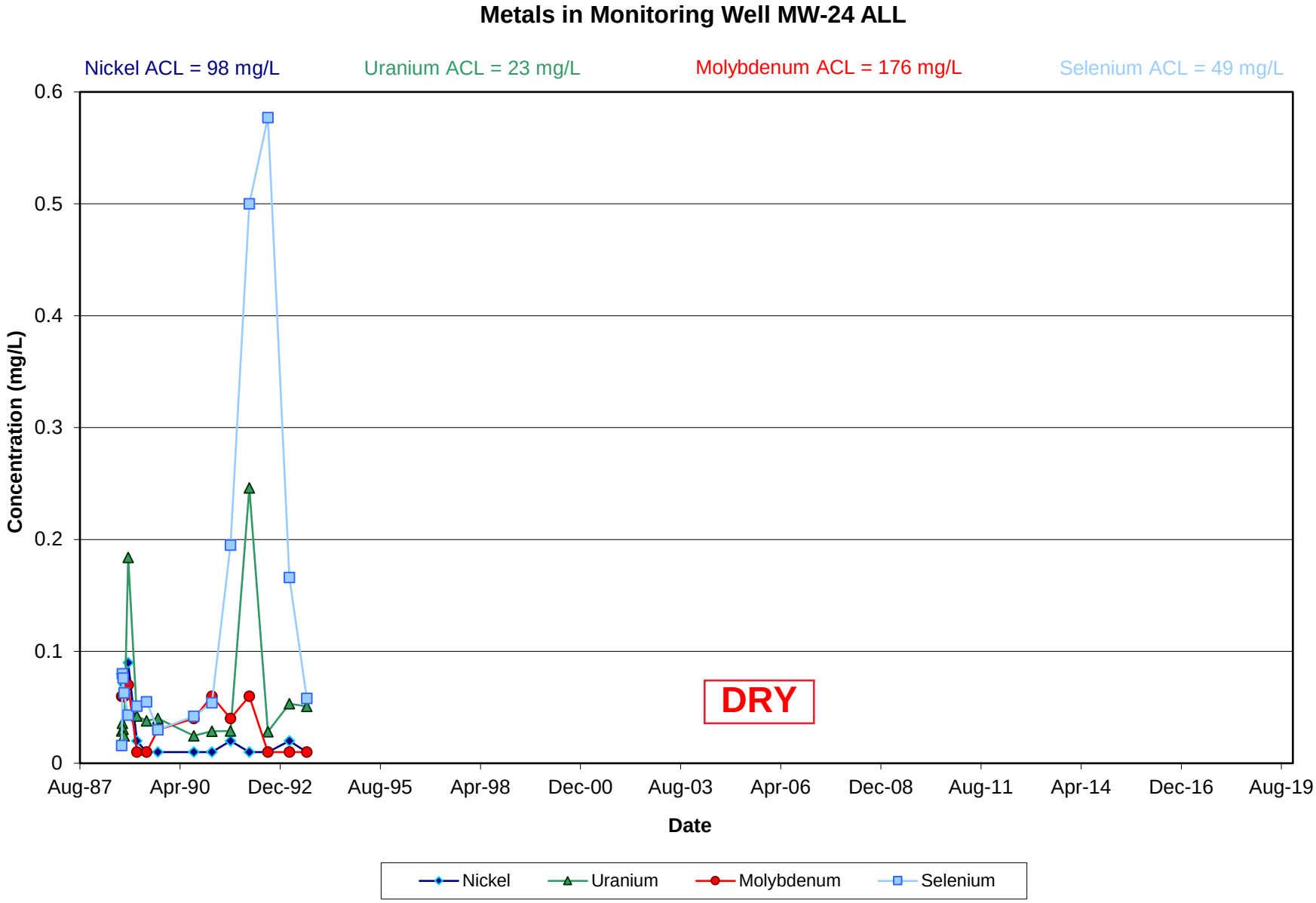

Radionuclides in Monitoring Well 32-59 ALL
Pb-210 ACL = 1,274 pCi/L
Th-230 ACL = 13,627 pCi/L
Ra-226+228 ACL = 3,167 pCi/L
Gross Alpha ACL = 8,402 pCi/L
INSUFFICENT WATER IN SECOND HALF 2019
Activity (pCi/L)
200
160
120
80
40
0
-40
-80
-120
Mar-83
Aug-85
Jan-88
Jul-90
Dec-92
May-95
Oct-97
Mar-00
Aug-02
Jan-05
Jun-07
Nov-09
May-12
Oct-14
Mar-17
Aug-19
Date
Pb-210
Th-230
Ra-226+228
Gross Alpha

Nitrate in Monitoring Well 32-59 ALL

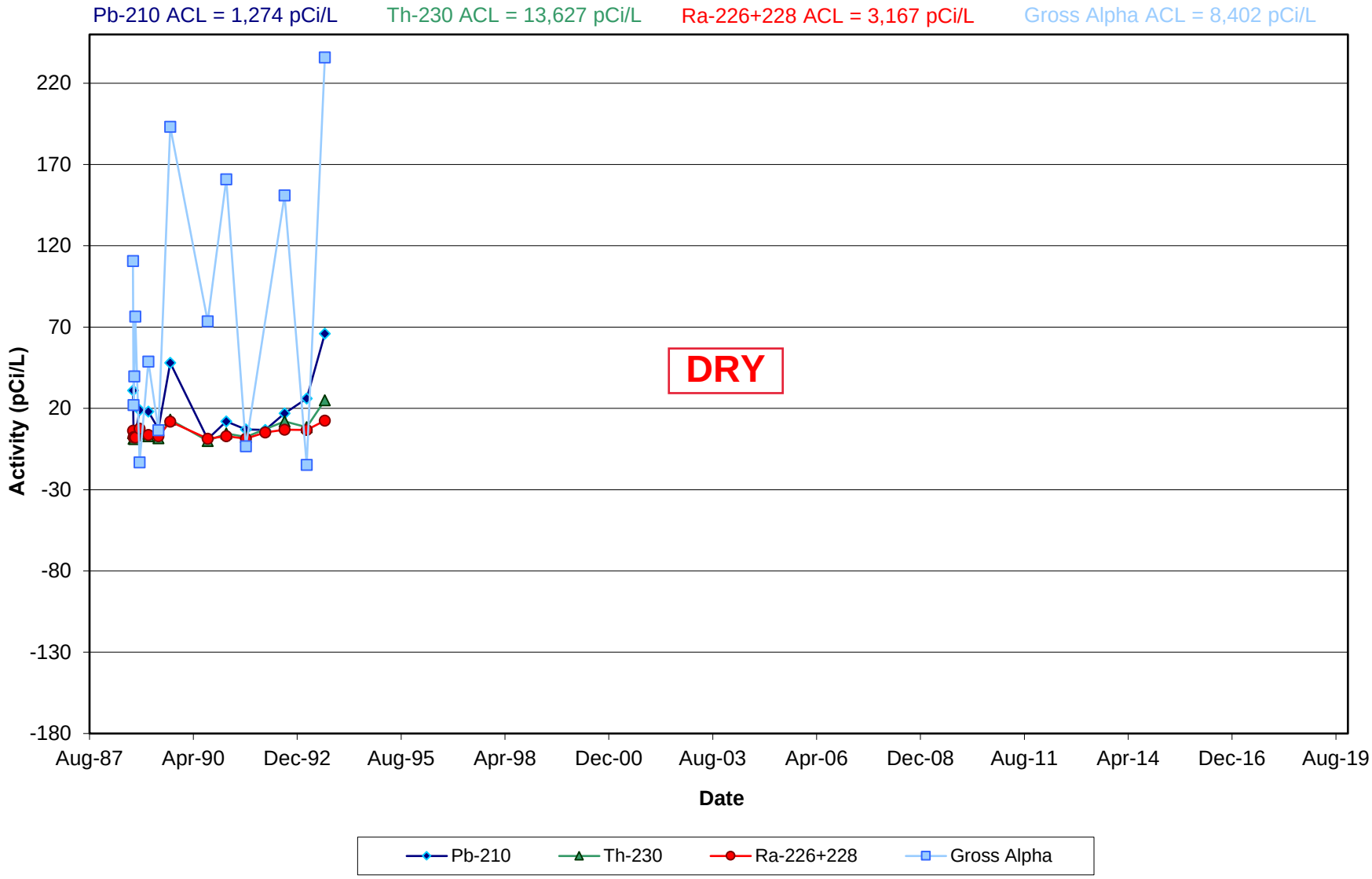


Anions and TDS in Monitoring Well MW-24 ALL

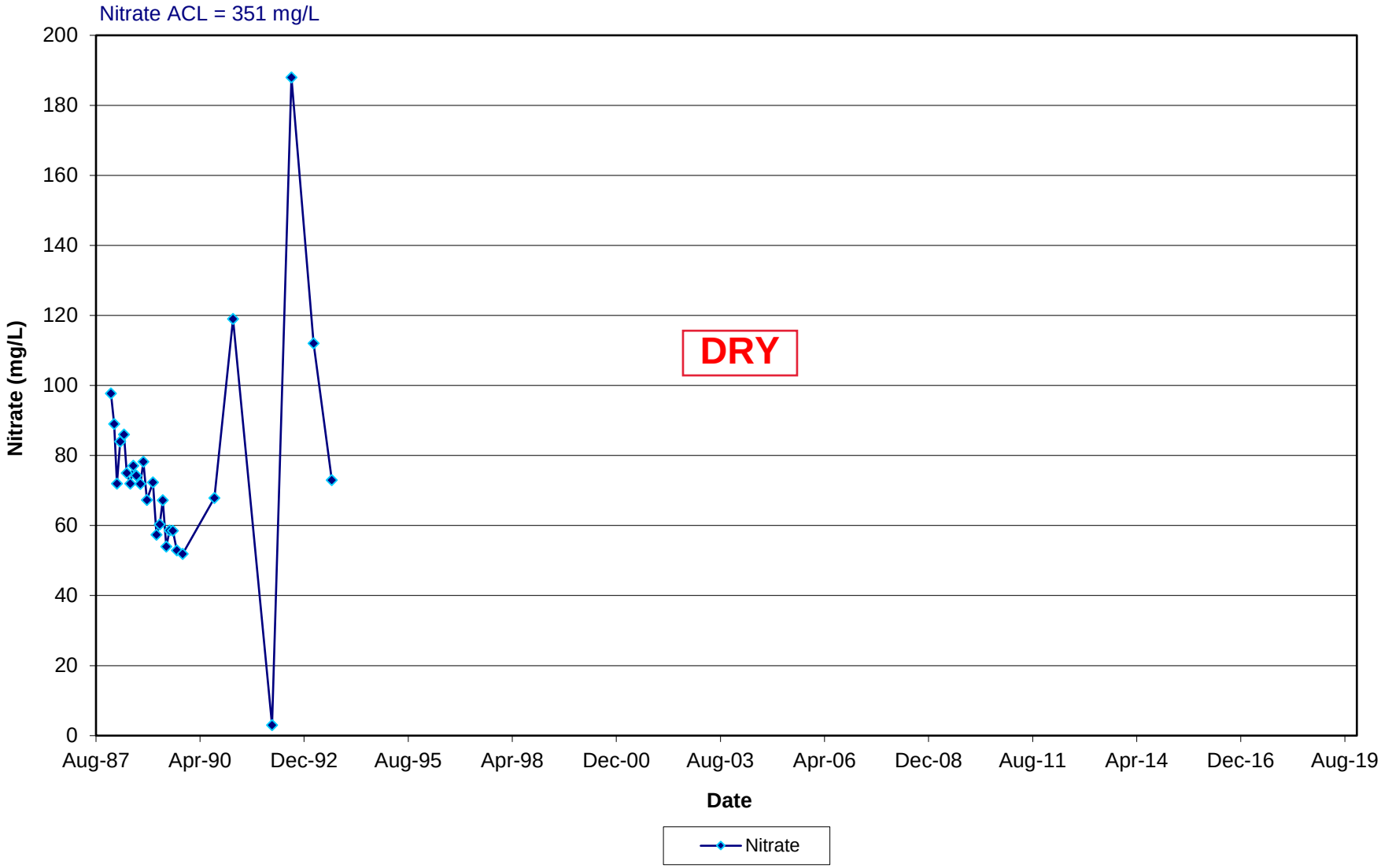



Metals in Monitoring Well MW-24 ALL
Nickel ACL = 98 mg/L
Uranium ACL = 23 mg/L
Molybdenum ACL = 176 mg/L
Selenium ACL = 49 mg/L
Concentration (mg/L)
0.6
0.5
0.4
0.3
0.2
0.1
0
Aug-87
Apr-90
Dec-92
Aug-95
Apr-98
Dec-00
Aug-03
Apr-06
Dec-08
Aug-11
Apr-14
Dec-16
Aug-19
Date
DRY
Nickel
Uranium
Molybdenum
Selenium

Radionuclides in Monitoring Well MW-24 ALL



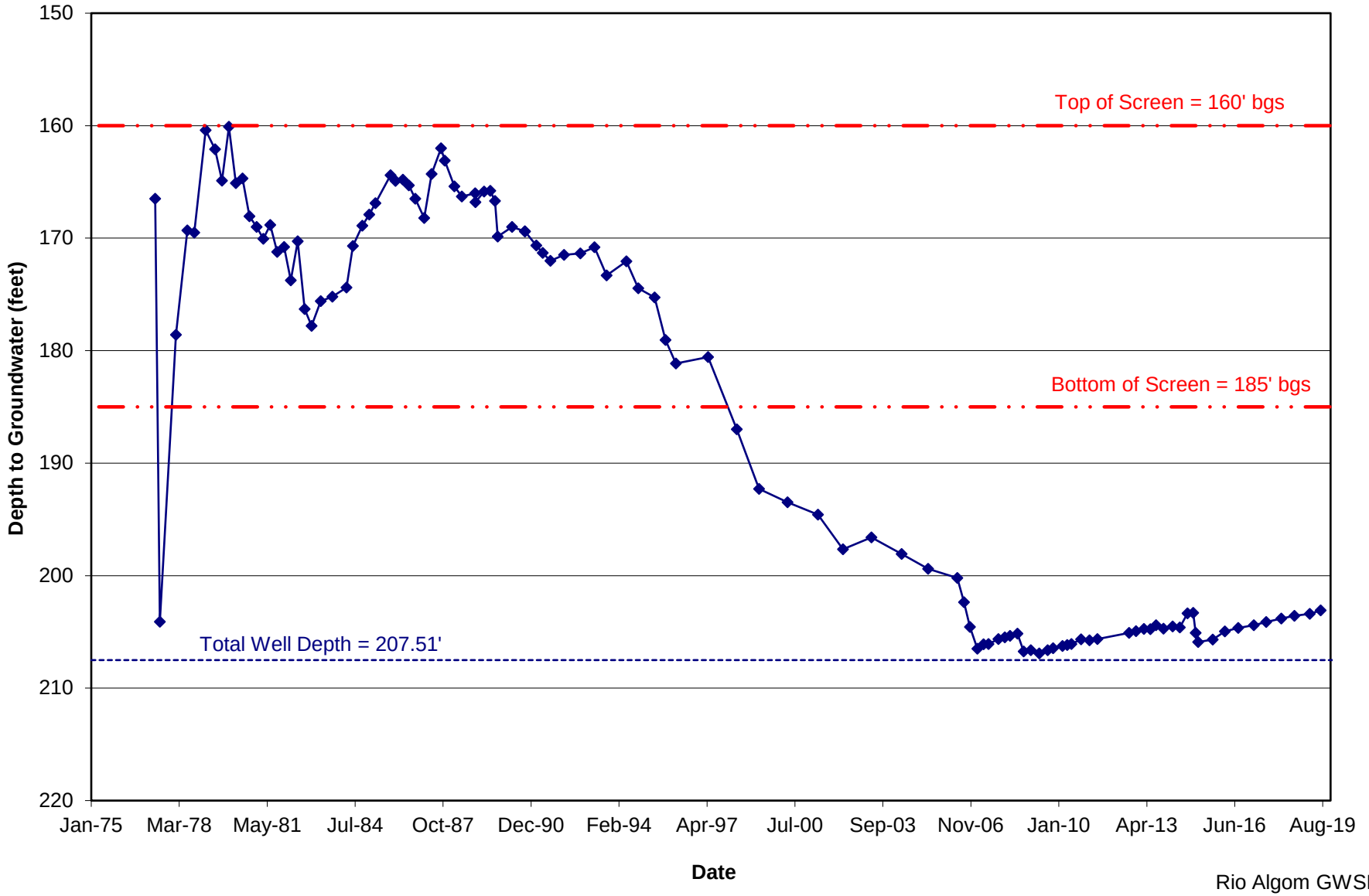
Nitrate in Monitoring Well MW-24 ALL



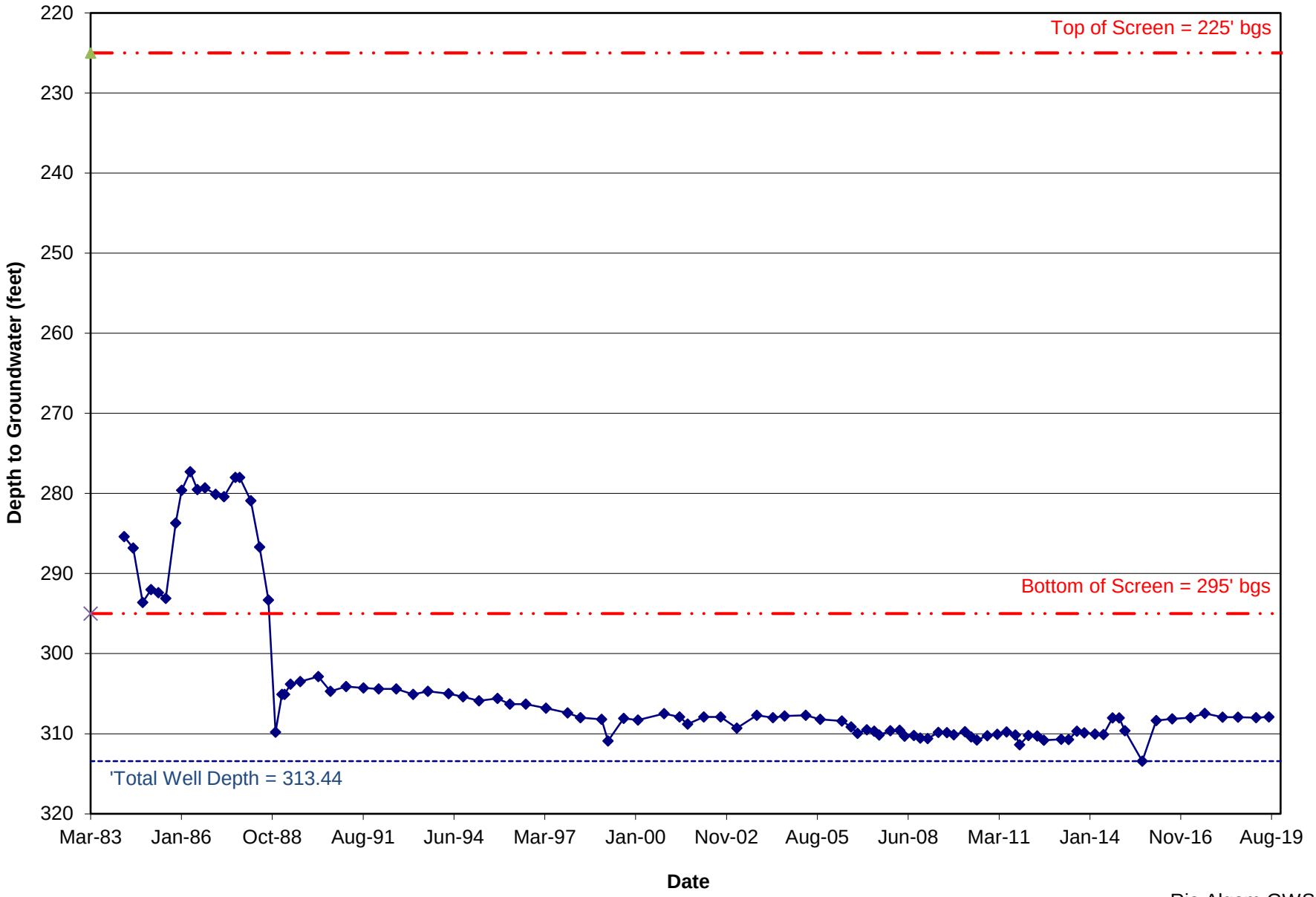
APPENDIX 3

Stability Monitoring Plan
Hydrographs

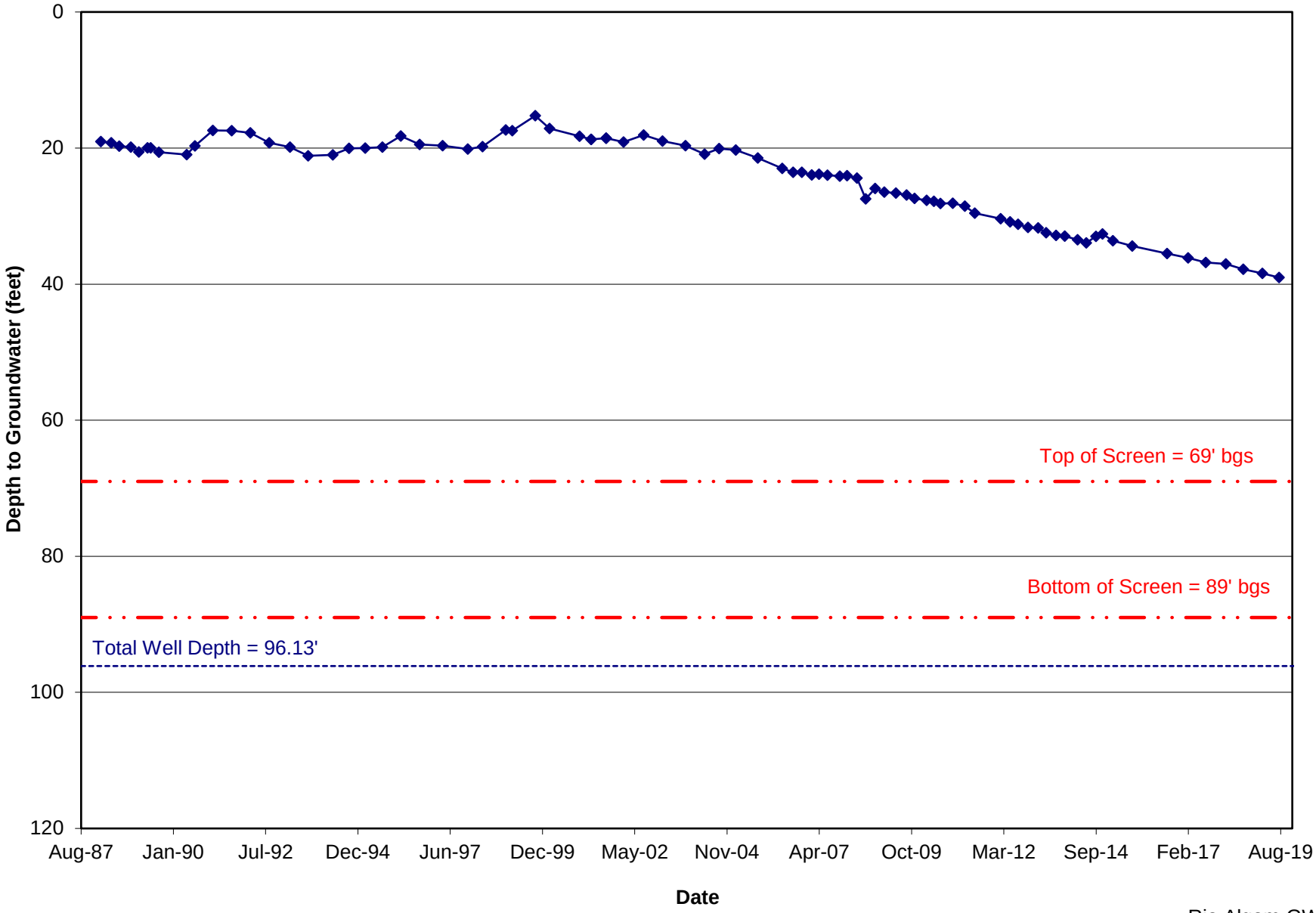
Hydrograph for TRA Monitoring Well 30-01 TRA



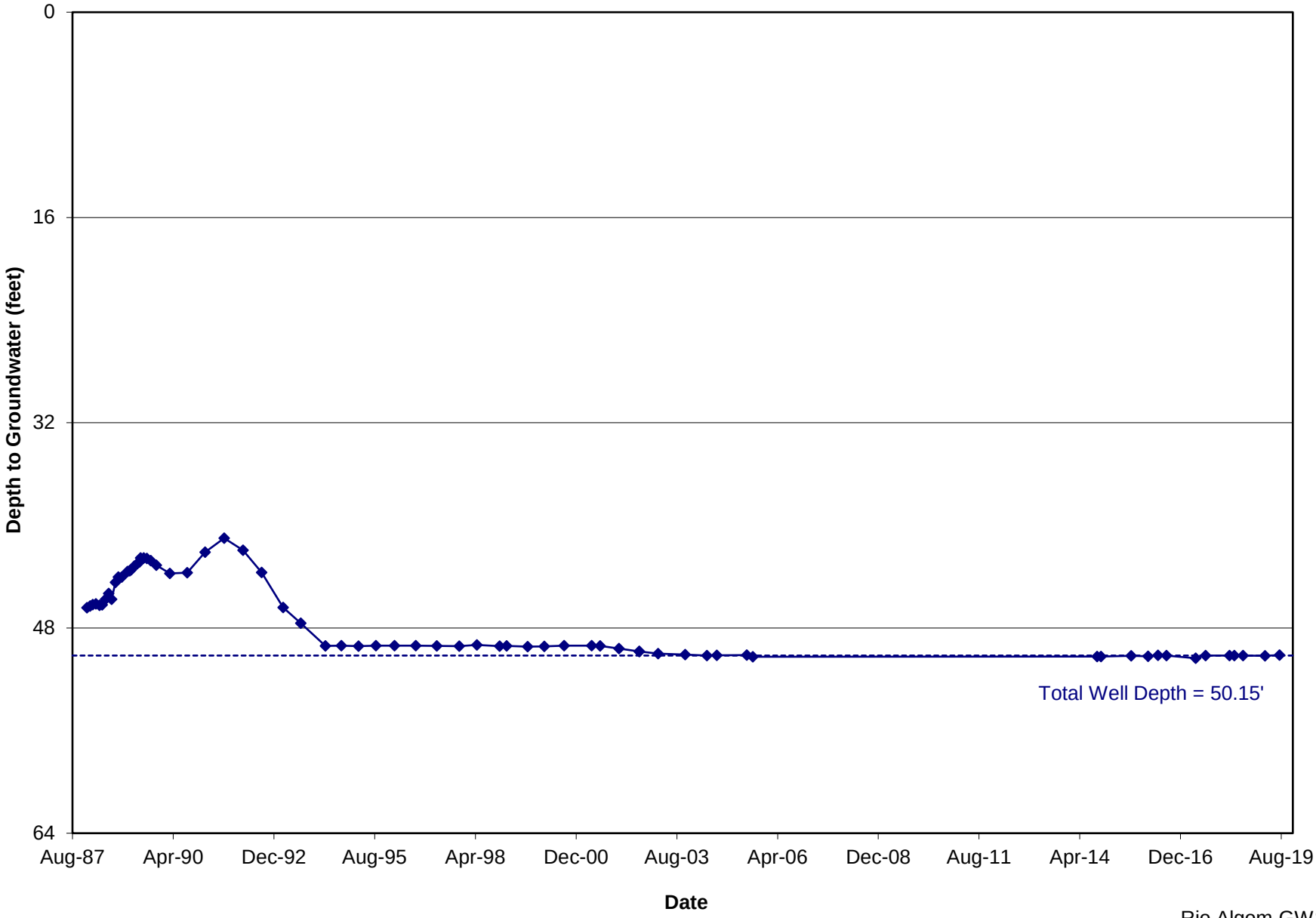
Hydrograph for Dakota Monitoring Well 30-02 KD



Hydrograph for TRB Monitoring Well 31-67 TRB

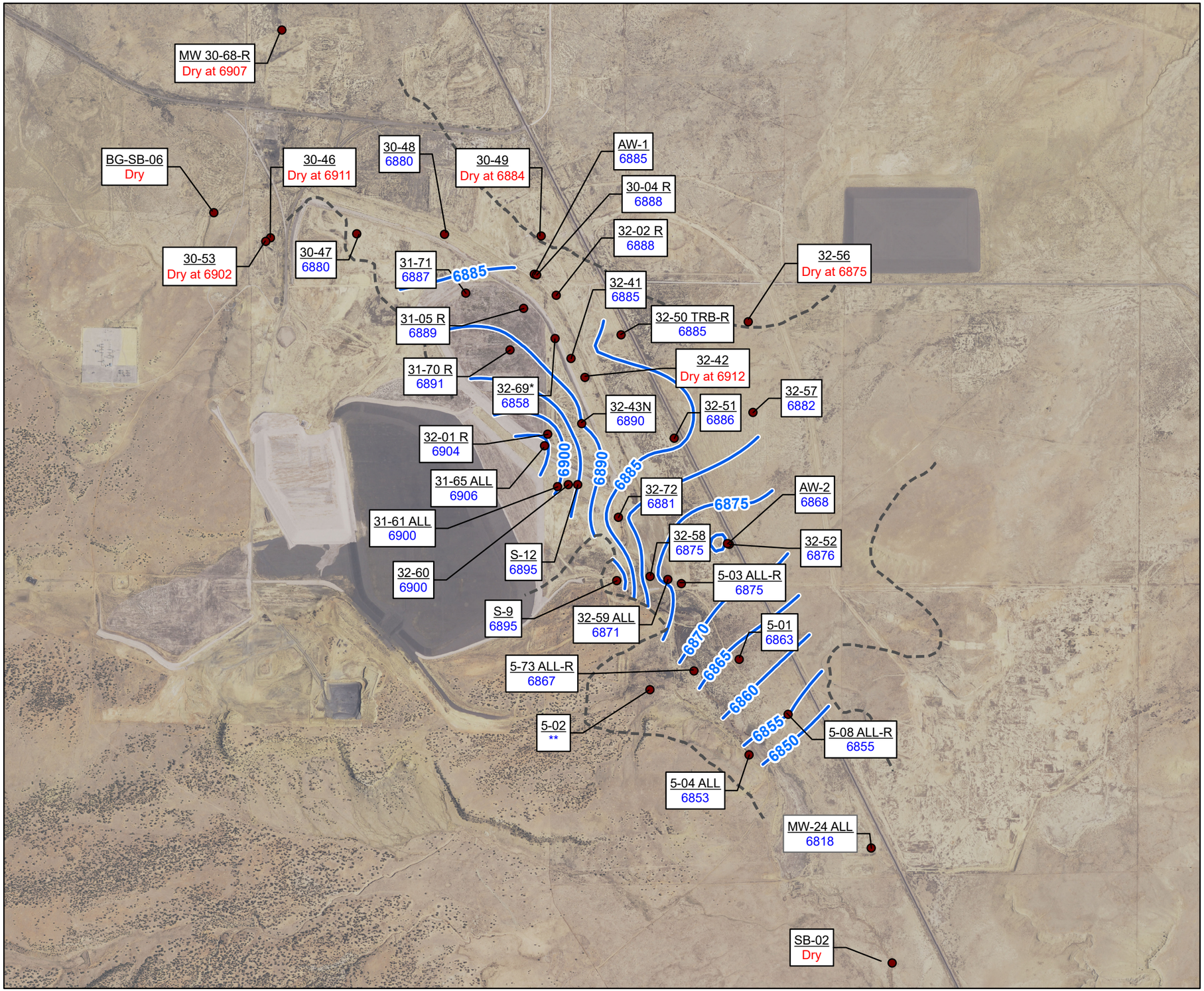


Hydrograph for Alluvial Monitoring Well MW-24 ALL



APPENDIX 4

Stability Monitoring Plan
Potentiometric Surface Maps



INTERA

N

0 1,800 3,600

Feet

Aerial – NAIP imagery, dated 2018

Legend

- Alluvial Monitoring Well Location
- Alluvial Groundwater Surface Elevation (ft amsl)
- Estimated Boundary of Saturated Alluvium

Well ID
Groundwater Surface Elevation (ft amsl)

Notes:
1) All data collected 2nd half, 2019;
2) Elevations at DRY wells are at the base of the screened interval or most recent Total Depth, whichever is greater.
* = Water level at well not used for contouring due to inaccurate TOC survey.
** = Water level not measured due to insufficient water in well.

Gradient calculation:
(Difference in Groundwater Elevation Between Point of Compliance Well 31-61 ALL and Trend Well 5-08 ALL-R = 6,900 - 6,855 = 45 feet) Divided by (Distance Along a Flow Path Between Point of Compliance Well 31-61 and Trend Well 5-08 = 5802 feet)

= 0.008 feet per foot

2nd Half 2019 Alluvial Potentiometric Surface Elevation Iso-Contours ACL

Rio Algom Mining LLC
Groundwater Stability Monitoring Report

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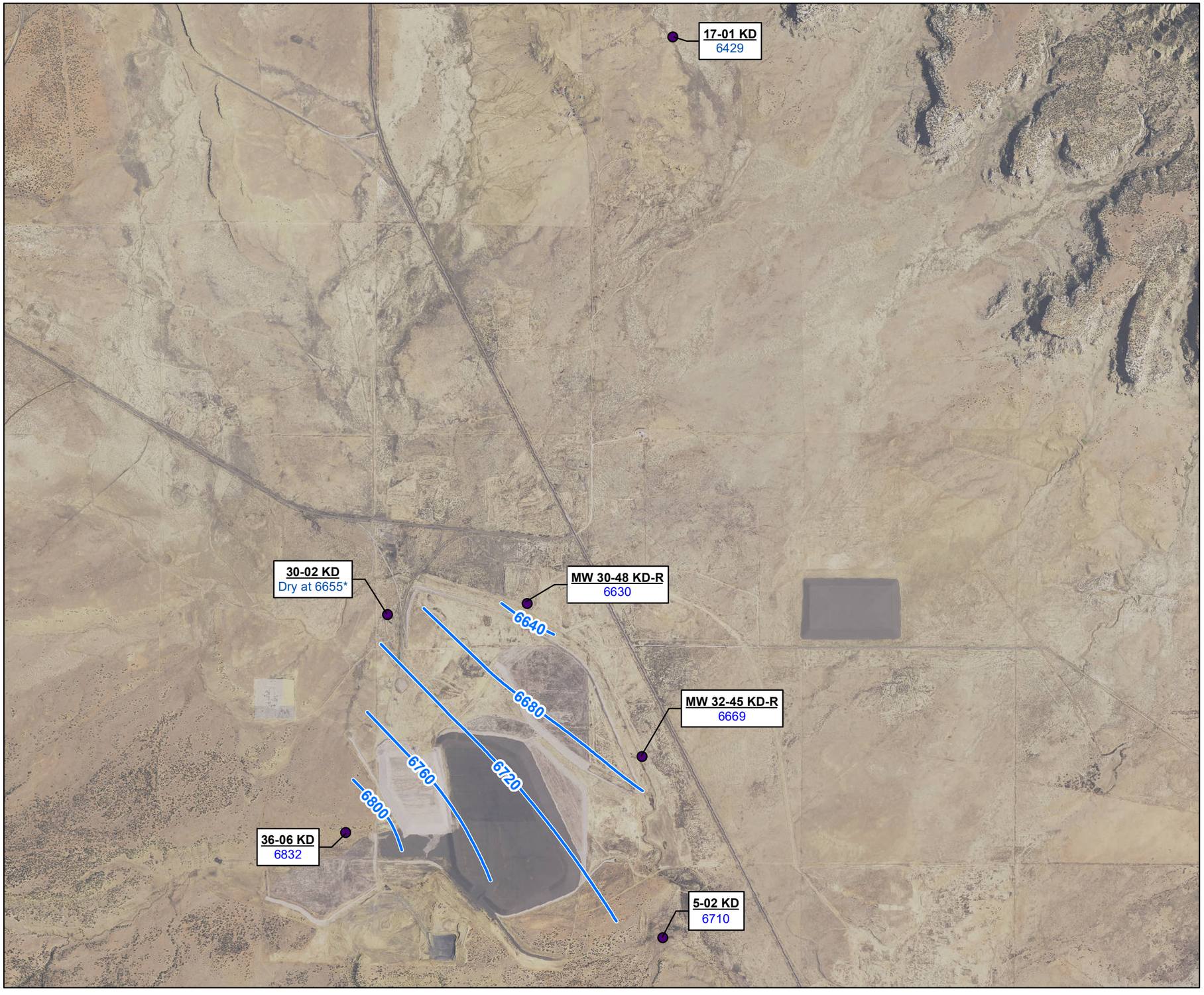

INTERA

N

0 1,250 2,500 5,000

Feet

Aerial – NAIP imagery, dated 2018

Legend

- Dakota Monitoring Well
- KD Potentiometric Surface Elevations (ft amsl)

Well ID
Groundwater Surface Elevation (ft amsl)

* Elevation at bottom of screen since water level is below the bottom of the screened interval in the 30-02 KD well casing (sump)

Note: All data collected 2nd half, 2019

Gradient calculation:
(Difference in Groundwater Elevation Between Point of Compliance Well 36-06 KD and Trend Well 30-48 KD-R = 6,830 - 6,630 = 200 feet) Divided by (Distance Along a Flow Path Between Point of Compliance Well 36-06 KD and Trend Well 30-48 KD-R = 7277 feet)

= 0.028 feet per foot

2nd Half 2019 Dakota Potentiometric Surface Elevation Iso-Contours

Rio Algom Mining LLC
Groundwater Stability Monitoring Report

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N

0 750 1,500 3,000

Feet

Aerial – NAIP imagery, dated 2018

Legend

TRA Monitoring Well Location

Well ID
Groundwater Surface Elevation (ft amsl)

* Elevation at bottom of screen since water level is below the bottom of the screened interval in the 30-01 TRA well casing (sump)

Notes:
a) Insufficient data to estimate potentiometric surface elevation contours.
b) All data collected 2nd half, 2019

Gradient calculation:
Due to lack of groundwater elevation data, hydraulic gradients were not calculated

2nd Half 2019 TRA Potentiometric Surface Elevation Iso-Contours

Rio Algom Mining LLC
Groundwater Stability Monitoring Report

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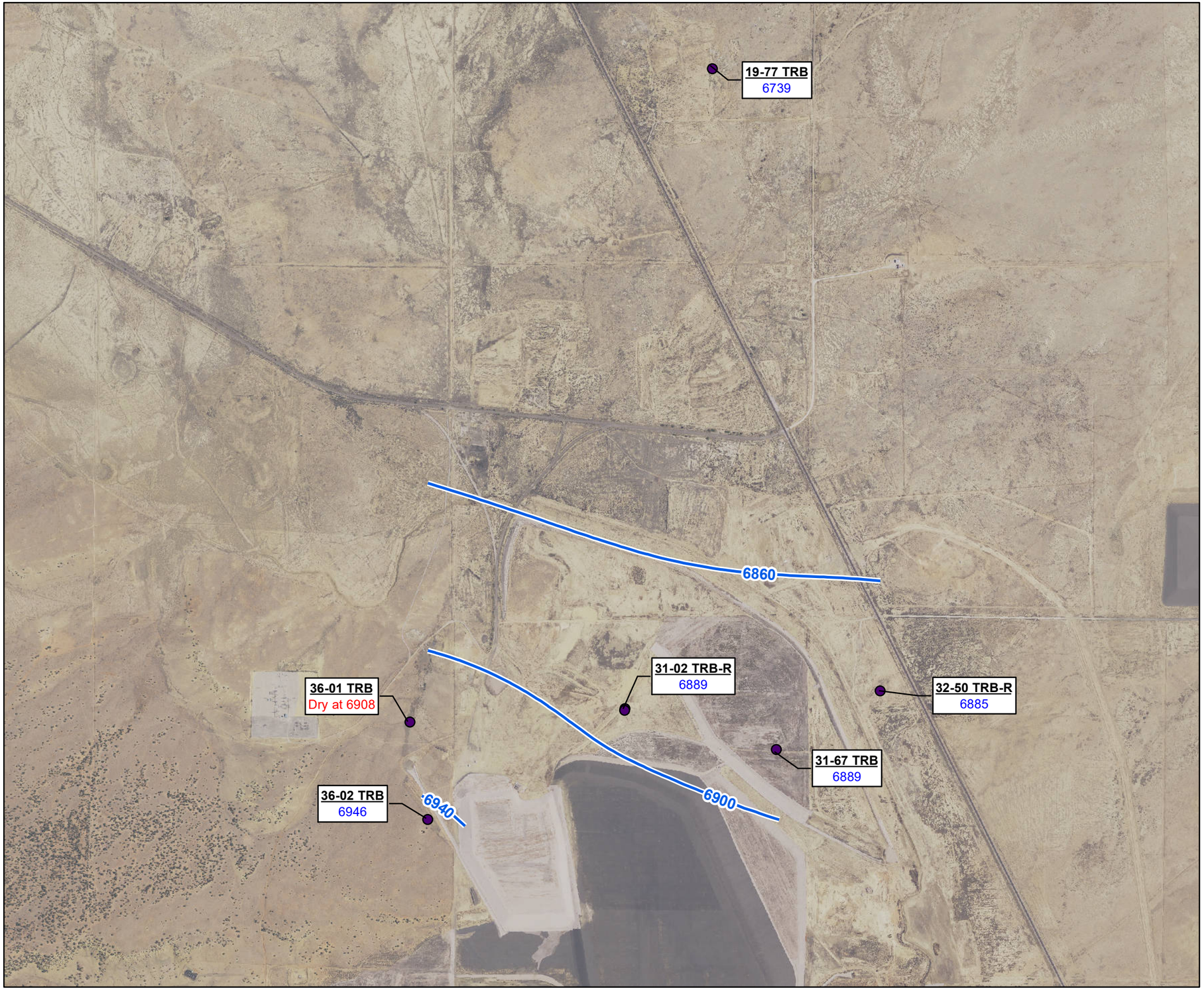

N

0 750 1,500 3,000

Feet

Aerial – NAIP imagery, dated 2018

Legend

- TRB Monitoring Well Location
- TRB Potentiometric Surface Elevations (ft amsl)
- **Well ID**
  Groundwater Surface Elevation (ft amsl)

Notes:
1) All data collected 2nd half, 2019;
2) Elevations at DRY wells are at the base of the screened interval or most recent Total Depth, whichever is greater.

Gradient calculation:
(Difference in Groundwater Elevation Between Point of Compliance Well 31-02 TRB-R and far downgradient Well 19-77 = 6,946 - 6,739 = 207 feet)
Divided by
(Distance Along a Flow Path Between Point of Compliance Well 31-02 TRB-R and far downgradient Well 19-77 = 9,665 feet)

= 0.016 feet per foot

2nd Half 2019 TRB Potentiometric Surface Elevation Iso-Contours ACL
Rio Algom Mining LLC
Groundwater Stability Monitoring Report

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