DEPARTMENT OF ENERGY
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos, New Mexico 87544

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NMED Hazardous Waste Bureau

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September 29, 2023

Mr. Rick Shean
Designated Agency Manager
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6313

Subject: Submittal of the 2023 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area

Dear Mr. Shean:

Enclosed please find two hard copies with electronic files of the "2023 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area." This report summarizes activities completed from August 2022 to July 2023 related to monitoring and maintenance of the Technical Area 16 260 Outfall former settling pond cap; monitoring of the surge bed water levels; monitoring of water quality at select springs and alluvial seep; and monitoring of alluvial groundwater and surface water quality at select locations within Cañon de Valle, S-Site Canyon, Pajarito Canyon, Water Canyon, and Fishladder Canyon.

If you have questions, please contact Christian Maupin at (505) 695-4281 (christian.maupin@em-la.doe.gov) or Cheryl Rodriguez at (505) 414-0450 (cheryl.rodriguez@em.doe.gov).

Sincerely,

Digitally signed by BRIAN HARCEK
Date: 2023.09.28 16:08:37 -06'00'

Arturo Q. Duran For
Compliance and Permitting Manager
U.S. Department of Energy
Environmental Management
Los Alamos Field Office

Enclosure(s):

1. Two hard copies with electronic files:
   2023 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area (EM2023-0581)

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September 2023
EM2023-0581

2023 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area

EM2023-0581

2023 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area

September 2023

Responsible T2S program director:

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1.0 INTRODUCTION

This “2023 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area” (hereafter, the Long-Term Monitoring and Maintenance Report) within Technical Area 16 (TA-16) at Los Alamos National Laboratory (LANL or the Laboratory) fulfills the annual reporting requirement of the Long-Term Monitoring and Maintenance Plan specified in Appendix A to the “Remedy Completion Report for Corrective Measures Implementation at Consolidated Unit 16-021(c)-99” (hereafter the corrective measures implementation [CMI] remedy completion report) (LANL 2017, 602597). This annual Long-Term Monitoring and Maintenance Report covers the reporting period from August 2022 through July 2023, and includes information from two semiannual sampling events conducted in August 2022 and in March 2023.

The 260 Outfall area consists of the high explosives– (HE-) machining building (building 16-260) and associated sumps, drainlines, and troughs that formerly discharged wastewater into the 260 Outfall drainage channel. The 260 Outfall drainage channel consists of the outfall, a former settling pond, and the lower portion of the drainage channel leading to Cañon de Valle (Figure 1.0-1). Historically, HE-contaminated water from the outfall entered the former settling pond and drained into the 260 Outfall drainage channel.

Corrective measures were implemented to address HE contamination associated with the 260 Outfall, including hexahydro-1,3,5-Trinitro-1,3,5-triazine, Royal Demolition Explosive (RDX) and barium (a byproduct of processing the HE Baratol), which are the primary contaminants addressed in the CMI remedy completion report (LANL 2017, 602597) and in this report. Other compounds associated with the 260 Outfall include octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX); 2,4,6-trinitrotoluene (TNT); volatile organic compounds (VOCs); metals; and HE byproducts and degradation products. As part of the Long-Term Monitoring and Maintenance Plan, groundwater samples were analyzed for all or some of the following analytical groups as shown in Table 1.1-1: per- and poly-fluoroalkyl substances (PFAS), low-level tritium, general inorganics, and nitrogen-15/14 and oxygen-18/16 isotopes in nitrate. These analytes are evaluated for exceedances of applicable screening values in accordance with the criteria established by the 2016 Compliance Order on Consent (Consent Order) for groundwater samples, and New Mexico Water Quality Standards for Interstate and Intrastate Surface Waters (20.6.4 New Mexico Administrative Code [NMAC]) for surface water. All exceedances are noted and discussed in this report. Additionally, field parameters (e.g., dissolved oxygen, oxidation-reduction potential [ORP], pH, specific conductance, temperature, and turbidity) were measured at select locations, and results are provided.

This report discusses:

- monitoring and maintenance of the 260 outfall former settling pond cap;
- monitoring of the surge bed (16-612309) water levels;
- monitoring of water quality at Sanitary Wastewater Systems Consolidation (SWSC) Spring, Burning Ground Spring, Martin Spring, Bulldog Spring, and 16-61439 [the permeable reactive barrier (PRB) alluvial seep]; and
- monitoring of groundwater and surface water (base flow) quality at select locations within Cañon de Valle, S-Site Canyon, Pajarito Canyon, Water Canyon, and Fishladder Canyon.

1.1 Regulatory Context

Long-term monitoring and maintenance activities follow the CMI remedy completion report for corrective measures at Consolidated Unit 16-021(c)-99, Appendix A (LANL 2017, 602597). The New Mexico Environment Department (NMED) approved the CMI remedy completion report on November 27, 2017 (NMED 2017, 602758). Additionally, the "Interim Facility-Wide Groundwater Monitoring Plan for the 2022 Monitoring Year, October 2021–September 2022, Revision 1" (N3B 2021, 701672) and the "Interim Facility-Wide Groundwater Monitoring Plan for the 2023 Monitoring Year, October 2022–September 2023, Revision 1" (IFGMP) (N3B 2022, 702346) integrate and complement the long-term monitoring and maintenance surface and groundwater quality monitoring objectives. Newport News Nuclear BWXT-Los Alamos, LLC (N3B) has implemented the IFGMP in accordance with Section XII of the Consent Order.

Historically, monitoring of surface water and groundwater in alluvial, intermediate and regional wells and springs in the vicinity of, and downgradient of, the 260 Outfall, has been conducted under the IFGMP as part of the TA-16 260 monitoring group. After the completion of surface CMI activities at Consolidated Unit 16-021(c)-99, and NMED's approval of the "Remedy Completion Report for Corrective Measures Implementation at Consolidated Unit 16-021(c)-99 (LANL 2017, 602597; NMED 2017, 602758), the IFGMP was adapted to incorporate monitoring associated with the Long-Term Monitoring and Maintenance Plan objectives.

1.2 Conceptual Model for Transport of RDX and Barium

RDX and barium were the primary chemicals of potential concern (COPCs) in alluvial groundwater during implementation of the 260 outfall interim measure, associated best management practices installations (LANL 2010, 108868), and surface CMI remedies from 1999 to 2010 (LANL 2002, 073706; LANL 2010, 108868). RDX, the most significant COPC within Cañon de Valle and Water Canyon (LANL 2017, 602597), is a potentially mobile compound that does not strongly adsorb to environmental media deficient in solid organic matter. RDX will partition between dissolved and adsorbed phases in organic-rich sediments distributed along stream channels at LANL; it adsorbs minimally to the Bandelier tuff and organic-poor sediment, with greater sorption if solid organic matter is present (Heerspink et al. 2017, 602560). RDX can be degraded both biologically (i.e., microbial degradation) and chemically (base hydrolysis, reduction, oxidation) (LANL 2017, 602597). Barium was released at the site through the degradation of HE Baratol—an explosive made of a mixture of TNT and barium nitrate (LANL 2011, 207069). Barium nitrate dissociates in water into the barium cation and the nitrate anion (LANL 2017, 602597).

Barium continues to be mobilized by fluctuating water levels in the alluvium that can mobilize sorbed or mineral forms of barium in the sediments. Increased water levels have the potential to flush barium from pore water, desorb barium from matrix surfaces, and dissolve soluble barium minerals, such as witherite (barium carbonate), that are present in the unsaturated zone (Reid et al. 2005, 093660). Barium can be removed from groundwater through the precipitation of barite (barium sulfate), which has been found in the alluvium, and may be responsible for decreasing barium concentrations in alluvial waters (Reid et al. 2005, 093660). However, the dissolution of soluble witherite can release barium, thereby balancing the potential reduction of dissolved barium by precipitation (LANL 2017, 602597). The effect of these contrasting processes may be visible in the long-term barium concentration decline in alluvial groundwater samples collected from location CdV-16-02656, upgradient of the former PRB and the location where the outfall enters Cañon de Valle, as well as the increasing barium concentrations at location CdV-16-611923, located upstream of the former PRB cutoff wall. Water retained by the cutoff wall raises water levels in the alluvium, possibly saturating sediments that contained witherite. The elevated barium eventually dissipated after flooding breached the cutoff wall in 2011, and shows a long-term decline (Table 1.2-2). The Las Conchas wildfire, which began on June 26, 2011, caused a severe disruption to the hydrogeologic system in the Cañon de Valle watershed. Subsequent flooding in August 2011 may be the cause of barium concentration spikes in the alluvial wells at that time.

The relatively lower sorption of RDX compared to barium makes it more mobile, which is reflected in concentration distributions in the intermediate and regional aquifer. Long-term decreases in concentrations of RDX and barium throughout the downgradient hydrogeologic system are anticipated because of source removal—the elimination of the original outfall source with the cessation of National Pollutant Discharge Elimination System [NPDES] discharges into Cañon de Valle (EPA 1996, 109793), surface soil removal activities conducted in 2001, and the surface CMI actions in 2009 and 2010—and from naturally occurring degradation processes.

1.3 Monitoring Objectives

The CMI performance objectives were to reduce concentrations of barium and RDX in alluvial groundwater to prevent their migration to deeper groundwater. The Long-Term Monitoring and Maintenance Plan established the following performance-monitoring points:

- five existing alluvial wells in Cañon de Valle,
- three existing alluvial wells in S-Site Canyon,
- two surface water sampling points along the perennial surface water reach of Cañon de Valle,
- one surface water sampling point in S-Site Canyon, and four spring locations.

Key objectives of the long-term monitoring program include the following:

- monitoring effectiveness of the low-permeability cap and surge-bed grouting to ensure that infiltrating water does not encounter and mobilize residual COPCs in the outfall area and underlying shallow vadose zone;
- monitoring the long-term trend in COPC concentrations (primarily RDX and barium) in springs, surface water, and alluvial groundwater to evaluate if historically declining and/or stable concentrations persist, in order to assess the long-term effectiveness of the CMI for Consolidated Unit 16-021(c)-99; and
- continuing evaluation of the conceptual model for the fate and transport of residual COPCs in nearby surface water, alluvial groundwater, and springs.

2.0 LONG-TERM MONITORING AND MAINTENANCE SAMPLING AND RESULTS

This section presents the data collected for this 2023 Long-Term Monitoring and Maintenance Report. The monitoring results are evaluated according to their respective screening levels, and the constituents that exceed their screening levels are discussed in more detail.

2.1 Sampling

Sampling of surface water, groundwater, and springs for the TA-16-260 monitoring group is conducted semiannually under the IFGMP (LANL 2021, 701672; LANL 2022, 702346). Table 1.1-1 summarizes the monitoring locations, the watershed, the surface water body or source aquifer, and the frequency of analytical suites collected. Table 2.1-1 provides a list of the field parameters and measurement results.

Appendix A provides the field forms associated with sample collection (on CD included with this document).

2.2 Sampling Locations

Sampling locations were selected to monitor contaminants released from the 260 Outfall drainage channel that are contained in surface water, alluvial groundwater, and the springs within Cañon de Valle, S-Site Canyon, Pajarito Canyon, Water Canyon, and Fishladder Canyon. The analytical results are organized by canyon, beginning with the most upgradient sample location and moving downgradient within each canyon (Figure 1.0-1):

- Cañon de Valle segment 1
    - ❖ CdV-16-02656
    - ❖ CdV-16-02657r
    - ❖ SWSC Spring
    - ❖ Burning Ground Spring
- Cañon de Valle segment 2
    - ❖ 16-61439 (PRB alluvial seep)
    - ❖ CdV-16-611923
    - ❖ CdV-16-611937
    - ❖ Cañon de Valle below Material Disposal Area (MDA) P
    - ❖ CdV-16-02659
- S-Site Canyon
    - ❖ Martin Spring
    - ❖ MSC-16-06293
    - ❖ MSC-16-06294
- Pajarito Canyon
    - ❖ Bulldog Spring
    - ❖ Pajarito below S&N Ancho E Basin Confluence
- Water Canyon
    - ❖ Between E252 and Water at Beta
    - ❖ Water at Beta
- Fishladder Canyon
    - ❖ FLC-16-25280

Section IX of the Consent Order describes the role of contaminant screening levels in the corrective action process. Screening levels are used to identify the potential for unacceptable risk resulting from the presence of contaminants in groundwater. Screening levels for this report are derived from New Mexico Water Quality Control Commission (NMWQCC) groundwater standards, U.S. Environmental Protection

Agency (EPA) maximum contaminant levels, NMED screening levels for tap water, and EPA regional screening levels for tap water, as listed in Table 2.2-1.

Surface water screening levels are used to evaluate base-flow locations for the potential for unacceptable risk resulting from the release of site-related contaminants other than from permitted discharges. The Consent Order does not establish screening levels or cleanup levels for contaminants in surface water; therefore, applicable New Mexico Water Quality Standards for Interstate and Intrastate Surface Waters (20.6.4 NMAC) are used as screening levels.

The sources for standards and screening levels from which specific screening values are derived are listed in Tables 2.2-2, 2.2-3, and 2.2-4, based on the following criteria:

- Base-flow monitoring locations are assigned to one of three screening categories based on hydrology of the waterbody being monitored: perennial, intermittent, or ephemeral, as listed in Table 2.2-2. Along with a hardness value in Table 2.2-3, this category determines the screening values used for data at each monitoring location.
- Hardness-dependent screening values used to screen data at each base-flow monitoring location are determined from 20.6.4.900 NMAC.

Hardness acute and chronic aquatic life criteria for metals are calculated using the hardness-dependent equations at 20.6.4.900.I NMAC. Hardness-dependent acute and chronic criteria were used for total recoverable aluminum and dissolved cadmium, chromium, copper, lead, manganese, nickel, silver, and zinc in accordance with the requirements therein. For aluminum, the criteria are based on analysis of total recoverable aluminum in a sample with a pH between 6.5 and 9.0 that is filtered to minimize mineral phases as specified by the NMED.

Toxic equivalents are used to report the toxicity-weighted masses of mixtures of dioxins and furans. This is more meaningful than reporting the number of grams of dioxins or furans because toxic equivalents provide information on toxicity (https://www.epa.gov/toxics-release-inventory-tri-program/2010-dioxin-and-dioxin-compounds-and-teq-data-files). In addition, there are surface water quality standards for a total dioxin toxic equivalent, whereas there are no standards for individual dioxins or furans.

Total dioxins are calculated using toxic equivalent values as reported in Table 2.2-4.

Table 2.2-5 presents the unfiltered RDX results, by canyon or canyon segment, and identifies the five RDX exceedances during this monitoring period. Four RDX exceedance detections were at the springs, and one in 16-61439 (PRB alluvial seep). Table 2.2-6 presents the barium results, by canyon or canyon segment, and identifies the six barium exceedances at three locations: 16-61439 (PRB alluvial seep), CdV-16-02659, and CdV-16-611923. There were 14 additional analyte exceedances detected above applicable standards, which are presented in Table 2.2-7 and discussed in section 4.0.

All validated analytical results are provided in Appendix B (on CD included with this document).

2.3 Deviations from the Sampling Plan

Tables 2.1-1, 2.2-5, and 2.2-6 contain comments to indicate whether a sampling location was dry or had insufficient water for sampling.

Table 2.3-1 summarizes the sampling deviations from the 2023 Long-Term Monitoring and Maintenance Plan. Information provided includes the location ID, watershed, monitoring year (MY), and quarter of the sampling event, the planned sample collection date, and the deviation.

3.0 INSPECTION AND MAINTENANCE

Section 3.1 discusses the inspection and maintenance of the low-permeability cap in the former settling pond. Section 3.2 discusses the surge-bed monitoring well installed to evaluate the effectiveness of the injection grouting.

3.1 Low-Permeability Cap

The function of the low-permeability cap atop the former settling pond is to prevent water infiltration. The low-permeability cap is inspected semiannually for evidence of settling, cracking, erosion, water ponding, undesirable vegetation growth, and animal intrusion. The spring inspection (in March or April) also checks for damage associated with winter and snowmelt conditions, while the fall inspection (in September) monitors for damage from summer rainfall runoff.

The September 2022 inspection of the low-permeability cap did not detect settling, cracking, erosion or rutting, ponding, or burrowing animals. There was evidence of undesirable vegetation growth, with new grass growth on the cap. The slopes were adequate for surface water drainage, and there was no evidence of soil movement or slope instability such as soil sloughing. No conditions requiring attention were identified.

The April 2023 inspection of the low-permeability cap did not detect settling, cracking, erosion or rutting, ponding, or burrowing animals. The slopes were adequate for surface water drainage, and there was no evidence of soil movement or slope instability. Two saplings were removed from the cap. No additional conditions requiring attention were identified.

The inspection forms used to document the fall and spring inspections are provided in Appendix C.

Monitoring and maintenance of the stormwater control structures at the former 260 Outfall area continue under NPDES Permit No. NM0030759 (Individual Permit or Permit), issued by the EPA Region 6 on September 30, 2010 (EPA 2010, 213450). Stormwater controls are installed at the site under the Individual Permit to prevent erosion of the low-permeability cap and to prevent sediment transport down the 260 Outfall drainage channel. These controls currently include vegetation, earthen berms, curbing, riprap, a rock check dam, and the low-permeability cap.

The Permit requires inspection of stormwater controls and additional inspections of the low-permeability cap. Two inspections of the stormwater control structures, including the low-permeability cap at the former 260 Outfall area, were performed on August 11, 2022, and June 7, 2023. The inspection forms are provided in Appendix C.

3.2 Surge-Bed Monitoring Well

The surge-bed monitoring well (16-612309) was installed in the upper Bandelier Tuff with a screen from 15 to 19 ft bgs to evaluate the effectiveness of the grout injected into the subsurface surge bed and the low-permeability cap. Water was not detected in the surge-bed monitoring well during semiannual inspections. Additionally, the dedicated transducer in the surge-bed monitoring well did not detect any measurable water. The raw transducer data are provided in Appendix D.

4.0 DISCUSSION AND CONCLUSIONS

This section discusses the RDX and barium results from the August 2022 and March 2023 sampling period in comparison to historical trends (January 2001 through March 2022). Additionally, this section describes other analytes (e.g., aluminum, boron, iron, manganese) detected above their respective NMED screening levels or groundwater standards, and how these relate to conditions in the alluvial groundwater.

RDX and barium concentration trends from January 2001 to March 2023 were analyzed using the Mann-Kendall (M-K) test. The M-K test is a nonparametric statistic that identifies presence or absence of increasing or decreasing trends for time-series data. This test offers a statistical confidence that a monotonic trend is or is not occurring (Gilbert 1987, 056179). The M-K test was employed using a 95% confidence level; therefore, trends were identified only when the calculated p-value (α) is ≤0.05. The M-K test statistic (S) is calculated using Equations 1 and 2 where each data point is compared with all previous data points and assigned a value [-1, 0, 1] depending on if the resulting summed value is less than, equal to, or greater than 0 (Gilbert 1987, 056179). Large positive numbers of the sum of the assigned values indicate that later recorded data are higher than previous data and an upward trend is occurring; and large negative numbers indicate a downward trend. When S is small or zero, no trend is observed.

$$S = \sum_{k=1}^{n-1} \sum_{j=k+1}^{n} sgn(x_j - x_k)$$ **Equation 1**

$$sgn(x_j - x_k) = \begin{cases} 1 \; if \; x_j - x_k > 0 \\ 0 \; if \; x_j - x_k = 0 \\ -1 \; if \; x_j - x_k > 0 \end{cases}$$ **Equation 2**

Tables 4.0-1 and 4.0-2 show the summary of the M-K test for RDX and barium, respectively. It should be noted that the long time window can dampen or negate short-term trends such as increasing barium trends in Canyon de Valle after the the Las Conchas wildfire. However, long-term trends are still valuable in evaluating concentrations across the canyons. Appendix E provides graphical results of statistically significant decreasing or increasing trends of RDX or barium. Each M-K graph provides the standard deviation, standardized value of S, M-K Test statistic (S), critical value, p-value, and ordinary least squares (OLS) regression line.

4.1 RDX

4.1.1 RDX Review of Alluvial Groundwater and Springs

RDX concentrations detected in alluvial monitoring wells indicate that RDX is either below the NMED screening level of 9.66 µg/L, or had insufficient water for sampling, at all wells with the exception of 16-61439 (PRB alluvial seep). The RDX concentration detected at 16-61439 (PRB alluvial seep) in March 2023 was above the applicable screening value and is a historical maximum concentration. The M-K test of RDX results in alluvial wells show decreasing concentration trends at CdV-16-02656 and CdV-16-02659 (Table 4.0-1). Statistically significant trends are shown in graphical form in Appendix E, Figures E-1 through E-4. These results align with results presented in the 2017 CMI remedy completion report (LANL 2017, 602597) that indicated that the majority of detections of RDX in alluvial wells in Cañon de Valle were near or below the screening level.

The majority of RDX concentrations in discharges from Burning Ground Spring, Martin Spring, and SWSC Spring from 2000 to 2021 were above the NMED screening level. RDX concentrations in samples collected during the report period are consistent with past concentrations. At Bulldog Spring, RDX concentrations remained below the NMED screening level, with the exception of one sample collected in September 2021 (11.8 µg/L). RDX was detected above the NMED screening level at both Burning Ground Spring and Martin Spring in August 2022 and March 2023. The Martin Spring RDX concentrations remain well above the NMED screening level, although the sample results from the period of record (Figure 4.1-3) are consistent with the conclusion that RDX levels continue to decline over time perhaps due to source-removal actions at the 260 Outfall during the CMI or at other mesa-top sites such as the 30s Line and 90s Line Ponds. Note that it is hypothesized that Martin Spring has different sources than the springs in Cañon de Valle based on different contaminant signatures such as high boron concentrations (LANL 2006, 095626). Plate 1 shows RDX concentrations across the canyon with no impacts to surface water downgradient of Martin Spring, suggesting that the high RDX concentration observed in Martin Spring is of limited extent in the Martin Canyon alluvial system. No RDX concentrations were reported for SWSC Spring in August 2022 or March 2023 because there was insufficient water for sampling. The RDX sampling results from August 2022 and March 2023 at Bulldog Spring, Burning Ground Spring, and Martin Spring are consistent with past results and with the description in the CMI remedy completion report (LANL 2017, 602597). The M-K test of RDX in the springs shows no concentration trends (Table 4.0-1).

4.1.2 RDX Review by Canyon

The RDX data records for Cañon de Valle segments 1 and 2 are presented in Figures 4.1-1 and 4.1-2, respectively. RDX concentrations in alluvial groundwater remain below the screening level or show a long-term decline, with the exception of 16-61439 (PRB alluvial seep) which was at a historical maximum concentration. 16-61439 (PRB alluvial seep) does not show a statistically significant RDX concentration trend. CdV-16-02659 shows a statistically significant decline in RDX concentrations (Appendix E, Figure E-2), with the last four sample concentrations below the screening level. Overall, RDX concentrations vary across the canyon, but RDX concentrations are below the screening level in most locations.

The S-Site Canyon RDX data record is shown in Figure 4.1-3. The alluvial well MSC-16-06293 was not sampled during the reporting period; RDX concentrations at that location have historically been below the RDX screening level. RDX concentrations at the alluvial well MSC-16-06294 align with historical results, and were below the screening level. Martin Springs continues to be above the screening level, but the M-K test shows declining concentration trends (Appendix E, Figure E-3).

The Pajarito Canyon locations include Bulldog Spring and a surface water location at the Pajarito below S&N Ancho E Basin Confluence. Figure 4.1-4 presents the data record for both locations. At the Pajarito below S&N Ancho E Basin Confluence surface water location, the RDX results are consistent with past data—concentrations are below the NMED screening level or RDX is not detected.

The Water Canyon RDX data record, presented in Figure 4.1-5, demonstrates that the samples are consistent with historical results—below the NMED screening level or not detected. Samples from the August 2022 and March 2023 sampling events were not available for Water at Beta because the location was dry. However, the location between E252 and Water at Beta was sampled in August 2022 and March 2023, with no detections of RDX.

Figure 4.1-6 presents the data record for the Fishladder Canyon. FLC-16-25280 had insufficient water for sampling during the August 2022 event but was sampled in March 2023. This result was below the screening value.

Plate 1 shows the spatial distribution of RDX concentrations across the RDX project area since the completion of the CMI remedial action (January 2012 to current). Overall, the monitoring results are consistent with past RDX concentrations. Additionally, the low-permeability cap and the stabilized surge-bed remedies continue to be effective for reducing RDX contamination of adjacent waterbodies.

4.2 Barium

4.2.1 Barium Review of Alluvial Groundwater and Springs

Barium concentrations at surface water locations are below the screening level, although two locations, Canon de Valle below MDA-P and Pajarito below S&N Ancho E Basin, show increasing barium concentration trends.

The M-K test of dissolved barium concentrations at three alluvial wells shows declining concentration trends, which is consistent with the removal of the majority of the barium inventory (Table 4.0-2, Appendix E, Figures E-5 through E-12). However, Table 4.0-2 also does not show decreasing concentration trends at an additional five locations, suggesting that elevated, but consistent, barium concentrations persist at these locations. Concentrations remain above the screening level at 16-61439 (alluvial seep), CdV-16-02657r, CdV-16-611923, and CdV-16-02659.

Barium concentrations remain below the screening level at the springs, although two locations, Burning Ground Spring and Bulldog Spring, show increasing barium concentrations.

4.2.2 Barium Review by Canyon

Barium concentration data for filtered samples collected in the Cañon de Valle segments 1 and 2 are presented in Figures 4.2-1 and 4.2-2, respectively. A review of these data indicate that the temporal and spatial trends, and conditions in the surface water, alluvial groundwater, and springs, are consistent with conditions described in the CMI remedy report (LANL 2017, 602597). The alluvial wells show barium concentration spikes after the Las Conchas wildfire and subsequent flooding in 2011, and associated declines more recently. The concentration spikes are consistent with flooding leading to barium desorption and witherite dissolution causing temporary increases in barium.

Barium was not detected above the 2 mg/L (2000 µg/L) NMED screening level in S-Site Canyon (Figure 4.2-3), Pajarito Canyon (Figure 4.2-4), Water Canyon (Figure 4.2-5), or Fishladder Canyon (Figure 4.2-6). The results are consistent with the historical data record.

The monitoring results indicate the following:

- Dissolved barium concentrations in springs are less than the NMED screening level, except at 16-61439 (PRB alluvial seep), which remains above the screening level.
- Dissolved barium concentrations at CdV-16-02659 continue to show long-term decline but remain above the screening level (Appendix E, Figure E-8).
- The remaining sampling sites did not contain barium concentrations above the screening level.

Plate 2 shows the spatial distribution of dissolved barium across Cañon de Valle segments 1 and 2 since the completion of the early phase of the IM and CMI remedial actions (i.e., cessation of the Outfall 260 discharge and first phase of soil removal) in January 2012. The barium sampling results are consistent with past barium results and the conceptual site model, and are congruent with the RDX results, demonstrating the continued effectiveness of the low-permeability cap and the stabilized surge bed.

4.3 Other Analytes Exceeding their Respective Screening Levels

Table 2.2-7 shows that 14 additional groundwater analytical results exceeded applicable screening values. The screening value exceedances included 7 analytes: aluminum, amino-2,6-dinitrotoluene[4-], boron (filtered), iron (filtered), manganese (filtered), tetrachloroethene (unfiltered), and trichloroethene (unfiltered).

4.4 Conclusions

The CMI objectives were to reduce the concentrations of RDX and barium in alluvial groundwater and to prevent the migration of these compounds into deeper groundwater. The Long-Term Monitoring and Maintenance Plan was implemented to monitor the performance of the CMI remedial actions that included the low-permeability cap and surge-bed grouting, and to monitor the long-term trends of RDX and barium in springs, surface water, and alluvial groundwater, to ensure that historically declining and/or stable concentrations persist. The 2023 sampling and inspection program has met the objective of monitoring the performance of the CMI remedial actions.

5.0 RECOMMENDATIONS

Based on the results from the August 2022 and March 2023 semiannual sampling events and the inspections of the low-permeability cap and surge-bed grouting addressed in this report, the U.S. Department of Energy (DOE) Environmental Management Los Alamos Field Office (EM-LA) recommends continuance of the Long-Term Monitoring and Maintenance Plan. Sampling and inspection will continue to evaluate the effectiveness of the low-permeability cap and surge-bed grouting and monitoring of the long-term trends in RDX and barium concentrations. Alluvial groundwater, surface water, and spring water are anticipated to continue showing stable or declining concentrations of RDX and barium. If the data show a significant increase in COPC concentrations over time, the conditions near the former 260 Outfall will be reassessed to identify the cause and evaluate whether additional corrective action is necessary.

6.0 REFERENCES AND MAP DATA SOURCES

6.1 References

The following reference list includes documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. ERIDs were assigned by Los Alamos National Laboratory's (the Laboratory's) Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by N3B (IDs 700000 and above).

EPA (U.S. Environmental Protection Agency), July 31, 1996. "Discontinuance fo Outfalls-NPDES Permit No. NM0028355, University of Calif. and Department of Energy," U.S. Environmental Protection Agency letter to G.T. Todd (DOE-LAAO) from J. Fontenot (EPA Region 6), Dallas, Texas. (EPA 1996, 109793)

EPA (U.S. Environmental Protection Agency), September 30, 2010. "Authorization to Discharge under the National Pollutant Discharge Elimination System, NPDES Permit No. NM 0030759," Region 6, Dallas, Texas. (EPA 2010, 213450)

Gilbert, R.O., 1987. *Statistical Methods for Environmental Pollution Monitoring*, Van Nostrand Reinhold, New York, New York. (Gilbert 1987, 056179)

Heerspink, B.P., S. Pandey, H. Boukhalfa, D.S. Ware, O. Marina, G. Perkins, V.V. Vesselinov, and G. WoldeGabriel, May 2, 2017. "Fate and Transport of Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) and Its Degradation Products in Sedimentary and Volcanic Rocks, Los Alamos, New Mexico," *Chemosphere,* Vol. 182, pp. 276-283. (Heerspink et al. 2017, 602560)

LANL (Los Alamos National Laboratory), July 2002. "Interim Measure Report for Potential Release Site 16-021(c)-99," Los Alamos National Laboratory document LA-UR-02-4229, Los Alamos, New Mexico. (LANL 2002, 073706)

LANL (Los Alamos National Laboratory), December 2006. "Field Summary Report, Slug Test Analysis for Cañon de Valle and Martin Spring Canyon Alluvial Wells," Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 2006, 095626)

LANL (Los Alamos National Laboratory), March 2010. "Summary Report for the Corrective Measures Implementation at Consolidated Unit 16-021(c)-99," Los Alamos National Laboratory document LA-UR-10-0947, Los Alamos, New Mexico. (LANL 2010, 108868)

LANL (Los Alamos National Laboratory), September 2011. "Investigation Report for Water Canyon/ Cañon de Valle," Los Alamos National Laboratory document LA-UR-11-5478, Los Alamos, New Mexico. (LANL 2011, 207069)

LANL (Los Alamos National Laboratory), September 2017. "Remedy Completion Report for Corrective Measures Implementation at Consolidated Unit 16-021(c)-99," Los Alamos National Laboratory document LA-UR-17-27678, Los Alamos, New Mexico. (LANL 2017, 602597)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), September 2021. "Interim Facility-Wide Groundwater Monitoring Plan for the 2022 Monitoring Year, October 2021–September 2022, Revision 1," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2021-0535, Los Alamos, New Mexico. (N3B 2021, 701672)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), September 2022. "Interim Facility-Wide Groundwater Monitoring Plan for the 2023 Monitoring Year, October 2022–September 2023, Revision 1," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2022-0656, Los Alamos, New Mexico. (N3B 2022, 702346)

NMED (New Mexico Environment Department), March 2017. "Risk Assessment Guidance for Site Investigations and Remediation, Volume 2, Soil Screening Guidance for Ecological Risk Assessments," Hazardous Waste Bureau and Ground Water Quality Bureau, Santa Fe, New Mexico. (NMED 2017, 602274)

NMED (New Mexico Environment Department), November 27, 2017. "Approval with Modifications, Remedy Completion Report for Corrective Measures Implementation at Consolidated Unit 16-021(c)-99," New Mexico Environment Department letter to D. Hintze (DOE-NA-LA) and B. Robinson (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2017, 602758)

NMED (New Mexico Environment Department), June 2022. "Risk Assessment Guidance for Site Investigations and Remediation, Volume 1, Soil Screening Guidance for Human Health Risk Assessments," Hazardous Waste Bureau and Ground Water Quality Bureau, Santa Fe, New Mexico. (NMED 2022, 702141)

Reid, K.D., S.L. Reneau, B.D. Newman, and D.D. Hickmott, August 2005. "Barium and High Explosives in a Semiarid Alluvial System, Cañon de Valle, New Mexico," *Vadose Zone Journal,* Vol. 4, pp. 744–759. (Reid et al. 2005, 093660)

6.2 Map Data Sources

Hillshade; Los Alamos National Laboratory, ER-ES, As published; \\slip\gis\Data\HYP\LiDAR\2014Bare_Earth\BareEarth_DEM_Mosiac.gdb; 2014.

Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.

Unpaved road; Los Alamos National Laboratory, ER-ES, As published, GIS projects folder; \\slip\GIS\Projects\14-Projects\14-0062\project_data.gdb; digitized_site_features; digitized_road; 2017.

Paved Road Arcs; Los Alamos National Laboratory, FWO Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.

Drainage Channel; Los Alamos National Laboratory, ER-ES, As published, GIS projects folder; \\slip\GIS\Projects\11-Projects\11-0108\\gdb\gdb_11-0108_generic.mdb; drainage; 2017.

TA-16 260 Outfall, As Published, GIS project folder: Q:\14-Projects\14-0080\project_data.gdb\polygon\outfall_260

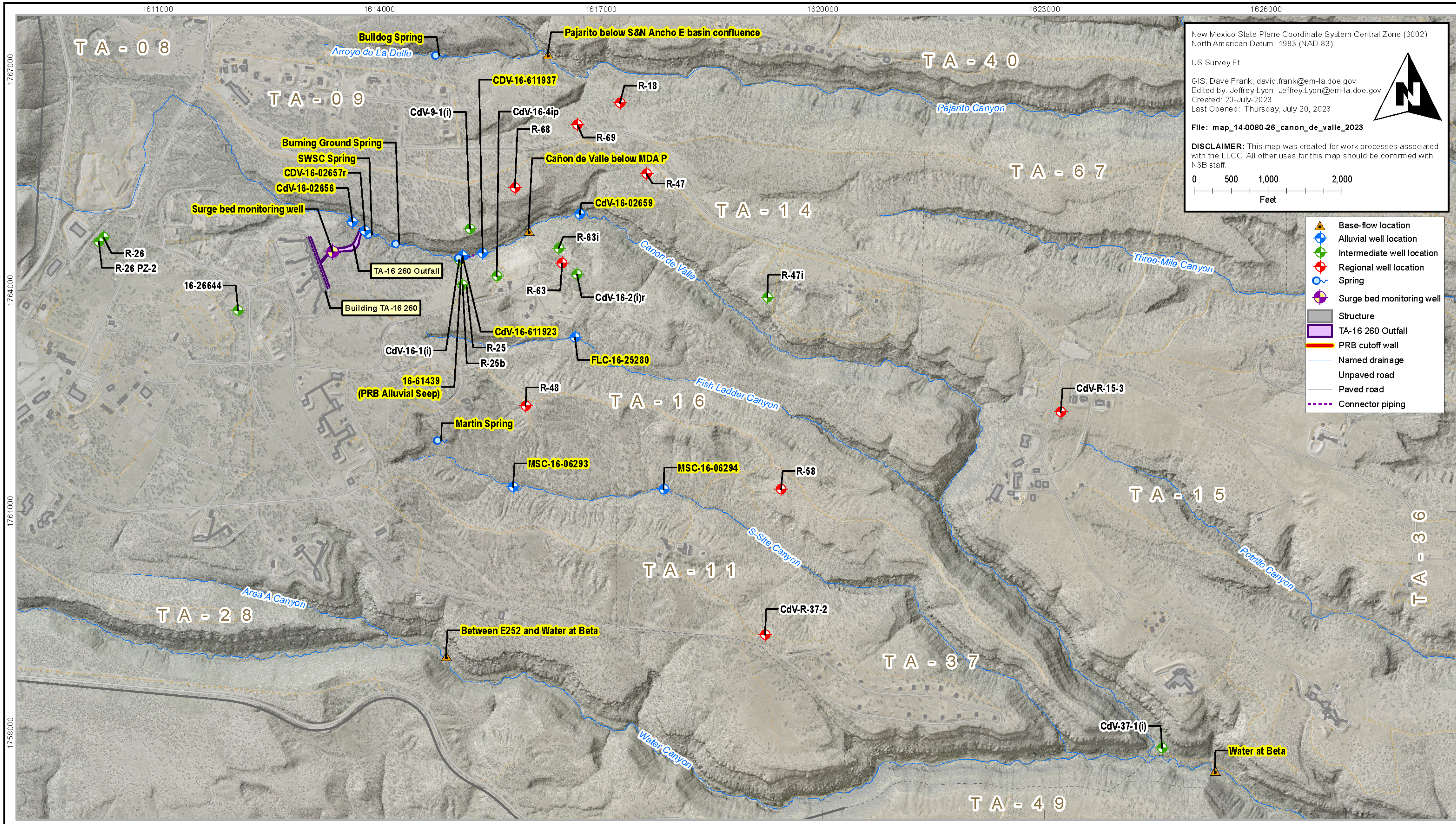
M Wall-PRB, As Published, GIS project folder: Q:\14-Projects\14-0080\project_data.gdb\line\wall_PRB

Connector piping, As Published, GIS project folder: Q:\14-Projects\14-0080\project_data.gdb\line\connector_piping

Tech areas; Los Alamos National Laboratory, Database Connections\GIS.PUB.PRD1.sde\PUB.Boundaries\PUB.tecareas

Tech Areas line; Los Alamos National Laboratory, Database Connections\GIS.PUB.PRD1.sde\PUB.Boundaries\PUB.tecareas_line

PUB.prs_all_reg_admin; Los Alamos National Laboratory, Database Connections\GIS.PUB.PRD1.sde\PUB.Regulatory\PUB.prs_all_reg_admin



Note: Yellow highlights indicate locations of interest in this report.

Figure 1.0-1 Long-Term Monitoring and Maintenance Plan locations

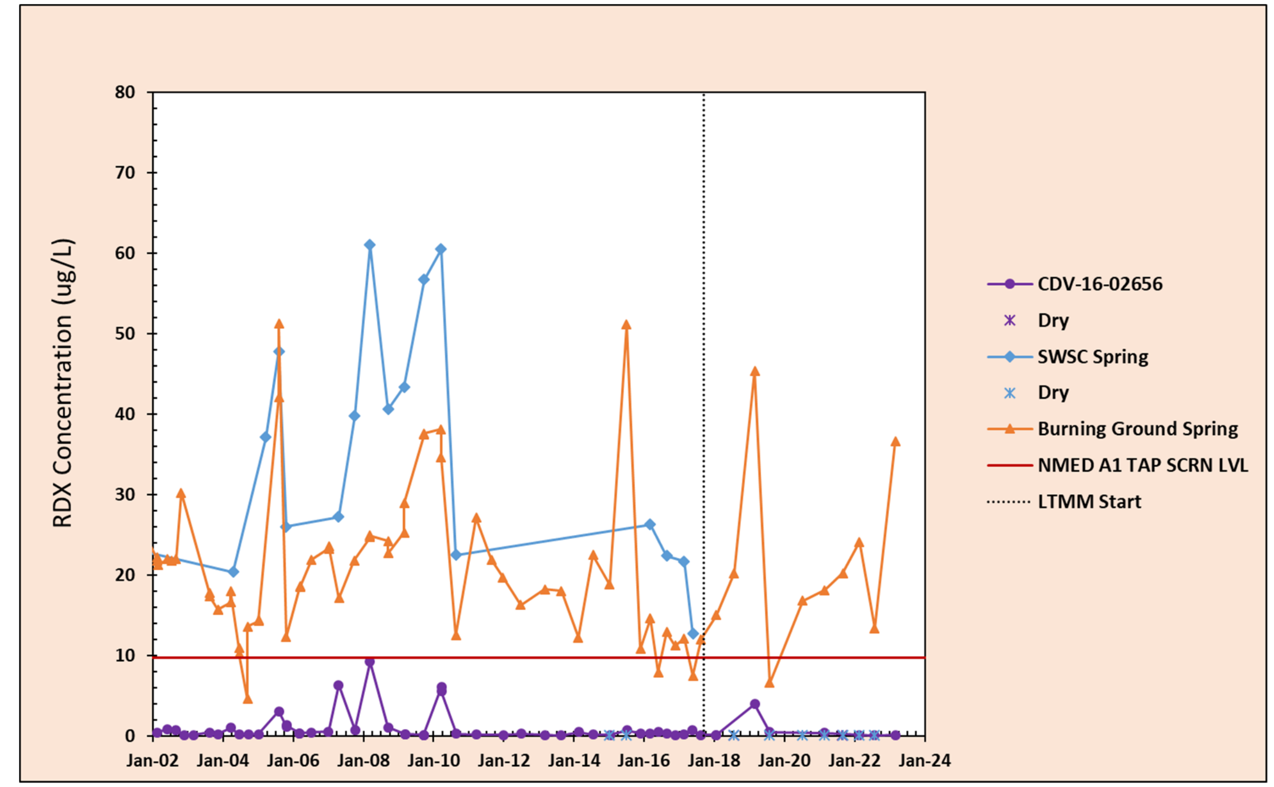


Figure 4.1-1 Cañon de Valle segment 1 RDX data record

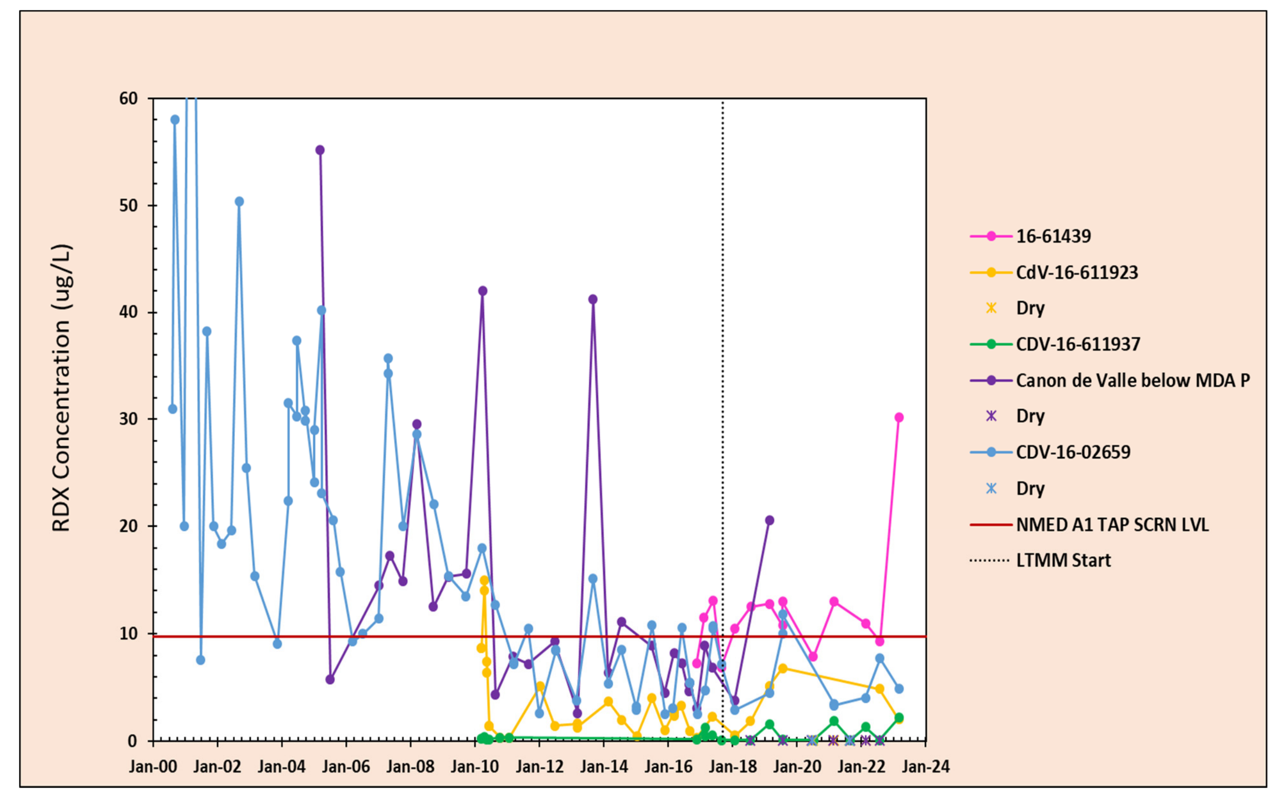


Figure 4.1-2 Cañon de Valle segment 2 RDX data record

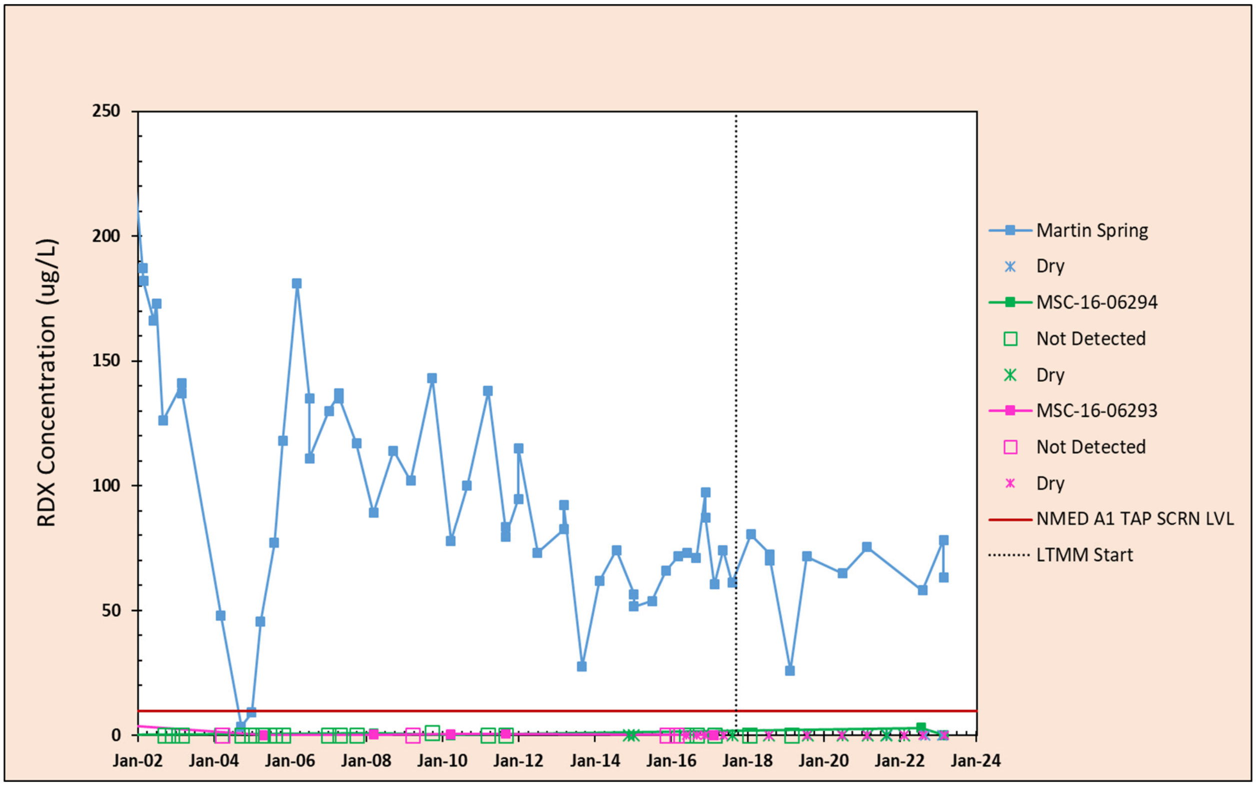


Figure 4.1-3 S-Site Canyon RDX data record

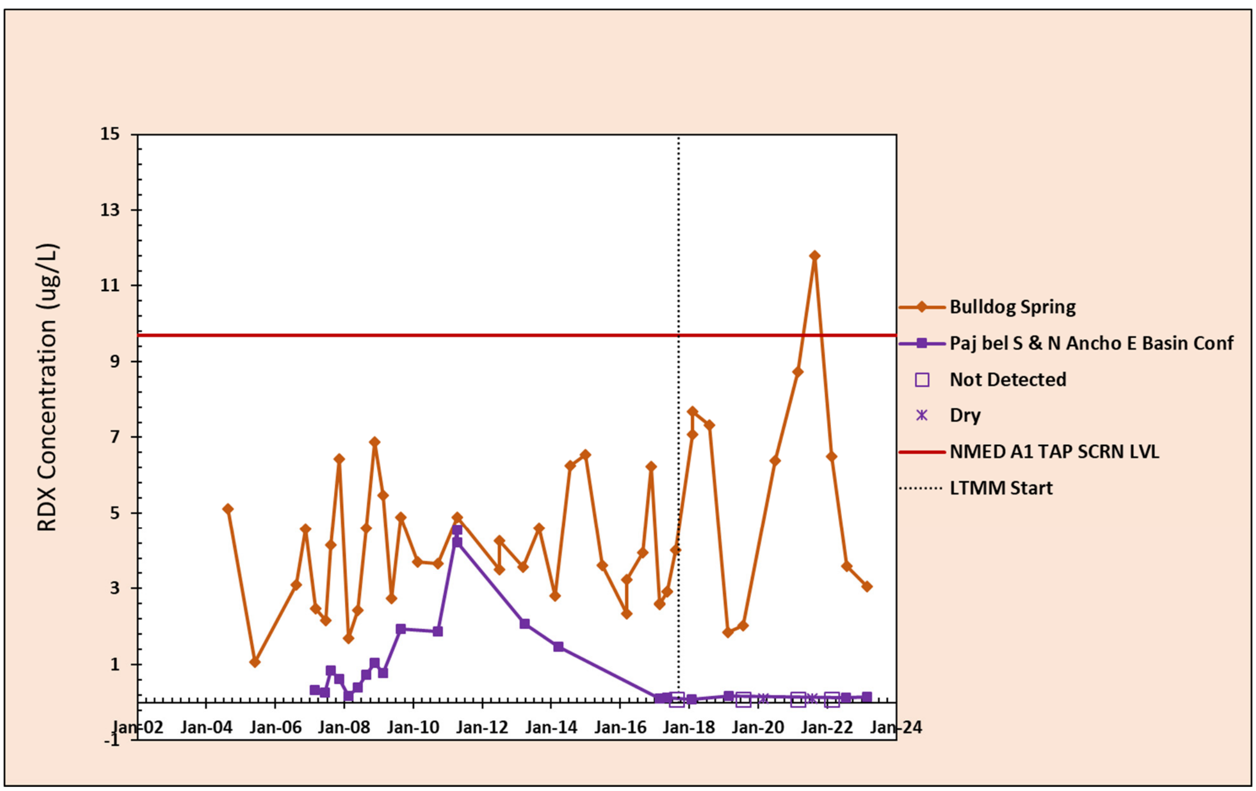


Figure 4.1-4 Pajarito Canyon RDX data record

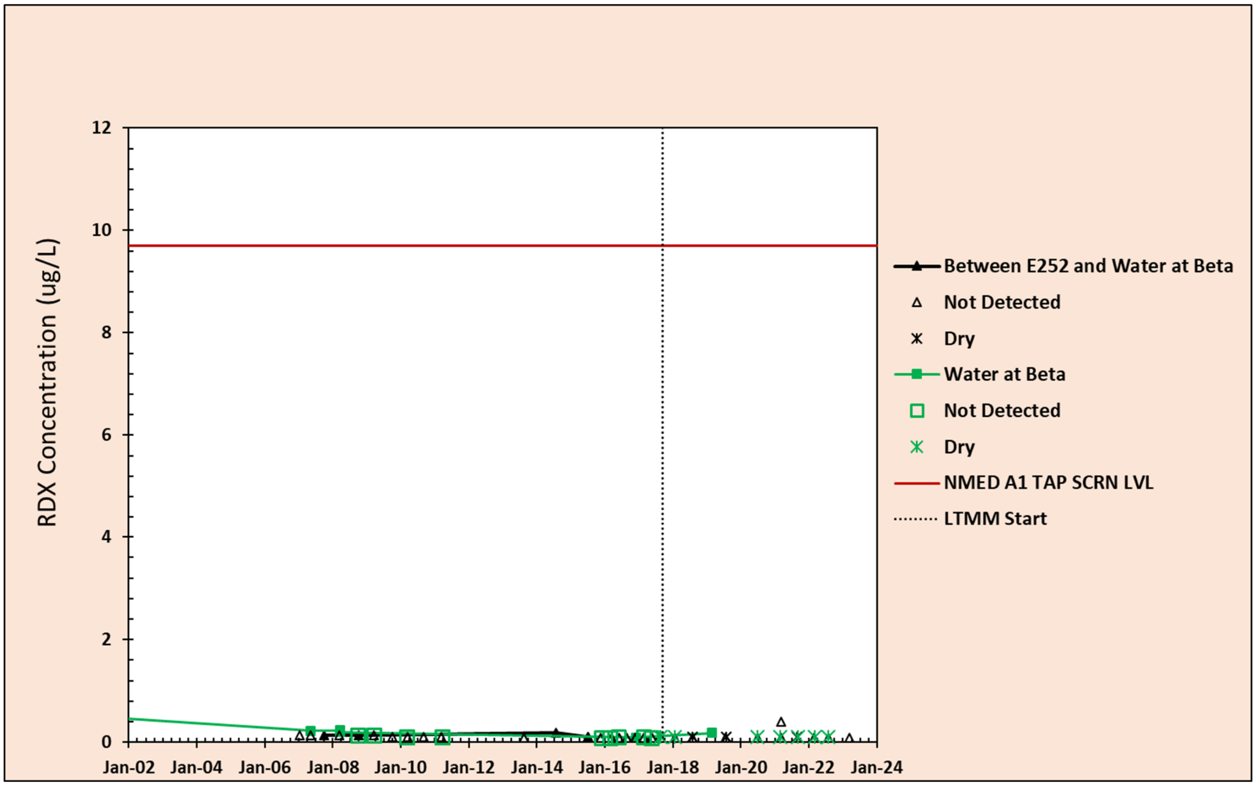


Figure 4.1-5 Water Canyon RDX data record

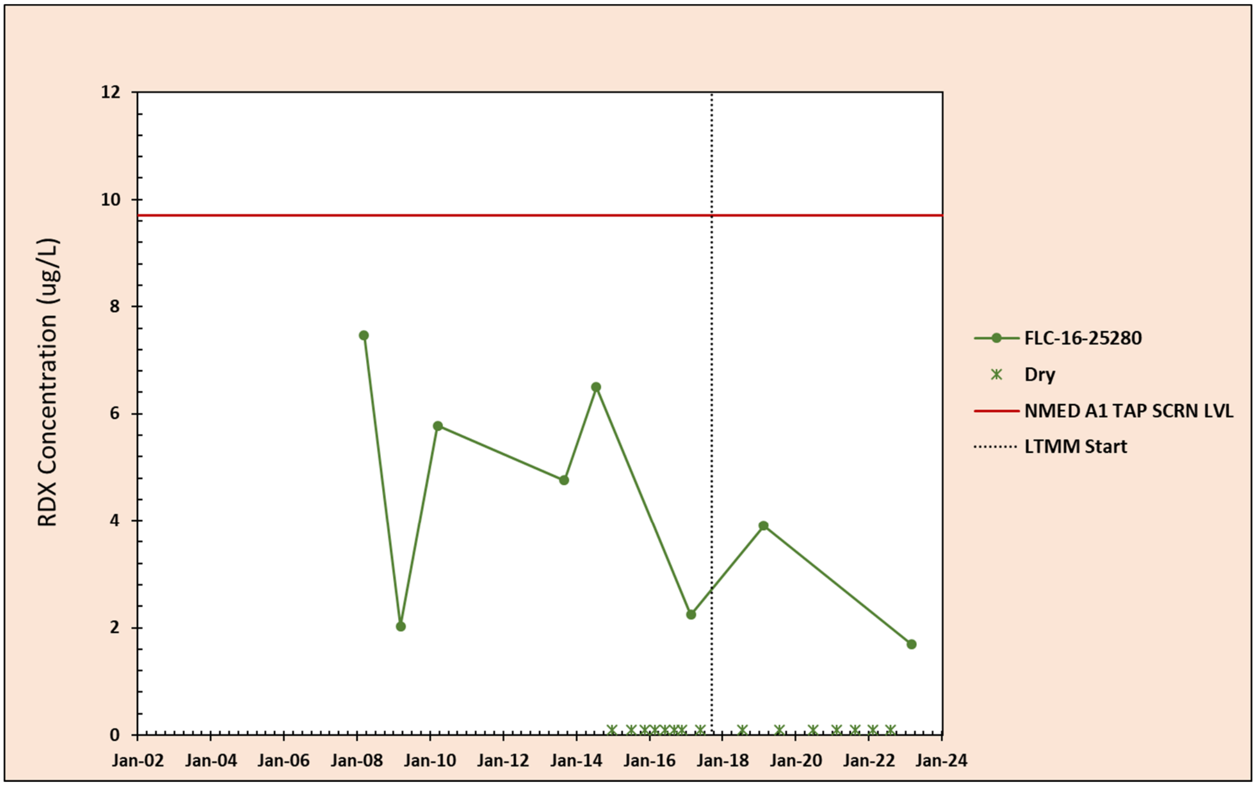


Figure 4.1-6 Fishladder Canyon RDX data record

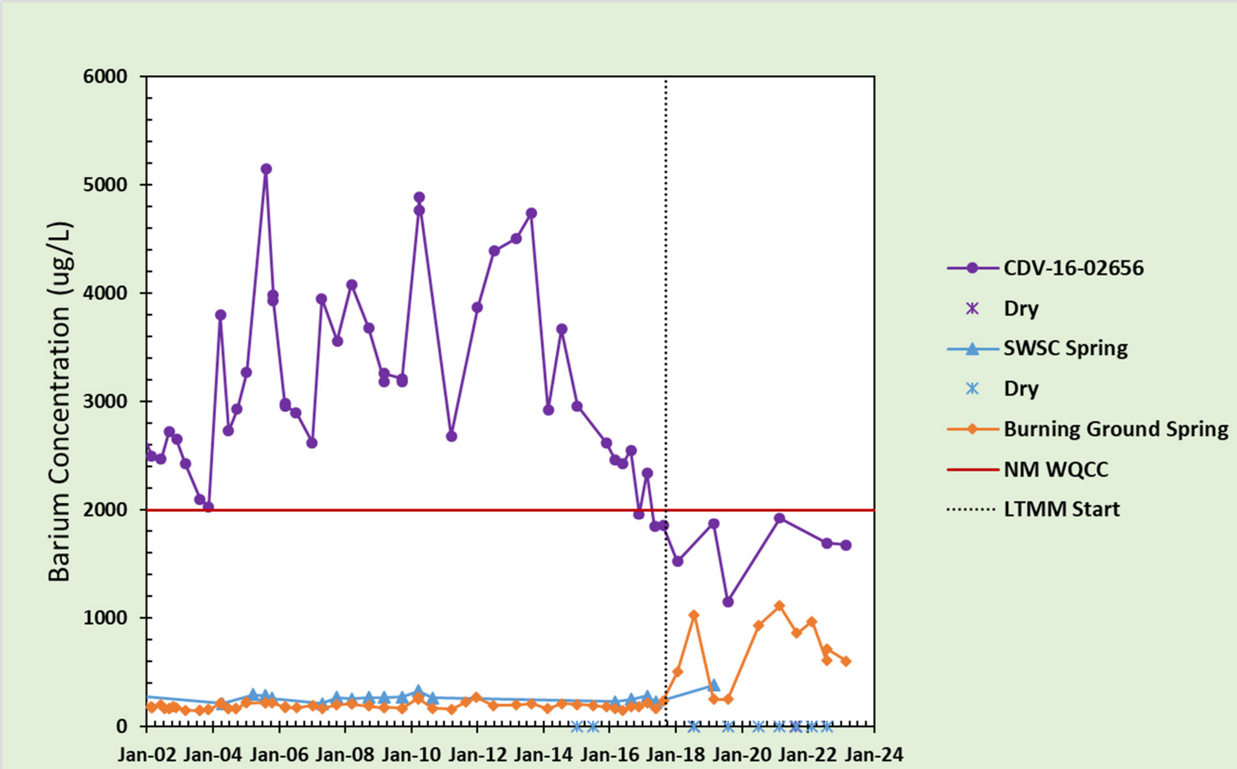


Figure 4.2-1 Cañon de Valle segment 1 barium data record

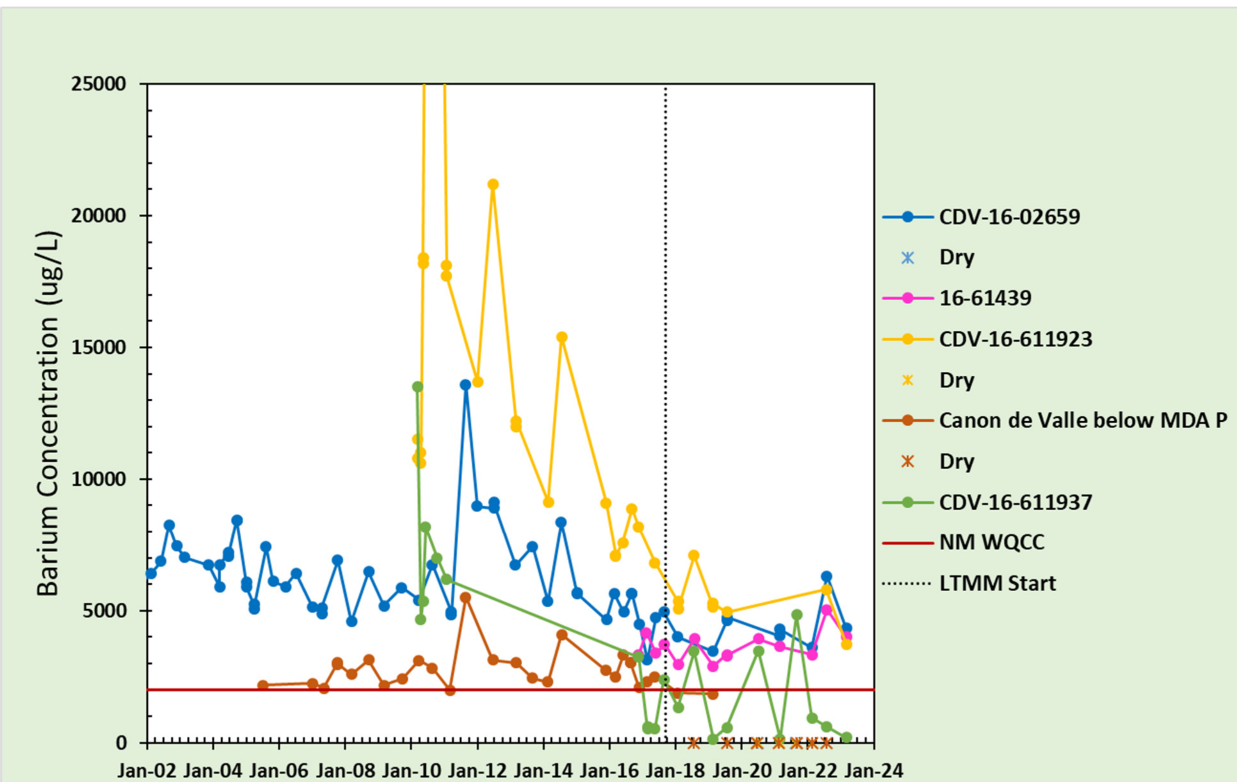


Figure 4.2-2 Cañon de Valle segment 2 barium data record

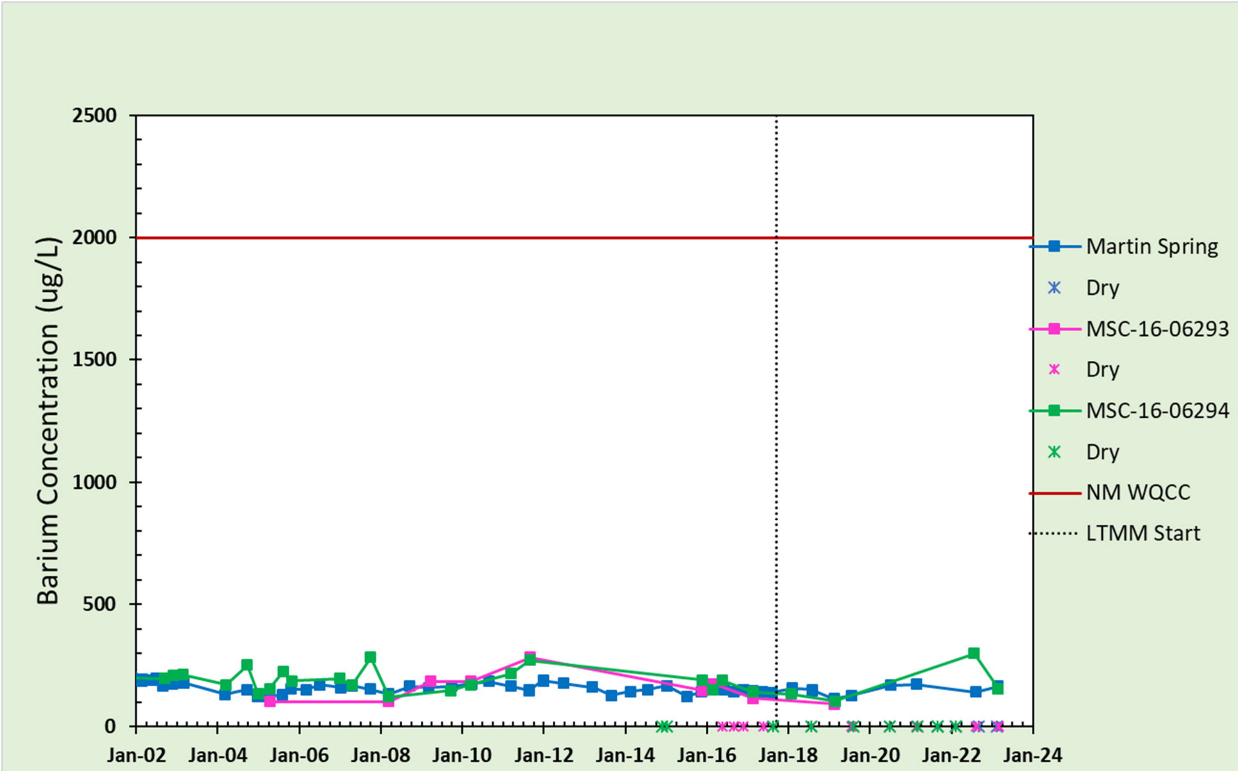


Figure 4.2-3 S-Site Canyon barium data record

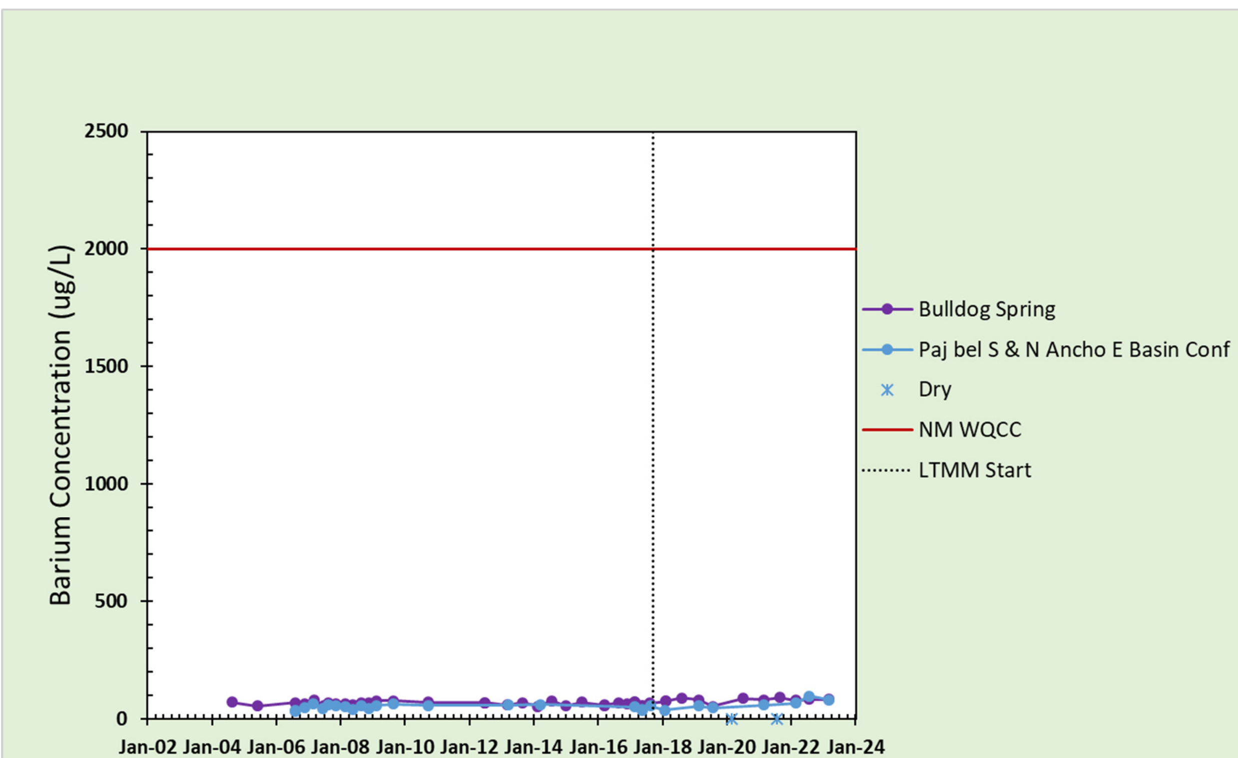


Figure 4.2-4 Pajarito Canyon barium data record

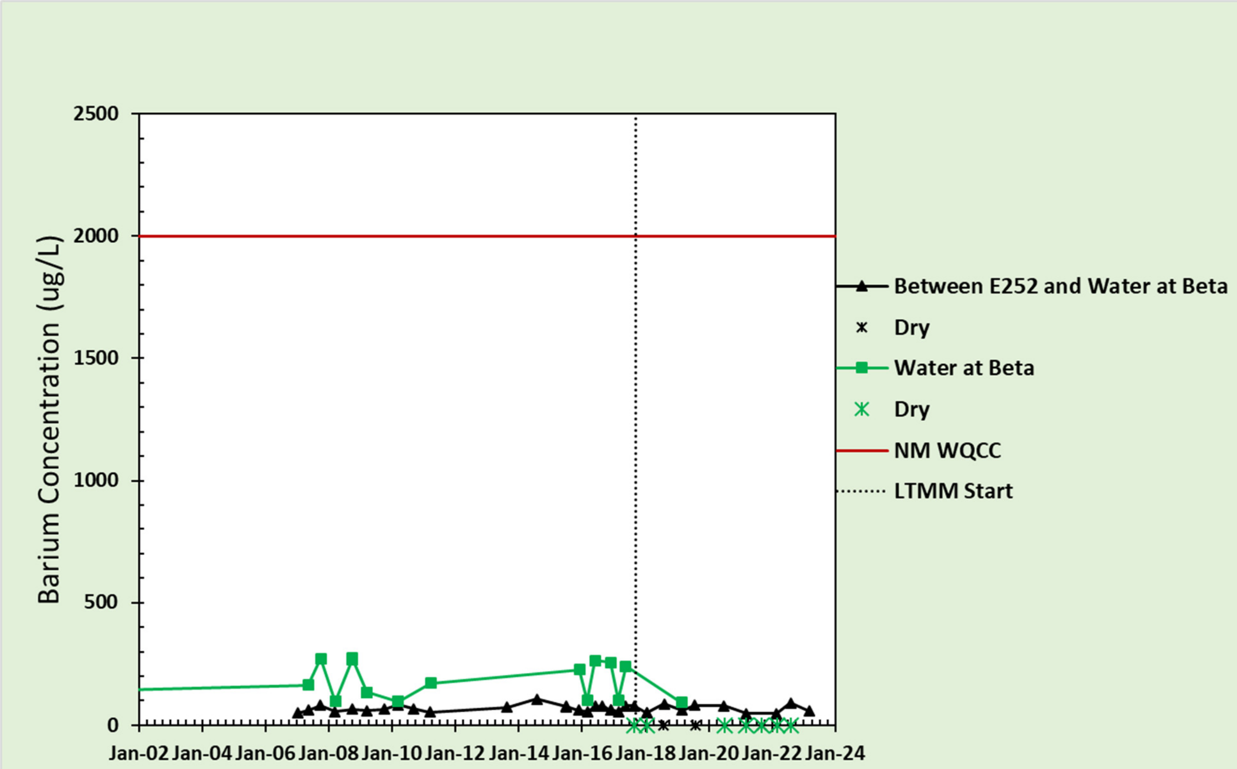


Figure 4.2-5 Water Canyon barium data record

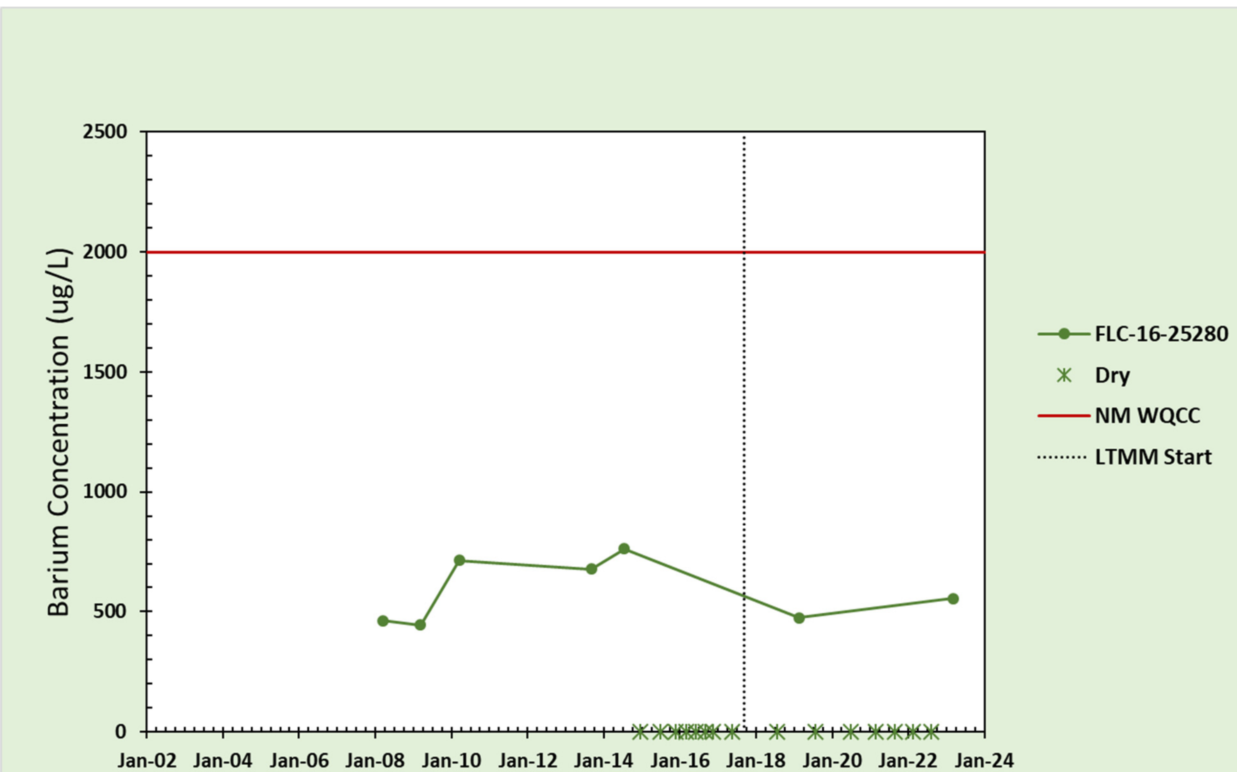


Figure 4.2-6 Fishladder Canyon barium data record

Table 1.1-1
Monitoring Locations, Analytes, and Frequency

Canyon	Location	Interim Plan Monitoring Year	Surface Water Body or Source Aquifer	Metals	VOCs	SVOCs	PFAS	HEXMOD[a]	Radionuclides	Low-Level Tritium	General Inorganics	$^{15}N/^{18}O$ Isotopes in Nitrate
Cañon de Valle 1	CdV-16-02656	2022	Alluvial	S[b]	S	B[c] (2022)	—[d]	S	B (2022)	—	S	—
		2023		S	S	B (2024)	A[e]	S	B (2024)	B (2024)	S	—
	CdV-16-02657r	2022	Alluvial	S	S	B (2022)	A	S	B (2022)	—	S	—
		2023		S	S	B (2024)	A	S	B (2024)	B (2024)	S	—
	SWSC Spring	2022	Spring	S	S	B (2022)	A	S	B (2022)	—	S	A
		2023		S	S	B (2024)	A	S	B (2024)	B (2024)	S	A
	Burning Ground Spring	2022	Spring	S	S	B (2022)	—	S	B (2022)	A	S	A
		2023		S	S	B (2024)	A	S	B (2024)	A	S	A
Cañon de Valle 2	16-61439 (PRB Alluvial Seep)	2022	Spring	S	S	B (2022)	—	S	B (2022)	—	S	—
		2023		S	S	B (2024)	A	S	B (2024)	B (2024)	S	—
	CdV-16-611923	2022	Alluvial	S	S	B (2022)	A	S	B (2022)	—	S	—
		2023		S	S	B (2024)	A	S	B (2024)	B (2024)	S	—
	CdV-16-611937	2022	Alluvial	S	S	B (2022)	—	S	B (2022)	—	S	—
		2023		S	S	B (2024)	A	S	B (2024)	B (2024)	S	—
	Cañon de Valle below MDA P	2022	Base flow	S	S	B (2022)	A	S	B (2022)	—	S	—
		2023		S	S	B (2024)	A	S	B (2024)	B (2024)	S	—
	CdV-16-02659	2022	Alluvial	S	S	B (2022)	A	S	B (2022)	—	S	—
		2023		S	S	B (2024)	A	S	B (2024)	B (2024)	S	—

Table 1.1-1 (continued)

Canyon	Location	Interim Plan Monitoring Year	Surface Water Body or Source Aquifer	Metals	VOCs	SVOCs	PFAS	HEXMOD[a]	Radionuclides	Low-Level Tritium	General Inorganics	$^{15}N/^{18}O$ Isotopes in Nitrate
S-Site Canyon	Martin Spring	2022	Spring	S	S	B (2022)	—	S	B (2022)	A	S	A
		2023		S	S	B (2024)	A	S	B (2024)	A	S	A
	MSC-16-06293	2022	Alluvial	S	S	B (2022)	A	S	B (2022)	—	S	—
		2023		S	S	B (2024)	A	S	B (2024)	B (2024)	S	—
	MSC-16-06294	2022	Alluvial	S	S	B (2022)	A	S	B (2022)	—	S	—
		2023		S	S	B (2024)	A	S	B (2024)	B (2024)	S	—
Pajarito Canyon	Bulldog Spring	2022	Spring	S	S	B (2022)	—	S	B (2022)	—	S	A
		2023		S	S	B (2024)	A	S	B (2024)	B (2024)	S	A
	Pajarito below S&N Ancho E Basin Confluence	2022	Base flow	S	S	B (2022)	A	S	B (2022)	—	S	—
		2023		S	S	B (2024)	A	S	B (2024)	B (2024)	S	—
Water Canyon	Between E252 and Water at Beta	2022	Base flow	S	S	B (2022)	—	S	B (2022)	—	S	—
		2023		S	S	B (2024)	—	S	B (2024)	B (2024)	S	—
	Water at Beta	2022	Base flow	S	S	B (2022)	A	S	B (2022)	—	S	—
		2023		S	S	B (2024)	A	S	B (2024)	B (2024)	S	—
Fishladder Canyon	FLC-16-25280	2022	Alluvial	S	S	B (2022)	A	S	B (2022)	—	S	—
		2023		S	S	B (2024)	A	S	B (2024)	B (2024)	S	—
n/a[f]	Surge Bed Monitoring Well	2022	Surge Bed (Intermediate)	S	S	S	A	S	—	—	S	—
		2023		S	S	S	A	S	—	—	S	—

Note: Red indicates a change.

[a] HEXMOD = Analytical suite for high explosives and RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine) degradation products

[b] S = Semiannual (two times per yr).

[c] B = Biennial (one time per 2 yr).

[d] — = This analytical suite is not scheduled to be collected for this type of water at locations assigned to this monitoring group.

[e] A = Annual.

[f] n/a = Not applicable.

Table 2.1-1
Long-Term Monitoring and Maintenance Plan Sampling Program Field Parameters

Watershed	Location	Date	Screen Top Depth (ft)	Dissolved Oxygen (mg/L)	Oxidation-Reduction Potential (mV)	pH (SU[a])	Specific Conductance (µS/cm)	Temperature (°C)	Turbidity (NTU[b])	Comments
Cañon de Valle 1	CdV-16-02656	8/13/2022	3	2.29	97.2	6.23	341.9	14.6	5.02	None
		3/18/2023	3	8.97	213.4	6.54	414.5	4.2	3.65	Prioritized suite collected because of limited available water
	CdV-16-02657r	8/13/2022	1.35	—[c]	—	—	—	—	—	Canceled: site was dry
		3/18/2023	1.35	—	—	—	—	—	—	Canceled: site was dry
	SWSC Spring	8/13/2022	—	—	—	—	—	—	—	Canceled: site was dry
		3/18/2023	—	—	—	—	—	—	—	Canceled: site was dry
	Burning Ground Spring	8/13/2022	—	7.88	—	7.04	339.5	12.4	7.03	None
		3/18/2023	—	8.24	—	6.96	364.8	9.5	1.82	None
Cañon de Valle 2	16-61439 (PRB Alluvial Seep)	8/18/2022	—	—	—	—	—	—	—	Field data not available at the time of report
		3/20/2023	—	9.60	—	6.75	354.4	5.1	172	None
	CdV-16-611923	8/12/2022	3.2	2.25	83.1	6.34	442.9	14.6	1.85	None
		3/20/2023	3.2	7.32	162.3	6.26	385	4.2	3.15	None
	CdV-16-611937	8/12/2022	3	1.14	51.5	5.96	344.3	15.4	5.04	None
		3/20/2023	3	3.63	206.8	5.85	297.5	2.2	16.79	Prioritized suite collected because of limited available water
	Cañon de Valle below MDA P	8/18/2022	n/a	—	—	—	—	—	—	Canceled: site was dry
		3/20/2023	n/a	—	—	—	—	—	—	Canceled: site was dry
	CdV-16-02659	8/18/2022	1.7	3.34	181.8	6.19	398.2	12.3	3.14	None
		3/20/2023	1.7	8.01	199.2	6.65	322.2	5.4	4.27	None
S-Site Canyon	Martin Spring	8/25/2022	—	6.58	—	7.4	325.2	12.1	21.32	None
		3/13/2023	—	7.22	—	6.87	450.4	10	15.03	None
	MSC-16-06293	8/25/2022	2	—	—	—	—	—	—	Canceled: site was dry
		3/24/2023	2	—	—	—	—	—	—	Canceled: site was dry
	MSC-16-06294	8/11/2022	2.5	1.08	33.4	6.06	298	18.2	2.15	None
		3/13/2023	2.5	8.05	181.7	6.11	144.7	4	173.8	None
Pajarito Canyon	Bulldog Spring	8/11/2022	—	8.07	—	7.51	274.4	11.6	37.72	None
		3/21/2023	—	8.73	—	7.38	330.6	8.9	9.67	None
	Pajarito below S&N Ancho E Basin Confluence	3/21/2023	—	10.3	—	7.3	381.1	3.3	9.56	None
Water Canyon	Between E252 and Water at Beta	3/28/2023	—	10.87	—	7.29	175.5	1.00	4.51	None
	Water at Beta	8/17/2022	—	—	—	—	—	—	—	Canceled: area inaccessible due to downed tree in the road
		3/29/2023	—	—	—	—	—	—	—	Canceled: area inaccessible due to downed tree in the road
Fishladder Canyon	FLC-16-25280	8/24/2022	—	—	—	—	—	—	—	Canceled: insufficient sample available
		3/23/2023	—	7.75	233.7	5.78	108.2	3.7	149.6	None

[a] SU = Standard unit.

[b] NTU = Nephelometric turbidity unit(s).

[c] — = Not applicable.

Table 2.2-1
Sources for Standards and Screening Levels for Groundwater at Los Alamos National Laboratory

Standard Type	Standard Source	Description	Groundwater
New Mexico			
Standard	20 6.2.3103 New Mexico Administrative Code (New Mexico Water Quality Control Commission groundwater standard)	Groundwater Human Health Standards, other standards for domestic water supply, and standards for irrigation use	X[a]
Screening Level	NMED	Tap water screening levels[b]	X
EPA			
Standard	40 Code of Federal Regulations 141	EPA MCLs[c]	X
Risk-Human	EPA generic screening levels	EPA generic screening levels for tap water[d]	X
DOE			
Standard	DOE Order 458.1	DOE 100-mrem public dose derived concentration technical standards	X
Standard	DOE Order 458.1	DOE 4-mrem drinking water derived concentration technical standards	X

[a] X = Applied to data screen for this report.

[b] Screening levels derived from NMED guidance (NMED 2017, 602274; NMED 2022, 702141).

[c] EPA maximum contaminant levels (https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations).

[d] EPA generic screening levels (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

Table 2.2-2
Sources for Standards and Screening Levels for Surface Water (Base Flows) at Los Alamos National Laboratory

Standard Type	Standard Source	Between E252 and Water at Beta	Cañon de Valle below MDA P	Pajarito below S&N Ancho Basin Confluence	Water at Beta
Irrigation Standard	20 6.4.900.C NMAC	—[a]	—	—	—
Livestock Watering Standard	20 6.4.900.F NMAC	X[b]	X	X	X
Wildlife Habitat Standard	20 6.4.900.G NMAC	X	X	X	X
Aquatic Life Standards Acute[c,d]	20 6.4.900.H NMAC	X	X	X	X
Aquatic Life Standards Chronic[c,d]	20 6.4.900.H NMAC	—	X	X	—
Aquatic Life Human Health-Organism Only Standard	20 6.4.900.H NMAC	—	X	X	—
Human Health-Organism Only criteria apply only for persistent pollutants	20.6.4.900.J NMAC	X	—	—	X
Domestic Water Supply	20.6.4.900.B NMAC	—	—	—	—

[a] — = Not applied to data screen for this report.

[b] X = Applied to data screen for this report.

[c] Hardness-dependent acute and chronic criteria were used for total recoverable aluminum and dissolved cadmium, chromium, copper, lead, manganese, nickel, silver, and zinc.

[d] Standard for dissolved hexavalent chromium conservatively compared with results for dissolved chromium (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables).

Table 2.2-3
Base-Flow Location Type and Hardness Assignments Used to Select Screening Values

Watershed	Location	Stream Type	New Mexico Water Quality Standard Classification	Date	Sample Purpose	Hardness[a] (µg/L as $CaCO_3$)
Water	Between E252 and Water at Beta	Ephemeral	20.6.4.128	3/11/22	REG	39.3
Water	Cañon de Valle below MDA P	Perennial	20.6.4.126	—	—	—
Pajarito	Pajarito below S&N Ancho Basin Confluence	Perennial	20.6.4.126	3/08/22	REG	56.9
Water	Water at Beta	Ephemeral	20.6.4.128	—	—	—

Notes: 20.6.4 NMAC defines the three stream types as follows. Intermittent = Water body contains water for extended periods only at certain times of the year, such as when it receives seasonal flow from springs or melting snow. Perennial = Water body typically contains water throughout the year and rarely experiences dry period. Ephemeral = Water body contains water briefly only in direct response to precipitation; its bed is always above the water table of the adjacent region.

[a] Hardness values were calculated using calcium and magnesium. The reported value is a mean filtered result for each specific location.

[b] Tribal-designated uses and types are assigned separately for each water body monitored. These are assigned by the Pueblo de San Ildefonso and utilize the parameters described in 20.6.4 NMAC.

[c] — = No hardness value available because site was dry.

[d] REG = Regular sample.

[e] FD = Field duplicate.

Table 2.2-4
Toxic Equivalents

Analyte	Parameter Code	Toxic Equivalent
2,3,7,8-TCDD	1746-01-6	1
1,2,3,7,8-PeCDD	40321-76-4	1
1,2,3,4,7,8-HxCDD	39227-28-6	0.1
1,2,3,6,7,8-HxCDD	57653-85-7	0.1
1,2,3,7,8,9-HxCDD	19408-74-3	0.1
1,2,3,4,6,7,8-HpCDD	35822-46-9	0.01
OCDD	3268-87-9	0.0003
2,3,7,8-TCDF	51207-31-9	0.1
1,2,3,7,8-PeCDF	57117-41-6	0.03
2,3,4,7,8-PeCDF	57117-31-4	0.3
1,2,3,4,7,8-HxCDF	70648-26-9	0.1
1,2,3,6,7,8-HxCDF	57117-44-9	0.1
1,2,3,7,8,9-HxCDF	72918-21-9	0.1
2,3,4,6,7,8-HxCDF	60851-34-5	0.1
1,2,3,4,6,7,8-HpCDF	67562-39-4	0.01
1,2,3,4,7,8,9-HpCDF	55673-89-7	0.01
OCDF	39001-02-0	0.0003
3,3',4,4'-TCB (77)	32598-13-3	0.0001
3,4,4',5-TCB (81)	70362-50-4	0.0003
3,3',4,4',5-PeCB (126)	57465-28-8	0.1
3,3',4,4',5,5'-HxCB (169)	32774-16-6	0.03
2,3,3',4,4'-PeCB (105)	32598-14-4	0.00003
2,3,4,4',5-PeCB (114)	74472-37-0	0.00003
2,3',4,4',5-PeCB (118)	31508-00-6	0.00003
2',3,4,4',5-PeCB (123)	65510-44-3	0.00003
2,3,3',4,4', 5 -HXCB (156)	PCB-156/157	0.00003
2,3,3',4,4',5'-HxCB (157)	PCB-156/157	0.00003
2,3',4,4',5,5'-HxCB (167)	52663-72-6	0.00003
2,3,3',4,4',5,5'-HpCB (189)	39635-31-9	0.00003

Note: Toxic equivalents are expressed as 2,3,7,8-TCDD dioxin (https://www.epa.gov/toxics-release-inventory-tri-program/2010-dioxin-and-dioxin-compounds-and-teq-data-files)

Table 2.2-5
RDX Concentrations in Groundwater, Surface Water, and Springs

Canyon	Location	Field Sample ID	Depth to Top of Screen (ft)	Date	Field Preparation Code	Sample Purpose	Result (µg/L)	Detected	NMED Screening Level[a] (µg/L)	Comment
Cañon de Valle 1	CdV-16-02656	CAWA-22-254149	3	8/13/2022	UF[b]	REG[c]	0.0861	N[d]	9.66	None
		CAWA-23-269530	3	3/18/2023	UF	REG	0.0890	N	9.66	None
	CdV-16-02657r	—[e]	1.35	8/13/2022	—	—	—	—	—	Canceled: site was dry
		—	1.35	3/18/2023	—	—	—	—	—	Canceled: site was dry
	SWSC Spring	—	—	8/13/2022	—	—	—	—	—	Canceled: site was dry
		—	—	3/18/2023	—	—	—	—	—	Canceled: site was frozen
	Burning Ground Spring	CAWA-22-254573	—	8/13/2022	UF	REG	13.4	Y[f]	9.66	None
		CAWA-23-269516	—	3/18/2023	UF	REG	36.6	Y	9.66	None
Cañon de Valle 2	16-61439 (PRB Alluvial Seep)	CAWA-22-253999	—	8/18/2022	UF	REG	9.27	Y	9.66	None
		CAWA-23-269524	—	3/20/2023	UF	REG	30.2	Y	9.66	None
	CdV-16-611923	CAWA-22-254427	3.2	8/12/2022	UF	REG	4.88	Y	9.66	None
		CAWA-23-269539	3.2	3/20/2023	UF	REG	2.04	Y	9.66	None
	CdV-16-611937	CAWA-22-254433	3	8/12/2022	UF	REG	0.0825	N	9.66	None
		CAWA-23-269585	3	3/20/2023	UF	REG	2.18	Y	9.66	None
	Cañon de Valle below MDA P	—	—	8/18/2022	—	—	—	—	9.66	Canceled: site was dry
		—	—	3/20/2023	—	—	—	—	9.66	Canceled: site was dry
	CdV-16-02659	CAWA-22-254425	1.7	8/18/2022	UF	REG	7.69	Y	9.66	None
		CAWA-23-269536	1.7	3/20/2023	UF	REG	4.93	Y	9.66	None
S-Site Canyon	Martin Spring	CAWA-22-254576	—	8/25/2022	UF	REG	57.9	Y	9.66	None
		CAWA-23-269520	—	3/13/2023	UF	REG	78.1	Y	9.66	None
		CAWA-23-269659	—	3/13/2023	UF	FD[g]	63.1	Y	9.66	None
	MSC-16-06293	—	2	8/25/2022	—	—	—	—	9.66	Canceled: site was dry
		—	2	—	—	—	—	—	9.66	Canceled: site was dry
	MSC-16-06294	CAWA-22-254431	2.5	8/11/2022	UF	REG	3.09	Y	9.66	None
		CAWA-23-269582	2.5	3/13/2023	UF	REG	0.207	Y	9.66	Canceled: insufficient available water
Pajarito Canyon	Bulldog Spring	CAPA-22-254554	—	8/11/2022	UF	REG	3.60	Y	9.66	None
		CAPA-23-269695	—	3/21/2023	UF	REG	3.05	Y	9.66	None
	Pajarito below S&N Ancho E Basin Confluence	CAPA-22-254552	—	8/10/2022	UF	REG	0.134	Y	9.66	None
		CAPA-23-269691	—	3/21/2023	UF	REG	0.148	Y	9.66	None
Water Canyon	Between E252 and Water at Beta	CAWA-22-254569	—	8/17/2022	UF	REG	0.0813	N	9.66	None
		CAWA-23-269505	—	3/28/2023	UF	REG	0.0803	N	9.66	None
	Water at Beta	—	—	8/17/2022	—	—	—	—	9.66	Canceled: site was dry
		—	—	3/29/2023	—	—	—	—	9.66	Canceled: area inaccessible due to downed tree

Table 2.2-5 (continued)

Canyon	Location	Field Sample ID	Depth to Top of Screen (ft)	Date	Field Preparation Code	Sample Purpose	Result (µg/L)	Detected	NMED Screening Level[a] (µg/L)	Comments
Fishladder Canyon	FLC-16-25280	—	—	8/24/2022	—	—	—	—	9.66	Canceled: insufficient sample available
		CAWA-23-269527	—	3/23/2023	UF	REG	1.69	Y	9.66	None

[a] NMED screening level = NMED screening level for tap water (NMED 2017, 602274; NMED 2022, 702141).
[b] UF = Unfiltered sample.
[c] REG = Regular sample.
[d] N = No (not detected). (The method detection limit is 0.0869)
[e] — = Not applicable.
[f] Y = Yes (detected).
[g] FD = Field duplicate.

Table 2.2-6
Barium Concentrations in Groundwater, Surface Water, and Springs

Canyon	Location	Field Sample ID	Depth to Top of Screen (ft)	Date	Field Preparation Code	Sample Purpose	Result (µg/L)	Detected	NMED Screening Level[a] (µg/L)	Comment
Cañon de Valle 1	CdV-16-02656	CAWA-22-254150	3	8/13/2022	F[b]	REG[c]	1690	Y[d]	2000	None
		CAWA-23-269531	3	3/18/2023	F	REG	1670	Y	2000	None
	CdV-16-02657r	—[e]	1.35	8/13/2022	—	—	—	—	2000	Canceled: site was dry
		—	1.35	3/18/2023	—	—	—	—	2000	Canceled: site was dry
	SWSC Spring	—	—	8/13/2022	—	—	—	—	2000	Canceled: site was dry
		—	—	3/18/2023	—	—	—	—	2000	Canceled: site was frozen
	Burning Ground Spring	CAWA-22-254574	—	8/13/2022	F	REG	716	Y	2000	None
		CAWA-23-269517	—	3/18/2023	F	REG	601	Y	2000	None
Cañon de Valle 2	16-61439 (PRB Alluvial Seep)	CAWA-22-254000	—	8/18/2022	F	REG	5040	Y	2000	None
		CAWA-23-269525	—	3/20/2023	F	REG	4000	Y	2000	None
	CdV-16-611923	CAWA-22-254428	3.2	8/12/2022	F	REG	5800	Y	2000	None
		CAWA-23-269540	3.2	3/20/2023	F	REG	3730	Y	2000	None
	CdV-16-611937	CAWA-22-254434	3	8/12/2022	F	REG	625	Y	2000	None
		CAWA-23-269586	3	3/20/2023	F	REG	205	Y	2000	None
	Cañon de Valle below MDA P	—	—	8/18/2022	—	—	—	—	2000	Canceled: site was dry
		—	—	3/20/2023	—	—	—	—	2000	Canceled: site was dry
	CdV-16-02659	CAWA-22-254426	1.7	8/18/2022	F	REG	6310	Y	2000	None
		CAWA-23-269537	1.7	3/20/2023	F	REG	4340	Y	2000	None

Table 2.2-6 (continued)

Canyon	Location	Field Sample ID	Depth to Top of Screen (ft)	Date	Field Preparation Code	Sample Purpose	Result (µg/L)	Detected	NMED Screening Level[a] (µg/L)	Comment
S-Site Canyon	Martin Spring	CAWA-22-254577	—	8/25/2022	F	REG	142	Y	2000	None
		CAWA-23-269521	—	3/13/2023	F	REG	166	Y	2000	None
		CAWA-23-269660	—	3/13/2023	F	FD[f]	171	Y	2000	None
	MSC-16-06293	—	2	8/25/2022	—	—	—	—	2000	Canceled: insufficient available water
		—	2	3/24/2023	—	—	—	—	2000	Canceled: insufficient available water
	MSC-16-06294	CAWA-22-254432	2.5	8/11/2022	F	REG	300	Y	2000	None
		CAWA-23-269583	2.5	3/13/2023	F	REG	156	Y	2000	None
Pajarito Canyon	Bulldog Spring	CAPA-22-254555	—	8/11/2022	F	REG	84.0	Y	2000	None
		CAPA-23-269696	—	3/21/2023	F	REG	84.0	Y	2000	None
	Pajarito below S&N Ancho E Basin Confluence	CAPA-22-254552	—	8/10/2022	UF[g]	REG	106	Y	2000	None
		CAPA-22-254553	—	8/10/2022	F	REG	98.8	Y	2000	None
		CAPA-23-269691	—	3/21/2023	UF	REG	83.7	Y	2000	None
		CAPA-23-269692	—	3/21/2023	F	REG	82.9	Y	2000	None
Water Canyon	Between E252 and Water at Beta	CAWA-22-254569	—	8/17/2022	UF	REG	88.3	Y	2000	None
		CAWA-22-254570	—	8/17/2022	F	REG	89.9	Y	2000	None
		CAWA-23-269505	—	3/28/2023	UF	REG	62.4	Y	2000	None
		CAWA-23-269506	—	3/28/2023	F	REG	56.5	Y	2000	None
	Water at Beta	—	—	8/17/2022	—	—	—	—	2000	None
		—	—	3/29/2023	—	—	—	—	2000	None
Fishladder Canyon	FLC-16-25280	—	—	8/25/2022	—	—	—	—	2000	None
		CAWA-23-269528	—	3/23/2023	F	REG	554	Y	2000	None

[a] New Mexico Water Quality Control Commission groundwater standards.
[b] F = Filtered sample.
[c] REG = Regular sample.
[d] Y = Yes.
[e] — = Not applicable.
[f] FD = Field duplicate
[g] UF = Unfiltered sample.

Table 2.2-7
Additional Analytes Exceeding Screening Levels

Canyon	Location	Field Sample ID	Sampling Date	Sample Purpose	Analyte	Result (µg/L)	Screening Level (µg/L)	Field Preparation Code	Action Limit
Cañon de Valle 2	16-61439	CAWA-22-254425	3/20/2023	REG[a]	Amino-2,6-dinitrotoluene[4-]	1.90	1.9	UF[b]	NMED A1 TAP SCRN LVL[c]
	CdV-16-02659	CAWA-23-269537	8/18/2022	REG	Amino-2,6-dinitrotoluene[4-]	2.33	1.9	UF	NMED A1 TAP SCRN LVL
	CdV-16-611937	CAPA-22-254555	8/12/2022	REG	Iron	2240	1000	F[d]	NM GW STD[e]
	CdV-16-611937	CAWA-22-254574	8/12/2022	REG	Manganese	1190	200	F	NM GW STD
Fishladder Canyon	FLC-16-25280	CAWA-22-254434	3/23/2023	REG	Aluminum	22100	5000	F	NM GW STD
	FLC-16-25280	CAWA-23-269528	3/23/2023	REG	Iron	15000	1000	F	NM GW STD
	FLC-16-25280	CAWA-22-254432	3/23/2023	REG	Tetrachloroethene	237	5	UF	NM GW STD
	FLC-16-25280	CAWA-22-254574	3/23/2023	REG	Trichloroethene	6.29	5	UF	NM GW STD
Pajarito Canyon	Bulldog Spring	CAWA-22-254434	8/11/2022	REG	Iron	1520	1000	F	NM GW STD
S-Site Canyon	Martin Spring	CAWA-23-269524	8/25/2022	REG	Boron	1140	750	F	NM GW STD
	Martin Spring	CAWA-22-254573	3/13/2023	REG	Boron	957	750	F	NM GW STD
	MSC-16-06294	CAWA-23-269520	8/11/2022	REG	Iron	3610	1000	F	NM GW STD
	MSC-16-06294	CAWA-23-269527	3/13/2023	REG	Iron	2890	1000	F	NM GW STD
	MSC-16-06294	CAWA-23-269527	8/11/2022	REG	Manganese	786	200	F	NM GW STD

[a] REG = Regular sample.

[b] UF = Unfiltered

[c] NMED A1 TAP SCRN LVL = NMED screening level for tap water.

[d] F = Filtered.

[e] NM GW STD = NMWQCC groundwater standard.

Table 2.3-1
Deviations

Location Name	Watershed	Sampling Event MY	Sampling Event Quarter	Sample Collection Date	Note
Base Flow					
Cañon de Valle below MDA P	Water/CdV	2022	4	08/18/2022	Canceled: site was dry; no field or analytical data will be available for this site.
Cañon de Valle below MDA P	Water/CdV	2023	2	03/20/2023	Canceled: site was dry; no field or analytical data will be available for this site.
Water at Beta	Water/CdV	2022	4	08/17/2022	Canceled: site was dry; no field or analytical data will be available for this site
Water at Beta	Water/CdV	2023	2	03/29/2023	Canceled: area inaccessible due to downed tree in the road.
Springs					
SWSC Spring	Water/CdV	2022	4	08/13/2022	Canceled: site was dry; no field or analytical data will be available for this site.
SWSC Spring	Water/CdV	2023	2	03/18/2023	Canceled because site was frozen.
Alluvial Wells					
CdV-16-02657r	Water/CdV	2022	4	08/13/2022	Canceled: site was dry; no field or analytical data will be available for this site.
CdV-16-02657r	Water/CdV	2023	2	03/18/2023	Canceled: site was dry; no field or analytical data will be available for this site.
CdV-16-02656	Water/CdV	2023	2	03/18/2023	Prioritized suite collected because of limited available water.
CdV-16-611937	Water/CdV	2023	2	03/20/2023	Prioritized suite collected because of limited available water.
FLC-16-25280	Water/CdV	2022	4	08/24/2022	Canceled: insufficient sample available; no field or analytical data will be available for this site.
MSC-16-06293	Water/CdV	2022	4	08/25/2022	Canceled: insufficient available water; no field or analytical data will be available for this site.
MSC-16-06293	Water/CdV	2023	2	03/24/2023	Canceled: insufficient available water. Purged dry on 03/23/2023 and allowed to recharge overnight. Insufficient available water on 03/24/2023 (did not reach stabilization)
Surge bed monitoring well (16-612309)	Water/CdV	2022	4	08/13/2022	Canceled: site was dry; no field or analytical data will be available for this site
Surge bed monitoring well (16-612309)	Water/CdV	2023	2	03/18/2023	Canceled: site was dry; no field or analytical data will be available for this site

Table 4.0-1
RDX Mann-Kendall (M-K) Trend Analysis

Canyon	Location	M-K Test Statistic (S)	Critical Value (0.05)	Standard Deviation of S	Standardized Value of S	Approximate p-value	Concentration Trend
Cañon de Valle 1	CdV-16-02656	-319	-1.645	122.4	-2.597	0.0047	Decreasing
	CdV-16-02657r	—*	—	—	—	—	—
	SWSC Spring	-19	-1.645	37.86	0.475	0.317	None
	Burning Ground Spring	-143	-1.645	168.6	-0.842	0.2	None
Cañon de Valle 2	16-61439 (PRB Alluvial Seep)	19	0.153	16.36	1.1	0.136	None
	CdV-16-611923	51	0.07	33.1	1.511	0.0655	None
	CdV-16-611937	23	0.175	21.19	1.038	0.15	None
	Cañon de Valle below MDA P	-95	-1.645	98.87	-0.951	0.171	None
	CdV-16-02659	-694	-1.645	126.7	-5.469	2.26E-08	Decreasing
S-Site Canyon	Martin Spring	-432	-1.645	145.3	-2.967	0.0015	Decreasing
	MSC-16-06293	-9	0.271	12.5	-0.64	0.261	None
	MSC-16-06294	31	1.645	33.59	0.893	1.86E-01	None
Pajarito Canyon	Bulldog Spring	141	1.645	85.82	1.631	0.0514	None
	Pajarito below S&N Ancho E Basin Confluence	-78	-1.645	40.21	-1.915	0.0277	Decreasing
Water Canyon	Between E252 and Water at Beta	-45	-1.645	26.98	-1.631	0.0514	None
	Water at Beta	-19	0.165	15.55	-1.158	0.123	None
	FLC-16-25280	-12	0.089	8.083	-1.361	0.0868	None

Note: Analysis from January 2001 to March 2023.
* — = Not available.

Table 4.0-2
Barium Mann-Kendall (M-K) Trend Analysis

Canyon	Location	M-K Test Statistic (S)	Critical Value (0.05)	Standard Deviation of S	Standardized Value of S	Approximate p-value	Concentration Trend
Cañon de Valle 1	CdV-16-02656	-275	-1.645	105.6	-2.595	0.00474	Decreasing
	CdV-16-02657r	—*	—	—	—	—	—
	SWSC Spring	11	0.358	24.26	0.412	0.34	None
	Burning Ground Spring	596	1.645	149	3.992	3.27E-05	Increasing
Cañon de Valle 2	16-61439 (PRB Alluvial Seep)	15	0.218	16.36	0.856	0.196	None
	CdV-16-611923	-137	0	28.58	-4.758	9.77E-07	Decreasing
	CdV-16-611937	-33	0.083	22.19	-1.442	0.0746	None
	Cañon de Valle below MDA P	249	1.645	95.54	2.596	0.00472	Increasing
	CdV-16-02659	-480	-1.645	116	-4.129	1.82E-05	Decreasing
S-Site Canyon	Martin Spring	-412	-1.645	130.3	-3.154	8.04E-04	Decreasing
	MSC-16-06293	-3	0.46	9.539	-0.21	0.417	None
	MSC-16-06294	-55	-1.645	42.78	-1.262	0.103	None
Pajarito Canyon	Bulldog Spring	205	1.645	79.52	2.565	0.00515	Increasing
	Pajarito below S&N Ancho E Basin Confluence	73	1.645	42.81	1.682	0.0463	Increasing
Water Canyon	Between E252 and Water at Beta	20	1.645	53.31	0.356	0.361	None
	Water at Beta	-7	0.385	20.21	-0.297	0.383	None
	FLC-16-25280	5	0.281	6.658	0.601	0.274	None

Note: Analysis from January 2001 to March 2023.
* — = Not available.

Appendix A

Field Forms Associated with Sample Collection
(on CD included with this document)

Appendix B

Analytical Suites and Results
(on CD included with this document)

N3B RECORDS	
Media Information Page	
This is a placeholder page for a record that cannot be uploaded or would lose meaning or content if uploaded. The record can be requested through regdocs@em-la.doe.gov	
Document Date: 9/29/2023	**EM ID number:** 702917
Document Title: Appendix B 2023 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area	☒ **No restrictions** ☐ **UCNI** ☐ **Copyrighted**
Media type and quantity: 1 CD	**Software and version required to read media:** Adobe Acrobat 9.0
Other document numbers or notes: Files are too numerous and large to upload.	

Appendix C

Inspection Forms

Inspection Report
Corrective Measures at Consolidation Unit 16-021(c)-99

Date/Time: 1205
9/27/2022

Weather: Sunny Low 70s

Report Number: 10

Personnel: Ashley Kavaleuski
David Pelloux
Ashley Gasca

Low-Permeability Cap Inspection

	Yes	No	Comments
Is there evidence of new settlement?		X	
Is there evidence of cracking?		X	
Is there evidence of erosion/rutting?		X	
Is there evidence of ponding?		X	
Is there evidence of burrowing animals?		X	
Is there evidence of undesirable vegetative growth?		X	10+ of new grass growth on cap
Are the slopes adequate for surface water drainage?	X		
Is there evidence of soil movement/slope instability? (example: cracks in the soil running parallel to the slope or soil sloughing)		X	

Are there any additional conditions during the inspections that require attention?

Signature: AKavaleuski

N3B Los Alamos

Inspection Report
Corrective Measures at Consolidation Unit 16-021(c)-99

Date/Time: 4/12/2023
0920

Report Number: 11

Weather: overcast, 40s, breezy

Personnel: Ashley Kowalewski
Dave Pelloux
Caleb Craft
Tara Bessette

Low-Permeability Cap Inspection

	Yes	No	Comments
Is there evidence of new settlement?		✓	
Is there evidence of cracking?		✓	
Is there evidence of erosion/rutting?		✓	
Is there evidence of ponding?		✓	
Is there evidence of burrowing animals?		✓	
Is there evidence of undesirable vegetative growth?	✓		pulled 2 sapplings
Are the slopes adequate for surface water drainage?	✓		
Is there evidence of soil movement/slope instability? (example: cracks in the soil running parallel to the slope or soil sloughing)		✓	

Are there any additional conditions during the inspections that require attention?

Signature: Ashley Kowalewski

N3B Los Alamos

N3B Los Alamos

Work Order BMP-94885
Ind Permit BMP Insp & Maint
Printed 7/27/2023 - 4:05 PM (Duplicate Copy)

Maintenance Details

Requested: 8/1/2022 1:15:00 PM
Procedure: Post Storm Control Measures Inspection Form (N3B-SOP-ER-5002 CMI)
Last PM: 7/29/2022
Project: IP Rain Event on July 30, 2022 (P-BMP-6165)

Reason: IP Rain Event on July 30, 2022

Special Instructions: Route 4, V006-13-0006-177-CDV2-R11.

Target: 8/13/2022
Priority/Type: Normal / Inspection

IP
RG257
V006
CDV-SMA-2

Contact:
Phone:

Tasks

#	Description	Meas.	No	Yes
	CONTROL MEASURE REVIEW			
20	**Established Vegetation [V00602040013]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
30	**Established Vegetation [V00602040013]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
40	**Earthen Berm [V00603010006]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
50	**Earthen Berm [V00603010006]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
60	**Earthen Berm [V00603010007]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
70	**Earthen Berm [V00603010007]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
80	**Earthen Berm [V00603010008]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
90	**Earthen Berm [V00603010008]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
100	**Earthen Berm [V00603010009]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
110	**Earthen Berm [V00603010009]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
120	**Earthen Berm [V00603010010]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
130	**Earthen Berm [V00603010010]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
140	**Riprap [V00604060003]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
150	**Riprap [V00604060003]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
160	**Rock Check Dam [V00606010002]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
170	**Rock Check Dam [V00606010002]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
180	**Rock Cap [V00608020012]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
190	**Rock Cap [V00608020012]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
	MAP REVIEW			
210	Have you changed the location of a BMP on the Site Map?		X	
220	Have you ammended the Site Map in any other way?		X	
	SMA and SITE REVIEW			
240	Is there evidence of floatable waste, floatable garbage, or floatable debris within the SMA that could be discharged to receiving waters?		X	
250	Is there evidence of dust generation or evidence of off-site vehicle tracking of raw, final, or waste materials or sediments?		X	
260	Is there evidence of the introduction of raw, final, or waste material to the SMA?		X	
270	Has there been a significant increase in erosion potential at the SMA since the last inspection?		X	
280	**Industrial or sanitary wastewater treatment at 16-260 [16-021(C)]** Has there been an increase in erosion potential at the Site since the last inspection?		X	

Labor

Labor	Work Date	Reg Hrs	OT Hrs	Other Hrs
Jonathan Romero	8/11/2022	1	0	0
Wedgeworth, Zach	8/11/2022	1	0	0

Labor Report

Completed: 8/11/2022 6:25:00 AM

Report: 8/18/2022 - 184219: Corrected task 220 from unanswered to no per Jonathan Romero email.

Images

From: Jonathan Romero
To: Shannon M. Smith
Subject: [EXTERNAL] Corrections
Date: Thursday, August 18, 2022 8:43:24 AM

Hi Shannon. Here are the correct answer to fix the correction .

BMP-94885 I did not amend the sits map.
SMPLR-93556 -Sampler displayed sampler inhibited .

Thanks
Jonathan

N3B Los Alamos

Work Order BMP-99471
Ind Permit BMP Insp & Maint
Printed 7/27/2023 - 4:06 PM

Maintenance Details

Requested: 6/1/2023 10:37:00 AM
Procedure: Post Storm Control Measures Inspection Form (N3B-SOP-ER-5002 CMI)
Last PM: 8/11/2022
Project: IP Rain Event on May 31, 2023 (P-BMP-6204)

Target: 6/14/2023
Priority/Type: Normal / Inspection

IP
RG257
V006
CDV-SMA-2

Contact:
Phone:

Reason: IP Rain Event on May 31, 2023

Special Instructions: Route 4, V006-13-0006-177-CDV2-R11.

Tasks

#	Description	Meas.	No	Yes
	CONTROL MEASURE REVIEW			
20	**Established Vegetation [V00602040013]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
30	**Established Vegetation [V00602040013]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
40	**Earthen Berm [V00603010006]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
50	**Earthen Berm [V00603010006]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
60	**Earthen Berm [V00603010007]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
70	**Earthen Berm [V00603010007]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
80	**Earthen Berm [V00603010008]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
90	**Earthen Berm [V00603010008]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
100	**Earthen Berm [V00603010009]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
110	**Earthen Berm [V00603010009]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
120	**Earthen Berm [V00603010010]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
130	**Earthen Berm [V00603010010]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
140	**Riprap [V00604060003]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
150	**Riprap [V00604060003]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
160	**Rock Check Dam [V00606010002]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
170	**Rock Check Dam [V00606010002]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
180	**Rock Cap [V00608020012]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.			✓
190	**Rock Cap [V00608020012]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		X	
	MAP REVIEW			
210	Have you changed the location of a BMP on the Site Map?		X	
220	Have you ammended the Site Map in any other way?		X	
	SMA and SITE REVIEW			
240	Is there evidence of floatable waste, floatable garbage, or floatable debris within the SMA that could be discharged to receiving waters?		X	
250	Is there evidence of dust generation or evidence of off-site vehicle tracking of raw, final, or waste materials or sediments?		X	
260	Is there evidence of the introduction of raw, final, or waste material to the SMA?		X	
270	Has there been a significant increase in erosion potential at the SMA since the last inspection?		X	
280	**Industrial or sanitary wastewater treatment at 16-260 [16-021(C)]** Has there been an increase in erosion potential at the Site since the last inspection?		X	

Labor

Labor	Work Date	Reg Hrs	OT Hrs	Other Hrs
Chavez, Dillon	6/7/2023	1	0	0
Shendo, Maurice	6/7/2023	1	0	0

Labor Report

Completed: 6/7/2023 12:10:00 PM

Report:

Images

Appendix D

Surge Bed Monitoring Well Transducer Data
(on CD included with this document)

N3B RECORDS	
Media Information Page	
This is a placeholder page for a record that cannot be uploaded or would lose meaning or content if uploaded. The record can be requested through regdocs@em-la.doe.gov	
Document Date: 9/29/2023	**EM ID number:** 702917
Document Title: Appendix D 2023 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area	☒ **No restrictions** ☐ **UCNI** ☐ **Copyrighted**
Media type and quantity: 1 CD	**Software and version required to read media:** Adobe Acrobat 9.0
Other document numbers or notes: Files are too numerous and large to upload.	

Appendix E

Mann-Kendall Trend Analysis

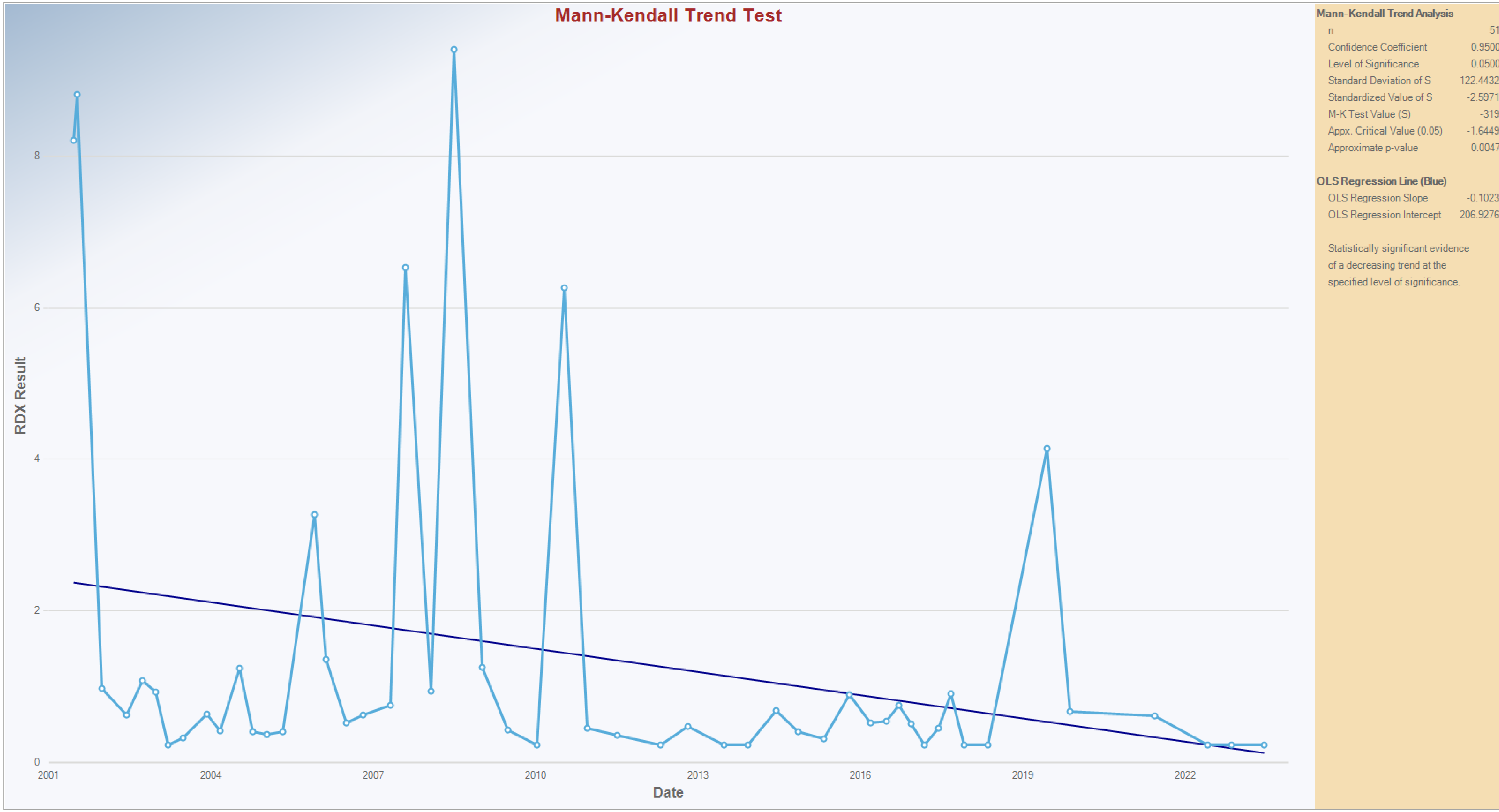


Figure E-1 RDX results for CdV-16-02656

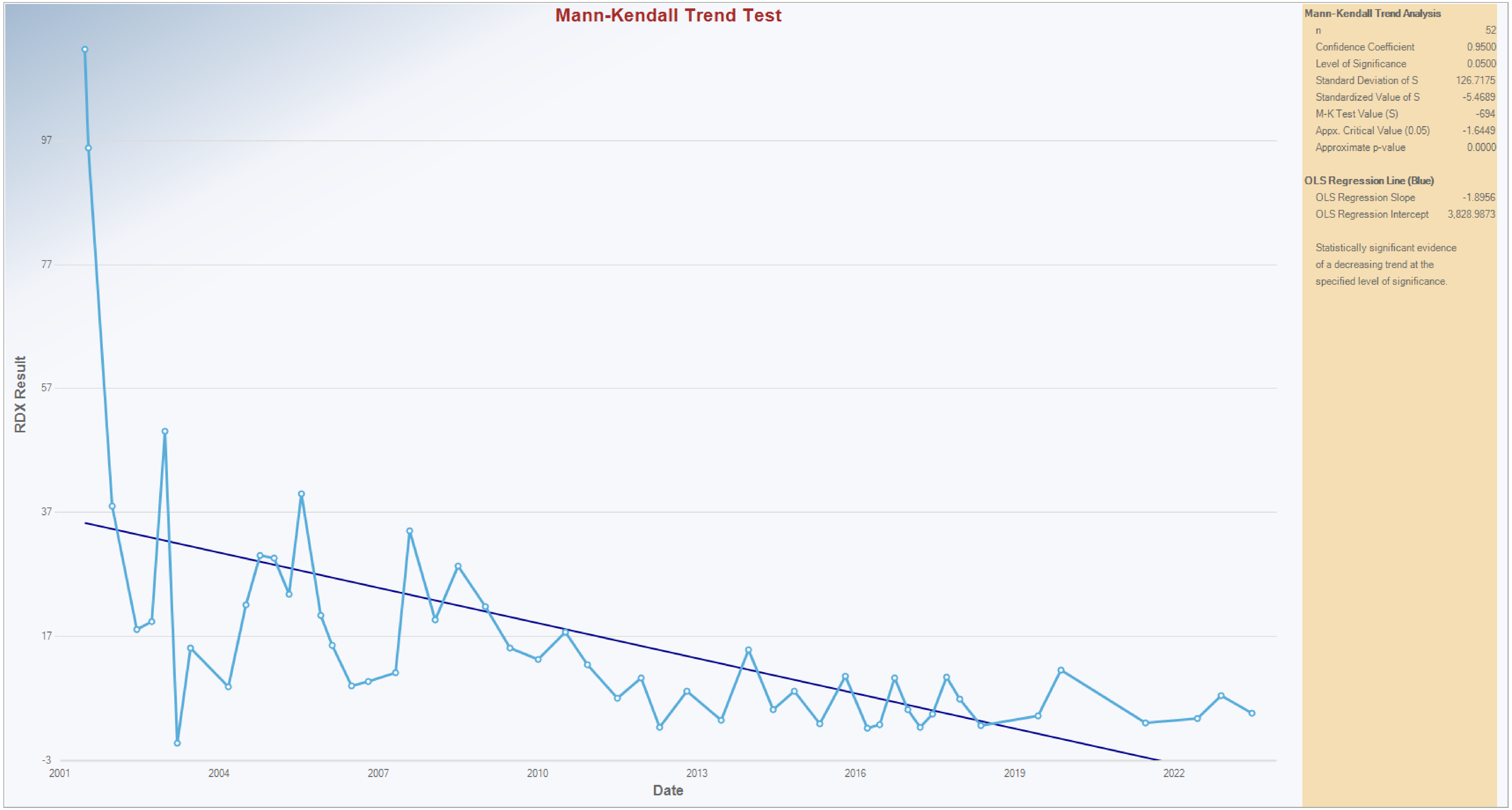


Figure E-2 **RDX results for CdV-16-02659**

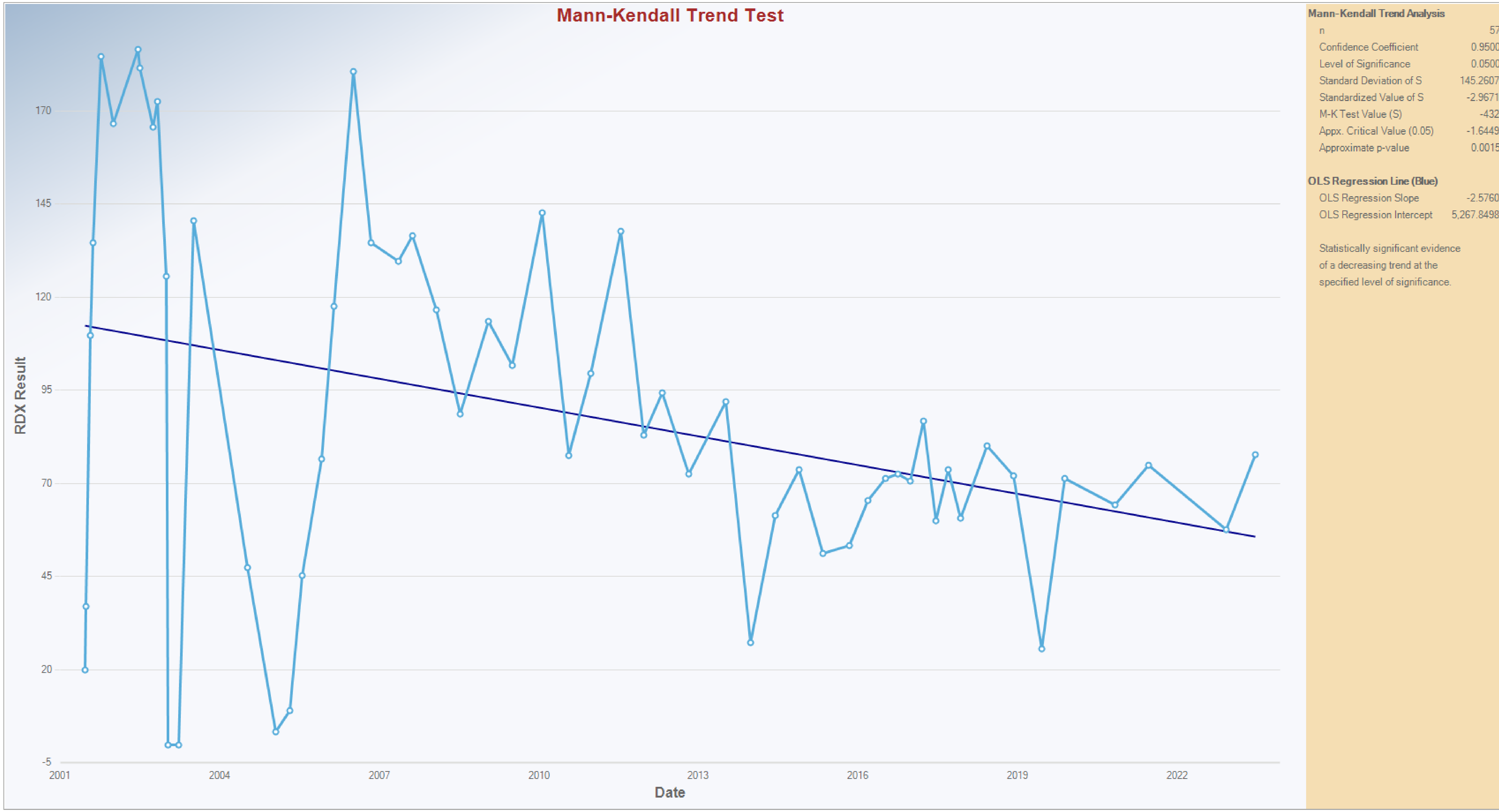


Figure E-3 **RDX results for Martin Spring**

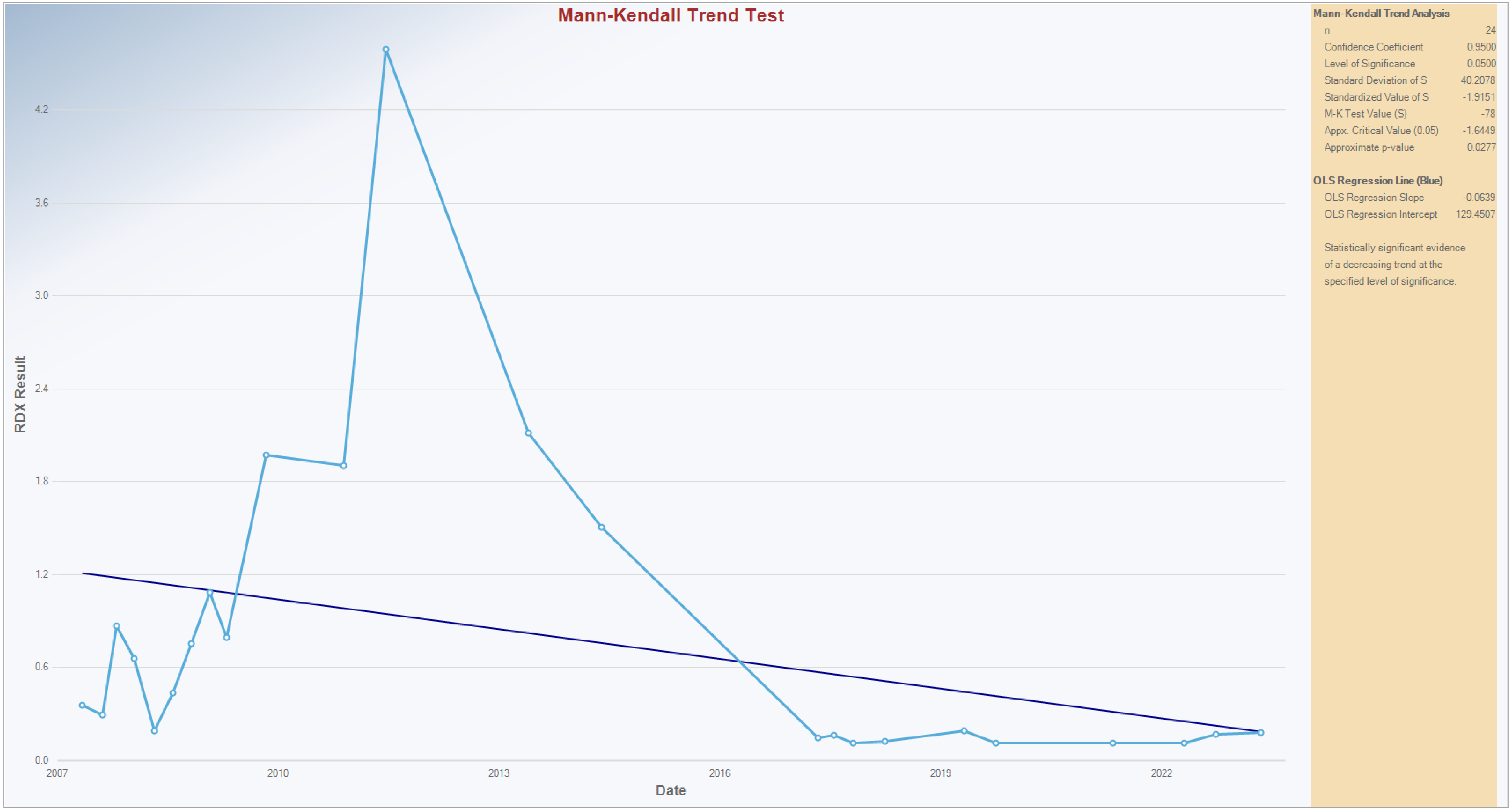


Figure E-4 RDX results for Pajarito below S&N Ancho East Basin Confluence

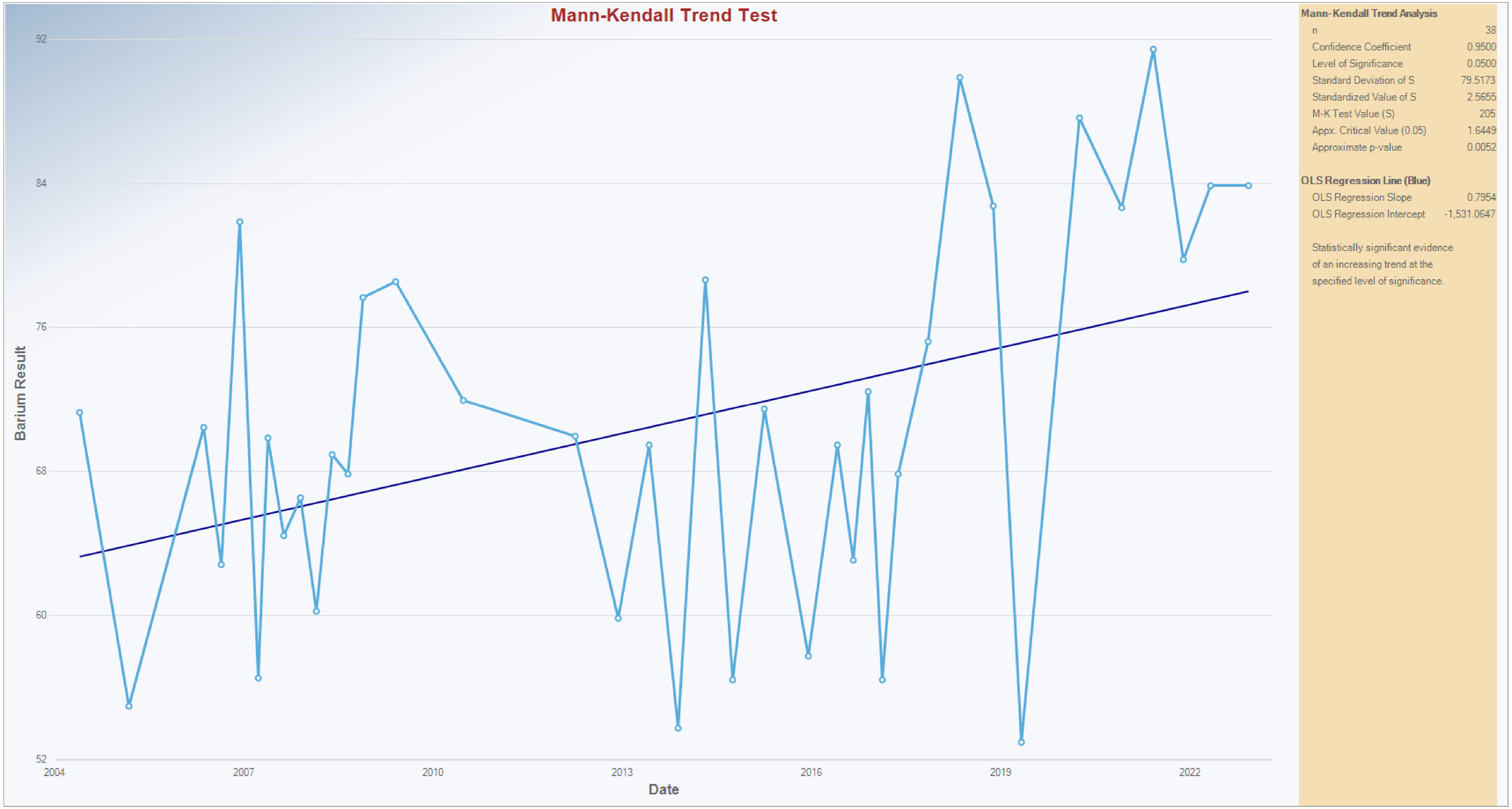


Figure E-5 Barium results for Bulldog Spring

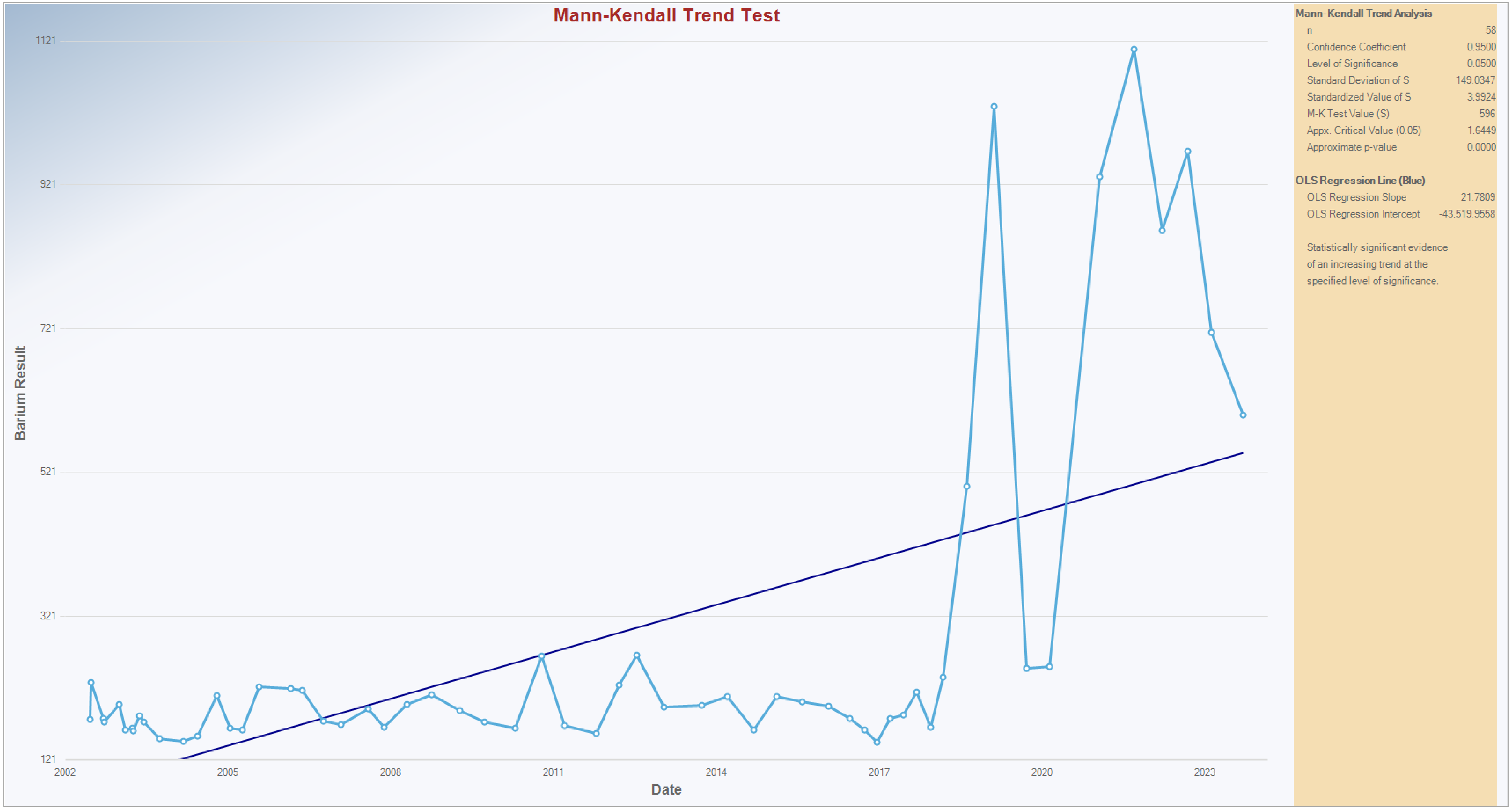


Figure E-6 Barium results for Burning Ground Spring

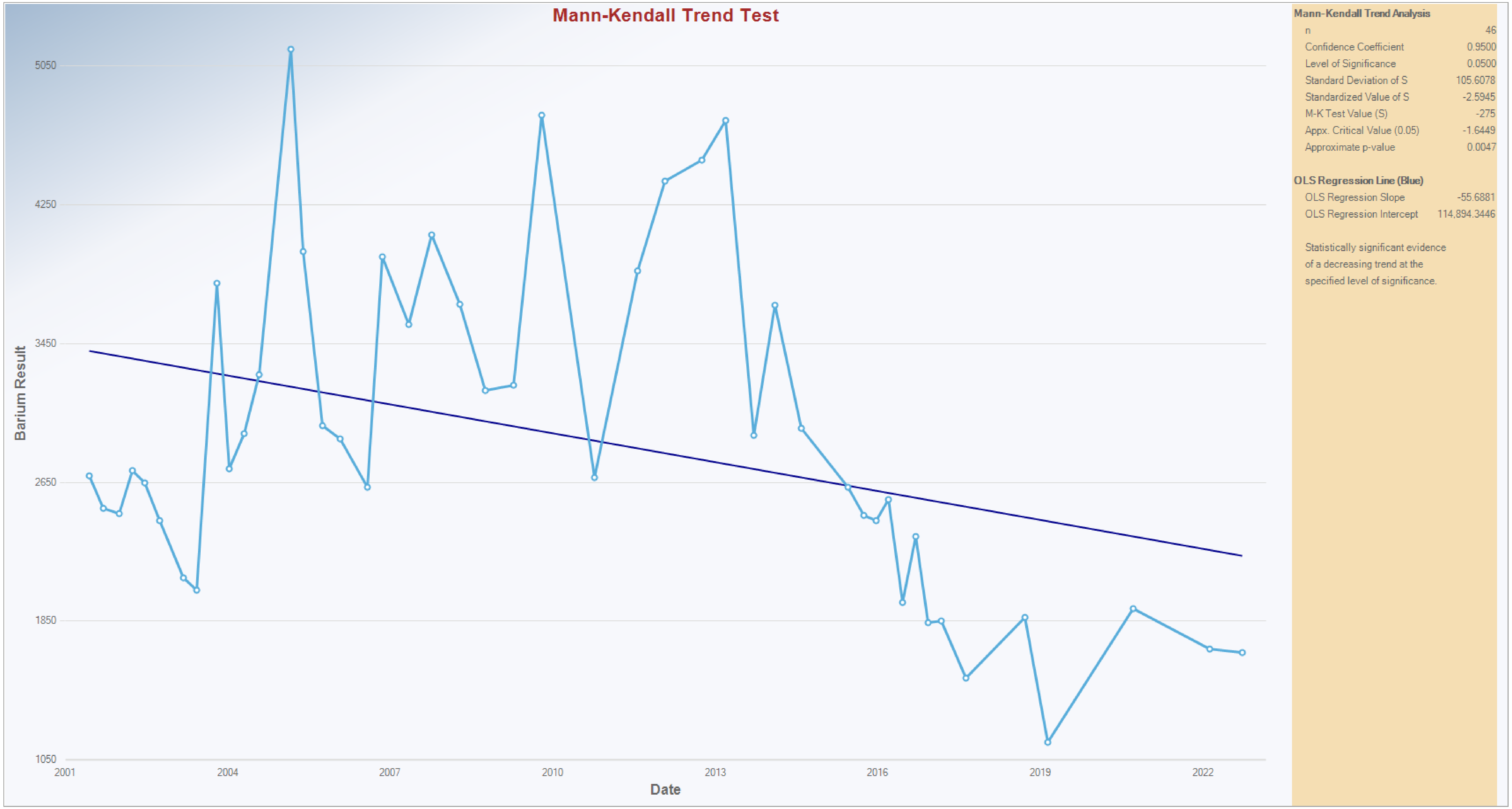


Figure E-7 **Barium results for CdV-16-02656**

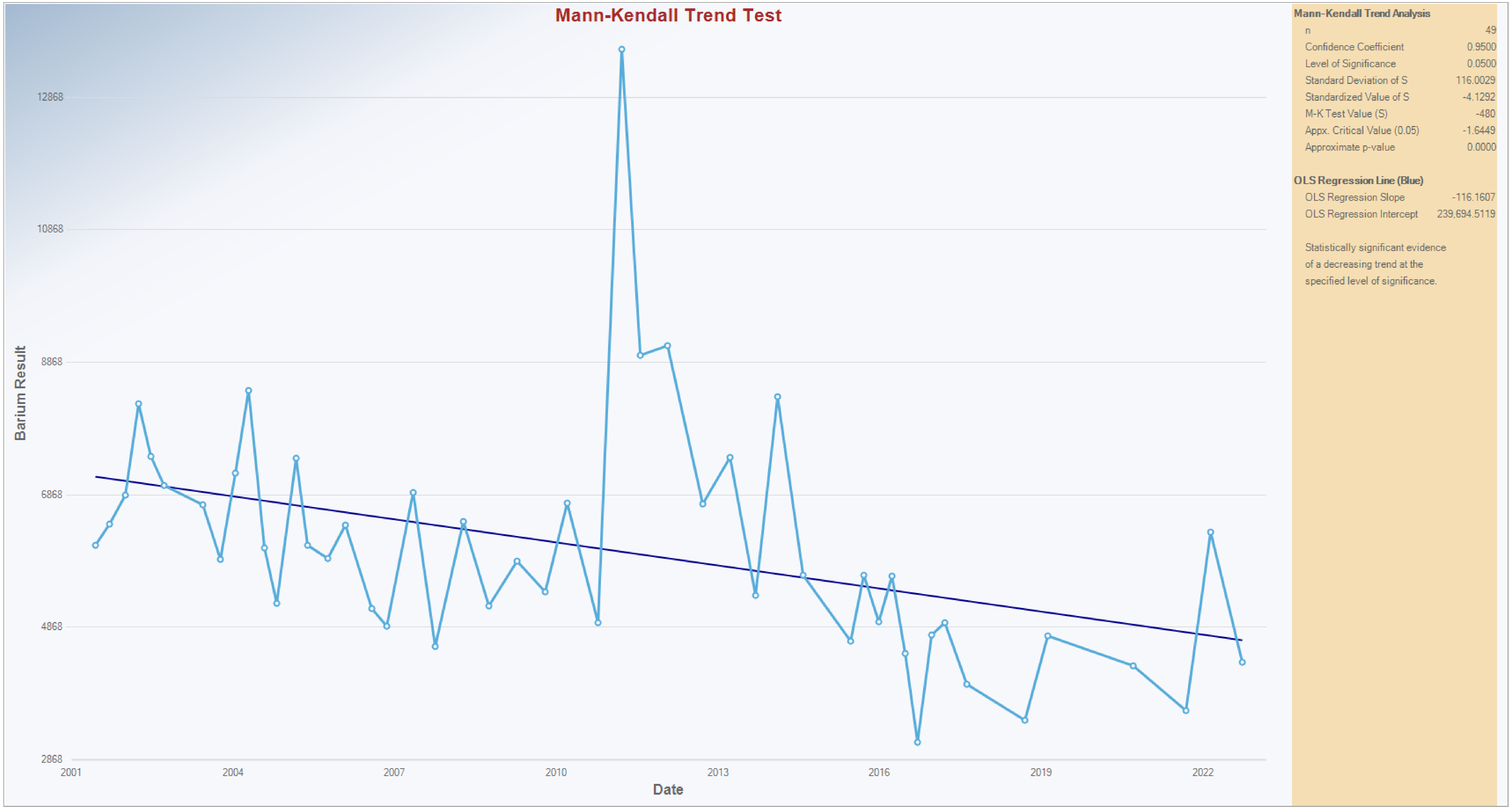


Figure E-8 Barium results for CdV-16-02659

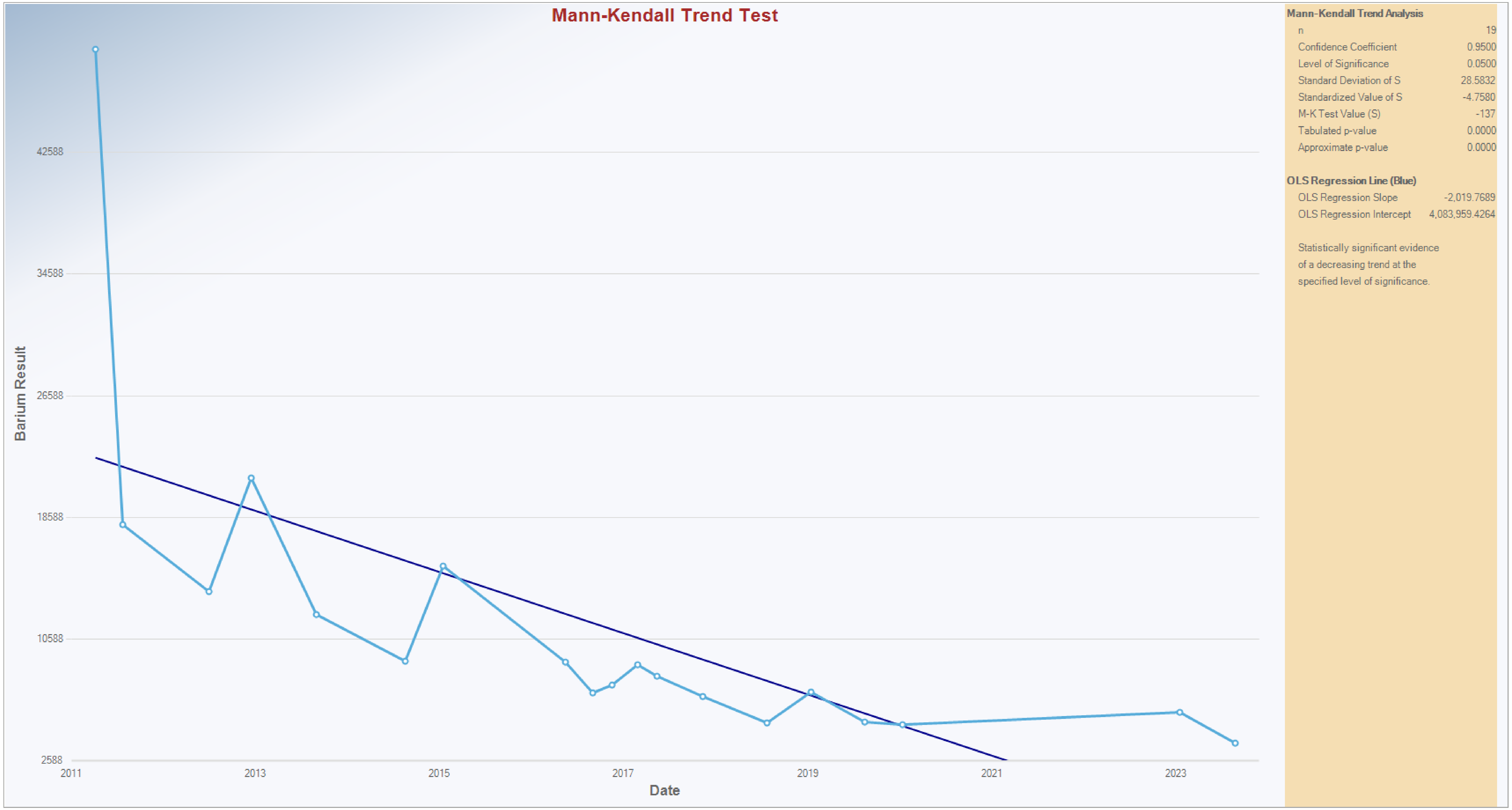


Figure E-9 Barium results for CdV-16-611923

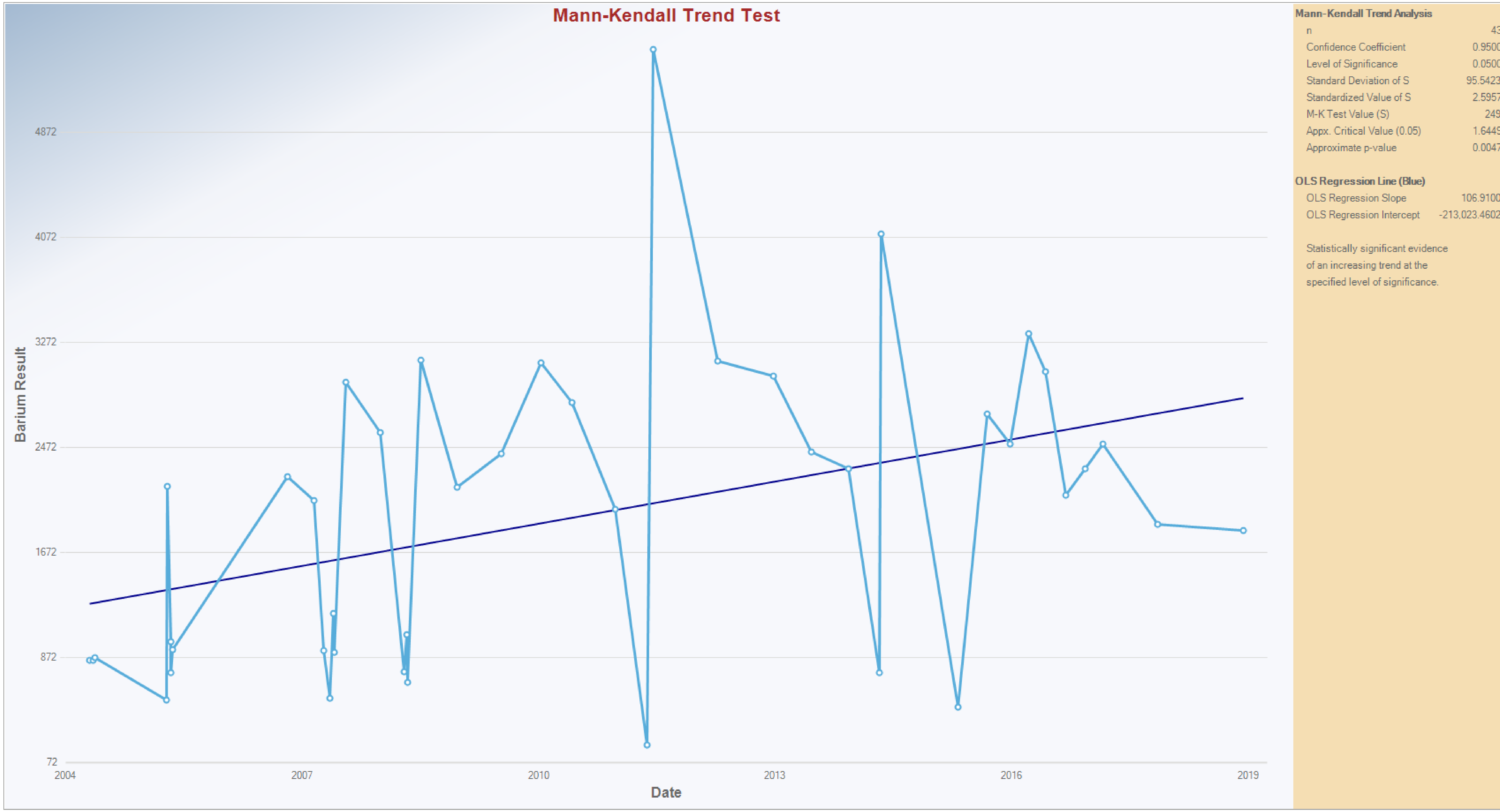


Figure E-10 Barium results for Cañon de Valle best management practice

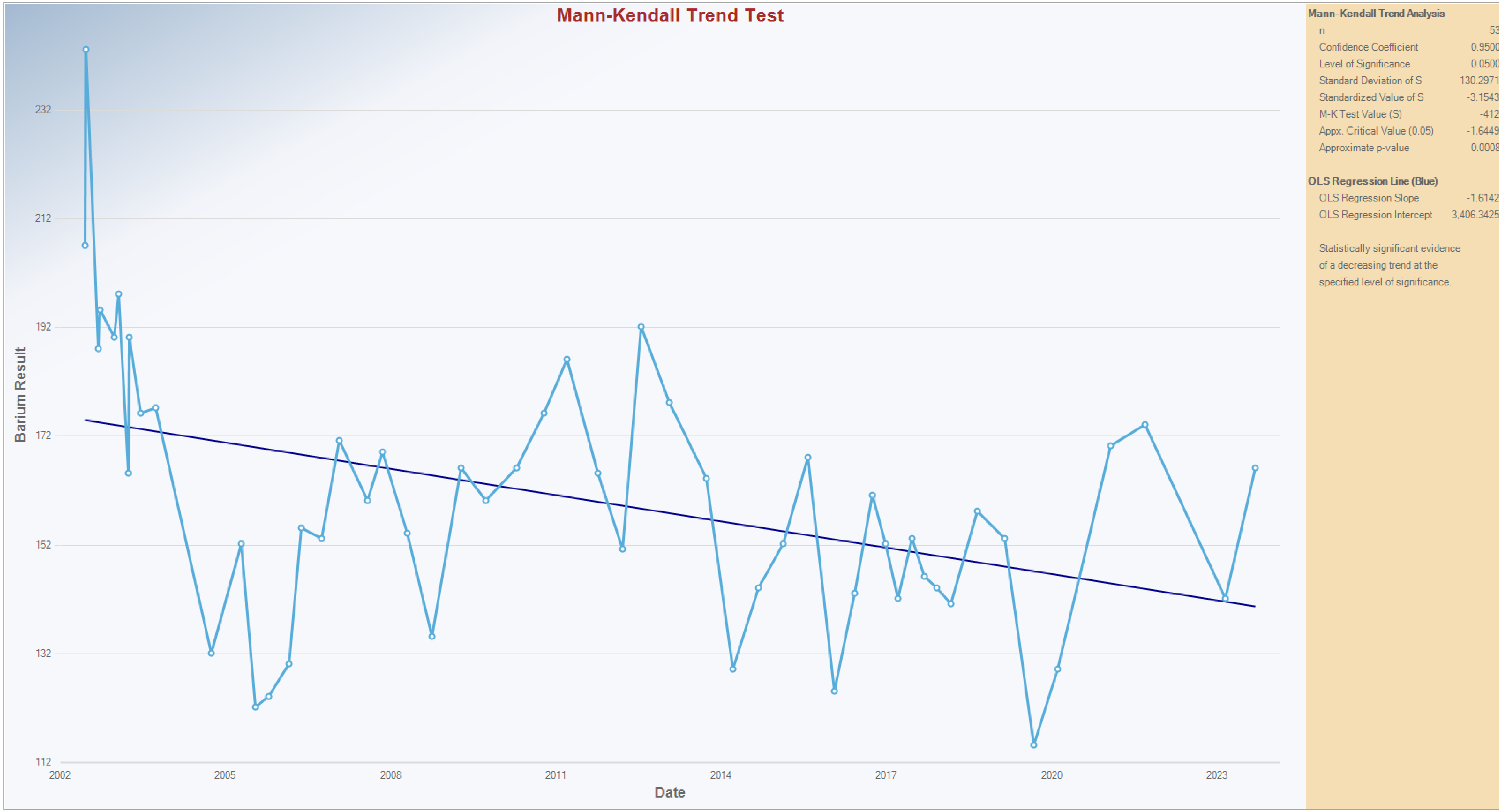


Figure E-11 Barium results for Martin Spring

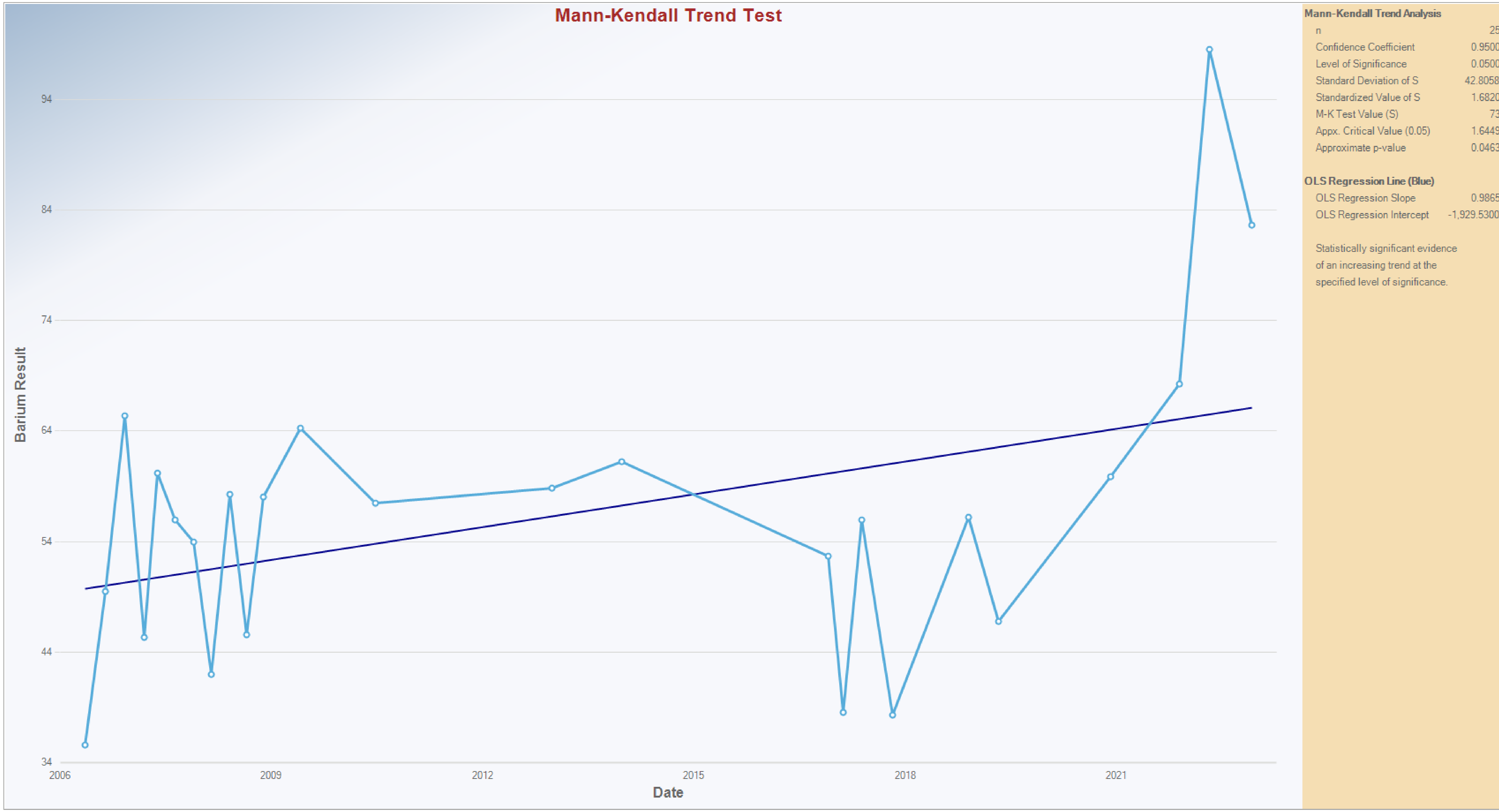


Figure E-12 Barium results for Pajarito below S&N Ancho East Basin Confluence

Path: Q:\14-Projects\14-0080\mxd\other_rdx_plates\map_14-0080-52_canon_de_valle_RDX_july_2023.mxd

Path: Q:\14-Projects\14-0080\mxd\RDX_barium_2023\map_14-0080-51A_canon_de_valle_barium_july_2023.mxd