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December 11, 2025

Jacob Mulinex and Christy Luciani, McKinley Mine Team Leaders
USDI- Office of Surface Mining Reclamation and Enforcement
P.O. Box 25065
Denver, CO 80225-0065

via email:
jmulinex@osmre.gov
cluciani@osmre.gov

Re: McKinley Mine
Permit No. NM-0001K
Vegetation Management Unit 8 Final Bond Release and Liability Release & Termination of Jurisdiction Application

Dear Mr. Mulinex and Ms. Luciani:

Enclosed for OSMRE review is an application for final bond release on Permanent Program lands and full reclamation liability release and termination of jurisdiction on Prelaw lands and Initial Program lands in Vegetation Management Unit 8. There are approximately 794 acres associated with this application. CMI requests OSMRE's review and comment on the completeness and content of this application package to ensure that all necessary information is contained in the application document.

The submittal of the document on this date will be transmitted via the OSMRE SharePoint transfer to download the documents referred to above. If you have any questions regarding this submittal, please contact me at (575) 585-7639 or Kyle Kutter at (314) 984-8800.

Sincerely,

Armando Martinez
McKinley Mine – Remediation Ops Specialist
CEMREC

Kyle Kutter, P.E.
Assistant Vice President
WSP USA, Inc

McKinley Mine Permit No. NM-0001K
Vegetation Management Unit 8
Application for a Permanent Program Final Bond Release and
Pre-SMCRA Reclamation Liability Release & Termination of Jurisdiction

Submitted to: The Office of Surface Mining Reclamation and Enforcement
Western Region Office
P.O. Box 25065
Denver, Colorado 80225-0065

Submitted by: Chevron Environmental Management Company
On behalf of Chevron Mining Inc.
6001 Bollinger Canyon Road, C-2144
San Ramon, CA 94583-2324

Prepared by: WSP USA, Inc.1
701 Emerson Road, Suite 250
Creve Coeur, Missouri, 63141

Date: December 11, 2025

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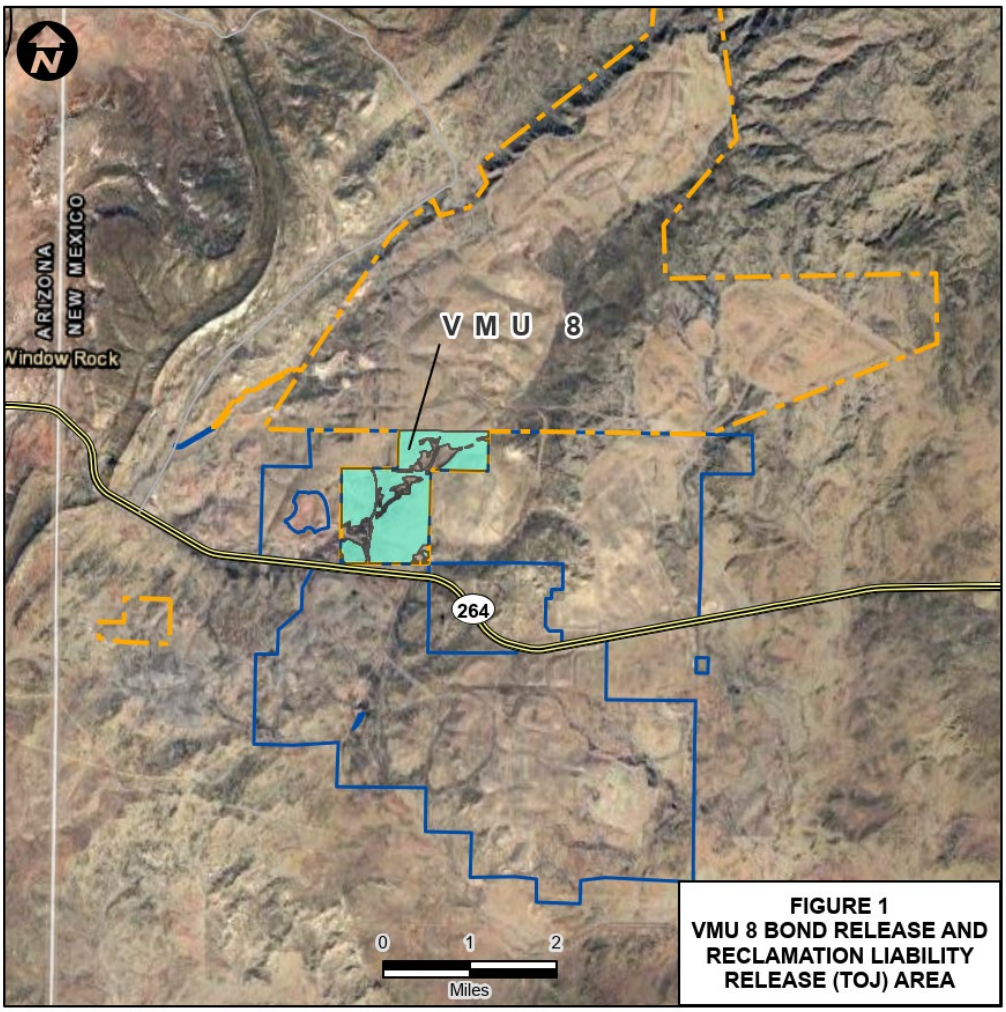
1.0 Overview

On behalf of Chevron Mining Inc. (CMI), the Chevron Environmental Management Company (CEMC) hereby submits this application for a Phase III bond release of Permanent Program Lands (PPL) and a reclamation liability release and termination of jurisdiction (TOJ) of Prelaw Lands (PLL) and Initial Program Lands (IPL) for reclaimed lands in Vegetation Management Unit 8 (VMU 8). The application includes a request for 0.6 acres of Phase I, II and III bond release on one Permanent Impoundment (PI). The associated performance bond reduction for VMU 8 requested in this application is $1,202,000, as discussed in Section 12 of this document.

The lands are generally located in former mining Areas 1 and 10 of the McKinley Mine. Figure 1 shows the location and configuration of VMU 8. Section 3.0 references more detailed exhibits showing the configurations of the VMU.

Figure 1: General Location of VMU 8



The McKinley Mine is permitted under Permit NM-0001K (the Permit). The McKinley Mine permittee is CMI (formerly the Pittsburg and Midway Coal Mining Co. [P&M]).

This application addresses bond release requirements under 30 CFR 800.40 (c) (3) and the Office of Surface Mining, Reclamation, and Enforcement's (OSMRE's) Permanent Program Phase III bond release guidance provided in the following document, "Guideline to Bond Release Procedures for Permanent Program Lands, Indian Programs Branch, Western Region (OSMRE Bond Release Guideline) (OSMRE 2017)".

The application demonstrates that the plant community is moving toward a desired successional trajectory to meet the intended postmining land use per 30 CFR 816.111 and the currently approved Permit. Reclamation was completed in conformance with the performance standards in place at the time for the PLL, 30 CFR 715 for IPL, and 30 CFR 816 and the PPL permit for PPL. The PPL reclamation also meets all applicable requirements of the performance standards in 30 CFR Part 810 through 828.

VMU 8 combines PLL, IPL, and PPL in accordance with Section 6.5.1.2 of the Permit, and together as one logical unit must meet the Permit revegetation success standards, which they do, as discussed in this application. The lands constitute a bond release block as described in the OSMRE Bond Release Guideline. The period of extended responsibility of ten years for the PPL has been met in accordance with 30 CFR 816.116. Furthermore, this application contains information that demonstrates revegetation success has been met on PPL in any two years following Year 6 of the responsibility period, which for this VMU is 2023 and 2024, as required by the OSMRE Bond Release Guidance.

The IPL has been revegetated for decades well beyond the minimum two growing seasons for cover called for in 30 CFR 715.20 (f). The majority of PLL were reclaimed decades ago, with recent rework done in the CDK valley and highwall areas as discussed in Section 4.0 and 12.0. The application has been organized to cohesively address PLL, IPL, and PPL application requirements as much as possible. The application follows this order of information: 2.0 Application Certification, 3.0 VMU 8 Location and Regulatory Acreages, 4.0 Brief History, 5.0 Access Roads, 6.0 Surface and Subsurface Water, 7.0 Erosion and Sediment Control, 8.0 Postmining Water-Containment Structures, 9.0 Postmining Land Use, 10. Revegetation, 11.0 Wildlife Habitat Enhancements, 12.0 Performance Bond, 13.0 Landowner Notification, 14.0 Newspaper Advertisement. Section 15.0 Supplemental Information for PLL and IPL; this section includes information to make the reclamation liability release and TOJ IPL application complete.

2.0 Application Certification

An executed Application Certification is contained in Appendix A1, which certifies that all applicable reclamation activities have been completed in VMU 8 that are necessary for a Phase I, II and III for the impoundments, a Phase III bond release of the rest of the PPL, and a full reclamation liability release and TOJ of the PLL and IPL. The document also states that these activities were done in accordance with applicable mine permits, reclamation requirements, and regulations, and consistent with the intent of the Surface Mining Control and Reclamation Act of 1977. The Application certification includes a statement that there are no outstanding violations or cessation orders for the lands contained in this Application.

3.0 VMU 8 Location and Regulatory Acreages

VMU 8 consists of 794 acres of land, located on leased Navajo Nation fee lands in Section 5, T16N, R20W, and Section 33, T17N, R20W (Sections 5 and 33). The approximate center of VMU 8 is Latitude 35.6496 N, Longitude -108.9771 W.

VMU 8, which consists of PLL, IPL, and PPL is shown on Exhibit E1. Minor adjustments were made to the initial VMU 8 boundary to develop a logical release boundary defined by the disturbance limits. Exhibit E2 shows the location of VMU 8 relative to the other McKinley Mine VMUs. Table T1 shows the VMU 8 acreage by regulatory category.

Table T1: VMU 8 by Regulatory Category (in acres).

Prelaw Lands	157.7
Initial Program Lands	132.8
Permanent Program Lands	503.5
VMU 8 Total Acres	794.0
One Permanent Impoundment (Included in Permanent Program Lands acreage above)	0.6

A USGS 7.5 Minute Quadrangle map (from the Tse Bonita School Quadrangle) with the boundaries of VMU 8 depicted on it is provided on Exhibit E3.

4.0 Brief History

This VMU 8 configuration is primarily based on the footprint from the September 30, 2020 Phase I and II bond release application on PPL approved through OSMRE correspondence dated September 30, 2022. That footprint was expanded in this application to include PLL and IPL in Sections 5 and 33, which are part of VMU 8.

There was a previous application for Termination of Jurisdiction and Reclamation Liability Release on the PLL or IPL dated August 14, 1994 (final revised application date) (1994 TOJ Application), and approved by the New Mexico Mining and Minerals Division (MMD) December 15, 1994, when these lands were under MMD jurisdiction (See Appendix A2). The Section 5 and 33 lands were later designated as Indian Lands and subject to OSMRE authority under SMCRA and still requiring OSMRE TOJ.

Exhibit E4 shows the VMU 8 boundary superimposed over the previous Phase I and II bond release application. Exhibit E4 shows the one impoundment included in this Package.

Primary mining was done by dragline in Area 10, which proceeded from Tse Bonita Wash toward the southeast. Mining area 1 was primarily mined by truck/shovel/loader operations. The various reclamation phases through seeding were conducted contemporaneously with mining activities.

5.0 Access Roads

The Navajo Nation requested that two-track trails be the primary access for the postmining land users. Section 5.1.5 and 5.6.3.7 in the Permit contain details regarding configurations for the postmining road system in accordance with the Navajo Nation request. Annual updates to the currently active road system shown on Exhibit 5.1-4 are submitted to OSMRE for incorporation into the Permit. Exhibit 5.1-4, dated March 27, 2024, was used as the source of the road locations for the final postmining primary road system provided in this application. Exhibit E5 shows the final postmining primary road network in and around VMU 8 and which ones are in this bond release application. The location of the primary road network within VMU 8 has been certified by a Professional Engineer.

6.0 Surface and Subsurface Water

This section provides information regarding impacts to surface and subsurface water by lands in VMU 8. The VMU 8 lands are reclaimed and revegetated such that they are not contributing total suspended solids to streamflow or runoff outside the permit area. A detailed analysis is provided in Appendix A3, which also includes information on ground water. The data will also show that there is no alkaline or acid drainage coming from the reclaimed land.

Sedimentology and NPDES Outfalls

As stated in Section 5.7.4.3 of the Permit, extensive sediment-yield analyses have been done throughout the mine through paired watershed sampling and modelling that all demonstrated acceptable sediment yields for various reclaimed-land scenarios.

All outfalls at McKinley Mine are categorized under the EPA NPDES Western Alkaline Coal Mining (reclamation areas) standards, which focus on a sediment control plan (SCP) supported by modeling built around attaining sediment discharge levels that do not exceed pre-mining conditions. The primary attainment mechanism is monitoring of and compliance with Best Management Practices (BMPs). The BMPs for the reclaimed areas include the reconstructed landforms, the hydrologic structures (including terraces and down-drains, and armored channels), seeding and mulching, and revegetation. These BMPs are further augmented by the application of rock mulch in zones prone to higher levels of sheet erosion. Compliance is verified through collection of water monitoring data from outfall discharges and field inspections of the BMPs.

The NPDES outfalls associated with VMU 8 can be found in Table T2 below. The locations are shown on Exhibit 6.1-1 in Appendix A4 and on Figure 2-1 In Appendix A3.

Table T2: VMU 8 NPDES Outfalls

018/CH 2.14	027/DC 10-1	083/DC 10-33
019/DC 2-5	028/DC 10-2	084/DC 10-34
020/DC 10-17	031/DC 10-10	085/DS-1
021/DC 10-6	032/DC 10-27	086/DS-2
022/CD 10-3	065/DC 17	087/DS-3
023/CD 1-5	076/DC 26	088/DS-4
024/DC 2	077/DC 10-30	089/DS-5
024/DC 2	081/DC 28	090/DS-6
026/CH 10-29	082/DC 10-32	091/CH 2-11

7.0 Erosion Control and Maintenance

Maintenance of structures and erosion has been conducted regularly during the liability period. Disturbance associated with the maintenance work was seeded and mulched.

8.0 Postmining Water-Containment Structures

This Section contains support information for the design and function of Permanent Impoundments. There are no Reclamation Channel Pools (RCPS), or Small Depressions (SDs), in VMU 8 that had been identified specifically for wildlife, although there are likely some unnamed SDs. Information regarding wildlife enhancements for these structures is provided in the Wildlife Habitat Enhancements Section of this Application.

Permanent Impoundments

The Navajo Nation requested that as many impoundments as possible be retained for the postmining land use (See Permit Appendix 5.6-B). To that end, VMU 8 has one Permanent Impoundment in this application, Impoundment CDK. This impoundment has been approved for retention by OSMRE and meets the requirements of 30 CFR 816.49 and the Permit.

This impoundment was not included in Phase I or II applications since the impoundment was still temporary at the time. It is included in this application for Phase I, II and III bond release. The location of this impoundment may be found in Exhibit E6.

Impoundment Design and Construction

This Permanent Impoundment was designed to be adequate for their intended use, and the water level will be sufficiently stable and capable of supporting grazing and wildlife, as discussed in Permit Section 5.7.3.4. This impoundment has historically been used to store water from Gallup Sandstone Aquifer Well No. 3. Professional Engineer certified as-built drawings of the impoundments were submitted to OSMRE for incorporation into Permit Appendix 5.7-B.

The impoundment was last inspected on May 16, 2025, and an impoundment report for the structure was certified on June 20, 2025. The volume measured on May 16, 2025, are provided in Table T3, which includes the average annual 10-year annual capacity loss from sedimentation.

As previously discussed, after the regraded area was returned to the required contour a sediment yield analysis was completed. This analysis demonstrated that the average annual sediment yield of reclaimed lands was less than the sediment yield levels from pre-mined undisturbed conditions, meaning the impoundment would no longer be required for sediment control. Over time, the impoundment will continue to accumulate sediment and may even silt in completely.

A minimum impoundment capacity is no longer required, because the annual average sediment yield is less than the sediment yield levels from pre-mined undisturbed conditions. The Permanent Impoundment As-Built Design assumes a worst-case scenario in which the structure is silted into the spillway crest to demonstrate the spillway is still able to safely pass the 25-year, 6-hour discharge event. This discharge event was selected for this watershed since this impoundment does not meet size requirements of Class B or C criteria for dams in the U.S. Department of Agriculture Soil Conservation Service (SCS) Technical Release Number 60 (TR-60) or meet or exceed the size or other criteria of 30 CFR 77.216(a).

The Permanent Impoundment provides a water resource for livestock and wildlife in their current condition, and at minimum will function in the post-mining landscape as a wildlife enhancement feature to complement the approved wildlife habitat post-mining land use. After the watershed area is reclaimed and released, it is recognized that cleanout of sediment and organic material is no longer necessary; the postmining land user; however, may continue maintenance, so the structure provides long-term livestock watering.

Table T3: Permanent Impoundment Summary

Impoundment	Volume (Ac-Ft)	Average Annual Capacity Loss (Ac-Ft)
CDK	2.97	0.065

Impoundment Water Quality

The requirements for impoundment water quality may be found under 30 CFR 816.49 (b)(2). As discussed in Permit Section 5.6.3.4.3 Permanent Impoundment Water Quality, it was demonstrated that the water quality in these impoundments met the applicable water-quality standards for livestock watering.

Impoundment Riparian PATFM

Permit section 5.3.5.12 requires that Permanent Impoundments built on spoil have the spoil tested to confirm the soil materials are not detrimental to riparian plant establishment. These requirements do not apply to Impoundment CDK since it was not built on spoil material. Permit section 5.3.5.12 includes a Technical Report entitled Riparian PATFM Assessment dated 6/4/25 in Appendix 5.3-B that documents this status of Impoundment CDK. The narrative from that report has been included in Appendix A5.

Small Depressions

Some minor small depressions may exist in VMU 8 that were not necessary to locate and identify on an exhibit for this application. In accordance with 30 CFR 816.102 (h), however, such small depressions would be compatible with the postmining land use, not restrict normal access or constitute a hazard, conserve soil moisture, and promote revegetation and landscape diversity.

9.0 Postmining Land Use

The IPL were reclaimed to rangeland for grazing, and the PPL have been reclaimed to a grazing and wildlife habitat postmining land use. PLL revegetation is also consistent with a rangeland postmining land use. As discussed below, PLL, IPL, and PPL together as one unit meet the revegetation success standards and are suitable for grazing and wildlife habitat.

10.0 Revegetation

Standard revegetation practices were followed as part of final reclamation. The seedbed was prepared by plowing, scarifying, or ripping the soil. Seeding was done using various implements that drilled and/or broadcast the seed. After the seeding, hay, or straw mulch, was applied at a rate of about two tons per acre. The mulch was anchored into the cover with a tractor-drawn straight coulter disc. The approved seed mixes used at McKinley have varied over time but included both introduced and native warm-season grasses, cool-season grasses, forbs, and shrubs. More detail by regulatory category (IPL, PL, or PPL) follows in the next two subsections.

PPL Revegetation

Final seeding was conducted after topdressing was applied. Most of the PPL lands were initially seeded from 1986-2014, with some small parcels done after that period. Over the years, there have been several interseeding areas to strengthen vegetation on land that had been previously seeded. There was other reseeding or interseeding activities for areas that required erosion repair or to support vegetation establishment. Seeding, reseeding, and interseeding activities are shown on Exhibit E7.

The permanent seed mix shown in Table T4 (Table 5.5-3 of the Permit) below was the primary seed mix used based on the availability of the species listed. CMI worked with the seed supplier to substitute comparable species for unavailable seeds.

Table T4: Permanent Program Seed Mix

Common Name - Scientific Name	Bulk Total Mix % by WT	Bulk SubMix % by WT	Bulk Appl Rate Lbs/Ac	# Total Seeds/Lb	Bulk Appl Rate Seeds/Ac	% Purity	% Germination	Appl Rate PLS/Sq-Ft	Mix % by PLS/Sq-Ft	Application Rates & Mix% by PLS/sq-ft									
										Warm Season Grasses		Cool Season Grasses		Brush & Shrub		Forb/Legume Native		Forb/Legume Introduced	
DRILL SUBMIX																			
Western wheatgrass - Agropyron smithii	1.9%	3.7%	0.37	110,000	40,810	0.91	0.92	0.8	2.1%			0.8	2.1%						
Thickspike wheatgrass - Agropyron dasystachyum	1.3%	2.6%	0.26	154,000	39,270	0.97	0.87	0.8	2.0%			0.8	2.0%						
Streambank wheatgrass - Agropyron riparium	1.5%	3.0%	0.30	156,000	46,800	0.92	0.77	0.8	2.0%			0.8	2.0%						
Mountain brome - Bromus marginatus	2.1%	4.2%	0.42	90,000	37,800	0.91	0.99	0.8	2.1%			0.8	2.1%						
Arizona fescue - Fituca arizonica	0.4%	0.8%	0.08	550,000	41,250	0.84	0.95	0.8	2.0%			0.8	2.0%						
Indian ricegrass - Oryzopsis hymenoides	2.6%	5.3%	0.53	141,000	74,025	0.96	1.00	1.6	4.3%			1.6	4.3%						
Sandberg bluegrass - Poa sandbergii	0.2%	0.4%	0.04	925,000	37,000	0.84	0.97	0.7	1.8%			0.7	1.8%						
Needle and Thread - Stipa comata	3.4%	6.8%	0.68	115,000	77,625	0.95	0.96	1.6	4.3%			1.6	4.3%						
Fourwing saltbush - Atriplex canescens	4.8%	9.5%	0.95	52,000	49,400	0.59	0.98	0.7	1.7%					0.7	1.7%				
Shadscale - Atriplex confertifolia	4.3%	8.7%	0.87	65,000	56,225	0.80	0.97	1.0	2.6%					1.0	2.6%				
Mat saltbush - Atriplex corrugata	4.2%	8.4%	0.84	60,000	50,400	0.60	0.94	0.7	1.7%					0.7	1.7%				
Trident saltbush - Atriplex tridentata	2.7%	5.3%	0.53	111,500	59,541	0.50	0.96	0.7	1.7%					0.7	1.7%				
Antelope bitterbrush - Purshia tridentata	19.7%	39.5%	3.95	15,000	59,175	0.93	1.00	1.3	3.3%					1.3	3.3%				
Blueflax - Linum lewisii	0.5%	1.0%	0.10	293,000	29,300	0.88	1.00	0.6	1.6%							0.6	1.6%		
Palmers penstemon - Penstemon palmeri	0.2%	0.4%	0.04	610,000	24,400	0.99	0.85	0.5	1.2%							0.5	1.2%		
Rocky Mtn. penstemon - Penstemon strictus	0.3%	0.5%	0.05	592,000	29,600	0.87	0.97	0.6	1.5%							0.6	1.5%		
Black-eyed susan - Rudbeckia hirta	0.1%	0.2%	0.02	1,710,000	25,650	0.94	1.00	0.6	1.5%							0.6	1.5%		
SUBMIX TOTAL	50.0%	100.0%			778,271			14.2	37.6%	0.0	0.0%	7.8	20.7%	4.2	11.2%	2.2	5.8%	0.0	0.0%
BROADCAST SUBMIX																			
Big bluestem - Andropogon gerardi	1.8%	3.7%	0.41	130,000	52,650	0.94	0.95	1.1	2.9%	1.1	2.9%								
Blue grama - Bouteloua gracilis	0.9%	1.8%	0.20	825,000	165,000	0.93	0.67	2.4	6.2%	2.4	6.2%								
Buffalograss - Buchloe dactyloides	4.2%	8.4%	0.93	56,000	51,800	0.92	0.99	1.1	2.9%	1.1	2.9%								
Switchgrass - Panicum virgatum	0.7%	1.4%	0.15	389,000	58,350	0.92	0.99	1.2	3.2%	1.2	3.2%								
Inland saltgrass - Distichlis stricta	0.6%	1.3%	0.14	520,000	72,800	0.84	0.82	1.1	3.0%	1.1	3.0%								
Galleta - Hilaria jamesii	5.9%	11.8%	1.30	159,000	206,541	0.89	0.56	2.4	6.3%	2.4	6.3%								
Alkali sacaton - Sporobolus airoides	0.3%	0.7%	0.08	1,758,000	131,850	0.91	1.00	2.8	7.3%	2.8	7.3%								
Silver sagebrush - Artemisia cana	2.1%	4.3%	0.47	850,000	399,500	0.79	0.12	0.9	2.3%					0.9	2.3%				
Fringed sagebrush - Artemisia frigida	0.1%	0.1%	0.01	4,536,000	49,896	0.78	0.95	0.9	2.3%					0.9	2.3%				
Black sagebrush - Artemisia nova	2.6%	5.2%	0.58	907,200	521,640	0.74	0.10	0.9	2.4%					0.9	2.4%				
Winterfat - Ceratoides lanata	12.6%	25.3%	2.77	56,700	157,116	0.60	0.80	1.7	4.6%					1.7	4.6%				
Cliffrose - Cowania mexicana	11.6%	23.2%	2.54	64,800	164,064	0.50	0.50	0.9	2.5%					0.9	2.5%				
White yarrow - Achelea millefolium	0.1%	0.2%	0.02	2,770,000	47,090	0.93	0.97	1.0	2.6%							1.0	2.6%		
Blanket flower - Gaillardia aristata	2.1%	4.2%	0.46	132,000	60,720	0.73	0.92	0.9	2.5%							0.9	2.5%		
Alfalfa - Medicago sativa	0.9%	1.8%	0.19	210,000	40,320	0.94	1.00	0.9	2.3%									0.9	2.3%
Sainfoin - Onobrychis viciaefolia	1.5%	3.0%	0.33	30,000	9,900	0.87	1.00	0.2	0.5%									0.2	0.5%
Prairie coneflower - Ratibida columnarias	0.2%	0.3%	0.04	1,230,000	43,050	0.83	0.96	0.8	2.1%							0.8	2.1%		
Globemallow - Sphaeralcea parvifolium	0.3%	0.7%	0.08	500,000	37,500	0.95	0.99	0.8	2.2%							0.8	2.2%		
Purple prairie clover - Petalostemum purpureum	0.8%	1.6%	0.18	210,000	36,750	0.95	1.00	0.8	2.1%							0.8	2.1%		
Strawberry clover - Trifolium fragiferum	0.6%	1.1%	0.13	300,000	37,500	0.96	1.00	0.8	2.2%							0.8	2.2%		
SUBMIX TOTAL	50.0%	100.0%	10.970		2,344,057			23.5	62.4%	12.0	31.8%	0.0	0.0%	5.3	14.1%	5.1	13.6%	1.1	2.8%
MIX TOTAL	100.0%				3,122,328			37.7	100.0%	12.0	31.8%	7.8	20.7%	9.5	25.3%	7.3	19.5%	1.1	2.8%

PLL and IPL Revegetation

PLL and IPL lands in VMU 8 were mostly seeded between 1973 and 1993 as shown on the drawing in Appendix A6. Subsequent interseeding or seeding of repair areas since that time are shown on Exhibit E7.

The seed mixes utilized on PLL and IPL varied over the years. While definitive records are not available for what was planted where, the 1994 TOJ application contains details on plantings up to time when the application was originally submitted. Additional information concerning plantings in the early years may be found in the Settlement Agreement B.8 Report Volume I Revegetation report developed by the Pittsburg & Midway Coal Mining Co. (P&M (now CMI)) (SA B.8 Report) (P&M 1994). The SA B.8 Report may be found in Appendix 5.5-A of the Permit No. NM-0001K, which has a table that summarizes the mixes that were used during the PLL and IPL time period; that table is replicated below as Table T5. PLL was likely initially seeded with the mixes shown in the mid-1970s. Most of the IPL would have been initially seeded with the mixes shown during the late 1980s and early 1990s. Interseeding and seeding in the more recent years were planted with mixes like those shown for the early 1990s or the permanent seed mix in Table T4.

Table T5: Expected Seed Mixtures for PLL and IPL

	SPECIES Common Name - *Scientific Name*	MIX APPROVED BY YEAR			MIX PLANTED BY YEAR								
		spoil 73 75	topsoil 73 75	80	75	77	79	80-84	85	86-87	88 & 90	91	92
	Alkali sacaton - *Sporobolus airoides*								●	●	●	●	●
	Sandberg bluegrass - *Poa sandbergii*								●	●	●	●	●
	Mountain brome - *Bromus marginatus*								●	●	●	●	●
	Smooth brome - *Bromus inermis*				●	●							
	Arizona fescue - *Festuca arizonica*								●	●	●		●
	Sheeps fescue - *Festuca ovina*											●	
	Galleta - *Hilaria jamesii*		●	●				●		●	●	●	●
G	Blue grama - *Bouteloua gracilis*										●	●	●
R	Sideoats grama - *Bouteloua curtipendula*			●			●	●	●	●	●	●	●
A	Indian ricegrass - *Oryzopsis hymenoides*			●			●	●	●	●	●	●	●
S	Mountain muhly - *Muhlenbergia montana*					●							
S	Spike muhly - *Muhlenbergia wrightii*					●			●	●	●	●	●
E	Sand dropseed - *Sporobolus cryptandrus*					●	●					●	●
S	Crested wheatgrass - *Agropyron cristatum*	●	●		●	●							
	Intermediate wheatgrass - *Agropyron intermedium*			●				●					
	Pubescent wheatgrass - *Agropyron trichophorum*	●	●	●		●		●					
	Siberian wheatgrass - *Agropyron sibericum*	●	●		●	●							
	Slender wheatgrass - *Agropyron trichycautum*				●	●						●	
	Streambank wheatgrass - *Agropyron riparium*					●	●						
	Tall wheatgrass - *Agropyron elongatum*			●	●	●		●					
	Thickspike wheatgrass - *Agropyron dasystachyum*						●		●	●			
	Western wheatgrass - *Agropyron smithii*		●	●	●	●	●	●	●	●	●	●	●
S	Fourwing saltbush - *Atriplex canescens*		●	●			●	●	●	●	●	●	●
H	Shadscale - *Atriplex confertifolia*								●	●	●	●	●
R	Winterfat - *Ceratoides lanata*			●				●	●	●	●	●	●
U	Cliffrose - *Cowania mexicana*											●	●
B	Utah serviceberry - *Amelanchier utahfolia*											●	●
S	Skunkbush sumac - *Rhus trilobata*											●	●
	Alfalfa - *Medicago sativa*								●	●	●	●	●
	Black-eyed Susan - *Rudbeckia hirta*									●	●	●	●
	Blanket flower - *Gaillardia aristata*									●	●	●	●
	Blueflax - *Linum Lewisii*									●	●	●	●
F	Purple prairie clover - *Petalostemum purpureum*											●	
O	Red prairie coneflower - *Ratibida columnaris*											●	●
R	Globemallow - *Sphaeralcea coccinea*								●	●	●		●
B	Globemallow - *Sphaeralcea parvifolia*											●	
S	Rocky Mtn. penstemon - *Paststemon strictus*								●	●	●	●	●
	Hooker evening primrose - *Oenothera hookeri*											●	
	Sainfoin - *Onobrychis viciaefolia*								●				
	Sulphur Flower - *Eriogonum umbellatum*									●			
	Yellow sweet clover - *Melilotus officinalis*				●	●							
	White yarrow - *Achillea millefolium*									●	●	●	●

Source: Settlement Agreement B.8 Report – Volume I: Revegetation

Revegetation Success Standards

Revegetation success standards are those provided in Table T6 (Table 5.5-1 of the Permit). The standards are applicable to both PLL, IPL, and PPL, which are sampled as one unit in the VMU. There was a change to the revegetation success standards in 2023 through OSMRE-approved Permit Modification 23-03. The change in standards allowed for an improved and more accurate assessment of revegetation success. More information regarding and supporting this modification may be found in the Permit. Table T6 shows the revegetation success criteria applicable for the 2023 and 2024 sample results.

Table T6: Permanent Program Revegetation Success Standards

Table 5.5-1: Revegetation Standards for McKinley Mine			
Ground Cover	Total Ground Cover (Live Vegetation and Litter)		≥ 52%
	Perennial Vegetation Cover		≥ 24%
Diversity "Lifeform Statement"	Perennial Grasses	All grasses	≥ 7% cover
		Cool season	≥ 2 species, 1st species ≥ 5% relative perennial cover, 2nd species ≥ 2.5% relative perennial cover
		Warm season	≥ 2 species, 1st species ≥ 5% relative perennial cover, all other species combined ≥ 1.5% relative perennial cover
	Perennial Forbs		≥ 3 species, combining for ≥ 1% relative cover
	Shrubs	All shrubs	≥ 6% relative total perennial cover
		Any single species	≤ 70% relative total shrub density
	Any single species		≤ 40% relative total vegetative cover
Production	Pounds/acre (air dry)		≥ 550 lbs/ac
Woody Plant Density			≥ 400/acre

Notes:
1) Success for cover, production, and stocking shall be ≥ 90% of the standard in accordance with 30 CFR 816.116 (a)(2).
2) Total ground cover does not include noxious weeds.
3) Perennial vegetation cover is foliar cover from LPI, not including annuals and noxious weeds.
4) Relative cover is the percent cover of a species or functional group divided by the total vegetation cover.
5) Relative perennial cover is the total cover of a perennial species or perennial functional group divided by the total perennial cover (see below).
6) Total perennial cover includes shrubs, cactus, trees, perennial grasses and perennial forbs not including noxious species.
7) Relative total shrub density is the density of each woody species divided by the total woody plant density not including noxious weeds.
8) Production is above-ground biomass of forage species.

Revegetation Sampling

Sampling methodologies were updated in 2023, which were approved by OSMRE as part of Permit Modification 23-03. The change in methodology allowed for better capture of data more representative of the revegetation conditions on the reclaimed land. More information regarding this change may be found in the Permit in Section 5.5 and 6.5. The revegetation success sampling reports in Appendix A7 detail what methodologies were used for the respective years of sampling.

Vegetation sampling for bond release was conducted on the PLL, IPL, and PPL in VMU 8 from 2019 through 2024. All the revegetation success standards were met in 2023 and 2024, which addresses the requirement that the revegetation success standards have been met in two growing seasons.

Table T7: VMU 8 Summary of Successful Vegetation Results

Veg Parameter	Components		Approved Standards[1]	O-VMU-8	
				2023	2024
Cover	Total Ground Cover [2]		≥ 52%	P	P
	Perennial Vegetation Cover[3]		≥ 24%	P	P
Diversity "Lifeform Statement"	Perennial Grasses	All Grasses	≥ 7% absolute cover	P	P
		Cool-season	≥ 2 species, 1st species ≥ 5% relative perennial cover, 2nd species ≥ 2.5% relative perennial cover	P	P
		Warm-season	≥ 2 species, 1st species ≥ 5% relative perennial cover, all other species combined ≥ 1.5% relative perennial cover	P	P
	Perennial Forbs[4]		≥ 3 species, combining for ≥ 1% relative perennial cover	P	P
	Shrubs[4]	All Shrubs	≥ 6% relative total perennial cover	P	P
		Any single species	≤ 70% relative total shrub density	P	P
	Any single species[4,5]		≤ 40% relative total vegetative cover	P	P
Production	Annual Forage[6]		≥ 550 lbs/ac	P	P
Woody Plant Density	Density by Belt Transet		≥ 400/acre	P	P
All Parameters				P	P
# Years All Parameters Met				**2**	

Moreover, the longevity of the revegetation on the PLL and IPL that goes back 40 years shows the long-term resiliency of the vegetation. Vegetation sampling sites were selected that included transects on PLL, IPL, and PPL lands as called for in the Permit. The locations sampled, methodologies, and results may be found in the Vegetation Success Monitoring Reports in Appendix A7.

Carrying Capacity

While there has been no formal grazing for carrying capacity demonstrations, this section contains information on the livestock carrying capacity for VMU 8. The calculations were based on an average of 30 days per month with a 50% utilization of the vegetation production values. Carrying capacity is in terms of the animal-unit-month (AUM), which is the amount of dry forage required by one animal unit for one month based on a forage allowance of twenty-six (26) pounds per day for a 1,000-pound cow either dry or with calf up to 6 months of age, or four (4) sheep or goats (MMD 2000).

Table T8 summarizes the carrying capacities calculated from VMU 8 forage production data collected in 2023 and 2024. The calculations were performed on both mean and median forage production values. The utility of these calculations can be assessed by comparing them to an acceptable range condition. To that end, the mine reclaimed soils best fit the NRCS range site description (RSD) for Shallow Savannah, and the carrying capacity for this RSD for a good range condition is 0.20 AUM/Ac (See SA B.8 Report in the Permit Appendix 5.5-A). The 2023 and 2024 forage production data for VMU 8 significantly exceed 0.20 AUM/AC, which supports that the intended postmining land use of grazing is met by the level of vegetation on the reclamation.

Table T8: VMU 8 Carrying Capacity Calculations for 2023 and 2024 Forage Production

VMU	Year	Mean/ Median	Total Forage Production	Production - 50% Utilization	Forage Production	
			lb/ac	lb/ac	days/ac	AUM/ac
8	2023	Mean	801	400.5	15.4	0.51
8	2023	Median	757	378.5	14.6	0.49
8	2024	Mean	917	458.5	17.6	0.59
8	2024	Median	974	487	18.7	0.62

Note: AUM - Animal Unit Month
Assumptions: 1 Cow will utilize 26 lbs/day in forage
30 Days/month

Weed Management

Because the proposed Phase III bond release area plant community is moving toward a desired successional trajectory as per 30 CFR 816.111 and the currently approved Permit to meet the intended post-mine land use, continued ecologically based invasive plant management practices have been employed. Various options for weed control are contained in the McKinley Mine Integrated Weed Management Plan (HMI 2018). The most effective tools from the weed management plan have been appropriately timed herbicides and mechanical treatments, complemented with interseeding. The revegetation monitoring reports have not indicated that weeds have been problematic towards revegetation meeting revegetation success or the postmining land uses. Weeds are not included in measurements for revegetation success.

11.0 Wildlife Habitat Enhancements

Wildlife enhancements were completed in VMU 8 that included: application of the permanent seed mix (which contains species important for wildlife), creation of rock piles, enhanced shrub plantings in wildlife corridors, planting of materials beneficial to mule deer, construction of Permanent Impoundments, riparian plantings, and wildlife fencing. Each of these categories is discussed below:

Permanent Seed Mix

The permanent seed mix contains species beneficial to wildlife for browse and cover. The mix includes important browse species, including shrubs such as Cliff rose or Antelope bitter brush, or a forb such as Sainfoin. Shrubs, such as Fourwing saltbush, are also utilized for cover by small mammals, and even mule deer have been observed using it as cover.

Rock Piles

Rock piles to support wildlife habitat were constructed on PLL, IPL and PPL. Rock piles were created from stones and boulders that became available during grading operations. The availability of suitably sized materials partially determined the number and distribution of these features. The rock features were generally constructed in piles or in elliptical shapes along the contour to maximize the surface area of each pile and facilitate topsoil replacement and revegetation operations. In some areas, rock was placed along the top or base of the slopes to simulate escarpment outcrops or ledge features. Shrub and/or tree plantings were conducted at rock piles to compliment and augment the utility of the rock piles in some areas.

The rock piles range from about 20 to 400 square feet and from two to twelve feet high. The rock piles were constructed at an average density mine wide of about one per twenty acres of reclaimed land.

Permit Section 5.7.3.3 contains more details regarding rock piles. Exhibit E8 shows the rock pile locations.

Enhanced Shrub Planting in Wildlife Corridor

A wildlife corridor on permanent program lands was developed that extended from the north end of Area 6, south to Area 10 near State Highway 264; a part of that corridor extends through VMU 8. The corridor was established as a zone in which many of the supplemental plantings were done. Exhibit E8 displays this corridor.

The corridor has a permit requirement of 100 shrubs/acre comprising of at least four shrub species. The 100 shrubs/acre were to include plants established from the permanent seed mix, supplemental plantings, ad-mixes, and volunteer growth. As documented in Permit Section 5.7.3.2.1, this standard was met.

Mule deer plantings

Permit Section 5.7.3.2.3 contains a commitment to plant additional browse species beneficial to mule deer throughout the mine, which included sites in VMU 8. Table T9 (Table 5.5-1A from the Permit) shows the standard for the supplemental wildlife enhancement plantings.

This commitment was successfully completed and documented in the 2021 Annual Report. The report is entitled McKinley Mine: Mule Deer Additional Browse Species

Planting Success (Golder 2022). Note that supplemental mule deer plantings also occurred as part of riparian plantings, as discussed in the next subsection.

Table T9: Permanent Program Requirements for Supplemental Wildlife and Impoundment/Riparian Plantings and Enhancements

Table 5.5-1a: Supplemental Wildlife and Pond/Riparian Plantings and Enhancements		
Supplemental Wildlife Enhancement Plantings	Supplemental perennial shrubs in proposed wildlife enhancement areas in accordance with Section 5.8.	≥ 4 target shrubs combining for ≥ 100 stems/acre; any single species ≤ 50%. Target species include Cliffrose, Antelope bitterbrush, Winterfat, Ephedra, ≤ 5% Rubber rabbitbrush, and other species approved by OSMRE.
Supplemental Pond/Riparian Enhancements	Enhancements at each pond/riparian area (i.e., fencing and riparian plantings), and weed control in accordance with Section 5.8.	Success will be based on detailed documentation demonstrating execution of planned enhancements, and documentation of the results of those efforts.

Permanent Impoundments and Riparian Plantings

This section provides information on postmining water resources and associated riparian habitat enhancements. The term pond is used in this subsection to broadly reference a Permanent Impoundment. As stated earlier, VMU 8 contains one Permanent Impoundment (PI CDK). Wildlife Enhancements Exhibit E8 shows the location of the pond. The pond is also part of a greater mine-wide network for access to water by wildlife (See Permit Section 5.8.3.4).

Impoundments not only promote reclaimed-land diversity but also have conditions for riparian habitat establishment. The Permit (Appendix 5.8-B, Table 5.8-B1) lists the ponds proposed for riparian plantings; PI CDK, however, was not selected for such supplemental plantings.

PLL and IPL Plantings

There were no specific PPL and IPL plantings in VMU 8 beyond those done as part of the enhanced shrub planting in the wildlife corridor discussed above.

Wildlife fencing

To promote the longevity of the riparian plantings and the utility of the impoundments by wildlife, the Permit (Appendix 5.8-B, Table 5.8-B1) identified impoundments to be fenced with wildlife-friendly fences (See Permit Section 5.8.3.4.2). PI CDK was not selected for fencing.

12.0 Performance Bond

The current performance bond amount is shown on Table T10 for the remaining permanent program reclamation liability. There are two final costs to be deducted from the performance bond for VMU 8 at this last phase. The first bond deduction is for the cost to revegetate the reclaimed lands, which includes the acreage for Impoundment CDK. The other bond deduction is for the cost reserved in the bond to remove the impoundment. There is no bond associated with the SDs.

The methodology for deducting the revegetation costs required factoring in that the performance bond is set up primarily by mining area. VMU 8 contains lands from different mining areas, and while prorating and tracking costs from each area could be done, it would be complex and difficult to follow in this Application and in future applications for other Phase III bond releases.

Subsequently, the clearest and most supportable method to calculate the Phase III bond reduction is to multiply the number of PPL acres in VMU 8 by the unit cost/acre to revegetate disturbed land from the bond assumptions. In a similar manner, the bond reduction for reclamation of the impoundments was calculated by multiplying the number of impoundments by the unit cost to remove each impoundment. The unit cost for impoundment reclamation included dewatering, backfilling, and grading.

The calculations for the bond reduction related to Phase III revegetation costs and impoundments are provided in Appendix A8. The amount of bond to be released in this application and the remaining total bond are shown in Table T10. Approximately $42,000 of the total bond reduction is associated with Phase I and II costs for the impoundment removal.

Table T10: Performance Bond Summary

Current Total Bond Amount	Reclamation Bond Reduction	Remaining Total Bond
$53,921,545	$1,202,000	$52,719,545

13.0 Landowner Notification

The list of property owners and entities adjacent to the reclamation liability release area affected by this application is provided in Appendix A9. The appendix includes a typical copy of the notification letter with a map to be sent along with a list of recipients.

A copy of this Application will be available for public inspection at the following locations:

Mr. Jacob Mulinix and Ms. Christy Luciani
Western Region Office
Office of Surface Mining Reclamation and Enforcement
One Denver Federal Center, Building 41
Western Region Mine Plan Library
Lakewood, CO 80225-0065
Advance call required: WR Permitting Information Line 1-866-847-7362

The Navajo Nation Minerals Department – Office of Surface Mining Program
P.O. Box 9000
Window Rock, AZ 86515

County Clerk's Office
McKinley County Courthouse
201 W. Hill Ave.
Gallup, NM 87301

14.0 Newspaper Advertisement

The reclamation liability release notice (and associated map) to be published in the local newspapers is provided in Appendix A10. The announcement will be published in both the Gallup Independent and Navajo Times for four consecutive weeks. Affidavits of publication from these newspapers will be sent to OSMRE.

15.0 Supplemental Information for Prelaw Lands and Initial Program Lands

The 1994 TOJ Application in Appendix A2 contains extensive information for the PLL and IPL regarding their history, as well as information on erosion and landscape stability, revegetation, vegetation sampling done for the TOJ application, and hydrology.

CDK Projects

There are two known projects that were conducted in Section 5 in what is referred to as the CDK Area. For simplicity, they will be referred to as the CDK Valley and the CDK Highwall. The CDK Valley project was conducted on IPL and the CDK Highwall project occurred on PLL; the locations are shown on Exhibit E4. Seeding at the conclusion of these projects would have been done with the OSMRE permanent seed mix.
The CDK Valley project was done around 2003-2004 and concerned utilizing various BTCA practices in lieu of a sediment pond. These efforts are documented in a report entitled, Comparison of Pre- and Post-mining Soil Loss for the CDK Area dated August 26, 2004. A copy of this report may be found in Appendix A11a.

The CDK Highwall project was completed in 2021 and involved bringing suitable soil from the nearby railroad embankment that was being removed, to address BIA concerns with a Prelaw remnant highwall and the quality of the vegetation on Prelaw spoil directly across from the highwall. The plan for this project was entitled Section 5 Pre-Law Highwall and Rail Embankment Mitigation Plan (March 2020). A copy of this plan and associated communications are contained in Appendix A11b.

Backfilling and Grading

Backfilling and grading were conducted in a manner that promoted stability, eliminated spoil piles, and blended into unmined land. A proposed postmining topographical map was not available for this application. Spoil was graded to at least a 3H:1V slope in accordance with the IP regulations. A topographical map showing the final configuration may be found on Exhibit E9; the exhibit also shows cross section locations of the topography. Cross sections of the final topography are provided on Exhibit E10.

Exhibit E11 is an isogram with a gradient analysis for the slopes throughout the reclaimed area. Slopes showing as greater than 30 percent are typically affiliated with drainages.

Potentially Acid and Toxic Forming Materials (PATFM)

Based on available information, the only known PATFM mitigation occurred in association with the CDK Highwall and spoil adjacent to it (see Appendix A11b).

The level of PATFM monitoring on the IPL is unknown, although the reclaimed land today does not show evidence of poor soil conditions or vegetation that might not be growing because of poor spoil quality.

PLL Topdressing

These lands may have had very limited topdressing as discussed in the 1994 TOJ Application. The soil materials used as a planting medium, however, appear to have been suitable since they have supported revegetation since the 1970s. As stated earlier, these PLL were included in the vegetation sampling program for the VMU they were located in.

IPL Topdressing

Topsoil replacement would have been done in conformance with 30 CFR 715.16 (b) Topsoil Redistribution. Regraded land would have been scarified prior to the placement of topdressing. Topsoil would have been redistributed in a uniform thickness (typically a minimum of six inches) and in a manner that minimized the potential for compaction. To that end, topsoil depth checks were conducted at four locations on IPL. The locations included a diversity of locations representative of the IPL. Topsoil was found to be at least six inches at the locations tested, which supports that at least a six-inch topdressing was applied at the time as required. Successful revegetation after 40 years, as discussed below, also supports that there is good soil medium for vegetation throughout the area. The locations of topsoil depth checks and the depths recorded are shown on Exhibit E12.

Drainage Control

Drainage control technologies were instituted to create a stable landform and to safely route the design storm runoff through the reclaimed areas and into adjacent undisturbed lands. While terraces and down-drains were constructed on the PPL and on some later IPL to promote controlled drainage of runoff from the reclaimed land, such structures were not built on the early PLL and IPL. Other hydrologic structures, however, were constructed to control runoff on PLL and IPL. The 1994 TOJ Application in Appendix A2 provides additional information.

Drainage channels that concentrate flow were armored with riprap to control runoff and to promote a smooth transition into undisturbed drainages. Exhibit E6 shows the locations of primary hydrologic structures installed to control runoff and minimize erosion in PLL and IPL.

Sedimentology and Surface Water

This section provides information regarding impacts to surface water by PLL and IPL in VMU 8. The section also covers sedimentology since that is directly related to surface water quality.

Sediment yields from VMU 8 PLL and IPL are expected to be below pre-mining levels based on the reclaimed landform, mine-wide sediment-yield analysis, and the EPA watershed status. Regarding the reclaimed landform, VMU 8 PLL and IPL were reconstructed in a manner consistent with stable landforms, hydrologic structures have been constructed in accordance with standard practice on the rest of the mine, and the land has been seeded, mulched, and revegetated.

As stated in Section 5.7.4.3 in PP Permit No. NM-0001K, extensive sediment-yield analyses have been done throughout the mine through paired watershed sampling and modelling that all demonstrated acceptable sediment yields for various reclaimed-land scenarios. Finally, the 1994 TOJ application also provides corroborative information on sediment yield.

16.0 Bibliography

Habitat Management Inc. December 2018. McKinley Mine Integrated Weed Management Plan.

McKinley Mine Permit No. NM-0001K, 2016. OSMRE McKinley Mine SMCRA Mining and Reclamation Permanent Program Permit.

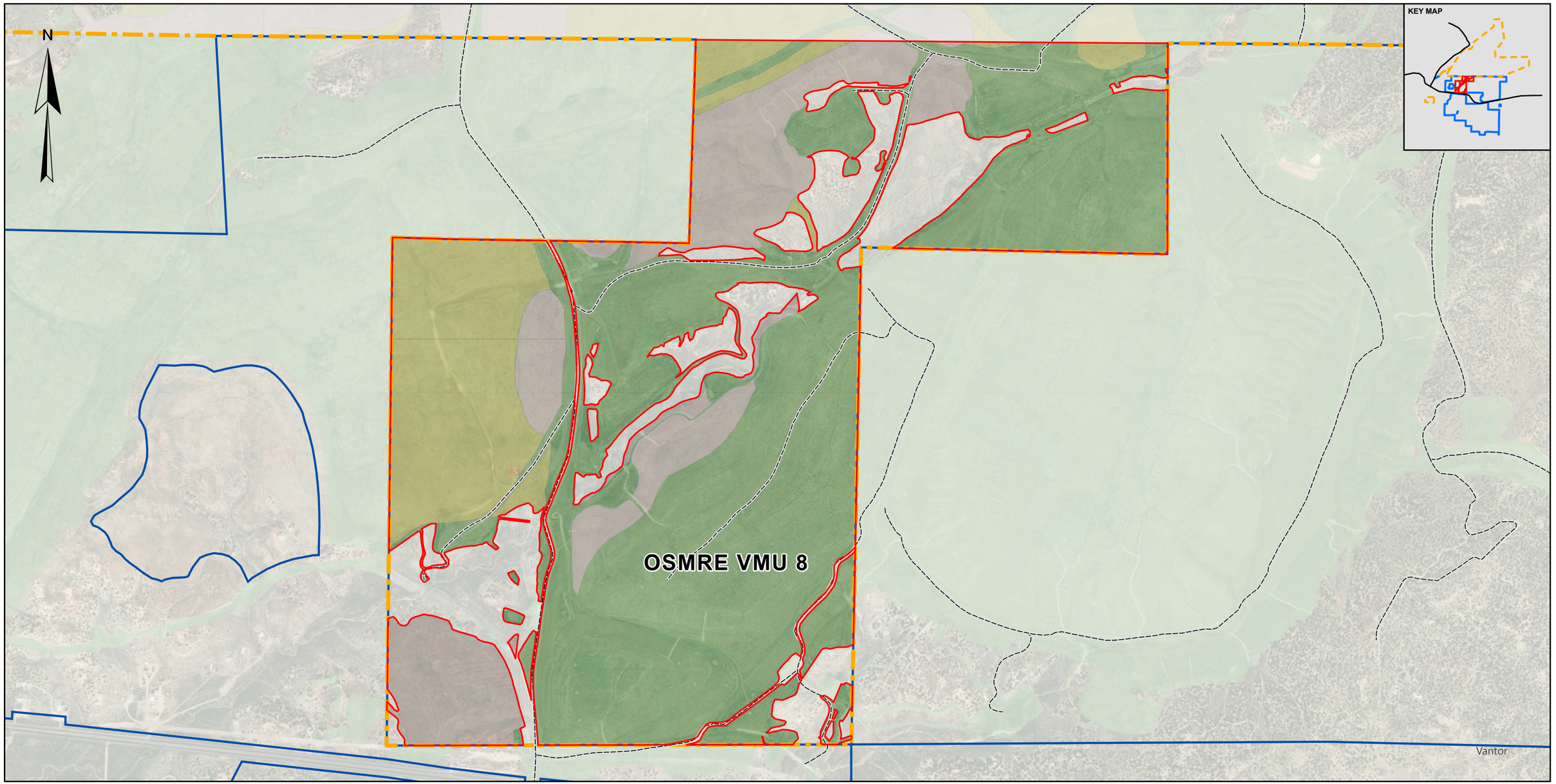
The Pittsburg & Midway Coal Mining Co (P&M). May 17,1994 Settlement Agreement B.8 Report-Volume I Revegetation Report.

WSP USA Inc. 2024. Vegetation Management Unit 8, Vegetation Success Monitoring, 2023.

WSP USA Inc. 2025. Vegetation Management Unit 8, Vegetation Success Monitoring, 2024.

Trihydro Associates. 2025. Vegetation Management Unit 8 Final Bond Release and Liability Release & Termination of Jurisdiction Application, Groundwater and Surface Water Evaluation.

Exhibits



LEGEND

- Bond Release and Reclamation Liability Release (TOJ)
- Initial Program Lands
- Prelaw Lands
- Permanent Program Lands
- OSMRE Permit Boundary
- MMD Permit Boundary
- Post-Mining Two-Track Trails

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Feet

NOTE(S)
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CLIENT
Chevron Mining Inc.
McKINLEY MINE

CONSULTANT
wsp

YYYY-MM-DD	2025-12-11
DESIGNED	-
PREPARED	HJ
REVIEWED	FR
APPROVED	KK

PROJECT
VEGETATION MANAGEMENT UNIT 8
BOND RELEASE

TITLE
GENERAL LOCATION

PROJECT NO.	PHASE	REV.	EXHIBIT
1338105302	0003	A	**E1**

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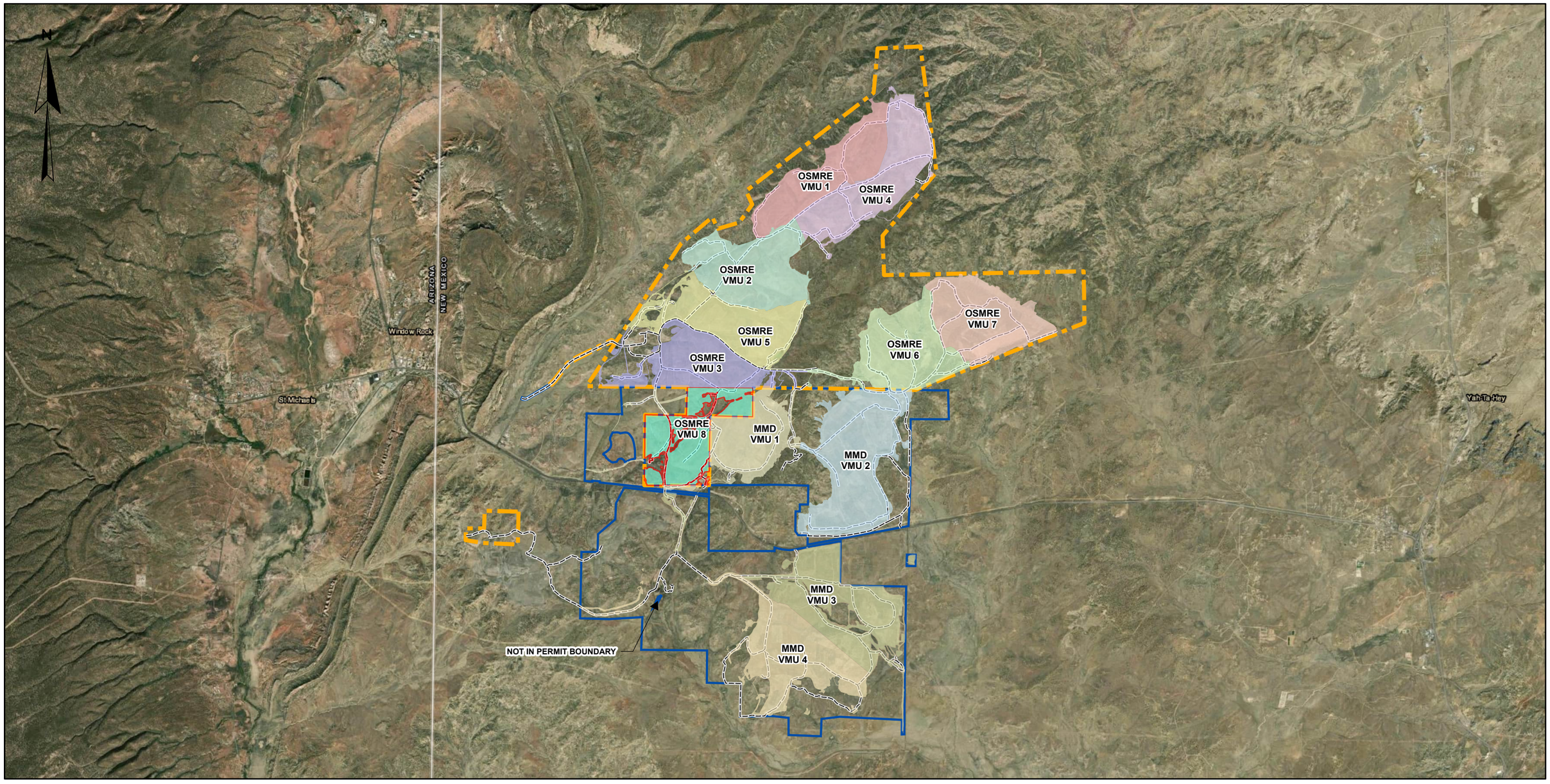

LEGEND

- OSMRE Permit Boundary
- MMD Permit Boundary
- Post-Mining Two-Track Trails

Vegetation Management Unit

- OSMRE VMU 8
- OSMRE VMU 1
- OSMRE VMU 2
- OSMRE VMU 3
- OSMRE VMU 5
- OSMRE VMU 4
- OSMRE VMU 6
- OSMRE VMU 7
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- MMD VMU 3
- MMD VMU 4

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2. SERVICE LAYER CREDITS: WORLD IMAGERY: EARTHSTAR GEOGRAPHICS
WORLD BOUNDARIES AND PLACES: ESRI, HERE, GARMIN

CLIENT
Chevron Mining Inc.
McKINLEY MINE

CONSULTANT
WSP

YYYY-MM-DD	2025-12-11
DESIGNED	-
PREPARED	HJ
REVIEWED	FR
APPROVED	KK

PROJECT
VEGETATION MANAGEMENT UNIT 8
BOND RELEASE

TITLE
MCKINLEY MINE VEGETATION MANAGEMENT UNITS

PROJECT NO.	PHASE	REV.	EXHIBIT
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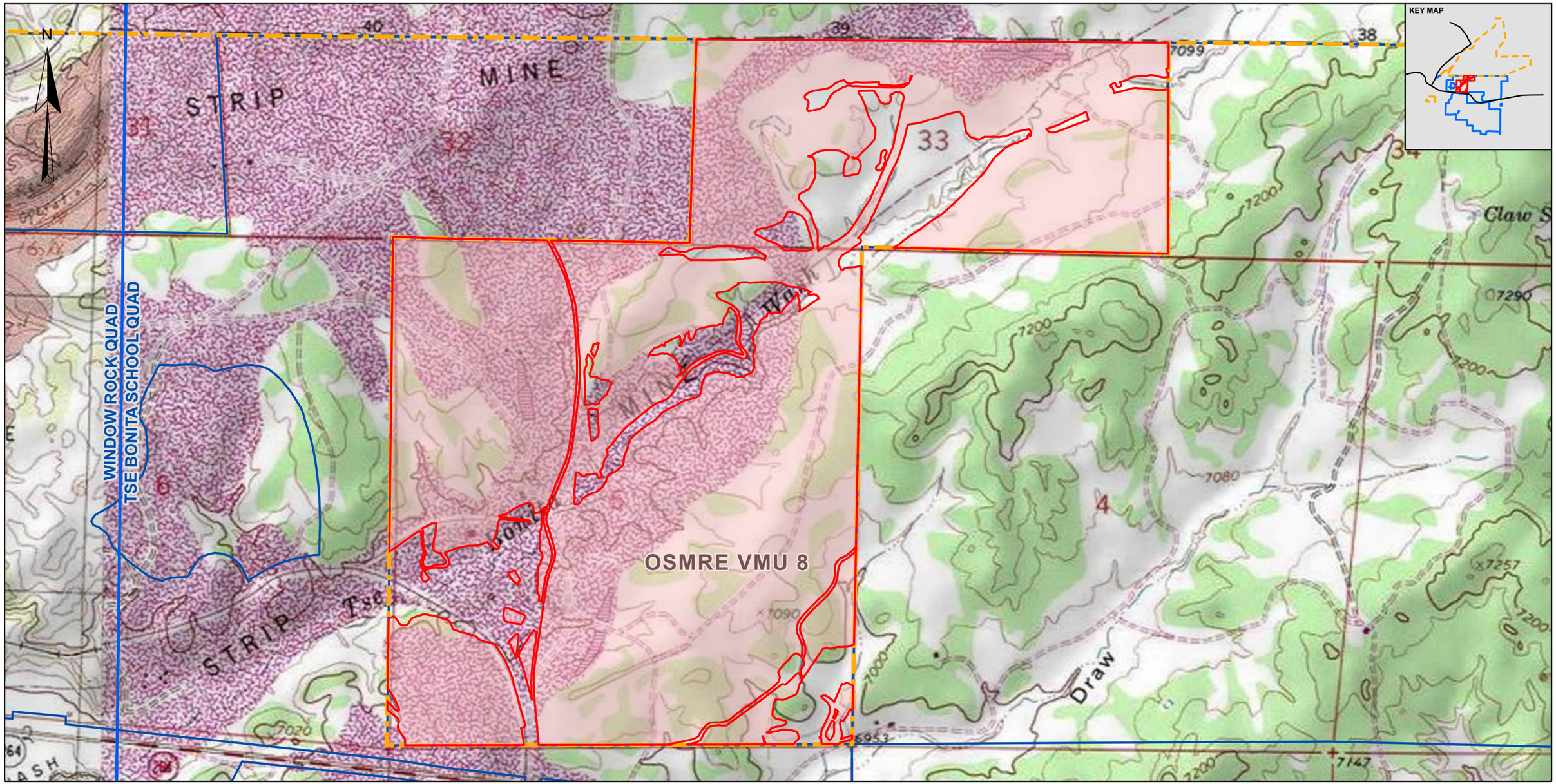

LEGEND

- Bond Release and Reclamation Liability Release (TOJ)
- USGS 24k Topo Map Boundaries
- OSMRE Permit Boundary
- MMD Permit Boundary

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NOTE(S)
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REFERENCE(S)
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2. SERVICE LAYER CREDITS: USGS TOPO MAPS (MAP SERVICE): COPYRIGHT:© 2013 NATIONAL GEOGRAPHIC SOCIETY, I-CUBED

CLIENT
Chevron Mining Inc.
McKINLEY MINE

CONSULTANT
wsp

YYYY-MM-DD	2025-12-11
DESIGNED	-
PREPARED	HJ
REVIEWED	FR
APPROVED	KK

PROJECT
VEGETATION MANAGEMENT UNIT 8
BOND RELEASE

TITLE
USGS 7.5 MINUTE (24K) TOPOGRAPHIC MAP
TSE BONITA SCHOOL QUADRANGE

PROJECT NO.	PHASE	REV.	EXHIBIT
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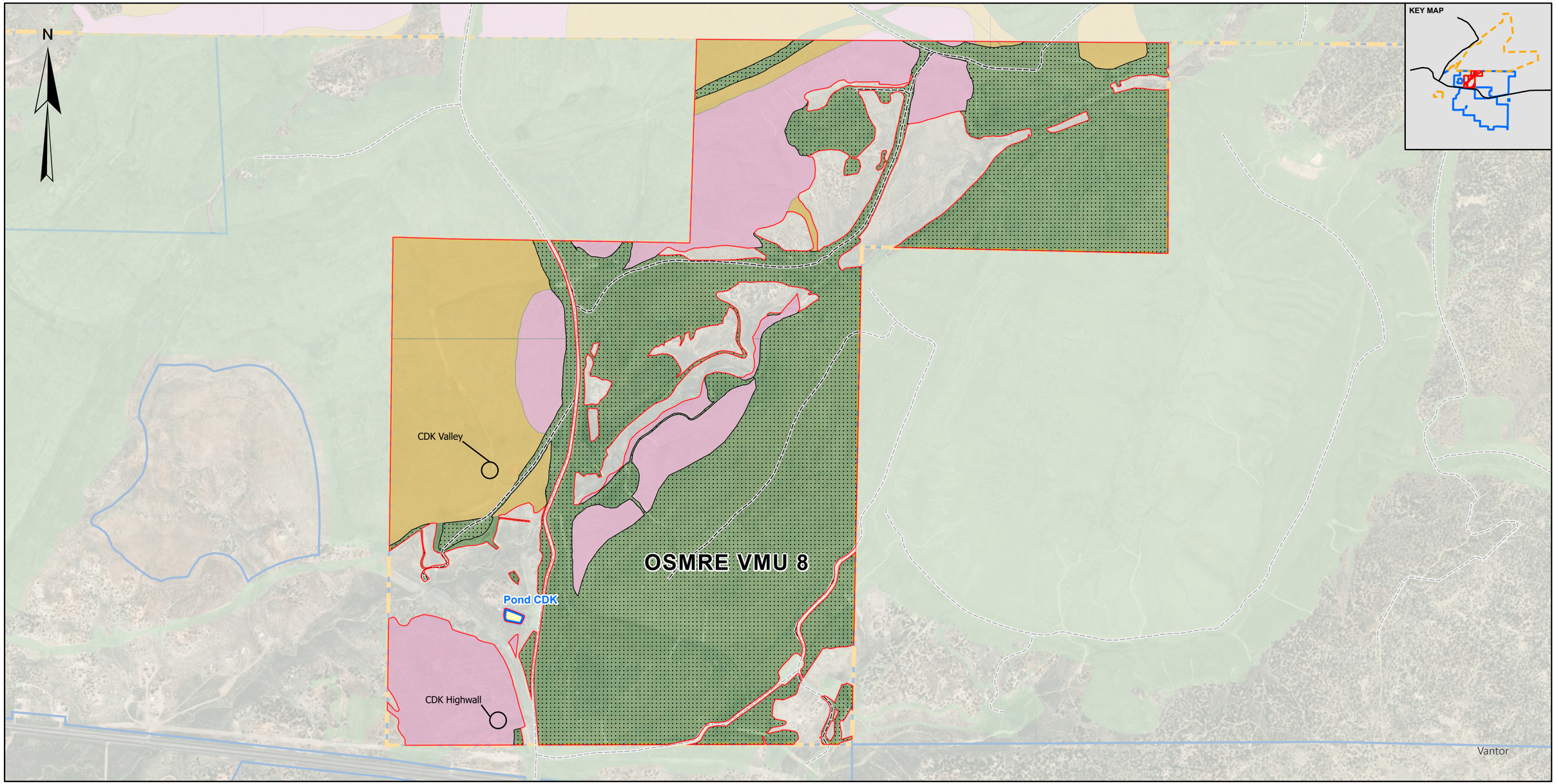


LEGEND

- Bond Release and Reclamation Liability Release (TOJ)
- Phase I, II and III Bond Release of Impoundment
- Phase I and II Bond Release Area Previously Approved by OSMRE
- Post-Mining Two-Track Trails
- Initial Program Lands
- Prelaw Lands
- Permanent Program Lands in Bond Release Application
- OSMRE Permit Boundary
- MMD Permit Boundary

0 1,000 2,000
Feet

NOTE(S)
1.

REFERENCE(S)
1. COORDINATE SYSTEM: NAD 1983 STATEPLANE NEW MEXICO WEST FIPS 3003 FEET

CLIENT **Chevron Mining Inc.**
McKINLEY MINE

CONSULTANT

YYYY-MM-DD	2025-12-11
DESIGNED	-
PREPARED	HJ
REVIEWED	FR
APPROVED	MS

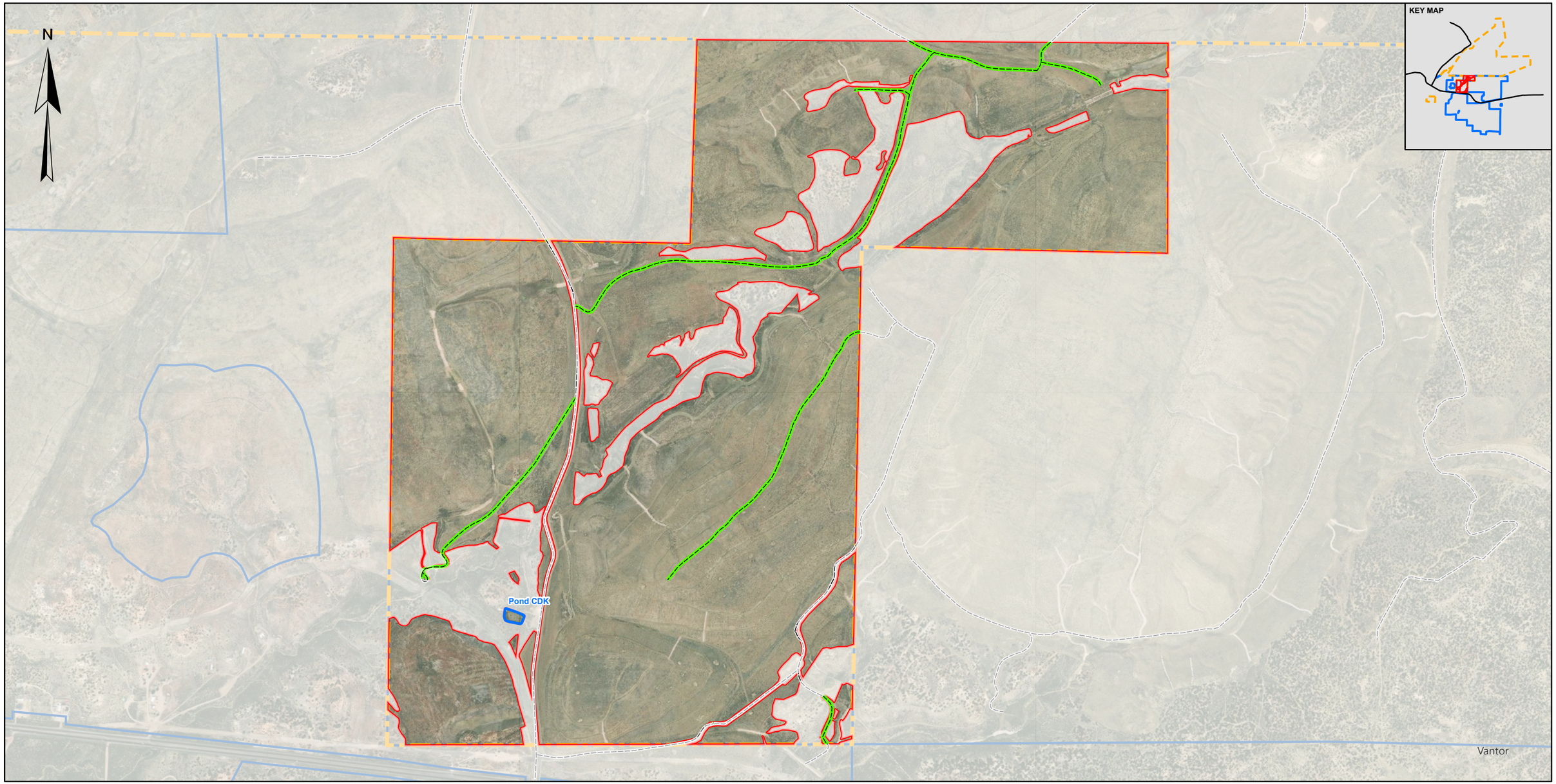
PROJECT
VEGETATION MANAGEMENT UNIT 8
BOND RELEASE

TITLE
OSMRE VMU 8
BOND RELEASE AREAS

PROJECT NO.	PHASE	REV.	EXHIBIT
1338105302	0003	A	**E4**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

PATH: P:\Projects\Chevron\McKinley_Mine\99_PROJECTS\1338105207_McKinley_Mine\0016_BondRelease\OSM_VMU_8_BondRelease_OSM_VMU8.aprx PRINTED ON: AT 11:08:00 AM



LEGEND

- Bond Release and Reclamation Liability Release (TOJ)
- Two-Track Trails in Bond Release Application
- Post-Mining Two-Track Trails
- Impoundment
- OSMRE Permit Boundary
- MMD Permit Boundary

SEAL

KYLE J KUTTER NEW MEXICO 21519 PROFESSIONAL ENGINEER

12/11/25

I certify that the primary road locations shown within the VMU 8 boundary are correct to the best of my knowledge and belief.

0 1,000 2,000 Feet

NOTE(S)
1.

REFERENCE(S)
1. COORDINATE SYSTEM: NAD 1983 STATEPLANE NEW MEXICO WEST FIPS 3003 FEET

CLIENT **Chevron Mining Inc.**
McKINLEY MINE

CONSULTANT wsp

YYYY-MM-DD	2025-12-11
DESIGNED	-
PREPARED	HJ
REVIEWED	FR
APPROVED	KK

PROJECT
VEGETATION MANAGEMENT UNIT 8
BOND RELEASE

TITLE
OSMRE VMU 8
PRIMARY ROADS

PROJECT NO.	PHASE	REV.	EXHIBIT
1338105302	0003	A	**E5**

PATH: P:\Projects\Chevron\McKinley Mine\99_PROJECTS\1338105207_McKinley_Mine\0016_BondRelease\OSM_VMU_8_BondRelease_OSM_VMU8.aprx PRINTED ON: AT: 11:07:23 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

LEGEND

- Bond Release and Reclamation Liability Release
- Undisturbed Stream
- "CH" represents Channels
  "DD" represents Downdrains
  "SC" represents Scallops
- Concentrated Flow Path and Terrace
- Step Drain
- Diversion
- Impoundment
- Initial Program Lands
- Prelaw Lands
- Post-Mining Two-Track Trails
- OSMRE Permit Boundary
- MMD Permit Boundary

SEAL

KYLE J KUTTER NEW MEXICO 21519 PROFESSIONAL ENGINEER

12/11/25

I certify that the hydrologic structures shown within the VMU 4 boundary are correct to the best of my knowledge and belief.

0 1,000 2,000 Feet

NOTE(S)
1.

REFERENCE(S)
1. COORDINATE SYSTEM: NAD 1983 STATEPLANE NEW MEXICO WEST FIPS 3003 FEET

CLIENT Chevron Mining Inc.
McKINLEY MINE

CONSULTANT wsp

YYYY-MM-DD	2025-12-11
DESIGNED	-
PREPARED	HJ
REVIEWED	FR
APPROVED	KK

PROJECT
VEGETATION MANAGEMENT UNIT 8
BOND RELEASE

TITLE
OSMRE VMU 8
HYDROLOGIC FEATURES

PROJECT NO.	PHASE	REV.	EXHIBIT
1338105302	0003	A	**E6**

PATH: P:\Projects\Chevron\McKinley_Mine\99_PROJECTS\1338105207_McKinley_Mine\0016_BondRelease\OSM_VMU_8_BondRelease_OSM_VMU8.aprx PRINTED ON: AT: 11:06:58 AM

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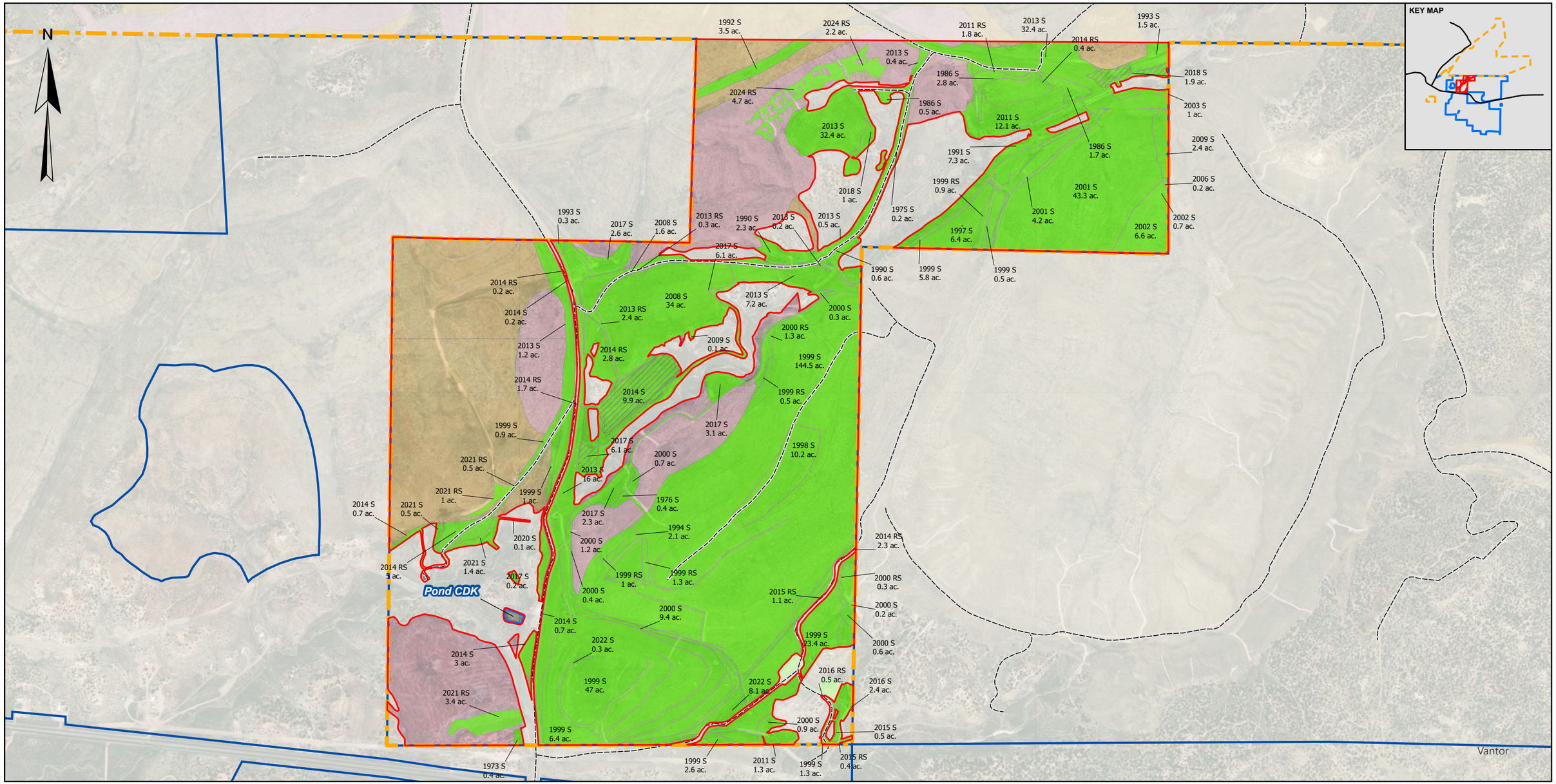
1 in 0



LEGEND

- Bond Release and Reclamation Liability Release (TOJ)
- Seeding Year Seeded ("S") or Reseeded ("R") and acreage
- Interseeded ("I")
- Initial Program Lands
- Prelaw Lands
- Post-Mining Two-Track Trails
- Impoundment
- OSMRE Permit Boundary
- MMD Permit Boundary

0 1,000 2,000
Feet

NOTE(S)
1.

REFERENCE(S)
1. COORDINATE SYSTEM: NAD 1983 STATEPLANE NEW MEXICO WEST FIPS 3003 FEET

CLIENT
Chevron Mining Inc.
McKINLEY MINE

CONSULTANT
wsp

YYYY-MM-DD	2025-12-11
DESIGNED	-
PREPARED	HJ
REVIEWED	FR
APPROVED	KK

PROJECT
VEGETATION MANAGEMENT UNIT 8
BOND RELEASE

TITLE
OSMRE VMU 8
SEEDING

PROJECT NO.	PHASE	REV.	EXHIBIT
1338105302	0003	A	**E7**

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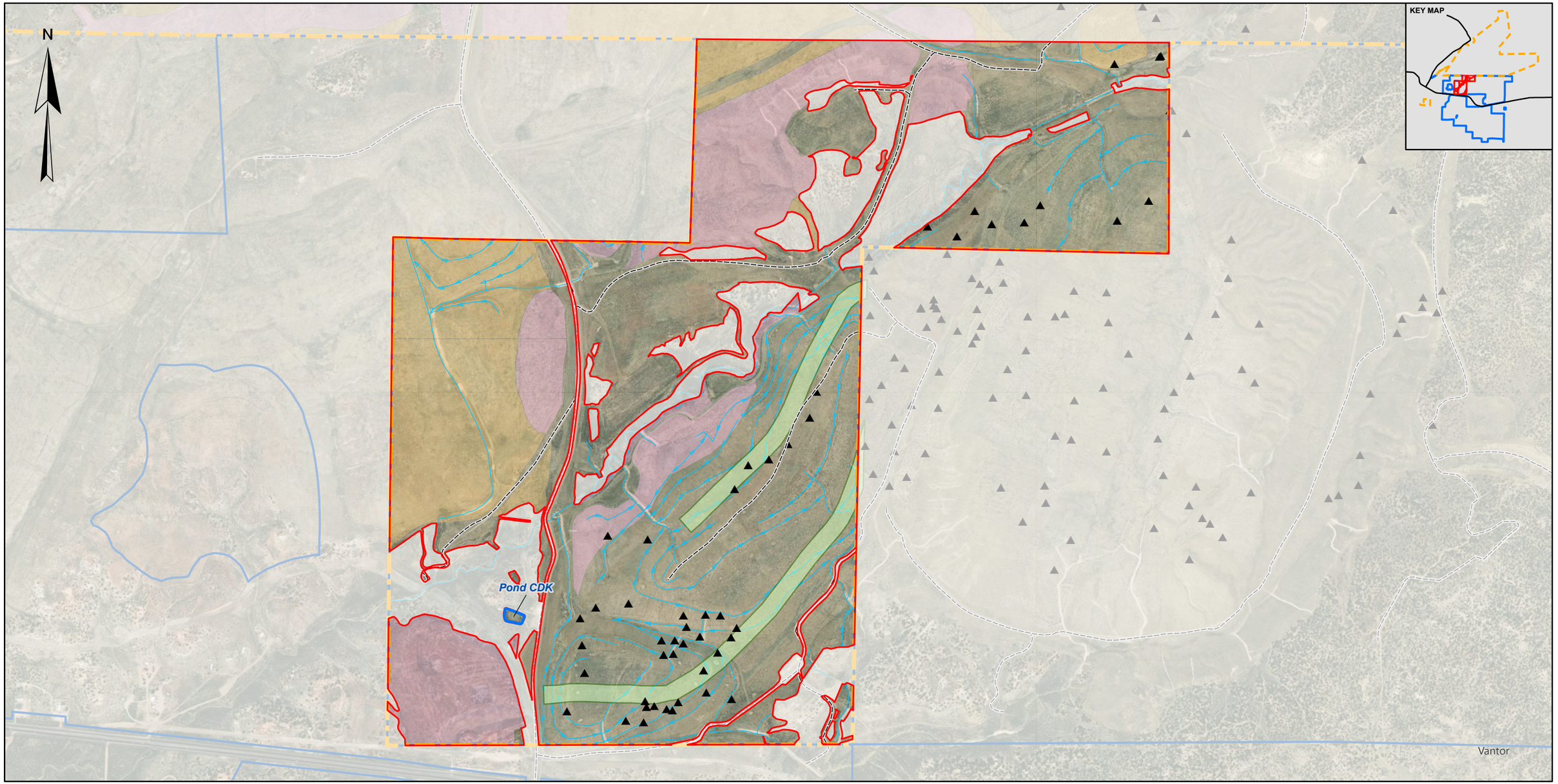
1 in
0



LEGEND

- Bond Release and Reclamation Liability Release (TOJ)
- Wildlife Rock Pile
- Pre-2018 Planted Wildlife Corridors
- Drainage Features
- Impoundment
- Initial Program Lands
- Prelaw Lands
- OSMRE Permit Boundary
- MMD Permit Boundary
- Post-Mining Two-Track Trails

0 1,000 2,000
Feet

NOTE(S)
1.

REFERENCE(S)
1. COORDINATE SYSTEM: NAD 1983 STATEPLANE NEW MEXICO WEST FIPS 3003 FEET

CLIENT Chevron Mining Inc.
McKINLEY MINE

CONSULTANT WSP

YYYY-MM-DD	2025-12-11
DESIGNED	-
PREPARED	HJ
REVIEWED	FR
APPROVED	KK

PROJECT
VEGETATION MANAGEMENT UNIT 8
BOND RELEASE

TITLE
OSMRE VMU 8
WILDLIFE ENHANCEMENTS

PROJECT NO.	PHASE	REV.	EXHIBIT
1338105302	0003	A	**E8**

PATH: P:\Projects\Chevron\McKinley_Mine\09_PROJECTS\1338105207_McKinley_Mine\0016_BondRelease\OSM_VMU_8_BondRelease_OSM_VMU8.aprx PRINTED ON: AT: 10:49:00 AM

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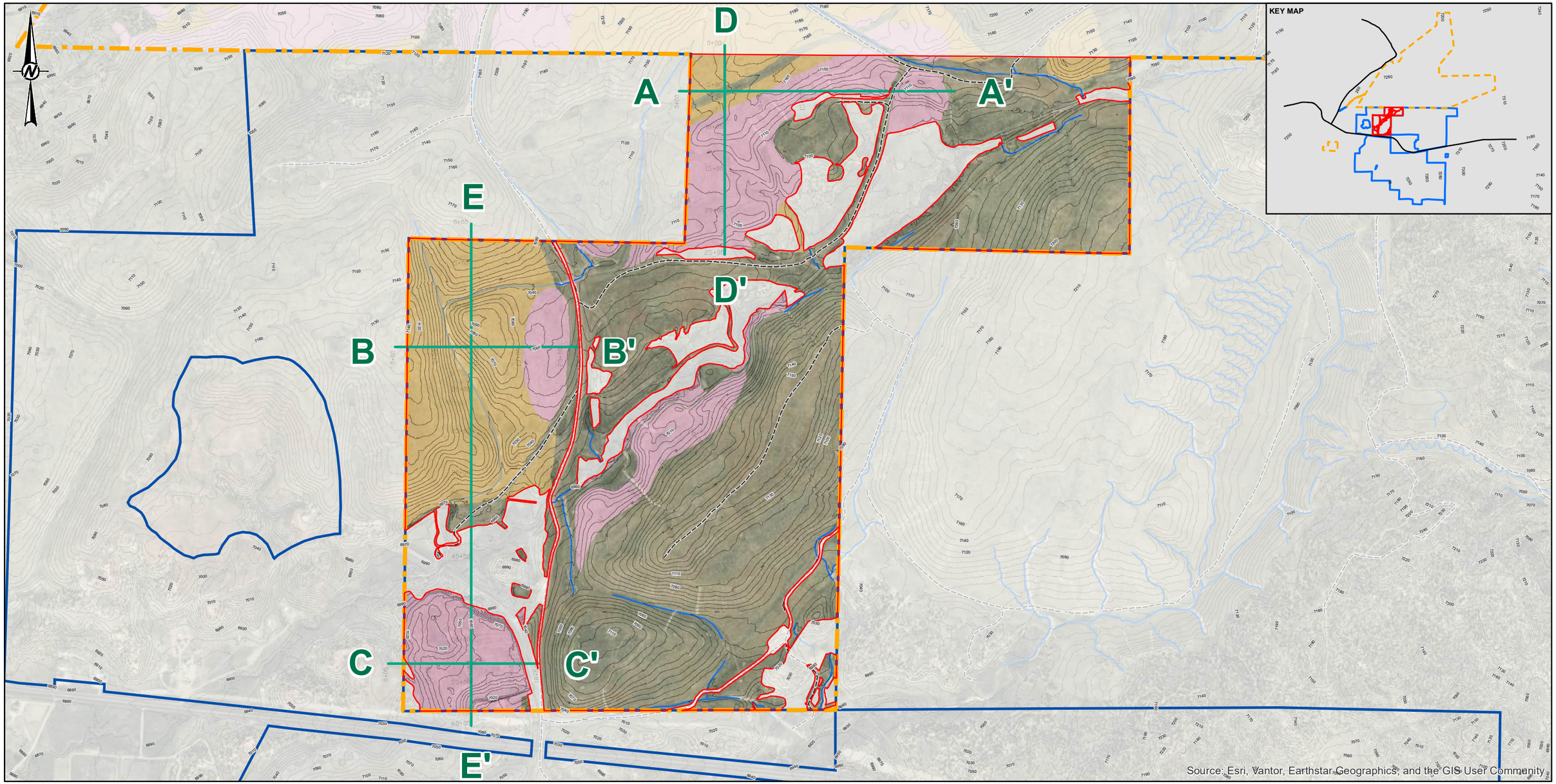

LEGEND

- Bond Release and Reclamation Liability Release (TOJ)
- Cross section
- Contour (ft)
- Channel
- Initial Program Lands
- Prelaw Lands
- OSMRE Permit Boundary
- MMD Permit Boundary
- Post-Mining Two-Track Trails

0 1,000 2,000
Feet

NOTE(S)
1.

REFERENCE(S)
1. COORDINATE SYSTEM: NAD 1983 STATEPLANE NEW MEXICO WEST FIPS 3003 FEET

CLIENT
Chevron Mining Inc.
McKINLEY MINE

CONSULTANT
wsp

YYYY-MM-DD	2025-12-11
DESIGNED	-
PREPARED	HJ
REVIEWED	FR
APPROVED	KK

PROJECT
VEGETATION MANAGEMENT UNIT 8
BOND RELEASE

TITLE
IPL AND PPL TOPOGRAPHY AND CROSS SECTION LOCATIONS

PROJECT NO.	PHASE	REV.	EXHIBIT
1338105302	0003	A	**E9**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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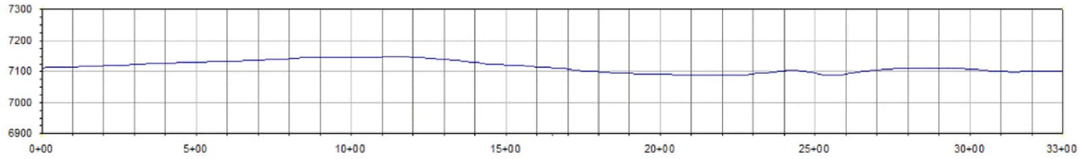
PROFILE A - A'



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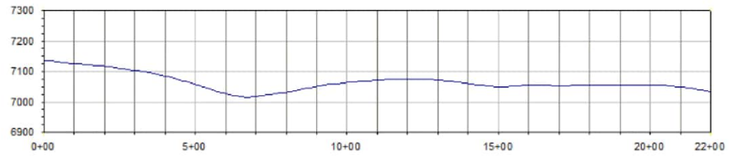

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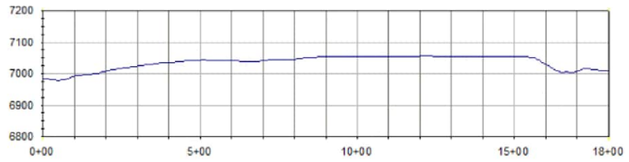

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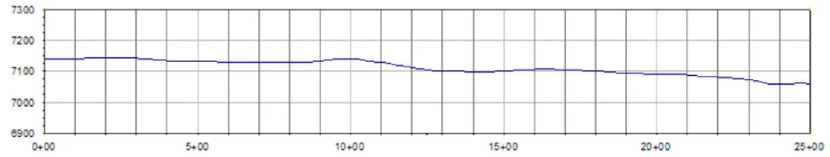

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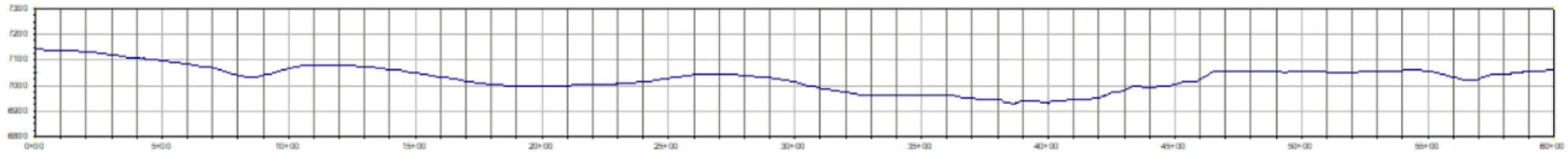


CLIENT

Chevron Mining Inc.
McKINLEY MINE

CONSULTANT

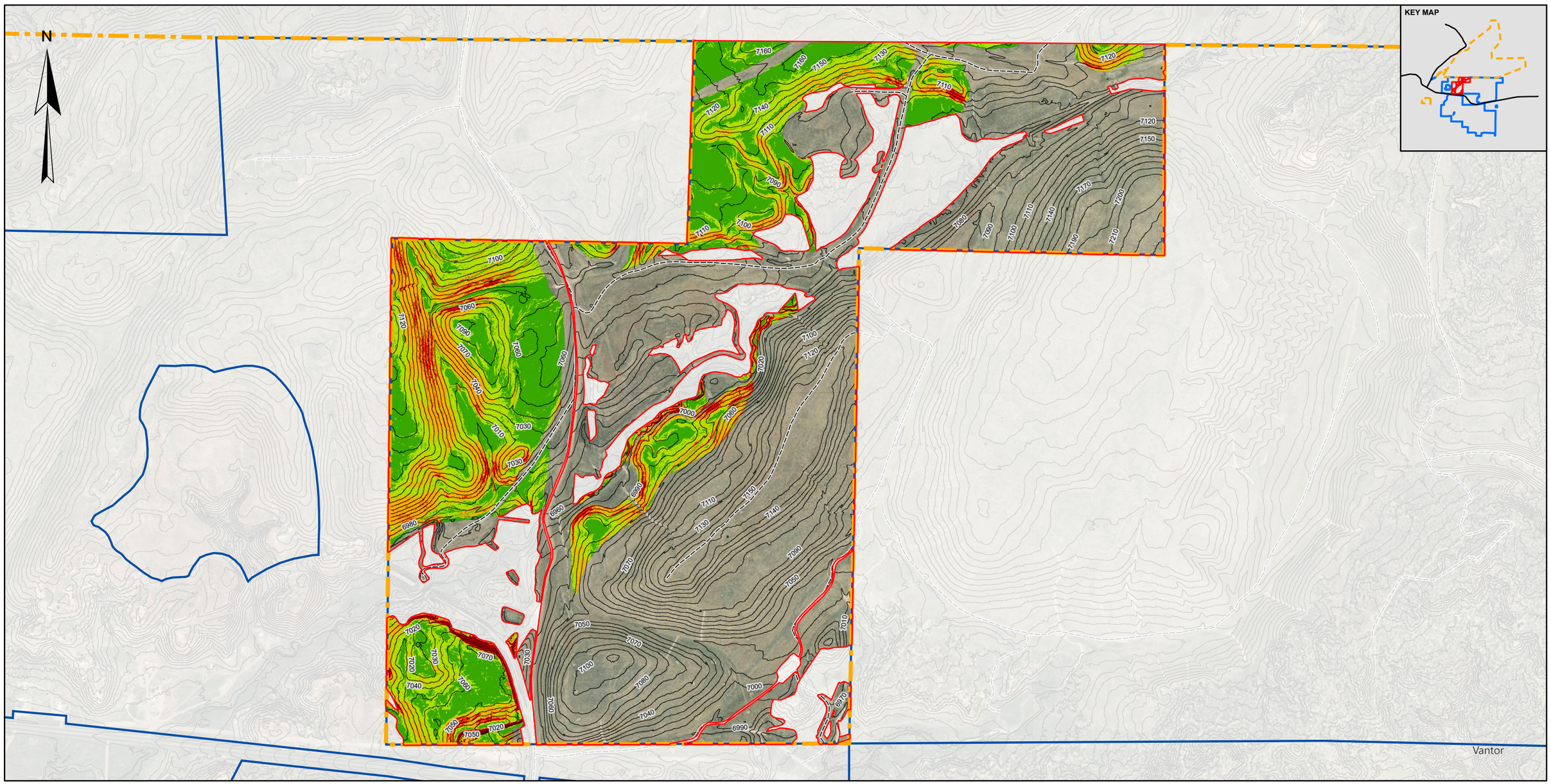
wsp

YYYY-MM-DD	2025-12-11
DESIGNED	-
PREPARED	HJ
REVIEWED	FR
APPROVED	KK

PROJECT
VEGETATION MANAGEMENT UNIT 8
BOND RELEASE

TITLE
IPL AND PLL CROSS SECTION PROFILES

PROJECT NO.	PHASE	REV.	EXHIBIT
1338105302	0003	A	**E10**



LEGEND

Percent Slope
- 0 - 10%
- 11 - 20%
- 21 - 30%
- > 30%

- Bond Release and Reclamation Liability Release (TOJ)
- Post-Mining Two-Track Trails
- OSMRE Permit Boundary
- MMD Permit Boundary

0 1,000 2,000
Feet

NOTE(S)
1.

REFERENCE(S)
1. COORDINATE SYSTEM: NAD 1983 STATEPLANE NEW MEXICO WEST FIPS 3003 FEET

CLIENT
Chevron Mining Inc.
McKINLEY MINE

CONSULTANT
WSP

YYYY-MM-DD	2025-12-11
DESIGNED	-
PREPARED	HJ
REVIEWED	FR
APPROVED	KK

PROJECT
VEGETATION MANAGEMENT UNIT 8
BOND RELEASE

TITLE
IPL AND PLL SLOPE GRADIENT ANALYSIS

PROJECT NO.	PHASE	REV.	EXHIBIT
1338105302	0003	A	**E11**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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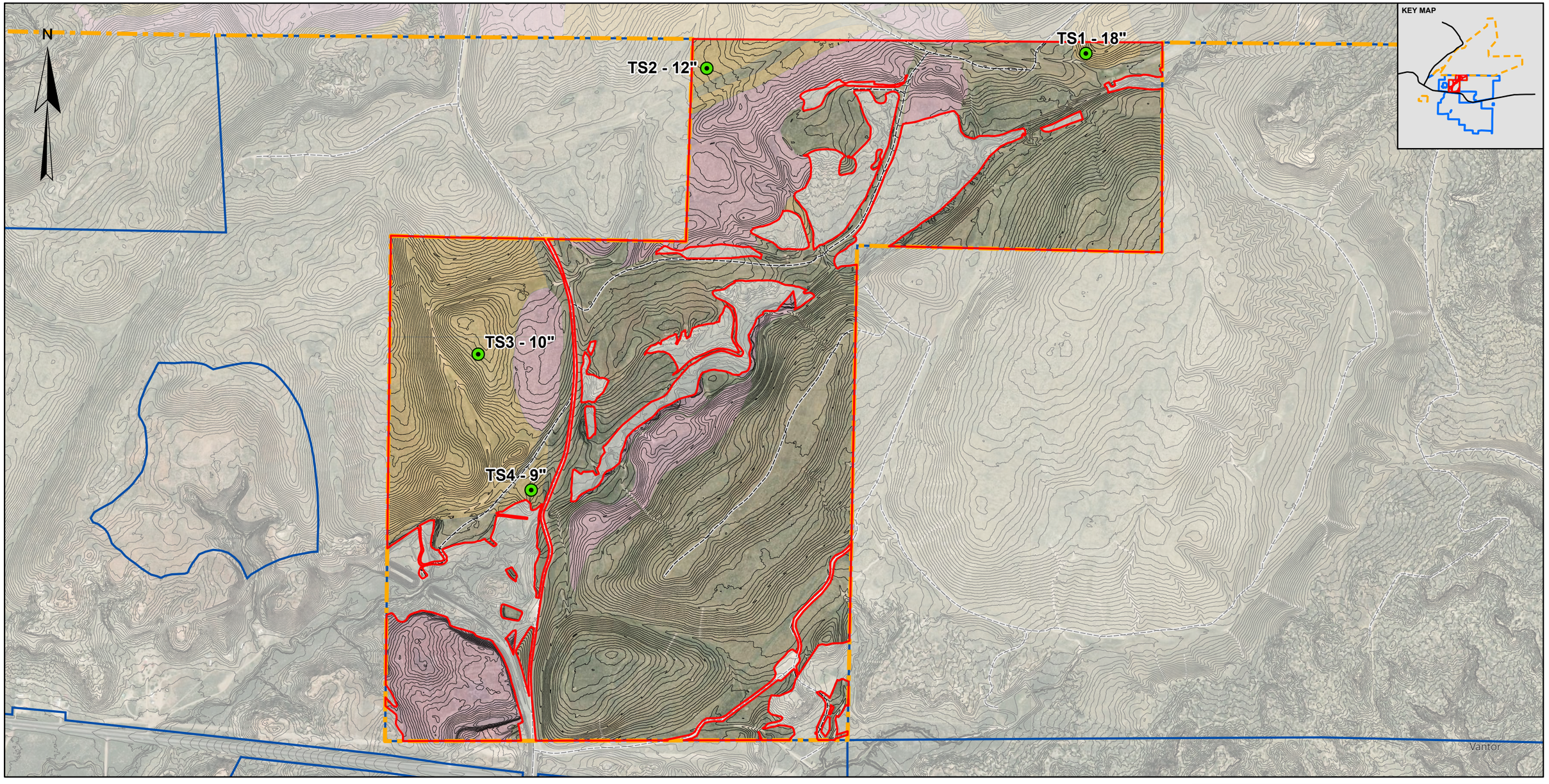

LEGEND

- Topsoil Depth Verification Location
- Bond Release and Reclamation Liability Release (TOJ)
- Contour
- Post-Mining Two-Track Trails
- OSMRE Permit Boundary
- MMD Permit Boundary
- Initial Program Lands
- Prelaw Lands

0 1,000 2,000
Feet

NOTE(S)
1.

REFERENCE(S)
1. COORDINATE SYSTEM: NAD 1983 STATEPLANE NEW MEXICO WEST FIPS 3003 FEET

CLIENT
Chevron Mining Inc.
McKINLEY MINE

CONSULTANT
wsp

YYYY-MM-DD	2025-12-11
DESIGNED	-
PREPARED	HJ
REVIEWED	FR
APPROVED	KK

PROJECT
VEGETATION MANAGEMENT UNIT 8
BOND RELEASE

TITLE
OSMRE VMU 8
IPL TOPSOIL DEPTH - VERIFICATION LOCATION

PROJECT NO.	PHASE	REV.	EXHIBIT
1338105302	0003	A	**E12**

PATH: P:\Projects\Chevron\McKinley_Mine\99_PROJECTS\1338105207_McKinley_Mine\0016_BondRelease\OSM_VMU_8_BondRelease_OSM_VMU8.aprx, PRINTED ON: AT: 10:47:36 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
1 in
0

Appendix A1: Application Certification

McKinley Mine

Vegetation Management Unit 8

Permanent Program Final Bond Release

and

Prelaw and Initial Program Reclamation Liability Release and Termination of Jurisdiction Application

CERTIFICATION

Chevron Mining Inc. (CMI) certifies that all applicable reclamation activities have been accomplished in this application that are necessary for final bond release of Permanent Program lands and for a reclamation liability release and termination of jurisdiction of Prelaw and Initial Program lands in McKinley Mine Vegetation Management Unit 8 in accordance with the requirements of the Surface Mining Control and Reclamation Act, the regulatory program, and the approved reclamation plans.

There are no outstanding violations, cessation orders, or other Office of Surface Mining, Reclamation and Enforcement (OSMRE) enforcement actions on the lands subject to this release application.

Armando Martinez
Operations Lead
Chevron Environmental Management Company (CEMC)

Date: 12/9/25

State of New Mexico)
) SS
County of Taos)

Subscribed and sworn to before me, in my presence, this 9th day of December, 2025, a Notary Public in and for the State of New Mexico.

Anna C. Martinez

Notary Public

ANNA C. MARTINEZ
Notary Public - State of New Mexico
Commission # 1058122
My Comm. Expires Jul 24, 2026

My Commission expires: July 24, 2026

Appendix A2: 1994 MMD Termination of Jurisdiction

State of New Mexico
ENERGY, MINERALS and NATURAL RESOURCES DE
Santa Fe, New Mexico 87505

G.Whitman ✓ R.G.Wise ✓ N.Moore ✓
A.F.Balok ✓ O.Dayzie _ T.J.Laughlin _
M.G.Premo ✓ L.Fischer ✓ B.Passmore _
J.A.Borders ✓ C.Thompson _ W.Brady _
A.K.Bowles ✓ A.Grass _ F.H.Haller ✓
R.Mark _ F.G.Rivera ✓ Den.Eng. ✓
L.Lano _ Den.Law ✓

0180. 501
0710. MMD Bond Release

DEC 1994
Received
P & M
McKinley Mine
Reclamation

BRUCE KING
GOVERNOR

December 15, 1994

ANITA LOCKWOOD
CABINET SECRETARY

James A. Borders
General Environmental Supervisor
McKinley Mine
The Pittsburg & Midway Coal Mining Company
P.O. Box 338
Gallup, New Mexico 87305-0338

Dear Mr. Borders:

Enclosed is a copy of the Director's decision to release the 1745.6 acres of Pre-Permanent Program lands located on the McKinley South Surface Coal Mine (Area 1, and parts of areas 4, 7 and 8). Please note that "Attachment A" mentioned in the Finding of Fact and Conclusion of Law is Exhibit 1.1 (Sheets 3-5) from the liability release application. You should place a copy of these maps with the enclosed document in your permanent files.

We would like to congratulate you on a fine job of reclamation. We also appreciate the excellent documentation that you provided to us in your application. It made our job that much easier.

Please contact Jim O'Hara if you have any questions.

Sincerely,

William Sanderford
Chief
Coal Mining Reclamation Bureau

WS/JMO

Enclosure

VILLAGRA BUILDING - 408 Galisteo
Forestry and Resources Conservation Division
P.O. Box 1948 87504-1948
827-5830

Park and Recreation Division
P.O. Box 1147 87504-1147
827-7465

2040 South Pacheco
Office of the Secretary
827-5950

Administrative Services
827-5925

Energy Conservation & Management
827-5900

Mining and Minerals
827-5970

LAND OFFICE BUILDING - 310 Old Santa Fe Trail
Oil Conservation Division
P.O. Box 2088 87504-2088
827-5800

BEFORE THE DIRECTOR OF THE MINING AND MINERALS DIVISION
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
STATE OF NEW MEXICO

IN THE MATTER OF THE PITTSBURG & MIDWAY COAL MINING COMPANY'S APPLICATION FOR THE RECLAMATION LIABILITY RELEASE OF PRE-SMCRA LANDS ASSOCIATED WITH THE MCKINLEY SOUTH SURFACE COAL MINE

DIRECTOR'S ORDER OF APPROVAL WITH FINDINGS OF FACT AND CONCLUSIONS OF LAW

THIS MATTER having come before the Director of the Mining and Minerals Division (Division), of the Energy, Minerals and Natural Resources Department, of the State of New Mexico, upon the application of the Pittsburg & Midway Coal Mining Company for the reclamation liability release of 1745.6 acres of Pre-Permanent Program lands associated with the McKinley South Surface Coal Mine (Mine) under the jurisdiction of the Division, the Director having considered the entire Application, having reviewed the Division's files and being otherwise fully advised in the premises, now makes the following Finding of Fact and Conclusions of Law:

Findings of Fact

1. The applicant is the McKinley Mine of the Pittsburg & Midway Coal Mining Company located near Gallup, in McKinley County, New Mexico. The application, *Reclamation Liability Release Request No. 3: Pre-Permanent Program Lands* (Application), was received on August 17, 1994.

2. Pre-Permanent Program lands means those lands disturbed before the promulgation of CSMC Rule 80-1 within mining areas 1 and parts of 4, 7, and 8 as identified in Attachment A. These lands are further categorized as follows:

   a. **Pre-Law Lands** are those lands disturbed prior to December 13, 1973. MMD has no direct regulatory authority over the reclamation of these lands. Pre-Law lands total 360.4 acres.

   b. **Rule 73-1 Lands** are those lands disturbed under the regulatory program enacted pursuant to CSMC Rule 73-1, between December 13, 1973 and

August 30, 1978. A total of 920.5 acres of land were disturbed during this period.

c. **Rule 79-1 Lands** are those lands disturbed under the interim-Surface Mining Control and Reclamation Act (SMCRA) period between August 31, 1978 and March 7, 1986. A total of 464.7 acres were disturbed during the administration of the Rule 79-1 program.

3. The Division conducted an inspection of the Pre-Permanent Program lands between April 25 and 29, 1988. In April of 1988, the Division also prepared the *Reclamation Liability Release Criteria* to provide guidance concerning bond and liability release. As a result of the inspection, the Mine, in consultation with the Division, initiated a number of plans to correct deficiencies in the pre-permanent program areas based on the reclamation standards found in CSMC Rule 79-1, which represents the highest of the pre-permanent program standards.

4. The performance criteria used for the liability release are summarized as follows (c.f. CSMC Rule 79-1):

a. Post mining use of the land "shall be those uses which the land previously supported" (Section 18(a) and (b)). Since the pre-mine use was for grazing the post mining land use is "Rangeland" (Section 18(c)(6)). In addition, these lands have historically been used by the Navajo inhabitants for winter range (Section 7 of the Application. pp. 3-6).

b. The post mining landscape must be similar to the premining landscape, provide stability and protection from erosion (Section 19).

c. The reclamation must provide for the protection of the hydrologic system (Sections 22 and 23). Specifically to ensure that water quality from the Pre-Permanent Program reclamation areas are as good or better than water entering from undisturbed areas and to prevent toxic or acid mine drainage.

d. Revegetation on the Pre-Permanent Program areas must be "diverse, effective, and permanent cover of species native to the area of disturbed land or species that will support the planned postmining uses of the land..." (Section 26(a) and (f))

5. The Mine has implemented, with the Division's approval and oversight, a number of plans designed to correct reclamation deficiencies, identified on the Pre-Permanent Program lands, and achieves the necessary performance standards:

a. Areas 4, 7 and 8 Acid and Toxic Materials Sampling and Mitigation Plan;

b. Topdressing Replacement on Areas 4, 7, and 8;

c. Chronic Erosion Features Maintenance Plan;

d. McKinley Mine Hydrologic Control Plan;

e. Area 7 Reclamation Deficiencies Correction Plan; and

f. Area 8 Reclamation Upgrade.

6. Since the 1988 inspection, the Division has included the Pre-Permanent Program areas in its monthly mine inspections.

7. On October 26, 27 and 28, 1994, the Division conducted a thorough inspection of all the lands included in the Application (*Inspection Report McKinley Mine*, prepared by Mr. John Guranich, P.E., Ms. Robyn Tierney, Ph.D., and Robert Young, October 31, 1994).

8. On November 29, 30 and December 1, 1994 the Division conducted another inspection to confirm that all of the maintenance items found in October had been repaired (Inspection Report by Mr. Robert Russell, December 14, 1994).

9. Based on the monthly inspections and the inspections conducted in October, 1994, the Division has determined that:

a. the post-mining topography is stable and provides protection from erosion. (The inspections conducted in the last six and one-half years have not identified any significant erosion problems on these lands.)

b. the post mining topography is similar to pre-mining conditions and the topography of adjacent undisturbed areas. The AOC is also consistent with the proposed post-mining land use.

10. On November 12, 1992, the Director of the Division determined, through analysis of seven years of sampling data from Area 4, that "there is no <u>significant</u> difference in water runoff quality between reclaimed and undisturbed areas."

11. On May 3, 1994, the Director of the Division determined, through the analysis of 930 surface water samples collected since 1983, that the run-off from areas 1, 7, and 8 "is as good or better than waters entering the permit area."

12. Subsequent to the field inspections conducted in October 26, 27 and 28, 1994, the Division received and analyzed vegetation data collected in 1991, 1992, 1993 and 1994 from the Pre-Permanent Program lands. Based on all available data the Division has determined that:

a. McKinley Mine has established a diverse, effective, and permanent vegetative cover of species that will support the planned postmining use of the land as winter grazing land.

1. Diverse - Based on calculations using the Shannon Wiener Diversity Index (Appendix E of the Application), measures of diversity on the liability release areas are equal to or exceed that of the reference areas.

2. Effective - Although many of the species established on these prelaw lands are introduced, their establishment provides an effective mixture of similarly aspected perennial species that will support the postmining land use of winter season grazing.

3. Permanent - The establishment of a permanent vegetation has been achieved with a average relative percent perennial cover over a three year period of 35.6%. Canopy cover on the liability release areas (usually comprised of shrubs such as *Atriplex canescens*) was approximately 6% higher than that on the reference areas (Appendix F of the Application). Visual inspection of the acreage in September and October of 1994 evidenced considerable seed production and tiller development for all of the perennial grasses. Seed set in the shrub component was also high on these same sites. **This evidence of reproductive and propagative success indicates that under proper management and use (controlled winter grazing) the vegetation will remain as a permanent component of landscape.**

b. Revegetation has been carried out in a manner that encourages rapid growth of vegetative cover and recovery of productivity levels compatible with the approved postmining land use of grazing. Annual perennial production on liability release areas in both 1992 and 1993 exceeded production levels on the reference areas by 123 lbs/ac and 171 lbs/ac, respectively.

c. Current levels of vegetation cover (Appendix E of the Application) are equal to or exceeds that of comparable reference areas. This level of vegetative cover has been demonstrated to be capable of stabilizing the soil surface from erosion.

d. The highest forage nutritive value of the species established on the liability release areas is in the winter (November - February). Established vegetative cover on the liability release areas is currently composed of species with equal or superior utility for the intended land use of winter grazing. Established species include both native and introduced species; the forage values of which are demonstrated in Table 7.1 (Section 7 of the Application, p. 5).

e. The Mine has seeded introduced species including: Russian Wildrye, crested wheatgrass, and alfalfa on the liability release areas. Most of these lands, however, are Pre-Law lands. Further, it must be acknowledged that during the 1970s and early 1980s, the use of introduced species for mineland reclamation was a widely accepted practice among all of the State and Federal land management agencies because there were very few sources for native seeds or plant materials. These introduced species were selected for reclamation because they do provide stabilizing cover and appropriate utility to western rangelands.

f. Success of revegetation on the liability release areas has been measured on the basis of reference areas. MMD has evaluated the reference areas for geology, soils, aspect and vegetation type and has found them to be suitable for making comparisons with the liability release areas.

g. Ground cover of living plants on all portions of the liability release area during the 1991, 1992, 1993 growing seasons was not significantly different (Kruskal-Wallis test, $\alpha = .05$) from that of the reference areas.

h. Species diversity, distribution, seasonal variety, and vigor on liability release lands were evaluated using both a technical standard and criteria from CSMC 79-1. Approximately 1280 acres were reclaimed or redisturbed as prelaw or pre-SMCRA lands from 1973-1979. The remainder of lands (534 acres) were redisturbed from 1979 to 1986. Thus, it is appropriate to evaluate the reclamation success of this liability release on the basis of both technical/scientific information and the technical standards outlined in 79-1.

CONCLUSION OF LAW

1. The Director has jurisdiction over the applicant and the subject matter of this proceeding.

2. The Applicant, the McKinley Mine, has conducted reclamation activities 1745.6 acres. The success of the reclamation on these lands meets or exceeds the regulatory requirements under which they were mined and permitted: the State of New Mexico's Coal Surfacemining Act of 1972, and its pursuant regulations CSMC Rule 73-1, and interim SMCRA regulations, CSMC Rule 79-1. It is also important to note that lands mined before the existence of coal mining regulatory programs in New Mexico (pre 1973) have also been reclaimed to the same standards as the other lands included in the Application (post 1973).

ORDER

NOW THEREFORE, IT IS HEREBY ORDERED that the 1745.6 acres of Pre-permanent program lands, identified on Attachment A, be released from further liability by the Division.

By Order of the Director, Mining and Minerals Division, Energy, Minerals and Natural Resources Department, of the State of New Mexico.

Dated this 14th day of December, 1994

John Lingo, Acting Director
Mining and Minerals Division
Energy, Minerals and Natural Resources Department

MCKINLEY MINE
RECLAMATION LIABILITY RELEASE REQUEST NO. 3
PRE-PERMANENT PROGRAM LANDS

AUGUST 15, 1994

MCKINLEY MINE
RECLAMATION LIABILITY RELEASE REQUEST NO. 3
PRE-PERMANENT PROGRAM LANDS

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SECTION 1--EXECUTIVE SUMMARY

This document represents The Pittsburg & Midway Coal Mining Co.'s ("P&M") reclamation liability release request for a portion of lands disturbed by mining under Pre-Law, the 1973 Surface Coal Mining Regulations, Rule 78-1 and Interim SMCRA Program laws and regulations (Rule 79-1), and attendant permits, at the McKinley Mine. This document summarizes activities accomplished by P&M, and correspondence between the Mining and Minerals Division ("MMD") related to the release of reclamation liability on these lands. In addition, it contains new information addressing MMD deficiencies related to the release of these lands identified in correspondence from the MMD to P&M dated June 17, 1988.

This document contains:

SECTION 1--EXECUTIVE SUMMARY, A synopsis of this document;

SECTION 2--RECLAMATION LIABILITY RELEASE HISTORY, A synopsis of the request for reclamation liability release on these lands to date;

SECTION 3--RELEASE AREA DESCRIPTION, A description of the lands, including location, for which release of reclamation liability is sought;

SECTION 4--ADDITIONAL REQUIREMENTS, A description of methods and practices which have been used to address erosional stability, acid and toxic forming materials and landscape stability on these lands;

SECTION 5--REVEGETATION, A description of the revegetation activities that have been carried out on the requested release area and the monitoring that has been conducted to show that the revegetation meets release criteria;

SECTION 6--HYDROLOGY, A description of the hydrologic controls used in the mining and reclamation process, and monitoring activities that have been carried out on the proposed release area to minimize disruption of the hydrologic balance and show that hydrologic requirements for liability release have been met; and

SECTION 7--POST MINING LAND USE; Describes the utility of the reclaimed lands and compares them with baseline and reference area lands, with regard to year-round and seasonal postmining livestock grazing, wildlife values, and SCS condition and carrying capacities.

Reclamation has been accomplished on the disturbed lands in accordance with the requirements of the approved permits and the applicable regulations. Requirements for backfilling and grading, revegetation, hydrology and mitigation of potentially acid or toxic forming materials, as applicable, have been met or exceeded. In addition, correction plans for specific problem areas within the release areas identified during previous release request site inspections have been satisfactorily accomplished. Implementation of the specified corrective measures at these sites has corrected the problems and satisfied the deficiencies. This has been verified by subsequent site inspections of these sites by MMD personnel.

SECTION 2--RECLAMATION LIABILITY RELEASE HISTORY

MINING AND RECLAMATION OVERVIEW

The Pittsburg & Midway Coal Mining Co. ("P&M") began mining coal at the McKinley Mine during the middle of the 1960's. At this time there were no federal or state laws regulating surface coal mining in the State of New Mexico, nor were any special permits required. In 1973 the State of New Mexico permitted surface coal mining activities (permit nos. 3 and 3-A-1) at the McKinley Mine under the 1973 Surface Coal Mining Regulations.

In 1978 the state's interim SMCRA program regulations (Rule 78-1) were approved, with mining activities then being inspected under these regulations by the Mining and Minerals Division ("MMD"). In 1979, Rule 79-1 was approved and became the applicable standard for interim SMCRA program inspection purposes. At this time it was agreed between the MMD and P&M that all interim SMCRA program lands would all be inspected under Rule 79-1. Accordingly, Interim-SMCRA as used in this document refers to those lands which were disturbed under Rules 78-1 and 79-1. An interim SMCRA program permit was not issued for the McKinley Mine. In 1986, McKinley's first permanent program SMCRA permit was issued by the MMD.

During each of these regulatory periods, Pre-Law, Rule 73-1, Rule 79-1 and Permanent Program SMCRA, the location of lands which were disturbed and subject to particular regulatory standards were documented. Period specific reclamation standards apply to the lands based on the timing of their disturbance.

RECLAMATION LIABILITY RELEASE--CORRESPONDENCE HISTORY

A number of documents concerning release of reclamation liability on these lands have been produced by the MMD and P&M. A summary of these documents and a brief description of their contents is contained in **Table 1**. Copies of the documents are contained in Appendix A.

RECLAMATION LIABILITY RELEASE AREAS

Mining disturbance occurred under three regulatory categories including Pre-Law, Rule 73-1 and Rule 79-1. Pre-Law lands were those disturbed from the mines opening in 1967 until 1973 when the state promulgated the 1973 law and attendant regulations. Rule 73-1 mining disturbance lands were those mined under the 1973 regulations during the period from 1973 through adoption of the SMCRA interim program regulations in 1978. In 1978, Rule 78-1, and in 1979, Rule 79-1, were adopted and approved by the Coal Surface Mining Commission. The OSMRE approved these regulations and granted the State of New Mexico primacy for the enforcement of SMCRA. For the purposes of this document, lands disturbed under Rules 78-1 and 79-1 will be collectively referred to as Rule 79-1 lands.

Table 1

DOCUMENT DATE	ORIGINATOR	DESCRIPTION
10-Sep-85	P&M	Areas 4 and 8 Topdressing Requirements Identification Plan
8-Feb-86	P&M	Permit No. 3-A-1 Permit/Bond/Insurance, Graded Spoil Sampling Plan Areas 4, 7 and 8
26-Sep-86	P&M	Areas 4 and 8 Graded Spoil Sampling Results and Proposed Mitigation
1-Oct-86	P&M	Permit Nos. 3 and 3-A-1, Areas 4, 7 and 8 Acid and Toxic Materials Sampling and Mitigation Plan
9-Oct-86	MMD	Permit 3-10P, Topdressing Replacement on Areas 4, 7 and 8
15-Oct-86	P&M	Permit No. 3-10P 1986 Revision-Area 4 Continuation of Mining
26-Mar-87	MMD	Permit No. 3-10P 1986 Revision-Area 4 Continuation of Mining
27-Mar-87	P&M	Permit No. 3-10P 1986 Revision Acceptance
19-Jun-87	P&M	Chronic Erosion Features Maintenance Plan
April 1988	MMD	Reclamation Liability Release Criteria
9-Jun-88	MMD	File Memo-Liability Release Permit No. 3
17-Jun-88	MMD	Permit No. 3 and 3-A-1, Pre-SMCRA Reclamation
21-Nov-88	P&M	McKinley Mine Hydrologic Control Plan Implementation Update and Completion Deadline Extension
12-Dec-88	MMD	Reclamation Upgrading-Permit No. 3 Lands
18-Jan-89	P&M	Permit No. 3, Area 7 Reclamation Deficiencies Correction Plan
24-Jan-89	MMD	Permit No. 3, Area 7 Reclamation Deficiencies Correction Plan Approval
7-Feb-89	P&M	Permit No. 3, Area 7 Reclamation Deficiencies Correction Plan-Performance Standard Applicability Clarification
18-Aug-89	P&M	Areas 4 and 8 Hydrologic Control Plan As-Builts and Drainage Designs Submittal

COMPLETED RECLAMATION ACTIVITIES

Mining and reclamation operations have been completed on the lands disturbed by mining for which the release is requested. The disturbed lands have been backfilled and graded to approximate original contours, blending in with surrounding lands. Where required, topdressing has been uniformly redistributed to create a suitable plant growth medium. Revegetation operations have been carried out, with a permanent, diverse stand of vegetation being established that will support postmining land uses. The minimum two year growth period for permanent establishment has been met by all vegetation, where applicable.

In addition to requirements contained in the regulations and the applicable permits, MMD and P&M personnel have previously inspected the areas contained in this release. During the course of these inspections, a number of conditions have been identified which did not completely satisfy the reclamation requirements. In order to correct these problems, P&M developed and implemented correction plans. The MMD reviewed and approved these plans, and monitored their implementation and effectiveness after completion. These corrective plans included the following:

1) Areas 4, 7 and 8 Acid and Toxic Materials Sampling and Mitigation Plan;

2) Topdressing Replacement on Areas 4, 7 and 8;

3) Chronic Erosion Features Maintenance Plan;

4) McKinley Mine Hydrologic Control Plan;

5) Area 7 Reclamation Deficiencies Correction Plan; and

6) Area 8 Reclamation Upgrade.

Detailed information concerning the problems which were identified and the corrective measures undertaken to correct them are described in the correspondence contained in Appendix A. A brief discussion of the reclamation activities accomplished under these plans follows below by plan. **Table 2** lists the Mining Areas and the drainage structures placed within them to control erosion problems. The corrective measures have been completed, have effectively corrected the problems, and have been evaluated by MMD personnel in the field during routine and special inspections and have met with their approval. Additionally, items identified during the course of routine monthly inspections on the release areas have been corrected to the satisfaction of the MMD.

Areas 4, 7 and 8 Acid and Toxic Materials Sampling and Mitigation Plan

This plan addressed the testing and mitigation of Potential Acid and Toxic Forming Materials ("PATFM") occurring within the rooting zone of graded spoil. Testing was carried out on a grid pattern, with SAR being the only PATFM identified in the areas. Where PATFM materials were identified at unacceptable levels of concentration, a minimum of two feet of neutral dressing was imported to cover these areas. Required operations were accomplished while P&M conducted mining operations in Area 4 under Permit No. 3-10P.

Topdressing Replacement on Areas 4, 7 and 8

This document established the requirements for the placement of neutral dressing and topdressing on Pre-Law disturbance areas. Soil reconstruction required the replacement of a minimum of six inches of topdressing, PATFM areas required the placement of a minimum of two feet of neutral dressing. Oxidized sandstone materials were imported from Area 4 to fulfill the requirements of this plan.

Chronic Erosion Features Maintenance Plan

Eleven sites were identified through site inspection in mining Areas 1 and 4. Problems identified for correction included slope erosional stability and concentrated flow erosion in the form of gullies and headcutting. Sites where concentrated flow erosion required correction included 1-1, 1-2, 1-5, 1-6, 1-7, 1-8, 1-10 and 4-1. Riprapped lined channels or railroad tie stabilization measures were used to control the unacceptable erosion rates in the drainage features. Revegetation problems were identified at sites 1-3 and 1-9. These areas were interseeded or had transplants placed to improve the vegetation. Slope erosion problems were identified at sites 1-4 and 1-9 which were corrected through the placement of gradient terraces and drains which feed into reconstructed drainage channels. The work identified in this plan was completed June 1, 1987.

Areas 4 and 8 Hydrologic Control Plan

Concentrated flow areas were identified were erosion rates were excessive. The plan required the design and placement of gradient terraces and drains, reconstructed drainage channels and check dams, and the revegetation of areas disturbed in implementing this plan. The required structures were designed, approved and constructed during the 1989 reclamation season.

Area 7 Reclamation Deficiencies Correction Plan

This plan identified: 1) Areas of high acidity or sodicity in Area 7 that were impacting the establishment of vegetation, and 2) Areas which were hydrologically unstable and

required stabilization work. For the acid and sodic materials problem areas, suitable mitigative materials were identified and imported, with the problem areas being covered with a minimum of two feet of neutral dressing. Following the placement of the neutral dressing, the areas were revegetated. For the areas that were hydrologically unstable, steep slopes were graded flatter and one terrace and three drainage channels constructed to route concentrated flows through the reclaimed area. Revegetation was established following the completion of grading, and terrace and channel construction.

Area 8 Reclamation Upgrade

In Area 8 reclamation maintenance and repair items were identified where: 1) Vegetation was marginally successful, 2) Concentrated flows were causing erosion problems, 3) Long slopes were experiencing excessive erosion towards the bottom of their length, 4) A small depression required filling, 5) and the elimination of a highwall remnant was needed. To repair the vegetation problem areas, a minimum of two feet of neutral dressing was imported and revegetated. Berms, terraces and small depressions were judiciously placed to improve hydrologic stability. The longer slopes were shortened using gradient terraces and the depressional area filled. The highwall remnant was eliminated by pushing spoil against it. Areas disturbed by these operations were revegetated during the 1989 seeding season.

Table 2

MINING AREA	STRUCTURE TYPE	STRUCTURE IDENTIFICATION NO.	COMMENTS
1	rocked drains	1D1 thru 1D4	Constructed under Chronic Erosion Features Maintenance Plan Site 1-2
1	check dams	1CD1 thru 1CD3	Constructed under Chronic Erosion Features Maintenance Plan Site 1-2
1	rocked drains	1D5 thru 1D18	Constructed under Chronic Erosion Features Maintenance Plan Site 1-4
1	check dams	1CD4 thru 1CD6	Constructed under Chronic Erosion Features Maintenance Plan Site 1-4
1	check dams	1CD7	Constructed under Chronic Erosion Features Maintenance Plan Site 1-7
1	rocked drains	1D20, 1D21	Constructed under Chronic Erosion Features Maintenance Plan Site 1-7
1	check dams	1CD8	Constructed under Chronic Erosion Features Maintenance Plan Site 1-8
1	rocked drain	1D22	Constructed under Chronic Erosion Features Maintenance Plan Site 1-7
4	check dams	4CD2 and 4CD3	Constructed under Chronic Erosion Features Maintenance Plan Site 4-1
4	rock drains	4D1	Constructed under Chronic Erosion Features Maintenance Plan Site 4-1
4	check dams	4CD1	Constructed under Areas 4 and 8 Hydrologic Control Plan
4	check dams	4CD4 thru 4CD14	Constructed under Areas 4 and 8 Hydrologic Control Plan
4	rock drains	4D2 thru 4D15	Constructed under Areas 4 and 8 Hydrologic Control Plan
7	check dams	7CD1 thru 7CD5	Constructed under Area 7 Reclamation Deficiencies Correction Plan
7	rock drains	7D1 thru 7D7	Constructed under Area 7 Reclamation Deficiencies Correction Plan
8	rock drain	8D1	Constructed under Areas 4 and 8 Hydrologic Control Plan

SECTION 3--RELEASE AREAS DESCRIPTION

The areas for which release of reclamation liability is sought are depicted on Exhibit 1.1. The formation of logical units of land disturbed prior to the issuance of Permit No. 3-10P (1986) was the primary basis for selecting the release areas shown in this release application. Land ownership information is contained on Exhibit 2.4-1, contained in Volume I of the current PAP (No. 3-11P).

The regulatory periods under which these areas have been classified as logical units of initial disturbance or redisturbance are depicted on Exhibit 2.1. This exhibit shows disturbance or redisturbance under three distinct regulatory periods. These periods were established with MMD June 5, 1987 as documented in Permit No. 3-10P (page 4.8-6 and Exhibit 4.8-1) and include:

- Pre-Law Disturbance (Prior to December 12, 1973),
- Pre-SMCRA Disturbance (between December 12, 1973 and February 15, 1979), and
- Interim SMCRA Disturbance (between February 15, 1979 and March 7, 1986).

These regulatory periods are depicted on Exhibit 2.1 using symbols that correspond to initial disturbance or redisturbance according to these regulatory periods. The acreages that correspond to these regulatory periods are summarized in Table 3.1 below.

TABLE 3.1: INITIAL DISTURBANCE OR REDISTURBANCE ACREAGES

Initial Disturbance Period	Redisturbance Period	Acreage
Pre-1973	not redisturbed	360.4
Pre-1973	1973-1979	21.1
Pre-1973	1979-1986	184.5
1973-1979	not redisturbed	899.4
1973-1979	1979-1986	27.5
1979-1986	Not applicable	252.7
Total acreage in this release application:		**1745.6**

SECTION 4--ADDITIONAL REQUIREMENTS

Based on observed problem areas during the 1988 inspections, MMD requested that P&M address three additional concerns, as follows.

> *"In addition to providing more complete data on vegetation and water quality than was submitted with the January 19, 1988 application, P&M must provide information on landscape stability, erosional stability, and potential off-site damage from toxic and acid forming materials. The CSMC is required by law to ascertain that post mine erosion is no greater than pre-mine erosion, that probable damage to biological communities from acid and toxic forming materials is no greater than before mining and that reclaimed landscapes are stable and suited to the planned postmining land use."*

EROSIONAL STABILITY

> *"There is a substantial amount of evidence that pre-mine erosion was slight to moderate over most of the area covered by this request. Of the 27 site locations where erosion was documented during the soil survey of the McKinley Mine, 23 indicated slight erosion, 1 indicated slight to moderate erosion and 3 indicated moderate erosion.*
>
> *"The New Mexico Soil and Water Conservation Division Erosion Survey indicated that erosion rates in the general area of McKinley Mine are 0.6 to 3.0 tons per acre per year. P&M Permit No. 3-IOP indicates pre-mine erosion is 1.6 to 2.0 tons per acre per year. A field study conducted by P&M and MMD personnel during 1986 predicted erosion rates from the most severe slopes was 1.2 to 6.1 tons per acre per year.*
>
> *"In contrast to pre-mine erosion data, post-mine data is very limited. Data collected by Devon E. Jercinovic from "reclaimed bedrock areas that had been seeded to crested wheatgrass" indicated that erosion was removing 0.9 centimeter per year of material from convex slopes. This is equal to 57 tons per acre annually. At that rate, 6 inches of topdressing would be removed in 17 years even at a constant rate of removal.*

"Erosion rates in a specific climatic region are governed by soil, surface cover, and slope length, shape and gradient. According to data provided by P&M, post-mining vegetation is better than pre-mine vegetation. This should result in less erosion after reclamation. However, P&M has been forced to repair rills and gullies on many steeper slopes and there is other evidence that erosion is excessive.

"The major difference in pre and post mine features is the much greater post-mining slope lengths. The longest 3:1 and 4:1 slopes found by P&M and MMD personnel on pre-mine landscapes were 84 and 100 feet respectively. Most slopes were much shorter. Many post-mine areas have 3:1 and 4:1 slopes with lengths of 300 to 400 or more feet. These kinds of slopes may preclude long term stability of the areas for the intended use since rangeland, in contrast to more intensive uses, should be stable without continuous maintenance.

"In addition to data provided in the January 19, 1988 request for liability release, P&M must provide data on post-mine erosion rates."

P&M installed terraces and drains, check dams and additional water harvesting and control structures to minimize surface runoff and to control concentrated flows in accordance with corrective action plans approved by the MMD during the 1987-88 period. These efforts combined with considerable vegetative improvements have significantly reduced sheet erosion on steeper, longer slopes within the reclaimed area.

Under this process, the areas where hydrologic mitigation actions were required were identified and implemented with MMD guidance and approval. During all subsequent MMD inspections of these sites, it was indicated that mitigative activities implemented by P&M satisfied MMD concerns.

To address the MMD's concern related to rill and gully formation, no slope erosion repairs have been required for rills or gullies on any of the release area lands in at least the last six years, testifying to both the erosional stability and to the soundness of the mitigative repairs. Please note that no significant rill and/or gully formation has been noted on any of the mine's reclaimed lands within the same time period, further verifying the validity of methods currently employed, particularly terracing and drains, to assure erosional stability both during and after reclamation activities.

A significant analytical study of numerous similar slopes contained on OSM jurisdictional areas has resulted in verification that annual erosional losses were less than 2.0 tons/ac-yr for all cases, meeting a requirement that reclaimed erosional rates be less than premining erosional stability as determined by the MMD. In many of the cases, these slopes were both steeper and considerably longer than those of concern to MMD. Further, the OSM preferred that P&M not consider terraces or contour

furrows in these post-reclamation slope analyses, because the longer term stability of such structures could not be verified beyond the immediate reclamation activities.

Through this lengthy process, P&M established through field investigations by Mariah & Associates, more correct values for basal cover and canopy cover. The Mariah Study is contained in Appendix G3. In addition, these erosional loss studies employed the use of RUSLE for segmented slopes (i.e. convex slopes), rather than the uniform slopes addressed by USLE.

The validity of these analytical determinations has been verified through erosion pin studies (i.e. some by MMD) and by a mine-wide lack of rill and gully formation. Each phase of the work performed in this study was supervised and accepted by both OSM and MMD personnel.

The other method employed to verify erosional loss rates was through monitoring of small paired watersheds (reclaimed verses undisturbed). These stations were set in watersheds that were first determined to be comprised of similar slope and channel configurations. Over a sampling period of six years, monitoring of the paired stations established that surface runoff from reclaimed areas held less suspended and settleable solids than runoff from undisturbed areas. This verifies that erosional loss rates are less for reclaimed areas than for premining/undisturbed areas. The MMD concurred in their May 3, 1994 correspondence stating that:

> *"The Division concurs that erosion from the regraded areas has been controlled to the satisfaction of the director and that vegetation exists in sufficient quantities to continue to control erosion at this time."*

To P&M's knowledge, this finding addresses all erosional stability concerns related to PreLaw areas, old Permit 3 and 3A areas, and Interim Permit areas, comprising this release request; relieving P&M of any further sampling or obligation to prove stability for these areas.

ACID AND TOXIC FORMING MATERIALS MITIGATION

> *"During the week of April 25, 1988, MMD personnel evaluated areas on P&M's McKinley Mine (South) that were seeded prior to 1979. The surface material in isolated spots within several areas exhibited evidence of toxic or acid conditions, e.g. poor vegetative cover, very firm or very friable surfaces, and staining from runoff or drainage. Subsequent analyses of surface soil samples collected during the week show pH of surface materials as low as 2.9 and SAR of other samples as high as 22. Fortunately the areas of toxic and acid materials are small and isolated.*

"Although locally severe, the problem with acid and toxic forming materials should be easily mitigated provided mine management initiates corrective actions at opportune times during mining activities."

All significant areas so identified were treated according to MMD approved plans. No significant areas exist at this time which lack vegetation sufficient to stabilize the soils. Over time, many of the smaller identified areas have exhibited moderated PATFM conditions through natural oxidation and leaching processes. On such areas, the vegetation has thickened over the same period, providing for both additional stabilization and increased infiltration/oxidation rates. Under these cyclic processes, vegetative cover will continue to improve over time, as PATFM factors continue to moderate.

No significant occurrence of toxic agents in runoff waters from any of these areas has ever been noted in any of the water monitoring programs. Many of the identifiable toxic parameters have moderated and continue to moderate over time (see Monte Anderson findings at Appendix B). Thus, with sufficient vegetative cover established, with moderating soil conditions, with no significant occurrences of toxic elements in runoff water, and with continuing improvements to water quality; P&M is confident that all concerns related to Acid and/or Toxic-forming materials have been sufficiently addressed.

In reviewing to approximately 930 surface water samples taken to evaluate chemical quality of waters, the MMD has previously determined that P&M has met regulatory requirements (Monte Anderson correspondence of May 3, 1994):

"Values for pH, total suspended solids, total dissolved solids, and sulfates are better than values in waters entering the permit area. Values for total iron are slightly higher than waters entering the permit area, but not so much as to pose a threat or danger to the environment. Values for total iron can also be shown to be improving over time in a time series forecast."

To P&M's knowledge, this finding addresses all concerns related to the effect of PATFM occurrences on water quality from PreLaw areas, old Permit 3 and 3A areas, and Interim Permit areas, comprising this release request. This finding therefore relieves P&M of any further sampling or obligation to prove that no probable damage to biological communities from PATFM for these areas would occur.

LANDSCAPE STABILITY

"Except for surface sheet and rill erosion, the landscapes appear stable in most places. During the week of April 25, 1988 two headcuts were

noted, which unless treated, will negatively impact landscape stability in the reclaimed areas where they occur. In addition, there are two impoundments which may or may not be permanently stable. These impoundments have a potential to cause mass movement on a reclaimed slope or overflow and cause gullies to form.

"P&M must stabilize all headcuts around the perimeter of the reclaimed areas and verify the stability of all permanent impoundments."

The entire perimeter of the release areas had been inventoried during the 1988-89 period. All identified problems were noted and repaired under plans approved by MMD. Subsequent inspections and inventories have identified no further instabilities at these sites or identified any new sites for concern. Thus, all headcuts around the perimeter of the release areas have been stabilized and are verified to be stable. P&M maintains that the issue of landscape stability has been fully addressed.

At Chapter 6, P&M has included maps (Exhibit 6.1) which identify all impoundments, check dam series, channel control structures, significant rock drains, and significant depressions. Each of these sites have been examined for any signs of instability by a Professional Engineer and certified statements from these inspections are included in Appendix C which verify that all structures or series of structures are considered stable and that no concerns have been noted.

In the case of the two impoundments mentioned by MMD, one has been converted to a channel control structure with a small depression, but no water retention by the associated berm. The second structure has been filled in to the point that it only acts as a rocked downdrain, with no remaining storage capacity. All slopes and spillways originally associated with those structures have been inspected for any sign of instability and as certified by the PE at Appendix C, no problems have been noted.

SECTION 5--REVEGETATION

REVEGETATION SUCCESS CRITERIA

Narratives under Rule 79-1 require that revegetation be a *"diverse, effective, and permanent vegetative cover of species native to the area of disturbed land or species that will support the planned postmining uses of the land..."* Section 26 (a) (2) also requires that reclaimed vegetation be prompt, that it will *"encourage recovery of productivity levels compatible with approved land uses"*, and that it be capable of stabilizing the soil surface with respect to erosion. In order to demonstrate that such requirements have been met, P&M has monitored the reclaimed areas and provided data to MMD.

Revegetation monitoring information is contained in the annual reports submitted to the commission. Copies of this information are contained in Appendix E. Such information includes revegetation sampling to statistical adequacy for ground cover; with data based upon cover (total, basal, canopy, and live perennial grass & shrub), diversity and annual biomass productivity.

Section 26 (a) (2) also requires that the vegetation be of *"the same seasonal variety native to the area disturbed"*, and defines seasonal variety as *"when it consists of a mixture of species of equal or superior utility for the intended land use when compared to the utility of naturally occurring vegetation during each season of the year"*. P&M has included considerable discussion of the reclaimed vegetation as it relates to postmining land uses and comparison to both baseline vegetation and reference areas, in SECTION 7 of this request.

Section 26 (f) discusses the use of reference areas as the basis for establishing a benchmark for success. However, this same section at (f) (2) exempts lands disturbed prior to June 15, 1979, which actually comprise the majority of the lands addressed by this request. Therefore, even though reference data has been supplied which can be compared to data obtained from all reclaimed areas contained in the release request, before finding that an area might potentially fail, the reviewer must consider the date of disturbance and whether vegetative cover is sufficient to prevent erosion. However, P&M is confident that all areas for which release is requested will meet or exceed both old law and Rule 79-1 requirements.

The actual requirement of the exemption at Section 26 (f) (2) is that ground cover will not be considered equal if it is *"less than 90 percent of the ground cover of the*

*reference area for any **significant portion** of the mined area."* (emphasis added) P&M would note that the interim areas included in this release request do not make up a *"significant portion"* of any of the management units defined for sampling. Therefore, the absolute need that any of the areas meet 79-1 criteria is a moot point, not worthy of consideration unless Rule 79-1 lands make up a significant portion for an area and the vegetation is inadequate for that Rule, which is not the case.

For the reasons discussed, Appendix F contains vegetative sampling data and complete descriptions for five reference areas established in conjunction with Permanent Program Permit 3-11P, for years 1991 through 1993. A short comparison of data for years 1991 through 1993, revegetated areas verses reference areas, has also been included here for comparison purposes.

P&M has included baseline studies prepared by Dames & Moore (1974), Harner-White (1980), and Mariah (1990). These studies are contained in Appendices G.1, 2, & 3, respectively. For general purposes, a short data comparison between premining and reclaimed vegetation has been included here. Because most of the reclaimed areas are comprised of pre-Rule 79-1 disturbance (i.e. Pre-SMCRA), comparison to these baseline studies becomes the primary evaluation for success. Note that data from these baseline studies is similar to that data provided for the reference areas only for sage-grass areas. Because the majority of the reclaimed areas exhibit the characteristics of these sage-grass areas, with the exception of a near total lack of sage species, P&M will agree that these higher productivity areas be the basis for comparisons with reclaimed areas.

It is incumbent upon the Director or the Commission to make determinations of vegetative success based upon the considerable body of data presented, tempered with field investigations and independent reports by MMD personnel. In this regard, P&M has not attempted to establish hard criteria for success, but relies on comparison to both the reference areas and the information contained in the baseline studies, under various forms of cover, productivity, and utility analysis.

REVEGETATION METHODS

The lands in this release application have been reclaimed using the prescribed topdressing and revegetation methods, as contained in P&M's Permit conditions. Topdressing has been applied to all lands requiring this treatment. Please note that redisturbed pre-law lands did not require the use of topdressing. Soils were not replaced in these locations, but revegetation has been accomplished using the required methods. Discussion here and additional discussion in SECTION 7 -- POST MINING LAND USE addresses the revegetation methods employed on the release areas, while Appendix D provides maps showing seeding dates and enhancement endeavors to establish additional species, tree seedlings and transplanted species.

Revegetation was an integral part of the mining operation and has been timely completed. Vegetative species planted in the disturbed areas were those designated in the approved mine plan, with mixes used being documented in the annual reports. Both native and adapted introduced species have been utilized in reclamation on these areas. Such efforts established a stable vegetative cover adequate to protect against surface erosion in a very short timeframe. In addition to these vegetative stability efforts, over a longer period P&M has established later seral stage vegetation aimed at increasing long term stability, diversity, tree and wildlife habitat species through interseedings, custom plantings, and transplantings.

The lands disturbed under P&M's permits have been reclaimed to rangeland, with significant increases in annual grazable forage production. Following reclamation liability release it is expected that the land owners will utilize these lands for that purpose. As a subset of this landuse, P&M has endeavored to establish through interseedings certain species (brush, legumes and forbs) determined to provide valuable browse and cover for wildlife. P&M's enhancement endeavors also included efforts to establish additional trees, brush, warm-season grasses and riparian/aquatic species through custom plantings of over 240,000 seedlings and 14,000 transplantings, either by hand or machine methods. Documentation describing these efforts is contained in Appendix D.

MEASURING REVEGETATION

This section describes revegetation sampling design and methodologies used to evaluate the success of revegetation efforts and plant community establishment on reclaimed lands and Reference Areas. The sampling methodology is the same as what was approved for the MMD permit and what was used during the 1991, 1992 and 1993 revegetation monitoring programs. This sampling, along with ongoing monitoring of all of the reclaimed areas, has allowed P&M to create a database. This database will be made available to MMD upon request and will help P&M to determine the following:

- Which plant species are growing and regenerating on reclaimed lands;
- If the current seed mix is establishing adequate amounts of each species;
- The optimal reclamation and vegetation management practices;
- If the species being established are adequate for livestock grazing and wildlife food or cover needs; and
- If the vegetation is stable under various weather conditions, grazing practices, or management practices.

Sampling Timing and Design

Revegetation success sampling is conducted periodically during the liability period and at a minimum, during the last two years prior to submittal of a liability release applica-

tion. In the case of this release request, partial areas were sampled in 1985 and 1991, with full area sampling for cover, productivity and statistical evaluations for 1992 and 1993. Diversity is a number calculated from cover statistics (i.e. Shannon-Weiner Diversity Index).

Vegetation samples are collected between June 1 and October 15 for each management unit. If additional time is needed, and weather conditions are favorable, the October 15 date is requested to be extended. For the purpose of this release request, management units will consist of those vegetation sampling areas as shown on Exhibit 5.1.

Exhibit 5.1 was developed from Exhibit 1.1, using the pre-existing boundary lines of Exhibit 1.1 and incorporating the boundaries into smaller unit areas that are more consistent in aspect and relative position within the larger release areas. Each unit in some respect crosses over haulroad and ramp areas, which either have been or will be reclaimed, and are subject to sampling as revegetation progresses. Haulroads to remain for final use purposes, as instructed by land-owner lease agreements, will be narrowed and just the outer shoulders reclaimed.

Each unit is located within the release request boundaries and each unit was defined using a "best fit" approach. Sample area boundaries were delineated so as to establish trends that could be evaluated with one primary success standard. The areas consist of one or more years of seeding and are large enough that they can be reasonably sampled.

Vegetation sample points within a management unit have been located by subdividing the management unit into a 200' x 200' grid that is oriented north-south and east-west. The grids are numbered consecutively along the two axis. Sampling points have been selected by computer generating groups of random numbers that correspond to grid numbers. The first number generated will identify the X-axis, the second number will identify the Y-axis, and the third number identifies the orientation of the transect. After sample points are selected, the points have been located in the field by pacing from known locations.

Except during the last two years prior to the submittal of a liability release application, any given management unit may or may not have been sampled to adequacy each year. The following criteria is used to determine if sampling to adequacy is beneficial:

- If previous sampling has shown that the vegetation is adequate to meet success standards and that stability has been established, annual sampling to adequacy would be unnecessary to meet goals of the sampling and would be wasteful of resources. On such areas, reduced sampling or at a minimum, visual inspection has been performed to determine if any gross changes were noted. If such items were noted, further sampling or additional management practices have been completed.

- During periods of drought or in extremely wet years, P&M may choose to sample for adequacy to collect data depicting the changes in stability and/or succession rates caused by the weather condition.
- Prior to, during, and after the implementation of a grazing program, P&M will sample to adequacy. This data, despite being generated over a short-term period, will be more beneficial in showing final land use related productivity than long-term annual productivity, alone.
- Where previous sampling has indicated that vegetation is unstable or does not meet success standards, P&M has performed sufficient sampling to properly manage the unit. Such sampling may include plant tissue samples, soil toxicity samples, and soil nutrient levels, as well as the standard parameters discussed herein.
- Where previous sampling or observations indicate the presence of poisonous or noxious species, P&M will sample and perform the necessary, prudent and justified management practices to reduce the occurrence of such species.
- If P&M or MMD feel additional sampling is necessary for any specific reason, P&M will perform sampling to adequacy on any given management unit.

Sample size is determined using a 90% statistical confidence interval and the formula below (Snedcor and Cochran, 1967).

$$m = \frac{t^2 + s^2}{(0.1 * x)^2}$$

where: m = minimum number of observations needed
t = table value for the 90% level of confidence with n-1 degrees of freedom (one tailed t distribution)
s = variance estimates from preliminary vegetation sampling (standard deviation)
x = mathematical mean of the measured values

One minor exception to what was approved in the MMD permit is that the table value for t has been based on a 90% confidence interval with n-degrees of freedom, instead of infinite degrees of freedom. This error has been subsequently revised in the current New Mexico 3-11P Permit.

Vegetative Sampling Methodologies

This section discusses vegetative sampling methodologies for ground cover, productivity, diversity, and woody stem stocking. Exception to the standard methods was 1991, when lack of availability of 50 meter tapes made the use of 15 meter transects neccessary, with all values adjusted accordingly.

GROUND COVER MEASUREMENTS

Ground cover is measured using point sampling along a 50 meter transect. Measurements are collected every meter along the transect. Transect orientation is randomly chosen for each sample point by using a computer program to generate a random number between 0 and 1, which is multiplied by 360 to obtain the bearing. If the transect runs out of the sample area, a new random orientation is selected that brings the transect back into the sampling area. Data is collected by recording objects that intercept the line of sight below and perpendicular to the tape (cover and basal). Objects that are recorded are plant litter, living plants, rocks, aggregates, or bare ground. When a living plant is recorded, the species is also recorded.

PRODUCTIVITY MEASUREMENTS

A 1.0 m^2 hoop is the sampling unit used for measuring herbaceous and woody species annual herbage production. One hoop is located at the center of the 50 meter transect used to determine ground cover. Production measurements are obtained by clipping the aboveground current year's growth of perennial grasses, forbs, and shrubs. Trees and annual species are not included. Clipped material is separated by species, placed in labeled paper bags, dried, and weighed.

Under the 1972 Coal Surface Mining Act, the 1973 regulations, the 78-1 and 79-1 regulations, there was no specific requirement for productivity, only that productivity levels be "compatible with approved land uses." Therefore, as support augmentation for utility purposes, production data was recovered for each management area, consisting of either one productivity hoop per transect or the minimum number of samples as determined by the Snedcor and Cochran, 1967 sample adequacy formula referred to above, whichever is fewer.

DIVERSITY MEASUREMENTS

Species composition of the reclaimed landscape is determined at the same time as ground cover and using the same methodology. Note that no specific requirement exists for diversity in the requested release areas, only that the permittee establish "a diverse, effective, and permanent cover..." Therefore, P&M has provided these determinations in order to demonstrate the diversity, effectiveness, and permanency of the vegetation established in these areas.

Diversity data will be evaluated using the Shannon-Weiner Diversity Index. The Shannon-Weiner Diversity Index allows for statistical comparisons of the reclaimed areas with reference areas, the baseline information, and/or the actual seed mixtures used. The index allows for the determination of success in a single management unit

WOODY STEM STOCKING RATE

A 50 m x 2 m belt transect is used for collecting density data for woody species. The belt transect is located so that the 50 meter transect used to determine cover is the longitudinal axis of the belt transect. The number and species of woody plant stems within the belt transect are recorded. Shrub and tree species are separated to determine shrub and tree density, respectively. Both shrub and tree density are calculated by the following formula:

$$Density = \frac{N}{A}$$

where: N = Total Number of Individuals of Species
A = Sample Unit Area

According to the 1972 Coal Surface Mining Act, the 1973 regulations, 78-1 and 79-1 regulations, woody stem stocking is not a required success standard. However, woody stem stocking will be considered optional depending on whether a determination needs to be made as to the regeneration and natural succession of woody stem species. Further, such data support P&M's endeavors to establish woody stem species within the reclaimed areas.

Reference Area and Reclaimed Areas Vegetation Sampling Data

This section of the submittal contains a description of the vegetation sampling data that was collected from the reference and reclaimed areas of the mine. Most of the data itself and the summaries of the data are contained in the appendices that follow. A brief description of the vegetation sampling time periods, the sampling methodologies and the areas that were sampled are addressed below. Detailed descriptions of each reference area is contained in Appendix F.

SAMPLE AREAS AND SAMPLING TIME PERIODS

Initial vegetation sampling for the release request in 1988 was performed by Metric Corporation in 1985. However, this study was limited to a small portion of section 11 located at the Northwest portion of Area 4. That study was augmented in the original 1988 request by a second Metric study performed on areas North of Area 1. Both studies were included with the original release request and are still attached to that request, contained in Appendix A of this current request. However, P&M relies on the more complete vegetation surveys performed in 1990, 1991, 1992, and 1993; as contained in Appendix E of this request.

Vegetation sampling was conducted in the spring and fall of 1990, the fall of 1991, the fall of 1992, and the fall of 1993. Mariah Associates, Inc. conducted vegetation

sampling in the spring and fall of 1990 on 645 acres of reclaimed interim and pre-law lands associated with the OSM Settlement Agreement. The purpose of the sampling Mariah Associates, Inc. conducted was to provide canopy, ground cover and production data necessary to estimate "C" factors for the Revised Universal Soil Loss Equation. Copies of the reports for these periods were previously provided to MMD. Copies of the text for both the spring and fall studies have been included with this submittal and are shown in Appendices G.3a and G.3b respectively. This data was subsequently used to recalculate slope erosional soil loss values for questionable areas with RUSLE.

Revegetated sample areas for these studies were stratified according to aspect. The four aspects that were identified were warm, cool, drainways, and ridgetops. Of the 645 acres sampled 396 acres were classified as warm, 187 as cool, 40 as ridgetop and 22 as drainway. Sample adequacy for live perennial cover was met in all four aspects in both the spring and fall studies. Productivity samples were collected in the fall study only and vegetation samples from 50 productivity hoops were collected from each aspect at this time.

Productivity was not sampled to adequacy since the productivity was shown to have a negligible effect on the calculation of the "C" factor. The most noticeable observation from these studies was the change in cover between the spring and the fall sampling periods. During this period the mine vegetation was recovering from an extended drought.

When the vegetation was sampled in the spring, it was at the height of the drought which lasted until it started to rain near the end of June. The reclaimed areas received adequate amounts of precipitation between this time and when the vegetation was sampled in the fall. By fall, the live perennial cover had almost doubled. Where the cover averaged only 11.5% in June, by September the cover averaged 18.8%. The total ground cover rose only slightly between these time periods. The reason for this small difference in ground cover was the drop in the amount of litter. A lot of what was counted as litter in June had now become live vegetation, due to a break in dormancy caused by the precipitation.

McKinley Mine personnel conducted intensive vegetation sampling of reference and reclaimed areas in the fall of 1991, 1992 and 1993. The sampling conducted in 1991 was performed under the guidance and direction of Dr. Jan Briede. Mine personnel were trained by Dr. Briede' in the identification of vegetation species on reclaimed lands and the design and methodology for conducting the sampling. Mr. Dan Bloedel of the SCS Office in Gallup also provided valuable assistance with productivity sampling of the reference areas in 1991.

During 1991, specific areas of the mine which showed potential release with regard to the revegetation, were sampled to adequacy for live perennial cover. For the

remainder of the reclaimed lands, which represented the majority of the reclaimed lands that were sampled, a grid system was devised and transect locations and directions were randomly chosen. These lands were identified as a general survey area and transects were numbered consecutively in this and the other sample areas.

The location of the areas that were sampled are shown on a map titled "Exhibit 1, 1991 Vegetation Sample Areas" in the annual report. This same exhibit is shown as Exhibit E.1 in this submittal and was included with the report titled "Review of the McKinley Mine's Reclamation Successes as Related to Edaphic Variables", already submitted to MMD under separate cover in 1991 and not resubmitted here. A large part of the vegetation results and statistics presented in this study were gleaned from the vegetation sampling conducted in 1991. The main emphasis of this report was to demonstrate that P&M could achieve vegetation success without salvaging additional subsoil materials. The results demonstrated that an increase in topsoil replacement depth tended to decrease diversity, showing that replacement of excess topsoil had a deleterious effect on diversity.

With the adequate amounts of precipitation the mine received between the 1990 fall sampling period and this period, 1991 sampling showed live perennial cover increasing to an average of 25.6%, on a mine-wide basis. Vegetation in all areas of the mine was sampled according to the approved designs and methodologies outlined in the MMD permit. Although productivity information was collected in each of the reference areas, no productivity samples were collected on reclaimed lands during 1991. Note that the basis for at least half the data collected was for areas other than covered by this release request. Therefore, efforts for this submittal have focused on isolating and presenting only those data that apply to the release management units, as shown on Exhibit 5.1.

Intensive sampling of reference and reclaimed areas was again conducted in 1992 by mine personnel who helped with one or both vegetation samplings in 1990 and 1991. The mine also assisted in 1993 samplings by AgriService and Associates. Vegetation units in all areas of the mine, including release areas, were again sampled according to the approved designs and methodologies outlined in the MMD permit. In addition to collecting productivity samples on the reference areas, productivity samples were also collected on all reclaimed lands.

An average of three random transects per sample area were identified for collecting productivity samples. A 1 m^2 hoop was located at the center of each 50 meter transect so identified. Productivity for all reclaimed lands as a whole averaged approximately 772 pounds per acre in 1992. Sample areas or management units were selected as described above and contained in the approved Revegetation Plan in the MMD permit. These sample areas have been located on a map and are shown as Exhibit 5.1 for the release areas, with data collected and contained in Appendix E.

Vegetation data and summary sheets for all sample areas was submitted to the MMD in the Annual Report. This information has been reduced to address only release sampling units as shown on Exhibit 5.1 and provided again in this submittal in Appendix E for the release areas and Appendix F for the reference areas. With near record precipitation amounts in 1992, fall sampling of the entire mine during 1992 showed the best average live perennial cover over the last three years at approximately 35.8% and total cover at approximately 61%. Sample adequacy for determining live perennial cover was achieved for most areas sampled.

SECTION 6--HYDROLOGY

In response to P&M's 1988 release request submittal, MMD expressed concerns based on two hydrologic issues; water resource structures and the stability of said structures, and issues related to water quality. Discussions here relate to the issues as presented by MMD.

WATER RESOURCES

In Permit No. 3, Condition #1, MMD was concerned as follows.

> *"Records of the amount of water stored or diverted to use as a result of mining activities shall be submitted for each mining year in the annual report to be submitted to the Commission pursuant to Section 7 of the Regulations of the Coal Surface Mining Commission.";*

Water usage information was contained in the annual reports submitted to the commission and has not been resubmitted here.

In Permit No. 3, Condition #6, MMD was concerned as follows.

> *"The erosion and sediment control structures described in Findings 28 and 29 and fencing as described in Finding 30 shall be constructed and maintained until such time as the established vegetative cover is equal to or greater than the natural condition of the land prior to mining.*
>
> *"Finding 28 requires a diversion to prevent water runoff from going over the final highwall. Finding 29 addresses the desirability of constructing a berm or ditch to impede water flow across revegetated areas."*

The prescribed sediment control structures were utilized during mining, as required. All such structures were routinely designed, constructed and reported upon during the mining and reclamation activities. Routine inspections of said structures were performed by both P&M and MMD personnel, and are contained either in annual recertifications or in MMD's inspection report files.

Some of the required structures have remained after reclamation and are located on Exhibit 6.1. Examinations and PE certifications as to stability of significant structures

remaining after reclamation have been included in Appendix C. None of the structures comprise surface water retention and usage, other than normal infiltration, that would require treatment under water rights regulations.

MMD required that P&M make Mine Plan Commitment #3, which follows.

> *"A rough surface condition with contoured furrows and pits will be left on ridges and depressions in the undulating surface so that surface drainage will be retained and runoff will be minimized."*

Surface backfilling and grading has been accomplished in a fashion that aids in moisture retention and minimizes surface runoff, including contour furrows and flood routing, where applicable. Additionally, small depressions and other hydrologic structures have been constructed to retain surface water runoff on site and increase water harvesting.

These efforts have resulted in additional water infiltration, which in turn increases vegetative success and surface stabilization. As infiltration and vegetative cover increase, the rate of infiltration and moisture retention also increases, creating a long term stabilization cycle. Some of these structures also provide small seasonal sources of water for livestock grazing.

All problem hydrologic areas identified during the 1988 inspections have been reconstructed to include contour furrows, terracing, rock drains, check dams, depressions and other hydrologic structures as required. Specific responses to address correction of identified problem areas and hydrologic structure stability is contained in Chapter 2 and/or Chapter 4 of this document.

Perimeter fencing was constructed and has been maintained to protect the revegetation from unauthorized livestock grazing. Some trial grazing has been effected as agronomic practices to amend the vegetation and these programs will be continued until such time as P&M is released from all reclamation liability.

WATER QUALITY MONITORING

> *"A monitoring system of a type approved by, installed in a manner and placed in locations acceptable to the Commission shall be established within six months of the date of this decision;*
>
> *A. To determine the chemical quality of the surface water below the affected area;*
>
> *B. To determine the sediment content of the surface water below the affected area: and*

C. To determine the chemical quality of the underground water in the vicinity of the affected area."

In response, P&M established a Tse Bonita large watershed sampling station, four medium watershed sampling stations and eight small watershed paired sampling stations (disturbed verses undisturbed). Surface and ground water monitoring information is contained in the annual reports.

A complete report on P&M's monitoring effort, including a monitoring data recap from 1986 through 1993, is contained in Appendix B. Appendix B also contains a findings response from Mr. Monte Anderson, MMD, which allows P&M to discontinue sampling on small area paired watersheds. In this response MMD states,

"Through review of approximately 930 undisturbed and reclaimed surface water samples, the Division has determined that runoff from the regraded area is as good as or better than waters entering the permit area.."

To P&M's knowledge, this finding addresses all concerns related to PreLaw areas, old Permit 3 and 3A areas, and Interim Permit areas, comprising the lands in this release request. This finding relieves P&M of any further sampling for these areas, in order to prove that the chemical quality and sediment content of surface water runoff is as good as or better than premining values.

In regards to the chemical quality of underground water, P&M has demonstrated in Section 6.3 of it's current PAP (3-11P) that no significant underground water resources exists that might be impacted by any of the mining or reclamation activities.

SECTION 7 -- POST MINING LAND USE

FINDINGS

There is little doubt that a great majority, if not all, of the range lands contained within the mine lease have historically been utilized for winter season grazing. From a practical standpoint, it is clear that pre-mining land use was driven by natural factors beyond the Navajo's ability to modify, such as vegetation types, water supplies, and available shelter.

The same natural forces which shaped pre-mining vegetation stands into highly desirable winter range, have acted upon revegetated areas through succession processes, to naturally select those species which again provide valuable winter forage. A great majority of the release areas exhibit the vegetation characteristics of prime winter range.

Under the optimum grazing practices proposed and the highest post-mining landuse, P&M believes these areas should be utilized as winter range. However, this discussion and the analysis of the vegetation data will show that use for summer grazing is not only possible, but probably of equal or better grazing capacity than pure summer range located in more favorable micro-climates off the lease, although long-term capacities may be reduced by using this range in other than the optimum season.

P&M will introduce the concept of early-spring range, and discuss the beneficial effects of such on successful yearlong grazing and to overall range stability. P&M does not maintain these early spring areas are native, being comprised mostly of introduced species; nor that this type of range existed in pre-mining lands. However, even though release areas suitable as early-spring range are less diverse than native areas, these areas provide a very important component to spatial diversity and to a balanced range system. These areas are small, but the importance of their inclusion to the highest land use value is disproportionate to their actual size.

Although the reclaimed areas have not been subjected to the grazing pressures to which they will be eventually be subjected, these lands are routinely subjected to the environmental pressures of nature, in a relatively severe climate. Time and environmental pressures have adjusted the vegetation to an ungrazed sub-climax condition, by definition; although this may differ greatly from the sub-climax condition for over-grazed range. P&M has developed a grazing plan, under which these lands may be grazed with a reasonable expectation that the vegetation will remain stable

in it's current sub-climax condition. The vegetation on these areas has been purposely planned to offer this increased productivity and stability. Short of purposely over-grazing this range, P&M cannot do more to anticipate and prepare these lands for a return to their pre-mining land uses and whatever "new" sub-climax condition they will eventually attain.

The vegetation established on the release tracts serves to provide a "diverse, effective, and permanent vegetative cover" with the same seasonal utility, distribution, and regenerative capabilities that were native to the area. To support this assertion, P&M has evaluated the quality of the vegetation on the release tracts, in order to determine annual biomass production; relative useful forage productivity values according to yearlong, winter, and summer grazing scenarios; range condition, under an SCS RSD determination; and grazing capacity in acres per AUM. This work took tolerance to drouth into account and further considered that grazing cycles must be based upon land being idle during optimum growth and regrowth seasons.

SEASONALITY ISSUES

Traditional Navajo land use, primarily as related to grazing procedures, is central to the issue of seasonality. P&M believes pre-mining usage of the grazing lands contained within the lease, particularly in regards to seasonal range, to be of primary importance to demonstrating that "permanent vegetative cover with seasonal variety...native to the area" has been established. An added purpose to establishing that this range land meets seasonality requirements, based on how it was used in the past and probably used in the future, is proving that these range lands are stable and tolerant to stresses introduced from grazing pressures and drouth conditions.

Rule 79-1 regulations at Section 26 (e) (2) require:

> *Where hayland, pasture, or range is to be the postmining land use, the species of grasses, legumes, browse, trees, or forbs for seeding or planting and their pattern of distribution shall be selected by the permittee to provide a diverse, effective, and permanent vegetative cover with seasonal variety, succession, distribution, and regenerative capabilities native to the area. (emphasis added)*

Traditional Navajo grazing practices followed many of the accepted SCS methods for rotating livestock between fields that exhibit seasonal characteristics. However, the traditional Navajo grazing usage is based upon only two classifications for seasonality, winter and summer range, while current SCS practices would tend to define and highly value a third range seasonality, namely, early-spring. Therefore, and for reasons to be discussed, P&M will address seasonality based on the range's productivity of useful forage for year-round grazing and during winter and summer grazing seasons.

Available soil moisture is the single most important factor in range management on the mine lease area. Range on the mine lease area is subject to normal drouth conditions for the semi-arid Southwest, with most moisture occurring in late-winter, early-spring, or mid-summer to fall. In ordinary circumstances, late-spring to early-summer is an extremely dry period of up to three months. Average rainfall is 10.1 inches, however, it is not unusual that three to four consecutive drouth years may occur in an average 8-year cycle period. For this reason, evolutionary development of the mine's seed mixes has addressed seasonality by considering only species with good drouth tolerance and species which do not rely upon late-spring to early-summer as a primary growth period.

Traditional Navajo grazing practices result in the tendency to overstock the range and subsequent range degradation. Therefore, in addressing seasonality, analysis considered a species' tolerance to grazing in the season being analyzed. However, it should be noted that this tolerance is based upon reasonable stocking rates and responsible grazing practices. As much as possible, parcels will be evaluated for their ability to withstand overgrazing, based on deep roots, rhizomal spreading and other regenerative characteristics.

Particularly devastating to quality range lands is the practice of overstocking range that is also being subjected to drouth conditions. Where possible, the management units were examined to judge their ability to withstand such severe pressures. However, P&M is aware of no range or vegetation types that can withstand this combination of factors. It must be assumed that extreme abuses of this nature are so destructive as to be beyond reasonable expectations and should most likely be classified as intentional and wanton destruction of valuable range lands.

Seasonal Land Use

In 1986, Klara B. Kelly published *NAVAJO LAND USE, An Ethnoarcheological Study*. This treatise is a discussion of traditional uses of lands contained within the McKinley Mine Lease area, and goes into some detail as to traditional grazing practices and the socio-economic factors that historically led to overstocking and degradation of the range lands contained in the lease.

Of importance to establishing pre-mining uses, is Kelly's ethnographic finding, based on interviews, that primary grazing usage of the lease area was as winter range. Archeological findings by Kelly, based upon the number and type of structures contained in the lease area; and furthered by the observation that family dwellings, feed/grain storage, lambing pens, and sheltering structures were traditionally located near winter-spring range areas; also points to a conclusion that the lease areas were utilized for winter range. Kelly states.

> *Some households used summer range outside the lease townships that seems to have been contiguous with their winter range inside the lease townships. Others used summer range outside the lease townships that was not contiguous. (These summer*

lands, however, are not considered here.) And in the lease townships, families had not subdivided so greatly that they were forced to use discontiguous tracts.

Examination of the baseline vegetation studies by Dames & Moore and subsequent work by Harner-White, indicates that while usage as summer range would not be infeasible, the primary benefit of the lease area range lands is for winter forage. This should be concluded from the pre-mining stands of high quality winter forage species, offering good winter protein and energy from a few grass species (Western Wheatgrass being primary) and predominant brush species (Big Sagebrush, Fourwing Saltbush, Winterfat, and Cliff Rose). During summer grazing, many of these species are only marginally palatable, such as Sagebrush, and have not cured through the fall to build up the high levels of protein and nutrients for which they are highly valued; such as Sagebrush, Saltbush, and Winterfat (see Table 7.1).

Many of the grass species, western wheatgrass being a prime example, have a dual-seasonality for grazing purposes, in that they offer similar forage value and are tolerant to grazing in either season. However, the high winter value of the mine lease areas stands in comparison to the lowlands and sage-grass plains located off the lease, which have fewer palatable shrubs (Sagebrush-grass transitions to Greasewood and Rabbitbrush vegetation types) and increased understory, based upon predominantly warm and cool season grasses. These lowland and sage-grass areas provide an equal, if not higher quality summer forage, but offer only moderate to poor winter protein and energy levels. While the lease areas can be grazed as summer range, many times supporting equal or better grazing capacity, the higher value usage as prime winter forage would be lost.

It should be noted that this arrangement is a natural occurrence, as many of the warm/cool season grasses are more tolerant to the thicker deposits, elevated moisture contents and occasional flooding, of the heavy clay-loam soils found in the flatter lowlands. The lowlands also hold more abundant water sources for summer utilization (by animals or plants), while the sloping uplands trap more snow and water during the winter season. The brushier uplands also provide more shelter for livestock and wildlife during the winter season, particularly in the form of Pinyon-Juniper tree stands and rocky outcrops.

Through ethnoarcheological research, Kelly has observed that much of the land usage in the lease area can be determined from elevations. As example, for purpose of defining potential archeological significance of Anasazi sites, the 7000 ft. elevation delineated the order level of survey that was performed. In regard to contemporary land use, Kelly states:

> In their distribution over the landscape of the lease townships, the first grazing tracts may have covered both lowlands and uplands, but people may have herded mostly in the sage-grass plains below 6800 ft... the smaller the tract, the less likely it was to encompass either a reliable water source or the larger tracts of sage-grassland that exist only below 6800 ft.. The best range in the lease townships is in the sage-grass flats of the major drainages, and the widest expanses of sage and grass are below 6800 ft. in elevation....

TABLE 7.1 -- NUTRIENT ANALYSIS TABLE

DRY ROUGHAGE FEEDSTUFF	TOTAL DRY MATTER %	DIGESTIBLE PROTEIN %	TDN %	PROTEIN %
Alkali Sacaton	90.0	6.3	60.0	9.0
Sandberg Bluegrass	91.9	6.7	52.6	11.2
Mountain Brome	88.1	5.0	48.9	9.9
Smooth Brome	88.1	5.0	48.9	9.9
Arizona Fescue	90.0	5.3	53.5	9.1
Sheeps Fescue	90.0	5.3	53.5	9.1
Galleta	90.0	6.3	60.0	9.0
Blue Grama	89.8	3.5	51.1	5.8
Indian Ricegrass	90.0	6.3	60.0	9.0
Russian Wildrye	90.0	7.0	56.6	9.4
Crested Wheatgrass	87.9	6.9	50.3	11.5
Other Wheatgrass	90.1	4.9	52.1	8.2
Western Wheatgrass	89.1	5.4	51.3	9.0
Saltbush	93.5	10.2	36.6	13.8
Saltbush-leaves	94.5	10.3	45.2	14.3
Winterfat	92.6	7.7	51.7	12.9
Sagebrush	88.6	8.0	43.8	10.6
Sagebrush-leaves	91.8	11.2	57.8	15.5
Greasewood	95.4	14.7	39.7	19.8
Alfalfa	90.9	10.6	50.3	14.7
Sainfoin	84.1	7.6	49.3	10.5
Sweetclover	92.0	10.5	49.9	14.0

GREEN ROUGHAGE FEEDSTUFF	TOTAL DRY MATTER %	DIGESTIBLE PROTEIN %	TDN %	PROTEIN %
Alkali Sacaton	30.2	3.3	19.6	4.7
Sandberg Bluegrass	32.0	1.7	17.2	2.6
Mountain Brome	36.3	3.0	20.8	4.5
Smooth Brome	33.8	2.9	19.7	4.2
Arizona Fescue	36.0	2.1	21.0	3.5
Sheeps Fescue	36.0	2.1	21.0	3.5
Galleta	30.2	3.3	19.6	4.7
Blue Grama	35.7	2.0	20.6	3.2
Indian Ricegrass	30.2	3.3	19.6	4.7
Russian Wildrye	31.1	1.3	14.0	3.4
Crested Wheatgrass	46.9	2.0	27.0	4.1
Other Wheatgrass	46.9	2.0	27.0	4.1
Western Wheatgrass	46.9	2.0	27.0	4.1
Saltbush	24.3	2.9	9.8	3.9
Alfalfa	25.0	3.4	14.7	4.6
Sainfoin	25.6	2.8	16.3	3.8
Sweetclover	22.0	3.0	14.0	3.9

TAKEN FROM FEEDS & FEEDING, F. B. MORRISON, 20TH EDITION, 1937

Note that while the lease township contains lands below 6800 ft., the mine lease proper contains very little, and many of the elevations for the release areas are in excess of 7000 ft. Again, natural succession may have restricted establishment of the vegetation types required for summer range, as this is close to maximum recommended elevations for a few of the warm-season species found in local summer range. While this would not preclude their existence, plant vigor would be reduced to a point where the ability to compete with hardier cool-season grasses and brush species would be severely affected.

Early-Spring Range

In addition to range overstocking, much of the noticeable range degradation may be attributable to the lack of an adequate early-spring range type. These early-spring ranges are critical units to overall range stability in the yearlong livestock operation, since they furnish fresh green growth about the time lambs and calves are dropped. Superior spring forage provides for increased nutrients in mother's milk, which has been shown to reduce lamb mortality and result in lamb weight increases as great as 30 lbs at weaning time (W.R. Chapline).

Traditional Navajo grazing practices do not normally include supplemental feeding, with such activities being extremely rare. The value of early-spring range is increased by this lack of allowance for supplemental feed or hay in traditional practices. Without early-spring range or supplemental feeding, allowance must be made for grazing livestock in stubble (i.e. traditional practice) or designated holdover fields from previous seasons. As example, many of the dormant warm-season grasses remaining from the previous summer, could provide forage, if still present after winter grazing. However, in most cases, such forage, while palatable, is very low in needed protein and energy. Further, these practices are damaging to any early-spring growth.

The high value of early-spring vegetation to range stability is based on concepts that this season is also a critical period in the growth of many established perennial grasses. As food reserves stored in the roots and lower stems during the previous fall are exhausted, further growth depends on food produced in new leaves. Too early grazing of these leaves will weaken the plant and if such grazing is continued for several years, the plant will starve and eventually die-out. The critical nature of this growth period is further reinforced by the normally drouthy late-spring to early-summer weather patterns, as the lack of available soil moisture would further restrict a plant's ability to uptake nutrients, compounding die-back.

Although the critical early-spring growth period is relatively short, a well balanced range, providing yearlong livestock operation, must include units that are tolerant to spring grazing. However, due to the short season, these units can be relatively small as related to the size of the overall range. Proper maintenance of stable vegetation

and well balanced range lands precludes early-spring grazing for all but a few select species, many of which are not native to this region (i.e. introduced species, such as Crested Wheatgrass and Russian Wildrye).

Reclamation areas that can provide this capability are primarily composed of introduced grasses, such as Crested Wheatgrass, Russian Wildrye, or Smooth Brome; native grasses, such as Western Wheatgrass, or Mountain Brome; with minor components of native forbs, such as Lewis Flax, Rocky Mountain Penstemon, or Palmers Penstemon. In the 1948 USDA, Yearbook of Agriculture, *Restoring the Range by Reseeding* article by Pearse, Plummer, and Savage; it was recommended to plant Western and Crested Wheatgrass, Smooth Brome, and Russian Wildrye in designated early-spring grazing areas. Such species are either tolerant to early grazing and harsh winter weather, or do not contribute significantly to livestock grazing in other seasons.

Tolerance to Environmental Factors

As previously stated, available soil moisture is the single most important factor in the Lease area rangeland forage production. To be used by range plants, soil nutrients are dissolved and moved through the soil by mass flow for subsequent root uptake. Without sufficient soil moisture, roots cannot tap nutrients from the soil, and mineralization cycles of nitrogen and sulfur from organic matter cannot be completed. Without these soluble nutrients, less drouth tolerant plants will lose vigor and the ability to compete against hardier species, eventually starving.

Vegetation withstands dry periods best when dormant. Therefore, it is essential that plants on the lease be dormant through the normal drouth period (i.e. late-spring to mid-summer), and making initial growth during late-winter through spring or mid-summer to fall, and regrowth during late-summer through fall. The fall regrowth period is critical to proper curing of brush and cool-season grasses, during which the plant assimilates and stores winter food reserves. Range subjected to drouth or grazing in the fall regrowth period will not normally provide the high TDN's (total digestible nutrients) valued for winter grazing purposes.

Primarily due to the elevation, the most consistent moisture period occurs in fall to early-spring, a pattern typical of Intermountain West environments. This period corresponds well to the cool-season drouth-tolerant grasses, such as wheatgrasses and bromes. A secondary moisture period, although less dependable, is mid-summer to fall, a pattern typical of the semi-arid Southwest environments. This period corresponds well to growth of warm-season grasses, such as grammas, bluestems, or galleta. Although somewhat limited by synecological associations or general compatibility, and greatly limited by grazing pressures during critical growth cycles, it is feasible that dual-seasonality range might be sustained, providing yearlong

grazing, although under very limited carrying capacity. However, higher overall unit capacities can be maintained, under healthier livestock regimes, when the range is used within the season for which it is best suited.

When evaluating the lease area range for dual-seasonality, it must be considered that the summer growth period for warm-season species is considerably shorter and more drouthy than the combined growth-regrowth periods for cool-seasons. Synecological compatibility of these species is always based upon competition for available soil moisture, sunshine, and open ground. As previously discussed, plants assimilate nutrients through a combination of photosynthesis and soluble mineral uptake. Therefore, healthy and balanced rangelands in the lease area tend to reach an equalibrium ratio of warm to cool season grasses, based on growth seasons and available moisture. Due to the average expected productivity for each type of grass specie, productivity for warm-season grasses in healthy winter range rarely exceeds 20% of the total perennial grass forage.

Areas that have been heavily over-grazed or affected by drouth see an increase in the warm to cool ratio, as well as increases in annual weeds and brush, caused by regression. Over time, areas withdrawn from grazing tend to the equalibrium, although control of annual weeds and brush is more difficult. Healthy ranges withdrawn from grazing, tend to drop below the equalibrium level, as cool-season species, not stunted by grazing, crowd out less hardy warm-season grasses, forbs, and some shrubs in a natural succession process. In the 1986 CRC Press Publication, Reclamation of Surface-Mined Lands, E.J. DePuit described the process as follows:

> *In cases where mixtures of plants are to be established, it is critically important that species selected be synecologically "compatible" for coexistence, in some acceptable proportion, in the initial or ultimate plant communities established. Allelopathic, mutualistic, and competitive relationships among species must be recognized and addressed during selection to promote establishment of plant communities with desired productivity, composition, and trend. Unfortunately, the area of interspecific (synecological) relationships remains one of the least understood aspects of rangeland revegetation.* (emphasis added)

Subsequently, establishment and maintenance of a well-balanced dual-season range through drouth periods, and complicated by grazing, is an extremely difficult project. Given that in this climate, dual-seasonality comes at the price of lower productivity within any individual season, the goal of establishing dual-seasonality is not always justified by the cost in winter range productivity. This is a situation where such land use factors as summer range availability, type of livestock, and ranching purpose, must be weighed. However, as adequately demonstrated, traditional rotational range usage patterns in the Lease areas are for winter range. Therefore, the highest landuse value must be assumed to be a return to the pre-mining condition of winter range, and this is the trend towards which natural processes (i.e. succession) have proceeded, given no outside influences, such as grazing.

The existence of dual-seasonality forage values on the Lease area rangelands is mostly by chance or through the use of more vigorous introduced species. This result is more properly assumed to be an indication of a healthy and more productive range, exhibiting tolerance to drouth, and a return to natural succession and regenerative potentials; rather than establishment of true extended or dual-seasonality, that never existed in the pre-mining conditions.

Therefore, P&M believes that establishment of healthier and optimally productive range, with true extended or dual-seasonality, based only upon a balanced blend of native warm and cool season species; is an unreasonable expectation for the Lease area lands, regardless of the seed mixtures utilized or approved under Rule 79-1 Section 26 (e). With this, P&M is not implying that Lease area range is only suited for winter range, or that this range is not suited to year-round grazing. However, given traditional rotational usage and heavy stocking rates, P&M does assert that optimum production from Lease area range; within the limits of the local climate, and growing seasons; would be based upon regime designed to provide increased seasonal forage production, not dual-seasonality.

WILDLIFE CONSIDERATIONS

P&M's reclamation plan for McKinley Mine is based on a "holistic" view of what the final reclamation goals should be, and how these expectations can be met. Special emphasis is placed on individual components of the revegetation plan, to assure areas are reclaimed to a configuration that optimize livestock grazing capacity, while enhancing wildlife habitat to the greatest extent possible. The holistic method utilized to accomplish these goals is based to a large degree upon vegetation communities and life forms within that community.

The premining land uses at McKinley Mine consisted primarily of grazing land with residential and garden plots being a minor related component. While a joint incidental usage of the area by wildlife also existed; the primary usage for grazing, combined with such impacts as overgrazing, heavy silt loads, and human habitation; severely restricted that usage. Based on these premining land uses and conditions, the primary reclamation goal at McKinley Mine is to create a permanent and diverse vegetative community for the grazing of domestic livestock, with secondary attention to wildlife uses, where this usage can co-exist in harmony with livestock forage productivity requirements. Thus, beginning in 1986, P&M has planted an extremely diverse seed mix as related to inclusion of grass, brush, forbs and legumes, in order to assure prime livestock grazing values and land stabilization, while enhancing wildlife food sources and habitat.

Although not a point stressed in earlier discussion, a need perceived in the mid-80's, namely to provide an "enhanced" wildlife habitat, has again moved reclamation efforts away from summer range establishment and more towards winter range

establishment. In this, it should be recognized that summer range is normally regraded to a flatter, "rolling" terrain, with less vertical relief. Revegetation efforts for summer range are aimed more at establishment of grass stands, with less diversity, particularly in brush, trees, and forbs. Efforts at McKinley Mine are aimed at purposely creating additional vertical relief when practical, to provide increased topographic cover, separation, and additional micro-climates for habitat. Although revegetation productivity efforts are still centered on grass establishment; higher diversity is a priority item; as based on forb, legume, brush, and tree components; which provide additional browse and vegetative cover.

P&M accomplishes higher vegetative diversity and wildlife habitat enhancement in a number of ways. First, efforts are maximized to live-handle as much of the topdressing as possible. Live-handling not only results in improved soil characteristics, which greatly enhances vegetation establishment; but also establishes pre-mining species not included in the mix, through germination of the live seed load carried in the soil (i.e. volunteer growth). This results in quick establishment of some perennial species of trees, shrubs, and forbs; as well as significant stands of annual species. Some outstanding perennial species noted from this process are Pines, Oaks, Cottonwoods, Willows, Sedge, Serviceberry, Wolfberry, Penstemons, Bottlebrush Squirreltail, Foxtail Barley, and other minor grasses; none of which are included in the mix. Primary annuals noted are Cheatgrass Brome, Salsify, Thistles, and other "weed" components, which offer added browse and cover in critical seasons.

As shown by Table 7.2, P&M has used an extremely diverse Permanent seed mix for Post-1986 reclamation areas, and has used this mix to interseed many of the earlier areas. This mix allows for the creation of valuable nutrients, browse, and cover sources for all types of resident wildlife; through inclusion of forbs, legumes, and trees in the mix. The current standard seed mix includes 36 species, and fully 22 of those species are partially aimed at providing browse and cover for wildlife (i.e. forbs, legumes, brush, and trees). Many of the non-legume forbs are included in the mix only to increase esthetics and provide wildlife habitat. Also listed in Table 7.2 are special-use mixes utilized to increase habitat and diversity in special micro-climates, opportunistically created through grading processes. Specifically geared to wildlife needs, are the Warm Season, Riparian, and S.A.R. seed mixes, which offer added components highly valued for wildlife habitat. Some additional diversity and species are introduced through volunteer germination of seed loads contained in mulching materials, although many species are not always desirable for wildlife usage (i.e Crested, Smooth Brome, or Barley).

Considerable additional efforts are aimed at both reinforcing the seed mix species and introduction of additional species (i.e. particularly trees and brush) into all reclaimed areas, through custom plantings. Species addressed in this fashion are listed in Table 7.3 along with the method being utilized. During the period 1991 through 1994, in excess of 200,000 seedlings will have been custom planted in the release areas, in addition to 3500 Ponderosa Pine seedlings planted in a reforestation effort in conjunction with Navajo Forestry Department (NFD). In the early-80's, seedlings were

TABLE 7.2 -- PREVIOUS SEED MIXES FOR RELEASE AREA LANDS

Scientific Name (Common Name)	PERM MIX % PLS	WARM MIX % PLS	S.A.R. MIX %PLS	RIPARIAN MIX %PLS	STAB. MIX %PLS	GRASS MIX %PLS
Achillea millefolium (White Yarrow)	0.5					
Agropyron elonatum (Tall Wheatgrass)						17.0
Agropyron riparium (Streambank Wheatgrass)						10.0
Agropyron smithii (Western Wheatgrass)	13.0			6.0	18.0	30.0
Agropyron trachycaulum (Slender Wheatgrass)				6.0		
Agropyron trichophorum (Pubescent Wheatgrass)						15.0
Amelanchier utahensis (Utah Serviceberry)	2.0			5.0		
Atriplex canescens (Fourwing Saltbush)	5.0		7.0			
Atriplex confertifolia (Shadescale)	5.0		8.0			
Atriplex corrugata (Mat saltbush)			8.0			
Atriplex cuneata (Cuneate Saltbush)			15.0			
Aster chilensis (Pacific Aster)				10.0		
Aster tanacetifolius (Prairie Aster)				10.0		
Avena sativa (Oats)					18.0	
Bromus inermis (Smooth Brome)						10.0
Bromus marginatus (Mountain Brome)	5.0					15.0
Bouteloua curtipendula (Sideoats Grama)	7.0	22.0				
Bouteloua gracilis (Blue Grama)	7.0	22.0				
Chysothamnus viscidiflorun (Douglas Rabbitbrush)			10.0			
Cowenia neomexicana (Cliffrose)	2.5					
Elymus canadensis (Canada Wildrye)				6.0		
Elymus cinereus (Great Basin Wildrye)			15.0	6.0		
Elymus junceus (Russian Wildrye)					18.0	
Eurotia lanata or *Ceratoides lanata* (Winterfat)	5.0					
Festuca arizonica (Arizona Fescue)	5.0					
Gaillardia aristata (Blanket Flower)	0.5					
Hillaria jamesii (Galleta)	7.0	22.0				
Hordum vulgare (Barley)					18.0	
Iris missouriensis (Rocky Mountain Iris)				10.0		
Linum lewisii (Blueflax)	1.0		7.0	10.0		
Lolium multiform (Annual Ryegrass)					18.0	
Muhlenbergia wrightii (Spike Muhly)	2.5	17.0				
Medicago sativa rhizoma (Alfalfa)	1.0					
Melilotus alba (White Sweet Clover)				10.0		
Oryzopsis hymenoides (Indian Ricegrass)	10.0					3.0
Panicum virgatum (Switchgrass)				8.0		
Penstemon palmeri (Palmer Penstemon)			5.0			
Penstemon strictus (Rocky Mountain Penstemon)	3.0					
Phalaris arundinacea (Reed Canary Grass)				6.0		
Poa sandbergii (Sandberg Bluegrass)	5.0					
Puccinellia distans (Alkaligrass)			15.0			
Prunus virginiana (Chokecherry)				7.0		
Ratibida columnarias (Red Prairie Coneflower)	1.0					
Rosa woodsii (Woods Rose)				5.0		
Rudbeckia hirtia (Black-eyed Susan)	0.5					
Rhus trilobata (Skunkbush Sumac)	1.0			3.0		
Sphaeralcea parvifolium (Globe Mallow)	3.0					
Sporobulus airoides (Alkali Sacaton)	5.0	17.0	10.0	2.0		
Sporobulus cryptandrus (Sand Dropseed)*	2.5	17.0				

* Substitution seed when regular seed unavailable

custom planted in a few of the release areas for a test which totalled approximately 38,000 seedlings of Sagebrush, Pinyon, Wood's Rose, Skunkbush, and Saltbush species. Current seedlings are grown locally by NFD, and stored in lathe houses until ready for out-planting. The MMD has been shown areas where these seedlings were custom planted, both for early-80's and recent efforts, including transects established to monitor initial survival rates in many areas.

Additional efforts are based on transplanting, either by hand or with VerMeer tree spades. Hand transplants are limited specifically to smaller species and aquatic species (i.e. Bullrush, Cattails, Reeds, Reedgrass), with approximately 12,000 placed in release area channels and ponds during 1992-1994. Tree spades are used to transplant trees during dormancy, and shrubs in tree growth periods, with approximately 2000 placed in release areas during 1991-1994. The MMD has been shown many of the transplant areas, including both trees and shrubs.

In addition to these range related vegetative efforts, P&M has paid particular attention to developed water resources. In order to establish highest land use values for a developed water resource, attention is paid to establishing an integrated riparian-type micro-ecosystem. Under this concept, consideration must be given to expanding beyond the minimum effort, which might create a water resource to provide water for livestock, to consideration that a stable water resource is rare in this climate, and that every possible benefit/usage must be gained from the resource.

Establishment of riparian areas has dramatically increased habitat diversity, providing additional cover and food sources for smaller mammals, fish, and reptiles; assuring a more continuous food chain through the wildlife hierarchy. The juxtapositioning of riparian habitat against other reclaimed land types has provided the important edge effect. These riparian areas have not only increased wildlife habitats, but have increased the forage types, forage productivity, shelter, and water supplies for domestic livestock. It is important to note that due to overgrazing and the flash nature of many channel flows, with resultant deep arroyos, riparian habitats are rare, and limited in size in pre-mining areas to small occurrences in arroyo bottoms.

Water resources have been developed to "harvest" as much water as possible, expanding the benefit to include providing water for livestock and wildlife, providing additional water availability for vegetation, providing cleaner water through physical and vegetative methods, and using the additional water to establish communities of native vegetation types that are dependent upon water availability (i.e. riparian species). Efforts include construction of terraces, channels, check dams, silt traps, rocked drops structures, sediment ponds, and final impoundments; all of which include special rock placements to create shoreline niches for enhanced habitat.

As demonstrated in Table 7.2, P&M utilizes a special seed mix, based upon riparian species. Since 1991, this mix has been utilized as an admixture to the standard mix

TABLE 7.3 -- MCKINLEY MINE CUSTOM PLANTING AND WILDLIFE SPECIES

Scientific Name	Common Name	Seedling Planting	Tree Spade	Transplant Planting	Propagated Poles	Natural Invasion	Seed Mix
Achillea milefolium	White yarrow						•
Amelanchier utahensis	Utah serviceberry	•					•
Artemisia cana	Silver sagebrush		•				•
Artemisia frigida	Fringed sagebrush		•				•
Artemisia nova	Black sagebrush	•	•			•	•
Artemisia tridentata	Big sagebrush	•	•			•	•
Atriplex canescens	Fourwing saltbush	•				•	•
Atriplex confertifolia	Shadescale	•	•				•
Atriplex corrugata	Mat saltbush			•			•
Carex neomexicana	New Mexico sedge			•+		•	
Ceracarpus montanus	True mountain mahogany	•					•
Coryphantha vivipara	Ball cactus			•+		•	•
Cowenia neomexicana	Cliffrose	•	•	•			•
Echinocereus triglochidarus	Hedgehog cactus			•+		•	
Elaeagnus angustifolia	Russian olive	•					
Ephedra viridis	Mormon tea			•+		•	
Eriogonum umbellatum	Sulphur flower						•
Eurotia lanata	Winterfat	•	•				•
Fallugia paradoxa	Apache plume	•					•
Gaillardia aristata	Blanket Flower						•
Hedysarum boreale	Northern sweetvetch						•
Juniperus communis	Common juniper		•	•			
Juiperus osteosperma	Utah juniper	•	•				•
Leyla platyglossa	Tidy tips						•
Linum lewisii	Blueflax					•	•
Lycium pallidum	Wolfberry						•
Medicago sativa	Alfalfa						•
Melilotus officinalis	Yellow sweetclover					•	•
Oenothera hookeri	Hooker evening primrose						•
Opuntia phaecantha	Prickly pear			•+		•	
Opuntia whipplei	Whipple prickly pear			•+		•	
Panisum virgarum	Switchgrass						•
Pensteon baratus	Beard-lip penstemon					•	
Penstemon crandallii	Crandall penstemon					•	
Penstemon palmari	Palmers penstemon						•
Petalostemum purpureum	Purple prairie clover						•
Phalaris arundinacea	Reed canary grass		•				•
Phragmites	Reed grass			•		•	•
Pinus edulis	Pinyon pine	•		•		•	
Pinus ponderosa	Ponderosa pine	•					
Populus alba	Silverleaf popular	•					
Populus remontii	Fremont cottonwood	•	•	•		•	
Populus sp. hybrid	Hybrid cottonwood				•		
Populus wislizeni	Rio Grande cottonwood				•		
Potentilla fruticosa	Shrubby cinquefoil	•					•
Purshia tridentata	Antelope bitterbrush					•	•
Quercus gambelii	Gambels oak	•		•		•	
Rhus tilobata	Skunkbush	•				•	•
Ribes inebrians	Squaw current			•+		•	
Rosa woodsii	Wood's rose	•	•				•
Rumex spp.	Dock			•+		•	
Salix scouleriana	Scouler willow	•					
Sacobatus vermiculatus	Greasewood					•	
Scripus californicus	California bulrush			•		•	•
Sphaelalcea coccinea	Globemallow					•	•
Sphaelalcea parcvifolia	Red globemallow						•
Stipa comata	Needle and Thread						•
Tamirix pentandra	Salt cedar			•		•	
Typhia larifolia	Broad-leaved cattail			•		•	•
Yucca angustissima	Spanish bayonet			•+		•	
Yucca baccata	Datil yucca			•+		•	

*NOTE: * Plant species that are natural invaders are considered for transplanting*

for initial seedings in riparian areas, and has been used as an interseeding mix for established water resources on earlier release areas. Efforts have also included custom planting of riparian seedlings (i.e. Cottonwoods, Willows, and assorted shrubs), with over 15,000 having been planted to MMD areas during 1992-1994.

Efforts include transplanting of some riparian species with the tree spade, although this method is less effective, due to restricted access from mud. However, a method employed, which has been extremely effective, is transplanting by hand for aquatic species such as Bullrush, Reeds, Cattails, and Reed Canary Grass, with approximately 12,000 transplants to release area ponds and channels, during 1992-1994. The MMD inspectors have been shown many of these areas, including large check dams, final impoundments, and channels at all proposed release areas.

Baseline information contained in the current OSM PAP, NM-0001G as Appendix 3.7-A, indicates and supports a finding that reclamation areas seeded prior to 1980, were already enhancing the areas for wildlife usage at the time of the data collection for those initial studies (i. 1979-1980). This is reflected by studies performed in the 1980's of Mule Deer populations and their land usage, as well as a marked increase in Raptor populations, since the initial studies. P&M believes these Raptor studies not only address actual populations of raptors, but address food sources based upon small mammals, reptiles, and invertebrates.

TABLE 7.4 -- RIPARIAN SPECIES PRESENT IN RELEASE AREA LANDS

Scientific Name	Common Name
Agropyron trachycaulum	Slender wheatgrass
Amelanchier utahensis	Utah serviceberry
Carex neomexicanus	New Mexico sedge
Elaeagnus angustifolia	Russian olive
Elymus cinereus	Great Basin wildrye
Forestiera neomexicana	New Mexico olive
Iris missouriensis	Rocky Mountain iris
Linum lewisii	Blueflax
Panicum virgatum	Switchgrass
Phalaris arundinacea	Reed canary grass
Phragmites	Reed grass
Populus alba	Silverleaf popular
Populus fremontii	Fremont cottonwood
Populus sp. hybrid	Hybrid cottonwood
Populus wislizeni	Rio Grande cottonwood
Rhus trilobata	Skunkbush
Ribes cereum	Squaw current
Rosa woodsii	Wood's rose
Salix scouleriana	Scouler willow
Scripus californicus	California bulrush
Sporobolus airoides	Alkali sacaton
Tamarix pentandra	Salt cedar
Typha latifolia	Broad-leaved cattail

Although results have varied somewhat (i.e. between 5 and 35% survival), in the

great majority of the cases these efforts have at least established these species; so that over time the stands will fill in to natural densities. Table 7.4 lists riparian species that have been established through these methods on the release areas. More than any other type of planting, riparian species have a tendency to establish, thrive and spread only where conditions are the best suited (i.e. natural succession).

The bond release regulations do not specifically require that P&M establish methods and standards to be used to measure the success of wildlife species or brush stocking rates, nor do the they address requirements for riparian plantings. Rather, the regulations required that P&M endeavor to establish such species, and this is exactly what P&M has done. The potential value of the reclaimed release areas to wildlife stability, must weigh against normal bond release standards. For instance, in an area where riparian plantings fail ordinary standards (i.e. cover or productivity), a case-by-case evaluation should be undertaken that weighs the potential wildlife habitat created against the severity of the failure, potential for instability, and the size of the area.

UTILITY EVALUATIONS

To this point, productivity issues have been discussed at length in the seasonality section. To restate, the release areas have been shown to provide seasonal grazing capability for both the pre-mining usage as winter range, and for use as summer range. Most of the areas will serve equally for both purposes, although year-round grazing is, overall, a less productive method. Areas that are lower in shrub productivity can be utilized for early-spring grazing, but at a cost of stability to the vegetation. It is by far preferable to use the less diverse Pre-1977 areas, with stands of Crested Wheatgrass, Smooth Brome, and Russian Wildrye for early-spring grazing, as this vegetation is suited to that activity, and considerably less likely to be affected.

Biomass data has been presented from the healthy vegetation stands on all revegetated MMD areas, and the average productivity value, as measured in perennial biomass, is 740 lbs/ac, for 1992. While the moisture levels for 1992 were favorable, much of this vegetation was still recovering from the extreme drouthy years in the late 1980's. However, it is assumed that this production was near a maximum level for the reclaimed under normal weather and grazing stress.

This average figure compares favorably to the approved permanent program permit standard (3-11P) of 650 lbs/ac, as derived from Range Site Description (RSD) determinations. Under permanent program requirements, success for this standard is based upon not less than 90% of the value. However, as will be demonstrated, a biomass determination does not adequately reflect the actual utility of the vegetation for the approved postmining land use, as required by early regulations. Further, this was an RSD determination, based upon 50% range condition, that in no way reflects actual pre-mining conditions. It is also based on a composited RSD with equal

weighting of four RSD's. Exhibit 5.5-1 in the PAP clearly demonstrates that pre-mining conditions were primarily Savannah type (i.e. 57%), and discussion will show why post-mining conditions are expected to return to that single range type.

If an RSD determination was based only upon the soil sand-silt-clay characteristics, a composited value might work. However, an RSD determination also considers climate, aspect, vegetation type, and soil thickness; with the determination allowing only fixed percentages of certain specie types. Therefore, the actual post-mining range description should be based upon conditions actually anticipated in the reclaimed area designs, not a theoretical composite. P&M has most closely matched these areas to a Shallow Savannah description, and from all pre-mining conditions, this is the **reasonable expectation**. Therefore, it can be soundly argued that the composited figure is misleading and not representative of anticipated post-mining conditions or any actual range value.

It should be stated at the outset that 57% of the mine's pre-mine RSD classification is Shallow Savannah. There are many reasons why the Shallow Savannah RSD classification should be used for postmining conditions instead of the Loamy RSD or a hypothetical composite. A review of the two RSD's is in order. A Range Site Comparison Table has been developed to assist with this process (Table 7.5).

TABLE 7.5 RANGE SITE COMPARISON TABLE

RANGE SITE DESCRIPTION	LOAMY	SHALLOW SAVANNAH
Physiographic	Slopes to 15%	Slopes 5-25%
Soils	<35% Coarse Fragments	May be Cobbly or Stony
Available Water	Medium - High	Low - Medium
Plant Community	Grass, scattered shrubs	Grass, shrub mix with savannah-type pinyon overstory
Canopy Cover		
Tress, Shrubs, Half-Shrubs	10%	20%
Ground Cover		
Grass & Forbs	25%	22%
Bare Ground	50%	48%
Surface Gravel	5%	10%
Stones	0%	10%
Litter	20% @ 1cm	10% @ 1.5 cm
Production		
Favorable Years	1100	800
Unfavorable Years	600	500
Stocking Rate	AC/AUM	AC/AUM
Range Condition		
Excellent	2.5	3.7
Good	3.3	4.9
Fair	5.0	7.3
Poor	10.0	15.2

The most obvious differences between the RSD's is in the physiographic features. The Loamy RSD states *"it is nearly level, but slopes range to 15%"*. In contrast, the slopes in the Shallow Savannah RSD range from 5-25%. This physiographic parameter alone provides sufficient justification, because a large portion of the McKinley Mine terrain exceeds 15% in both premining and postmining conditions.

The reclaimed topsoil depth at the mine is six inches. Clearly, this would place it in a shallow classification. Additionally, the Loamy RSD contains less that 35% coarse fragments, while the Shallow Savannah may contain gravelly sand loams or be cobbly and/or stony. Most of the soil profile in the reclaimed areas would contain more than 35% coarse fragments. There is also an increase in the percentage of surface cobble and rocks in the ground cover, as demonstrated by the reference and revegetated areas sampled for cover in 1991 and 1992.

The vegetation found in the two RSD's must also be considered. The potential plant community found in the Loamy RSD is predominately grass with a few scattered shrubs, while the Shallow Savannah RSD is a "*grass shrub mixture having a savannah-type overstory of juniper and pinyon*". Even a cursory examination of the undisturbed areas on the mine demonstrates a strong PJ component, which is lacking in the Loamy RSD.

Further, baseline studies included in Appendix G indicate that in excess of 80% of the premining vegetation was classified as PJ. P&M has gone to great lengths through custom plantings and transplants to assure that a starter PJ component has been revegetated. There is also a 10% increase in the canopy cover for shrubs, half-shrubs, and trees in the Shallow Savannah RSD over the Loamy site, which is representative of the Sage-Grass areas, which make up the remaining major portion of the pre-mining vegetation communities.

When all of the RSD factors are considered, P&M must conclude that the physiographic, soil, and vegetative characteristics of the McKinley Mine premining and reclamation conditions more closely simulate the Shallow Savannah RSD than the Loamy RSD.

Under a Savannah description, only 10% of wheatgrasses are allowed in a range condition consideration and carrying capacity determination; and this is the major biomass producer on the reclaimed areas (i.e. 74.6%). Therefore, P&M feels it's determinations, based on Savannah, were extremely conservative both as to range condition and carrying capacity.

P&M proposes then, that the values listed in the PAP for biomass production from the Savannah site description are more properly applied as success standards for total perennial biomass on reclaimed areas. More importantly, the Shallow Savannah RSD has been utilized to determine range conditions and carrying capacity. As

example of the applicability, the biomass figures for Savannah are 800, 500, and 650 lbs/ac; for favorable, unfavorable and average condition years, respectively. These numbers are well supported by actual results from the reclaimed areas, as follows.

> 1990 was an unfavorable year, in that the mine was just recovering from the 1989 drouth year (i.e. 3.4 inches total rainfall). Productivity values determined by Mariah (Appendix VI.F) for this year were 548 lbs/ac. This compares favorably to the RSD value of 500 lbs/ac, at 109.6%.
>
> 1992 was a favorable year, with vegetation basically recovered from the drouth, and total rainfall of 19.4 inches. Productivity values determined by P&M for this year were 740 lbs/ac. This compares favorably to the RSD value of 800 lbs/ac, at 92.5%.
>
> Average production for 1990 and 1992 was 644 lbs/ac. This compares favorably to the RSD value of 650 lbs/ac, at 99.1%.

Baseline information presented by Dames & Moore, placed pre-mining productivity levels at 485.4 lbs/ac with a standard error of 50.6, for 1973 (Table 20). This number, derived for Sagebrush-grass areas which represented the best producing areas examined, is very much in-line with RSD determinations as currently approved in the PAP for an unfavorable year. However, it must be remembered that premining range conditions were heavily overgrazed at nearly all locations. Dames & Moore cited this as near maximum potential for that existing range condition, as follows.

> *Although these production data indicate current productivity of forage species is below the potential for these vegetation types, they do represent nearly maximum values for the present conditions because of the high precipitation received during winter and spring. Cool season species such as Western Wheatgrass, Indian Ricegrass, and Bottlebrush Squirretail were favored by the winter-spring moisture.* (emphasis added)

This figure does represent actual pre-mining range conditions, which Dames & Moore classified as fair to poor. However, a full 75% of the vegetational production was by Big Sagebrush and Broom Snakeweed. While further breakdown data is sketchy, it should be noted that Broom Snakeweed represents 21.4% of this mix in Table 11, or 104 lbs/ac, and this is a poisonous forage, to sheep or cattle. Reduction of the biomass results in 381.5 lbs/ac, if it would be possible to actually utilize this range for grazing purposes. SCS recommendations indicate that grazing range with this high a concentration of Snakeweed would be an extremely risky business.

Harner-White performed baseline investigations in 1979 with much higher biomass noted over a larger study area. Four vegetation types were noted as compared to two for Dames & Moore. However, inventory by Dames & Moore is clear that the McKinley Mine area was comprised of primarily Pinyon-Juniper, followed by Sage-

Grass vegetation areas. Rabbitbrush and Greasewood areas are primarily located on the areas below 6800 ft. elevations, not included in this release request. Therefore, this evaluation concentrates on the Sage-Grass vegetation types. In Table 2.4-2, Harner-White summarized production figures for Sage-Grass areas, placed on "to be affected" areas and "not to be affected" reference areas as 985.4 and 845.5 lbs/ac, respectively. Again, Pinyon-Juniper areas produced considerably less biomass.

These figures were again based on all biomass produced and not restricted to perennial vegetation. In these areas, Broom Snakeweed contributed only 2 of 87 grams of the biomass, or 2.3%. However, a major contributor was Rabbitbrush (i.e. 11.5%), another poisonous plant when eaten in quantity. The major producing species was Big Sagebrush, which produced over 720 lbs/ac, or nearly 75% of all biomass. The major grass specie was Western Wheatgrass, which produced 166 lbs/ac of a total 194 lbs/ac for grasses, or 86%. P&M has strived to avoid situations where a single species produces over 40% of the total biomass, or where grass production relies so heavily on a single species.

While the Harner-White areas do not present a standard that P&M wishes to pursue, it is probably indicative of a typical prime winter grazing range in the general area. A critical observation is that Big Sagebrush is only a marginal forage for summer grazing, while it's leaves offer superior nutrients (i.e. TDN 57.8%, protein 11.2%) during winter grazing seasons. At a combined 13.8%, poisonous species could be somewhat of a problem if the area was utilized in spring or summer, however these are mostly stalks or fibrous during winter, and should not attract healthy livestock. Mature Sagebrush plants can become quite large and are not controlled through grazing, with limitation of understory perennial grasses quite common for larger plants.

While biomass productivity from this area appears to offer a good high-end goal, this assumption is deceiving on two counts. First, this area has very little diversity, with nearly 85% of the production from only two species. Most of the remaining production is from poisonous species, which render the area relatively dangerous for summer usage. Further, Sagebrush production is severely impacted by over-grazing, becoming quite woody, so much so that the use factor is rated at only 20%, as developed by Dames & Moore from SCS and Forest Service Allowable Use figures for the mine environmental conditions in Dames & Moore -- Table 22. This stands in comparison to Atriplex or many rhizomatous grasses that have use factors in the range of 40%. Applying a factor of 20% to the Sage and 40% to the grasses, provides the following determination with direct application to utility.

Baseline:	720 x 0.20	=	144	Brush (Sage)
	194 x 0.40	=	78	Grass

	Total Useful Forage		222 lbs/ac	

The above derived utility (i.e. useful forage) compares unfavorably to the average for all the reclaimed areas for 1992, which are comprised of significantly more grasses and brush species. Further these areas exhibit considerably more diversity and a more balanced blend of producing species. This balance and the lack of poisonous species, indicates that the areas could be employed for summer grazing, as well as winter. Applying the same usage factors of 40% to the grasses and 40% to Atriplex species, provides the following determination, which verify that reclaimed area utility, based on forage production, was better than the Harner-White figures.

Reclaim areas:	180 x 0.40	=	72	Brush (Atriplex)
	553 x 0.40	=	221	Grass

	Total Useful Forage		293 lbs/ac	

The use factors developed consider only application for year-round grazing. For reasons already discussed, range grazing capacities are substantially increased for seasonal rotation grazing systems. To summarize, grazing should avoid the primary growth, early-spring, and early-drouth periods. Therefore, the use factors will be increased by 50%, for plants grazed only in their prime grazing season, but should remain as indicated for non-prime seasons. The Forest Service Handbook addresses the adjustment of these numbers as follows.

> *These are guidelines as amended by nearly 50 years experience by the National Forests in Region 3 and were developed primarily under continuous year-long grazing systems. Intensive management systems with varying periods of use will provide different levels of allowable use.* (emphasis added)
>
> *Allowable use is determined from proper use and is the level of grazing utilization that can be permitted on an area when all influencing factors are considered. The individual making the initial analysis is best qualified to set allowable use factors.*
>
> *Management practices and efforts by the permittee will affect the distribution of grazing use more than any other single item. The effect of allowable use will be an increase or decrease in the area that receives concentrated grazing use.* (i.e. assumed under a fixed flock size)

Therefore, for purposes of this evaluation P&M will set in-season grazing values at the recommended use factor plus 50%, and will leave out-of-season grazing at the year-long use factor. A reprint of the Forest Service Allowable Use Section has been included as Appendix G4. Assuming the Baseline areas can be grazed in summer, ignoring any risk from toxic plants, but not the effects upon plants during this primary growth period, the following summer and winter values are developed for baseline and reclaimed areas. The factors utilized are estimated on life forms, based on primary production species (i.e. cool-season grass = Western Wheatgrass, warm = Alkali Sacaton, brush = either Atriplex or Sage).

Baseline - summer:	720 x 0.20	=	144	Brush (Sage)
	194 x 0.60	=	116	Grass

	Total Useful Forage		260 lbs/ac	
Baseline - winter:	720 x 0.30	=	216	Brush (Sage)
	194 x 0.60	=	116	Grass

	Total Useful Forage		332 lbs/ac	
Reclaimed - summer	180 x 0.40	=	72	Brush (Atriplex)
	553 x 0.60	=	332	Grass

	Total Useful Forage		404 lbs/ac	
Reclaimed - winter	180 x 0.60	=	108	Brush (Atriplex)
	553 x 0.60	=	332	Grass

	Total Useful Forage		440 lbs/ac	

These calculations adequately demonstrate two important considerations. First, the difference between summer and winter grazing utility values. Ignoring any potential problem of toxic plants in vigorous growth condition, both sets of areas do have utility in both seasons. However, the reclaimed areas retain higher utility in both seasons, due to the higher grazing use factors of the primary brush species (Atriplex) verses Sagebrush, and due to a wider-ranging grazing season of the more dominant cool-season grasses. Second, these figures demonstrate that Use Factors must be used to classify simple biomass against the actual utility value for rangeland forage. Biomass calculations alone are not reflective of a plant's tolerance to grazing pressures, and therefore are not indicative of the utility value of an area, either on a year-round or seasonal rotation grazing program.

The problem with poisonous plants in the undisturbed range areas, is particularly bothersome. Another common species in the area that has been identified as poisonous, is Greasewood. Sheep will die within 4 to 6 hours, after ingesting less than 2 pounds of Greasewood in it's vigorous growth state. This species, like Broom Snakeweed and Rubber Rabbitbrush, was common in the pre-mining lease areas, and continually shows up in baseline study data and in the reference areas. However, it might be noted that as in the case of seleniferized plants, much of this vegetation can provide nutritious forage, if ingested in small quantities blended with other species. Also, the effects are relatively short-lived, with livestock recovering quickly when removed from these feed sources.

P&M has the ability to remove the poisonous species from reference area calculations, but as in the case of annuals, lacks enough detailed information on

either biomass or carrying capacity calculations to remove the species and recalculate the numbers for the baseline work. This work is complicated by the fact that livestock have a "sense" of which plants to eat, and ordinarily eat poisonous plants only in over-grazing scenarios. This, of course, is of little comfort, when one considers that traditional practices are based upon over-stocking the range. However, we can simply point out with complete confidence, that the reclaimed areas do not contain appreciable amounts of any of these species. P&M asserts that this fact, alone, is indicative of the overall utility value of it's reclaimed areas, to both year-round grazing and to seasonal grazing, regardless of the season. This same statement is not true of pre-mining range areas.

As discussed in Appendix F, reference areas have been established in range that will not be disturbed, all located in MMD jurisdictional areas. P&M does not maintain that these areas are representative of range in good or excellent condition, although they were the best areas locatable in the general mine vicinity. SCS range evaluation methods develops a only fair-poor condition rating for these areas, based on cover values of 20-30% of theoretical maximum. However, in many ways these areas are representative of the pre-mining range. The determinations for 1991 and 1992 productivity are 493 and 503 lbs/ac which compare closely to the Dames & Moore baseline value of 485.4 lbs/ac, with 50.6 standard error. However, it should again be stressed that reference area biomass is based upon only perennial species, while the Dames & Moore baseline value is not.

The reference areas are relatively free of poisonous species (i.e. Greasewood 2.84%, Snakeweed 1.83%), so that risk to livestock health in seasonal grazing is not a consideration. Brush is based more upon Atriplex variants than Sagebrush. Forbs in these areas are relatively high as compared to the baseline areas, so that this component is available for summer grazing values. Utilizing the various Use Factors for in- and out-season grazing, as in above calculations, develops the following utility for yearlong and seasonal usage.

Reference - yearlong	369 x 0.40 =	148	Brush (Atriplex)
	22 x 0.20 =	5	Forbs
	111 x 0.40 =	44	Grass

	Total Useful Forage	197 lbs/ac	
Reference - summer	369 x 0.40 =	148	Brush (Atriplex)
	22 x 0.20 =	5	Forbs
	111 x 0.60 =	67	Grass

	Total Useful Forage	220 lbs/ac	

Reference - winter	369 x 0.60	=	221	Brush (Atriplex)
	111 x 0.60	=	67	Grass

	Total Useful Forage		288 lbs/ac	

Again, the reclaimed area values of 293, 404 and 440 lbs/ac compare favorably to the reference areas, and again, the highest utility value would be for winter grazing,

Range conditions are another basis under which the reclaimed areas were examined. This method has been developed by the SCS to identify range conditions in order to establish the direction of management practices. Analysis is based upon a percentage of the theoretical maximum for an RSD description. It should be noted that the RSD determination for biomass production from Shallow Savannah, cited earlier, is based upon a 50% range condition. Numbers for condition by management unit and reference area are contained in Appendices E and F, respectively.

Ratings for the reclaimed areas, based on a percentage of optimum condition, range from 27.5% to 50.91%. Ratings were also developed for the five reference areas, which ranged from 24.4% to 51.08%. Most ratings fall in the fair category, with the exception of the pre-law reclamation areas, which were rated as good. This method is basically a less accurate technique which estimates range condition from cover values for comparing against the RSD values. However, these numbers have been developed in order to determine grazing carrying capacity

The grazing carrying capacity, or stocking rate, has been determined in order to evaluate and compare the reclaimed areas, reference areas, and baseline estimates. P&M feels that these numbers give indication of the return to utility levels "equal to or better than" pre-mining conditions. Carrying capacities were originally calculated as AUY/S (i.e. Animal Unit per Year per Section) in the Dames & Moore study. However, for the current evaluations, the numbers are calculated as Ac/AUM (i.e. Acres per Animal Unit per Month). Note, an animal unit is defined as one mature cow and calf, or five mature sheep or ewes. Table 7.6 presents all reported values with conversion to the current units of Ac/AUM's.

Pre-mining conditions, as determined by Dames & Moore at Table 19, range from a value of 0.67 AUY/S for Pinyon-Juniper vegetation to 5.8 AUY/S for the best Sagebrush-Grass area. Averages are 1.9 AUY/S for Pinyon-Juniper and 3.8 AUY/S for Sagebrush-Grass. It should be noted that even though these figures were reported by Dames & Moore, the actual calculations were made by BIA personnel. From these estimates, Dames & Moore states, *"A reasonable stocking rate for the area as a whole would probably be intermediate between the extremes calculated by the BIA (0.7 - 6.0 animal units per section)."* From this it can be determined that Dames & Moore's anticipated stocking rate would be the calculated average of all values, 2.85 AUY/S, or 18.7 Ac/AUM.

Also included in Table 7.6 are grazing capacity estimates calculated by two methods and as taken from BIA records for the Lease areas. These values range from 1.12 AUY/S for the Pinyon-Juniper to 6.42 AUY/S for the Sagebrush-Grass. Under these evaluations, the forage production method was higher than the range evaluation method. P&M used the range evaluation method for examining the reclaimed and reference areas. Dames & Moore stated, "*Grazing capacity estimates were slightly higher as calculated by the forage production method for both vegetational types, probably because of the favorable conditions for growth during the spring.*" It was not reported which method the BIA used, to develop the values for Table 19, but because forage production was listed on the same table, it is logical to assume the higher forage production method was employed.

TABLE 7.6 -- GRAZING CAPACITY

Community Type & Location		AUY/S	Stocking Rate Ac/AUM	Useful Forage Production (lbs/ac)
Pinyon-Juniper				
	1	0.7	79.6	12
	2	2.4	22.1	43
	3	1.9	28.2	33
	4	2.5	21.3	44
	Average	**1.9**	**28.7**	**33**
Sagebrush-Grass				
	1	5.8	9.2	105
	2	4.0	13.3	72
	3	3.6	14.8	62
	4	1.8	29.6	32
	Average	**3.8**	**14.0**	**68**
Range Survey				
	Pinyon-Juniper	1.1	47.6	N/A
	Sagebrush-Grass	**5.8**	**9.3**	**N/A**
Forage Production				
	Pinyon-Juniper	2.4	21.9	N/A
	Sagebrush-Grass	**6.4**	**8.3**	**N/A**
BIA Records				
	Pinyon-Juniper	1.9	28.7	N/A
	Sagebrush-Grass	**3.8**	**14.0**	**N/A**

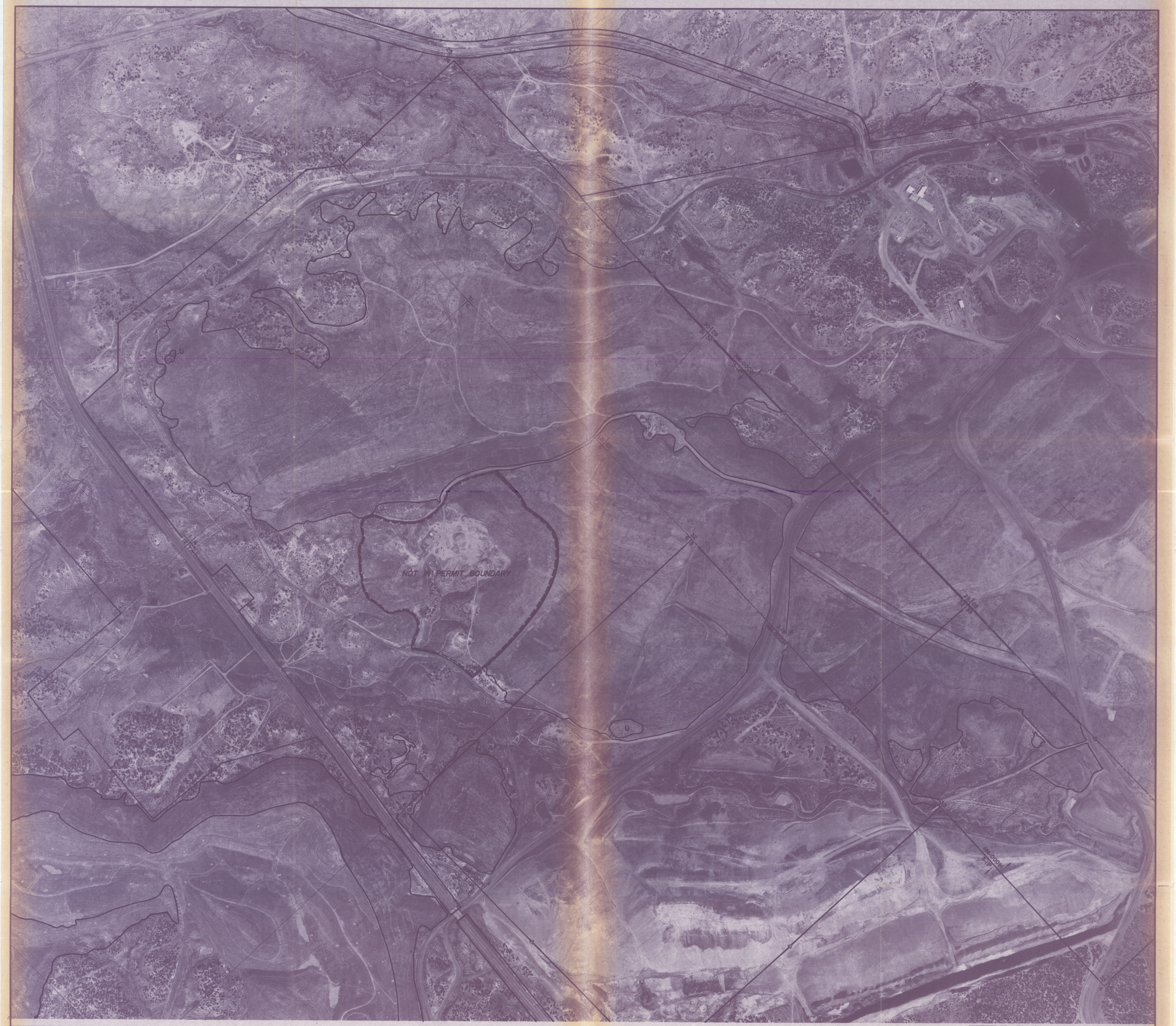
Again, P&M would point out that production from Pinyon-Juniper areas, which made up the majority of the Lease area lands, is lower in all categories (i.e. biomass, usable forage, and grazing capacity) than production from Sagebrush-Grass areas. P&M has consistently based it's comparisons against values for Sagebrush-Grass areas and will

continue because shrub-grass is the intended post-mining vegetation type. Therefore, values from Pinyon-Juniper areas were only included for informational purposes. Where Dames & Moore estimated carrying capacity at 2.85 AUY/S, P&M would utilize the average value of 3.8 AUY/S. However, because this is only an estimated value, and not a fixed standard, P&M would propose to use the range of values from sagebrush-grass for comparison purpose. Analysis of Table 7.6 shows this range to be as follows.

High end	5.8 AUY/S	9.2 Ac/AUM
Average	3.8	14.0
Low end	1.8	29.6

P&M has demonstrated two additional methods by which MMD may be assured that productivity, as based upon utilization by the regulations, has been returned to the postmining lands contained in this release request. One based upon comparison to the theoretical RSD production of simple perennial biomass, and the other based upon comparison of useful forage; evaluated for year-long, summer, and winter grazing conditions.

In a further effort to provide assurance to the MMD that the release area vegetation will provide utility levels compatible with the postmining land uses (i.e. at equal or better than premining levels), vegetation data has been evaluated for species richness by individuals (Shannon-Weiner), range condition % and rating, and grazing capacity by SCS range evaluation methods. Such information has been included by individual management unit and individual reference area in Appendices E and F, respectively.



REVISION	Date	App'd By

Cooper Aerial Survey Co.
(602) 884-7580
1692 WEST GRANT ROAD / TUCSON, ARIZONA 85745

LEGEND

Lease Boundary – Permitted	
Lease Boundary – Not Permitted	
Area To Be Released	
Undisturbed	U

The Pittsburg & Midway Coal Mining Co.
A Chevron Company
McKINLEY MINE
EXHIBIT I.1

RECLAMATION LIABILITY RELEASE AREAS

Photo Base Date: 6-24-94
SHEET 3
Drawn By: C.T.
Date Drawn: 8/2/94
Checked By: T.R.
Approved By: T.R.
Scale: 1" = 400'
Drawing No:

C.A.S. 940622

Appendix A3: Groundwater and Surface Water Evaluation (Trihydro)

VEGETATION MANAGEMENT UNIT 8
FINAL BOND RELEASE AND
LIABILITY RELEASE & TERMINATION OF JURISDICTION APPLICATION
GROUNDWATER AND SURFACE WATER EVALUATION
CHEVRON MINING INC. – MCKINLEY MINE, NEAR GALLUP, NEW MEXICO

December 10, 2025

Project #: CHEVR-025-0034

SUBMITTED BY: Trihydro Corporation

1252 Commerce Drive, Laramie, WY 82070

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1.0 INTRODUCTION

This report contains a surface water and groundwater assessment in support of the Phase III bond release application for Vegetation Management Unit 8 (VMU). VMU 8 is located on reclaimed land in Section 5, T16N, R20W and Section 33, T17N, 20W near New Mexico State Highway 264 and part of the Northern area of the McKinley Mine (Mine) permitted under Office of Surface Mining Reclamation and Enforcement (OSMRE) Permit No. NM0001K. This report was prepared in accordance with the OSMRE Guideline to Bond Release Procedures for Permanent Program Lands as well as the 30 CFR 800.40 Requirement to Release Performance Bonds. Information regarding the Probable Hydrologic Consequences (PHC) and the Cumulative Hydrologic Impact Assessment (CHIA) is discussed in OSMRE Permit NM-0001K, Section 3.4, and included in Appendix A of this report. -

The Mine is located approximately 24 miles northwest of Gallup, New Mexico. The Mine began operations in the early 1960s and ceased operations in 2009. Since that time, the Mine has been in various phases of reclamation including grading to post-mine topography, placement of topsoil, and revegetation. VMU 8 surface and groundwater sources have been monitored through a network of surface water monitoring stations and wells. Figure 2-1 shows the location of these monitoring facilities. The map also shows National Pollutant Discharge Elimination System (NPDES) Permit No. NN0029386 outfalls affiliated with the proposed bond-release area and other nearby areas within the watersheds containing VMU 8, since information from the outfalls is discussed in this report.

Trihydro Corporation (Trihydro) began collecting water quality data in October 2012 and managing water quality data in January 2013. This report provides an evaluation of water data from 2013 through 2025 as data during this time period are representative of post-mining conditions and are the most complete dataset available. The data analysis includes comparisons to baseline information, effluent standards, and the PHC.

A summary of the hydrologic setting and protection requirements for the Mine are included in this report in Section 2.0. Section 3.0 reviews the -long-term chemical and physical characteristics of surface water associated with the NPDES outfalls 018, 019, 020, 021, 022, 023, 024, 026, 027, 028, 031, 032, 065, 076, 077, 081, 082, 083, 084, 085, 086, 087, 088, 089, and 090, as well as surface water monitoring sites Tse Bonita Wash (TBW) and Defiance Draw (DD) that receive waters from the VMU 8 area. Of these Outfalls, the stormwater discharge locations that have been monitored since 2013 and that have current surface water data include: 018, 020, 021, 024, 026, 032, 084, and 090. Therefore, Outfalls 019, 022, 023, 027, 028, 031, 065, 076, 077, 081, 082, 083, 085, 086, 087, 088, and 089 are not represented on the discharge data tables or temporal plots. Section 4.0 provides a review of the long-term chemical and physical characteristics of the groundwater wells (Well 1, Well 2, Well 3, Well 11, Well SW9-A, Well MBR-2, Well MBR-5, Well TB2A, Well TB2B2, Well TB2C, Well TB2D, Well TB3D) located nearest to VMU 8.

Wells TB2A, TB2D, TB3D, TB2C and SW9-A have not been sampled due to lack of available water, and therefore have no available sampling data for the 2013 to 2024 reporting period.

2.0 HYDROLOGIC SETTING AND PROTECTION

2.1 GEOLOGIC SETTING AND CLIMATE

The Mine is located in the southwest corner of the San Juan Basin in a structural sub-basin known as the Gallup Sag. The San Juan Basin, which is roughly circular in shape, occupies much of northwestern New Mexico, a narrow strip of northeastern Arizona, and a small portion of southwestern Colorado. The basin is bordered on the north by the San Juan Mountains, on the east by the Nacimiento Uplift, on the south by several uplifts including the Lucero Uplift and Zuni Uplift, and on the west by the Defiance Monocline, which separates it from the Black Mesa Basin.

The sedimentary rocks in the San Juan Basin are predominantly of Mesozoic age with some Tertiary rocks outcropping in the central basin and some Paleozoic and Pre-Cambrian rocks upturned along the basin margins. The sediments increase in thickness toward the basin's center. The geology in the vicinity of Gallup and McKinley County is comprised of Middle to Upper Jurassic (175-145 million years old) and Quaternary (less than 1-million years old) rocks. Older rocks, the Triassic River deposits of the Chinle Group, are exposed in the plains to the south and Cretaceous rocks form the high ridges. The rock formations include sandstone, shale, limestone, coal, and mudstone.

The San Juan Basin is characterized by low surface relief. Most of the basin is a relatively featureless plain with wide shallow valleys and some low mesas and cuestas. Elevations in the area range from 5,000 feet above mean sea level (ft amsl) in the north to 7,000 ft amsl in the south. A prominent north-south trending range, the Chuska Mountains, occurs along the western part of the basin with elevations exceeding 9,500 ft amsl. The Mt. Taylor volcanic area, with elevations up to 10,000 ft amsl, occurs within the southeast corner of the basin. The margins of the basin are characterized by hogback ridges, which are associated with the tectonic uplifts defining the basin boundaries.

The majority of the Mine is located in the Puerco River Drainage Basin with a small portion of the Mine located in the San Juan River Drainage. The main drainages or watersheds in the Mine are the headwaters of Defiance Draw (DD) and its tributary, Defiance Draw Tributary (DDT), Tse Bonita Wash (TBW), Coal Mine Wash (CMW), and its tributary, CMWT, and an unnamed tributary to Black Creek. A small portion of the Mine lease area is in the headwaters of Deer Springs Wash and Black Springs Wash (both in the San Juan River Drainage Basin). Of the drainage basins listed above, DD is the largest drainage basin with an area of 27.5 square miles. TBW is the drainage basin that encompasses the highest percentage within the Mine boundary at 35.0%. The watersheds encompassing VMU 8 discharge surface water run-off to TBW and DD; the sampling locations for those drainages are shown on Figure 2-1.

As presented in Mine Permit No. NM-0001K, Section 3.4, groundwater resources within the Mine fall into three main types: alluvial, bedrock, and aquifer. Alluvial and bedrock groundwater resources are discontinuous, of poor physical and chemical quality, and of limited extent. The first major deep aquifer is the Gallup Sandstone Aquifer (GSA). The GSA lies well below the zone of mining impact and is overlain by several impermeable shale members. Most recharge to the Gallup Sandstone comes from the Chuska Mountains to the northwest of the Mine. In addition to these three types, groundwater may also be found in spoil material above bedrock. The groundwater monitoring wells nearest VMU 8 are alluvial monitoring wells TB2A, TB2B2, TB2C, TB2D, and TB3D; bed rock monitoring wells MBR2 and MBR5; GSA wells 1, 2, and 3, and spoil monitoring wells 11 and SW9-A. The locations of these wells are shown on Figure 2-1.

The Mine climate is semi-arid with an average annual precipitation of approximately 11 inches (in.) per year. More than half of the annual precipitation typically falls during the months of July through October. Precipitation often occurs as rainfall from intense, localized thunderstorms that occur sporadically in the region. This can result in high suspended solids levels in the runoff. In addition, soil chemistry and geomorphology contribute to the high levels of dissolved solids, salinity, and alkalinity. Within the general area of the Mine, runoff due to precipitation events occurs in the form of surface runoff. Natural drainages or watersheds convey or temporarily store the runoff as it is routed to the Puerco River or San Juan River.

Precipitation data nearest to VMU 8 is reported from the precipitation monitoring stations at Bluff, Rain 10, and South Tipple, as shown on Figure 2-1. The Rain 10 precipitation station operates between mid-April and mid-November and is shut down annually during the winter months. The Bluff and South Tipple precipitation stations operate all year round.

Table 2-1 provides the monthly and annual precipitation data from the three precipitation stations for the 2013-2024 period. Average monthly precipitation between April and November at the three precipitation stations ranged from 0.28 in. in April to 1.85 in. in July during the 12-year evaluation period. On average, most of the precipitation is received between July and September. The month with the highest one-month precipitation total was July 2021 with 5.45 in. at South Tipple. Precipitation data are referenced throughout the report to help explain some of the observations presented for surface and groundwater stations.

2.2 HISTORICAL WATER QUALITY DATA

The Mine began operations in the early 1960s, before the passage of the Surface Mine Control and Reclamation Act and other regulations governing coal mining on Indian lands. At that time, baseline surface and groundwater quality

and quantity data were not required before mining. As a result, comparisons cannot be made with pre-mining watershed conditions of the Mine as a single unit.

The original 1980 Geohydrology Associates Inc. (GAI) baseline groundwater report, incorporated into the Mine permits, provides surface and groundwater quality and quantity data that can be referenced for evaluating trends since that time. There are no baseline groundwater data applicable to the Mine site. Groundwater monitoring is reported annually as required by OSMRE Permit Number NM 0001K. The monitoring requirements were recently changed so all wells are sampled annually through Permit Modification Mod 23-04, which was approved by OSMRE on February 21, 2024. Groundwater resources within the Mine include alluvial, bedrock, Gallup Sandstone Aquifer, and spoil.

Alluvial groundwater is present in some fill and low-lying soils at the Mine. Wells penetrating the alluvial groundwater are designed to monitor the quality and quantity of shallow groundwater in alluvial valley-fill sediments. Valley-fill sediments in the Mine area serve as a reservoir for meteoric water to reside. Because the area is semi-arid and annual precipitation is limited, the presence of alluvial groundwater is generally dependent on rainfall and, to a lesser extent, snowfall quantities.

In 1980, five bedrock wells (MBR1, MBR2, MBR3, MBR4, and MBR5) were installed approximately 50 feet (ft) below the Green Coal Seam to monitor groundwater below this unit. The Green Coal Seam was the lower-most recoverable coal seam at the Mine. These monitoring wells, referred to as McKinley bedrock wells, were located in and around the major drainage watersheds throughout the Mine. Three of the original five wells (MBR1, MBR3, and MBR4) were mined through and not replaced. The active bedrock monitoring wells include MBR2 and MBR5, to the north and south of VMU 8.

The original 1980 GAI baseline groundwater report concluded that bedrock wells had little potential as a meaningful groundwater resource. The transmissivity of the bedrock deposits was less than 6 square feet per day (ft^2/day) and not capable of maintaining a sustained yield of 1 gallon per minute (gpm). Even though groundwater was present, none of the strata had sufficient continuity to be considered an aquifer.

Five water wells (1, 2, 3, 3A, and 4) have been completed in the Gallup Sandstone Aquifer throughout the Mine area. These wells were used as primary water sources for mine activities and reclamation. The wells now provide domestic water, dust-control water, and are also used as monitoring wells. Because of the relatively low permeability of the shale units overlying the Gallup Sandstone Aquifer and the geologic structure in the area, the Gallup Sandstone Aquifer can be under artesian conditions. Moreover, due to the presence of the overlying shales, there is no hydraulic

connection between the underlying Gallup Sandstone and the mined strata. Gallup Sandstone Aquifer Well 1 is located outside of VMU 8, near the South Tipple weather monitoring station. Gallup Sandstone Aquifer Well 2 is located outside of VMU 8, near the Bluff weather monitoring station. Well 3 is located within VMU 8 near the south end of the proposed release area, as shown on Figure 2-1.

Five spoil recharge wells (2G2, 4A, SW9-A, 9S, and 11) were constructed in the Mine area. The spoil recharge wells were installed throughout the Mine in reclaimed areas to determine chemical presence and groundwater properties. These wells were terminated at bedrock and their screens encompassed the spoil interval immediately above bedrock.

Two spoil wells 4A and SW9-A on New Mexico Mining and Minerals Division (MMD) regulated lands were installed in 1990; of these two wells, only SW9-A remains. Well 4A was not monitored after 2015 following approval by MMD to discontinue monitoring this well because the land at the well location had a full reclamation liability release. Well 4A was abandoned on October 29, 2018.

In April 2013, three additional spoil recharge wells were constructed and designated as wells 2G2 (on OSMRE lands), 11 (on MMD lands), and 9S (on MMD lands). Spoil Wells 11 and SW9-A are the spoil recharge wells in the vicinity of VMU 8. Well SW9-A has had insufficient volume to sample during the reporting period.

Surface water has been monitored since the early 1980s through active and passive surface water monitoring stations, although the number and locations of stations have evolved over time. The currently monitored active, mine permit related surface water stations for large watersheds are located in and around the major drainage watersheds throughout the Mine and include the DD, TBW, DDT6, CMW, and CMWT stations. In the annual hydrology report, Station CMW is used to monitor flow and water quality from a relatively undisturbed large watershed drainage; the data from this station are used as background information and to contrast against other station data from large, disturbed watersheds.

2.3 APPLICABLE PROTECTION STANDARDS

2.3.1 SURFACE WATER COMPARISON

Stormwater runoff from the Mine drains through impoundments and/or hydraulic control structures (e.g., check dams, designed channels, etc.) before discharging into Defiance Draw, a tributary to the Puerco River segment from the Arizona border to the Gallup wastewater treatment plant in McKinley County. Data collected from the disturbed stations in the large watersheds are compared to data collected at the undisturbed CMW station, which are considered background data. The comparison is used to determine impacts from mining activities. This comparison is provided in

the annual hydrology report, which is an appendix to the annual reclamation report that is submitted to OSMRE (Trihydro 2025).

2.3.2 NPDES REQUIREMENTS

The Mine operates under NPDES Permit No. NN0029386 which was last renewed on July 1, 2017. A renewal application was submitted to the United States Environmental Protection Agency (USEPA) on December 27, 2021, and the Mine is currently operating under the current permit pending approval of the renewal application. As required under NPDES Permit No. NN0029386, the Mine submitted an updated Sediment Control Plan on September 5, 2017. OSMRE approved the Sediment Control Plan on July 12, 2018, and USEPA acknowledged the OSMRE approval (per a 2003 Memorandum of Understanding) on October 15, 2025. The Mine is currently operating under the September 5, 2017, Sediment Control Plan. All watersheds within the Mine are classified as Western Alkaline, and in accordance with NPDES Permit No. NN0029386, reclamation inspections are conducted quarterly within the drainage basins associated with the Sediment Control Plan and inspection findings are summarized in quarterly reports.

Additionally, discharge sampling is conducted at NPDES outfalls per Table 1 of Permit No. NN0029386. All outfalls are subject to the Effluent Limitation Guidelines as specified in 40 CFR §434.80-81, water quality-based effluent limitations (WQBELs) in 40 CFR §122.44 (applicable to State NPDES programs), and Navajo Nation Water Quality Standards for outfalls located on Navajo Nation lands. There are 25 watersheds and NPDES outfalls located in the vicinity of VMU 8. Outfalls associated with VMU 8 and their associated watersheds are shown on Figure 2-1. The Mine will continue conducting quarterly reclamation inspections and sampling discharges through final bond release and subsequent removal of the outfalls from the NPDES permit.

2.3.3 GROUNDWATER PROTECTION STANDARDS

The Mine permit contains a list of parameters to analyze but there are no groundwater standards included with them since the intent of the permit is to monitor the change in water quality over time and to use that information to identify possible impacts to water quality during and after mining. While the permit has no standards, it may be useful to include in this report how the quality of the groundwater compares to known standards.

The Navajo Nation Environmental Protection Agency (NNEPA) exercises jurisdiction on Navajo Nation lands but does not have general groundwater protection standards. The New Mexico Administrative Code (NMAC), however, contains groundwater standards for the State of New Mexico, which will be reviewed in this report to provide a possible picture around utility of groundwater at the Mine. The table below contains a list of parameters with NMAC groundwater standards that would correlate to various parameters analyzed at the Mine.

Analyte	Upper Limit (unless otherwise indicated)
pH	6.0-9.0 s.u.
Fluoride	1.6 mg/L
Nitrate as N	10 mg/L
Selenium	0.05 mg/L
Chloride	250 mg/L
Dissolved Iron	1 mg/L
Dissolved Manganese	0.2 mg/L
Sulfate	600 mg/L
TDS	1,000 mg/L
Zinc	10 mg/L

Criteria listed for chloride, iron, manganese, sulfate, TDS, zinc, and pH represent the maximum concentration for domestic water supply. The NMAC also has an existing total dissolved solids (TDS) concentration of 10,000 milligrams per liter (mg/l) or less (also the case for the NNEPA standards), for present and potential future use as domestic and agricultural water supply (NMAC 20. 6.2.3103).

2.3.4 IMPOUNDMENT WATER QUALITY

VMU 8 includes one permanent impoundment: CDK. This impoundment meets the required livestock watering standards as discussed in the McKinley Mine OSMRE Permit Section 5.7.3.4.3 Permanent Impoundment Water Quality. A water quality demonstration with data showing the Mine permanent impoundments met livestock watering standards is also provided in the McKinley Mine OSMRE Permit Section 5.7.3.4.3.

2.4 PROTECTION OF HYDROLOGICAL BALANCE

The Mine permit includes preventative and remedial measures for any potential adverse hydrologic consequences identified in the PHC determination. The Permit includes sections on the PHC determination, groundwater and surface water monitoring plans, general plans to address possible hydrologic consequences, and a CHIA, as provided by the MMD/OSMRE. These items can be found in Section 3.4 of the Mine permit. Related permit sections are summarized below. A copy of the active and approved Permit Section 3.4 is provided as Appendix A.

2.4.1 PHC DETERMINATION

The PHC first reviews the possible impacts of the impoundments on other surface waters, which are reviewed here for the purposes of a PHC update. Assumptions for, and analysis of runoff to the impoundments and consumptive losses from the impoundments are provided. The impoundments have no negative impacts on regional water quantity and

should enhance local property use for livestock and wildlife. The PHC also acknowledges and evaluates the possible impact from impoundment stormwater discharge on downstream water chemistry. Review of available data indicated identifiable impact as related to pre- and post-mine monitoring stations along Defiance Draw and its tributaries. Lastly, the PHC considers the possible impacts of the groundwater, located in the alluvial, bedrock, and Gallup Sandstone Aquifer. This last item will be further discussed in report Section 4.5.3.

2.4.2 CUMULATIVE HYDROLOGIC IMPACT ASSESSMENT (CHIA)

A CHIA was prepared by Radian Corporation for OSMRE and MMD in 1995 for the Mine. The CHIA follows the PHC language in Appendix A. Sections 3.0 and 4.0 of this report summarize possible surface and groundwater impacts/material damages concluded by the CHIA.

2.4.3 SURFACE AND GROUNDWATER MONITORING PLANS

Per Section 6.3.2.1 of the OSMRE Mine Permit, surface-water monitoring in large watersheds is conducted at five stations identified as DD, TBW, DDT6, CMW, and CMWT. Groundwater monitoring is conducted on the following sources: alluvial groundwater, bedrock groundwater, Gallup Sandstone Aquifer, and spoil recharge groundwater. McKinley Mine OSMRE Permit required analytes vary by water source, which are provided in Table 22.

3.0 SURFACE WATER MONITORING

VMU 8 is located in the Puerco River Drainage Basin, with possible influence on ephemeral and perennial streams. Surface water quality is monitored at 25 points downstream from VMU 8. The stormwater discharge locations that have been monitored since 2013 and that have current surface water data include: Outfall 018 (CH-2-14), Outfall 020 (DC-10-17), Outfall 021 (DC-10-6), Outfall 024 (DC-2), Outfall 026 (DC-10-29), Outfall 032 (DC-10-27), Outfall 084 (DC-10-34), and Outfall 090 (DS-6). Additionally, two stream monitoring locations along Defiance Draw and Tse Bonita Wash have been monitored since 2013.

Temporal plots were developed for a graphical representation of surface water monitoring data. The surface water temporal plots are found in Appendices B-1 and B-2. A statistical analysis was performed on the data as the temporal plots were developed. Outliers noted during the statistical analysis are depicted as a red dot on the temporal plots. As these are relatively small datasets (less than 30 observations for each given parameter), outliers are detected using Dixon's Test. The test focuses on the most extreme observation in a given data set and determines if the observation is an outlier by assessing the gap between the extreme values and its nearest neighbor relative to the overall range of the data. Dixon's Test is a standardized test and was used to identify outliers on both the discharge data sets and the stream water quality data sets.

3.1 SURFACE WATER DATA

3.1.1 DISCHARGE DATA

USEPA conducted a reasonable potential analysis based on comparisons with applicable water quality standards and found no basis for incorporating WQBELs in Permit No. NN0029386. If available data or other information showed that discharges had reasonable potential to contain levels of a pollutant in excess of a standard, this would demonstrate the reasonable potential to cause or contribute to future exceedances and a limit for that pollutant would be incorporated into Permit No. NN0029386. Limits for pH (Table 1, NN0029386) are established based on the Navajo Nation water quality standards and State of New Mexico water quality standards, based on the location of the outfall.

There are 8 stream discharge sampling locations affiliated with watersheds in VMUs 8 that are associated with data; Outfall 018 (CH-2-14), Outfall 020 (DC-10-17), Outfall 021 (DC-10-6), Outfall 024 (DC-2), Outfall 026 (DC-10-29), Outfall 032 (DC-10-27), Outfall 084 (DC-10-34), and Outfall 090 (DS-6) (see Figure 2-1). Historical discharge data have been recorded since July 2018 at Outfall 018, Outfall 020, Outfall 021, Outfall 024, and Outfall 032; since March 2019 at Outfall 026 and Outfall 084; and since August 2021 at Outfall 090. No discharge data have been recorded from Outfalls 019, 022, 023, 027, 028, 031, 065, 076, 077, 081, 082, 083, 085, 086, 087, 088, and 089 during the reporting

period; therefore, these outfalls are not represented on the discharge data tables or temporal plots. Outfall 018 has sampling data from 2018 to 2024. Outfalls 020, 021, 024, and 032 have sampling data from 2018 to 2025. Outfalls 026 and 084 have sampling data from one sampling event in March 2019. Outfall 090 has sampling data from 2021 to 2023. Sample data for Outfalls 018, 020, 021, 024, 026, 032, 084, and 090 are presented in Tables 3-1, 3-2, 3-3, 3-4, 3-5, 3-6, 3-7, and 3-8, respectively. Appendix B-1 presents temporal plots including Outfalls 018, 020, 021, 024, 026, 032, 084, and 090. The temporal plots are based on available 2018 to 2025 data. A discussion concerning the data for each analyte follows.

- Aluminum concentrations fluctuated over time for Outfall 024. Aluminum concentrations in most outfalls were lower and generally less variable, but consistent with the fluctuations of Outfall 024. The aluminum concentration spiked for Outfall 020 in August 2022 and for Outfall 024 in July 2021 and July 2022.
- Conductance is similar across the included outfalls and fluctuates between approximately 50-300 microsiemens per centimeter (µS/cm) with one high outlier at Outfall 021 in March 2023. All outfalls had measured conductance that varied in a similar fashion within the stated range.
- Only Outfall 024 had cyanide detections over the 12-year reporting period. Cyanide was typically not detected above the laboratory limit of quantification for most sampling events at most outfalls.
- Gross Alpha concentrations fluctuated over time for Outfall 024, with notable spikes in 2021 and 2024, including an outlier of 1,810 pCi/L in 2021. The remaining outfalls showed relatively low and stable concentrations, with no outliers.
- Related to the concentration of metals and biotoxicity is hardness. Discharge hardness has typically stayed below 500 mg/L CaCO3 and has almost always stayed below 1,000 mg/L CaCO3. Discharge hardness at Outfall 024 reached 1,000 mg/L CaCO3 in July 2021. Outfall 020 exhibited moderate variability, following the fluctuation pattern of Outfall 024. Even with elevated concentrations of iron and selenium, hardness will reduce toxicity for aquatic life.
- Iron concentrations fluctuated over time for Outfall 024. Iron concentrations at the remaining outfalls stayed well below 200 mg/L with the exception of Outfall 024.
- Oil & grease were not detected above the laboratory limit of quantification except for one outlier at Outfall 018 with 46.9 mg/L in July 2022. Aside from this outlier, only Outfall 032 had a detection, also in July 2022.
- Across all outfalls, field and lab pH fluctuated between 7 and 9 s.u.
- Selenium concentrations were generally stable and stayed below 0.015 mg/L. Outfall 024 had two notable spikes: one with a selenium concentration of 0.028 mg/L in July 2021, and one with a selenium concentration of

0.031 mg/L in July 2022. Selenium concentrations have remained comparatively stable for all other outfalls, with fluctuations mirroring the pattern of Outfall 024 at a lesser severity.

- Total dissolved solids generally remained below 5,000 mg/L and were stable over the reporting period. One high outlier was recorded at Outfall 024 in June of 2024, with a concentration of 35,000 mg/L.
- Total suspended solids concentrations generally followed a similar fluctuation pattern for all outfalls across the reporting period, with spikes occurring during the summer monsoon season. Reported values are typically below 5,000 mg/L. Outfall 024 showed significant variability, including multiple peaks between 2021 and 2025 that exceeded 10,000 mg/L, reaching a maximum of 18,000 mg/L in July 2021. Outfall 020 exhibited moderate fluctuations, reaching its highest concentration at 8,700 mg/L in July of 2021.

Permanent impoundments are not suspected to significantly impact surface water quality or regional hydrology. In VMU 8, impoundment CDK is upstream from Outfall 022, which had no recorded discharge data during the reporting period. Small depressions do not pose any additional impacts to the PHC assessment in the Permit. These structures provide opportunistic water for livestock and wildlife and add diversity to the vegetation. Since they are small (less than one acre-ft), there would be minimal impact from small depressions on the water quality leaving the Mine.

Examination of the previously discussed analytical trends suggests that discharge water quality outcomes have remained relatively consistent, sometimes with a great degree of variability in the data ranges. Many analyte concentrations were anomalous in 2021 and 2024 for much of the surface water data available in the vicinity of VMU 8. Overall, these trends support the presumption that there are no significant impacts from mining and reclamation operations on surface waters.

3.1.2 STREAM WATER QUALITY DATA

There are large watershed stream monitoring stations downstream of VMU 8: DD along Defiance Draw and TBW along Tse Bonita Wash (Figure 2-1). Stream water quality data are available for both of these locations since July 2013. Required analyte data are presented in Tables 3-9 and 3-10. Appendix B-2 presents temporal plots for stream monitoring data at DD and TBW from 2013 to 2025.

- Even though alkalinity is not a reportable analyte specified in the permit, it is a useful parameter when discussing bicarbonate and carbonate, which are the two most important compounds that determine alkalinity. Alkalinity has generally remained steady with alkalinities below 500 mg/L as $CaCO_3$ during the reporting period for DD and TBW. DD reported a major alkalinity outlier of 2,400 mg/L as $CaCO_3$ in July of 2020.
- Bicarbonate concentrations shown on the temporal plot mimic alkalinity trends for DD and TBW.

- Total calcium concentrations at DD have been highly variable for the reporting period while remaining comparatively stable at TBW from 2013 to 2025. Calcium concentrations have been similar in both streams since 2022. The average calcium concentrations for TBW are around 90 mg/L with low levels of variation, while the average calcium concentrations for DD are around 235 mg/L, with yearly spikes (outliers) in concentration coinciding with the monsoon season. The maximum total calcium concentration, an outlier, observed throughout the reporting period at DD was 1,200 mg/L in July of 2020.
- Carbonate concentrations shown on the temporal plot are misleading as this analyte has historically been reported at or near the laboratory detection limit or the limit of quantification and is an insignificant component of total alkalinity at the historical pH levels. Several outliers are shown on the temporal plot for both DD and TBW between 2015 and 2019 and one at TBW in 2025.
- The calculated cation-anion balance at both DD and TBW has been variable during the reporting period, and values for both streams have been similar during the reporting period.
- Chloride concentrations have been relatively stable at both streams with multiple outliers throughout the reporting period.
- Field conductance is similar for both DD and TBW and has generally decreased over the reporting period.
- Total hardness concentrations showed consistent fluctuations for both DD and TBW, with DD exhibiting higher variability than TBW. Total hardness concentrations have generally decreased over the reporting period for both DD and TBW.
- Dissolved iron concentrations have decreased over time at DD, with multiple outliers between 2017 and 2020. TBW maintained consistently low dissolved iron levels throughout the entire period, with minimal fluctuation.
- Total iron concentrations showed substantial variability for DD, with multiple peaks between 2015 and 2025, including a clear outlier just above 800 mg/L in July of 2020, another outlier of 750 mg/L in July of 2022, and another outlier of 590 mg/L in September of 2025. TBW total iron levels are consistently lower than DD throughout the entire period, with concentrations generally below 200 mg/L and minimal fluctuation.
- Total magnesium concentrations at DD have been variable during the reporting period, with concentrations in TBW consistently lower than those at DD. DD experienced multiple peaks in concentration throughout the reporting period with the greatest outlier occurring at 270 mg/L in July of 2020. TBW remained consistently lower, with concentrations generally below 50 mg/L and minimal fluctuation.
- Dissolved manganese concentrations have shown a trend that is similar to that of total magnesium over the reporting period, with DD concentrations being variable during the reporting period and TBW concentrations

consistently lower than those at DD. TBW remained consistently lower, with concentrations generally below 1 mg/L and minimal fluctuation.

- Total manganese concentrations have shown a trend that is similar to that of dissolved manganese over the reporting period, with DD concentrations being variable during the reporting period and TBW concentrations consistently lower than those at DD. TBW remained consistently lower, with concentrations generally below 5 mg/L and minimal fluctuation.
- Total mercury concentrations have been relatively stable over the reporting period with concentrations lower than 0.002 mg/L. Multiple outliers are noted on the temporal plot for DD and one for TBW.
- Nitrogen, expressed as nitrate, concentrations have remained relatively stable for DD and TBW during the reporting period with concentrations decreasing over time. From mid-2021 through 2025, many reported values are below the laboratory limit of quantification.
- Field pH values have been variable during the reporting period with normal values at both TBW and DD ranging from around 7.9 to around 8.9.
- Lab pH values have been variable during the reporting period with values at TBW ranging from 7.6 to 8.4 and those at DD ranging from 7.8 to 8.2.
- Phosphate levels have shown DD concentrations as variable during the reporting period, with concentrations in TBW consistently lower than those at DD. DD reported multiple outliers in concentration throughout the reporting period with the greatest outlier occurring at 52.2 mg/L in August of 2018. TBW remained consistently lower, with concentrations generally below 10 mg/L and minimal fluctuation.
- Total phosphorous concentrations have shown an increasing trend both DD and TBW over the reporting period. Concentrations for TBW are generally more stable than those of DD, with less fluctuation and only one major outlier, occurring in 2024. Oppositely, DD concentrations experienced greater fluctuations with several outliers, the greatest one being a total phosphorus concentration of 28 mg/L in July of 2022.
- Total potassium concentrations have shown a trend in which TBW and DD experience similar fluctuations at different scales over the reporting period, with DD concentrations being more variable during the reporting period and with concentrations in TBW consistently lower than those at DD. DD reported multiple outliers in concentration throughout the reporting period with the greatest outlier occurring at 100 mg/L in July of 2020. TBW remained consistently lower, with concentrations generally below 50 mg/L and minimal fluctuation.
- Total selenium concentrations have shown DD and TBW concentrations being generally stable with a decreasing trend. DD reported multiple outliers in concentration throughout the reporting period with the greatest outliers

occurring at 0.25 mg/L in 2018 and 2020. TBW remained consistently lower, with concentrations generally below 0.05 mg/L and minimal fluctuation.

- The sodium adsorption ratio for both DD and TBW has followed the same decreasing trend over the reporting period, where both DD and TBW have an outlier value in September 2014. After this spike, the ratio decreases and becomes relatively stable from 2019 through 2025.
- Total sodium concentrations at DD have been variable during the reporting period with multiple instances of outliers. Concentrations at TBW have been generally stable and lower than those of DD with the exception of elevated outlier values reported in September 2014 and June 2024.
- Sulfate concentrations have been stable at DD over the reporting period. Concentrations at TBW have generally decreased and remained stable after an outlier in 2014 and decrease to approximate current levels in 2017. An outlier was reported at TBW in June 2024 before returning to levels consistent with prior concentrations.
- Settleable solids concentrations have been stable, generally less than 50 mg/L, at both DD and TBW when disregarding outliers.
- Total dissolved solids concentrations have been stable, generally less than 2,000 mg/L, at both DD and TBW when disregarding outliers.
- Total suspended solids concentrations at DD have been variable over the reporting period. Concentrations at TBW have been comparatively stable during the reporting period with a high outlier value in the second quarter of 2024. The majority of the cations found in surface water exist in the suspended phase relative to the dissolved phase.

Examination of the previously discussed analytical trends suggests that stream water quality has improved or remained consistent since 2013 in both Defiance Draw and Tse Bonita Wash. Lower constituent concentrations over time were expected as vegetation established in the area. Water quality is comparable between the two streams. Along with comparisons to the undisturbed Coal Mine Wash discussed in the McKinley Mine 2024 Annual Report (Trihydro 2025), these trends support the presumption that impacts from mining and reclamation operations on surface water are limited or insignificant. Geochemical parameters such as pH, alkalinity, and hardness also indicate stream water is resistant to such impacts.

The McKinley Mine 2024 Annual Report – Hydrology Section (Trihydro 2025), Section 3.3, compared analyte concentrations between disturbed watersheds, such as DD and TBW, with the relatively undisturbed watershed CMW. This report found that, after accounting for year-to-year variability associated with naturally occurring climatic factors, most analytes were similar to or higher in samples from CMW than in samples from the disturbed watersheds. Based on the comparison of water quality in the disturbed watersheds versus the undisturbed watershed, the data indicate that

mining and reclamation have not adversely impacted water quality in the disturbed watersheds. For more details and further watershed comparison discussion, please refer to the McKinley Mine 2024 Annual Report (Trihydro 2025).

3.2 ASSESSMENT OF SURFACE WATER DATA

3.2.1 COMPARISON TO BASELINE WATER QUALITY

There are no actual surface water data from pre-mining conditions available for comparison to current discharge or stream water quality data. Therefore, this comparison is not included in this report.

3.2.2 COMPARISON TO REGULATORY STANDARDS

There are 8 NPDES outfalls affiliated with VMU 8 that have data over the reporting period: Outfall 018 (CH-2-14), Outfall 020 (DC-10-17), Outfall 021 (DC-10-6), Outfall 024 (DC-2), Outfall 026 (DC-10-29), Outfall 032 (DC-10-27), Outfall 084 (DC-10-34), and Outfall 090 (DS-6). USEPA conducted a reasonable potential analysis based on comparisons with applicable water quality standards and found no basis for incorporating WQBELs in the site NPDES Permit other than pH. Therefore, there are no regulatory standards to compare the outfall water quality results.

There are two stream monitoring stations downstream of the outfalls; Defiance Draw and Tse Bonita Wash (Figure 2-1). There is no discharge data available from Outfalls 019, 022, 023, 027, 028, 031, 065, 076, 077, 081, 082, 085, 086, 087, 088, 083, and 089. Discharge water quality analysis from the outfalls showed generally neutral trends, sometimes with a great degree of variability in the data range. Analytical trend analysis of surface water quality of DD and TBW indicates attenuation of impacts observed at Outfalls 018, 120, 021, 024, 026, 032, 084, and 090. The overall findings of this report, as well as the trends outlined in the 2024 Hydrology Report (Trihydro 2025), for the surface water monitoring sites, conclude that there are limited or no impacts to surface waters after mining and reclamation operations and there are no impacts to the hydrologic balance.

3.2.3 COMPARISON TO PROBABLE HYDROLOGIC CONSEQUENCES

The PHC determination (Permit Section 3.4.4) acknowledges the possible consequence of stormwater on downstream water chemistry. Data show that there are no deleterious effects to watershed health of the Puerco River. Regional surface waters are also protected because of ephemeral flow patterns of the streams of interest and limited constituent loadings to downstream reaches as a result. Monitoring at NPDES outfalls and McKinley Mine surface water monitoring stations will cease upon final stages of bond release and regulatory approval. NPDES outfalls will be removed from the stormwater permit subsequent to Phase III approval of permanent program lands and Termination of Jurisdiction on initial program lands. Full discussion of the surface water quality from each of the Mine watersheds is included in the 2024 Annual Hydrology Report (Trihydro 2025) Section 3.0.

4.0 GROUNDWATER MONITORING

Groundwater at the Mine is monitored at four sources: alluvial, bedrock, Gallup Sandstone Aquifer, and spoil. A summary of data for the four groundwater sources is provided below followed by a comparison of results to baseline water quality, regulatory standards, and the PHC, as applicable. Depth to water data for the groundwater sources are presented in Table 4-1. Tabulated water quality data for the groundwater sources are presented in Tables 4-2, 4-3, 4-4, 4-5, 4-6, 4-7, and 4-8. Historical groundwater data tables include relevant groundwater protection standards for reference.

Temporal plots were developed for a graphical representation of the long-term groundwater monitoring data. The groundwater temporal plots are found in Appendices C-1, C-2, C-3, and C-4. A statistical analysis was performed on the data as the temporal plots were developed. Any outliers noted during the statistical analysis are depicted as a red dot on the temporal plots. As these are relatively small datasets (less than 30 observations for each given parameter), outliers are detected using Dixon's Test. The test focuses on the most extreme observation in a given data set and determines if the observation is an outlier by assessing the gap between the extreme values and its nearest neighbor relative to the overall range of the data. Dixon's Test is a standardized test and was used to identify outliers on both the GSA well data set and the bedrock well data set.

4.1 ALLUVIAL GROUNDWATER

Alluvial wells are located in and around major drainage watersheds throughout the Mine. Since water levels in these wells are dependent on direct precipitation, the depth to groundwater and the saturated thickness in wells vary to some degree based on rain and snowfall.

In 2016, OSMRE and MMD approved a permit modification to monitor only seven alluvial wells. Four of these wells have historically been considered recharging (DT2A, DT2B, TB2B2, and TB3D) whereas the remainder of the wells (CMC, D2C, and D3B2) have historically been dry. The alluvial wells being dry is consistent with the PHC. Wells TB2A, TB2B2, TB2D, TB3D, and TB2C are in the vicinity of VMU 8. Due to insufficient water depth, Wells TB2A, TB2D, TB3D, and TB2C have not been sampled and therefore have no available sampling data for the 2013 to 2024 reporting period. Only Well TB2B2 has been sampled and has sampling data for the 2013 to 2024 reporting period.

4.1.1 WATER LEVELS

Water level and saturated thickness are presented in Table 4-1 for alluvial well TB2B2. Depth to ground water in TB2B2 has been generally increasing since depth measurement began in 2013 and ended in 2016 (due to lack of recharge), with corresponding decreases in saturated thickness.

4.1.2 WATER QUALITY

Chemical concentrations from recharging alluvial wells were evaluated in this report and are included in the Groundwater Quality Summary 2013-2024 (Table 4-2). Samples were not collected at well TB2B2 beginning the second quarter of 2016 through 2024 due to inadequate recharge. When sufficient groundwater is present, water quality data are collected during quarterly sampling events from the alluvial wells. Appendix C-1 includes temporal plots by individual analyte listed in the permit for the sampled alluvial well, TB2B2, and are based on 2013 through 2016 data.

- While alkalinity is not a reportable analyte specified in the permit, it is a useful parameter when discussing bicarbonate and carbonate trends below. Alkalinity concentrations at TB2B2 have trended upward throughout the monitoring period.
- Bicarbonate concentrations in TB2B2 are similar to the alkalinity trend for the monitoring period. Nearly all the alkalinity present in alluvial groundwater is attributable to bicarbonate as carbonate is a relatively minor to non-existent component. These results are expected, given the neutral to slightly basic pH of alluvial groundwater.
- Calcium concentrations have remained stable at well TB2B2.
- Carbonate values were below the laboratory limit of quantification for TB2B2 over the reporting period.
- Although the calculated cation / anion balance appears to vary seasonally and with precipitation, they are generally less than 10%. High ratios are noted in the second half of 2014 at TB2B2.
- Chloride concentrations have generally remained consistent with no observed trend. Chloride levels at TB2B2 fluctuate over a relatively narrow range.
- Field conductance at TB2B2 has been relatively stable around 3,000 µS/cm over the reporting period.
- Total hardness concentrations, expressed as CaCO3, have been generally stable in TB2B2 at around 1,150-1,225 mg/L CaCO3 between August 2014 and November 2016. Hardness was not measured at TB2B2 from 2013 through the second quarter of 2014.
- Dissolved iron concentrations have fluctuated in well TB2B2 during the reporting period with an increase over the last three quarters of 2016.

- Total iron concentrations are variable at Well TB2B2, where total iron increased by an order of magnitude in the third and fourth quarters of 2014. However, during the majority of the reporting period, total iron has been reported near the laboratory detection limit.
- Total magnesium values are relatively stable at TB2B2 over the reporting period.
- Dissolved manganese concentrations have fluctuated in a narrow concentration range at TB2B2.
- Total manganese concentrations have fluctuated in a narrow concentration range at TB2B2 during the reporting period. A sizable portion of the observed total manganese exists in the dissolved phase.
- Nitrate, expressed as nitrogen, at well TB2B2 has consistently been at or below laboratory limits of detection or quantification throughout the reporting period.
- Field pH values were relatively variable over the reporting period with normal values falling between 6.7 to 7.4 at TB2B2.
- Laboratory pH values in the alluvial wells remain consistently in the 7.2 to 7.5 range, with no discernible trend.
- Phosphate is generally not present in TB2B2 above laboratory detection limits or limits of quantification, with one detection in 2013.
- Total phosphorus values have fluctuated in a narrow concentration range at TB2B2 during the reporting period.
- Dissolved potassium concentrations at TB2B2 are generally stable from 2013 through 2016.
- Dissolved selenium concentrations have been below the laboratory limit of quantification at TB2B2.
- Total sodium concentrations have been relatively stable at TB2B2 with no trend.
- Sulfate values show a stable trend as shown on the temporal plot for TB2B2.
- Total dissolved solids concentrations presented on the temporal plot for well TB2B2 have remained stable over the reporting period. A strong correlation between sulfate and total dissolved solids exists. Sulfate is the predominant anion included in the total dissolved solids results.

Examination of the previously discussed analytical trends from the alluvial well TB2B2 suggests that water quality concentrations have remained consistent between 2013 and 2016 and support the presumption that impacts from mining and reclamation operations on the alluvial groundwater have not occurred.

4.2 GALLUP SANDSTONE AQUIFER

Five water wells (1, 2, 3, 3A, and 4) have been completed in the Gallup Sandstone Aquifer throughout the Mine area. These wells were used as primary water sources for mining activities and reclamation. The wells now provide domestic water, dust-control water, or are only monitored. Because of the relatively low permeability of the shale units overlying the Gallup Sandstone Aquifer and the geologic structure in the area, the Gallup Sandstone Aquifer can be under artesian conditions. Moreover, due to the presence of the overlying shales, there is no hydraulic connection between the underlying Gallup Sandstone and the mined strata. The nearest GSA wells to VMU 8 – Well 1, Well 2, and Well 3 – are located as follows: Well 3 is within the VMU 8 release area, Well 2 is north of the VMU 8 release area near Bluff weather monitoring station, and Well 1 is directly south of the VMU 8 release area near South Tipple weather monitoring station (Figure 2-1).

4.2.1 WATER LEVELS

Water level and saturated thickness are presented in Table 4-1 for Wells 1, 2, and 3. Depth to ground water in Well 2 has been generally increasing since depth measurement began in 2014 with corresponding decreases in saturated thickness.

4.2.2 WATER QUALITY

Sampling of Wells 1, 2, and 3 has been conducted quarterly for multiple parameters since 2013. Significant chemical parameters are included in the Groundwater Quality Summary 2013-2024 (Table 4-3, Table 4-4, and Table 4-5). Appendix C-2 presents temporal plots for Well 1, Well 2, and Well 3 based on available 2013 to 2024 data.

Examination of the analytical data and temporal plots for the reporting period associated with Well 1, Well 2 and Well 3 indicates the following.

- Well 1 alkalinity concentrations have been relatively stable and much lower than Well 2 and 3 over the reporting period, staying under 170 mg/L $CaCO_3$, except for a higher outlier value reported in 2022. Alkalinity concentrations at Well 2 and Well 3 were variable with high and low outliers until early 2020. Since then, their alkalinity concentrations have been relatively stable. Nearly all the alkalinity present in Gallup Sandstone groundwater is attributable to bicarbonate, as carbonate is a relatively minor component.
- Bicarbonate concentrations are extremely similar to alkalinity trends for the reporting period.
- Dissolved calcium concentrations have been relatively stable at Well 1 over the reporting period at around 70 mg/L. Dissolved calcium concentrations at Well 2 were variable with high and low outliers until early 2020 when the values stabilized at just over 40 mg/L. Dissolved calcium concentrations at Well 3 are the highest of the

three wells and have remained relatively stable over the reporting period at around 90 mg/L with the exception of one low outlier in 2020.

- Carbonate concentrations have consistently been reported below the laboratory limit of quantification over the reporting period for Wells 1, 2, and 3.
- Chloride concentrations in Well 1 were stable over the reporting period at around 4 mg/L. Chloride concentrations in Well 2 were variable with high and low outliers until early 2020 when the values stabilized following a slightly decreasing trend with an uptick for the final value of 2024. Chloride concentrations in Well 3 have been variable throughout the reporting period, with high and low outliers until stabilizing in 2021 at around 10mg/L, also with an uptick in 2024.
- Fluoride concentrations in Well 1 and 2 were variable with high and low outliers over the reporting period. Fluoride concentrations in Well 3 were higher than those of Wells 1 and 2, with a trend of increasing concentration over the reporting period.
- Total hardness concentrations, expressed as CaCO3, have been generally stable in Well 1 at around 250 mg/L CaCO3. Well 2 followed the same neutral trend as Well 1 but with a lower concentration at around 150 mg/L CaCO3. Well 3 has had a slightly decreasing trend with values around 325 mg/L CaCO3 with a few low and high outliers throughout the reporting period.
- Total iron concentrations were relatively stable at Well 1 and Well 3 during the reporting period with concentrations at around 2-3 mg/L. Total iron concentrations for Well 2 were much more variable than those of the other wells, with high outliers reported throughout the reporting period and a stabilized concentration of around 1 mg/L after 2021.
- Dissolved magnesium concentrations in Well 1 were stable over the reporting period at around 15 mg/L. Dissolved magnesium concentrations in Well 2 were variable with high and low outliers until early 2020 when the values stabilized following a slightly increasing trend with values up to 10 mg/L. Dissolved magnesium concentrations for Well 3 have been stable with a neutral trend, remaining close to 22 mg/L with one major low outlier in 2020.
- Total manganese concentrations at Well 1 remained stable over the reporting period at around 0.12 mg/L. Total manganese concentrations at Well 2 were variable but typically lower than concentrations in Wells 1 and 3 with some high outliers; values have generally been below 0.05 mg/L over the reporting period. Total manganese concentrations have been relatively stable for Well 3 with values around 0.06 mg/L over the reporting period with both high and low outliers.

- Field pH values were relatively variable over the reporting period with normal values falling between 6.9 to 7.4 at Wells 1, 2, and 3, excluding outliers.
- Lab pH values were relatively variable over the reporting period with normal values falling between 7.25 to 8.0 at Wells 1, 2, and 3, excluding outliers.
- Phosphate was detected above the laboratory limit of quantification only once at Well 2 and only twice at Well 3 during the reporting period.
- Potassium concentrations in Well 1 remained stable over the reporting period at around 5mg/L. Potassium concentrations have slightly decreased in Well 2 and Well 3 over the reporting period, with the potassium concentrations in Well 3 higher than those in Well 2, with a low outlier in 2020.
- Dissolved sodium concentrations in Well 1 remained stable over the reporting period at around 35 mg/L. Dissolved sodium concentrations in Well 2 were variable with high and low outliers until early 2020 when the values stabilized following a neutral to slightly decreasing trend with values around 100 mg/L. Dissolved sodium concentrations at Well 3 have been variable over the reporting period with a few high and low outliers, averaging at about 75 mg/L.
- Sulfate concentrations in Well 1 remained relatively stable over the reporting period at around 150 mg/L with a couple of high outliers. Sulfate concentrations in Well 2 were variable with high and low outliers until early 2020 when the values generally stabilized with values around 120 mg/L. Sulfate concentrations remained relatively stable throughout the reporting period for Well 3, fluctuating around 230 mg/L with both high and low outliers.
- Total dissolved solids concentrations in Well 1 remained stable over the reporting period at around 400 mg/L. Total dissolved solids concentrations in Well 2 were variable with high and low outliers until early 2020 when the values generally stabilized with values around 425 mg/L. Total dissolved solids concentrations have been relatively stable at Well 3 just over 600 mg/L since 2016 except for a low outlier value reported in 2020.
- Turbidity values were relatively variable for Wells 1, 2, and 3, each experiencing a few high outliers throughout the reporting period. For all wells, the average turbidity remained around 15 NTU throughout the reporting period.

Examination of the previously discussed analytical trends suggests that water quality concentration trends have been generally neutral since 2013 at Wells 1, 2, and 3, with a noticeable decrease in data variability starting in 2020. Water-quality concentrations have remained relatively consistent since 2015 at Wells 1, 2, and 3. Anomalous high and low outlier values were reported throughout the reporting period for all wells. Additional water quality data comparison with other GSA wells located at the McKinley Mine can be found in Section 2.3 of the 2024 Annual Hydrology Report

(Trihydro 2025). Overall, these trends support the presumption that impacts from mining and reclamation operations on groundwater in the Gallup Sandstone Aquifer have not occurred.

4.3 BEDROCK AQUIFER

In 1980, five bedrock wells (MBR1, MBR2, MBR3, MBR4, and MBR5) were installed approximately 50 feet (ft) below the Green Coal Seam to monitor groundwater below this unit. The Green Coal Seam was stratigraphically the lower-most recoverable coal seam at the Mine. These monitoring wells, referred to as McKinley bedrock wells, were located in and around the major drainage watersheds throughout the Mine. Three of the original five wells (MBR1, MBR3, and MBR4) were mined through and not replaced. The active bedrock monitoring wells include MBR2 and MBR5, with MBR2 being north of the VMU 8 release area, and MBR5 being southeast of the VMU 8 release area. Upon the ultimate stages of bond release, MBR2 and MBR5 will be plugged and abandoned in accordance with Permit Section 6.3.2.2.1 and NMAC 19.27.4.30.C.1.

4.3.1 WATER LEVELS

Water level and saturated thickness data are presented in Table 4-1 for MBR2 and MBR5. Depth to groundwater in both MBR2 and MBR5 have been gradually increasing since 2013 with corresponding gradual decreases in saturated thickness. Slight recoveries were noted in 2022 and 2024 for MBR2 and in 2016 for MBR5, however, 2022 and 2024 depths to water were still higher than pre-2020 levels for MBR2.

4.3.2 WATER QUALITY

Sampling of MBR2 and MBR5 has been conducted annually for multiple parameters. Significant chemical parameters are included in Table 4-6 for MBR2 and Table 4-7 for MBR5. Appendix C-3 presents temporal plots for MBR2 based on available 2013 to 2024 data.

Examination of the analytical data and temporal plots for the reporting period associated with MBR2 indicate the following.

- Alkalinity is a useful parameter when discussing bicarbonate and carbonate trends below. Alkalinity concentrations have been relatively stable at MBR2 and fluctuate around 550 mg/L $CaCO_3$. Alkalinity concentrations have also been relatively stable at MBR5 and fluctuate around 900 mg/L $CaCO_3$. Nearly all the alkalinity present in bedrock groundwater is attributable to bicarbonate as carbonate and is a relatively minor component.
- Bicarbonate concentrations are identical to alkalinity trends for the reporting period.

- Total boron levels have fluctuated from around 0.15 to 0.20 mg/L at both MBR2 and MBR5, with the exception of an outlier of 0.27 mg/L reported in October 2024 for MBR2. Overall, boron levels show a slight increasing trend during the reporting period.
- Total calcium concentrations at MBR2 and MBR5 were generally stable over the reporting period, staying below 7.1 mg/L. A high outlier concentration of 120 mg/L for MBR2 was reported in October 2024.
- Carbonate concentrations have consistently been reported below the laboratory limit of quantification over the reporting period for MBR2. Carbonate concentrations for MBR5 have been reported above the laboratory limit of quantification for a third of the sampling events; when reported, the concentrations for MBR5 are normal yet variable.
- The calculated cation-anion balance percentages at both MBR2 and MBR5 have been consistently less than 10%, other than outliers in October 2014.
- Chloride concentrations at MBR2 have fluctuated since 2013 but indicate a generally neutral trend around 7.0 mg/L. Chloride concentrations at MBR5 have been more variable than MBR2 but still relatively stable at around 75 mg/L.
- Field conductance at MBR2 has been relatively stable around 2,250 µS/cm over the reporting period. Field conductance at MBR5 has followed the same trend as MBR2 with the exception of an outlier in 2017.
- Fluoride concentrations at MBR2 have fluctuated since 2013 but indicate a generally neutral trend. At MBR5, the concentration follows a similar trend to MBR2 with a pronounced peak in 2018. Fluoride has consistently been around 5 mg/L for MBR2 and 7 mg/L for MBR5 after 2019, above the water quality standard of 1.6 mg/L.
- Total hardness at MBR2 has been generally stable over the reporting period, fluctuating between 20 to 45 mg/L with a slightly decreasing trend prior to a high outlier concentration of 370 mg/L in October 2024. Total hardness at MBR5 followed a similar trend to MBR2 but has slightly more variation throughout the reporting period.
- Dissolved iron has not been detected above the laboratory limit of quantification for the majority of samples for MBR2. Dissolved iron in MBR5 has been relatively stable over the reporting period at around 0.25 mg/L.
- Total iron concentrations have fluctuated over the reporting period but have decreased since 2021 for MBR2. Total iron concentrations for MBR5 follow the trends of MBR2 with a slight time delay and the exception of an outlier in 2016. Most of the iron exists in the suspended phase since dissolved iron has often been non-detect.
- Total magnesium concentrations at MBR2 have been generally stable over the reporting period, fluctuating between 1.5 and 3.9 mg/L and with the exception of a high outlier concentration of 18 mg/L that was reported in

October 2024. Total magnesium concentrations for MBR5 have been more variable over the reporting period with a decreasing trend.

- Dissolved manganese concentrations at MBR2 have fluctuated since 2013 but indicate a generally neutral trend with the exception of a high outlier concentration reported in October 2021. Dissolved manganese has not been detected above the water quality standard of 0.2 mg/L during the reporting period for MBR2. Dissolved manganese concentrations at MBR5 have fluctuated since 2013 but have maintained an overall trend in decreasing concentration.
- Total manganese concentrations at MBR2 have fluctuated over the reporting period but show a slightly decreasing trend. A high outlier concentration was reported in October 2021 corresponding to the increased dissolved manganese reported during the same period. Total manganese concentrations at MBR5 have fluctuated since 2013 but have maintained an overall trend in decreasing concentration.
- Nitrogen, expressed as nitrate, concentrations for both MBR2 and MBR5 have been below the laboratory limit of quantification except during September 2016 and October 2020 for MBR2. The laboratory limit of quantification has varied as a result of matrix interference.
- Field pH values at MBR2 have varied over the reporting period ranging from 7.3 to 8.0. Field pH values at MBR5 have varied over the reporting period ranging from 7.4 to 8.7.
- Lab pH values at MBR2 have varied over the reporting period ranging from 7.5 to 8.1. Lab pH values at MBR5 have varied over the reporting period ranging from 7.7 to 8.5.
- Phosphate has consistently been reported below the laboratory limit of quantification during the reporting period except for one instance in November of 2016 for MBR5. The variability shown on the temporal plot is a result of varying limits of quantification through the reporting period.
- Total phosphorous concentrations at both MBR2 and MBR5 that were above the laboratory limit of quantification have exhibited a slight increasing trend over the reporting period. MBR5 reported a high outlier in late 2016.
- Total potassium concentrations at both MBR2 and MBR5 were generally stable over the reporting period, fluctuating between 2.3 and 5.8 mg/L. A high outlier concentration of 25 mg/L was reported in October 2024 for MBR2.
- Total selenium concentrations for both MBR2 and MBR5 were generally below the laboratory limit of quantification during the reporting period. The exceptions were detections reported in October 2014, October 2023, and October 2024. The limit of quantification varies due to sample matrix interference.

- Total sodium concentrations have been relatively stable at MBR2 over the reporting period with the exception of a low outlier reported in October 2024. Total sodium concentrations for MBR5 follow a similar trend to MBR2 but are higher in concentration, stabilizing around 600 mg/L.
- Sulfate concentrations at MBR2 have fluctuated since 2013, ranging from 540 mg/L to 600 mg/L, but indicate a generally neutral trend. Sulfate concentrations at MBR5 are more variable than those of MBR2, with a decreasing concentration around 400 mg/L, and a high outlier in 2013.
- Total dissolved solids concentrations at MBR2 and MBR5 have fluctuated since 2013 but indicate a generally neutral trend over the reporting period. Total dissolved solids concentrations routinely exceed the water quality standard of 1,000 mg/L.
- Total zinc concentrations at MBR2 that were above the laboratory limit of quantification have exhibited a slightly increasing trend over the reporting period, with the highest values reported in November 2015 and October 2024. Total zinc concentrations at MBR5 follow the same trend as MBR2 with the exception of an outlier in 2016.

Examination of the previously discussed analytical trends suggests that water-quality concentrations have remained relatively consistent since 2013 at Well MBR2 and Well MBR5. Anomalous high and low outlier values were reported for several analytes in the second half of 2024. Overall, these trends support the presumption that impacts from mining and reclamation operations on groundwater have not occurred.

4.4 SPOIL GROUNDWATER

Five spoil recharge wells (2G2, 4A, SW9-A, 9S, and 11) were constructed in the Mine area. Two spoil wells (4A and SW9-A on MMD lands) were installed in 1990; of these two wells, only SW9-A remains. Well 4A was not monitored after 2015 following approval by MMD to discontinue monitoring this well because the land at the well location had a full bond and liability release. Well 4A was abandoned on October 29, 2018. In April 2013, three additional spoil recharge wells were constructed and designated as wells 2G2 (on OSMRE lands within VMU 5), 11 (on MMD lands), and 9S (on MMD lands). Spoil recharge wells were installed throughout the Mine in reclaimed areas to determine chemical presence and groundwater properties. These wells were terminated at bedrock, and their screens encompassed the spoil interval immediately above bedrock. Spoil Wells 11 and SW9-A are the spoil recharge wells in the vicinity of VMU 8. Well SW9-A has had insufficient volume to sample during the reporting period, and therefore has no available sampling data.

4.4.1 WATER LEVELS

Water level and saturated thickness data are presented in Table 4-1 for Spoil Well 11. Depth to groundwater in Well 11 has remained relatively constant since 2013 with corresponding saturated thickness. Slight recoveries were noted in 2015.

4.4.2 WATER QUALITY

Sampling of Spoil Well 11 has been conducted quarterly for multiple parameters since 2013. Significant chemical parameters are included in the Groundwater Quality Summary 2013-2024 (Table 4-8). Appendix C-4 presents temporal plots for Well 11 based on available 2013 to 2024 data.

Examination of the analytical data and temporal plots for the reporting period associated with Well 11 indicate the following.

- Alkalinity is a useful parameter when discussing bicarbonate and carbonate trends below. Alkalinity concentrations at Well 11 followed a trend of increasing alkalinity over the reporting period, generally stabilizing at just above 2,000 mg/L $CaCO_3$. There were two low outliers in 2016 and 2021, and a high outlier in 2020.
- Bicarbonate concentrations for Well 11 follow the exact same trend as alkalinity concentrations for Well 11.
- Total boron concentrations for Well 11 were highly variable over the reporting period, with many high and low outliers. Generally, the total boron concentrations measured at Well 11 have increased over time. The average concentration over the reporting period is around 0.26 mg/L.
- Total calcium concentrations for Well 11 have also been highly variable over the reporting period with a group of outliers from 2017 to mid-2019. Aside from this period, the concentrations seem to be following an overall increasing trend, stabilizing at around 160-180 mg/L following 2019.
- Carbonate concentrations for Well 11 have consistently been reported either below the laboratory limit of quantification or as outliers during the reporting period.
- Cation-anion balance percentages for Well 11 have remained relatively stable over the reporting period at around 5%, with the exception of two outliers; one in 2017 and another in 2023.
- Chloride concentrations for Well 11 have remained relatively stable over the reporting period at around 35 mg/L, with the exception of outliers in 2018 and 2020.
- Conductance for Well 11 has remained constant at around 10,000 µS/cm, excluding outliers.
- Fluoride concentrations for Well 11 have consistently been reported either below the laboratory limit of quantification or as outliers during the reporting period.

- Hardness concentrations for Well 11 have generally been stable with an increasing trend over the reporting period, stabilizing at around 700 $CaCO_3$ following 2020. High and low outliers were observed at Well 11 from 2017 until 2020.
- Dissolved iron concentrations for Well 11 have been variable over the reporting period, stabilizing in 2020 at around 1 mg/L. High outliers were observed throughout the reporting period.
- Total iron concentrations for Well 11 have generally been stable with a decreasing trend over the reporting period, stabilizing at around 2 mg/L. High outliers were observed at Well 11 from 2017 until 2019, and then again in 2022.
- Magnesium concentrations at Well 11 have maintained an increasing trend, stabilizing at around 60 mg/L following 2019. High outliers were observed at Well 11 from 2017 until 2019.
- Dissolved manganese concentrations at Well 11 have maintained a neutral trend throughout the reporting period, stabilizing at around 1 mg/L. High outliers were observed at Well 11 from 2017 until 2019.
- Total manganese concentrations at Well 11 follow the same trends as dissolved manganese, along with the same outlier trends.
- Nitrogen, expressed as nitrate, concentrations for Well 11 have consistently been reported below the laboratory limit of quantification during the reporting period. Nitrogen concentrations for Well 11 have been reported above the laboratory limit of quantification for only six of the sampling events.
- Field pH for Well 11 has remained relatively stable over the reporting period, generally in the 7.5-7.8 range. High and low outliers were observed throughout the reporting period.
- Lab pH for Well 11 has been highly variable over the reporting period, ranging from 6.8 to 7.5. High and low outliers were observed throughout the reporting period.
- Phosphate concentrations for Well 11 have consistently been reported below the laboratory limit of quantification during the reporting period. Phosphate concentrations for Well 11 have been reported above the laboratory limit of quantification for three of the sampling events.
- Phosphorus concentrations for Well 11 are stable at around 0.05 mg/L for the first half of the reporting period, until 2020. Phosphorus concentrations for Well 11 have consistently been reported below the laboratory limit of quantification during the second half of the reporting period, following 2020.
- Potassium concentrations at Well 11 followed a trend of increasing concentration over the reporting period, generally stabilizing at just below 17.5 mg/L. There was a period of high outliers from 2016 to 2018 during the reporting period.

- Selenium concentrations for Well 11 have consistently been reported below the laboratory limit of quantification during the reporting period. Selenium concentrations for Well 11 have been reported above the laboratory limit of quantification for two of the sampling events.
- Total sodium concentrations for Well 11 have followed a trend of increasing concentration over the reporting period, averaging at around 2,300 mg/L. High and low outliers were observed throughout the reporting period.
- Sulfate concentrations for Well 11 have been variable over the reporting period with no discernable trend. The average sulfate concentration is around 3,800 mg/L. Many high and low outliers were observed throughout the reporting period.
- Total dissolved solids concentrations for Well 11 follow a neutral trend throughout the reporting period, stabilizing at around 7,500 mg/L. Many high and low outliers were observed throughout the reporting period.
- Total zinc concentrations for Well 11 follow a fairly neutral trend, stabilizing at around 0.015 mg/L until 2021, where multiple high outliers were observed and then followed by concentrations that were reported below the laboratory limit of quantification during the reporting period.

4.5 ASSESSMENT OF GROUNDWATER DATA

4.5.1 COMPARISON TO BASELINE WATER QUALITY

There are no baseline groundwater data from pre-mining conditions available for comparison to current groundwater quality data. Therefore, this comparison is not included in this report.

4.5.2 COMPARISON TO REGULATORY STANDARDS

Though not required or necessary, water quality from the alluvial aquifer, Gallup Sandstone Aquifer, bedrock aquifer, and spoil recharge groundwater were assessed against the regulatory standards established for the maximum allowable concentrations of groundwater of 10,000 mg/L TDS or less (NMAC 20.6.2.3103). Tables 4-2 through 4-8 include these standards at the bottom, allowing for easy comparison to groundwater quality data, with bolded values indicating exceedances. Only the following monitored constituents are captured by the referenced standards: fluoride, nitrate as N, and selenium for human health standards and chloride, dissolved iron, dissolved manganese, sulfate, TDS, zinc, and pH for domestic water supply.

Alluvial well TB2B2 reported exceedances in concentration above the domestic water supply standards of dissolved iron in 2013, 2015, and 2016. Concentrations of manganese, TDS, and sulfate at TB2B2 consistently exceeded the domestic water supply standard.

Gallup Sandstone Aquifer Wells 1, 2, and 3 had no observed exceedances (Tables 4-3 and 4-5). Fluoride and TDS were observed in exceedance of 1,000 mg/L for every sampling event at MBR2 and MBR5 (Table 4-6 and Table 4-7). MBR2 also has reported exceedances for dissolved iron (Q4 2013). MBR5 had exceedances for dissolved manganese twice (2013 and 2022) and sulfate once (2013). Please see the McKinley Annual Hydrology Report (Trihydro 2025) for comparison between other GSA and MBR wells.

In samples from Well 11 in spoil recharge groundwater, concentrations of iron, manganese, sulfate, and TDS exceeded domestic water supply standards. Exceedances in concentrations of iron have been occasional and relatively close to concentration standard across the 2013 to 2024 sampling period, with the exception of an elevated period from 2017 to 2019. Concentrations of manganese, sulfate, and TDS have consistently exceeded the concentration standard.

4.5.3 COMPARISON TO PROBABLE HYDROLOGIC CONSEQUENCES

Data establish that bedrock groundwaters are of poor quality that cannot be used for beneficial purposes. Data also show, however, that they have had no deleterious effect on established surface or groundwater uses. Upon the final stages of bond release, wells will be abandoned or transitioned to the Navajo Nation with regulatory approval.

5.0 SURFACE AND GROUNDWATER ASSESSMENT SUMMARY

As required for bond release of long-term surface and groundwater monitoring, water quality and quantity data are provided in this report. Evaluation of the data was presented in two separate sections to confirm that mining activities at the McKinley Mine have not adversely disturbed the hydrologic balance in or around the site. Findings from the 1980 GAI Report, comparison with the undisturbed Coal Mine Wash watershed, comparison with regulatory standards, and the PHC determination indicate that mining and reclamation have had minimal impact on the quality and quantity of this resource. The following provides a brief summary of those findings.

5.1 SURFACE WATER ASSESSMENT SUMMARY

There are eight NPDES outfalls affiliated with VMU 8 that have data within the reporting period: 018, 020, 021, 024, 026, 032, 084, and 090. Outfalls 019, 022, 023, 027, 028, 031, 065, 076, 077, 081, 082, 083, 085, 086, 087, 088, and 089 are not represented on the discharge data tables or temporal plots but are within the vicinity of VMU 8. There are two stream monitoring stations downstream of the outfalls, Tse Bonita Wash (TBW), and Defiance Draw (DD) (Figure 2-1). Discharge water quality analysis from the outfalls showed generally neutral trends, sometimes with a great degree of variability in the data range. Analytical trend analysis of surface water quality of DD and TBW indicates attenuation of impacts observed at the associated outfalls. The overall findings conclude there are limited or no impacts to surface waters after mining and reclamation operations and there are no impacts to the hydrologic balance.

The PHC determination (Permit Section 3.4.4) acknowledges the possible consequence of stormwater on downstream water chemistry. Data show that there are no deleterious effects to watershed health of the Puerco River. Regional surface waters are also protected because of ephemeral flow patterns of the streams of interest and limited constituent loadings to downstream reaches as a result.

5.2 GROUNDWATER ASSESSMENT

Near VMU 8, there is one alluvial well with data, Well TB2B2, two bedrock wells, Well MBR2 and Well MBR5, three Gallup Sandstone Aquifer wells, Well 1, 2, and 3, and one spoil well with data, Well 11. Analyte concentrations for wells had generally neutral trends over the 2013 to 2024 reporting period. Comparison of groundwater quality data to NMAC standards indicates exceedances of various analytes had the standards been applicable. Alluvial well TB2B2 reported exceedances in concentration above the domestic water supply standards for iron, manganese, TDS, and sulfate. The three GSA wells had no observed exceedances over the reporting period. Fluoride and TDS were

observed in exceedance of 1,000 mg/L for every sampling event at MBR2 and MBR5. MBR2 also has reported exceedances for dissolved iron and MBR5 had exceedances for dissolved manganese and sulfate. Samples from Well 11 in spoil recharge groundwater, concentrations of iron, manganese, sulfate, and TDS exceeded domestic water supply standards. Based on this water quality analysis, there are no impacts from mining on groundwater, which is consistent with the PHC.

6.0 REFERENCES

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30 CFR 800. Bond and Insurance Requirements for Surface Coal Mining and Reclamation Operations under Regulatory Programs. 1983 (as amended in 2017).

National Pollutant Discharge Elimination System (NPDES) Permit No. NN0029386. 2017. July 1.

New Mexico Administrative Code (NMAC). 2022. Title 20, Environmental Protection Chapter 6, Water Quality Part 4: Standards for Interstate and Intrastate Surface Waters. April 23.

New Mexico Administrative Code (NMAC). 2017. Title 19, Natural Resources and Wildlife Chapter 27, Underground Water Part 4: Well Driller Licensing; Construction, Repair, and Plugging of Wells. June 30.

New Mexico Administrative Code (NMAC). 2007. Title 20, Environmental Protection Chapter 6, Water Quality Part 2: Ground and Surface Water Protection. June 1.

Trihydro Corporation (Trihydro). 2025. McKinley Mine – 2024 Annual Report Hydrology Section. February 26.

TABLES

TABLE 2-1. PRECIPITATION DATA, SOUTH TIPPLE, RAIN 10, AND BLUFF
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Month	2013			2014			2015			2016			2017		
	S. Tipple (in)	Rain 10 (in)	Bluff (in)	S. Tipple (in)	Rain 10 (in)	Bluff (in)	S. Tipple (in)	Rain 10 (in)	Bluff (in)	S. Tipple (in)	Rain 10 (in)	Bluff (in)	S. Tipple (in)	Rain 10 (in)	Bluff (in)
January	1.38	--	1.08	0.04	--	0.05	2.05	--	1.39	0.62	--	0.39	1.25	--	0.81
February	0.15	--	0.11	0.06	--	0.03	1.59	--	1.21	0.22	--	0.25	1.64	--	0.04
March	0.39	0.00	0.27	0.73	--	0.65	0.11	--	0.11	0.05	--	0.03	0.48	--	0.70
April	0.23	0.19	0.25	0.36	0.02	0.28	0.52	0.42	0.35	1.31	1.00	1.28	0.35	0.13	0.32
May	0.00	0.00	0.02	0.14	0.12	0.20	1.64	1.32	1.54	0.80	0.67	0.70	0.77	0.55	0.41
June	0.05	0.07	0.25	0.00	0.00	0.00	1.11	1.11	1.65	0.07	0.08	0.19	0.42	0.20	0.16
July	1.80	2.26	1.95	0.85	0.72	1.90	2.37	2.59	2.81	1.37	0.94	1.15	2.48	2.75	3.71
August	2.53	2.09	2.14	1.44	0.72	0.46	1.62	1.39	1.91	1.74	1.63	1.85	0.90	0.38	0.37
September	3.03	3.37	2.87	2.12	2.05	2.64	0.30	0.30	0.51	1.75	1.36	1.79	1.34	0.99	0.62
October	0.58	0.43	0.45	0.36	0.28	0.19	1.36	1.10	1.18	0.40	0.34	0.69	0.15	0.14	0.54
November	1.67	0.45	1.36	0.09	0.00	0.10	1.31	0.78	1.16	1.57	0.81	1.18	0.09	0.02	0.05
December	0.20	--	0.26	1.53	--	1.43	0.76	--	0.74	1.84	--	1.98	0.02	--	0.02

Total Annual Precipitation

Year	2013			2014			2015			2016			2017		
Apr-Nov (inches)	10.28	8.86	9.56	5.36	3.91	5.77	10.23	9.01	11.11	9.01	6.83	8.83	6.50	5.16	6.18
Jan-Dec (inches)	12.01		11.01	7.72		7.93	14.74		14.56	11.74		11.48	9.89		7.75

Notes:
-- - precipitation station not operating due to freezing tem
--- - precipitation station data not collected
in - inches
Apr - April
Nov - November
Jan - January
Dec - December

TABLE 2-1. PRECIPITATION DATA, SOUTH TIPPLE, RAIN 10, AND BLUFF
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Month	2018			2019			2020			2021			2022		
	S. Tipple (in)	Rain 10 (in)	Bluff (in)	S. Tipple (in)	Rain 10 (in)	Bluff (in)	S. Tipple (in)	Rain 10 (in)	Bluff (in)	S. Tipple (in)	Rain 10 (in)	Bluff (in)	S. Tipple (in)	Rain 10 (in)	Bluff (in)
January	0.35	--	0.23	1.30	--	0.95	0.98	--	1.00	1.11	--	1.13	0.36	--	---
February	0.79	--	0.48	1.81	--	0.98	1.44	--	1.35	0.34	--	0.21	0.74	--	---
March	0.54	--	0.44	1.23	--	1.10	1.35	--	1.15	0.40	--	0.46	1.25	--	0.59
April	0.09	0.08	0.08	0.44	0.20	0.24	0.17	0.11	0.26	0.07	0.01	0.04	0.00	0.00	0.03
May	0.29	0.20	0.22	1.77	1.49	0.17	0.01	0.02	0.02	0.08	0.06	0.04	0.01	0.00	0.00
June	0.51	0.27	0.28	0.33	0.37	0.03	0.04	0.13	0.14	0.37	0.24	0.20	0.66	0.69	1.24
July	2.61	3.05	2.17	0.22	0.19	0.03	1.13	0.79	0.89	5.45	2.48	2.17	3.68	3.57	3.13
August	1.34	1.15	0.00	0.05	0.27	1.14	0.24	0.14	0.26	1.24	1.80	1.31	5.36	4.27	4.66
September	1.10	0.92	1.00	1.59	1.34	0.10	0.15	0.14	0.21	2.12	0.96	1.13	1.51	1.02	1.27
October	1.65	1.51	---	0.09	0.03	0.04	0.26	0.16	0.33	1.77	0.80	0.86	2.92	1.83	1.40
November	0.19	0.00	0.14	1.14	0.05	1.15	0.40	0.09	0.28	0.55	0.00	0.20	0.59	0.33	0.48
December	0.67	--	0.43	0.85	--	0.97	0.27	--	0.32	2.26	--	0.92	0.74	--	0.58

Total Annual Precipitation

Year	2018			2019			2020			2021			2022		
Apr-Nov (inches)	7.78	7.18	3.89	5.63	3.94	2.90	2.40	1.58	2.39	11.65	6.35	5.95	14.73	11.71	12.21
Jan-Dec (inches)	10.13		5.47	10.82		6.90	6.44		6.21	15.76		8.67	17.82		13.38

Notes:
-- - precipitation station not operating due to freezing tem
[green] - Nov - November
--- - precipitation station data not collected
in - inches

Apr - April
Jan - January
Dec - December

TABLE 2-1. PRECIPITATION DATA, SOUTH TIPPLE, RAIN 10, AND BLUFF
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Month	2023			2024		
	S. Tipple (in)	Rain 10 (in)	Bluff (in)	S. Tipple (in)	Rain 10 (in)	Bluff (in)
January	--	--	1.21	--	--	1.06
February	--	--	0.50	--	--	0.58
March	--	--	1.64	--	--	2.22
April	--	0.03	0.05	--	0.16	0.45
May	--	0.53	0.55	--	0.05	0.03
June	--	0.13	0.13	--	2.65	2.27
July	--	0.06	0.03	--	0.38	1.17
August	--	2.61	3.16	--	1.92	2.33
September	--	0.51	0.33	--	0.37	0.32
October	--	0.03	0.57	--	0.98	1.18
November	--	0.00	0.95	--	0.12	0.36
December	--	--	0.46	--	--	0.00

Average (2013-2024) (in)	Maximum (2013-2024) (in)
0.89	2.05
0.69	1.81
0.69	2.22
0.28	1.31
0.42	1.77
0.47	2.65
1.85	5.45
1.60	5.36
1.21	3.37
0.75	2.92
0.52	1.67
0.78	2.26

Total Annual Precipitation

Year	2023			2024		
Apr-Nov (inches)	0.00	3.90	5.77	0.00	6.63	8.11
Jan-Dec (inches)	0.00		9.58	0.00		11.97

Apr-Nov Average (2013-2024)	S. Tipple Average (in)
6.70	8.36
Rain 10 Average (in)	**Bluff Average (in)**
6.26	6.89

Notes:
-- - precipitation station not operating due to freezing tem
--- - precipitation station data not collected
in - inches

Apr - April
Nov - November
Jan - January
Dec - December

TABLE 2-2. McKINLEY MINE WATER ANALYSIS PARAMETERS
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Parameter	Sample Type		
	Surface	Alluvial	Bedrock/Spoil
Bicarbonate	*	*	*
Boron			*
Calcium, Total	*	*	*
Carbonate	*	*	*
Cation-Anion Balance	*	*	*
Chloride	*	*	*
Conductance, Field	*	*	*
Fluoride			*
Hardness	*	*	*
Iron, Dissolved	*@	*@	*@
Iron, Total	*	*	*
Magnesium, Total	*	*	*
Manganese, Dissolved	*@	*@	*@
Mercury, Total	*		
Manganese, Total	*	*	*
Nitrate	*	*	*
pH, Lab	*	*	*
pH, Field	*	*	*
Phosphate	*	*	*
Phosphorus, Total	*	*	*
Potassium, Total	*	*	*
SAR	*		
Selenium, Total	*	*	*
Settleable Solids	*		
Sodium, Total	*	*	*
Sulfate	*	*	*
Total Dissolved Solids	*	*	*
Total Suspended Solids	*		
Zinc, Total			*
Depth to water		*	*

Notes: * indicates that sample is analyzed for this parameter.
@ indicates a 0.45 micron filter is utilized.

TABLE 3-1. HISTORICAL DISCHARGE DATA - OUTFALL 018
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Location	Date Sampled	Aluminum, Total (mg/L)	Calcium, Total (mg/L)	Cyanide, Total (mg/L)	Gross Alpha (pCi/L)	Hardness [3] (mg/L CaCO)	Iron, Total (mg/L)	Magnesium, Total (mg/L)	Oil & Grease (mg/L)	pH, Field (s.u.)	pH, Lab (s.u.)	Selenium, Total (mg/L)	Solids, Total Dissolved (mg/L)	Solids, Total Suspended (mg/L)
Outfall 018	7/18/2018	26.4	---	ND(0.01)	51.8	130	25.4	---	ND(5)	8.5	7.9	ND(0.002	384	536
Outfall 018	8/11/2021	17	50	ND(0.005)	9.84	170	20	12	--- ǂ	8.77	7.88	0.0028	530	350
Outfall 018	7/27/2022	99	35	ND(0.005)	16.6	130	44	11	46.9	8.4	7.8	0.0029	686	260
Outfall 018	8/16/2022	86	36	ND(0.005)	41.6	140	54	12	ND(9.9)	8.11	7.98	0.0038	1,240	150
Outfall 018	2/21/2023	1.8	21	ND(0.01)	36.5	69	1.4	4.3	ND(10.3)	8.92	7.9	ND(0.001)	188	31
Outfall 018	8/24/2023	14	36	ND(0.005)	5.86	120	8.5	6.5	ND(9.62)	7.5	7.94	ND(0.001)	174	85
Outfall 018	8/14/2024	11	41	ND(0.005)	11.1	140	10	8.5	ND(5)	8.26	7.9	0.0016	350	66
Standard		-	-	0.0052	15	-	-	-	-	6 - 9	6 - 9	0.005	1,000	-

Abbreviations:
mg/L - milligrams per liter
mg/L CaCO - milligrams per liter as calcium carbonate
µS/cm - microSiemens per centimeter
ND - non-detect (detection limit in parentheses)
NM - not measured
pCi/L - picocuries per liter, measure of radioactivity
s.u. - standard units

These analytes aren't reported in the Discharge Monitoring Reports. They are run by the lab only to use in calculating Hardness.

--- = no data

ǂ = The 8/11/2021 oil & grease sample bottle for this outfall arrived at the lab broken.

TABLE 3-2. HISTORICAL DISCHARGE DATA - OUTFALL 020
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Location	Date Sampled	Aluminum, Total (mg/L)	Calcium, Total (mg/L)	Cyanide, Total (mg/L)	Gross Alpha (pCi/L)	Hardness [3] (mg/L CaCO)	Iron, Total (mg/L)	Magnesium, Total (mg/L)	Oil & Grease (mg/L)	pH, Field (s.u.)	pH, Lab (s.u.)	Selenium, Total (mg/L)	Solids, Total Dissolved (mg/L)	Solids, Total Suspended (mg/L)
020/DC 10-17	7/18/2018	89.3	---	ND(0.01)	135	146	115	---	ND(5)	8.5	7.6	0.001	1,420	3,000
020/DC 10-17	7/12/2021	150	110	ND(0.005)	324	490	190	52	ND(9.43)	8.7	7.58	0.018	650	8,700
020/DC 10-17	8/19/2022	180	26	ND(0.005)	72	120	92	13	ND(9.45)	8.6	7.79	0.0066	380	1,400
020/DC 10-17	8/26/2025	24	NA	ND(0.01)	112	190	25	NA	ND(5.1)	7.35	7.6	0.00066	910	3,000
Standard		-	-	0.0052	15	-	-	-	-	6 - 9	6 - 9	0.005	1,000	-

Abbreviations:
mg/L - milligrams per liter
mg/L CaCO - milligrams per liter as calcium carbonate
µS/cm - microSiemens per centimeter
ND - non-detect (detection limit in parentheses)
NM - not measured
pCi/L - picocuries per liter, measure of radioactivity
s.u. - standard units
[3] These analytes aren't reported in the Discharge Monitoring Reports. They are run by the lab only to use in calculating Hardness.
--- = no data

TABLE 3-3. HISTORICAL DISCHARGE DATA - OUTFALL 021
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Location	Date Sampled	Aluminum, Total (mg/L)	Calcium, Total (mg/L)	Cyanide, Total (mg/L)	Gross Alpha (pCi/L)	Hardness [3] (mg/L CaCO)	Iron, Total (mg/L)	Magnesium, Total (mg/L)	Oil & Grease (mg/L)	pH, Field (s.u.)	pH, Lab (s.u.)	Selenium, Total (mg/L)	Solids, Total Dissolved (mg/L)	Solids, Total Suspended (mg/L)
021/DC 10-6	7/12/2018	115	NA	ND(0.01)	195	366	116	NA	ND(5)	8.5	7.7	0.00084	256	6,100
021/DC 10-6	7/12/2021	64	55	ND(0.005)	179	220	68	21	ND(9.75)	8.71	7.57	0.0072	650	3,600
021/DC 10-6	8/19/2022	69	23	ND(0.005)	26.4	87	27	7	ND(9.96)	8.5	7.77	0.0027	570	520
021/DC 10-6	2/20/2023	3.8	29	ND(0.005)	8.49	94	3.6	5.5	ND(9.72)	8.27	8	0.001	ND(500)	480
021/DC 10-6	3/22/2023	2.7	79	ND(0.005)	ND(116)	270	2.5	17	ND(9.77)	8.63	7.91	0.0019	705	60
021/DC 10-6	8/26/2025	61	NA	ND(0.01)	127	210	61	NA	ND(5.5)	7.44	7.8	0.0015	1,300	3,000
Standard		-	-	0.0052	15	-	-	-	-	6 - 9	6 - 9	0.005	1,000	-

Abbreviations:
mg/L - milligrams per liter
mg/L CaCO - milligrams per liter as calcium carbonate
µS/cm - microSiemens per centimeter
ND - non-detect (detection limit in parentheses)
NM - not measured
pCi/L - picocuries per liter, measure of radioactivity
s.u. - standard units
[3] These analytes aren't reported in the Discharge Monitoring Reports. They are run by the lab only to use in calculating Hardness.
--- = no data

TABLE 3-4. HISTORICAL DISCHARGE DATA - OUTFALL 024
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Location	Date Sampled	Aluminum, Total (mg/L)	Calcium, Total (mg/L)	Cyanide, Total (mg/L)	Gross Alpha (pCi/L)	Hardness [3] (mg/L CaCO)	Iron, Total (mg/L)	Magnesium, Total (mg/L)	Oil & Grease (mg/L)	pH, Field (s.u.)	pH, Lab (s.u.)	Selenium, Total (mg/L)	Solids, Total Dissolved (mg/L)	Solids, Total Suspended (mg/L)
Outfall 024/DC 2	7/12/2018	91.3	---	ND(0.01)	335	579	76	---	ND(5)	8.6	7.8	0.0011	351	5,860
Outfall 024/DC 2	7/18/2018	99.6	---	ND(0.01)	204	432	101	---	ND(5)	8.6	7.9	0.001	664	4,320
Outfall 024/DC 2	3/2/2019	5.41	---	ND(0.01)	9.49	57.2	4.19	---	ND(5)	8.6	7.8	ND(0.002)	131	136
Outfall 024/DC 2	7/12/2021	230	260	ND(0.005)	1810	1000	260	85	ND(9.97)	8.64	7.33	0.028	520	18,000
Outfall 024/DC 2	7/24/2021	86	62	ND(0.005)	117	260	98	26	ND(9.36)	8.3	7.67	0.0073	900	1,300
Outfall 024/DC 2	7/25/2022	330	220	0.0055	63.8	930	370	93	ND(10)	8.5	8.12	0.031	490	12,000
Outfall 024/DC 2	7/30/2022	130	31	ND(0.005)	25.7	130	52	12	ND(9.29)	8.4	8.02	0.0051	885	460
Outfall 024/DC 2	10/17/2022	16	31	ND(0.005)	17.9	110	14	8.4	ND(9.59)	8.29	7.93	0.0066	444	130
Outfall 024/DC 2	2/20/2023	3.7	42	ND(0.005)	68.2	140	2.9	7.7	ND(9.61)	8.35	8.05	0.002	500	1,400
Outfall 024/DC 2	6/27/2024	50	200	0.008	809	620	160	29	ND(5.2)	8.75	8.1	0.0069	35,000	15,000
Outfall 024/DC 2	7/25/2024	140	170	0.0055	63.8	660	160	58	ND(10)	7.96	8	0.019	1,500	7,300
Outfall 024/DC 2	8/24/2024	37	46	ND(0.005)	48.7	180	45	17	ND(5)	8.87	7.9	0.0043	490	310
Outfall 024/DC 2	8/25/2025	120	NA	ND(0.01)	351	480	110	NA	ND(5.3)	7.7	7.8	0.0026	1,800	12,000
Standard		-	-	0.0052	15	-	-	-	-	6 - 9	6 - 9	0.005	1,000	-

Abbreviations:
mg/L - milligrams per liter
mg/L CaCO - milligrams per liter as calcium carbonate
µS/cm - microSiemens per centimeter
ND - non-detect (detection limit in parentheses)
NM - not measured
pCi/L - picocuries per liter, measure of radioactivity
s.u. - standard units
[3] These analytes aren't reported in the Discharge Monitoring Reports. They are run by the lab only to use in calculating Hardness.
--- = no data

TABLE 3-5. HISTORICAL DISCHARGE DATA - OUTFALL 026
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Location	Date Sampled	Aluminum, Total (mg/L)	Calcium, Total (mg/L)	Cyanide, Total (mg/L)	Gross Alpha (pCi/L)	Hardness [3] (mg/L CaCO)	Iron, Total (mg/L)	Magnesium, Total (mg/L)	Oil & Grease (mg/L)	pH, Field (s.u.)	pH, Lab (s.u.)	Selenium, Total (mg/L)	Solids, Total Dissolved (mg/L)	Solids, Total Suspended (mg/L)
026/CH 10-29	3/3/2019	1.37	NA	ND(0.01)	5.19	76.8	1.24	NA	ND(5)	8.8	7.9	0.00078	184	30
Standard		-	-	0.0052	15	-	-	-	-	6 - 9	6 - 9	0.005	1,000	-

Abbreviations:
mg/L - milligrams per liter
mg/L CaCO - milligrams per liter as calcium carbonate
µS/cm - microSiemens per centimeter
ND - non-detect (detection limit in parentheses)
NM - not measured
pCi/L - picocuries per liter, measure of radioactivity
s.u. - standard units
These analytes aren't reported in the Discharge Monitoring Reports. They are run by the lab only to use in calculating Hardness.
--- = no data

TABLE 3-6. HISTORICAL DISCHARGE DATA - OUTFALL 032
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Location	Date Sampled	Aluminum, Total (mg/L)	Calcium, Total (mg/L)	Cyanide, Total (mg/L)	Gross Alpha (pCi/L)	Hardness [3] (mg/L CaCO)	Iron, Total (mg/L)	Magnesium, Total (mg/L)	Oil & Grease (mg/L)	pH, Field (s.u.)	pH, Lab (s.u.)	Selenium, Total (mg/L)	Solids, Total Dissolved (mg/L)	Solids, Total Suspended (mg/L)
032/DC 10-27	7/18/2018	48.8	NA	ND(0.01)	100	195	115	NA	ND(5)	8.4	7.3	0.00089	2,760	6,210
032/DC 10-27	8/19/2022	26	15	ND(0.005)	47.3	54	11	4.1	12.8	8.6	7.97	0.0012	360	1,200
032/DC 10-27	2/21/2023	2.8	22	ND(0.01)	ND(91.9)	74	5.8	4.8	ND(9.76)	8.44	7.83	0.0013	335	450
032/DC 10-27	3/22/2023	0.75	37	ND(0.005)	ND(94.2)	130	0.67	8	ND(10.5)	8.76	8.23	0.0014	610	170
032/DC 10-27	8/26/2025	140	NA	ND(0.01)	141	290	160	NA	ND(5.1)	7.34	8	0.0029	740	6,100
032/DC 10-27	10/14/2025	27	NA	ND(0.01)	ND(3)	110	26	NA	ND(5.1)	7.55	7.1	ND(0.002)	810	550
Standard		-	-	0.0052	15	-	-	-	-	6 - 9	6 - 9	0.005	1,000	-

Abbreviations:
mg/L - milligrams per liter
mg/L CaCO - milligrams per liter as calcium carbonate
µS/cm - microSiemens per centimeter
ND - non-detect (detection limit in parentheses)
NM - not measured
pCi/L - picocuries per liter, measure of radioactivity
s.u. - standard units

These analytes aren't reported in the Discharge Monitoring Reports. They are run by the lab only to use in calculating Hardness.

--- = no data

TABLE 3-7. HISTORICAL DISCHARGE DATA - OUTFALL 084
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Location	Date Sampled	Aluminum, Total (mg/L)	Calcium, Total (mg/L)	Cyanide, Total (mg/L)	Gross Alpha (pCi/L)	Hardness [3] (mg/L CaCO)	Iron, Total (mg/L)	Magnesium, Total (mg/L)	Oil & Grease (mg/L)	pH, Field (s.u.)	pH, Lab (s.u.)	Selenium, Total (mg/L)	Solids, Total Dissolved (mg/L)	Solids, Total Suspended (mg/L)
084/DC 10-34	3/3/2019	2.16	NA	ND(0.01)	8	104	2.16	NA	ND(5)	8.1	8.1	0.0023	153	87
Standard		-	-	0.0052	15	-	-	-	-	6 - 9	6 - 9	0.005	1,000	-

Abbreviations:
mg/L - milligrams per liter
mg/L CaCO - milligrams per liter as calcium carbonate
µS/cm - microSiemens per centimeter
ND - non-detect (detection limit in parentheses)
NM - not measured
pCi/L - picocuries per liter, measure of radioactivity
s.u. - standard units
These analytes aren't reported in the Discharge Monitoring Reports. They are run by the lab only to use in calculating Hardness.
--- = no data

TABLE 3-8. HISTORICAL DISCHARGE DATA - OUTFALL 090
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Location	Date Sampled	Aluminum, Total (mg/L)	Calcium, Total (mg/L)	Cyanide, Total (mg/L)	Gross Alpha (pCi/L)	Hardness [3] (mg/L CaCO)	Iron, Total (mg/L)	Magnesium, Total (mg/L)	Oil & Grease (mg/L)	pH, Field (s.u.)	pH, Lab (s.u.)	Selenium, Total (mg/L)	Solids, Total Dissolved (mg/L)	Solids, Total Suspended (mg/L)
090/DS-6	8/11/2021	110	81	ND(0.005)	186	320	130	28	ND(10.3)	8.77	8.11	0.014	1,310	3,800
090/DS-6	8/16/2022	32	34	ND(0.005)	11.8	120	20	7.7	ND(9.58)	7.49	7.71	ND(0.001)	880	58
090/DS-6	3/6/2023	9.8	25	ND(0.005)	ND(100)	87	9.9	5.8	ND(10.1)	8.85	7.7	0.0018	236	400
Standard		-	-	0.0052	15	-	-	-	-	6 - 9	6 - 9	0.005	1,000	-

Abbreviations:
mg/L - milligrams per liter
mg/L CaCO - milligrams per liter as calcium carbonate
µS/cm - microSiemens per centimeter
ND - non-detect (detection limit in parentheses)
NM - not measured
pCi/L - picocuries per liter, measure of radioactivity
s.u. - standard units
[3] These analytes aren't reported in the Discharge Monitoring Reports. They are run by the lab only to use in calculating Hardness.
--- = no data

TABLE 3-9. HISTORICAL SURFACE WATER DATA - DEFIANCE DRAW (DD)
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Date Sampled	Alkalinity [3] (mg/L CaCO)	Bicarbonate [3] (mg/L CaCO)	Calcium, Total (mg/L)	Carbonate [3] (mg/L CaCO)	Chloride (mg/L)	Conductance, Field (uS/cm)	Hardness [3] (mg/L CaCO)	Iron, Dissolved (mg/L)	Iron, Total (mg/L)	Magnesium, Total (mg/L)	Manganese, Dissolved (mg/L)	Manganese, Total (mg/L)	Mercury (mg/L)
7/22/2013	135	135	63	ND(2)	3	334	NA	16	116	28	0	1	NA
7/26/2013	106	106	82	ND(2)	6	449	NA	84	105	33	1	2	NA
7/29/2013	81	81	104	ND(2)	27	419	NA	48	150	41	1	2	NA
8/6/2013	80	80	72	ND(2)	9	260	NA	0	128	32	0	2	NA
8/25/2013	99	99	85	ND(2)	4	228	255	23	149	38	0	2	NA
8/2/2014	130	130	324	ND(2)	4	225	994	44	38	29	3	7	ND(0.0002)
9/29/2014	82	82	279	ND(2)	3	180	1020	8	116	56	0	5	ND(0.0002)
10/9/2014	117	117	128	ND(2)	4	223	450	0	218	57	0	4	ND(0.0002)
6/13/2015	128	128	332	ND(2)	6	166	1510	2	29	42	0	7	0
7/13/2015	264	264	319	ND(200)	5	235	2520	1	342	110	0	7	0
8/1/2015	76	76	45	ND(20)	4	160	237	0	64	20	0	1	0
8/8/2015	192	192	83	ND(200)	6	235	483	8	149	37	0	2	0
8/27/2015	182	182	103	ND(100)	8	287	520	18	204	48	0	2	0
10/21/2015	98	98	316	ND(2)	6	237	1380	1	263	109	0	8	0
7/21/2016	360	342	293	18	5	355	1400	44	326	143	3	6	0
8/8/2016	82	82	107	ND(5)	3	212	439	89	223	51	1	2	0
8/26/2016	151	151	673	ND(5)	6	337	2250	9	73	53	1	10	ND(0.0002)
9/2/2016	93	93	66	ND(5)	8	272	366	3	16	14	0	1	0
9/29/2016	91	91	245	ND(5)	4	206	1190	143	34	41	2	5	ND(0.0002)
11/5/2016	76	76	36	ND(5)	8	233	213	37	39	12	0	1	0
7/24/2017	87	87	225	ND(5)	10	347	714	ND(0.2)	54	37	0	4	0
8/21/2017	101	101	172	ND(5)	4	310	748	67	224	77	2	4	0
6/16/2018	297	269	429	28	3	293	1360	387	452	188	6	11	0
7/12/2018	288	272	458	ND(50)	6	332	1600	43	257	135	1	10	0
7/24/2018	28	28	71	ND(50)	5	246	348	ND(0.2)	78	27	0	1	0
8/9/2018	149	145	305	ND(25)	3	204	1100	165	259	115	4	8	0
8/16/2018	294	294	506	ND(25)	8	240	1430	100	70	70	4	9	0
8/23/2018	232	197	323	35	3	217	898	48	78	54	6	7	0
9/2/2018	100	100	35	ND(25)	5	247	97	9	42	12	0	0	ND(0.002)
10/23/2018	193	173	334	20	4	230	602	215	315	126	5	9	0

TABLE 3-9. HISTORICAL SURFACE WATER DATA - DEFIANCE DRAW (DD)
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Date Sampled	Alkalinity [3] (mg/L CaCO)	Bicarbonate [3] (mg/L CaCO)	Calcium, Total (mg/L)	Carbonate [3] (mg/L CaCO)	Chloride (mg/L)	Conductance, Field (uS/cm)	Hardness [3] (mg/L CaCO)	Iron, Dissolved (mg/L)	Iron, Total (mg/L)	Magnesium, Total (mg/L)	Manganese, Dissolved (mg/L)	Manganese, Total (mg/L)	Mercury (mg/L)
7/26/2019	183	183	298	ND(8)	5	218	997	333	368	117	7	9	0
9/16/2019	141	141	145	ND(8)	4	134	317	78	99	43	3	4	0
7/27/2020	2400	2400	1200	ND(8)	7	335	3600	100	810	270	8	23	0
8/26/2020	170	170	200	ND(8)	7	305	ND(2000)	19	200	61	3	5	0
7/12/2021	111	111	270	ND(2)	10	282	1000	5	270	88	3	7	ND(0.0008)
7/24/2021	97	97	160	ND(2)	7	289	720	1	310	78	0	4	ND(0.0008)
8/3/2021	78	78	71	ND(2)	ND(5)	230	320	7	170	34	1	2	ND(0.0008)
8/12/2021	80	80	70	ND(2)	ND(5)	161	310	4	150	33	0	2	ND(0.0004)
7/25/2022	111	111	480	ND(2)	ND(2.5)	226	2100	15	750	220	4	15	0
8/11/2022	92	92	79	ND(2)	ND(5)	252	380	14	310	44.0	0.069	2.7	0.00076
9/21/2022	90	90	320	ND(2)	4.7	270	1300	16	360	130.0	3.2	8.8	0.002
10/4/2022	75	75	49	ND(2)	3.4	167	230	8.4	130	25.0	0.33	1.2	0.00028
10/17/2022	80	80	33	ND(2)	3.3	187	130	9.9	45	12.0	0.22	0.53	ND(0.0002)
8/15/2023	84	84	180	ND(2)	15.0	317	680	0.042	180	58.0	ND(0.002)	3.7	ND(0.0002)
8/24/2023	80	80	450	ND(2)	8.6	503	1800	0.074	360	160.0	ND(0.002)	9.5	ND(0.0002)
9/14/2023	95	95	220	ND(2)	ND(5)	91	810	0.022	230	66.0	ND(0.002)	6	ND(0.0002)
6/21/2024	100	100	600	ND(2)	ND(5)	331	1900	ND(0.1)	370	100.0	ND(0.01)	9.6	0.0016
7/1/2024	90	90	49	ND(2)	4.1	176	190	0.027	52	17.0	ND(0.002)	0.84	ND(0.0002)
7/25/2024	89	89	330	ND(2)	2.8	194	1300	0.099	350	120.0	0.0028	7.4	0.002
8/14/2024	82	82	250	ND(2)	ND(5)	258	970	0.06	280	85.0	ND(0.002)	6.4	0.0013
8/24/2024	89	89	41	ND(2)	3.1	245	170	0.028	58	16.0	0.0029	0.56	ND(0.0002)
9/17/2024	77	77	400	ND(2)	6.2	201	1500	0.035	360	120.0	0.0021	9.2	0.0011
10/20/2024	74	74	48	ND(2)	3.6	164	190	0.041	60	17.0	0.0033	1.3	0.00021
8/26/2025	120	120	250	ND(10)	3.2	191	840	0.066	110	43.0	0.0018	4.2	0.0019
9/4/2025	96	96	240	ND(10)	2.7	126	60	0.82	590	120.0	0.0064	7.6	0.0013
10/11/2025	97	97	73	ND(10)	2.9	155	320	ND(0.2)	9	11.0	ND(0.003)	1.6	0.0002
Water Quality Standards	--	--	--	--	250	--	--	--	--	--	--	--	0.01

TABLE 3-9. HISTORICAL SURFACE WATER DATA - DEFIANCE DRAW (DD)
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Date Sampled	Nitrogen Nitrate (mg/L)	pH, Field (s.u.)	pH, Lab (s.u.)	Phosphate (mg/L)	Phosphorus, Total (mg/L)	Potassium, Total (mg/L)	Selenium, Total (mg/L)	Sodium, Total (mg/L)	Solids, Total Dissolved (mg/L)	Solids, Total Suspended (mg/L)	Sulfate (mg/L)
7/22/2013	1	7.9	8.1	1	1.74	20.5	ND(0.02)	42.8	636	3100	37.7
7/26/2013	2	7.9	7.9	1	1.81	22.9	ND(0.02)	29	**3840**	9500	32
7/29/2013	2	7.9	8.0	2	2.25	29.9	ND(0.02)	39.7	**1780**	8400	51.1
8/6/2013	1	7.9	7.8	2	1.74	22.8	ND(0.02)	28.6	**3480**	5400	28.4
8/25/2013	1	8.4	8.1	1	1.89	21.9	ND(0.02)	27.3	**7740**	7650	25.1
8/2/2014	0	7.8	8.1	17	4.23	24.1	ND(0.02)	22	395	32900	7.1
9/29/2014	1	8.2	8.1	21	4.15	27.8	ND(0.02)	22.4	338	30600	15.8
10/9/2014	ND(0.1)	8.0	8.2	8	3.54	42.3	ND(0.1)	32.8	246	4400	19.9
6/13/2015	1	8.7	8.1	42	4.5	25.6	ND(0.02)	25.9	258	26100	8.9
7/13/2015	1	**9.6**	7.9	33	5.21	45.3	0.0085	32	375	36700	11.7
8/1/2015	0	8.8	7.6	4	0.821	15.6	**0.0104**	12	225	2890	9.2
8/8/2015	1	8.5	7.9	8	2.08	20.4	ND(0.02)	22.4	318	8740	22.1
8/27/2015	1	8.1	8.0	10	2.45	30.1	**0.016**	37	901	8160	24.9
10/21/2015	1	8.8	8.1	6	5.36	42	ND(0.02)	37.3	549	40000	19.6
7/21/2016	2	8.2	8.1	6	5.07	58.1	ND(0.1)	61.5	442	28300	54.3
8/8/2016	1	8.5	8.0	2	2.22	28.2	**0.0141**	26.5	464	7760	12.7
8/26/2016	0	7.9	7.8	2	5.63	27.6	ND(0.02)	31.1	**1180**	38900	19.6
9/2/2016	5	8.3	8.4	ND(1.5)	0.699	8.37	ND(0.02)	30.6	424	4780	30.3
9/29/2016	1	9.0	7.9	10	2.72	14	ND(0.02)	38.2	422	5710	18.4
11/5/2016	1	8.7	7.8	1	0.613	10.1	ND(0.02)	21.3	535	1640	20.1
7/24/2017	2	8.6	7.6	15	3.82	21.1	ND(0.02)	42	590	21600	55.7
8/21/2017	1	8.5	8.0	18	2.26	32.6	ND(0.02)	43.2	**1240**	18800	28.8
6/16/2018	1	8.8	7.9	30	4.52	59.2	ND(0.02)	66.9	**1200**	46400	34.3
7/12/2018	1	8.4	7.7	7	6.46	52	ND(0.05)	41.9	390	40100	40.4
7/24/2018	2	8.3	8.2	5	1.14	19.3	ND(0.05)	24.5	**2340**	3760	18.4
8/9/2018	1	8.9	7.8	43	5.11	43.7	ND(0.05)	28.3	**6500**	9970	22
8/16/2018	1	8.9	8.0	52	8.13	27.1	ND(0.05)	42.7	**5900**	2150	24.5
8/23/2018	1	8.6	8.0	21	4.87	22.2	ND(0.05)	36.5	**4730**	14000	22
9/2/2018	1	8.5	7.9	2	0.629	9.62	ND(0.05)	27	**1450**	432	25.6
10/23/2018	1	8.8	8.4	15	5.94	49.5	ND(0.25)	42.5	336	19100	28.7

TABLE 3-9. HISTORICAL SURFACE WATER DATA - DEFIANCE DRAW (DD)
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Date Sampled	Nitrogen Nitrate (mg/L)	pH, Field (s.u.)	pH, Lab (s.u.)	Phosphate (mg/L)	Phosphorus, Total (mg/L)	Potassium, Total (mg/L)	Selenium, Total (mg/L)	Sodium, Total (mg/L)	Solids, Total Dissolved (mg/L)	Solids, Total Suspended (mg/L)	Sulfate (mg/L)
7/26/2019	1	8.5	7.9	35	4.85	50.9	ND(0.05)	30.5	230	700	18.3
9/16/2019	0	8.9	8.2	19	3.34	28.7	ND(0.05)	16.3	982	3190	5.1
7/27/2020	1	8.9	8.0	20	11	100	ND(0.25)	44	410	3100	29
8/26/2020	1	8.8	8.1	ND(0.31)	5.2	44	ND(0.05)	35	120	11000	18
7/12/2021	1	8.3	7.6	ND(2.5)	14	46	**0.034**	34	760	22000	27
7/24/2021	2	8.2	7.9	ND(2.5)	5.8	43	**0.041**	38	840	14000	35
8/3/2021	2	8.3	8.0	ND(2.5)	2.4	21	**0.018**	21	4150	3000	23
8/12/2021	1	8.5	8.0	ND(5)	2.8	22	**0.015**	14	2520	2600	13
7/25/2022	1	8.6	8.1	ND(2.5)	28	92	**0.1**	50	5400	44000	28
8/11/2022	1.5	8.4	7.6	ND(5)	3.4	40	**0.03**	22	**1660**	13000	23
9/21/2022	1.1	8.7	8.1	ND(2.5)	12	58	**0.077**	45	**1240**	21000	32
10/4/2022	0.57	8.5	8.0	ND(2.5)	1.5	20	**0.011**	18	870	2700	17
10/17/2022	ND(1)	7.9	7.8	ND(2.5)	0.65	10	**0.009**	20	185	780	22
8/15/2023	1.4	8.6	8.2	ND(5)	5.5	25	**0.011**	34	770	13000	30
8/24/2023	1.6	8.5	8.1	ND(5)	17	54	0.0025	53	ND(2500)	28000	52
9/14/2023	ND(1)	8.4	8.1	ND(5)	8.8	44	**0.0073**	21	ND(5000)	9900	6.8
6/21/2024	ND(1)	8.9	7.9	ND(5)	22	57	**0.033**	28	800	31000	14
7/1/2024	ND(1)	8.5	8.0	ND(2.5)	1.5	16	**0.0075**	19	550	2300	13
7/25/2024	ND(1)	8.7	8.0	ND(0.5)	15	50	**0.032**	33	**1800**	23000	21
8/14/2024	ND(1)	8.9	8.1	ND(0.5)	5.2	36	**0.027**	25	990	16000	16
8/24/2024	ND(1)	8.7	8.1	ND(2.5)	0.84	13	**0.0056**	19	560	1400	22
9/17/2024	ND(1)	8.1	8.2	ND(5)	16	50	0.043	29	**1200**	26000	19
10/20/2024	ND(1)	8.5	7.7	ND(2.5)	1.7	10	**0.0094**	14	1000	3200	10
8/26/2025	0.6	8.4	8.0	21	6.8	27	0.0024	20	**1400**	34000	16
9/4/2025	0.81	7.8	8.2	11	3.5	78	**0.0078**	23	**1300**	19000	13
10/11/2025	0.39	8.1	8.2	1.1	0.37	7.1	0.00067	17	800	5000	14
Water Quality Standards	10	6 - 9	6 - 9	--	--	--	0.005	--	1000	--	600

Abbreviations:
mg/L - milligrams per liter
s.u. - standard units
mg/L CaCO3 - milligrams per liter as calcium carbonate
ND - non-detect (detection limit in parentheses)
NTU - Nephelometric Turbidity Units

TABLE 3-10. HISTORICAL SURFACE WATER DATA - SE BONITA WASH (TBW)
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Date Sampled	Alkalinity (mg/L CaCO3)	Bicarbonate (mg/L CaCO3)	Calcium, Total (mg/L)	Carbonate (mg/L CaCO3)	Chloride (mg/L)	Conductance, Field (uS/cm)	Hardness (mg/L CaCO3)	Iron, Dissolved (mg/L)	Iron, Total (mg/L)	Magnesium, Total (mg/L)	Manganese, Dissolved (mg/L)	Manganese, Total (mg/L)	Mercury (mg/L)	Nitrogen Nitrate (mg/L)	pH, Field (s.u.)	pH, Lab (s.u.)
7/20/2013	76.4	76.4	176	ND(2)	3.5	NR	NM	38.1	197	59.5	0.65	3.58	NM	0.66	7.8	7.8
7/29/2013	93	92.7	33.7	ND(2)	11.9	252	NM	0.0604	19.8	9.02	0.0194	0.222	NM	0.72	7.9	7.8
8/6/2013	79.6	79.6	85	ND(2)	3.7	320	NM	8.44	76.8	25.6	0.136	1.76	NM	0.42	7.8	7.7
9/29/2014	87.3	87.3	55.1	ND(2)	8	686	200	ND(0.2)	19.4	16.5	0.0014	0.348	ND(0.0002)	0.32	8.1	8
7/13/2015	76.1	76.1	48.1	ND(2)	4.4	466	201	0.0546	25.3	14.6	0.0056	0.342	0.000054	0.39	**9.6**	7.9
7/15/2015	79.4	79.4	44.3	ND(2)	3.2	351	179	0.311	28.3	13.5	0.004	0.485	0.00011	0.38	**9.5**	7.9
8/31/2015	127	127	60.6	ND(200)	3.2	335	225	0.137	41.7	18.8	0.0107	0.689	0.00028	0.37	8.1	8.4
7/24/2017	75.9	75.9	40.3	ND(5)	5	238	162	ND(0.2)	41.6	14.9	0.0033	0.514	0.00014	2.8	8.5	7.6
7/18/2018	127	116	169	ND(50)	3.6	173	554	53.1	97.9	45.2	1.44	3.85	0.00052	0.94	8.7	7.9
9/2/2018	103	103	58.1	ND(25)	4.1	242	151	10.4	64.3	19.5	0.139	0.951	ND(0.002)	1.3	8.4	7.7
7/12/2021	85.52	85.52	87	ND(2)	6	168	360	3.4	130	36	0.8	1.7	ND(0.0008)	ND(1)	8.26	7.9
7/24/2021	72.76	72.76	34	ND(2)	4.7	277	130	0.41	34	11	0.0084	0.33	ND(0.0008)	1.4	8.3	7.49
8/3/2021	87.64	87.64	41	ND(2)	ND(5)	271	160	0.78	38	13	0.04	0.33	ND(0.0008)	1.4	8.1	7.9
8/11/2021	67.76	67.76	180	ND(2)	ND(5)	113	690	5.8	230	61	1	4.9	ND(0.0008)	ND(1)	8.48	8
10/6/2021	89.68	89.68	35	ND(2)	4.7	286	120	0.35	10	7.7	0.014	0.1	ND(0.0002)	ND(0.5)	8.68	8.1
8/17/2022	86.04	86.04	40	ND(2)	2.5	225	150	4.3	49	13	0.16	0.52	ND(0.0002)	ND(0.5)	8.5	7.9
9/22/2022	86.6	86.6	42	ND(2)	ND(2.5)	231	160	2.1	63	14	0.14	0.51	ND(0.0002)	ND(0.5)	8.3	7.8
10/17/2022	101.4	101.4	36	ND(2)	2.6	290	130	1.4	15	8.9	0.056	0.19	ND(0.0002)	ND(1)	8.6	8
6/27/2024	100	100	350	ND(2)	3.5	158	1200	0.068	230	82	0.0035	4.1	ND(0.0002)	1.4	8.86	8
7/25/2024	95	95	160	ND(2)	3.2	144	620	0.02	130	53	0.006	3.2	0.00093	ND(1)	7.76	8
8/24/2024	120	120	62	ND(2)	4.3	376	230	0.038	46	18	0.0024	0.58	ND(0.0002)	ND(1)	8.64	8
8/25/2025	87	87	110	ND(10)	5.9	144	380	0.25	240	64	0.013	3.5	0.00079	0.76	7.8	7.8
Standard	-	-	-	-	250		-	-	-	-	-	-	0.01	10	6 - 9	6 - 9

Abbreviations:
mg/L - milligrams per liter
mg/L CaCO3 - milligrams per liter as calcium carbonate
ND - non-detect (detection limit in parentheses)
NM - not measured
NTU - Nephelometric Turbidity Units
s.u. - standard units

TABLE 3-10. HISTORICAL SURFACE WATER DATA - TSE BONITA WASH (TBW)
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Date Sampled	Phosphate (mg/L)	Phosphorus, Total (mg/L)	Potassium, Total (mg/L)	Selenium, Total (mg/L)	Sodium, Total (mg/L)	Solids, Total Dissolved (mg/L)	Solids, Total Suspended (mg/L)	Sulfate (mg/L)
7/20/2013	1.5	3.71	36.6	**0.0096**	37.8	574	13,700	142
7/29/2013	3.6	0.408	9.69	ND(0.02)	18	**1,050**	8,300	70.4
8/6/2013	0.77	1.52	16.7	ND(0.02)	19.5	**1,650**	4,200	62.5
9/29/2014	ND(0.31)	0.371	9.96	ND(0.02)	70.2	697	860	213
7/13/2015	1.2	0.454	10.1	ND(0.02)	33.6	370	663	111
7/15/2015	1.7	0.519	10.1	ND(0.02)	21.1	322	950	68.6
8/31/2015	2.4	0.725	12.8	ND(0.02)	17.9	470	2,770	71.2
7/24/2017	2.6	0.769	16.5	ND(0.02)	17.5	424	1,360	18.7
7/18/2018	7.9	2.54	27.7	ND(0.05)	14	**1,770**	6,700	9.8
9/2/2018	4.6	1.09	13.9	ND(0.05)	14.6	536	1,590	28.8
7/12/2021	ND(2.5)	3.4	28	**0.011**	14	700	5,900	17
7/24/2021	ND(2.5)	0.7	14	**0.0059**	16	920	250	26
8/3/2021	ND(2.5)	0.71	13	**0.0062**	18	**1,160**	520	32
8/11/2021	ND(5)	6.6	35	**0.029**	8.3	**1,600**	6,300	7.2
10/6/2021	ND(2.5)	ND(0.5)	7.8	0.0031	15	335	170	39
8/17/2022	ND(2.5)	0.87	13	0.0048	9	810	920	23
9/22/2022	ND(2.5)	0.67	13	**0.0051**	9.1	590	980	23
10/17/2022	ND(2.5)	0.27	8.5	0.0032	9.3	530	230	22
6/27/2024	ND(2.5)	16	38	**0.022**	56	ND(2500)	62000	100
7/25/2024	ND(0.5)	5	35	**0.017**	26	**1,600**	9200	15
8/24/2024	ND(2.5)	1.2	15	0.0045	14	510	1600	37
8/25/2025	6.6	2.1	55	0.004	12	550	9100	12
Standard	-	-	-	0.005	-	1,000	-	600

Abbreviations:
mg/L - milligrams per liter
mg/L $CaCO_3$ - milligrams per liter as
ND - non-detect (detection limit in pa
NM - not measured
NTU - Nephelometric Turbidity Units
s.u. - standard units

TABLE 4-1. ANNUAL WATER LEVEL SUMMARY
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

YEAR	WELL 1, TD = 930 ft bmp		WELL 2, TD = 798 ft bmp		WELL 3, TD = 882 ft bmp		WELL MBR2, TD = 179.8 ft bmp		WELL MBR5, TD = 32.4 ft bmp	
	DTW	Saturated Thickness	DTW	Saturated Thickness	DTW	Saturated Thickness	DTW	Saturated Thickness	DTW	Saturated Thickness
	ft bmp	ft	ft bmp	ft	ft bmp	ft	ft bmp	ft	ft bmp	ft
2013	**482**	448	**NM**	NM	**482**	400	**132.84**	45.86	**24.67**	7.73
2014	**466.33**	463.67	**734.67**	63.33	**466.33**	415.67	**132.17**	46.53	**24.81**	7.59
2015	**466**	464	**738**	60	**466**	416	**132.23**	46.47	**32.4**	0
2016	**472**	458	**764.51**	33.49	**472**	410	**133.63**	46.17	**21.66**	10.74
2017	**483**	447	**765.66**	32.34	**483**	399	**133.68**	46.12	**27.32**	5.08
2018	**462.2**	467.8	**773.96**	24.04	**462.2**	419.8	**134.34**	45.46	**27.6**	4.8
2019	**481.85**	448.15	**778.79**	19.21	**481.85**	400.15	**133.82**	45.98	**26.4**	6
2020	**526.9**	403.1	**777.63**	20.37	**526.9**	355.1	**133.86**	45.94	**27.25**	5.15
2021	**530.35**	399.65	**778.79**	19.21	**530.35**	351.65	**138.62**	41.18	**27.75**	4.65
2022	**529.2**	400.8	**779.94**	18.06	**529.2**	352.8	**134.05**	45.75	**27.87**	4.53
2023	**543.05**	386.95	**782.25**	15.75	**543.05**	338.95	**135.18**	44.62	**28.4**	4
2024	**529.2**	400.8	**781.1**	16.9	**529.2**	352.8	**134.38**	45.42	**29.73**	2.67
2025	**546.55**	383.45	**779.94**	18.06	**543.1**	338.9	**ND**	0	**ND**	0

Note:
1. Values in bold represent arithmetic means calculated from at least two measurements from the same year.

Abbreviations:
bmp - below measuring point
DTW - depth to water
ft - feet
ND - non-detect/dry well
NM - not measured

TABLE 4-2. WELL TB2B2 HISTORICAL GROUNDWATER QUALITY DATA
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Date Sampled	Alkalinity mg/L CaCO3	Bicarbonate mg/L CaCO3	Calcium, Total mg/L	Carbonate mg/L CaCO3	Chloride mg/L	Conductance, Field µS/cm	Hardness mg/L CaCO3	Iron, Dissolved mg/L	Iron, Total mg/L	Magnesium, Total mg/L	Manganese, Dissolved mg/L	Manganese, Total mg/L	Nitrogen Nitrate mg/L	pH, Field s.u.	pH, Lab s.u.	Phosphate mg/L	Phosphorus, Total mg/L	Potassium, Total mg/L	Selenium, Total mg/L	Sodium, Total mg/L	Solids, Total Dissolved mg/L	Sulfate mg/L
3/20/2013	417	417	301	ND(2)	81.7	3090	NA	0.39	4.09	81	**0.38**	0.637	0.054	6.9	7.4	ND(0.1)	0.0315	6.55	ND(0.02)	277	**2270**	**1110**
5/23/2013	448	448	293	ND(2)	97.6	2930	NA	0.493	10	79.2	**0.458**	0.648	ND(0.1)	7	7.4	ND(0.1)	0.0857	6.2	ND(0.02)	296	**2130**	**1080**
8/21/2013	458	458	307	ND(2)	85.3	334	NA	**3.74**	45.3	85	**1.18**	2.26	ND(0.1)	7.1	7.4	0.14	0.24	7.58	ND(0.02)	295	**2050**	**1240**
11/7/2013	475	475	237	ND(2)	77.2	2760	NA	0.0967	0.164	66.7	**0.46**	0.495	ND(0.1)	7.2	7.2	ND(0.31)	ND(0.1)	5.53	ND(0.02)	284	**1940**	**1050**
2/12/2014	452	452	312	ND(2)	79.7	4500	NA	ND(0.2)	1.41	88.8	**0.434**	0.477	ND(0.1)	7.3	7.3	ND(0.31)	ND(0.1)	7.07	ND(0.02)	296	**2170**	**1140**
4/15/2014	487	487	295	ND(2)	75.7	2680	NA	0.0843	8.9	86.6	**0.528**	0.767	ND(0.1)	7	7.2	ND(0.31)	0.0699	7.72	ND(0.02)	290	**2130**	**1120**
8/21/2014	482	482	360	ND(2)	75.9	3070	1160.00	0.326	128	92.2	**0.45**	2.14	ND(0.1)	6.8	7.5	ND(0.31)	0.294	8.64	ND(0.02)	299	**2110**	**1110**
10/22/2014	485	485	317	ND(2)	71.6	3110	1110.00	0.152	110	88.3	**0.422**	2.08	0.053	7	7.3	ND(0.31)	0.337	7.93	ND(0.02)	281	**2300**	**1110**
6/30/2015	464	464	302	ND(2)	73.1	3150	1670.00	**2.01**	4.52	89.2	**0.385**	0.472	ND(0.1)	7.4	7.7	ND(0.31)	0.0225	7.46	ND(0.02)	304	**1980**	**1110**
9/1/2015	467	467	309	ND(2)	74.2	3040	1220.00	0.253	1.35	89.7	**0.4**	0.452	ND(0.1)	6.9	7.4	ND(0.31)	0.01	7.25	ND(0.02)	306.0	**2100**	**1010**
11/3/2015	478	478	285	ND(2)	80.5	3040	1230.00	0.944	0.618	85.2	**0.524**	0.476	ND(0.1)	6.7	7.5	ND(0.31)	0.0095	6.82	ND(0.02)	286.0	**2280**	**1140**
2/24/2016	481	481	300	ND(2)	71.5	3070	1170.00	0.11	3.95	87.9	**1.38**	0.788	0.044	7.1	7.5	ND(0.31)	0.0375	7.62	ND(0.02)	289.0	**2040**	**1050**
7/28/2016	480	480	301	ND(5)	71.1	2790	1160.00	**1.6**	13	84	**0.424**	0.595	ND(0.1)	7.3	7.4	ND(0.31)	0.0616	7.06	ND(0.02)	284.0	**2220**	**1110**
11/9/2016	493	493	282	ND(5)	77.2	3090	1070.00	**3.09**	26.5	87.3	**0.928**	0.676	0.046	7.1	7.2	ND(0.31)	0.111	8.4	ND(0.02)	297.0	**2080**	**1150**
Standard	-	-	-	-	250	-	-	1	-	-	0.2	-	10	6 - 9	6 - 9	-	-	-	-	-	1000	600

Bold values indicate concentration or detection limit exceeds groundwater quality standard
Abbreviations:
CaCO3 - calcium carbonate, molecular weight of 100.06 g
mg/L - milligrams per liter
ND - non-detect (detection limit in parentheses)
NTU - Nephelometric Turbidity Units
s.u. - standard units

TABLE 4-3. WELL 1 HISTORICAL GROUNDWATER QUALITY DATA
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Date Sampled	Alkalinity mg/L CaCO3	Bicarbonate mg/L CaCO3	Calcium, Dissolved mg/L	Carbonate mg/L CaCO3	Chloride mg/L	Fluoride mg/L	Hardness mg/L CaCO3	Iron, Total mg/L	Magnesium, Dissolved mg/L	Manganese, Total mg/L	pH, Field s.u.	pH, Lab s.u.	Phosphate mg/L	Potassium, Dissolved mg/L	Sodium, Dissolved mg/L	Solids, Total Dissolved mg/L	Sulfate mg/L	Turbidity NTU
3/20/2013	145	145	63.5	ND(2)	3.7	ND(0.5)	219	2.57	13.9	0.118	7.2	7.5	ND(0.1)	4.88	32.2	370	136	10
5/23/2013	152	152	62.1	ND(2)	4.2	0.48	221	1.12	13.5	0.11	6.9	7.5	ND(0.1)	4.71	33.1	348	134	11.2
8/22/2013	154	154	62	ND(2)	4	ND(0.5)	221	1.41	13.6	0.107	7.1	7.3	ND(0.1)	4.87	31.6	349	130	6.1
11/7/2013	150	150	64	ND(2)	3.7	ND(0.5)	220	1.67	14.2	0.121	7.3	7.3	ND(0.31)	4.81	32.7	357	131	7.1
3/19/2014	152	152	63.9	ND(2)	4.1	ND(0.5)	212	1.63	14.2	0.115	7	7.6	ND(0.31)	4.79	33.9	382	133	5.9
4/15/2014	155	155	69.3	ND(2)	3.8	ND(0.5)	235	1.69	15.1	0.114	7	7.4	ND(0.31)	5.06	36.8	361	128	9
9/9/2014	154	154	64.3	ND(2)	4.1	0.36	232	1.6	13.9	0.115	7.2	7.6	ND(0.31)	4.73	33.9	356	133	8.3
10/22/2014	155	155	65.8	ND(2)	3.9	ND(0.5)	221	1.83	14.8	0.124	7	7.2	ND(0.31)	4.87	34.4	378	133	11
2/10/2015	152	152	69	ND(2)	3.4	ND(0.5)	238	1.92	15.4	0.121	7.1	7.8	ND(0.31)	4.99	34.8	408	143	13.5
4/29/2015	153	153	66.2	ND(2)	4.4	ND(0.5)	237	1.48	14.9	0.117	7.2	7.5	ND(0.31)	4.86	33.8	351	138	12.8
9/2/2015	145	145	68.5	ND(2)	4.4	ND(0.5)	252	1.61	15.4	0.122	7.1	7.7	ND(0.31)	5.09	34.2	415	149	17.8
11/3/2015	144	144	72.2	ND(2)	3.6	ND(0.5)	227	1.65	16.2	0.125	6.8	7.3	ND(0.31)	5.24	35.2	444	149	6.3
3/9/2016	149	149	67.9	ND(2)	4	0.27	257	1.95	15.2	0.128	7.2	7.7	ND(0.31)	4.92	33.6	385	150	20.8
6/24/2016	148	148	70.2	ND(5)	4.3	0.33	251	1.82	15.9	0.129	7.1	7.4	ND(0.31)	5.11	33.4	379	153	3.1
7/28/2016	149	149	68.3	ND(5)	4.3	ND(0.5)	252	1.6	15.4	0.12	7.1	7.5	ND(0.31)	4.92	32.7	428	159	11.7
11/9/2016	151	151	65.2	ND(5)	4.3	0.46	250	1.51	14.5	0.118	7.2	7.3	ND(0.31)	4.98	31.7	399	174	9.8
3/3/2017	154	154	72	ND(5)	4.4	0.47	301	1.93	16.1	0.13	5.5	7.5	ND(0.31)	5.15	34.9	371	152	13.9
6/7/2017	148	148	70.9	ND(5)	3.6	0.45	265	1.62	15.8	0.123	7.1	7.6	ND(0.31)	5.14	34.5	396	138	4.8
9/13/2017	144	144	64.7	ND(5)	4.2	ND(0.5)	228	1.75	15.2	0.125	7	7.6	ND(0.31)	4.96	32	384	154	0.2
11/16/2017	148	148	62.8	ND(5)	4.2	0.38	217	1.33	14.2	0.115	7.2	7.4	ND(0.31)	4.54	31.4	373	150	7.3
2/21/2018	145	145	69.2	ND(5)	4.1	0.32	241	1.91	15.4	0.13	7.6	7.6	ND(0.31)	5.08	34.5	432	160	16
5/17/2018	142	142	69.5	ND(5)	4.3	0.53	229	1.46	15.5	0.119	7.5	7.6	ND(0.31)	5.11	34.5	368	144	13
9/13/2018	149	149	68.3	ND(5)	3.9	0.49	229	1.82	15.4	0.129	7	8.1	ND(0.31)	5.09	34.2	328	149	6.3
11/14/2018	152	152	66.8	ND(5)	4.2	0.39	226	1.41	15.1	0.122	7.6	7.5	ND(0.31)	4.86	32.8	397	150	16
2/28/2019	151	151	69.2	ND(5)	3.9	0.69	225	1.78	15.4	0.128	7	7.7	ND(0.31)	5.19	34	389	155	6.2
5/14/2019	146	146	71.6	ND(5)	4.2	0.97	269	1.8	15.6	0.124	7	7.5	ND(0.31)	5.12	34.2	395	152	11
8/20/2019	150	150	71.7	ND(8)	4.8	0.64	244	1.12	16.2	0.124	6.8	7.3	ND(0.31)	5.11	34.4	412	145	12
11/13/2019	151	151	67.5	ND(8)	4.2	0.51	264	1.02	15.5	0.113	7.1	8.1	ND(0.31)	4.92	32.8	385	151	8.8
2/19/2020	149	149	68.5	ND(8)	3.8	0.56	254	1.15	15.2	0.121	6.84	7.6	ND(0.31)	5.07	33.3	402	152	12
6/3/2020	150	150	65	ND(8)	4.3	0.68	280	1.3	14	0.12	7	7.7	ND(0.31)	4.6	33	370	220	19
7/30/2020	150	150	69	ND(8)	4.6	ND(0.5)	250	1.3	16	0.12	7.1	7.8	ND(0.31)	5	35	400	160	7.6
11/4/2020	150	150	71	ND(8)	4.1	0.42	270	1.2	15	0.12	7.1	7.5	ND(0.31)	4.9	34	380	150	11
2/24/2021	160	160	71	ND(8)	4.9	0.46	260	1.7	16	0.13	7.3	7.6	ND(0.31)	5.3	37	360	150	12
5/11/2021	157.6	157.6	71	ND(2)	3.6	ND(0.5)	240	1.1	16	0.11	7.31	7.71	ND(2.5)	5.1	34	395	150	12
8/10/2021	165.6	165.6	69	ND(2)	5.3	ND(0.5)	240	1.6	16	0.12	7.5	7.41	ND(2.5)	4.8	48	372	160	14
11/4/2021	150.5	150.5	69	ND(2)	3.7	0.36	240	1.4	16	0.12	7.39	7.38	ND(2.5)	5	35	387	150	6.2
2/10/2022	150.4	150.4	68	ND(2)	4	ND(0.5)	220	1.8	16	0.12	7.5	7.21	ND(2.5)	4.8	33	398	150	7
4/26/2022	148.6	148.6	72	ND(2)	3.3	0.27	240	1.2	16	0.12	7.04	7.28	ND(0.5)	4.5	35	396	150	7.2
8/31/2022	176.2	176.2	62	ND(2)	7	0.71	210	3.1	15	0.12	7.04	7.5	ND(2.5)	4.7	61	438	160	25
12/7/2022	150	150	66	ND(2)	3.7	ND(0.5)	250	2	15	0.13	7.41	7.22	ND(2.5)	4.7	37	387	150	18
2/9/2023	151.1	151.1	71	ND(2)	3.6	ND(0.5)	240	2	16	0.12	7.58	7.53	ND(2.5)	4.9	34	394	160	7.4
5/24/2023	150.7	150.7	66	ND(2)	3.6	ND(0.5)	230	1.2	15	0.11	7.06	7.55	ND(2.5)	4.8	34	389	150	7.8
7/12/2023	151.7	151.7	69	ND(2)	3.5	ND(0.5)	240	1.2	15	0.13	6.96	7.34	ND(2.5)	4.7	35	379	150	14
10/5/2023	152.4	152.4	69	ND(2)	3.7	ND(0.5)	240	1.2	16	0.11	7.25	7.32	ND(2.5)	4.5	33	390	160	4.3
1/17/2024	150.8	150.8	67	ND(2)	3.4	0.29	230	1.3	15	0.11	7.23	7.25	ND(0.5)	4.8	34	392	140	6.1
11/21/2024	150	150	65	ND(2)	3.4	0.31	220	0.62	17	0.1	7.48	8	ND(0.5)	5.3	29	380	140	2.8
Standard	-	-	-	-	250	1.6	-	-	-	-	6 - 9	6 - 9	-	-	-	1,000	600	-

Bold values indicate concentration or detection limit exceeds groundwater quality standard
Abbreviations:
CaCO3 - calcium carbonate, molecular weight of 100.06 g
mg/L - milligrams per liter
ND - non-detect (detection limit in parentheses)
NTU - Nephelometric Turbidity Units
s.u. - standard units

TABLE 4-4. WELL 2 HISTORICAL GROUNDWATER QUALITY DATA
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Date Sampled	Alkalinity mg/L CaCO3	Bicarbonate mg/L CaCO3	Calcium, Dissolved mg/L	Carbonate mg/L CaCO3	Chloride mg/L	Fluoride mg/L	Hardness mg/L CaCO3	Iron, Total mg/L	Magnesium, Dissolved mg/L	Manganese, Total mg/L	pH, Field s.u.	pH, Lab (s.u.)	Phosphate mg/L	Potassium, Dissolved mg/L	Sodium, Dissolved mg/L	Solids, Total Dissolved mg/L	Sulfate mg/L	Turbidity NTU
3/27/2013	217	217	38.2	ND(2)	13.2	ND(0.5)	141	0.978	7.85	0.0331	7	7.6	ND(0.1)	3.6	111	458	130	4.2
5/23/2013	218	218	37.1	ND(2)	13.9	0.68	132	1.48	7.75	0.0294	6.9	7.6	ND(0.1)	3.52	105	454	136	8.2
8/22/2013	234	234	32.1	ND(2)	16.8	0.66	114	2.98	6.63	0.0436	7.2	7.6	ND(0.1)	3.74	152	513	166	7.7
11/7/2013	207	207	51.1	ND(2)	10.3	0.4	159	19.4	10.6	0.0811	7.6	7.5	1.6	3.94	77.4	393	103	77.2
3/19/2014	218	218	61	ND(2)	5.5	ND(0.5)	203	1.08	12.4	0.0451	7.1	7.7	ND(0.31)	4.19	24.7	351	67.4	17.1
4/15/2014	213	213	42.9	ND(2)	6.5	ND(0.5)	165	1.27	8.82	0.0582	6.4	7.4	ND(0.31)	4.29	119	366	111	4.9
9/9/2014	236	236	34.4	ND(2)	16.4	0.75	129	3.76	7.04	0.0542	7.2	7.7	ND(0.31)	3.59	133	521	138	15
10/22/2014	239	239	22.9	ND(2)	20.7	0.58	63	2.07	4.91	0.0056	7.2	7.4	ND(0.31)	3.47	161	591	195	5.8
2/10/2015	181	181	55.4	ND(2)	5.9	0.34	193	0.404	11.4	0.018	7.1	7.6	ND(0.31)	4.19	46.1	337	81.8	0.91
4/29/2015	199	199	59.3	ND(2)	5.8	0.49	216	0.203	12.3	0.0195	7.5	7.3	ND(0.31)	4.24	36.6	341	87.8	1.3
9/2/2015	195	195	48.8	ND(2)	7.6	ND(0.5)	177	0.214	10.1	0.0209	7	7.7	ND(0.31)	4.32	62.9	371	89.4	0.98
11/3/2015	218	218	40.6	ND(2)	13.9	ND(0.5)	154	0.722	8.4	0.0698	7.2	7.4	ND(0.31)	4.02	119	531	139	3.2
2/24/2016	208	208	61.5	ND(2)	4.8	0.53	207	10.8	12.6	0.224	6.9	7.5	ND(0.31)	4.35	37.1	378	73.9	15.9
5/24/2016	211	211	54	ND(2)	10.3	0.63	182	0.91	11	0.0525	7	7.5	ND(0.31)	4.18	52.9	422	115	2.9
7/28/2016	216	216	47.7	ND(5)	12.4	0.72	159	0.987	10.1	0.0683	6.9	7.5	ND(0.31)	4.06	66.3	507	131	2.6
11/9/2016	186	186	51.2	ND(5)	7.9	0.64	196	4.64	10.5	0.111	7.2	7	ND(0.31)	4.12	57	394	106	3.9
3/3/2017	219	219	59.4	ND(5)	8.6	0.53	191	2.15	12.1	0.107	5.5	7.6	ND(0.31)	4.27	30.6	406	98.6	14.9
6/7/2017	189	189	55.2	ND(5)	8.2	0.45	132	0.265	11.2	0.0291	7	7.7	ND(0.31)	4.13	48.8	401	114	0.24
9/13/2017	209	209	45.7	ND(5)	12.3	0.65	147	1.07	9.75	0.0579	7	7.7	ND(0.31)	4.11	76.1	456	133	4.2
11/16/2017	205	205	36.4	ND(5)	9.5	0.5	141	0.184	7.68	0.0195	7.2	7.4	ND(0.31)	3.68	96.9	448	100	1.5
2/21/2018	188	188	50.1	ND(5)	8.3	0.38	164	0.0908	10.3	0.016	7.1	7.5	ND(0.31)	3.93	65.1	386	98.9	0.35
5/16/2018	189	189	35.2	ND(5)	7.3	0.65	167	0.271	7.48	0.0364	7.3	7.7	ND(0.31)	3.85	122	405	89.4	2.3
9/12/2018	232	232	24.4	ND(5)	16.1	0.75	81.1	0.229	5.24	0.013	7.3	7.8	ND(0.31)	3.91	155	728	151	2.4
11/15/2018	253	253	21.8	ND(5)	16.8	0.83	70.4	0.657	4.65	0.0171	7.6	8.2	ND(0.31)	3.58	180	566	153	9.5
2/28/2019	255	255	20.5	ND(5)	19.6	0.55	71.5	0.235	4.51	0.01	7.6	8	ND(0.31)	3.47	193	574	187	2.8
5/14/2019	198	198	50.7	ND(5)	11	1.1	177	0.693	10.3	0.0509	7	7.6	ND(0.31)	3.84	67.2	395	136	5.2
9/5/2019	189	189	52.6	ND(8)	7.1	0.58	167	0.0573	10.9	0.0187	7.1	7.4	ND(0.31)	4.14	54.3	330	86.9	0.4
11/13/2019	213	213	24.5	ND(8)	13.8	0.7	107	0.127	5.31	0.0102	7.6	7.9	ND(0.31)	3.57	169	427	138	1
2/19/2020	244	244	25.6	ND(2.6)	18	1.2	76	0.13	5.33	0.0128	7.1	8	ND(0.25)	3.59	157	584	199	1.6
4/29/2020	208	208	42.6	ND(2.6)	10.5	0.92	155	4.13	8.89	0.0444	7.2	7.7	ND(0.25)	3.51	95.7	441	131	28
9/2/2020	220	220	40	ND(8)	12	0.75	140	5	8.8	0.087	7.1	7.5	ND(0.25)	3.6	110	450	130	36
11/4/2020	210	210	43	ND(8)	10	0.63	160	2.4	8.4	0.077	7.1	8	ND(0.25)	3.5	96	420	120	16
2/3/2021	210	210	42	ND(8)	11	0.56	150	2.7	8.5	0.068	7.27	7.3	ND(0.25)	4.2	99	370	120	19
5/12/2021	208.4	208.4	44	ND(2)	8.9	ND(0.28)	150	0.97	9.4	0.032	7.2	7.29	ND(2)	3.7	96	435	110	6.4
8/10/2021	219.6	219.6	42	ND(2)	12	0.56	140	3	8.7	0.081	7.25	7.34	ND(2)	3.5	120	430	150	18
10/27/2021	212	212	42	ND(2)	10	0.58	140	0.25	9	0.034	7.35	7.5	ND(2)	3.5	93	432	130	2.3
2/10/2022	207.5	207.5	43	ND(2)	10	0.58	130	0.96	9.2	0.033	7.21	7.21	ND(2.5)	3.5	86	435	120	6.1
4/26/2022	207.5	207.5	43	ND(2)	11	0.47	140	0.49	9	0.029	6.98	7.17	ND(0.5)	3.1	99	446	120	3.2
8/31/2022	214.3	214.3	41	ND(2)	10	0.57	130	1.4	8.9	0.038	6.96	7.34	ND(2.5)	3.6	110	440	120	11
12/7/2022	217	217	38	ND(2)	10	0.59	140	0.57	8.1	0.024	7.42	7.14	ND(2.5)	3.6	110	452	120	1.4
2/9/2023	209.6	209.6	45	ND(2)	9.2	0.58	150	1.6	9.5	0.084	7.33	7.51	ND(2.5)	3.6	89	407	120	7.5
5/24/2023	208.4	208.4	43	ND(2)	8.5	ND(0.5)	150	0.11	9.3	0.018	7.06	7.59	ND(2.5)	3.5	87	411	110	1.4
7/12/2023	212.8	212.8	44	ND(2)	9.5	ND(0.5)	150	0.28	9	0.029	6.95	7.42	ND(2.5)	3.4	98	420	120	2.1
10/5/2023	202.8	202.8	46	ND(2)	8.6	ND(0.5)	160	0.46	10	0.022	7.21	7.54	ND(2.5)	3.1	81	414	110	7
1/17/2024	202.1	202.1	45	ND(2)	9.6	0.42	150	0.068	9.4	0.021	7.21	7.37	ND(0.5)	3.5	87	416	110	0.75
11/21/2024	220	220	39	ND(2)	13	0.54	130	0.15	9.3	0.02	6.81	7.5	ND(0.5)	3.8	110	440	130	1.8
Standard	-	-	-	-	250	1.6	-	-	-	-	6 - 9	6 - 9	-	-	-	1,000	600	-

Bold values indicate concentration or detection limit exceeds groundwater quality standard
Abbreviations:
CaCO3 - calcium carbonate, molecular weight of 100.06 g
mg/L - milligrams per liter
ND - non-detect (detection limit in parentheses)
NTU - Nephelometric Turbidity Units
s.u. - standard units

TABLE 4-5. WELL 3 HISTORICAL GROUNDWATER QUALITY DATA
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Date Sampled	Alkalinity mg/L CaCO3	Bicarbonate mg/L CaCO3	Calcium, Dissolved mg/L	Carbonate mg/L CaCO3	Chloride mg/L	Fluoride mg/L	Hardness mg/L CaCO3	Iron, Total mg/L	Magnesium, Dissolved mg/L	Manganese, Total mg/L	pH, Field s.u.	pH, Lab (s.u.)	Phosphate mg/L	Potassium, Dissolved mg/L	Sodium, Dissolved mg/L	Solids, Total Dissolved mg/L	Sulfate mg/L	Turbidity NTU
5/23/2013	159	159	98.3	ND(2)	4.7	ND(0.5)	366	0.656	22.3	0.0514	6.7	7.3	na	5.4	24.8	526	250	2.6
6/4/2015	196	196	87.9	ND(2)	21	0.65	353	1.87	20.5	0.0642	7.3	7.7	0.26	5.17	66.5	572	217	7.9
9/2/2015	185	185	90.3	ND(2)	19.9	0.84	330	2.69	21.8	0.0898	7.2	7.7	ND(0.31)	5.45	66.4	618	232	23
11/3/2015	188	188	97.4	ND(2)	18.8	0.53	368	3.18	23.7	0.104	7	7.4	ND(0.31)	5.73	65.5	631	246	11.4
2/24/2016	226	226	89	ND(2)	36.9	1.1	333	3.35	21.6	0.0676	7.4	7.5	ND(0.31)	5.65	109	655	223	29.2
5/24/2016	206	206	91.1	ND(2)	28.2	1.2	287	2.61	22.1	0.0797	7.2	7.5	ND(0.31)	5.71	88.8	633	265	22.6
7/28/2016	204	204	86.6	ND(5)	26.2	1.1	346	2.59	21.2	0.0797	7.2	7.5	ND(0.31)	5.45	79.9	649	245	25.4
11/9/2016	199	199	88.4	ND(5)	22.3	1.1	337	3.02	21.2	0.0836	7.2	7.3	ND(0.31)	5.43	72.6	581	254	17
3/3/2017	231	231	87.8	ND(5)	36.1	1.2	315	2.81	21.4	0.0841	6.2	7.6	ND(0.31)	5.54	106	620	227	31
6/7/2017	210	210	91.8	ND(5)	27.8	1.2	332	2.74	22.1	0.0698	7.3	7.8	ND(0.31)	5.83	88.5	614	294	21.8
9/27/2017	200	200	83.6	ND(5)	42.5	0.94	342	2.71	20.6	0.0735	7.2	7.4	ND(0.31)	5.77	77	613	235	20
11/20/2017	183	183	90.1	ND(5)	19.7	1.1	351	2.55	21.5	0.0824	7.4	7.3	ND(0.31)	5.78	61.4	581	210	5.5
2/22/2018	204	204	88.9	ND(5)	38.8	1.1	152	2.49	21.6	0.064	7.5	7.5	ND(0.31)	5.51	92.1	628	235	9.1
5/16/2018	184	184	93.5	ND(5)	19.5	0.98	329	2.27	22.4	0.0853	7.4	7.6	ND(0.31)	5.87	70.1	579	95.9	20
9/12/2018	221	221	87.1	ND(5)	26.6	0.97	304	2.68	21.2	0.0601	6.92	7.6	ND(0.31)	5.36	96.5	672	240	27
11/15/2018	221	221	89.1	ND(5)	24.6	1.2	311	2.28	21.6	0.0613	7	7.9	ND(0.31)	5.58	91.3	642	182	2.5
3/6/2019	203	203	92.8	ND(5)	25.3	0.72	323	2.33	22.3	0.0668	7.2	7.7	ND(0.31)	5.47	76.6	615	275	23
5/8/2019	189	189	93.5	ND(5)	19.6	1.4	346	2.55	22.4	0.0738	7.1	7.6	ND(0.31)	5.66	68.2	605	238	3.4
8/20/2019	194	194	98	ND(8)	20.8	0.8	334	2.63	23.8	0.0831	6.9	7.5	ND(0.31)	5.82	70.4	621	227	19
11/13/2019	199	199	92.4	ND(8)	23.7	1	376	1.88	22.1	0.0698	7	8	ND(0.31)	5.48	73.2	602	239	23
2/20/2020	207	207	86.1	ND(8)	29	1.1	340	1.51	21	0.0613	6.94	7.7	2.1	5.12	81.2	614	252	15
4/29/2020	204	204	90.2	ND(8)	24.8	1.4	391	1.86	21.7	0.0628	7.2	7.6	ND(0.31)	5.42	81.4	632	249	22
9/9/2020	220	220	85	ND(8)	38	1.3	360	1.8	21	0.056	7.1	7.5	ND(0.31)	5.3	100	670	220	19
10/22/2020	170	170	37	ND(8)	3.3	0.6	130	1.2	5	0.055	7	8.1	ND(0.31)	2.5	52	170	45	3.7
1/26/2021	200	200	88	ND(8)	27	1.1	330	1.8	23	0.064	7.2	7.6	ND(0.31)	5.4	94	610	230	17
5/12/2021	198.8	198.8	91	ND(2)	21	0.85	320	1.6	23	0.063	7.2	7.19	ND(2.5)	5.6	75	621	220	5.1
8/10/2021	188.5	188.5	99	ND(2)	17	0.76	340	2.6	25	0.065	7.03	7.16	ND(2.5)	5.6	69	568	240	8.2
10/27/2021	208	208	88	ND(2)	28	1.1	310	1.5	22	0.055	7.3	7.56	ND(2.5)	5.4	85	627	240	12
2/10/2022	192.8	192.8	91	ND(2)	20	0.96	320	2.1	23	0.059	7.2	7.23	ND(2.5)	5.4	64	616	230	5
4/26/2022	195.5	195.5	98	ND(2)	21	0.85	330	1.8	24	0.061	6.88	7.19	ND(0.5)	5.1	75	621	250	8.6
8/31/2022	197.6	197.6	92	ND(2)	22	0.98	320	1.5	23	0.056	7.15	7.21	ND(2.5)	5.5	75	615	230	6.4
12/7/2022	194.8	194.8	89	ND(2)	20	0.93	350	1.7	22	0.064	7.24	7.03	ND(2.5)	5.2	71	609	250	6.4
2/9/2023	204.4	204.4	92	ND(2)	22	1	320	1.4	22	0.056	7.41	7.52	ND(2.5)	5.3	77	607	230	5
6/8/2023	204.4	204.4	87	ND(2)	24	0.93	310	1.8	23	0.054	7.18	7.21	ND(2.5)	5.4	82	614	230	3.8
7/12/2023	199.3	199.3	94	ND(2)	20	0.96	330	1.2	22	0.065	6.95	7.23	ND(2.5)	5.2	75	605	220	9.5
11/16/2023	212.8	212.8	89	ND(2)	27	1.2	310	1.7	22	0.054	7.39	7.53	ND(2.5)	5.2	87	625	230	7.8
1/17/2024	206.8	206.8	89	ND(2)	25	0.99	310	1.6	22	0.056	7.36	7.26	ND(0.5)	5.3	80	626	240	8.3
12/4/2024	220	220	90	ND(2)	30	1.2	330	2.2	22	0.059	7.33	7.3	ND(0.5)	5.2	89	610	250	11
Standard	-	-	-	-	250	1.6	-	-	-	-	6 - 9	6 - 9	-	-	-	1,000	600	-

Bold values indicate concentration or detection limit exceeds groundwater quality standard
Abbreviations:
CaCO3 - calcium carbonate, molecular weight of 100.06 g
mg/L - milligrams per liter
ND - non-detect (detection limit in parentheses)
NTU - Nephelometric Turbidity Units
na - not analyzed
s.u. - standard units

TABLE 4-6. WELL MBR2 HISTORICAL GROUNDWATER QUALITY DATA
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Date Sampled	Alkalinity mg/L CaCO3	Bicarbonate mg/L CaCO3	Boron, Total mg/L	Calcium, Total mg/L	Carbonate mg/L CaCO3	Cation-Anion Balance Percent	Chloride mg/L	Conductance, Field µS/cm	Fluoride mg/L	Hardness mg/L CaCO3	Iron, Dissolved mg/L	Iron, Total mg/L	Magnesium, Total mg/L	Manganese, Dissolved mg/L	Manganese, Total mg/L	Nitrogen Nitrate mg/L	pH, Field s.u.	pH, Lab s.u.	Phosphate mg/L	Phosphorus, Total mg/L	Potassium, Total mg/L	Selenium, Total mg/L	Sodium, Total mg/L	Solids, Total Dissolved	Sulfate mg/L	Zinc, Total mg/L
11/12/2013	590	590	0.154	5.32	ND(2)	0.89	6.9	2060	**5.4**	NM	**2.21**	2.59	1.8	0.0205	0.0214	ND(0.1)	7.5	7.9	ND(0.31)	0.0545	3.3	ND(0.02)	485	**1,520**	581	0.0108
10/22/2014	520	520	0.164	6.87	ND(2)	38.87	6.3	2340	**4.3**	44.6	ND(0.2)	0.353	1.54	0.0205	0.023	ND(0.1)	7.3	7.9	ND(0.31)	0.0196	2.48	0.0069	544	**1,400**	595	0.0043
11/19/2015	539	539	0.173	6.77	ND(2)	1.72	7.1	2150	**4.6**	36.6	ND(0.2)	10.5	3.93	0.0122	0.0606	ND(0.1)	7.8	7.6	ND(0.31)	0.135	5.77	ND(0.02)	490	**1,500**	562	0.0486
11/9/2016	564	564	0.159	5.14	ND(5)	0.12	7.7	2420	**5.9**	25.2	ND(0.2)	1.52	1.6	0.0074	0.0172	0.055	8.0	7.9	ND(0.31)	0.0456	2.79	ND(0.02)	490	**1,400**	569	0.0079
11/15/2017	519	519	0.159	6.43	ND(5)	3.55	7.3	2380	**4.7**	22.5	0.113	0.218	1.47	0.0322	0.0307	ND(0.1)	7.7	7.9	ND(0.31)	ND(0.1)	2.41	ND(0.02)	500	**1,660**	573	ND(0.02)
11/14/2018	519	519	0.161	7.06	ND(5)	1.68	6.9	2300	**6.8**	18.6	ND(0.2)	0.313	1.53	0.0244	0.0262	ND(0.1)	7.4	7.9	ND(0.31)	ND(0.1)	2.33	ND(0.05)	498	**1,310**	595	ND(0.02)
11/13/2019	568	568	0.151	6.1	ND(8)	3.88	7.6	2350	**5.2**	25.7	0.325	3.07	2.14	0.0129	0.0302	ND(0.1)	7.4	8.1	ND(0.31)	0.0809	3.84	ND(0.05)	511	**1,400**	542	0.0196
10/28/2020	510	510	0.17	6.7	ND(8)	3.63	7	2040	**4.7**	27	ND(0.21)	0.068	1.5	0.022	0.022	0.1	7.5	7.5	ND(0.31)	ND(0.1)	2.4	ND(0.05)	510	**1,200**	590	ND(0.02)
10/27/2021	568.5	568.5	0.2	9.5	ND(2)	5.27	7.1	2070	**4.9**	36	0.53	4.3	2.8	0.06	0.083	ND(0.5)	7.6	7.7	ND(2.5)	0.094	4.3	ND(0.005)	540	**1,600**	580	0.023
11/9/2022	576.6	576.6	0.17	5.4	ND(2)	4.37	6.7	2300	**4.9**	20	ND(0.02)	1.1	1.6	0.011	0.018	ND(0.5)	7.4	7.8	ND(2.5)	0.16	2.9	ND(0.001)	520	**1,460**	540	ND(0.01)
10/17/2023	530.1	530.1	0.18	6	ND(2)	2.33	6.8	2330	**4.6**	21	ND(0.02)	0.29	1.5	0.011	0.018	ND(0.5)	7.9	7.7	ND(2.5)	ND(0.05)	2.4	ND(0.001)	510	**1,510**	600	ND(0.01)
10/9/2024	580	580	0.27	120	ND(2)	5.64	7.2	2240	**5.4**	370	ND(0.02)	ND(0.05)	18	0.013	0.004	ND(1)	7.6	7.9	ND(2.5)	0.12	25	0.0014	250	**1,600**	540	0.044
Standard	-	-	-	-	-	-	250	-	1.6	-	1	-	-	0.2	-	10	6 - 9	6 - 9	-	-	-	0.05	-	1,000	600	10

Bold values indicate concentration or detection limit exceeds groundwater quality standard
Abbreviations:
CaCO3 - calcium carbonate, molecular weight of 100.06 g
mg/L - milligrams per liter
ND - non-detect (detection limit in parentheses)
NTU - Nephelometric Turbidity Units
s.u. - standard units

TABLE 4-7. WELL MBR5 HISTORICAL GROUNDWATER QUALITY DATA
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Date Sampled	Alkalinity mg/L CaCO3	Bicarbonate mg/L CaCO3	Boron, Total mg/L	Calcium, Total mg/L	Carbonate mg/L CaCO3	Cation-Anion Balance Percent	Chloride mg/L	Conductance, Field µS/cm	Fluoride mg/L	Hardness mg/L CaCO3	Iron, Dissolved mg/L	Iron, Total mg/L	Magnesium, Total mg/L	Manganese, Dissolved mg/L	Manganese, Total mg/L	Nitrogen Nitrate mg/L	pH, Field s.u.	pH, Lab s.u.	Phosphate mg/L	Phosphorus, Total mg/L	Potassium, Total mg/L	Selenium, Total mg/L	Sodium, Total mg/L	Solids, Total Dissolved mg/L	Sulfate mg/L	Zinc, Total mg/L
11/12/2013	985	985	0.196	28.8	ND(2)	1.16	95.50	3610	**4.4**	NA	0.442	1.72	14.6	**0.372**	0.394	ND(0.1)	7.4	7.7	ND(0.31)	ND(0.1)	5.11	ND(0.02)	810	**2420**	**877**	0.0122
10/22/2014	903	903	0.172	15.7	ND(2))	36.15	84.70	3150	**5.1**	81	0.208	1.42	8.25	0.183	0.207	ND(0.1)	7.6	7.9	ND(0.31)	0.0358	3.7	ND(0.02)	689	**1790**	590	0.0541
11/5/2015	812	809	0.154	4.31	2.8	9.63	58.60	2210	**7.8**	25.3	0.0802	1.55	1.81	0.0324	0.0343	ND(0.1)	7.54	8.3	ND(0.31)	0.0577	2.4	ND(0.02)	579	**1540**	289	0.0137
11/9/2016	854	830	0.173	23.1	23.1	9.33	70.60	3030	**6.8**	139	0.323	29.6	10.1	0.151	0.247	ND(0.1)	8.1	8.4	1.1	0.5	7.5	ND(0.02)	573	**1650**	389	0.17
11/14/2017	828	797	0.158	3.1	30.9	3.20	66.40	14140	**8.9**	11.7	ND(0.2)	0.49	1.14	0.0098	0.0125	ND(0.1)	8.7	8.5	ND(0.31)	0.0317	2.18	ND(0.02)	582	**1290**	308	ND(0.02)
11/14/2018	830	808	0.146	2.83	21.5	0.05	79.50	2430	**13.3**	10.8	0.727	ND(0.2)	0.961	0.0134	0.009	ND(0.1)	8.7	8.4	ND(0.31)	ND(0.1)	2.02	ND(0.05)	536	**1490**	319	ND(0.02)
11/14/2019	875	824	0.178	8.17	51.4	0.79	130.00	2450	**6.7**	43	0.0899	1.38	4.23	0.0943	0.106	ND(0.1)	8.3	8.5	ND(0.31)	0.0314	3.03	ND(0.05)	630	**1660**	410	0.016
10/28/2020	940	930	0.17	14	ND(8)	4.77	92.00	2.65	**5.9**	74	0.22	2.1	7.4	0.2	0.23	ND(0.1)	8.2	8.3	ND(0.31)	0.043	3.8	ND(0.05)	680	**1400**	480	0.0096
10/27/2021	908.7	908.7	0.18	7.6	ND(2)	7.41	77.00	2500	**7.5**	34	0.19	0.86	3.6	0.09	0.11	ND(0.5)	8.39	8.28	ND(2.5)	0.0	2.8	ND(0.005)	660	**1700**	380	ND(0.01)
11/8/2022	959.4	959.4	0.17	16	ND(2)	9.87	80.00	2930	**5.2**	75	ND(0.02)	2.7	8.8	**0.25**	0.26	ND(0.5)	8.05	8.17	ND(2.5)	0.1	3.8	ND(0.001)	720	**1800**	420	ND(0.01)
10/18/2023	901.8	879.7	0.16	6.6	22.08	4.16	74.00	2730	**7.9**	34	ND(0.02)	5	4.2	0.059	0.088	ND(1)	8.58	8.48	ND(5)	ND(0.25)	5.0	0.0011	600	**1680**	340	0.021
10/8/2024	900	870	0.15	4.6	31	4.74	79.00	2560	**8.5**	22	ND(0.02)	3.5	2.6	0.031	0.049	ND(1)	8.62	8.6	ND(2.5)	0.1	3.0	0.0015	590	**1600**	280	0.014
Standard	-	-	-	-	-	-	250	-	1.6	-	1	-	-	0.2	-	10	6 - 9	6 - 9	-	-	-	0.05	-	1000	600	10

Bold values indicate concentration or detection limit exceeds groundwater quality standard
Abbreviations:
CaCO3 - calcium carbonate, molecular weight of 100.06 g
mg/L - milligrams per liter
ND - non-detect (detection limit in parentheses)
NTU - Nephelometric Turbidity Units
s.u. - standard units

TABLE 4-8. WELL 11 HISTORICAL GROUNDWATER QUALITY DATA
CHEVRON MINING, INC, McKINLEY MINE
NEAR GALLUP, NEW MEXICO

Date Sampled	Alkalinity mg/L CaCO3	Bicarbonate mg/L CaCO3	Boron, Total mg/L	Calcium, Total mg/L	Carbonate mg/L CaCO3	Cation-Anion Balance Percent	Chloride mg/L	Conductance, Field µS/cm	Fluoride mg/L	Hardness mg/L CaCO3	Iron, Dissolved mg/L	Iron, Total mg/L	Magnesium, Total mg/L	Manganese, Dissolved mg/L	Manganese, Total mg/L	Nitrogen Nitrate mg/L	pH, Field s.u.	pH, Lab s.u.	Phosphate mg/L	Phosphorus, Total mg/L	Potassium, Total mg/L	Selenium, Total mg/L	Sodium, Total mg/L	Solids, Total Dissolved	Sulfate mg/L	Zinc, Total mg/L
8/21/2013	1820	1820	0.261	144	ND(2)	0.69	36	1018	ND(0.5)	na	0.566	2.64	48.7	**0.678**	0.664	1.8	6.7	7	ND(0.1)	0.0464	15.4	ND(0.02)	2380	**6400**	**3960**	0.0138
11/7/2013	1940	1940	0.271	168	ND(2)	3.95	36.8	8240	ND(0.5)	na	0.267	2.51	55.8	**1.52**	1.53	ND(0.1)	6.6	6.9	ND(0.31)	ND(0.1)	18.2	ND(0.02)	2360	**7200**	**3570**	0.0141
2/12/2014	1860	1860	0.253	139	ND(2)	6.81	37.2	14510	ND(0.5)	na	0.979	3.91	46.8	**0.649**	0.651	ND(1)	6.7	7	ND(0.31)	ND(0.1)	15.5	ND(0.02)	2210	**7760**	**4400**	0.0152
4/15/2014	1850	1850	0.25	149	ND(2)	2.57	35.1	9040	ND(0.5)	na	0.655	3.09	49.9	**0.8**	0.766	ND(0.1)	6.6	7	ND(0.31)	ND(0.1)	15.7	ND(0.02)	2260	**8300**	**4110**	0.011
8/21/2014	1820	1820	0.267	144	ND(2)	7.11	35.2	9820	ND(0.5)	568	0.0782	1.73	47.3	**0.715**	0.732	ND(0.5)	6.7	7.3	ND(0.31)	0.0143	15.4	ND(0.02)	2350	**6940**	**3320**	0.0141
10/22/2014	1850	1850	0.254	146	ND(2)	1.87	39.7	9710	ND(0.5)	551	**3.64**	3.74	49	**0.809**	0.814	ND(1)	6.7	7.1	ND(0.31)	0.0406	16.1	ND(0.02)	2370	**5570**	**3200**	0.0196
2/10/2015	1890	1890	0.258	146	ND(2)	2.51	36.2	10010	0.29	618	0.141	2.25	48.3	**0.761**	0.748	ND(1)	6.6	7.3	0.28	0.0525	15.9	0.0065	2250	**7990**	**3500**	0.0154
4/29/2015	1870	1870	0.236	139	ND(2)	2.38	31.3	9920	0.46	598	0.231	4.16	47.4	**0.726**	0.733	ND(0.1)	7.2	7.4	ND(0.31)	0.0418	15.6	ND(0.02)	2280	**5720**	**3470**	0.019
9/1/2015	1780	1780	0.251	139	ND(2)	3.92	38.1	9320	ND(0.5)	669	0.359	3.59	46.1	**0.74**	0.738	ND(0.1)	6.7	7.2	ND(0.31)	0.0279	15.7	ND(0.02)	2260	**7840**	**3340**	0.0143
11/5/2015	1850	1850	0.228	141	ND(2)	1.55	37.2	8340	ND(0.5)	598	**3.09**	5.34	46.6	**0.953**	0.949	ND(0.1)	6.49	7.2	ND(0.31)	0.0189	17.9	ND(0.02)	2130	**7780**	**3690**	0.0093
2/24/2016	1860	1860	0.253	141	ND(2)	5.20	35.8	9820	ND(0.5)	614	**1.2**	2.92	47.8	**0.797**	0.754	ND(0.1)	6.8	7.4	ND(0.31)	0.0282	15.5	ND(0.02)	1970	**7250**	**3430**	0.0141
5/24/2016	1850	1850	0.268	153	ND(2)	0.30	34.9	9870	ND(0.5)	591	0.885	1.99	50.7	**0.798**	0.807	ND(0.1)	9	7.3	ND(0.31)	0.0146	15.4	ND(0.02)	2160	**6970**	**3620**	0.0067
7/28/2016	1560	1560	0.255	145	ND(50)	1.22	35.6	9650	ND(0.5)	597	0.915	2.01	46.7	**0.751**	0.762	ND(0.1)	7	7.1	ND(0.31)	0.0141	15.2	ND(0.02)	2150	**7010**	**3610**	0.0064
11/9/2016	1930	1930	0.256	151	ND(5)	1.48	33.7	10290	ND(0.5)	612	0.59	1.5	51.1	**0.814**	0.807	ND(0.1)	6.7	7.1	ND(0.31)	0.0141	21.5	ND(0.02)	2190	**5980**	**3710**	0.0071
3/1/2017	2030	2030	0.26	239	ND(5)	43.73	38	10130	ND(0.5)	861	0.724	4.12	73.4	**2.25**	2.46	0.23	6.8	7.1	ND(0.31)	ND(0.1)	19.5	ND(0.02)	2330	**7260**	**4610**	0.0192
6/8/2017	2000	2000	0.273	221	ND(5)	6.12	38.8	10060	ND(0.5)	807	**6.23**	10.9	69.5	**2.13**	2.21	0.077	6.8	6.7	3410	0.0459	21	ND(0.02)	2250	**8660**	**4480**	0.017
8/23/2017	2020	2020	0.244	242	ND(5)	4.11	39.6	10410	ND(0.5)	860	**6.87**	7.68	75.1	**2.68**	2.68	ND(0.1)	6.7	6.9	ND(0.31)	0.05	22.4	ND(0.02)	2450	**7500**	**4020**	0.0278
11/14/2017	2020	2020	0.239	226	ND(5)	1.64	40.8	10450	ND(0.5)	849	**6.51**	9.42	75.2	**2.48**	2.52	ND(0.1)	6.8	7	ND(0.31)	0.0515	23.9	ND(0.02)	2410	**3870**	**4410**	0.015
2/21/2018	2000	2000	0.229	242	ND(5)	3.07	106	10580	ND(0.5)	771	**3.47**	7.59	73.6	**2.57**	2.76	ND(0.1)	6.7	7	ND(0.31)	ND(0.1)	19.9	ND(0.02)	2500	**8000**	**4030**	0.0152
5/3/2018	2060	2060	0.239	263	ND(5)	3.07	38.1	10770	ND(0.5)	949	**5.15**	7.92	78.7	**2.72**	3.19	0.083	6.7	6.7	ND(0.31)	0.0439	19.6	ND(0.02)	2290	**8790**	**4230**	0.0247
8/2/2018	2010	2010	0.26	266	ND(5)	1.37	38.8	10290	ND(0.5)	939	**8.08**	9.61	82.5	**3.14**	3.21	ND(0.1)	6.7	6.9	0.26	0.0555	19.8	ND(0.05)	2570	**6420**	**4150**	0.0297
11/14/2018	2070	2070	0.252	266	ND(5)	5.82	30.8	10350	ND(0.5)	1070	**8.17**	9.4	83	**3.11**	3.21	0.068	6.7	7.2	ND(0.31)	0.0621	21	ND(0.05)	2390	**8620**	**3650**	0.0199
3/7/2019	2100	2100	0.231	243	ND(5)	4.77	35.7	10.49	ND(0.5)	1090	**7.53**	7.98	76.6	**3.5**	2.93	ND(0.1)	6.7	7.4	ND(0.31)	0.0654	17	ND(0.05)	2220	**7660**	**4390**	0.0143
5/14/2019	2030	2030	0.252	265	ND(5)	2.56	38.2	1029	ND(0.5)	1000	**5.12**	10.9	86.6	**3.53**	3.3	ND(0.1)	6.8	7.2	ND(0.31)	0.0579	19.6	ND(0.05)	2430	**8250**	**4120**	0.0169
8/20/2019	2060	2060	0.253	158	ND(8)	0.65	41.8	9930	ND(0.5)	610	0.638	2.34	52.6	**0.958**	0.973	ND(0.1)	6.8	7	ND(0.31)	ND(0.1)	18.1	ND(0.05)	2280	**7390**	**3620**	0.0188
11/13/2019	2050	2050	0.26	160	ND(8)	0.36	36.1	9880	ND(0.5)	516	0.619	3.15	52.7	**0.932**	0.958	ND(0.1)	6.9	7.5	ND(0.31)	0.0398	16.3	ND(0.05)	2220	**7760**	**3620**	0.0185
2/19/2020	2020	2020	0.233	157	ND(8)	2.92	33.8	9.09	ND(0.5)	684	0.559	1.79	52.7	**0.946**	0.881	ND(0.1)	6.41	7.2	ND(0.31)	ND(0.1)	16	ND(0.05)	2000	**5990**	**3430**	0.0113
5/13/2020	2040	2040	0.257	156	ND(8)	4.13	32.7	10.11	ND(0.5)	669	0.418	2.01	52.1	**0.865**	0.906	ND(0.1)	6.7	7.4	ND(0.31)	ND(0.1)	15.2	ND(0.05)	2140	**7350**	**3520**	0.007
9/1/2020	2100	2100	0.25	160	ND(8)	0.25	53	9960	ND(0.5)	670	0.18	0.74	53	**1**	1	0.093	6.7	7.2	ND(0.31)	ND(0.1)	16	ND(0.05)	2300	**7300**	**3500**	0.0096
10/22/2020	2200	2200	0.27	160	ND(8)	2.88	52	9.7	ND(0.5)	660	0.97	0.68	50	**0.94**	1	ND(0.1)	6.7	7.3	ND(0.31)	ND(0.1)	18	ND(0.05)	2200	**3100**	**3700**	0.01
1/21/2021	1900	1900	0.3	160	ND(8)	4.42	46	8620	0.81	710	0.53	1.9	57	**0.9**	0.97	ND(0.1)	6.6	7.4	ND(0.31)	ND(0.1)	17	ND(0.05)	2400	**7500**	**4600**	0.0089
5/5/2021	1435	1369	0.26	150	66.2	5.66	34	9010	ND(0.5)	590	0.28	1.8	54	**0.96**	0.9	ND(0.5)	6.7	7.44	ND(2.5)	ND(0.05)	17	ND(0.001)	2200	**7480**	**3400**	ND(0.01)
8/10/2021	2036	2036	0.27	160	ND(5)	0.63	35	8750	ND(0.5)	620	0.55	1.8	54	**0.98**	0.94	ND(0.5)	6.67	6.91	ND(2.5)	ND(0.1)	17	ND(0.005)	2300	**7400**	**3700**	ND(0.05)
11/10/2021	2020	2020	0.26	140	ND(5)	5.89	33	8770	ND(0.5)	570	0.78	1.9	52	**0.89**	0.92	ND(0.5)	6.81	7.09	ND(2.5)	ND(0.05)	15	ND(0.005)	2500	**7500**	**3500**	ND(0.01)
2/9/2022	2056	2056	0.26	170	ND(5)	1.72	34	9080	ND(0.5)	680	0.12	1.5	62	**1.7**	1.5	ND(0.5)	6.91	7.21	ND(2.5)	ND(0.25)	17	ND(0.005)	2300	**8140**	**4000**	0.017
4/26/2022	2093	2093	0.28	200	ND(5)	7.00	34	8920	ND(0.5)	760	**1.7**	11	64	**1.3**	1.8	ND(0.5)	6.64	7.03	ND(2.5)	0.3	17	ND(0.001)	2500	**7740**	**3500**	ND(0.05)
9/26/2022	2051	2051	0.28	170	ND(5)	10.14	33	10090	ND(0.5)	660	**1.5**	2.3	57	**0.91**	0.94	ND(0.5)	6.63	7.24	ND(2.5)	ND(0.05)	16	ND(0.005)	2600	**6580**	**3300**	ND(0.01)
11/10/2022	1943	1943	0.23	170	ND(5)	3.69	33	9970	ND(0.5)	680	0.89	3.2	60	**0.81**	0.81	ND(1)	6.86	7.46	ND(2.5)	0.079	15	ND(0.005)	2300	**7840**	**3500**	ND(0.01)
2/8/2023	1996	1996	0.29	170	ND(5)	20.44	33	9860	ND(1)	650	**1.3**	2.5	55	**0.8**	0.91	ND(1)	6.98	6.84	ND(5)	ND(0.25)	17	ND(0.005)	2600	**6260**	**3700**	ND(0.01)
5/4/2023	1998	1998	0.3	190	ND(5)	3.65	33	10960	ND(0.5)	700	**1.1**	2	58	**0.95**	1.2	ND(0.5)	6.62	7.15	ND(2.5)	ND(0.05)	17	0.0053	2300	**7820**	**3500**	ND(0.01)
7/12/2023	2010	2010	0.26	160	ND(5)	7.17	33	9960	ND(1)	610	0.96	1.8	52	**1**	0.94	ND(1)	6.43	6.99	ND(5)	ND(0.05)	16	ND(0.001)	2600	**7280**	**3600**	ND(0.01)
10/5/2023	1965	1965	0.26	170	ND(5)	4.29	34	10020	ND(1)	660	0.43	1.9	58	**0.91**	0.97	ND(1)	6.7	7.01	ND(5)	ND(0.25)	18	ND(0.001)	2500	**8630**	**3800**	ND(0.01)
1/18/2024	2032	2032	0.27	190	ND(5)	0.01	36	9800	ND(0.5)	760	0.35	2.3	67	**0.99**	1.7	ND(0.5)	6.77	7.19	ND(2.5)	0.35	17	ND(0.005)	2400	**7670**	**4100**	ND(0.01)
10/10/2024	2100	2100	0.29	180	ND(5)	4.20	39	9430	ND(1)	690	0.57	2.8	62	**1**	1.1	ND(1)	6.44	7.1	ND(5)	ND(0.05)	17	ND(0.001)	2400	**7900**	**4500**	ND(0.01)
Standard	-	-	-	-	-	-	250	-	1.6	-	1	-	-	0.2	-	10	6 - 9	6 - 9	-	-	-	0.05	-	1000	600	10

Bold values indicate concentration or detection limit exceeds groundwater quality standard

Abbreviations:

CaCO3 - calcium carbonate, molecular weight of 100.06 g

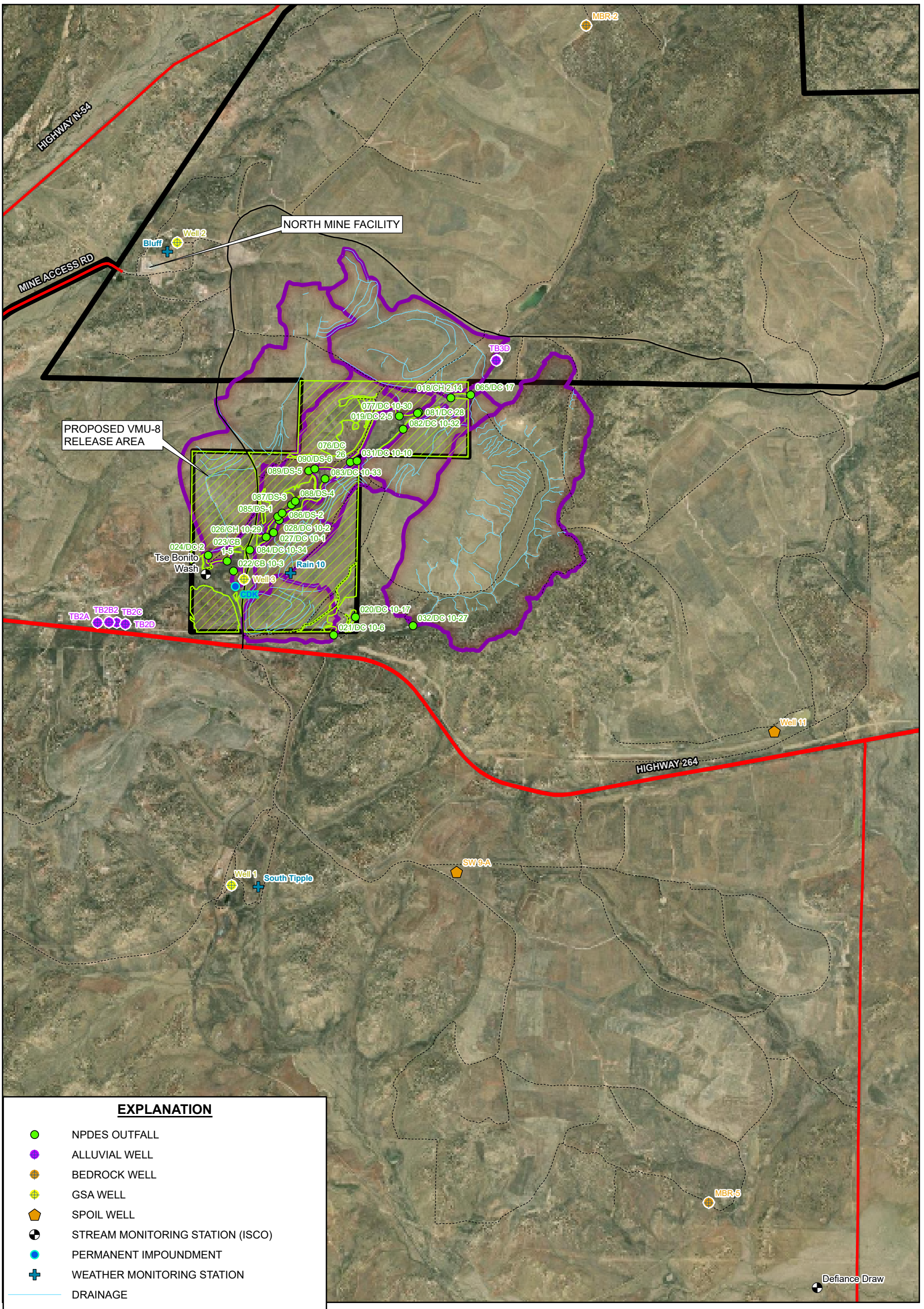
mg/L - milligrams per liter

ND - non-detect (detection limit in parentheses)

NTU - Nephelometric Turbidity Units

s.u. - standard units

FIGURE



EXPLANATION

- NPDES OUTFALL
- ALLUVIAL WELL
- BEDROCK WELL
- GSA WELL
- SPOIL WELL
- STREAM MONITORING STATION (ISCO)
- PERMANENT IMPOUNDMENT
- WEATHER MONITORING STATION
- DRAINAGE
- HIGHWAY
- ANCILLARY ROAD
- TWO TRACK TRAIL
- POND BOUNDARY
- PHASE III RELEASE AREA
- WATERSHED BOUNDARY
- MINE BOUNDARY

N

0 3,000'

Trihydro CORPORATION
1252 Commerce Drive
Laramie, WY 82070
www.trihydro.com
(P) 307/745.7474 (F) 307/745.7729

FIGURE 2-1

VMU 8 PROPOSED BOND RELEASE AREAS

CHEVRON MINING INC.
MCKINLEY MINE
MCKINLEY COUNTY, NEW MEXICO

Drawn By: PH	Checked By: TR	Scale: 1" = 3,000'	Date: 12/10/25	File: Fig2-1_VMU_8_PBRA

M:\CHEVRON\CEMC_MINING\MCKINLEY\MINE\GIS\PROJECTS\MMD\PHASEIII_BOND\RELEASE\HYDROREPORTS\2025\11_VMU-8\MCKINLEY_20251_VMU8.APRX

APPENDIX A

MCKINLEY MINE PERMIT SECTION 3.4, HYDROLOGY INFORMATION

- (108°56'40"; 35°41'38") 16.1 ac-ft/annum (File No. G-93)
- (108°54'35"; 35°40'52") 16.1 ac-ft/annum (File No. G-94)
- (SW¼, NW¼, SE¼ Sec 14, T16N, R20W) 16.1 ac-ft/annum (File No. G-95)
- (NW¼, SE¼, NW¼ Sec 9, T16N, R20W) Domestic/Sanitary (File No. G-258)

A search of the Office Of The State (NM) Engineer records indicates the following additional groundwater rights holders in the vicinity of McKinley Mine (Appendix 3.4-A):

- (NW¼, NE¼ Sec 3, T16N, R21W) (File No. G-160, M. Abukhalil, Domestic)
- (NE¼, NW¼, Sec 1, T16N, R21W) (File No. G-28, W. Bald, Domestic)
- (SE¼, NE¼, SE¼ Sec 11, T16N, R20W) (File No. G-51, C. Wilhelm, Stock)
- (NW¼, SE¼, SE¼ Sec 9, T16N, R20W) (File No. G-390, N. Murphy, Domestic)
- (NW¼, NW¼ Sec 9, T16N, R20W) (File No. G-976, B. Nicholson, Domestic)
- (NE¼, NE¼ Sec 7, T16N, R20W) (File No. G-131, C. Harris, Domestic/Stock)
- (SW¼, NW¼, SE¼ Sec 1, T16N, R20W) (File No. G-677, N. Nation, Domestic)

3.4.3 HYDROLOGIC MODELING

Appendix 3.4-E contains modeling information which characterizes and contrasts surface water quality and quantity for medium sized watersheds in undisturbed, disturbed, and reclaimed surficial conditions.

3.4.4 PROBABLE HYDROLOGIC CONSEQUENCES (PHC)

The PHC addresses existing mining areas and the new mining area referred to as the "East Wing." The addition of 1870 acres in the East Wing Revision does not alter any of the surface or groundwater parameters addressed in the PHC. To address the addition of the East Wing, a separate and detailed update follows this general PHC analysis.

The validity of the PHC for the existing mining areas and the East Wing is supported by surface and ground water sampling programs conducted by P&M since 1980, which verify the original assumptions of runoff quantity and quality in the PHC. Surface and groundwater monitoring data is submitted to the OSM quarterly and as part of the Annual Report. A collection of studies, which analyze the data for both surface and groundwater, further verify the validity of the basis for the PHC and are included in this PAP at Appendix 3.4-G for surface water and Appendix 3.4-H for ground water.

Data collected from the surface water sampling program includes small (1.2 - 6.1 acres), medium (188 - 235 acres) and large (5.7 - 27.5 square miles) paired watersheds. Quarterly ground water sampling results show a slight reduction in the sparse alluvial and bedrock aquifers, and confirm the stagnant nature and poor quality of the aquifers. Sampling of the Gallup Aquifer shows no reduction in pumping quantity other than ordinary well usage drawdown and no change in quality.

In summary, more surface water will be retained on the reclaimed areas resulting in a slight reduction in runoff to the Puerco River drainage. The quality of surface runoff from the reclaimed areas has been shown to improve due to lower suspended solids and total settleable solids. PATFM management will improve effluent levels of dissolved solids, salinity, and alkalinity. The ground water quantity will be reduced slightly in the alluvial and bedrock aquifers. There will be negligible impact on ground water quality in the alluvial and bedrock aquifers, and none in the Gallup Sandstone.

SURFACE WATER QUANTITY

Surface water quantity may be increased on the reclaimed areas through the construction of small impoundments. These impoundments will be used to provide water for livestock and wildlife and to create small riparian habitats for small mammals, birds and reptiles. The amount of postmining runoff as compared to the premining runoff to the Puerco River drainage will be diminished by the harvesting of the water in the impoundments and other riparian areas. This reduction of runoff is supported by the hydrologic model included in Appendix 3.4-E of this application. However, the impact on the Puerco River drainage will be negligible due to the small percentage of the drainage area that the McKinley Mine comprises.

SURFACE WATER QUALITY

For a short term following reclamation of an area there may be a slight increase in the levels of total dissolved solids, sulfates, and other soluble elements in the overburden. This increase will eventually lessen as the runoff leaches the overburden. This potential slight increase will be documented by the collection and analysis of surface water runoff during the permit term as described in Section 6.3. The long term surface water PHC is described below.

Physical Quality

Surface water physical quality will be improved through stabilization of the reclamation areas and the creation of post mining impoundments. These actions will result in lower TSS and T-Set-S in the runoff from the disturbed areas. The PHC is evaluated using hydrologic models contained in Appendix 3.4-E of the permit application, and through the collection of TSS and T-Set-S samples during flow events. The modeling indicated that per acre sediment yields from the mining and post-mining areas will be less than from the pre-mining areas. The analytical results indicate that the TSS concentrations from the disturbed watershed are consistently lower than the undisturbed watershed concentrations since monitoring began as documented in the Annual Hydrology Reports submitted to OSM. The following section provides a summary of the sediment yield modeling provided in Appendix 3.4.E.

The Area 6 total sediment yield from the 10-year, 24-hour precipitation event was estimated to be 415.4 tons, 472.3 tons, and 189.1 tons for the pre-mining, mining and

reclamation, and post-mining evaluations, respectively. On a per acre basis, sediment delivery equates to 0.45 tons/acre, 0.41 tons/acres, and 0.16 tons/acre for the pre-mining, mining and reclamation, and post-mining disturbance phases, respectively.

The average per acre sediment loading for the pre-mining condition is higher than for the mining and reclamation or post-mining conditions. For the mining and reclamation conditions, low sediment volumes are generated from reclaimed areas with BTCA sediment control practices, while somewhat higher sediment volumes are generated from the graded spoils where BTCA practices were not implemented. Nevertheless, the worst-case mining and reclamation condition does not exceed the pre-mining condition's average sediment loading values.

The volume of the sediment generated during the post-mining disturbance phase (when all disturbed areas have received a BTCA sediment control treatment) is significantly lower than either the pre-mining or mining and reclamation conditions. This leads to the conclusion that once BTCA practices are fully implemented, sediment transport is significantly reduced at the Mine compared to pre-mining conditions.

The times to peak sediment loading were estimated to occur at 12.4 hours, 12.0 hours and 12.2 hours for the pre-mining, mining and reclamation, and post-mining disturbance phases, respectively. These represent the period between commencement of the storm event and the time the peak sediment loading will be realized in runoff waters. The time to peak sediment loading for the pre-mining model corresponds to the time of peak runoff. The time to peak loading for the mining and reclamation and post-mining condition occurs approximately one hour before peak runoff occurs.

The predicted runoff volumes from the 10-year, 24-hour precipitation event for the three disturbance phase conditions are as follows: Pre-mining = 0.0389 acre-feet per acre of watershed, Mining and Reclamation = 0.0338 acre-feet per acre of watershed, and Post-mining = 0.023 acre-feet per acre of watershed. On a per acre basis, the largest volume of runoff occurs from lands in the pre-mining condition. The BTCA practices of land imprinting, mulching and revegetation utilized during the mining and reclamation, and post-mining disturbance phases reduce the overland flow velocity. As flow velocity is reduced, the runoff has increased opportunity to infiltrate into the soil and further reduce the volume of overland flow. Reduction in flow in turn reduces runoff, sediment carrying capacity and sediment delivery. Thus, the regulatory objective of preventing the contributions of additional suspended solids is met through the BTCA practices designed to harvest water and enhance soil moisture conditions in reclaimed areas. Also, water harvesting acts to stimulate plant growth and development. Increased vegetation cover in turn acts to improve the hydrologic characteristics of reclaimed lands.

Chemical Quality

Surface water chemical quality will be unaffected or could possibly improve by minimizing the potential of runoff coming into contact with potentially acid or toxic materials (PATFM). These materials consist of those uncovered during the mining operations, native soil materials that of are poor quality, and naturally occurring exposed coal seams. The PATFM Management program which is discussed in Section 5.2 of this permit, will identify graded spoil areas that have acid or toxic materials present in or near the rooting zone. Areas identified through this program will be mitigated prior to revegetation. These actions will prevent the degradation of the surface water quality within the mine and improve the effluent levels of dissolved solids, salinity, and alkalinity.

GROUNDWATER QUANTITY

Gallup Sandstone Aquifer

As discussed above, the Gallup Sandstone Aquifer is used as the primary source of water for the mine and for the McKinley County area. This aquifer occurs 400 to 1,000 feet below the lowest coal seam to be recovered and has no local recharge features. The recharge area for this aquifer is located to the north of McKinley Mine in the Chuska Mountains.

P&M drilled it's first large scale water supply well in 1975 and began measurement of withdrawals from their four supply wells in 1986. The average rate of groundwater withdrawal for the Mine between 1986 and 2002 is 275 ac-ft/yr. Under the imposed pumping stress, the potentiometric surface (as defined by the Mines production wells) has sustained a maximum rate of decline of 3.1 ft/yr in Wells #1 and #3, a 14-foot rise at Well #2, and has remained stable at Well #3A (Tetra Tech EM Inc. 2003).

The potentiometric surface defined by Wells #2 and #3A suggest that water levels in much of the Mine area are stable or rising. This condition has resulted from less water production or use of Wells #2 and 3A over the last five years.

Measured drawdown of the potentiometric surface within the Gallup Sandstone aquifer is between 700 to 1,000 feet in some of the older wells in the Yah-ta-hey well field located east of the Mine (NWCOG, 1998). This is the primary source of water for the City of Gallup. The dramatic decline in local water levels is the result of low storage within the Gallup Sandstone and large pumping interferences between closely spaced production wells.

Under the current Mine water production schedule, the probable hydrologic consequence of continued pumping is minimal to non-existent. Annual water withdrawals at the Mine represent less than 5% of total groundwater withdrawals from the Gallup Sandstone aquifer in the region.

To further substantiate this information and to show current information pertaining to the Gallup Sandstone formation, P&M developed a revised structure map of the Gallup Sandstone formation. This map has been included in this application as Exhibit 3.4-1. It should be noted that this map supplements or supersedes information provided in Appendix 3.4-C pertaining to the Gallup Sandstone formation. The changes made in the Gallup Sandstone Structure map are based on information collected from the drill logs for the four Gallup Sandstone Aquifer wells in use at McKinley Mine, therefore only the information in the immediate vicinity of the Mine has been modified.

In addition, P&M has developed a map showing the potentiometric surface of the Gallup Aquifer (Exhibit 3.4-2). Elevations of the potentiometric surface of the Gallup Sandstone Aquifer reflect an estimate of current static water levels for the four Gallup Sandstone Aquifer wells in use at McKinley Mine. As with Exhibit 3.4-1, only the information in the immediate vicinity of the Mine has been modified.

The potentiometric surface depicted on Exhibit 3.4-2 of the Mine permit application shows that groundwater flows in an east-northeast direction in the vicinity of the Mine. The potentiometric surface slopes from the hogback located immediately west of the Mine toward a pronounced trough defined by the 6600-, 6500-, and 6400-foot contours. The trough appears to drain groundwater toward the northeast or San Juan Basin. Geohydrology Associates, Inc (1980) were the first investigators to identify the trough feature, which appears to still exist.

Alluvial Aquifers

As discussed above, alluvial water is practically nonexistent, occurring generally in close proximity to arroyos, and in direct relation to the rate and amount of runoff in the arroyos. Water soaks into the sides and bottoms of the arroyos during runoff events. This type of recharge occurs principally during snowmelt and the summer runoff season. The only instance where this type of groundwater will be affected by the mining operations, is where alluvial areas are actually mined. The hydrologic impact on this groundwater source will be complete removal of the resource when encountered during mining. However, due to the limited areal extent of the resource, any impacts would be considered negligible.

Bedrock Aquifers

Bedrock water quantity is minimal in extent, consisting only as small pockets of perched water in the various stratums. The quantity and areal extent of these pockets of water are not of sufficient quantity or quality to be considered significant. This water is normally observed as seepage from the highwall or small amounts of water on the pit floor. The mining operation results in removal of this insignificant groundwater source.

GROUNDWATER QUALITY

Gallup Sandstone Aquifer

As noted above in the discussion on groundwater quantity, there will be no impact by mining on the recharge zones of the Gallup Sandstone Aquifer. Therefore, there will be no impact on the quality of the Gallup Sandstone Aquifer by the mining operations.

Alluvial Aquifers

Alluvial water quality, in undisturbed areas, will continue to be influenced primarily by the amount of runoff in the arroyos and characteristics of the soils in the area of infiltration. There will be minimal impacts on the quality of this resource by the mining operations.

Bedrock Aquifers

The bedrock water encountered during mining will be removed in the mining process. This removal will have no effect on the water present in areas not affected by mining. This is due to the low transmissivity of the formations associated with this type of water.

PROBABLE HYDROLOGIC CONSEQUENCES EAST-WING UPDATE

The section contains a detailed East Wing update regarding the Probable Hydrologic Consequences from this operation. The update also provides the necessary background information to show that there are no adverse impacts to the hydrologic regime from current mining and nor any expected from East Wing operations. This information also serves to show that surface and ground water monitoring mechanisms are in place to maintain an active watch over the hydrologic behavior of the East Wing and the rest of the mine. In order to accomplish this update, it was necessary to discuss information collected over the years mine wide from surface and ground water monitoring program.

Surface Water Monitoring

Major Drainage results and comparisons

Surface water from major drainages has been monitored since the early 1980's through active surface water monitoring stations. Four stations (TBW, CMWT, DDT6, DD) collect samples that have disturbed-area watersheds. One station (CMW) collects samples from a relatively undisturbed channel. The CMW station data is used as background information to contrast against the other four stations. One additional station has been constructed in the East Wing (EW1). EW1 went online in 2001 and provides baseline information concerning the East Wing area.

Data from the disturbed-watershed monitoring stations was contrasted with information from the undisturbed-drainage monitoring station in the 2000 Annual Report. That data has been included here under Appendix 3.4-I. The data ranges from the early 1980's through 2000. The following parameters are summarized in the report, as agreed upon with OSM, and include: pH, TDS, TSS, dissolved selenium, total iron, and dissolved boron. The data collected for a given year has been averaged and graphed. The original data for the entire list of parameters tested are submitted quarterly and are on file with OSM.

In general, the contrasted data shows a high level of agreement for nearly all the stations for most of the parameters over many years. That is, the background levels did not markedly differ from the disturbed watershed values. In very few instances, did the disturbed exceed the background levels significantly.

Various factors can affect the level of agreement between any of the watersheds. Perhaps of highest consideration is the effect localized thunderstorms can have on each watershed. For example, a high runoff event in one watershed could dilute TDS and raise total suspended solids (TSS). A low runoff event in another watershed could record a more concentrated TDS and lower TSS. Subsequently, the comparability of the two watersheds could be difficult at times. Therefore, to help evaluate the data, standards will be referenced where possible to see how the overall water quality measures up.

The CHIA for McKinley Mine (1984) established a value of 5000 mg/L of total dissolved solids (TDS) that could constitute material damage. The value represents the maximum TDS concentration recommended for livestock or irrigation. In the mid-1980's, a few high TDS averages are observed for some of the disturbed watersheds. While the counterpart TDS from CMW were generally less, the TDS were still below the 5000 mg/L reference.

The CHIA (1984) established that very high concentrations of TSS would be expected. The graphs show that most of the time TSS were higher for the undisturbed wash versus the other four disturbed watersheds. TBW had no data recorded in 1989, subsequently, no valid comparisons can be made that year.

As expected, average pH for both undisturbed and disturbed watersheds were alkaline. Generally, there was relatively good agreement in pH between the undisturbed and disturbed watersheds. The graphs show that pH averages were above 7.0 and below 9.0; quite often, the undisturbed watershed had the higher pH.

The other three parameters of interest are total iron, dissolved selenium, and dissolved boron. Initial data shows that the values for total iron and selenium were higher the first few years of sampling before leveling off. In those instances the undisturbed drainage had the higher values. The total iron for CMW and CMWT seems artificially high, but there is no information available at this point to confirm the data. Subsequent data,

however, reflects constant parallel values between the undisturbed and disturbed watersheds that are low.

Boron comes into play around 1991. While disturbed and undisturbed watershed data for dissolved boron values agree at times, other times they vary by up to 0.2 mg/L. The highest averages do not go above 0.4 mg/L, which is below the New Mexico Administrative Code standard for irrigation of 0.75 mg/L, and 5.0 mg/L for livestock watering.

The EW1 major drainage surface water monitoring station was constructed in late 2000, and data is available for 2001. This data is contained in Appendix 3.4-I. The station captures runoff from an undisturbed watershed that will be affected by the East Wing mining operations. Subsequently, this data will serve as baseline data to contrast against information gathered from the disturbed watershed.

The initial EW1 data for various key parameters is summarized in the Table 3.4-1. The maximum values (pH includes minimum) recorded are shown.

Table 3.4-1
East Wing Surface Water Monitoring Station Data

Parameter	pH	TDS (mg/L)	TSS (mg/L)	SAR	Sulfate (mg/L)	Total Iron (mg/L)	Boron (mg/L)
	7.78-8.84	320	83000	3025	104	100	0.2

In summary, no additional major drainage watershed monitoring stations are necessary to construct. The EW1 surface water monitoring station will provide adequate representation of the East Wing mining areas, and to the overall hydrologic regime.

Medium Drainage results and comparisons
There are three medium watershed-monitoring stations at McKinley Mine (DDT9, DDT10, and A12). All three monitoring stations are in the Defiance Draw watershed (the Defiance Draw drainage also includes the East Wing mining area watersheds). DDT9 and DDT10 are downstream from areas affected by mining. The A12 monitoring station is in an undisturbed watershed in Area 12 just southeast of the East Wing mining areas.

The 2000 annual report data from the three stations is provided in Appendix 3.4-I. The data represent average values for the runoff season. Detailed data for parameters in the 2000 annual report, plus all the other parameters tested were submitted to OSM via quarterly reports.

The graphs show consistent ranges of values for most years for the parameters shown for the undisturbed versus the disturbed watersheds. DDT9 shows a spike in total iron in 1998; however, nearly all the runoff to this location came from alluvial areas ahead of mining. Subsequently, it is difficult to quantify the spike. Most other years, there was

good agreement with iron.

No additional medium-drainage monitoring stations are needed for the East Wing since the A12 monitoring station is already near the East Wing. Since the East Wing is in the Defiance Draw drainage, the three medium-drainage monitoring stations are adequate to characterize surface water from medium drainages into Defiance Draw.

Ground Water Monitoring

Alluvial wells

Alluvial well transects are located in various locations throughout the mine. The intent of the transects was to monitor valley-fill water resources. The transects are located in five drainage locations that include Tse Bonita Wash, Coal Mine Wash, and Defiance Draw.

These drainages have one or more transects. The Tse Bonita Wash (TB) transect consists of 6 wells at two transects (TB2 and TB3). The Coal Mine wash (CM) transect consists of 6 wells. The Defiance Draw Drainage (the largest of the drainage systems) consists of three transect locations: DT2 (4 wells), D2 (5 wells), and D3 (4 wells).

Well information for key parameters agreed to between OSM and P&M from the 2000 annual report is provided in Appendix 3.4-I. Data is collected quarterly from some wells, and annually from others. Quarterly data was averaged by year for the 2000 annual report. Detailed data for 2000 annual report parameters, and all the other parameters tested were submitted to OSM via quarterly reports. The appendix also includes information regarding what alluvial wells have been historically dry.

The wells nearest to the East Wing are the four DT2 wells located to the southwest in Area 11. Over the past 15 years, water levels in three of the wells have not changed significantly (the 4th well is dry). An overview of the key chemical parameters shows that these values have remained fairly constant with the values originally recorded in the wells. Occasional spikes do appear, but have been short-lived and probably related to precipitation levels.

As reported in the original baseline report done by Geohydrology Associates, Inc., (1980), there were no existing wells which tap the valley-fill deposits of Defiance Draw. It was concluded in the report that Defiance Draw valley-fill material did not constitute an aquifer.
Geohydrology Associates, Inc. (1980) did a water quality evaluation of the well samples using the drinking water standards available at that time from the U.S. Public Health Service. None of the samples met these drinking-water recommendations for sulfate or dissolved solids.

Monitoring over the years has not shown any changes that would negate the original

evaluation. Since the remaining alluvial fills in the East Wing are also tributary to Defiance Draw, it is apparent that drilling more transects in these upper reaches of Defiance Draw would not provide information that is not already captured in the existing wells. Given the proximity of the DT2 wells to the East Wing, and the fact that there already exist three sets of transects in the Defiance Draw watershed, no additional transects are needed in the East Wing.

Bedrock wells

Five bedrock wells were drilled to a depth of about 50 feet below the Green coal. The holes were referred to as McKinley bedrock (MBR) wells and distributed around the lease. The five wells are referred to as MBR1, MBR2, MBR3, MBR4, and MBR5. MBR4, located in Area 9 (south of Highway 264) was mined through and not replaced.

Well information for key parameters agreed to between OSM and P&M from the 2000 annual report is provided in Appendix 3.4-I. The wells are sampled annually. Detailed data for 2000 annual report parameters, and all the other parameters tested were submitted to OSM via quarterly reports.

The original baseline report by Geohydrology Associates, Inc. (1980) concluded that the wells had little potential as meaningful groundwater resources. The transmissivity of the bedrock deposits were low, less than 6 ft^2/day and not capable of maintaining a constant discharge of 1 gallon per minute sustained yield. Also, even though ground water was present, none of the strata had sufficient continuity to be considered an aquifer.

Quality-wise, Geohydrology Associates, Inc.'s (1980) baseline work showed that the ground water that was there did not meet the recommended maximum drinking-water standards set by the U.S. Public Health Service. The total mineralization was more than twice the recommended standard, fluoride was three times above the standard for MBR 2 and 3, and sulfate values were above the standard (250 mg/L) for MBR 2 (325 mg/L).

The wells that provide the most useful information in assessing the existing and expected bedrock-hydrology of the East Wing are MBR2 and MBR3. MBR2 will be reviewed to see how it has behaved since mining has occurred around that site and because it is the second nearest well to the East Wing. MBR3 will be evaluated since it is located in the middle of the East Wing. The period 1995 – 2000 has been averaged and listed below and contrasted against the 1980 values in the baseline report, and the standards contained in The Safe Drinking Water Act.

Table 3.4-2
MBR2 and MBR3 Quality Evaluation (mg/L)

	Sulfate	TDS	Nitrate	Chloride	Iron	Fluoride
MBR2						
(95-00)	527	1458	0.3	13.3	0.5	5.1
1980	325	1136	0.4	6.4		5.5
MBR3						
(95-00)	120	1537	0.16	82.5	0.6	6.9
1980	70	1368	0.5	86		5.7
Standard	250	500	10	250	0.3	2.0

The data contrast shows that little has changed in either well. TDS and fluoride still remain unacceptably high in both wells. In MBR2, sulfate that was already above the threshhold, still remains above the threshold. Chloride did increase for MBR2, but still below the standard.

MBR3 shows little change from what was originally reported in the baseline assessment. Given that little has changed from the original 1980 evaluation, the need to keep MBR3 does not seem necessary. The well was originally determined to be a poor resource for ground water from a quantitative and qualitative perspective—nothing has changed to negate that finding. In conclusion, the well will be mined through and not replaced.

Gallup Sandstone Aquifer

The potential effect of mining on the Gallup Sandstone Aquifer is monitored through the sampling of four wells: Well 1, Well 2, Well 3, and Well 3A. As stated in the Geohydrology Associates, Inc. report (1980), the Gallup aquifer is under artesian conditions because of the impermeable shales above it. Data from the wells also had shown that transmissivity was quite variable from well to well.

The data from the 2000 annual report is included in Appendix 3.4-I. The data collected quarterly was averaged for each year for the annual report. The information shows key parameters that P&M and OSM agreed to include in the Annual Report. Detailed data for the 2000 annual report parameters, and for all the other parameters tested were submitted to OSM via quarterly reports.

The McKinley Mine CHIA (1984) contained initial information on total dissolved solids (TDS) that will be useful to evaluate. The CHIA states that total dissolved solids for the Gallup Sandstone Aquifer averaged 1,121 milligrams per liter (presumably the overall

aquifer).

Data from the four McKinley Mine wells show that total dissolved solids from these wells had a better quality initially than the average aquifer value of 1,121 mg/L. None of the wells started out with TDS above 700 milligrams per liter. Over the years, TDS for some wells has gone up and down; however, the quality has generally improved or stayed about the same. By 2000, TDS for three of the wells were below 400 mg/L; the fourth well was just below 500 mg/L.

The same trending and conclusions can be made about sulfate values, which also have gone up and down over time. By 2000, sulfate values have either decreased, or stayed close to the original 1983 values.

Iron values have stayed low and fairly constant over the past ten years. One spike, however, is noted in 1990 for Well 1; this anomaly is likely a sample contamination or lab error since the other values were very low (seven times less than the spike) and had not changed very much the other 17 years. Some other high iron values were recorded in the late 1980's for the other wells; since then, however, iron values have stayed consistently low. For the most part, iron values for two wells have been less than the original values (wells 3 and 3A); iron values for the other two wells (1 and 2) have generally stayed near the originally-tested values.

Static water levels have generally increased or stayed close to the initial recorded levels according to the data. Subsequently, no problem is noted with well recharge.

In summary, the well data show that the character of the aquifer has changed little and generally improved. Therefore, it is concluded that mining at the McKinley Mine is not adversely impacting the Gallup Sandstone aquifer. No future impact of the Gallup Sandstone Aquifer is likely; the recharge zone is not located in the McKinley Mine area, and the aquifer lies below impermeable shales.

3.4.5 CHIA (SYNOPSIS)

The Cumulative Hydrologic Impact Assessment (CHIA), completed by the Radian Corporation for the Office of Surface Mining as part of the Technical Analyses and Environmental Assessment by OSMRE on Permit No. NM-0001B/3-10P, covers all of the areas to be mined by this application and is still valid. Included below is a brief synopsis of the conclusions of the CHIA:

- Surface water use in the area is primarily stock watering with some irrigation. There are no permitted water rights holders downstream of the mining operation in the cumulative impact area. Indicator parameters related to hydrologic concerns in the basin are total dissolved solids and total suspended solids (TSS) concentrations.
- Cumulative impacts to the quantity of the flow in the Puerco River are

insignificant.

- Cumulative impacts to the quality (TDS and TSS) of flows in the Puerco River are minimal and should not cause significant changes in baseline conditions. No material damage to the hydrologic balance is expected.
- Ground water is an important source of water in the Gallup area. The major ground water pumping centers are at the Santa Fe and Yah-ta-hey well fields, both completed in the Gallup Sandstone and operated by the city of Gallup. Shallow ground water is not widely used owing to the relatively poor chemical quality and small well yields.
- Cumulative impacts related to ground-water quality are not expected: ground-water quality in terms of TDS and sulfate has not been demonstrated to change significantly and the poor physical properties of the near-surface zones are not greatly altered by mining.
- Ground-water quantity in the Gallup aquifer may be affected by the cumulative impacts of mining, particularly if declared water rights are fully used by P&M. Calculations of water-level drawdowns indicate that the Yah-ta-hey well field could experience up to 3 feet of drawdown attributable to mining activities; this does not constitute material damage. No material damage, based upon a criterion of a decline of 25% of available hydraulic head, is predicted as a result of surface coal mining.

Thus, based upon the report, P&M feels that any impacts which have or will occur on the hydrologic systems at the McKinley Mine are insignificant.

3.4.6 DEVELOPED WATER RESOURCES

SURFACE WATER RESOURCES

All identified developed surface water resources within the proposed permit area and within 1000 feet of the proposed permit boundary are shown on Exhibit 3.4-3. A total of 8 developed surface water resources were identified. All six of the resources are stockponds. Two of the resources will be disturbed by mining during this permit term; whereas, the other six resources will not be disturbed during this permit term. Replacement of the stockponds that will be disturbed during this permit term is discussed in Section 5.7.

Permit NM-0001B Exhibit 2.9-1 depicted an impoundment located in the center of section 5. Subsequently, the impoundment was noted as a Stockpond in the original Developed Water Resource documentation. However, this impoundment was not a stockpond but a temporarily abandoned mining pit which was being temporarily used to impound water for dust control. This pit was covered by a surface water user permit which allowed for the diversion of the Tse Bonita Wash into it for water storage. Mining has since resumed in this pit and it no longer exists. At no time was this pit ever used for any other purpose but mining related storage.

APPENDIX B

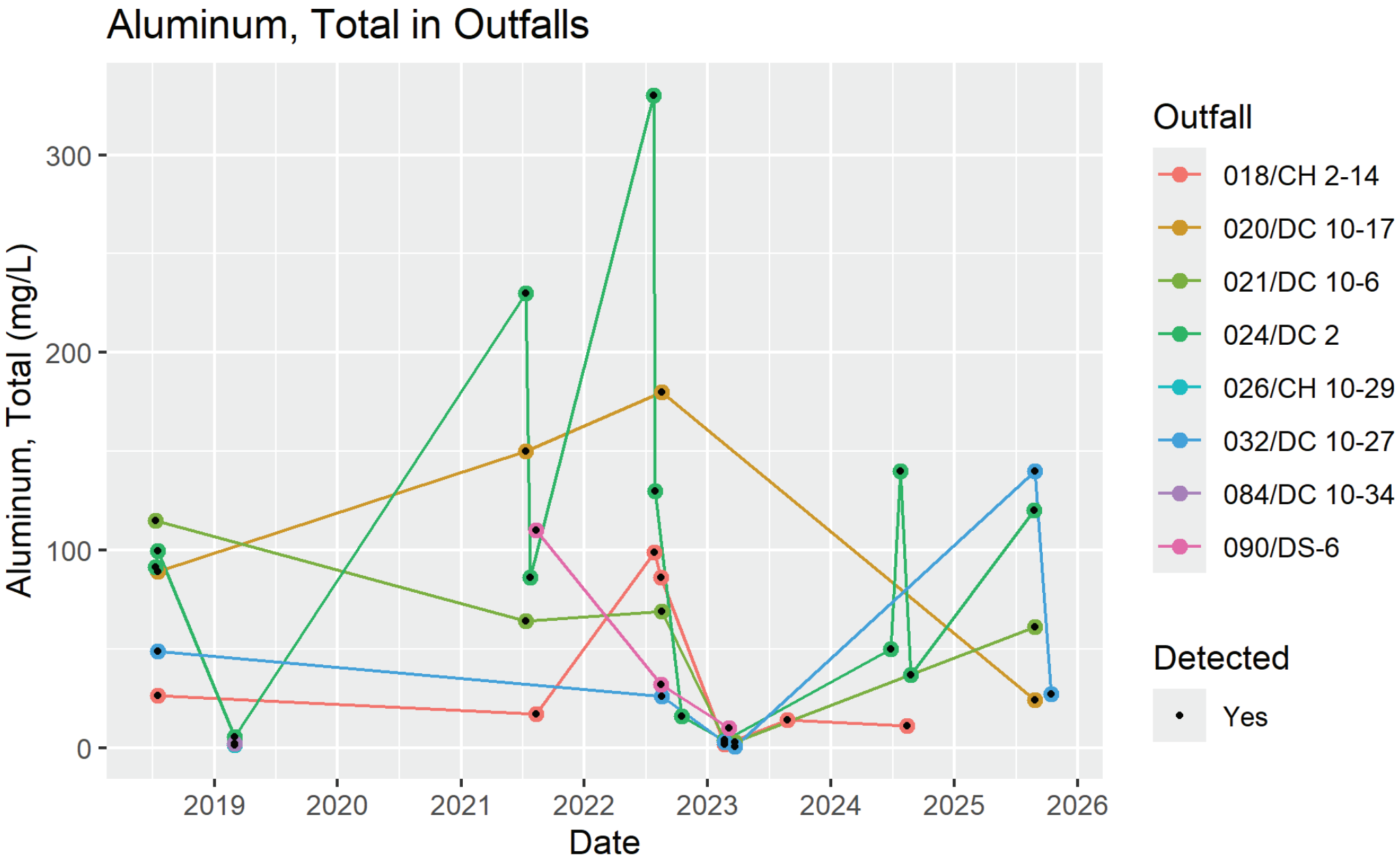
SURFACE WATER QUALITY TEMPORAL PLOTS

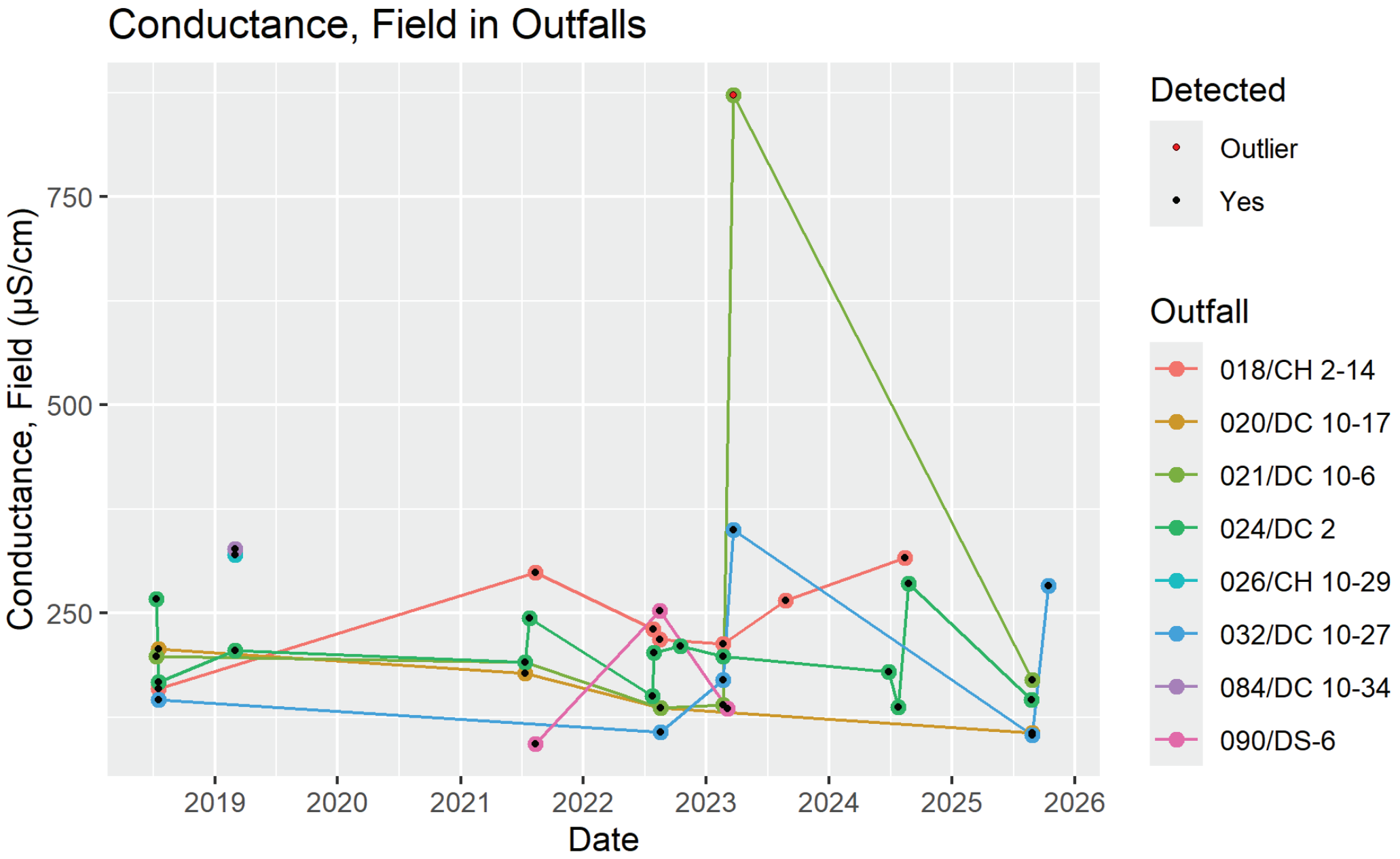
B-1. DISCHARGE SURFACE WATER QUALITY TEMPORAL PLOTS – OUTFALLS 018 (CH-2-14), 020 (DC-10-17), 021 (DC-10-6), 024 (DC-2), 026 (DC-10-29), 032 (DC-10-27), 084 (DC-10-34), AND 090 (DS-6)

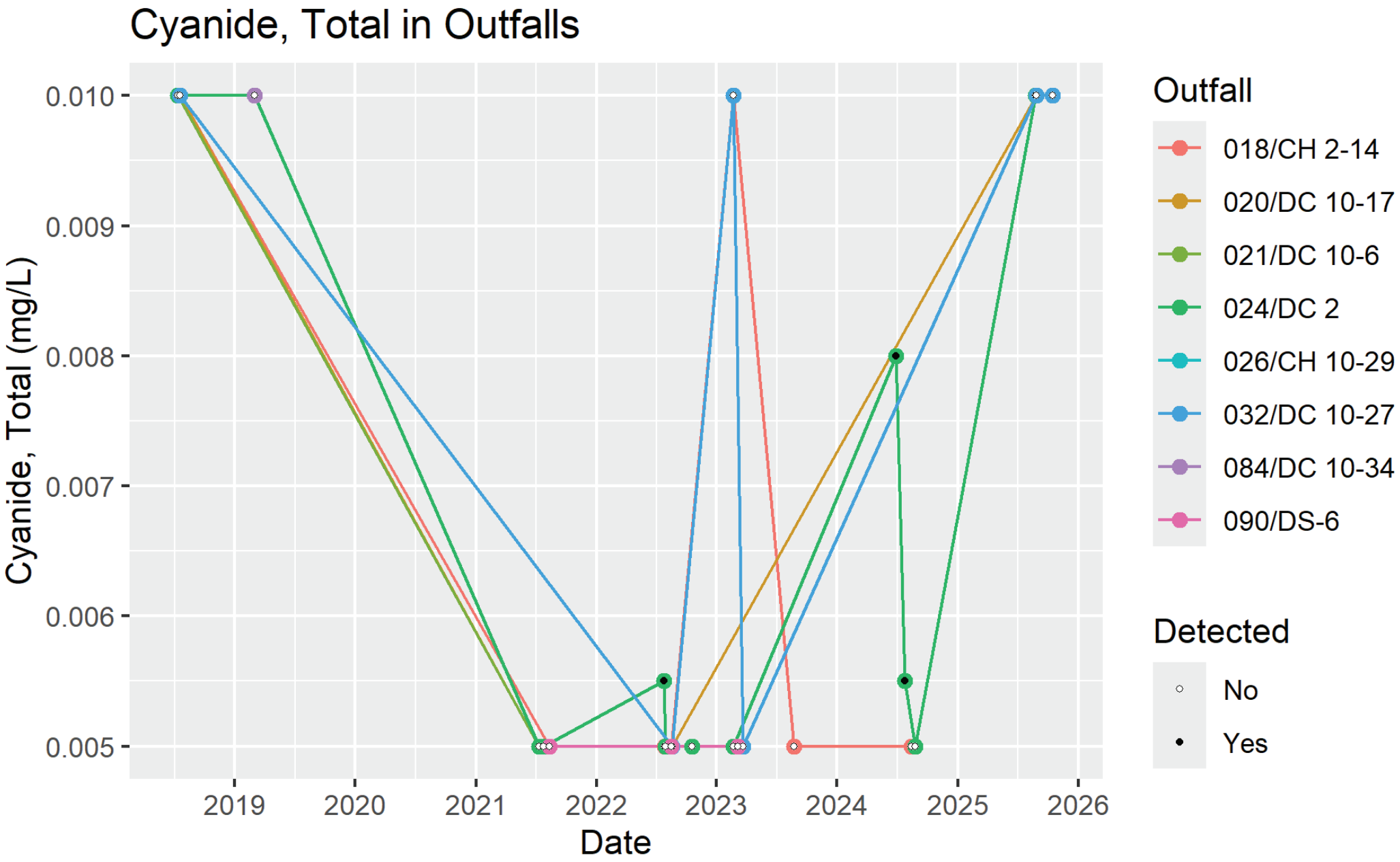
B-2. SURFACE WATER QUALITY TEMPORAL PLOTS – DEFIANCE DRAW (DD) AND TSE BONITA WASH (TBW)

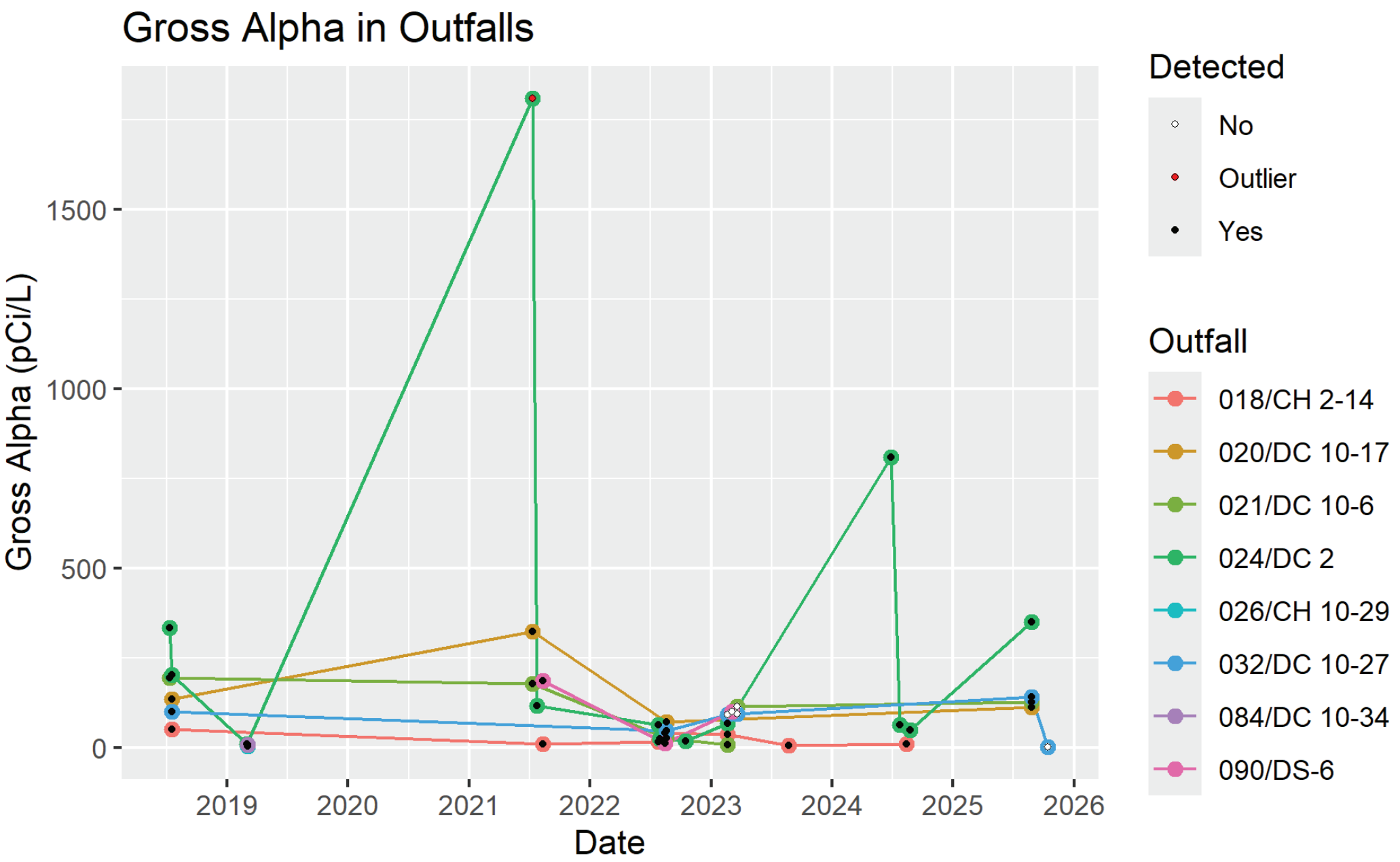
APPENDIX B-1

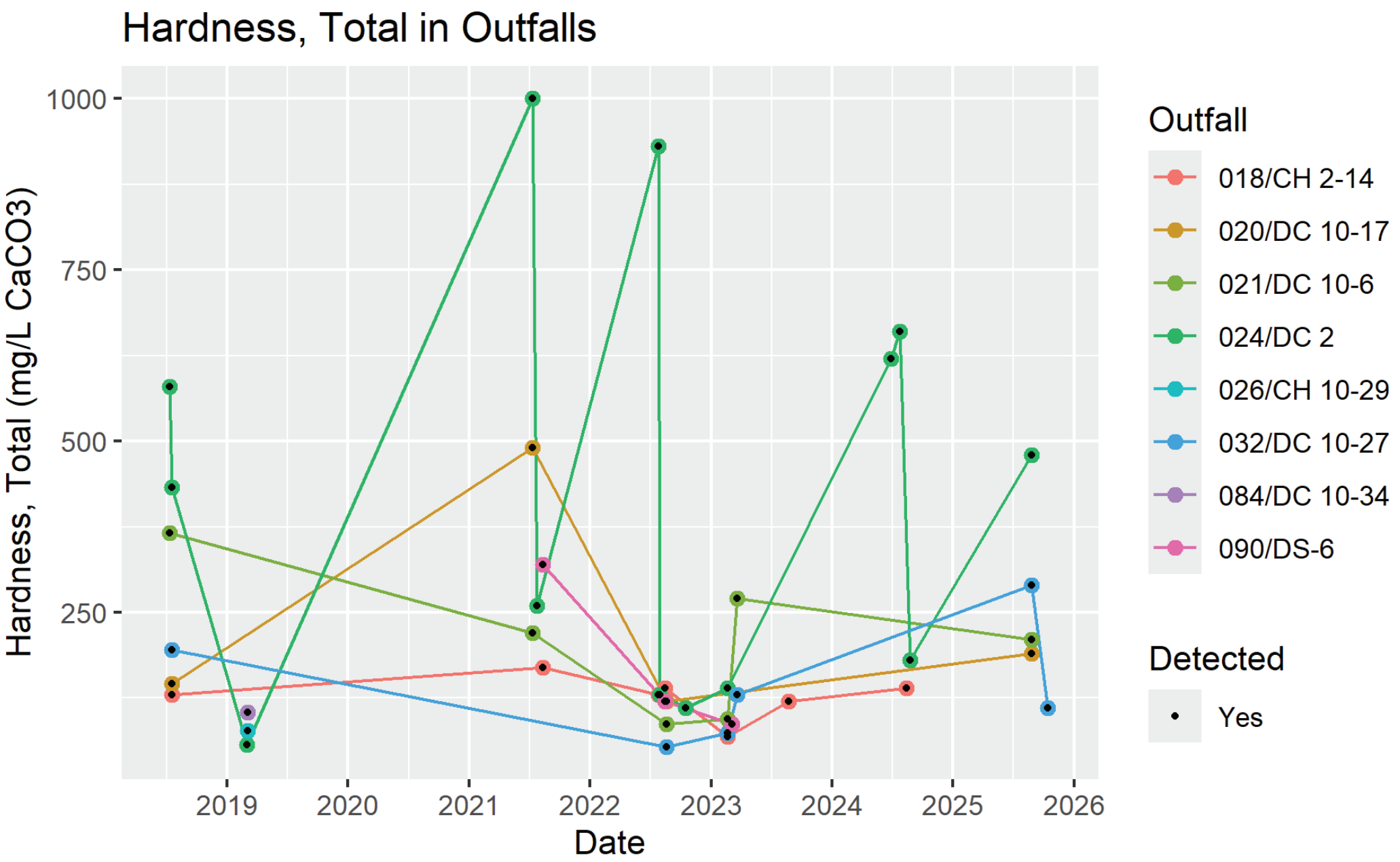
DISCHARGE SURFACE WATER QUALITY TEMPORAL PLOTS – OUTFALLS 018 (CH-2-14), 020 (DC-10-17), 021 (DC-10-6), 024 (DC-2), 026 (DC-10-29), 032 (DC-10-27), 084 (DC-10-34), AND 090 (DS-6)

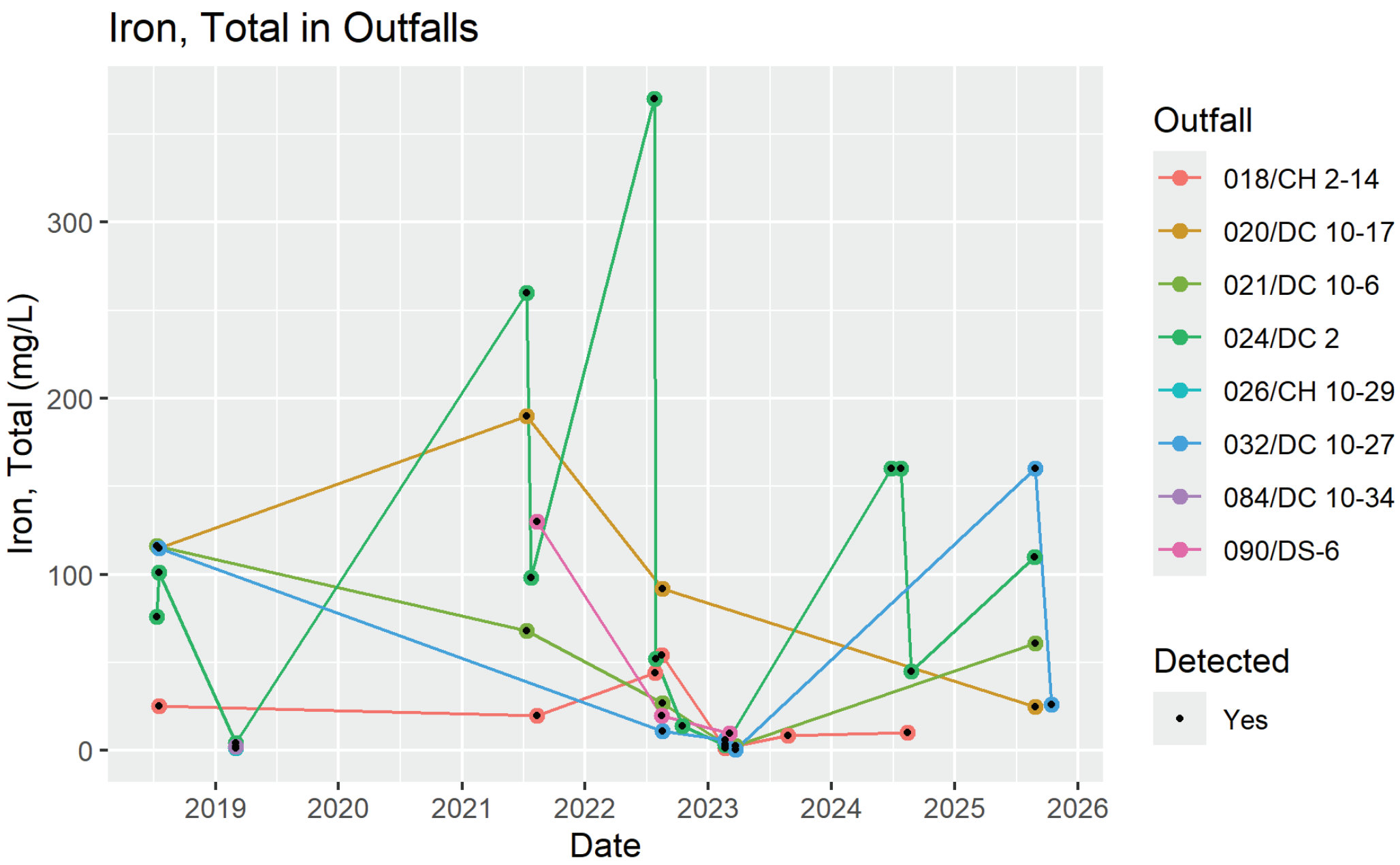

Aluminum, Total in Outfalls
Aluminum, Total (mg/L)
300
200
100
0
2019
2020
2021
2022
2023
2024
2025
2026
Date
Outfall
018/CH 2-14
020/DC 10-17
021/DC 10-6
024/DC 2
026/CH 10-29
032/DC 10-27
084/DC 10-34
090/DS-6
Detected
Yes

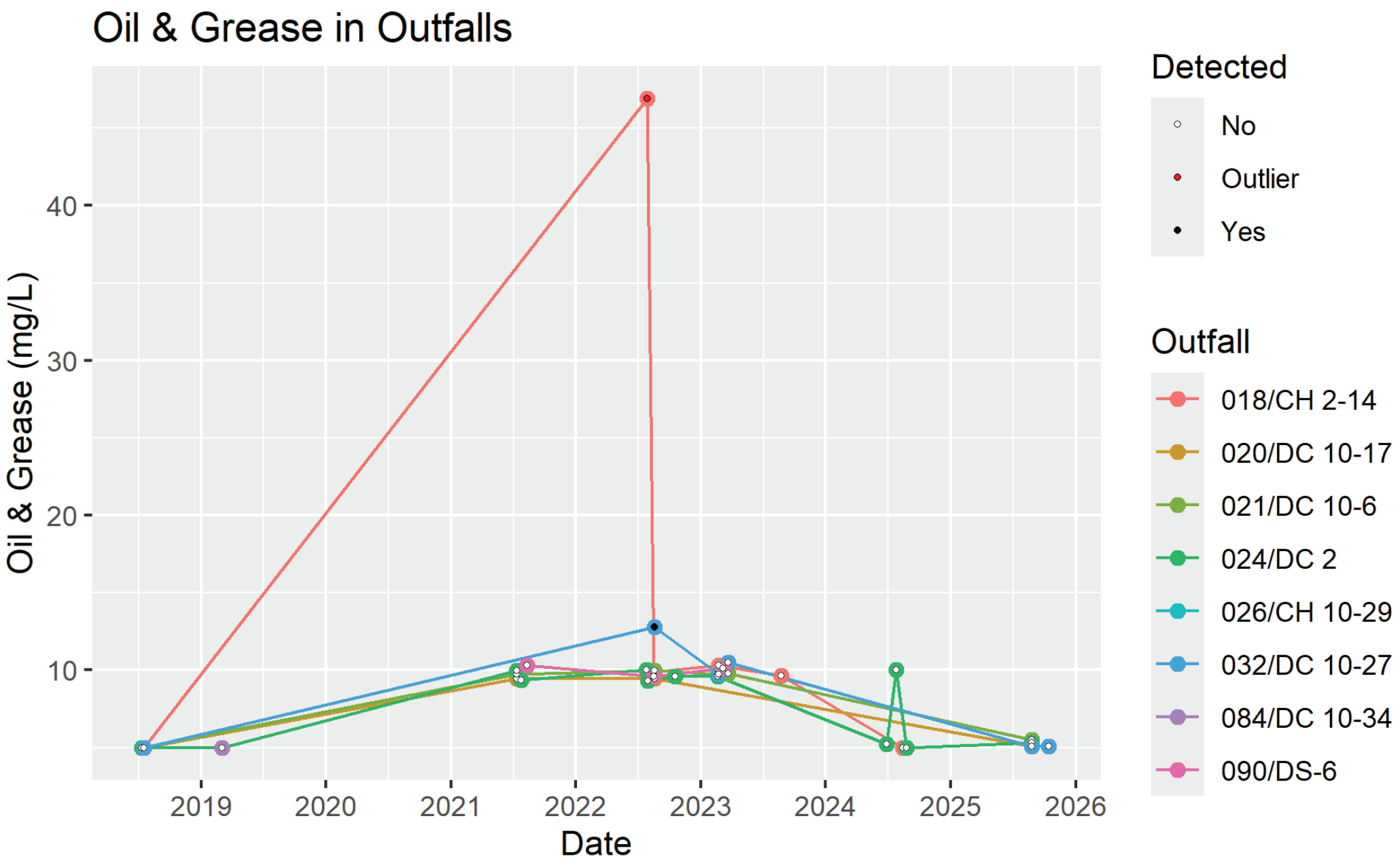

Conductance, Field in Outfalls
Conductance, Field (µS/cm)
750
500
250
2019
2020
2021
2022
2023
2024
2025
2026
Date
Detected
Outlier
Yes
Outfall
018/CH 2-14
020/DC 10-17
021/DC 10-6
024/DC 2
026/CH 10-29
032/DC 10-27
084/DC 10-34
090/DS-6

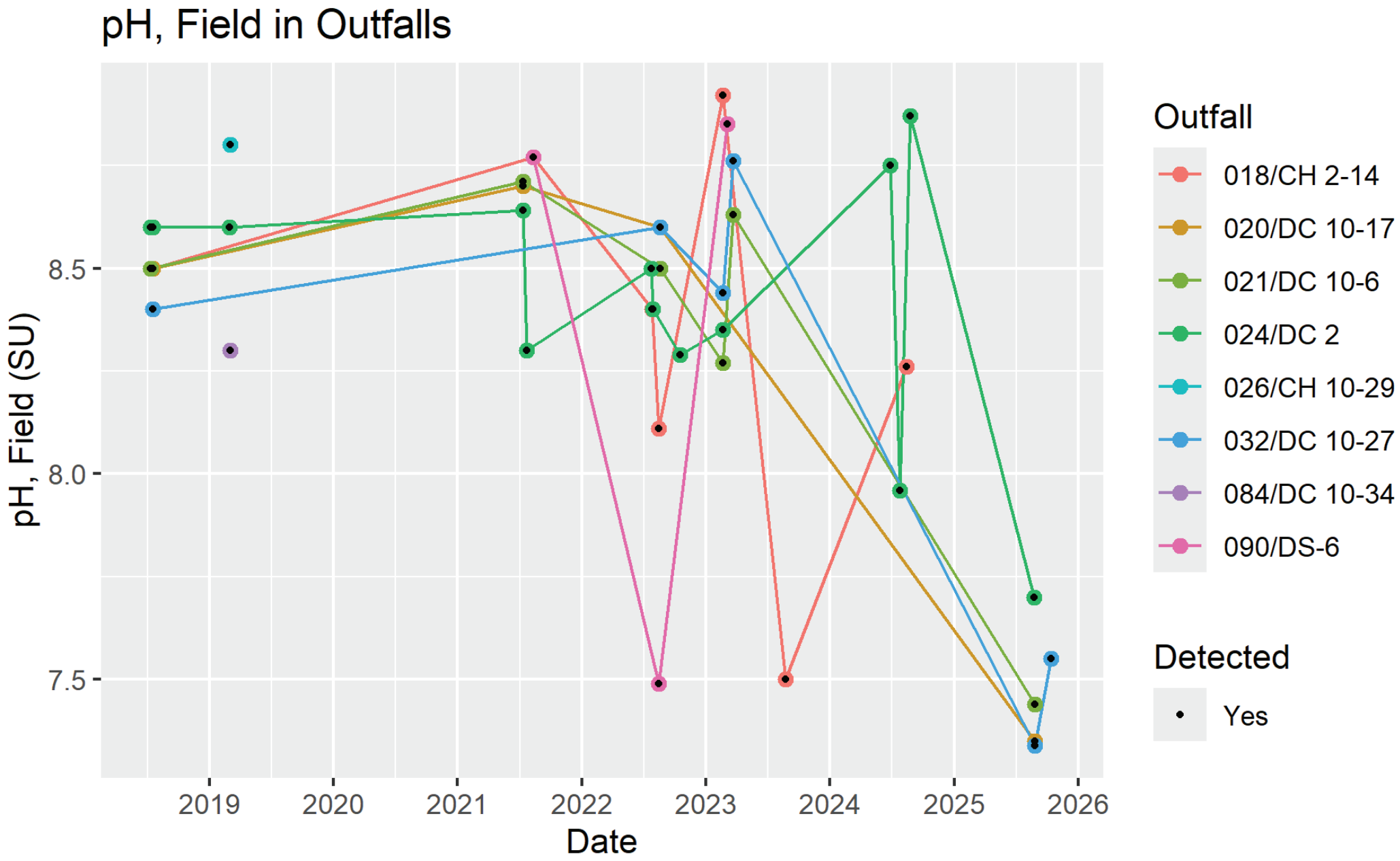

Cyanide, Total in Outfalls
Cyanide, Total (mg/L)
0.010
0.009
0.008
0.007
0.006
0.005
2019
2020
2021
2022
2023
2024
2025
2026
Date
Outfall
018/CH 2-14
020/DC 10-17
021/DC 10-6
024/DC 2
026/CH 10-29
032/DC 10-27
084/DC 10-34
090/DS-6
Detected
No
Yes

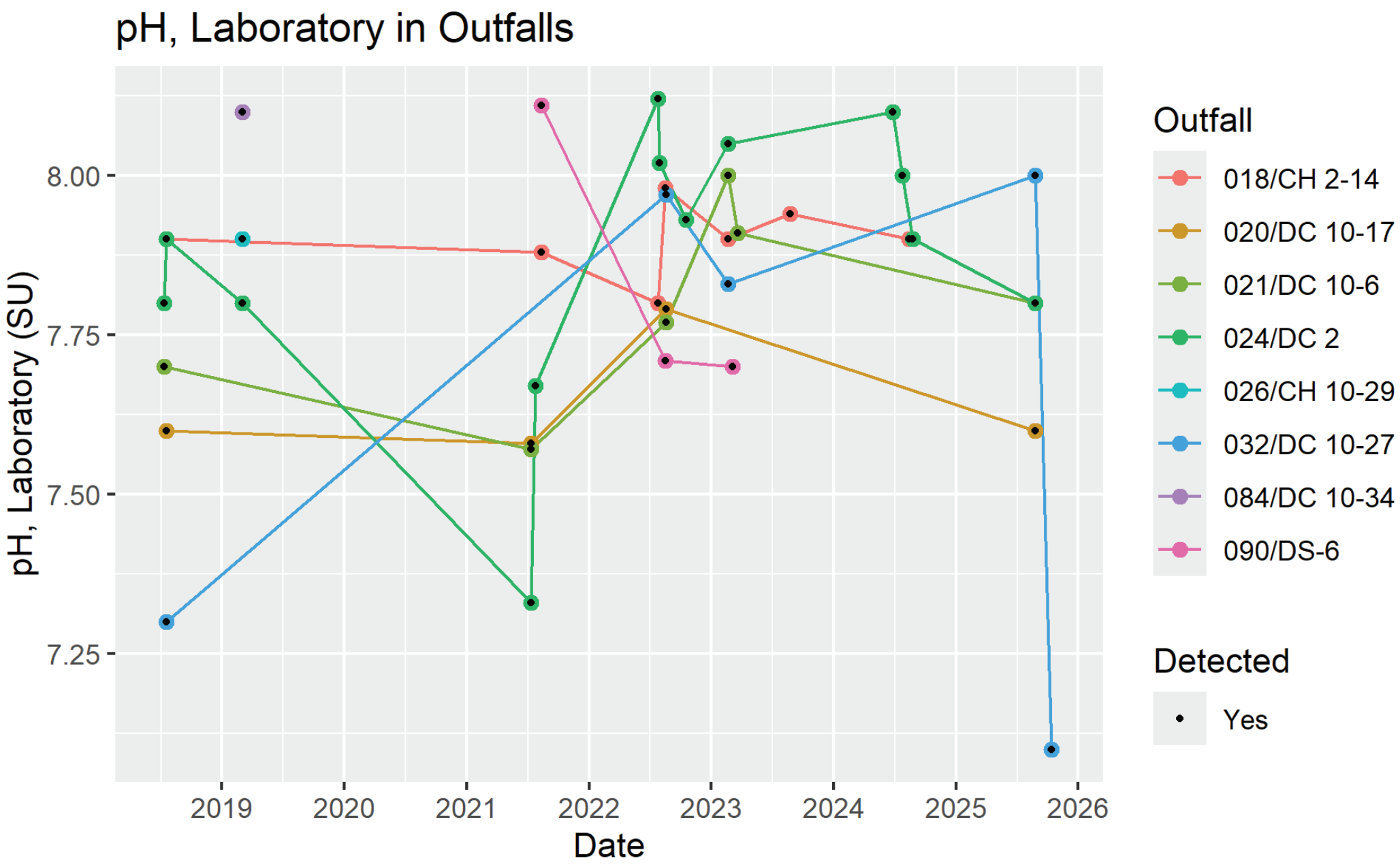

Gross Alpha in Outfalls
Gross Alpha (pCi/L)
1500
1000
500
0
2019
2020
2021
2022
2023
2024
2025
2026
Date
Detected
No
Outlier
Yes
Outfall
018/CH 2-14
020/DC 10-17
021/DC 10-6
024/DC 2
026/CH 10-29
032/DC 10-27
084/DC 10-34
090/DS-6

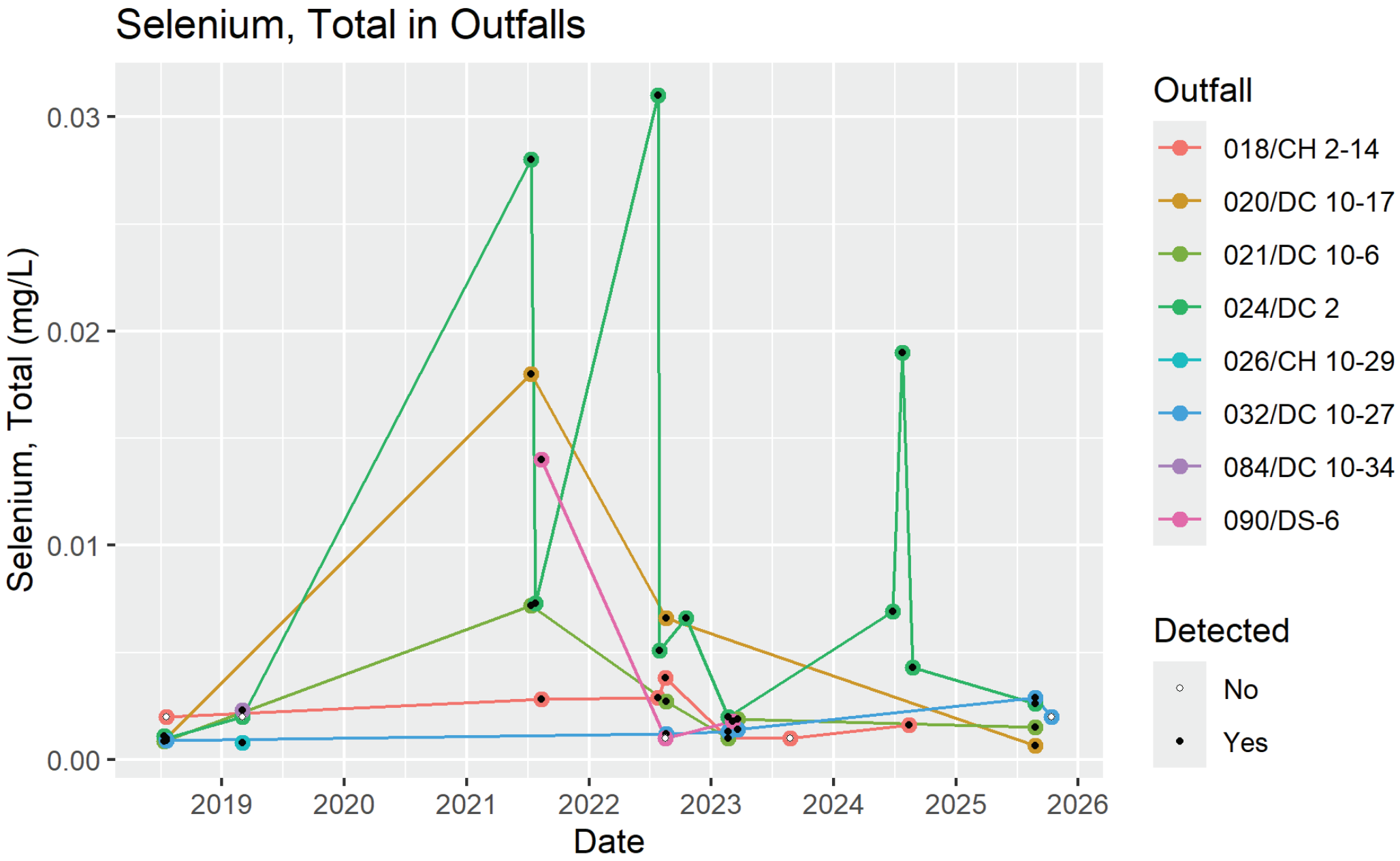

Hardness, Total in Outfalls
Hardness, Total (mg/L CaCO3)
1000
750
500
250
2019
2020
2021
2022
2023
2024
2025
2026
Date
Outfall
018/CH 2-14
020/DC 10-17
021/DC 10-6
024/DC 2
026/CH 10-29
032/DC 10-27
084/DC 10-34
090/DS-6
Detected
Yes

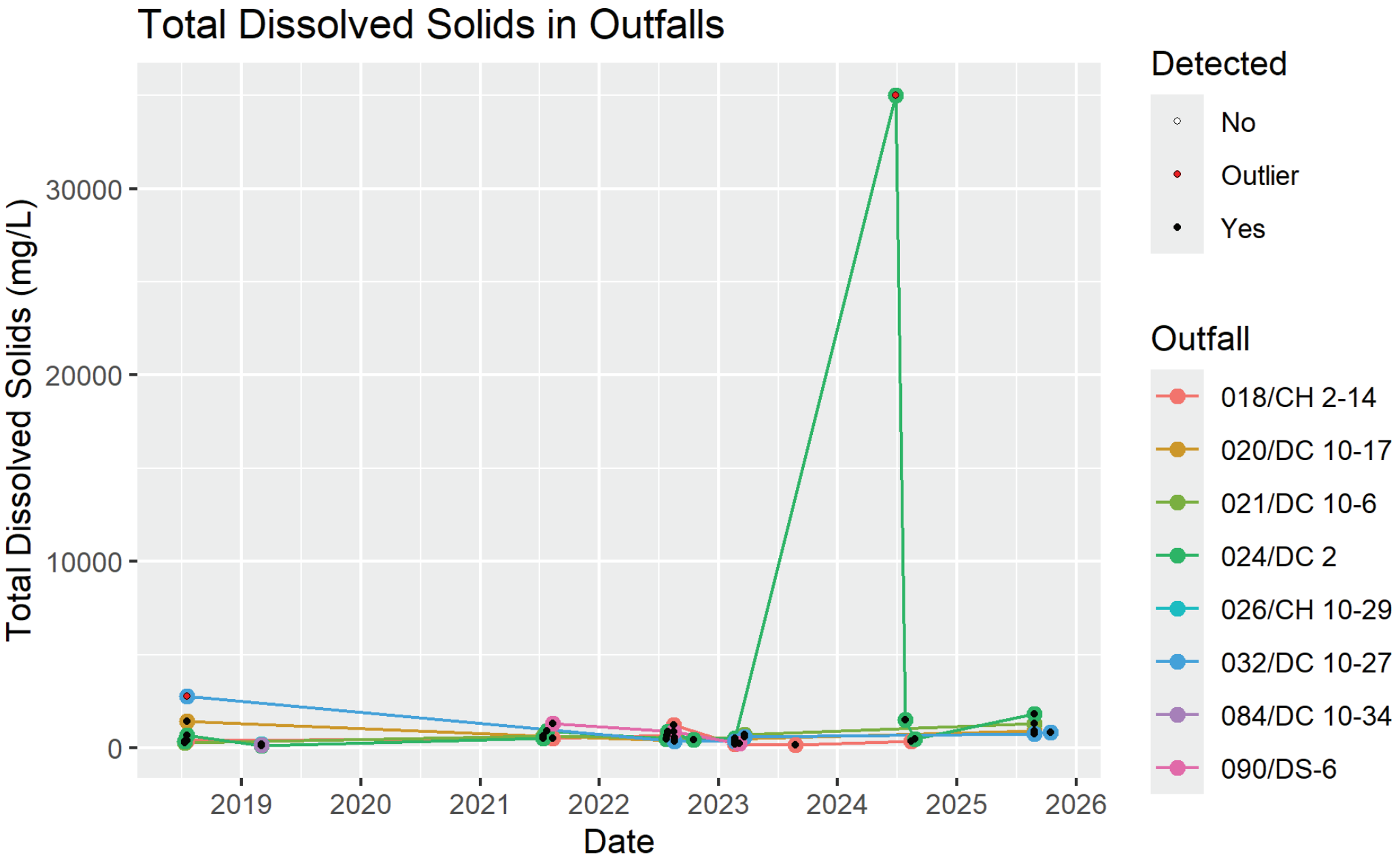

Iron, Total in Outfalls
Iron, Total (mg/L)
300
200
100
0
2019
2020
2021
2022
2023
2024
2025
2026
Date
Outfall
018/CH 2-14
020/DC 10-17
021/DC 10-6
024/DC 2
026/CH 10-29
032/DC 10-27
084/DC 10-34
090/DS-6
Detected
Yes

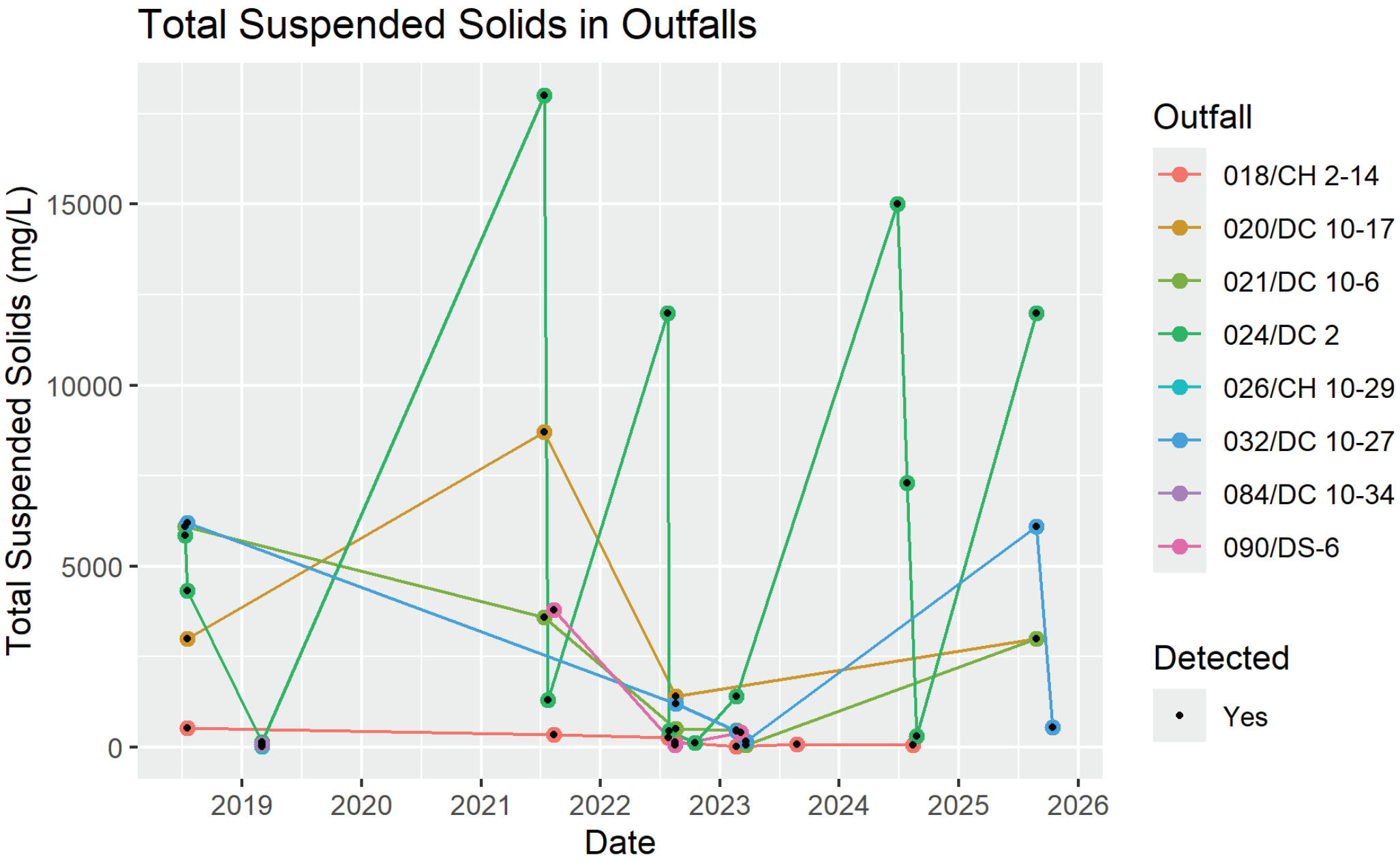

Oil & Grease in Outfalls
Oil & Grease (mg/L)
40
30
20
10
2019
2020
2021
2022
2023
2024
2025
2026
Date
Detected
No
Outlier
Yes
Outfall
018/CH 2-14
020/DC 10-17
021/DC 10-6
024/DC 2
026/CH 10-29
032/DC 10-27
084/DC 10-34
090/DS-6


pH, Field in Outfalls
pH, Field (SU)
8.5
8.0
7.5
2019
2020
2021
2022
2023
2024
2025
2026
Date
Outfall
018/CH 2-14
020/DC 10-17
021/DC 10-6
024/DC 2
026/CH 10-29
032/DC 10-27
084/DC 10-34
090/DS-6
Detected
Yes


pH, Laboratory in Outfalls
pH, Laboratory (SU)
8.00
7.75
7.50
7.25
2019
2020
2021
2022
2023
2024
2025
2026
Date
Outfall
018/CH 2-14
020/DC 10-17
021/DC 10-6
024/DC 2
026/CH 10-29
032/DC 10-27
084/DC 10-34
090/DS-6
Detected
Yes

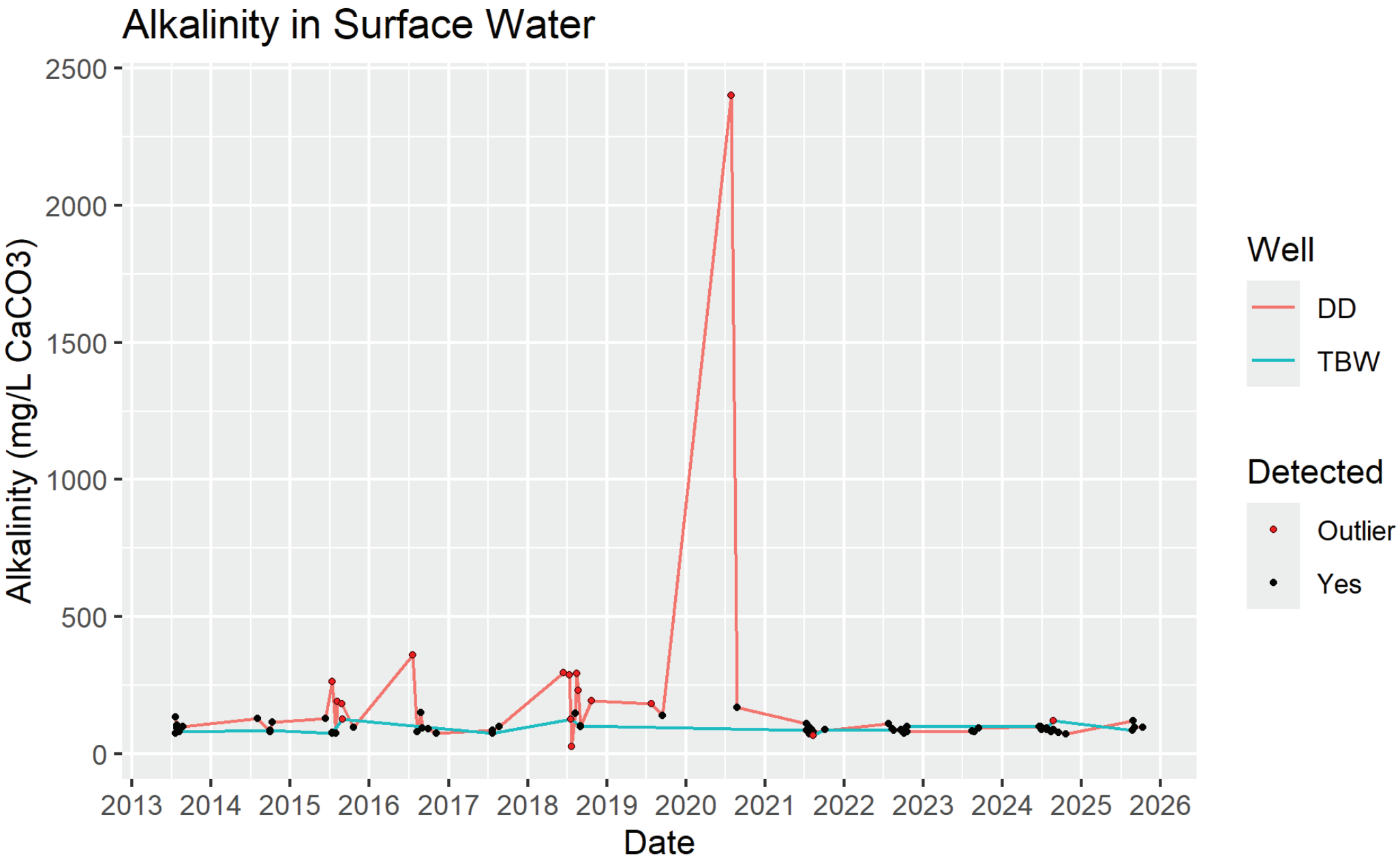

Selenium, Total in Outfalls
Selenium, Total (mg/L)
0.03
0.02
0.01
0.00
2019
2020
2021
2022
2023
2024
2025
2026
Date
Outfall
018/CH 2-14
020/DC 10-17
021/DC 10-6
024/DC 2
026/CH 10-29
032/DC 10-27
084/DC 10-34
090/DS-6
Detected
No
Yes

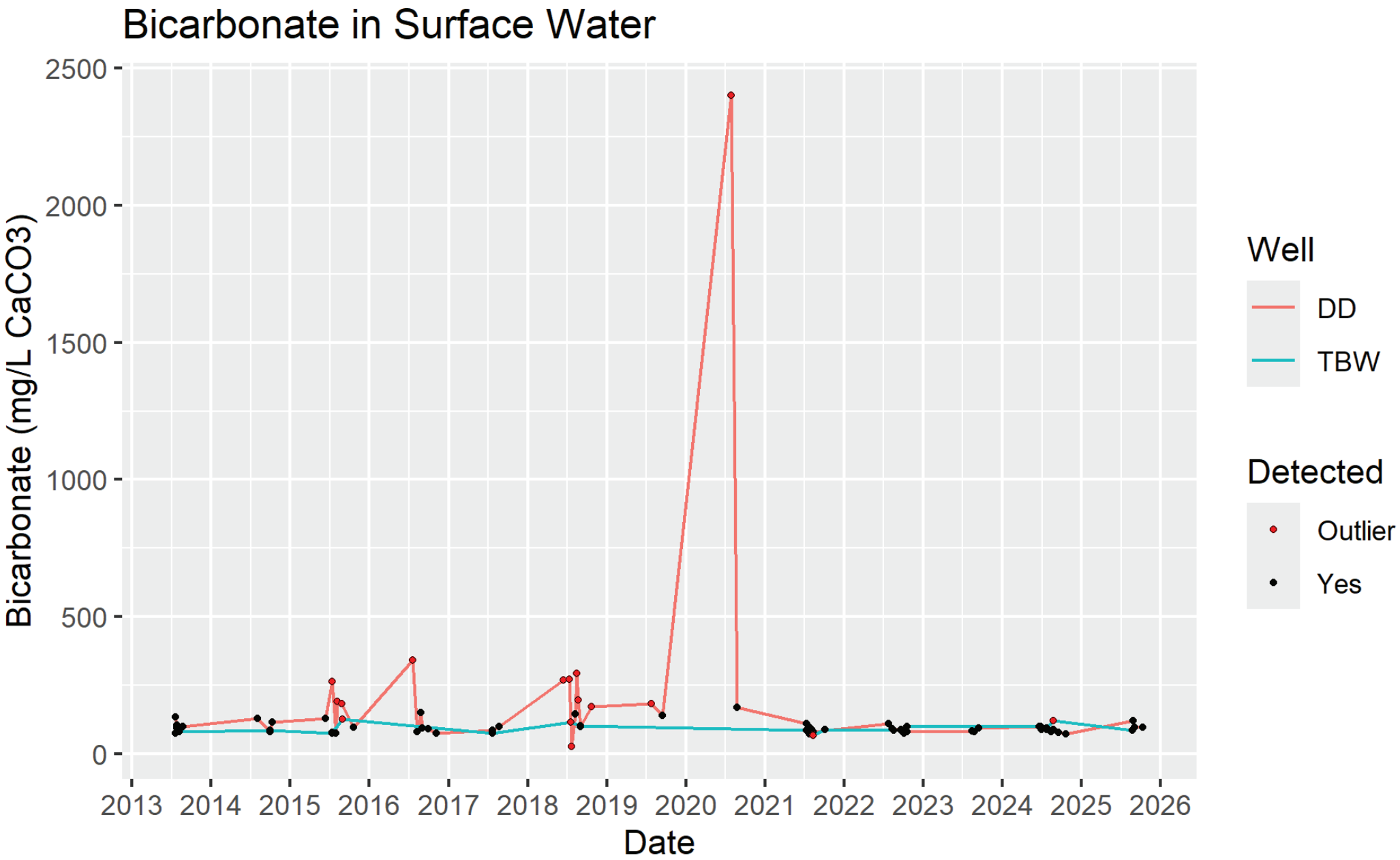

Total Dissolved Solids in Outfalls
Total Dissolved Solids (mg/L)
30000
20000
10000
0
2019
2020
2021
2022
2023
2024
2025
2026
Date
Detected
No
Outlier
Yes
Outfall
018/CH 2-14
020/DC 10-17
021/DC 10-6
024/DC 2
026/CH 10-29
032/DC 10-27
084/DC 10-34
090/DS-6

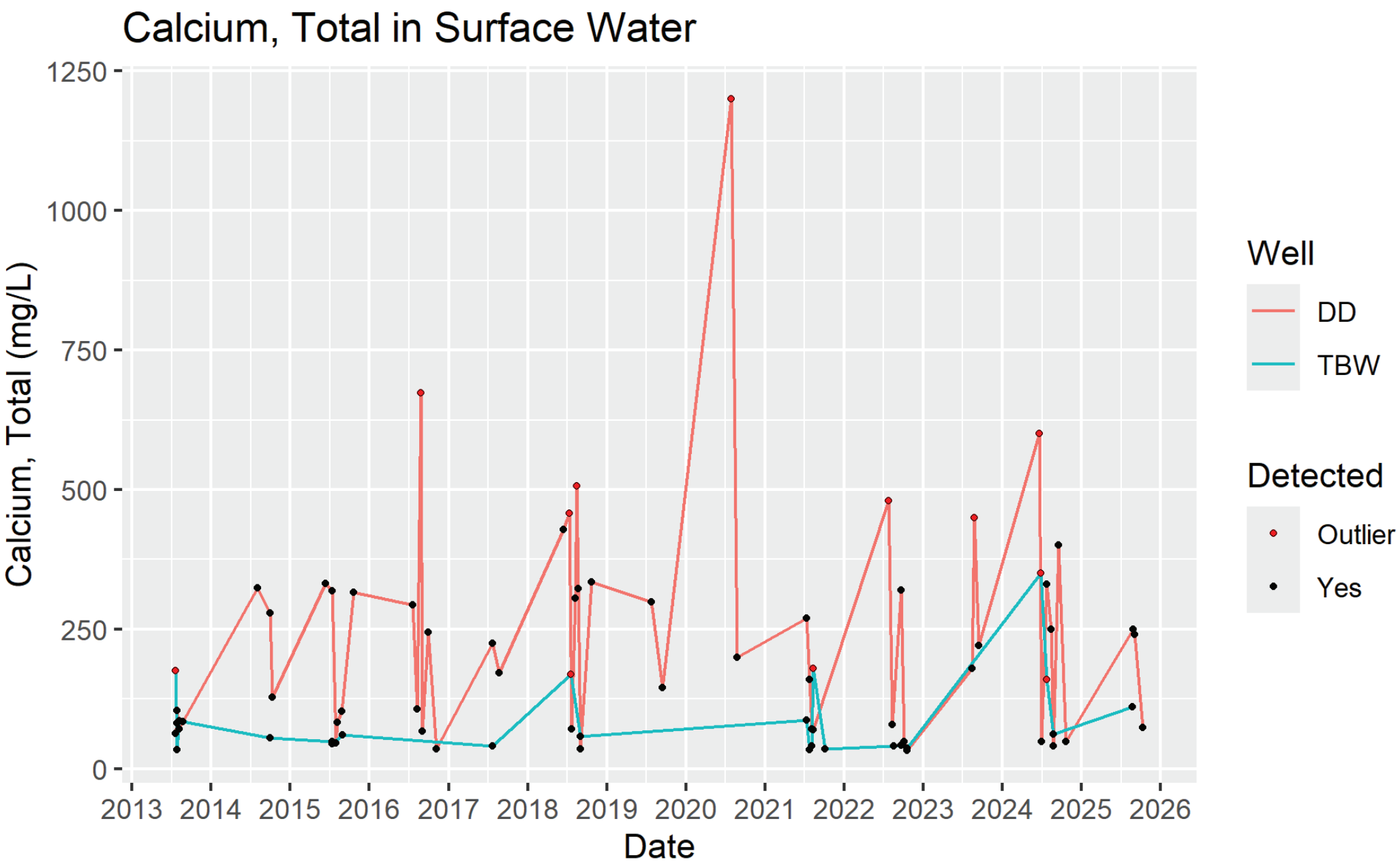

Total Suspended Solids in Outfalls
Total Suspended Solids (mg/L)
15000
10000
5000
0
2019
2020
2021
2022
2023
2024
2025
2026
Date
Outfall
018/CH 2-14
020/DC 10-17
021/DC 10-6
024/DC 2
026/CH 10-29
032/DC 10-27
084/DC 10-34
090/DS-6
Detected
Yes

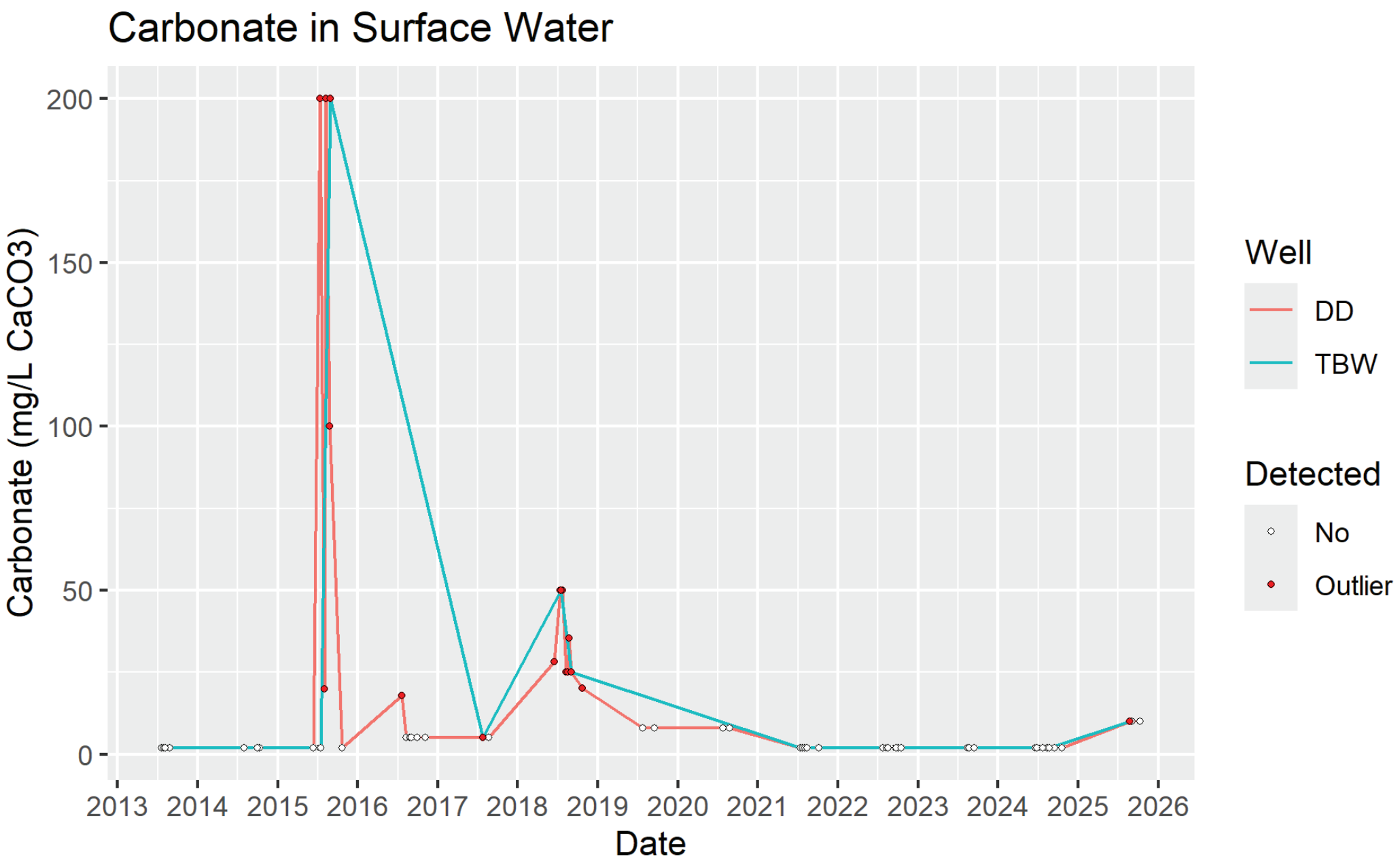
APPENDIX B-2

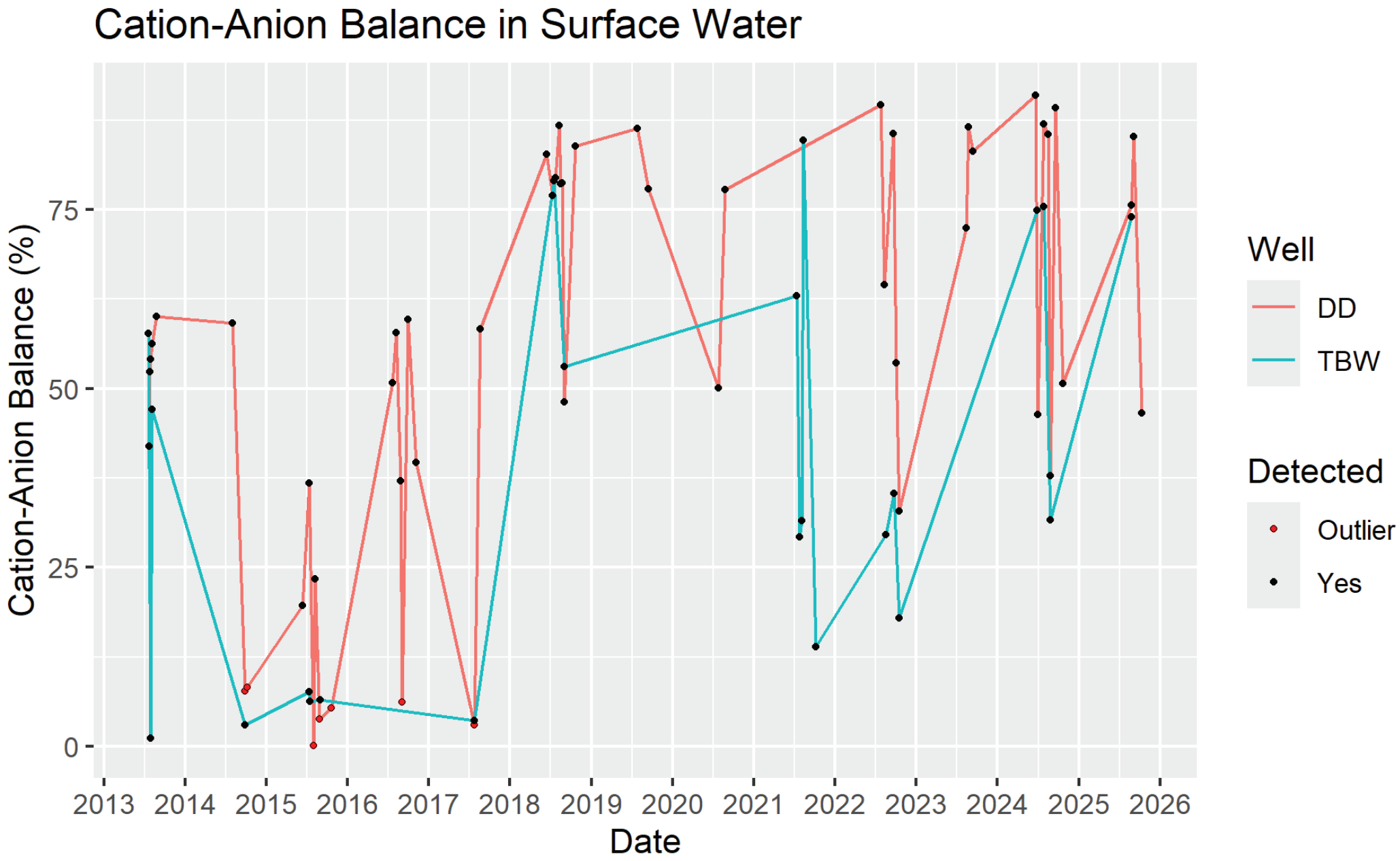
SURFACE WATER QUALITY TEMPORAL PLOTS – DEFIANCE DRAW (DD) AND TSE BONITA WASH (TBW)

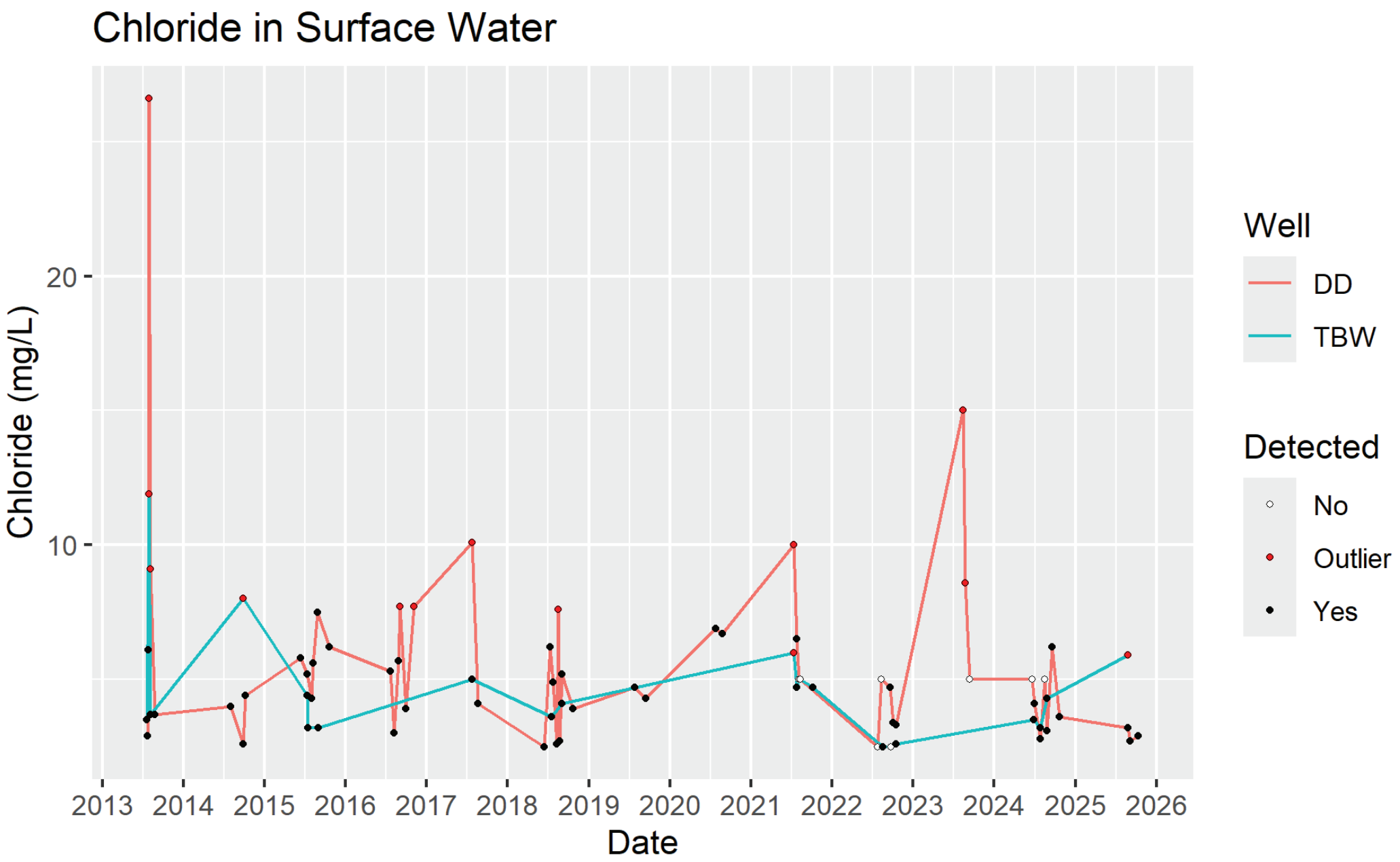

Alkalinity in Surface Water
Alkalinity (mg/L CaCO3)
2500
2000
1500
1000
500
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
Outlier
Yes

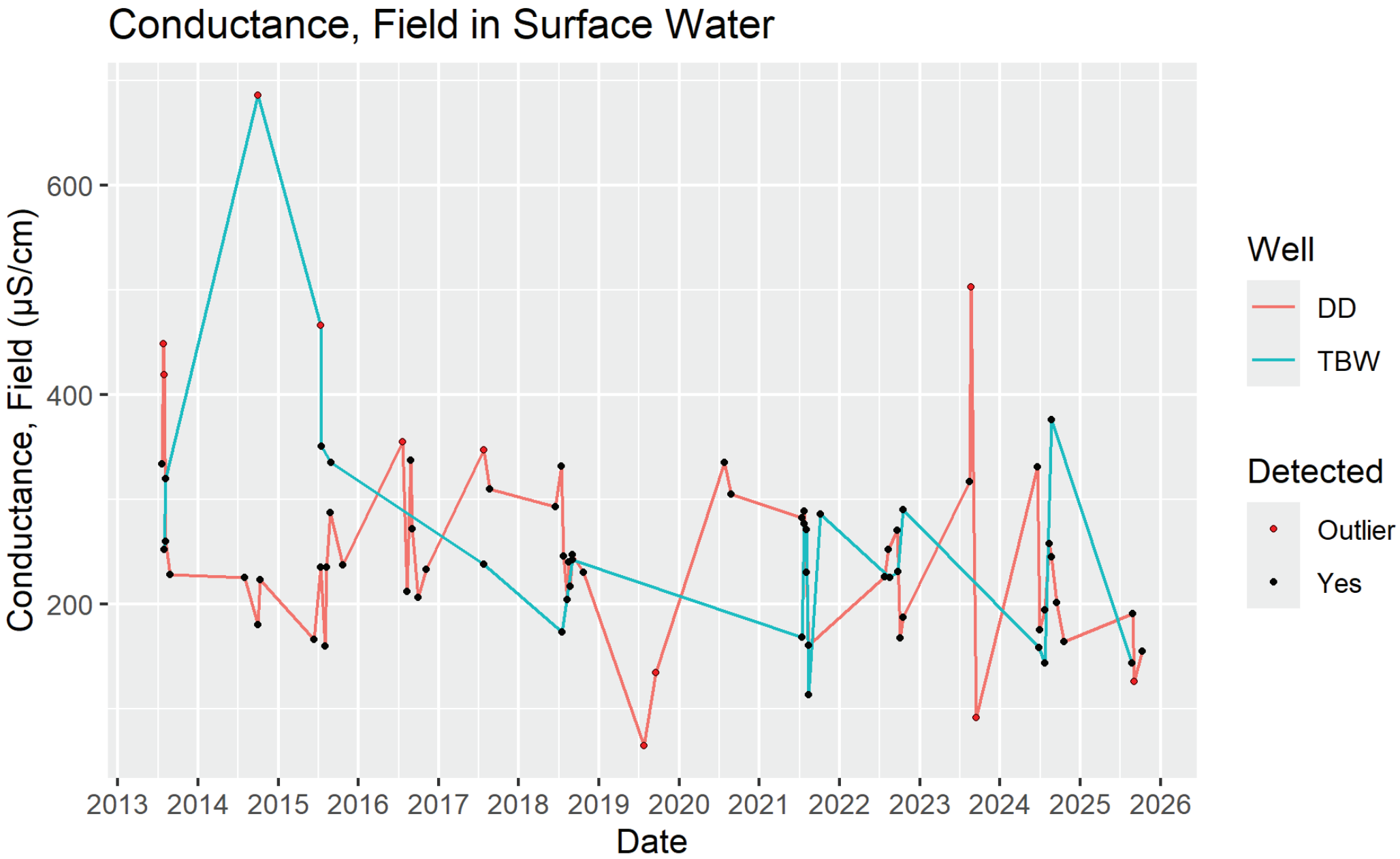

Bicarbonate in Surface Water
Bicarbonate (mg/L CaCO3)
2500
2000
1500
1000
500
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
Outlier
Yes

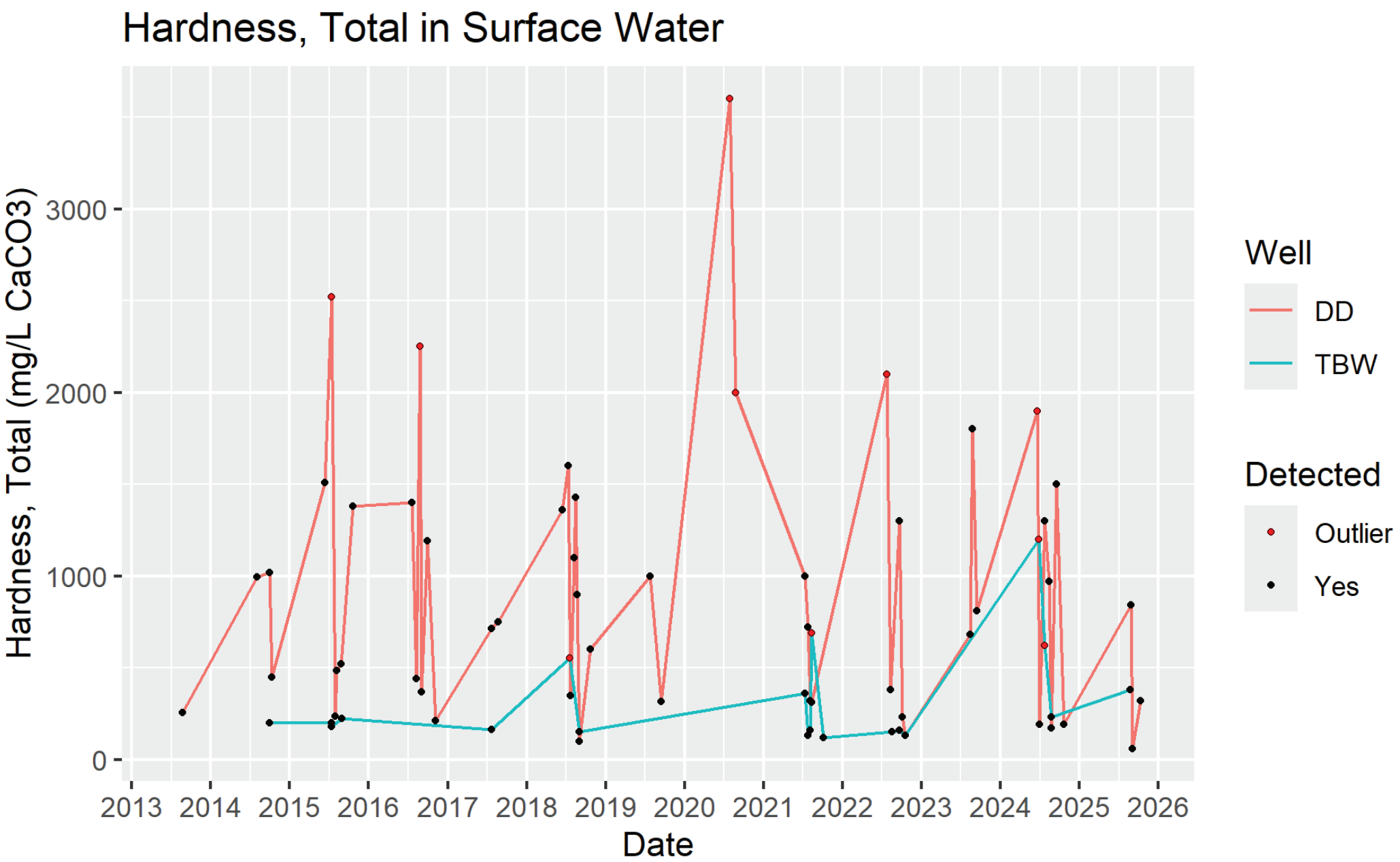

Calcium, Total in Surface Water
Calcium, Total (mg/L)
1250
1000
750
500
250
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
Outlier
Yes

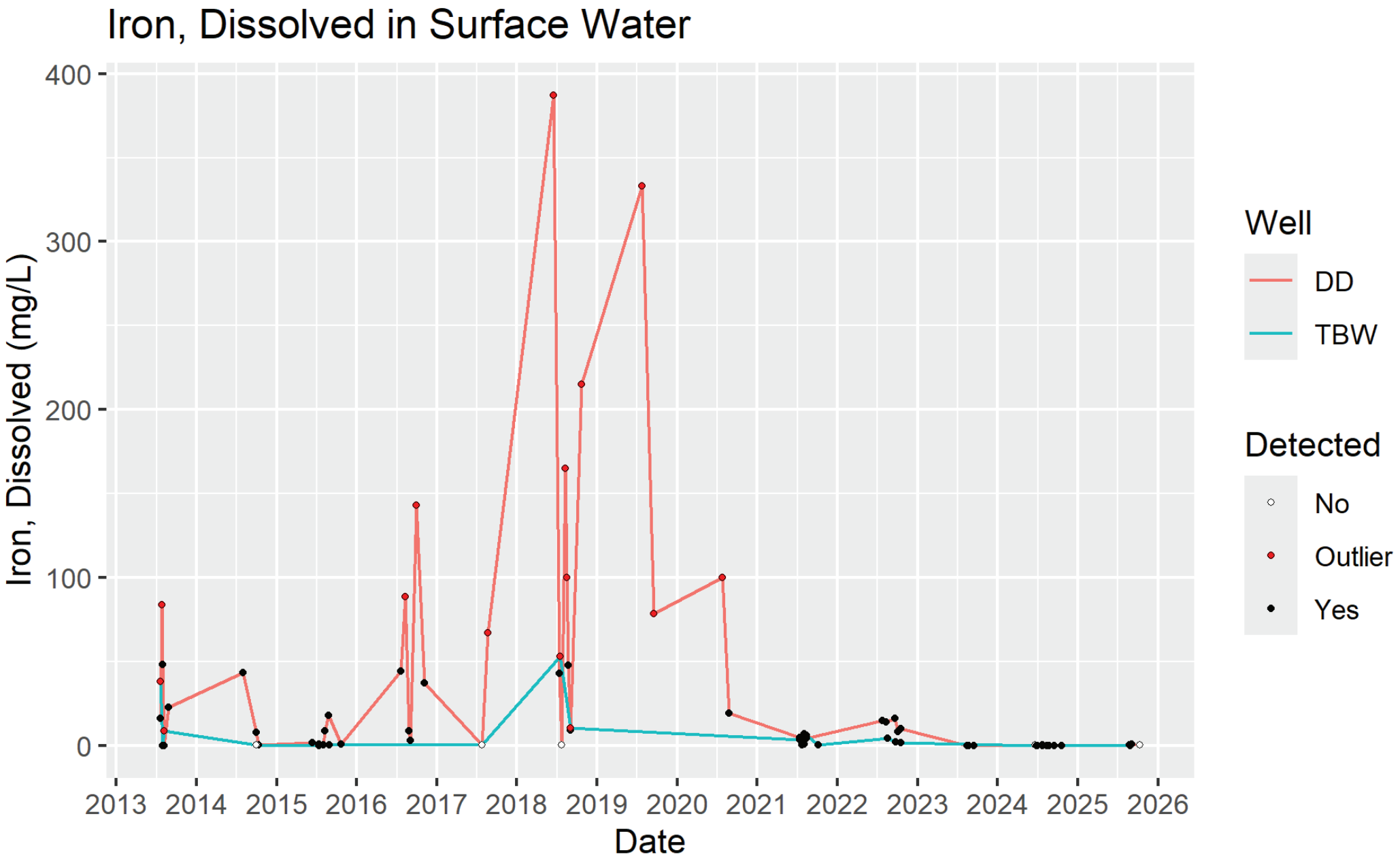

Carbonate in Surface Water
Carbonate (mg/L CaCO3)
200
150
100
50
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
No
Outlier

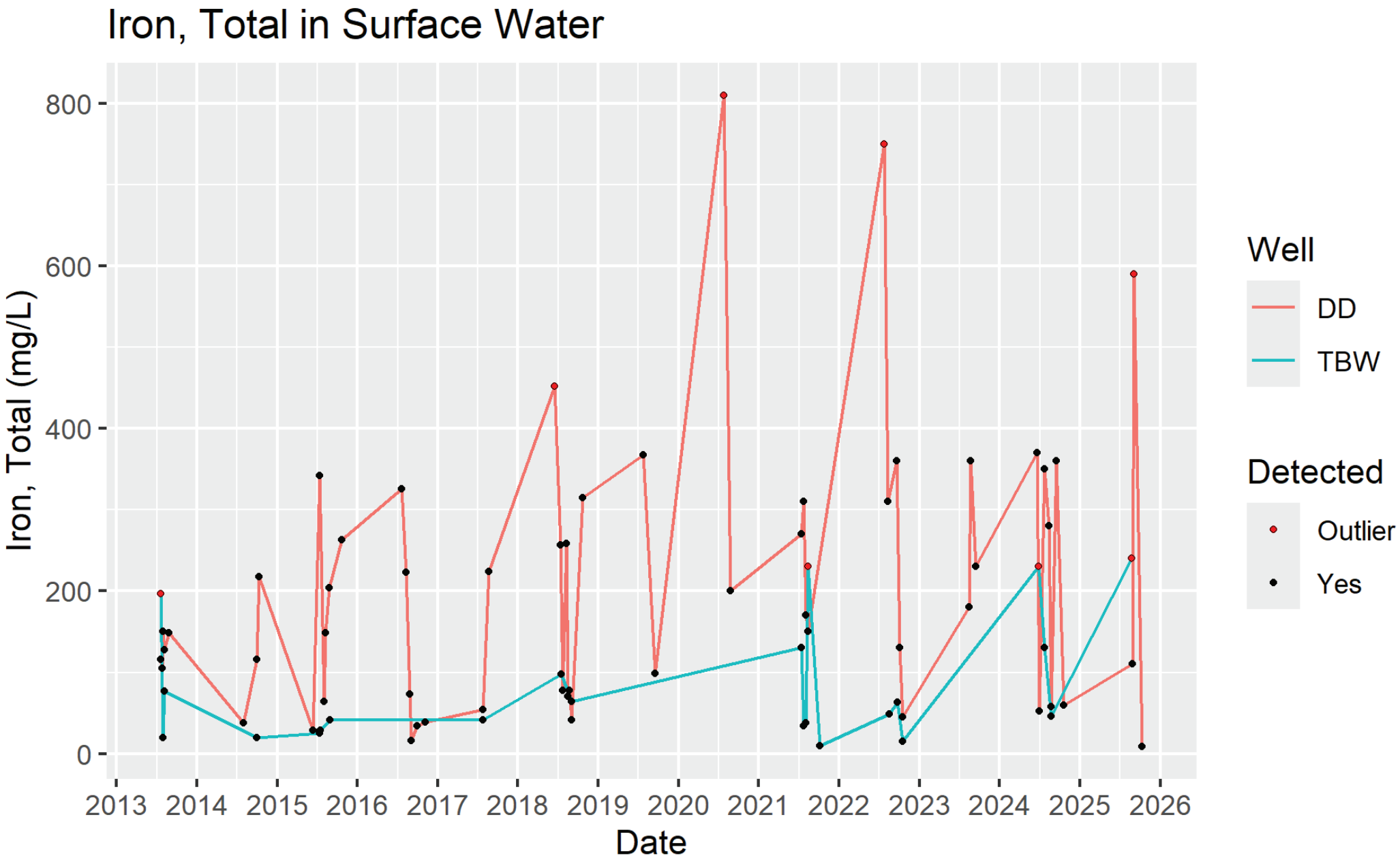

Cation-Anion Balance in Surface Water
Cation-Anion Balance (%)
75
50
25
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
Outlier
Yes

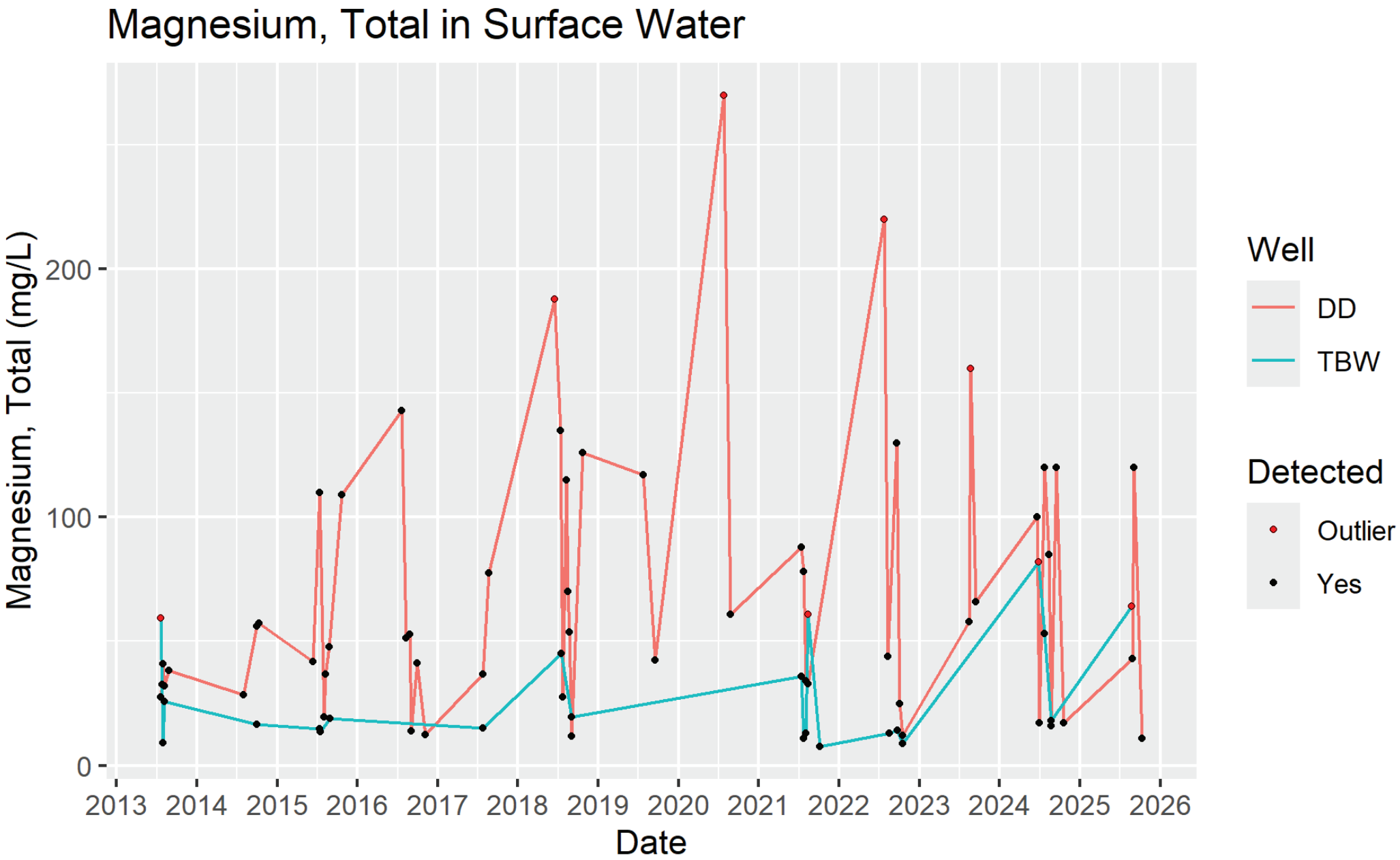

Chloride in Surface Water
Chloride (mg/L)
20
10
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
No
Outlier
Yes

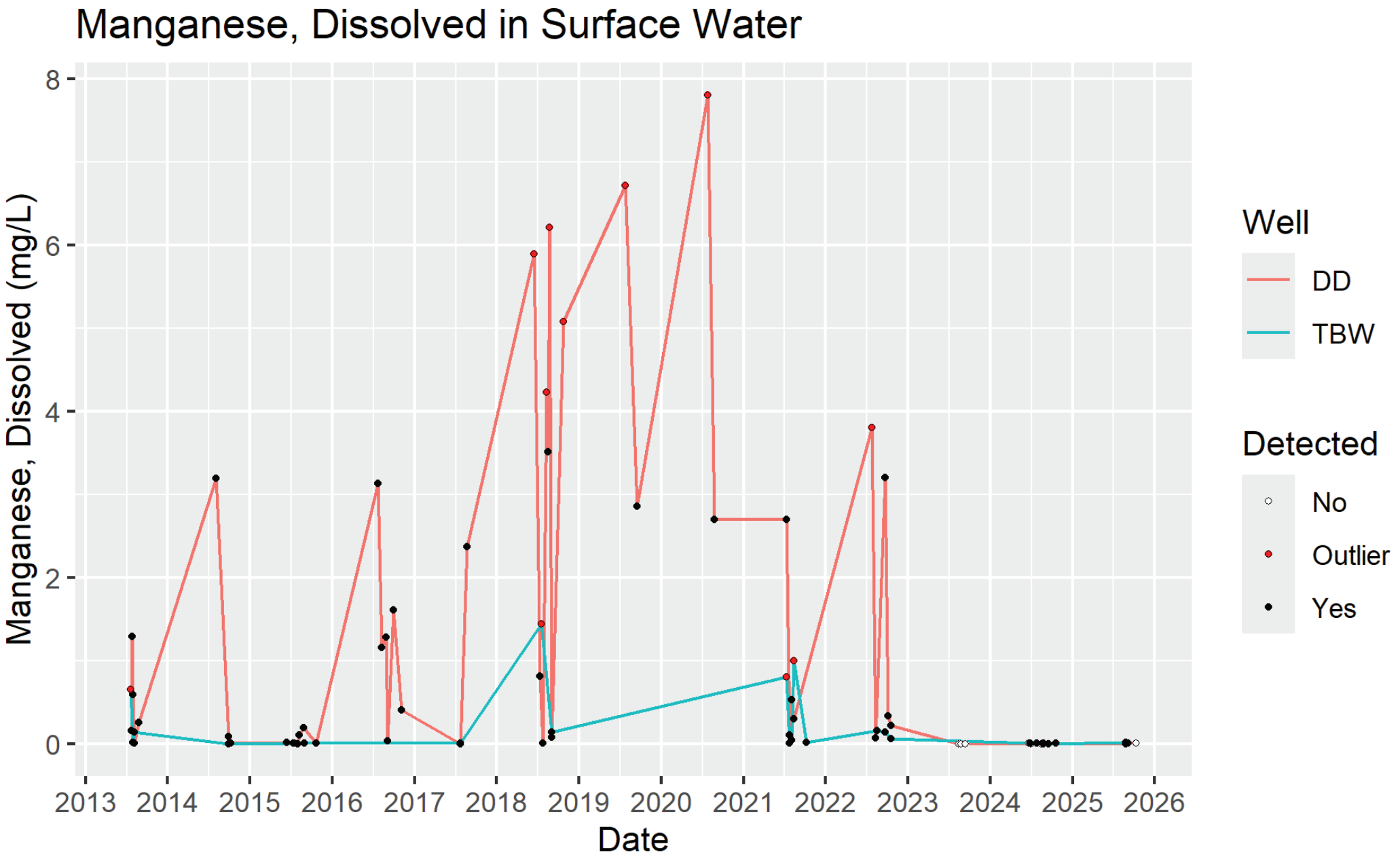

Conductance, Field in Surface Water
Conductance, Field (µS/cm)
600
400
200
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
Outlier
Yes

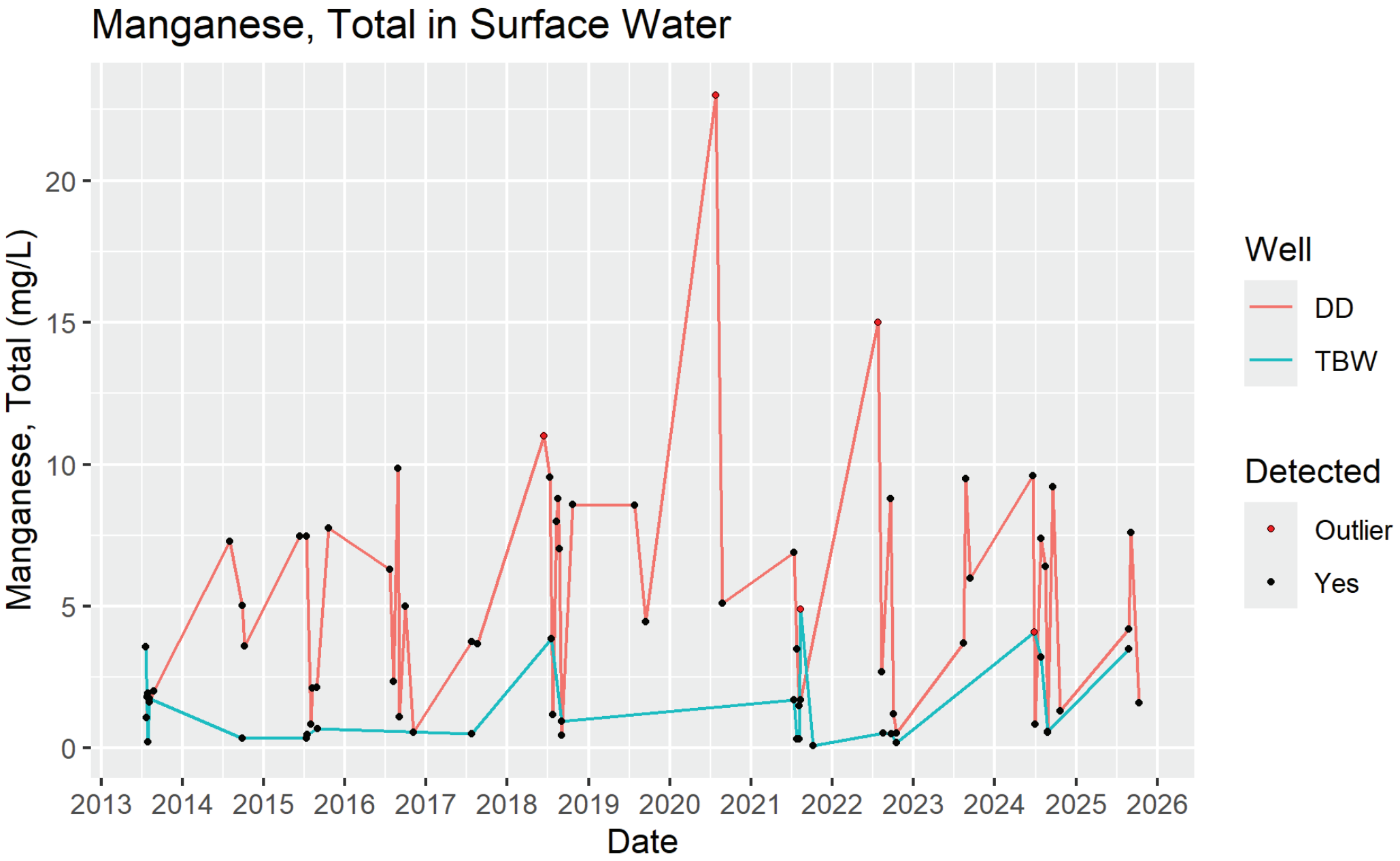

Hardness, Total in Surface Water
Hardness, Total (mg/L CaCO3)
3000
2000
1000
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
Outlier
Yes

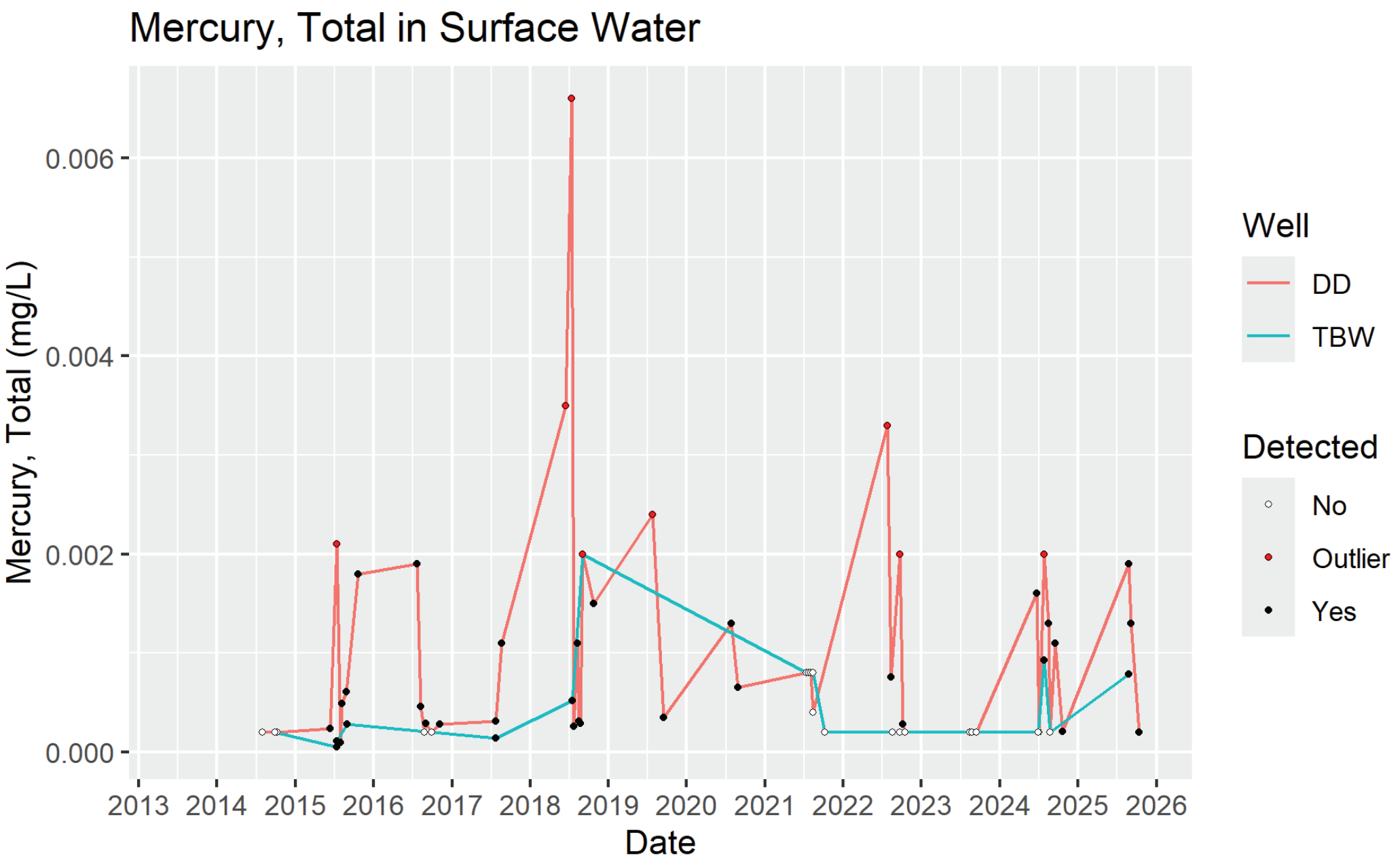

Iron, Dissolved in Surface Water
Iron, Dissolved (mg/L)
400
300
200
100
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
No
Outlier
Yes

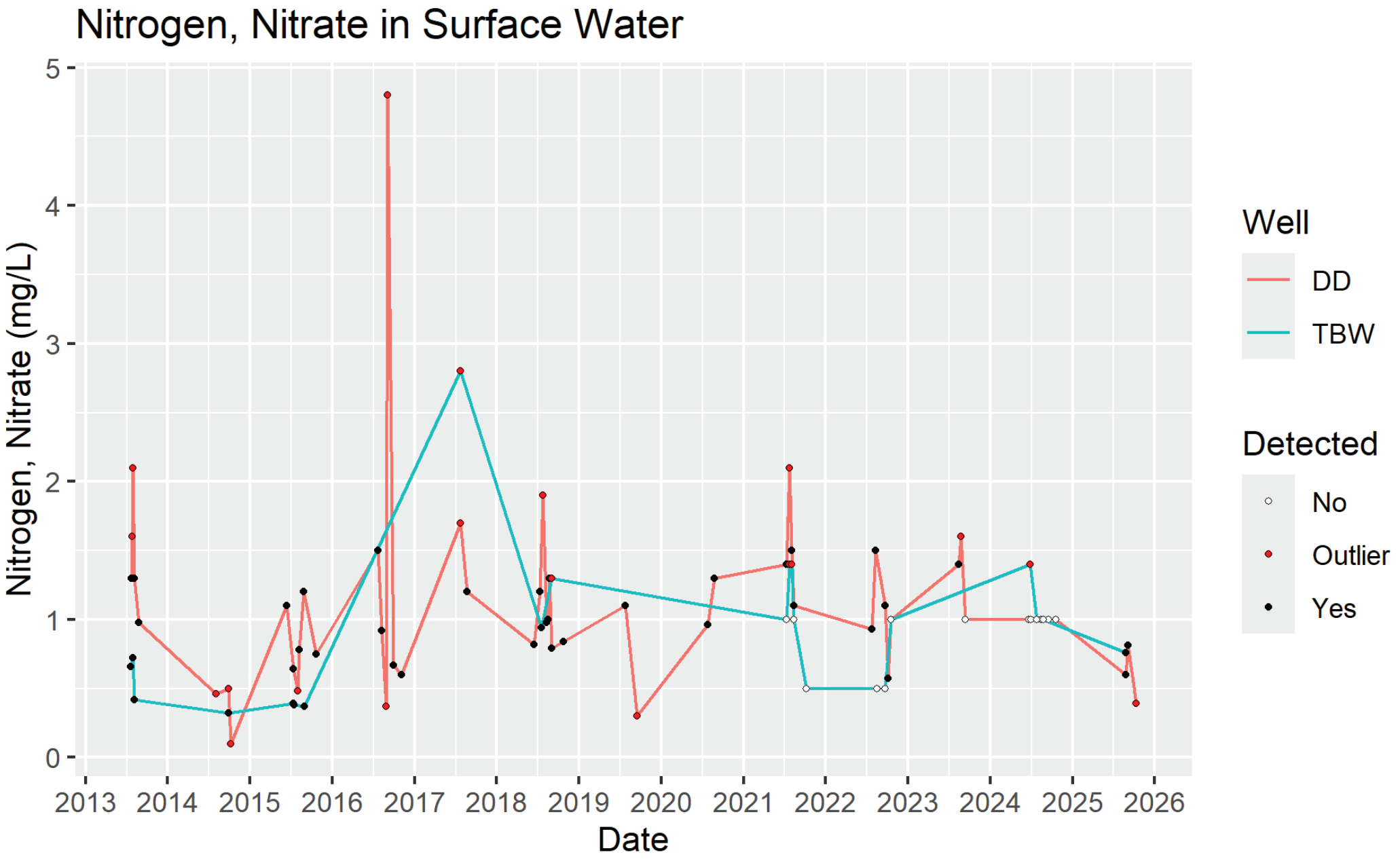

Iron, Total in Surface Water
Iron, Total (mg/L)
800
600
400
200
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
Outlier
Yes

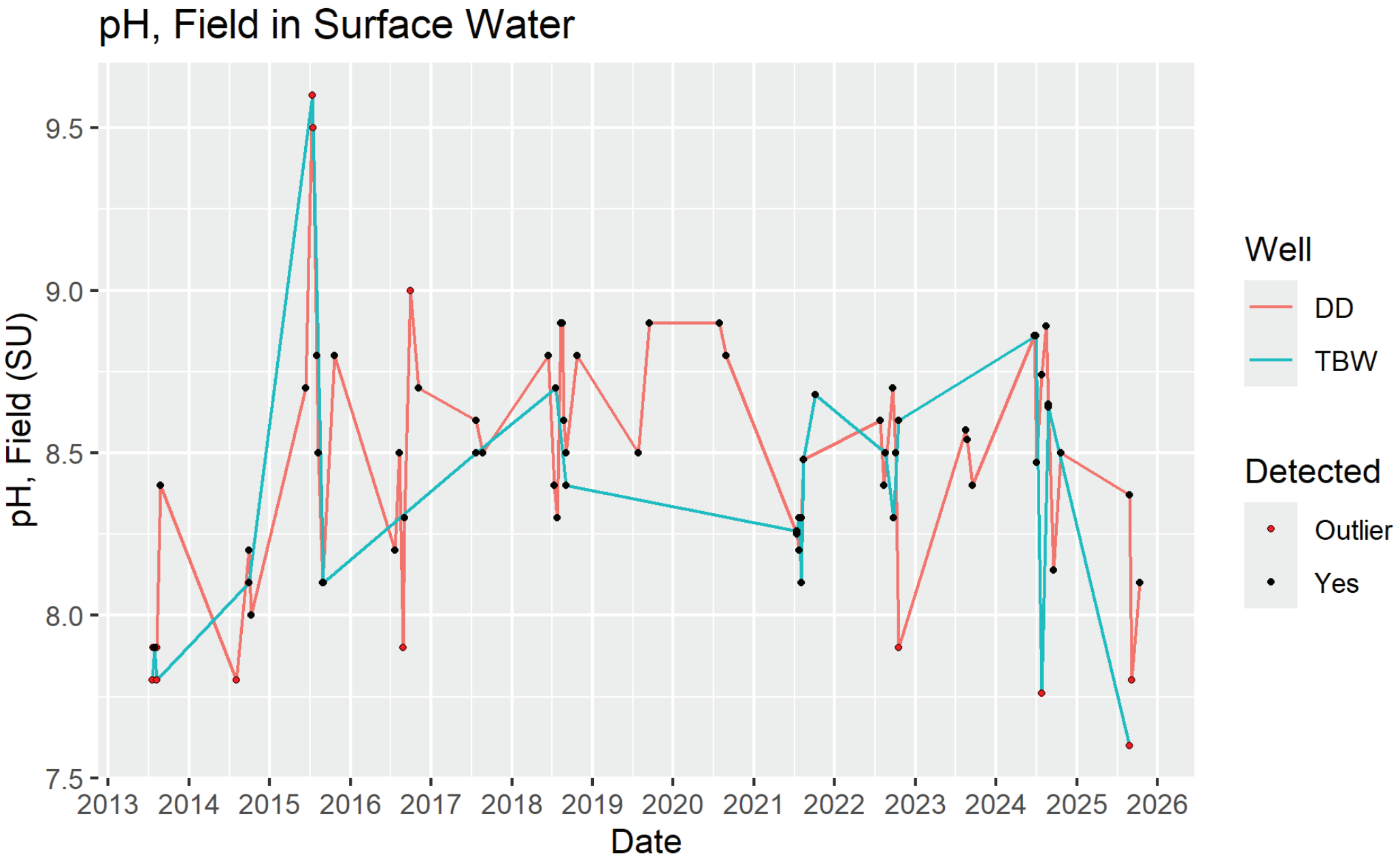

Magnesium, Total in Surface Water
Magnesium, Total (mg/L)
200
100
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
Outlier
Yes

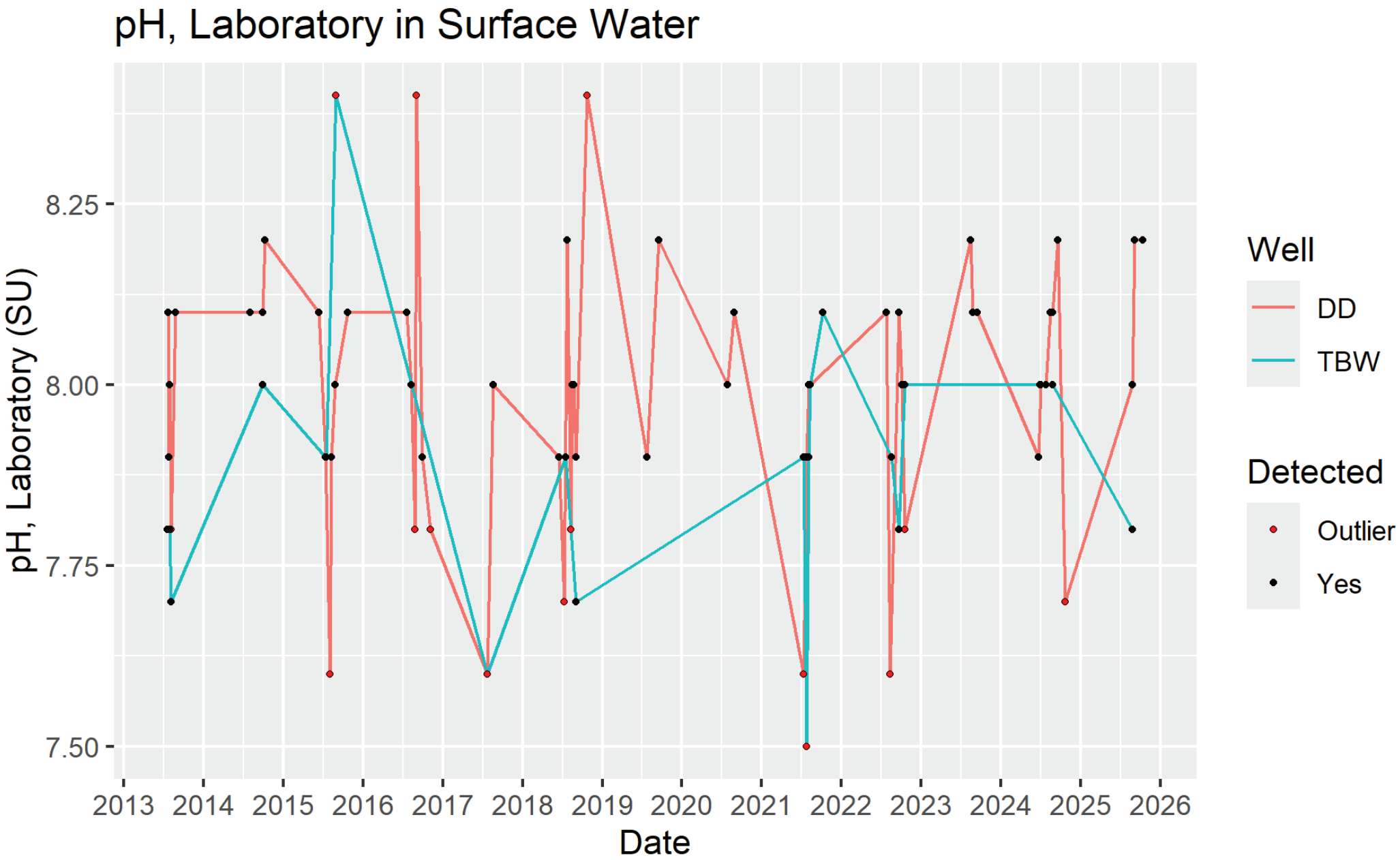

Manganese, Dissolved in Surface Water
Manganese, Dissolved (mg/L)
8
6
4
2
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
No
Outlier
Yes

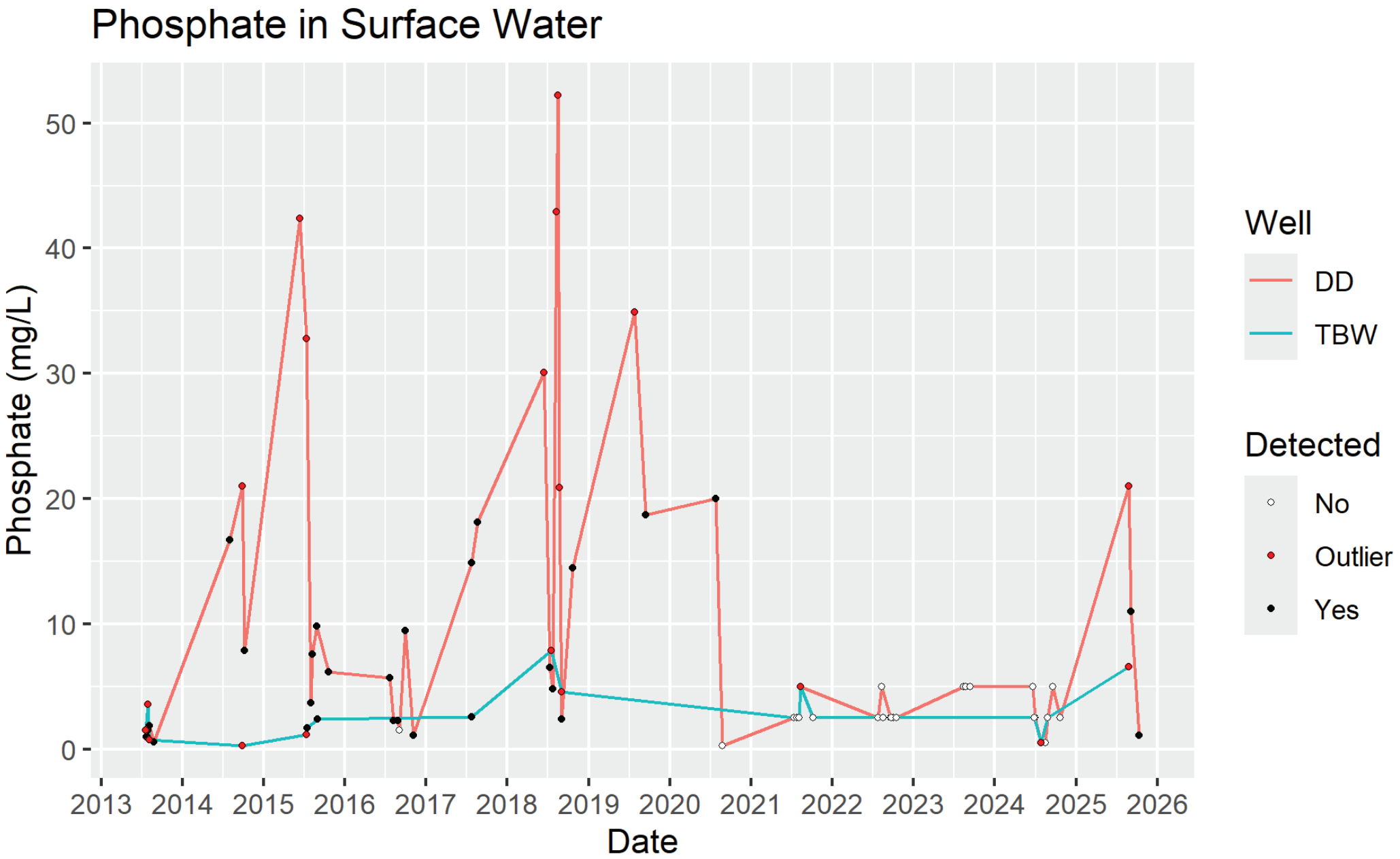

Manganese, Total in Surface Water
Manganese, Total (mg/L)
0
5
10
15
20
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
Outlier
Yes

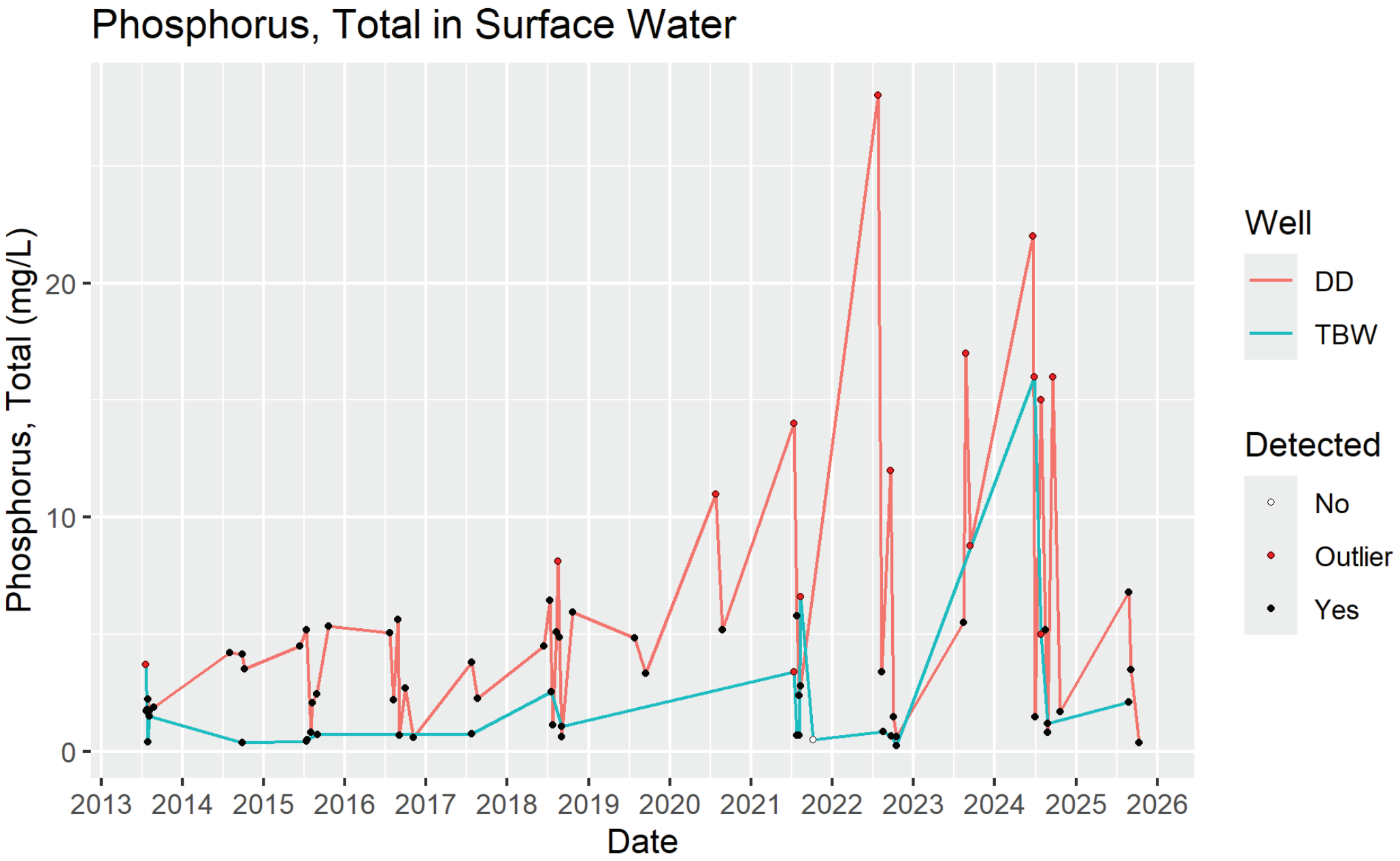

Mercury, Total in Surface Water
Mercury, Total (mg/L)
0.006
0.004
0.002
0.000
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
No
Outlier
Yes

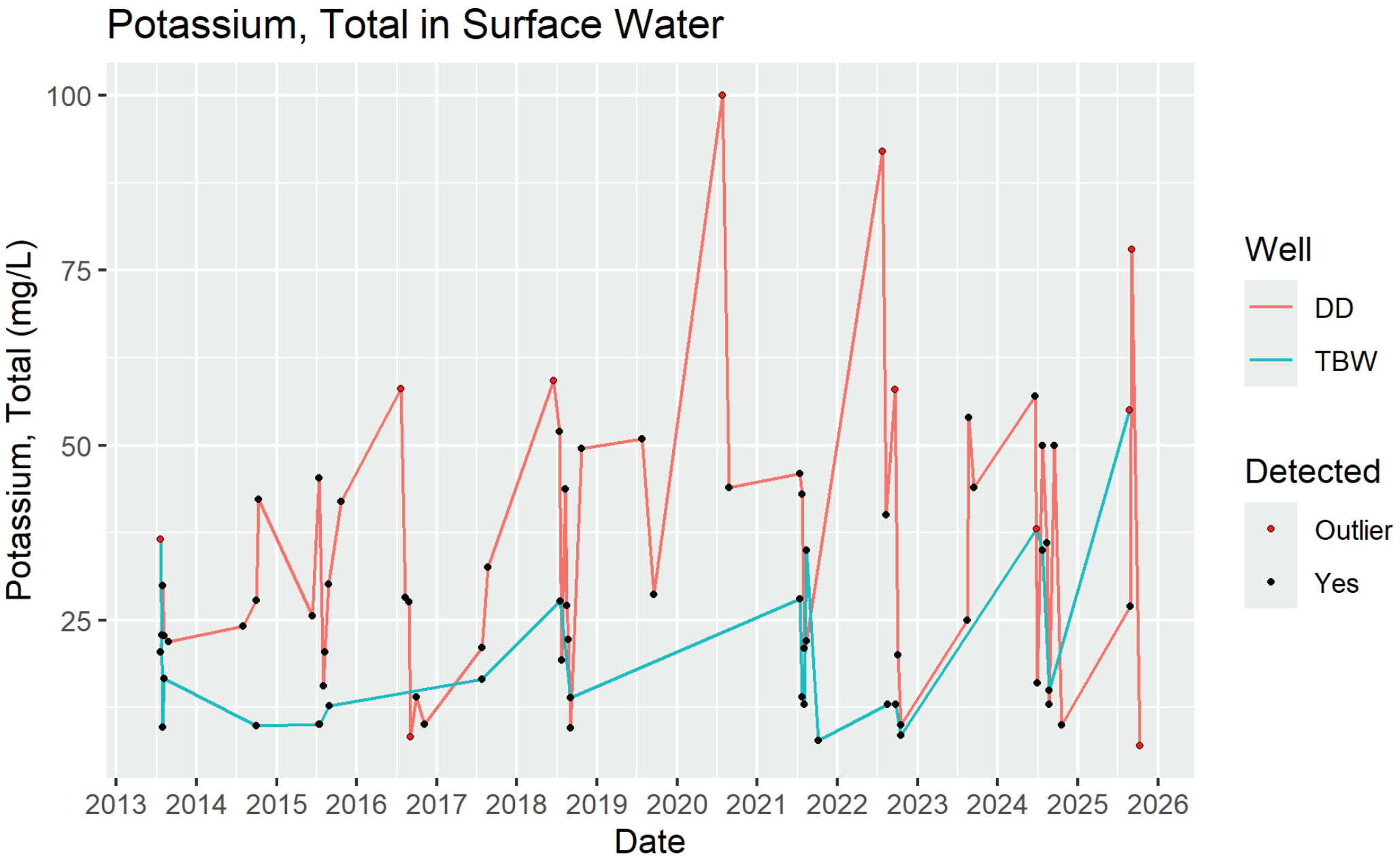

Nitrogen, Nitrate in Surface Water
Nitrogen, Nitrate (mg/L)
0
1
2
3
4
5
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
No
Outlier
Yes

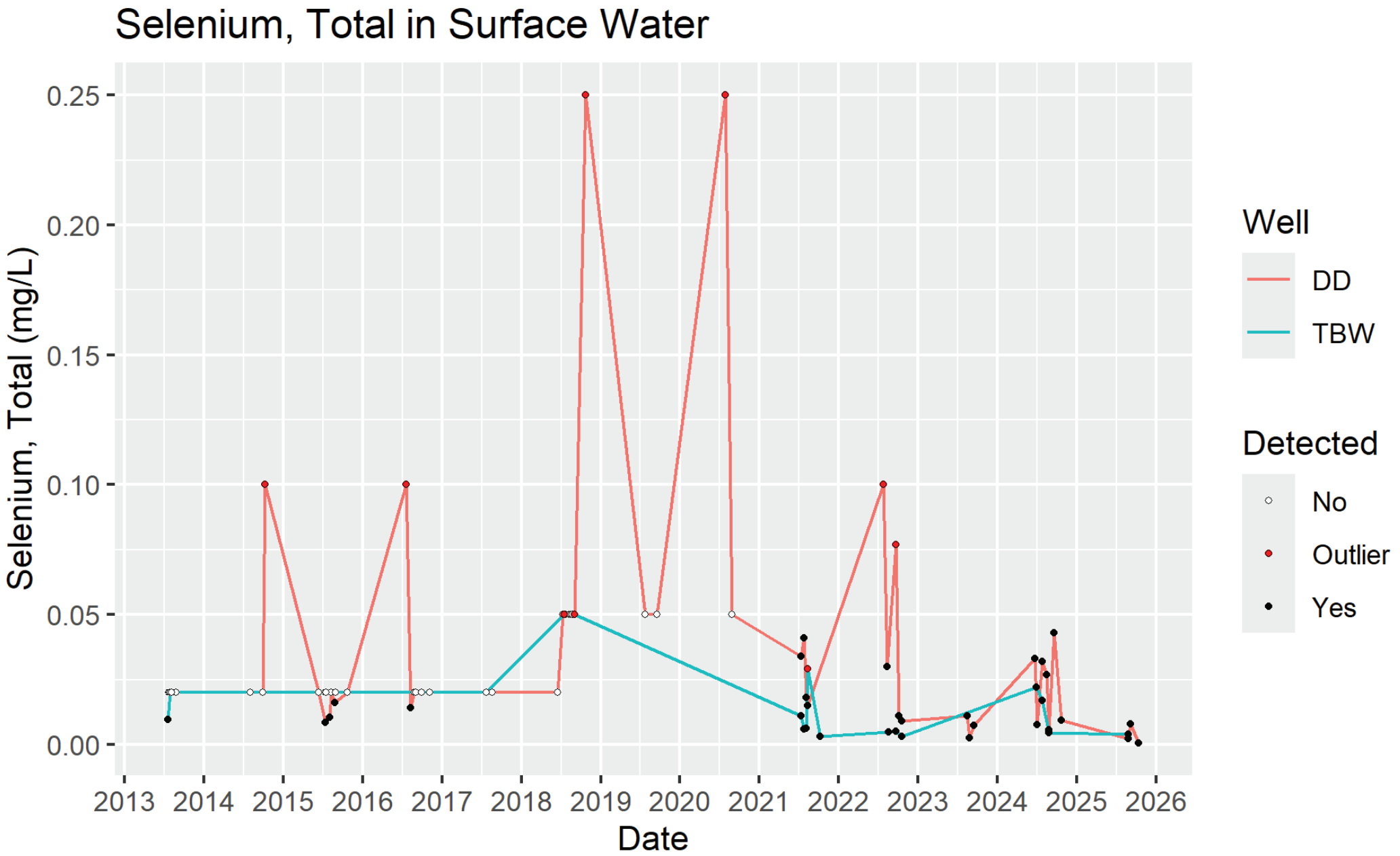

pH, Field in Surface Water
pH, Field (SU)
9.5
9.0
8.5
8.0
7.5
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
Outlier
Yes

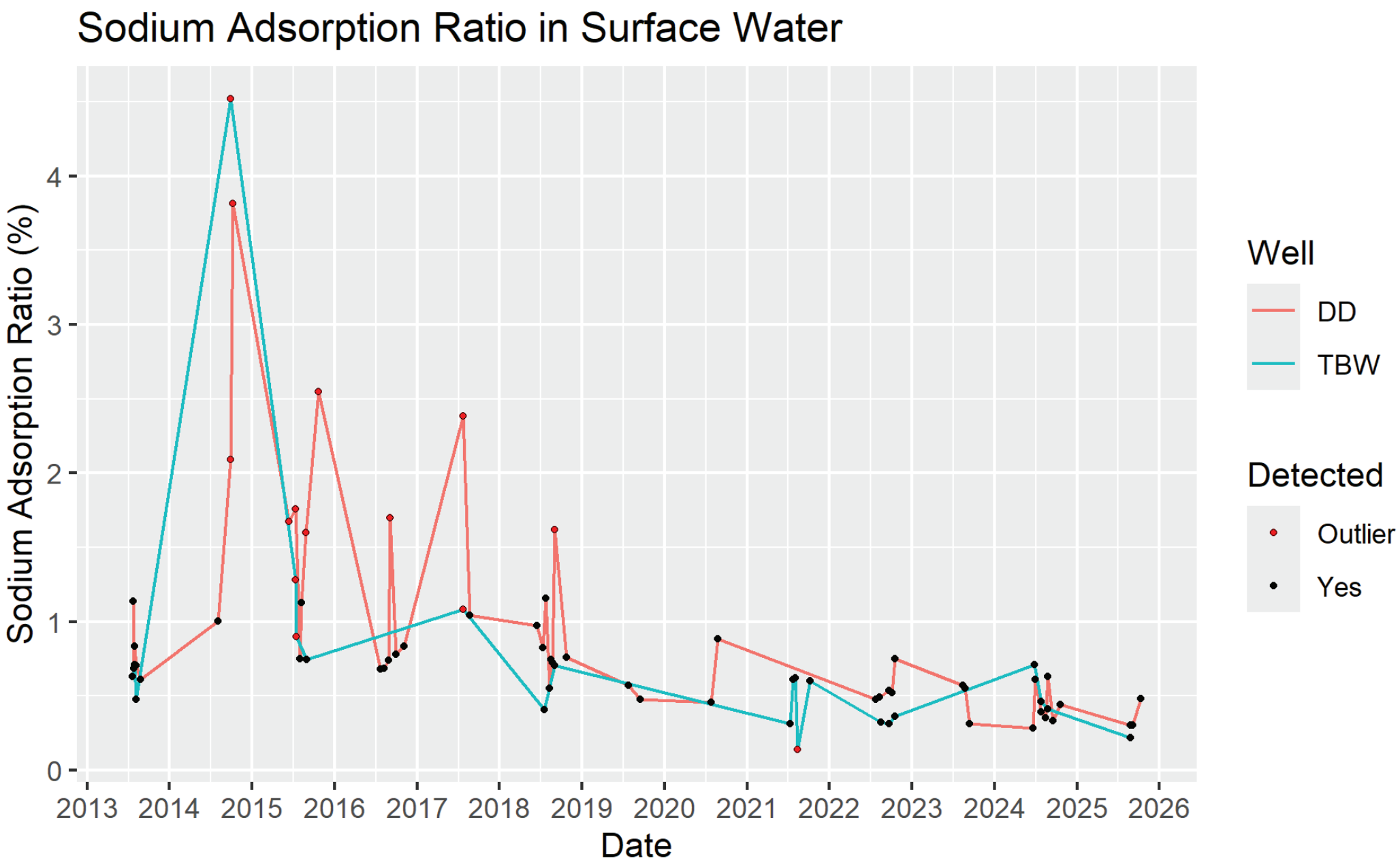

pH, Laboratory in Surface Water
pH, Laboratory (SU)
8.25
8.00
7.75
7.50
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
Outlier
Yes

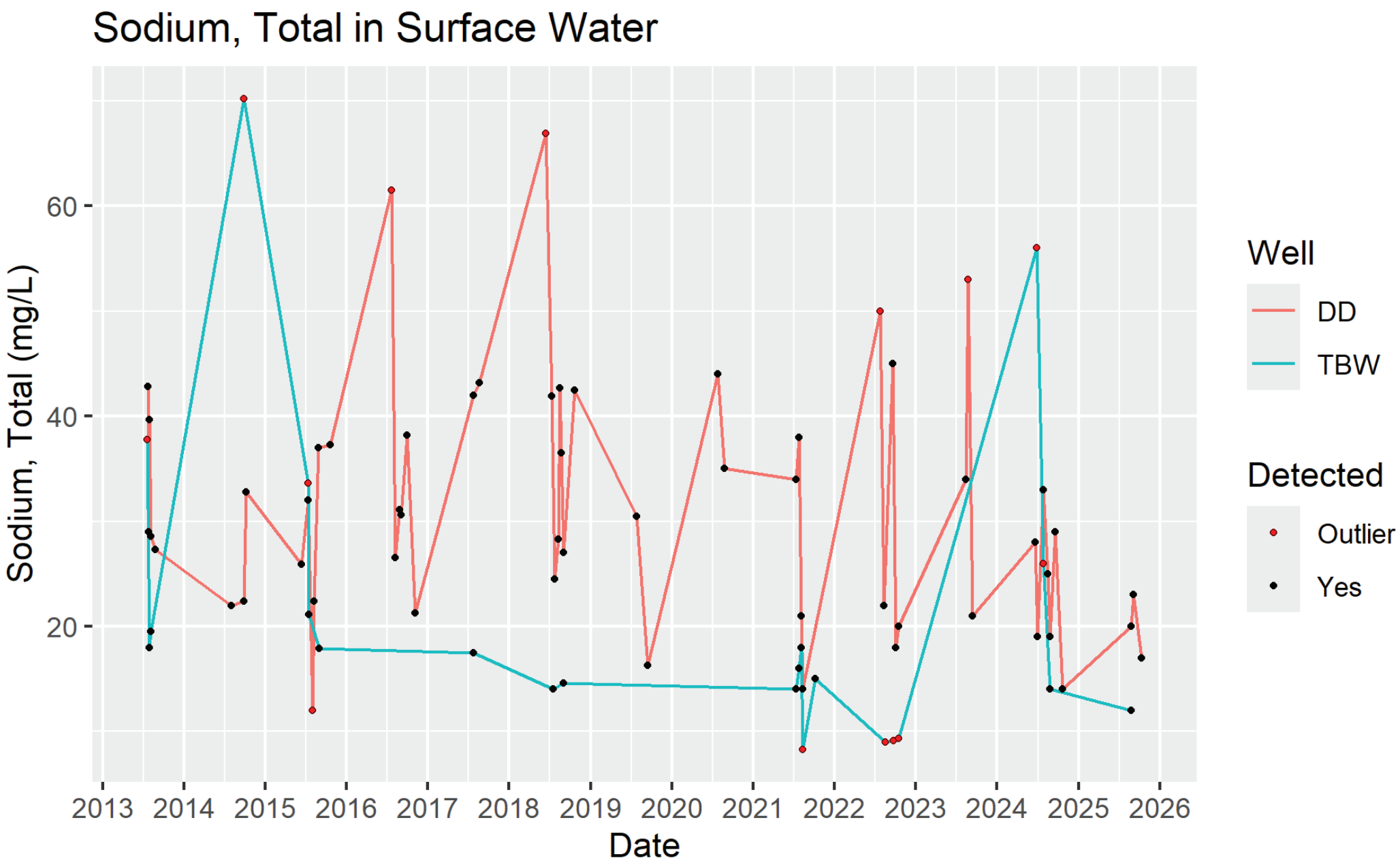

Phosphate in Surface Water
Phosphate (mg/L)
50
40
30
20
10
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
No
Outlier
Yes

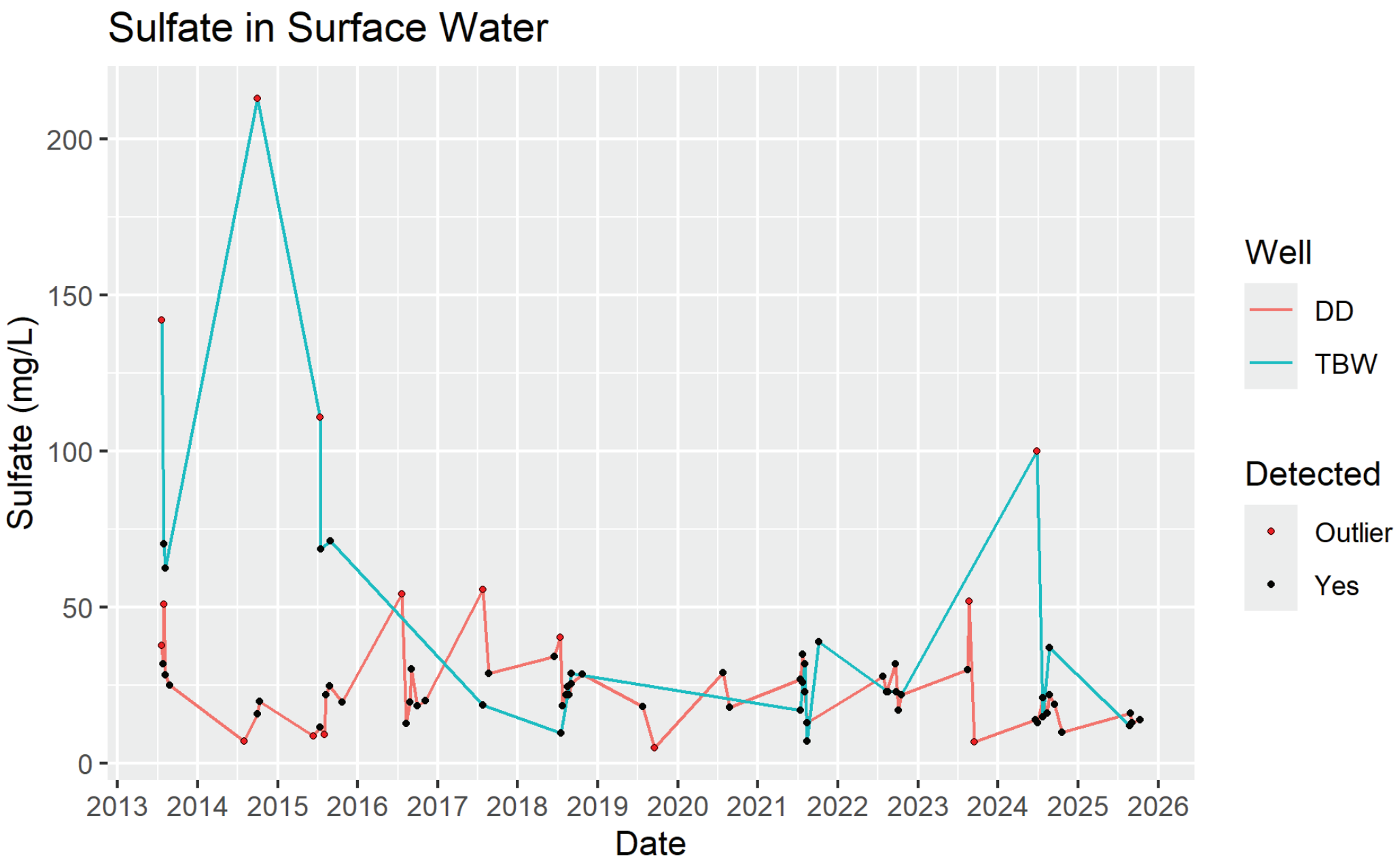

Phosphorus, Total in Surface Water
Phosphorus, Total (mg/L)
0
10
20
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
No
Outlier
Yes

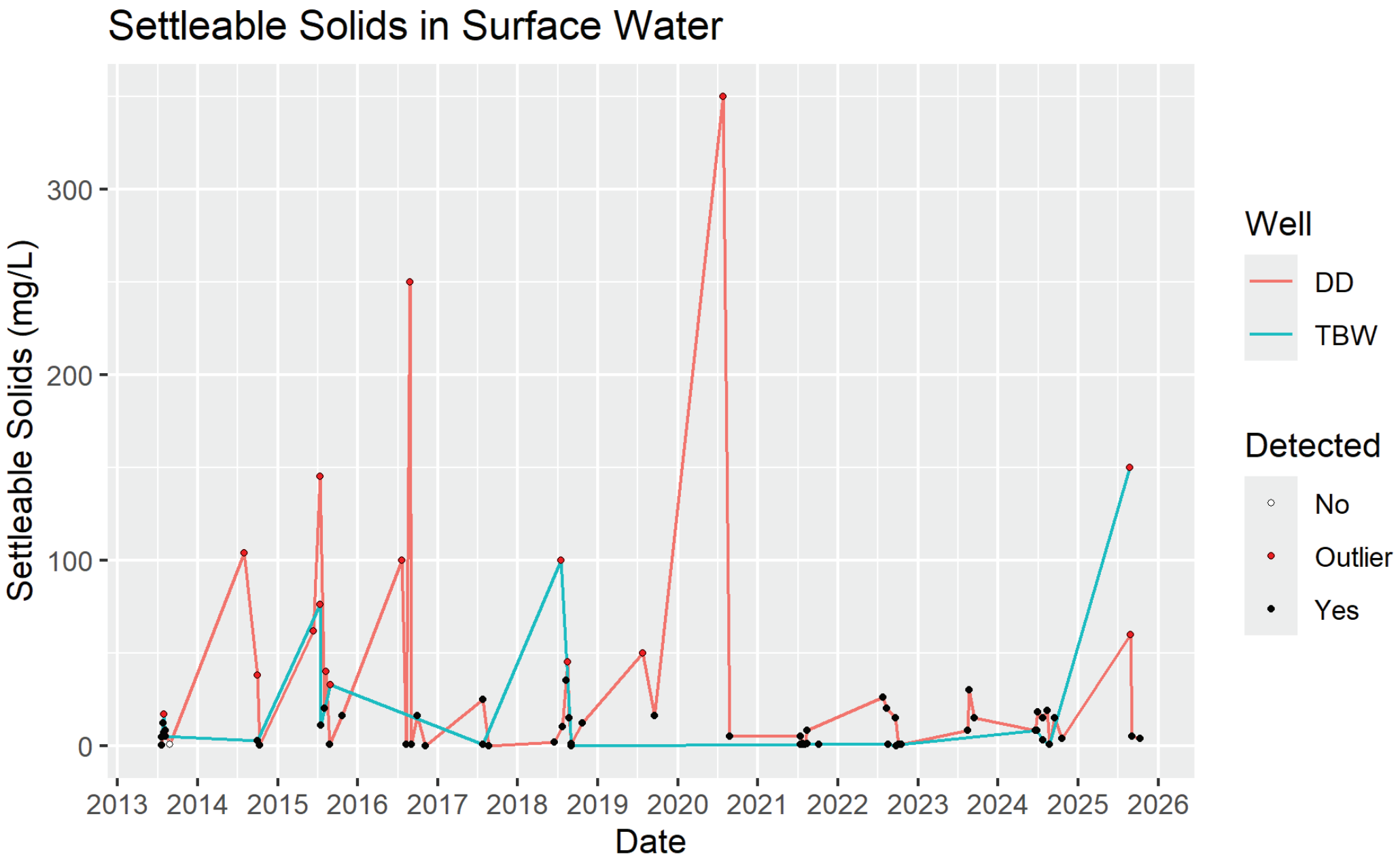

Potassium, Total in Surface Water
Potassium, Total (mg/L)
100
75
50
25
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
Outlier
Yes

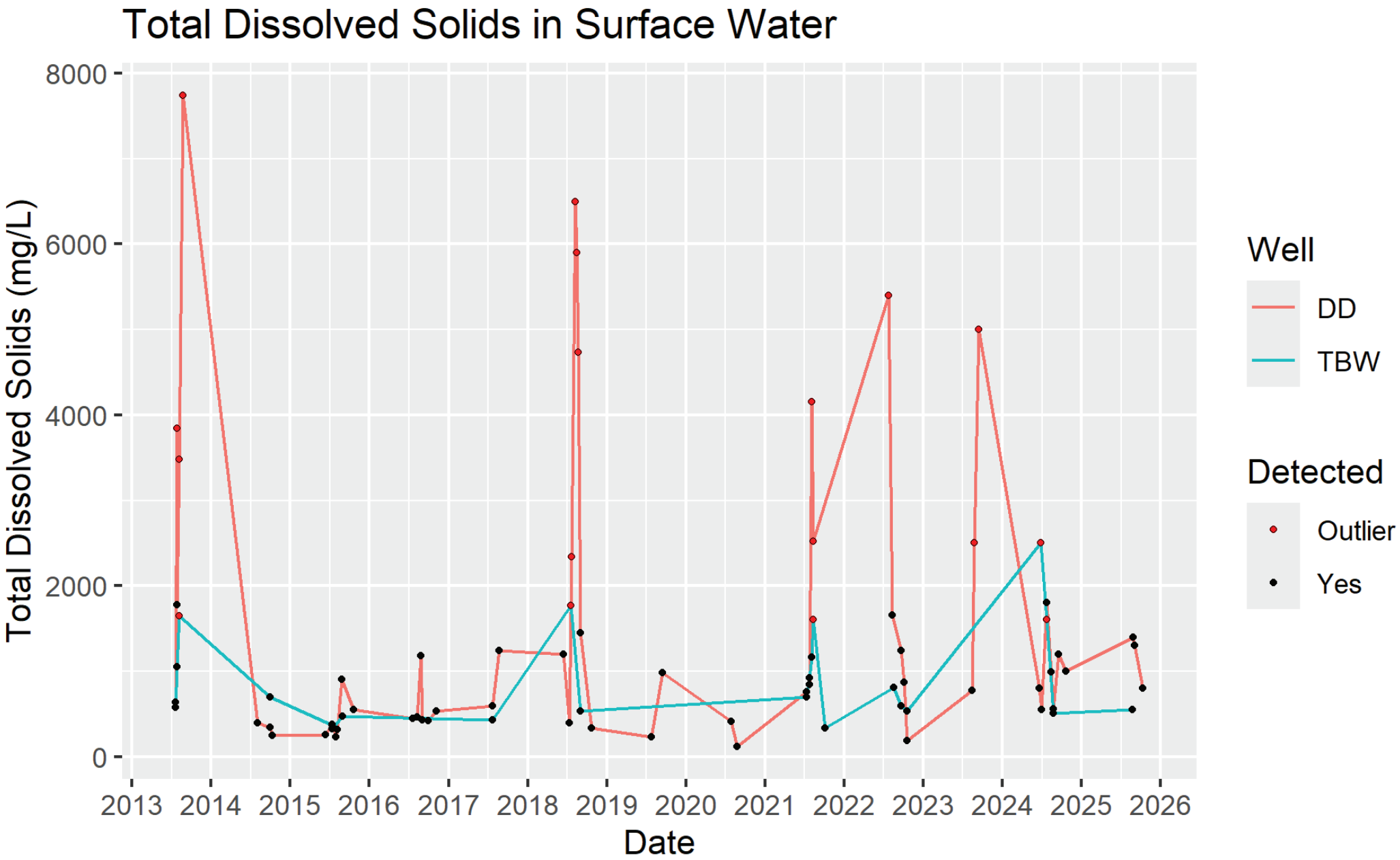

Selenium, Total in Surface Water
Selenium, Total (mg/L)
0.25
0.20
0.15
0.10
0.05
0.00
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
No
Outlier
Yes

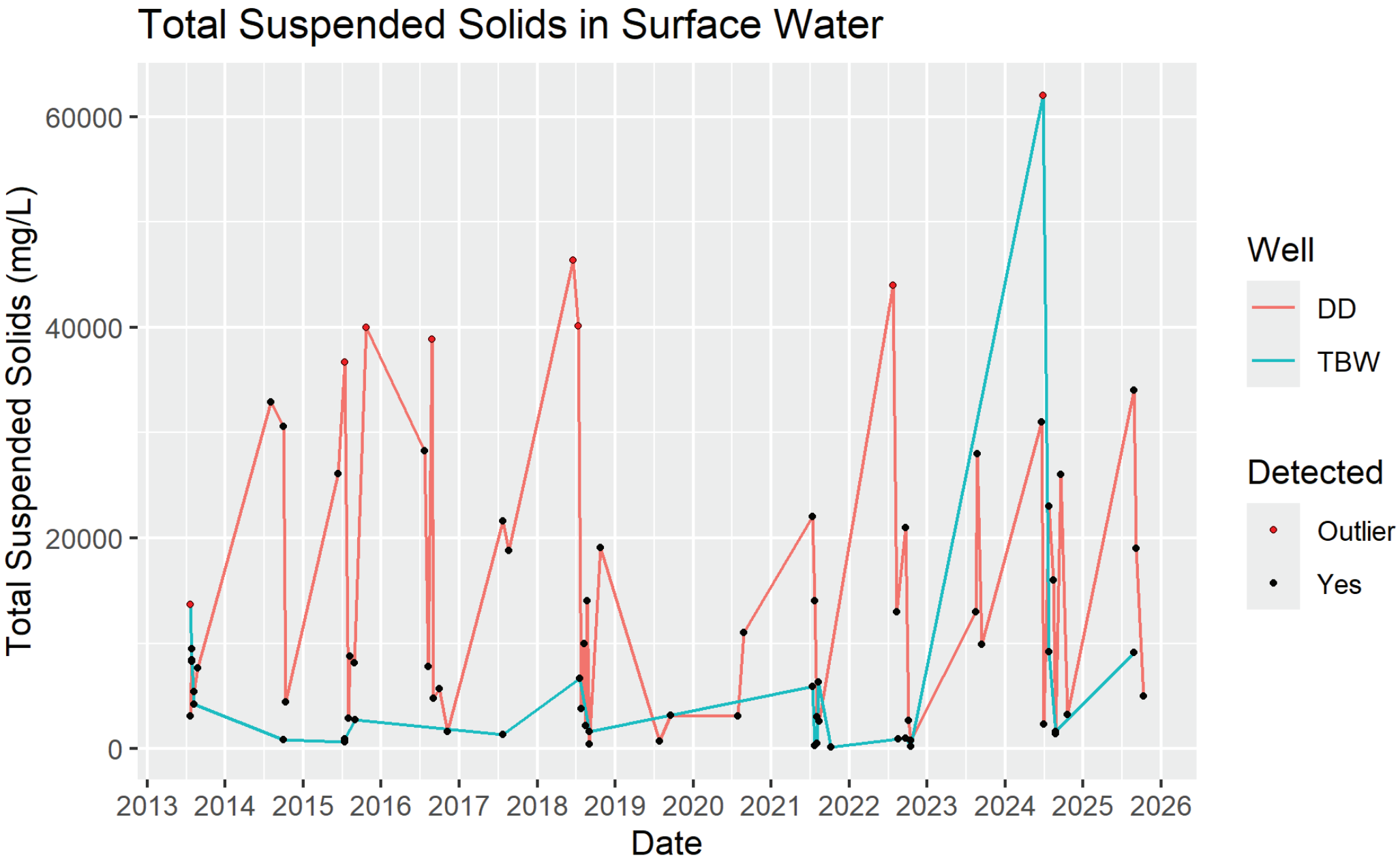

Sodium Adsorption Ratio in Surface Water
Sodium Adsorption Ratio (%)
0
1
2
3
4
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
Outlier
Yes


Sodium, Total in Surface Water
Sodium, Total (mg/L)
60
40
20
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
Outlier
Yes


Sulfate in Surface Water
Sulfate (mg/L)
200
150
100
50
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
Outlier
Yes


Settleable Solids in Surface Water
Settleable Solids (mg/L)
300
200
100
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
No
Outlier
Yes


Total Dissolved Solids in Surface Water
Total Dissolved Solids (mg/L)
8000
6000
4000
2000
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
Outlier
Yes


Total Suspended Solids in Surface Water
Total Suspended Solids (mg/L)
60000
40000
20000
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
Date
Well
DD
TBW
Detected
Outlier
Yes

APPENDIX C

GROUNDWATER QUALITY TEMPORAL PLOTS

C-1. HISTORICAL GROUNDWATER TEMPORAL PLOTS – ALLUVIAL GROUNDWATER WELL TB2B2

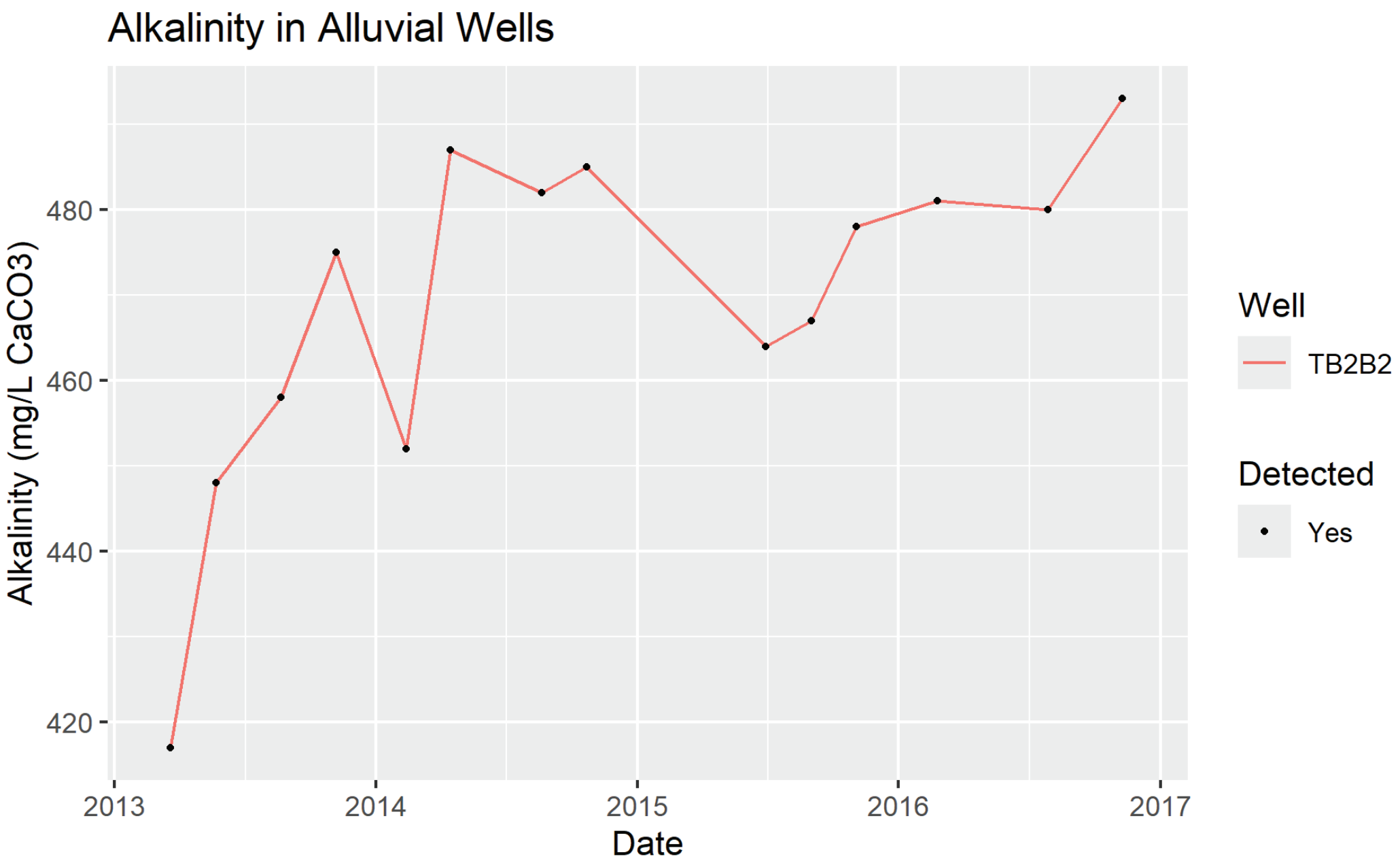
C-2. HISTORICAL GROUNDWATER TEMPORAL PLOTS – GALLUP SANDSTONE AQUIFER WELL 1, WELL 2, AND WELL 3

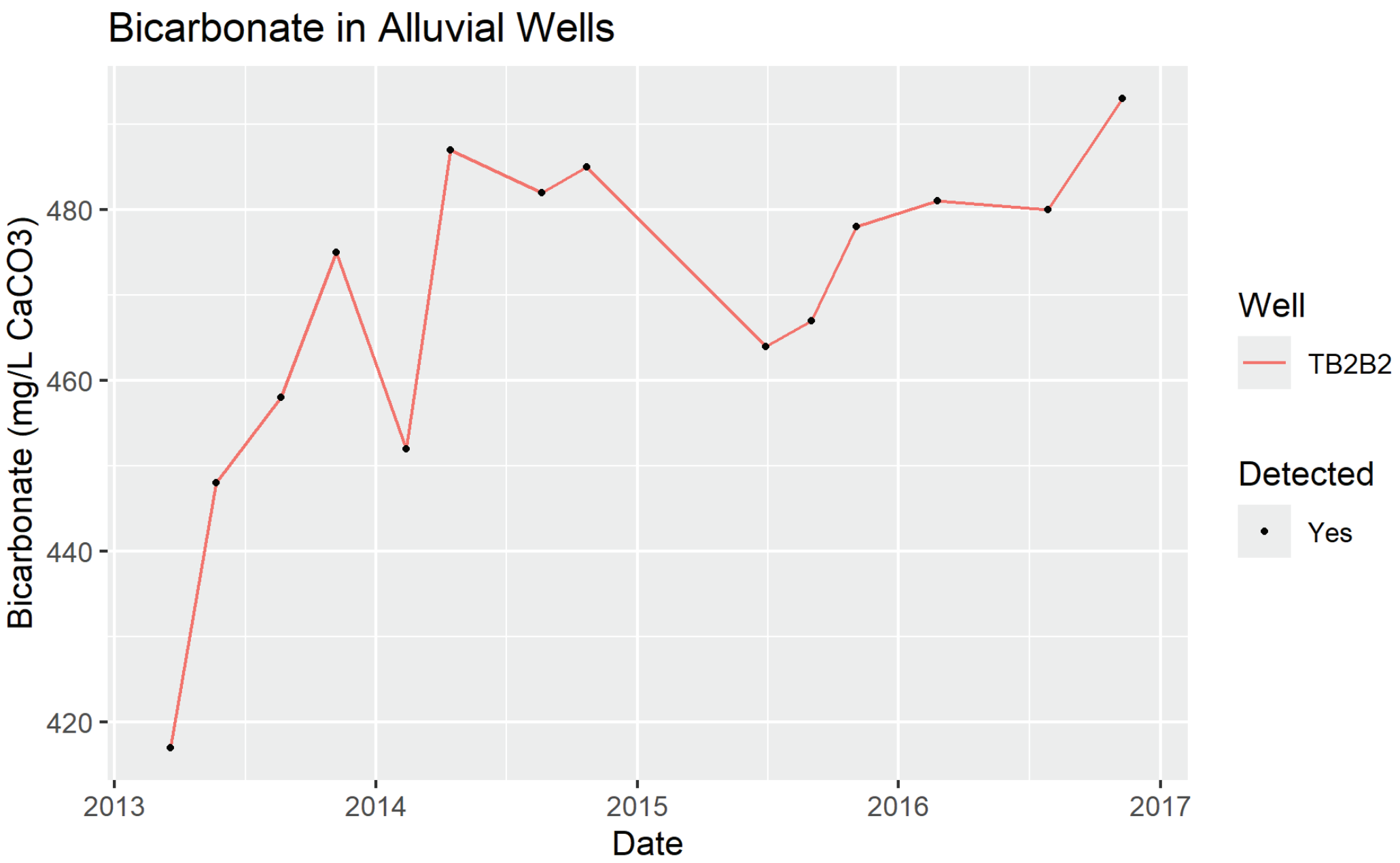
C-3. HISTORICAL GROUNDWATER TEMPORAL PLOTS – BEDROCK MONITORING WELL MBR2 AND WELL MBR5

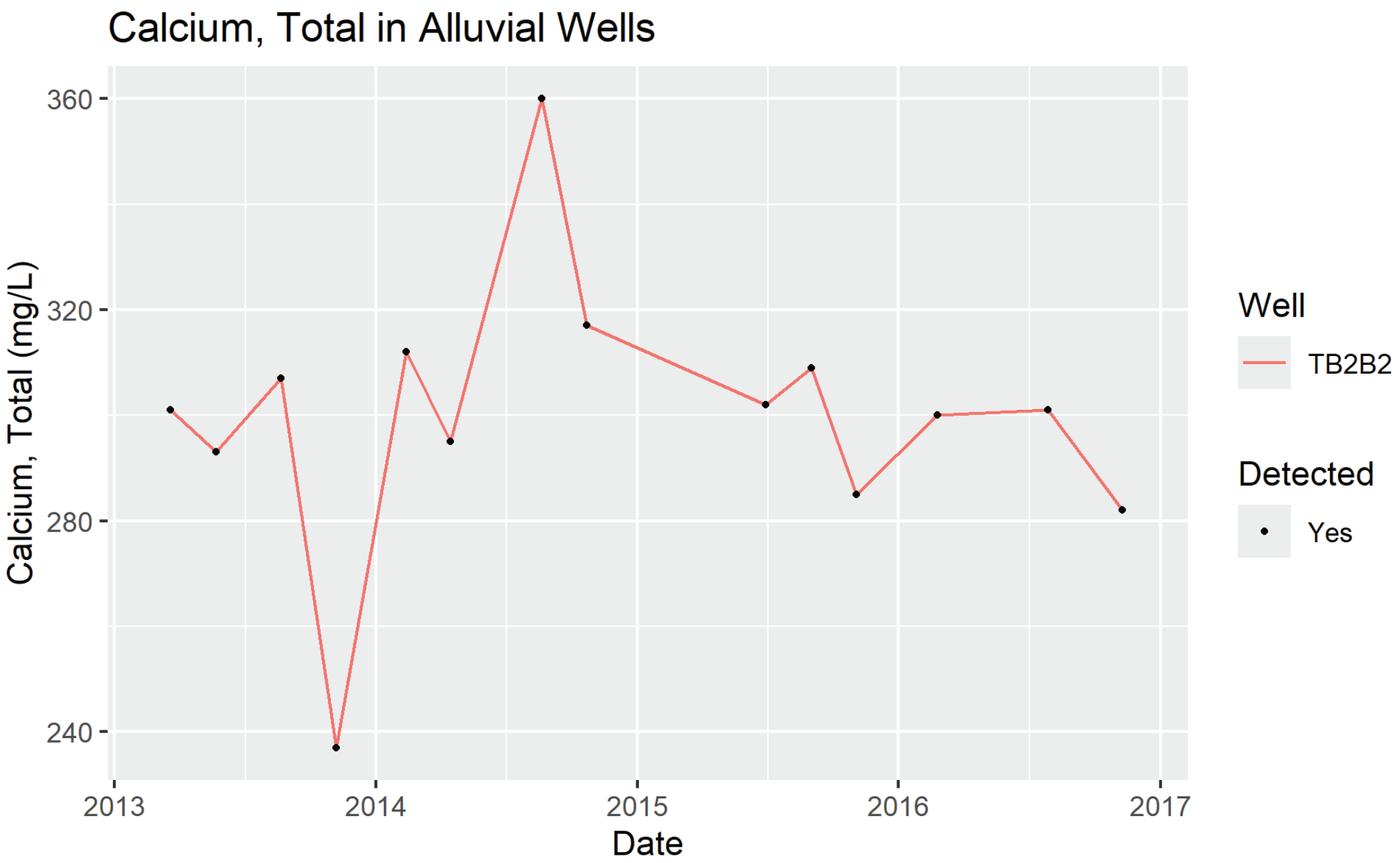
C-4. HISTORICAL GROUNDWATER TEMPORAL PLOTS – SPOIL GROUNDWATER WELL 11

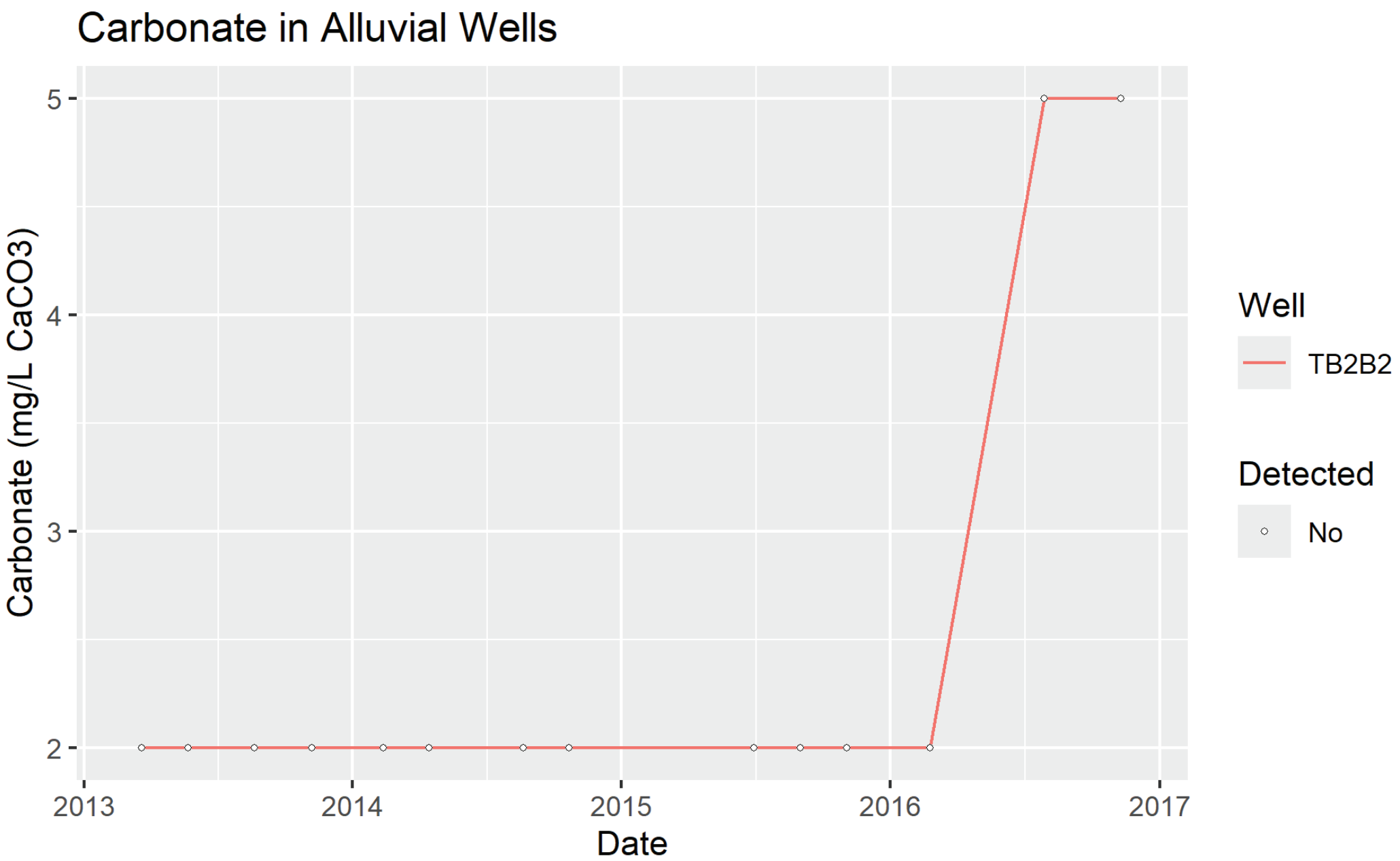
APPENDIX C-1

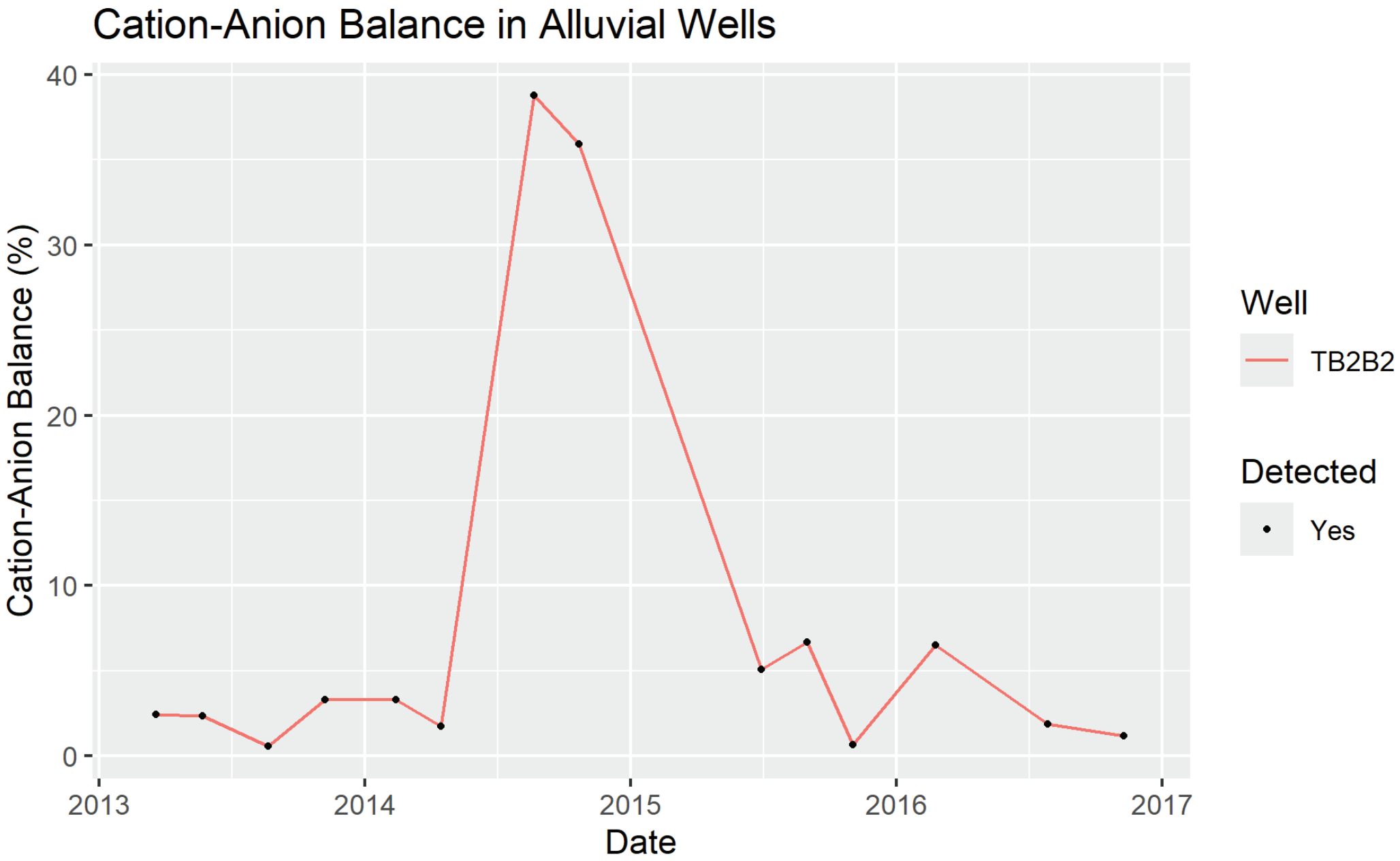
HISTORICAL GROUNDWATER TEMPORAL PLOTS – ALLUVIAL GROUNDWATER WELL TB2B2

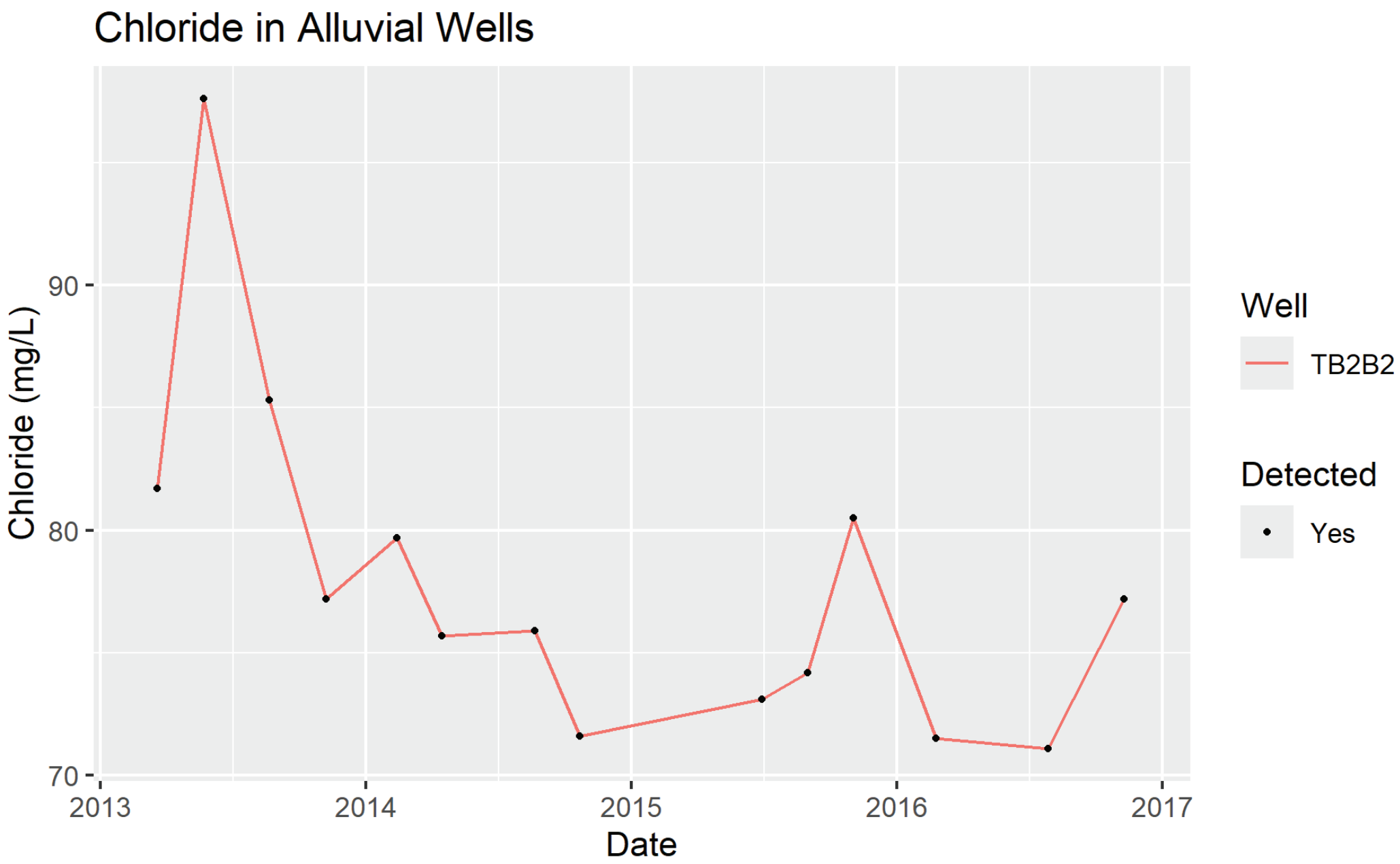

Alkalinity in Alluvial Wells
Alkalinity (mg/L CaCO3)
480
460
440
420
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
Yes

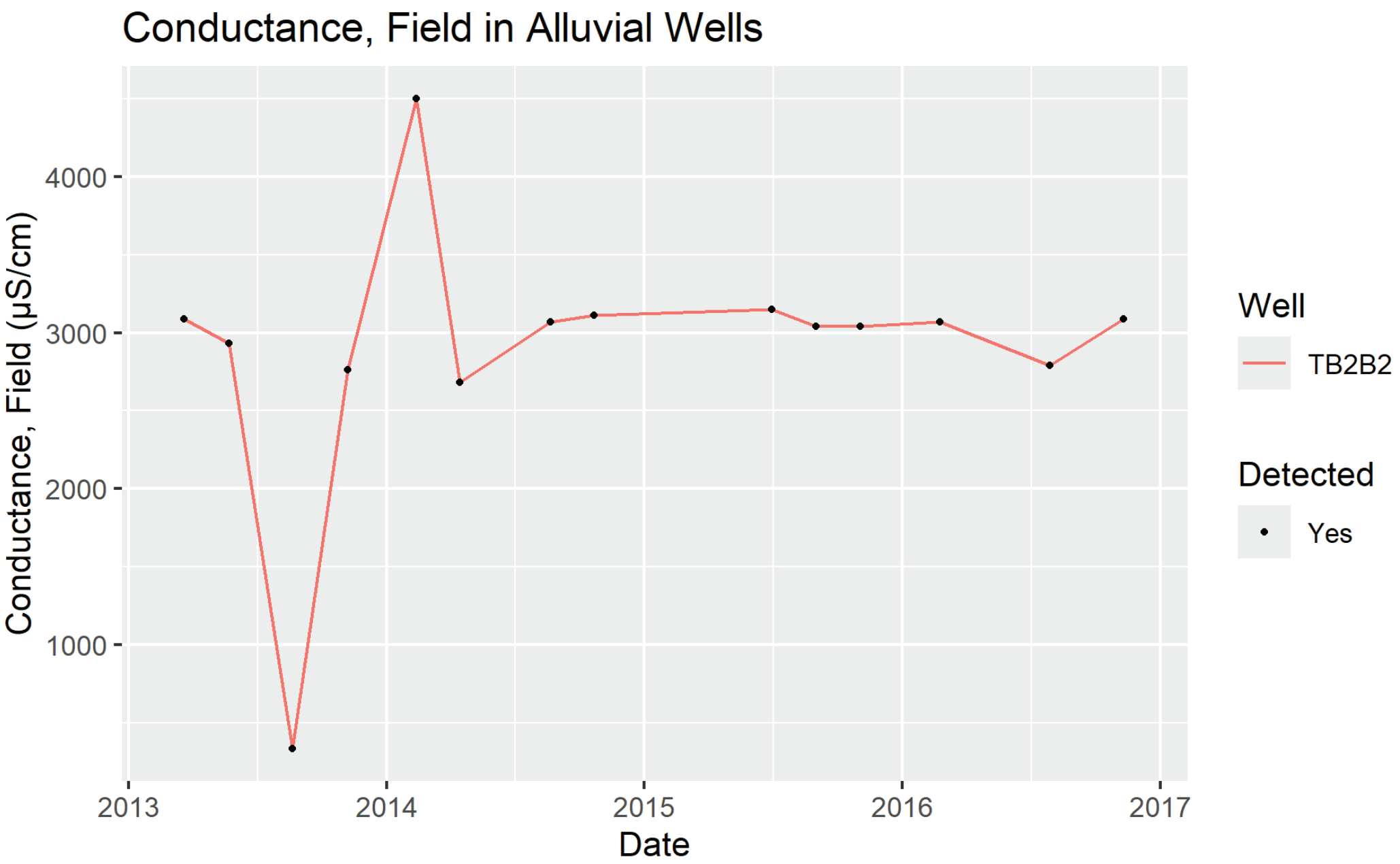

Bicarbonate in Alluvial Wells
Bicarbonate (mg/L CaCO3)
480
460
440
420
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
Yes

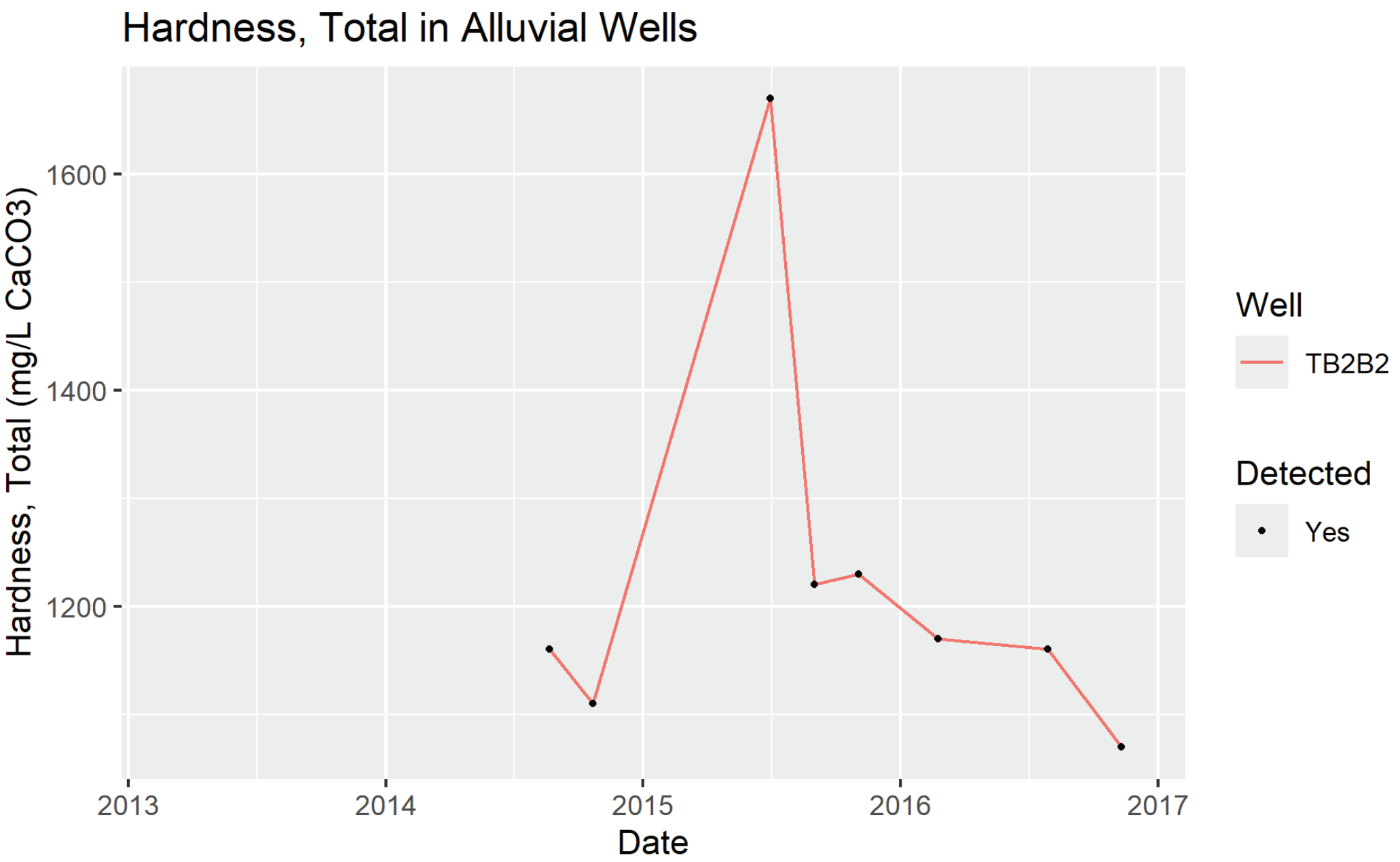

Calcium, Total in Alluvial Wells
Calcium, Total (mg/L)
360
320
280
240
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
Yes

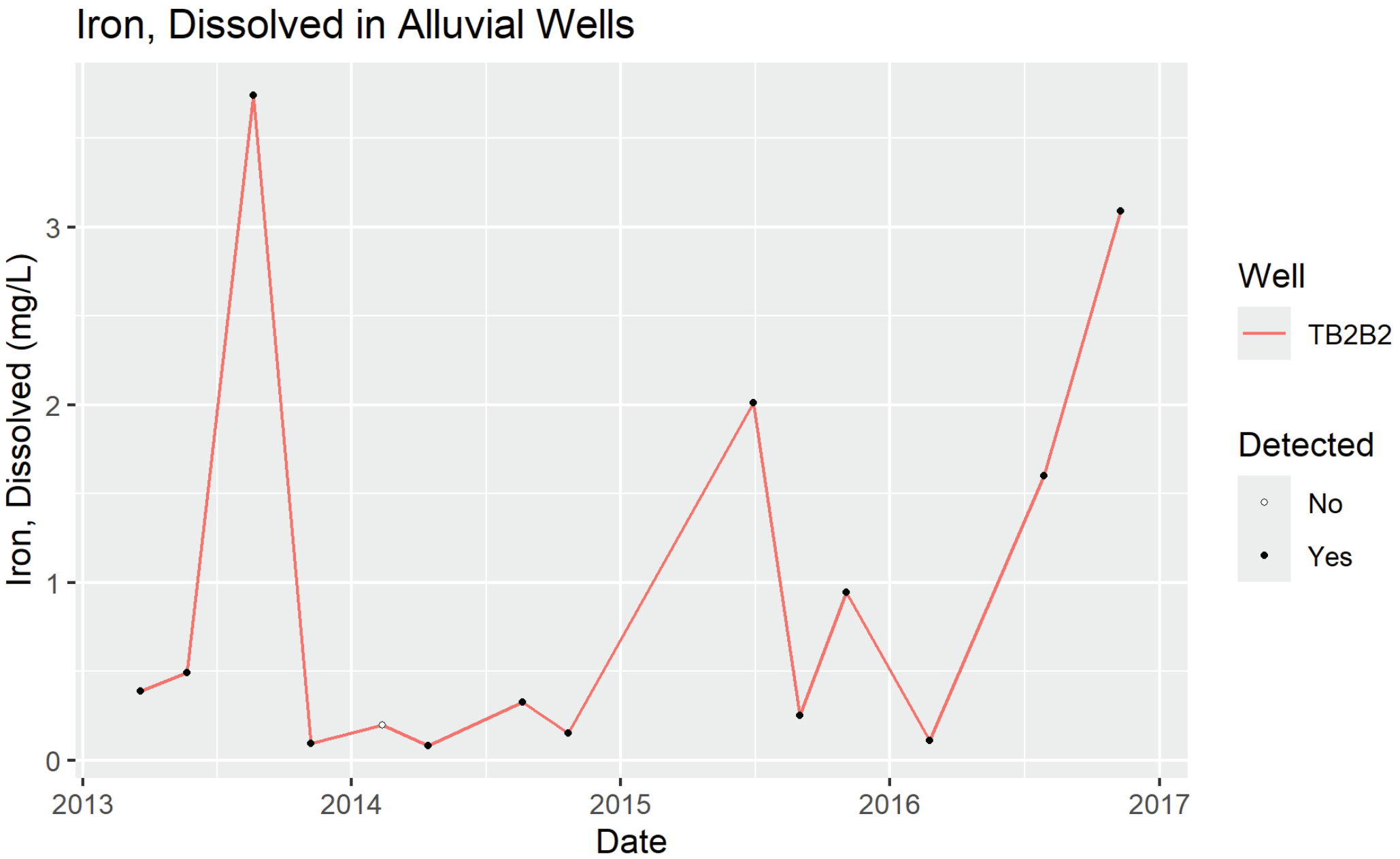

Carbonate in Alluvial Wells
Carbonate (mg/L CaCO3)
5
4
3
2
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
No

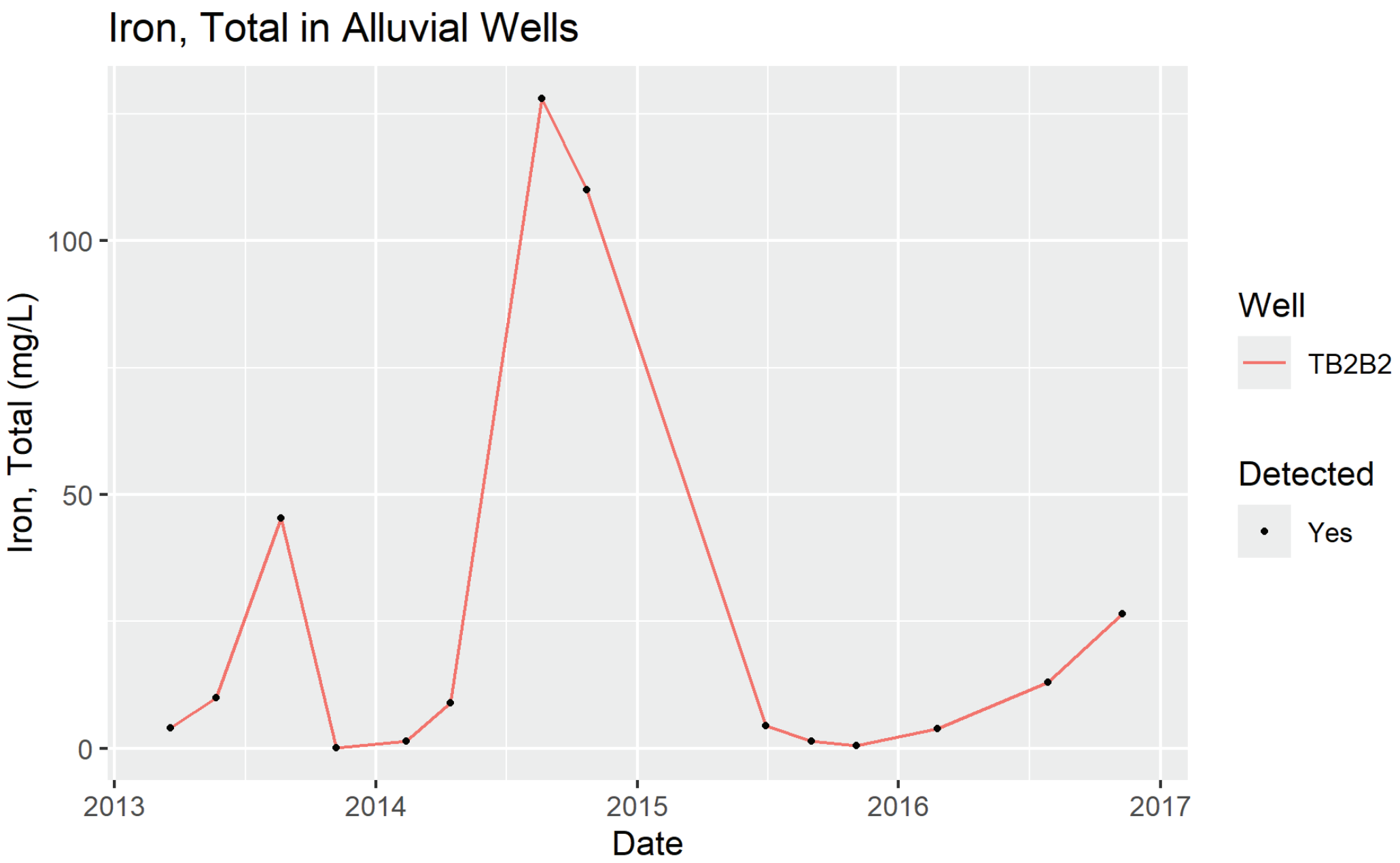

Cation-Anion Balance in Alluvial Wells
Cation-Anion Balance (%)
40
30
20
10
0
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
Yes

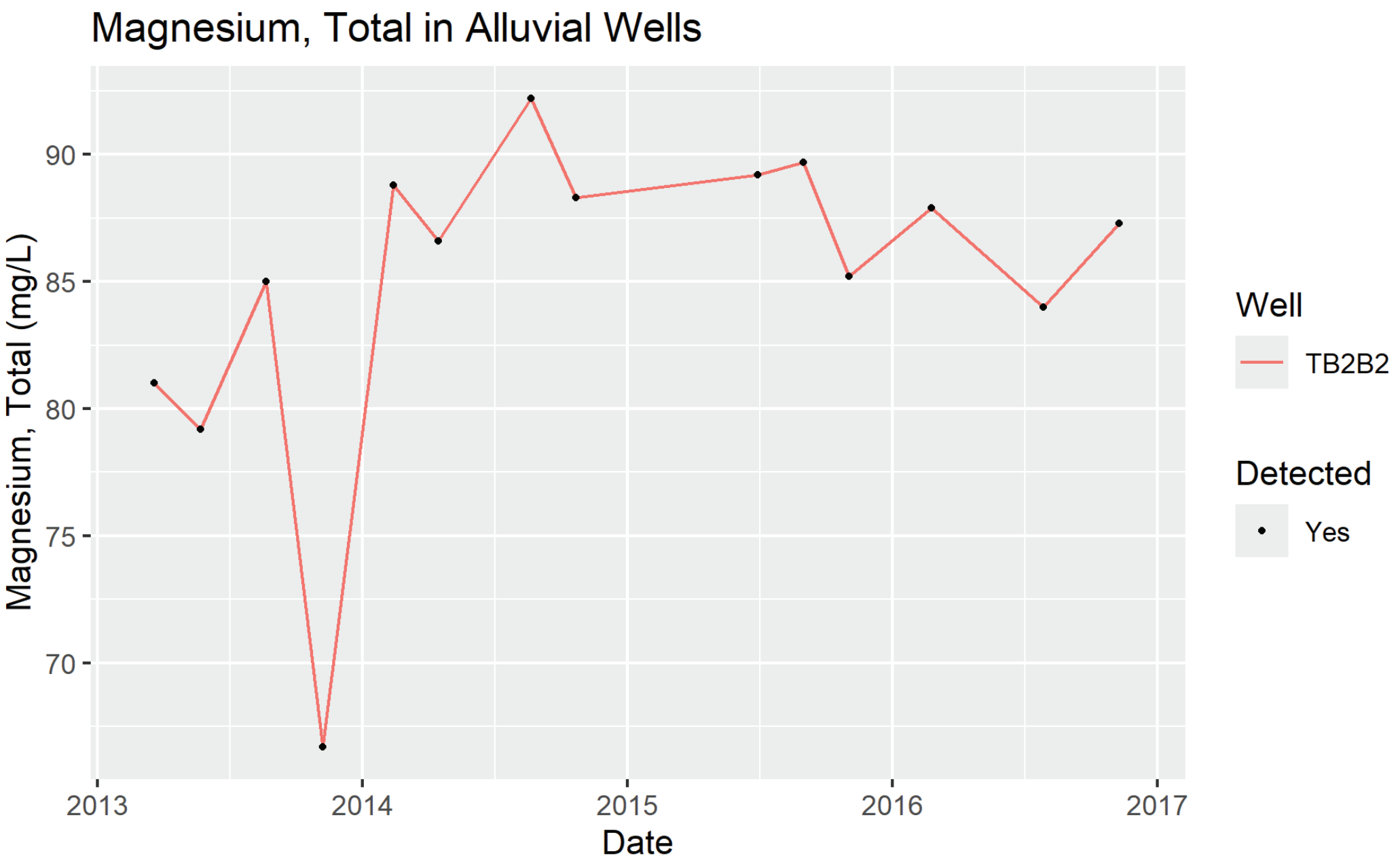

Chloride in Alluvial Wells
Chloride (mg/L)
90
80
70
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
Yes

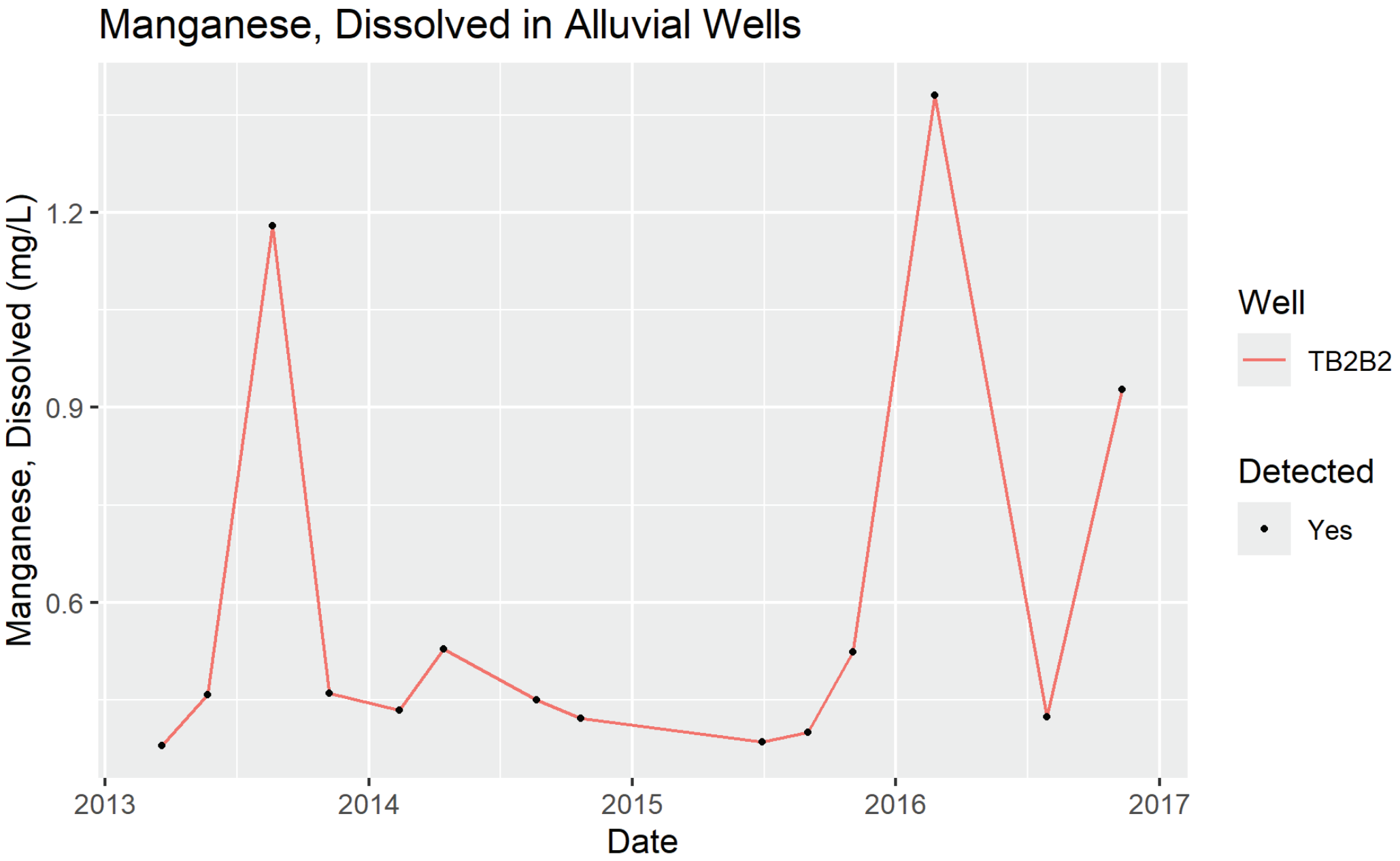

Conductance, Field in Alluvial Wells
Conductance, Field (µS/cm)
4000
3000
2000
1000
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
Yes

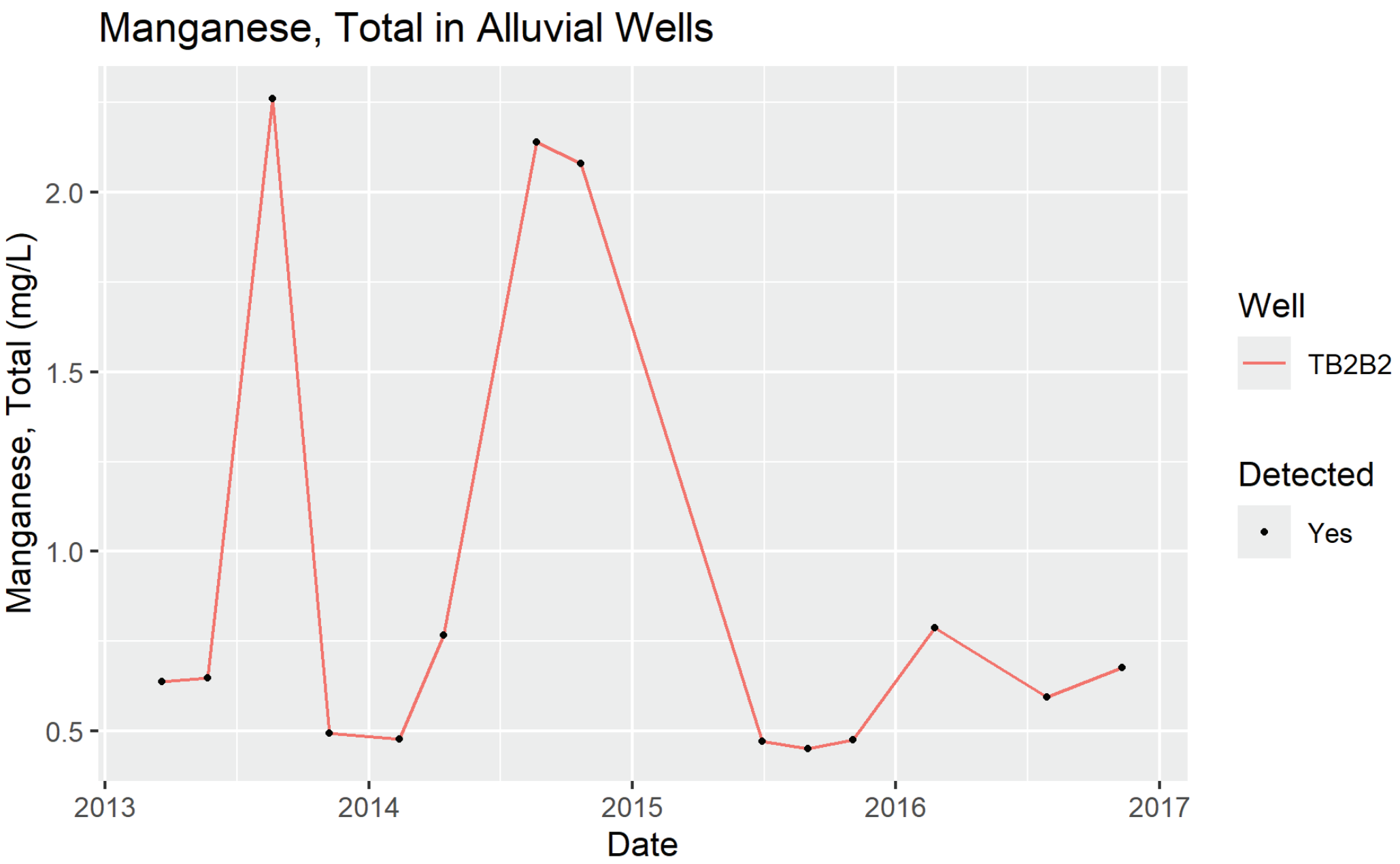

Hardness, Total in Alluvial Wells
Hardness, Total (mg/L CaCO3)
1600
1400
1200
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
Yes

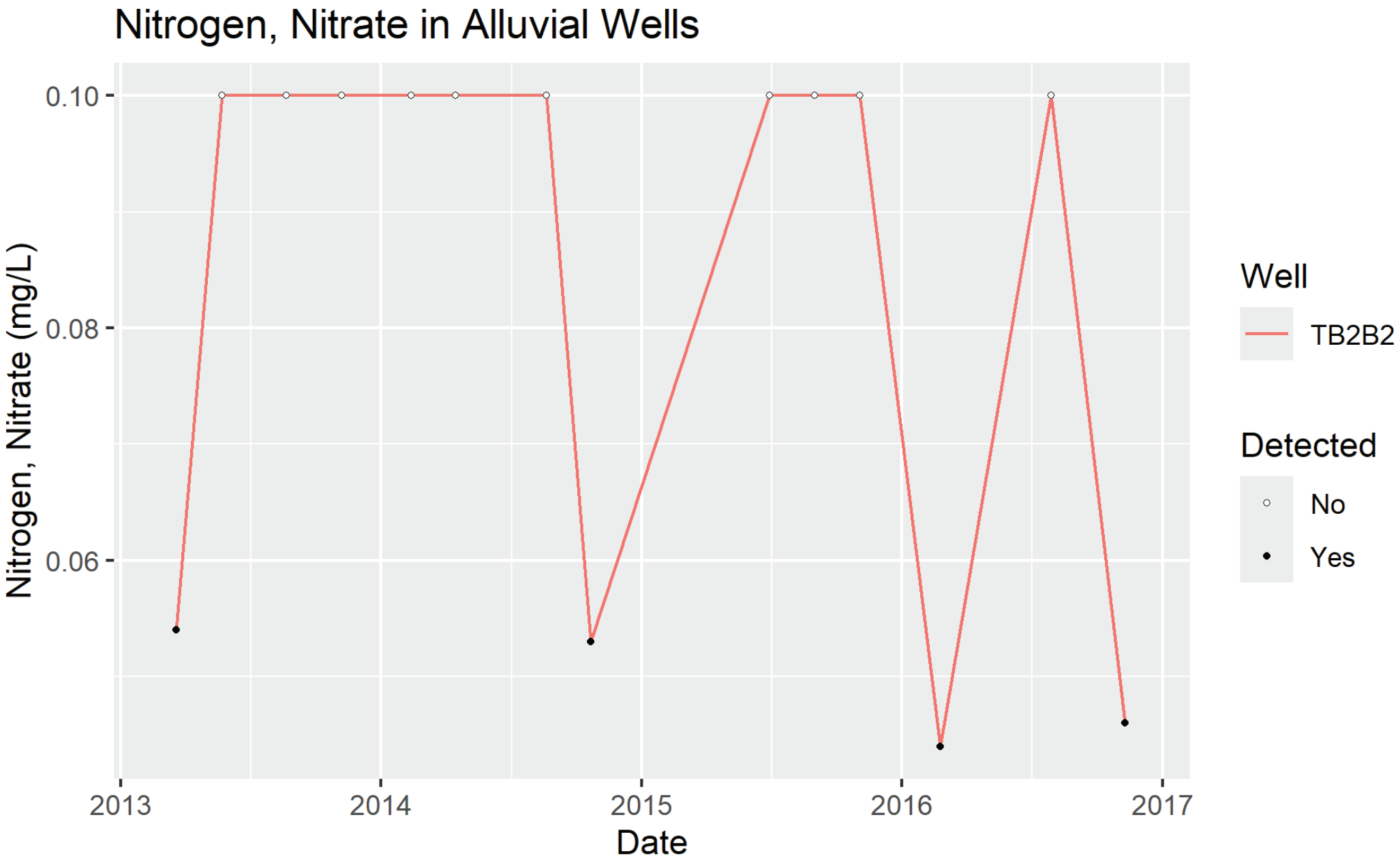

Iron, Dissolved in Alluvial Wells
Iron, Dissolved (mg/L)
0
1
2
3
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
No
Yes

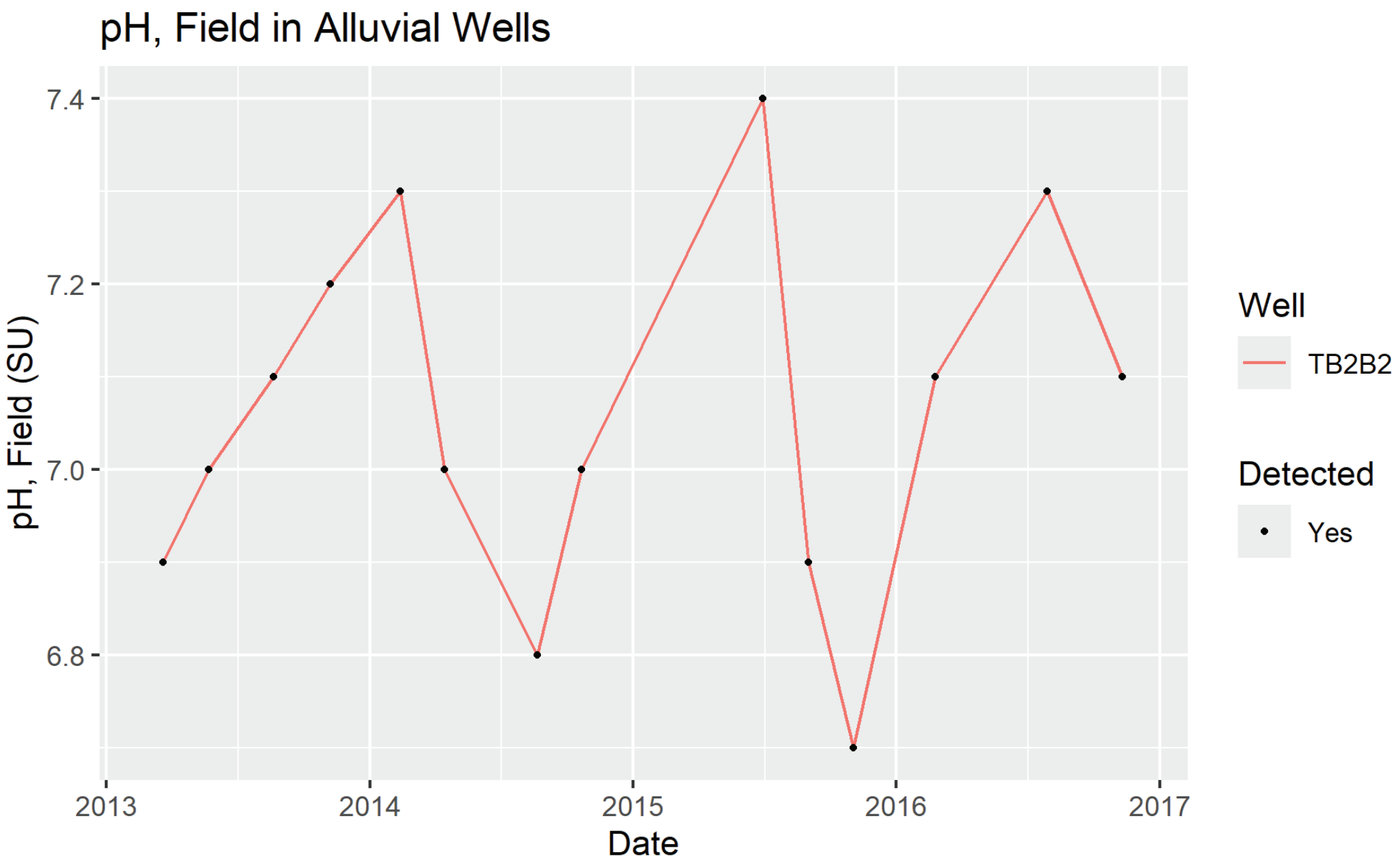

Iron, Total in Alluvial Wells
Iron, Total (mg/L)
100
50
0
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
Yes

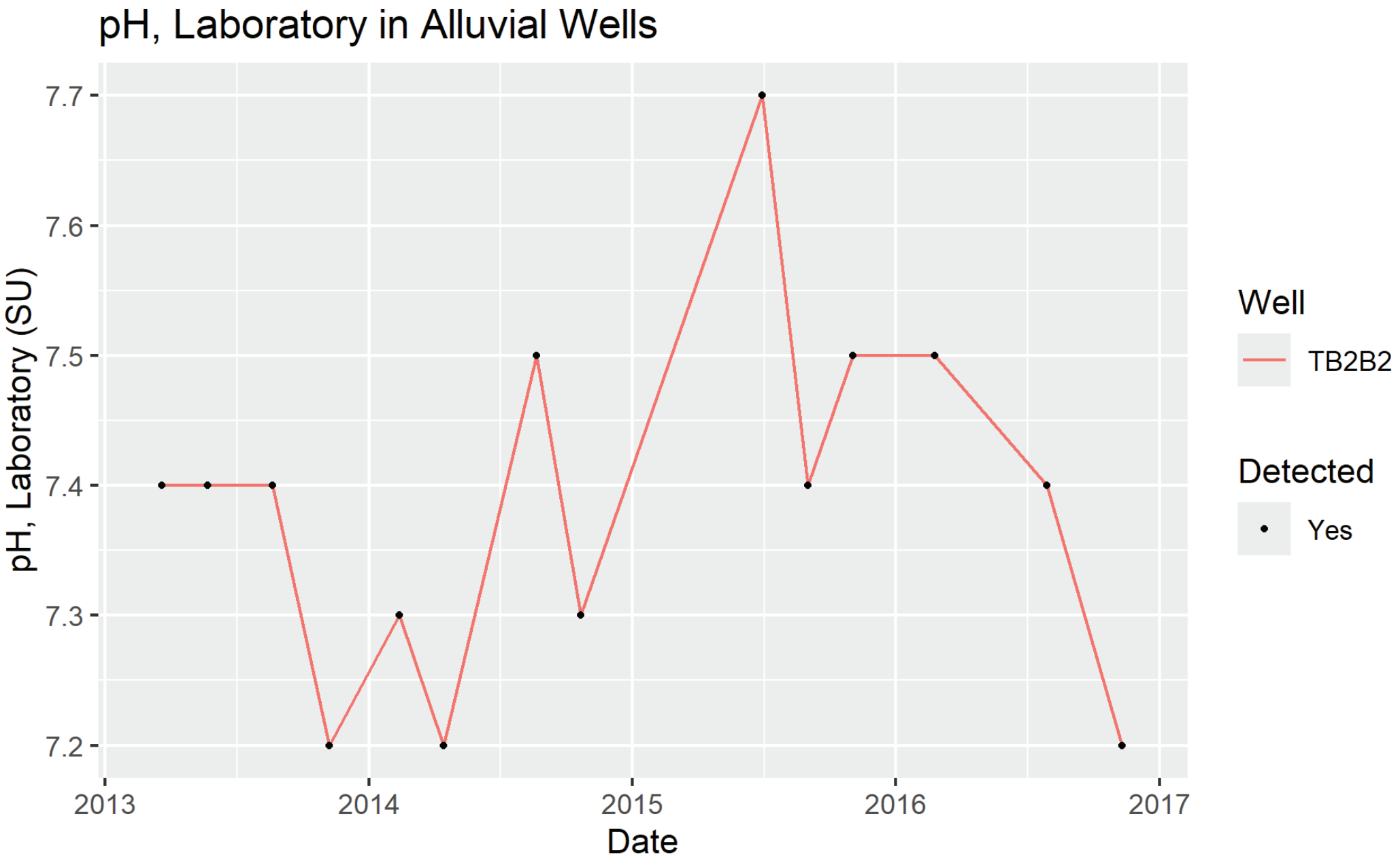

Magnesium, Total in Alluvial Wells
Magnesium, Total (mg/L)
90
85
80
75
70
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
Yes

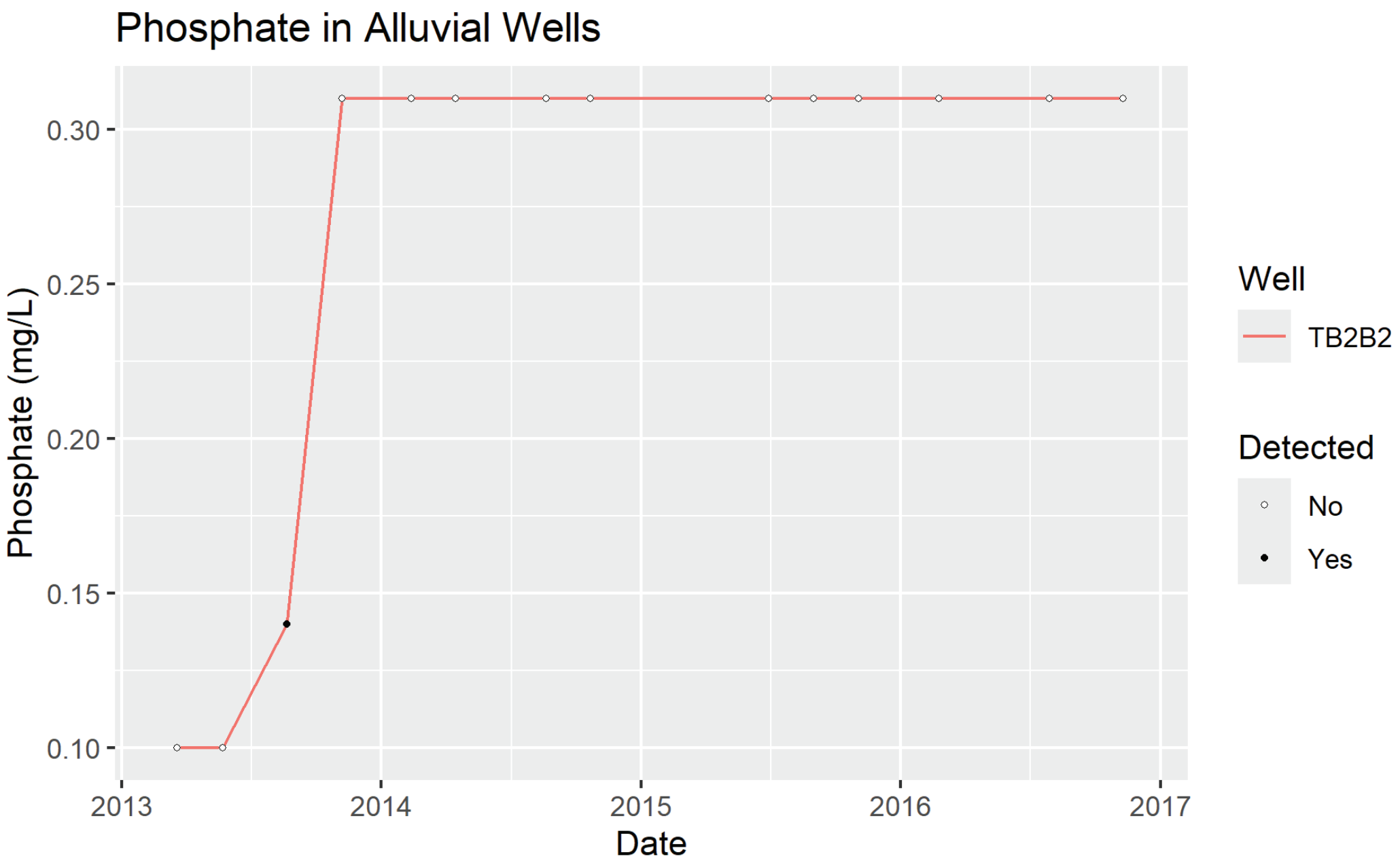

Manganese, Dissolved in Alluvial Wells
Manganese, Dissolved (mg/L)
1.2
0.9
0.6
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
Yes

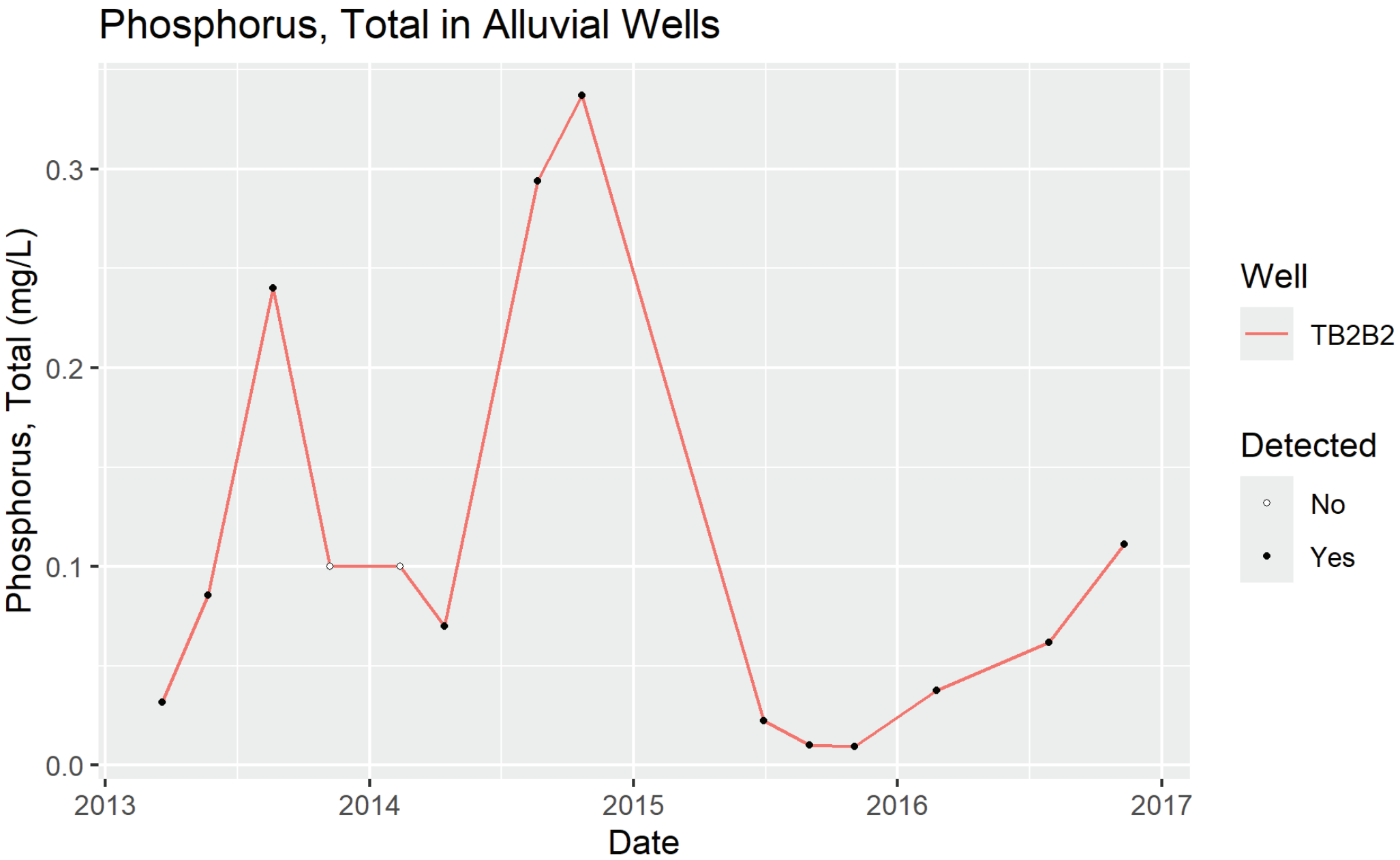

Manganese, Total in Alluvial Wells
Manganese, Total (mg/L)
2.0
1.5
1.0
0.5
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
Yes

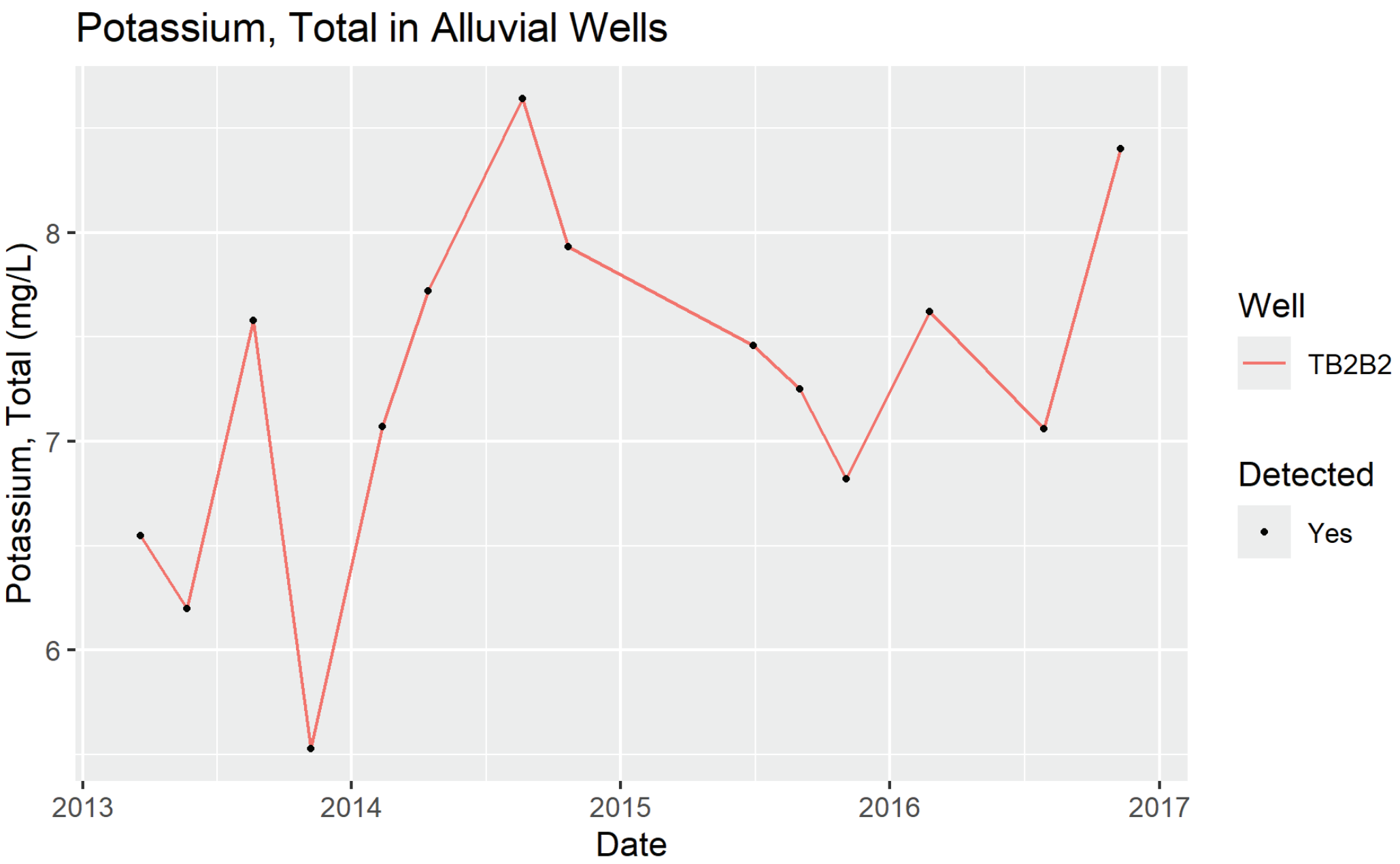

Nitrogen, Nitrate in Alluvial Wells
0.10
0.08
0.06
Nitrogen, Nitrate (mg/L)
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
No
Yes

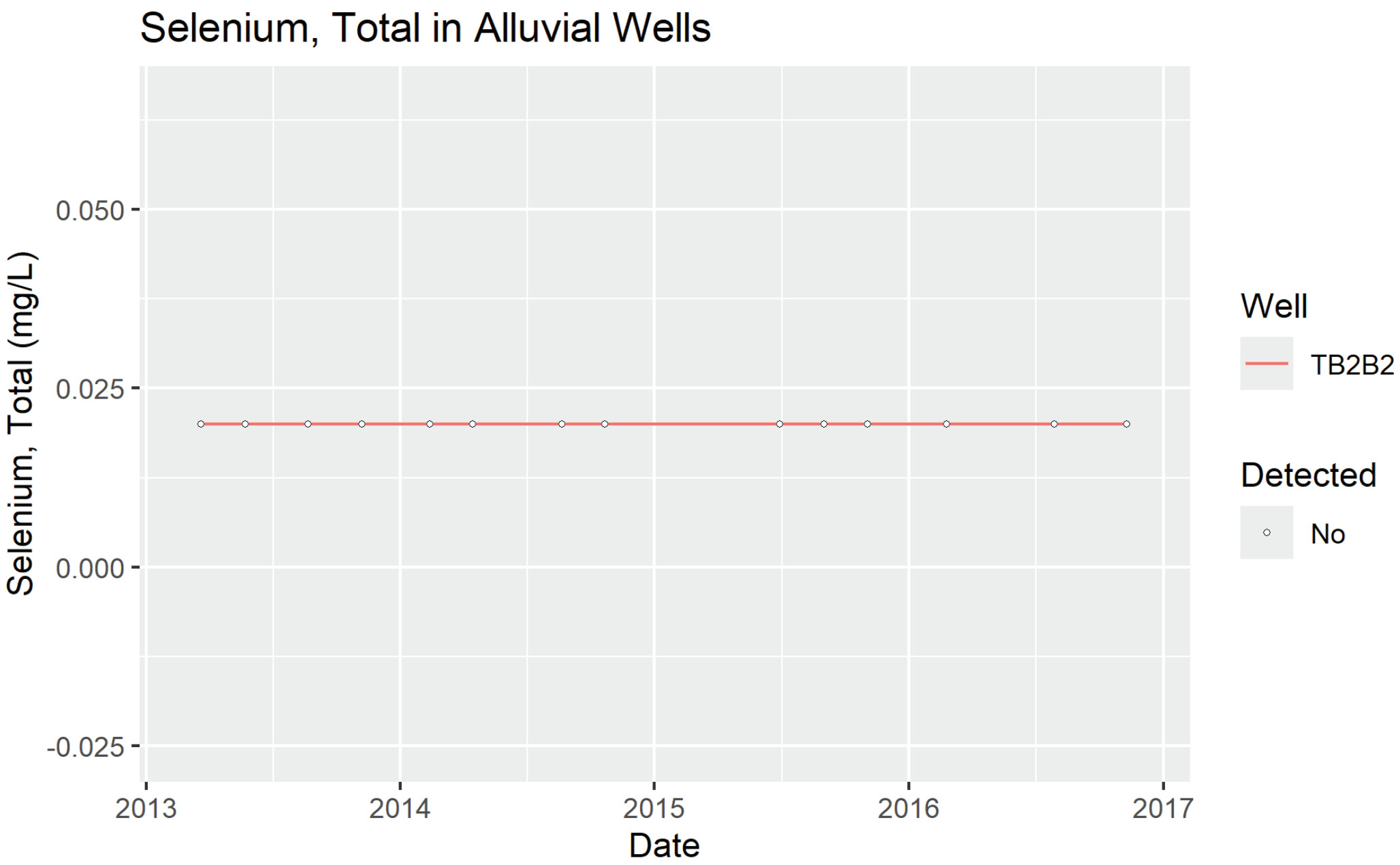

pH, Field in Alluvial Wells
7.4
7.2
7.0
6.8
pH, Field (SU)
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
Yes

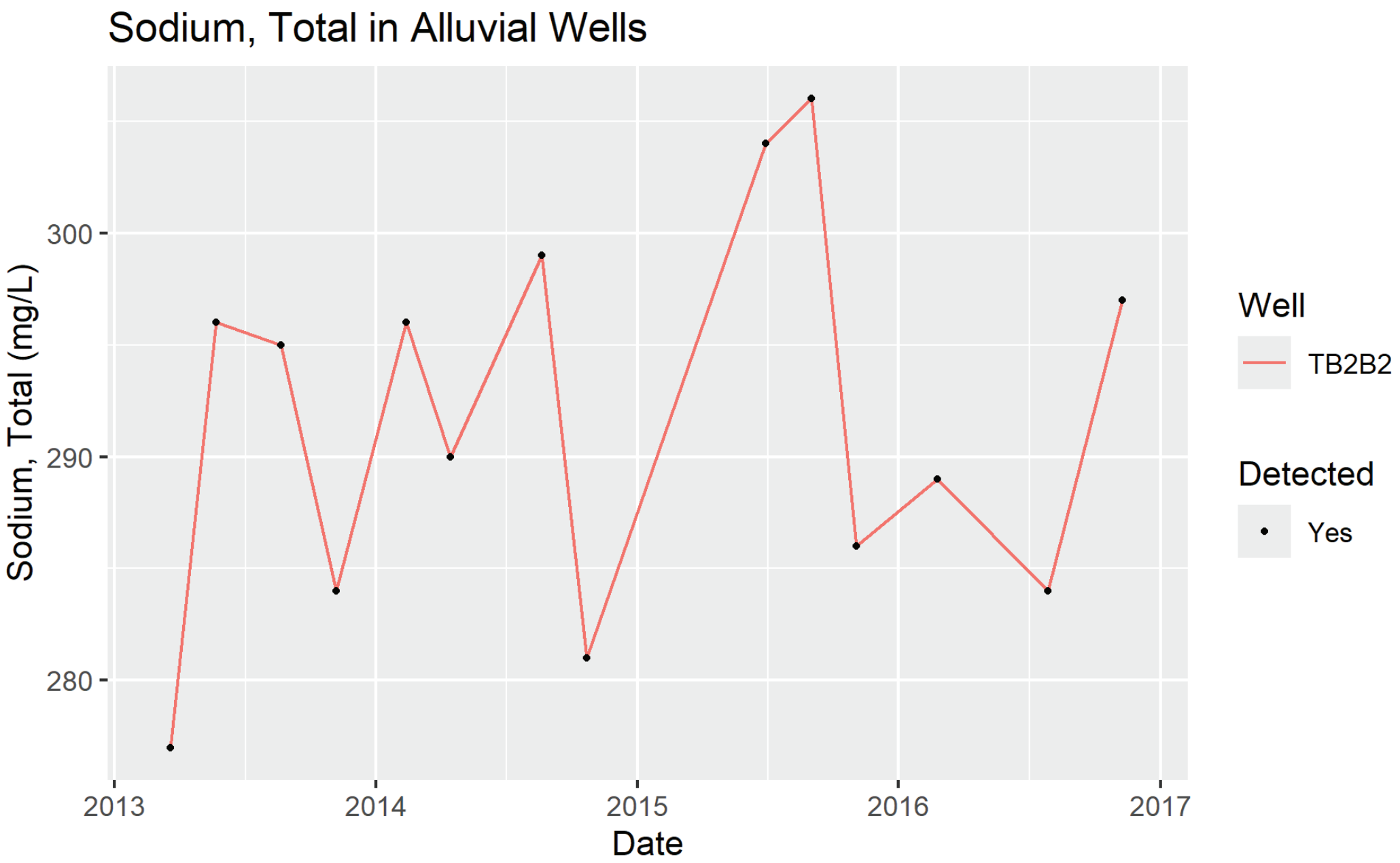

pH, Laboratory in Alluvial Wells
pH, Laboratory (SU)
7.7
7.6
7.5
7.4
7.3
7.2
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
Yes

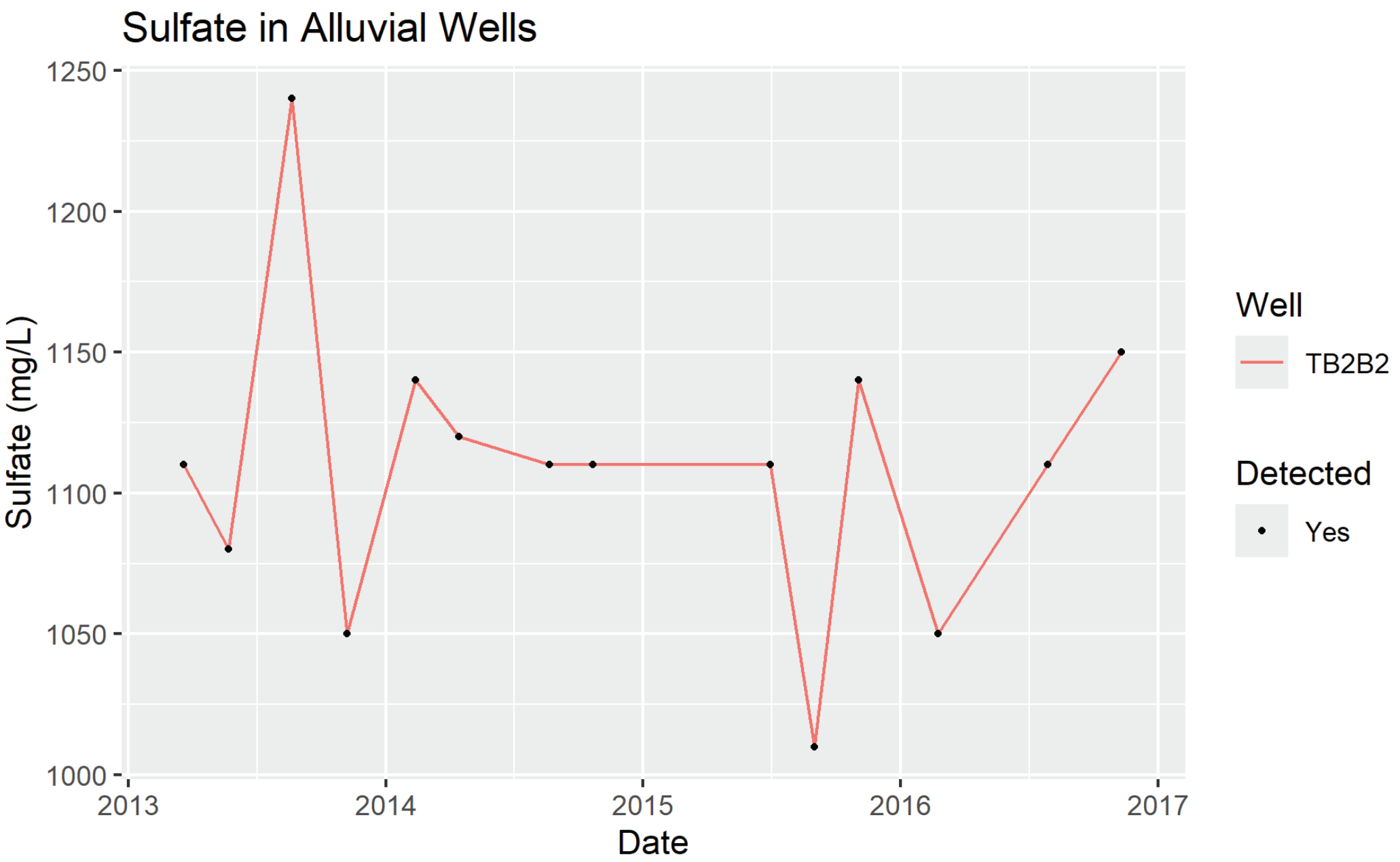

Phosphate in Alluvial Wells
Phosphate (mg/L)
0.30
0.25
0.20
0.15
0.10
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
No
Yes

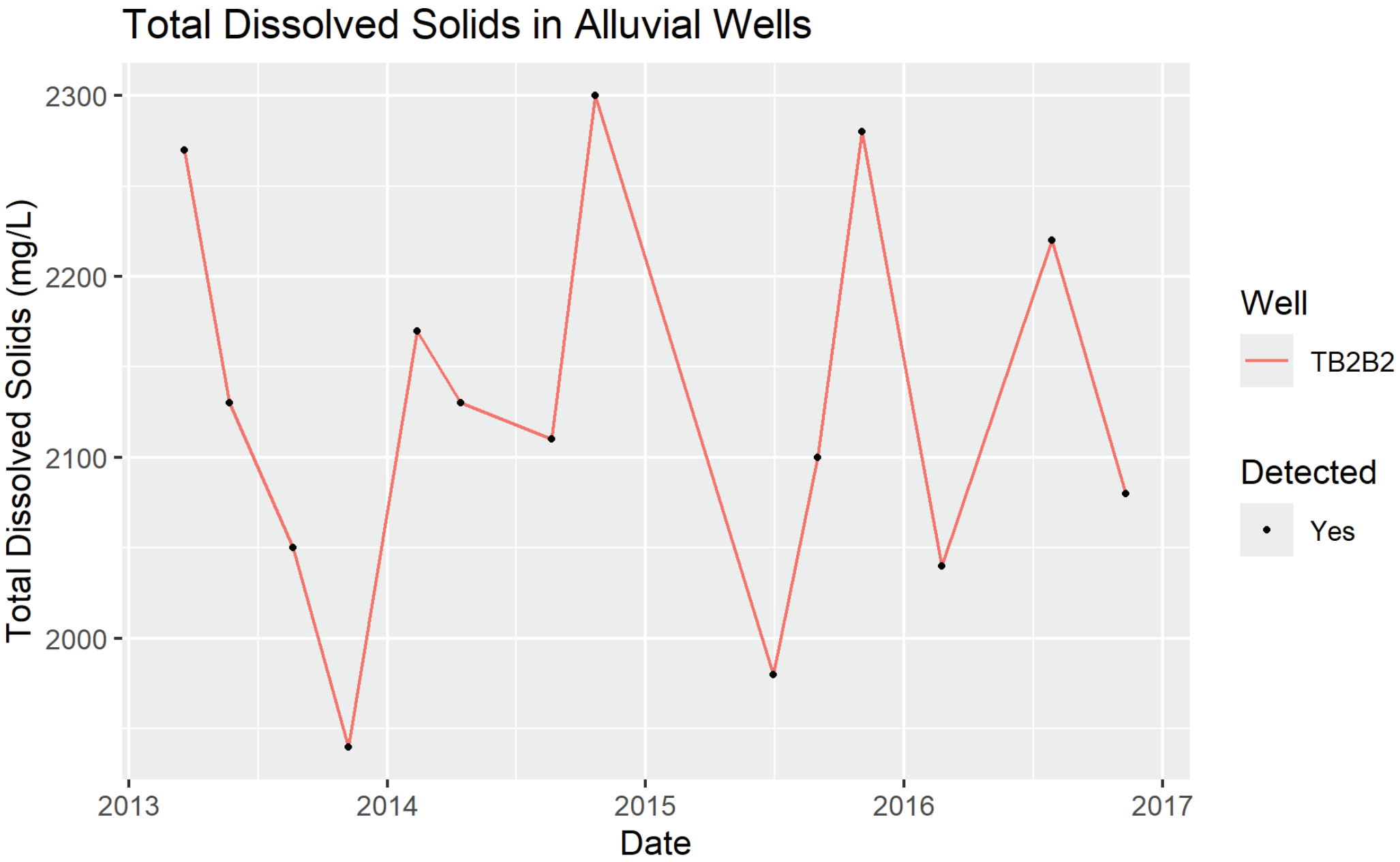

Phosphorus, Total in Alluvial Wells
Phosphorus, Total (mg/L)
0.0
0.1
0.2
0.3
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
No
Yes


Potassium, Total in Alluvial Wells
Potassium, Total (mg/L)
8
7
6
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
Yes


Selenium, Total in Alluvial Wells
Selenium, Total (mg/L)
0.050
0.025
0.000
-0.025
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
No

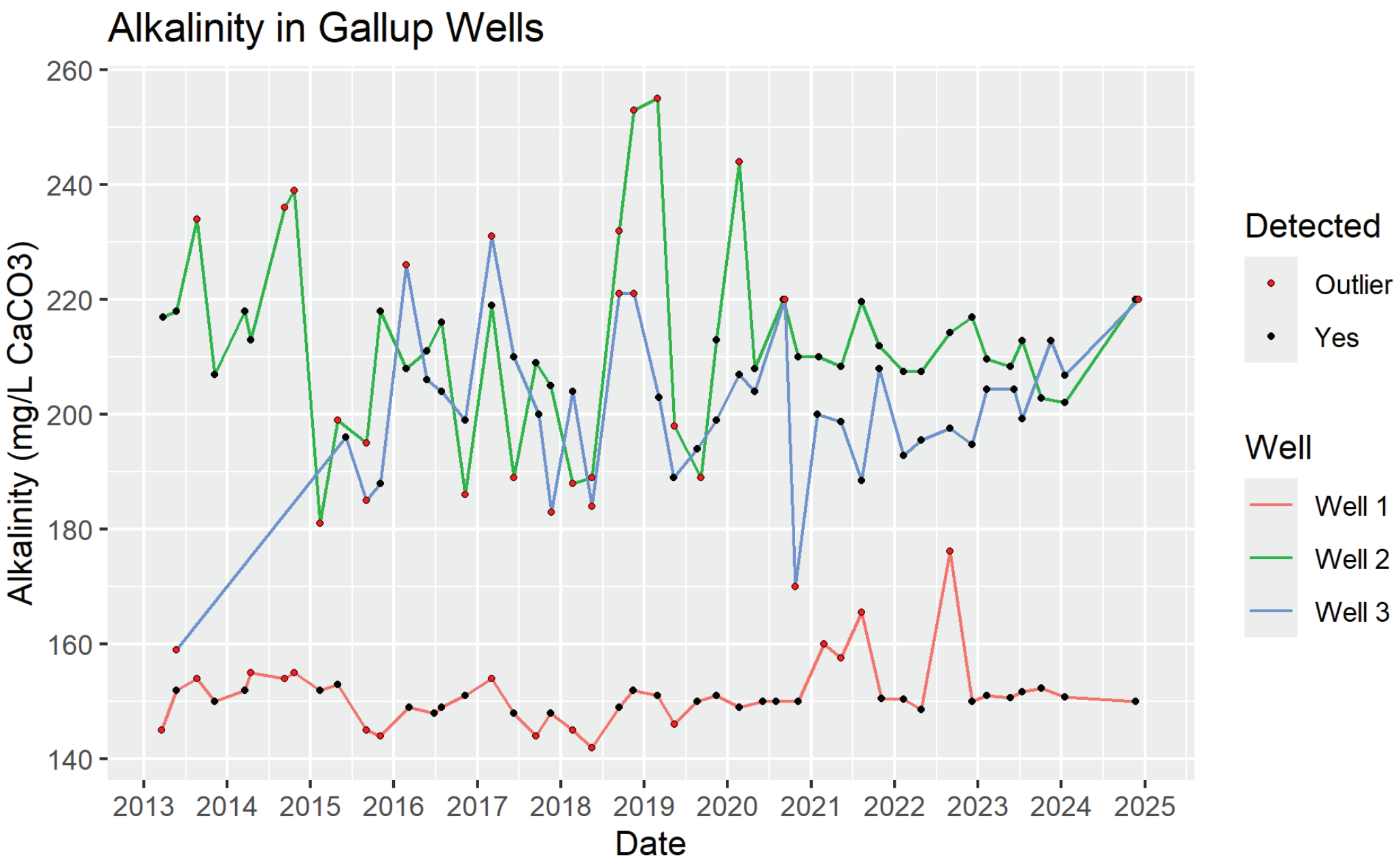

Sodium, Total in Alluvial Wells
Sodium, Total (mg/L)
300
290
280
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
Yes

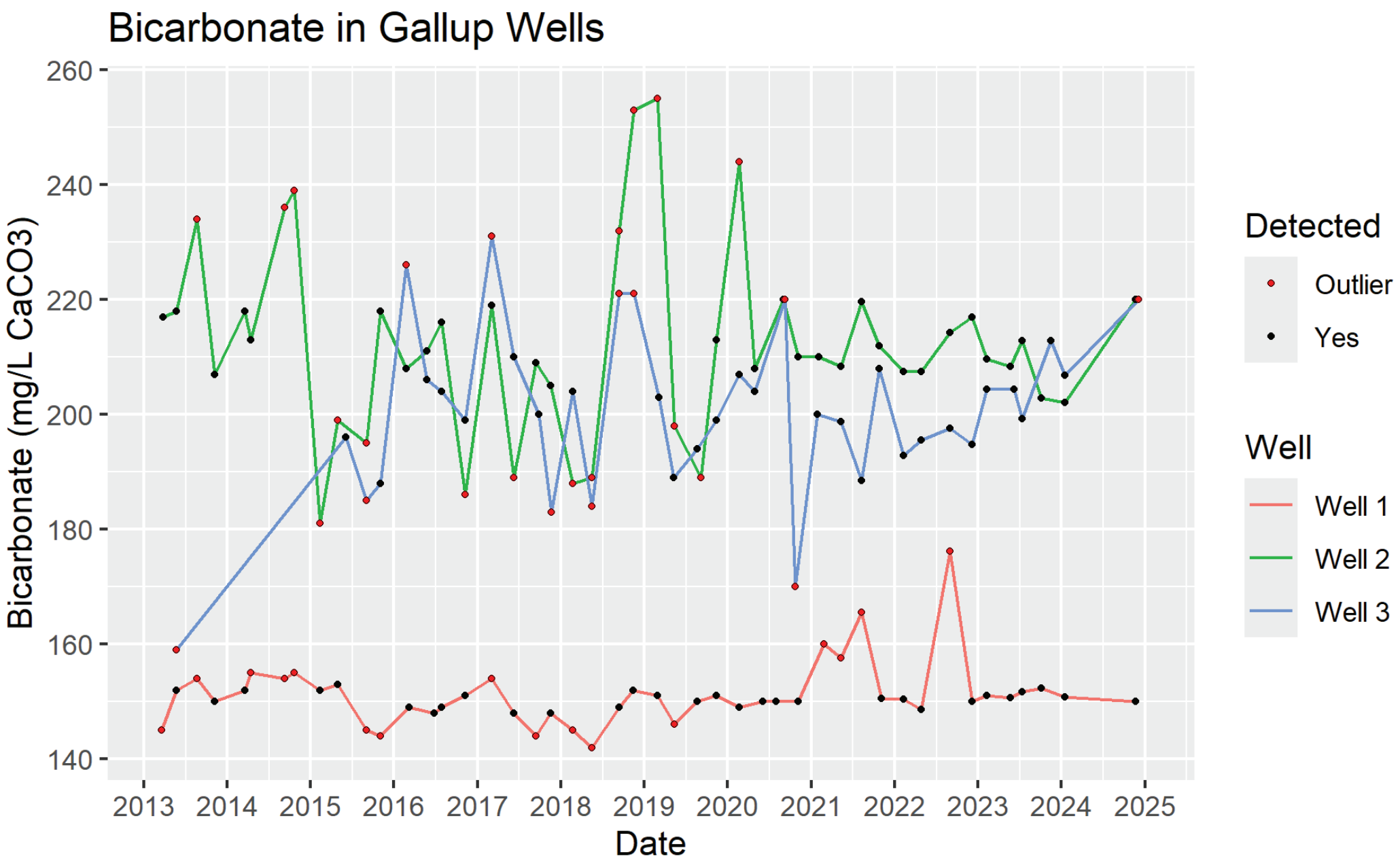

Sulfate in Alluvial Wells
1250
1200
1150
1100
1050
1000
Sulfate (mg/L)
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
Yes

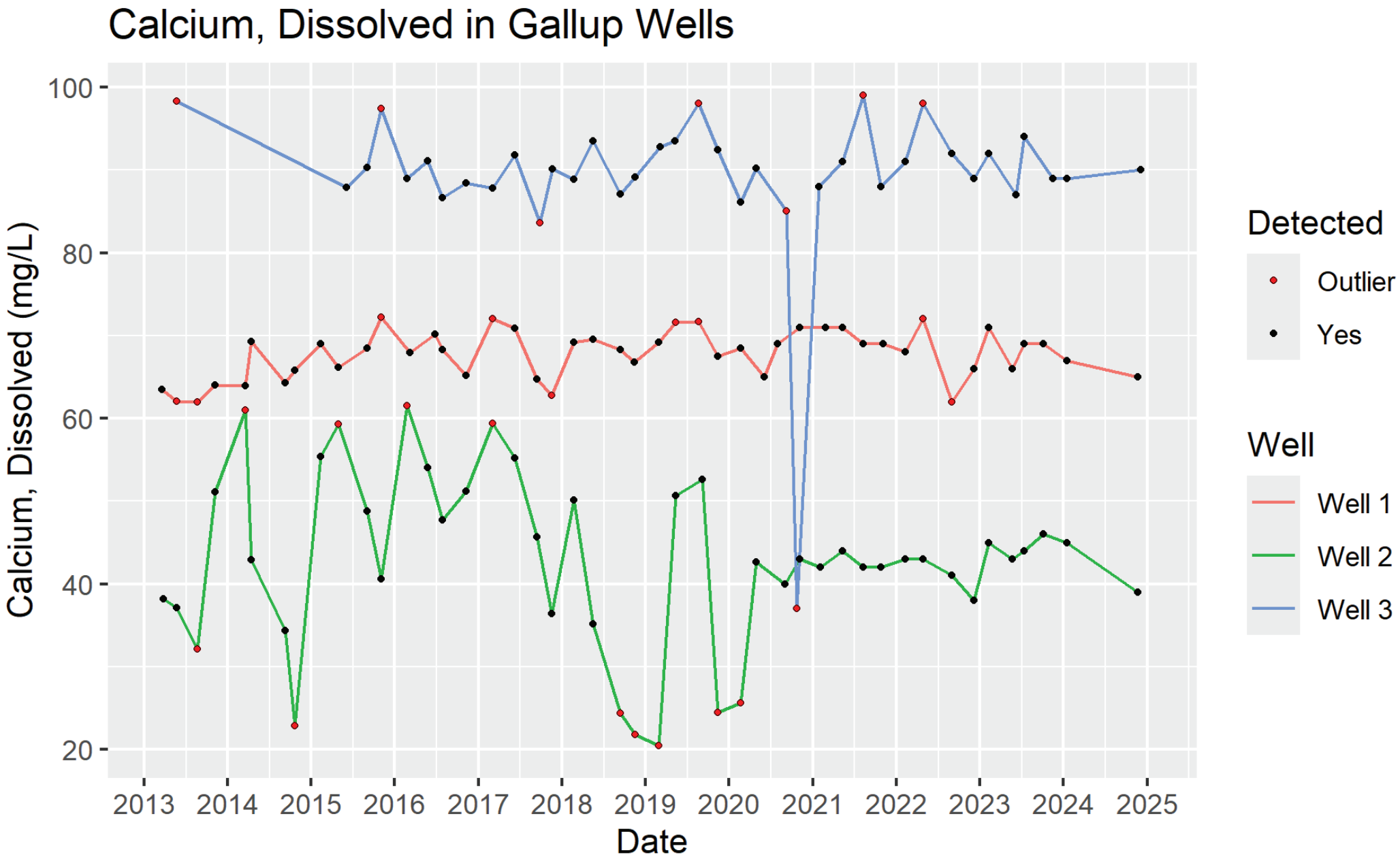

Total Dissolved Solids in Alluvial Wells
Total Dissolved Solids (mg/L)
2300
2200
2100
2000
2013
2014
2015
2016
2017
Date
Well
TB2B2
Detected
Yes

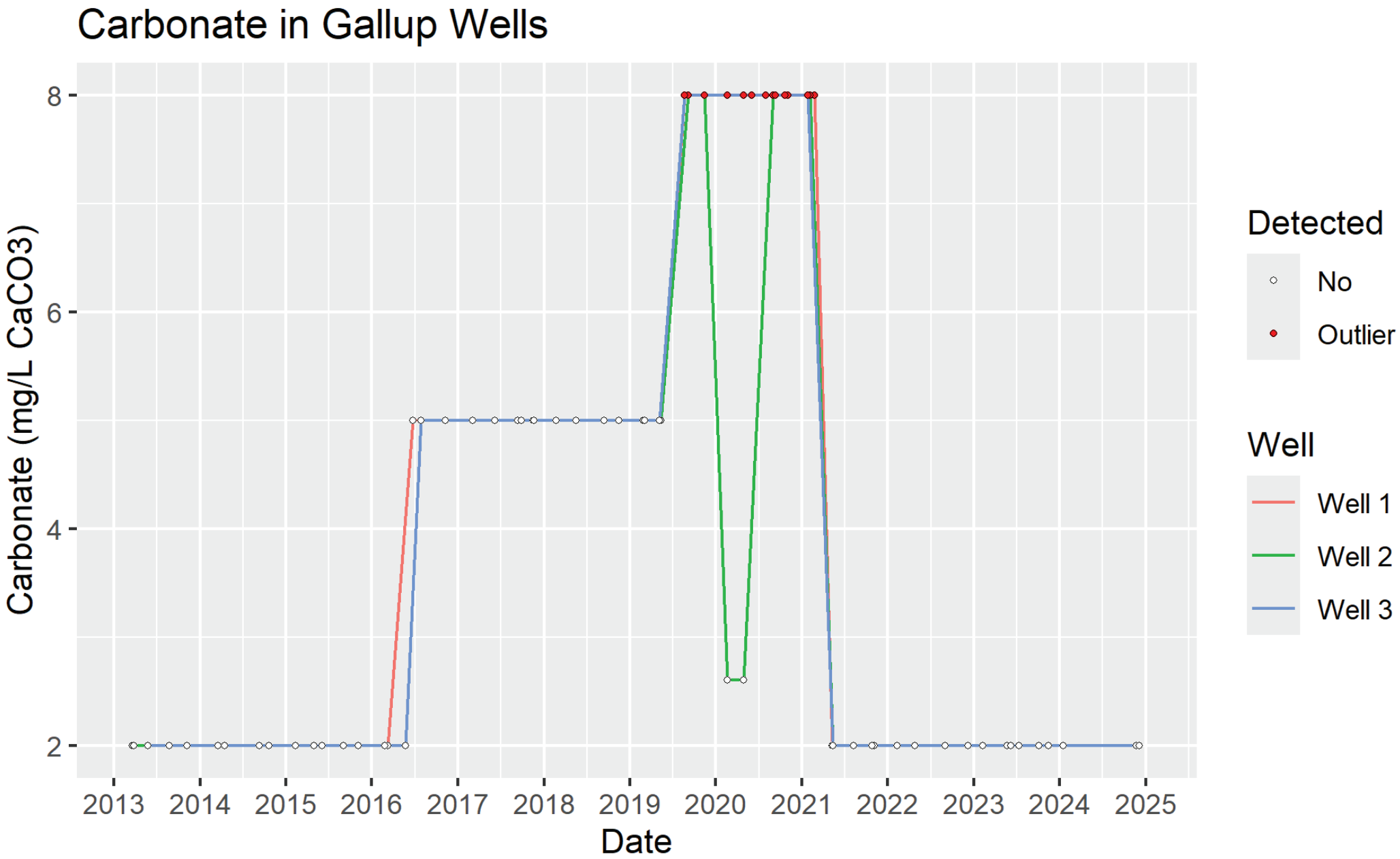
APPENDIX C-2

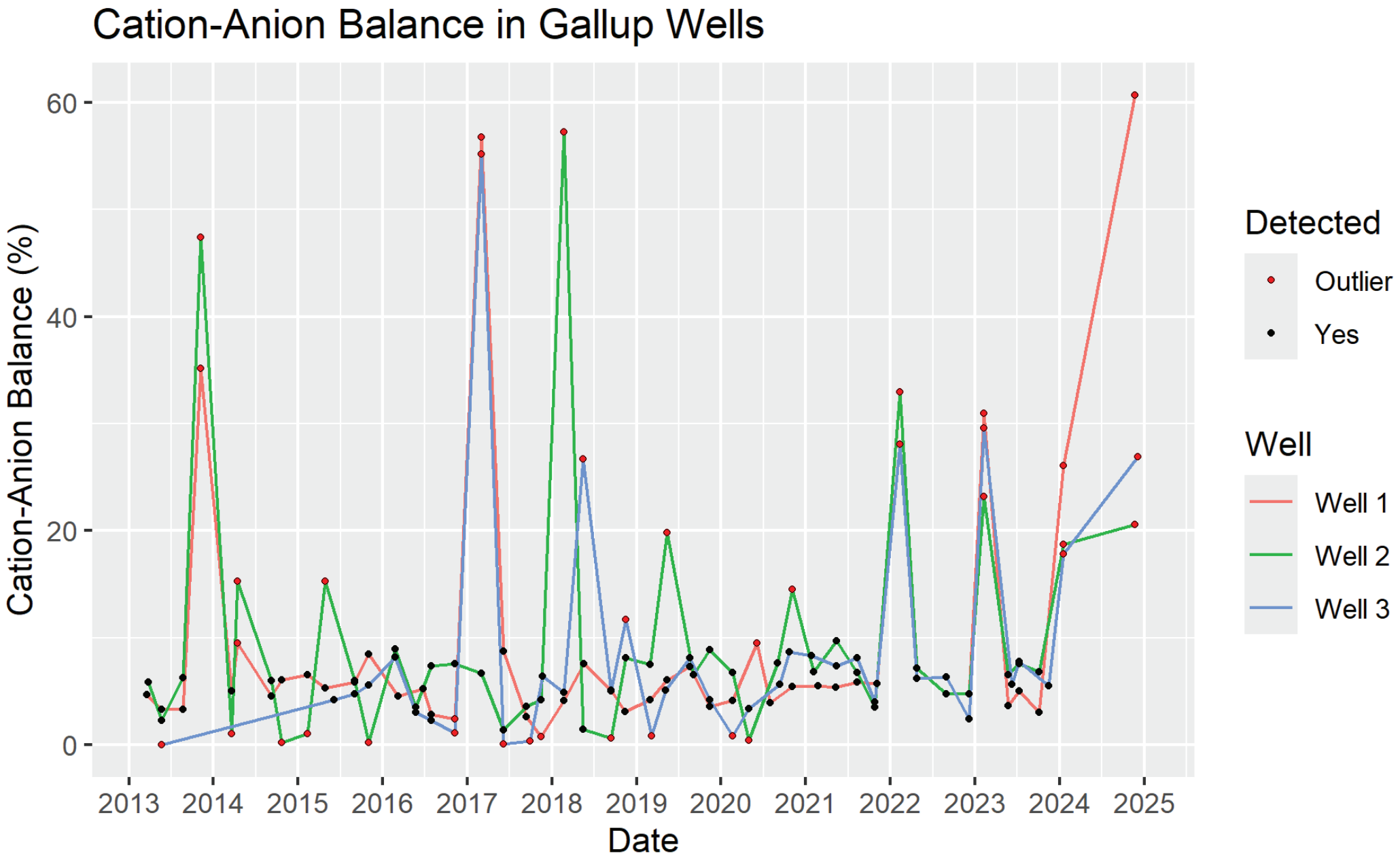
HISTORICAL GROUNDWATER TEMPORAL PLOTS – GALLUP SANDSTONE AQUIFER WELL 1, WELL 2, AND WELL 3

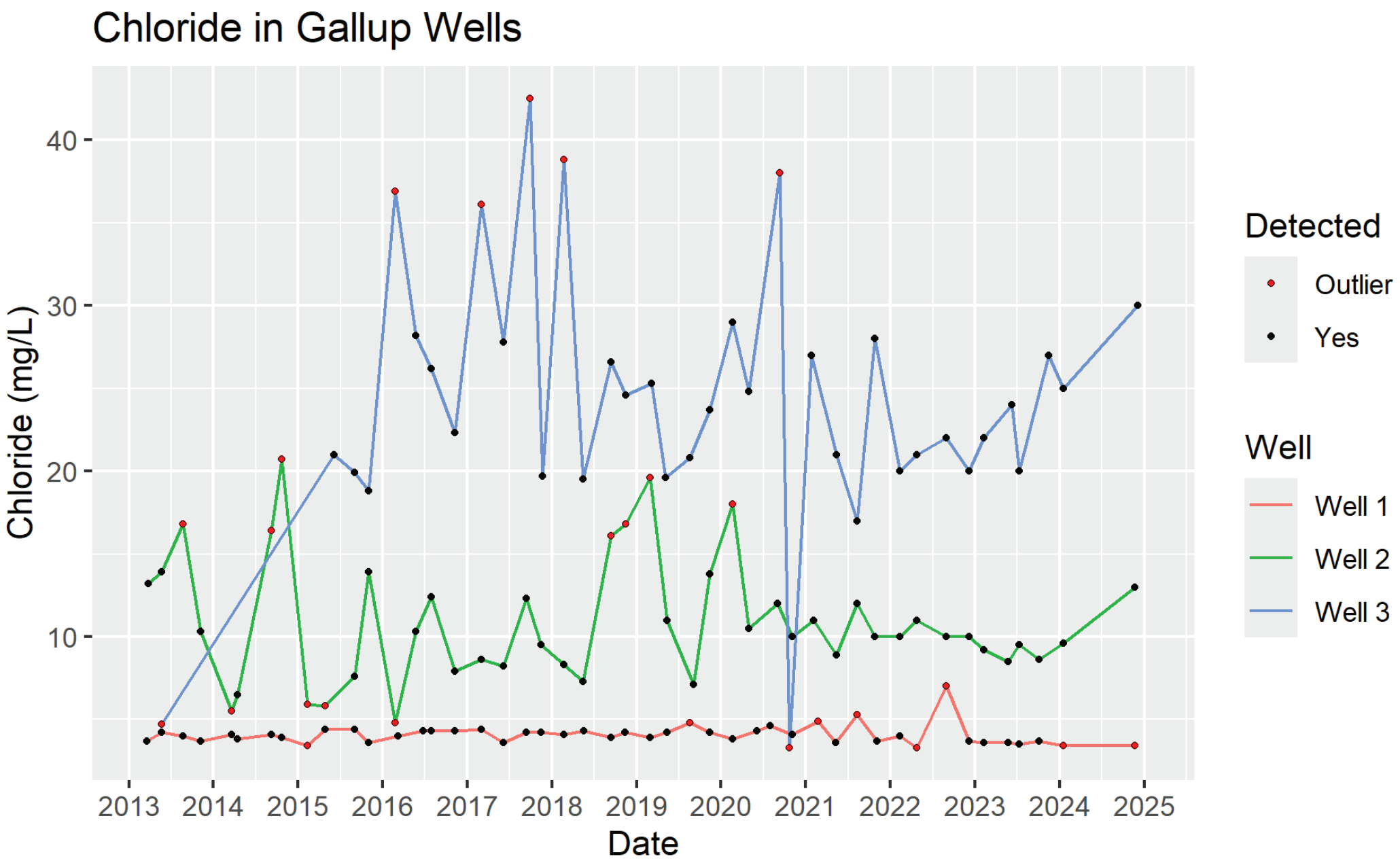

Alkalinity in Gallup Wells
Alkalinity (mg/L CaCO3)
260
240
220
200
180
160
140
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
Outlier
Yes
Well
Well 1
Well 2
Well 3

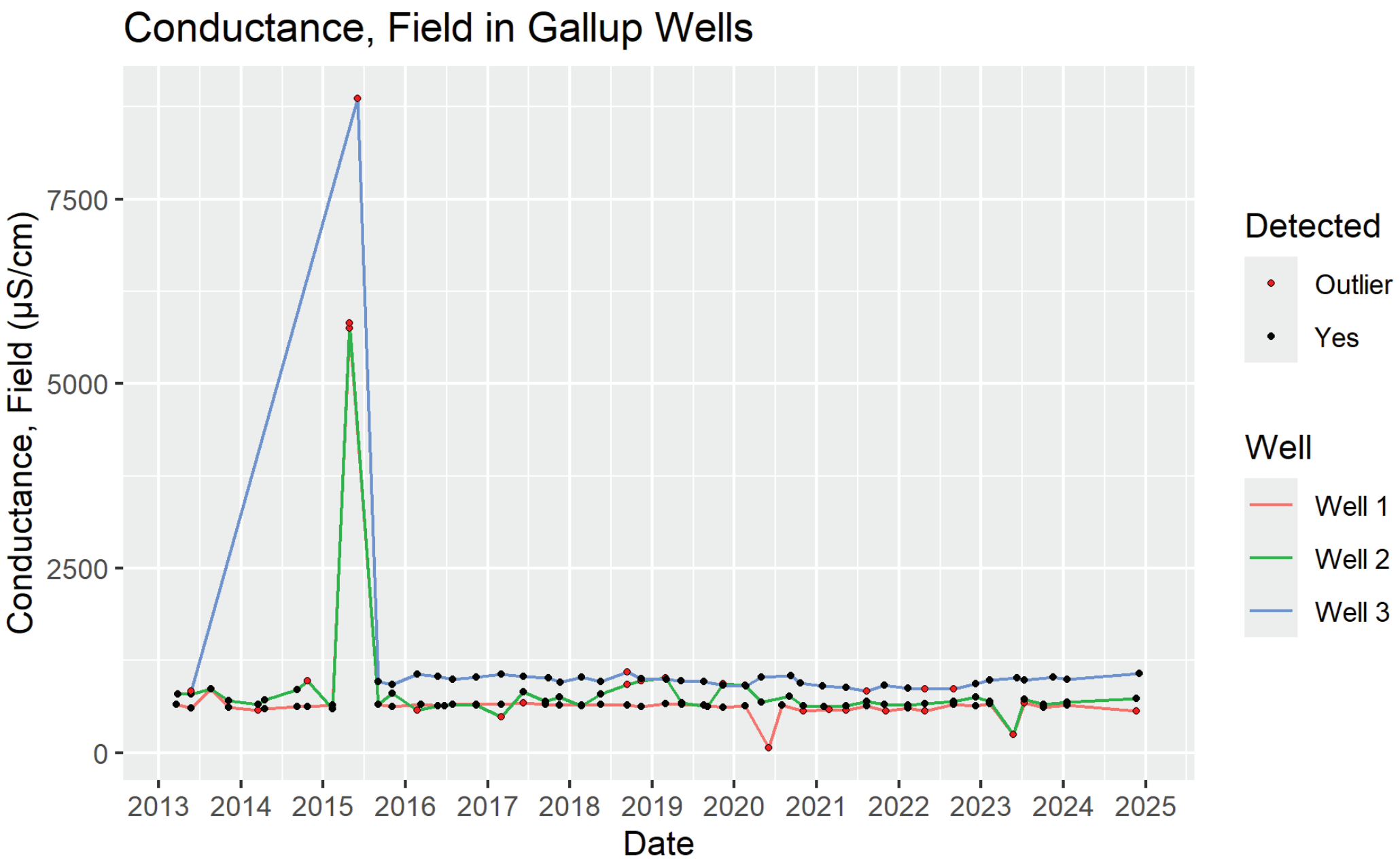

Bicarbonate in Gallup Wells
Bicarbonate (mg/L CaCO3)
260
240
220
200
180
160
140
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
Outlier
Yes
Well
Well 1
Well 2
Well 3

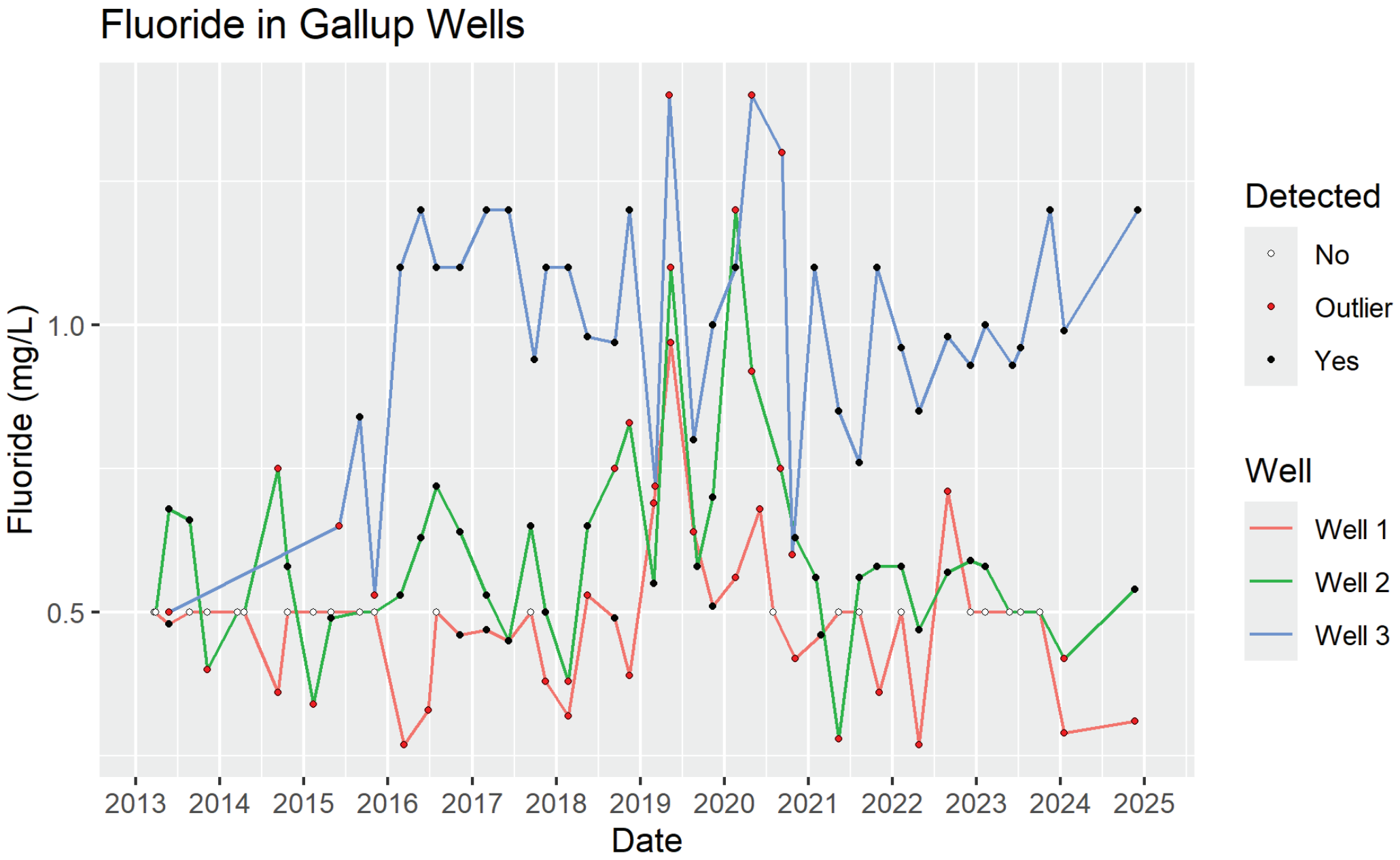

Calcium, Dissolved in Gallup Wells
Calcium, Dissolved (mg/L)
100
80
60
40
20
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
Outlier
Yes
Well
Well 1
Well 2
Well 3

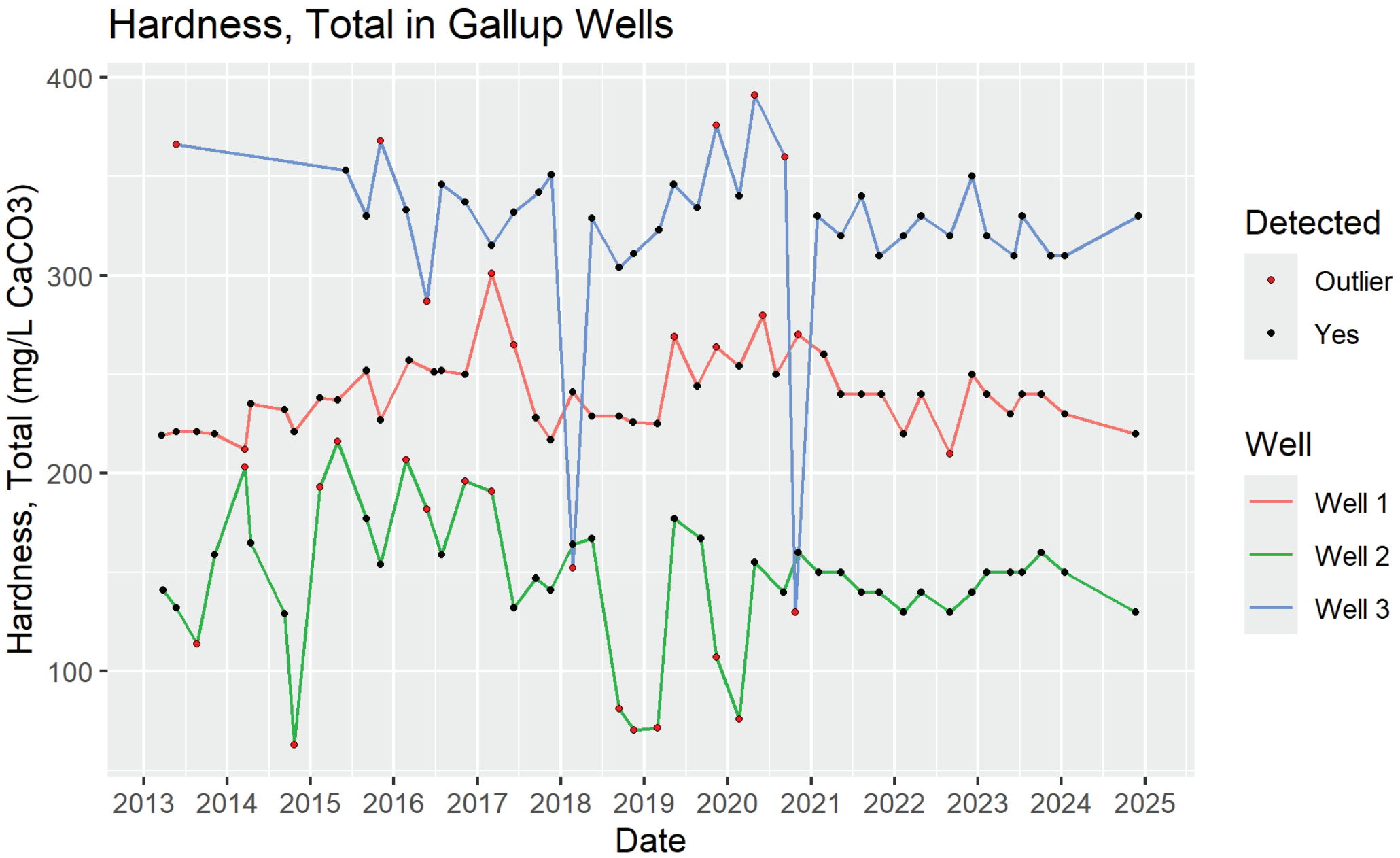

Carbonate in Gallup Wells
Carbonate (mg/L CaCO3)
8
6
4
2
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
No
Outlier
Well
Well 1
Well 2
Well 3

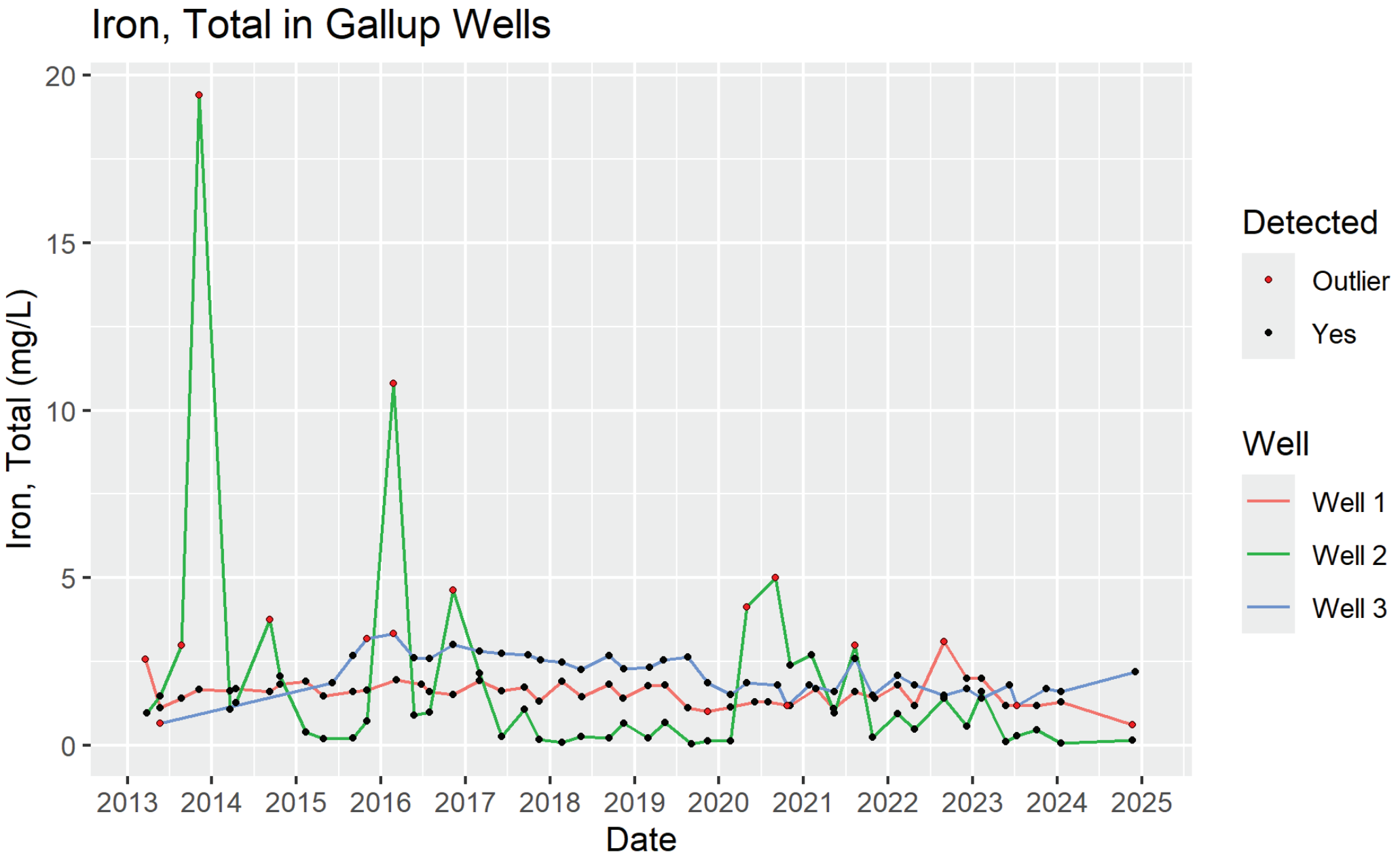

Cation-Anion Balance in Gallup Wells
Cation-Anion Balance (%)
60
40
20
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
Outlier
Yes
Well
Well 1
Well 2
Well 3

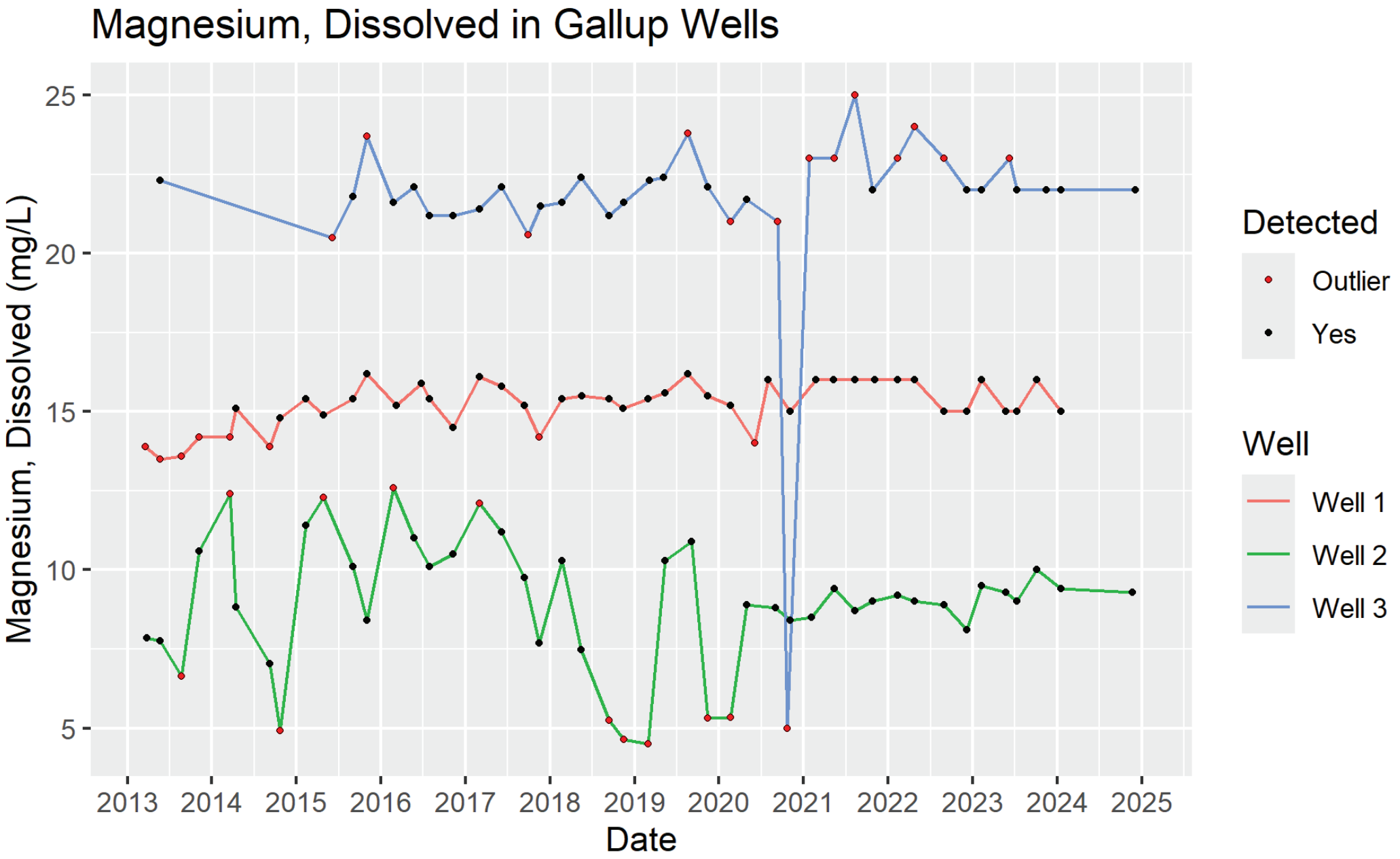

Chloride in Gallup Wells
Chloride (mg/L)
40
30
20
10
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
Outlier
Yes
Well
Well 1
Well 2
Well 3

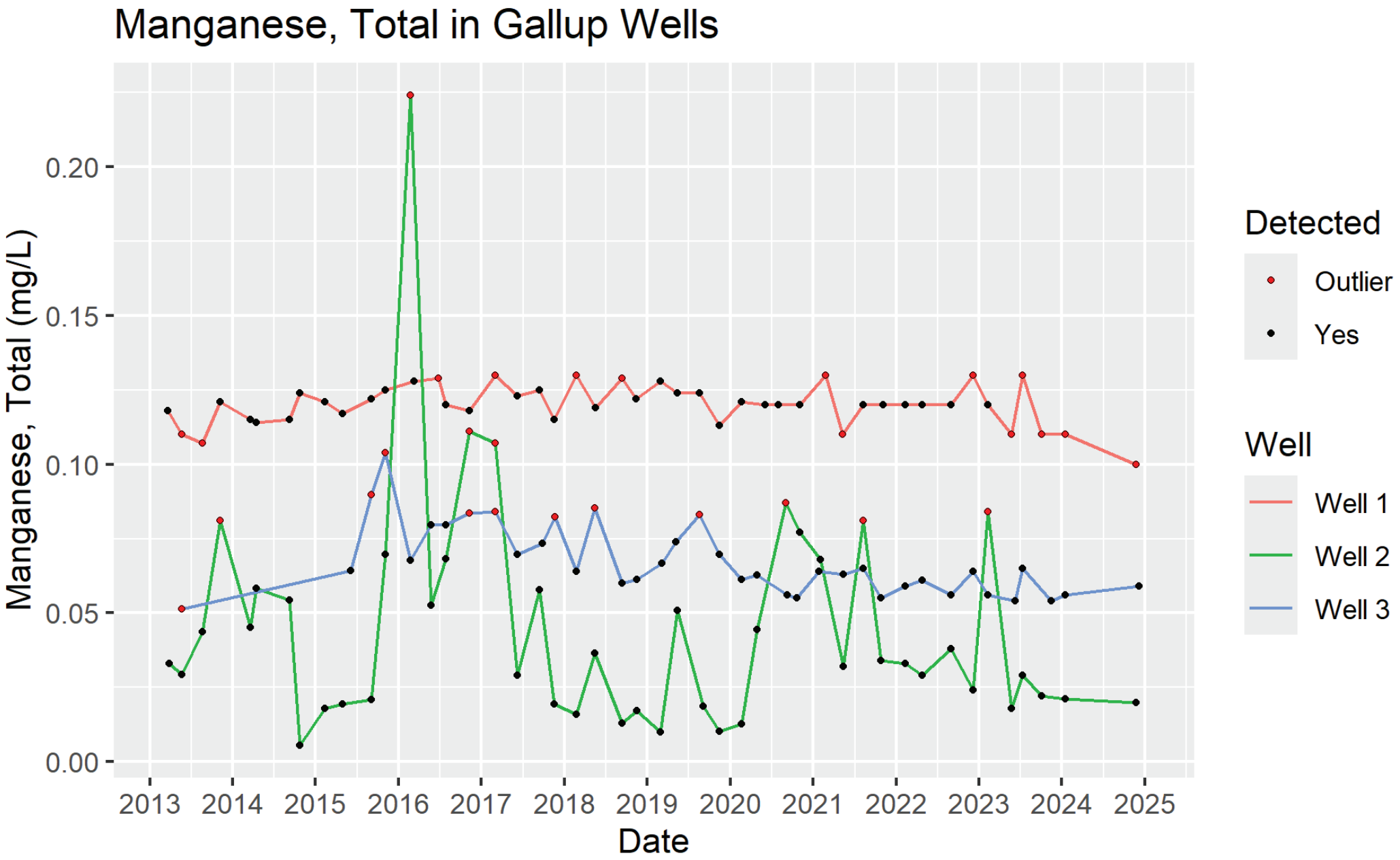

Conductance, Field in Gallup Wells
Conductance, Field (µS/cm)
7500
5000
2500
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
Outlier
Yes
Well
Well 1
Well 2
Well 3

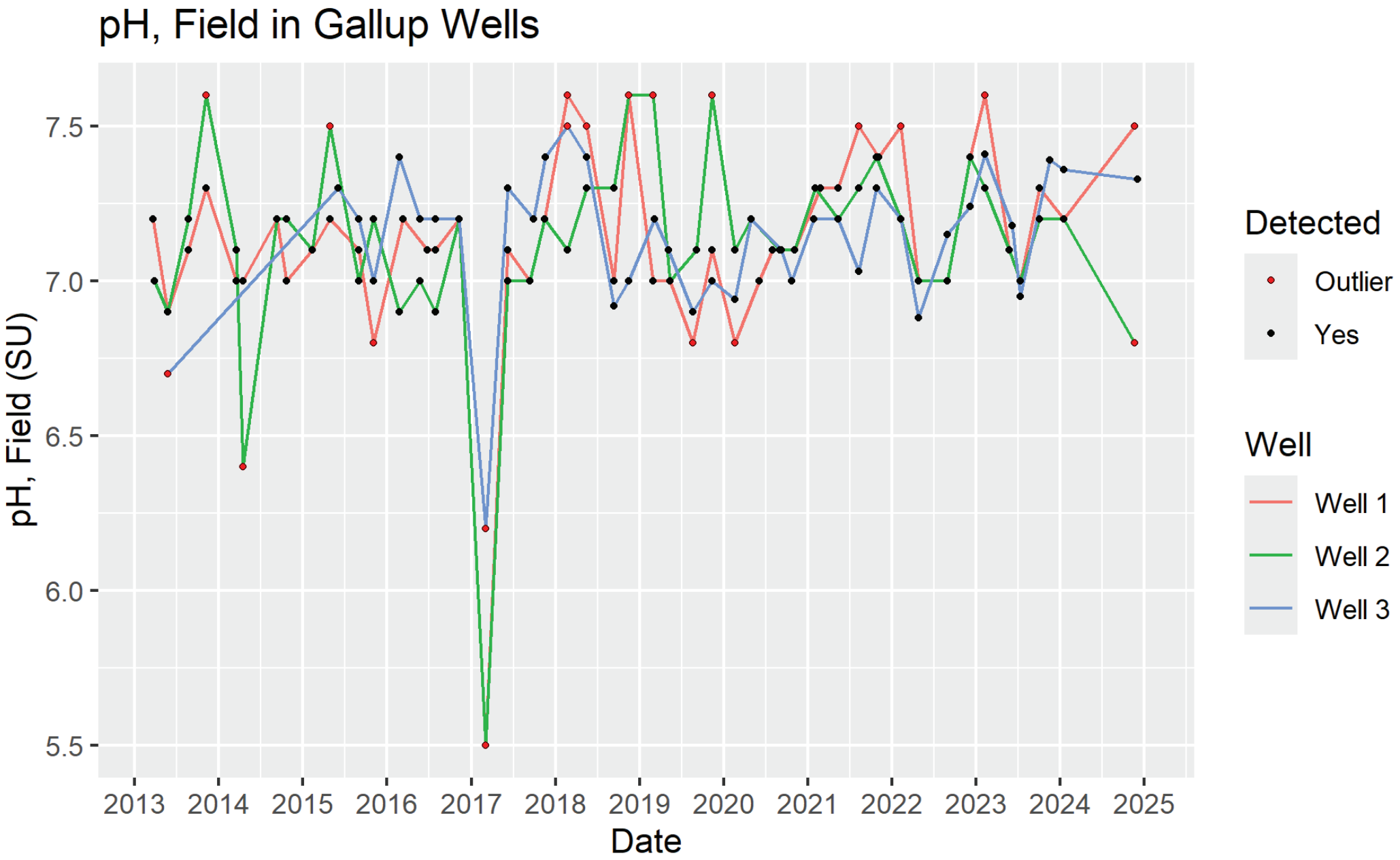

Fluoride in Gallup Wells
Fluoride (mg/L)
1.0
0.5
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
No
Outlier
Yes
Well
Well 1
Well 2
Well 3

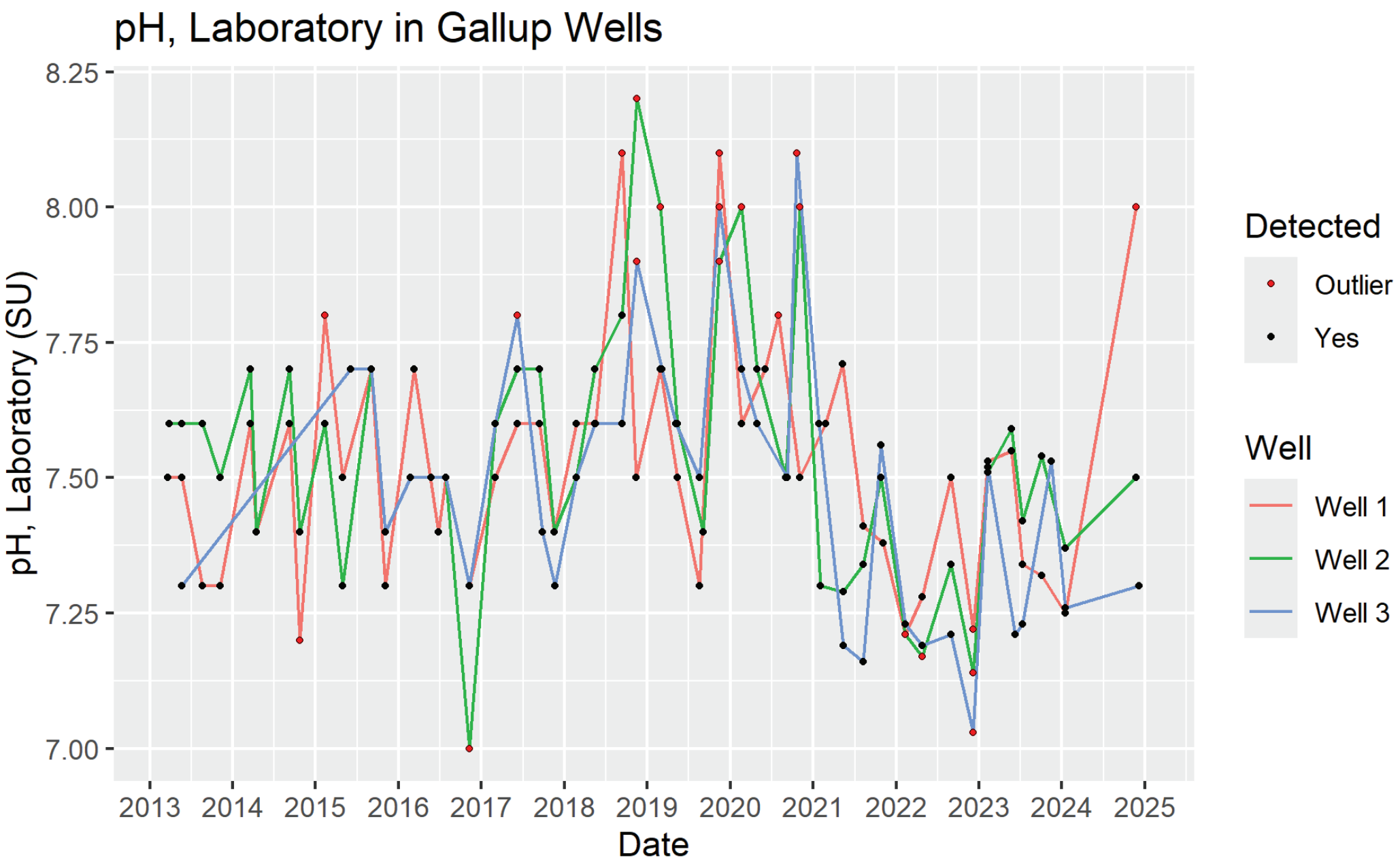

Hardness, Total in Gallup Wells
Hardness, Total (mg/L CaCO3)
400
300
200
100
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
Outlier
Yes
Well
Well 1
Well 2
Well 3

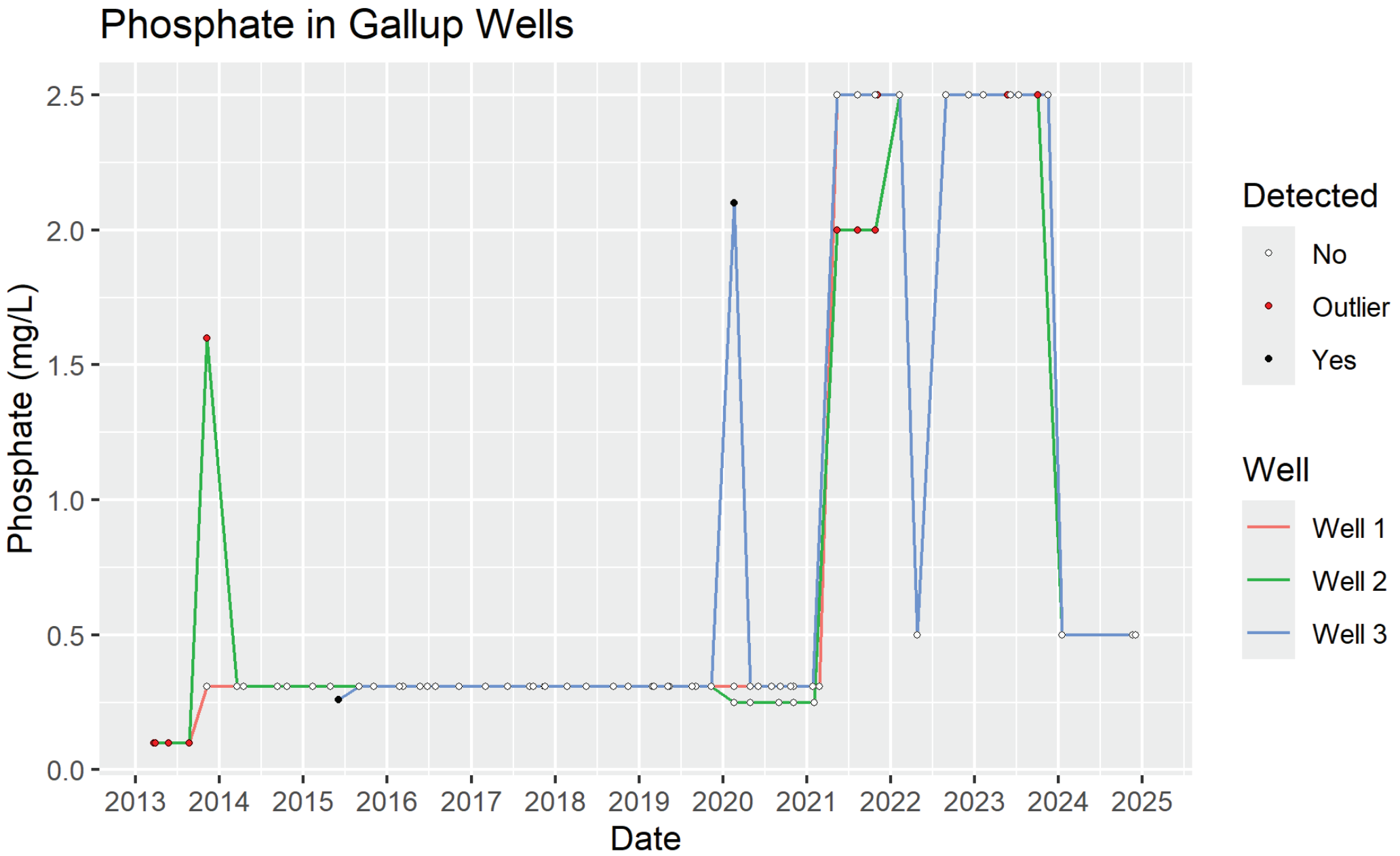

Iron, Total in Gallup Wells
Iron, Total (mg/L)
20
15
10
5
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
Outlier
Yes
Well
Well 1
Well 2
Well 3

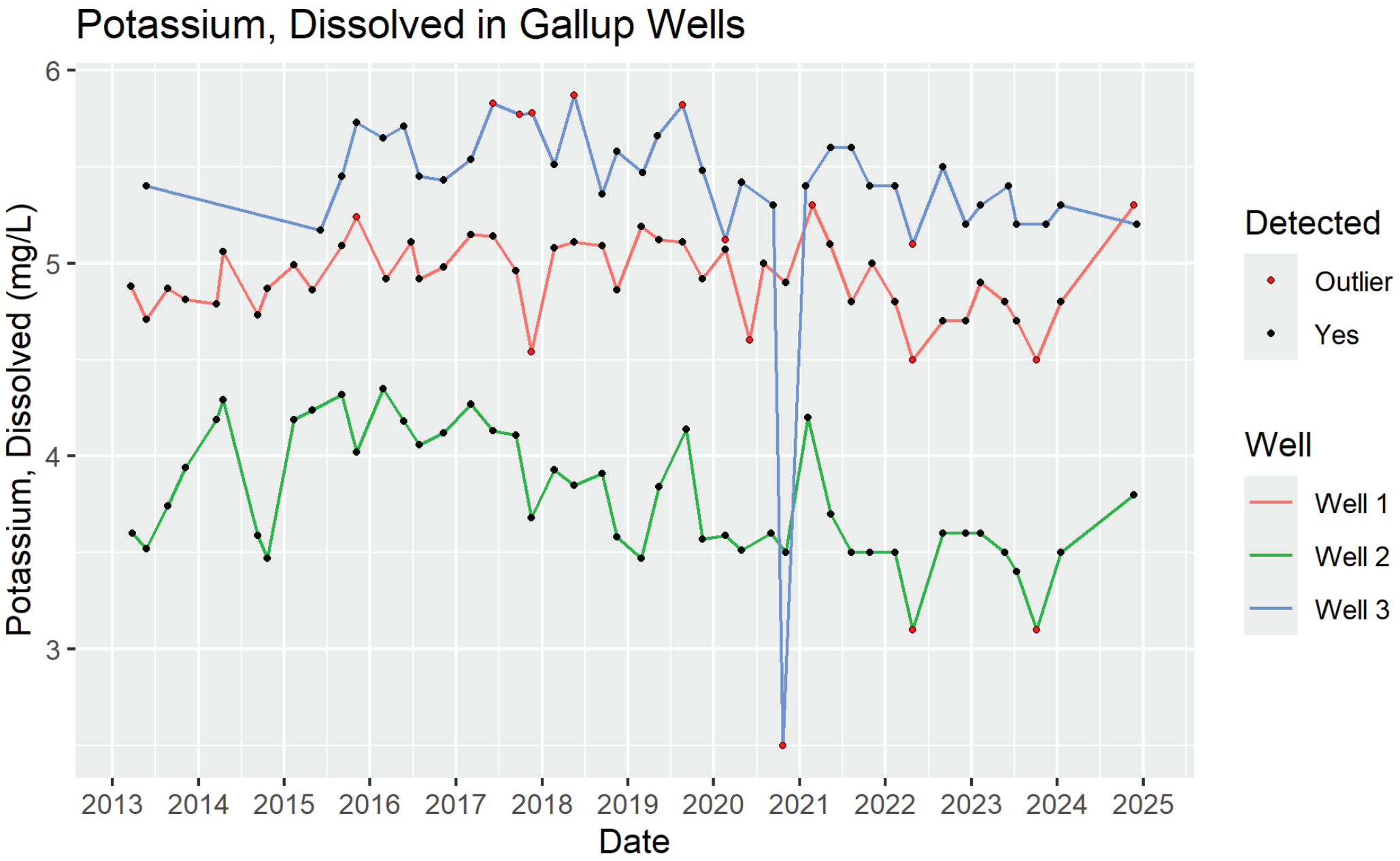

Magnesium, Dissolved in Gallup Wells
Magnesium, Dissolved (mg/L)
25
20
15
10
5
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
Outlier
Yes
Well
Well 1
Well 2
Well 3

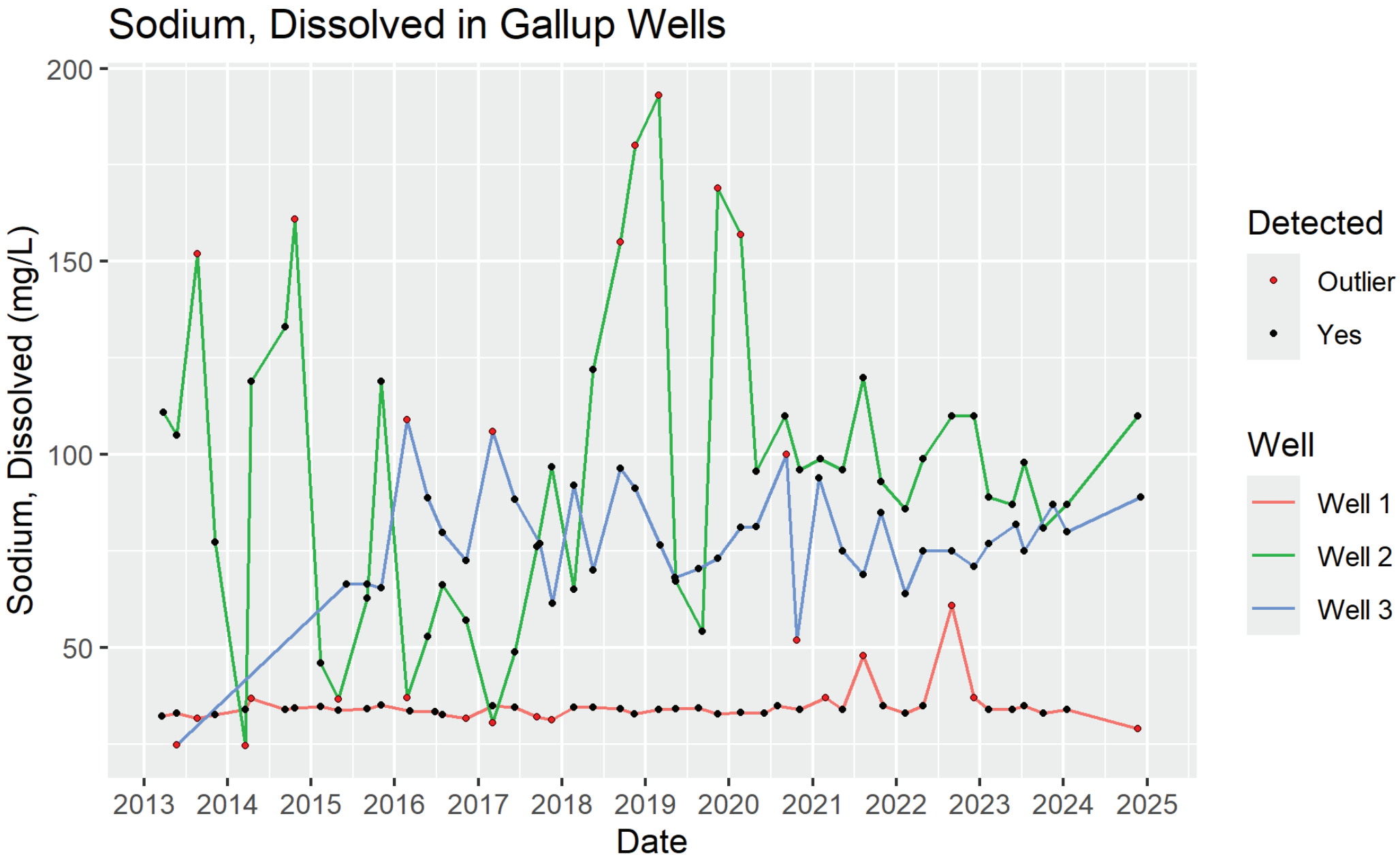

Manganese, Total in Gallup Wells
Manganese, Total (mg/L)
0.20
0.15
0.10
0.05
0.00
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
Outlier
Yes
Well
Well 1
Well 2
Well 3

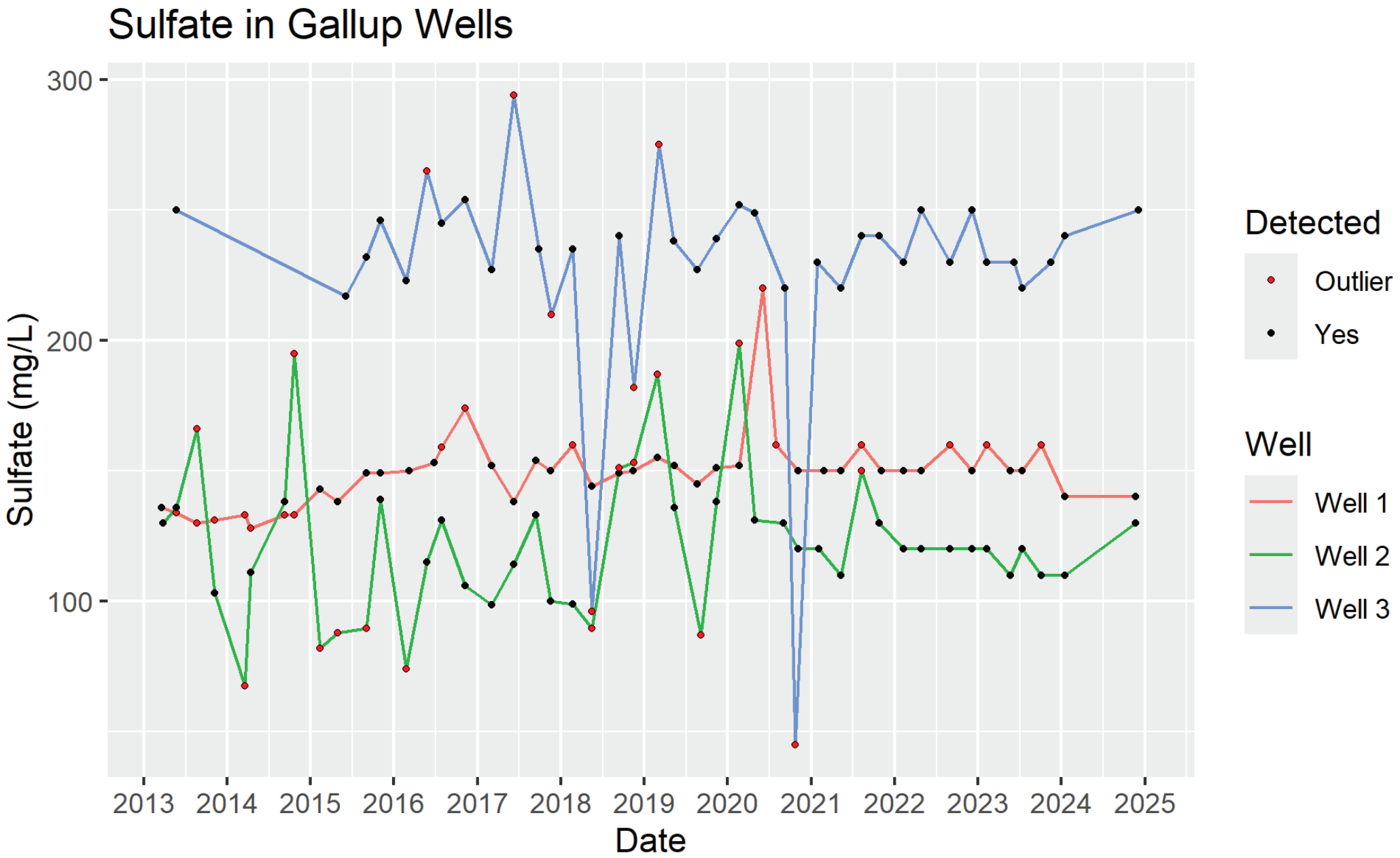

pH, Field in Gallup Wells
pH, Field (SU)
7.5
7.0
6.5
6.0
5.5
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
Outlier
Yes
Well
Well 1
Well 2
Well 3

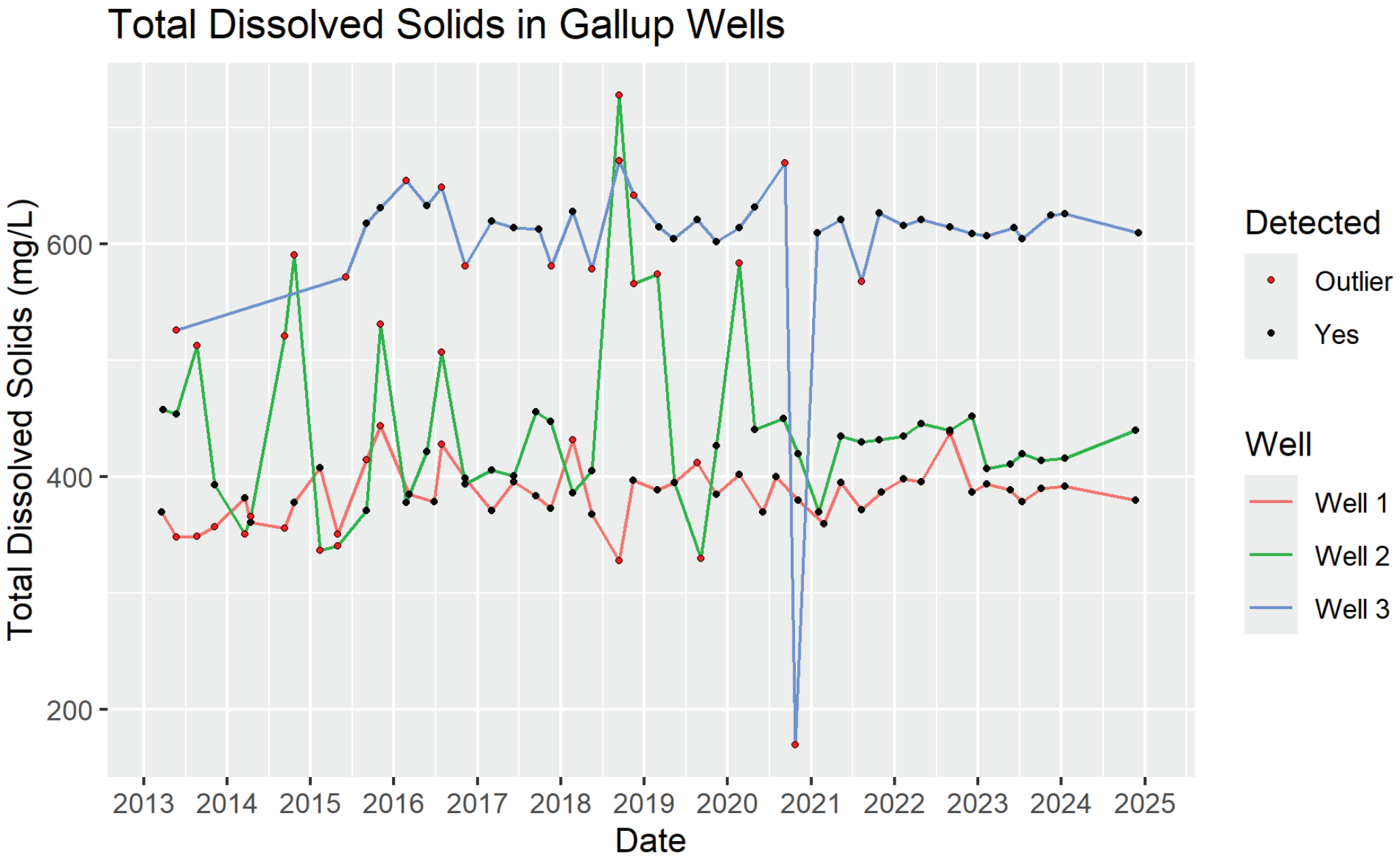

pH, Laboratory in Gallup Wells
8.25
8.00
7.75
7.50
7.25
7.00
pH, Laboratory (SU)
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
Outlier
Yes
Well
Well 1
Well 2
Well 3

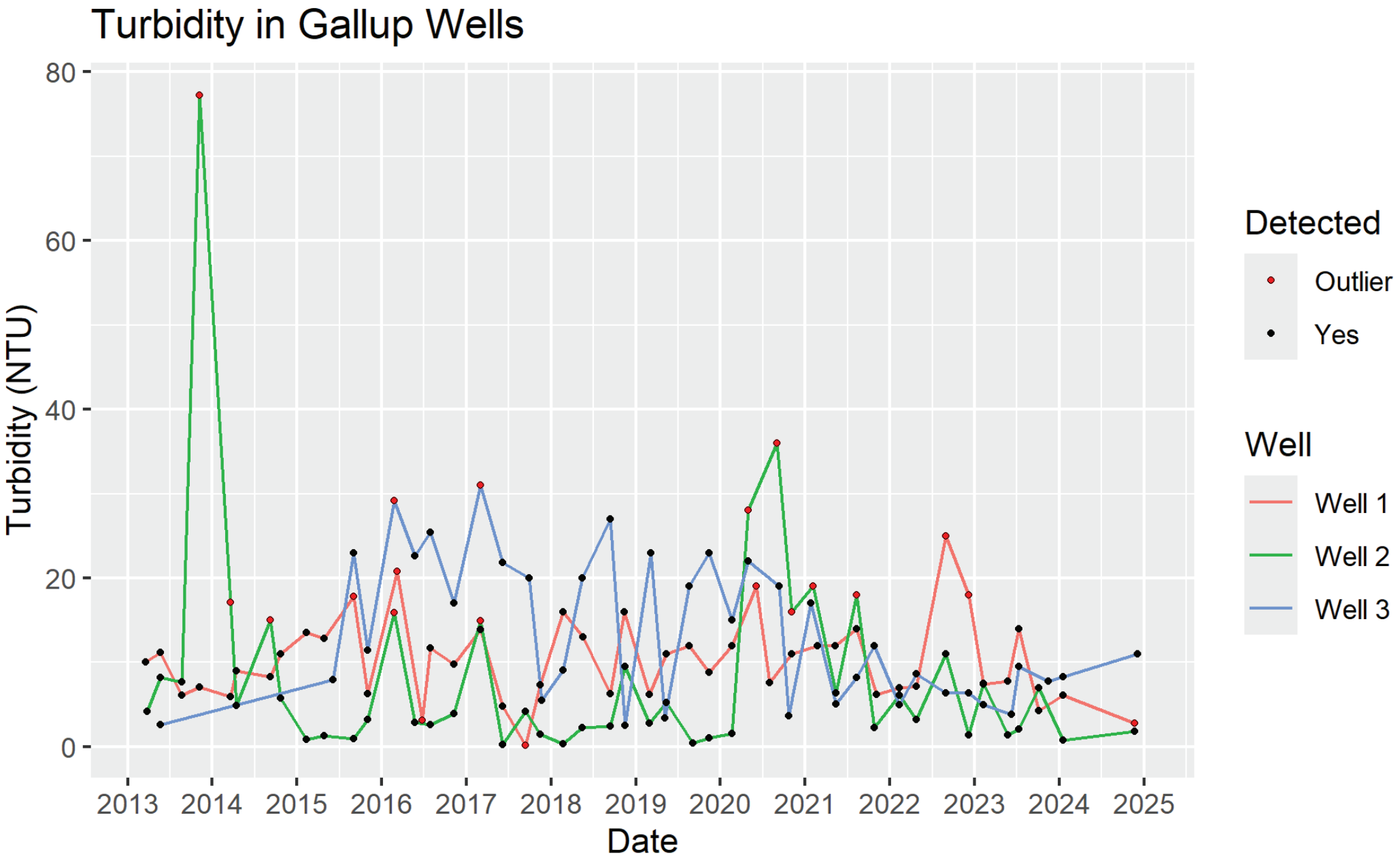

Phosphate in Gallup Wells
Phosphate (mg/L)
2.5
2.0
1.5
1.0
0.5
0.0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
No
Outlier
Yes
Well
Well 1
Well 2
Well 3


Potassium, Dissolved in Gallup Wells
Potassium, Dissolved (mg/L)
6
5
4
3
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
Outlier
Yes
Well
Well 1
Well 2
Well 3


Sodium, Dissolved in Gallup Wells
Sodium, Dissolved (mg/L)
200
150
100
50
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
Outlier
Yes
Well
Well 1
Well 2
Well 3

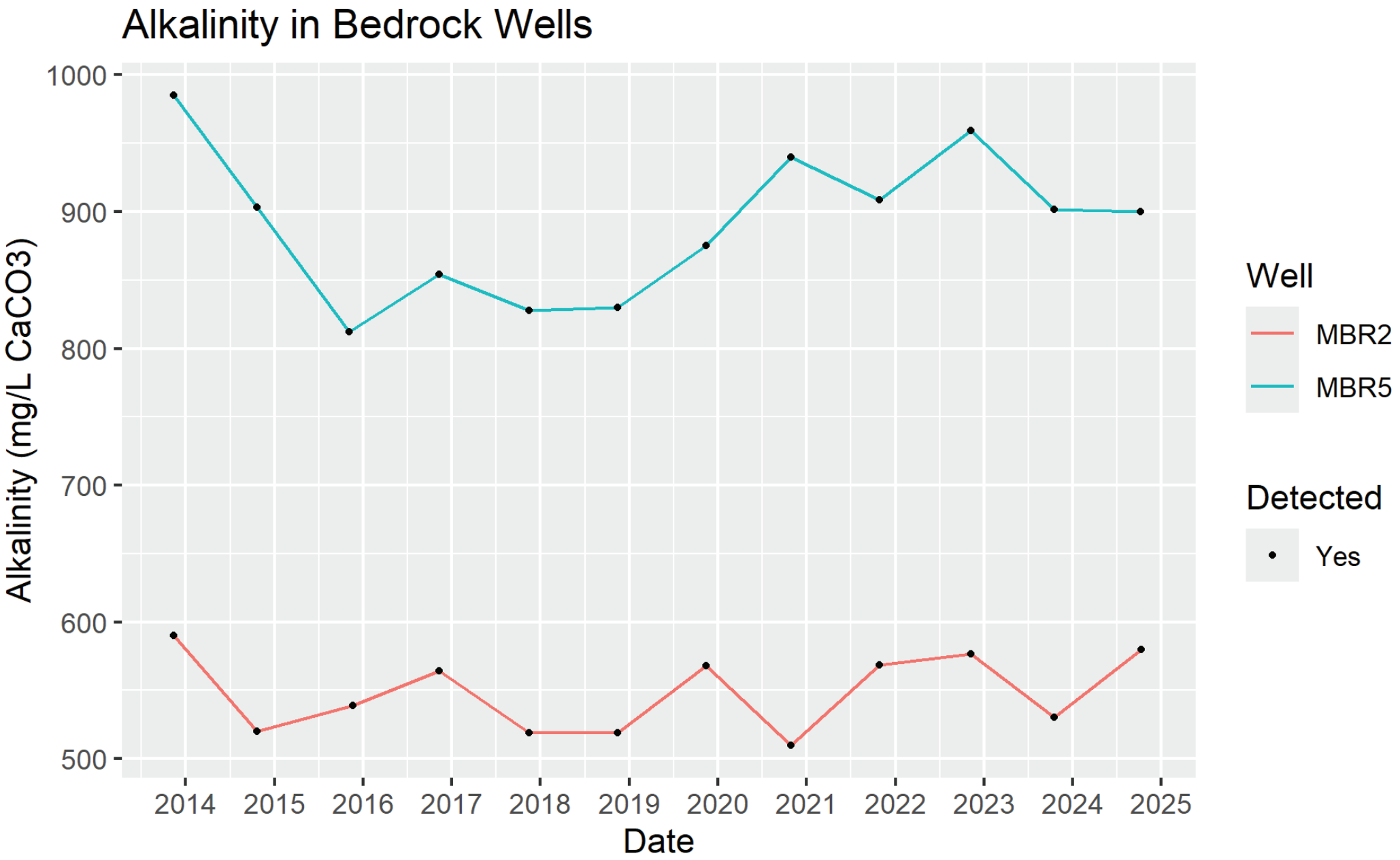

Sulfate in Gallup Wells
300
200
100
Sulfate (mg/L)
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
Outlier
Yes
Well
Well 1
Well 2
Well 3

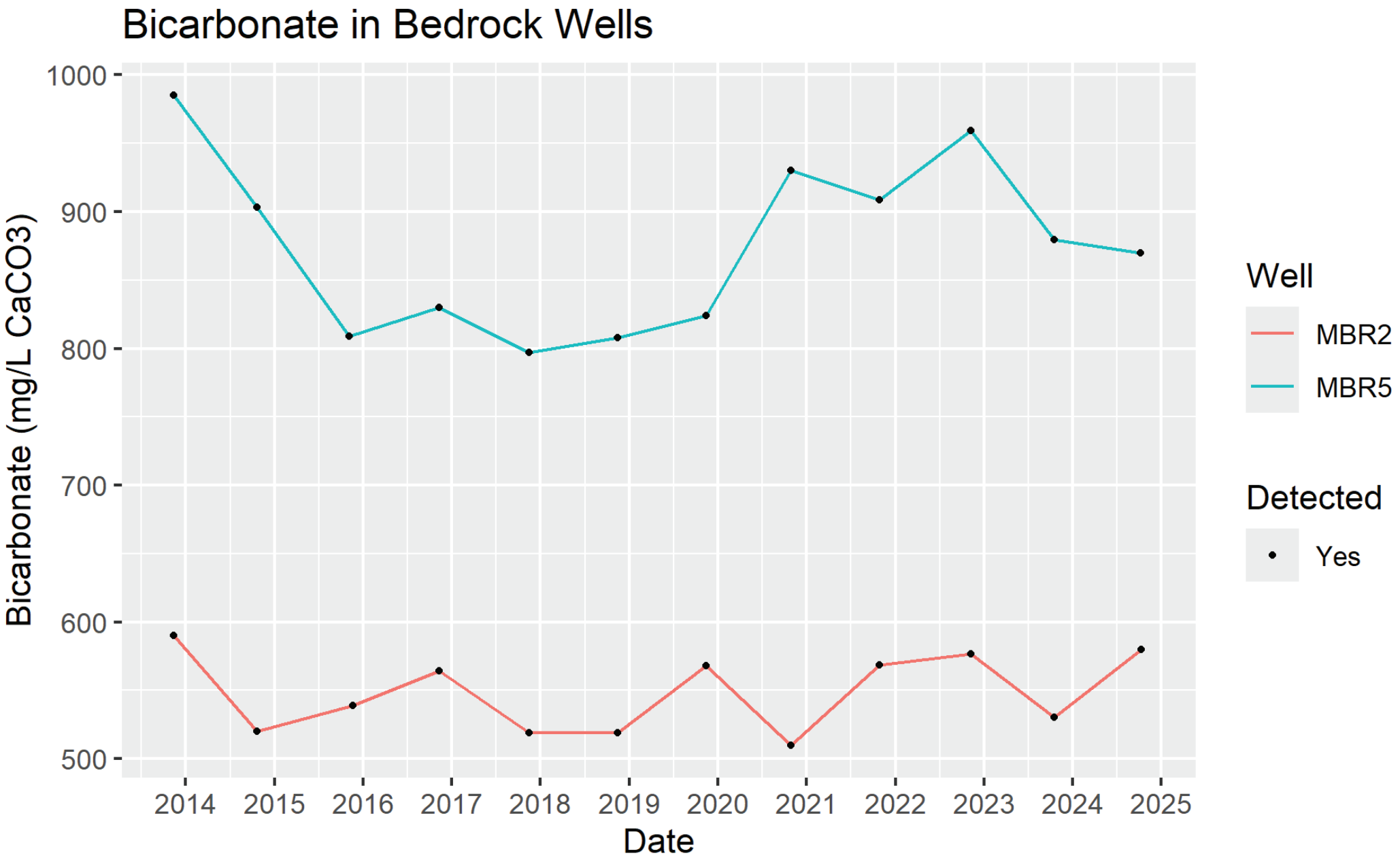

Total Dissolved Solids in Gallup Wells
Total Dissolved Solids (mg/L)
600
400
200
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
Outlier
Yes
Well
Well 1
Well 2
Well 3

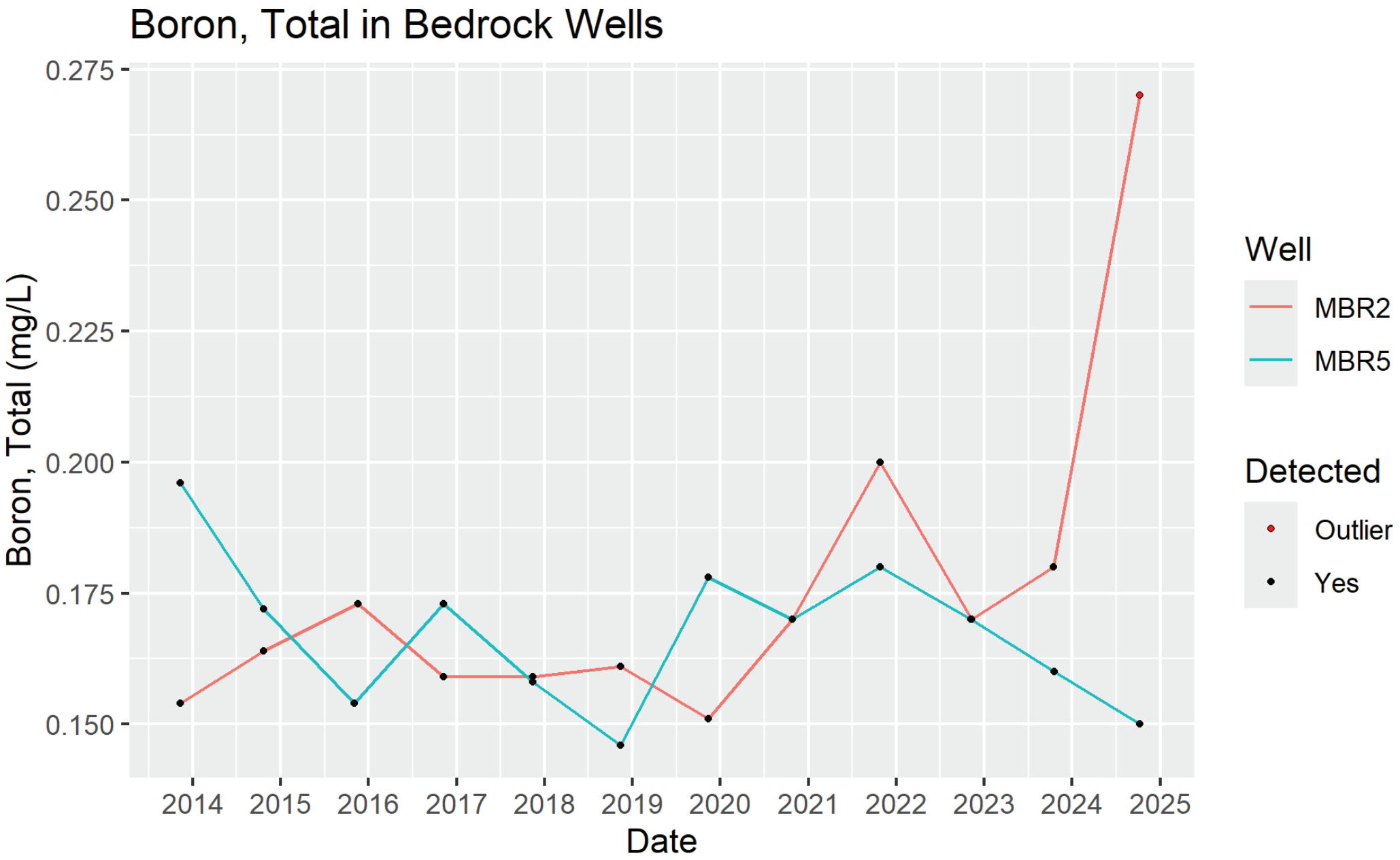

Turbidity in Gallup Wells
Turbidity (NTU)
80
60
40
20
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Detected
Outlier
Yes
Well
Well 1
Well 2
Well 3

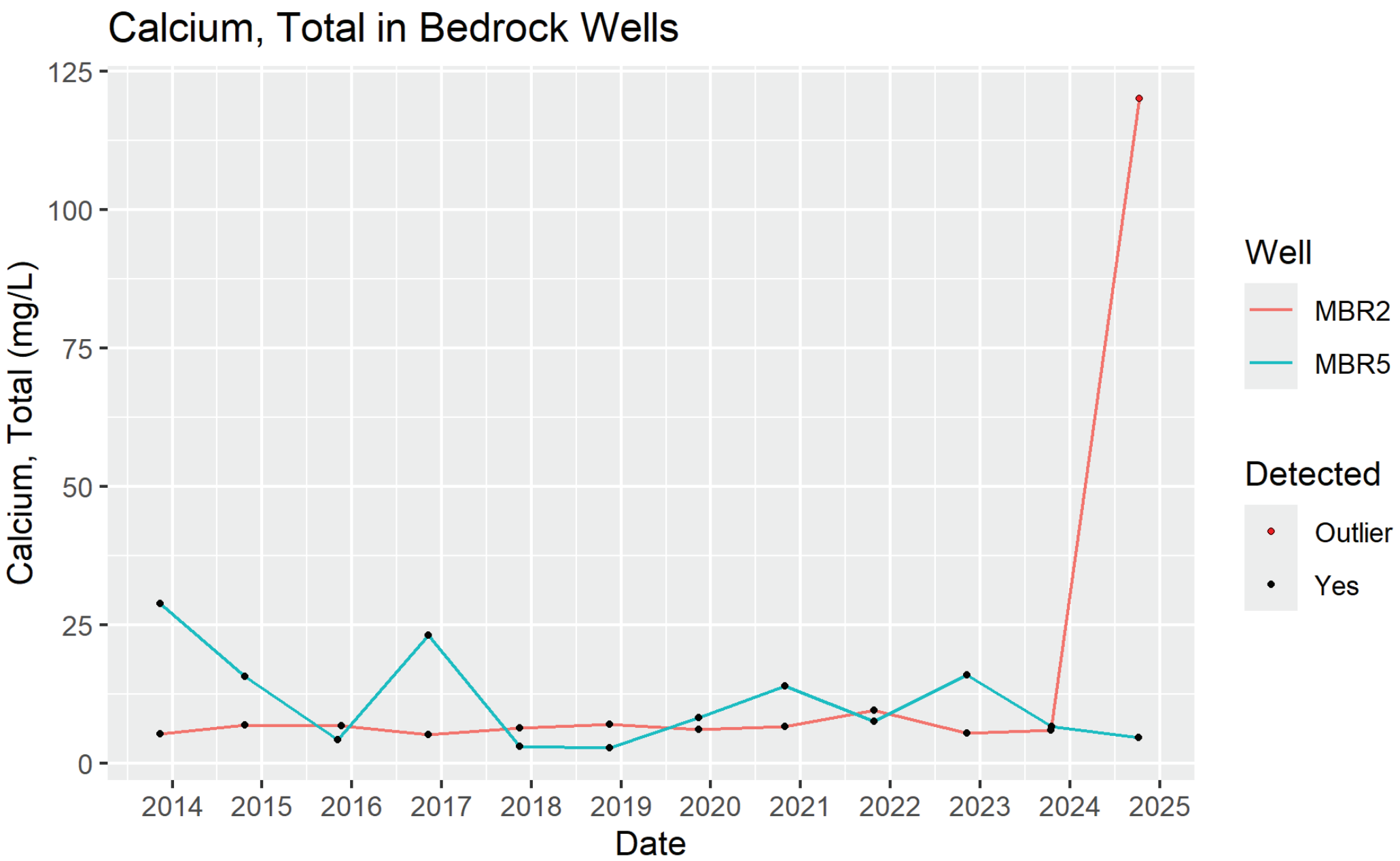
APPENDIX C-3

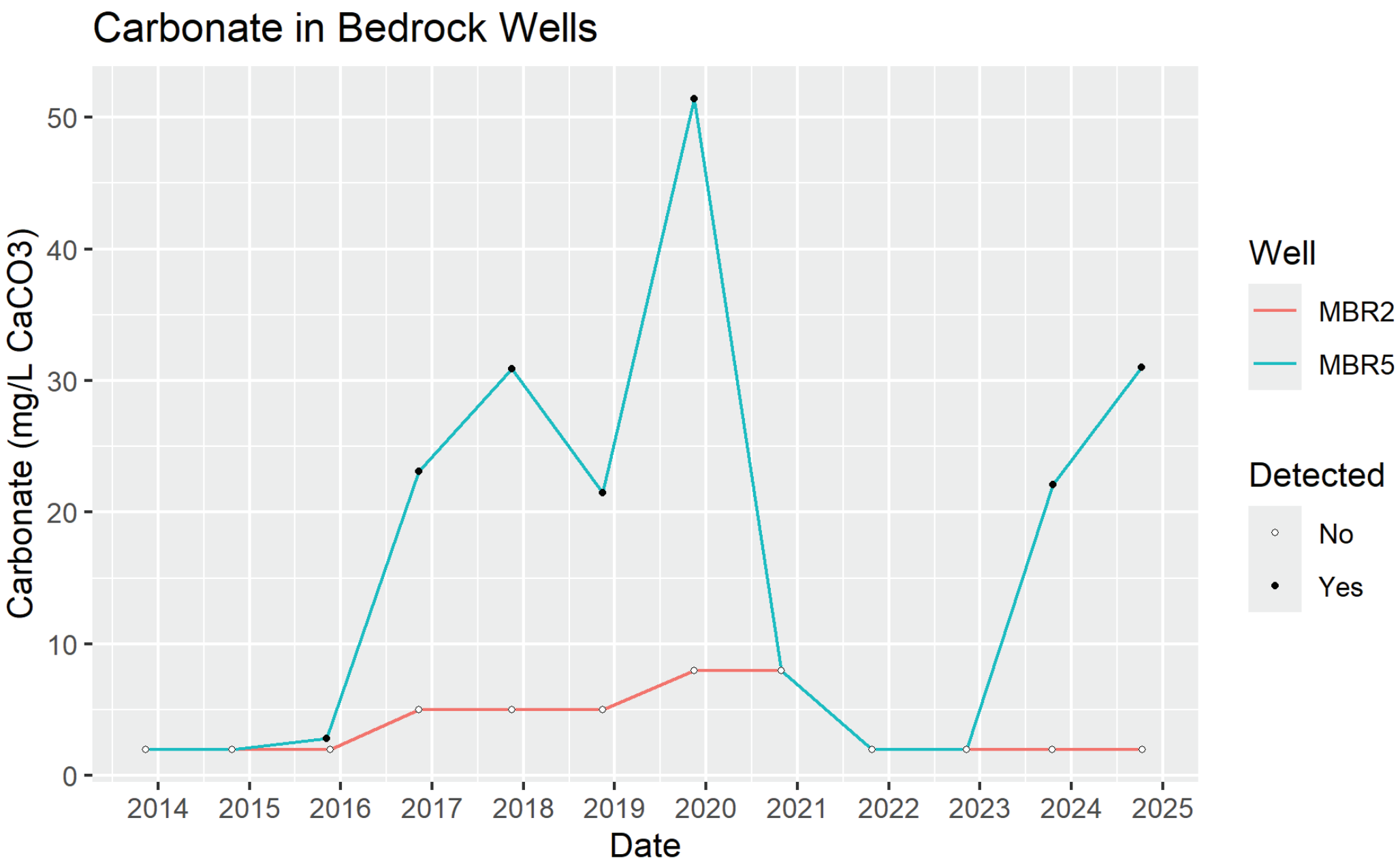
HISTORICAL GROUNDWATER TEMPORAL PLOTS – BEDROCK MONITORING WELL MBR2 AND WELL MBR5

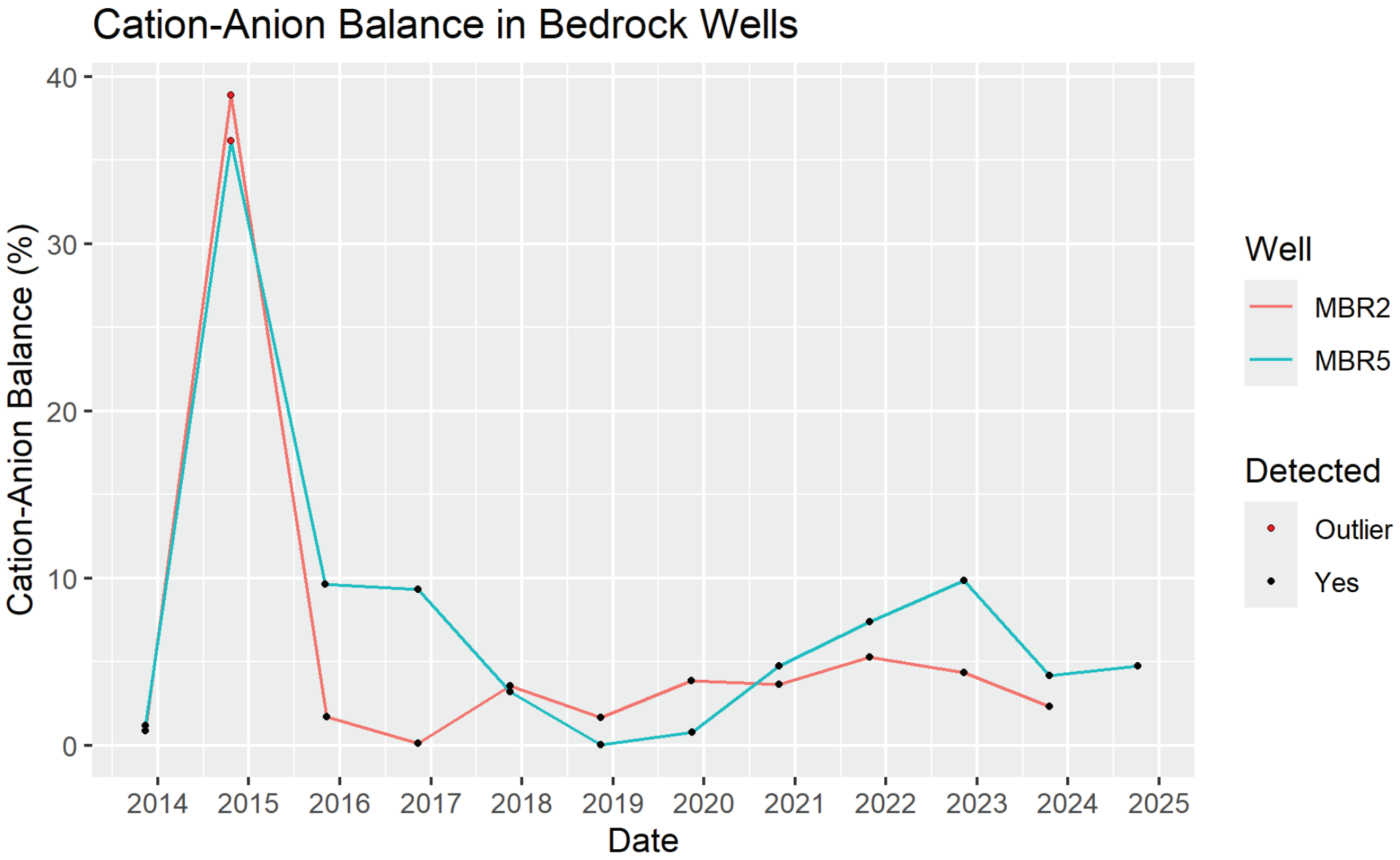

Alkalinity in Bedrock Wells
Alkalinity (mg/L CaCO3)
1000
900
800
700
600
500
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Well
MBR2
MBR5
Detected
Yes

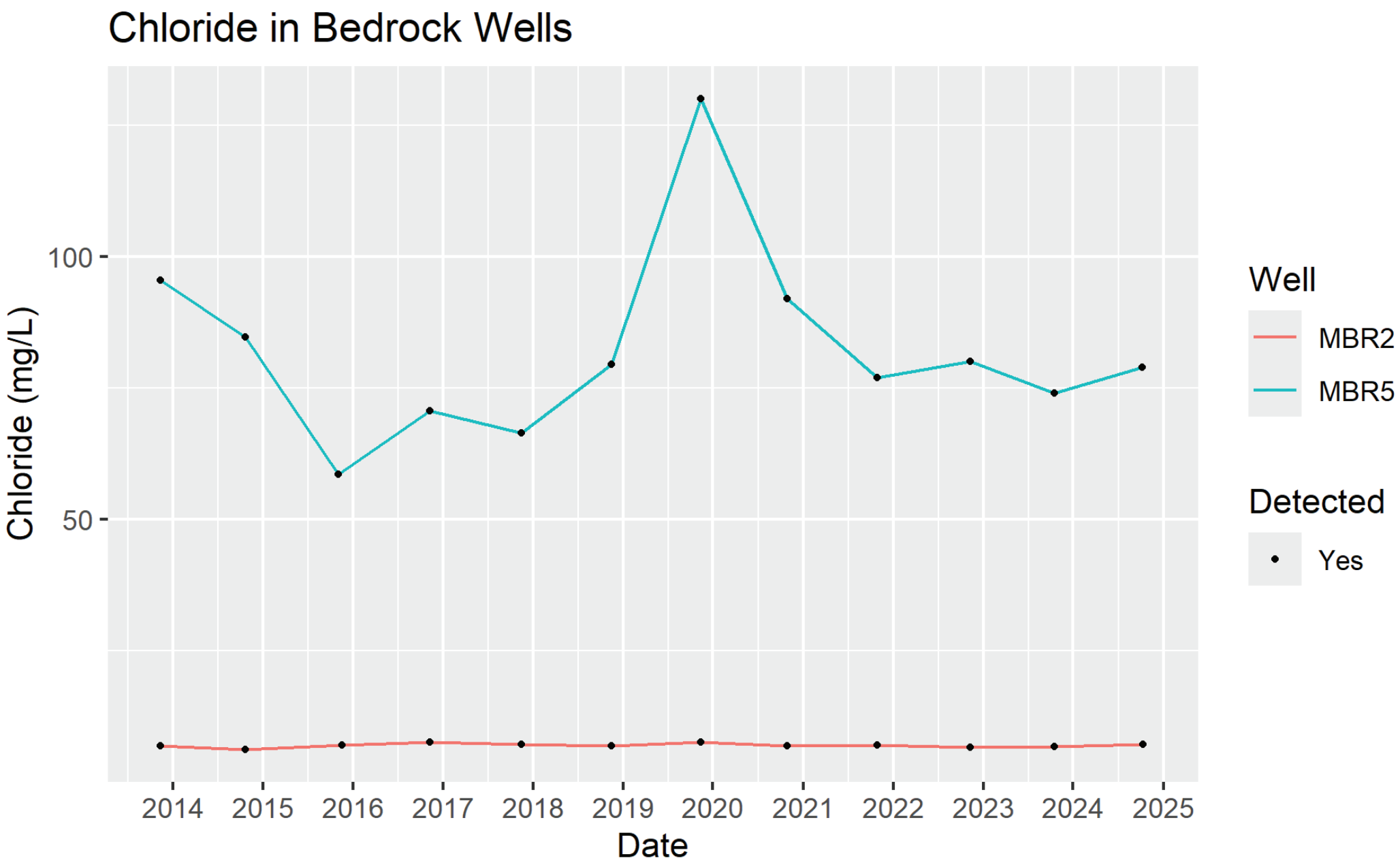

Bicarbonate in Bedrock Wells
Bicarbonate (mg/L CaCO3)
1000
900
800
700
600
500
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Well
MBR2
MBR5
Detected
Yes

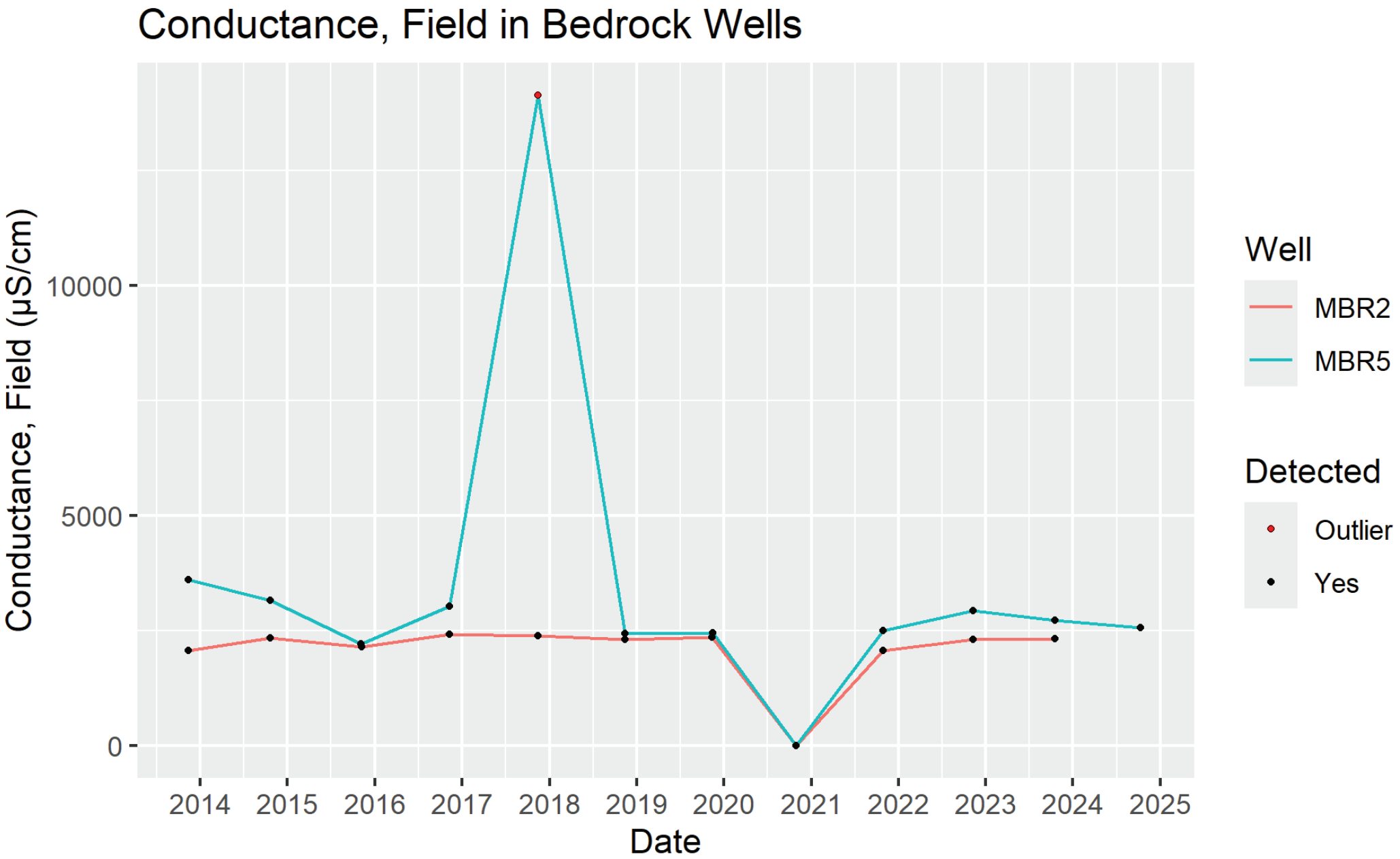

Boron, Total in Bedrock Wells
Boron, Total (mg/L)
0.275
0.250
0.225
0.200
0.175
0.150
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Well
MBR2
MBR5
Detected
Outlier
Yes

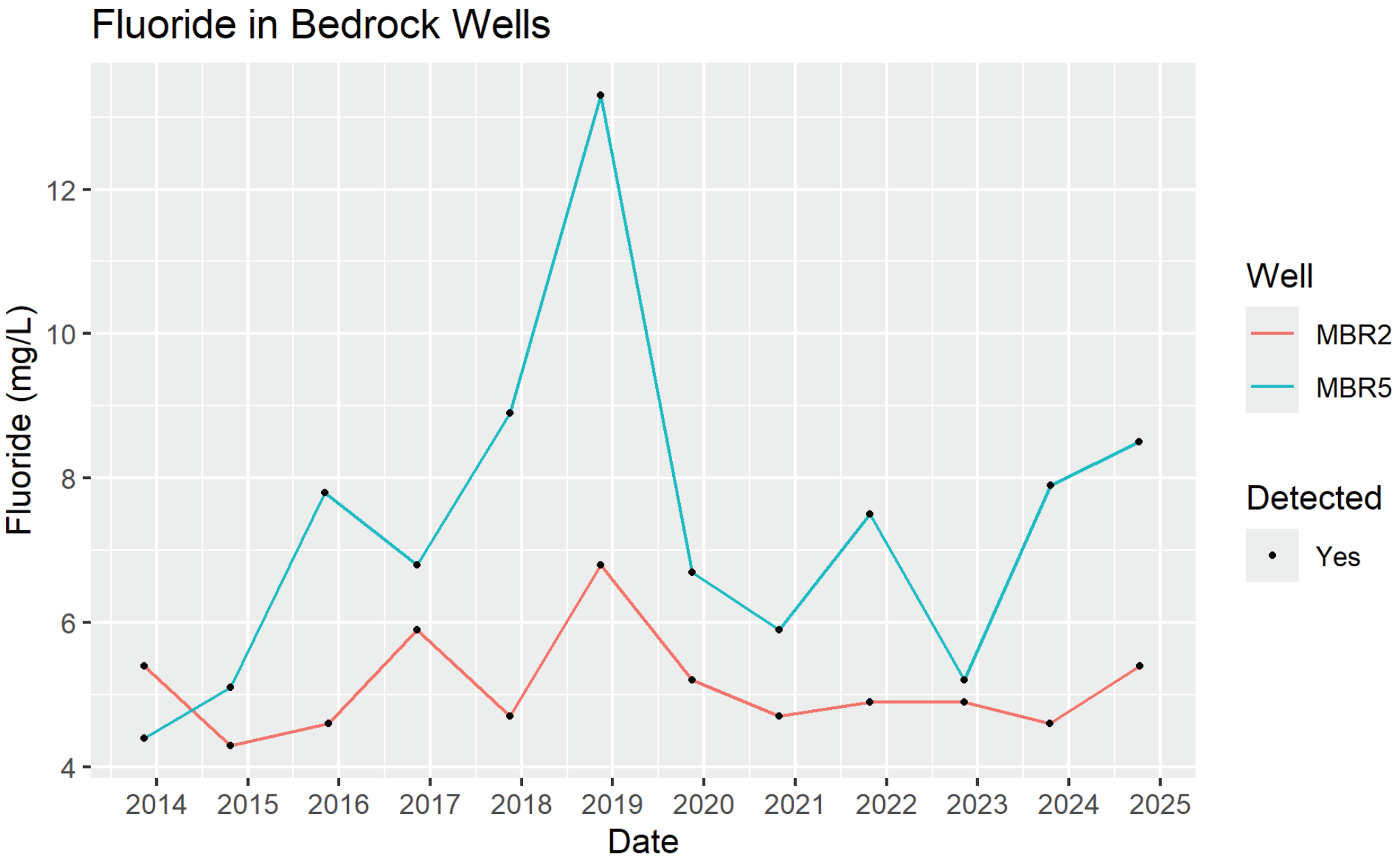

Calcium, Total in Bedrock Wells
Calcium, Total (mg/L)
125
100
75
50
25
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Well
MBR2
MBR5
Detected
Outlier
Yes

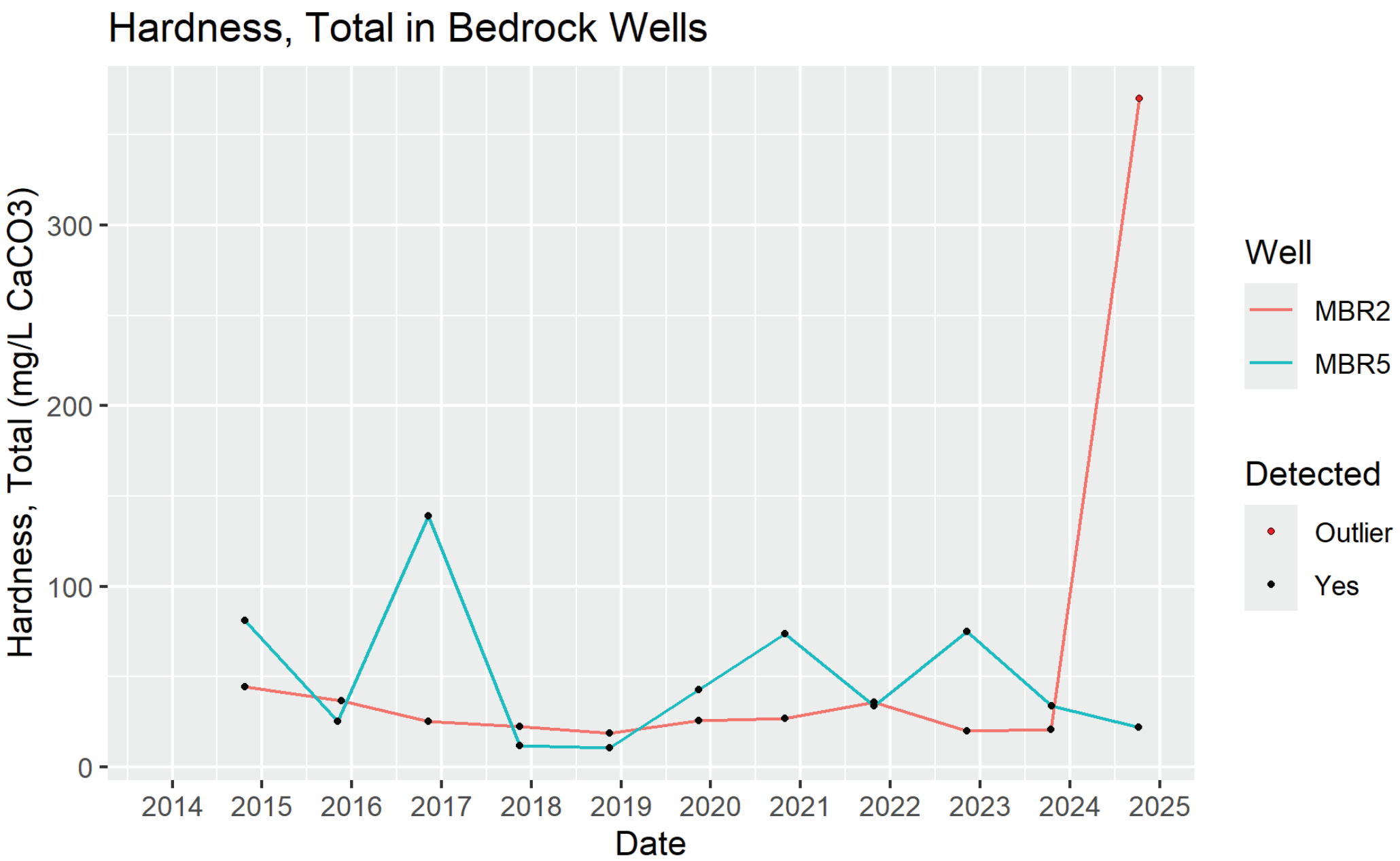

Carbonate in Bedrock Wells
Carbonate (mg/L CaCO3)
50
40
30
20
10
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Well
MBR2
MBR5
Detected
No
Yes


Cation-Anion Balance in Bedrock Wells
Cation-Anion Balance (%)
40
30
20
10
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Well
MBR2
MBR5
Detected
Outlier
Yes


Chloride in Bedrock Wells
Chloride (mg/L)
100
50
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Well
MBR2
MBR5
Detected
Yes


Conductance, Field in Bedrock Wells
Conductance, Field (µS/cm)
10000
5000
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Well
MBR2
MBR5
Detected
Outlier
Yes


Fluoride in Bedrock Wells
Fluoride (mg/L)
12
10
8
6
4
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Well
MBR2
MBR5
Detected
Yes


Hardness, Total in Bedrock Wells
Hardness, Total (mg/L CaCO3)
300
200
100
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Date
Well
MBR2
MBR5
Detected
Outlier
Yes