STATE OF COLORADO

Eschberger - DNR, Amy <amy.eschberger@state.co.us>

M-1980-244 TR-129 Points of Compliance - Numeric Protection Levels Second Adequacy Response

Ronald Parratt <Ronald.Parratt@newmont.com> Mon, May 9, 2022 at 3:03 PM
To: "Eschberger - DNR, Amy" <amy.eschberger@state.co.us>
Cc: Justin Raglin <Justin.Raglin@newmont.com>, Norma Townley <Norma.Townley2@newmont.com>, Katie Blake <Katie.Blake@newmont.com>

Good afternoon Ms. Eschberger,

Please see the attached second adequacy response for M-1980-244 Technical Revision No. 129 Points of Compliance and Numeric Protection Levels. If you have any questions please reach out to Ronald Parratt at 719-851-4019 or ronald.parratt@newmont.com or Justin Raglin at 719-851-4042 or justin.raglin@newmont.com

Thank you,

Ronald Parratt

Site Water Coordinator

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SENT VIA ELECTRONIC COMMUNICATIONS

May 9, 2022

Ms. Amy Eschberger
Environmental Protection Specialist
Colorado Department of Natural Resources
Division of Reclamation, Mining and Safety
Office of Mined Land Reclamation
1313 Sherman Street, Room 215
Denver, Colorado 80203

RE: Permit No. M-1980-244; Cripple Creek & Victor Gold Mining Company; Cresson Project; Second Adequacy Review Response; Technical Revision 129 (TR-129) Proposed Numeric Protection Levels and Site Point of Compliance Well Identification, Permit No. M-1980-244

Ms. Eschberger:

Cripple Creek and Victor Gold Mining Company (CC&V) received the Division of Reclamation, Mining, and Safety (DRMS) second adequacy review response to Technical Revision 129 (TR-129) for Permit No. M-1980-244. CC&V has reviewed the comments issued in the letter dated April 5, 2022 from DRMS and has prepared responses for each comment based on our understanding of the outcomes from our meeting on April 11, 2022. The DRMS adequacy review comments (*in italics*) and CC&V's corresponding response (**in bold**) are presented below.

<u>Proposed Numeric Protection Limits:</u>

1. *The Division will evaluate whether it is appropriate to supplement the current TR (TR-129) or submit a separate TR to review the NPL submittal.*

   As discussed and agreed to with the Division on April 11, 2022, CC&V, is submitting proposed NPLs for the Division's consideration as part of this Technical Revision. Please see Attachment A "Proposed Revisions to Numeric Protection Limits by Drainage Basin " with proposed NPLs for each basin presented in Table 3 of this document.

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Background

3. *Please update the table provided in the response with an additional column for the proposed point-of-compliance for each basin.*

Basin	DRMS Compliance Wells	Non-DRMS Monitoring Wells	Vibrating Wire Piezometers	Proposed Point of Compliance
Grassy Valley	GVMW-8A GVMW-8B GVMW-22A GVMW-22B GVMW-25	GVMW-4A, GVMW-4B GVMW-6A GVMW-7A, GVMW-7B GVMW-10 GVMW-15A, GVMW-15B GVMW-15C, GVMW-21A GVMW-23A, GVMW-23B GVMW-24A, GVMW-24B OSABH-12, OSABH-14 OSABH-16, OSABH-17 OSABH-18	GVPZ1 GVPZ2 GVPZ3 GVPZ4	GVMW-26*
Vindicator Valley	VIN-2A VIN-2B		CVWP-1 VVWP-1 BVWP-1	VIN-2B
Wilson Creek	WCMW-3-134 WCMW-6-234	WCMW-2-65		WCMW-6
Arequa Gulch	CRMW-3A, CRMW-3B CRMW-3C CRMW-5A, CRMW-5B CRMW-5C, CRMW-5D ESPMW-1	GRMW-1A GRMW-2A GRMW-3A		CRMW-5B
Rosebud Gulch	SGMW-5 (dry) SGMW-6A (dry), SGMW-6B SGMW-7A (dry), SGMW-7B (dry)			SGMW-8*
Poverty Gulch	PGMW-2 (dry), PGMW-3 PGMW-4 (dry)		GHC 15-1	PGMW-5*

***To be drilled and constructed pending approval of TR-129, Sourcing of Contractor, materials, and scheduling**

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Points of Compliance:

5. *On Figure 1 it appears WCMW-6 is located on the west side of the ephemeral drainage that drains to Wilson Creek, is this the correct location of the well? A review of historic aerial imagery and the DWR website indicate the well may be located on the other side of the drainage.*

Yes, WCMW-6 is on the west side of the ephemeral drainage which drains to Wilson Creek.

Figure 2 needs to be revised to show the potentiometric surface of the alluvial water bearing zone on one figure, and the deeper bedrock aquifer on another figure.

Please see Attachment B for Grassy Valley deeper bedrock aquifer, and updated figures with elevations at each well that were used to generate the contour map.

On all figures please indicate what the water elevation is at each well that is used to generate the contour map.

Please see Attachment B for requested additional, and updated figures with elevations at each well that were used to generate the contour map.

6. *(Follow up to Adequacy response received 2-10-2022, question #6) Groundwater at the site has been separated into a shallow, deep and deeper water bearing intervals, e.g., CRMW-5A, -5B, -5C, and -5D. All intervals need to have a point of compliance identified within each basin. Identify the additional points of compliance for Arequa Gulch, Grassy Valley, Vindicator Valley and Wilson Creek. At this time, Basins that do not currently have multiple groundwater intervals identified additional points of compliance do not to be identified.*

Contained in Attachment C, CC&V is providing the water analysis (piper diagrams) completed for monitoring wells within Arequa Gulch (CRMW-5A, CRMW-5B, CRMW-5C, and CRMW-5D), Vindicator Valley (VIN-2A & VIN-2B) and Grassy Valley (GVMW-22A & GVMW-22B) as discussed during our May 3, 2022 meeting. Demonstrated in these data is that the Arequa Gulch monitoring wells are sampling the same water, as is the Vindicator Valley monitoring wells. Data analysis of the Grassy Valley monitoring wells indicate that there are differences between in the water sampled from the shallow and deep well. From this analysis CC&V is proposing

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that the point of compliance for Arequa Gulch be the monitoring well CRMW-5B, and the point of compliance for Vindicator be the monitoring well VIN-2B.

6. *The proposed point-of-compliance wells within Grassy Valley, GVMW-22A and -22B, may not be accurately positioned to monitor the migration of potentially affected groundwater beyond the permit boundary. Currently, GVMW-22A and -22B are located on the northern flank of the valley floor uphill from an ephemeral incised drainage or thalweg. The Division infers affected alluvial groundwater is possibly passing through the system unmonitored closer to the thalweg or to the south of the thalweg. Recent monitoring results from GVMW-25 showed a substantial increase in analyte concentrations. Taking into account a delayed response, the Division anticipated some reaction to be detected in GVMW-22B, at a minimum, and yet to date no corresponding increase in concentrations has been detected in either well. During TR-97, for the installation of GVMW-25, the Division expressed its concern that if the well was located on the north side of the thalweg, it would not be able to detect affected groundwater, and recommended the well be located between the ECOSA and the thalweg. The Division believes the point-of-compliance well(s) for Grassy Valley needs to be located closer to the thalweg, south of the currently proposed point-of-compliance location.*

As discussed with the Division on May 3, 2022, CC&V is working to establish a monitoring location (GVMW-26) on the south side of the Grassy Valley drainage across from monitoring locations GVMW-22A and GVMW-22B to address the Divisions' concerns. CC&V will provide the Division with updates on progress of establishing this point of compliance monitoring location as they are available.

8. *The Division recommends quickly communicating the results of the drilling program for location SGMW-8 in the event the drilling program produces unforeseen conditions.*

CC&V commits to communicating results of the drilling program for monitoring well location SGMW-8 in the event the drilling program produces unforeseen conditions.

As discussed with DRMS on February 2, 2022, April 4, 2022, and May 3, 2022, CC&V has reviewed all available information to assess and propose Numeric Protection Levels (NPLs) as part of this technical revision. CC&V will update permit documentation including exhibits and maps as necessary once this technical revision is approved. Should the Division required further information please do not hesitate to contact

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Ronald Parratt at 719-851-4019 or ronald.parratt@Newmont.com or me at 719-851-4042 or justin.raglin@newmont.com.

Sincerely,

P.P. Ronald Parratt

Justin Raglin
Sustainability and External Relations Manager
Cripple Creek & Victor Mine

EC: T. Cazier – DRMS
M. Cunningham – DRMS
E. Russell – DRMS
P. Lennberg
D. Williams – Teller County
J. Raglin – CC&V
R. Parratt – CC&V
K. Blake - CC&V
Encl.
File

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Attachment A -

Proposed Revision to Numeric Protection Limits by Drainage Basin

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Attachment A: Proposed Revisions to Numeric Protection Limits by Drainage Basin

May 6, 2022

1. Introduction

This attachment has been prepared to provide the technical basis for proposed revisions to the numeric protection limits (NPLs) used to assess the results of groundwater monitoring in the six drainage basins at the Cripple Creek and Victor (CC&V) mine. These revisions are being proposed in conjunction with the installation of new monitoring wells, designation of Points of Compliance (POC) for groundwater monitoring, and recognition of certain constituents that have historically and continue to occur at elevated concentrations in groundwater.

Following this introduction (Section 1), which describes the process used by CC&V and the DRMS to develop NPLs for the CC&V mine, a comprehensive summary of historical mining and mine waste placement activities is provided to illustrate the factors that impacts to water quality (Section 2). A summary of NPLs is provided in Section 4 followed by a high-level summary of proposed NPLs in Section 5. The basis for these NPLs is described in more detail for each basin in Sections 5 through 10. Conclusions are summarized in Section 11.

In December of 2016, DRMS issued a request to CC&V for Demonstration of Compliance with WQCC Regulation No. 41 – The Basic Standards for Groundwater. The request required that CC&V provide a review of the currently approved groundwater monitoring plan and available site groundwater monitoring data compared against the WQCC Regulation 41 Interim Narrative Standard requirements. CC&V provided a monitoring plan review and data to DRMS on June 22 2017. Subsequently, DRMS issued a request in August 2018 for additional information to demonstrate compliance with the parameters not included within the June 22 2017 submission. These Interim Narrative Standard Requirements are presented below.

In its August 2019 request, DRMS indicated that:

> *"The 'Interim Narrative Standard' in 41.5(C)(6)(b)(i) below [in the letter] is applicable to all groundwater, to which standards have not already been assigned in the state… Until such time as use classifications and numerical standards are adopted for the groundwater on a site-specific basis throughout the state, and subject to the provisions of subsection (ii) below [in the letter], groundwater quality shall be maintained for each parameter at whichever of the following is less restrictive:*
>
> > *(A) Existing ambient quality as of January 31, 1994, or*
> > *(B) That quality which meets the most stringent criteria set forth in Tables 1 through 4 of 'The Basic Standards for Ground Water'"*

In Regulation 41, Section 41.5 (c)6)(b)(iii) the WQCC stated its intent regarding the application of the Interim Narrative Standard by implementing agencies including the DRMS:

> *"In applying this narrative standard, the Commission intends that agencies with authority to implement this standard will exercise their best professional judgment as to what constitutes adequate information to determine or estimate existing ambient quality, taking into account the location, sampling date, and quality of all available data. Data generated subsequent to January 31, 1994, shall be presumed to be representative of existing quality as of January 31, 1994, if the available information indicates that there have been no new or increased sources of groundwater*

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contamination initiated in the area in question subsequent to that date. If available information is not adequate to otherwise determine or estimate existing ambient quality as of January 31, 1994, such groundwater quality for each parameter shall be assumed to be no worse than the most stringent level provided for in Tables 1 through 4 of "The Basic Standards for Ground Water," unless the Commission has adopted alternative numerical standards for a given specific area."

In essence, if CC&V has sufficient water quality data to determine or estimate the existing ambient water quality as of January 31, 1994 these data must be used to establish the NPLs. If data are not adequate to determine or estimate the water quality as of January 31, 1994, item B above applies.
DRMS asserted in its December 2016 letter:

"If an operator wishes to propose a groundwater standard less restrictive than those contained in 'The Basic Standards for Ground Water' tables, it will be the operator's burden to sufficiently demonstrate to DRMS that their circumstances meet at least one of the two conditions outlined below [in the letter], thereby allowing DRMS to apply a less restrictive standard, and still fully implement the requirements of Regulation No. 41."

The first narrow circumstance and authority for DRMS to apply a groundwater quality standard that is less restrictive than the Table Value Standards at a Point of Compliance exists when a mine operator provides DRMS with adequate documentation and data to determine, to the satisfaction of DRMS, that the existing ambient groundwater quality on January 31, 1994 was above the Table Value Standard."

Only two of the drainages under review have analytical data prior to January 31, 1994: Arequa Gulch (two samples) and Wilson Creek (thirty samples). In this situation, the DRMS letter asserted:

"The second narrow circumstance and authority for DRMS to apply a groundwater quality standard less restrictive than the Table Value Standard is when an operator provides DRMS with data generated after January 31, 1994 which exceeds Table Value Standards and can also demonstrate that no new or increased sources of groundwater contamination in the area in question have been initiated since January 31, 1994, and therefore ambient conditions exceeded Table Value Standards prior to January 31, 1994."

The interpretation in DRMS's December 2016 letter is inconsistent with the language of Regulation 41. Section 41.5(C)(6)(b)(iii) requires the DRMS to exercise its best professional judgment to determine what constitutes adequate information to determine or estimate existing ambient quality. This requires consideration of all data. The regulation then creates a presumption that data after January 31, 1994, are representative of existing quality as of January 31, 1994, if the available information indicates that there have been no new or increased sources of groundwater contamination initiated in the area in question after that date. The regulation does not create a "narrow circumstance" for consideration of data after January 31, 1994; instead, it directs DRMS to weigh all the data but to apply a presumption that the data are representative of conditions before January 31, 1994, if the required conditions are met.
Finally, the December 2016 DRMS letter asserted:

"[F]or any NPL for a monitored analyte exceeding the applicable Table Value Standards to be valid, it will be the operator's burden to provide sufficient data and rationale to demonstrate to the satisfaction of DRMS and WQCC that at least one of the two conditions previously listed which would allow DRMS to apply a less restrictive standard have been met. "

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NPLs previously determined by the DRMS were based on data and information that CC&V submitted to DRMS at the time of approval and are presumptively valid. CC&V does not agree that it is the burden of the operator to establish the validity of previously-established NPLs, many of which were determined 20 or more years ago. Instead, as stated in the letter from DRMS to CC&V dated October 7 1996, establishing numeric standards for the Cresson Project, the standards apply to all monitoring wells unless CC&V makes a written request for a change of the standards. Therefore, CC&V bears the burden of making the demonstration only for newly-proposed NPLs.

As presented in Technical Revision 129 (TR-129) on December 2, 2021, and discussed in a meeting between DRMS and CC&V on February 17, 2022, CC&V has identified proposed points of compliance (POC) for monitoring groundwater within each of the six drainages around the mine site. This letter has been prepared to supplement the TR with proposed numeric protection limits (NPLs) which would be applicable at the proposed point (or points, if multiple wells are identified) of compliance in each basin. The NPLs presented in this letter were developed based on a technical review of existing NPLs, historical and current groundwater quality, historical mining operations, and current mining and mine waste disposal operations.

The proposed points of compliance presented in TR-129 are shown in Table 1. The proposed NPLs that are associated with these points of compliance are presented in this letter.

Table 1. Proposed Points of Compliance

Basin	Points of Compliance
Arequa Gulch	CRMW-5B
Rosebud Gulch	SGMW-8 (proposed new well)
Poverty Gulch	PGMW-5 (proposed new well)
Grassy Valley	GVMW-26 (proposed new well)
Vindicator Valley	VIN-2B
Wilson Creek	WCMW-6

2. Mining History

This section provides a summary of the mining, mineral processing, and waste disposal activities that occurred historically in the area where the CC&V mine is now located. The historical activities are described with an emphasis on their potential long-term impacts on water quality to identify the factors that were considered when identifying new or revised NPL values for each basin.

As described further in Sections 5, groundwater monitoring has been conducted in Arequa Gulch since the fourth quarter of 1993, which comprises the longest water quality dataset available for an area of the CC&V site that was affected by historical mining and mine waste disposal activities. Based on the similar historical land uses in both Arequa Gulch and Rosebud Gulch that are described in this section, the historical water quality data from Arequa Gulch are used in Section 6 as an analog to describe water quality in Rosebud Gulch.

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Rosebud Gulch

Substantial historic mining and mine waste disposal activity took place in Rosebud Gulch (formerly known as Squaw Gulch), as shown by the mining operations identified in Figure 1, which depicts a portion of Plate 1 from Lindgren and Ransome (1906). In addition to the numerous mines within Rosebud Gulch, three rail lines used to pass through the area. The largest mines in Rosebud Gulch that were located up-gradient of CC&V's groundwater monitoring wells included the Anaconda, Blue Bell, Morning Glory, Doctor-Jackpot, and Mary McKinney. These mines produced ores that were sulfidic to partly oxidized (Lindgren and Ransome, 1906), and ore from the Blue Bell mine assayed up to 18% zinc (Cross and Penrose, 1895). These mines were located largely within the limits of the diatreme, so it is probable that in addition to seepage from the historical waste rock dumps traveling down the Rosebud Gulch drainage in local perched, relatively shallow aquifers, seepage associated with the historic mines also infiltrated into the diatreme where it would report to various drainage tunnels.

During recent mining (from the 1970s on), waste rock began to be placed in the head of Rosebud Gulch around 1997. In 2000, the footprint of the waste rock pile began to be expanded, reaching its maximum extent in 2006, when the toe of the dump was approximately 2,800 feet from the Precambrian-diatreme contact. In 2012, additional waste rock was placed near the head of Rosebud Gulch for construction of the new processing plant, with the toe of this material approximately 1,300 feet from the Precambrian-diatreme contact. Figure 2 shows the extent of waste rock in Rosebud Gulch in 2006, 1997, and 1991, the Precambrian-diatreme contact, and Rosebud Gulch monitoring well SGMW-6, in comparison with the 1951 USGS 1:24000 topography.

Figure 3 is photograph of the town of Anaconda and the Mary McKinney mine around 1893 (Campbell, 1922).

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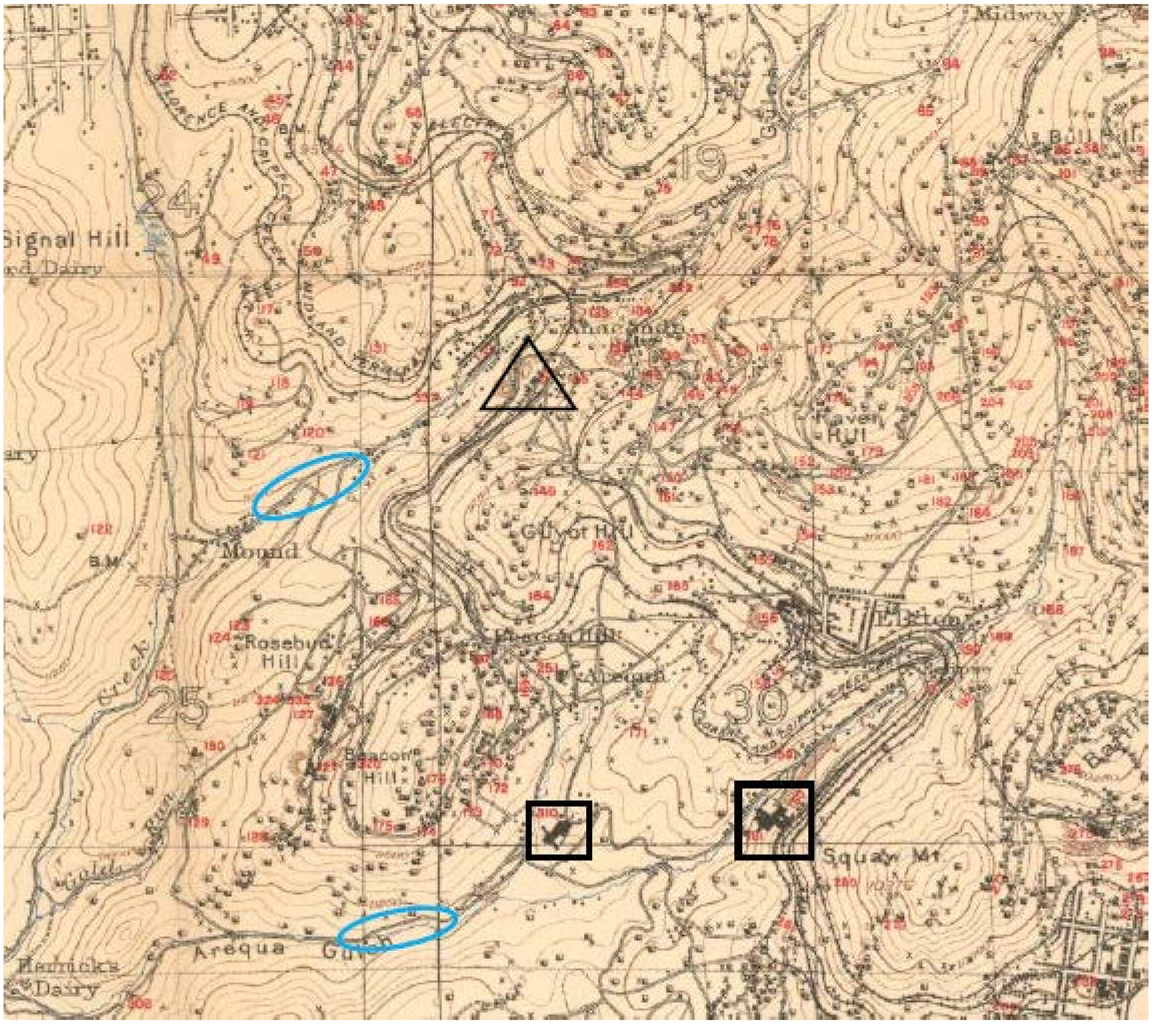

Figure 1: A portion of Plate 1 from Lindgren and Ransome (1906) showing the mining and milling facilities that existed in Rosebud Gulch and Arequa Gulch in 1903. The current Rosebud Gulch monitoring wells are within the ellipse at left center, and the current Arequa Gulch monitoring wells are within the ellipse at lower left. The Arequa mill is in the left black square, the Economic mill in the right black square, and the Mary McKinney mine in the triangle.

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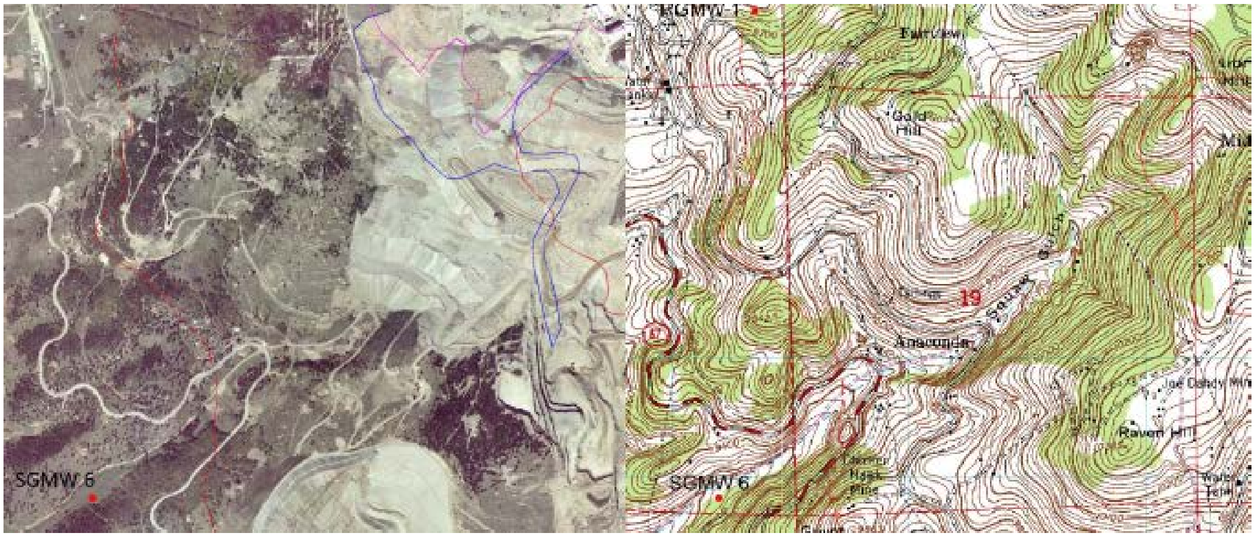

Figure 2: 2006 aerial image (L) showing the location of Rosebud Gulch monitoring well SGMW-6; the footprint of the waste rock in 1997 is shown in blue, yellow shows the extent in 1991. Right side is the same area on the 1951 USGS 1:24000 topography. The red line in both images is the Precambrian-diatreme contact.


Figure 3: Photograph of the town of Anaconda and the Mary McKinney mine, probably around 1893 (Campbell, 1922, Plate 28).

Figure 4 shows the footprint of VLF2 (construction began in 2013), the location of the Rosebud Gulch monitoring wells, and the Precambrian-diatreme contact, on the 1951 USGS 1:24000 topography. VLF2 incorporates a synthetic liner, which prevents meteoric water (as well as process solution) from infiltrating into the groundwater system within the footprint of the VLF. The VLF was constructed in 2014 and first ore was placed in October 2015. The construction of VLF2 has effectively eliminated groundwater recharge within the footprint of the facility.

Prior to construction of various drainage tunnels which lowered the groundwater level within the diatreme, Rosebud Gulch was the point at which groundwater discharged from the diatreme because the Precambrian-diatreme contact is at its lowest elevation in Rosebud Gulch. Over geologic time, groundwater became enriched in dissolved constituents as it passed through mineralized zones within the diatreme before it discharged into Rosebud Gulch. The solute-rich water would have enriched the soils and alluvium that host the shallow aquifer in Rosebud Gulch, and current groundwater quality as monitored at SGMW-6 may reflect a combination of this natural enrichment and seepage impacts from historical mine waste materials as well as inputs from meteoric water infiltrating into this basin. VLF2 is not a new source of soluble constituents.

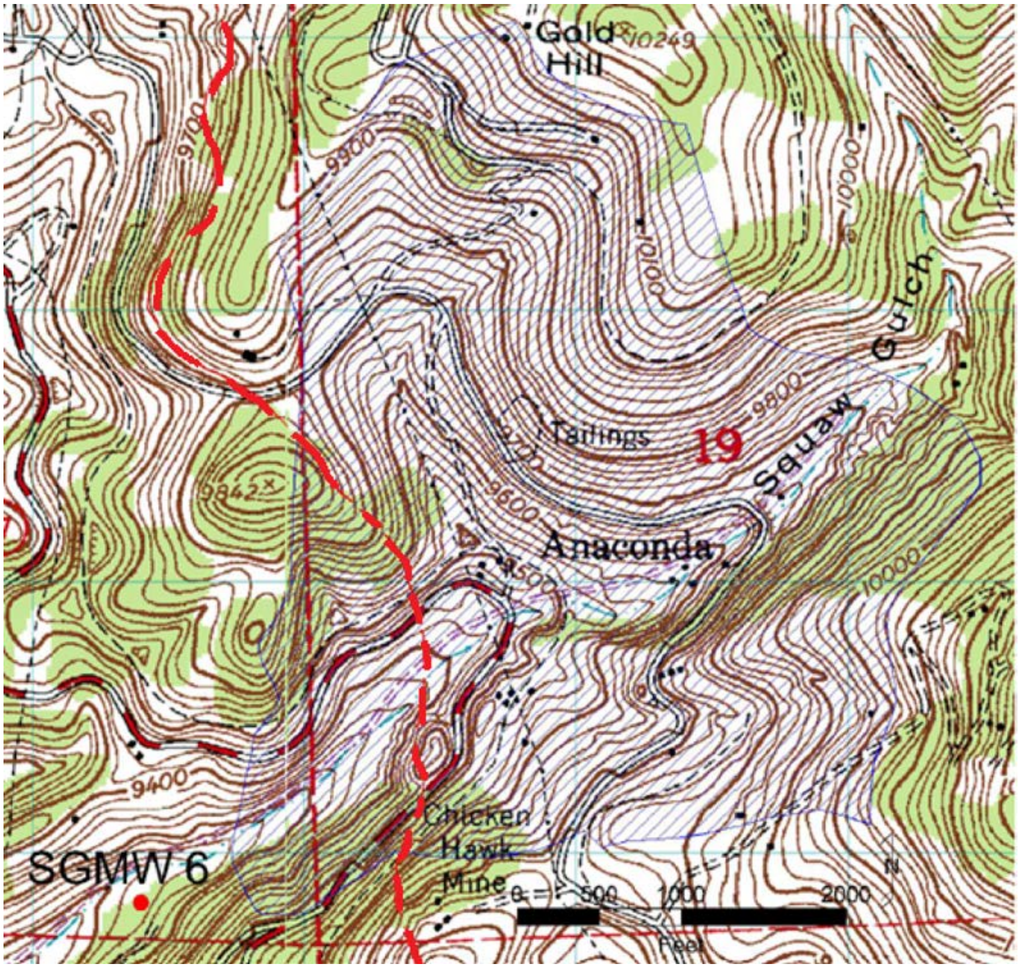

Figure 4: Footprint of VLF2 (blue hatched area), Rosebud Gulch monitoring wells (red dot, SGMW 6 label), and the Precambrian-diatreme contact (red dashed line) on 1951 USGS 1:24000 topography.

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Arequa Gulch

The Arequa Gulch drainage contained numerous mines as well as two railroads and at least two mills (Arequa and Economic, see Figure 1). The Arequa mill recovered gold using cyanidation for oxide ore, and roasting followed by chlorination for sulfide ore (Lakes, 1899). No information was found regarding when the Arequa mill was constructed or its throughput, but it appears to have been destroyed by fire in 1903 (Mining and Scientific Press, 1903). Figure 5 is a photograph of the Arequa mill (Grimstad and Drake, 1983).

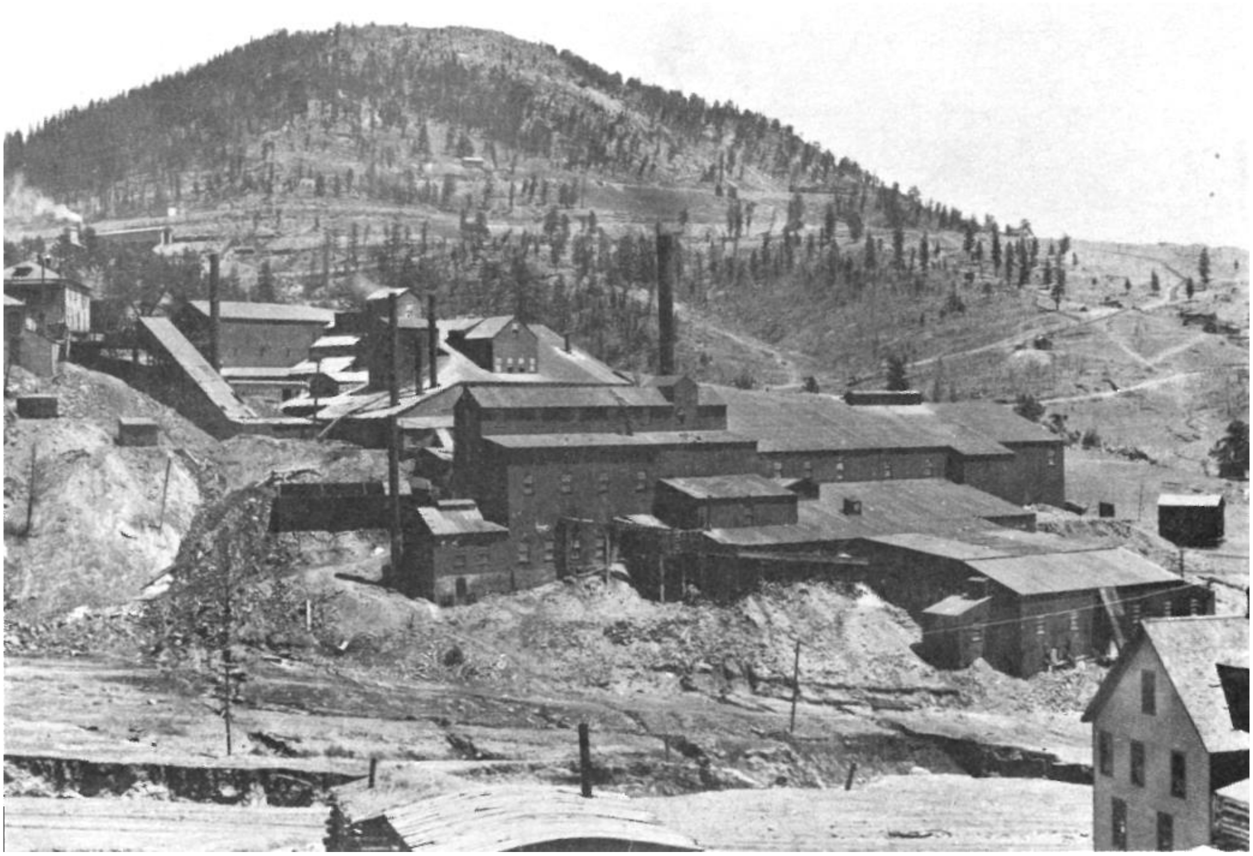

Figure 5: Photograph of the Arequa mill (Grimstad and Drake, 1983).

The Economic mill was built in 1899 (Levine, 1982) and utilized roasting and chlorination with hydrogen sulfide precipitation for gold recovery (Lakes, 1901). The Economic mill was a modestly-sized mill (300 tons per day), and operated until it was destroyed by fire in 1907 (Lindgren and Ransome, 1906; Henderson, 1926). Figure 6 is a photograph of the Economic Mill.

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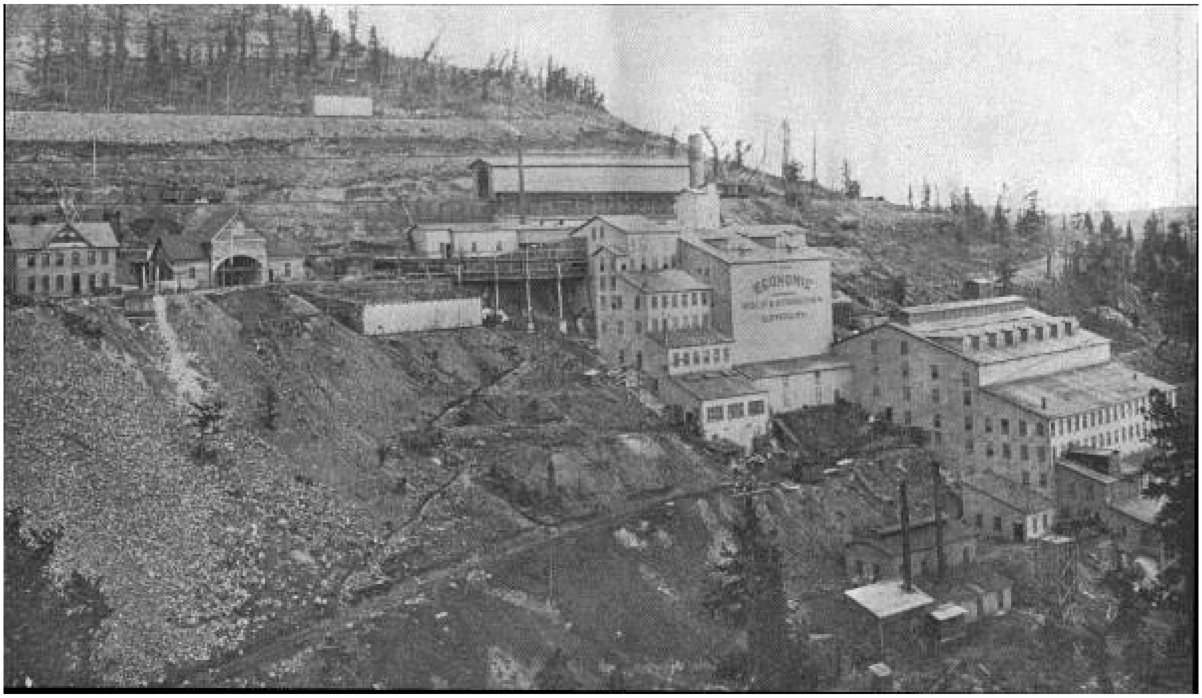

Figure 6: Photograph of the Economic mill (Woods, 1901).

No information regarding how these two mills disposed of tailings is available, but given the time period it is likely that the mill tailings were discharged directly to the Arequa Gulch drainage. Inefficiencies in metallurgical processing in the early 1900s would have resulted in incompletely oxidized sulfide minerals being contained within the tailings. After deposition of the tailings, the remaining sulfide minerals would gradually oxidize, resulting in soluble mineral species. These oxidation products, and soluble species that resulted from the beneficiation processes, including metal-cyanide complexes in the case of the Arequa mill tailings, could then be mobilized during precipitation events. A portion of these dissolved species would report to groundwater as a result of recharge following precipitation.

The Arequa Gulch monitoring wells are constructed in the bottom of the Arequa Gulch drainage, below the Arequa Gulch Valley Leach Facility (VLF1). Prior to construction of VLF1, tailings from the now-dismantled Carlton mill, which operated from 1951 into 1962 (Feitz, 1978) were deposited in an un-lined tailings facility which was located at the confluence of the north and east forks of Arequa Gulch, above the site of the Arequa mill (Grimstad and Drake, 1983). Figure 7 shows the Carlton mill, lower tailings facility, and two lined heap leach pads in a 1991 aerial view. The larger heap leach pad in Figure 7 was built on top of the upper Carlton Mill tailings pile (EPA, 1992). The Carlton mill tailings were relocated prior to construction of VLF1 (Henry et al., 1996). Tailings were also removed from the active stream channel of Arequa Gulch as part of VLF1 construction (Henry et al., 1996). Figure 8 shows the footprint of VLF1, the Arequa Gulch monitoring wells, and the Precambrian-diatreme contact on the 1951 USGS 1:24000 topography

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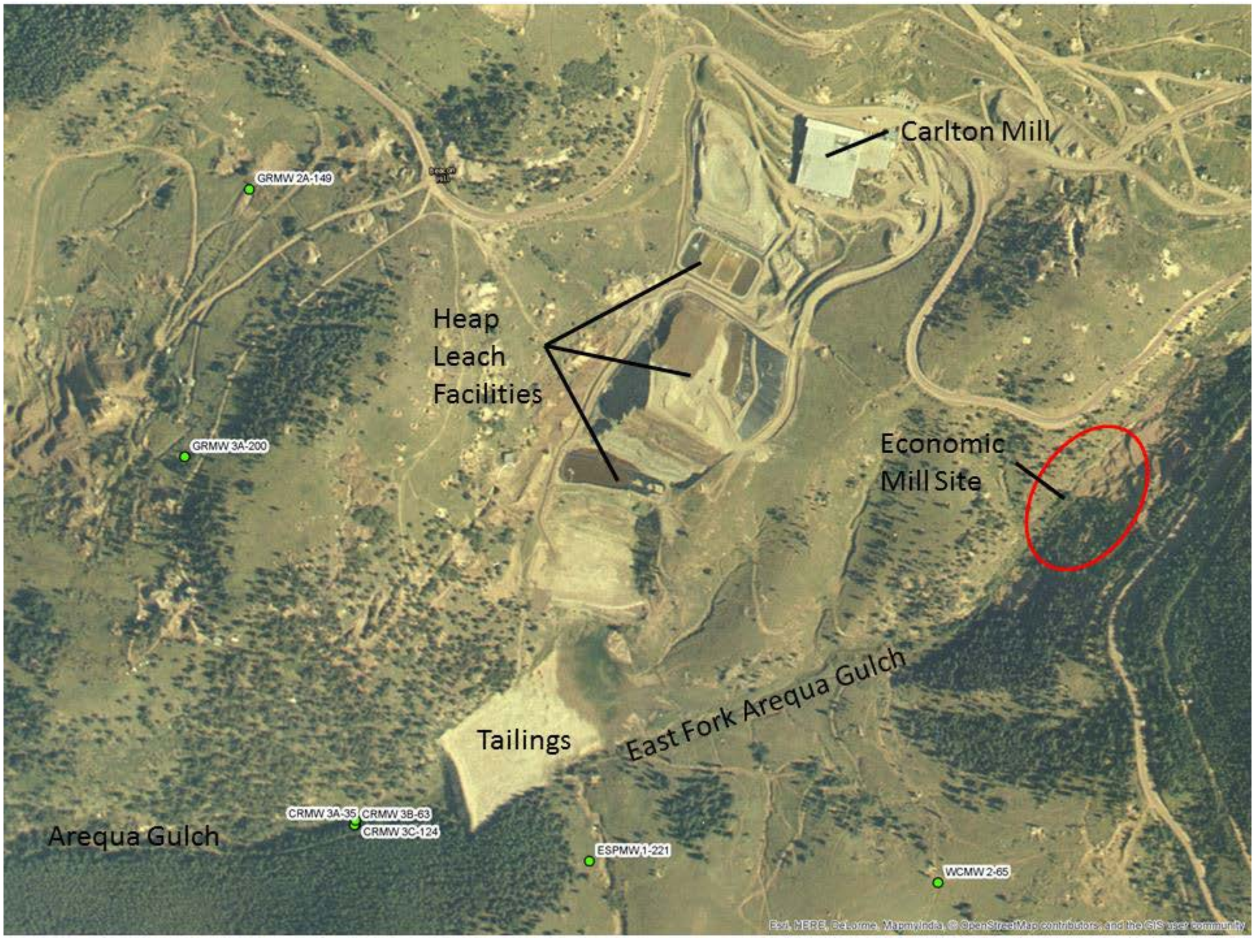

Figure 7: 1991 aerial view of Carlton mill and tailings facility. A heap leach facility, groundwater monitoring sites (most are not compliance monitoring points), and the approximate location of the historic Economic mill are also shown. The north fork of Arequa Gulch is essentially covered by the processing facilities and extends off the image at top center.

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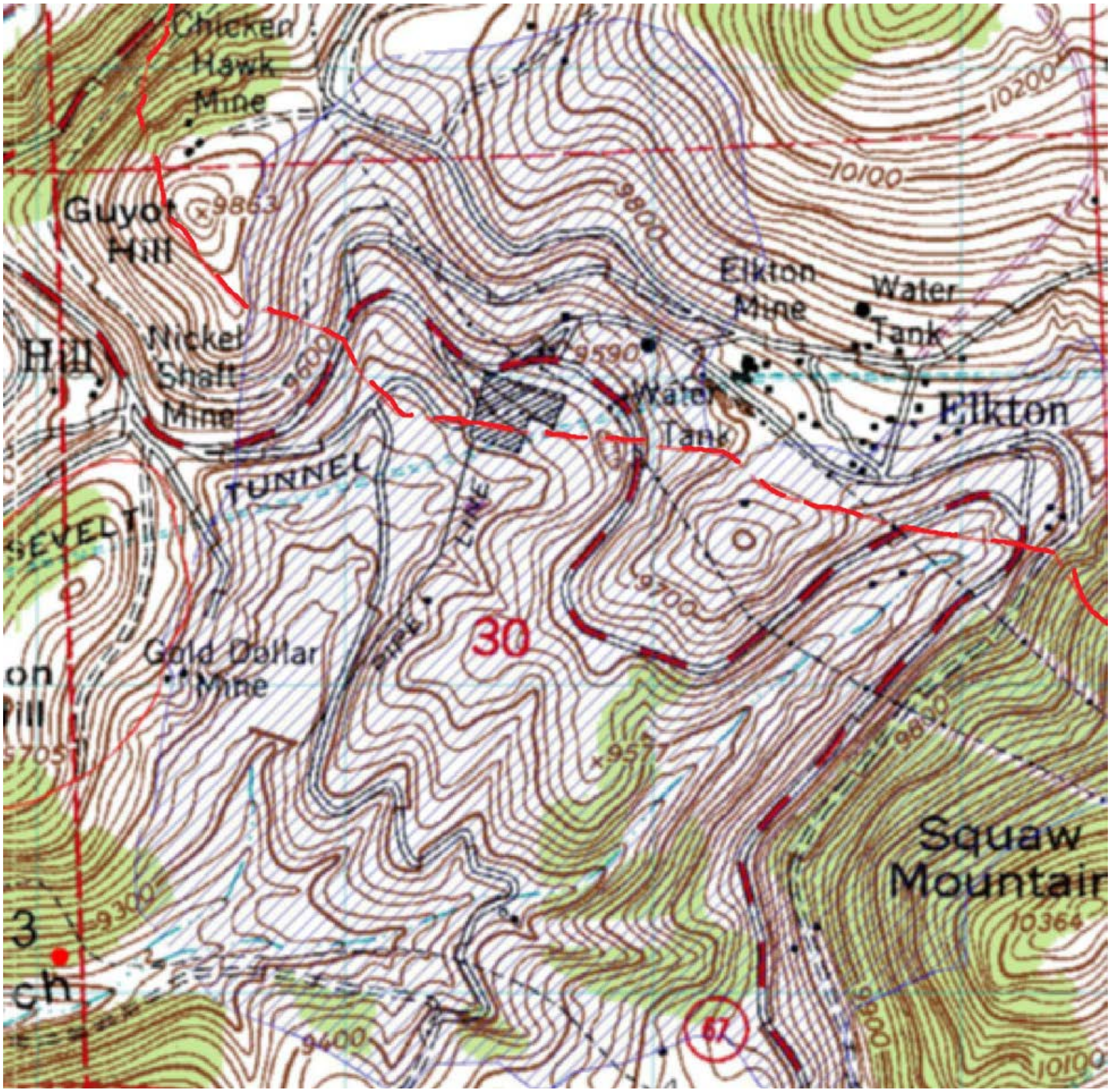

Figure 8: Footprint of VLF1 (blue hatched area), Arequa Gulch monitoring wells (red dot, lower left), and the Precambrian-diatreme contact (red dashed line) on 1951 USGS 1:24000 topography.

Texasgulf Minerals (later succeeded by Nerco Minerals) originally constructed the heap leach pads at the Carlton Mill (EPA, 1992). Nerco Minerals was required by Colorado Mined Land Reclamation Division (MLRD, a predecessor to DRMS) to monitor water quality in Arequa Gulch upstream and downstream of the tailings impoundments and heap leach facilities at the Carlton Mill (EPA, 1992). According to EPA (1992), Nerco Minerals sampled the french drain beneath Pad 1, monitoring wells driven into the tailings near the base of Dam 1, and well PZ-6 (the location of which is not given in EPA, 1992). Table 2 shows data from for the period 1987 to 1989 (EPA, 1992, Table 4-4).

Table 2: Groundwater and French drain water chemistry for Arequa Gulch near the Carlton Mill tailings and heap leach facilities (range of minimum to maximum values from 1987 to 1989 after EPA, 1992, Table 4-4).

Analyte	French Drain	Arequa Gulch Upstream	Arequa Gulch Downstream	Well PZ-6
Field pH (s.u.)	6.6 – 7.89	4.32 - 5.1	7.69 - 8.1	8.8
Total Dissolved Solids (mg/L)	850 - 860	1,100	1,400	6,200
Sulfate (mg/L)	350 - 440	450 - 970	400 – 3,500	2,700
Zinc (mg/L)	0.028 - 0.38	1.8 - 2.7	0.009 - 1.1	10

The data in Table 2 indicate that sulfate in Arequa Gulch groundwater has been above the domestic well standard of 250 mg/L for at least 30 years (i.e. by historic mining activity that occurred before January 31, 1994). It is likely that due to the low permeability of the Precambrian rocks, groundwater does not infiltrate much below the alluvium-Precambrian contact. Thus, the chemical load resulting from historic mining and milling is contained within a relatively shallow aquifer.

The construction of the lined VLF1 effectively eliminates recharge from the north and east forks of Arequa Gulch. As a result, recharge to the shallow Arequa Gulch aquifer can only come from the slopes north and south of the monitoring wells. Therefore, flushing of the soluble constituents from the shallow groundwater in Arequa Gulch is likely to be very slow. VLF1 is not a new source of soluble constituents.

Vindicator Valley

The Vindicator Valley compliance monitoring wells are constructed within the diatreme. Figure 9 shows the Vindicator Valley area from Plate 1 of Lindgren and Ransome (1906). Vindicator Valley contained a number of mines including the Vindicator, Lillie, Last Dollar, Hull City and Golden Cycle mines, which were located up-gradient of the current groundwater monitoring wells. These mines had significant waste rock dumps that spread down the hillside below the shafts, and the ore varied from oxidized to slightly sulfidic (Lindgren and Ransome, 1906). The dumps were removed for processing some time ago, and the slopes graded and revegetated. In addition, the valley contained multiple rail lines and the town of Independence.

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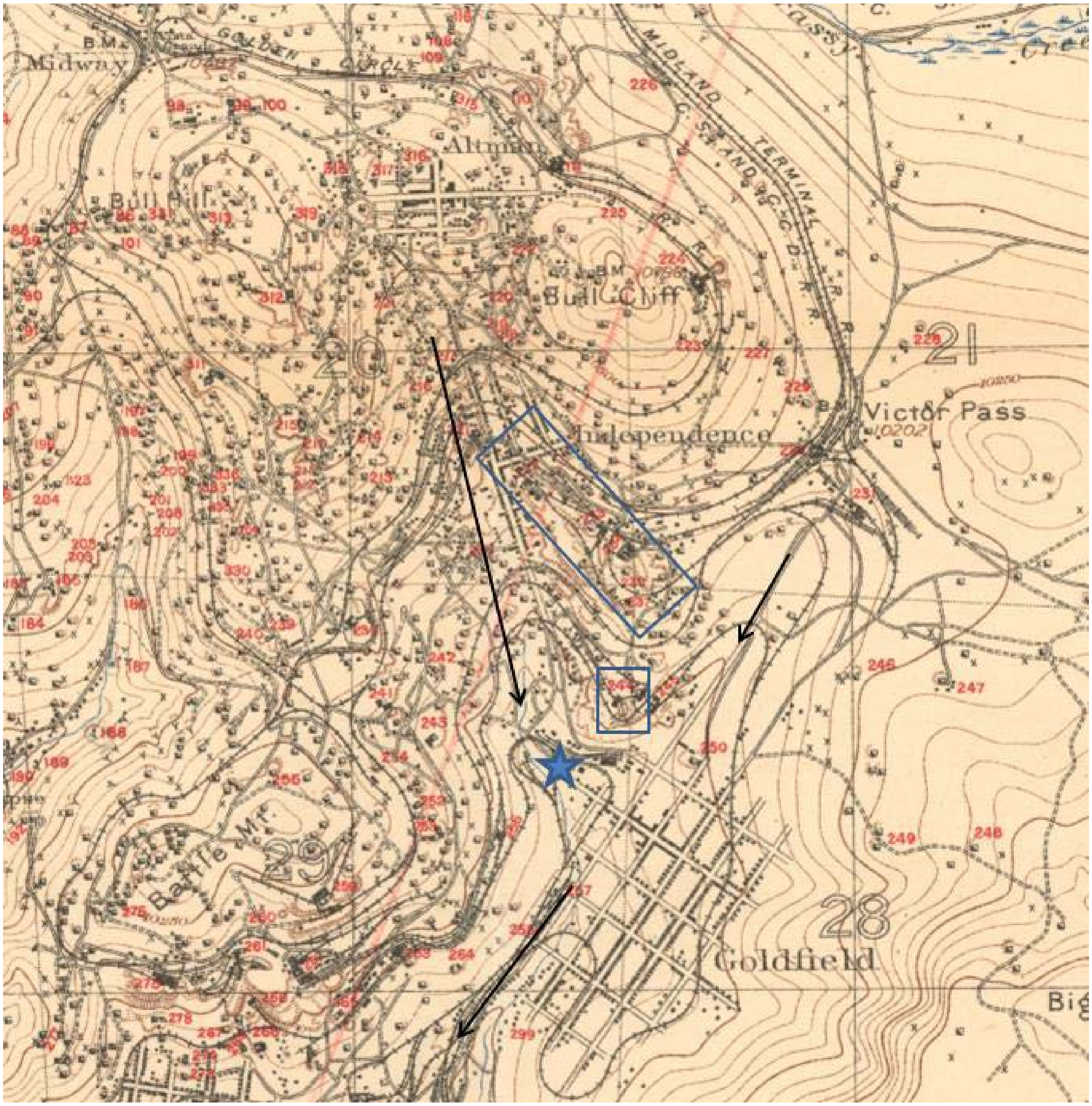

Figure 9: Vindicator Valley area from Plate 1 of Lindgren and Ransome (1906). The blue rectangles indicate the locations of the Vindicator and Golden Cycle mines, the black arrows indicate the groundwater flow directions, and the blue star shows the location of the current groundwater monitoring wells

Of particular relevance to the present discussion is the fact that the Golden Cycle mine was within a few hundred feet of the Vindicator Valley monitoring wells. Figure 10 shows the Vindicator Valley monitoring wells located on the 1951 USGS 1:24000 topography. The Golden Cycle, Vindicator, and Last Dollar mines are shown, as well as a number of "tailings" piles up-gradient of the monitoring wells. The "tailings" piles were more likely mine dumps, but these would have contributed chemical load to the shallow groundwater within Vindicator Valley. It is evident from Figures 9 and 10 that the monitoring

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wells are located at the focal point for impacted water that originates in the headwaters of the various tributaries to Vindicator Valley.

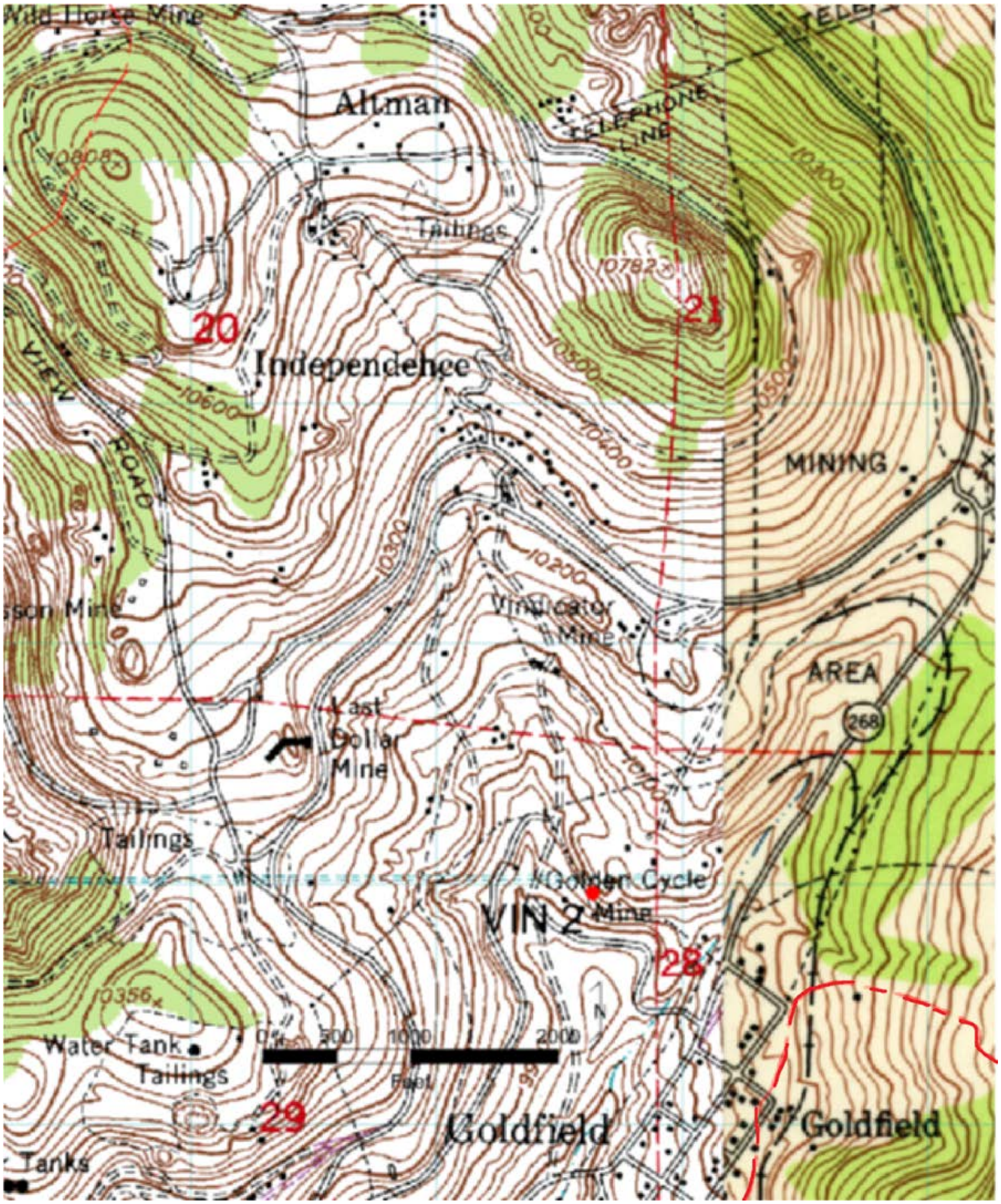

Figure 10: Location of the Vindicator Valley monitoring wells (red dot, VIN 2 label) on 1951 USGS 1:24000 topography. The red dashed line that passes through Goldfield from southwest to northeast, and then swings east-southeast, is the Precambrian-diatreme contact.

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Figure 11 shows the Vindicator Valley in 1903. In 1915, a flotation mill was constructed at the Vindicator mine to process low grade material from waste dumps (Henderson, 1926). No information regarding the disposal of tailings from the Vindicator mill is available, but it is likely that they were deposited in Vindicator Valley. The mill closed 30 July 1918, and at that time there were still two million tons of low grade ore on the dumps (Henderson, 1926).

Figure 11: Vindicator Valley in 1903, including the town of Independence and the Vindicator (upper center and upper left) and Lillie (upper right) mines (US Geological Survey public domain photograph taken by F.L. Ransome, 1903). The Golden Cycle mine and the Vindicator Valley compliance monitoring wells are just off the lower right portion of the image.

Figure 12 shows the Golden Cycle mine, a portion of Goldfield mine (lower right), and part of the Vindicator dumps (upper left) in 1903. The approximate location of the Vindicator Valley compliance monitoring well is also shown, and demonstrates the intense historic mining disturbance adjacent to the monitoring wells. The monitoring well location was determined from rail lines, roads, and buildings in Figure 12 in comparison with the same features shown in the 1951 USGS 1:24000 topographic map and a 1991 aerial image. It is evident from Figures 11 and 12 that there was extensive disturbance in Vindicator Valley up-gradient of the current compliance monitoring wells.

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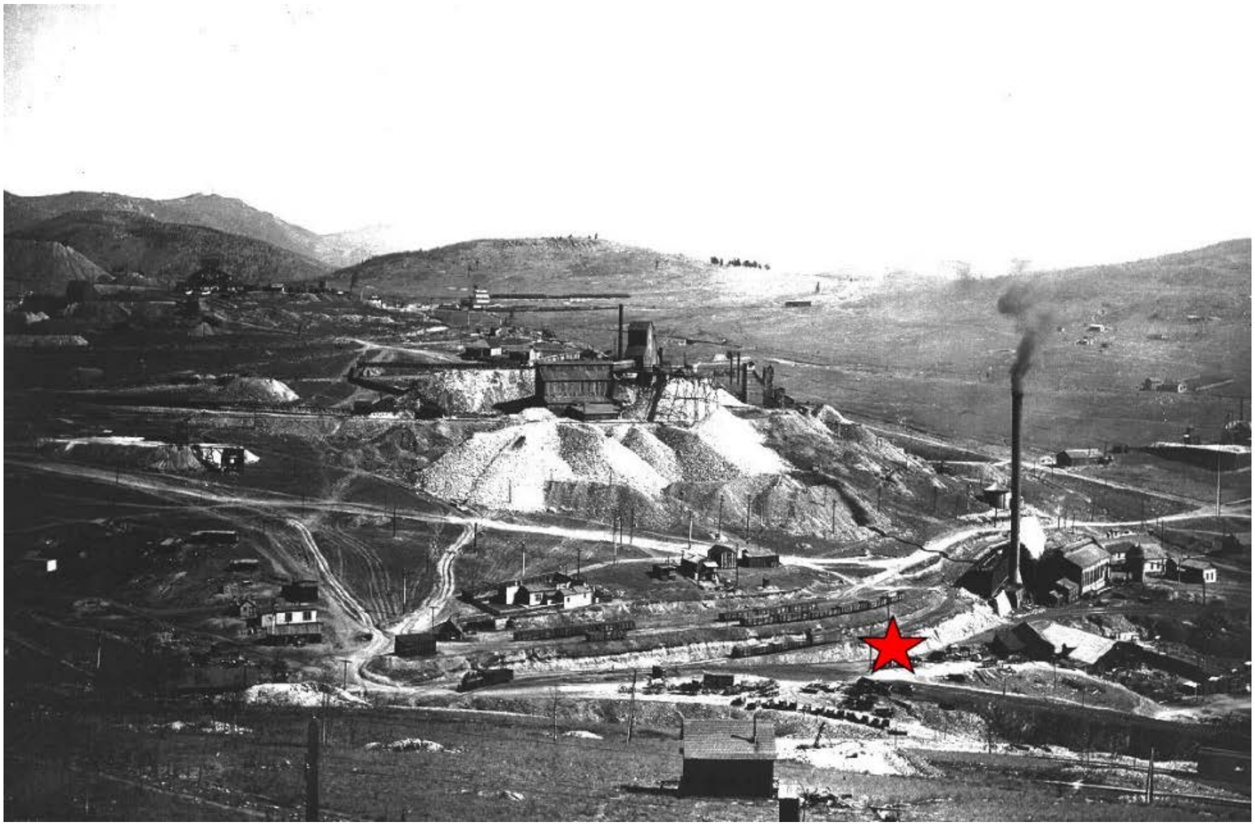

Figure 12: Golden Cycle mine from Battle Mountain (US Geological Survey public domain photograph taken by F.L. Ransome, 1903) . A portion of Goldfield is visible at lower right, and part of the Vindicator dumps are visible in the upper left. The red star is the approximate current location of the Vindicator Valley compliance monitoring wells.

Prior to 31 January 1994, there were fairly large waste rock dumps and a relatively small open pit at the head of Vindicator Valley. In 1999 the Altman pit was mined, ultimately consuming the earlier open pit. Mining of the Altman pit concluded in 2007, and the pit was back-filled over several years starting in 2008. Figure 13 shows Vindicator Valley in 1991 and in 2013. The location of the Vindicator Valley compliance monitoring point and the Precambrian-diatreme contact are also shown.

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Figure 13: Aerial images of Vindicator Valley in 1991 (left) and 2013 (right), with the compliance monitoring point shown with a red dot labeled VIN 2. The Precambrian-diatreme contact is the red dashed line in the lower right portion of both images.

Mining of the Altman pit removed significant quantities of historic mine waste until backfilling began sometime between 2007 and 2008. The backfill in the pit has significantly high vertical permeability, which allows for rapid infiltration of precipitation into the diatreme. Prior to being relocated for processing, the old waste dumps would have been a significant source of soluble species. With each precipitation event, soluble species would have been dissolved, and a portion of the water that infiltrated the dumps would have recharged the shallow groundwater, gradually building a chemical load. Recent open pit mining and reclamation appear to have resulted in improving groundwater quality, although several constituents still remain at elevated concentrations.

Given that Vindicator Valley and the compliance monitoring points are underlain by the diatreme, in order for the monitoring wells to have measurable water levels groundwater must be perched in recent unconsolidated sediments above the diatreme. It is apparent from Figures 9 and 10 that the groundwater gradient along the north fork of Wilson Creek, which flows southwesterly along the western side of the town of Goldfield. The surface topography has a gradient of about 230 feet over 3,870 feet, from near the monitoring wells to close to the northeast end of Victor. The groundwater surface generally mimics the topography, so it is probable that groundwater moves very slowly from Vindicator Valley to the North Fork of Wilson Creek near Victor.

The recharge area in Vindicator Valley is substantially reduced after mining of the two pits visible in Figure 13 (Altman is the pit that has been backfilled), because the exposed pit walls and backfill offer ready infiltration into the diatreme. Therefore, the impacted groundwater is likely to have the current concentrations of dissolved constituents for some time. While this area has a significant legacy of mining and mine waste disposal, it appears that a combination of factors, including the backfilling of waste rock

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into the Altman pit and the Altman pit acting as a preferential flow path for mine water to enter the diatreme, have reduced the potential for seepage impacts in the downgradient area compared to other basins where there is less seepage to the diatreme or a larger area is impacted by the presence of legacy mine workings and mine waste materials.

Poverty Gulch

The first regular producing mine in the Cripple Creek district was the Gold King, which produced ores with little oxidation (Lindgren and Ransome, 1906). The C.O.D. mine was also one of the earliest mines in the district, having commenced production prior to 1894, and the Abe Lincoln began production in 1895 (Lindgren and Ransome, 1906). The Mollie Kathleen was staked in 1891 (www.goldminetours.com), but no information regarding when the mine began production is available. Both the C.O.D. and Mollie Kathleen produced unoxidized ores, and in the case of the Mollie Kathleen, the ore included galena (lead sulfide) and sphalerite (iron-zinc sulfide). No information regarding the production history or the nature of the ore mined in the Chicago Tunnel was available.

Figure 14 shows the location of the Poverty Gulch monitoring wells on a 1991 aerial image and on a portion of Plate 1 from Lindgren and Ransome (1906). It is evident that the monitoring wells are down-gradient and in close proximity to the historic mines. The modern open pit and heap leaching operation shown in the lower right of the aerial image began in 1978.

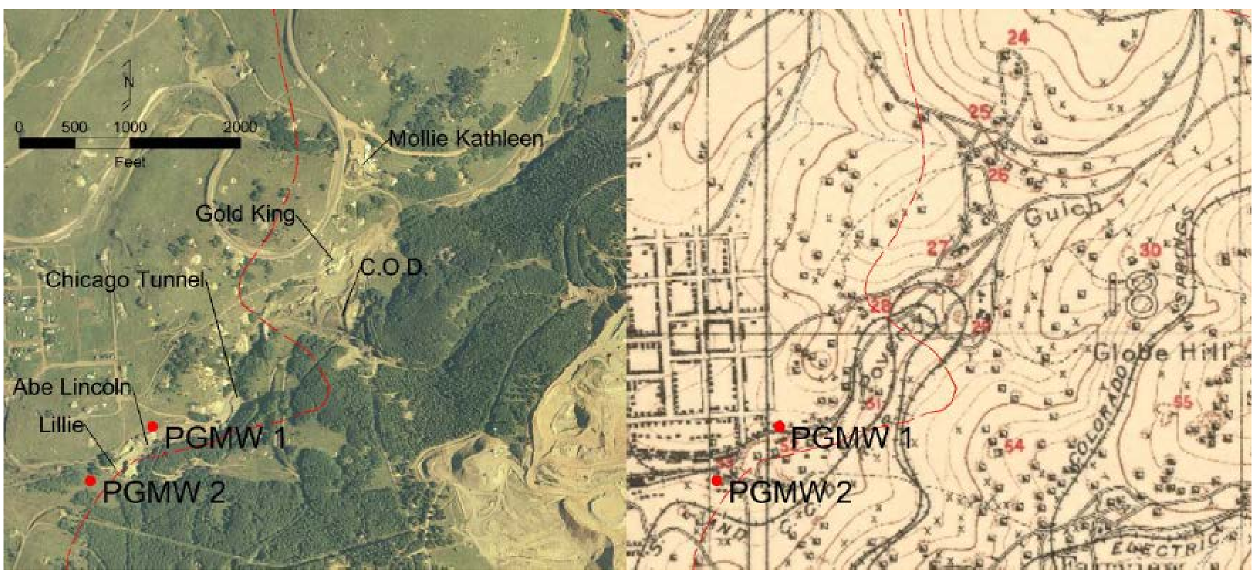

Figure 14: Poverty Gulch in a 1991 aerial image (left) and on a portion of Plate 1 from Lindgren and Ransome (1906). The current compliance monitoring wells are shown with a red dot and the label PGMW 1. The Precambrian-diatreme contact is shown by the red dashed line.

Figure 15 is a photograph looking up Poverty Gulch from a point just south of the Lillie (spelled Lily in Lindgren and Ransome, 1906) showing the mines in the period 1907-1915 (www.mtgothictimes.com). The Lillie is closest, followed by the Abe Lincoln, Chicago Tunnel, and C.O.D. The Gold King was located off the upper left of the image. Stars have been placed at the approximate locations of the current and abandoned Poverty Gulch monitoring wells, using features in the photograph as well as Plate 1 from Lindgren and Ransome (1906), 1951 USGS 1:24000 topography, and a 1991 aerial image.

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Figure 15: Photograph of Poverty Gulch from south of the Lillie mine, taken by Julia Skolas sometime between 1907 and 1915 (www.mtgothictimes.com). The Lillie mine is in the foreground, followed by the Abe Lincoln, Chicago Tunnel, and C.O.D. mines. The approximate location of the PGMW 1 monitoring wells is indicated with a blue star, and PGMW 2 with a red star.

It is hypothesized that the elevated constituents in water sampled from the Poverty Gulch monitoring wells result from long term geochemical processes leaching of soluble species from the waste rock that was dumped in Poverty Gulch during historic mining.

Wilson Creek

The groundwater quality monitoring data from the Wilson Creek monitoring wells do not show impacts from historic or current mining and processing activities. Although Lindgren and Ransome (1906) show a number of small shafts and adits in the Bateman Creek drainage, there was very little production. Furthermore, as shown in Figure 16 (the location of the monitoring wells on the 1951 USGS 1:24000 topography), a natural divide separates the Bateman Creek catchment from the Arequa Gulch catchment. This divide has served to segregate the impacted groundwater in Arequa Gulch from Bateman Creek.

The marked difference in groundwater chemistry between Arequa Gulch and Wilson Creek is additional evidence to support the conclusion that historic mining, and milling, are the reason for the impacted groundwater in Arequa Gulch, because these two drainages are separated by a ridge of Precambrian rock. Groundwater chemistry in Wilson Creek represents the natural background condition of this drainage south of the C&V mine.

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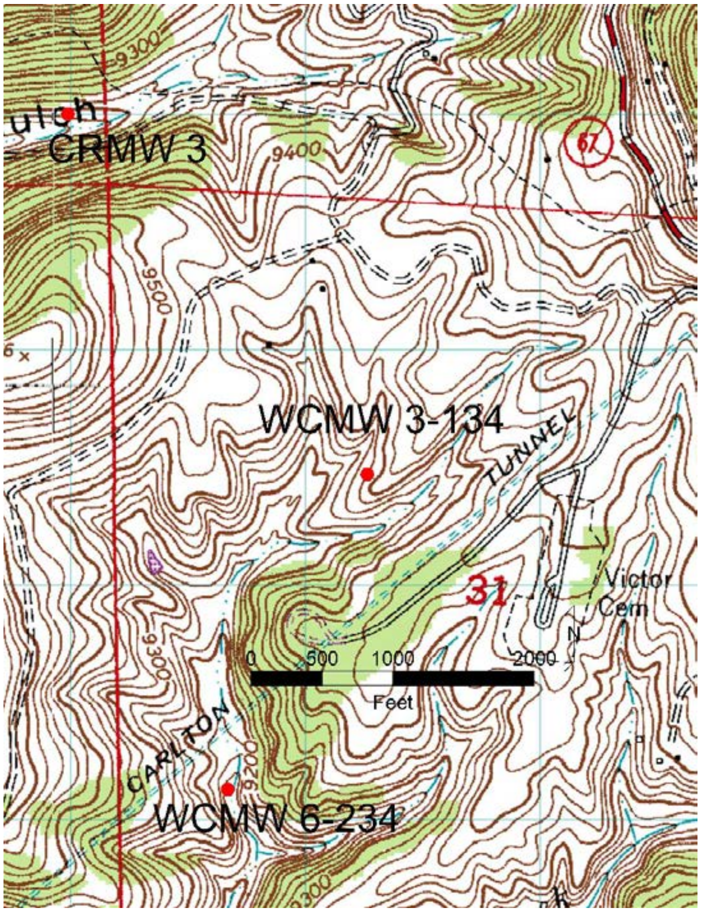

Figure 16: Wilson Creek monitoring well locations on 1951 USGS 1:24000 topography. The Precambrian-diatreme contact is about one mile north of WCMW 3-134.

Grassy Valley

The locations of the monitoring points and the portion of Grassy Valley upstream from the monitoring wells are shown on the 1951 USGS 1:24000 topography in Figure 17. Even though there were waste rock and tailings piles up-gradient of the two compliance monitoring points in Grassy Valley, and waste rock began to be stored in the ECOSA facility in 2013, groundwater at the compliance points has not been impacted. It is hypothesized that groundwater infiltration into the diatreme along the reach of Grassy Creek from the northwest quarter of section 16 to just upstream of GVMW 22 provides an alternate pathway for seepage resulting from historic mining and milling. Furthermore, the ECOSA facility is constructed on the diatreme, so solutes mobilized by precipitation that infiltrate the waste rock are transported into the diatreme, rather than the shallow groundwater of Grassy Valley. As a result, groundwater sampled at GVMW 8 and GVMW 22 has not been impacted by anthropogenic activity, and therefore represents background conditions.

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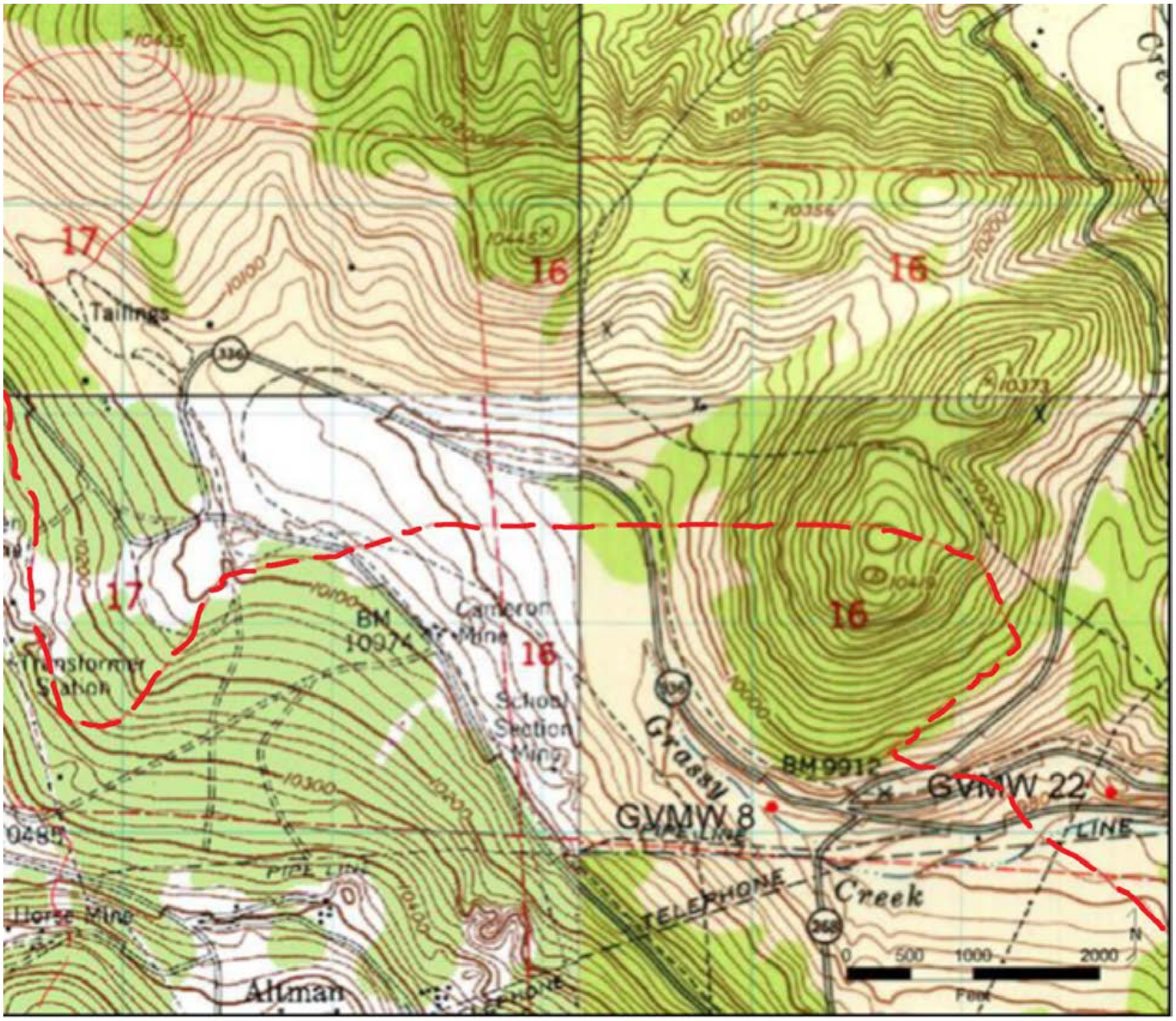

Figure 17: Grassy Valley groundwater compliance monitoring points (red dots, GVMW 8 and GVMW 22 labels) on 1951 USGS 1:24000 topography. The red dashed line represents the Precambrian-diatreme contact.

3. Previously Established Numeric Protection Limits

DRMS has issued NPLs for the CC&V mine site five times over the last 25 years. In issuing these NPLs, we understand that DRMS personnel complied with the Division's regulatory mandate to use its best professional judgement in analyzing the submitted data to determine NPLs that deviated from the criteria in Tables 1 through 4 of Colorado Regulation 41, The Basic Standards for groundwater. In using their best professional judgement, DRMS personnel appropriately determined that the groundwater quality of the sites reviewed was not impacted by sources of groundwater contamination since January 31, 1994, and subsequently that the observed groundwater quality is representative of water quality prior to January 31, 1994.

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DRMS issued NPLs to CC&V via correspondence on the following dates: October 7, 1996, November 20, 1998, May 18, 2006, August 7, 2012, and October 24, 2019. On October 7, 1996, DRMS issued NPLs pertaining to all groundwater monitoring locations at the CC&V mine site and set numerical protection limits for the following analytes: aluminum, arsenic, cadmium, copper, fluoride, iron, lead, manganese, mercury, nickel, nitrite, nitrate, nitrate & nitrite, selenium, zinc, cyanide (WAD), and pH. On November 20, 1998, DRMS issued NPLs pertinent to monitor wells CRMW-3B-63, GVMW-8A-250, and WCMW 6-234 and contained NPL values for manganese, cyanide (WAD), pH and sulfate. On May 18, 2006, DRMS issued NPLs for Vindicator Valley compliance well VIN 2B, which included NPL information for manganese, cyanide (WAD), pH and sulfate. On August 7, 2012, DRMS issued updated NPL information for WCMW-6 and new NPL information for WCMW 3-134, which included NPL values for manganese, zinc, cyanide (WAD), pH, and sulfate. On October 17, 2019, CC&V submitted TR-119 to propose updating the NPLs for arsenic, cadmium, copper, lead, mercury, nitrite, nitrate, and zinc to be set equal to the most restrictive Regulation 41 value, rather than a lower level that had previously been assigned. DRMS approved the revision on October 24, 2019. These NPLs are summarized in Table 3.

4. Proposed Numeric Protection Limits for Point of Compliance Wells

A summary of the most conservative CO Regulation 41 table values, previously established NPLs, and the NPLs proposed for the POC wells (as identified in Table 1) located in each of the six basins is presented in Table 3.

The technical rationale for the proposed NPLs is described further in the following sections supported by water quality monitoring data and references to the historical activities described in Section 2. For the parameters or basins that have no proposed NPLs shown in Table 3, CC&V intends to continue using either the applicable Regulation 41 table value or the most-recently issued NPL to assess compliance. These NPL values are shown for clarity in Table 3 (column entitled: POC Wells (Unless Otherwise Listed)).

Table 3. Summary of applicable Colorado Regulation 41 values, existing NPLs and NPLs proposed for compliance wells by basin

Analyte	Colorado Reg 41 (Table 1-4)	October 7, 1996 Groundwater Monitoring Numeric Standards letter	November 20, 1998 AM-07 letter Revised permit conditions			May 18, 2006 Vindicator Valley Compliance Well	August 7, 2012 AM-10 adequacy review	October 24, 2019 Update	Proposed NPLs for Point of Compliance Wells (May 2022)						
Location/Well	**Whole State**	**Whole Site**	**CRMW-3B-63**	**GVMW 8A-250**	**WCMW 6-234**	**VIN 2B**	**WCMW3-134 and WCMW-6**	**Whole Site**	**POC Wells (Unless Otherwise Listed)**	**Arequa Gulch**	**Rosebud Gulch**	**Poverty Gulch**	**Grassy Valley**	**Vindicator Valley**	**Wilson Creek**
Units	mg/L	NPL mg/L	NPL mg/L	NPL mg/L	NPL mg/L	NPL mg/L	NPL mg/L	NPL mg/L	NPL mg/L	NPL mg/L	NPL mg/L	NPL mg/L	NPL mg/L	NPL mg/L	NPL mg/L
Aluminum	5	7							7			20			
Arsenic	0.01	0.009						0.01	0.01						
Beryllium	0.004	-							-						
Cadmium	0.005	0.004						0.005	0.005			0.022			
Cobalt	0.05	-							-			0.08			
Copper	0.2	0.008						0.2	0.2			1.0			
Fluoride	2	2							2	9.9	9.9	9.9	9.9	9.9	9.9
Iron	5	14							14						
Lead	0.05	0.03						0.05	0.05						
Manganese	0.2	3	8.1	1	0.2	4	0.5 / 0.2	3	3		8.1	22.5		4	
Mercury	0.002	0						0.002	0.002						
Nickel	0.1	0.2							0.2						
Nitrite	1	0.05						1	1						
Nitrate	10	3						10	10						
Nitrate &Nitrite	10	11							11						
Selenium	0.02	0.024							0.024						
Sulfate	250	-	1,070	250	250	800	250		-		1,070	1,070		800	
Zinc	2	0.7	2	2	2		2	2	2						
Cyanide (WAD)	-	0.2	0.2	0.2	0.2	0.2	0.2		0.2						
Cyanide (Free)	0.2								-						
pH	6.5 to 8.5	6	6 to 9	6.5 to 8.5	6.5 to 8.5	6.6 to 8.5	6 to 9		6.0 to 8.5			3.4 – 8.5		6.6 to 8.5	

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5. Proposed Numeric Protection Limits: Arequa Gulch

Groundwater quality has been monitored in Arequa Gulch since December 7, 1993 at CRMW-3A and CRMW-3B. Proposed POC well CRMW-5B and three other adjacent wells CRMW-5A, CRMW-5C, and CRMW-5D are located downgradient in the same basin (Figure 18). CRMW-5A, CRMW-5B, CRMW-5C have been monitored since April 2013. CRMW-5D has been monitored since May 2013.

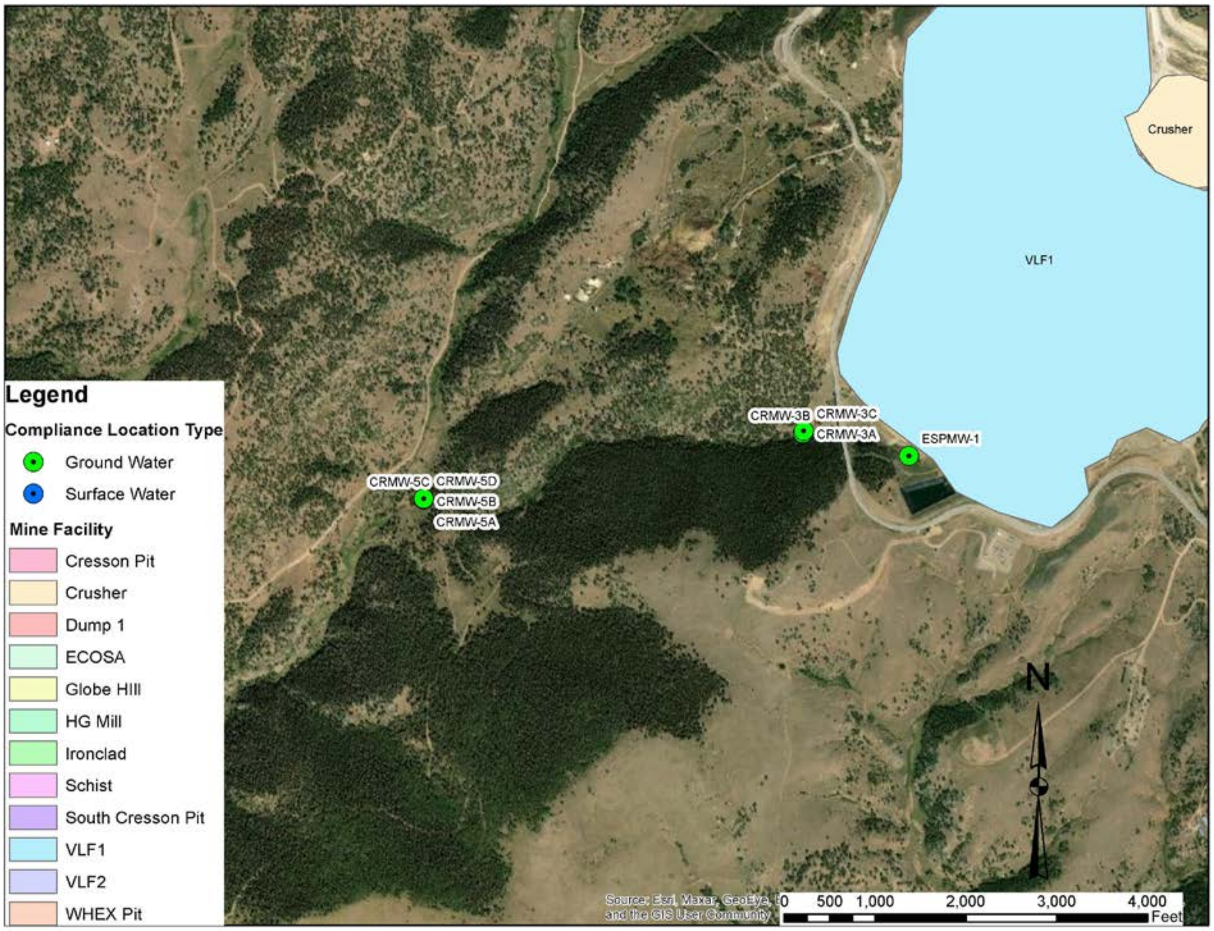

Figure 18. Arequa Gulch groundwater quality monitoring locations

Fluoride concentrations have exceeded their respective Regulation 41 values at CRMW-3A and CRMW-3B since the first groundwater samples were collected in Arequa Gulch in December 1993. As elevated concentrations of fluoride occurred prior to January 31, 1994, this elevated fluoride level meets the criteria of existing ambient quality, as stated by the DRMS in its August 2019 request.

The elevated concentration of fluoride represent the effects of both the natural geological conditions around the CC&V site and the exposure of this rock by the historical mining activities that occurred in Arequa Gulch. As described in Section 2.2, there were numerous mines as well as two railroads and at least two mills in Arequa Gulch.

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Fluoride currently has an NPL value of 2 mg/L, which was set equal to the Regulation 41 value for Agricultural use (more conservative than the Human Health Standard for drinking water supply of 4 mg/L) by DRMS in the October 7, 1996 Groundwater Monitoring Numeric Standards letter.

A new NPL of 9.9 mg/L is proposed for fluoride based on the concentration measured at CRMW-3B on December 7, 2013, which represents the existing ambient quality in Arequa Gulch. The proposed NPL is compared to fluoride concentrations at all Arequa Gulch groundwater monitoring wells, including the proposed POC well CRMW-5B, in Figure 19. While fluoride concentrations only occasionally reached elevated levels at CRMW-3B, they exceeded 12 mg/L in groundwater samples collected from the shallower well CRMW-3A slightly later in 1996 and 1997. Fluoride concentrations have exhibited a slight declining trend in Arequa Gulch groundwater over the following three decades, which suggests that loading from historical source materials is declining.

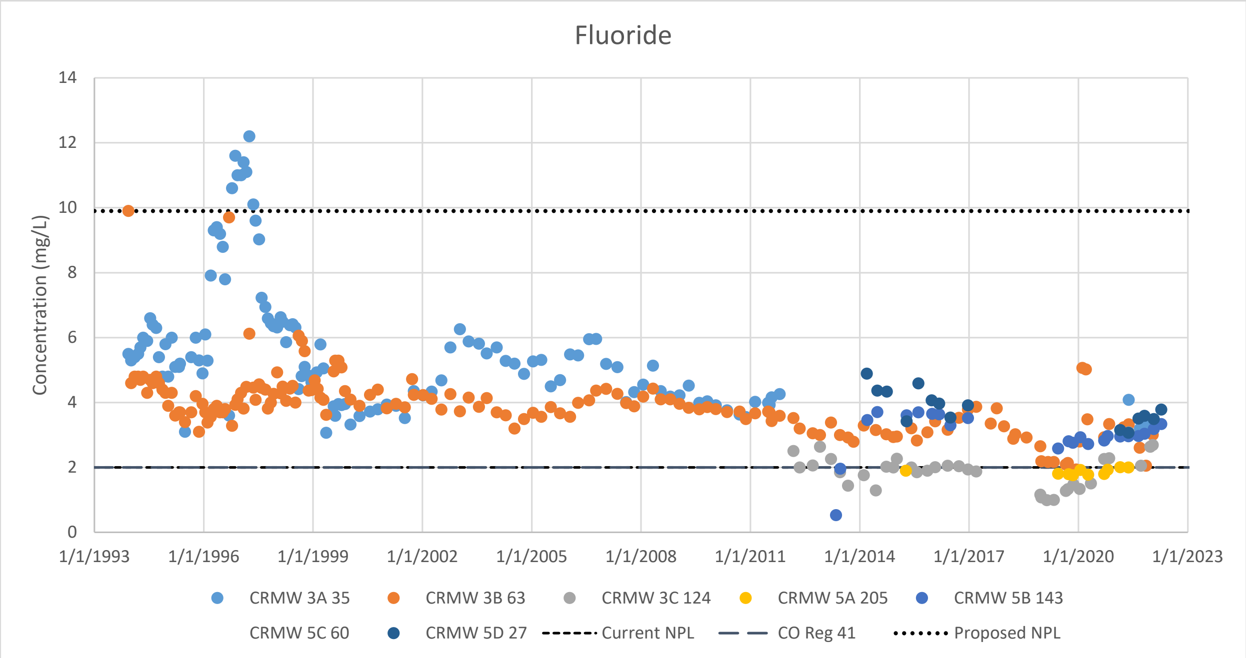

Figure 19. Arequa Gulch fluoride concentrations with Reg 41 limit and current and proposed NPLs

6. Proposed Numeric Protection Limits: Rosebud Gulch

Groundwater quality has been monitored in Rosebud Gulch (formerly known as Squaw Gulch) since March 17, 1994. Although numerous wells have been installed (SGMW-1A, SGMW-1B, SGMW-2A, SGMW-3A, SGMW-3B, SGMW-4A, SGMW-4B, SGMW-6A, SGMW-6B, and SGMW-7A, SGMW-7B) most were either found to be consistently dry, or required removal prior to construction of VLF2 in 2012. Groundwater monitoring is currently only possible at SGMW-6B (Figure 20). Monitoring well SGMW-8 has been proposed as a new POC well for Rosebud Gulch. As SGMW-8 is yet to be constructed, an evaluation of NPLs for Rosebud Gulch is presented in this section based on the most recent water quality monitoring data available from SGMW-6B and the historical wells that were monitored between 1994 and 2012.

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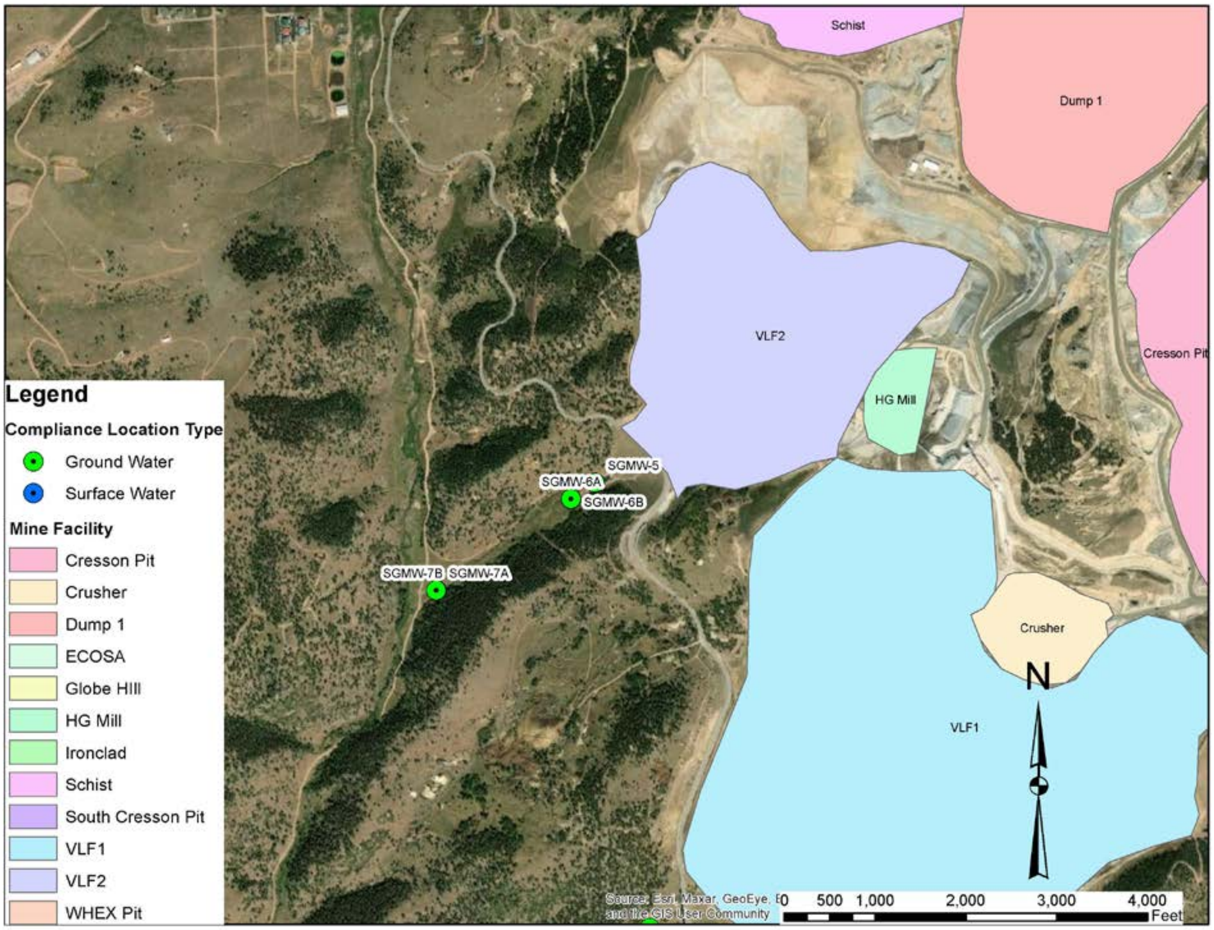

Figure 20. Rosebud Gulch groundwater quality monitoring locations

As shown in Figures 21, 22, and 23, fluoride, manganese, and sulfate concentrations have consistently exceeded their respective Regulation 41 or NPL values at SGMW-6B since groundwater monitoring commenced at this location in September 2014. New or revised NPLs are proposed for these three parameters in Rosebud Gulch on the following technical basis:

- Rosebud Gulch is located directly north of Arequa Gulch in the same geological setting on the western fringe of the Cripple Creek Diatreme.
- As described in Section 2, the upper reaches of both Rosebud and Arequa Gulch are characterized by similarly extensive historical mining, milling, and mine waste disposal activities.
- Groundwater quality monitoring was conducted at SGMW-3B between June 8, 1998 and October 4, 2012, prior to construction of VLF-2. Concentrations of fluoride, manganese, and sulfate occurred at similar concentrations at SGMW-3B compared to the groundwater at Arequa Gulch and also consistently exceeded Regulation 41 values.
- The water quality measurements at SGMW-3B are considered equivalent to pre-1994 ambient groundwater as CC&V did not conduct any mining, ore placement, or mine waste disposal activities in Rosebud Gulch until 2012 when VLF-2 was constructed.

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New or revised NPLs proposed for fluoride, manganese, and sulfate in Rosebud Gulch have been selected to be consistent with existing or proposed NPLs applied in Arequa Gulch in order to maintain a consistent approach for the two similar locations.

Fluoride: A revised NPL of 9.9 mg/L is proposed for fluoride in Rosebud Gulch. This value has been selected based on it being the maximum concentration measured prior to January 31, 1994 in the adjacent Arequa Gulch, which like Rosebud Gulch was similarly impacted by historical mining activities. Water quality monitoring data are compared to the existing (2 mg/L) and proposed (9.9 mg/L) NPLs in Figure 21, which shows fluoride concentrations have varied between these two levels since 1998.

Manganese: A revised NPL of 8.1 mg/L is proposed for manganese in Rosebud Gulch. This value has been selected to be consistent with an existing NPL for manganese that was assigned to monitoring well CRMW-3B in the adjacent Arequa Gulch by the DRMS on November 20, 1998 in letter AM-07 providing revised permit conditions. Weathering of legacy mine waste materials in Rosebud Gulch has caused manganese concentrations in groundwater to exceed the Regulation 41 value (0.2 mg/L) and the existing site-wide NPL (3 mg/L) assigned in the October 7, 1996 Groundwater Monitoring Numeric Standards letter, but concentrations generally remain below the proposed NPL (8.1 mg/L), as shown in Figure 22. Based on the increasing concentration trend for manganese at SGMW-6B, it is likely that variable manganese concentrations exist in Rosebud Gulch groundwater and following the installation of SGMW-8 further review of an appropriate NPL may be required for this basin.

Sulfate: A new NPL of 1,070 mg/L is proposed for sulfate in Rosebud Gulch. Like for manganese, this value has been selected to be consistent with an existing NPL for sulfate that was assigned to monitoring well CRMW-3B in Arequa Gulch by the DRMS on November 20, 1998. The sulfate concentration in Rosebud Gulch groundwater has consistently exceeded the Regulation 41 value (250 mg/L), but generally remained below the proposed NPL (1,070 mg/L), as shown in Figure 23. Sulfate concentrations in Rosebud Gulch and Arequa Gulch groundwater are compared in Figure 24 to demonstrate the similar water quality of the two adjacent basins.

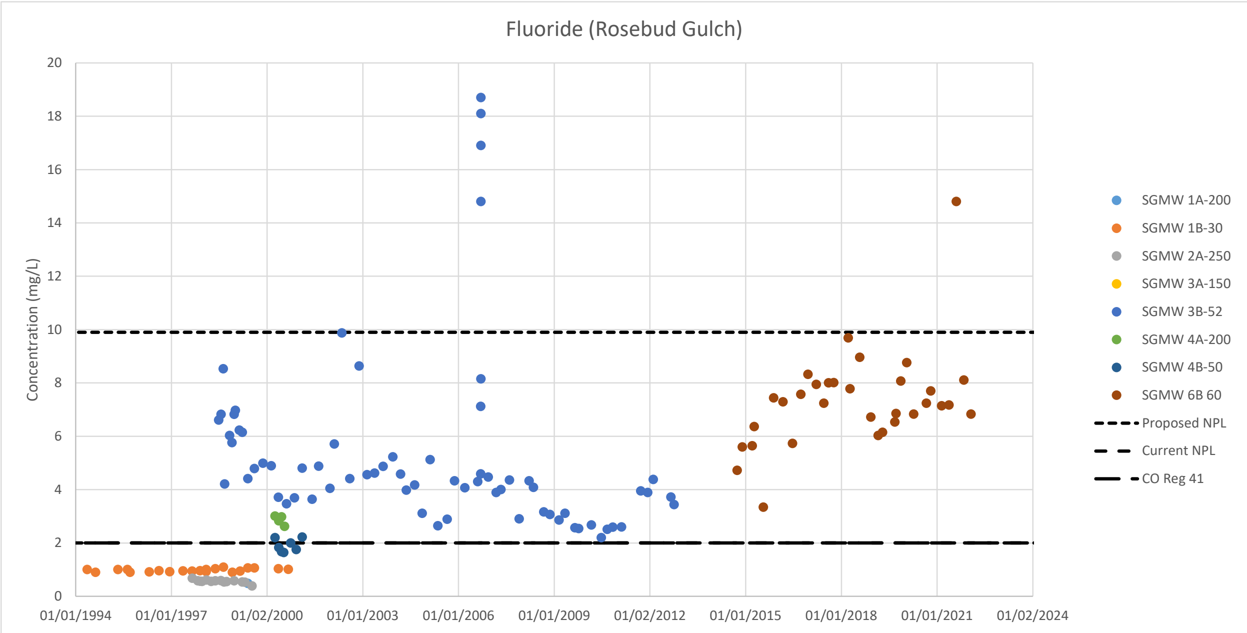

Figure 21. Rosebud Gulch fluoride concentrations with Reg 41 limit and current and proposed NPLs

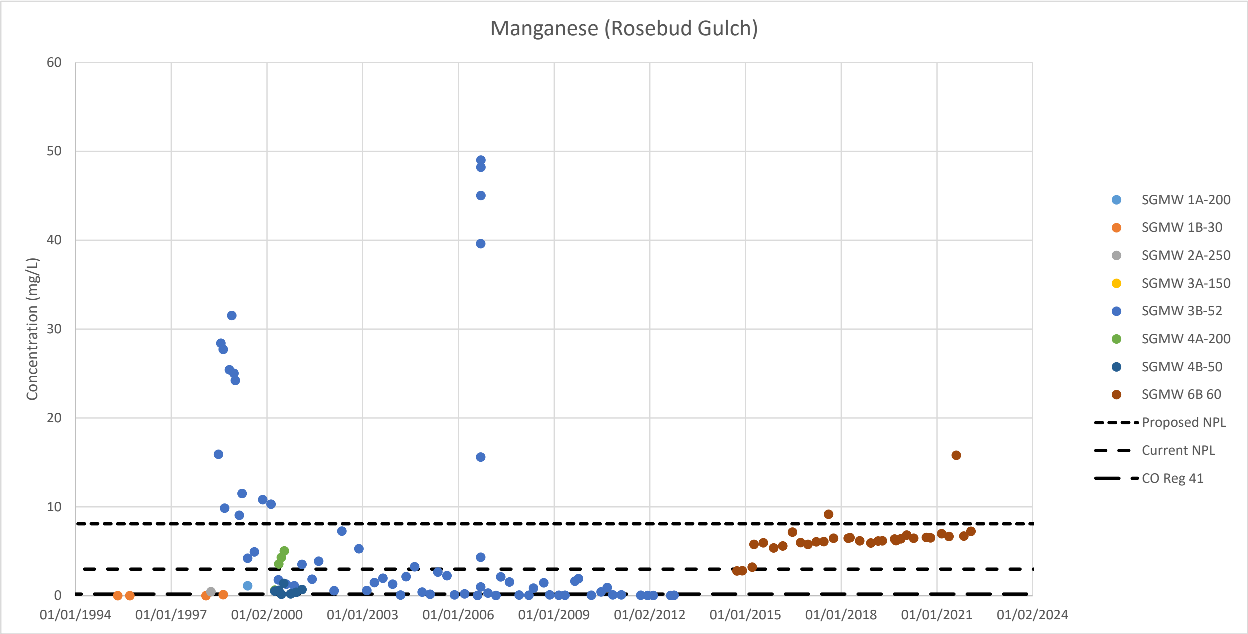

Figure 22. Rosebud Gulch manganese concentrations with Reg 41 limit and current and proposed NPLs

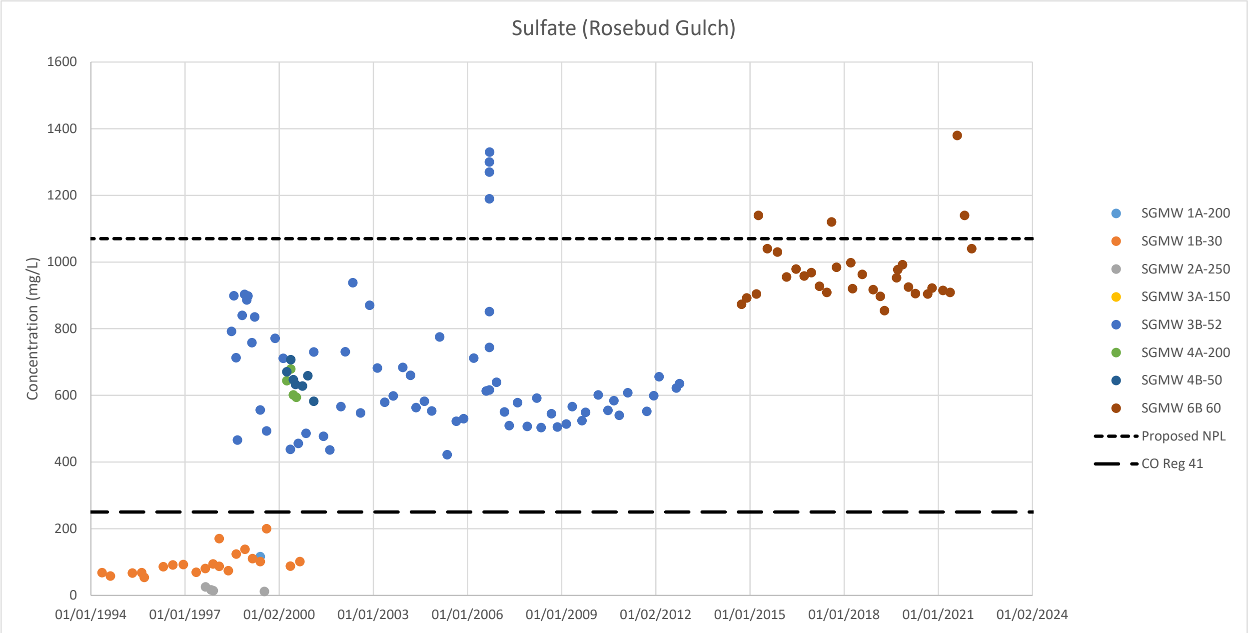

Figure 23. Rosebud Gulch sulfate concentrations with Reg 41 limit and proposed NPL

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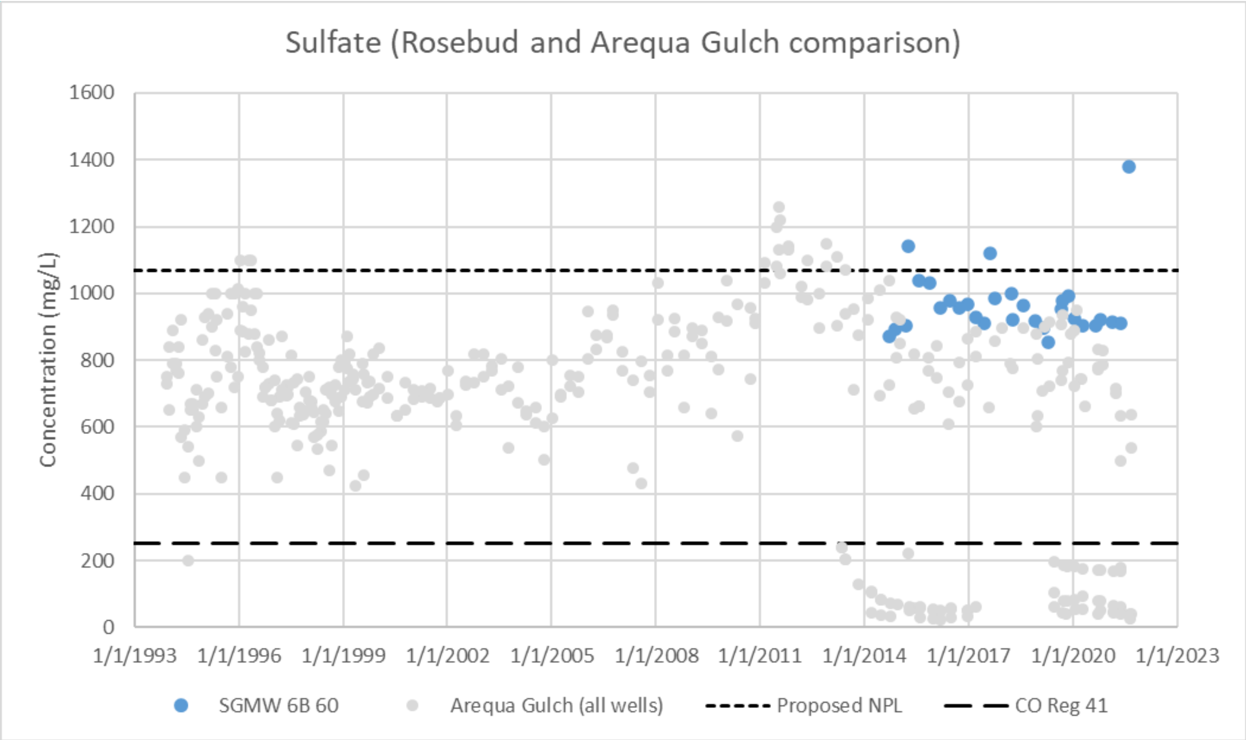

Figure 24. Rosebud Gulch sulfate concentrations compared to Arequa Gulch (all wells)

In addition to fluoride, manganese, and sulfate, the concentration of beryllium in Rosebud Gulch groundwater has consistently exceeded its respective Regulation 41 value of 0.004 mg/L (concentration range: 0.028 to 0.057 mg/L with one outlier at 0.11 mg/L). This is the only monitoring location at CC&V where beryllium has been detected at elevated concentrations and therefore CC&V has identified two possibilities: a) analytical interferences caused by other components of the sample that report as beryllium when analyzed using certain techniques, or b) beryllium originating from a discrete mine waste material source that was placed in Rosebud Gulch upgradient of monitoring well SGMW-6B. However, as groundwater samples have only been analyzed for beryllium since the analyte list for monitoring at well SGMW-6B was updated in July 2018, and it was not measured in groundwater samples collected from the Rosebud Gulch monitoring wells that predate VLF2, it is not possible to demonstrate that the elevated concentrations are related to the same historical mine waste materials that are the source of other loading to Rosebud Gulch groundwater. Beryllium concentrations will be reassessed after the new compliance well SGMW-8 proposed for Rosebud Gulch has been installed to determine the extent of the groundwater that is impacted by beryllium and continue assessing the long-term concentration trend.

On occasion since monitoring began at SGMW-6B in 2014, aluminum, cadmium, cobalt, nitrate, nickel, pH, uranium, and zinc concentrations have exceeded their respective Regulation 41 water quality standards and/or NPLs. However, as these exceedances were limited to one or two monitoring occasions in August 2017 and 2021 (coinciding with late-summer monsoon conditions), they are believed to reflect the short-term flushing of soluble mineral weathering products from mine waste materials located near well SGMW-6B rather than long-term groundwater quality in Rosebud Gulch. These eight constituents will continue to be monitored and evaluated against existing Regulation 41 water quality standards and NPLs.

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7. Proposed Numeric Protection Limits: Poverty Gulch

Groundwater quality has been monitored in Poverty Gulch since March 2000. Like Rosebud Gulch, numerous wells have been installed (PGMW-1A, PGMW-1B, PGMW-2, PGMW-3, PGMW-4) but most were either found to be dry upon installation or became dry after a short period of sampling. Groundwater monitoring is currently only possible at PGMW 3 (Figure 25). Monitoring well PGMW-5 has been proposed as a new POC well for Poverty Gulch. As PGMW-5 is yet to be constructed, an evaluation of NPLs for Poverty Gulch is presented in this section based on water quality monitoring data available from PGMW-3, PGMW-1A, and PGMW-1B.

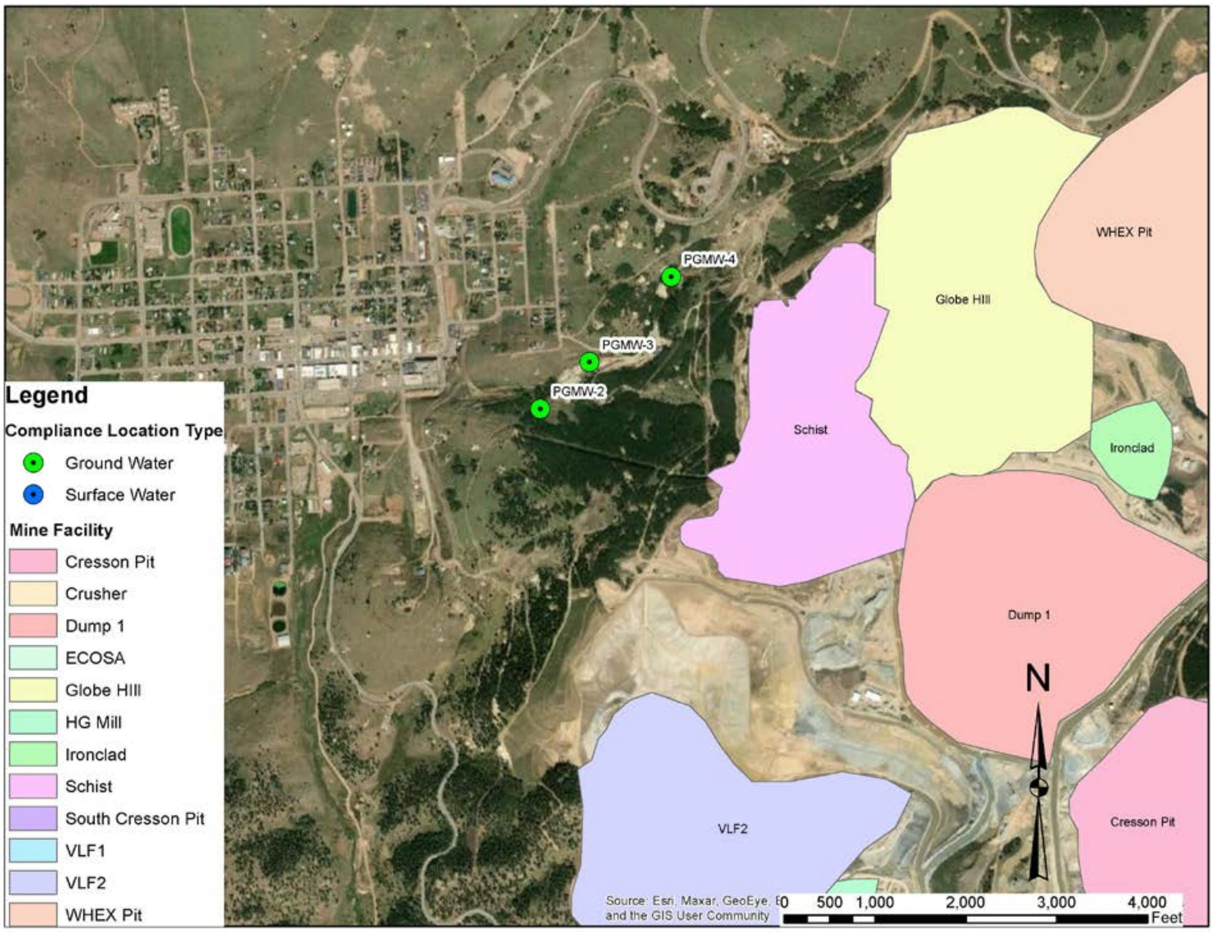

Figure 25. Poverty Gulch groundwater quality monitoring locations

New or revised NPLs are proposed for aluminum, cadmium, cobalt, copper, fluoride, manganese, sulfate, and pH in Poverty Gulch and have been identified based on the maximum concentrations observed in the historical dataset. As groundwater monitoring was not conducted in Poverty Gulch prior to January 31, 1994, these proposed NPLs are based upon the fact there have been no new mining activities in Poverty Gulch since January 31, 1994, consistent with an assertion in the DRMS's October 7, 1996 letter. The demonstration that no new or increased sources of groundwater contamination in the area in question since January 31, 1994, and therefore ambient conditions exceeded Table Value Standards prior to

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January 31, 1994, is provided with the historical information mining use summary for Poverty Gulch presented in Section 2.

The proposed NPLs for Poverty Gulch include:

- Aluminum: An NPL of 20 mg/L is proposed based on historical concentrations at PGMW 1B, as shown in Figure 26. This value is higher than the current site-wide NPL (7 mg/L) and CO Regulation 41 table value (5 mg/L).
- Cadmium: An NPL of 0.022 mg/L is proposed based on historical concentrations at PGMW 1B, as shown in Figure 27. This value is higher than the current site-wide NPL (0.005 mg/L), which is equal to the CO Regulation 41 table value.
- Cobalt: An NPL of 0.008 mg/L is proposed based on historical concentrations at PGMW 1B, as shown in Figure 28. This value is higher than the current site-wide NPL (0.2 mg/L), which is equal to the CO Regulation 41 table value (0.05 mg/L).
- Copper: An NPL of 1 mg/L is proposed based on historical concentrations at PGMW 1B, as shown in Figure 29. This value is higher than the current site-wide NPL (0.2 mg/L), which is equal to the CO Regulation 41 table value.
- Fluoride: A NPL of 9.9 mg/L is proposed based on the pre-January 31, 1994 concentration measured in Arequa Gulch (value represents a background concentration for groundwater impacted by historical mining and mine waste disposal activities, as described earlier in Section 5), as shown in Figure 30. This value is higher than the current site-wide NPL (2 mg/L), which is equal to the CO Regulation 41 table value.
- Manganese: An NPL of 22.5 mg/L is proposed based on historical concentrations at PGMW 1B, as shown in Figure 31. This value is higher than the current site-wide NPL (3 mg/L) and the CO Regulation 41 table value (0.2 mg/L).
- Sulfate: An NPL of 1,070 mg/L is proposed to be consistent with the NPL for Arequa Gulch monitoring well CRMW 3B, which was assigned by the DRMS in the November 20, 1998 AM-07 letter where sulfate concentrations have been historically-elevated. As shown in Figure 32, this value is higher than the CO Regulation 41 table value (250 mg/L).
- pH: An NPL for a minimum pH of 3.4 is proposed based on the historical minimum at PGMW 1B, as shown in Figure 33. This value is lower than the current site-wide NPL (pH 6) and the CO Regulation 41 table value (pH 6.5). It is recognized that the groundwater pH at the three monitoring wells shown in Figure 33 exhibited a declining trend between the time of installation and when the wells were deemed dry and could no longer be sampled (as is the case for PGMW-1A, and PGMW-1B). Groundwater pH will continue to be monitored at PGMW 3 and at PGMW-5 once it has been installed and the NPL will be reviewed in the future.

It is important to recognize that concentrations of all constituents with NPLs proposed in this section have varied substantially over time, both at individual wells over short periods and between wells located in the same area screened at different depths (i.e. concentrations were consistently lower in deeper groundwater at PGMW 1A than PGMW 1B). This variation is related to both the distributed nature of mine workings, mine waste placement, and monitoring well proximity to discarded mine waste (waste rock and tailings). Additional groundwater monitoring well installation (i.e. PGMW-5) and sampling is required to further the understanding of the nature and extent of groundwater impacts from the historical activities.

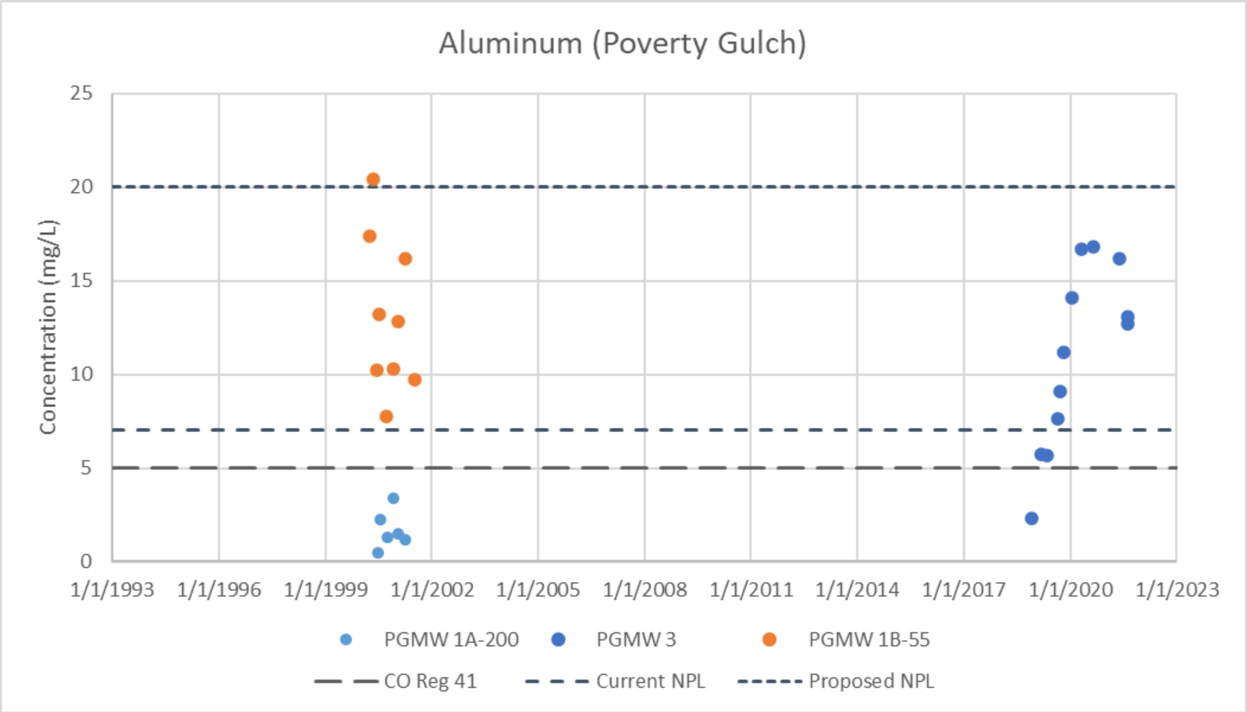

Figure 26. Poverty Gulch aluminum concentrations with Reg 41 limit and current and proposed NPLs

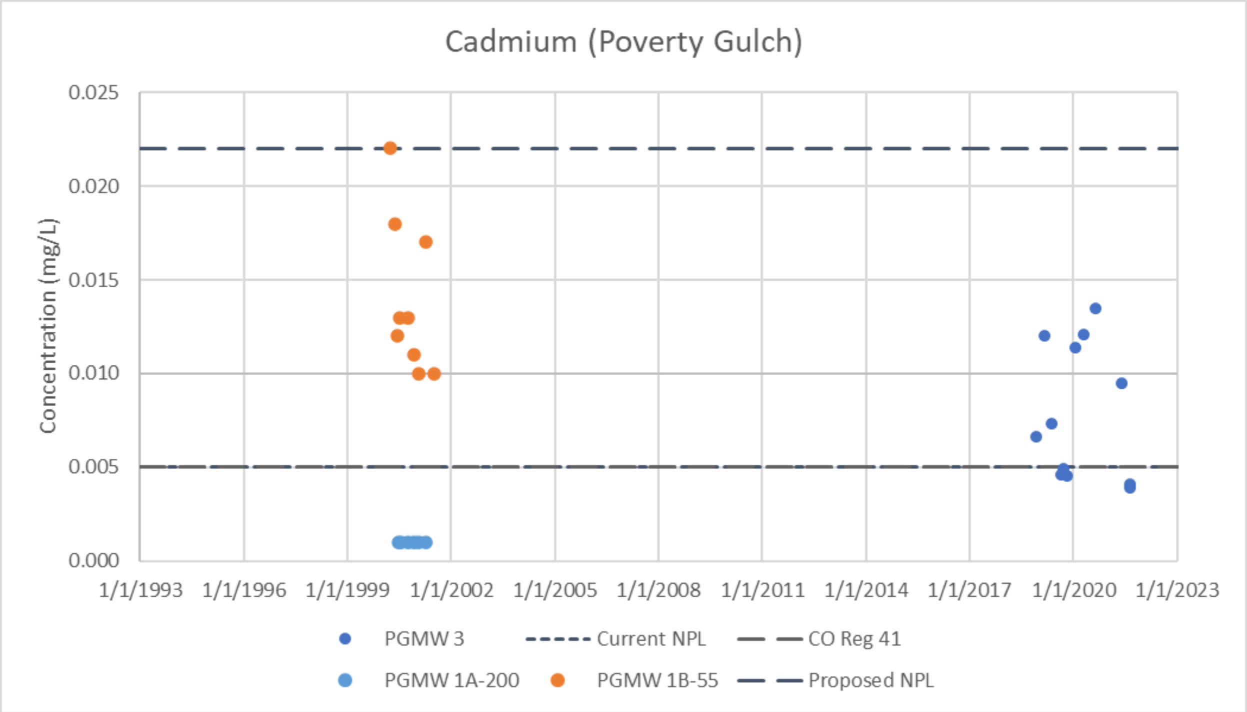

Figure 27. Poverty Gulch cadmium concentrations with Reg 41 limit and current and proposed NPLs

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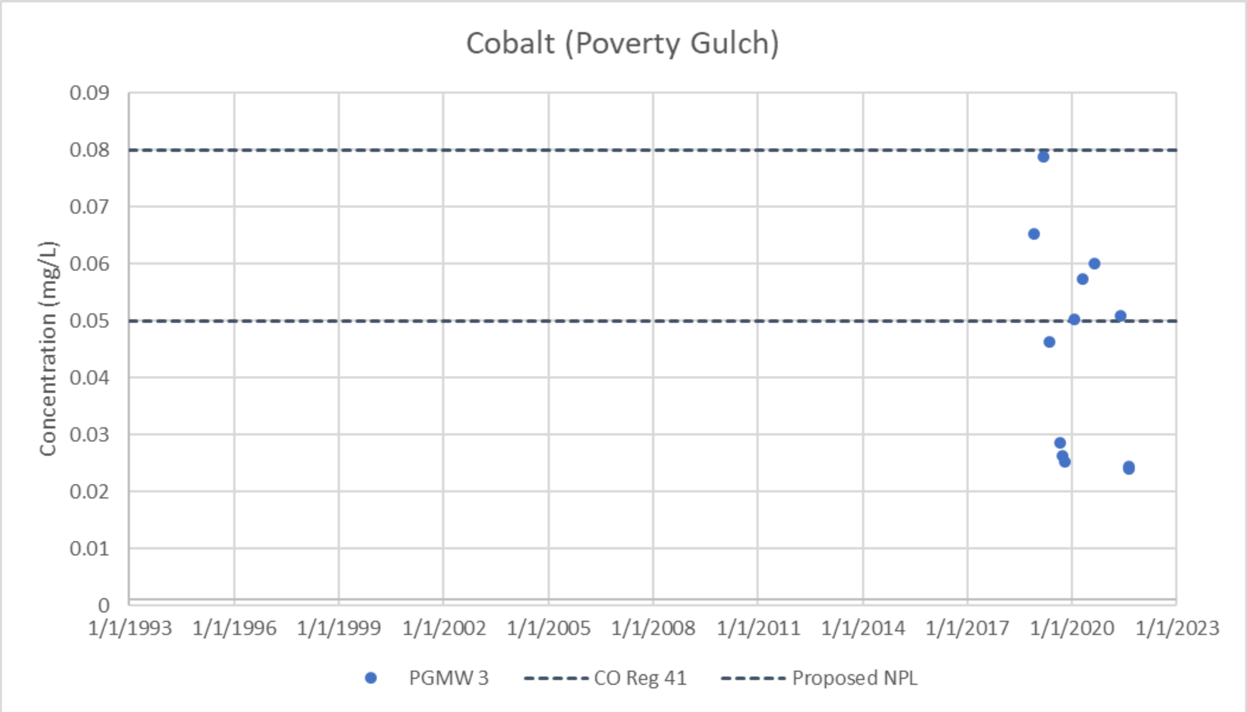

Figure 28. Poverty Gulch cobalt concentrations with Reg 41 limit and current and proposed NPLs

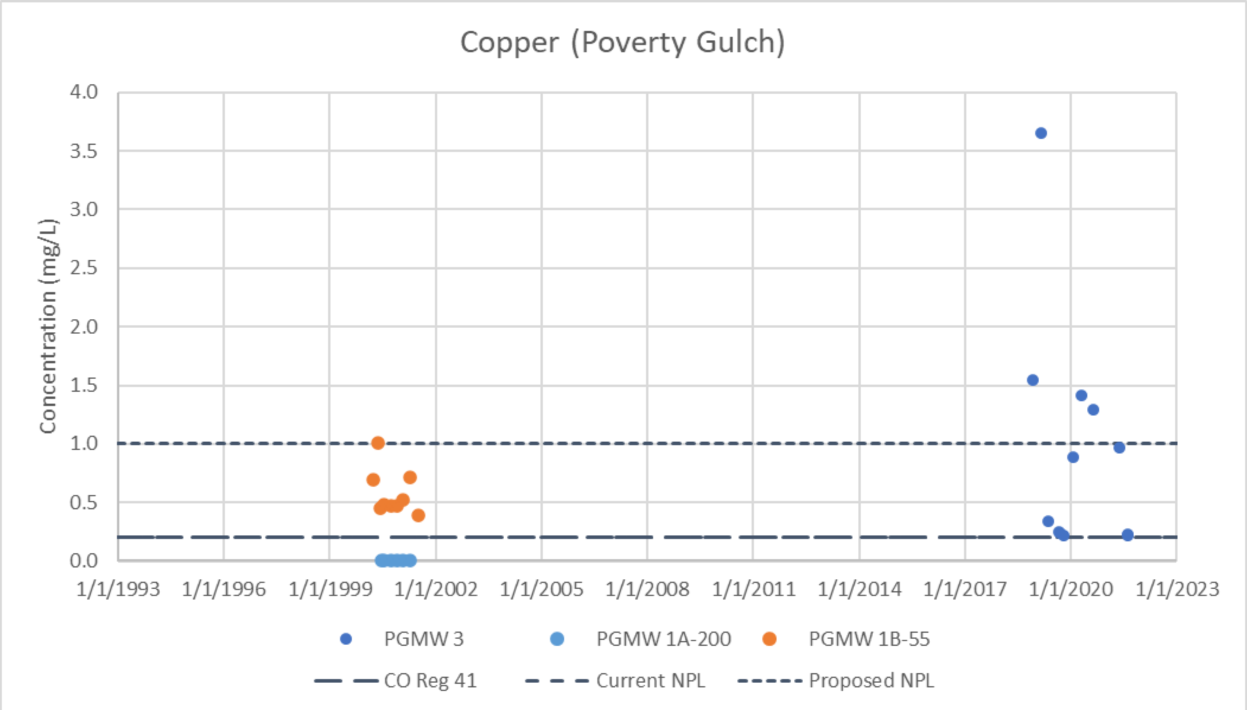

Figure 29. Poverty Gulch copper concentrations with Reg 41 limit and current and proposed NPLs

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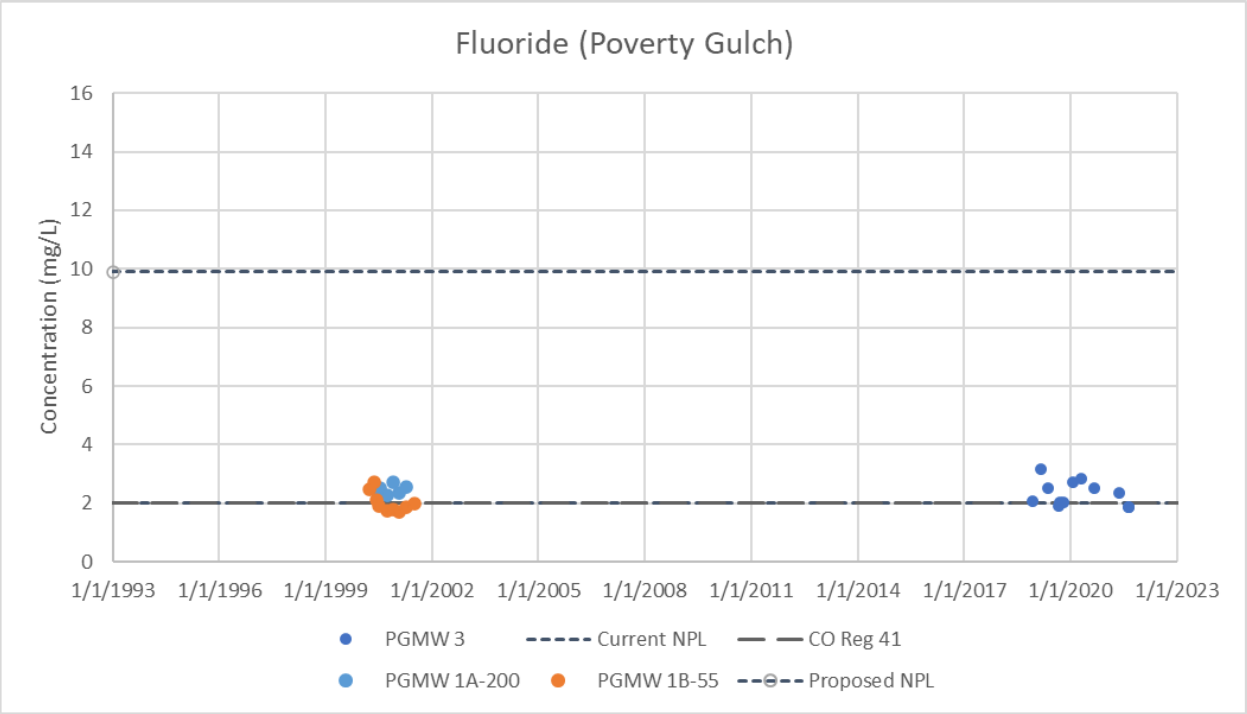

Figure 30. Poverty Gulch fluoride concentrations with Reg 41 limit and current and proposed NPLs

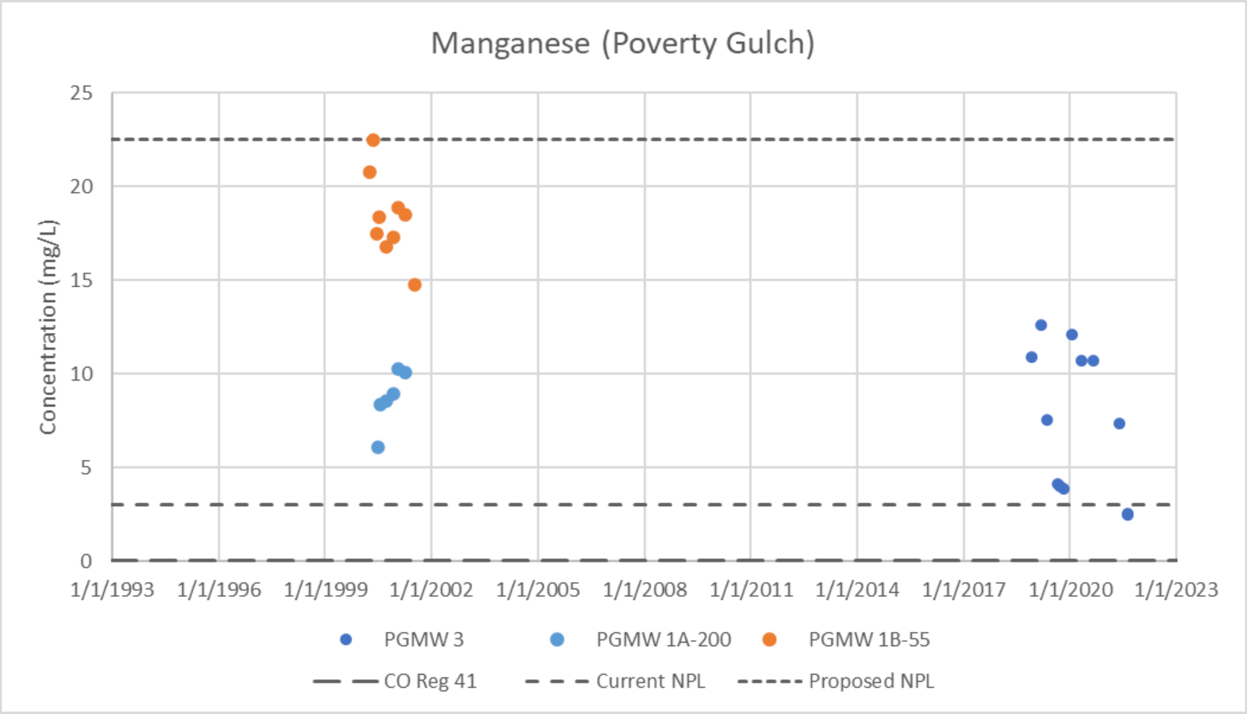

Figure 31. Poverty Gulch manganese concentrations with Reg 41 limit and current and proposed NPLs

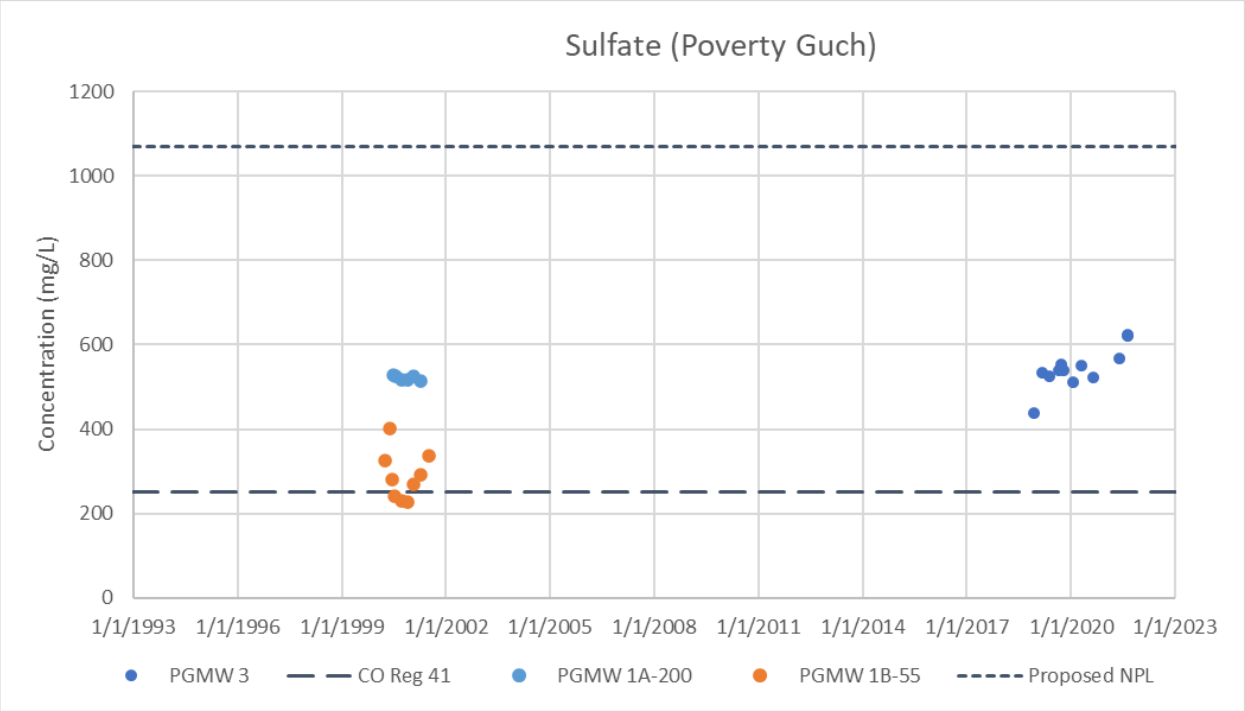

Figure 32. Poverty Gulch sulfate concentrations with Reg 41 limit and current and proposed NPLs

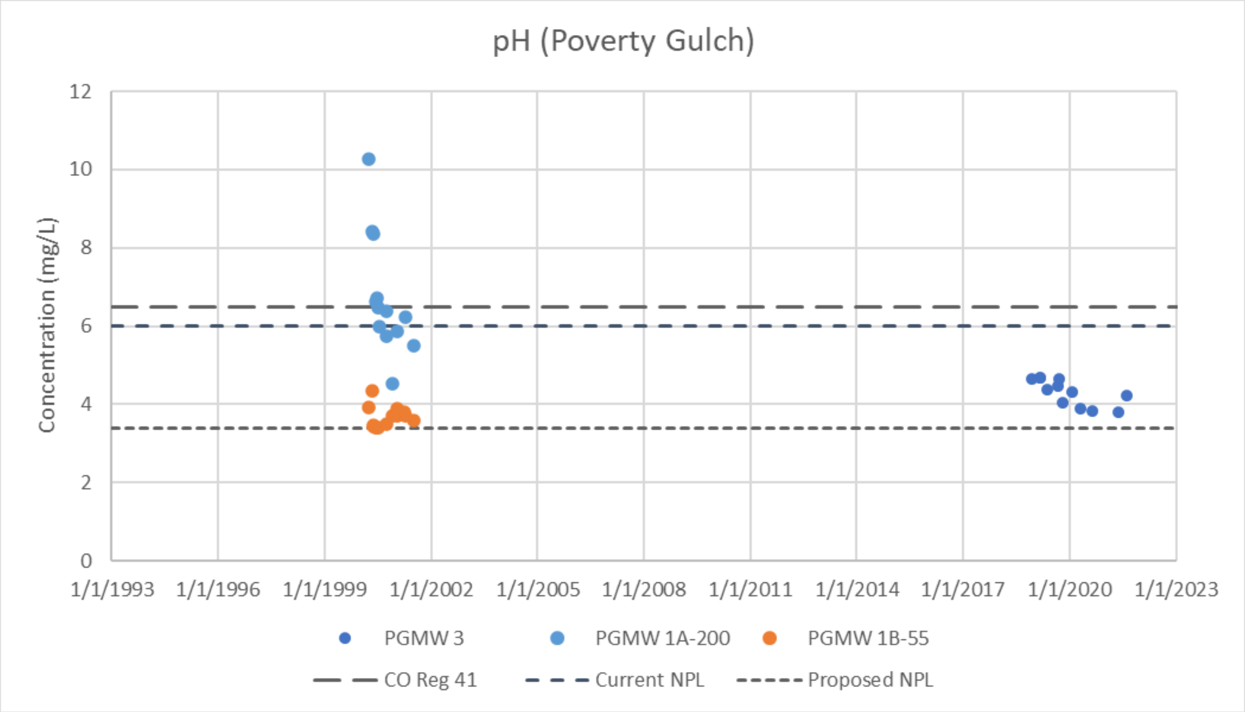

Figure 33. Poverty Gulch pH with Reg 41 limit and current and proposed NPLs

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8. Proposed Numeric Protection Limits: Vindicator Valley

Groundwater quality has been monitored in Vindicator Valley at monitoring wells VIN 2A and VIN 2B (Figure 34) since June 30, 2004.

These two monitoring wells are located within an area that contained a substantial amount of mine waste, as described in Section 2 and shown in Figures 11 and 12. At the time groundwater monitoring commenced at VIN 2A and VIN 2B in 2004, the Altman pit was nearing the end of its operational life. Backfilling of this pit with waste rock from surficial stockpiles commenced in 2007 or 2008, thus reducing the amount of waste material exposed on the ground surface in the basin. As shown by the data presented in the figures in this section, groundwater quality has been reasonably consistent over the last 18 years of monitoring.

Three revised NPLs are proposed for Vindicator Valley in order to provide a consistent NPL for fluoride at all POC wells and recognize the NPLs assigned to VIN 2B will be applied as the NPLs for Vindicator Valley groundwater as VIN 2B has been proposed as the single POC well.

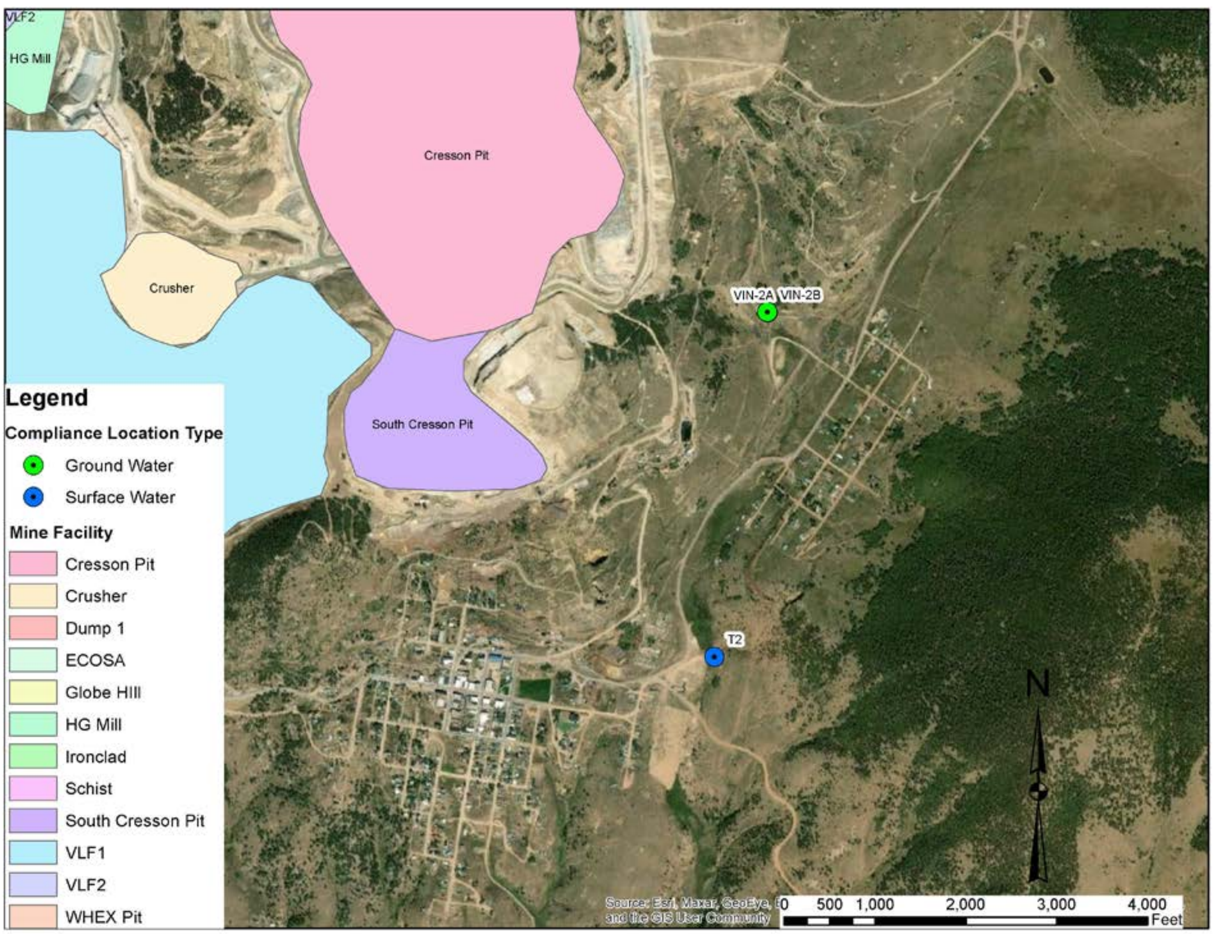

Figure 34. Vindicator Valley groundwater quality monitoring locations

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Water quality monitoring data are compared to the existing (2 mg/L) and proposed NPL for fluoride (9.9 mg/L) in Figure 35. The single NPL is being proposed in order to reflect the presence of fluoride in groundwater around the site due to historical mining activities and mine waste disposal practices. As shown in Figure 35, the fluoride concentration in groundwater at VIN 2B has remained consistently less than both the current and proposed NPLs since monitoring began in 2004.

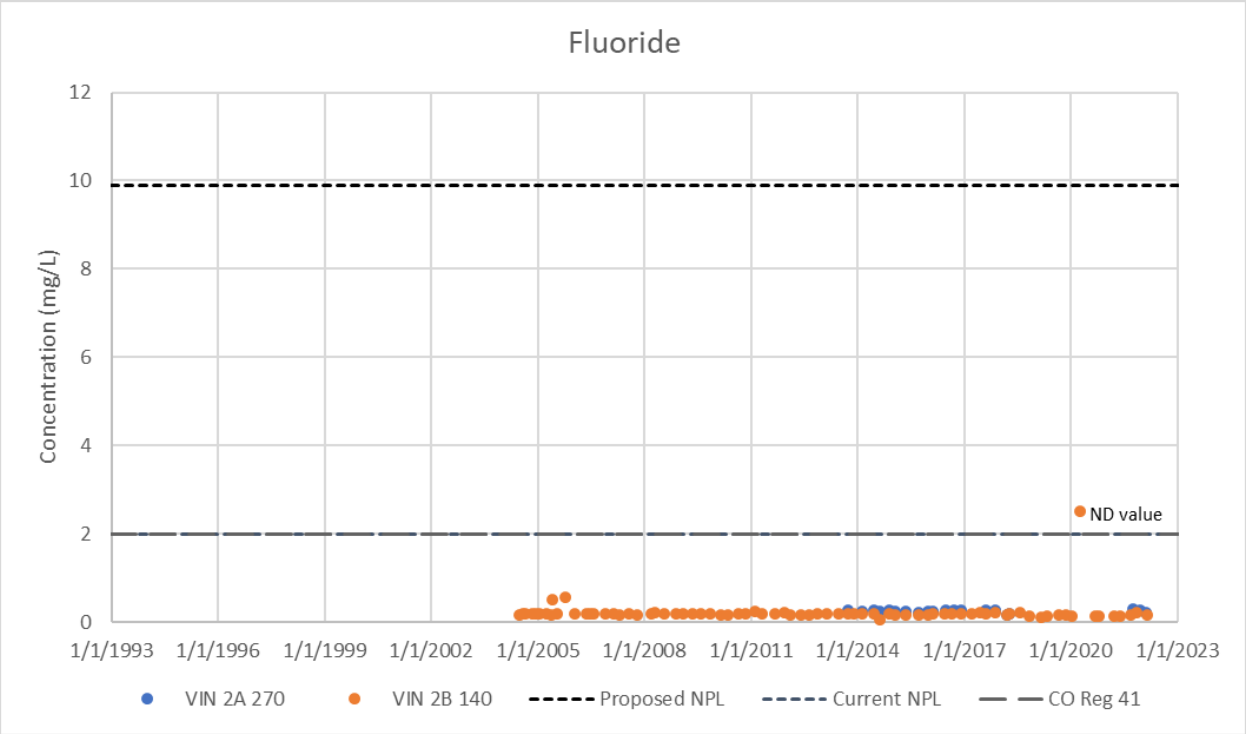

Figure 35. Vindicator Valley fluoride concentrations with Reg 41 limit and current and proposed NPLs

In a letter dated May 18, 2006, the DRMS assigned NPLs for manganese, sulfate, and pH at monitoring well VIN 2B that differed from the NPLs assigned to monitoring well VIN 2A. Given VIN 2B has been proposed as the POC well for Vindicator Valley, standardization of NPL values for the basin is proposed so water quality can data be assessed against a common NPL. Concentrations of manganese and sulfate and the pH in Vindicator Valley groundwater are compared to the proposed NPL values for the basin in Figures 36, 37, and 38.

Manganese concentrations in Vindicator Valley groundwater are compared to the existing site-wide (3 mg/L) and proposed (4 mg/L; currently applicable to VIN 2B only) NPLs in Figure 36, which shows manganese concentrations at VIN 2B have varied between these two levels since 2004. While other constituents occur at similar concentrations at both wells (e.g., fluoride and sulfate, as shown in Figures 37 and 38), it appears manganese concentrations are higher in groundwater intercepted by the shallower well VIN 2B, but are lower in deeper groundwater at VIN 2A, possibly due to a difference in the proximity of the deeper well to mine waste source materials or a geochemical mechanism that preferentially attenuates manganese from groundwater at depth.

Sulfate concentrations in Vindicator Valley groundwater are compared to the Regulation 41 value (250 mg/L) and proposed NPL for the basin (800 mg/L; currently VIN 2B 140 only) in Figure 37, which shows sulfate concentrations at VIN 2A and VIN 2B have both varied between these two levels since 2004. A gradual concentration decline at both locations appears to have occurred since approximately 2012.

The pH of Vindicator Valley groundwater is compared to the Regulation 41 range (6.5 to 8.5) and proposed NPLs for the basin (6.6 to 8.5; currently VIN 2B only) in Figure 37. The NPL values that currently apply to VIN 2B are proposed for Vindicator Valley.

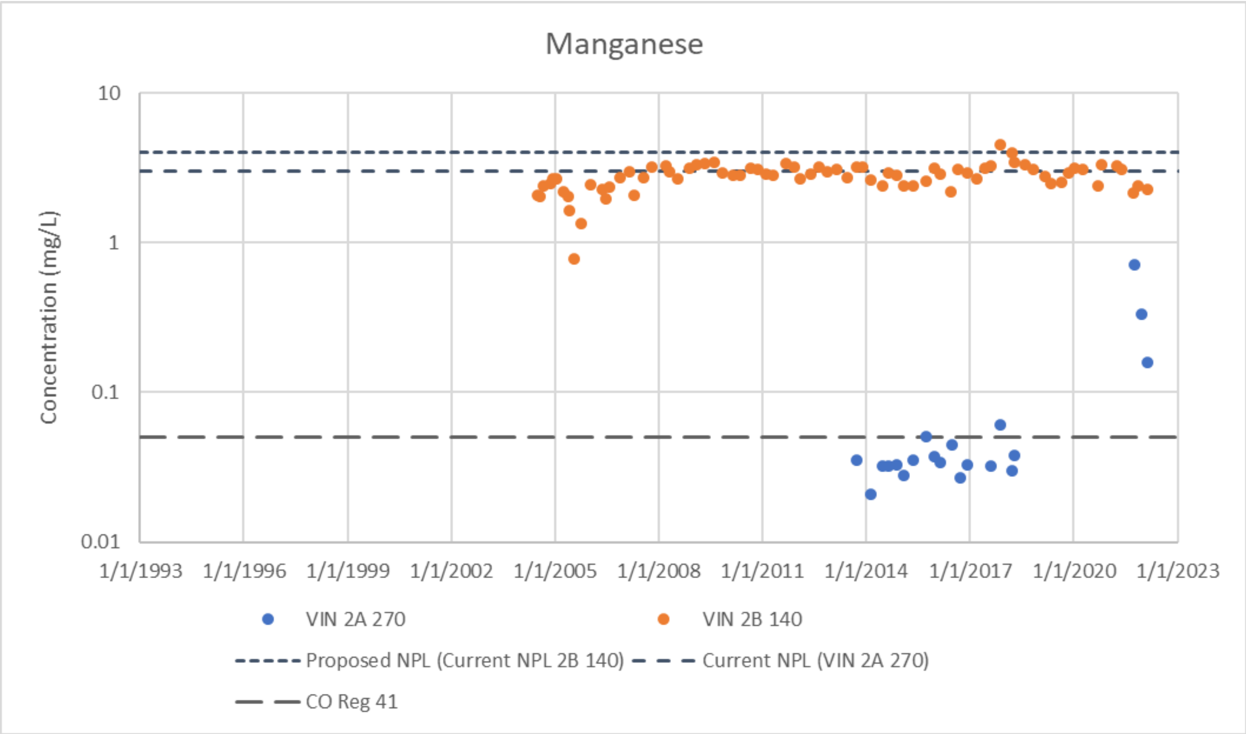

Figure 36. Vindicator Valley manganese concentrations with Reg 41 limit and current and proposed NPLs

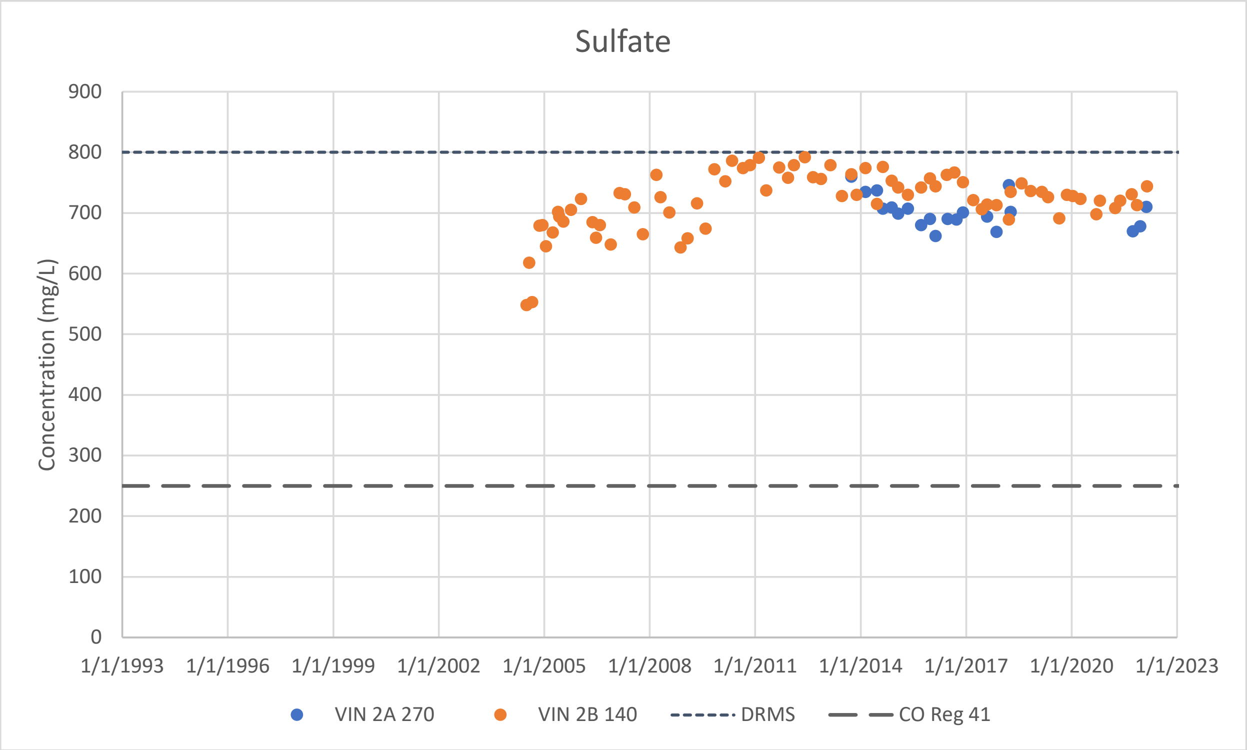

Figure 37. Vindicator Valley sulfate concentrations with Reg 41 limit and current and proposed NPLs

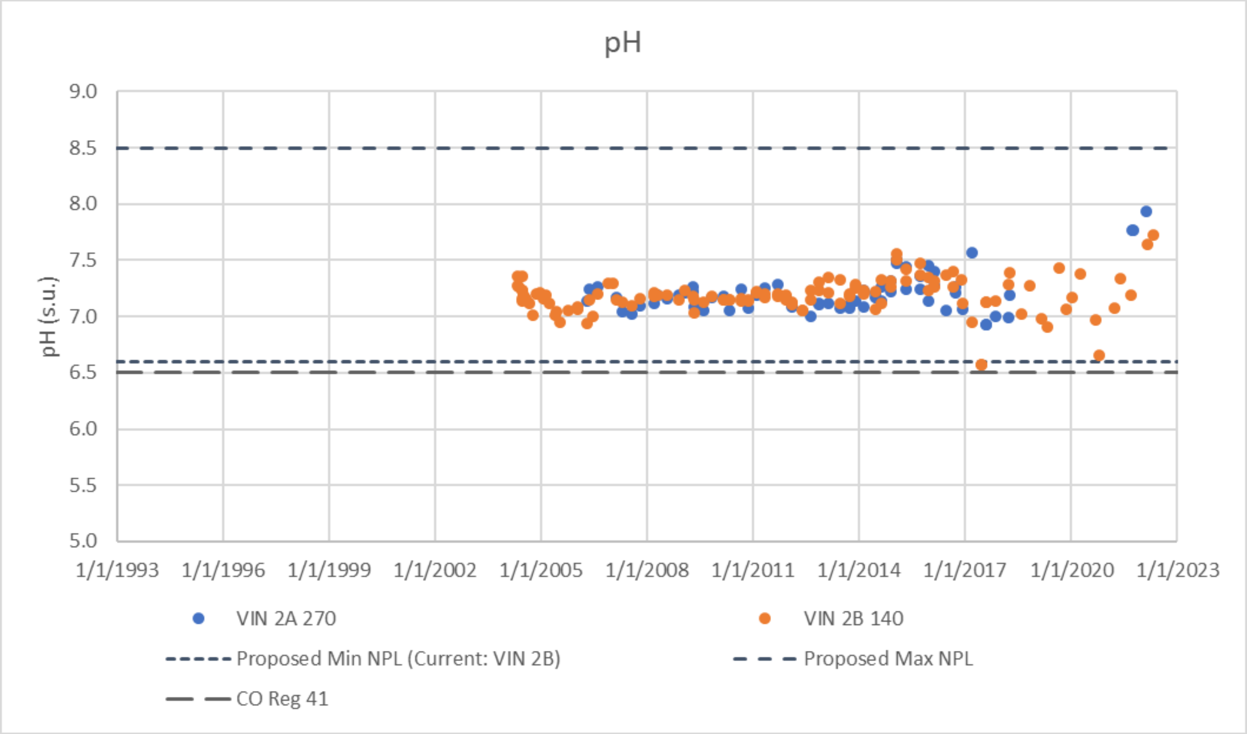

Figure 38. Vindicator Valley pH with Reg 41 limit and current and proposed NPLs

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9. Proposed Numeric Protection Limits: Grassy Valley

Groundwater quality has been monitored in Grassy Valley at monitoring wells GVMW 8A, GVMW 8B since June 12, 1998, GVMW 22A and GVMW 22B since July 23, 2008, and GVMW 25 since September 6, 2018 (Figure 39). As described in Section 2, only a limited amount of historical mining activity occurred in Grassy Valley, but it was also the site of the former town of Cameron. Monitoring well GVMW-26 is being proposed as the point of compliance well for the Grassy Valley Drainage.

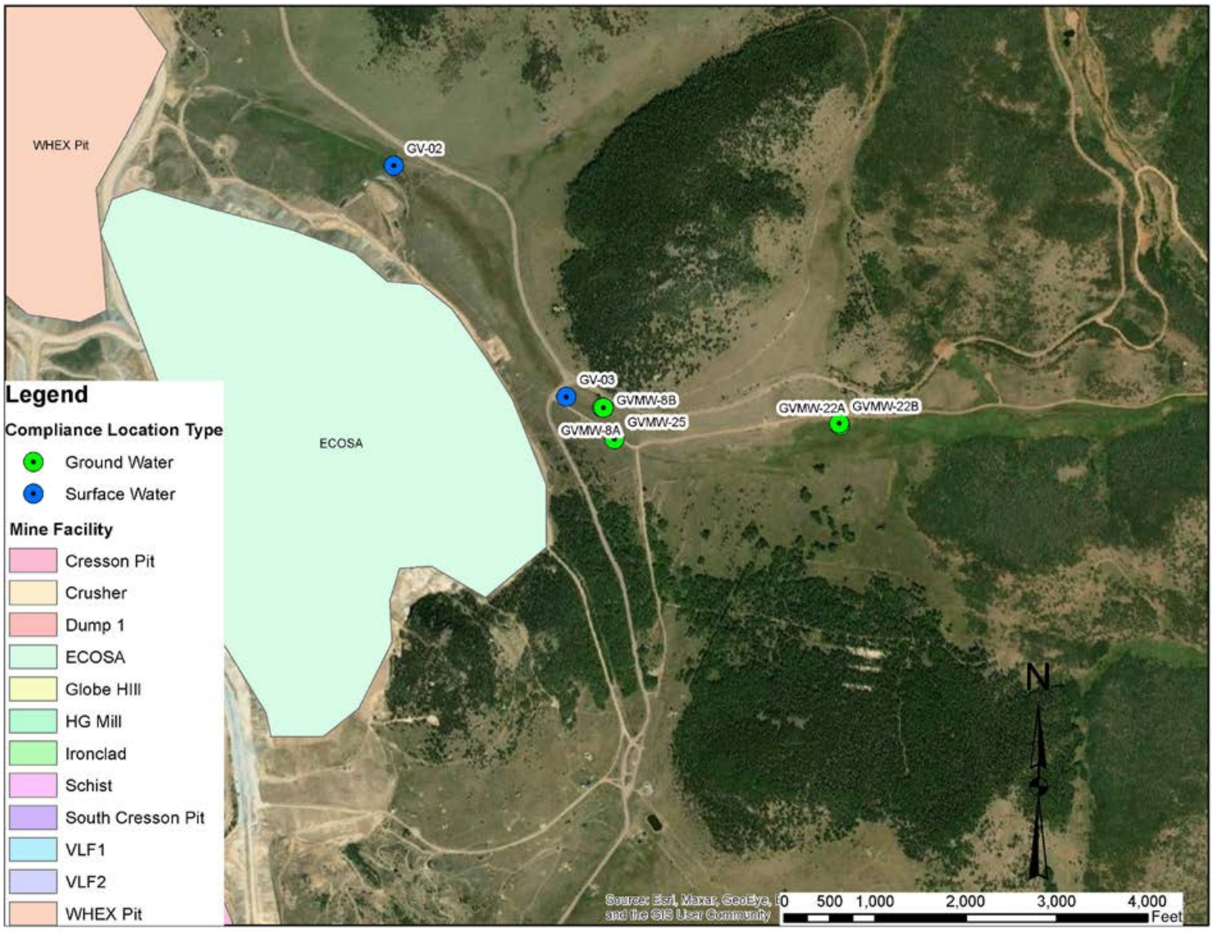

Figure 39. Grassy Valley groundwater quality monitoring locations

One revised NPL is proposed for Grassy Valley in order to provide a consistent NPL for fluoride. Water quality monitoring data are compared to the existing and proposed NPL for fluoride (9.9 mg/L) in Figure 39. As described in the previous section, the single NPL is being proposed to recognize the presence of fluoride in groundwater around the site due to historical mining activities and mine waste disposal practices. As shown in Figure 39, the fluoride concentration in groundwater at multiple Grassy Valley groundwater monitoring wells (i.e. GVMW 8A, GVMW 8B, and GVMW 22A) has been elevated compared to both the current and proposed NPLs since monitoring began in 1998.

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Fluoride concentrations have remained relatively stable at all Grassy Valley monitoring locations since monitoring began, except at GVMW 25 in the fall of 2021 following a series of monsoon rain events. During this period, the concentration of fluoride and a series of other constituents (e.g., manganese) increased temporarily from August 2021, peaked in October 2021 (maximum fluoride concentration of 14.4 mg/L), then declined through to the latest available result April 2022. The factors that caused this rapid, yet temporary, response in shallow groundwater are currently being investigated. A similar fluctuation in fluoride concentrations was not observed at monitoring wells GVMW 8A, GVMW 8B, GVMW 22A, or GVMW 22B, as shown in Figure 40.

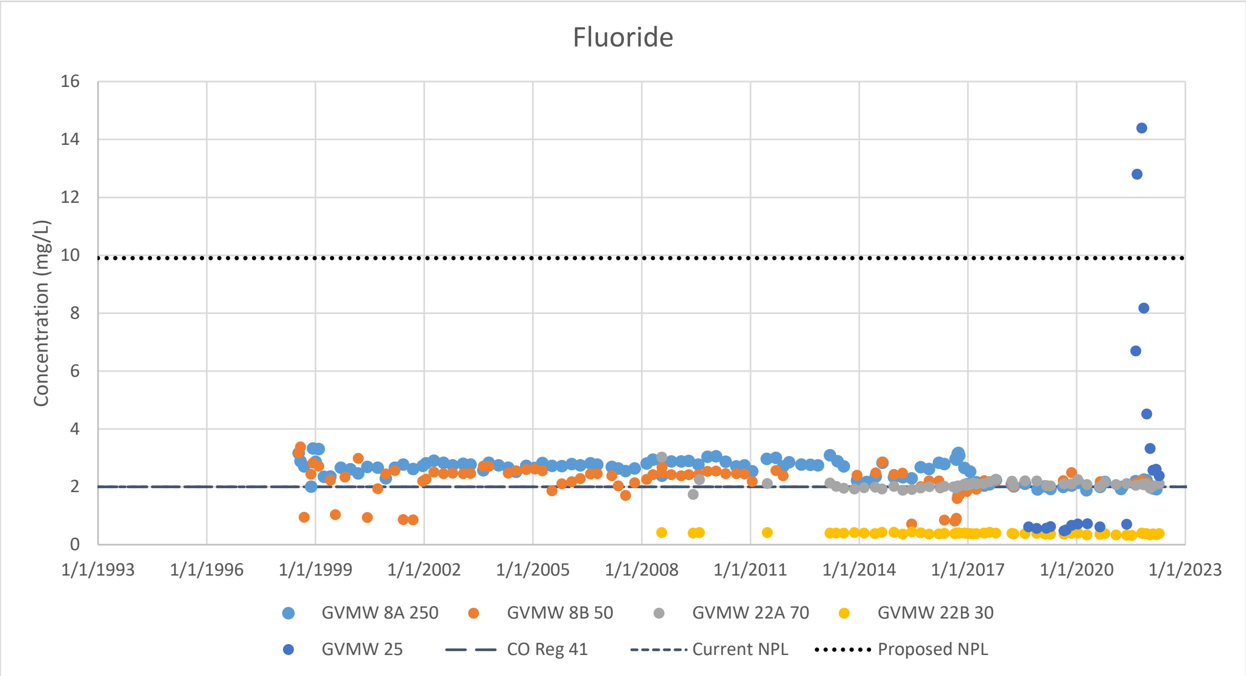

Figure 40. Grassy Valley fluoride concentrations with Reg 41 limit, current NPL, and proposed NPL

10. Proposed Numeric Protection Limits: Wilson Creek

Groundwater quality has been monitored in Wilson Creek at monitoring wells WCMW 3, WCMW 6, WCMW 6 and WCMW 6 since March 1993 and at WCMW 6 since June 1993 (Figure 41).

As described in Section 2, there was less historical mining activity in the Wilson Creek area than the other basins around the CC&V mine site and it is considered relatively unimpacted. However, the concentration of fluoride in groundwater at the proposed point of compliance well WCMW 6 has consistently exceeded the CO Regulation 41 table value and current NPL (2 mg/L). Water quality monitoring data from all Wilson Creek monitoring wells are compared to the current and proposed NPLs for fluoride (9.9 mg/L) in Figure 42. As described previously, the single NPL is being proposed to recognize the presence of fluoride in groundwater around the site due to historical mining activities and mine waste disposal practices, or in the case of Wilson Creek, an elevated background concentration influenced by local geological conditions.

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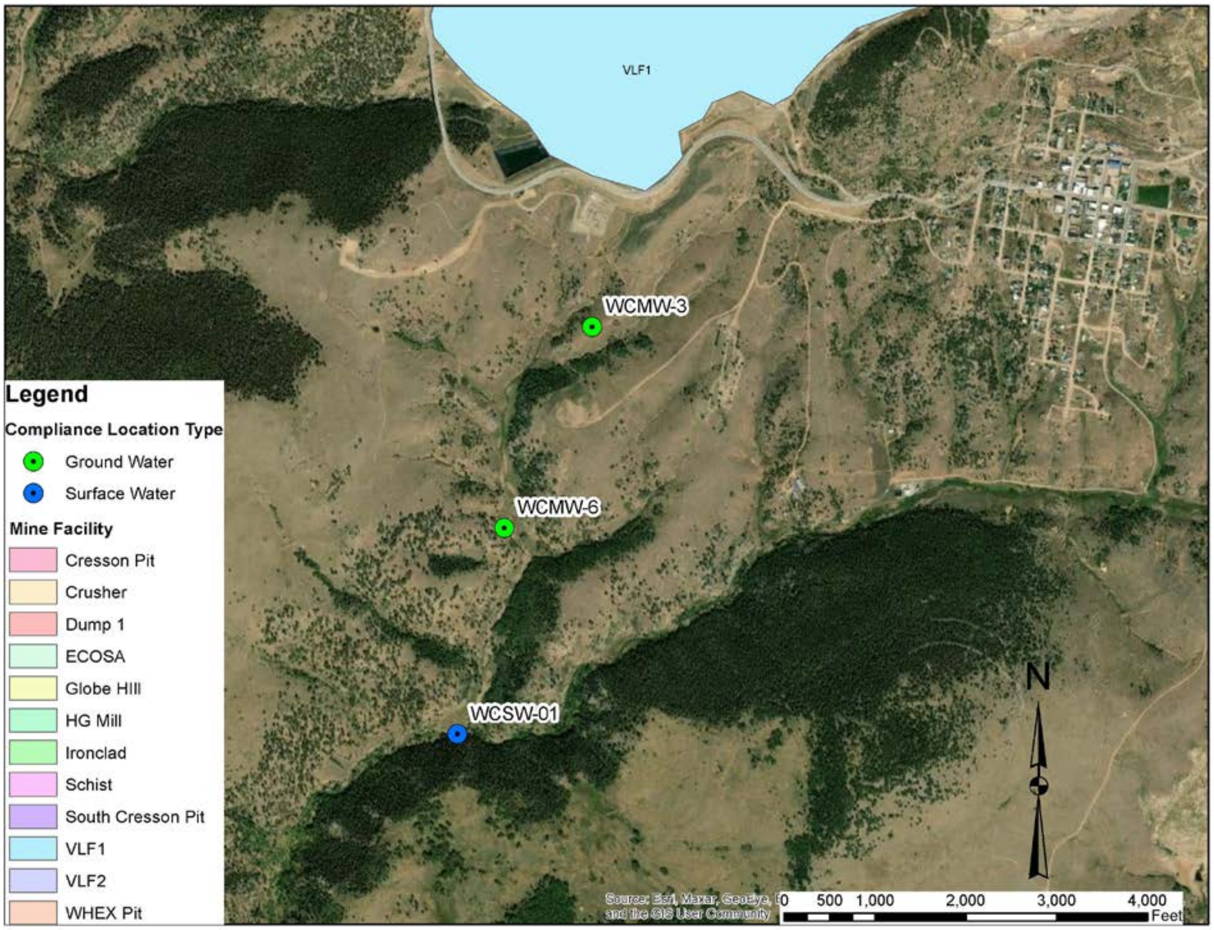

Figure 41. Wilson Creek groundwater quality monitoring locations

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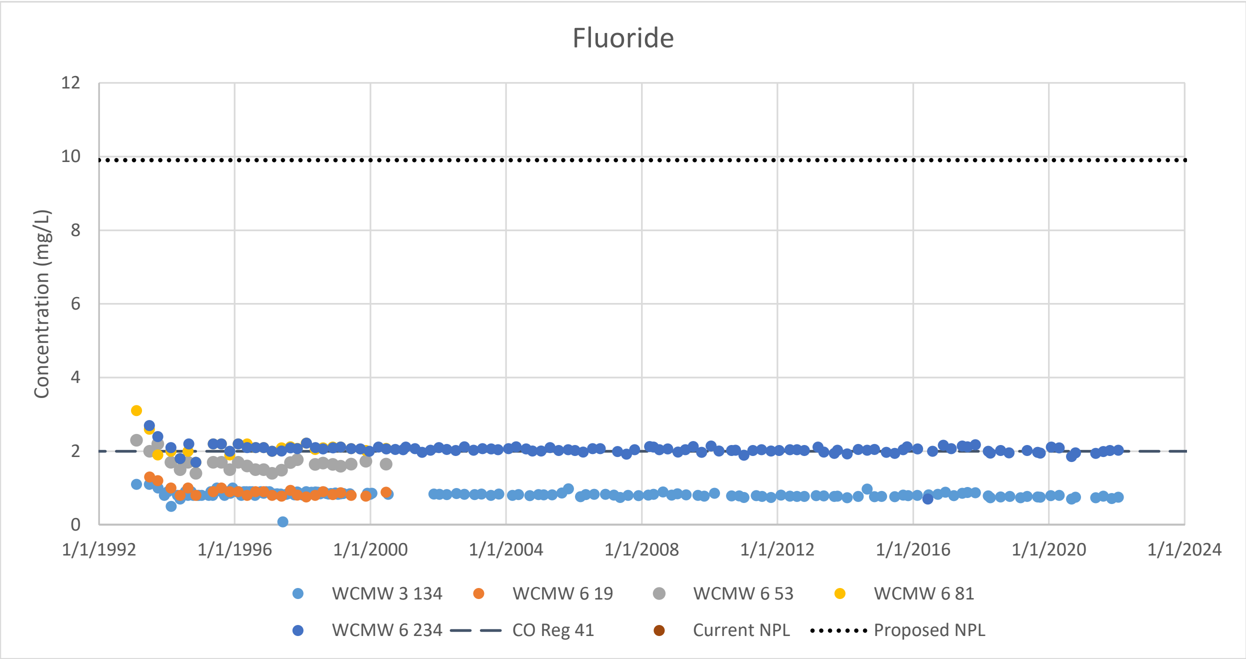

Figure 42. Wilson Creek fluoride concentrations with Reg 41 limit and proposed NPL

11. Summary

Historical mining activities in the vicinity of the CC&V mine have caused groundwater in Arequa Gulch, Poverty Gulch and Vindicator Valley to be impacted by historic mining and milling activities. Precipitation has mobilized soluble species from mine dumps and tailings, and likely the native rock or soils, particularly in the Grassy Valley and Wilson Creek basins, which have less historical mining impacts, but the groundwater still contains fluoride at elevated concentrations, into groundwater. The sources of the elevated constituents in these four drainages existed well before 31 January 1994, and the data presented in the present report show that mining and processing activities undertaken since 1994 do not represent new sources of groundwater contamination. Therefore, consistent with Regulation 41 the data collected after 1994 "shall be presumed to be representative of existing quality as of January 31, 1994".

CC&V has proposed a series of new or revised NPLs in conjunction with the installation of new monitoring wells, designation of Points of Compliance (POC) for groundwater monitoring, and recognition of certain constituents that have historically and continue to occur at elevated concentrations in groundwater. NPLs proposed for future comparison to groundwater quality monitoring results are summarized in Table 3.

Further to the implementation of these NPLs, CC&V will continue monitoring groundwater quality at the existing monitoring wells and the new POC wells once they have been installed. Groundwater quality at the new POC wells will be reviewed once at least two quarters of sampling and analysis data are available and the NPLs will be reviewed to confirm they remain appropriate.

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Table 3. Summary of Proposed NPLs

Analyte	Colorado Reg 41 (Table 1-4)	Proposed NPLs for Point of Compliance Wells (May 2022)						
Location/Well	**Whole State**	**POC Wells (Unless Otherwise Listed)**	**Arequa Gulch**	**Rosebud Gulch**	**Poverty Gulch**	**Grassy Valley**	**Vindicator Valley**	**Wilson Creek**
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Aluminum	5	7			20			
Arsenic	0.01	0.01						
Beryllium	0.004	-						
Cadmium	0.005	0.005			0.022			
Cobalt	0.05	-			0.08			
Copper	0.2	0.2			1			
Fluoride	2	2	9.9	9.9	9.9	9.9	9.9	9.9
Iron	5	14						
Lead	0.05	0.05						
Manganese	0.2	3		8.1	22.5		4	
Mercury	0.002	0.002						
Nickel	0.1	0.2						
Nitrite	1	1						
Nitrate	10	10						
Nitrate &Nitrite	10	11						
Selenium	0.02	0.024						
Sulfate	250	-		1,070	1,070		800	
Zinc	2	2						
Cyanide (WAD)	-	0.2						
Cyanide (Free)	0.2	-						
pH	6.5 to 8.5	6.0 to 8.5			3.4 to 8.5		6.6 to 8.5	

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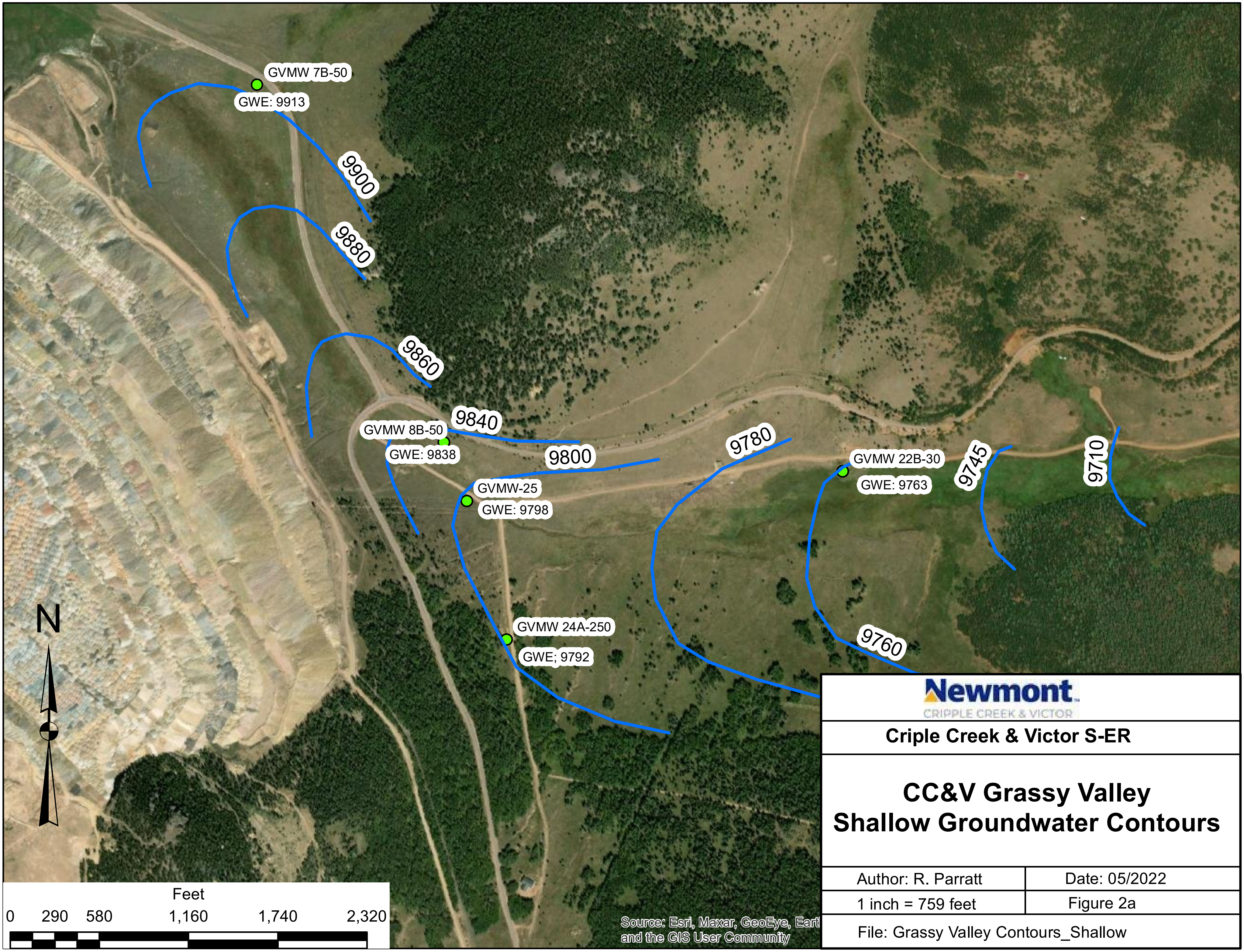
newmont.com

Attachment B - Contour Maps



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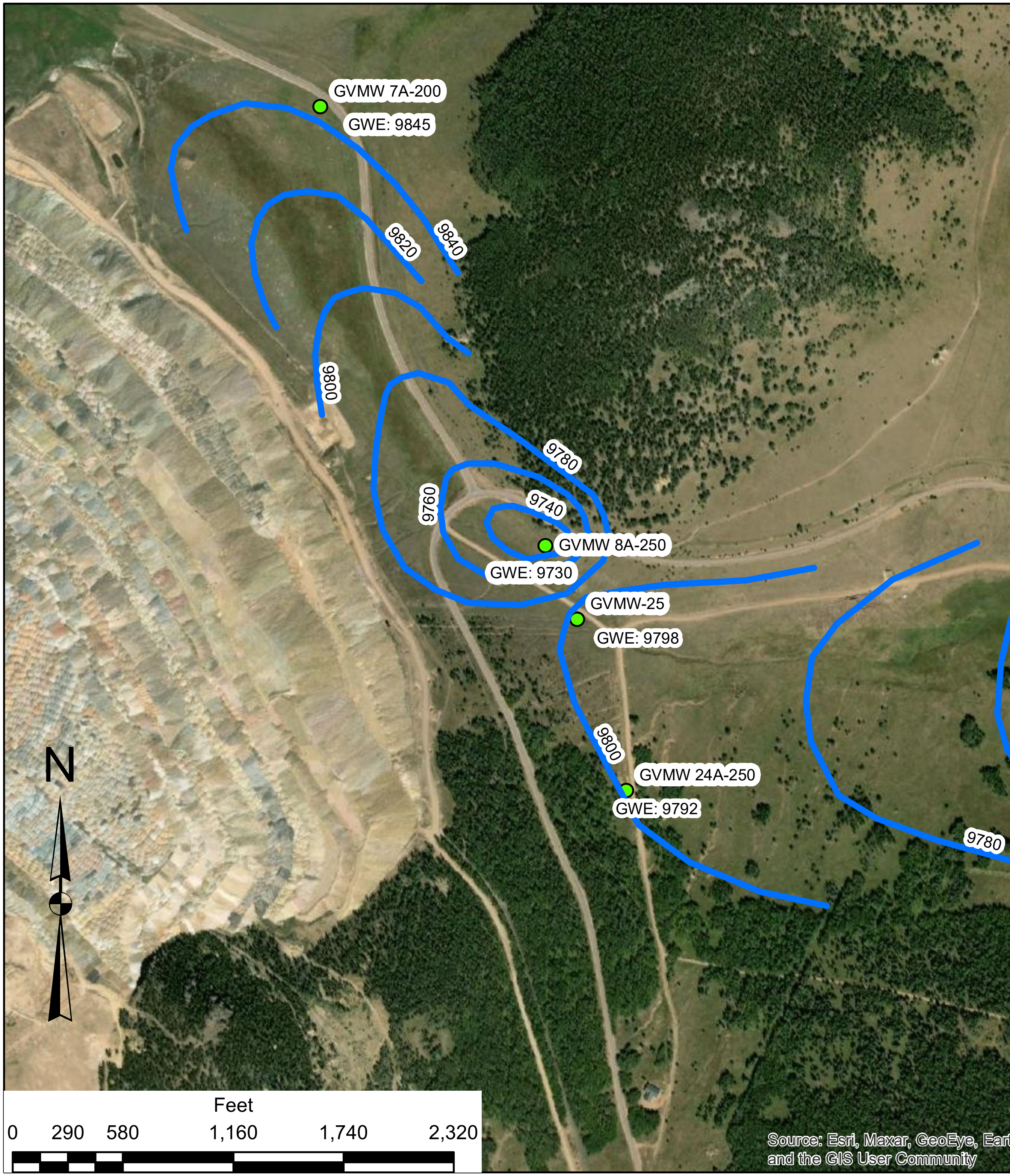
Criple Creek & Victor S-ER

CC&V Grassy Valley Shallow Groundwater Contours

Author: R. Parratt	Date: 05/2022
1 inch = 759 feet	Figure 2a
File: Grassy Valley Contours_Shallow	



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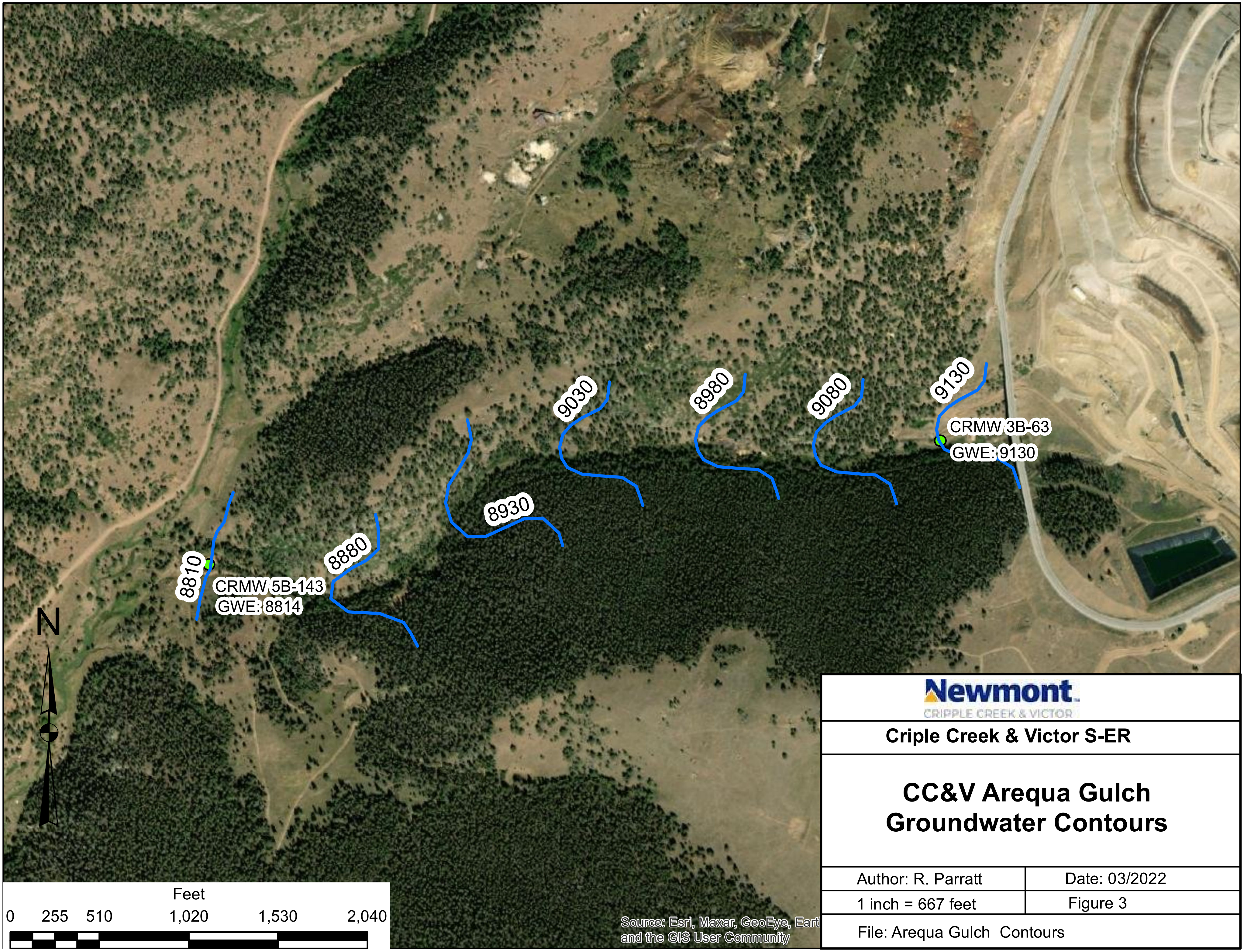
Criple Creek & Victor S-ER

CC&V Grassy Valley Deep Groundwater Contours

Author: R. Parratt	Date: 05/2022
1 inch = 759 feet	Figure 2b
File: Test_1	



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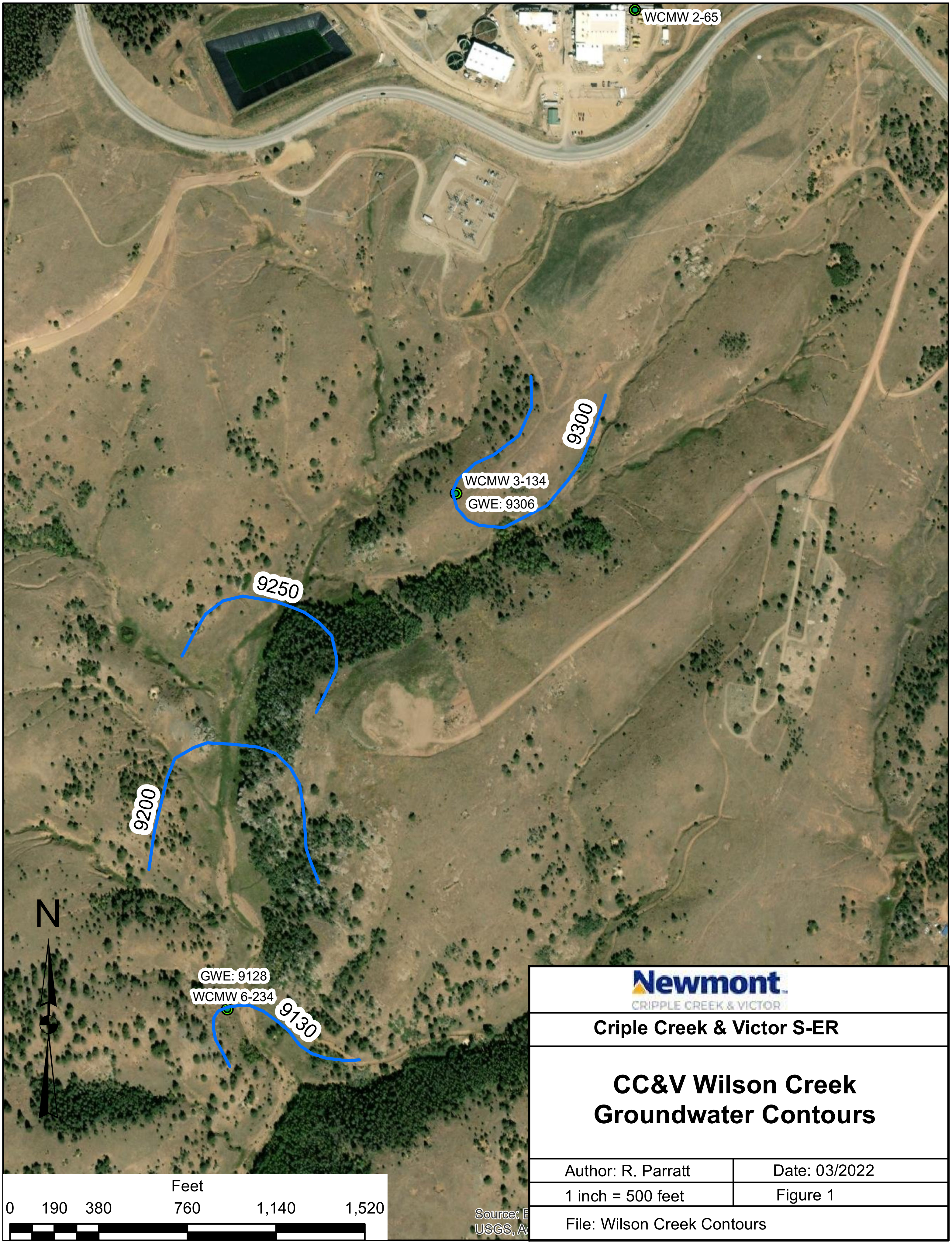
CC&V Arequa Gulch Groundwater Contours

Author: R. Parratt	Date: 03/2022
1 inch = 667 feet	Figure 3
File: Arequa Gulch Contours	


WCMW 2-65
9300
WCMW 3-134
GWE: 9306
9250
9200
N
GWE: 9128
WCMW 6-234
9130
Feet
0 190 380 760 1,140 1,520
Newmont
CRIPPLE CREEK & VICTOR
Criple Creek & Victor S-ER
CC&V Wilson Creek
Groundwater Contours
Author: R. Parratt
Date: 03/2022
1 inch = 500 feet
Figure 1
File: Wilson Creek Contours

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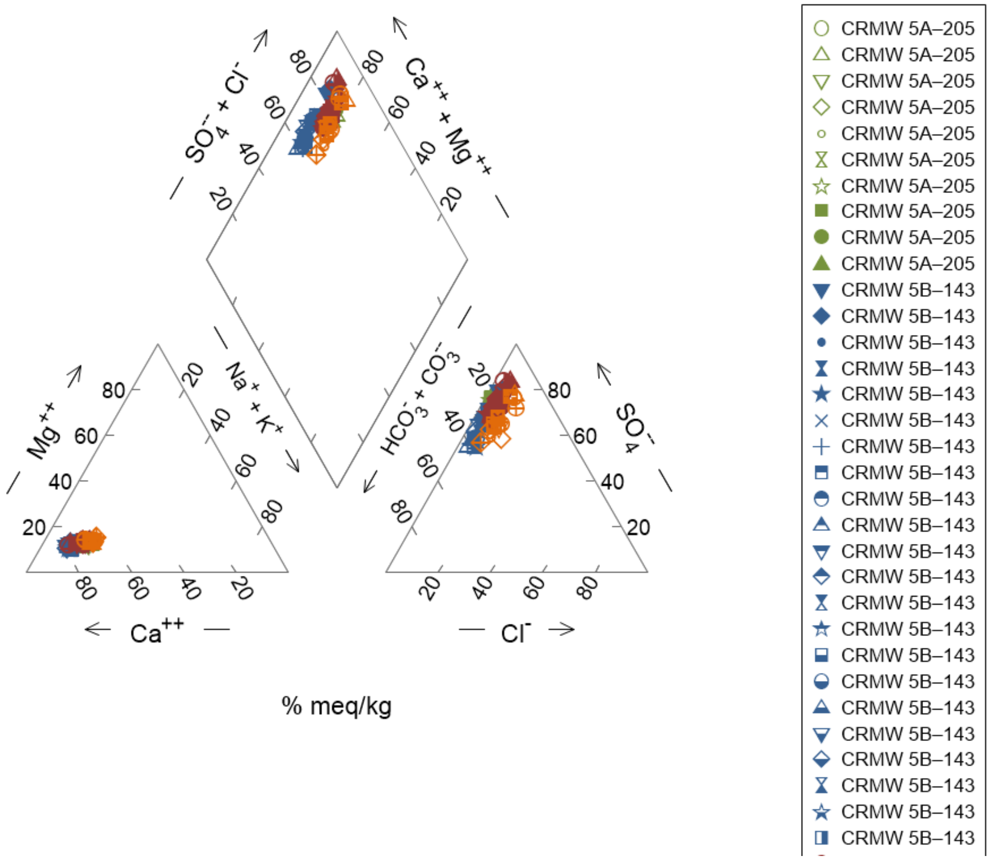
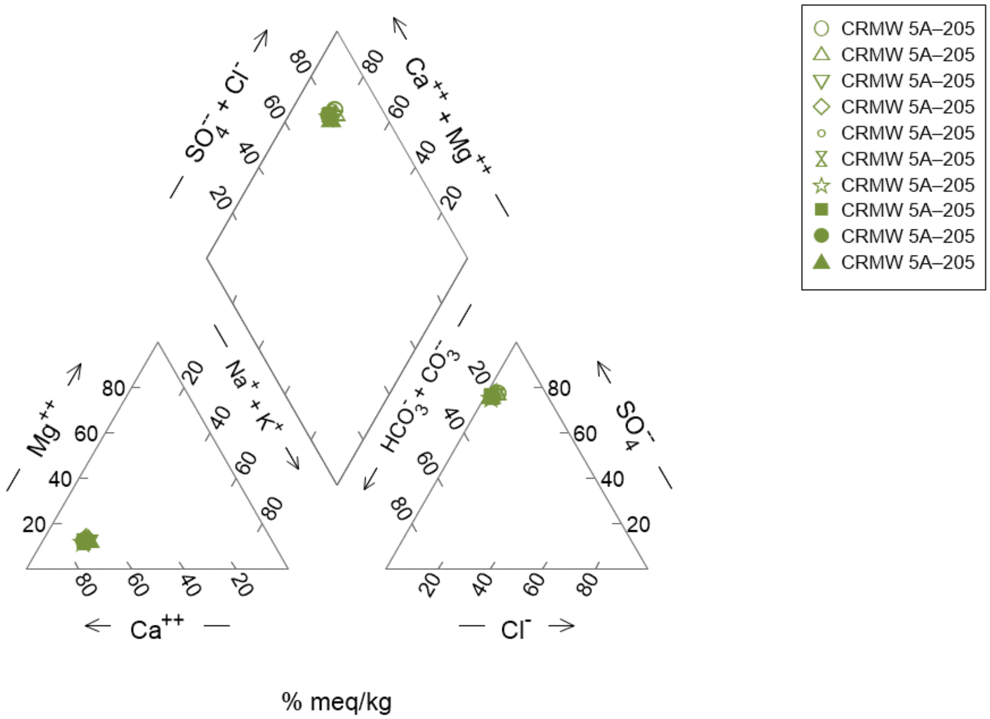
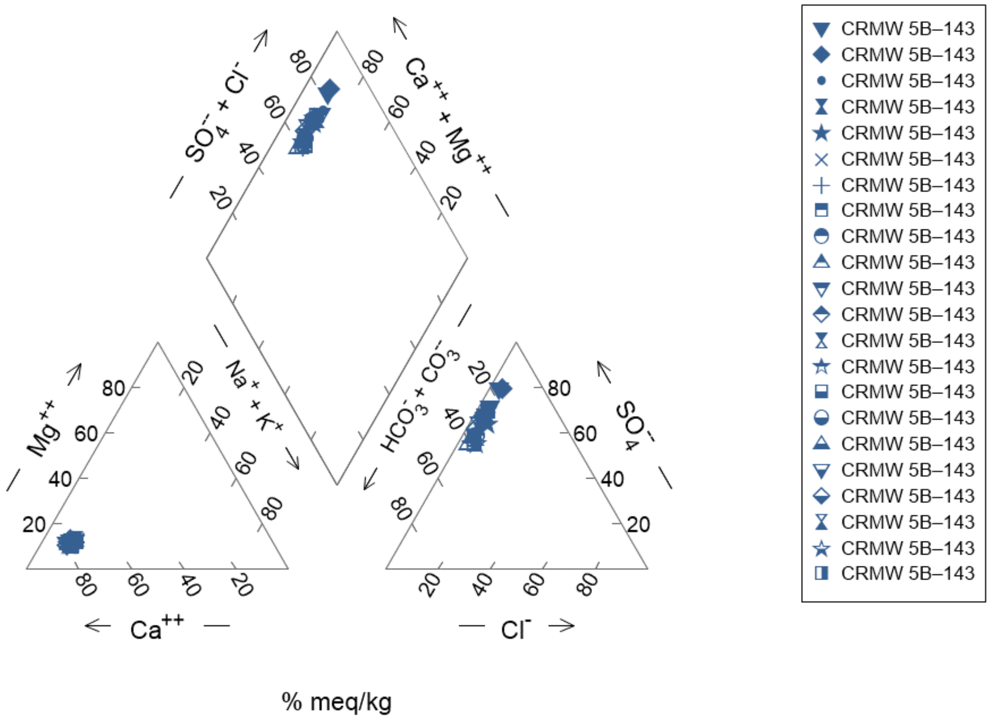
Attachment C - Piper Diagrams



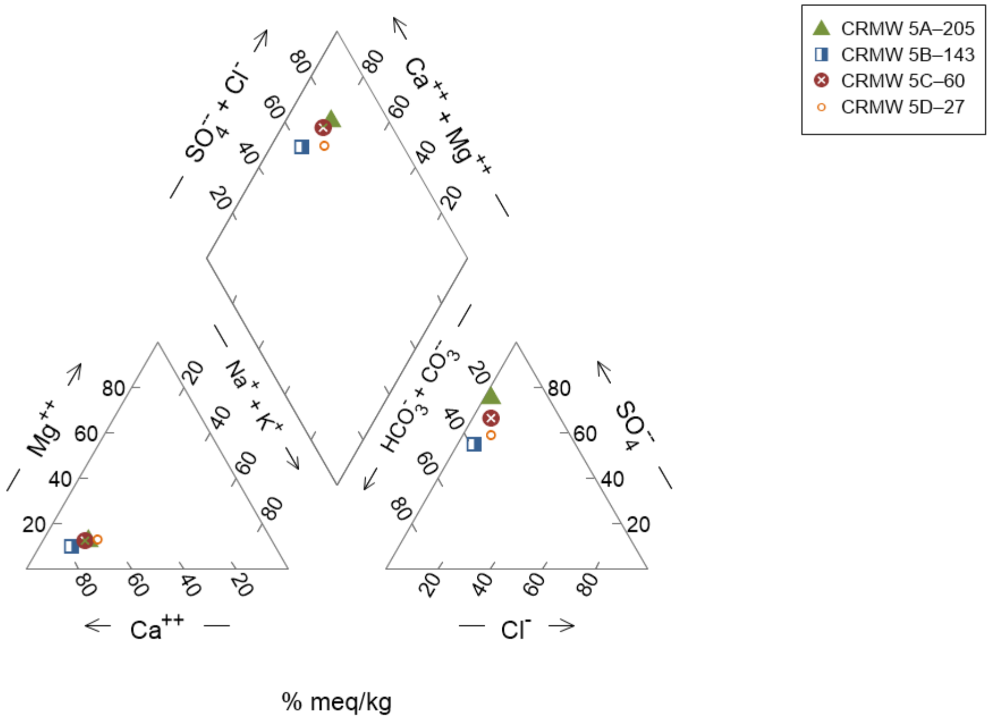
SO4-- + Cl-
Ca++ + Mg++
Mg++
Na+ + K+
HCO3- + CO3--
SO4--
Ca++
Cl-
20
40
60
80
% meq/kg
CRMW 5A–205
CRMW 5B–143



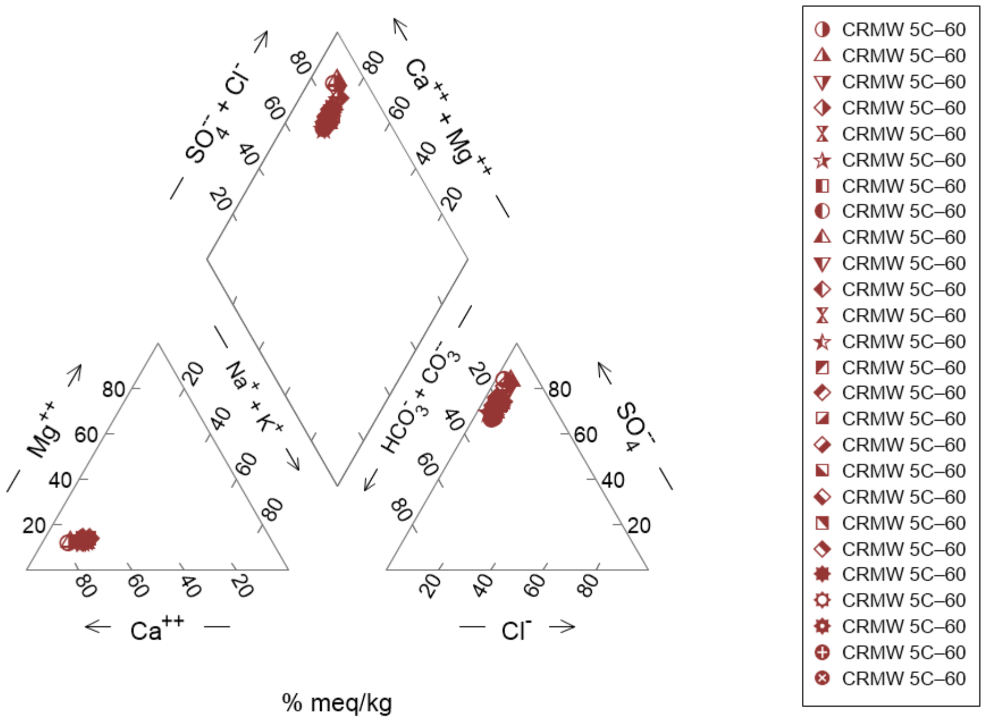
CRMW 5A–205
CRMW 5A–205
CRMW 5A–205
CRMW 5A–205
CRMW 5A–205
CRMW 5A–205
CRMW 5A–205
CRMW 5A–205
CRMW 5A–205
CRMW 5A–205
$SO_4^{--} + Cl^-$
$Ca^{++} + Mg^{++}$
Mg^{++}
$Na^+ + K^+$
$HCO_3^- + CO_3^{--}$
SO_4^{--}
Ca^{++}
Cl^-
20
40
60
80
% meq/kg



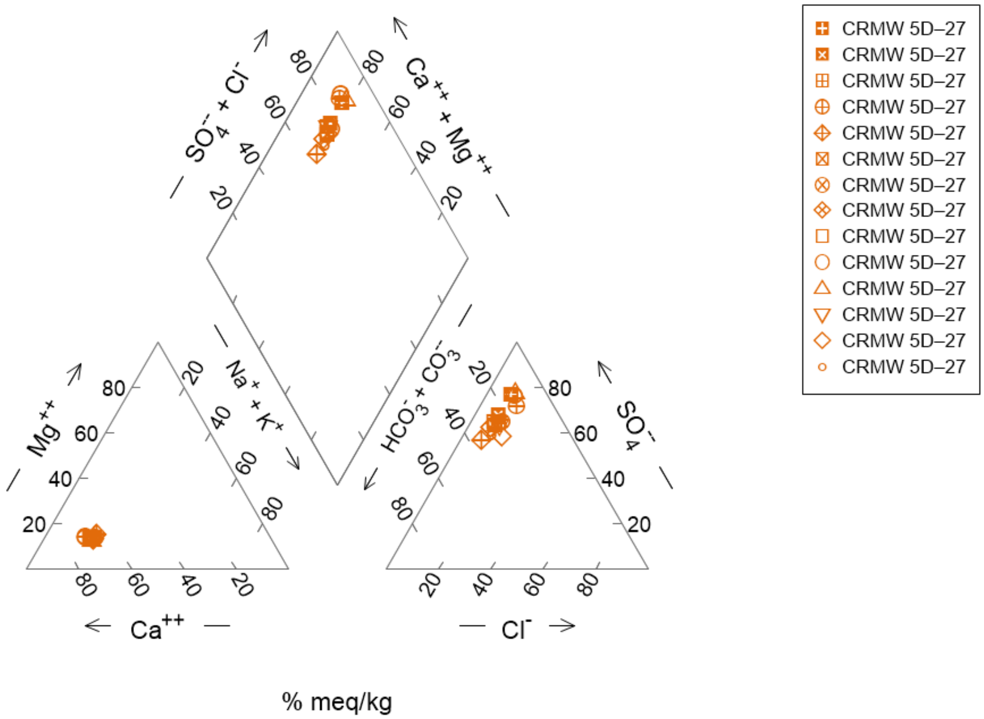
SO4-- + Cl-
Ca++ + Mg++
Mg++
Na+ + K+
HCO3- + CO3-
SO4-
Ca++
Cl-
20
40
60
80
% meq/kg
CRMW 5B–143



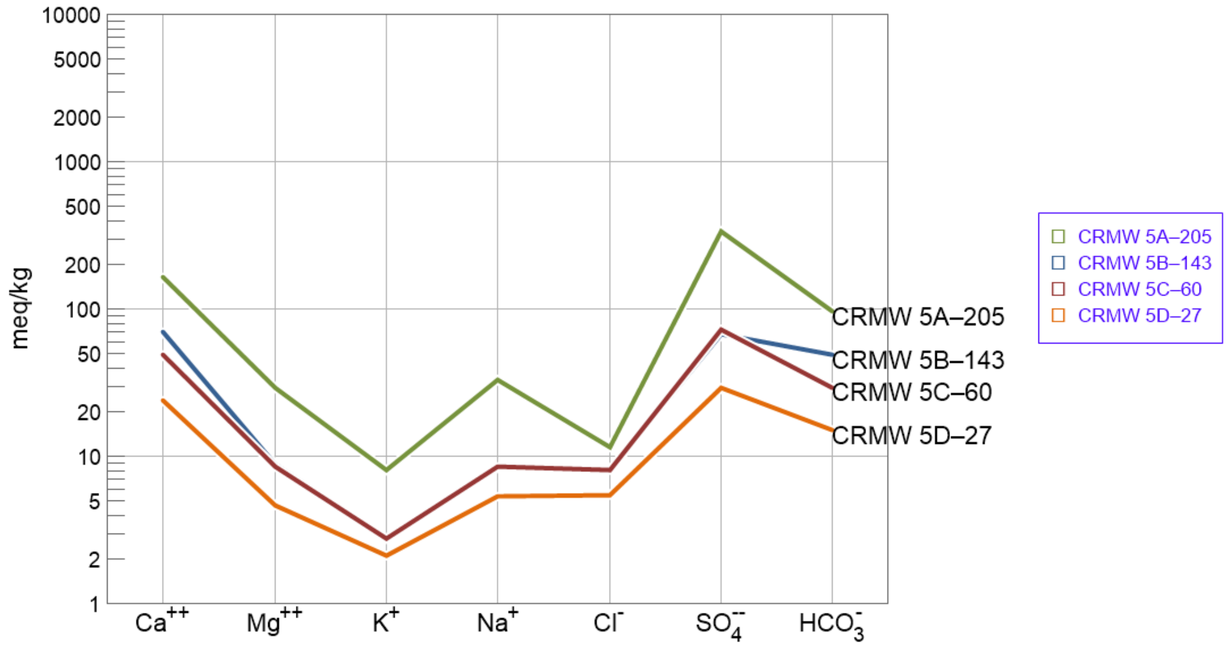
CRMW 5A–205
CRMW 5B–143
CRMW 5C–60
CRMW 5D–27
SO4-- + Cl-
Ca++ + Mg++
Mg++
Na+ + K+
HCO3- + CO3--
SO4--
Ca++
Cl-
20
40
60
80
% meq/kg



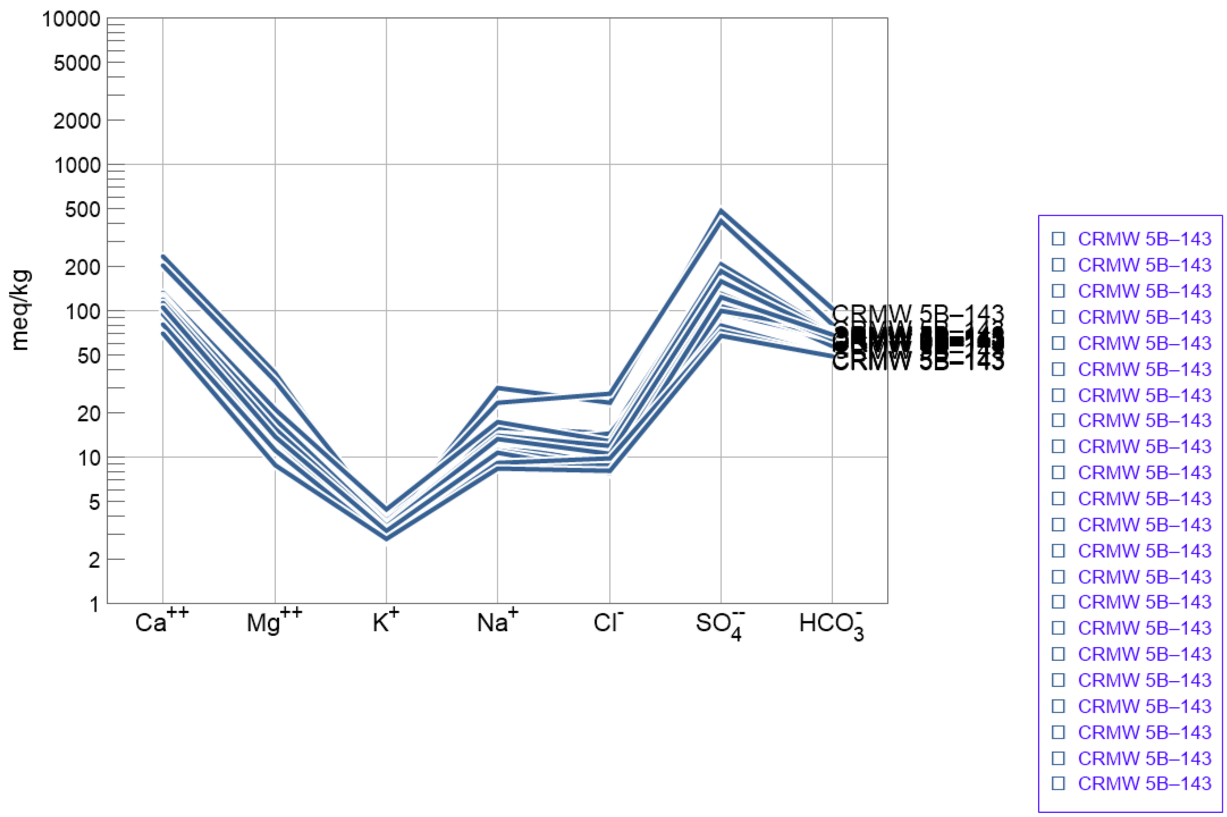
SO4-- + Cl-
Ca++ + Mg++
Mg++
Na+ + K+
HCO3- + CO3--
SO4--
Ca++
Cl-
20
40
60
80
% meq/kg
CRMW 5C–60



CRMW 5D–27
CRMW 5D–27
CRMW 5D–27
CRMW 5D–27
CRMW 5D–27
CRMW 5D–27
CRMW 5D–27
CRMW 5D–27
CRMW 5D–27
CRMW 5D–27
CRMW 5D–27
CRMW 5D–27
CRMW 5D–27
CRMW 5D–27
$SO_4^{--} + Cl^-$
$Ca^{++} + Mg^{++}$
Mg^{++}
$Na^+ + K^+$
$HCO_3^- + CO_3^{--}$
SO_4^{--}
Ca^{++}
Cl^-
20
40
60
80
% meq/kg



meq/kg
10000
5000
2000
1000
500
200
100
50
20
10
5
2
1
Ca++
Mg++
K+
Na+
Cl-
SO4--
HCO3-
CRMW 5A–205
CRMW 5B–143
CRMW 5C–60
CRMW 5D–27



meq/kg
10000
5000
2000
1000
500
200
100
50
20
10
5
2
1
Ca++
Mg++
K+
Na+
Cl-
SO4--
HCO3-
CRMW 5B–143
CRMW 5B–143
CRMW 5B–143
CRMW 5B–143
CRMW 5B–143
CRMW 5B–143
CRMW 5B–143
CRMW 5B–143
CRMW 5B–143
CRMW 5B–143
CRMW 5B–143
CRMW 5B–143
CRMW 5B–143
CRMW 5B–143
CRMW 5B–143
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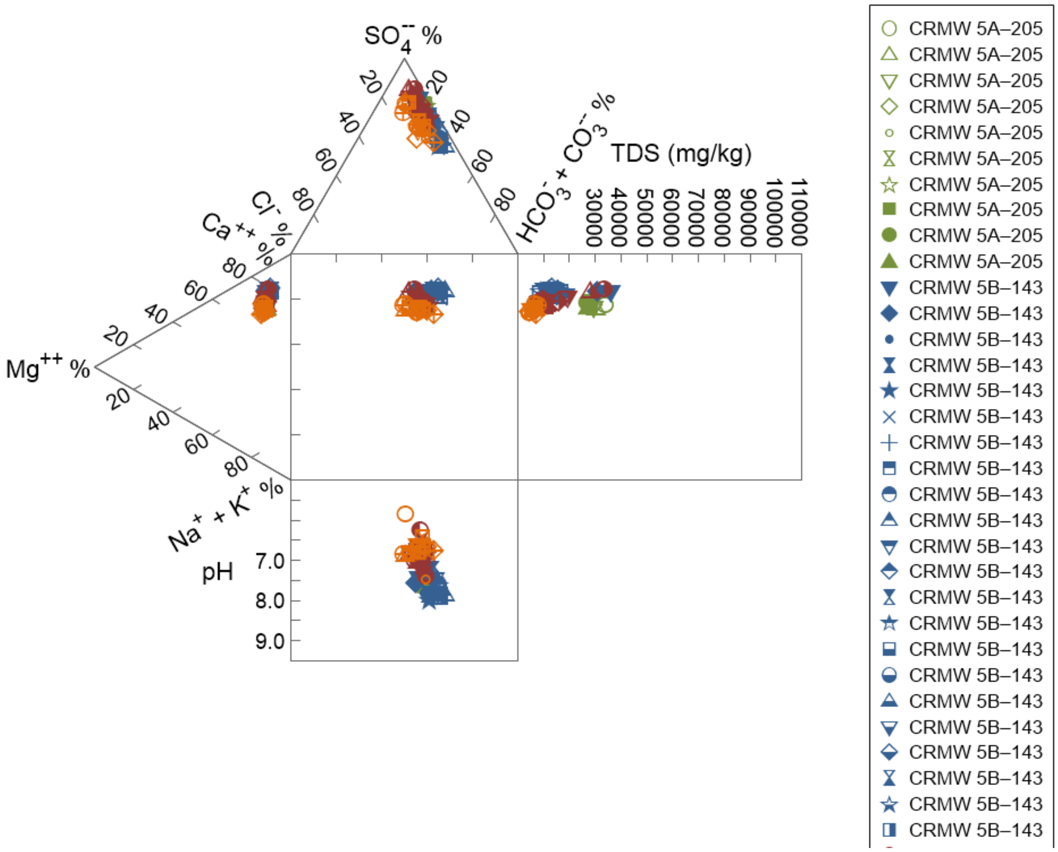
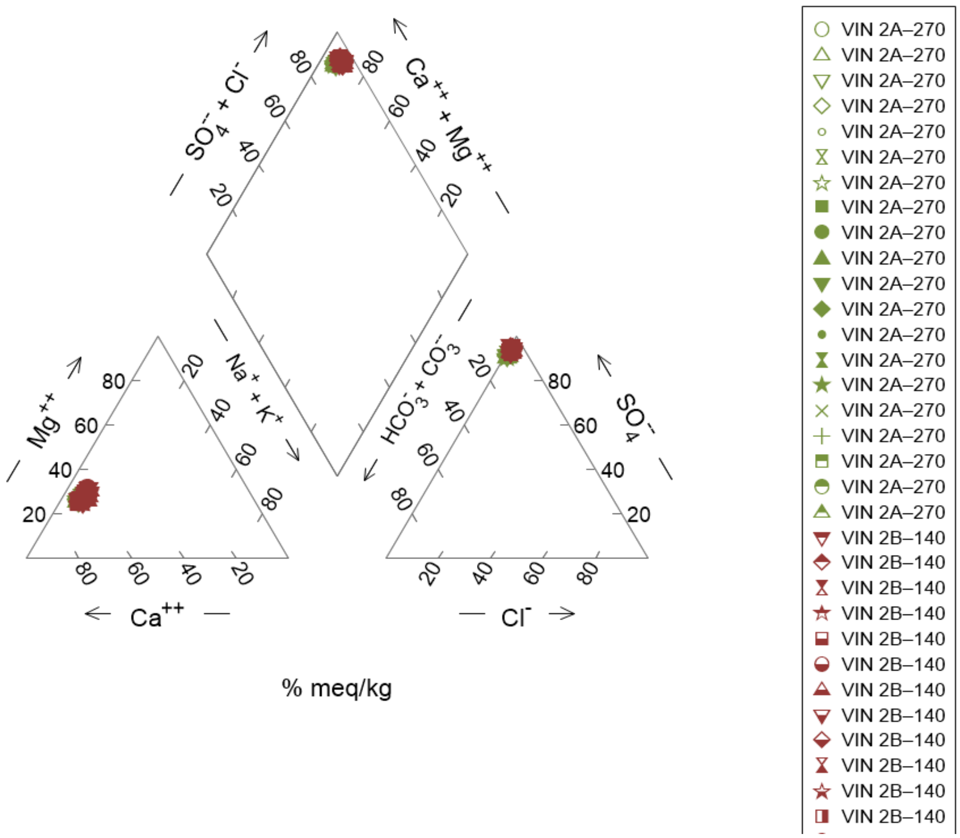
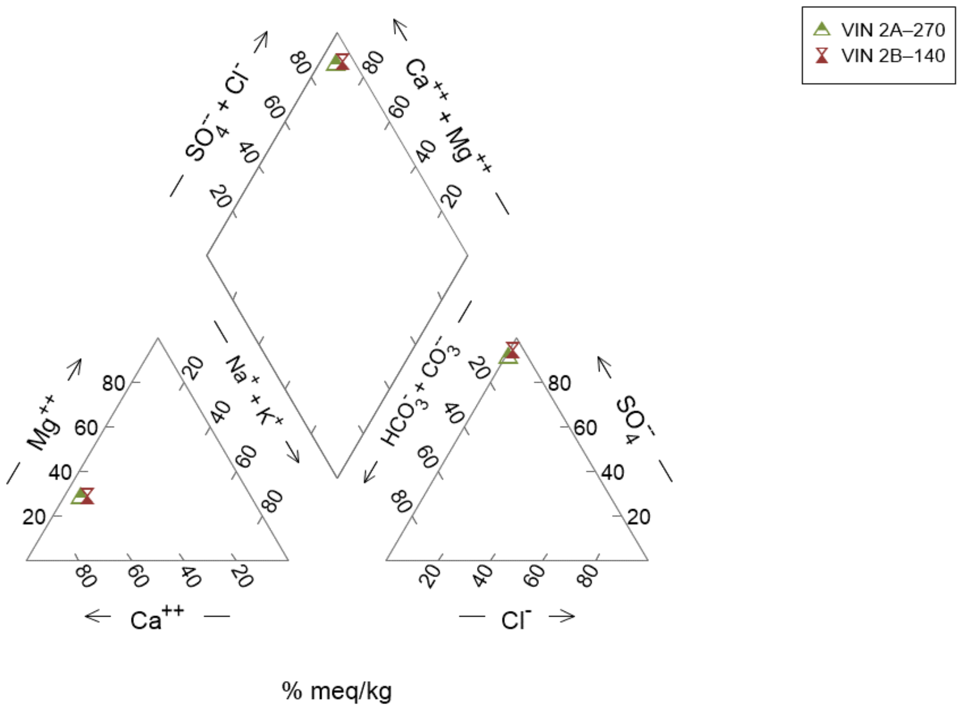
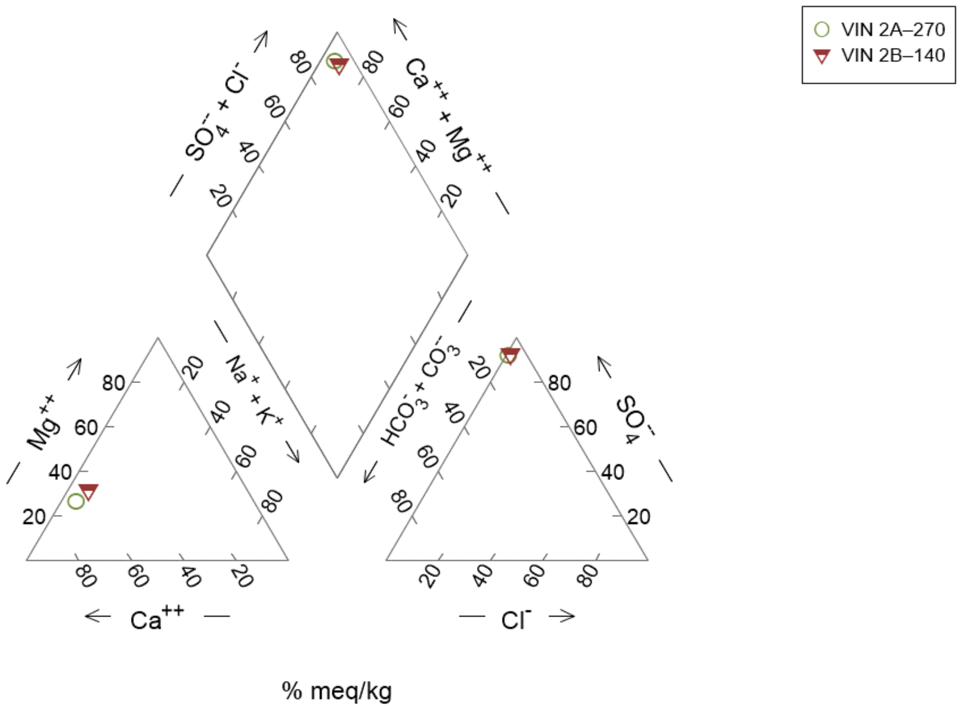
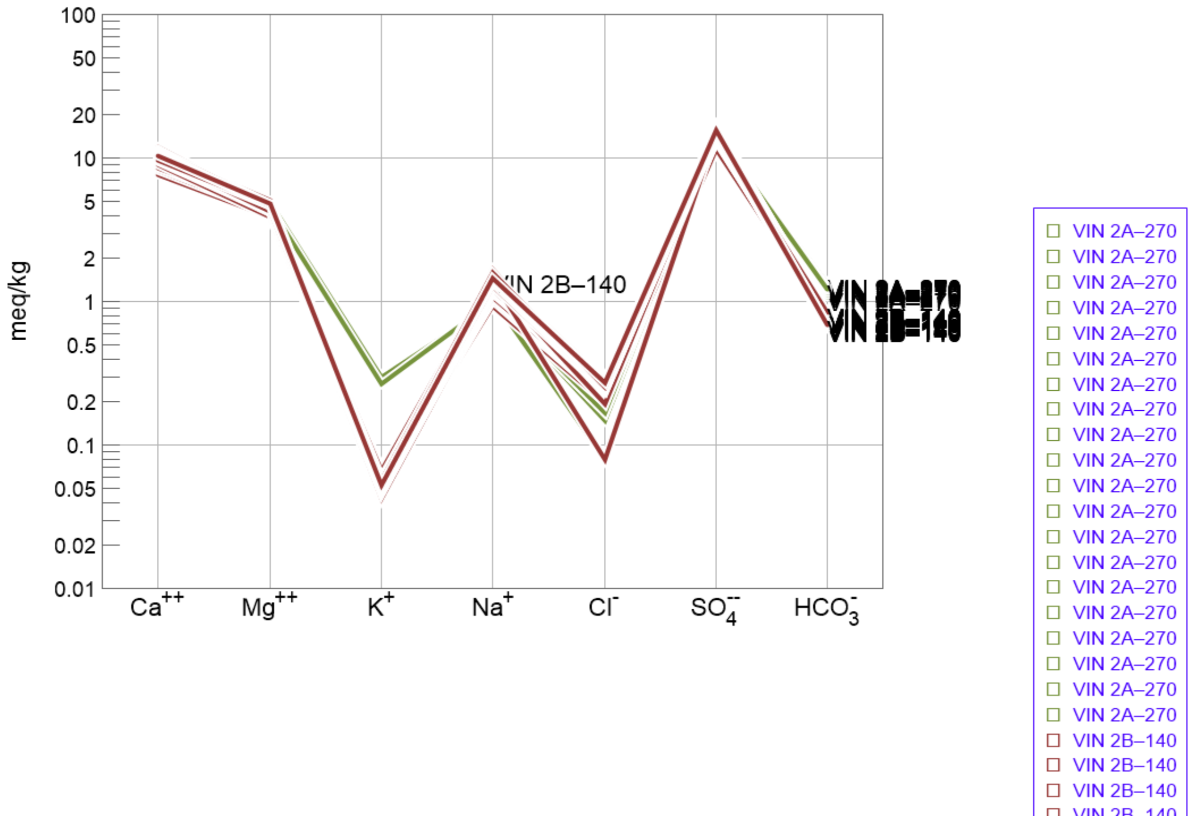
CRMW 5B–143
CRMW 5B–143


SO4 %
Cl- %
Ca++ %
Mg++ %
Na+ + K+ %
HCO3- + CO3-- %
TDS (mg/kg)
30000
40000
50000
60000
70000
80000
90000
100000
110000
pH
7.0
8.0
9.0
CRMW 5A–205
CRMW 5B–143


SO4-- + Cl-
Ca++ + Mg++
Mg++
Na+ + K+
HCO3- + CO3--
SO4--
Ca++
Cl-
20
40
60
80
% meq/kg
VIN 2A–270
VIN 2B–140


VIN 2A–270
VIN 2B–140
$SO_4^{--} + Cl^-$
$Ca^{++} + Mg^{++}$
$Na^+ + K^+$
$HCO_3^- + CO_3^{--}$
Mg^{++}
SO_4^{--}
Ca^{++}
Cl^-
% meq/kg


VIN 2A–270
VIN 2B–140
SO4 + Cl
Ca++ + Mg++
Na+ + K+
HCO3 + CO3
Mg++
SO4
Ca++
Cl
80
60
40
20
% meq/kg


100
50
20
10
5
2
1
0.5
0.2
0.1
0.05
0.02
0.01
meq/kg
Ca++
Mg++
K+
Na+
Cl-
SO4--
HCO3-
VIN 2B–140
VIN 2A–270
VIN 2A–270
VIN 2A–270
VIN 2A–270
VIN 2A–270
VIN 2A–270
VIN 2A–270
VIN 2A–270
VIN 2A–270
VIN 2A–270
VIN 2A–270
VIN 2A–270
VIN 2A–270
VIN 2A–270
VIN 2A–270
VIN 2A–270
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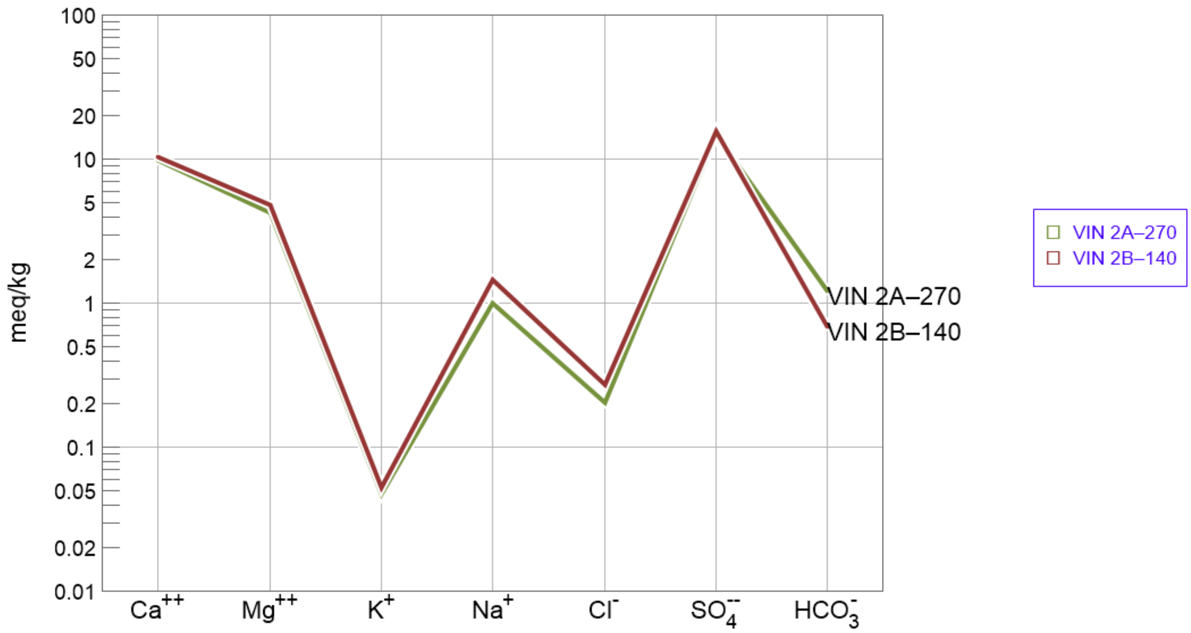
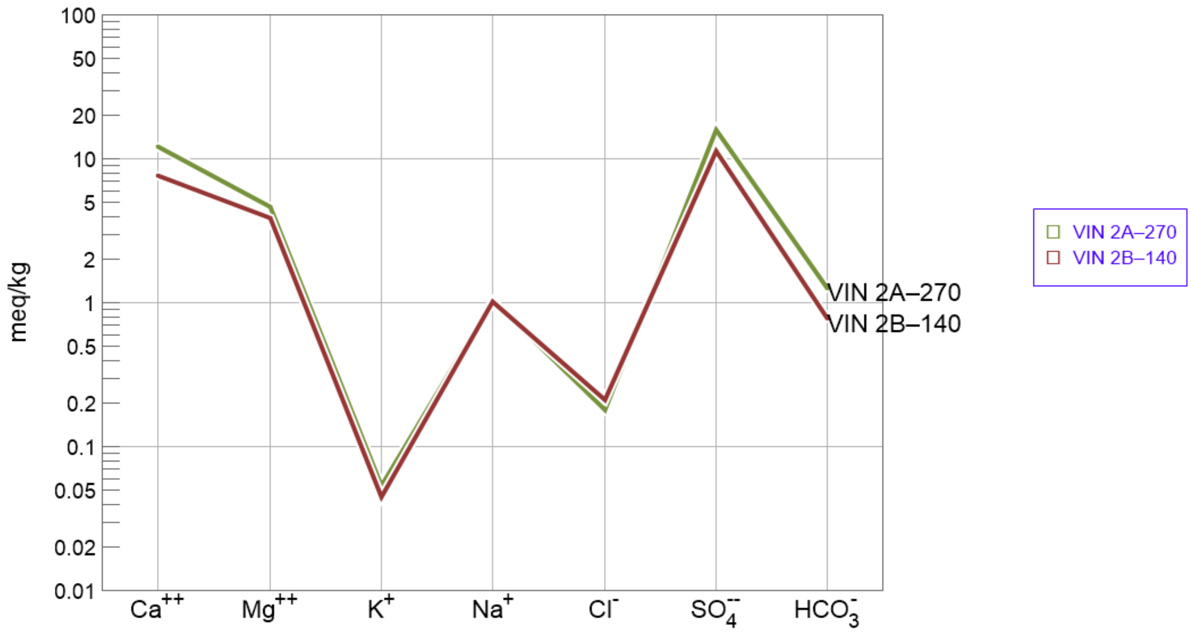
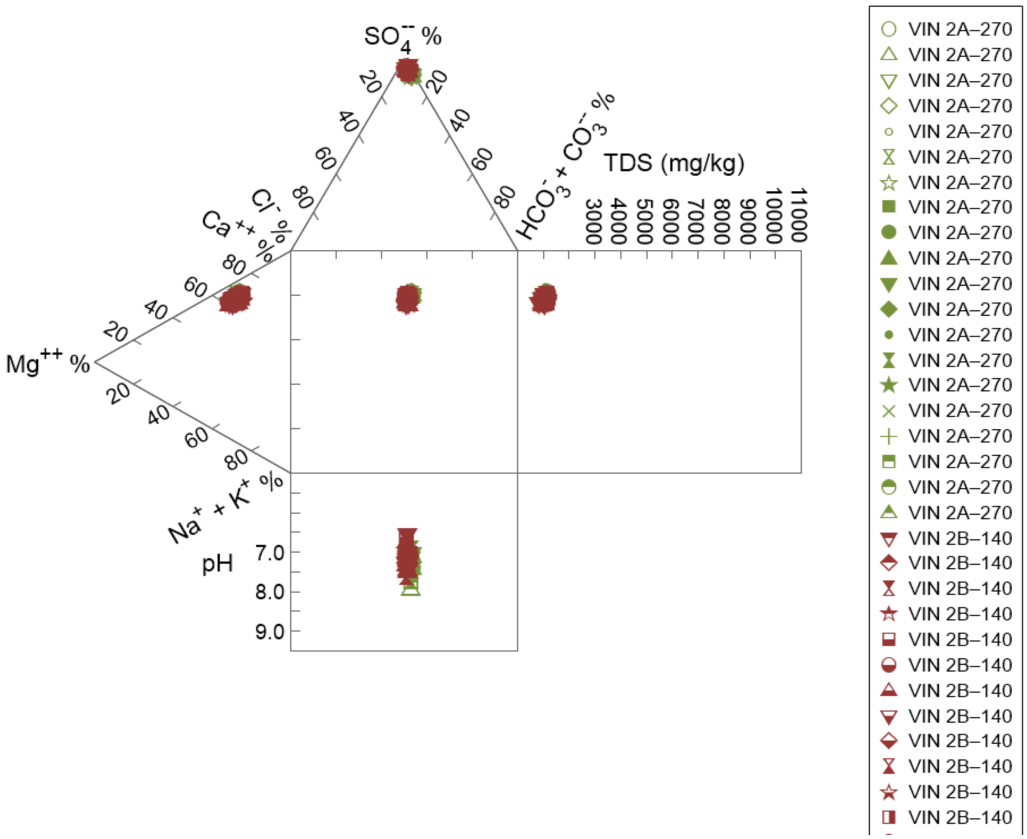
VIN 2A–270
VIN 2B–140
VIN 2B–140
VIN 2B–140

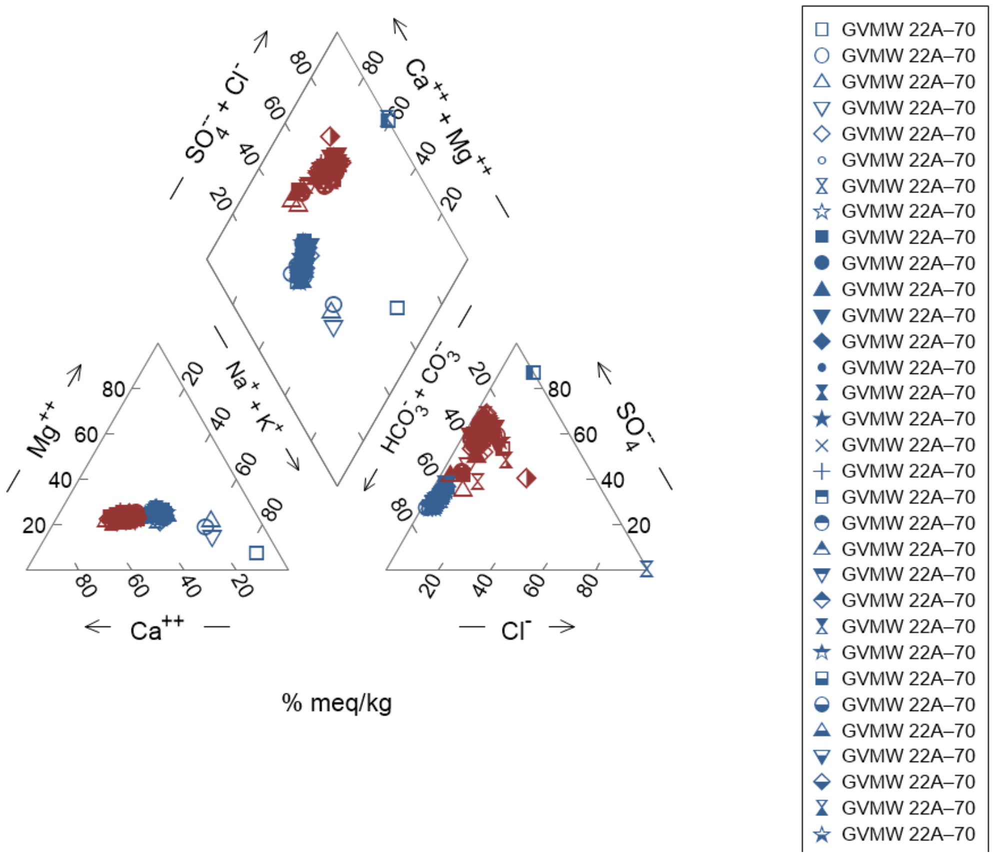

100
50
20
10
5
2
1
0.5
0.2
0.1
0.05
0.02
0.01
meq/kg
Ca++
Mg++
K+
Na+
Cl-
SO4--
HCO3-
VIN 2A–270
VIN 2B–140
VIN 2A–270
VIN 2B–140



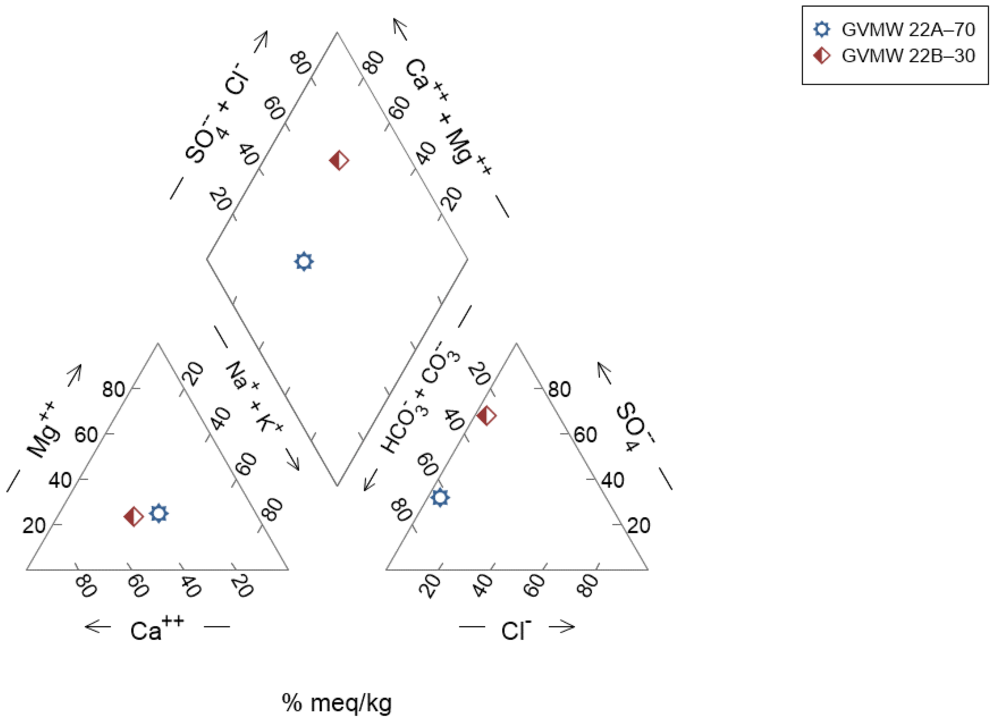
meq/kg
100
50
20
10
5
2
1
0.5
0.2
0.1
0.05
0.02
0.01
Ca^{++}
Mg^{++}
K^+
Na^+
Cl^-
SO_4^{--}
HCO_3^-
VIN 2A–270
VIN 2B–140
VIN 2A–270
VIN 2B–140

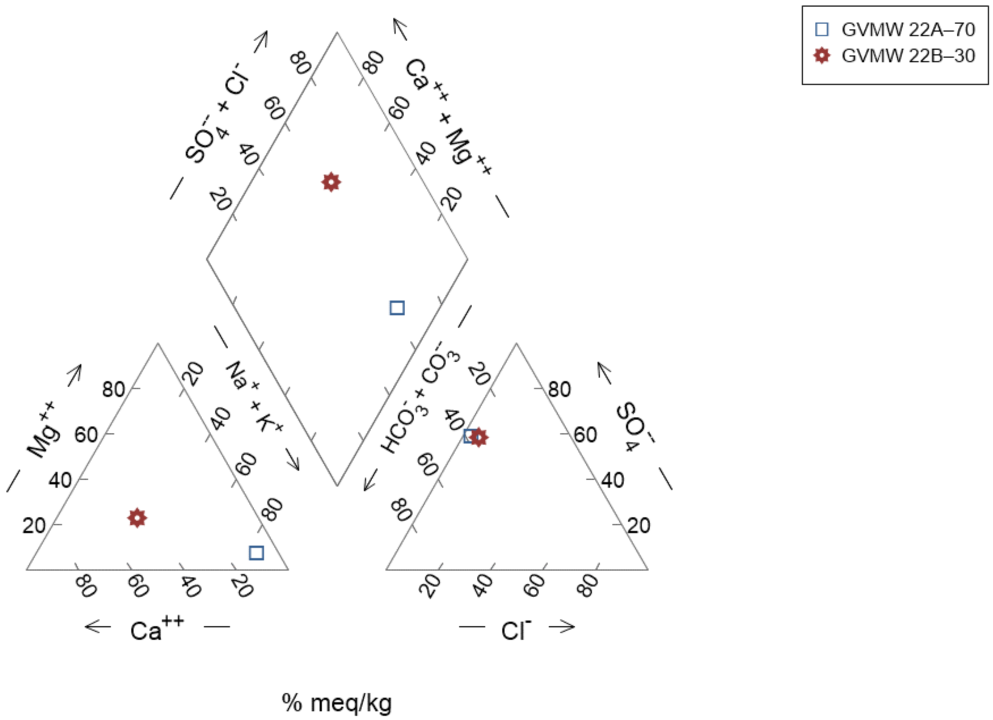


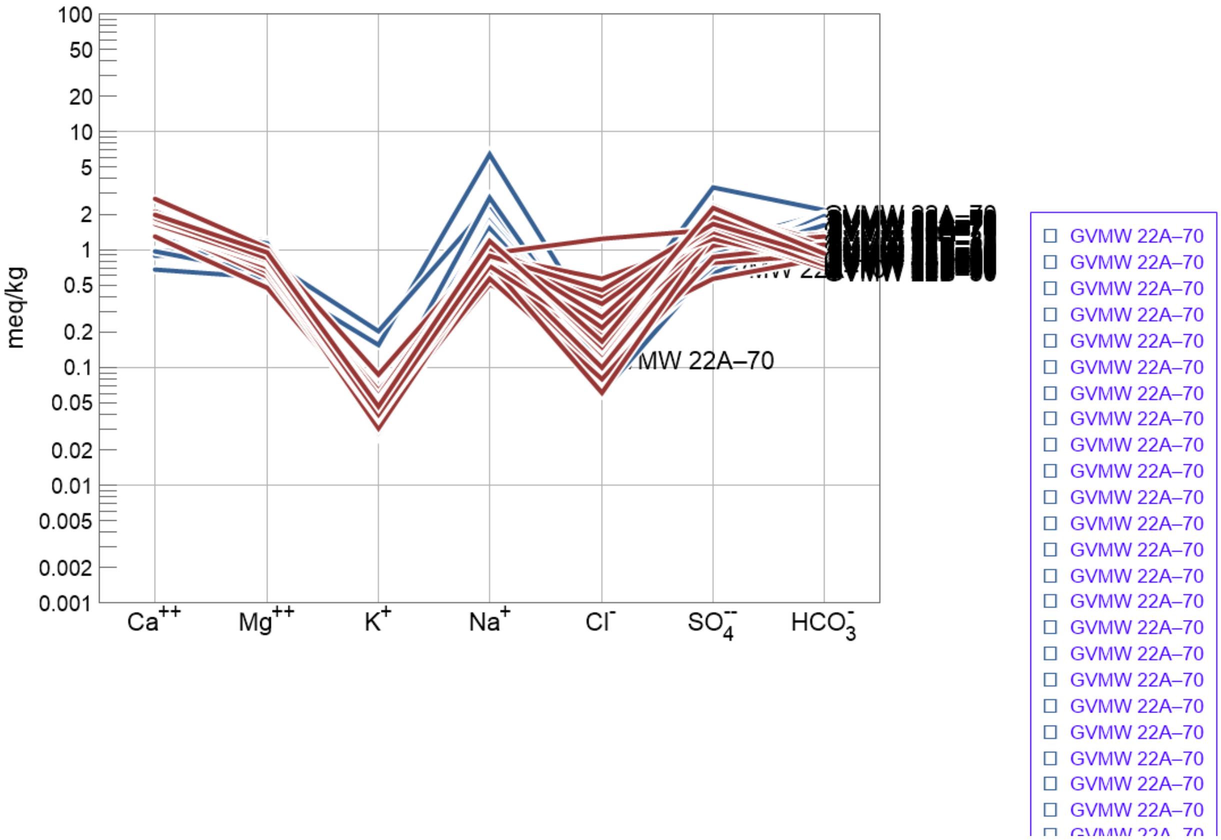
SO4-- %
HCO3- + CO3-- %
TDS (mg/kg)
Cl- %
Ca++ %
Mg++ %
Na+ + K+ %
pH
20
40
60
80
3000
4000
5000
6000
7000
8000
9000
10000
11000
7.0
8.0
9.0
VIN 2A–270
VIN 2B–140



SO4-- + Cl-
Ca++ + Mg++
Mg++
Na+ + K+
HCO3- + CO3--
SO4--
Ca++
Cl-
20
40
60
80
% meq/kg
GVMW 22A–70


GVMW 22A–70
GVMW 22B–30
$SO_4^{--} + Cl^-$
$Ca^{++} + Mg^{++}$
$Na^+ + K^+$
$HCO_3^- + CO_3^{--}$
Mg^{++}
SO_4^{--}
Ca^{++}
Cl^-
20
40
60
80
% meq/kg


GVMW 22A–70
GVMW 22B–30
$SO_4^{--} + Cl^-$
$Ca^{++} + Mg^{++}$
$Na^+ + K^+$
$HCO_3^- + CO_3^{--}$
Mg^{++}
SO_4^{--}
Ca^{++}
Cl^-
20
40
60
80
% meq/kg



100
50
20
10
5
2
1
0.5
0.2
0.1
0.05
0.02
0.01
0.005
0.002
0.001
meq/kg
Ca^{++}
Mg^{++}
K^{+}
Na^{+}
Cl^{-}
SO_4^{--}
HCO_3^{-}
MW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
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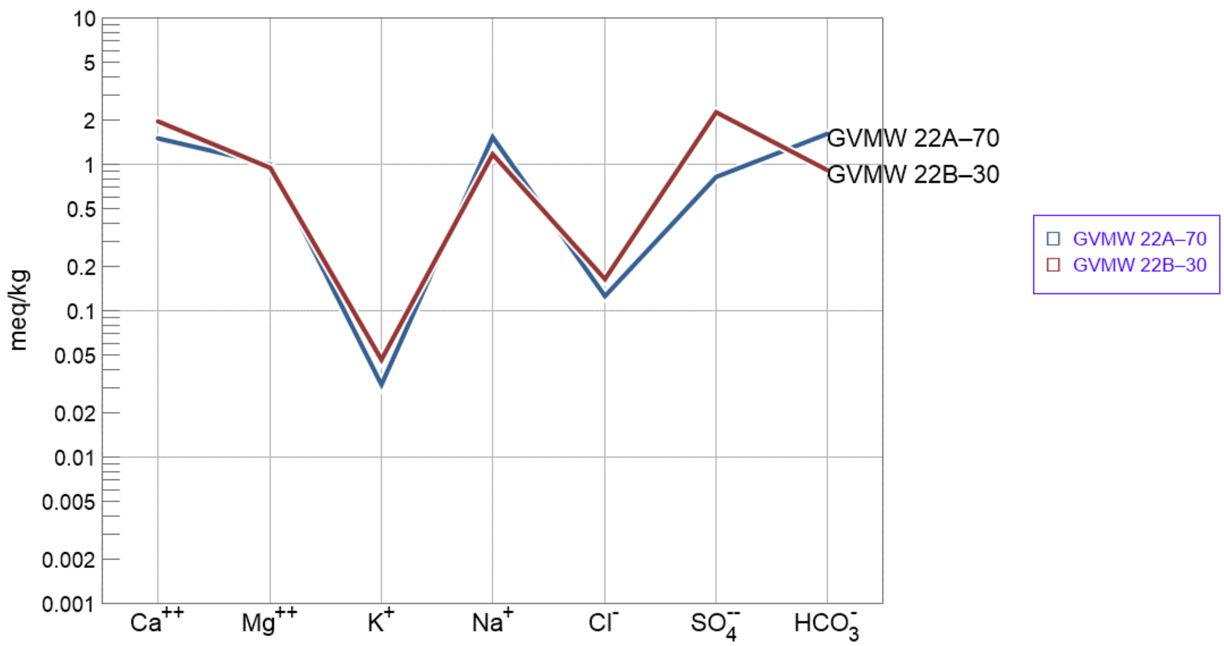
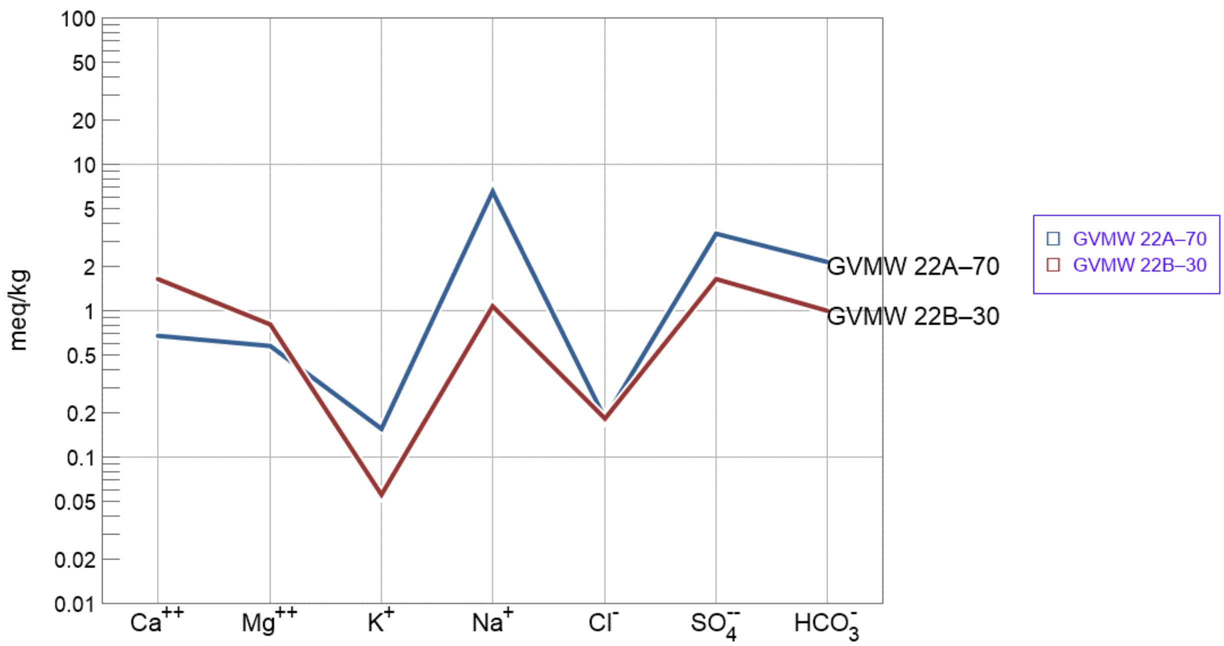
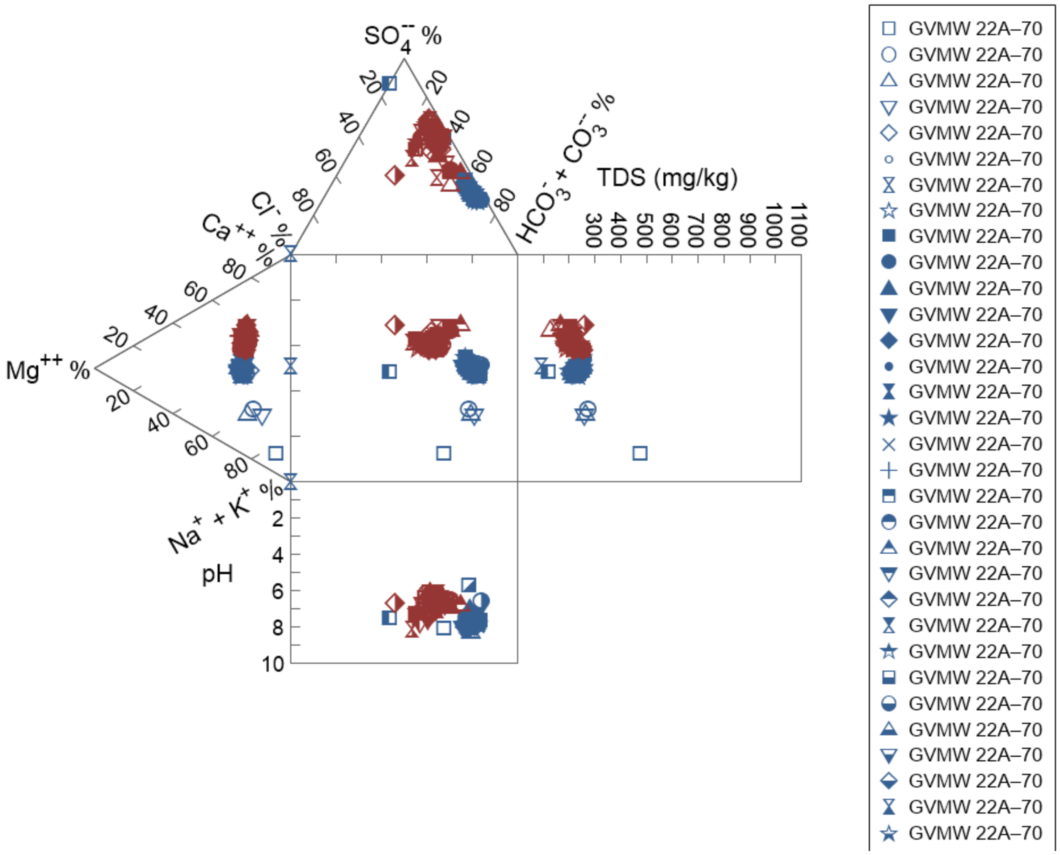
GVMW 22A–70



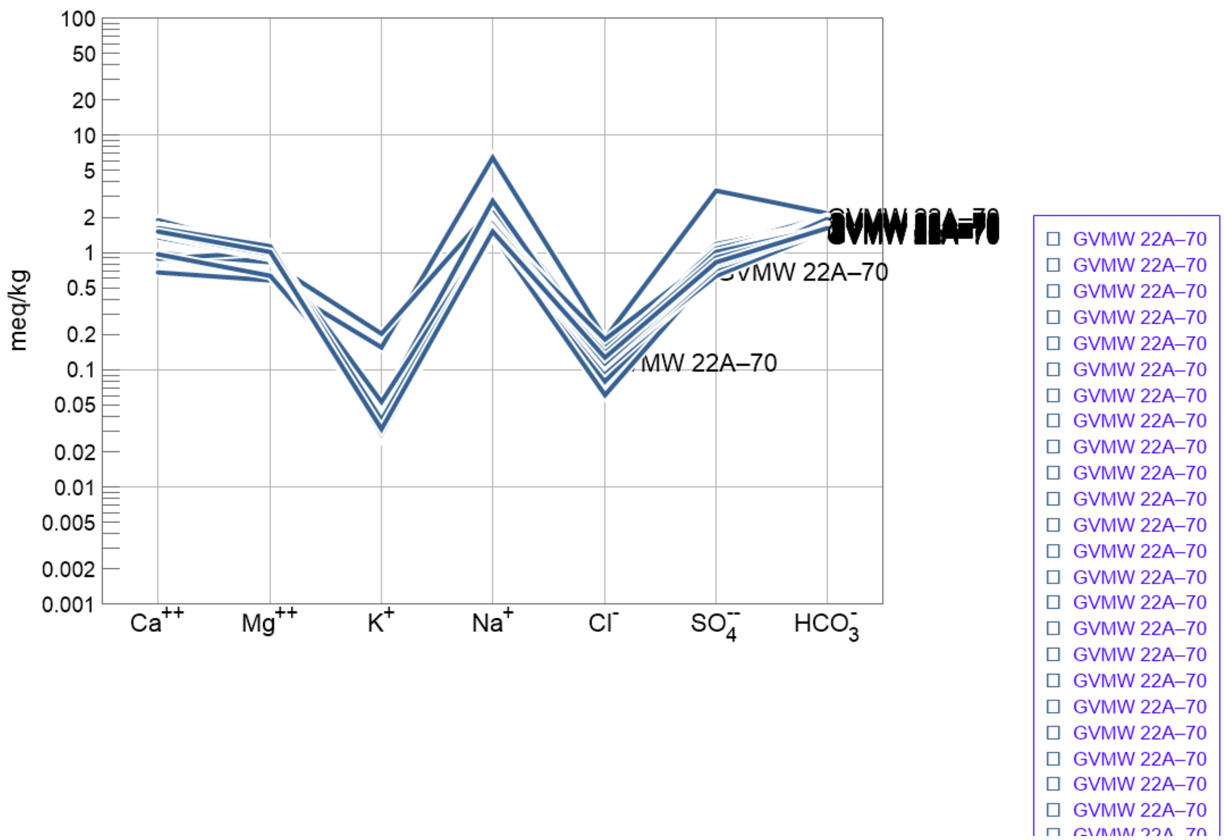
10
5
2
1
0.5
0.2
0.1
0.05
0.02
0.01
0.005
0.002
0.001
meq/kg
Ca++
Mg++
K+
Na+
Cl-
SO4--
HCO3-
GVMW 22A–70
GVMW 22B–30
GVMW 22A–70
GVMW 22B–30



meq/kg
100
50
20
10
5
2
1
0.5
0.2
0.1
0.05
0.02
0.01
Ca^{++}
Mg^{++}
K^{+}
Na^{+}
Cl^{-}
SO_4^{--}
HCO_3^{-}
GVMW 22A–70
GVMW 22B–30
GVMW 22A–70
GVMW 22B–30



SO4-- %
Cl- %
Ca++ %
Mg++ %
Na+ + K+ %
HCO3- + CO3-- %
TDS (mg/kg)
pH
20
40
60
80
300
400
500
600
700
800
900
1000
1100
2
4
6
8
10
GVMW 22A–70



100
50
20
10
5
2
1
0.5
0.2
0.1
0.05
0.02
0.01
0.005
0.002
0.001
meq/kg
Ca^{++}
Mg^{++}
K^{+}
Na^{+}
Cl^{-}
SO_4^{--}
HCO_3^{-}
GVMW 22A–70
GVMW 22A–70
MW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
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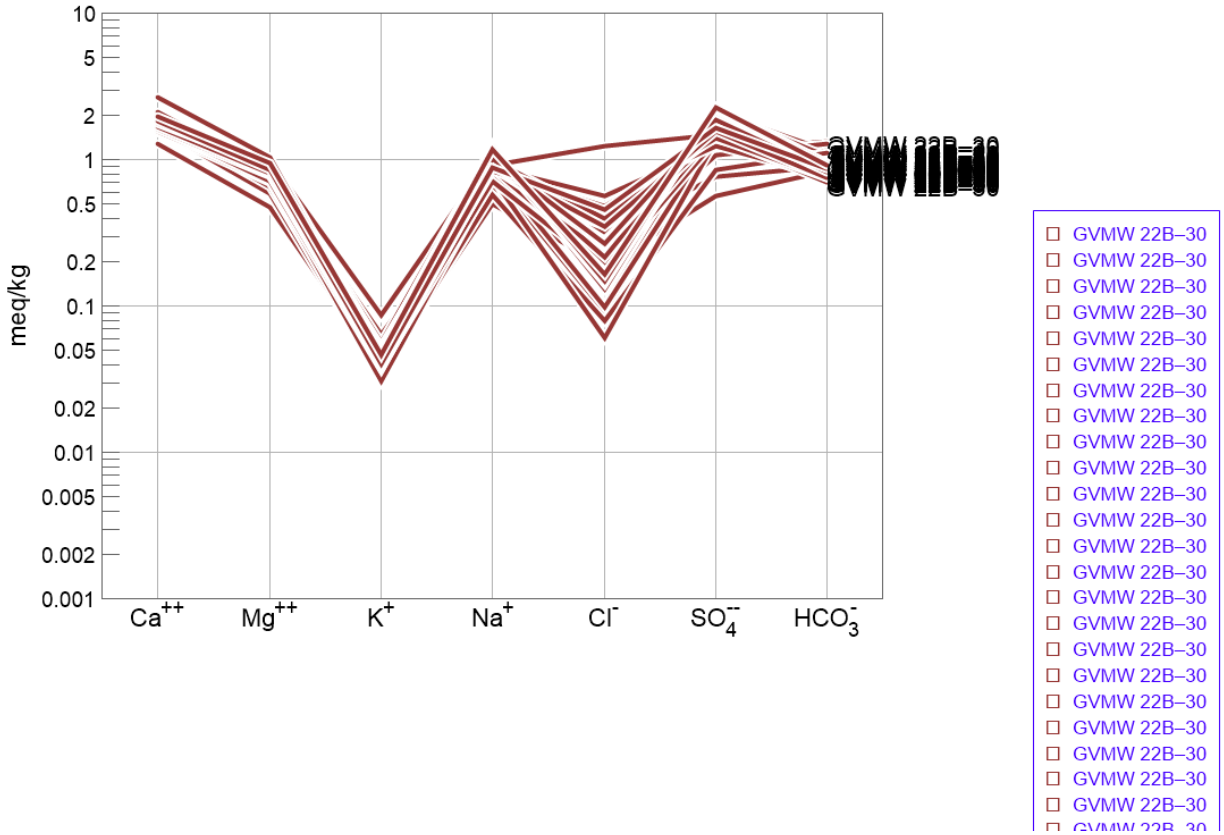
GVMW 22A–70



10
5
2
1
0.5
0.2
0.1
0.05
0.02
0.01
0.005
0.002
0.001
meq/kg
Ca^{++}
Mg^{++}
K^{+}
Na^{+}
Cl^{-}
SO_4^{--}
HCO_3^{-}
GVMW 22B–30
GVMW 22B–30
GVMW 22B–30
GVMW 22B–30
GVMW 22B–30
GVMW 22B–30
GVMW 22B–30
GVMW 22B–30
GVMW 22B–30
GVMW 22B–30
GVMW 22B–30
GVMW 22B–30
GVMW 22B–30
GVMW 22B–30
GVMW 22B–30
GVMW 22B–30
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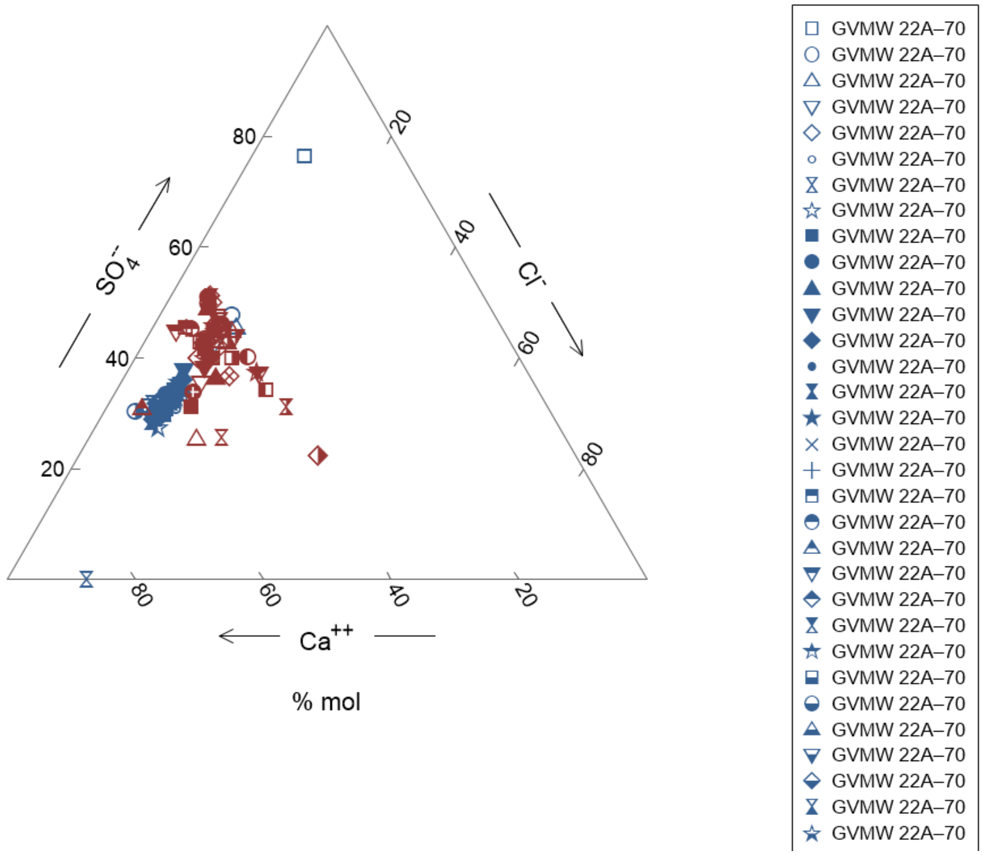
GVMW 22B–30



80
60
40
20
SO4--
20
40
60
80
Cl-
80
60
40
20
Ca++
% mol
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
GVMW 22A–70
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