2025 Groundwater Remedial Action Mitigation Plan Update – Results of CKD Water Quality Investigation

Submitted by:

Bowman Consulting Group
179 River Street
Troy, NY 12180
(518) 270-1620

Submitted on Behalf of:

Continental Cement Company, L.L.C.
301 East Front Street
Buffalo, IA 52728
800-823-6368

bowman.com

Bowman

2025 Remedial Action Mitigation Plan

Submitted by:

Bowman Consulting Group
179 River Street
Troy, NY 12180
(518) 270-1620

Submitted on Behalf of:

Continental Cement Company, L.L.C.
301 East Front Street
Buffalo, IA 52728
(800) 823-6368

Todd Kincaid, PhD – GeoHydros LLC

Stephan Spath, PE (IA) – Bowman

Table of Contents

179 River Street, Troy, New York 12180
bowman.com

Tables

179 River Street, Troy, New York 12180

Figures

Appendices

APPENDIX A Proposed Scope of Work – CKD Water Quality Investigation

APPENDIX B 2024 Annual Water Quality Report Addendum – CKD Water Quality Investigation without Appendices

APPENDIX C 567 Iowa Administrative Code 115 - Sanitary Landfills Industrial Monofills

APPENDIX D Well Construction Diagrams

APPENDIX E Geologic Well Logs

APPENDIX F IDNR – Monitoring Well/Piezometer Construction Documentation Forms

APPENDIX G In-Situ Equipment Specifications

APPENDIX H USEPA – SESDPROC-205-R3

APPENDIX I ASTM – Standards for Logging Soils

APPENDIX J USEPA – LSADPROC-300-R5

APPENDIX K Total Concentration Analysis of Solid Samples – Plots

APPENDIX L TCLP Analysis of Solid Samples – Plots

APPENDIX M Laboratory Reports

179 River Street, Troy, New York 12180
bowman.com

1.0 Introduction and Background

1.1. Background

This report provides an update of the work completed by Continental Cement Company, LLC (Continental) between November 2024 and July 2025 in general accordance with the Remedial Action Mitigation Plan (RAMP) for the Continental Cement Kiln Dust (CKD) monofill area. As background, the RAMP was submitted by Blackstone Environmental (Blackstone) in May 2022 and approved by the Iowa Department of Natural Resources (IDNR) in August 2022. As stated in Sanitary Disposal Project Permit No. 82-SDP-97P (Permit) Special Provision #4.b, the work performed under the RAMP is intended to alleviate or reduce contamination to the fullest extent possible at monitoring points MW-2CR, MW-3L, MW-4, MW-4L, MW-5, MW-7, MW-11, MW-12, MW-14, and MW-18, in accordance with 567 IAC 115.26(9)"d." Since August 2022, Continental has undertaken additional sampling and evaluation of the Site (defined below) to identify potential contaminant sources.

The monitored area (Site) spans approximately 790 acres on the north side of Front Street and across the road from Continental's Portland cement manufacturing plant (Plant) located at 301 East Front Street, Buffalo, Iowa 52728 (Figure 1). The CKD monofill area is comprised of three sections (Figure 3). The Original CKD Disposal Area spans approximately 28 acres on the eastern side of the Continental property. This section is unlined and received CKD until the late 1990s. Between approximately 1998 and 1999, the Phase I Cell was constructed by previous site owner, Lafarge North America, Inc. (Lafarge), on top of a portion of the northern half of the Original CKD Disposal Area (Shive-Hattery, 1999). In 2000, Lafarge capped and closed the southern half of the Original CKD Disposal Area (Shive-Hattery, 2000), and subsequently constructed the Phase II Cell on top of the northernmost portion of the Original CKD Disposal Area (Shive-Hattery, 2002). Both the Phase I and Phase II Cells are lined and were permitted by the IDNR. The Phase I Cell was capped and closed by Lafarge in 2003 and 2004 (Terracon, 2005). The Phase II Cell is active and still being filled, now by Continental Cement. The groundwater monitoring currently being performed at the Site is a condition of the Permit for the Phase I and Phase II Cells.

The geology of the Site, as defined by numerous previous investigations, consists of a sequence of Pennsylvanian, Devonian, and Silurian-age carbonates (e.g. Komex, 1996; Terracon, 2011; Blackstone, 2023). The Devonian carbonates are exposed in the mine faces while Silurian carbonates are not exposed at the Site. Mississippian-age sediments are missing from the geologic record at the Site.

A network of monitoring wells has been installed at the Site through prior investigations conducted by Komex International Ltd. (Komex), Terracon, and Blackstone Environmental, and as part of the recent investigations conducted by Bowman (Figure 2; Table 1). The series of wells are screened through four hydrogeologic units that Bowman and previous consultants have identified as distinct groundwater bearing zones (GBZs) and a confining layer.

As has been described in previous reports and continues to be used in this report, these zones include:

- The Upper GBZ, represented by shallow groundwater within the near surface;
- The Middle GBZ, represented by a continuous groundwater surface that exists above the Silurian age bedrock and within the Devonian-age bedrock; and
- The Lower GBZ, represented by groundwater within the Silurian-age bedrock, which is the lowest unit investigated on Site.
- The Otis Formation has been identified as a confining layer separating the Middle and Lower GBZs.

179 River Street, Troy, New York 12180
bowman.com

In accordance with IDNR solid waste rule 567 IAC 115.26(8)"d" and the Permit, the monitoring wells are sampled to evaluate the effect of the facility on groundwater and surface water quality. Various levels of contamination have been identified in various wells at the Site since sampling began in or before the middle 1990s. Contamination is defined by the presence of dissolved or total phase constituents in groundwater at concentrations that exceed the IDNR Statewide Standards for a Protected Groundwater Source (SWS) or the US Environmental Protection Agency (USEPA) Maximum Concentration Limits (MCL). Various constituents have been observed at concentrations exceeding the IDNR SWS and/or the USEPA MCLs in various wells at the Site over time.

During the 1996 Komex investigation, a void was encountered underneath the property now owned by Continental. The void was identified as the western section of Linwood Mining and Materials Corporation's (Linwood's) Davenport Stope (Stope; Komex, 1996). The Stope was encountered at four drilling locations during the installation of the "MW-2" series monitoring wells (MW-2A, MW-2B [Abandoned], MW-2C [Abandoned], and MW-2CR). The Stope was encountered three more times during the 2024 Site investigations performed by Bowman in monitoring points BMW-24-01, BMW-24-02, and BMW-24-03. The dimensions of the Stope, as determined from measurements taken at four of the seven borings that intercept the Stope and were accessible in 2024 and 2025, are listed in Table 2, and their locations are depicted relative to the footprint of the Stope on Figure 2.

The Stope has been mapped by Linwood to extend from Linwood's mining operation westward more than 400 feet beneath Continental's property at depths consistent with the Middle GBZ and the approximate bottom of the CKD within Continental's Original CKD Disposal Area (Figure 2). Linwood uses a portion of the Stope as an air emissions control device for the four lime kilns utilized in its lime manufacturing operations. The Stope collects lime kiln dust (LKD) and other emissions from the kilns, which are piped into the Stope through an exhaust system that extends across East Front Street and into the underground workings. Exhaust travels through the Stope and exits approximately 1,200 feet from where it enters through a stack referred to as "Big Willie" (Figure 2). Because the Stope extends under Continental's property, Linwood's air emission practices are impacting groundwater quality on Continental's Site.

Five new borings were installed in 2024. Three were drilled into the Stope (BMW-24-01, BMW-24-02, and BMW-24-03; Figure-2) and two were drilled into the Original CKD Disposal Area south of the capped and closed Phase I Cell and proximal to MW-09 and MW-10 (BMW-24-04 and BMW-24-05; Figure 2). BMW-24-03, BMW-24-04, and BMW-24-05 were completed as monitoring wells in 2024 with screened intervals open to the Middle GBZ immediately below the Stope (BMW-24-03) and the CKD (BMW-24-04 and BMW-24-05).

1.1. Purpose

The purpose of the RAMP is to summarize the environmental conditions at the Site, evaluate the technical Site data, and, if needed, propose remedial actions to address impacts to groundwater at specified Site monitoring points identified by IDNR. This RAMP Update describes the currently understood nature and extent of the groundwater contaminants based on Site investigations conducted by Bowman from November 2024 to July 2025, and proposes additional investigative actions to be taken in 2026.

Table 1. Monitoring Locations

Monitoring Point Location				Elevations (Feet AMSL)					Depths BMP (Feet)		
Zone	Name	Easting (Feet)	Northing (Feet)	Ground Surface	Measuring Point	Screen Top	Screen Bottom	Well Bottom	Screen Top	Screen Bottom	Total
U	MW-1B	2,408,910	546,268	614.9	617.7	594.3	574.4	574.4	23.5	43.4	43.4
U	MW-2A	2,409,895	545,676	586.8	589.8	550.6	525.1	525.1	39.3	64.7	64.7
M	MW-1A	2,408,901	546,267	614.6	617.3	494.2	474.5	474.5	123.1	142.8	142.8
M	MW-3	2,410,006	545,114	566.5	569.2	487.6	467.8	467.8	81.6	101.4	101.4
M	MW-4	2,408,798	545,107	488.6	490.9	485.6	456.6	456.6	5.3	34.3	34.3
M	MW-5	2,408,744	545,496	487.3	490.3	470.2	464	464	20.2	26.4	26.4
M	MW-12	2,408,546	545,903	523.2	526.5	451.8	445.5	445.3	74.7	81	81.2
M	MW-13	2,409,208	544,443	565.2	567.9	475	467.5	467.5	93	100.5	100.5
M	MW-14	2,408,612	544,787	486.6	488.2	466	456	456	22.2	32.2	32.2
M	BMW-24-04	2,409,753	545,446	591.5	593.8	501.7	481.8	481.8	92.1	112	112
M	BMW-24-05	2,409,563	545,388	591.2	593.8	496.9	476.9	476.9	96.9	117	117
M/S	MW-2CR	2,409,764	545,875	590.4	593	574	492.2	492.2	19	100.8	100.8
M/S	BMW-24-03	2,409,991	545,543	583.9	586.9	476.2	466.2	466.2	110.8	120.8	120.8
S	BMW-24-01	2,410,538	545,676	571	571.9	551.8	492.3	492.3	20.1	79.6	79.6
S	BMW-24-02	2,410,288	545,672	579.1	580	540.1	493.2	493.2	39.9	86.8	86.8
M/L	MW-15	2,407,821	543,883	562.9	564.8	435.9	429.5	429.5	128.9	135.4	135.4
M/L	MW-16	2,408,010	545,085	482.4	483.5	437.1	417.5	417	46.3	66	66.5
M/L	MW-18	2,408,823	545,092	488.7	490.5	443.3	423.6	423.6	47.3	67	67
M/L	MW-4L	2,408,806	545,113	488.8	490.5	433	429.1	429.1	57.5	61.4	61.4
L	MW-3L	2,410,008	545,144	568.1	570.3	426.5	417.6	417.6	143.8	152.7	152.7
L	MW-7	2,409,278	547,324	595.2	597.9	422.5	412.5	412.5	175.5	185.4	185.4
L	MW-11	2,409,216	544,851	532.5	536.1	432.4	422.7	422.7	103.7	113.4	113.4
L	MW-16L	2,408,015	545,094	482.8	483.2	377.2	367.5	367.1	105.9	115.7	116.1
L	MW-19	2,409,193	546,682	613.5	615.2	419.3	399.4	399.4	195.9	215.9	215.9
L	MW-20	2,408,421	544,090	564.2	567	422.4	402.8	402.8	144.6	164.2	164.2
L	MW-21	2,409,275	546,551	611.5	614.1	408.5	389.6	389.6	205.6	224.5	224.5
U/M/L	Quarry Sump	2,407,813	544,434	Varies	455	-	-	-	-	-	Unk*

Notes:

BMP = Below Measuring Point
AMSL = Above Mean Sea Level
"-" = Not Relevant
Unk = Unknown

U = Upper Groundwater Bearing Zone
M = Middle Groundwater Bearing Zone
L = Lower Groundwater Bearing Zone
S = Stope

*The bottom of the Quarry Sump has been previously reported by Komex at elevation 425 feet AMSL

Projection: Iowa South State Plane Zone 11 - North American Datum 1983 / North American Vertical Datum 1988

1.2. Historical Sampling and Analysis

1.2.1. Constituents of Concern

Continental's Permit requires that groundwater samples collected from the Site monitoring wells be analyzed for a series of constituents at an either quarterly or semi-annual frequency. These are described in this report as constituents of concern (COCs). The term "COC" has been applied to a subset of these constituents in prior investigations (Blackstone, 2023). As specified in the Permit, the COCs include (Table 2):

- Aluminum
- Arsenic
- Barium
- Boron
- Bromate
- Calcium
- Chloride
- Chromium
- Cobalt
- Fluoride
- Lead
- Lithium
- Magnesium
- Manganese
- Molybdenum
- Nickel
- Nitrates
- Nitrites
- Phosphorus
- Potassium
- Sodium
- Sulfate
- Thallium
- Vanadium
- Bicarbonate Alkalinity
- pH
- Specific Conductance
- Total Dissolved Solids

1.2.2. Other Investigation Constituents

In 2024, Continental requested and received IDNR approval to sample for other constituents that have been historically sampled for at the Site to aid in identifying contamination flow paths. These include (Table 2):

- Alkalinity, Carbonate
- Alkalinity, Total
- Antimony
- Beryllium
- Biochemical Oxygen Demand
- Bromide
- Cadmium
- Chemical Oxygen Demand
- Copper
- Nitrogen, Ammonia
- Oxidation Reduction Potential
- Selenium
- Silver
- Temperature
- Zinc

2.0 Scope of Work for the CKD Water Quality Investigation

On October 16, 2024, Continental proposed a scope of work to the IDNR to investigate the quality of water and potential sources of groundwater contamination around the Site in furtherance of the objectives of the RAMP (Appendix A). The scope of work was approved by IDNR on October 30, 2024, and included the following major tasks:

1. Installing six new monitoring wells, three within the Stope and three within the Original CKD Disposal Area;
2. Collecting water, soil, CKD, and stope sludge samples; and
3. Deploying groundwater monitoring equipment within the six new wells and select wells across the Site targeting the Lower and Middle GBZs.

179 River Street, Troy, New York 12180
bowman.com

Modifications to this initial scope were requested by Continental and approved by IDNR because of changes in field conditions. Substantive changes to the original scope of work included:

- Changing the groundwater sampling method from low flow to standard purge;
- Modifying the Stope well construction plans from constructed monitoring wells to boreholes (BMW-24-01 and -02); and
- Reducing the number of new wells installed from six to three (BMW-24-03, -04, and -05).

The revised work plan was implemented by Bowman, which led site activities accompanied by Continental personnel. The field effort was completed in two mobilizations, November 2024 and March 2025. During the first mobilization (November 2024), Bowman completed drilling, well installation, sediment and soil sampling, surveying and instrumentation deployment. During the second mobilization (March 2025), groundwater sampling was completed.

In May 2025, the newly installed wells (BMW-24-03, -04, and -05) were sampled, and in June 2025, transducers and telemetry devices were installed throughout the remaining monitoring network and leachate monitoring locations.

An updated series of chemistry and groundwater elevation tables and concentration versus time graphs, including results from the quarterly monitoring of the new wells, are provided in the 2025 Annual Water Quality Report (AWQR) accompanying this report.

3.0 New Boreholes and Monitoring Wells

As described above, in November 2024, the following three wells and two boreholes were installed at the Site (Figure 2; Appendices D, E, and F):

- Two boreholes in the Stope (BMW-24-01 and BMW-24-02);
- One well screened below the Stope (BMW-24-03); and
- Two wells screened within and beneath the Original CKD Disposal Area (BMW-24-04 and BMW-24-05).

The following summarizes the general conditions encountered during drilling at the Site:

- In situ bedrock;
- Open voids;
- LKD and kiln exhaust airfall within open voids in the Stope;
- Air temperatures exceeding 200°F within the open voids in the Stope; and
- Emplaced clay and CKD in boreholes penetrating the Original CKD Disposal Area.

All of the open voids encountered during the drilling of BMW-24-01, BMW-24-02, and BMW-24-03 (Figure 3) were determined to be part of the Stope based on the location of the well or boring relative to the mapped extent of the Stope and the depth of drilling when the void was encountered. Fill material within the open voids was determined to be LKD and other lime kiln exhausts deposited via air-fall resulting from Linwood's exhaust of LKD into the Stope. Air temperatures measured in the Stope ranged from 108°F to 205°F.

A detailed description of drilling methods and well construction for the boreholes and wells installed in 2024 that intercept the closed Original CKD Disposal Area and the Stope is provided in the Addendum to the 2024 Aquifer Water Quality Report (Appendix B).

Table 2. List of Constituents

	Constituent	Water Sample Analysis Method
Constituents of Concern	Aluminum, Total	SW846 6020B
	Arsenic, Total	SW846 6020B
	Barium, Total	SW846 6020B
	Boron, Total	SW846 6020B
	Bromate	EPA 300.1B-1997 R1/ 9056A
	Calcium, Total	SW846 6020B
	Chloride	SW846 6020B/ SW846 9056A
	Chromium, Total	SW846 6020B
	Cobalt, Total	SW846 6020B
	Fluoride	SW846 9056A
	Lead, Total	SW846 6020B
	Lithium, Total	SW846 6020B
	Magnesium, Total	SW846 6020B
	Manganese, Total	SW846 6020B
	Molybdenum, Total	SW846 6020B
	Nickel, Total	SW846 6020B
	Nitrate	SW846 9056A
	Nitrite	SW846 9056A
	Phosphorus	EPA 365.1
	Potassium, Total	SW846 6020B
	Sodium, Total	SW846 6020B
	Sulfate	SW846 9056A
	Thallium, Total	SW846 6020B
	Vanadium, Total	SW846 6020B
	Alkalinity, Bicarbonate	SM 2320B
	pH[2]	EPA SPSP[3], SW846 9056C
	Specific Conductance	EPA SPSP
	Total Dissolved Solids	SM 2540C

	Constituent	Water Sample Analysis Method
Additional Investigation Constituents	Alkalinity, Carbonate	SM 2320B
	Alkalinity, Total	SM 2320B
	Antimony, Total	SW846 6020B
	Beryllium, Total	SW846 6020B
	Biochemical Oxygen Demand	SM5210B
	Bromide	SW846 9056A
	Chemical Oxygen Demand	5220D
	Cadmium, Total	SW846 6020B
	Copper, Total	SW846 6020B
	Nitrogen, Ammonia	SW846 9056A/ EPA 350.1
	Oxidation Reduction Potential	EPA SPSP
	Selenium, Total	SW846 6020B
	Silver, Total	SW846 6020B
	Temperature[1]	EPA SPSP
	Zinc, Total	SW846 6020B

Notes:

[1] Recorded as a field parameter.

[2] Recorded as field parameter and measured in the lab.

[3] USEPA Standard Purge Sampling Procedures

179 River Street, Troy, New York 12180
bowman.com

4.0 Groundwater Monitoring

4.1. Longterm Monitoring

In 2024 and 2025, various groundwater monitoring devices were installed at 33 groundwater and leachate monitoring locations around the Site. These devices are automated water level meters with various sondes (e.g. recording meters) used to collect additional data at each location. This equipment was installed at the following locations:

- MW-1A (Level Troll 400)
- MW-1B (Level Troll 400)
- MW-2A (Level Troll 400)
- MW-2CR (Level Troll 400)
- MW-3 (Level Troll 400)
- MW-3L (Level Troll 400)
- MW-4 (Aqua Troll 500)
- MW-4L (Level Troll 400)
- MW-5 (Level Troll 400)
- MW-7 (Level Troll 400)
- MW-11 (Level Troll 400)
- MW-12 (Level Troll 400)
- MW-13 (Level Troll 400)
- MW-14 (Level Troll 400)
- MW-15 (Level Troll 400)
- MW-16 (Level Troll 400)
- MW-16L (Level Troll 400)
- MW-18 (Level Troll 400)
- MW-19 (Level Troll 400)
- MW-20 (Level Troll 400)
- MW-21 (Level Troll 400)
- BMW-24-02 (Level Troll 400)
- BMW-24-03 (Level Troll 400)
- BMW-24-04 (Aqua Troll 500)
- BMW-24-05 (Aqua Troll 500)
- Quarry Sump (Aqua Troll 500)
- Leachate Sump (Level Troll 400)
- UL-1 (Level Troll 400)
- LL-1 (Level Troll 400)
- UL-2R (Level Troll 400)
- LL-2 (Level Troll 400)
- UL-3R (Level Troll 400)
- LL-3 (Level Troll 400)

4.1.1. *In-Situ Aqua TROLL 500*

In 2024, Bowman deployed four In-Situ Aqua TROLL 500 multiparameter sondes at MW-4, BMW-24-04, BMW-24-05, and the Quarry Sump. These sondes are currently recording:

- Temperature
- Pressure
- Conductivity
- pH
- Oxidation Reduction Potential (ORP)
- Nitrate

The specifications for each parameter are indicated in Appendix G.

Pressure readings from the Aqua TROLL 500s represent the sum of the pressure of the water column and ambient barometric pressure, which are used to define groundwater elevations. Temperature, conductivity, pH, ORP, and nitrate readings represent the conditions of the groundwater within the screened interval of the well.

4.1.2. *In-Situ Level TROLL 400*

In 2024 and 2025, Bowman deployed 30 In-Situ Level TROLL 400 transducers at the 29 monitoring locations identified in Section 4.1 above, which record pressure and temperature. One of the In-Situ Level TROLL 400 transducers was placed in tandem (in the aperture) within the Stope well (BMW-24-03) to record Stope air pressure and temperature.

Pressure readings from the Level TROLL 400s represent the sum of the pressure of the water column and the ambient barometric pressure, which are used to define groundwater elevations. Temperature readings represent the conditions of the groundwater within the screened interval of the well.

Transducers in wells are supported via a steel cable with clamps that connects to the In-Situ Rugged Cable at the surface. Transducers within the leachate monitoring well system are resting on the bottom of each location. The In-Situ Rugged Cable transmits data from the transducer to the VuLink telemetry device and suspends the transducers within the wells. Data is recorded at 30-minute intervals, uploaded every 24 hours and available to view remotely 24 hours a day.

4.1.3. *In-Situ VuLink*

In 2024 and 2025, Bowman deployed 33 In-Situ VuLink telemetry devices, one at each monitored well, allowing for the remote monitoring of data on a real-time basis via In-Situ's HydroVu web-hosted software. The In-Situ VuLink devices also record and compensate for ambient barometric pressure such that total pressure readings recorded by the transducers can be converted to water level readings. Data is recorded at 30-minute intervals, uploaded every 24 hours and available to view remotely 24 hours a day (Appendix G).

VuLinks are supported via a steel cable with clamps. VuLinks are either positioned in the aperture between the inner and outer casing or fixed to the outside of the outer casing of each well.

4.2. Reclassification of Groundwater Monitoring Network

Groundwater elevation and chemistry are a function of the GBZ that the wells intercept. The groundwater monitoring network of wells at the Site has been established over multiple investigations (Komex, 1996; Terracon, 2011; Blackstone, 2023), most of which predate Continental's ownership of the Site. Bowman consolidated this information for evaluation and has now developed a comprehensive groundwater flow database.

4.2.1. *Prior Misinterpretation of Site Hydrogeologic Setting*

Designation of the GBZ intersected by the wells has varied historically (Table 3) and it appears that the definition of GBZs have been based solely on the depths of the respective screened intervals and not necessarily on the geologic unit or units intersected by the screened intervals.

Comparison of screened intervals to the available geologic logs, however, indicates that the screened interval in several wells crosses multiple geologic units and, therefore, likely crosses multiple GBZs. Thus, the apparent spatial variation in hydraulic continuity between GBZs, as determined from water table maps, is therefore likely, at least in part, due to inappropriate GBZ designations.

In order to better interpret the recorded groundwater levels and groundwater chemistry, Bowman evaluated the geology relative to the reported screened intervals in conjunction with the high-frequency groundwater measurements (Figures 4 and 5A-C). As discussed in the following subsections, the monitoring wells were then reclassified with respect to the primary GBZ they represent based on those evaluations.

Note that the wells installed as part of the CKD Water Quality Investigation were specifically designed to evaluate the part of the Middle GBZ that is laterally continuous and common to the Original CKD Disposal Area and the Stope. None of the previously installed wells uniquely target this zone.

4.2.2. *Geologic Correlations*

In order to define the hydrostratigraphic contacts across the Site, a three-dimensional geologic model was created using the Leapfrog™ software. The model incorporated data from over 70 geologic core holes that have been installed as part of the mining operation to define the vertical position of the stratigraphic contacts depicted on Figure 4. The model results were aligned with a Lafarge study that mapped the local bedrock with a strike of 95° and a dip of 0.5° (Lafarge, 1999).

179 River Street, Troy, New York 12180
bowman.com

The focus of the modeling effort was to identify wells screened within or through the Otis Formation, which is believed to be a confining unit that separates the Middle GBZ from the Lower GBZ in the underlying Silurian Bedrock (Figure 4).

The model-defined stratigraphic horizons were used in conjunction with well survey data collected by Bowman, well construction logs, and geologic logs to identify the geologic unit or units intersected by the screened interval in each well (Table 3).

4.2.3. Groundwater Level Correlations

Previously, GBZs represented by each well had presumably been identified based on the reported depths of the well screens. While there was general consensus, reasonable interpretations of groundwater flow patterns within and between the respective GBZs has been challenging to date because the well-screened intervals are not always isolated to an individual GBZ (Figure 4; Table 3).

Ideally, the well-screened intervals would target a specific GBZ such that the measured heads and gradients could be independently evaluated. Paired wells (wells located within a few feet of each other and screened within different GBZs) or nested piezometers (small-diameter wells screened in different GBZs contained in the same borehole) are the standard tools for characterizing vertical gradients between GBZs. None of these are present at the Site, thus, the hydraulic continuity or separation between the GBZs must be inferred from the subset of Site wells that can be confidently assumed to characterize individual GBZs.

The following section discusses an evaluation of the GBZs as a function of the well-screened intervals and analysis of high-frequency groundwater measurements (every 30 minutes) collected at 26 locations (Figure 2; Table 3).

4.2.4. Groundwater Bearing Zone Classification

In order to improve the reliability of groundwater flow mapping at the Site, the groundwater monitoring network was reclassified based on the geologic units intersected by the respective screened intervals and the trends in measured groundwater elevations. Bowman reviewed the well screen placement as it related to the geologic units, as well as the groundwater level trends recorded in the 26 groundwater monitoring wells on the Site between November 2024 and July 2025. Similar groundwater level elevations and/or similar patterns of groundwater level fluctuation were deemed to be indicative of wells open to the same or hydraulically connected GBZs (Figure 5). A comparison of the reclassification to the historical association of GBZ for the monitoring points is provided in Table 3.

Table 3 – Monitoring Location Groundwater Bearing Zone Classification

Monitoring Point	Current GBZ Classification	Water Level Trends	Geologic Log Available?	Previous GBZ Classification	
				Terracon	Blackstone
MW-1B	Upper	ND	Yes	Upper	Shallow
MW-2A	Upper	ND	Yes	Upper	Shallow
MW-1A	Middle	Middle	Yes	Middle	Deep
MW-3	Middle	ND	Yes	Middle	ND
MW-4**	Middle	Middle	Yes	Middle	Deep
MW-5**	Middle	Surface Water	Yes	Middle	Deep
MW-12**	Middle	Middle	No	Middle	Deep
MW-13**	Middle	Middle	Yes*	Middle	Deep
MW-14**	Middle	Middle	Yes*	Middle	Deep
BMW-24-04	Middle	Middle	Yes	DNE	DNE
BMW-24-05	Middle	Middle	Yes	DNE	DNE
MW-2CR**	Stope & Middle	Stope & Stope	No	Middle	Other
BMW-24-03	Stope & Middle	Middle	Yes	DNE	DNE
BMW-24-01**	Stope	Stope	Yes	DNE	DNE
BMW-24-02**	Stope	Stope	Yes	DNE	DNE
MW-15	Middle & Lower	Middle & Lower	No	Middle	Deep
MW-16	Middle & Lower	Middle & Lower	No	Middle	Deep
MW-18	Middle & Lower	Middle & Lower	No	Middle	Deep
MW-4L	Middle & Lower	Middle & Lower	Yes	Lower	Deep
MW-3L	Lower	Lower	Yes	Lower	Deep
MW-7	Lower	ND	Yes	Lower	Deep
MW-11**	Lower	Lower	No	Middle	Deep
MW-16L	Lower	Lower	No	Lower	Deep
MW-19	Lower	Lower	No	DNE	Deep
MW-20	Lower	Lower	Yes*	DNE	Deep
MW-21	Lower	Lower	Yes*	DNE	Deep
Quarry Sump**	Upper, Middle, Lower	Middle & Lower	No	Middle	Other

Notes:
GBZ = Groundwater Bearing Zone / ND = Not Detected / DNE = Well did not exist
*Geologic logs present, but lack detailed geologic descriptions
**Screened Interval or borehole elevations used due to lack of sand pack data/sand pack

The period of record for the analyses (November 2024 through July 2025) was chosen because that is the period over which the high frequency groundwater elevations measurements were available. Prior to the collection of the high-frequency data provided by the network of data sondes installed during the CKD Water Quality Investigation, the patterns of groundwater level trends fluctuations could not be identified. For this reason, the revised designation of GBZs for the monitoring points presented in this report is considered more reliable than the historical designations.

As part of the effort to reclassify the GBZs, it was determined that water level measurements in MW-9 and MW-10 were not representative of the groundwater table. Investigations with a downhole camera indicated that water was pooled below the bottom of the well screen and sitting within the PVC bottom caps. In addition, review of the historic water levels within MW-9 and 10 demonstrate that they do not fluctuate like any other well on Site. Further, the observed water levels did not recover after bailing the wells dry. Thus, water levels historically recorded within these wells were likely a result of condensation and CKD dewatering and should not be used for groundwater level analyses. Historically reported water levels in these wells were not used as part of the groundwater mapping discussed in this report. IDNR indicated its agreement with this determination in a letter dated June 11, 2025 (IDNR Doc. #113236).

4.3. Groundwater Flow

The direction and pattern of groundwater flow across the Site within the three GBZs have been determined from the groundwater elevations measured in March, May, and June 2025 (Figure 6A-G; Table 4). Groundwater elevations and, therefore, groundwater flow directions are affected by variations in precipitation and variations in the magnitude of pumping from the Quarry Sump and the Deep Well located at the Plant.

Precipitation data is collected by a Davis Instruments Weatherlink weather station located at the front office of the Plant. Pumping data was available from the Quarry Sump and the Deep Well, which are both believed to be open to the Middle and Lower GBZs. It is likely variations in pumping occurring at the adjacent Linwood site is affecting Site groundwater levels, though no data was available to define such effects as of the preparation of this report.

4.3.1. Upper GBZ

The Upper GBZ consists of the following wells:

- MW-1B
- MW-2A

Since there are only two wells characterizing groundwater elevations within the Upper GBZ, the direction of groundwater flow within the Upper GBZ cannot be confidently defined (Figures 6A and 6D). If the flow direction is consistent with flow in the underlying Middle GBZ, flow would be generally to the west. No wells within the Upper GBZ show any connection to the pumping of the Quarry Sump or the Deep Well (Figure 5A).

4.3.2. Middle GBZ

Groundwater flow in the Middle GBZ is generally east-to-west across or under the Original CKD Disposal Area toward the Quarry Pond and the Quarry Sump; south-to-north from the area between Front Street and the Mississippi River toward the Original CKD Disposal Area and the Quarry Sump; and northwest-to-southeast from the southeast corner of the Original CKD Disposal Area and adjacent Stope toward the Mississippi River. An apparent groundwater divide in the Middle GBZ near BMW-24-03 separates east-to-west from northwest-to-southeast components of the groundwater flow regime. The position of the divide fluctuated over the period of record (December 2024 to July 2025). Throughout January, and parts of February and June 2025, groundwater flow through the Middle GBZ was east-to-west at BMW-24-03 whereas at other times flow was northwest-to-southeast (Figures 6B, 6E, and 6G).

Groundwater elevations measured at the 12 Middle GBZ wells show significant variation both over time during the period of record and spatially between wells (Figure 5B). Groundwater elevations at some wells respond to precipitation, some respond to pumping at either the Quarry Sump or the Deep Well, some don't appear to respond to either precipitation or pumping (Table 5).

179 River Street, Troy, New York 12180
bowman.com

Table 4 – March, May, and June 2025 Groundwater Measurements

Monitoring Point		March 2025		May 2025		June 2025		September 2025	
Zone	Name	DTW	GWE	DTW	GWE	DTW	GWE	DTW	GWE
U	MW-1B	23.8	593.9	23.3	594.4	23.6	594.1	25.5	592.2
U	MW-2A	28.2	561.6	27.5	562.3	27.9	562.0	28.1	561.7
M	MW-1A	133.8	483.5	133.9	483.4	133.0	484.3	132.4	484.9
M	MW-3	98.3	470.9	100.9	468.3	95.4	473.8	97.4	471.7
M	MW-4	7.5	483.4	6.8	484.1	6.6	484.3	6.7	484.2
M	MW-5	3.8	486.6	3.8	486.6	3.7	486.7	5.0	485.4
M	MW-12	53.4	473.1	51.8	474.7	50.9	475.6	50.6	475.9
M	MW-13	67.4	500.5	62.3	505.6	59.0	508.9	59.8	508.1
M	MW-14	13.8	474.4	14.5	473.7	13.6	474.6	13.6	474.6
M	BMW-24-04	102.6	491.2	102.3	491.5	102.3	491.5	101.9	491.9
M	BMW-24-05	108.9	484.9	108.3	485.5	108.5	485.4	107.8	486.1
M/S	MW-2CR	99.7	493.5	99.9	493.3	100.0	493.2	99.6	493.6
M/S	BMW-24-03	98.0	489.0	98.5	488.5	96.4	490.5	97.4	489.5
S	BMW-24-01	DRY	-	DRY	-	DRY	-	DRY	-
S	BMW-24-02	86.5	493.5	84.8	495.2	84.1	495.9	83.7	496.3
M/L	MW-15	67.6	497.2	70.2	494.6	67.2	497.6	66.5	498.3
M/L	MW-16	8.8	474.7	12.2	471.3	10.7	472.8	11.2	472.3
M/L	MW-18	10.2	480.3	11.4	479.2	10.0	480.6	10.4	480.1
M/L	MW-4L	11.0	479.5	11.4	479.1	10.0	480.5	10.4	480.1
L	MW-3L	96.2	474.1	102.0	468.3	96.6	473.8	98.6	471.8
L	MW-7	127.3	470.6	128.2	469.7	125.6	472.3	125.7	472.2
L	MW-11	61.7	474.4	68.6	467.5	62.3	473.8	65.1	471.0
L	MW-16L	8.6	474.6	19.0	464.1	12.0	471.2	15.0	468.2
L	MW-19	143.9	471.3	145.8	469.4	142.7	472.5	142.9	472.3
L	MW-20	91.6	475.4	105.5	461.5	94.8	472.2	100.2	466.8
L	MW-21	142.5	471.6	145.0	469.1	141.6	472.5	142.1	472.0
U/M/L	Quarry Sump	29.2	455.0	29.0	455.2	27.3	456.9	29.3	454.9

Notes:
DTW = Depth to water (feet)
GWE = Groundwater level elevation (feet NAVD88)
WCT = Water column thickness (feet)
"-" = Not Relevant
Unk = Unknown

Zones
U=Upper Groundwater Bearing Zone
M=Middle Groundwater Bearing Zone
L=Lower Groundwater Bearing Zone
S=Stope
Elevations are relative to NAVD88

179 River Street, Troy, New York 12180
bowman.com

Table 5 – Middle GBZ Wells Response to Precipitation and Pumping

Monitoring Well	Responds to Precipitation	Responds to Pumping Quarry Sump	Deep Well	Significant Observations
MW-1A	No	No	No	Sprayed leachate could be recharging MGBZ at MW-1A.
MW-2CR	No	No	No	Very minor (<0.1 foot) changes in groundwater levels have been recorded within the borehole.
MW-3	No	No	Yes	Tracks trends in LGBZ, is affected by Deep Well pumping.
MW-4	Yes	Yes	Unknown	Shallow but UGBZ removed here due to mining so connected to MGBZ.
MW-5	Yes	Yes	Unknown	Shallow but UGBZ removed here due to mining so connected to MGBZ; Remains high after precipitation events; Pooled surface water around well.
MW-12	No	No	No	Long recovery time after purging.
MW-13	No	Unknown	Yes	None
MW-14	No	Unknown	Yes	None
BMW-24-02	No	No	No	Transducer became buried by lime kiln exhaust between May and June sampling events. Water measurements are limited.
BMW-24-03	Limited	No	No	May be receiving recharge from Moore Creek.
BMW-24-04	No	No	No	Likely reflecting high permeability zone immediately below the Original CKD Disposal Area due to previous mining activities.
BMW-24-05	No	No	No	

Notes:
UGBZ = Upper Groundwater Bearing Zone
MGBZ = Middle Groundwater Bearing Zone
LGBZ = Lower Groundwater Bearing Zone

4.3.3. Stope Water Measurements

Water is present or has been observed at all four Stope monitoring locations. Water may be entering the Stope through three processes, each of which is causing the LKD and kiln exhaust material within the Stope to be wet, as has been observed at BMW-24-01, -02, -03, and MW-2CR, or inundated in groundwater (Figure 5B), as has been observed at BMW-24-03 and MW-2CR. Those processes include:

- Lateral flow of groundwater within the Middle GBZ.
- Vertical groundwater flow from the Upper GBZ.
    - Downward groundwater flow through unidentified flow-restrictive geologic units or parts of the geologic units separating the Upper GBZ from the Middle GBZ (leakage); and/or
    - Downward flow along open boreholes that intercept the Stope (e.g. MW-2CR and BMW-24-01, BMW-24-02, and BMW-24-03, as well as any others that may exist on the Linwood property).
- Condensation of water from emissions within Linwood's lime kiln exhaust.

The identified influences on groundwater such as pumping and precipitation have little to no effect on groundwater measured within the Stope. Groundwater influence from Linwood's property (dewatering wells and sumps, production wells, kiln operations, etc.) may be driving factors for groundwater level changes measured within the Stope, however, no data is available to verify such influences.

Upon stabilization, groundwater level measurements inside the inner casing (screened below the Stope) and outside the inner casing (within the borehole) at BMW-24-03 were identical. As a result, water level readings within BMW-24-03 are representative of groundwater levels within the Stope and within the Middle GBZ.

179 River Street, Troy, New York 12180
bowman.com

4.3.4. Lower GBZ

Groundwater flow through the Lower GBZ at the Site appears to generally emanate from an apparent mound on the western side of the Original CKD Disposal Area to the east, south, and west. The highest groundwater levels in the Lower GBZ north of East Front Street were consistently recorded at MW-4L and MW-18, both of which are screened across parts of the Otis Formation and the Lower GBZ (Table 6). Because of the extent to which these wells penetrate the aquitard separating the Middle and Lower GBZs, it is possible that the wells have created a pathway along which downward flow (leakage) from the Middle GBZ enters the Lower GBZ to create the apparent groundwater level mound. Downward flow along the fractured zones bounding the Original CKD Disposal Area created by historical mining may also be contributing to the apparent mounding. The hydraulic gradient away from the mound to the west and southwest is toward the Quarry Sump (Figures 6C and 6F).

Groundwater elevations measured at the 11 wells that characterize either the Lower GBZ or a combination of the Middle and Lower GBZs show significant variation over time but are generally similar to one another with respect to elevation and trend (Figure 5C). Groundwater elevations at three of the four wells open to both the Middle and Lower GBZs (MW-4L, MW-16, and MW-18) respond to precipitation and groundwater elevations in all wells respond to pumping at the Deep Well (Table 6).

Table 6 – Lower GBZ Wells Response to Precipitation and Pumping

GBZ	Monitoring Well	Responds to Precipitation	Responds to Pumping		Significant Observations
			Deep Well	Recovery Rate	
Middle / Lower	MW-4L	Yes	Yes	NR	None
Middle / Lower	MW-15	No	Yes	0.3	None
Middle / Lower	MW-16	Yes	Yes	0.4	None
Middle / Lower	MW-18	Yes	Yes	NR	None
Lower	MW-3L	No	Yes	NR	When Deep Well pumping < 200,000 gpd, water levels at MW-3 and MW-3L are less than 0.05 feet of each other
Lower	MW-7	No	Yes	0.6	None
Lower	MW-11	No	Yes	2.6	None
Lower	MW-16L	No	Yes	2.2	None
Lower	MW-19	No	Yes	0.7	When Deep Well pumping increases, water level elevation drops 4-5 feet over between 4 and 30 days
Lower	MW-20	No	Yes	4.8	When Deep Well pumping increases, water level elevation drops ~10 feet within 1 day
Lower	MW-21*	NR	NR	NR	Equipment failed ~1 week after installation

<u>Notes:</u>

GBZ = Groundwater Bearing Zone

NR = No Record

Recover Rate = rate of groundwater level rise (feet/day) after a significant reduction in pumping from the Deep Well as determined by evaluating the high frequency groundwater elevation data.

* = Available data indicates that elevations are similar to those recorded at MW-19

179 River Street, Troy, New York 12180
bowman.com

5.0 Solid Sampling Analysis

Fifty-one solid samples were retrieved from the Stope and Original CKD Disposal Area during the CKD Water Quality Investigation. Samples were collected from BMW-24-01, -02, -03, -04, and -05 during drilling utilizing the sonic drilling method (Figure 7). Sonic drilling returns largely undisturbed solids, which were removed from the drill barrel, placed in bags, and geologically logged. Composite samples were comprised of the cores and core fragments collected over five-foot intervals. Samples were collected by taking a uniform quantity of material across each five-foot interval and placing the material in a stainless-steel homogenization container. Solids were homogenized using stainless steel spoons and the quartering method. Some material was broken apart by hand during the homogenization process. Samples were containerized using the alternate shoveling method. Sample homogenization, containerizing, and equipment decontamination was conducted consistent with USEPA procedures (Figure 7; Appendices H, I, and J).

Since the drilling of BMW-24-01, -02, and -03, lime kiln emissions have blown up through the boreholes that penetrate the Stope. In order to characterize the most recently deposited LKD and other kiln exhausts within the Stope, one additional solid sample was collected in May 2025 (CAP-1). The sampled material was deposited on the inside of the metal well caps of BMW-24-02 and BMW-24-03. This material was blown up the boreholes and adhered to the well caps due to the air pressure within the Stope from March 2025 through May 2025. The CAP-1 sample was collected by first removing the well cap of BMW-24-03 and collecting all material from the cap. Next, the well cap of BMW-24-02 was removed, and material was collected from the cap and the inside of the steel casing of the well. Containers were stirred by hand and alternate shoveling was utilized to homogenize the material and create a composite sample.

Solid samples were analyzed for Toxicity Characteristic Leaching Procedure (TCLP) and total concentration with the objective of identifying potential sources of contamination. TCLP is a test that simulates the leaching action of acidic landfill conditions on a solid waste. Samples are ground to less than 1 cm, screened, and agitated within an extraction fluid, and the resulting leachate is analyzed to determine concentrations of specific contaminants. TCLP results indicate whether a waste is considered hazardous based on the "toxicity characteristics" defined by Resource Conservation and Recovery Act (RCRA).

The total solid composition analysis provides a breakdown of the elemental and mineral content of material. Understanding this total composition is significant for identifying the source of contamination, since distinctive chemical "fingerprints" can link a material to specific exceedances.

179 River Street, Troy, New York 12180
bowman.com

Solids sampled during this effort were deposited through the following processes:

- Linwood's kiln exhaust discharge (LKD), characterized by samples from BMW-24-01, BMW-24-02, and BMW-24-03 and the sample CAP-1;
- Placement of CKD into the closed and capped Original CKD Disposal Area under prior ownership, characterized by samples from BMW-24-04 and BMW-24-05; and
- Placement of clay cap material onto the closed and capped Original CKD Disposal Area under prior ownership, characterized by samples BMW-24-05.

5.1. Constituents of Concern – Below Water Table Samples

The analysis below focuses on the presence of COCs below the groundwater table as recorded on January 27, 2025. Due to the saturated nature of the material in the Stope, all samples within the Stope have been included in this analysis.

5.1.1. Total Concentration

With the exception of Nitrate and Nitrite, which were found exclusively in the Stope, the COCs are present within both the Original CKD Disposal Area (below the water table) and the Stope. (Table 7; Appendix K).

The following constituents have greater than a 200% difference (2x) in their highest mean total concentration as measured in samples collected from the Original CKD Disposal Area (below the water table) and from the Stope, marking a distinct difference in chemistry between the two sources of the material (Table 7; Appendix K):

- Chloride, higher in Stope
- Magnesium, higher in Stope
- Manganese, higher in Orig CKD Disp Area
- Nickel, higher in Stope
- Nitrate, higher in Stope
- Nitrite, higher in Stope
- Potassium, higher in Orig CKD Disp Area
- Sulfate, higher in Stope
- Vanadium, higher in Stope

5.1.2. Toxicity Characteristic Leaching Procedure Results

Based on the TCLP analysis, several constituents are unique in their ability to leach from the Original CKD Disposal Area below the water table or from the Stope. Barium, lithium, and selenium were exclusively detected in TCLP results from samples below the water table in the Original CKD Disposal Area. Boron, molybdenum, nickel and vanadium were exclusively detected in TCLP results from samples within the Stope (Table 9; Appendix L). The remaining COCs were not detected in the TCLP analysis of material below the water table.

179 River Street, Troy, New York 12180
bowman.com

Table 7. Total Concentration of Solids for the COCs in Samples Collected Below the Water Table.

	Mean Total Concentration (mg/kg)						Source of Highest Mean Result
	Stope				Orig CKD Disposal Area		
Constituent	BMW-24-01	BMW-24-02	BMW-24-03	CAP-1	BMW-24-04	BMW-24-05	
Aluminum	5,133	5,770	2,255	4,070	990	9,860	Orig CKD DA
Arsenic	5.35	3.51	2.96	5.57	13.5	4.04	Orig CKD DA
Barium	28.9	52.7	37.2	19.7	4.98	73.8	Orig CKD DA
Boron	47.9	28.3	14.5	15.1	ND	50.8	Orig CKD DA
Calcium	208,000	217,000	281,000	283,000	492,000	239,333	Orig CKD DA
Chloride	354	396	1,980	970	60.70	372	Stope
Chromium	8.70	9.94	5.63	11.1	1.70	17.2	Orig CKD DA
Cobalt	3.28	2.74	2.22	6.06	3.48	9.11	Orig CKD DA
Fluoride	ND	19.60	7.22	ND	2.36	9.53	Stope
Lead	25.2	25.4	25.8	94.0	25.0	38.5	Stope
Lithium	5.46	5.17	2.17	6.82	1.50	9.72	Orig CKD DA
Magnesium	49,825	16,585	4,465	20,500	2,760	12,173	Stope
Manganese	427	370	442	398	1,040	2,533	Orig CKD DA
Molybdenum	21.3	26.5	7.68	9.36	13.2	2.09	Stope
Nickel	227	215	72.6	980	31.7	19.8	Stope
Nitrate	ND	14.6	88.2	16.0	ND	ND	Stope
Nitrite	ND	9.13	ND	62.5	ND	ND	Stope
Phosphorus	185	106	91.95	105	245	264	Orig CKD DA
Potassium	415	1,093	1,029	2,010	659	8,720	Orig CKD DA
Sodium	424	321	383	1,060	ND	852	Stope
Sulfate	25,475	20,600	19,039	42,900	637	7,610	Stope
Thallium	0.49	0.50	0.74	2.19	0.97	1.37	Stope
Vanadium	824	695	450	2,140	4.84	20.1	Stope
pH	10.5	9.40	8.65	7.66	10.8	11.8	Orig CKD DA

Notes:

ND = Non-Detect (result was below the laboratory minimum detection limit)

% Difference Highest Mean Value = (Maximum of Mean Values in Highest Source-Maximum of Mean Values in Lowest Source) / Maximum of Mean Values in Lowest Source

Table 8. Number of Samples and Standard Deviation of Values for Total Concentration of Solids in Samples Collected Below the Water Table.

	Number of Samples / Standard Deviation of Measured Values						% Difference Highest Mean Result
	Stope				Orig CKD Disposal Area		
Constituent	BMW-24-01	BMW-24-02	BMW-24-03	CAP-1	BMW-24-04	BMW-24-05	
Aluminum	4 / 4,095	2 / 4,370	2 / 2,510	1 / -	1 / -	3 / 1,248	70.9%
Arsenic	4 / 4.73	2 / 2.54	2 / 2.48	1 / -	1 / -	3 / 1.19	142%
Barium	4 / 17.8	2 / 36.3	2 / 5.37	1 / -	1 / -	3 / 12.2	40.1%
Boron	4 / 41.4	2 / 18.5	1 / -	1 / -	- / -	3 / 5.00	6.1%
Calcium	4 / 9,201	2 / 33,941	2 / 97,581	1 / -	1 / -	3 / 33,292	73.9%
Chloride	4 / 226	2 / 387	1 / -	1 / -	1 / -	3 / 40.7	432%
Chromium	4 / 5.54	2 / 2.35	2 / 6.19	1 / -	1 / -	3 / 5.36	55.0%
Cobalt	4 / 2.22	2 / 0.64	2 / 0.76	1 / -	1 / -	3 / 0.72	50.3%
Fluoride	- / -	1 / -	2 / 9.02	- / -	1 / -	3 / 1.18	106%
Lead	4 / 13.5	2 / 24.3	2 / 27.7	1 / -	1 / -	3 / 11.1	144%
Lithium	4 / 4.92	2 / 2.04	2 / 1.15	1 / -	1 / -	3 / 1.33	42.5%
Magnesium	4 / 12,236	2 / 14,446	2 / 2,185	1 / -	1 / -	3 / 3,498	309%
Manganese	4 / 138	2 / 82.7	2 / 470	1 / -	1 / -	3 / 360	474%
Molybdenum	4 / 9.03	2 / 19.7	2 / 10.5	1 / -	1 / -	3 / 0.61	100%
Nickel	4 / 102	2 / 168	2 / 81.2	1 / -	1 / -	3 / 2.00	2,991%
Nitrate	- / -	1 / -	1 / -	1 / -	- / -	- / -	-
Nitrite	- / -	1 / -	- / -	1 / -	- / -	- / -	-
Phosphorus	3 / 144	2 / 13.6	2 / 59.5	1 / -	1 / -	3 / 17.3	42.9%
Potassium	4 / 311	2 / 604	2 / 1,063	1 / -	1 / -	3 / 1,214	334%
Sodium	4 / 198	2 / 49.5	2 / 416	1 / -	- / -	3 / 197	24.4%
Sulfate	4 / 8,948	2 / 7,920	2 / 26,533	1 / -	1 / -	3 / 2,891	464%
Thallium	3 / 0.13	2 / 0.34	1 / -	1 / -	1 / -	3 / 0.51	60.0%
Vanadium	4 / 602	2 / 687	2 / 634	1 / -	1 / -	3 / 2.13	10,547%
pH	4 / 2.12	2 / 1.99	2 / 0.03	1 / -	1 / -	3 / 0.32	12.3%

Notes:
ND = Non-Detect (result was below the laboratory minimum detection limit)
% Difference Highest Mean Value = (Maximum of Mean Values in Highest Source-Maximum of Mean Values in Lowest Source) / Maximum of Mean Values in Lowest Source

179 River Street, Troy, New York 12180
bowman.com

5.2. Comprehensive Results – All Constituents

A comprehensive review of all solids data was conducted, independent of the constituents of concern and the presence of groundwater. This exercise was conducted to further characterize the material within the Original CKD Disposal Area and identify sources of contaminants that are not readily identifiable in the dataset limited to constituents found below the water table.

Table 9. TCLP Results for the COCs in Samples Collected Below the Water Table.

	Mean TCLP Result (mg/L)						Source of Highest Mean Result
	Stope				Original CKD Disposal Area		
Constituent	BMW-24-01	BMW-24-02	BMW-24-03	CAP-1	BMW-24-04	BMW-24-05	
Barium	ND	ND	ND	ND	0.14	0.16	Orig CKD DA
Boron	2.30	ND	ND	ND	ND	ND	Stope
Calcium	1,379	2,195	1,678	2,770	1,070	2,987	Orig CKD DA
Lithium	ND	ND	ND	ND	ND	0.19	Orig CKD DA
Magnesium	410	187	82.8	171	27.3	55.8	Stope
Manganese	1.48	1.14	2.79	3.74	1.35	3.97	Orig CKD DA
Molybdenum	0.54	0.40	0.11	ND	ND	ND	Stope
Nickel	0.46	0.72	0.52	3.82	ND	ND	Stope
Potassium	13.4	26.6	34.0	25.5	30.8	335	Orig CKD DA
Vanadium	1.28	1.12	2.77	9.54	ND	ND	Stope

	Number of Samples / Standard Deviation of Measured Values						% Difference Highest Mean Result
	Stope				Original CKD Disposal Area		
Constituent	BMW-24-01	BMW-24-02	BMW-24-03	CAP-1	BMW-24-04	BMW-24-05	
Barium	- / -	- / -	- / -	- / -	1 / -	3 / 0.02	-
Boron	1 / -	- / -	- / -	- / -	- / -	- / -	-
Calcium	4 / 882	2 / 940	2 / 979	1 / -	1 / -	3 / 85.0	7.8%
Lithium	- / -	- / -	- / -	- / -	- / -	2 / 0.05	-
Magnesium	2 / 393	2 / 96.2	2 / 101	1 / -	1 / -	3 / 46.1	635%
Manganese	2 / 0.45	2 / 0.01	2 / 2.74	1 / -	1 / -	1 / -	6.1%
Molybdenum	2 / 0.51	2 / 0.25	1 / -	- / -	- / -	- / -	-
Nickel	2 / 0.50	2 / 0.62	1 / -	1 / -	- / -	- / -	-
Potassium	1 / -	1 / -	1 / -	1 / -	1 / -	3 / 49.4	886%
Vanadium	2 / 0.19	2 / 1.00	1 / -	1 / -	- / -	- / -	-

Notes:
ND = Non-Detect (result was below the laboratory minimum detection limit)
Orig CKD DA = Original CKD Disposal Area
% Difference Highest Mean Value = (Maximum of Mean Values in Highest Source-Maximum of Mean Values in Lowest Source) / Maximum of Mean Values in Lowest Source

5.2.1. Total Concentration

With the exception of ammonia nitrogen, nitrate, and nitrite (found exclusively in the Stope) and silver (found exclusively in the Original CKD Disposal Area) all analyzed constituents are present within both the Original CKD Disposal Area and the Stope.

The following constituents have greater than a 200% difference (2x) in their highest mean total concentration as measured in samples collected from the Original CKD Disposal Area and from the Stope, marking a distinct difference in chemistry between the two sources of the material (Table 10, Table 11; Appendix K):

- Ammonia Nitrogen, higher in Stope
- Magnesium, higher in Stope
- Molybdenum, higher in Stope
- Nickel, higher in Stope
- Nitrate, higher in Stope
- Nitrite, higher in Stope
- Vanadium, higher in Stope
- Bromide, higher in Orig CKD Disp Area
- Cadmium, higher in Orig CKD Disp Area
- Manganese, higher in Orig CKD Disp Area
- Potassium, higher in Orig CKD Disp Area
- Silver, higher in Orig CKD Disp Area
- Zinc, higher in Orig CKD Disp Area

Changes in LKD material that may have occurred over time would be recorded in the differences of material known to be recently deposited versus material retrieved from the bottom of the Stope. To study this relationship, the homogenized sample of the airfall from the LKD blown into the Stope that was deposited on the caps of wells BMW-24-02 and BMW-24-03 between March and May 2025 (sample CAP-1) was compared to samples collected from within the Stope (Samples BMW-24-01, BMW-24-02, BMW-24-03). The following constituents were found at a higher concentration on the well cap sample (CAP-1; Table 10, Table 11; Appendix K) than within the Stope:

- Arsenic
- Calcium
- Chromium
- Cobalt
- Lead
- Lithium
- Nickel
- Nitrite
- Potassium
- Selenium
- Sodium
- Sulfate
- Thallium
- Vanadium

The pH of solid samples collected between the Stope and the Original CKD Disposal Area were distinctly different. Mean Stope pH level, excluding the CAP-1 sample, was 9.5. Within the Stope, there is a trend in pH values of solid material extending from the east to the west with a more caustic pH of 10.48 measured in the material collected from BMW-24-01 and less caustic pH of 8.65 measured in the material collected from BMW-24-03. The CAP-1 sample has a more neutral pH of 7.66 (Table 10, Table 11; Appendix K).

The pH of solids samples collected from the Original CKD Disposal Area were more caustic relative to the Stope samples. The mean of the pH values measured in the materials collected from BMW-24-04 and BMW-24-05 was 11.80 and 12.00, respectively (Table 10, Table 11; Appendix K).

179 River Street, Troy, New York 12180
bowman.com

5.2.2. *Toxicity Characteristic Leaching Procedure Results*

Barium, boron, calcium, chromium, lithium, magnesium, manganese, molybdenum, nickel, potassium, selenium, vanadium, and zinc were the only analytes detected in the TCLP analysis (Table 12; Appendix L).

Based on the TCLP analysis the following constituents are unique in their ability to leach from either Original CKD Disposal Area or the Stope (i.e. detected TCLP result from one source, but not the other; Table 12; Appendix L).

Exclusively in Stope

- Boron
- Vanadium
- Zinc
- Molybdenum
- Nickel

Exclusively in Original CKD Disposal Area material

- Barium
- Chromium
- Lithium
- Selenium

Of the constituents with detectable TCLP results from both the Original CKD Disposal Area and the Stope, calcium, magnesium, and manganese have higher TCLP results from material in the Stope, and potassium has a higher TCLP result from material in the Original CKD Disposal Area (Table 12; Appendix L).

Regarding changes in LKD chemistry, calcium, manganese, nickel, and vanadium all have higher TCLP results from material that has been deposited on well caps between March 2025 and May 2025, when compared to the LKD material retrieved from the bottom of the Stope during drilling (Table 12; Appendix L). Vanadium, molybdenum, and nickel are present at a higher total concentration and have a higher TCLP result from the LKD material retrieved from the bottom of the Stope during drilling when compared to the LKD material that has been deposited on well caps between March 2025 and May 2025. There are no constituents that both have a higher total concentration and TCLP result from material sampled within the Original CKD Disposal Area (Table 10, Table 11, Table 12; Appendices K and L).

5.1. Limitations

Samples were run for TCLP at room temperature, and at a pH of 4.9 or 2.9 (depending on sample pH). Leachability will be higher at higher temperatures and under either more acidic (lower pH) or more caustic (higher pH) conditions (Tom Patten, personal communication). It is therefore reasonable to expect that in situ leachability rates are higher than those that have been measured in the laboratory and reported here. It is also reasonable to expect that the leachability rates of the CKD on Continental's property have been rendered higher as a consequence of the higher temperatures imposed by Linwood's kiln activity.

5.2. Laboratory Reporting

Laboratory reports are provided as Appendix M.

Table 10. Total Concentration of Solids in All Solid Samples.

	Mean Total Concentration (mg/kg)						Source of Highest Mean Result	% Difference Highest Mean Result
	Stope				Orig CKD Disposal Area			
Constituent	BMW-24-01	BMW-24-02	BMW-24-03	CAP-1	BMW-24-04	BMW-24-05		
Aluminum	5,133	5,770	2,255	4,070	9,662	11,433	Orig CKD DA	98.2%
Ammonia Nitrogen	33.05	14.25	119.0	ND	ND	ND	Stope	1,064%
Antimony	0.51	0.45	0.45	0.44	0.84	0.44	Orig CKD DA	65.1%
Arsenic	5.35	3.51	2.96	5.57	4.80	4.40	Stope	16.1%
Barium	28.93	52.65	37.20	19.70	72.87	84.80	Orig CKD DA	61.1%
Beryllium	1.82	1.81	0.45	0.30	0.60	0.66	Stope	176%
Boron	47.93	28.30	14.50	15.10	47.97	45.50	Orig CKD DA	0.1%
Bromide	ND	186.0	111.0	ND	1,630	33.20	Orig CKD DA	776%
Cadmium	0.82	0.34	0.21	0.43	2.78	1.13	Orig CKD DA	237%
Calcium	208,000	217,000	281,000	283,000	235,420	252,709	Stope	12.0%
Chloride	353.8	396.0	1,980	970.0	3,873	942.7	Orig CKD DA	95.6%
Chromium	8.70	9.94	5.63	11.10	32.30	17.46	Orig CKD DA	191%
Cobalt	3.28	2.74	2.22	6.06	8.65	9.87	Orig CKD DA	62.9%
Copper	5.02	8.00	3.80	7.86	10.04	16.55	Orig CKD DA	107%
Fluoride	ND	19.60	7.22	ND	4.27	8.05	Stope	143%
Lead	25.18	25.43	25.80	94.00	35.79	48.59	Stope	93.5%
Lithium	5.46	5.17	2.17	6.82	10.02	15.26	Orig CKD DA	124%
Magnesium	49,825	16,585	4,465	20,500	13,769	11,767	Stope	262%
Manganese	426.5	369.5	441.5	398.0	2,359	2,615	Orig CKD DA	492%
Molybdenum	21.30	26.45	7.68	9.36	2.42	2.47	Stope	971%
Nickel	227.0	215.4	72.55	980.0	21.15	22.15	Stope	4,324%
Nitrate	ND	14.60	88.20	16.00	ND	ND	Stope	NA
Nitrite	ND	9.13	ND	62.50	ND	ND	Stope	NA
Phosphorus	184.8	106.4	91.95	105.0	224.2	249.3	Orig CKD DA	35.0%
Potassium	415.3	1,093	1,029	2,010	9,779	17,409	Orig CKD DA	766%
Selenium	1.28	1.22	0.90	3.21	2.28	3.98	Orig CKD DA	23.9%
Silver	ND	ND	ND	ND	0.21	0.25	Orig CKD DA	49.5%
Sodium	424.3	321.0	383.2	1,060	1,041	1,771	Orig CKD DA	67.0%
Sulfate	25,475	20,600	19,039	42,900	12,542	25,954	Stope	65.3%
Thallium	0.49	0.50	0.74	2.19	1.08	1.91	Stope	14.4%
Total Solids	65.48	79.00	72.90	52.40	72.01	71.20	Stope	9.7%
Vanadium	824.3	694.5	449.9	2,140	20.79	26.57	Stope	7,953%
Zinc	28.48	30.95	13.85	15.90	1,166	80.37	Orig CKD DA	3,668%
pH	10.48	9.40	8.65	7.66	11.80	12.00	Orig CKD DA	14.5%

Notes:
ND = Non-Detect (result was below the laboratory minimum detection limit)
NA = Calculation not applicable because laboratory minimum detection limits exceeded results from other source
Orig CKD DA = Original CKD Disposal Area
% Difference Highest Mean Value = (Maximum of Mean Values in Highest Source-Maximum of Mean Values in Lowest Source) / Maximum of Mean Values in Lowest Source

Table 11. Number of Samples and Standard Deviation of Values for Total Concentration of Solids in All Samples.

Constituent	Number of Samples / Standard Deviation of Measured Values					
	Stope				Original CKD Disposal Area	
	BMW-24-01	BMW-24-02	BMW-24-03	CAP-1	BMW-24-04	BMW-24-05
Aluminum	4 / 4,095	2 / 4,370	2 / 2,510	1 / -	20 / 2,467	23 / 1,697
Ammonia Nitrogen	2 / 10.4	2 / 3.89	1 / -	- / -	- / -	- / -
Antimony	4 / 0.24	2 / 0.07	2 / 0.09	1 / -	20 / 0.55	23 / 0.14
Arsenic	4 / 4.73	2 / 2.54	2 / 2.48	1 / -	20 / 2.29	23 / 1.01
Barium	4 / 17.8	2 / 36.3	2 / 5.37	1 / -	20 / 20.8	23 / 11.7
Beryllium	2 / 1.16	1 / -	1 / -	1 / -	19 / 0.1	23 / 0.12
Boron	4 / 41.4	2 / 18.5	1 / -	1 / -	19 / 11.8	23 / 8.19
Bromide	- / -	1 / -	1 / -	- / -	1 / -	1 / -
Cadmium	4 / 0.83	2 / 0.1	1 / -	1 / -	20 / 8.41	23 / 0.69
Calcium	4 / 9,201	2 / 33,941	2 / 97,581	1 / -	20 / 81,330	23 / 52,968
Chloride	4 / 226	2 / 387	1 / -	1 / -	11 / 3,214	14 / 483
Chromium	4 / 5.54	2 / 2.35	2 / 6.19	1 / -	20 / 52.8	23 / 3.59
Cobalt	4 / 2.22	2 / 0.64	2 / 0.76	1 / -	20 / 1.81	23 / 1.12
Copper	4 / 3.89	2 / 1.97	2 / 0.61	1 / -	20 / 2.54	23 / 33.9
Fluoride	- / -	1 / -	2 / 9.02	- / -	2 / 2.69	4 / 3.12
Lead	4 / 13.5	2 / 24.3	2 / 27.7	1 / -	20 / 22.9	23 / 29.1
Lithium	4 / 4.92	2 / 2.04	2 / 1.15	1 / -	20 / 4.16	23 / 4.18
Magnesium	4 / 12,236	2 / 14,446	2 / 2,185	1 / -	20 / 7,340	23 / 1,681
Manganese	4 / 138	2 / 82.7	2 / 470	1 / -	20 / 721	23 / 530
Molybdenum	4 / 9.03	2 / 19.7	2 / 10.5	1 / -	20 / 2.64	23 / 0.65
Nickel	4 / 102	2 / 168	2 / 81.2	1 / -	20 / 4.11	23 / 4.46
Nitrate	- / -	1 / -	1 / 0.	1 / -	- / -	- / -
Nitrite	- / -	1 / -	- / -	1 / -	- / -	- / -
Phosphorus	3 / 144	2 / 13.6	2 / 59.5	1 / -	20 / 83.8	23 / 27.6
Potassium	4 / 311	2 / 604	2 / 1,063	1 / -	20 / 6,535	23 / 7,397
Selenium	4 / 0.88	2 / 0.66	1 / -	1 / -	20 / 2.26	23 / 1.51
Silver	- / -	- / -	- / -	- / -	10 / 0.12	20 / 0.2
Sodium	4 / 198	2 / 49.5	2 / 416	1 / -	19 / 491	22 / 765
Sulfate	4 / 8,948	2 / 7,920	2 / 26,533	1 / -	20 / 10,448	22 / 12,503
Thallium	3 / 0.13	2 / 0.34	1 / -	1 / -	20 / 0.79	23 / 0.83
Total Solids	4 / 12.	2 / 10.9	2 / 19.	1 / -	20 / 9.93	23 / 9.89
Vanadium	4 / 602	2 / 687	2 / 634	1 / -	20 / 5.74	23 / 10.8
Zinc	4 / 20.4	2 / 11.4	2 / 1.63	1 / -	20 / 4,632	23 / 41.8
pH	4 / 2.12	2 / 1.99	2 / 0.03	1 / -	20 / 0.59	23 / 0.22

Notes:
"-" Not measured or not detected

Table 12. TCLP Results in Solid Samples Where Detected at One or More Locations.

Constituent	Mean Total Concentration (mg/L) Stope BMW-24-01	BMW-24-02	BMW-24-03	CAP-1	Orig CKD Disposal Area BMW-24-04	BMW-24-05	Source of Highest Mean Result
Barium	ND	ND	ND	ND	0.22	0.23	Orig CKD DA
Boron	2.30	ND	ND	ND	ND	ND	Stope
Calcium	1,379	2,195	1,678	2,770	1,195	1,762	Stope
Chromium	ND	ND	ND	ND	ND	0.20	Orig CKD DA
Lithium	ND	ND	ND	ND	0.27	0.24	Orig CKD DA
Magnesium	410.0	187.0	82.75	171.0	35.57	53.52	Stope
Manganese	1.48	1.14	2.79	3.74	0.55	2.56	Stope
Molybdenum	0.54	0.40	0.11	ND	ND	ND	Stope
Nickel	0.46	0.72	0.52	3.82	ND	ND	Stope
Potassium	13.40	26.60	34.00	25.50	325.8	721.2	Orig CKD DA
Selenium	ND	ND	ND	ND	ND	0.13	Orig CKD DA
Vanadium	1.28	1.12	2.77	9.54	ND	ND	Stope
Zinc	ND	0.51	ND	ND	ND	ND	Stope

Constituent	Number of Samples / Standard Deviation of Measured Values Stope BMW-24-01	BMW-24-02	BMW-24-03	CAP-1	Orig CKD Disposal Area BMW-24-04	BMW-24-05	% Difference Highest Mean Result
Barium	- / -	- / -	- / -	- / -	8 / 0.18	19 / 0.27	-
Boron	1 / -	- / -	- / -	- / -	- / -	- / -	-
Calcium	4 / 882	2 / 940	2 / 979	1 / -	20 / 232	23 / 775	57.2%
Chromium	- / -	- / -	- / -	- / -	- / -	10 / 0.06	-
Lithium	- / -	- / -	- / -	- / -	2 / 0.13	20 / 0.05	-
Magnesium	2 / 393	2 / 96.2	2 / 101	1 / -	7 / 45.1	5 / 43.2	666%
Manganese	2 / 0.45	2 / 0.01	2 / 2.74	1 / -	5 / 0.58	2 / 2.	46.4%
Molybdenum	2 / 0.51	2 / 0.25	1 / -	- / -	- / -	- / -	-
Nickel	2 / 0.5	2 / 0.62	1 / -	1 / -	- / -	- / -	-
Potassium	1 / -	1 / -	1 / -	1 / -	20 / 249	22 / 291	2,021%
Selenium	- / -	- / -	- / -	- / -	- / -	2 / 0.01	-
Vanadium	2 / 0.19	2 / 1.	1 / -	1 / -	- / -	- / -	-
Zinc	- / -	1 / -	- / -	- / -	- / -	- / -	-

Notes:
ND = Non-Detect (result was below the laboratory minimum detection limit)
"-" Not measured or not detected
% Difference Highest Mean Value = (Maximum of Mean Values in Highest Source-Maximum of Mean Values in Lowest Source) /Maximum of Mean Values in Lowest Source

6.0 Groundwater Exceedances and Solid Analysis Results

Tying the results of the solid source material testing to groundwater exceedances can suggest which solid source is responsible for each constituent recorded in the groundwater at the Site. This analysis establishes whether contaminants detected in groundwater are consistent with the chemistry of potential source materials.

Elevated TCLP values indicate greater potential for leaching to groundwater, even if total concentrations are lower. Conversely, a source with higher total concentration but low TCLP results may represent a larger concentration of contaminants but a lower probability of leaching from the solid source into the groundwater. Leachability also requires interaction between the contaminants and water. A comparison of the total concentration, TCLP results, and position of the sampled material relative to the measured water table elevation indicates which source is likely to be the larger contributor to the observed groundwater exceedances (Table 13).

Based on those comparisons, the following groundwater concentration exceedances are likely due to leaching of constituents from the solid source material in the Stope:

- Lead
- Molybdenum
- Nitrite
- Nickel
- Thallium
- Vanadium

The comparisons indicate that the following exceedances are likely due to leaching of constituents from the solid source material in the Original CKD Disposal Area:

- Antimony
- Cobalt
- Lithium

The following exceedances are likely due to leaching of constituents from a combination of the solid source materials in the Stope and the Original CKD Disposal Area:

- Arsenic
- Manganese
- Selenium

The following exceedances were also recorded in the upgradient wells (MW-13 and MW-15) at concentrations that are both higher than the IDNR SWS and the USEPA MCLs and are higher than the concentrations recorded in the exceedance wells:

- Antimony
- Cobalt
- Lithium
- Manganese
- Nitrite
- Selenium
- Thallium

The exceedances determined to be likely due to leaching of constituents from the solid source material in the Original CKD Disposal Area could therefore also be associated with background conditions in the aquifer and/or traceable to one or more unidentified offsite sources.

179 River Street, Troy, New York 12180
bowman.com

7.0 Apparent Groundwater Bearing Zone Connection

Groundwater samples exceeding the IDNR SWS and US EPA MCL (with the exception of exceedances of Lithium) within the Lower GBZ were observed exclusively in MW-4L, MW-18, and MW-11 (Figures 10B, 12B, and 14B). The source of the constituent exceedances recorded in the Lower GBZ is not certain. However, as described in Section 4.3.4, monitoring wells MW-4L and MW-18 could be providing a pathway for constituent movement from the Middle to the Lower GBZ because the screened intervals in those wells cross parts of both the Otis Formation and the Lower GBZ. Fracturing in the rocks adjacent to and below the Original CKD Disposal Area associated with the historical mining activities could have also created one or more pathways along which the COCs could be moving.

Table 13. Source of Groundwater Exceedances Measured in March and May 2025.

		All Soil Samples Source of Highest Mean Result		Samples Collected Below the Water Table Source of Highest Mean Result		
GBZ	Constituent	TCLP	Total Analysis	TCLP	Total Analysis	Figure References
Upper	Cobalt	ND	Orig CKD DA	ND	Orig CKD DA	8A
Middle	Antimony	ND	Orig CKD DA	ND	ND	9A, 9B
Middle	Arsenic	ND	Stope	ND	Orig CKD DA	10A
Middle	Cobalt	ND	Orig CKD DA	ND	Orig CKD DA	8B, 8C
Middle	Lead	ND	Stope	ND	Stope	11A, 11B
Middle	Lithium	Orig CKD DA	Orig CKD DA	Orig CKD DA	Orig CKD DA	12A, 12C
Middle	Manganese	Stope	Orig CKD DA	ND	ND	13A, 13B
Middle	Molybdenum	Stope	Stope	ND	ND	14A, 14C
Middle	Nitrite	ND	Stope	ND	Stope	15
Middle	Nickel	Stope	Stope	Stope	Stope	16
Middle	Selenium	Orig CKD DA	Orig CKD DA	Orig CKD DA	Stope	17A, 17B
Middle	Thallium	ND	Stope	ND	Stope	18A, 18B
Middle	Vanadium	Stope	Stope	Stope	ND	19A, 19B
Lower	Arsenic	ND	Stope	ND	Orig CKD DA	10B
Lower	Lithium	Orig CKD DA	Orig CKD DA	Orig CKD DA	Orig CKD DA	12B
Lower	Molybdenum	Stope	Stope	ND	ND	14B

Notes:
GBZ = Groundwater Bearing Zone
TCLP = Toxicity Characteristic Leaching Procedure
ND = Non-Detect
Orig CKD DA = Original CKD Disposal Area

8.0 Groundwater Temperature

8.1. Temperature as a Tracer

Because of the excessive heat coming from the Linwood Stope, using groundwater temperature as a tracer can help identify and map groundwater flow paths and velocities. Seasonal air temperature fluctuations and precipitation can affect ground temperatures and propagate downward, creating thermal signals that can be tracked through the monitoring network. Differing sources of groundwater and surface water infiltration can also influence groundwater temperatures. The depth and timing of these temperature changes help determine the direction and rate of groundwater movement.

As previously discussed, Linwood currently has an air permit to route emissions from its kilns into the Stope. Linwood's lime kilns operate at temperatures above 1,500°F. At depth, The Stope extends 400 feet onto the Continental Property, as mapped by Linwood, and the Linwood kiln emissions are located approximately 200 feet east of the Continental Property (SCS Engineers, 2024; Figure 2).

This source of heat can contribute to unnaturally elevated groundwater temperatures by heating groundwater exposed directly to the Stope environment, or by heating the bedrock surrounding the Stope through which groundwater is flowing.

The average groundwater temperature of wells most distant from the Stope is approximately 54°F (Figures 20A-C). Groundwater temperatures appreciably higher than 54°F recorded in wells generally downgradient from the Stope were considered to have been caused by heating from the Stope.

All transducers installed on Site record groundwater temperatures in the respective wells that they're monitoring. Measurements are collected from each well every 30 minutes. Temperature data from these transducers have been verified through temperature readings from other equipment (Horiba Multimeter temperature readings during well sampling; Figures 20A-C).

8.2. Groundwater Temperature – June 28, 2025

The spatial distribution of groundwater temperatures in the Middle and Lower GBZs as measured on June 28, 2025 is presented on Figures 21, 22, and 23. A groundwater temperature of 58.9°F was recorded at the Quarry Sump, which reflects the influence of ambient air temperature on the groundwater temperature at this location. Groundwater temperature measurements below the floor of the quarry pit and within the Plant are consistent with average background groundwater temperatures in Davenport IA (52.4-55.3°F). While there are no natural geologic features in the region that have the potential to heat groundwater, groundwater temperatures gradually increase moving east, consistent with proximity to the Stope.

Monitoring well BMW-24-02 has a groundwater temperature of 135.5°F, and BMW-24-03 has a groundwater temperature of 115.4°F; both are located within the Stope. BMW-24-02 is located less than 500 feet from the Linwood Kiln discharge point. MW-2CR, also within the Stope, has a groundwater temperature of 107.1°F.

Downgradient of the Stope, the groundwater temperature is 15°F higher than background at BMW 24-04 and 10°F higher than background at BMW 24-05. Despite MW-3's proximity to the Stope (equidistant relative to BMW-24-05), groundwater temperature in this area is representative of background, likely because groundwater is flowing from the northwest to MW-3 rather than from the Stope (Figure 6B and 6E).

In the Lower GBZ, groundwater temperature readings range from 53°F to 65°F, excluding the Quarry Sump. The general trend within this Zone shows that groundwater is warmer along the eastern side of the property. Notably, monitoring well MW-21 records a groundwater temperature of 63°F, approximately 5-10°F warmer than groundwater temperatures observed in the western wells. This elevated temperature is likely the result of thermal input from the Stope, either directly from the deeper Stope area to the east, or indirectly via warmer groundwater infiltrating vertically from the Middle GBZ.

The spatial distribution of groundwater temperatures across the Site combined with the recorded air temperatures in Linwood's Stope strongly support the determination that, within the Middle GBZ, groundwater is flowing from

Linwood's Stope on the east, within, or under the Original CKD Disposal Area and into the central part of Continental's property.

9.0 Conclusions

This RAMP summarizes the findings of the CKD Water Quality Investigation conducted by Continental from November 2024 to July 2025. A series of five new wells and borings were installed across the southern limits of the Original CKD Disposal Area and within the abutting Linwood Stope that extends westward from the Linwood property, across the property boundary and underlies part of the eastern section of Continental's CKD monofil area. Groundwater level and temperature monitoring devices were installed at all of the Site wells and were continuously recording data between December 2024 and September 2025 (as of preparing this report). All Site wells and leachate monitoring wells were gauged and sampled in March 2025. All Site wells and leachate monitoring wells were gauged again in May 2025. Potentiometric surface maps were prepared for both gauging events and for June 2025 using data from the monitoring devices. Isotherm maps were developed for the Middle and Lower GBZs for June 28, 2025, using the temperature data recorded by the monitoring devices.

- In the Middle GBZ, groundwater flows from east-to-west; from the western part of the Stope across or under the Original CKD Disposal Area and toward the Quarry Pond and the Quarry Sump.
- In the Lower GBZ, groundwater flows nearly radially away from the western side of the CKD monofill area, likely due to mounding created by downward flow from the Middle GBZ along a combination of flow paths created by the screened intervals at MW-4L and MW-18 and fractured rock surrounding the CKD monofill area created by historical mining.
- Two wells (BMW-24-04 and BMW-24-05) located within the Original CKD Disposal Area indicate that the groundwater table intersects the bottom of the Original CKD Disposal Area.
- Groundwater to the east of the Site beneath the Stope is being heated by Linwood's Lime Kiln exhaust to temperatures exceeding 120°F, more the 60°F hotter than average groundwater temperatures in the region.
- Westward groundwater flow from the Stope is heating groundwater in the Middle and Lower GBZs to temperatures well in excess of ambient groundwater temperatures (10-80°F over the ambient temperature in the Middle GBZ and 5-10°F over the ambient temperature in the Lower GBZ).
- Airfall deposits of LKD and other lime kiln exhausts within the Stope and emplaced CKD within the Original CKD Disposal Area are two likely sources of the observed groundwater contamination at the Site.
- Groundwater flow patterns across the Site mapped to date indicate that all wells other than MW-13 and MW-15 are downgradient from the Original CKD Disposal Area and/or the Stope.
- Solid chemistry analyses indicate that the COCs identified in groundwater beneath the Site are sourced to a combination of the Stope and the Original CKD Disposal Area wherein some are likely sourced to a combination of the Stope and the Original CKD Disposal Area; some are more strongly linked to the Stope.
- Groundwater exceedances measured during March and May 2025 can be traced back to the two sources of contamination, the Stope and the Original CKD Disposal Area, based on the solid chemistry analysis.
- Elevated groundwater temperatures attributable to the discharge of the lime kiln emissions into the Linwood Stope likely impact the ability for constituents to leach from solid source material into the groundwater within the Middle GBZ.

179 River Street, Troy, New York 12180
bowman.com

- Antimony, bromate, cobalt, lithium, manganese, nitrite, selenium, and thallium recorded in the downgradient monitoring wells at the Site occurred at concentrations that, although in exceedance of the IDNR SWS and/or US EPA MCLs, are lower than the concentrations of those constituents measured in the upgradient control wells (MW-13 and MW-15). Those exceedances are therefore potentially attributable to background conditions and/or one or more offsite sources.
- Historic water levels recorded in Wells MW-9 and MW-10 likely do not represent the water table in the Original CKD Disposal Area.

10.0 Monitoring and Reporting

As required by the Permit, Continental will continue to report the findings of its CKD Water Quality Investigation in annual updates to the RAMP submitted with the AWQR

11.0 Remedial Action Objectives

11.1.Current Actions

Continental is currently implementing the following actions that support efforts to investigate, mitigate, and/or remediate impacted groundwater underlying the Site.

1. While currently generated CKD is being placed in the active Phase II Cell above the Upper GBZ, the quantity of CKD landfilled on Site is being reduced through:
    a. Reusing CKD produced onsite in the cement manufacturing process; and
    b. Investing in research and development of beneficial uses and reuse of CKD.
2. Collection of high frequency water level data within the leachate monitoring well network such that water level exceedances can be promptly detected and addressed through jetting the leachate drainage pipes.
3. Initiated more frequent maintenance of the leachate collection system including:
    a. Jetting the drainage lines; and
    b. Maintaining maximum hydraulic gradient from the upper leachate collection zone into the leachate sump by regularly pumping the leachate sump.
4. Investigating the design of the Active Phase II Cell, specifically the possibility of hydraulic connection between the lower leachate collection zone and:
    a. The vertically adjacent formerly emplaced CKD; and
    b. The laterally adjacent native rocks and sediments.

179 River Street, Troy, New York 12180
bowman.com

11.2.Future Actions

Continental is planning to initiate the following actions in 2026 to expand on the investigation, mitigation and/or remediation of groundwater at the Site.

1. Pumping out the lower leachate collection zone via one or more of the lower leachate collection zone monitoring wells to maintain maximum downward hydraulic gradients between the upper and lower leachate collection zones and better understand the source of the COCs measured in the lower leachate collection zone monitoring wells.
2. Continuation of more frequent jetting of the upper leachate collection zone drain pipes on an as-needed basis to better maintain water levels in the upper leachate collection zone below the 1-foot threshold.
3. High frequency groundwater monitoring of all monitoring locations on Site will continue. This high frequency groundwater monitoring will aid in developing an understanding of groundwater and, therefore, contaminant transport pathways.
4. More detailed and frequent mapping of groundwater flow patterns across the Site within the three GBZs by capitalizing on the automated depth to groundwater measurements collected from the transducers installed in 2025 to better understand the hydrogeologic conditions resulting from dewatering at the Quarry Sump, evapotranspiration from the Quarry Pond, Continental's pumping from the Deep Well, and if possible, pumping activities at the Linwood operation.
5. Repairing the well at BMW-24-03 such that groundwater levels and groundwater quality can be measured between the Original CKD Disposal Area and the Stope.
6. Developing a hydrostratigraphic model that will synthesize the available geologic, hydrologic, and contaminant data into a single internally consistent representation of Site conditions from which more effective mitigation and remediation strategies can be developed.

12.0 References

Blackstone Environmental, 2023. "Groundwater Remedial Action Mitigation Plan Update", Report prepared for Continental Cement (Tyler Sundell, R.G., Environmental Geologist; Krista A. Brodersen, Senior Project Manager; Eric Sonsthagen, P.E., Senior Project Engineer; Lindsay E. James, R.G., Senior Project Manager) and submitted to Iowa Department of Natural Resources on November 30, 2023.

Bowman, 2026. 2025 Annual Water Quality Report. Submitted on behalf of Continental Cement to the Iowa Department of Natural Resources on January 30, 2026.

Komex International, 1996. "Hydrogeological Investigation Cement Kiln Dust Management Area Lafarge Davenport Plant", Report prepared for Lafarge Corporation and submitted in February 1996.

Lafarge, 1999 "Davenport Plant, Joint Mapping Report", Report prepared by Levaque, Ethier, & Fontaine.

SCS Engineers, 2024. "1st Site Assessment Report Linwood Mine Stope", Report prepared for Linwood Mining and Materials (Sean Marczewski, Project Professional II; Timothy C. Buelow, P.E., Senior Project Advisor) and submitted to Iowa Department of Natural Resources on December 30, 2024.

Shive-Hattery, 1999. Transmittal of Records and Drawings for Phase I CKD Cell. Submitted to Iowa Department of Natural Resources on May 24, 1999. IDNR Document Numbers: 44912-44916.

Shive-Hattery, 2000. "RE: Cement Kiln Dust (CKD) Pile Closure Status", Transmittal prepared for Lafarge Corporation (Todd J. Kinney, P.E.) and submitted to Iowa Department of Natural Resources on January 6, 2000. IDNR Document Number 44817.

Shive-Hattery, 2002. CKD Monofill Phase II Plans. Submitted to Iowa Department of Natural Resources on November 11, 2002. IDNR Document Numbers: 44905-44908.

Terracon, 2005. "Construction compliance Report, Cell No. 1 Cap, Lafarge Cement Kiln Dust Landfill, Buffalo, Iowa", Report prepared for Lafarge North America (John F. Brimeyer, P.E., Senior Project Manager; Gerald T. Hentges, P.G., Senior Project Manager) and submitted to Iowa Department of Natural Resources on October 25, 2005. IDNR Document Number 44903.

Terracon, 2011. Groundwater Quality Assessment Report, Report prepared for Lafarge North America (John F. Brimeyer, PE, Environmental Manager; Gerald T. Hentges, PG, Senior Project Manager) and submitted to Iowa Department of Natural Resources on September 29, 2011.

Tom Patten. General Manager. Pace Analytical. Personal communication on June 9, 2025.