Seeps and Springs Report for the Kings Mountain Lithium Mine, Cleveland County, North Carolina

NOVEMBER 2022

PREPARED FOR

Albemarle U.S., Inc.

PREPARED BY

SWCA Environmental Consultants

SEEPS AND SPRINGS REPORT
FOR THE KINGS MOUNTAIN LITHIUM MINE, CLEVELAND COUNTY, NORTH CAROLINA

Prepared for

Albemarle U.S., Inc.
348 Holiday Inn Drive
Kings Mountain, North Carolina 28086
Attn: Trevor Chesal

Prepared by

SWCA Environmental Consultants
113 Edinburgh South Drive, Suite 120
Cary, North Carolina 27511
(919) 212-2200
www.swca.com

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1 INTRODUCTION

On behalf of Albemarle Corporation (Albemarle), SWCA Environmental Consultants (SWCA) conducted seeps and springs surveys for the Kings Mountain Lithium Mining Project (Project) located in southeastern Cleveland County, North Carolina. The Project includes restarting mining operations at a site where previous mining has occurred. Since future mining activities may affect groundwater levels, the purpose of this study is to identify seeps and springs in the Project area to understand and monitor site hydrology related to these resources.

Seeps and springs are water features that are fed by groundwater. Spring flow supports riparian vegetation and can provide habitat for aquatic species and drinking water during periods of freezing. Since they are fed by groundwater, springs can be an important source of information about groundwater levels and changes that might be occurring within the aquifer. Seeps and springs also typically provide water to headwater streams and wetlands that form the initial portions of larger river systems. Baseline surveys of seeps and springs help provide an understanding of groundwater conditions before mining restarts. Once mining starts, seeps and springs provide an opportunity to observe potential groundwater changes as they occur. For the purposes of this report, springs are defined as emergence of groundwater at a particular point, often eventually forming a stream. Seeps are defined as areas where groundwater emerged in a dispersed manner, often forming a wetland.

SWCA performed field surveys February 28–March 4, March 7–11, and March 14, 2022, to identify seeps and springs originating in the Project area. On September 27 and 28, 2022, SWCA reassessed the seeps and springs on the Albemarle Main Site to confirm the presence of flow or saturation later in the year. Additionally, some but not all seeps and springs on the Albemarle East Property were re-assessed in late October 2022. Streams and wetlands originating outside of the Project area are not included in this report but are discussed under separate cover in the wetland and waterbody delineation report (SWCA 2022).

1.1 Location

The Project is on private land owned or leased by Albemarle and consists of approximately 1,403 acres (Project area). The Project is located approximately 2 miles south of downtown Kings Mountain, North Carolina, and is located on the USGS Kings Mountain, North Carolina, 7.5-minute quadrangle (Figure 1). The Project area is divided by Interstate-85 (I-85), with the main parcel on the north side of the highway and two smaller parcels on the south side of the highway. The main parcel is bordered by South Battleground Avenue (Highway 216), Parkgrace Road, and Tin Mine Road to the west; Quarry Road to the north; and I-85 to the south and east.

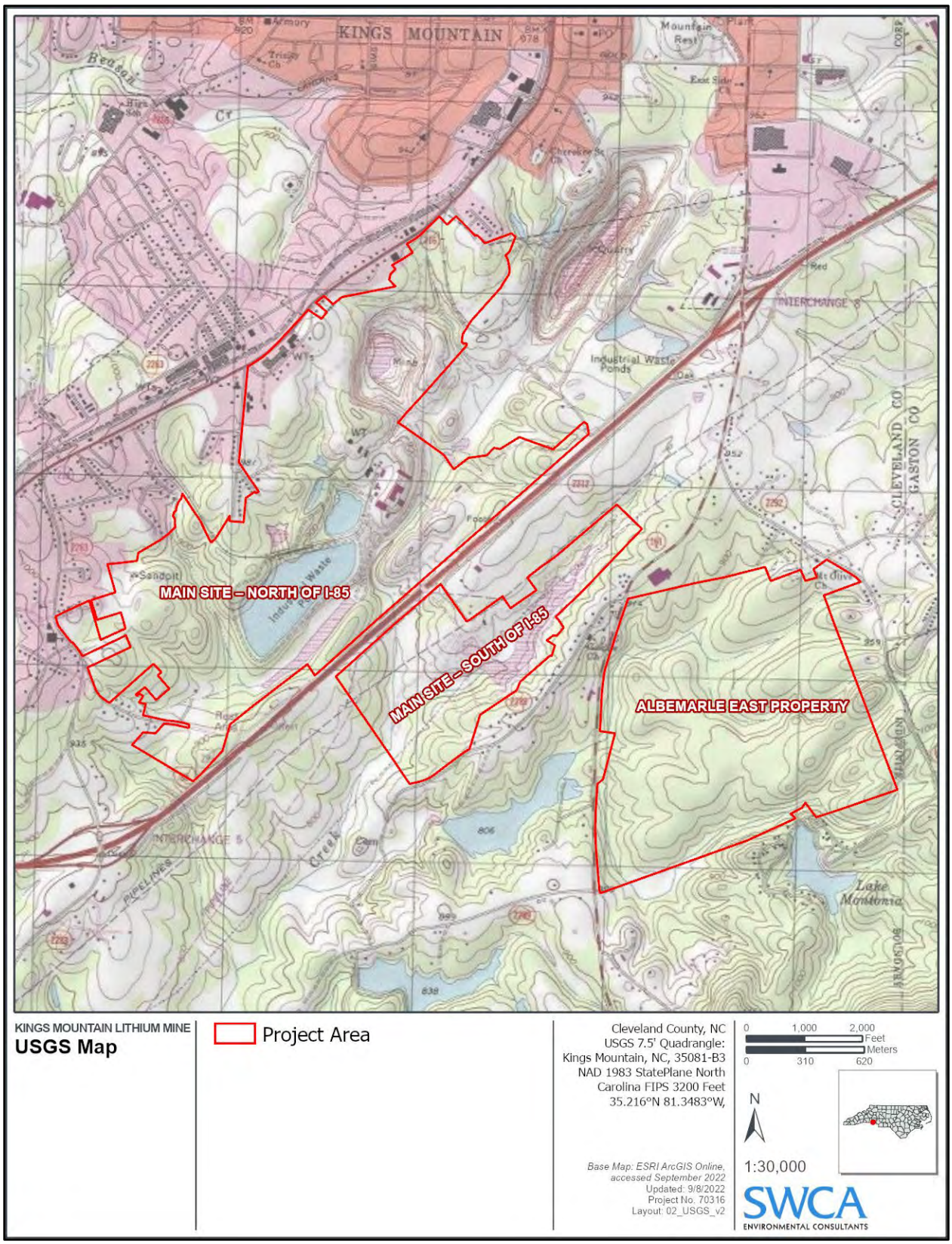

Figure 1. Project location.

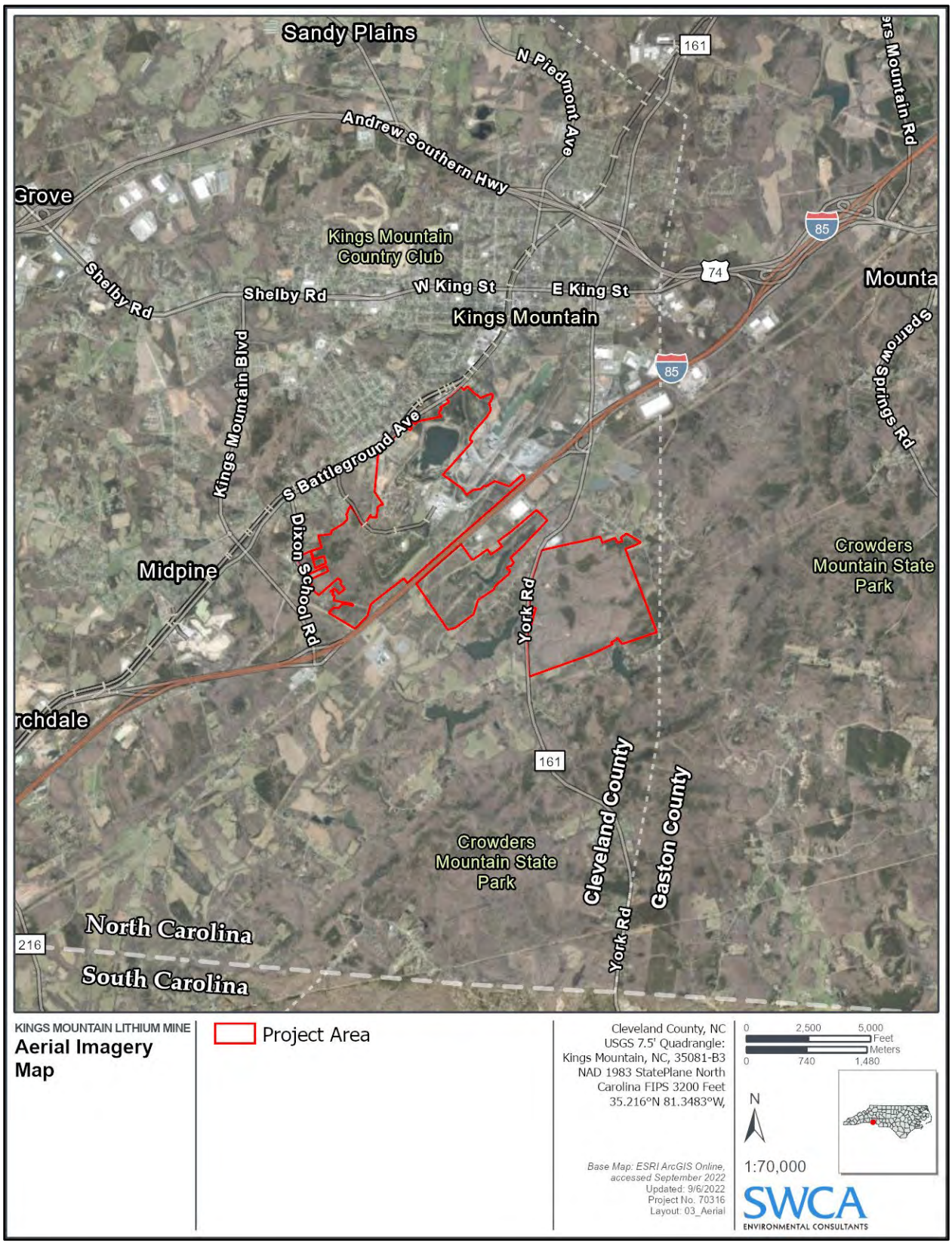

Figure 2. Aerial imagery of the Project area.

1.2 Project Area Description

The main parcel is mostly developed/disturbed and includes Albemarle's lithium salts and compound processing facility and Albemarle's Global Technical Center. The west side includes an active drive-in theater, remnants of a textile plant, old school building, and recreational vehicle campground. Five utility rights of way (ROWs) cross the northern and central portions of the parcel. The parcel directly south of I-85 is mostly undeveloped. The Kings Mountain Gateway Trail goes around the northern and eastern boundaries of this parcel with trailheads off Galilee Church Road and Battleground Road. Additionally, three utility ROWs cross the parcel running northeast–southwest. The easternmost parcel, east of York Road, is undeveloped with only a few unpaved roads for access. Undeveloped land in the three parcels consists primarily of forest and wetland habitats. Kings Creek and its tributaries flow through the three parcels. The Project area is surrounded by residential, commercial, and industrial development to the north, west, and south (Figure 2). The Martin Marietta mine borders the Project area to the north. To the east is primarily undeveloped land associated with Crowders Mountain State Park.

2 METHODS

2.1 Precipitation

Understanding precipitation levels and patterns is important when assessing the output of seeps and springs. If abnormally high or low periods of precipitation occur, it may not provide an accurate understanding of seeps and springs in an area. Abnormally dry periods may prevent seep or spring production or identification, while abnormally wet periods may inflate their contribution to site hydrology. Some seeps and springs were identified and observed after periods of rain. However, overall, the Project area had normal rainfall during the 3-month period prior to field surveys. Precipitation data from the National Weather Service's Gastonia Municipal Airport (FIPS 37071), North Carolina, station, which is approximately 10 miles east of the Project area, was used to determine the normality of rainfall over the Project area (National Oceanic and Atmospheric Administration 2022). This was compared with the Direct Antecedent Rainfall Evaluation Methods (DAREM) calculations data for the Gastonia Municipal Airport, North Carolina, for the 3 months prior to field surveys to provide an objective characterization of precipitation as drier than normal, normal, or wetter than normal. The DAREM calculations for the 3 months prior to each survey were calculated using observed rainfall data and comparative WETS data (Table 1). WETS tables, or National Resource Conservation Service (NRCS) Climate Analysis for Wetlands Tables, provide a statistical range for the area precipitation.

Based on these calculations, the 3-month period prior to March 2022 was found to have normal precipitation patterns. While some months had higher or lower rainfall than average, the overall precipitation data during the 3-month period were found to be normal. The 3-month precipitation data prior to the September 2022 re-assessment were also found to be normal. These data help support that the observed seeps and springs in the Project area were representative of the typical site hydrology and are likely to be present during normal precipitation levels.

Table 1. Rainfall Summary for Gastonia Municipal Airport, North Carolina (FIPS 37071)

Prior Month	WETS Rainfall Percentile (inches)		Measured Rainfall (inches)	Evaluation Month: March 2022		
	30th	70th		Condition*	Month Weight†	Score‡
September 2022	2.34	4.69	5.69	3	3	9
August 2022	2.11	4.50	1.94	1	2	2
July 2022	2.54	4.23	5.28	3	1	3
					Sum:	14
				Description:§	**Normal**	
February 2022	2.21	3.52	2.52	2	3	6
January 2022	2.15	3.46	3.80	3	2	6
December 2021	2.27	4.29	2.07	1	1	1
					Sum:	**13**
				Description:§	**Normal**	

* Condition values are 1 for <30th percentile, 2 for between 30th and 70th percentile, 3 for >70th percentile.

† Month weight is 3 for the most recent month, 2 for the previous month, and so on.

‡ Score is the product of the condition and month weight.

§ Description: drier than normal (sum is 6–9), normal (sum is 10–14), wetter than normal (sum is 15–18).

2.2 Defining Stream Flow

Stream flow velocity was categorized according to the North Carolina Department of Environmental Quality's *Methodology for Identification of Intermittent and Perennial Streams and Their Origins*, Version 4.11 (North Carolina Department of Environmental Quality 2010). These categories are detailed below and used in Table 3.

- Strong – Water is present and flowing in the deepest portion of the channel throughout the evaluation reach, and there is significant baseflow through the riffles or other shallow zones. Evidence of groundwater discharge into the channel or a groundwater table above the deepest portion is readily observable throughout the reach.
- Moderate – Water is present in the deepest portion of the channel throughout the evaluation reach, and there is a small amount of baseflow through the riffles or other shallow zones. Evidence of groundwater discharge into the channel or a groundwater table slightly above the deepest portion is observable in the reach but not abundant throughout the reach.
- Weak – Water is standing in pools and the stream bed is saturated, but there is not visible flow through the riffles or other shallow zones. Evidence of groundwater discharge is present but requires considerable time to locate. The groundwater table is at or slightly above the level of water in the pools.
- Absent – There is little to no visible water in the deepest portion of the channel. There is no evidence of groundwater discharge into the channel, and the groundwater table is at or below the deepest parts of the channel.

Stream type was also categorized using the North Carolina Department of Environmental Quality (2010) methodology. These are described below and used in Table 3.

- Ephemeral stream – A feature that carries only stormwater in direct response to precipitation with water flowing only during and shortly after large precipitation events. An ephemeral stream may

or may not have a well-defined channel, the aquatic bed is always above the water table, and stormwater runoff is the primary source of water

- Intermittent stream – A well-defined channel that contains water for only part of the year, typically during winter and spring when the aquatic bed is below the water table. The flow may be heavily supplemented by stormwater runoff.
- Perennial stream – A well-defined channel that contains water year-round during a year of normal rainfall with the aquatic bed located below the water table for most of the year. Groundwater is the primary source of water for a perennial stream, but it also carries stormwater runoff.

3 RESULTS

3.1 Overview

During the winter 2022 surveys, 16 seeps and 23 springs were observed (Figure 3). These resources are summarized in Table 2 and detailed in Table 3 below. Most springs formed into intermittent streams that are tributaries to larger streams within the Project area. Most seeps formed into wetlands that contributed hydrology to larger streams or wetlands within the Project area. See Appendix A for photographs of the seeps and springs.

Table 2. Seeps and Springs Overview

Location	Seeps	Springs
Main Site – North of I-85	5	12
Main Site – South of I-85	2	2
Albemarle East Property	9	9
Total	**16**	**23**

In September 2022, SWCA revisited all seeps and springs on the Main Site. The observed seeps and springs generally still exhibited flow and/or saturation consistent with the observations made in the original assessment during February and March of 2022. Portions of the Albemarle East Property were re-visited in late October in tandem with other field work. During the October surveys, most seeps and springs contained flow and/or saturation but were noticeably drier than when observed in February and March of 2022. However, total precipitation for the surrounding area in October was 1.33 inches, which is less than the normal; additionally, October is historically the driest month of the year in the surrounding area (National Oceanic and Atmospheric Administration 2022).

Table 3. Seeps and Springs Observed in the Albemarle Kings Mountain Mine Project Area

Resource Name	Classification	Flow	Resource Location	Observations	Photo #
S-A02	Spring - Intermittent stream	Weak	35.207162, -81.363059 Main Site – North of I-85	Stream is depicted as an intermittent National Hydrography Dataset flowline stream. However, during the delineation, most of it was an ephemeral stream. The coordinates represent the transition zone from ephemeral to intermittent where groundwater emerges.	1
S-A04	Spring - Intermittent stream	Moderate	35.209266, -81.366336 Main Site – North of I-85	Has an ephemeral portion upstream of intermittent portion. There appears to be a small historic stone spring house adjacent to the area where groundwater emerges.	2; 39
S-A06	Spring - Intermittent stream	Moderate	35.212176, -81.368552 Main Site – North of I-85	Groundwater-fed stream with additional contribution from surrounding seepage wetland W-A03. Originates within wetland and forms into a perennial stream.	3
W-A03	Seepage wetland	N/A	35.212005, -81.368541 Main Site – North of I-85	Large seepage wetland at the toe slope of a hillside. Contributes to stream S-A06.	4
S-A09	Spring - Intermittent stream	Moderate	35.213468, -81.367636 Main Site – North of I-85	Groundwater-fed stream that connects into perennial S-A07. Small spring.	5
S-A13	Spring - Intermittent stream	Moderate	35.218202, -81.358818 Main Site – North of I-85	Receives flow from upstream wetland as well as groundwater. Originates as spring from bank.	6
S-B05	Spring - Intermittent stream	Moderate	35.212957, -81.364604 Main Site – North of I-85	Groundwater-fed stream in the floodplain portion of South Creek (S-A05).	7
GW-B02-SPRING	Spring	Weak	35.212645, -81.36441 Main Site – North of I-85	Small hillside spring with no channelization. Contributes to wetland W-B02.	8
W-A17	Potential seepage wetland	N/A	35.220078, -81.358215 Main Site – North of I-85	Ponded area on margin of mine pit shelf. Potentially just accumulated rainwater on rock but was identified as potential spring/seep by other on-site scientists. Could not confirm a water source at time of visit.	9
S-A43	Spring - Intermittent stream	Moderate	35.221428, -81.357748 Main Site – North of I-85	Previously identified spring coming out of mining pit hillside.	10
S-A14	Spring - Intermittent stream	Weak	35.229068, -81.347242 Main Site – North of I-85	Stream originating from groundwater within the Project area. Resource appeared to potentially originate from a stormwater structure just outside of the Project area.	11
S-B13	Spring - Intermittent stream	Weak	35.218825, -81.350866 Main Site – North of I-85	Originates from groundwater and wetland W-B12.	12
GW-B01	Spring	Weak	35.219026, -81.350696 Main Site – North of I-85	Spring lacking channelization originating within Albemarle and Martin Marietta boundary.	13

Resource Name	Classification	Flow	Resource Location	Observations	Photo #
W-B08-PFO	Seepage wetland	N/A	35.213617, -81.354167 Main Site – North of I-85	Seepage wetland located along Kings Creek (S-B08). Old piping and turn valve are located within wetland.	14
GW-B04-SEEP	Seep	Moderate	35.21336, -81.354173 Main Site – North of I-85	Located along Kings Creek (S-B08). Seep 6 feet wide coming out of marshy hillslope and rock.	15
GW-B03-SEEP	Seep	Moderate	35.213247, -81.354218 Main Site – North of I-85	Seep coming out of rock on hillside adjacent to Kings Creek (S-B08).	16
GW-B05-SPRING	Spring	Weak	35.215413, -81.352328 Main Site – North of I-85	Feeds into stream S-B10, which is a short tributary to Kings Creek.	17
S-A17	Spring - Intermittent stream	Moderate	35.207493, -81.348682 Main Site – South of I-85	Has an ephemeral portion upstream of groundwater origination. Eventually connects into large wetland associated with Kings Creek. Intermittent portion originates as groundwater discharge.	18
W-B14	Seepage wetland	N/A	35.215859, -81.340238 Main Site – South of I-85	Small seepage wetland portion of W-B14. Becomes channelized into S-A25. No photo of this portion.	No photo
S-A25	Spring - Intermittent stream	Moderate	35.215767, -81.34045 Main Site – South of I-85	Originates from groundwater and wetland W-B14. Flows into tailings pond south of I-85.	19
W-A16	Seepage wetland	N/A	35.216092, -81.340688; 35.211633, -81.347285; 35.214716, -81.34256 Main Site – South of I-85	Large wetland complex south of I-85 that goes along the Gateway Trail. Three portions of this wetland are seepage areas coming down from the utility right-of-way. Only one of the areas is represented by a photo.	20
W-A30	Seepage wetland	N/A	35.210537, -81.339122 Albemarle East Property	Large seepage wetland. Area was mentioned to historically have mining activity, and this may have influenced the hydrology. There are two observable springs emerging vertically from the ground in this area at 35.210493, -81.339326 and 35.210979, -81.338696.	21
W-A31	Seepage wetland	N/A	35.211152, -81.334734 Albemarle East Property	Small seepage wetland that connects into perennial S-B29	22
W-A32	Seepage wetland	N/A	35.21015, -81.330551 Albemarle East Property	Seepage wetlands that connect into perennial S-B31. Other portions of this wetland are related to the stream floodplain but are all hydrologically connected.	23
S-A41	Spring - Intermittent stream	Moderate	35.210772, -81.327383 Albemarle East Property	Spring/groundwater fed stream found within W-A33.	24
W-A24	Seepage wetland	N/A	35.204011, -81.325536 Albemarle East Property	Seepage wetland originating at bottom of hillside and associated with S-A36.	25

Resource Name	Classification	Flow	Resource Location	Observations	Photo #
S-A36	Spring - Perennial stream	Strong	35.2041493, -81.3254499 Albemarle East Property	Spring-fed stream surrounded by wetland W-A24, which is also groundwater-fed.	26
S-A34	Spring - Intermittent stream	Moderate	35.20409, -81.32746 Albemarle East Property	Stream originates from groundwater seepage. An ephemeral portion of the stream is located upstream.	27
W-A22	Seepage wetland	N/A	35.201692, -81.334994 Albemarle East Property	Hillside seepage wetland that becomes channelized into S-A31.	28
S-A31	Spring - Intermittent stream	Moderate	35.201543, -81.334935 Albemarle East Property	Originates from channelization of seepage wetland W-A22.	29
S-A30	Spring - Intermittent stream	Moderate	35.20066, -81.335996 Albemarle East Property	Short groundwater-fed stream. Observed after a heavy rainfall.	30
S-B18	Spring - Intermittent stream	Moderate	35.20177, -81.334349 Albemarle East Property	Groundwater-fed stream. Originates within wetland W-A21.	31
W-B17	Seepage wetland	N/A	35.199879, -81.340088 Albemarle East Property	Seepage wetland on hillside that connects into perennial S-B16.	32
S-A28	Spring - Intermittent stream	Moderate	35.202061, -81.336957 Albemarle East Property	Groundwater-fed stream that connects into S-B16.	33
S-A29	Spring - Intermittent stream	Moderate	35.202642, -81.339072 Albemarle East Property	Groundwater-fed stream that connects into S-B16. Fed by seepage wetland W-A19 upstream of it.	34
W-A19	Seepage wetland	N/A	35.202711, -81.339068; 35.202238, -81.339486 Albemarle East Property	Seepage wetland that becomes channelized into S-A29.	35
W-A26	Seepage wetland	N/A	35.207473, -81.334643 Albemarle East Property	Seepage wetland that connects into perennial S-B22.	36
W-A35	Seepage wetland	N/A	35.204483, -81.335837 Albemarle East Property	Seepage wetland that becomes channelized into S-A42.	37
S-A42	Spring - Intermittent stream	Weak	35.2045106, -81.3358268 Albemarle East Property	Groundwater-fed stream. Associated with seepage stream W-A35.	38

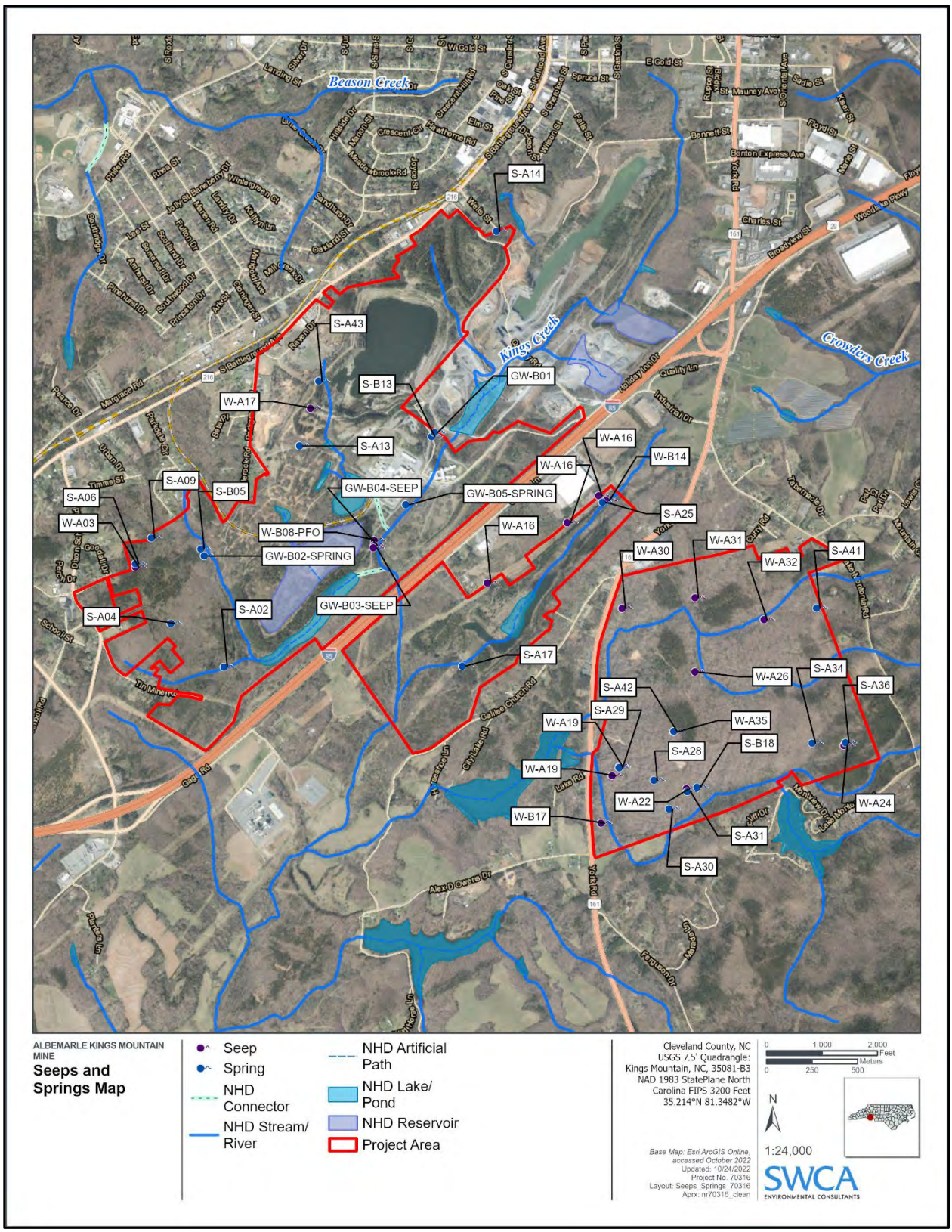

Figure 3. Seeps and springs map.

3.2 Summary and Conclusions

SWCA identified 16 seeps and 23 springs during surveys in February and March 2022. Most seeps and springs observed are on the Albemarle Main Site – North of I-85 and the Albemarle East Site and contribute to the larger streams and wetlands in these areas. Surveys were conducted during a period of normal rainfall and likely represent typical conditions at the Project area. The amount of flow or saturation of seeps and springs revisited in September were consistent with those observed in February and March. Seeps and springs on the Albemarle East Property revisited in late October exhibited flow or saturation but were noticeably drier than the February and March observations. However, October is the driest month of the year and only 1.33 inches of total precipitation occurred in the surrounding area.

The results of the baseline surveys of seeps and springs provide an understanding of groundwater conditions before mining restarts. Once mining starts, these seeps and springs can be monitored for any potential groundwater changes as they occur.

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APPENDIX A

Seeps and Springs Photo Log

Photo 1. Intermittent stream spring S-A02.

Photo 2. Intermittent stream spring S-A04.

Photo 3. Intermittent stream spring S-A06.

Photo 4. Seepage wetland W-A03.

Photo 5. Intermittent stream spring S-A09.

Photo 6. Intermittent stream spring S-A13.

Photo 7. Intermittent stream spring S-B05.

Photo 8. Small hillside spring GW-B02-SPRING.

Photo 9. Wetland W-A17 (potential spring/seep).

Photo 10. Hillside spring S-A43.

Photo 11. Intermittent stream spring S-A14.

Photo 12. Intermittent stream spring S-B13.

Photo 13. Groundwater spring GW-B01.

Photo 14. Seepage wetland W-B08-PFO. Water color is a result of naturally occurring iron-oxidizing bacteria.

Photo 15. Groundwater seep GW-B04-SEEP. Water color is a result of naturally occurring iron-oxidizing bacteria.

Photo 16. Groundwater seep GW-B03-SEEP.

Photo 17. Small spring GW-B05-SPRING along Kings Creek.

Photo 18. Intermittent stream spring S-A17.

Photo 19. Intermittent stream spring S-A25. Water color is a result of naturally occurring iron-oxidizing bacteria.

Photo 20. Seepage wetland W-A16 in utility right-of-way.

Photo 21. Seepage wetland W-A30. Water color is a result of naturally occurring iron-oxidizing bacteria.

Photo 22. Hillside seepage wetland W-A31.

Photo 23. Seepage wetland W-A32.

Photo 24. Groundwater-fed stream spring S-A41.

Photo 25. Seepage wetland W-A24.

Photo 26. Groundwater-fed perennial stream spring S-A36.

Photo 27. Spring-fed intermittent stream S-A34.

Photo 28. Hillside seepage wetland W-A22.

Photo 29. Groundwater-fed intermittent stream spring S-A31.

Photo 30. Groundwater-fed intermittent stream spring S-A30.

Photo 31. Groundwater-fed intermittent stream spring S-B18.

Photo 32. Hillside seepage wetland W-B17.

Photo 33. Groundwater-fed intermittent stream spring S-A28.

Photo 34. Groundwater-fed intermittent stream spring S-A29.

Photo 35. Seepage wetland W-A19.

Photo 36. Seepage wetland W-A26.

Photo 37. Seepage wetland W-A35.

Photo 38. Groundwater-fed intermittent stream spring S-A42.

Photo 39. Small stone spring house by S-A04 (shown in Photo 2).