REVISED
GROUNDWATER MONITORING PLAN
FOR THE PROPOSED SNOW CAMP QUARRY
SNOW CAMP, ALAMANCE COUNTY, NORTH CAROLINA

Prepared for:

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March 22, 2019

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GROUNDWATER MONITORING PROGRAM FOR THE PROPOSED SNOW CAMP QUARRY SNOW CAMP, ALAMANCE COUNTY, NORTH CAROLINA

Geologists have previously submitted a hydrogeologic study in the vicinity of the proposed Snow Camp Quarry located between Clark Road and Quackenbush road, approximately 2 miles south of the unincorporated town of Snow Camp in Alamance County, North Carolina. The preliminary investigation was based on site observations and measurements by Chris Reinhardt, PG (RCR) and on information provided by Alamance Aggregates, LLC and Carolina Geological Services, Inc. to support work in the preliminary permitting process for the proposed quarry. The scope of work primarily included the compilation of existing data and the evaluation of new data and field observations collected during several site visits. The report describes the hydrogeology of the area and estimates potential impacts of quarry development on local ground- water resources.

As the quarry operations will require de-watering of the quarry pit, a condition of the mining permit for this facility will require a Groundwater Monitoring Program to be implemented prior to beginning mining operations. Based on conversations with North Carolina Department of Environmental Quality (NCDEQ) personnel in the Division of Energy, Mineral, and Land Resources (DEMLR) and the Division of Water Resources (DWR), the permit will require monitoring groundwater levels and conditions in the vicinity of the quarry. The NCDEQ is especially concerned where private water supply wells may be impacted by quarry operations.

Expanded Well Survey

Based on a review of the Alamance County GIS aerial map for the vicinity surrounding the proposed quarry, there do not appear to be any residential properties within 500 feet of the proposed mining limit. The DMLR has requested a water supply well survey for properties within a 1,500 foot radius of the proposed permit boundary (**Figure 1**). Following an extensive review of Alamance County records, 89 individual properties were identified as being wholly or partly within the 1,500 foot radius. A public water supply is not available in the area. County records for existing water supply wells are incomplete and only extend back to 1990 when their permitting process began.

After viewing recent aerial photography for the properties (Alamance County GIS – 2018), RCR determined that 21 of the properties are currently undeveloped and are not likely to have an active water supply well. A review of county records for the area confirmed water supply wells exist on at least 45 of the properties within the search radius. These records

consisted of water supply well permits and requests for groundwater analysis from individual wells.

On February 25 and March 5, 2019 and on behalf of Alamance Aggregates, LLC, RCR sent Certified letters to 29 local property owners where there was no information or very limited information concerning potential water supply wells on their properties. The letter requested that they confirm if a well was on that property and, if so, provide any details they had concerning the well(s). To date (March 21, 2019) RCR has received Return Receipts for 24 of the 29 letters and has received a response from 8 of the recipients. One letter was returned as undeliverable and we are currently trying to determine how to get information on that property. **Figure 1** indicates the properties within the 1,500 foot radius of the proposed permit boundary and shows properties with confirmed and/or suspected water supply wells. **Appendix I** tabulates the residential properties the within search radius and provides available details for wells on those properties. **Appendix II** includes a compilation of the Certified Mailing and Return Receipts as well as the responses received to date.

Dewatering Influence on Area Water Supplies

The submitted mining permit application has proposed that the quarry may discharge as much as 500,000 gallons per day for dewatering purposes in the mine. In this geologist experience, the potential for a discharge of that volume of water is unlikely to occur unless there was a catastrophic rain event or significant rainfall for extended periods. The water discharged from the pit will be a combination of groundwater and rainwater, however, the majority of water in the pit is rainwater. Based on the average annual rainfall for the Burlington area (http://usclimatedata.com), 1 acre of active quarry pit will receive an average of approximately 3,350 gallons of rainwater per day. As an example, the Martin Marietta Burlington quarry, located 13 miles northwest and in a similar geologic situation, is permitted to discharge 340,000 gallons per day. The active mining area is 211 acres, yielding an average daily rainfall of about 700,000 gallons. Evaporation will account for the loss of much of the rainwater in the pit and part of the water is used for dust control and washing the crushed stone. The dust control and wash water seeps back into the ground and is effectively recycled on the property. A review of the permit for this quarry indicates that groundwater pumping from the pit is minimal. Records for the East Alamance quarry (18 miles north) show that pit water was only discharged to the surface receptor after periods of heavy rainfall and that daily discharge didn't exceed approximately 25,000 gallons per day. Based on this information, it is obvious that the amount of groundwater being pumped is relatively small and the pumping does not significantly impact groundwater conditions away from the quarry pit. Monitoring wells

installed at quarries with similar hydrogeologic conditions have shown little to no impact 800 feet from the pit. As part of the permitting process, Alamance Aggregates, LLC will register, monitor, and report water withdrawals from the pit in excess of 100,000 gallons per day in accordance with G.S. 143-215.22H.

Monitoring Plan

The proposed groundwater monitoring well network for the Snow Camp Quarry will, if possible, incorporate at least 1 of the 3 existing in-active water supply wells located on the quarry property. During the site reconnaissance, water levels were measured in 2 existing, in-active water supply wells on the property near the southern and northern edges of the property (**Figure 2**). Construction details or other information about the wells such as total depth, casing depth, and yield were not available. However, the drilled water supply wells could be converted to monitoring wells and at least one is located at a prime spot for continued long term monitoring of the site. Before incorporating existing wells into a monitoring network, the wells will need to be sounded for depth and obstructions, and we recommend a down-hole video screening of each well to confirm well conditions and suitability for conversion to monitoring wells. If any of the wells are in an acceptable condition, they could be converted to monitoring wells. The monitoring well network will be installed to determine the influence of quarry dewatering on the adjacent properties. Any well that is not in a suitable condition for conversion to a monitoring well should be abandoned in accordance with the NC Well Construction Standards (15A NCAC .2C).

The recommended monitoring plan will include 2 monitoring wells at each of the proposed monitoring locations north, south, east, and west of the quarry pit (**Figure 2**). One well at each location will be completed in the overburden/saprolite and will likely be approximately 30 feet to 40 feet deep. This zone acts as a storage reservoir and recharge source for the underlying fractured rock aquifer. A second well at each location will be completed in fractured bedrock and should extend to a depth similar to the projected depth of the proposed quarry. The shallow monitoring wells will be constructed of 2 inch ID PVC screen and riser, with a coarse sand filter pack, bentonite seal and grout to land surface. The deep monitoring wells can be completed as open hole wells into bedrock. Each water bearing fracture zone should be noted in the log as the borehole is advanced. All wells should be completed with riser extending above land surface with a protective steel casing. Additional protective structures (bollards, etc.) should be placed around the wellheads to protect from vehicular traffic. All wells will be installed under the supervision of a licensed NC Geologist and constructed by a certified driller in accordance with North Carolina Well Constructions Standards (15A NCAC .2C).

As the main concern for groundwater impact to surrounding properties is the lowering of the water table, periodic monitoring of water levels in the wells will be required. The frequency for monitoring and reporting will be included in the permits issued for quarry operations. The Division of Water Resources has recommended monthly water level measurements, beginning at least 2 months prior to any dewatering activities. Monthly water level measurements would be recorded and reported with the pumping data from the quarry dewatering. No water quality monitoring is recommended for the monitoring well network.

Adverse Impact Letter

In addition to monthly groundwater monitoring, the DWR has requested an "adverse impact" letter be provided by Alamance Aggregates, LLC to local residents. This letter would state "how the mine would rectify the situation if they impact their neighbors' wells". The DWR also suggested language for such a letter. On behalf of Alamance Aggregates, LLC, we suggest the following revision of the DWR suggested lette:

To Whom it may concern: (needs legal review)
If the proposed mine named Snow Camp Quarry, operated by Alamance Aggregates, Inc., should be shown to adversely impact any existing water supply wells within the surrounding area due to quarry dewatering activities, then Alamance Aggregates, Inc. will promptly take action to correct the adverse impact and notify the NC Division of Water Resources - Groundwater Management Branch. Alamance Aggregates, Inc. will take action to determine the direct cause of the issue(s) and will work to promptly resolve the issue(s).
Sincerely:

_____ (Title)
Alamance Aggregates, LLC

Original Monitoring Plan dated 09/22/2018
Revised Monitoring Plan dated 03/22/2019

Figures

Appendix I

Appendix II