Geologic and Geophysical Investigation
Alamance Aggregates, Snow Camp, NC

By Timothy W. Clark, P.G. #1932

October 1, 2019

Geologic and Geophysical Investigation
Alamance Aggregates, Snow Camp, NC

A detailed geologic investigation was performed at a large 100+ acre site in southern Alamance County, near the community of Snow Camp, NC (Figure 1). The investigation included detailed geologic mapping of existing outcrops and several days of ground magnetometer surveys. The ground magnetometer investigation was performed to identify the potential presence of any diabase dikes on the site that may act as preferential hydrologic conduits. The results of both the geologic and geophysical surveys are as follows.

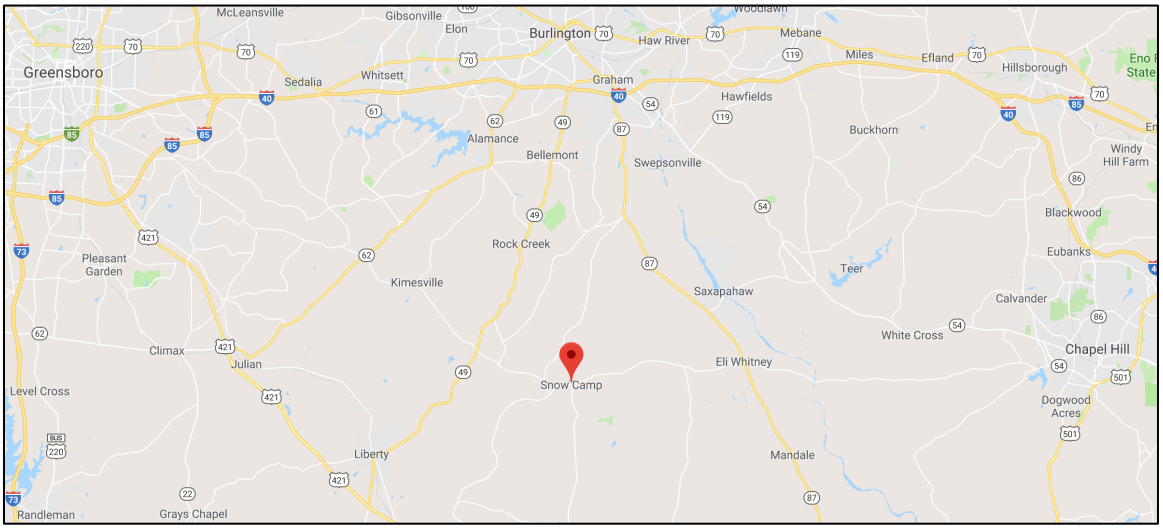

Figure 1. Location of Snow Camp, NC. Image from Google Maps 9/7/2019.

Geologic Background

The property lies within a geologic region of the state called the Carolina Terrane. Regional geologic mapping describes the area as a mixture of mostly felsic volcanic and epiclastic rock. Carpenter (1982) and the North Carolina Geologic Survey (1985) (Figure 2) describe the area as metamorphosed dacitic to rhyolitic flows and tuffs, light gray to greenish gray; interbedded with mafic and intermediate metavolcanic rock, meta-argillite, and metamudstone. The State geologic map (Figure 2) also shows a pod of intermediate metavolcanic rock immediately northeast of the property. It describes this unit as metamorphosed andesitic tuffs and flows, medium to dark grayish green; minor felsic and mafic metavolcanic rock.

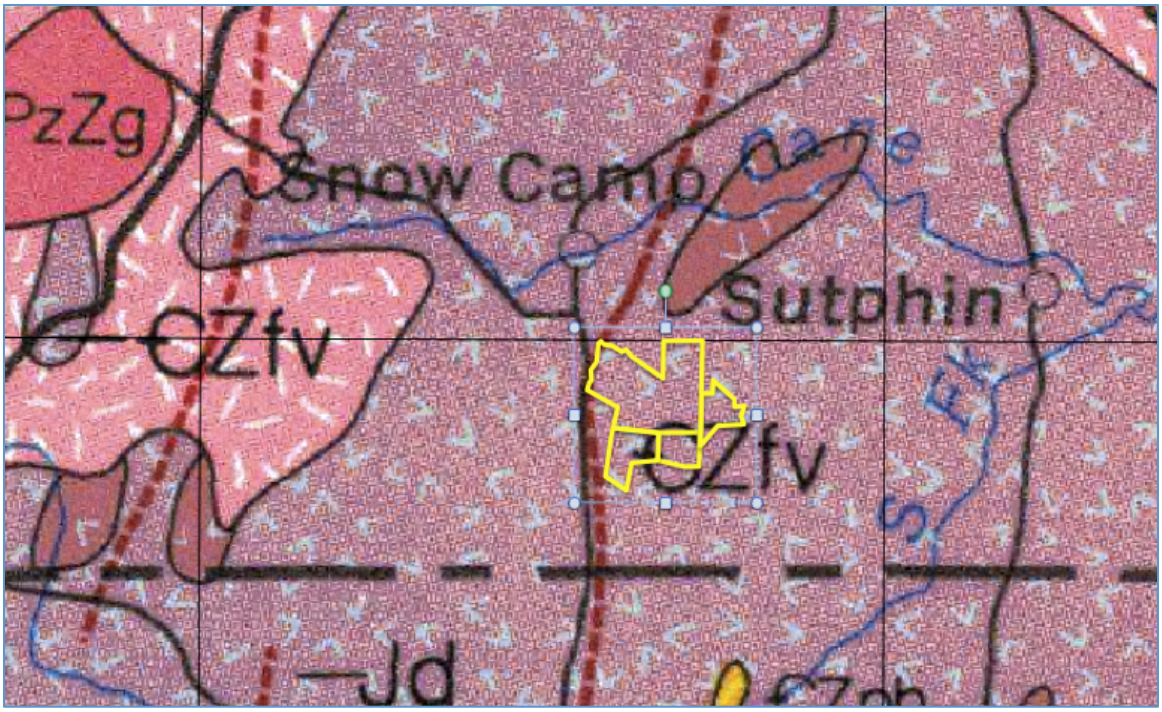

Figure 2. Excerpt from the Tate Geologic Map (North Carolina Geologic Survey, 1985) showing the project area (yellow parcels) just south-southeast of the community of Snow Camp, NC. The light pink shaded area labeled Cuffs is described as felsic volcanics. The darker pinkish unit labeled Chive is described as intermediate volcanics. The bold red dashed line labeled Jd is a large diabase dike. Thin black lines running north-south and east-west are boundaries of 1:24,000-scale 7.5' topographic maps.

No detailed geologic mapping (1:24,000-scale or less) is available for the property. However, Bradley and others (2017) produced a geologic map of the Crutchfield Crossroads quadrangle, which stopped just about 1 mile south of the property. The unit that projects toward the property is listed as unit Zhe/pl – Mixed epiclastic-pyroclastic rocks with interlayered dacitic lavas. The detailed description from Bradley and others (2017) is as follows: Grayish-green to greenish-grey, siliceous, metamorphosed: aphanitic dacite, porphyritic dacite with plagioclase phenocrysts, and flow banded dacite. The dacites are interpreted to have been coherent extrusives or very shallow intrusions associated with dome formation.

A second rock type, called diabase, is also known to exist in the Carolina Terrane. Diabase is a hard, black, igneous rock, and occurs in the area as a geologic structure called a dike. Diabase dikes are narrow bands of rock, usually between two and fifty feet wide, that typically run in a general north-south or northwest-southeast direction; however, some run in other directions. These dikes extend underground at a steep angle, commonly near vertical. Water wells drilled in diabase dikes generally yield more than wells in the surrounding rock, due to an increase in the number and density of fractures. Depending on the size of the diabase dike, well yield averages between 10-25 gallons per minute, which can sometimes be much higher than the surrounding rock.

The geologic map of Bradley does not indicate the presence of any diabase dikes that pass through the property. However, the map does show two north-northwest-trending dikes just south of the site (labeled Jd). A large diabase dike also appears on the State Geologic Map (figure 2) just west of the project area. Dikes sometime occur in swarms, with smaller, sub-parallel dikes branching off the main dike. Therefore, there was a good possibility that diabase dikes might be found on the subject property.

Geologic Investigation A site walkover was performed to become familiar with the geologic units in the project area. Several medium-sized pavements of rock were discovered in the pasture area in the central portion of the project area. Most of the geologic outcrops encountered in the project area are mixed epiclastic-pyroclastic rocks as described by Bradley and other (2017). The rocks are weakly foliated but have a consistent 025-035° strike with near vertical dips. No diabase boulders or loose float were identified in any of the cleared pasture areas of the site. The site walkover continued along the east-west-flowing creek on the north side of the project area. In the extreme northwestern corner of the project area an abundant amount of diabase float in the form of 4-25 cm cobbles and boulders was identified along the hill slope of the west side of the north-flowing creek. These scattered boulders were traced almost continuously due south to Clark Road on the southern side of the project area. This debris field of diabase is almost certainly the surface trace of the large diabase dike shown on the State Geologic map in Figure 2. A location map of the diabase dike trace and locations of geologic outcrops is presented as Figure 3.

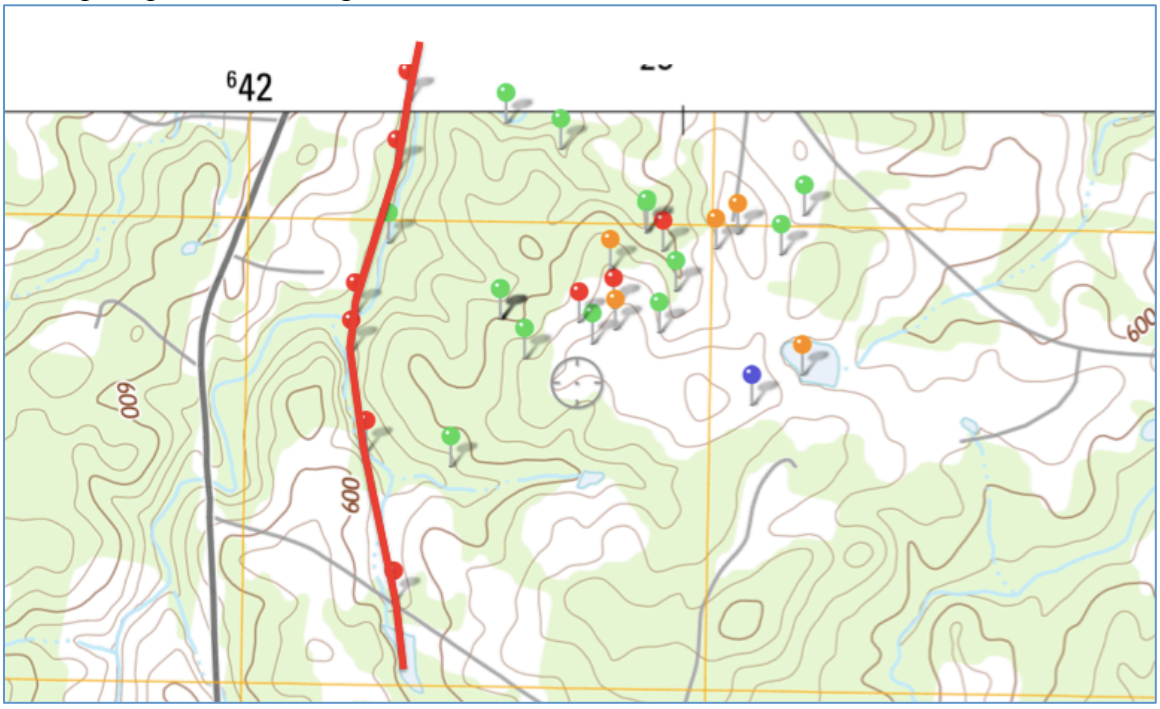

Figure 3. A portion of the Crutch fields Crossroads 7.5-minute topographic map showing geologic points of interest in the project area. The bold red line is the large diabase dike shown in figure 2. Green pins show the location of outcrops of epiclastic-pyroclastic rocks. Orange pins are locations of magnetometer traverses discussed later in the report.

Magnetometer Survey A ground magnetometer investigation was performed using a Geometrics G-856 Proton Procession Magnetometer to identify the potential presence of any diabase dikes on the site that may act as preferential hydrologic conduits. Because diabase is a magnetic rock, a detailed magnetometer survey usually helps to trace diabase beneath the ground, even in areas where none is seen on the surface.

The first step of the geophysical investigation was to run a long magnetometer traverse (Traverse A on Figure 4) across a large stretch of open pasture to potential identify any dikes in the area. The traverse was started at the edge of a small pond in the center of the project area. Readings were taken approximately every five feet along a bearing of 285°. The eastern portion of Traverse A initially appeared rather flat and uninteresting (magnetically speaking). However, a decent, medium-sized magnetic anomaly was detected toward the western end of the traverse (Figure 5). Magnetic interference occurred at two locations along the traverse when overhead power lines were encountered. This interference resulted in gaps in the data as shown on Figure 5. Additionally, a trash dump containing old car parts and appliances was encountered at the western end of the line, which resulted in the erratic readings in that area (see Figure 5).

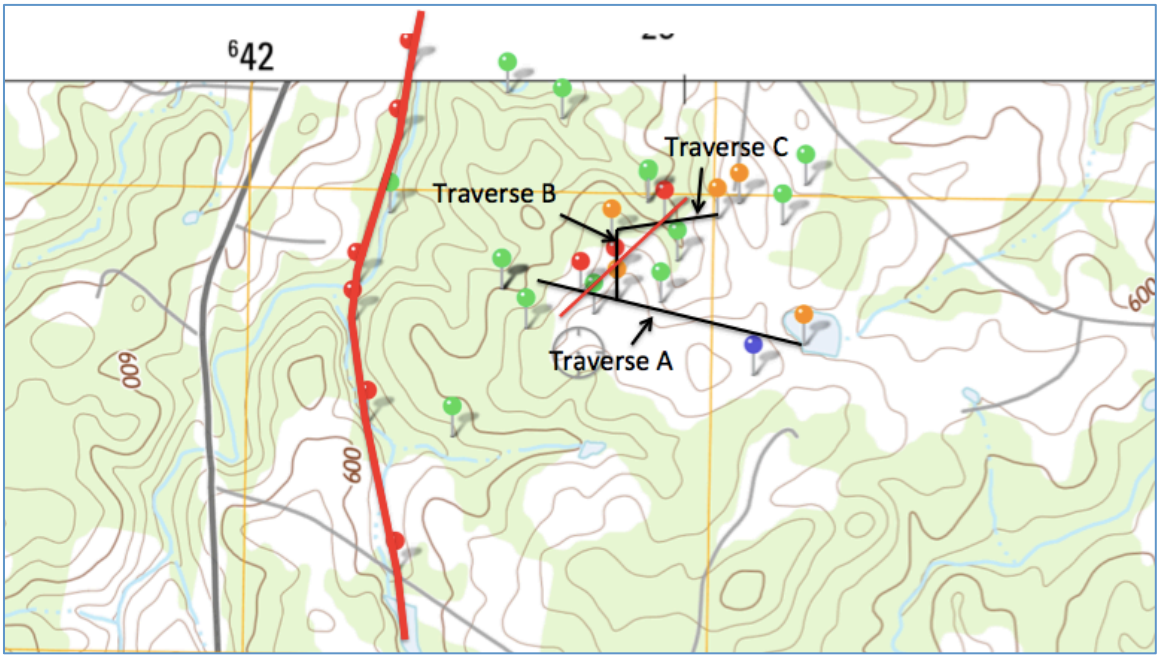

Figure 4. Location of magnetometer traverses A, B, and C in the project area. Magnetic anomalies were detected along all three lines as indicated by the red pins.

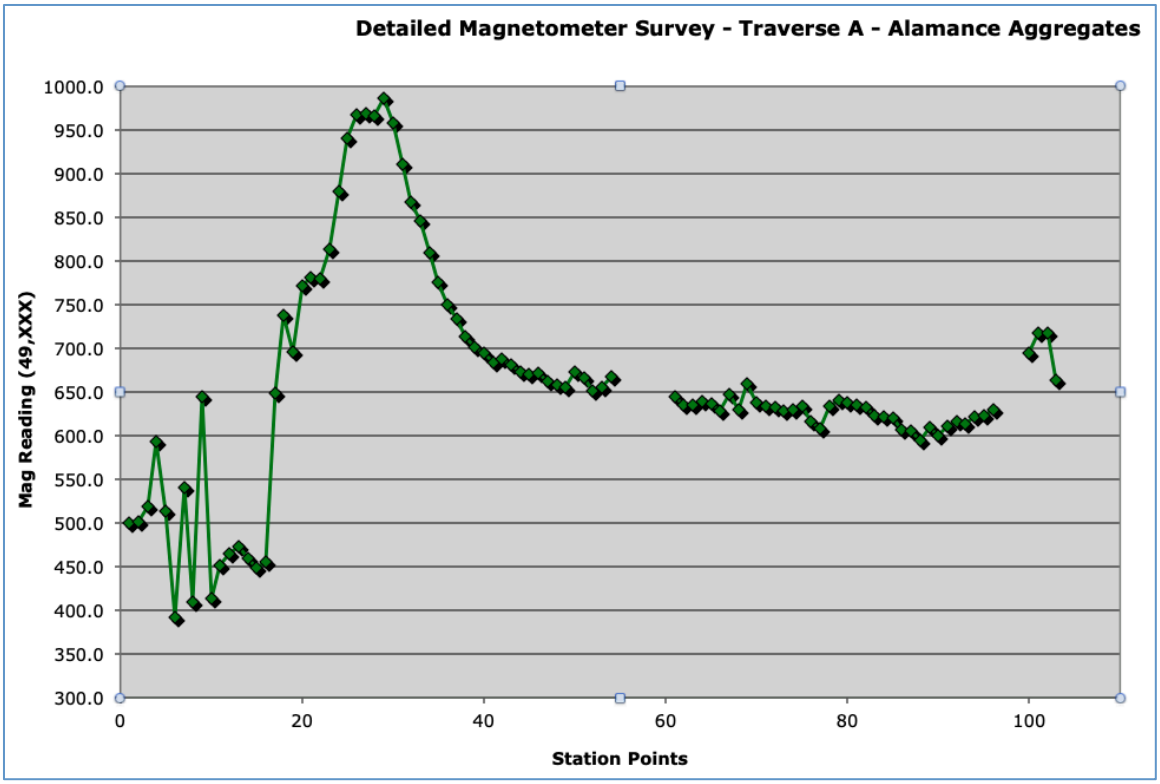

Figure 5. Detailed magnetometer Traverses A (see figure $ for location. Gaps in data are the result of interference from overhead power lines. A medium-sized magnetic anomaly occurred between stations 25-35.

After the magnetic anomaly was detected along Traverse A, several small, exploratory traverses were conducted around the anomaly. These traverses indicated that the anomaly had a northeast-southwest trend. Magnetometer Traverses B & C were then conducted to confirm the presence of a linear magnetic feature. Magnetic anomalies were detected along both Traverses B and C at the points indicated by the red pins in Figure 4. Both anomalies had profiles similar to the one shown for Traverse A in figure 5. All three magnetic anomalies occur along a straight line trending 035°.

Conclusions The results of the geologic and geophysical investigation confirmed the presence of a large diabase dike just west of the project area and an unexplained magnetic anomaly in the north-central portion of the project area. The approximate locations of these features are shown in Figure 6. The diabase dike is confidently located based on the existing geology maps and the abundance of diabase cobbles and boulders in the field. In sharp contrast, not a single piece of diabase was seen anywhere in proximity of the unexplained magnetic anomaly. This observation, coupled with the fact that the 035° trend of the anomaly closely matches the strike of the regional foliation observed in the numerous outcrops of mixed epiclastic and pyroclastic rocks, suggest that the anomaly may be nothing more than a more mafic pod of country rock embedded in the felsic volcanics. In fact, an intermediate volcanic unit occurs along the same trend to the northeast of the project area (see Figure 2). The magnetic anomaly does not appear to be associated with diabase in any way.

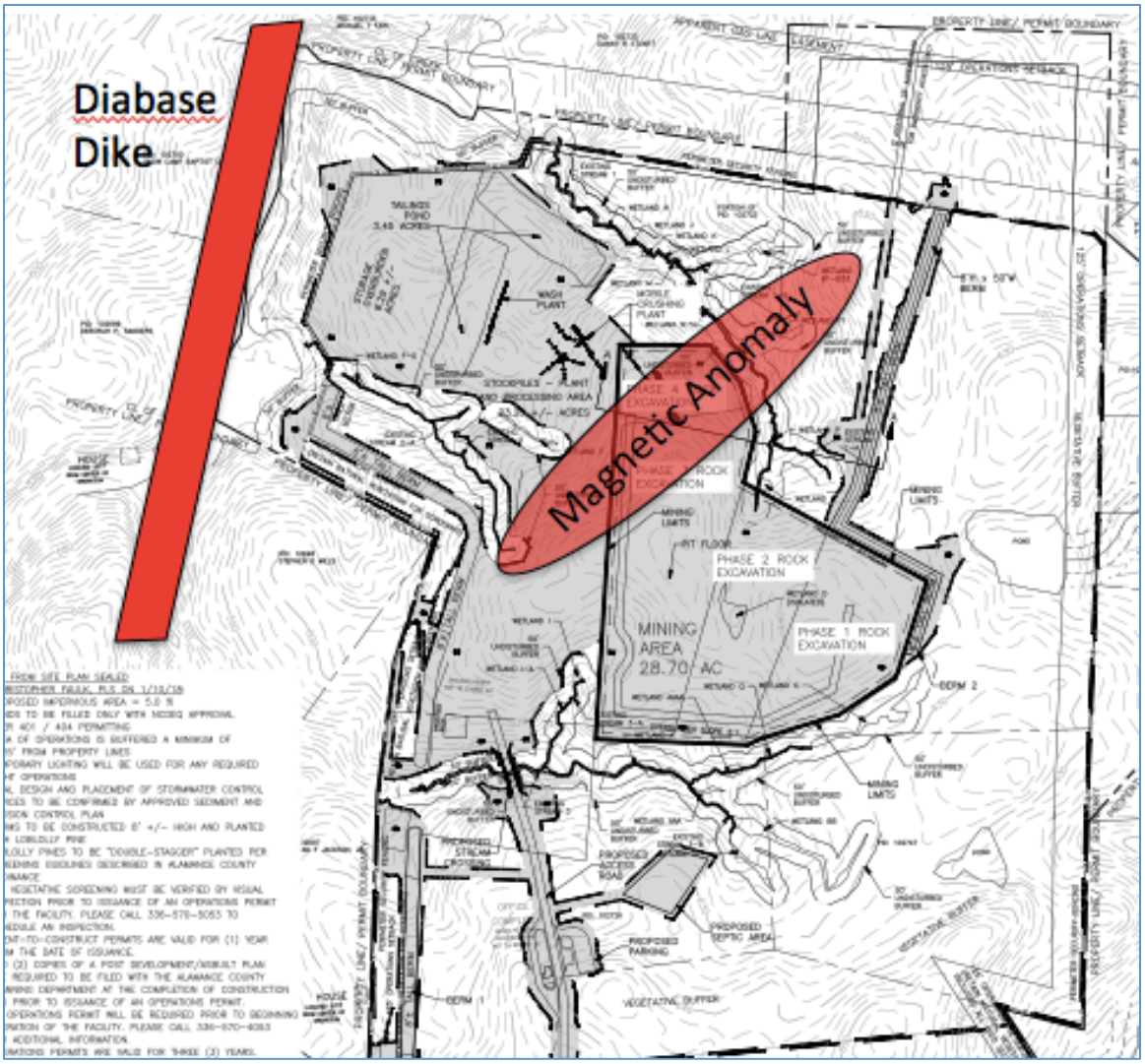

Figure 6. Mine plan map of the project area showing the approximate locations of the confirmed diabase dike and the zone of the magnetic anomaly interpreted to be a pod of more mafic rock embedded in the felsic rocks of the area.

References

Carpenter, P.A. III. 1982. Geologic map of Region G (Alamance, Caswell, Davidson, Guilford, Randolph, and Rockingham counties), North Carolina. Regional Geology Series 2. North Carolina Geological Survey: Raleigh.

North Carolina Geologic Survey, 1985, Geologic Map of North Carolina: Raleigh, North Carolina Department of Natural Resources and Community Development, Geological Survey Section, scale 1:500,000, in color.