



Conceptual Alternatives Report
Phase 1 - Design Services for the Repair or
Replacement of the Retaining Wall
Montford North Star Academy Retaining Wall
Asheville, North Carolina
S&ME Project No. 1541-20-010

PREPARED FOR:

Buncombe County General Services Department
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Asheville, North Carolina 28801

PREPARED BY:

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October 16, 2020



October 16, 2020

Buncombe County General Services Department
40 McCormick Place
Asheville, North Carolina 28801

Attention: Mr. Ronnie Lunsford

Reference: **Conceptual Alternatives Report**
Phase 1 - Design Services for Wall Repair or Replacement
Montford North Star Academy Retaining Wall
Asheville, North Carolina
S&ME Project No. 1541-20-010

Dear Mr. Lunsford:

In accordance with our proposal dated March 31, 2020, and the County's authorization on June 29, 2020, S&ME has completed a conceptual alternatives evaluation for repair or replacement of the existing retaining wall on the property of the Montford North Star Academy in Asheville, North Carolina. S&ME is pleased to provide this report which presents the results of our field investigation, communications with the Asheville Historic Resources Commission, and presents conceptual alternatives for repair and/or replacement of the retaining wall. At your convenience, S&ME can discuss the results of this report and discuss the path forward for the next phase of the project.

We appreciate having been given the opportunity to be of service on this project. If you have any questions, please feel free to contact us at any time.

Sincerely,

S&ME, Inc.

A handwritten signature in blue ink that reads "M. Romanello".

Michael T. Romanello, P.E.
Project Engineer

A handwritten signature in blue ink that reads "Michael Revis".

Michael Revis, P.E.
Principal Engineer



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1.0 Introduction

1.1 Background

An approximate 500-foot long stone masonry retaining wall is located on the property of Asheville City School's Montford North Star Academy, at 90 Montford Avenue, Asheville, North Carolina. The retaining wall is oriented generally north to south, and provides grade separation between the school's parking lot and Gudger Street on the north end. The wall continues south and separates the school building grade from the recreation/playground area. The retaining wall, believed to be constructed in the 1950s, contains a segment along Gudger Street which has rotated outward, creating a negative face batter. Continued rotation could lead to wall failure that would pose a threat to public safety. Many other areas of the wall require aesthetic and internal drainage repairs. (A structural evaluation of the wall was beyond our work scope.) A Site Vicinity Map, which shows the school's location relative to downtown Asheville, is presented as Figure 1-1 below. The approximate alignment of the retaining wall is also shown on the map.



Figure 1-1: Site Vicinity Map

S&ME understands the retaining wall has required ongoing maintenance over many years, typically in the form of patching and mortar repointing. Due to the age of the wall and severe condition of the rotated section along Gudger Street, Buncombe County (County) requested evaluation of the wall for repair or replacement as the main focus of this project. S&ME understands the County's preference is for full replacement of the wall, but the overall

direction of the project will be mostly dictated by the City of Asheville Historic Resources Commission's assessment of the wall feature.

For the purpose of identification and discussion throughout this report, the stone walls on the property have been divided into 5 sections as numbered and described below, with corresponding number annotation on the aerial photo presented as Figure 1-2.

1. Montford Avenue Wall: short freestanding wall along Montford Avenue. This wall was originally a low height retaining wall constructed in front of the 1890s school building.
2. Courtland Avenue Wall: short freestanding wall located between the sidewalk along the south side of Courtland Avenue and the school parking lot;
3. North Wall: Retaining wall along Gudger Street and extending to the vertex point in the recreation area;
4. South Wall: Retaining wall section south of the opening into the recreation area; and
5. Middle Wall: Retaining wall section between the North and South sections.

The Montford Avenue and Courtland Avenue walls were visually observed, but not considered as part of the conceptual alternative's evaluation.



Figure 1-2: Site Aerial View



1.2 Scope of Work

S&ME, in collaboration with the County, developed a scope of work to perform desktop and field investigations of the stone masonry retaining wall (North, Middle & South walls). In recognition of the uncertainty of evaluating the existing structure, as well as need for a review of the site in regard to the State Historic Preservation Office (SHPO)/City of Asheville Historic Resources Commission (HRC), S&ME recommended a phased approach to the project consisting of the following 3 general phases: 1) retaining wall observations and conceptual alternative development; 2) design of the repair or replacement and preparation of the construction documents; and 3) project bid and construction administration.

The purpose of Phase 1 is to evaluate the retaining wall from a historical standpoint, perform a subsurface exploration, observe the condition of the existing walls and evaluate potential options for repair and/or replacement. This report represents the conclusion of Phase 1, except for a final meeting with the County to discuss the findings.

The following tasks were completed during the Phase 1 work. During this phase we completed additional site reconnaissance, investigated the subsurface conditions of the foundation soils and retained backfill, and evaluated conceptual alternatives.

- Task 1 – Historical Registry Review, Archival Research, and Coordination
 - Task 1A – Asheville SHPO File Review
 - Task 1B – Consultation with Asheville Historic Resources Commission
- Task 2 – Site Investigation
 - Task 2A – Geotechnical Drilling
 - Task 2B – Limited Geophysical Survey
- Task 3 – Site Survey
 - Task 3A – Boundary/Right-of-Way Survey
 - Task 3B – Topographic, Location, and Utility Survey
- Task 4 – Conceptual Alternatives Report

Each of the completed tasks is discussed in more detail in Sections 2 through 7. Following a review meeting with the County, S&ME will work with stakeholders to develop a Scope of Work for Phase 2.

2.0 Historical Review

2.1 Archival Research Summary

The stone masonry retaining wall is located on the west side of the Montford North Star Academy school building. The school building, formerly known as the Williams Randolph Elementary, was constructed in the mid-1950s.

The north portion of the property, at the southwest corner of Montford Avenue and Courtland Avenue, has been utilized as a school location since the mid-1800s. The Asheville Male Academy, founded in 1848, was originally located along College Street. In the 1860s, the school was relocated to a new building along the current Montford Avenue (formerly Academy Street). In 1887, the newly organized Asheville City School Board purchased the former



Asheville Male Academy building on Academy Street. In January 1888, the school was opened as a public school and named Montford Avenue (Graded) School (*Asheville Citizen-Times* 28 July 1957). Both the 1891 Bird's Eye View map (Appendix A, Figure 1) and the 1891 Sanborn Fire Insurance Map (Appendix A, Figure 7) show the original Montford Avenue School building along the west side of Montford Avenue.

Four years after purchasing the building, the Asheville City School Board contracted for the construction of a new school building, using funds from a newly increased school tax, approved by the Board of Aldermen in 1890 (*Asheville Citizen-Times* 28 July 1957). In April 1892, the school board commissioned Wills Brothers, architects (Arthur J. Wills and James W. U. Wills), a firm with offices in Knoxville and Asheville and the designers of Asheville's 1890 City Hall, to design a new school building to replace the former Asheville Male Academy building. A May 1892 architect's rendering and description show the design of the building (Appendix A, Figure 2), but make no mention of a surrounding stone wall, although the building's location is described as "noble and commanding", suggesting a hilltop location that may need a retaining wall to provide a level grade (*Asheville Daily Citizen* 10 May 1892). By May 17, 1892, demolition of the old building had begun. Construction of the new building was completed and opened in October 1892 (*Asheville Daily Citizen* 5 October 1892; 14 October 1892; *Asheville Citizen-Times* 5 October 1892; 22 October 1892). The building was expanded in 1916 and 1926 and was renamed William Randolph School in 1932 (*Asheville Citizen-Times* 26 March 1950; 28 July 1957).

An 1898 newspaper article indicates that the school board asked the Board of Aldermen "to furnish stone from its quarry free, in order to assist the school committee in building a stone wall in front of the Montford Avenue School and in making other improvements" (*Asheville Daily Gazette* 5 November 1898). A stone wall appears in front of the school building in historic photographs from throughout the school's period of use (1892 through 1951) and appears to be the same wall as present (Appendix A, Figures 3 through 5). The wall was constructed as a low height retaining wall with rectangular quarry stone, in comparison to the rough field stones comprising the other walls on the property. Note that the wall ends at the column on the right (north) side of the photo in Figure 5. No walls, either in front or in back of the school, are visible on the 1912 Bird's Eye View map (Appendix A, Figures 6), or the available early twentieth century Sanborn Fire Insurance maps (Appendix A, Figures 8 through 11).

Following demolition of the Montford Avenue School in the 1890s, the retaining wall along Montford Avenue was converted into a freestanding wall. The Courtland Avenue wall was extended to the original north column noted in the previous paragraph. The Courtland Avenue wall matches the style, stone type, and age characteristics of the North and Middle walls, indicating it was likely constructed at the same time.

When the new William Randolph School building was constructed in the mid-1950s, the alignment of Gudger Street was altered and extended north to intersect with Courtland Avenue (Appendix A, Figure 12), and Gudger Place, the small street south of the 1892 school building, was abandoned. Note in Figure 12 that the Gudger Street extension occurred within the school property boundary. This section of Gudger Street is still within the school property boundary today. The alignment of the South wall section appears to follow the northernmost segment of Gudger Place, at its intersection with Gudger Street, as viewed in Figure 12.

Historic aerial photographs were available for the years of 1951, 1963, 1975, and 1994, in addition to more recent aerial photographs. Although there are structures shown along the west property line of the school building on the 1912 Bird's Eye View map, including a structure with no windows that may have been an outbuilding, none of



these structures are depicted on Sanborn Fire Insurance maps and they were no longer extant by 1951, when the first aerial photograph was taken.

The following observations are noted from the aerial photographs:

1951 Aerial Photo (Appendix A, Figure 13): A retaining wall feature is visible along the west side of the property, in a north-south orientation and generally located between Courtland Avenue and the old intersection of Gudger Street and Gudger Place. Measurements in the Buncombe County GIS program suggest this wall feature was located along the school property's west boundary, approximately 25 feet east of the existing North Wall section. Gudger Street had not been realigned to connect to Courtland Avenue by this date.

1963 Aerial Photo (Appendix A, Figure 14): A retaining wall feature matching the alignment of the North and Middle Walls is visible. The South Wall is not evident on this photo. Gudger Street is shown as connecting to Courtland Avenue, but the east-west section of Gudger Street is not on its current alignment.

1975 Aerial Photo (Appendix A, Figure 15): The North and Middle wall sections are clearly visible on this photograph. Although inconclusive, the south wall does not appear to be present in this photo. The east-west section of Gudger Street is not on its current alignment.

1994 Aerial Photo (Appendix A, Figure 16): This photo shows most of the present-day features on the school property, the current alignment of Gudger Street, and all 3 sections (North, Middle, South) of the retaining wall.

Besides the vertex point between the North and Middle walls, there is no visible delineation, such as a vertical construction joint, between these sections. The wall (or possibly fence) feature visible on the 1951 aerial photo was likely demolished at the time of the Gudger Street extension to Courtland Avenue. The construction of the 1950s school building, extension of Gudger Street to Courtland Avenue, and construction of the North and South Wall sections appears to have occurred within a within a short time period from the mid-1950s to early 1960s.

2.2 State Historic Preservation Office File Review

S&ME conducted a desktop review of the project area. S&ME reviewed using the online GIS system HPOWEB that is maintained by the North Carolina State Historic Preservation Office (SHPO), and the City of Asheville's Historic District and Landmarks online GIS mapping. The mapping indicates the retaining wall is located within the Montford Area Historic District. Figure 2-1 shows the historic district limits at the site.

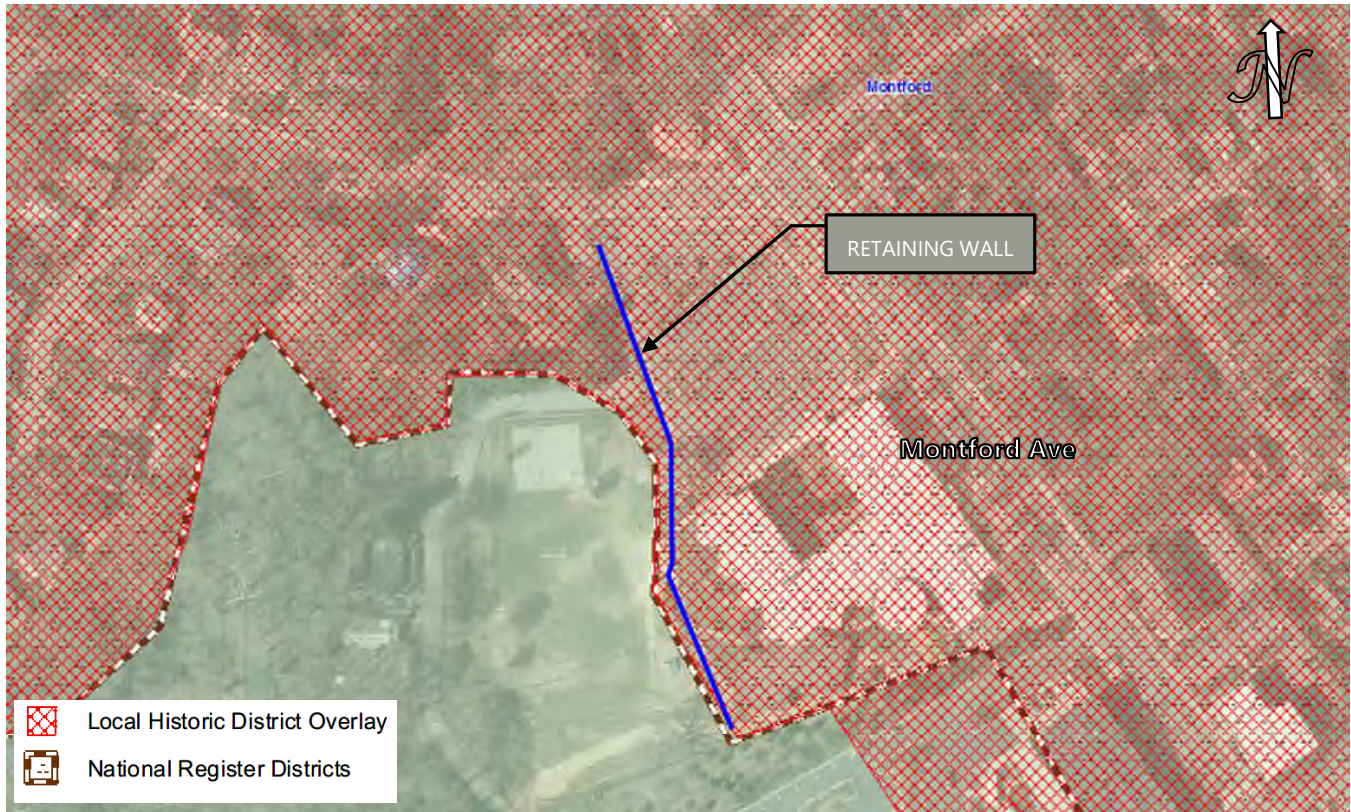


Figure 2-1: Montford Historic District Limits at Site

2.3 Consultation with Asheville Historic Resources Commission

S&ME corresponded with the Asheville Historic Resources Commission (Commission) through several emails and phone calls. The Commission offered the following comments, paraphrased below:

- The wall likely predates or was constructed around the same time as the current school building which makes it a historic feature of the district itself;
- The retaining wall is one of the more substantial walls in the district and is along a right of way, so it is visible and a feature of the district;
- If the wall in its entirety is planning to be replaced and there are sections that are still structurally sound, the Commission will not support the intact sections being replaced, they will want them left as is; and
- In accordance with the Montford Historic District Design Review Guidelines, the Commission will want to see sympathetic materials used in the wall construction to allow for the replacement to blend into the remaining sections of the wall.

As the wall is located within a historic district and has been identified as a feature of the district, a certificate of appropriateness (CA) must be filled out and submitted to the Commission for approval of any proposed repairs. There are two types of projects considered for a CA application: minor and major. For a project to be considered



minor, the proposed work must be limited to repairs, retaining as much original material as possible and replacing only affected areas in the same location, dimensions, and configuration. Anything outside of that is considered major and a pre-application meeting is necessary with the Commission.

A major CA application requires the following general items:

- application/checklist as cover sheet
- labeled color photos of existing wall
- existing and proposed site plan
- existing and proposed drawings of the wall repair/replacement
- engineering report on conditions of existing wall

2.4 Consultation on Alternative Options

S&ME discussed with the Commission two alternatives to repair or replacement of the retaining wall. The following options were presented to the Commission as alternatives:

1. Construction of a landscaped soil buttress on the front side of the wall along the middle section of wall, but leaving the top 2 to 3 feet of the wall exposed to keep a portion of the original aesthetic. This option would provide both long-term stability and reduce the amount of future maintenance required (i.e. patching and repointing); and
2. Completely demolish the south section of the wall, south of the opening in the wall for the sidewalk. The effective retaining wall height is significantly reduced along this section and the wall generally no longer serves a purpose other than to delineate the recreation area.

Our contact at the Commission did not feel that either of these options would be approved, as the guidelines require that historic retaining walls be preserved, and so covering or wholesale removal would not be in keeping with the guidelines.

S&ME also inquired if a segmental block retaining wall, such as the Redi-Rock system with a textured stone finish, would be an acceptable replacement. Our contact responded that any new material would need to match the existing material as closely as possible. They believed the Commission would not consider Redi-Rock to be an appropriate material to match the native stone.



3.0 Field Exploration

3.1 Site Visit

S&ME made several visits to the site during the course of the investigation. The following observations were documented during those visits:

- The North, Middle, South, and Courtland Avenue walls consist of stone masonry. The face of the walls consist of ledgerstone with stones either turned on edge with a smooth side facing outward, or stones laid flat with only the thin edge exposed. Stones visible on the backside of the wall are more consistent with field stone, varying in shape and size.
- Although aerial photography indicates the South wall may have been constructed at a later date, the stone type, dimensions, and visual characteristics match that of the other field stone walls;
- In many areas the stonework has been displaced or patched with concrete and brick due to deterioration of the mortar;
- The maximum exposed wall height is approximately 10 feet. From probing, the wall foundation appears to consist of stacked brick and/or concrete footing with about 12 to 18 inches of soil cover;
- A section of the wall along Gugder Street has rotated out approximately 10 to 15 degrees from vertical, resulting in an overhang of up to 1.6 feet (measured from the top of wall to the bottom). The total affected length is approximately 130 feet, with the most severe section limited to approximately 60 feet of the North wall;
- The wall width typically ranges between 24 to 26 inches;
- The North wall has various small diameter clay pipes, which are assumed to be weep holes for internal drainage. Most of these are filled/clogged with soil. The Middle Wall has 6" diameter clay pipe weep holes. The weep holes vary in spacing and elevation, appearing random in placement. No clay pipe weep holes are present on the South Wall;
- The clay pipe is consistent with 1950s time period, and appears to be original to the wall construction based on observations of the stone placement and mortar;
- Approximately 12 feet north of the HVAC pad, a brick wall structure was observed through a cluster of 4 weep holes. The face of the brick wall is approximately 4 ½ feet behind the face of the stone wall.
- Approximately 27 feet north of the HVAC pad, a semicircular open brick structure was observed through 2 weep holes spaced 30 inches apart. The brick matched that as noted in the previous observation; and
- A 2.5" diameter steel pipe pile was observed in the section of wall along Courtland Ave where stones were displaced on top of the wall. No evidence of additional pipe piles or other reinforcing features was observed in other locations.

Select photographs taken throughout the course of the investigation are presented in Appendix B – Site Photographs.

No other indications were made as to the origin of the brick structure located underground behind the wall. It is possible that the structure is the remains of the outbuilding foundation noted on the property in the Historic Review section. The semi-circular brick structure may be a brick cistern or old catch basin drainage structure.



3.2 Subsurface Investigation

On the dates of July 29, 2020 and August 12, 2020, 7 soil test borings, designated as Borings B-2 through B-8, were advanced at the project site to depths ranging between 15 and 25 feet below the existing ground surface. Borings were performed from the school parking lot, along Gudger Street, and in the recreation area. Details of the field exploration, a general description of the subsurface conditions, and results of laboratory testing are presented in Appendix C – Subsurface Investigation. Logs of the borings and a Boring Location Plan are presented in Attachments I of Appendix C. The laboratory test results are presented in Attachment II of Appendix C.

3.3 Geophysical Survey

S&ME retained Vaughn and Melton (V&M) to conduct a ground penetrating radar (GPR) scan behind the retaining wall to detect potential buried obstructions. In addition, V&M performed GPR scans around the proposed soil boring locations to identify potential buried structures or utilities which may not have been marked by the North Carolina 811 utility locating service.

The GPR scan was conducted on a continuous basis behind the wall as the scanning equipment was pushed along the parking lot side of the chain link fence which is situated just behind the wall. Field interpretation of the scan was verbally communicated to S&ME, and several locations with anomalies were flagged. The following field interpretations were noted:

- Rubble or debris is present within the backfill of the wall;
- The soil about 2.5 feet below the surface seems to be very soft through the entire area of the back of wall;
- There appears to be old tree stumps along the back of the north segment of the wall; and
- Several anomalies were noted along the back of the south segment of the wall.

Annotated photographs of the identified anomalies are presented in Appendix D.

4.0 Site Survey

S&ME subcontracted Cole Surveying and Design (Asheville, NC) to conduct a Boundary/Right-of-Way and Site Topographic Survey to support the wall evaluation and (future) design phase. The following tasks were completed for the survey:

Boundary/Right-of-Way Survey

1. Researched current deeds and plats for the subject property as well as all adjoining properties;
2. Field reconnaissance to search for property and field survey corners;
3. Office calculations, deed/plat research; and
4. Mapping to depict property boundary/right of way along Courtland Avenue and Gudger Street to the second curve (north to south) of Gudger Street.



Topographical, Location, and Utility Survey

1. Established survey datum with GPS. The horizontal datum is NC Grid NAD 83 (NSRS 2011) and the vertical datum is NAVD 88 (Geoid 18);
2. Performed topographic survey for the site area, generally limited to areas within 25 feet in front and behind the wall, but also extending 75 feet in front of the wall on the south end. Contours were generated on a 1 foot contour interval;
3. Located and mapped visibly apparent above ground and underground utilities including, but not limited to:
 - Sewer, water, electric, telephone, fiber, cable television, natural gas, propane gas, or petroleum and other visibly apparent underground features.
 - Survey of marked underground utilities and visibly apparent gravity lines.
 - Located visibly apparent water meters, valves, hydrants, transformers, utility pedestals, utility poles, guy wires, signs, sewer structures, cleanouts, stormwater structures, and other permanent utility structures.
 - Surveyed and located the rim elevation, pipe sizes and materials, and each inflow/outflow invert elevations at culverts, manholes, catch basins, and area drains.
4. Located and mapped permanent manmade improvements such as buildings, fences, roads and streets, curb & gutter, drives, sidewalks, walls, signs, etc. within 25 feet of the retaining wall; and
5. Surveyed top and bottom of wall elevations at 25-foot intervals along the wall alignment.

The survey work was combined into one formal drawing. S&ME previously provided a PDF version of the survey, sealed by a North Carolina Registered Land Surveyor, and the original AutoCAD (.dwg) file to the County for their records. The full size 24"x32" version of the survey is included in Appendix D – Site Survey.

The school property is divided into 5 tracts, labeled as Tracts A through E on the site survey. Tract C comprises of the school building, parking lot, a large percentage of the recreation area, and the north segment of Gudger Street. Tract D appears to be associated with an older alignment of Gudger Street. Tracts A, B, and E appear to be associated with smaller lots originally accessed from Gudger Street.

5.0 Assessment of Existing Conditions

Archival research places the construction period for the North and Middle Walls in the 1950s, with the South Wall possibly being constructed after 1975. General observations indicate the wall was constructed as a nominally 24" wide stone masonry retaining wall, with the exposed side consisting mostly of ledgerstone, and the backside with more randomly sized stones, similar to field stone. The characteristics of the walls are consistent with many built in the same time period in the Historic Montford District, however the North, Middle and South Walls have a significantly higher retained height compared to the low-grade retaining walls or freestanding walls that are common. The subsurface investigation and limited GPR survey did not reveal any additional clues regarding the structural details of the retaining wall, such as if the wall was widened toward the base to provide stability. Brick structures of unknown origin are visible behind the wall through clay pipe penetrations at two locations in the



Middle Wall. The variation of the clay pipes in height and spacing may suggest these were placed to correspond to particular structure locations, and additional buried structures may be present behind the wall.

Fill soils were encountered behind the North Wall, and extend below the foundation level in several borings. The presence of fill soils is not surprising given the original grade around the 1860s school sloped downward to the south as viewed on the 1891 Bird's Eye View. Many modifications to the property have been undertaken since that time, and the parking lot and finished floor elevation of the current school have a nearly level grade or minor topographic relief. GPR scans conducted behind the retaining wall indicated the presence of rubble, stumps and/or other debris in several locations. Boring B-6 encountered concrete below the asphalt pavement, but none of the 3 borings advanced from the parking lot encountered rubble or other debris.

While the entire wall has localized areas that have been repointed and patched, or require repointing and patching, the Middle and South walls appear to be in good visual condition, with no rotation or other signs of distress observed. The North Wall contains the area with a significant outward rotation. The sidewalk in front of the wall in this section has cracked/buckled, and a depression in the ground surface behind the wall has formed. The depression only exacerbates the problem, as additional water likely ponds and infiltrates behind the wall, and with the existing clay pipe weepholes clogged with soil, an increased hydrostatic pressure may form. The fact that a wall of this type can accommodate a significant rotation suggests that unknown features of the walls are contributing to its longevity. This may include additional structures located behind the wall, additional debris or rubblestone acting as a mass gravity wall, or some type of additional reinforcement such as small diameter driven pipe piles. Without additional known details, structural or geotechnical analysis producing a typical Factor of Safety for the current condition of the wall cannot be performed.

6.0 Conceptual Alternatives Analysis

Based on our evaluation and observations, S&ME recommends the majority of the North Wall be stabilized or reconstructed. The affected length generally extends between the vertex point at the transition to the Middle Wall, to slightly north of the halfway point along Gudger Street. This length totals approximately 160 feet. Given the age and uncertainty regarding the "structural" composition of the existing wall, consideration should be given to stabilizing or reconstructing most of the wall for long term stability. S&ME evaluated several concepts for stabilization or reconstruction with consideration of a wall facing aesthetically similar to the existing stone, or in some cases re-using the existing stone. Keep in mind that some reconstruction options require significant disturbance to the existing parking lot and the reconstructed wall section may need to include additional length.

6.1 Facing Alternatives

Following requirements from the Historic Resources Commission for either Minor or Major work, and in accordance with the Montford Historic District Design Review Guidelines, walls which are damaged or deteriorated beyond repair must be replaced in kind, matching the original design, configuration, texture, material and color as close as possible. The following facing options are available to meet this requirement:

6.1.1 *Re-Use Existing Stone*

For wall reconstruction options where the existing retaining wall would be demolished, the existing stone could be saved, cleaned and re-used as a veneer. Preparation of the existing stone would be labor intensive to remove the mortar and potentially cut the ledgerstone into more manageable pieces for use in a lighter weight veneer (over the new structural wall). If the stones on the backside are similar to the exposed section of the Middle Wall, then those irregular shaped field stones are likely not good candidates for a veneer application, limiting the amount of stone available for re-use.

6.1.2 *New Stone Veneer*

Natural thin stone veneer could be used as a likely cost saving alternative to re-using the existing stone. Natural stone, quarried, processed and sawn is routinely used for veneer applications on foundations, retaining walls, and other structures. The sawn side of the stone provides a good surface for a mortared connection to anchor ties, steel lath or other structural connection. There are numerous aesthetic options for this type of veneer. Figure 6-1 shows a natural stone veneer placed over a Mechanically Stabilized Earth (MSE) segmental block retaining wall.



Figure 6-1: Natural Stone Veneer Example Photo

6.1.3 *Shotcrete Sculpting*

Shotcrete is a sprayed concrete application, typically used on vertical surfaces. Shotcrete can be sculpted and stained to mimic the look of stone or natural rock face as shown in Figure 6-2.



Figure 6-2: Shotcrete Sculpted Facing Example Photo



6.2 Conceptual Repair Alternatives

S&ME evaluated several conceptual alternatives for the repair or replacement of the North Wall section, and possibly other sections of wall to increase long term performance. Three alternatives were advanced which require demolition of the existing wall (to construct a structural wall), and one alternative was advanced which would stabilize the existing wall, but still require new facing. The following sections present these alternatives, and list the advantages and disadvantages of each option. As these are conceptual alternatives, only a rough cost estimate for the retaining wall itself on a per square foot basis has been provided. Additional costs associated with grading, repaving and reconstruction of ancillary features was not included. Typical engineering cross-sections, example photographs, and a summary of the advantages and disadvantages is presented on Figures 1 through 4 of Appendix F.

6.2.1 *Cast-in-Place Concrete Cantilever Wall*

A cast-in-place (CIP) concrete cantilever wall represents a traditional approach to the construction of fill walls where site conditions limit access behind the wall. This option would require the removal of the existing wall and sidewalk, but can easily be aligned with the remaining wall sections. All 3 facing options would be available with a CIP concrete wall.

Advantages	Disadvantages	Facing Options & Cost Estimate
<ul style="list-style-type: none"> • Conventional construction practices • Less differential movements 	<ul style="list-style-type: none"> • Requires removal of existing stone wall • Excavation would extend into parking lot area, requiring temporary closure • Wide base required for overturning resistance • Highest cost 	<ul style="list-style-type: none"> • New natural stone veneer or Shotcrete sculpting <ul style="list-style-type: none"> • \$75 – \$100 / SQ FT • Re-use existing stone <ul style="list-style-type: none"> • \$125 - \$150 / SQ FT



6.2.2 Mechanically Stabilized Earth Wall

An MSE wall with segmental block facing units and geogrid reinforcement represents a typical and economical approach to the construction of fill walls. Segmental block MSE walls are routinely constructed by regular earthwork and landscape contractors. The segmental units range in size, but most are small enough to be placed by hand. The zone behind the wall is reinforced, typically with uniaxial geogrid, and the segmental blocks provide a long-lasting aesthetic facing. A conservative reinforcing length for a level backslope is estimated as 100 percent the height of the wall. At this length, safe excavation into the backslope, without temporary shoring, would likely extend into the pavement area. Alternatives to reduce the excavation limits, such as using no-fines concrete in the lower reinforced zone, are available but not included as separate concepts.

Advantages	Disadvantages	Facing Options & Cost Estimate
<ul style="list-style-type: none"> • Simple construction method performed by many contractors • Economical 	<ul style="list-style-type: none"> • Requires removal of existing stone wall • Excavation would extend further into parking lot area than other options • May require import of select backfill material 	<ul style="list-style-type: none"> • New natural stone veneer or Shotcrete Sculpting <ul style="list-style-type: none"> • \$30 – \$45 SQ FT • Aesthetic/split face block facing (not currently approved) <ul style="list-style-type: none"> • \$20 - \$25 / SQ FT

6.2.3 Soil Nail Wall Repair

This alternative represents an option to leave the existing retaining wall in place by stabilizing it with soil nails. Often used to stabilize natural soil slopes, or as a design component in cut soil or rock face walls, soils nails are constructed by inserting steel reinforcing bars into predrilled holes through the existing stone wall, then grouting the bars into place. An anchor plate distributes the stabilizing load from the nail head to the face of the wall. Soil nail walls are most commonly finished with a shotcrete facing, which for this project would be covered with a stone veneer or sculpted shotcrete facing.

Advantages	Disadvantages	Facing Options & Cost Estimate
<ul style="list-style-type: none"> • No excavation or disturbance behind existing stone wall • No foundation preparation required • Simple to construct 	<ul style="list-style-type: none"> • Requires specialty contractor • Gudger St Sidewalk would need moved (or permanently removed) • Possible interference with existing utilities • Higher Cost 	<ul style="list-style-type: none"> • New natural stone veneer/shotcrete facing <ul style="list-style-type: none"> • \$50 – \$60 / SQ FT



6.2.4 *Large Block Segmental Gravity Wall*

Large block segmental gravity retaining walls have become a common alternative to MSE walls generally less than 15 feet high. Block sizes are typically 18 to 24-inches tall by 2 to 3-feet wide by 2 to 5-feet deep, with the larger blocks located near the base of the wall. The Redi-Rock system is a common large block retaining wall system. Although the Asheville Historic Resources Commission stated that this type of system would likely not be considered an acceptable system, it has been included here for comparison to other options. Note, however, the wet cast construction method allows for custom texturing of the face.

Advantages	Disadvantages	Facing Options & Cost Estimate
<ul style="list-style-type: none"> • Simple construction method performed by many contractors • Economical • Requires slightly less excavation compared to MSE Wall • Can likely reduce disturbance to existing pavement in parking lot. 	<ul style="list-style-type: none"> • Requires removal of existing stone wall • No stone veneer or sculpted facing options • Requires a variance in the historic district design guidelines 	<ul style="list-style-type: none"> • Custom aesthetic facing (not currently approved) <ul style="list-style-type: none"> • \$40 – \$50 / SQ FT

7.0 Closing

Several conceptual alternatives have been presented to replace or repair the North Wall, each with at least two facing options available for each alternative. A review meeting is planned to discuss these options with Buncombe County, Asheville City Schools, and other stakeholders, in relation to the project goals, limitations, schedule, budget, and other considerations. As part of the Design Phase (2), more than one option could be advanced to develop a Preliminary Opinion of Probable Construction Cost for a more direct comparison, prior to a final alternative selection.



Appendix A – Archival Research Figures

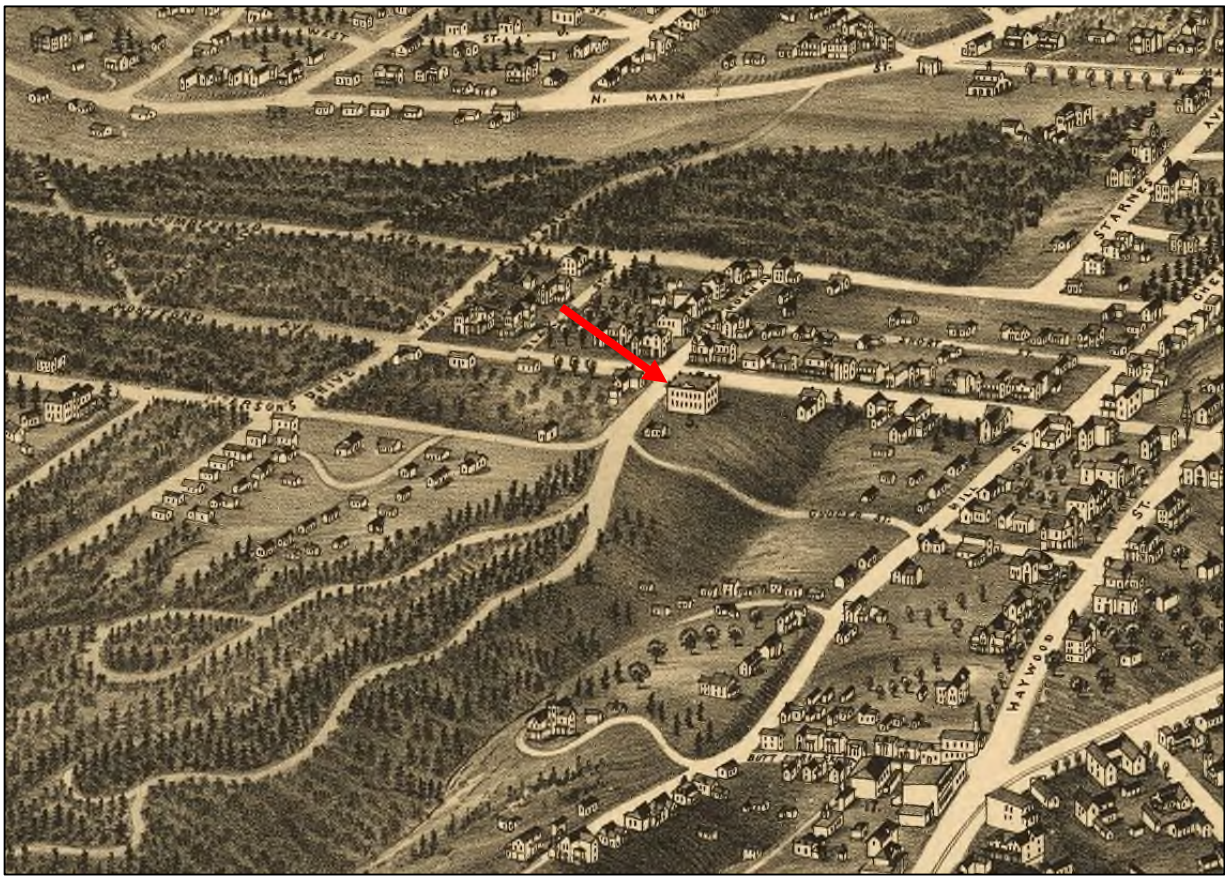


Figure 1: Bird's Eye View of Asheville (1891), showing Montford Avenue School (former Asheville Male Academy) building (Library of Congress).

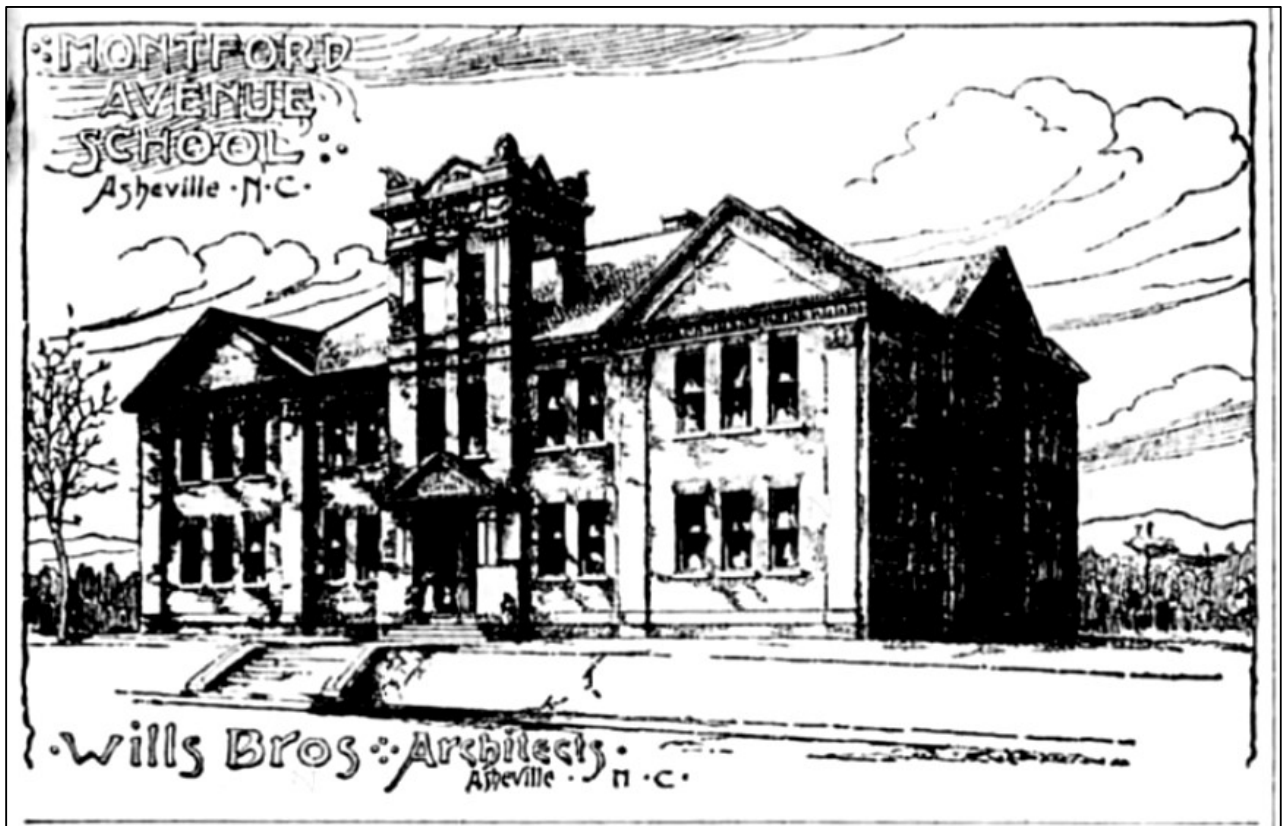


Figure 2. Architect's rendering of the new Montford Avenue School building (Asheville Daily Citizen 10 May 1892:1).



Figure 3. Undated photo of 1892 Montford Avenue School building (Pack Memorial Library, Asheville).

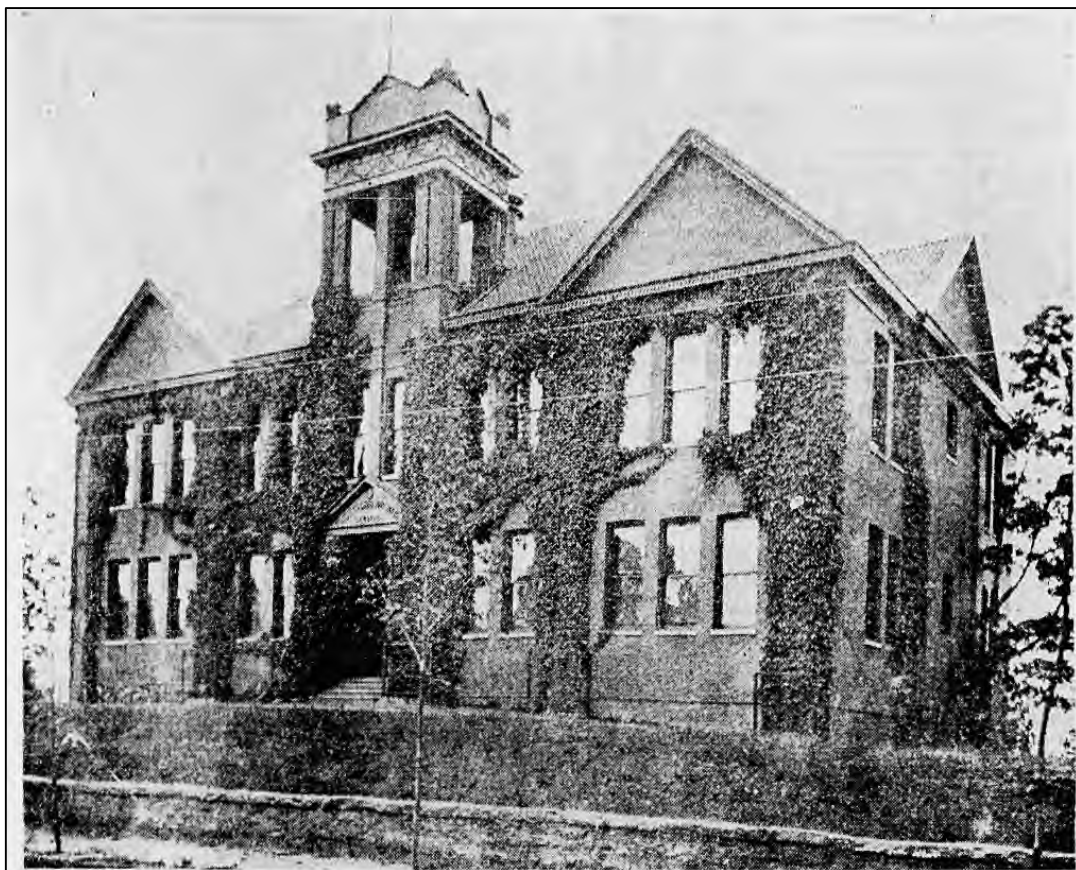


Figure 4. Undated photo of 1892 Montford Avenue School building (Asheville Citizen-Times 28 July 1957).



Figure 5. Undated photo of 1892 Montford Avenue School building (Pack Memorial Library, Asheville).

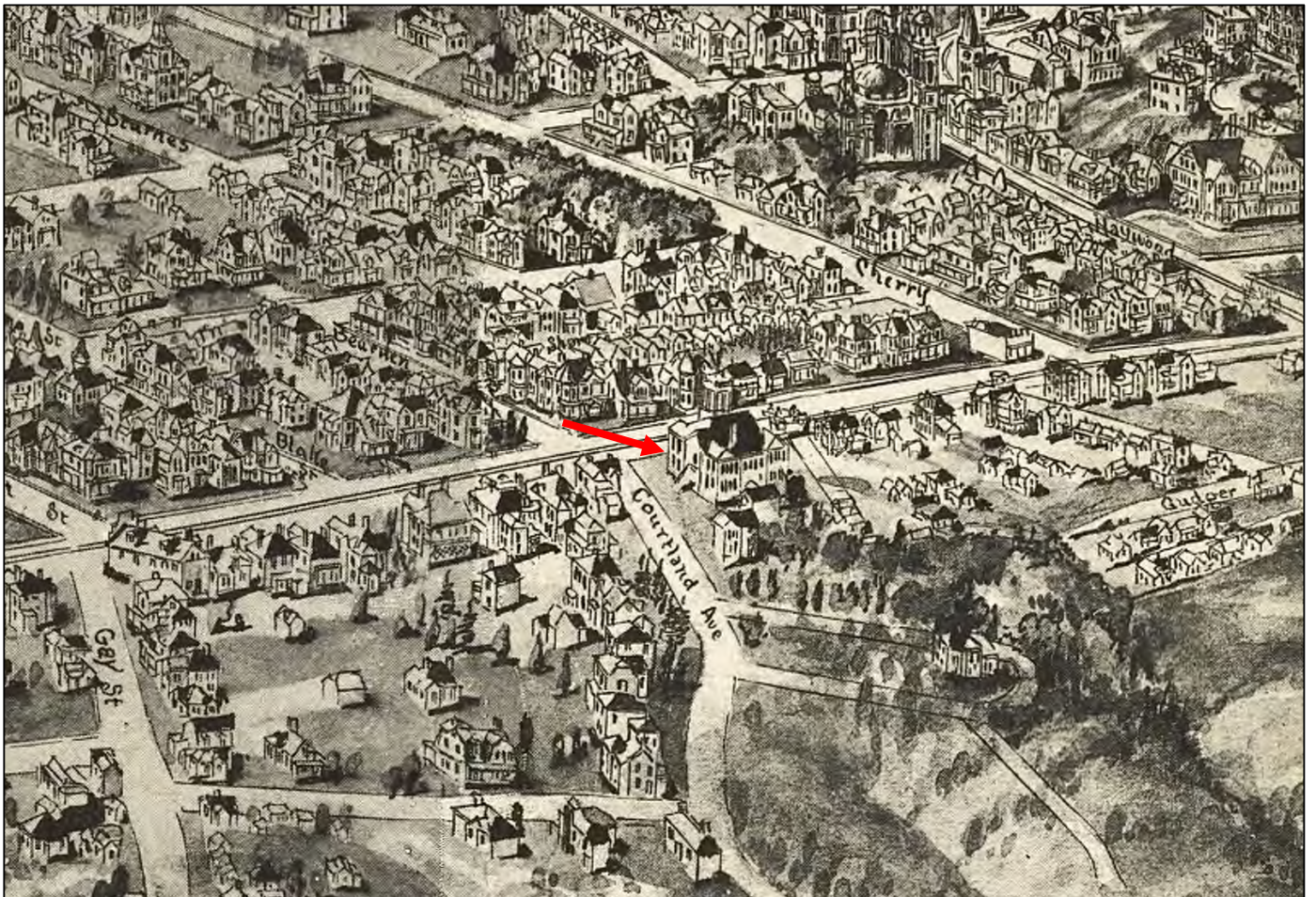


Figure 6. Bird's Eye View of Asheville (1912), showing Montford Avenue School (Library of Congress).

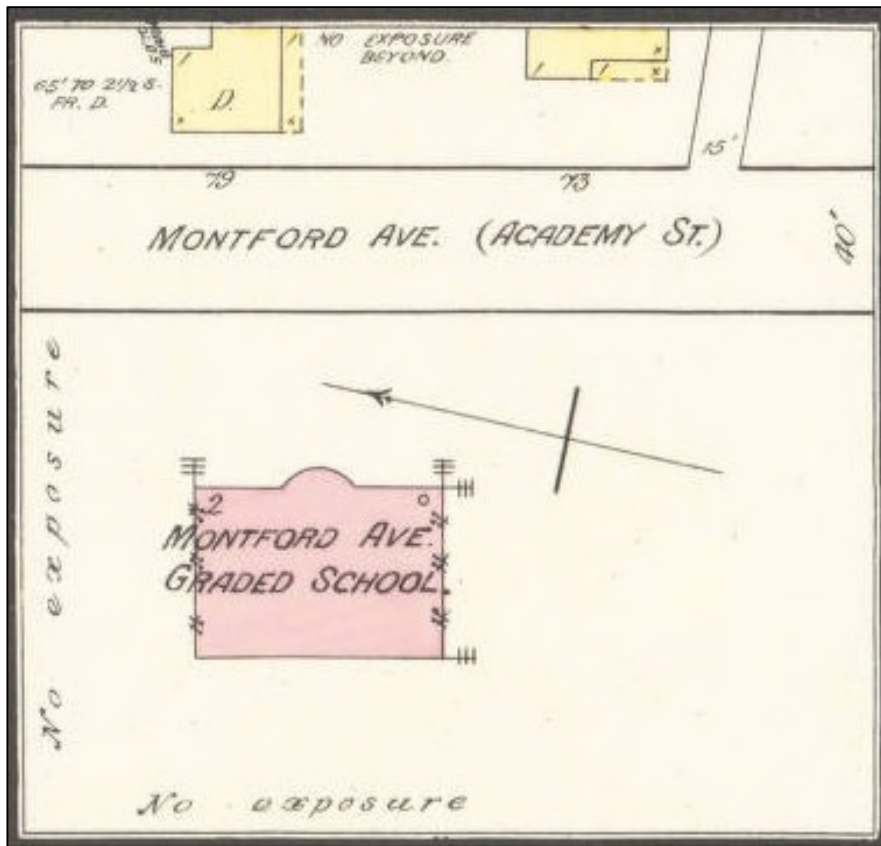


Figure 7. Sanborn Fire Insurance map (1891), showing Montford Avenue School (former Asheville Male Academy) building (North Carolina Maps, University of North Carolina).

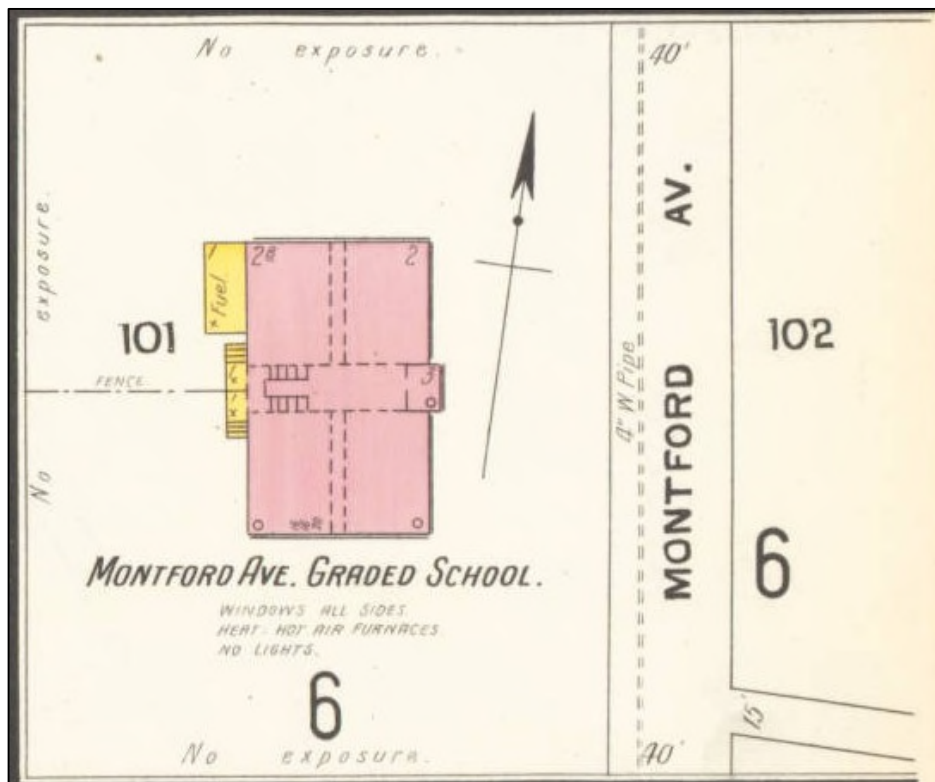


Figure 8. Sanborn Fire Insurance map (1906), showing Montford Avenue School building (North Carolina Maps, University of North Carolina).

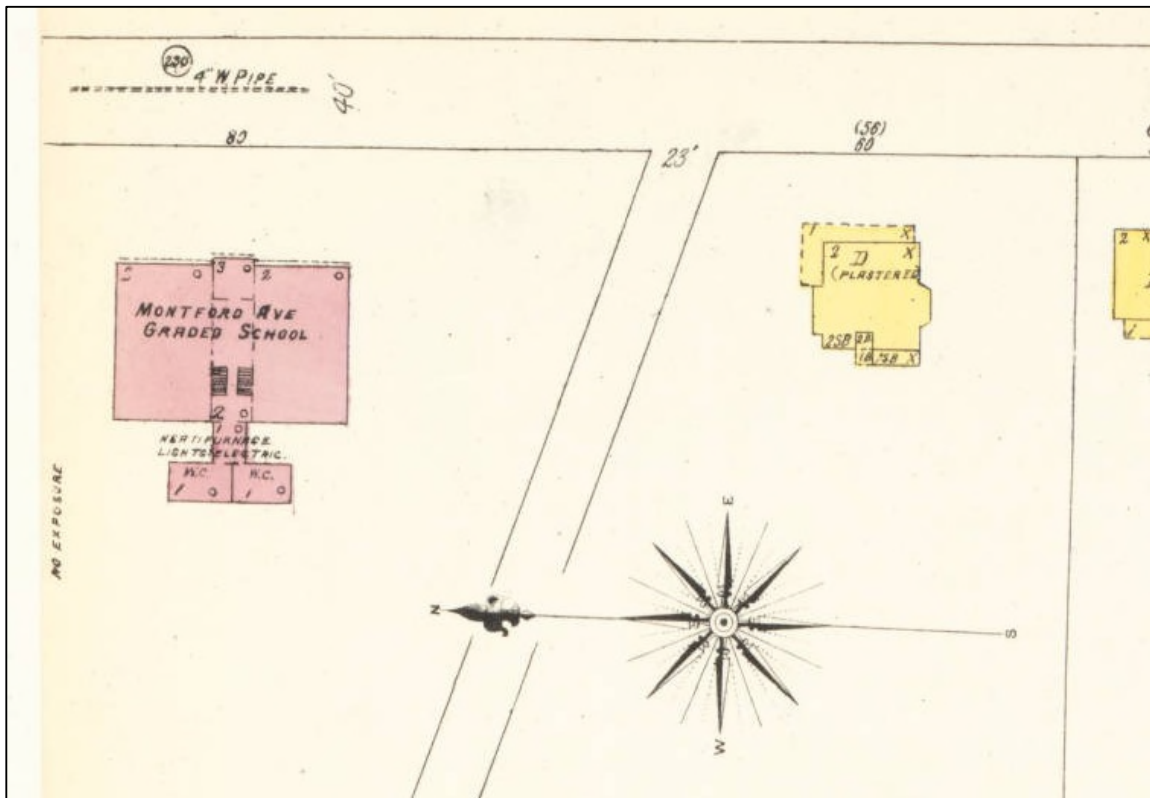


Figure 9. Sanborn Fire Insurance map (1907), showing Montford Avenue School building (North Carolina Maps, University of North Carolina).

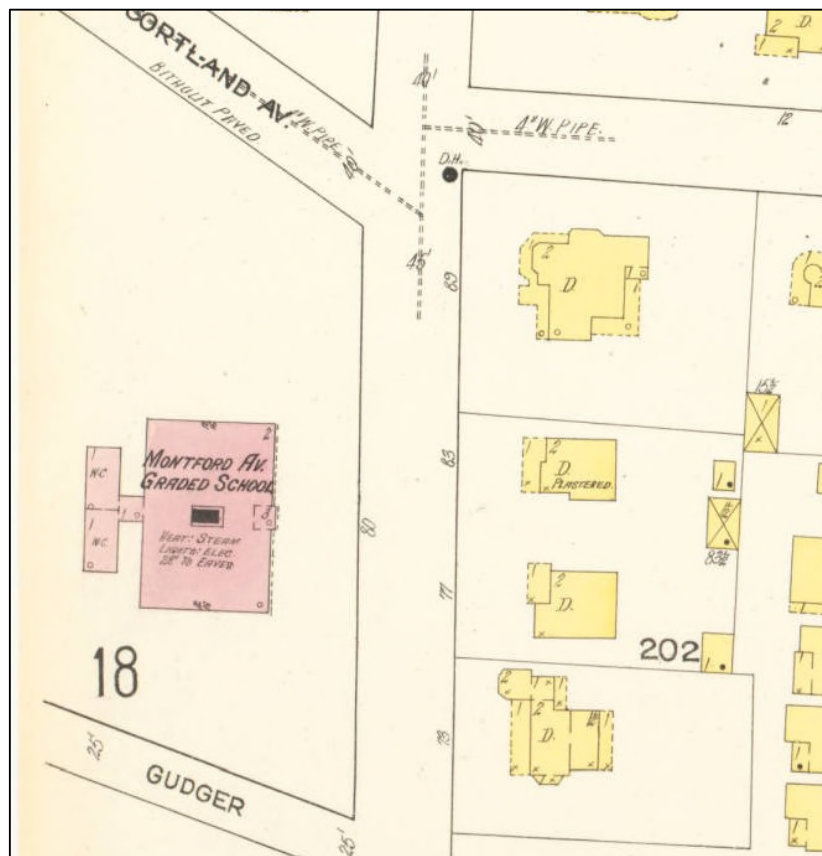


Figure 10. Sanborn Fire Insurance map (1913), showing Montford Avenue School building (North Carolina Maps, University of North Carolina).

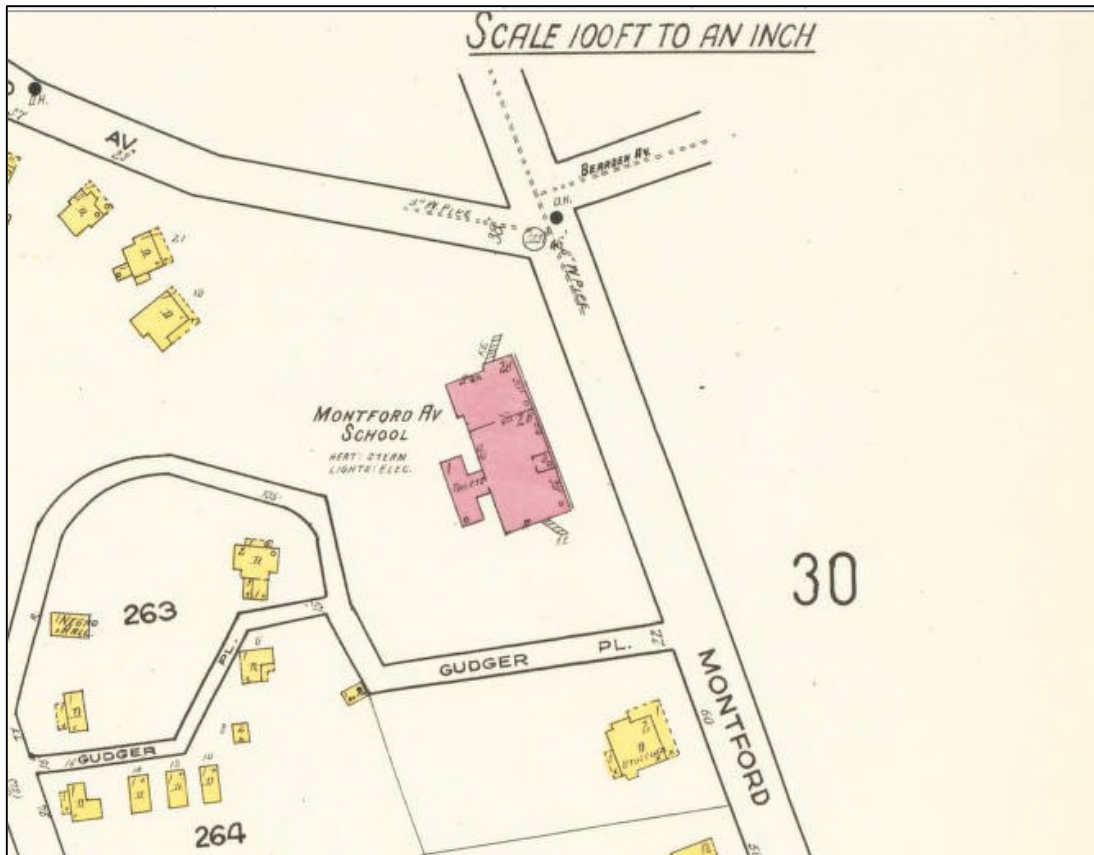


Figure 11. Sanborn Fire Insurance map (1917), showing Montford Avenue School building (North Carolina Maps, University of North Carolina).

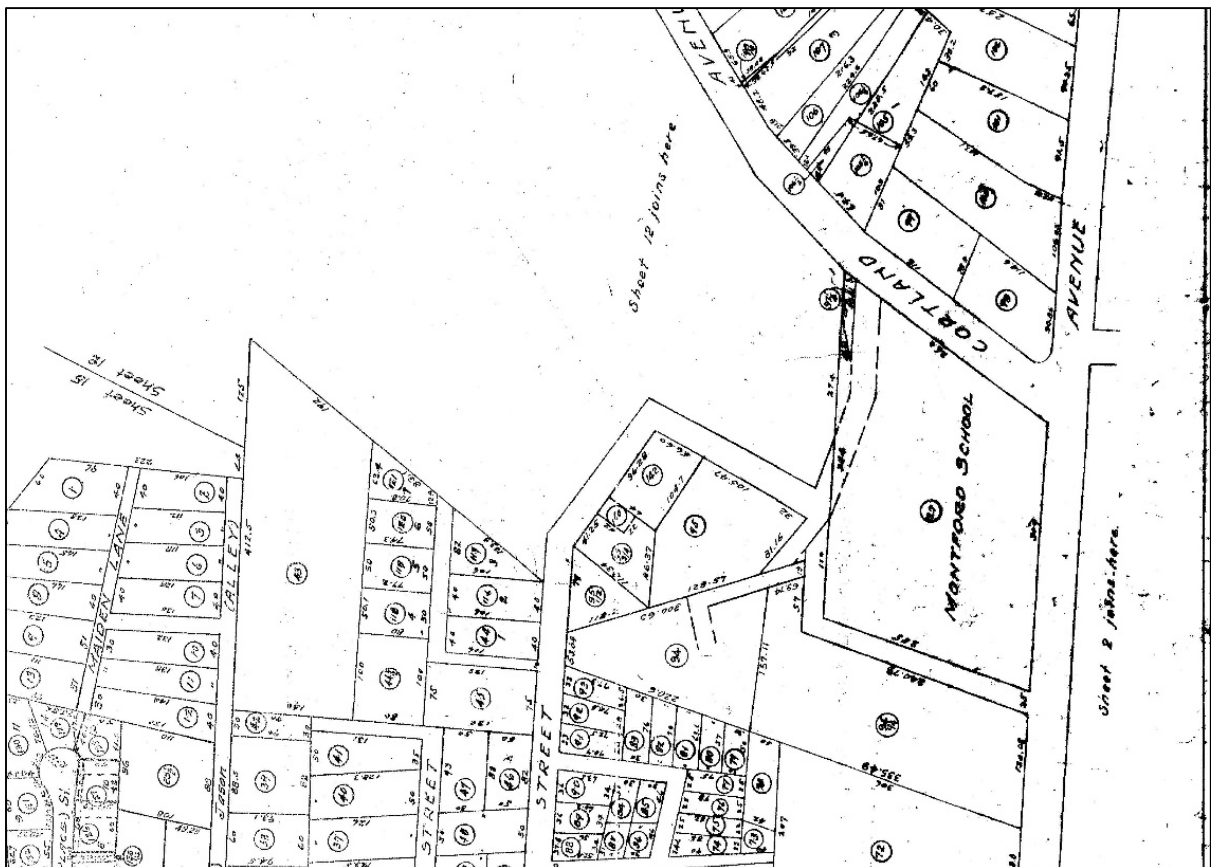


Figure 12. Buncombe County Tax Parcel Map (pre-1960), showing former alignment of Gudger Street and school property line.



Figure 13. Aerial photograph (1951), showing wall feature on west property edge (NRCS via Buncombe County GIS).



Figure 14 Aerial photograph (1963), showing wall location (Buncombe County GIS).



Figure 15. Aerial photograph (1975), showing wall location (Buncombe County GIS).



Figure 16. Aerial photograph (1994), showing wall location (Buncombe County GIS).

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Appendix B – Site Photographs

Appendix B - Site Photographs
Montford North Star Academy Retaining Wall

Asheville, NC

S&ME Project No. 1541-20-010



1	Location / Orientation	View from Gudger Street looking south	Photographer: S&ME	Date: Varies
	Remarks	General View. North Wall in foreground		



2	Location / Orientation	View from Gudger Street looking north	Photographer: S&ME	Date: Varies
	Remarks	General view		




Appendix B - Site Photographs
Montford North Star Academy Retaining Wall

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3	Location / Orientation	North and Middle Wall Sections / View looking SE
	Remarks	General View



Date: Varies

Photographer: S&ME

4	Location / Orientation	North Wall and Middle Wall sections / Looking East
	Remarks	Panoramic view



Date: Varies

Photographer: S&ME

Appendix B - Site Photographs
Montford North Star Academy Retaining Wall

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5	Location / Orientation	View looking north	Photographer: S&ME	Date: Varies
	Remarks	South Wall in foreground		



6	Location / Orientation	Middle Wall Section / View looking East	Photographer: S&ME	Date: Varies
	Remarks	General view. Note varied weep hole locations		



Appendix B - Site Photographs
Montford North Star Academy Retaining Wall

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7	Location / Orientation	North Wall Section	Photographer: S&ME	Date: Varies
	Remarks	Brick structure locations visible through weepholes		



8	Location / Orientation	South Wall / View looking south	Photographer: S&ME	Date: Varies
	Remarks	General view		



Appendix B - Site Photographs
Montford North Star Academy Retaining Wall

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9	Location / Orientation	North Wall at Courtland Ave/Gudger St Intersection	Photographer: S&ME	Date: Varies
	Remarks	Radius transition of wall to Courtland Ave		



10	Location / Orientation	From top of North Wall / View looking south	Photographer: S&ME	Date: Varies
	Remarks	General View		



Appendix B - Site Photographs
Montford North Star Academy Retaining Wall

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11	Location / Orientation	Top of North Wall / View looking south	Date: Varies
	Remarks	Depression behind rotated section of wall	



12	Location / Orientation	Transition between Middle and South Walls	Date: Varies
	Remarks	Opening into recreation area	




Appendix B - Site Photographs
Montford North Star Academy Retaining Wall

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		Date: Varies
		Photographer: S&ME
13	Location / Orientation	South Wall / View looking South
	Remarks	Back side of South Wall

		Date: Varies
		Photographer: S&ME
14	Location / Orientation	North Wall
	Remarks	Close-up of stone masonry wall construction. Note clay pipes through wall.

Appendix B - Site Photographs
Montford North Star Academy Retaining Wall

Asheville, NC

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15	Location / Orientation	Backside of Middle Wall at south end	Photographer: S&ME	Date: Varies
	Remarks	Freestanding wall section along sidewalk. Large section of displaced stone. Note difference in stone texture.		



16	Location / Orientation	North Wall	Photographer: S&ME	Date: Varies
	Remarks	Top view of displaced stone area from photo 15		



Appendix B - Site Photographs
Montford North Star Academy Retaining Wall

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17	Location / Orientation	Middle Wall	Photographer: S&ME	Date: Varies
	Remarks	Brick structure visible through clay pipe		



18	Location / Orientation	North Wall along Gudger St	Photographer: S&ME	Date: Varies
	Remarks	Cracking in sidewalk		



Appendix B - Site Photographs
Montford North Star Academy Retaining Wall

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19	Location / Orientation	Corner at north end of South Wall	Date: Varies
	Remarks	Vertical crack along mortar joints. Patching with brick and concrete	



20	Location / Orientation	Corner of Montford Ave and Courtland Ave / Looking SW	Date: Varies
	Remarks	Original Montford Avenue school wall, from right column going left	




Appendix B - Site Photographs
Montford North Star Academy Retaining Wall

Asheville, NC

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21	Location / Orientation	Montford Ave Wall / View looking north
	Remarks	Backside of wall



Date: Varies

Photographer: S&ME

22	Location / Orientation	Courtland Ave Wall / View looking west
	Remarks	General view



Date: Varies

Photographer: S&ME

Conceptual Alternatives Report
Montford North Star Academy Retaining Wall
Asheville, North Carolina
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Appendix C - Subsurface Investigation



S&ME completed a subsurface investigation associated with the existing retaining wall on the property of the Montford North Star Academy in Asheville, North Carolina. The subsurface investigation was designated as *Task 2A – Geotechnical Drilling* in the Scope of Work. This report has been prepared to document the findings of the subsurface investigation and has been prepared as Appendix C of the Conceptual Alternatives Report.

◆ **Field Exploration**

On the dates of July 29, 2020 and August 12, 2020, a total of 7 soils borings, designated as Borings B-2 through B-8, were advanced at the project site. Boring B-1 was omitted from our exploration due to a conflict with overhead utilities near the north end of Gudger Street. The borings were extended to depths ranging between 15 and 25 feet below the existing ground surface. Borings B-2 and B-4 (on the high side of the wall within the school parking lot) were each extended an additional 5 feet to further explore the soils near the foundation of the wall. Boring locations were established in the field by our personnel using existing site features on aerial imagery of the site.

The borings were drilled with a rubber-track mounted D-50 drill rig, equipped with an automatic hammer, using hollow-stem augers to advance the boreholes. Split-spoon samples and Standard Penetration Resistance (N-values) were obtained at 2.5-foot intervals in the upper 10 feet, and at 5-foot intervals thereafter. After completion of drilling each boring, water level measurements were attempted, and each borehole was backfilled with soil cuttings and a mechanical hole plug was installed to help reduce borehole settlement. Borings performed through existing pavements were repaired using cold asphalt patch.

Boring locations are depicted on the Boring Location Plan presented as Figure 1 in Attachment I. The classifications and field testing results are presented on the individual Boring Logs presented in Attachment I along with a Legend to Soil Classification and Symbols, and the Field Testing Procedures. Boring locations shown on the Boring Location Plan and ground surface elevations shown on the boring logs were obtained from the *Topographic & Location Survey* provided by Cole Surveying & Design and dated August 7, 2020, that was conducted as part of this project.

◆ **Laboratory Testing**

Following completion of the field work, the split-spoon samples were transported to our laboratory where a Geotechnical Professional visually and manually classified the soils in general accordance with the Unified Soil Classification System (USCS). Selected split-spoon samples were subjected to laboratory index testing (moisture content, Atterberg limits, and grain-size analysis) to aid in the classification and evaluation of the soil's engineering properties. Attachment II contains a Summary of Laboratory Test Data and the individual laboratory test reports. Results of the investigation are discussed in following sections of this report.



◆ Site and Subsurface Conditions

Area Geology

The project site is in the Blue Ridge Physiographic Province of North Carolina, an area underlain by ancient igneous and metamorphic rocks. The soils encountered in this area are the residual product of in-place physical and chemical weathering of the rock presently underlying the site. In areas not altered by erosion or disturbed by the activities of man, the residual soil profile typically consists of clayey soils near the surface, where soil weathering is more advanced, underlain by sandy silts and silty sands.

The boundary between soil and rock is not sharply defined. This transitional zone, termed "partially weathered rock," is normally found overlying parent bedrock. Partially weathered rock is defined, for engineering purposes, as residual material with standard penetration resistance values of at least 50 blows per 6 inches. Weathering is facilitated by fractures, joints, and the presence of less resistant rock types. Consequently, the profile of the partially weathered rock (as well as hard rock) is quite irregular and erratic, even over relatively short horizontal distances. Also, it is not unusual to find lenses and boulders of hard rock and zones of partially weathered rock within the soil mantle, well above the general bedrock level.

The natural geological profile of portions of the site have been modified/disturbed by past grading activities that have resulted in disturbance of soils and the placement of fill. Please keep in mind disturbed and fill soils can vary in composition and consistency, and the engineering characteristics of these soils can be difficult to predict. Fill can be comprised of a variety of soil types and can also contain debris from building demolition, organics, topsoil, trash, etc. The engineering properties of fill depend primarily on its composition, density, and moisture content. Although there is no specific correlation between the degree of compaction of existing fill and the results of standard penetration testing, a qualitative assessment of existing fill can typically be made based on visual observation of the fill materials sampled in the borings and the general magnitude of the standard penetration test values. Based on the exploration results and history of the site, we do not expect the fill was monitored and/or documented for compaction and moisture characteristics.

Subsurface Conditions

The following is a brief and general description of subsurface conditions encountered at the site. More detailed information is provided on the individual Boring Logs included in Attachment II.

Surface Materials

A layer of asphalt (approximately 2 to 5 inches thick) underlain by a layer of crushed stone (approximately 3 to 8 inches thick) was initially encountered in borings B-2, B-3, B-4, and B-6. Concrete was also encountered in boring B-6 directly below the crushed stone, which could not be penetrated with the drill augers. So, the boring was offset 3 feet and redrilled. (Concrete was not present in the offset boring.) Borings B-5, B-7, and B-8 initially encountered a layer of topsoil (about 2 to 3 inches thick) at the ground surface. Please note, surface material types and thicknesses will vary throughout the site and could be thicker or thinner between the borings.



Existing Fill

Beneath the surface materials, borings B-2, B-3, B-4, B-6, and B-7 encountered existing fill soils extending to depths ranging from 3 to 25 feet below the ground surface. In boring B-5, soils were encountered that exhibited some characteristics of existing fill, such as atypical color assemblage. However, because the samples could not be clearly identified as fill, we classified them as “possible fill” on the boring logs. Similar to fill, the engineering characteristics of the possible fill can vary, and distinguishing between the two can be difficult; therefore, the term “possible fill” will also be referred to as “fill” throughout the remainder of this report.

The fill materials consisted of silty sand, sandy silt, and sandy lean clay (USCS group symbols of SM, ML, and CL). Some of the sampled fill contained rock pieces, roots, and mica, and some samples were wetter than the estimated optimum moisture content (noted as moist, very moist, on the logs). Standard penetration resistance values (N-values) in the existing fill ranged from 2 to 12 blows per foot (bpf), indicating the fill was poorly to moderately compacted. Based on the wetness of much of the fill and the lower N-values, it appears the fill was placed erratically and is considered undocumented.

Boring B-4 was drilled 5 feet beyond the planned depth (to 20 feet) and terminated in existing fill at a depth of 25 feet below the ground surface.

Residuum

Residual soils were encountered beneath the topsoil in boring B-8 and beneath the existing fill in borings B-2 through B-7. The sampled residuum consisted of loose to medium dense silty sands (SM) and firm to hard sandy silts (ML) and sandy lean clays (CL). The residual soils contained varying amounts of mica, roots, and some samples were described as moist. The residuum exhibited standard penetration resistance values (N-values) ranging from 5 to 31 bpf.

Borings B-3, B-5, B-6, B-7, and B-8 terminated at their planned termination depths (between 15 and 20 feet below the ground surface) in residual soils. Boring B-2 terminated in residual soils and was drilled 5 feet beyond the planned depth (to 20 feet) to further evaluate the soils below the foundation of the wall.

Subsurface Water

Subsurface water was not encountered in the borings at the termination of boring (TOB) and the borings were not left open overnight due to safety concerns. However, please note that subsurface water levels will fluctuate during the year and from year to year due to such things as seasonal variations, precipitation, nearby creek levels, and construction activity in the area, and could therefore be encountered within the depths drilled in the future.



◆ Laboratory Test Results

Laboratory index testing (moisture content, Atterberg limits, and grain-size analysis) was performed on 16 select split-spoon samples. The results of the laboratory testing are summarized below:

- Percent fines for the tested soils ranged from 43.8 to 79.1 percent, and the majority of soils were classified as sandy silts (ML) and sandy lean clays (CL) with one sample classified as and silty sand (SM);
- Atterberg limits tests on the soils sampled indicated the Liquid Limits (LL) ranged between 33 and 50, the Plastic Limits (PL) ranged between 22 and 36, and the Plasticity Index (PI) ranged between 8 and 22;
- In situ Moisture Content for the sampled soils ranged from 10.4 to 28.1 percent.

List of Attachments

Attachment I

- Boring Location Plan
- Legend to Soil Classification and Symbols
- Boring Logs

Attachment II

- Summary of Laboratory Test Data
- Laboratory Testing Data Sheets

Attachment I


BORING ELEVATIONS

BORING	ELEVATIONS (FT)
B-2	2193.3
B-3	2182.7
B-4	2192.6
B-5	2178.5
B-6	2193.1
B-7	2181.6
B-8	2176.3



NOTE:
THE AERIAL PHOTOGRAPH FROM GOOGLE EARTH WAS MODIFIED BY S&ME. DRAWING IS FOR GENERAL INFORMATION ONLY AND SHOULD NOT BE USED FOR THE MEASUREMENT OR ESTIMATION OF QUANTITIES OR DISTANCES.

LEGEND

 Approximate Boring Location



BORING LOCATION PLAN

MONTFORD NORTH STAR RETAINING WALL
ASHEVILLE, BUNCOMBE COUNTY, NORTH CAROLINA

SCALE:
NOT TO SCALE
DATE:
OCT. 2020
PROJECT NUMBER
1541-20-010

FIGURE NO.

1

PROJECT:		Montford Retaining Wall Asheville, North Carolina S&ME Project No. 1541-20-010			BORING LOG B-2								
CLIENT: Buncombe County		ELEVATION: 2193.3 ft - NGVD			NOTES: Datum: NAD 83/NAVD 88								
DATE DRILLED: 7/29/20		BORING DEPTH: 25.0 ft											
DRILL RIG: Diedrich D-50		WATER LEVEL: Not Encountered at TOB											
DRILLER: Jordan Environmental, LLC		CAVE-IN DEPTH: 14'											
HAMMER TYPE: Automatic		LOGGED BY: K. Armstrong											
SAMPLING METHOD: Split spoon													
DRILLING METHOD: 2 1/4" H.S.A.													
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-NGVD)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			SPT N-Value (bpf)			N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RGD	PL	NM	LL	
		ASPHALT - 2 inches CRUSHED STONE - 8 inches											
		FILL: SANDY SILT (ML) - firm, red tan, fine, trace mica			SS-1	X	3	3	5				8
5		RESIDUUM: SANDY SILT (ML) - stiff, red tan white, fine, trace to some mica		2188.3	SS-2	X	5	6	8				14
		SILTY SAND (SM) - medium dense, tan white, fine to medium, micaceous			SS-3	X	4	6	8				14
10		SANDY SILT (ML) - very stiff to hard, red tan white, fine, trace to some mica, moist		2183.3	SS-4	X	6	12	14				26
15			HC	2178.3	SS-5	X	9	12	15				27
20				2173.3	SS-6	X	7	10	12				22
25				2168.3	SS-7	X	10	14	17				31
		Boring terminated at 25 feet											

S&ME BORING LOG - VOGTLE 1541-20-010 MONTFORD RETAINING WALL BORING LOGS.GPJ S&ME 2009_09_24.GDT 10/15/20

NOTES:

1. THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



PROJECT:		Montford Retaining Wall Asheville, North Carolina S&ME Project No. 1541-20-010		BORING LOG B-3										
CLIENT: Buncombe County		ELEVATION: 2182.7 ft - NGVD		NOTES: Datum: NAD 83/NAVD 88										
DATE DRILLED: 8/12/20		BORING DEPTH: 20.0 ft												
DRILL RIG: Diedrich D-50		WATER LEVEL: Not Encountered at TOB												
DRILLER: Jordan Environmental, LLC		CAVE-IN DEPTH: 15'												
HAMMER TYPE: Automatic		LOGGED BY: K. Armstrong												
SAMPLING METHOD: Split spoon														
DRILLING METHOD: 2 1/4" H.S.A.														
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-NGVD)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			SPT N-Value (bpf)			N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	PL	NM	LL		
		ASPHALT - 5 inches												
		CRUSHED STONE - 7 inches												
		FILL: SANDY SILT (ML) - firm, red brown, fine to medium, trace mica, trace rock pieces, moist			SS-1	⊗	4	4	2					6
5		FILL: SILTY SAND (SM) - very loose, red brown gray, fine to medium, trace mica, some clay, some rock pieces, moist		2177.7	SS-2	⊗	2	1	1					2
		FILL: SANDY LEAN CLAY (CL) - soft, brown, fine, trace mica, very moist			SS-3	⊗	1	2	1					3
10		RESIDUUM: SANDY LEAN CLAY (CL) - firm, red tan, fine, trace mica, moist		2172.7	SS-4	⊗	1	3	3					6
15		SANDY SILT (ML) - firm, red tan, fine to medium, some mica, moist	HC	2167.7	SS-5	⊗	4	2	3					5
20		SILTY SAND (SM) - medium dense, red tan white, fine, some mica, moist			SS-6	⊗	3	4	7					11
		Boring terminated at 20 feet		2162.7										

S&ME BORING LOG - VOGTLE 1541-20-010 MONTFORD RETAINING WALL BORING LOGS.GPJ S&ME 2009_09_24.GDT 10/15/20

NOTES:

1. THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



PROJECT:		Montford Retaining Wall Asheville, North Carolina S&ME Project No. 1541-20-010			BORING LOG B-4								
CLIENT: Buncombe County		ELEVATION: 2192.6 ft - NGVD			NOTES: Datum: NAD 83/NAVD 88								
DATE DRILLED: 7/29/20		BORING DEPTH: 25.0 ft											
DRILL RIG: Diedrich D-50		WATER LEVEL: Not Encountered at TOB											
DRILLER: Jordan Environmental, LLC		CAVE-IN DEPTH: 16'											
HAMMER TYPE: Automatic		LOGGED BY: K. Armstrong											
SAMPLING METHOD: Split spoon													
DRILLING METHOD: 2 1/4" H.S.A.													
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-NGVD)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			SPT N-Value (bpf)			N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RGD	PL	NM	LL	
		ASPHALT - 4 inches											
		CRUSHED STONE - 3 inches											
		FILL: SANDY SILT (ML) - firm to soft, brown purple red, fine, trace to some mica, moist --- No recovery of sample 2			SS-1	2	3	2					5
5				2187.6	SS-2	3	2	3					5
					SS-3	2	2	2					4
10		FILL: SANDY LEAN CLAY (CL) - firm, brown red, fine, trace mica, moist			SS-4	1	2	3					5
				2182.6									
15				2177.6	SS-5	3	3	3					6
			HC										
20		FILL: SILTY SAND (SM) - loose, brown red, fine, trace mica, moist			SS-6	3	2	4					6
				2172.6									
25		Boring terminated at 25 feet		2167.6	SS-7	3	2	3					5

S&ME BORING LOG - VOGTLE 1541-20-010 MONTFORD RETAINING WALL BORING LOGS.GPJ S&ME 2009_09_24.GDT 10/15/20

NOTES:

1. THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



PROJECT:		Montford Retaining Wall Asheville, North Carolina S&ME Project No. 1541-20-010			BORING LOG B-5								
CLIENT: Buncombe County		ELEVATION: 2178.5 ft - NGVD			NOTES: Datum: NAD 83/NAVD 88								
DATE DRILLED: 7/29/20		BORING DEPTH: 15.0 ft											
DRILL RIG: Diedrich D-50		WATER LEVEL: Not Encountered at TOB											
DRILLER: Jordan Environmental, LLC		CAVE-IN DEPTH: 9.5'											
HAMMER TYPE: Automatic		LOGGED BY: K. Armstrong											
SAMPLING METHOD: Split spoon													
DRILLING METHOD: 2 1/4" H.S.A.													
DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-NGVD)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			SPT N-Value (bpf)			N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RGD	PL	NM	LF	
		TOPSOIL - 3 inches											
		POSSIBLE FILL: SILTY SAND (SM) - loose, red tan, fine, trace mica, trace roots			SS-1	⊗	3	4	4				8
5		RESIDUUM: SANDY LEAN CLAY (CL) - stiff, tan red, fine, trace mica, moist --- Sample 2 contained trace roots		2173.5	SS-2	⊗	5	4	6				10
					SS-3	⊗	4	5	7				12
10			HC	2168.5	SS-4	⊗	3	4	6				10
		SANDY SILT (ML) - very stiff, tan red gray, fine to medium, some mica			SS-5	⊗	3	6	12				18
15		Boring terminated at 15 feet		2163.5									

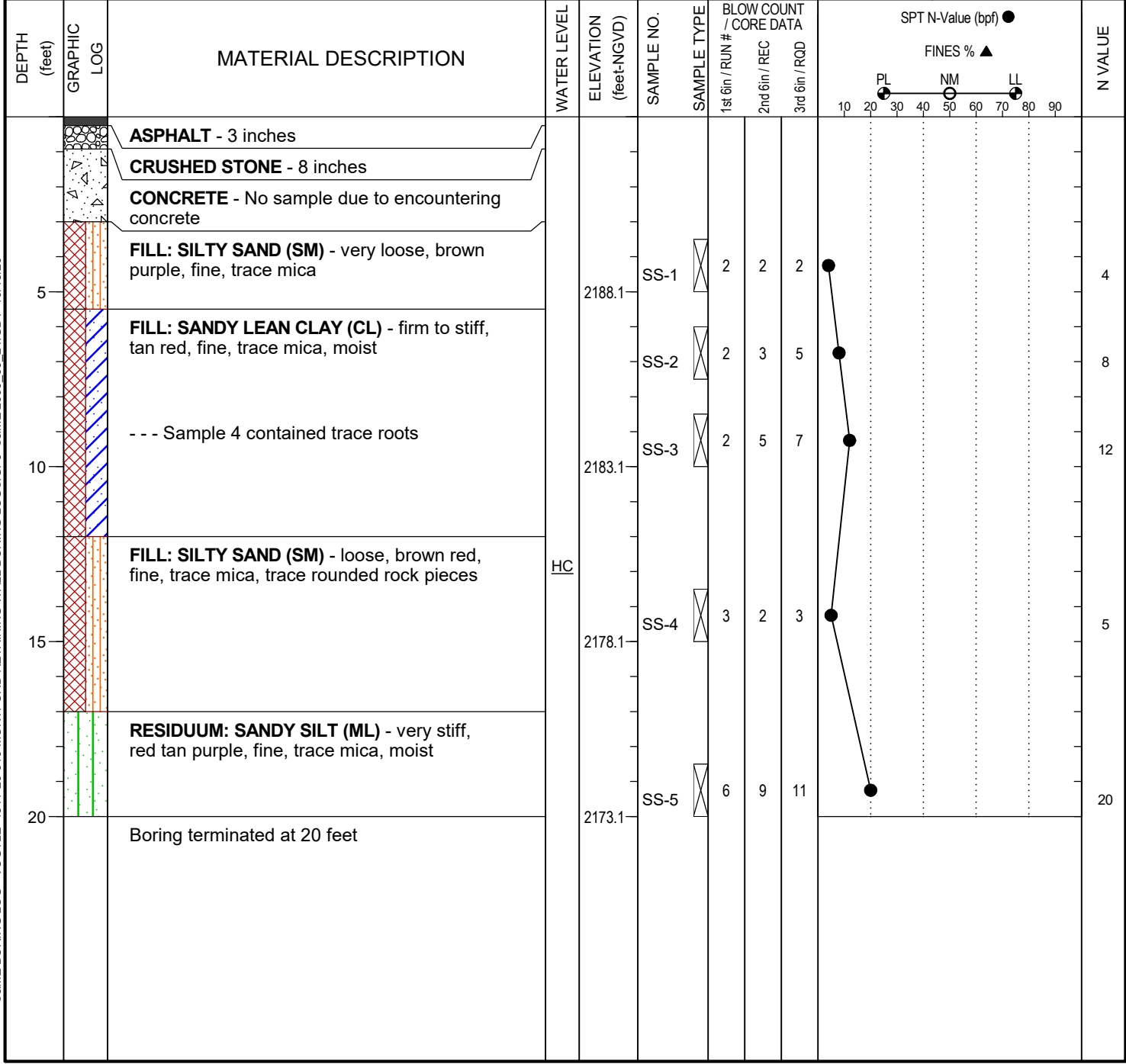
S&ME BORING LOG - VOGTLE 1541-20-010 MONTFORD RETAINING WALL BORING LOGS.GPJ S&ME 2009_09_24.GDT 10/15/20

NOTES:

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2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



CLIENT: Buncombe County	ELEVATION: 2193.1 ft - NGVD	NOTES: Datum: NAD 83/NAVD 88 Logs reflect a combination of samples from the original boring and offset boring.
DATE DRILLED: 7/29/20	BORING DEPTH: 20.0 ft	
DRILL RIG: Diedrich D-50	WATER LEVEL: Not Encountered at TOB	
DRILLER: Jordan Environmental, LLC	CAVE-IN DEPTH: 13'	
HAMMER TYPE: Automatic	LOGGED BY: K. Armstrong	
SAMPLING METHOD: Split spoon		
DRILLING METHOD: 2 1/4" H.S.A.		



S&ME BORING LOG - VOGTLE 1541-20-010 MONTFORD RETAINING WALL BORING LOGS.GPJ S&ME 2009_09_24.GDT 10/15/20

NOTES:

1. THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



CLIENT: Buncombe County	ELEVATION: 2181.6 ft - NGVD	NOTES: Datum: NAD 83/NAVD 88
DATE DRILLED: 7/29/20	BORING DEPTH: 15.0 ft	
DRILL RIG: Diedrich D-50	WATER LEVEL: Not Encountered at TOB	
DRILLER: Jordan Environmental, LLC	CAVE-IN DEPTH: 8.5'	
HAMMER TYPE: Automatic	LOGGED BY: K. Armstrong	
SAMPLING METHOD: Split spoon		

DRILLING METHOD: **2 1/4" H.S.A.**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-NGVD)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			SPT N-Value (bpf)					N VALUE
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	PL	NM	LL	FINES % ▲		
		TOPSOIL - 3 inches													
		FILL: SILTY SAND (SM) - loose, red brown, fine to medium, trace mica, trace roots, trace rock pieces			SS-1		10	6	4	●					10
5		RESIDUUM: SILTY SAND (SM) - medium dense, tan red, fine to medium, trace to some mica		2176.6	SS-2		5	6	7	●					13
					SS-3		7	11	11	●					22
10			HC	2171.6	SS-4		6	8	11	●					19
15		Boring terminated at 15 feet		2166.6	SS-5		8	8	10	●					18

S&ME BORING LOG - VOGTLE 1541-20-010 MONTFORD RETAINING WALL BORING LOGS.GPJ S&ME 2009_09_24.GDT 10/15/20

NOTES:

1. THIS LOG IS ONLY A PORTION OF A REPORT PREPARED FOR THE NAMED PROJECT AND MUST ONLY BE USED TOGETHER WITH THAT REPORT.
2. BORING, SAMPLING AND PENETRATION TEST DATA IN GENERAL ACCORDANCE WITH ASTM D-1586.
3. STRATIFICATION AND GROUNDWATER DEPTHS ARE NOT EXACT.
4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



CLIENT: Buncombe County	ELEVATION: 2176.3 ft - NGVD	NOTES: Datum: NAD 83/NAVD 88
DATE DRILLED: 8/12/20	BORING DEPTH: 15.0 ft	
DRILL RIG: Diedrich D-50	WATER LEVEL: Not Encountered at TOB	
DRILLER: Jordan Environmental, LLC	CAVE-IN DEPTH: 8'	
HAMMER TYPE: Automatic	LOGGED BY: K. Armstrong	
SAMPLING METHOD: Split spoon		

DRILLING METHOD: **2 1/4" H.S.A.**

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	ELEVATION (feet-NGVD)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT / CORE DATA			SPT N-Value (bpf)				N VALUE	
							1st 6in / RUN #	2nd 6in / REC	3rd 6in / RQD	PL	NM	LL	FINES % ▲		
		TOPSOIL - 2 inches RESIDIUM: SILTY SAND (SM) - loose to medium dense, tan red, fine to medium, trace to some mica													
5				2171.3	SS-1	3	4	5	●					9	
					SS-2	4	5	7	●					12	
					SS-3	6	7	8	●					15	
10			HC	2166.3	SS-4	5	5	8	●					13	
15		Boring terminated at 15 feet		2161.3	SS-5	5	7	12	●					19	

S&ME BORING LOG - VOGTLE 1541-20-010 MONTFORD RETAINING WALL BORING LOGS.GPJ S&ME 2009_09_24.GDT 10/15/20

NOTES:

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4. WATER LEVEL IS AT TIME OF EXPLORATION AND WILL VARY.



Attachment II – Laboratory Testing Data Sheets



SUMMARY OF LABORATORY TEST DATA
Montford North Star Retaining Wall
Asheville, North Carolina
S&ME Project No. 1541-20-010

Boring Number	Sample ID	Sample Depth (feet)	USCS Symbol	Natural Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
					Gravel (%)	Sand (%)	Fines (%)		LL (%)	PL (%)	PI (%)
							Silt (%)	Clay (%)			
B-2	SS-2	3.5-5'	ML	16.7	/	/	/	/	44	36	8
B-3	SS-1	1-2.5'	ML	20.7	/	/	/	/	/	/	/
B-3	SS-3	6-7.5'	CL	23.5	/	/	/	/	/	/	/
B-3	SS-4	8.5-10'	CL	20.2	0.2	34.9	64.8		35	22	13
B-3	SS-5	13.5-15'	ML	26.8	3.3	41.8	54.9		43	32	11
B-4	SS-1	1-2.5'	ML	23.2	/	/	/	/	/	/	/
B-4	SS-4	8.5-10'	CL	24.5	0.0	20.9	33.6	45.5	45	25	20
B-4	SS-5	13.5-15'	CL	28.1	/	/	/	/	/	/	/
B-5	SS-1	1-2.5'	SM	17.3	/	/	/	/	/	/	/
B-5	SS-3	6-7.5'	CL	23.0	0.0	26.2	73.7		50	28	22
B-6	SS-2	3.5-5'	SM	19.7	/	/	/	/	/	/	/
B-6	SS-4	8.5-10'	CL	24.5	/	/	/	/	48	27	21
B-6	SS-5	13.5-15'	SM	11.3	6.6	49.6	43.8		/	/	/
B-7	SS-1	1-2.5'	SM	10.4	/	/	/	/	/	/	/
B-7	SS-3	6-7.5'	SM	12.3	/	/	/	/	33	24	9
B-8	SS-2	3.5-5'	SM	11.3	/	/	/	/	/	/	/
TOTAL QUANTITIES:				16	5			7			

Notes:

USCS = Unified Soil Classification System

LL = Liquid Limit

PL = Plastic Limit

PI = Plasticity Index

**LABORATORY DETERMINATION OF WATER
 CONTENT & MATERIAL FINER THAN THE #200
 SIEVE**



ASTM D 2216 - D 1140

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	1541-20-010	Report Date:	9/4/20
Project Name:	Montford Retaining Wall	Test Date(s):	8/31 - 9/4/20
Client Name:	Buncombe County		
Client Address:	40 McCormic Place Asheville, North Carolina 28801		
		Sample Date(s):	7/29/20 & 8/12/20

Sampling Method: Split-spoon
 Method: **A** **B** Soaked Soak Time 2+ hrs.

Sample Identification	Tare Weight	Tare Wt. + Wet Wt	Tare Wt. + Dry Wt	Tare Wt. + Dry Wt. after Wash	Water Wt.	Percent Moisture	% Passing #200
Boring #, Sample #, Depth	grams	grams	grams	grams	grams	%	%
B-2, SS-2, 3.5-5'	0.00	65.64	56.26	---	9.38	16.7%	---
B-3, SS-1, 1-2.5'	0.00	184.99	153.28	---	31.71	20.7%	---
B-3, SS-3, 6-7.5'	0.00	220.05	178.22	---	41.83	23.5%	---
B-3, SS-4, 8.5-10'	0.00	91.56	76.16	---	15.40	20.2%	64.8%
B-3, SS-5, 13.5-15'	0.00	68.45	53.99	---	14.46	26.8%	54.9%
B-4, SS-1, 1-2.5'	0.00	202.64	164.48	---	38.16	23.2%	---
B-4, SS-4, 8.5-10'	0.00	65.23	52.40	---	12.83	24.5%	79.1%
B-4, SS-5, 13.5-15'	0.00	196.43	153.35	---	43.08	28.1%	---
B-5, SS-1, 1-2.5'	0.00	203.41	173.46	---	29.95	17.3%	---
B-5, SS-3, 6-7.5'	0.00	78.54	63.86	---	14.68	23.0%	73.7%
B-6, SS-2, 3.5-5'	0.00	153.13	127.88	---	25.25	19.7%	---
B-6, SS-4, 8.5-10'	0.00	66.28	53.25	---	13.03	24.5%	---
B-6, SS-5, 13.5-15'	0.00	175.82	158.01	---	17.81	11.3%	43.8%
B-7, SS-1, 1-2.5'	0.00	176.35	159.79	---	16.56	10.4%	---
B-7, SS-3, 6-7.5'	0.00	65.69	58.52	---	7.17	12.3%	---
B-8, SS-2, 3.5-5'	0.00	188.41	169.21	---	19.20	11.3%	---

Balance ID: 7537 Calibration Date: 1/31/20 #200 Sieve 14153 Calibration Date: 7/31/20

Notes / Deviations / References: ASTM D 1140: Amount of Material in Soil Finer Than the No. 200 (75-um) Sieve

Method B uses a deflocculating agent such as Sodium Hexametaphosphate while soaking the specimen for at least 2 hours.

ASTM D 2216: Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

Matt Jacobs / Ben Kovaleski
 Technician Name

NICET Lab Level III / 118202 & 117226 9/4/20
 Certification Type/No. Date

Brian Vaughan, P.E.
 Technical Responsibility

Brian Vaughan
 Signature

Group Leader 9/4/20
 Position Date

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LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



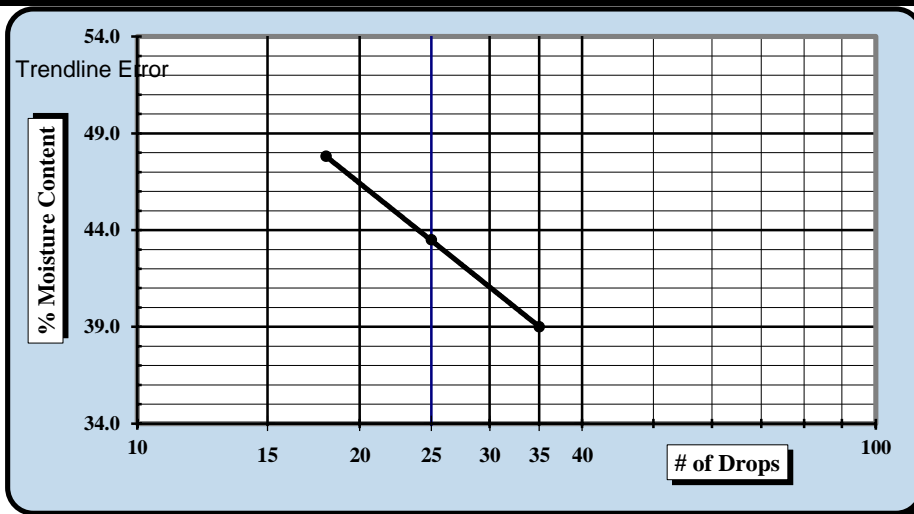
ASTM D 4318 AASHTO T 89 AASHTO T 90

S&ME, Inc. - Greenville 48 Brookfield Oaks Dr., Suite F Greenville, SC 29607

Project #:	1541-20-010	Report Date:	9/4/20
Project Name:	Montford Retaining Wall	Test Date:	9/2/20
Client Name:	Buncombe County		
Client Address:	40 McCormic Place Asheville, North Carolina 28801		
Boring #:	B-2	Log #:	98g
		Sample Date:	7/29/20
Location:	SS-2	Type:	Split-spoon
		Depth:	3.5 - 5'

Sample Description: SANDY SILT (ML) - red tan white					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	13942	9/10/2019	Grooving tool	23119	10/15/2019
LL Apparatus	23158	2/1/2020			
Oven	13978	10/7/2019			

Pan #	Tare #:	Liquid Limit					Plastic Limit		
		1	2	3			4	5	
A	Tare Weight	26.69	26.48	26.32			25.92	26.95	
B	Wet Soil Weight + A	41.42	40.87	43.16			32.77	33.13	
C	Dry Soil Weight + A	37.29	36.51	37.71			30.95	31.48	
D	Water Weight (B-C)	4.13	4.36	5.45			1.82	1.65	
E	Dry Soil Weight (C-A)	10.60	10.03	11.39			5.03	4.53	
F	% Moisture (D/E)*100	39.0%	43.5%	47.8%			36.2%	36.4%	
N	# OF DROPS	35	25	18			Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR								
Ave.	Average						36.3%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	44
Plastic Limit	36
Plastic Index	8
Group Symbol	ML

Multipoint Method
 One-point Method

Wet Preparation Dry Preparation Air Dried % Passing the #200 Sieve: N/A

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Benjamin J. Kovaleski
 Technician Name

9/4/20
 Date

Brian Vaughan, P.E.
 Technical Responsibility

9/4/20
 Date

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SIEVE ANALYSIS OF SOILS

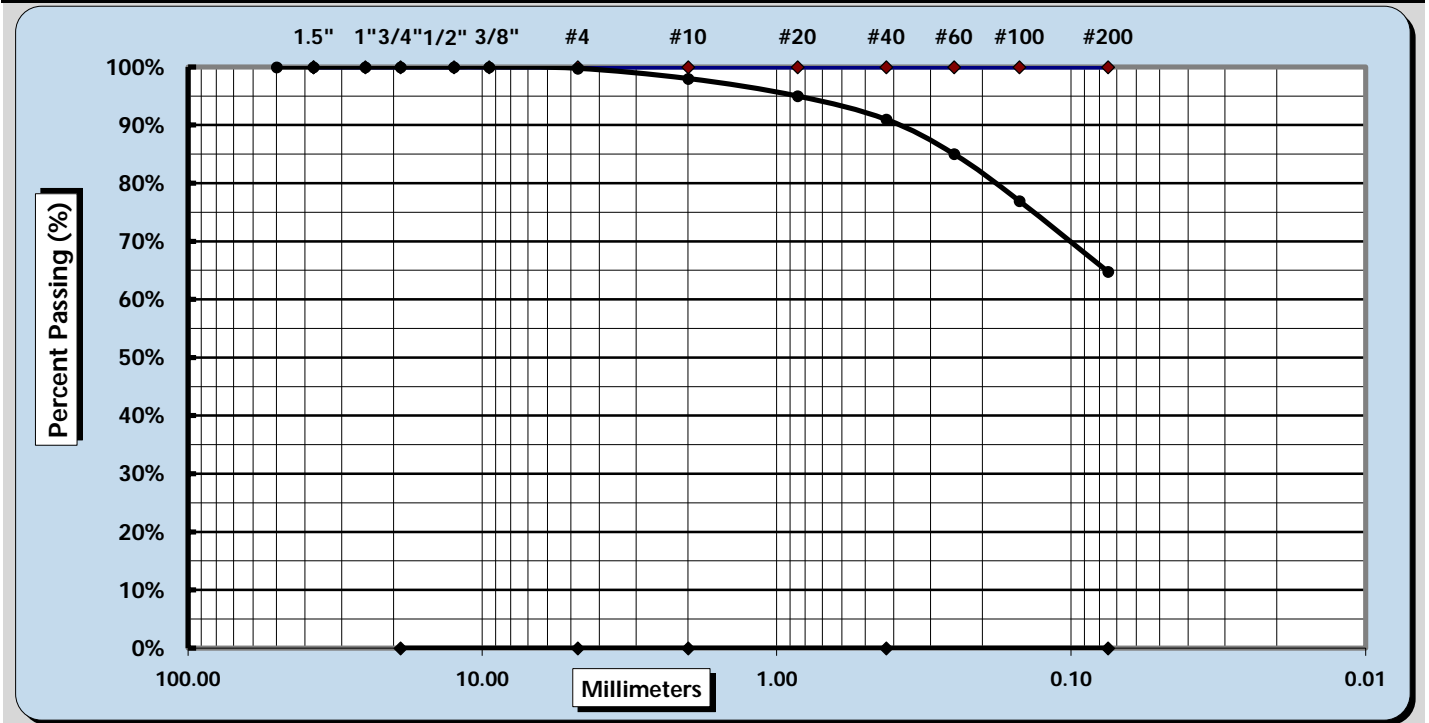


ASTM D 422

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	1541-20-010	Report Date:	9/4/20
Project Name:	Montford Retaining Wall	Test Date(s):	8/31 - 9/2/20
Client Name:	Buncombe County		
Client Address:	40 McCormic Place Asheville, North Carolina 28801		
Boring #:	B-3	Log #:	164
		Sample Date:	8/12/20
Location:	SS-4	Type:	Split-spoon
		Depth:	8.5 - 10'

Sample Description: SANDY LEAN CLAY (CL) - red tan, fine



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	4.75 mm	Coarse Sand	1.7%	Fine Sand	26.2%
Gravel	0.2%	Medium Sand	7.0%	Silt & Clay	64.8%
Liquid Limit	35	Plastic Limit	22	Plastic Index	13
Specific Gravity	2.650			Moisture Content	20.2%

Coarse Sand	1.7%	Medium Sand	7.0%	Fine Sand	26.2%
Description of Sand & Gravel Particles:		Rounded	<input type="checkbox"/>	Angular	<input checked="" type="checkbox"/>
Hard & Durable	<input checked="" type="checkbox"/>	Soft	<input type="checkbox"/>	Weathered & Friable	<input type="checkbox"/>

Notes / Deviations / References:

Brian Vaughan, P.E.
Technical Responsibility

Brian Vaughan
Signature

Group Leader
Position

9/4/20
Date

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LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



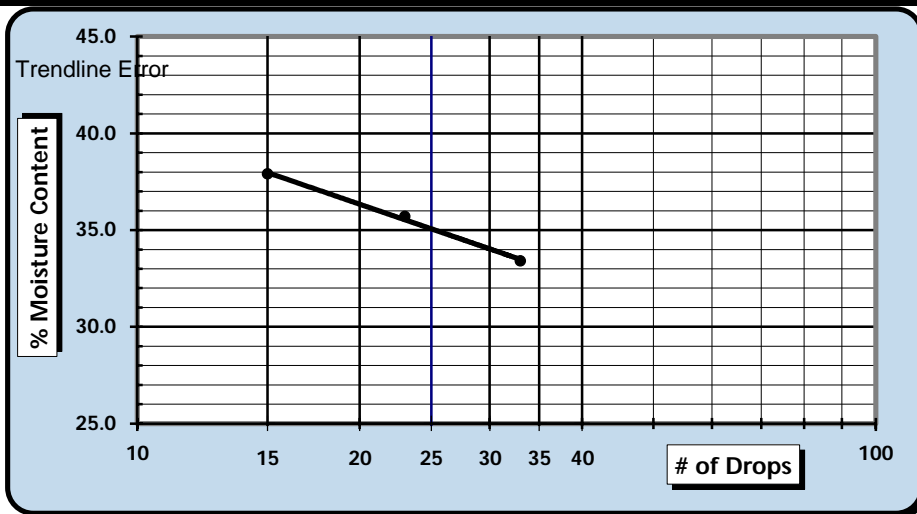
ASTM D 4318 AASHTO T 89 AASHTO T 90

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	1541-20-010	Report Date:	9/4/20
Project Name:	Montford Retaining Wall	Test Date:	9/3/20
Client Name:	Buncombe County		
Client Address:	40 McCormic Place Asheville, North Carolina 28801		
Boring #:	B-3	Log #:	164
		Sample Date:	8/12/20
Location:	SS-4	Type:	Split-spoon
		Depth:	8.5 - 10'

Sample Description: SANDY LEAN CLAY (CL) - red tan, fine					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	7537	1/31/2020	Grooving tool	14185	9/27/2019
LL Apparatus	13859	9/27/2019			
Oven	7313	7/30/2020			

Pan #	Tare #:	Liquid Limit					Plastic Limit		
		P-1	P-2	P-3			1	2	
A	Tare Weight	16.31	15.21	16.52			12.11	12.16	
B	Wet Soil Weight + A	41.14	40.55	40.21			20.73	20.55	
C	Dry Soil Weight + A	34.92	33.89	33.70			19.15	19.03	
D	Water Weight (B-C)	6.22	6.66	6.51			1.58	1.52	
E	Dry Soil Weight (C-A)	18.61	18.68	17.18			7.04	6.87	
F	% Moisture (D/E)*100	33.4%	35.7%	37.9%			22.4%	22.1%	
N	# OF DROPS	33	23	15			Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR								
Ave.	Average						22.3%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	35
Plastic Limit	22
Plastic Index	13
Group Symbol	CL

Multipoint Method
 One-point Method

Wet Preparation Dry Preparation Air Dried % Passing #200 Sieve: 64.8%

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Matt Jacobs
Technician Name

9/4/20
Date

Brian Vaughan, P.E.
Technical Responsibility

9/4/20
Date

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SIEVE ANALYSIS OF SOILS

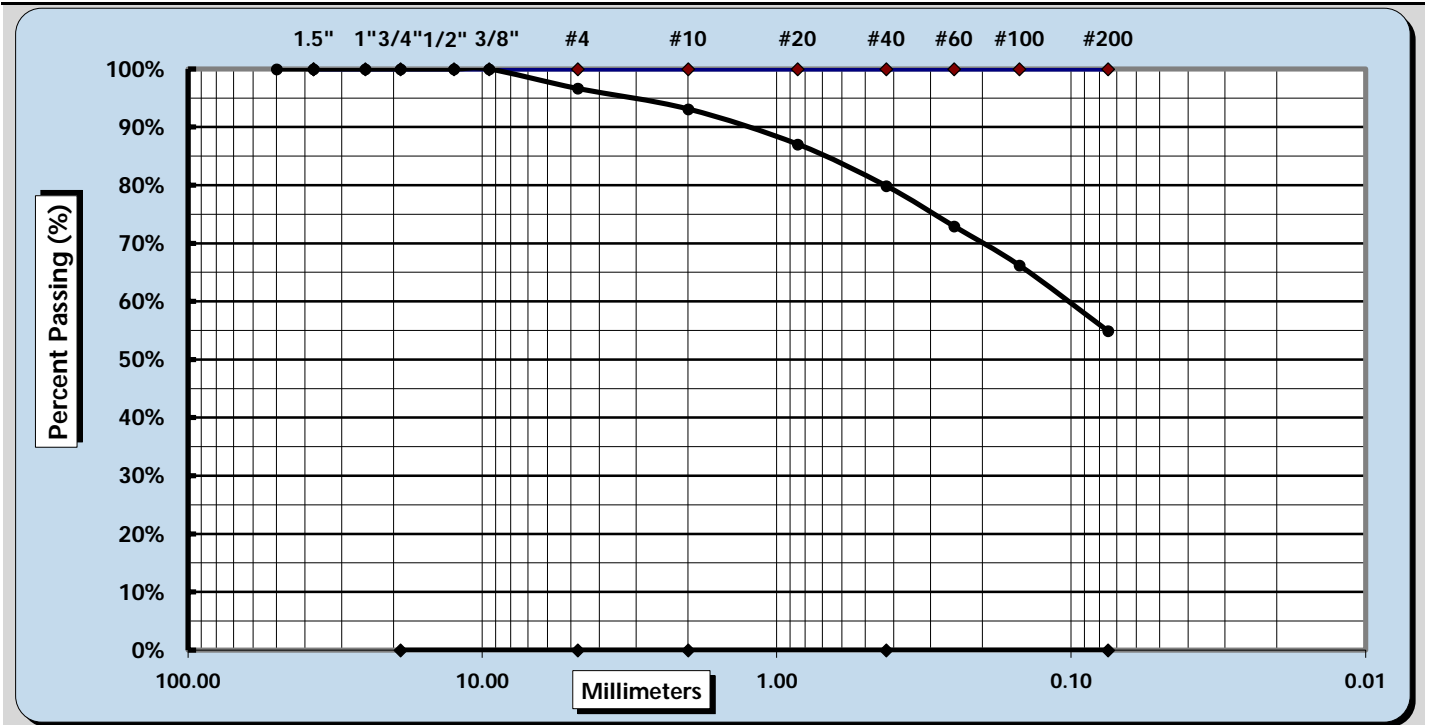


ASTM D 422

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	1541-20-010	Report Date:	9/4/20
Project Name:	Montford Retaining Wall	Test Date(s):	8/31 - 9/2/20
Client Name:	Buncombe County		
Client Address:	40 McCormic Place Asheville, North Carolina 28801		
Boring #:	B-3	Log #:	164
		Sample Date:	8/12/20
Location:	SS-5	Type:	Split-spoon
		Depth:	13.5 - 15'

Sample Description: SANDY SILT (ML) - red tan, medium to fine, some mica



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	9.50 mm	Coarse Sand	3.6%	Fine Sand	25.0%
Gravel	3.3%	Medium Sand	13.2%	Silt & Clay	54.9%
Liquid Limit	43	Plastic Limit	32	Plastic Index	11
Specific Gravity	2.650			Moisture Content	26.8%
Coarse Sand	3.6%	Medium Sand	13.2%	Fine Sand	25.0%
Description of Sand & Gravel Particles:		Rounded	<input type="checkbox"/>	Angular	<input checked="" type="checkbox"/>
Hard & Durable	<input checked="" type="checkbox"/>	Soft	<input type="checkbox"/>	Weathered & Friable	<input type="checkbox"/>

Notes / Deviations / References:

Brian Vaughan, P.E.
Technical Responsibility

Brian Vaughan
Signature

Group Leader
Position

9/4/20
Date

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LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



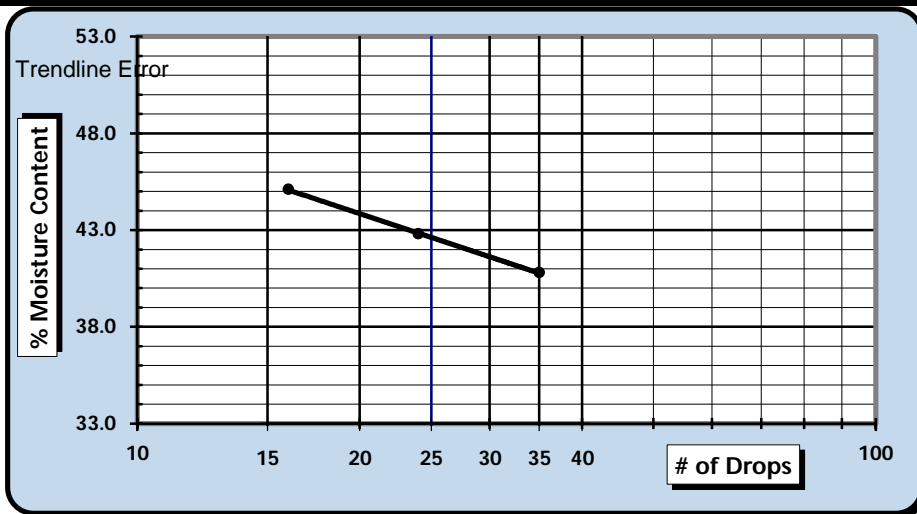
ASTM D 4318 AASHTO T 89 AASHTO T 90

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	1541-20-010	Report Date:	9/4/20
Project Name:	Montford Retaining Wall	Test Date:	9/3/20
Client Name:	Buncombe County		
Client Address:	40 McCormic Place Asheville, North Carolina 28801		
Boring #:	B-3	Log #:	164
		Sample Date:	8/12/20
Location:	SS-5	Type:	Split-spoon
		Depth:	13.5 - 15'

Sample Description: SANDY SILT (ML) - red tan, medium to fine, some mica					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	7537	1/31/2020	Grooving tool	14185	9/27/2019
LL Apparatus	13859	9/27/2019			
Oven	7313	7/30/2020			

Pan #	Tare #:	Liquid Limit					Plastic Limit		
		Q-1	Q-2	Q-3			3	4	
A	Tare Weight	16.65	16.60	15.72			11.60	12.26	
B	Wet Soil Weight + A	38.73	40.47	38.40			19.28	19.79	
C	Dry Soil Weight + A	32.33	33.32	31.35			17.40	17.97	
D	Water Weight (B-C)	6.40	7.15	7.05			1.88	1.82	
E	Dry Soil Weight (C-A)	15.68	16.72	15.63			5.80	5.71	
F	% Moisture (D/E)*100	40.8%	42.8%	45.1%			32.4%	31.9%	
N	# OF DROPS	35	24	16			Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR								
Ave.	Average						32.2%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	43
Plastic Limit	32
Plastic Index	11
Group Symbol	ML

Multipoint Method
 One-point Method

Wet Preparation Dry Preparation Air Dried % Passing #200 Sieve: 54.9%

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Matt Jacobs
Technician Name

9/4/20
Date

Brian Vaughan, P.E.
Technical Responsibility

9/4/20
Date

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PARTICLE SIZE ANALYSIS OF SOIL

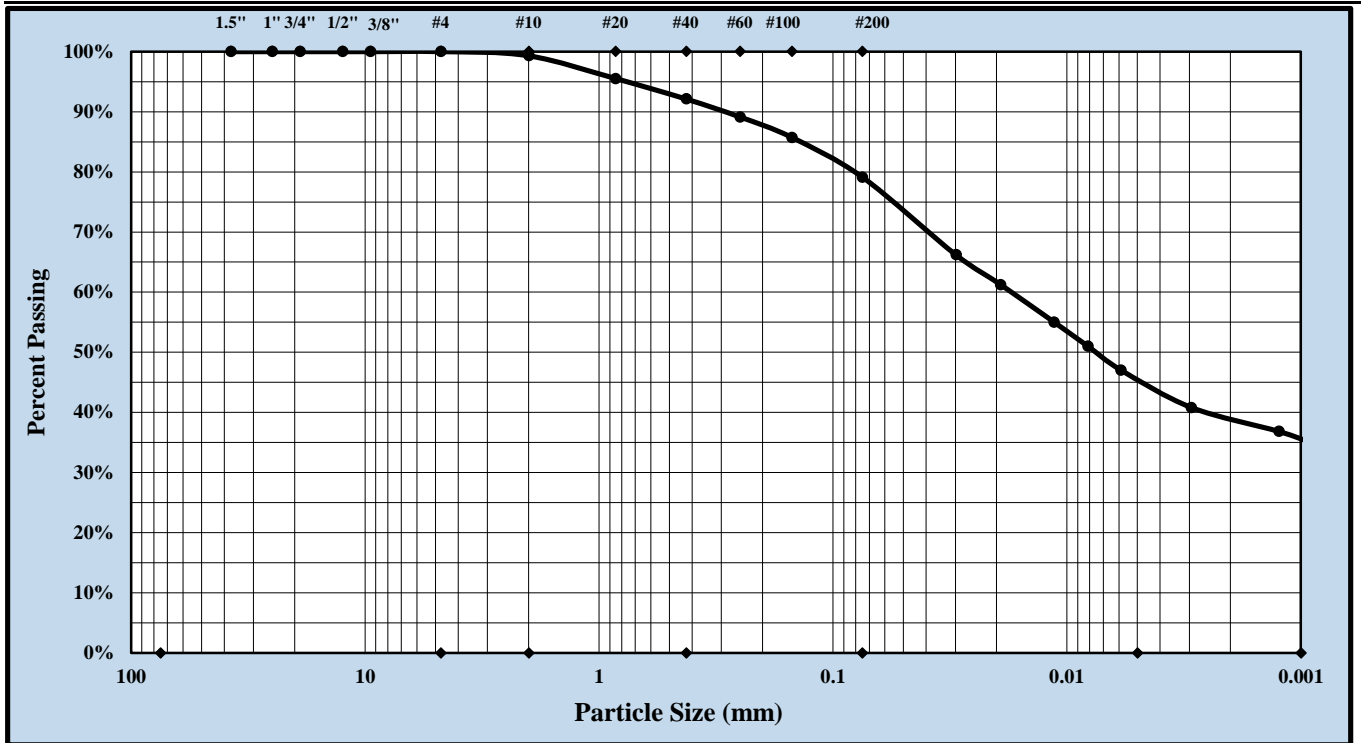


ASTM D 422

S&ME, Inc. - Greenville 48 Brookfield Oaks Dr., Suite F, Greenville, SC 29607

S&ME Project #:	1541-20-010	Report Date:	9/4/20
Project Name:	Montford Retaining Wall	Test Date(s):	9/1 - 9/4/20
Client Name:	Buncombe County		
Address:	40 McCormic Place Asheville, North Carolina 28801		
Boring #:	B-4	Log #:	98g
		Sample Date:	7/29/20
Location:	SS-4	Type:	Split-spoon
		Elevation:	8.5 - 10'

Sample Description: SANDY LEAN CLAY (CL) - brown red, fine



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm (#200)
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size:	2.00 mm	Gravel:	0.0%	Silt:	33.6%
Silt & Clay (% Passing #200):	79.1%	Total Sand:	20.9%	Clay:	45.5%
Apparent Relative Density:	2.650	Moisture Content:	24.5%	Colloids:	35.3%
Liquid Limit:	45	Plastic Limit:	25	Plastic Index:	20
Coarse Sand:	0.7%	Medium Sand:	7.2%	Fine Sand:	13.0%

Description of Sand and Gravel Rounded Angular Hard & Durable Soft Weathered & Friable

Mechanical Stirring Apparatus A Dispersion Period: 1 min. Dispersing Agent: Sodium Hexametaphosphate: 40 g./ Liter

References / Comments / Deviations:

*Specific Gravity assumed at 2.650

Brian Vaughan, P.E.
 Technical Responsibility

Brian Vaughan
 Signature

Group Leader
 Position

9/4/2020
 Date

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LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



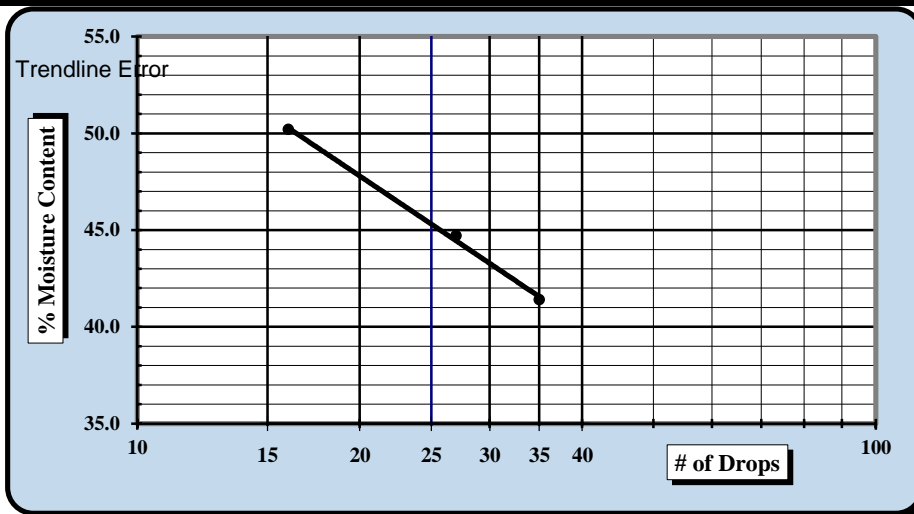
ASTM D 4318 AASHTO T 89 AASHTO T 90

S&ME, Inc. - Greenville 48 Brookfield Oaks Dr., Suite F Greenville, SC 29607

Project #:	1541-20-010	Report Date:	9/4/20
Project Name:	Montford Retaining Wall	Test Date:	9/2/20
Client Name:	Buncombe County		
Client Address:	40 McCormic Place Asheville, North Carolina 28801		
Boring #:	B-4	Log #:	98g
		Sample Date:	7/29/20
Location:	SS-4	Type:	Split-spoon
		Depth:	8.5 - 10'

Sample Description: SANDY LEAN CLAY (CL) - brown red, fine					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	13942	9/10/2019	Grooving tool	23119	10/15/2019
LL Apparatus	23158	2/1/2020			
Oven	13978	10/7/2019			

Pan #	Tare #:	Liquid Limit				Plastic Limit			
		1	2	3	4	5			
A	Tare Weight	26.70	26.49	26.32			25.92	26.96	
B	Wet Soil Weight + A	40.46	41.78	48.08			34.07	34.42	
C	Dry Soil Weight + A	36.43	37.06	40.81			32.46	32.94	
D	Water Weight (B-C)	4.03	4.72	7.27			1.61	1.48	
E	Dry Soil Weight (C-A)	9.73	10.57	14.49			6.54	5.98	
F	% Moisture (D/E)*100	41.4%	44.7%	50.2%			24.6%	24.7%	
N	# OF DROPS	35	27	16			Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR								
Ave.	Average							24.7%	



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	45
Plastic Limit	25
Plastic Index	20
Group Symbol	CL

Multipoint Method
 One-point Method

Wet Preparation Dry Preparation Air Dried % Passing the #200 Sieve: 79.1%

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Benjamin J. Kovaleski
 Technician Name

9/4/20
 Date

Brian Vaughan, P.E.
 Technical Responsibility

9/4/20
 Date

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SIEVE ANALYSIS OF SOILS

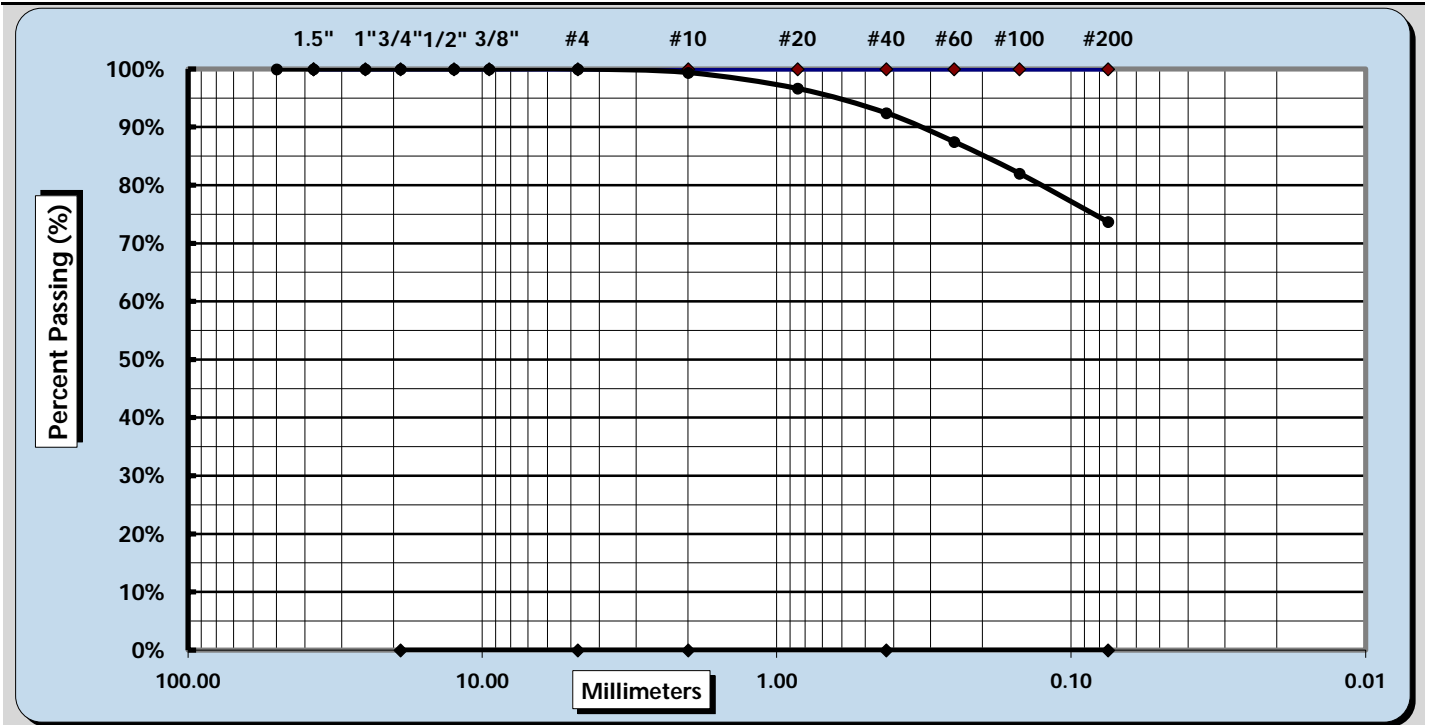


ASTM D 422

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	1541-20-010	Report Date:	9/4/20
Project Name:	Montford Retaining Wall	Test Date(s):	8/31 - 9/2/20
Client Name:	Buncombe County		
Client Address:	40 McCormic Place Asheville, North Carolina 28801		
Boring #:	B-5	Log #:	164
		Sample Date:	7/29/20
Location:	SS-3	Type:	Split-spoon
		Depth:	6 - 7.5'

Sample Description: SANDY LEAN CLAY (CL) - red tan, fine



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	2.00 mm	Coarse Sand	0.6%	Fine Sand	18.7%
Gravel	0.0%	Medium Sand	6.9%	Silt & Clay	73.7%
Liquid Limit	50	Plastic Limit	28	Plastic Index	22
Specific Gravity	2.650			Moisture Content	23.0%

Coarse Sand	0.6%	Medium Sand	6.9%	Fine Sand	18.7%
Description of Sand & Gravel Particles:		Rounded	<input type="checkbox"/>	Angular	<input checked="" type="checkbox"/>
Hard & Durable	<input checked="" type="checkbox"/>	Soft	<input type="checkbox"/>	Weathered & Friable	<input type="checkbox"/>

Notes / Deviations / References:

Brian Vaughan, P.E.
Technical Responsibility

Brian Vaughan
Signature

Group Leader
Position

9/4/20
Date

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LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



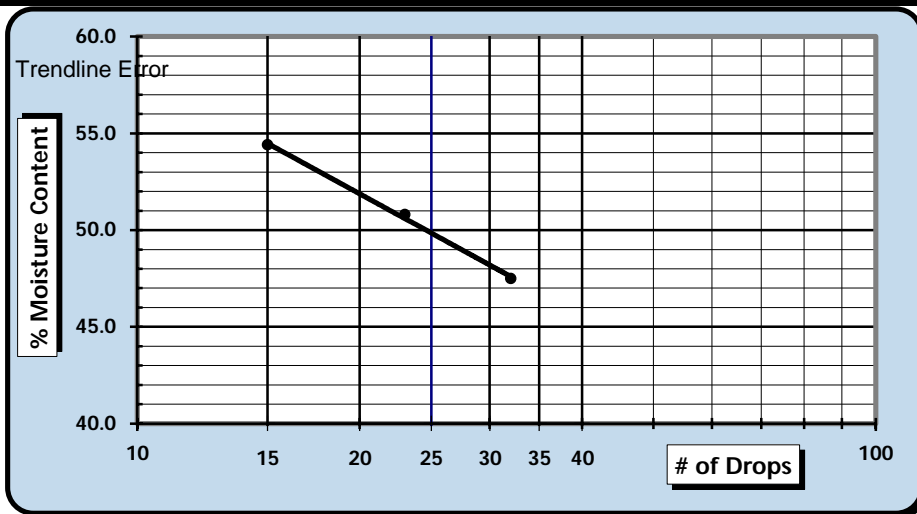
ASTM D 4318 AASHTO T 89 AASHTO T 90

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	1541-20-010	Report Date:	9/4/20
Project Name:	Montford Retaining Wall	Test Date:	9/3/20
Client Name:	Buncombe County		
Client Address:	40 McCormic Place Asheville, North Carolina 28801		
Boring #:	B-5	Log #:	164
		Sample Date:	7/29/20
Location:	SS-3	Type:	Split-spoon
		Depth:	6 - 7.5'

Sample Description: SANDY LEAN CLAY (CL) - red tan, fine					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	7537	1/31/2020	Grooving tool	14185	9/27/2019
LL Apparatus	13859	9/27/2019			
Oven	7313	7/30/2020			

Pan #	Tare #:	Liquid Limit					Plastic Limit		
		Y-1	Y-2	Y-3			5	6	
A	Tare Weight	16.40	16.44	16.99			12.10	12.29	
B	Wet Soil Weight + A	36.71	38.45	37.83			18.52	18.78	
C	Dry Soil Weight + A	30.17	31.04	30.49			17.10	17.36	
D	Water Weight (B-C)	6.54	7.41	7.34			1.42	1.42	
E	Dry Soil Weight (C-A)	13.77	14.60	13.50			5.00	5.07	
F	% Moisture (D/E)*100	47.5%	50.8%	54.4%			28.4%	28.0%	
N	# OF DROPS	32	23	15			Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR								
Ave.	Average						28.2%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	50
Plastic Limit	28
Plastic Index	22
Group Symbol	CL

Multipoint Method
 One-point Method

Wet Preparation Dry Preparation Air Dried % Passing #200 Sieve: 73.7%

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Matt Jacobs
Technician Name

9/4/20
Date

Brian Vaughan, P.E.
Technical Responsibility

9/4/20
Date

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LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



ASTM D 4318 AASHTO T 89 AASHTO T 90

S&ME, Inc. - Greenville 48 Brookfield Oaks Dr., Suite F Greenville, SC 29607

Project #:	1541-20-010	Report Date:	9/4/20
Project Name:	Montford Retaining Wall	Test Date:	9/2/20
Client Name:	Buncombe County		
Client Address:	40 McCormic Place Asheville, North Carolina 28801		
Boring #:	B-6	Log #:	98g
		Sample Date:	7/29/20
Location:	SS-4	Type:	Split-spoon
		Depth:	8.5 - 10'

Sample Description: SANDY LEAN CLAY (CL) - tan red					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	13942	9/10/2019	Grooving tool	23119	10/15/2019
LL Apparatus	23158	2/1/2020			
Oven	13978	10/7/2019			

Pan #	Tare #:	Liquid Limit					Plastic Limit		
		11	12	13			14	15	
A	Tare Weight	26.67	26.65	26.76			26.64	27.60	
B	Wet Soil Weight + A	41.49	39.95	43.82			33.98	34.98	
C	Dry Soil Weight + A	36.93	35.66	38.10			32.45	33.40	
D	Water Weight (B-C)	4.56	4.29	5.72			1.53	1.58	
E	Dry Soil Weight (C-A)	10.26	9.01	11.34			5.81	5.80	
F	% Moisture (D/E)*100	44.4%	47.6%	50.4%			26.3%	27.2%	
N	# OF DROPS	35	25	18			Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR								
Ave.	Average						26.8%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	48
Plastic Limit	27
Plastic Index	21
Group Symbol	CL

Multipoint Method
 One-point Method

Wet Preparation Dry Preparation Air Dried % Passing the #200 Sieve: N/A

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Benjamin J. Kovaleski
 Technician Name

9/4/20
 Date

Brian Vaughan, P.E.
 Technical Responsibility

9/4/20
 Date

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SIEVE ANALYSIS OF SOILS

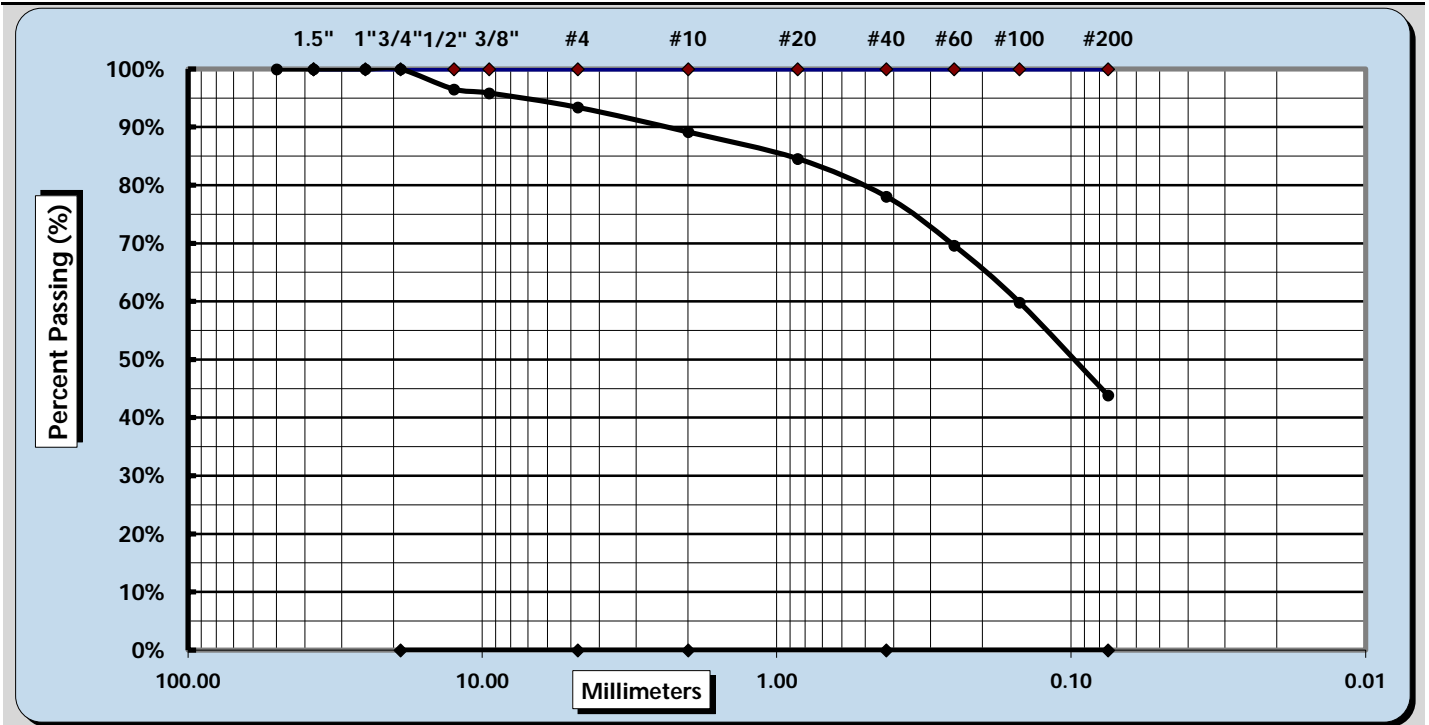


ASTM D 422

S&ME, Inc. - Spartanburg: 301 Zima Park Drive, Spartanburg, SC 29301

Project #:	1541-20-010	Report Date:	9/4/20
Project Name:	Montford Retaining Wall	Test Date(s):	8/31 - 9/2/20
Client Name:	Buncombe County		
Client Address:	40 McCormic Place Asheville, North Carolina 28801		
Boring #:	B-6	Log #:	164
		Sample Date:	7/29/20
Location:	SS-5	Type:	Split-spoon
		Depth:	13.5 - 15'

Sample Description: SILTY SAND (SM) - red brown, medium to fine, trace mica



Cobbles	< 300 mm (12") and > 75 mm (3")	Fine Sand	< 0.425 mm and > 0.075 mm
Gravel	< 75 mm and > 4.75 mm (#4)	Silt	< 0.075 and > 0.005 mm
Coarse Sand	< 4.75 mm and > 2.00 mm (#10)	Clay	< 0.005 mm
Medium Sand	< 2.00 mm and > 0.425 mm (#40)	Colloids	< 0.001 mm

Maximum Particle Size	19.00 mm	Coarse Sand	4.3%	Fine Sand	34.2%
Gravel	6.6%	Medium Sand	11.1%	Silt & Clay	43.8%
Liquid Limit	N/A	Plastic Limit	N/A	Plastic Index	N/A
Specific Gravity	2.650			Moisture Content	11.3%

Coarse Sand	4.3%	Medium Sand	11.1%	Fine Sand	34.2%
Description of Sand & Gravel Particles:		Rounded	<input type="checkbox"/>	Angular	<input checked="" type="checkbox"/>
Hard & Durable	<input checked="" type="checkbox"/>	Soft	<input type="checkbox"/>	Weathered & Friable	<input type="checkbox"/>

Notes / Deviations / References:

Brian Vaughan, P.E.
Technical Responsibility

Brian Vaughan
Signature

Group Leader
Position

9/4/20
Date

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LIQUID LIMIT, PLASTIC LIMIT, & PLASTIC INDEX



ASTM D 4318 AASHTO T 89 AASHTO T 90

S&ME, Inc. - Greenville 48 Brookfield Oaks Dr., Suite F Greenville, SC 29607

Project #:	1541-20-010	Report Date:	9/4/20
Project Name:	Montford Retaining Wall	Test Date:	9/2/20
Client Name:	Buncombe County		
Client Address:	40 McCormic Place Asheville, North Carolina 28801		
Boring #:	B-7	Log #:	98g
		Sample Date:	7/29/20
Location:	SS-3	Type:	Split-spoon
		Depth:	6 - 7.5'

Sample Description: SILTY SAND (SM) - tan red					
Type and Specification	S&ME ID #	Cal Date:	Type and Specification	S&ME ID #	Cal Date:
Balance (0.01 g)	13942	9/10/2019	Grooving tool	23119	10/15/2019
LL Apparatus	23158	2/1/2020			
Oven	13978	10/7/2019			

Pan #	Tare #:	Liquid Limit				Plastic Limit		
		6	7	8		9	10	
A	Tare Weight	27.79	26.26	27.32		26.84	26.75	
B	Wet Soil Weight + A	45.45	43.69	46.05		34.13	32.85	
C	Dry Soil Weight + A	41.43	39.38	41.00		32.71	31.67	
D	Water Weight (B-C)	4.02	4.31	5.05		1.42	1.18	
E	Dry Soil Weight (C-A)	13.64	13.12	13.68		5.87	4.92	
F	% Moisture (D/E)*100	29.5%	32.9%	36.9%		24.2%	24.0%	
N	# OF DROPS	35	26	17		Moisture Contents determined by ASTM D 2216		
LL	LL = F * FACTOR							
Ave.	Average					24.1%		



One Point Liquid Limit			
N	Factor	N	Factor
20	0.974	26	1.005
21	0.979	27	1.009
22	0.985	28	1.014
23	0.99	29	1.018
24	0.995	30	1.022
25	1.000		

NP, Non-Plastic	<input type="checkbox"/>
Liquid Limit	33
Plastic Limit	24
Plastic Index	9
Group Symbol	SM

Multipoint Method
 One-point Method

Wet Preparation Dry Preparation Air Dried % Passing the #200 Sieve: N/A

Notes / Deviations / References:

ASTM D 4318: Liquid Limit, Plastic Limit, & Plastic Index of Soils

Benjamin J. Kovaleski
 Technician Name

9/4/20
 Date

Brian Vaughan, P.E.
 Technical Responsibility

9/4/20
 Date

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Appendix D Geophysical Survey Photos


Appendix D - Geophysical Survey Photos
Montford North Star Academy Retaining Wall

Asheville, NC

S&ME Project No. 1541-20-010




1	Location / Orientation	North Wall Section
	Remarks	Observed anomalies from GPR survey



Date: 7/27/2020

Photographer: Vaughn & Melton

2	Location / Orientation	North Wall Section
	Remarks	Observed anomalies from GPR survey



Date: 7/27/2020

Photographer: Vaughn & Melton

Appendix D - Geophysical Survey Photos
Montford North Star Academy Retaining Wall

Asheville, NC

S&ME Project No. 1541-20-010



3	Location / Orientation	Middle Wall Section	Date: 7/27/2020
	Remarks	Observed anomalies from GPR survey	



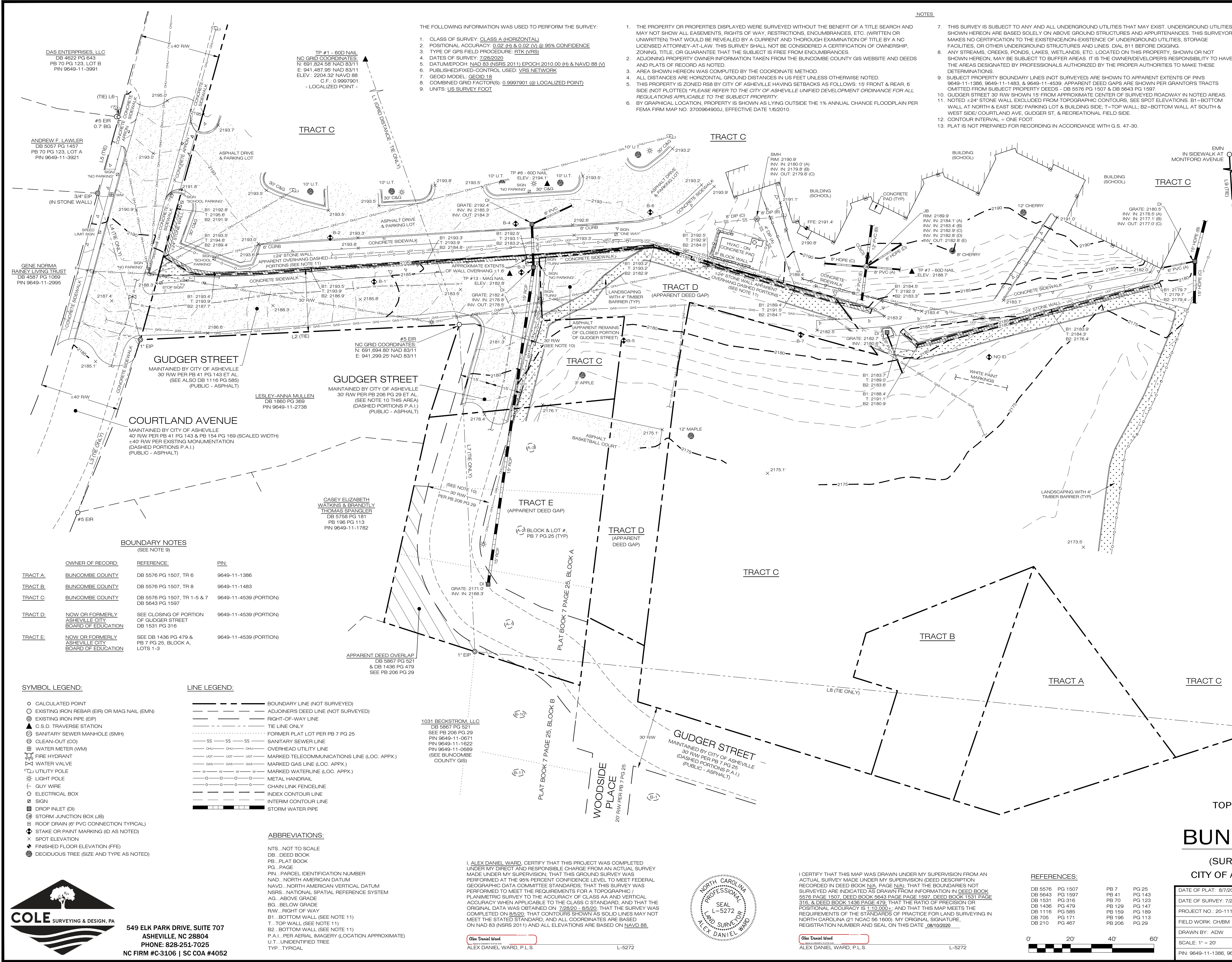
4	Location / Orientation	South Wall Section	Date: 7/27/2020
	Remarks	Observed anomalies from GPR survey	



Conceptual Alternatives Report
Montford North Star Academy Retaining Wall
Asheville, North Carolina
S&ME Project No. 1541-20-010



Appendix E - Site Survey



THE FOLLOWING INFORMATION WAS USED TO PERFORM THE SURVEY:

1. CLASS OF SURVEY: CLASS A (HORIZONTAL)
2. POSITIONAL ACCURACY: 0.02 (H) & 0.02 (V) @ 95% CONFIDENCE
3. TYPE OF GPS FIELD PROCEDURE: RTK (VRS)
4. DATES OF SURVEY: 7/28/2020
5. DATUM/EPOCH: NAD 83 (NSRS 2011) EPOCH 2010.00 (H) & NAVD 88 (V)
6. PUBLISHED/FIXED-CONTROL USED: VRS NETWORK
7. GEOID MODEL: GEOID 18
8. COMBINED GRID FACTORS(C): 0.9997901 (@ LOCALIZED POINT)
9. UNITS: US SURVEY FOOT

1. THE PROPERTY OR PROPERTIES DISPLAYED WERE SURVEYED WITHOUT THE BENEFIT OF A TITLE SEARCH AND MAY NOT SHOW ALL EASEMENTS, RIGHTS OF WAY, RESTRICTIONS, ENCUMBRANCES, ETC. (WRITTEN OR UNWRITTEN) THAT WOULD BE REVEALED BY A CURRENT AND THOROUGH EXAMINATION OF TITLE BY A NC LICENSED ATTORNEY-AT-LAW. THIS SURVEY SHALL NOT BE CONSIDERED A CERTIFICATION OF OWNERSHIP, ZONING, TITLE, OR GUARANTEE THAT THE SUBJECT IS FREE FROM ENCUMBRANCES.

2. ADJOINING PROPERTY OWNER INFORMATION TAKEN FROM THE BUNCOMBE COUNTY GIS WEBSITE AND DEEDS AND PLATS OF RECORD AS NOTED.

3. AREA SHOWN HEREON WAS COMPUTED BY THE COORDINATE METHOD.

4. ALL DISTANCES ARE HORIZONTAL GROUND DISTANCES IN US FEET UNLESS OTHERWISE NOTED.

5. THIS PROPERTY IS ZONED R58 BY CITY OF ASHEVILLE HAVING SETBACKS AS FOLLOWS: 15' FRONT & REAR, 6' SIDE (NOT PLOTTED) PLEASE REFER TO THE CITY OF ASHEVILLE UNIFIED DEVELOPMENT ORDINANCE FOR ALL REGULATIONS APPLICABLE TO THE SUBJECT PROPERTY.

6. BY GRAPHICAL LOCATION, PROPERTY IS SHOWN AS LYING OUTSIDE THE 1% ANNUAL CHANCE FLOODPLAIN PER FEMA FIRM MAP NO. 3700964900J, EFFECTIVE DATE 1/6/2010.

7. THIS SURVEY IS SUBJECT TO ANY AND ALL UNDERGROUND UTILITIES THAT MAY EXIST. UNDERGROUND UTILITIES SHOWN HEREON ARE BASED SOLELY ON ABOVE GROUND STRUCTURES AND APPURTENANCES. THIS SURVEYOR MAKES NO CERTIFICATION TO THE EXISTENCE/NON-EXISTENCE OF UNDERGROUND UTILITIES, STORAGE FACILITIES, OR OTHER UNDERGROUND STRUCTURES AND LINES. DIAL 811 BEFORE DIGGING.

8. ANY STREAMS, CREEKS, PONDS, LAKES, WETLANDS, ETC. LOCATED ON THIS PROPERTY, SHOWN OR NOT SHOWN HEREON, MAY BE SUBJECT TO BUFFER AREAS. IT IS THE OWNER'S RESPONSIBILITY TO HAVE THE AREAS DESIGNATED BY PROFESSIONALS AUTHORIZED BY THE PROPER AUTHORITIES TO MAKE THESE DETERMINATIONS.

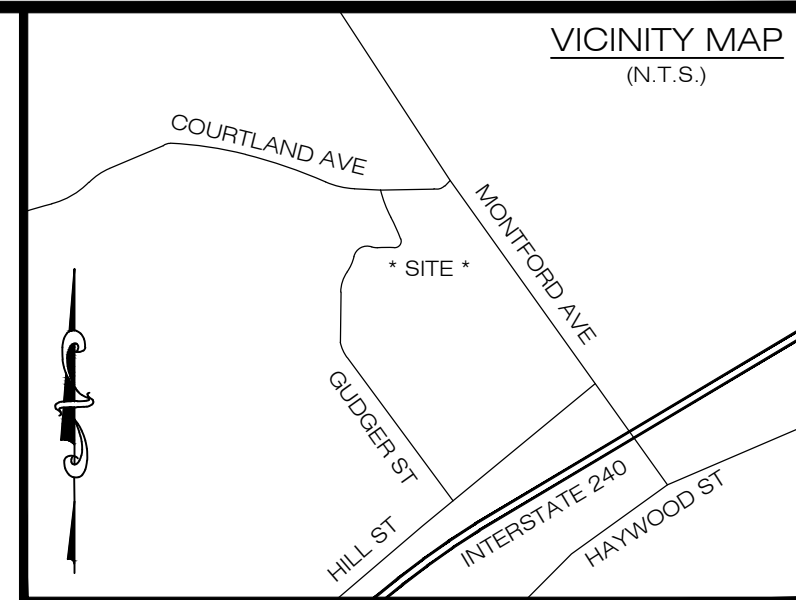
9. SUBJECT PROPERTY BOUNDARY LINES (NOT SURVEYED) ARE SHOWN TO APPARENT EXTENTS OF PINS 9649-11-1386, 9649-11-1483, & 9649-11-4539. APPARENT DEED GAPS ARE SHOWN PER GRANOR'S TRACTS OMITTED FROM SUBJECT PROPERTY DEEDS - DB 5576 PG 1507 & DB 5643 PG 1597.

10. GUDGER STREET 30' RW SHOWN 15' FROM APPROXIMATE CENTER OF SURVEYED ROADWAY IN NOTED AREAS.

11. NOTED ±24" STONE WALL EXCLUDED FROM TOPOGRAPHIC CONTOURS. SEE SPOT ELEVATIONS. B1-BOTTOM WALL AT NORTH & EAST SIDE/PARKING LOT & BUILDING SIDE; T-TOP WALL; B2-BOTTOM WALL AT SOUTH & WEST SIDE/COURTLAND AVE, GUDGER ST, & RECREATIONAL FIELD SIDE.

12. CONTOUR INTERVAL = ONE FOOT.

13. PLAT IS NOT PREPARED FOR RECORDING IN ACCORDANCE WITH G.S. 47-30.



LINE	BEARING	DISTANCE
L1	S 55°28'50" W	229.02' GRID
L2	N 17°43'09" W	152.96'
L3	N 85°02'25" W	88.11'
L4	N 58°40'42" E	73.13'
L5	S 89°32'43" E	37.92'
L6	N 07°13'17" W	1.00'
L7	S 72°18'02" W	156.90'
L8	S 09°25'15" E	380.01'
L9	N 71°31'56" E	556.11'

36 MONTFORD CONDOMINIUM DB 4960 PG 445 PB 159 PG 189 PIN 9649-11-5137

BOUNDARY NOTES
(SEE NOTE 9)

TRACT	OWNER OF RECORD	REFERENCE	PIN
TRACT A	BUNCOMBE COUNTY	DB 5576 PG 1507, TR 6	9649-11-1386
TRACT B	BUNCOMBE COUNTY	DB 5576 PG 1507, TR 8	9649-11-1483
TRACT C	BUNCOMBE COUNTY	DB 5576 PG 1507, TR 1-5 & 7 DB 5643 PG 1597	9649-11-4539 (PORTION)
TRACT D	NOW OR FORMERLY ASHEVILLE CITY BOARD OF EDUCATION	SEE CLOSING OF PORTION OF GUDGER STREET DB 1531 PG 316	9649-11-4539 (PORTION)
TRACT E	NOW OR FORMERLY ASHEVILLE CITY BOARD OF EDUCATION	SEE DB 1436 PG 479 & PB 7 PG 25, BLOCK A, LOTS 1-3	9649-11-4539 (PORTION)

SYMBOL LEGEND:

- CALCULATED POINT
- ⊙ EXISTING IRON REBAR (EIR) OR MAG NAIL (EMN)
- ⊙ EXISTING IRON PIPE (EIP)
- ⊙ C.S.D. TRAVERSE STATION
- ⊙ SANITARY SEWER MANHOLE (SMH)
- ⊙ CLEAN-OUT (CO)
- ⊙ WATER METER (WM)
- ⊙ FIRE HYDRANT
- ⊙ WATER VALVE
- ⊙ UTILITY POLE
- ⊙ LIGHT POLE
- ⊙ GUY WIRE
- ⊙ ELECTRICAL BOX
- ⊙ SIGN
- ⊙ DROP INLET (DI)
- ⊙ STORM JUNCTION BOX (JIB)
- ⊙ ROOF DRAIN (RD) (6" PVC CONNECTION TYPICAL)
- ⊙ STAKE OR PAINT MARKING (ID AS NOTED)
- ⊙ SPOT ELEVATION
- ⊙ FINISHED FLOOR ELEVATION (FFE)
- ⊙ DECIDUOUS TREE (SIZE AND TYPE AS NOTED)

LINE LEGEND:

- BOUNDARY LINE (NOT SURVEYED)
- ADJOINER'S DEED LINE (NOT SURVEYED)
- RIGHT-OF-WAY LINE
- TIE LINE ONLY
- FORMER PLAT LOT PER PB 7 PG 25
- SANITARY SEWER LINE
- OVERHEAD UTILITY LINE
- MARKED TELECOMMUNICATIONS LINE (LOC. APPX.)
- MARKED GAS LINE (LOC. APPX.)
- MARKED WATERLINE (LOC. APPX.)
- METAL HANDRAIL
- CHAIN LINK FENCING LINE
- INDEX CONTOUR LINE
- INTERIM CONTOUR LINE
- STORM WATER PIPE

ABBREVIATIONS:

- NTS... NOT TO SCALE
- DB... DEED BOOK
- PB... PLAT BOOK
- PG... PAGE
- PN... PARCEL IDENTIFICATION NUMBER
- NAD... NORTH AMERICAN DATUM
- NSRS... NATIONAL SPATIAL REFERENCE SYSTEM
- AG... ABOVE GRADE
- BL... BELOW GRADE
- RW... RIGHT OF WAY
- B1... BOTTOM WALL (SEE NOTE 11)
- T... TOP WALL (SEE NOTE 11)
- B2... BOTTOM WALL (SEE NOTE 11)
- P.A.I... PER AERIAL IMAGERY (LOCATION APPROXIMATE)
- U.T... UNIDENTIFIED TREE
- TYP... TYPICAL

I, ALEX DANIEL WARD, CERTIFY THAT THIS PROJECT WAS COMPLETED UNDER MY DIRECT AND RESPONSIBLE CHARGE FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION; THAT THIS GROUND SURVEY WAS PERFORMED AT THE 95% PERCENT CONFIDENCE LEVEL TO MEET FEDERAL GEOGRAPHIC DATA COMMITTEE STANDARDS; THAT THIS SURVEY WAS PERFORMED TO MEET THE REQUIREMENTS FOR A TOPOGRAPHIC / PLANIMETRIC SURVEY TO THE ACCURACY OF CLASS AA AND VERTICAL ACCURACY WHEN APPLICABLE TO THE CLASS C STANDARD; AND THAT THE ORIGINAL DATA WAS OBTAINED ON 7/28/20 - 8/5/20; THAT THE SURVEY WAS COMPLETED ON 8/5/20; THAT CONTOURS SHOWN AS SOLID LINES MAY NOT MEET THE STATED STANDARD; AND ALL COORDINATES ARE BASED ON NAD 83 (NSRS 2011) AND ALL ELEVATIONS ARE BASED ON NAVD 88.



I CERTIFY THAT THIS MAP WAS DRAWN UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTION RECORDED IN DEED BOOK N/A, PAGE N/A); THAT THE BOUNDARIES NOT SURVEYED ARE INDICATED AS DRAWN FROM INFORMATION IN DEED BOOK 5576 PAGE 1507, DEED BOOK 5643 PAGE 1597, DEED BOOK 1531 PAGE 316 & DEED BOOK 1428 PAGE 479; THAT THE RATIO OF PRECISION OR POSITIONAL ACCURACY IS 1:10,000; AND THAT THIS MAP MEETS THE REQUIREMENTS OF THE STANDARDS OF PRACTICE FOR LAND SURVEYING IN NORTH CAROLINA (21 NCAC 56 1600). MY ORIGINAL SIGNATURE, REGISTRATION NUMBER AND SEAL ON THIS DATE: 08/10/2020.

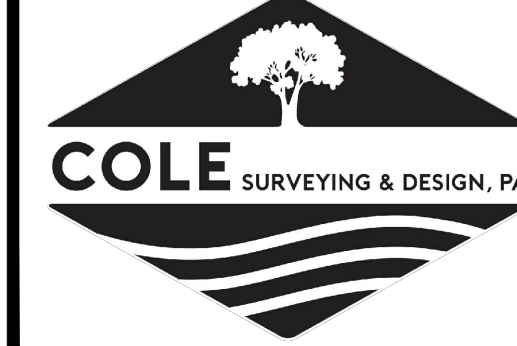
REFERENCES:

DB 5576	PG 1507	PB 7	PG 25
DB 5643	PG 1597	PB 41	PG 143
DB 1531	PG 316	PB 70	PG 123
DB 1436	PG 479	PB 129	PG 147
DB 1115	PG 585	PB 159	PG 189
DB 705	PG 171	PB 196	PG 113
DB 210	PG 467	PB 206	PG 29



TOPOGRAPHIC & LOCATION SURVEY
OF THE PROPERTY OF:
BUNCOMBE COUNTY
(SURVEY REQUESTED BY S&ME, INC.)
CITY OF ASHEVILLE, BUNCOMBE COUNTY, NC

DATE OF PLAT:	8/7/2020	REVISIONS			
DATE OF SURVEY:	7/2/2020 - 8/5/2020	NO.	DATE	DESC.	BY
PROJECT NO.:	20-111				
FIELD WORK:	CHBW				
DRAWN BY:	ADW				
SCALE:	1" = 20'				
PIN:	9649-11-1386, 9649-11-1483, & 9649-11-4539				



549 ELK PARK DRIVE, SUITE 707
ASHEVILLE, NC 28804
PHONE: 828-251-7025
NC FIRM #C-3106 | SC COA #4052



Appendix F - Conceptual Alternative Figures

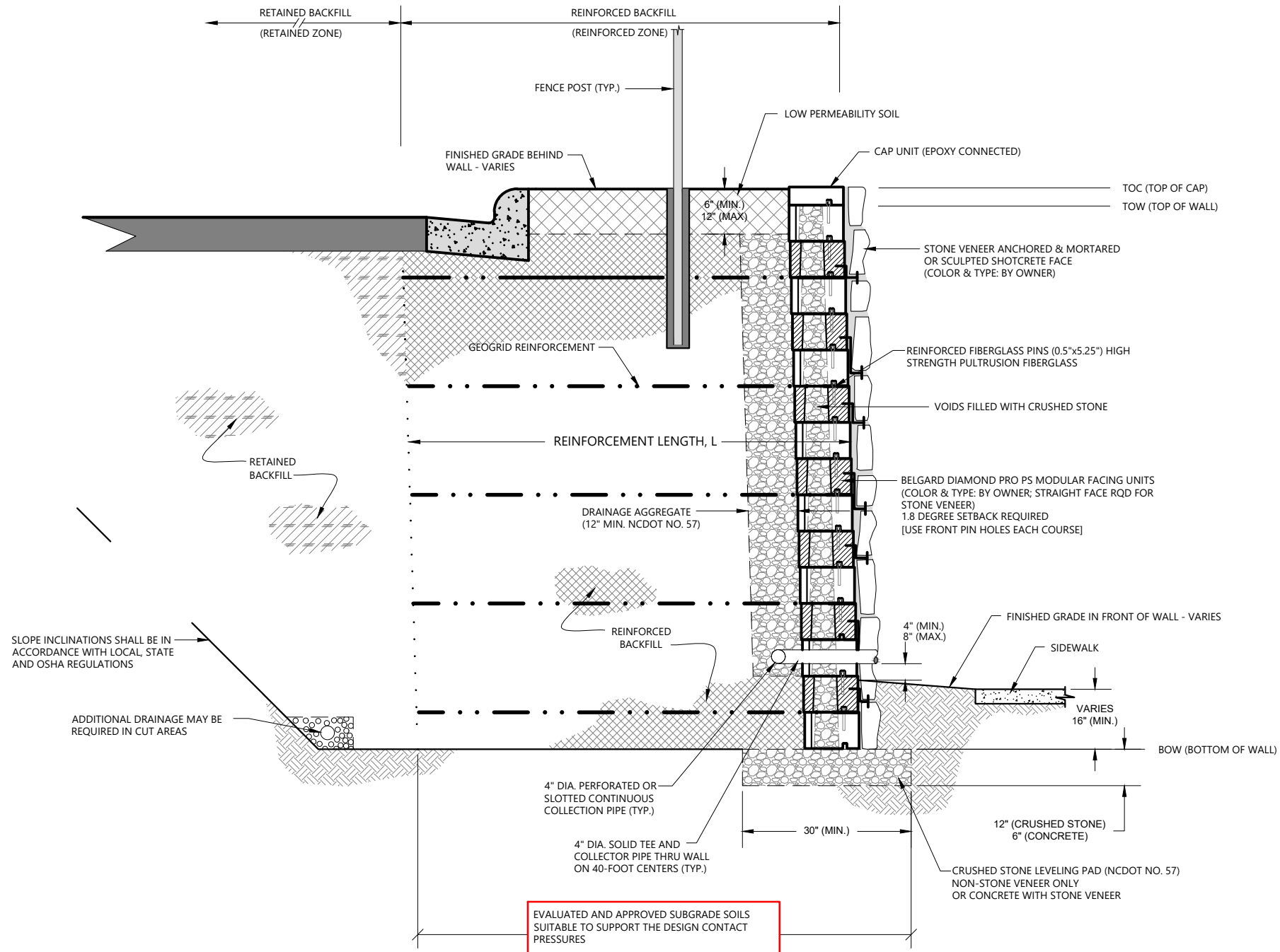
ADVANTAGES:

- SIMPLE TO CONSTRUCT
- CAN BE FACED WITH STONE VENEER OR SHOTCRETE SCULPTED FACE OPTION
- AESTHETIC FACING OPTIONS
- ECONOMICAL

DISADVANTAGES:

- CONSTRUCTION WOULD REQUIRE REMOVAL OF EXISTING STONE WALL
- EXCAVATION FOR WALL CONSTRUCTION WOULD REQUIRE TEMPORARY CLOSURE OF ACCESS DRIVE/PARKING WITH RE-PAVING & CURB
- STONE VENEER WOULD NOT BE FROM EXISTING STONE

ESTIMATED COST PER SQUARE FOOT:
 WITH AESTHETIC FACING (\$20-\$25/SF)
 WITH STONE VENEER/SCULPTING (\$30-\$45/SF)



TYPICAL MSE WALL SECTION



PHOTOGRAPH OF AESTHETIC FACING



PHOTOGRAPH OF STONE VENEER



MECHANICALLY STABILIZED EARTH (MSE) CONCEPT

MONTFORD NORTH STAR ACADEMY RETAINING WALL
 90 MONTFORD AVENUE
 ASHEVILLE, NORTH CAROLINA

SCALE:

NOT TO SCALE

DATE:

OCTOBER 2020

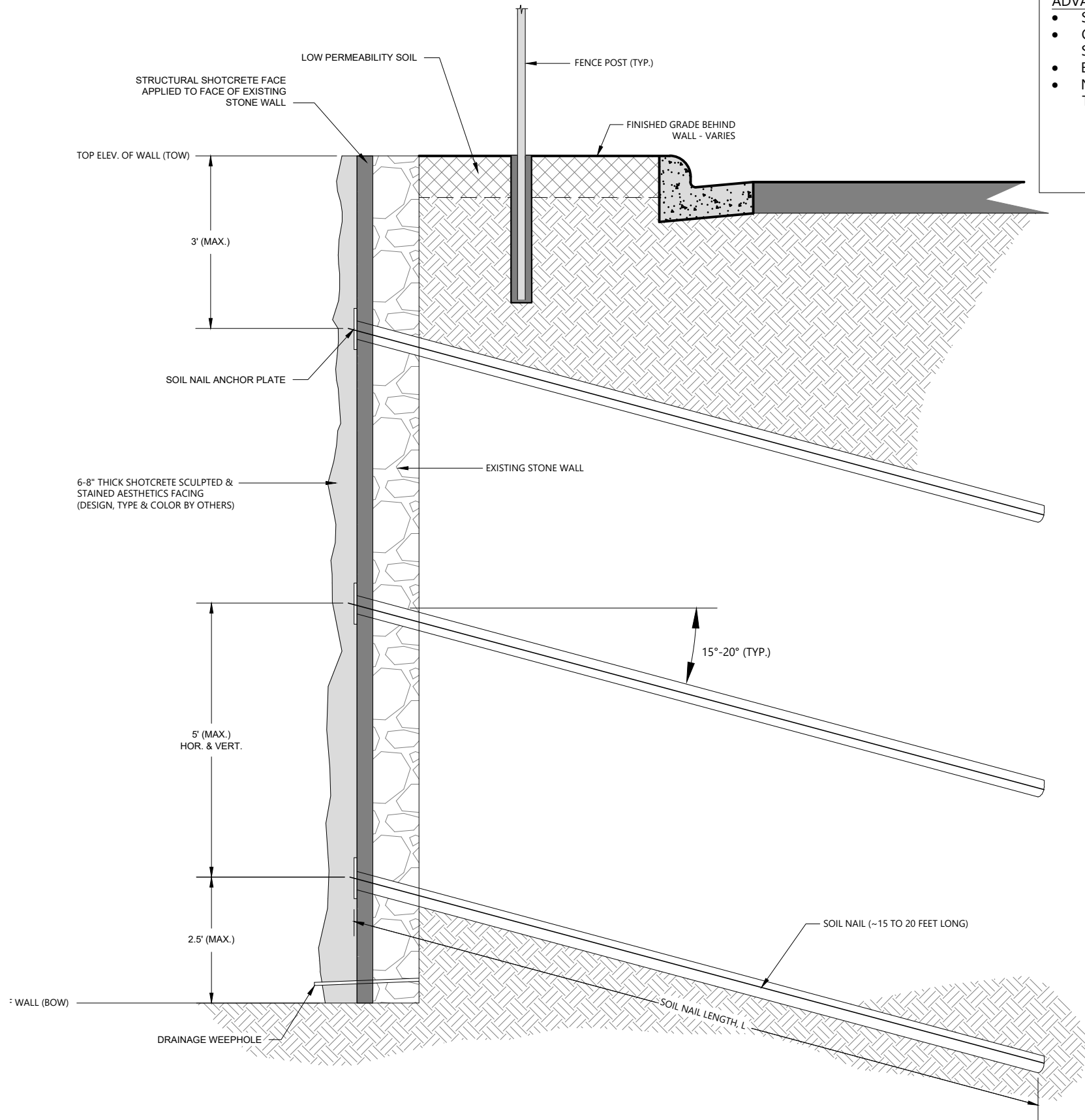
PROJECT NUMBER

1541-20-010

FIGURE NO.

1

Drawing path: C:\Users\mrevis\Desktop\temp\montford (existing) wall concepts\cad\montford wall options.dwg



TYPICAL SOIL NAIL WALL SECTION

ADVANTAGES:

- SIMPLE TO CONSTRUCT
- CAN BE FACED WITH STONE VENEER OR SHOTCRETE SCULPTED FACE OPTION
- EXISTING STONE WALL STAYS IN PLACE
- NO EXCAVATION BEHIND OR DISTURANCE TO UPPER ACCESS DRIVE/PARKING

DISADVANTAGES:

- EXISTING LOWER SIDEWALK WALL NEEDS TO BE MOVED
- POSSIBLE SOME RE-PAVING OF GUDGER ST
- POSSIBLE INTERFERENCE WITH EXISTING UTILITIES
- HIGHER COST

ESTIMATED COST PER SQUARE FOOT:
WITH STONE VENEER/SCULPTING (\$50-\$60/SF)



PHOTOGRAPH OF SCULPTED BOULDER FACE



PHOTOGRAPH OF SCULPTED ROCK FACE

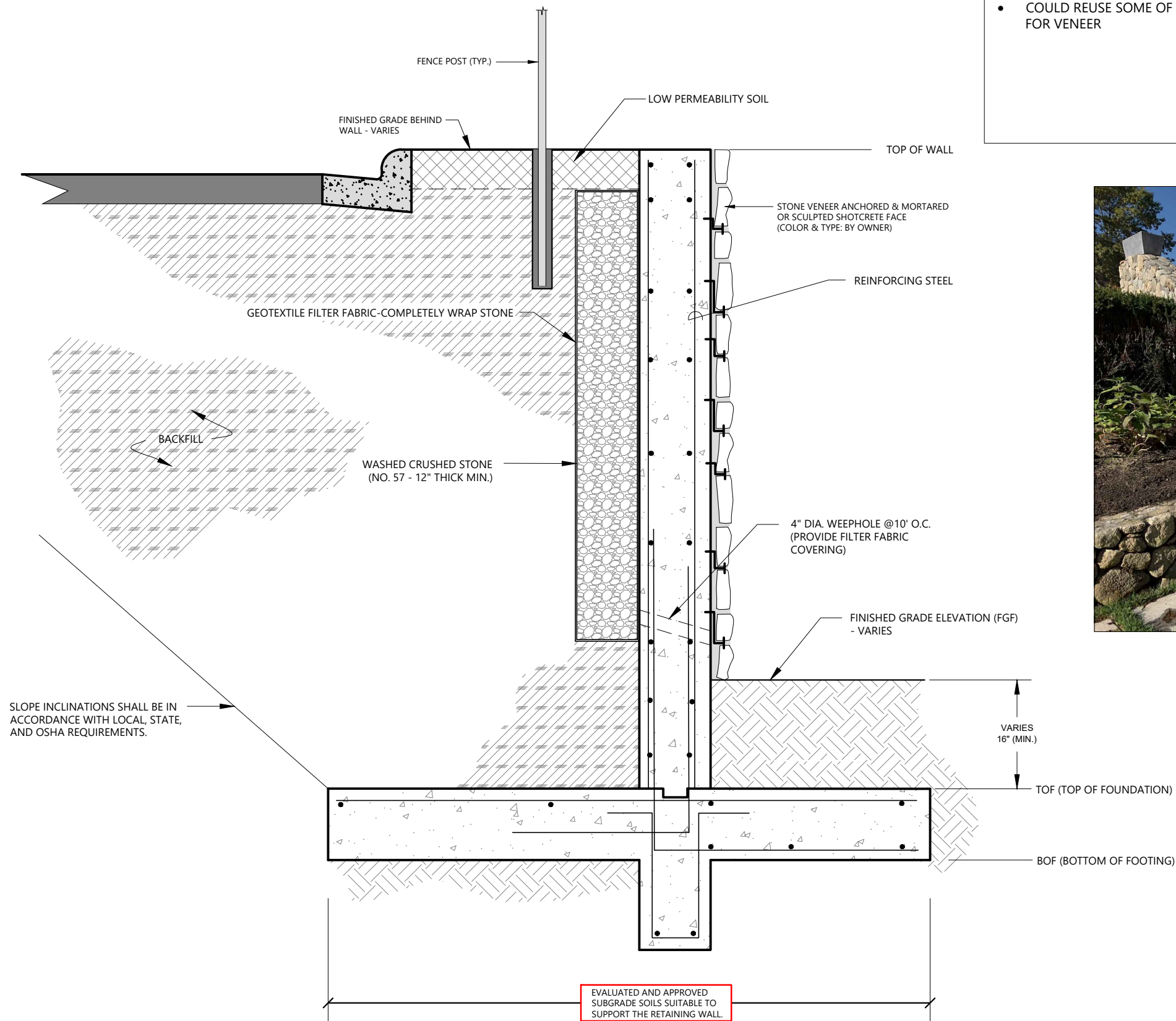


SOIL NAIL RETAINING WALL CONCEPT

MONTFORD NORTH STAR ACADEMY RETAINING WALL
90 MONTFORD AVENUE
ASHEVILLE, NORTH CAROLINA

SCALE:
NOT TO SCALE
DATE:
OCTOBER 2020
PROJECT NUMBER
1541-20-010
FIGURE NO.

Drawing path: c:\Users\mrevis\Desktop\temp\montford\existing\wall concepts\cad\montford wall options.dwg



SLOPE INCLINATIONS SHALL BE IN ACCORDANCE WITH LOCAL, STATE, AND OSHA REQUIREMENTS.

TYPICAL CIP WALL SECTION

ADVANTAGES:

- CAN BE FACED WITH STONE VENEER
- SOLID CONSTRUCTION, LESS MOVEMENTS
- COULD REUSE SOME OF EXISTING STONE FOR VENEER

DISADVANTAGES:

- CONSTRUCTION WOULD REQUIRE REMOVAL OF EXISTING STONE WALL
- EXCAVATION FOR WALL CONSTRUCTION WOULD REQUIRE TEMPORARY CLOSURE OF ACCESS DRIVE/PARKING WITH RE-PAVING & CURB
- CONSIDERABLE WORK & MODIFICATION REQUIRED TO REUSE EXISTING STONE
- VERY HIGH COST

ESTIMATED COST PER SQUARE FOOT:
WITH STONE VENEER/SCULPTING (\$75-\$100/SF)



PHOTOGRAPH OF STONE VENEER



CAST-IN-PLACE (CIP) CONCRETE RETAINING WALL CONCEPT

MONTFORD NORTH STAR ACADEMY RETAINING WALL
90 MONTFORD AVENUE
ASHEVILLE, NORTH CAROLINA

SCALE:

NOT TO SCALE

DATE:

OCTOBER 2020

PROJECT NUMBER

1541-20-010

FIGURE NO.

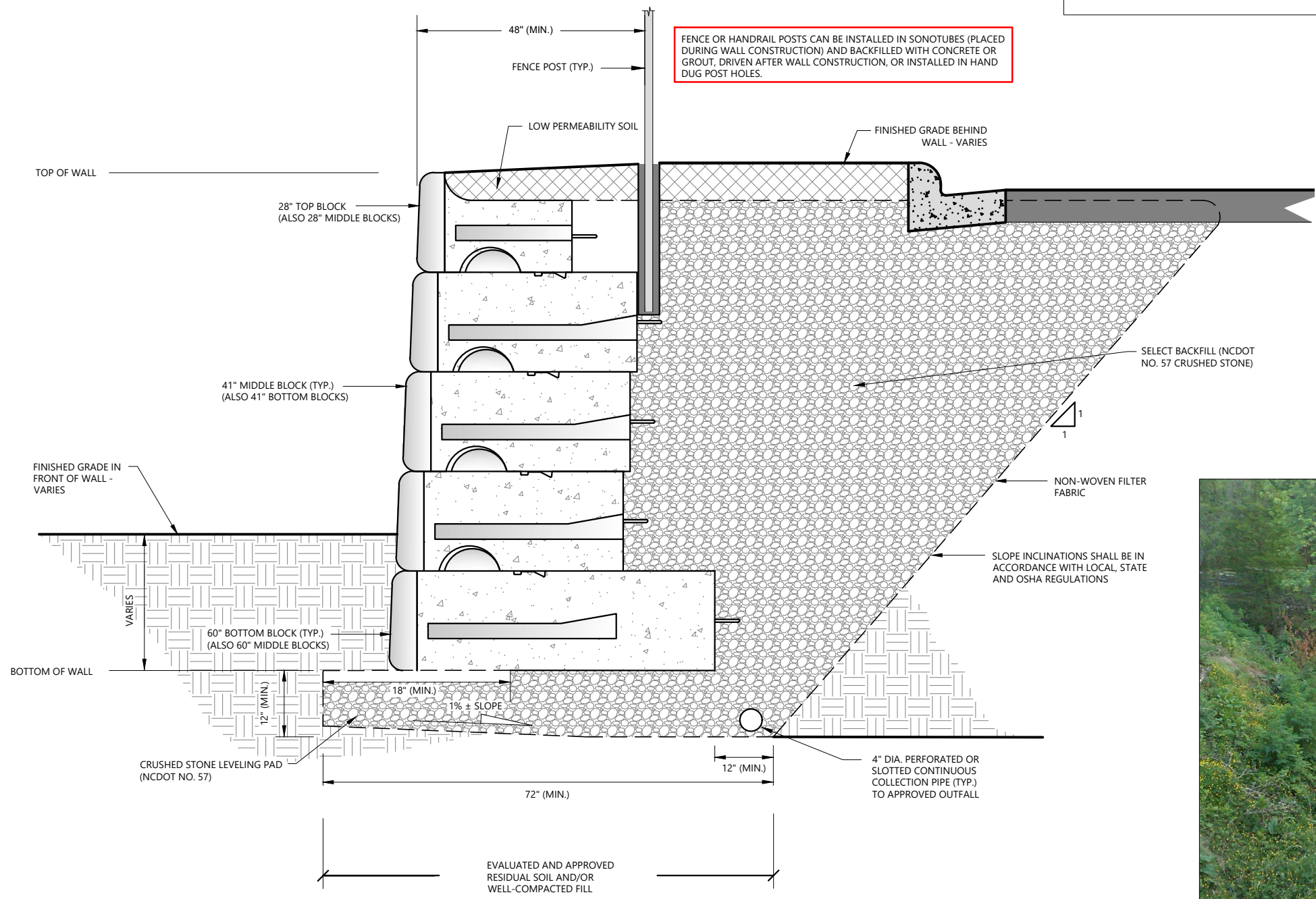
3



- ADVANTAGES:**
- SIMPLE TO CONSTRUCT
 - AESTHETIC FACING OPTIONS
 - POSSIBLE CUSTOM FACING PATTERN
 - LOWER COST

- DISADVANTAGES:**
- CONSTRUCTION WOULD REQUIRE REMOVAL OF EXISTING STONE WALL
 - EXCAVATION FOR WALL CONSTRUCTION WOULD REQUIRE TEMPORARY CLOSURE OF ACCESS DRIVE/PARKING WITH RE-PAVING & CURB
 - NO STONE VENEER OR SCULPTED FACE OPTIONS

ESTIMATED COST PER SQUARE FOOT:
(\$40-\$50/SF)



TYPICAL GRAVITY WALL SECTION

PHOTOGRAPH OF AESTHETIC FACING

Drawing path: c:\Users\mrevis\Desktop\temp\montford (existing) wall concepts\cad\montford wall options.dwg

GRAVITY RETAINING WALL CONCEPT

MONTFORD NORTH STAR ACADEMY RETAINING WALL
90 MONTFORD AVENUE
ASHEVILLE, NORTH CAROLINA

SCALE:
NOT TO SCALE
DATE:
OCTOBER 2020
PROJECT NUMBER
1541-20-010
FIGURE NO.