KOONTZ BRYANT JOHNSON WILLIAMS

Subsurface Investigation and Geotechnical Analysis
Lot 10 Quality Way- Warehouse Facility
Prince George County, Virginia

Client:
The Hollingsworth Companies
Clinton, Tennessee

June 18, 2020

11901 Old Stage Road, Chester, VA 23836 ■ (O) 804-541-1436 ■ (F) 804-541-1437 ■ kbjwgroup.com

June 18, 2020

The Hollingsworth Companies
Attn: Mr. J.D. King
2 Centre Plaza
Clinton Tennessee

RE: Subsurface Exploration and Geotechnical Site Analysis
Lot 10 Quality Way - Warehouse
Prince George County, Virginia
Project #2020-660

Dear Mr. King,

Koontz Bryant Johnson Williams PC is pleased to provide you with the following subsurface investigation and geotechnical analysis for the proposed Warehouse to be located on Lot 10 Quality Way in Prince George County, Virginia. This report has been completed to aid in the design and construction of footings, foundation, pavement and other soil related aspects of construction. This report has been completed in accordance with generally accepted industry standards and in compliance with local building codes.

Please do not hesitate to contact KBJW if you have any questions regarding the findings presented within this report. KBJW greatly appreciates the opportunity to serve as your geotechnical consultant on this project and we look forward to a continued successful working relationship.

Sincerely,

Koontz Bryant Johnson Williams

Brent E. Johnson P.E., P.G.
Principal Engineer/Geologist

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION AND PROJECT SCOPE

Our scope of services for this project included subsurface investigation and geotechnical analysis for the subject site. The investigation consisted of evaluating test borings and geologic data to develop general construction and building recommendations for land use as a light commercial building with associated roadways and parking lots. Laboratory tests were performed on selected samples to confirm field classifications and to clarify any potential shrink/swell concerns as well as additional construction considerations. The following report contains our observations, conclusions, and recommendations.

2.0 SITE DESCRIPTION

The subject site is approximately 141 acres in size and is located on Lot 10 Quality Way in Prince George County, Virginia (See appendix 1, Figure 1). The site is currently mostly cleared and slopes gently from the Southeast to the Northwest.

3.0 SUBSURFACE EXPLORATION AND CLASSIFICATION PROCEDURES

3.1 Description of Subsurface Exploration

Drilling services provided by Houff Drilling, Inc. included drilling thirteen (13) borings (B-1 through B-13) to depths of 20 feet below grade within reasonable proximity to the footprint of the proposed structure and drive lanes. These borings were field located by the KBJW personnel. The soil borings were completed with an All-Terrain Vehicle (ATV) mounted Central Mine Equipment drilling rig. A description of the methods and procedures used to perform soil sampling and classification are presented below.

3.2 Soil Sampling/Classification

A six-(6) inch hollow stem auger was used to advance each boring. In-place soil samples were obtained by means of the split-spoon sampling procedure in general accordance with ASTM Specification D-1586. In this procedure, a 2 inch OD, 1 3/8 inch ID, split-spoon sampler is driven into the soil a distance of 18 inches by means of a 140-pound hammer falling 30 inches. The Standard Penetration Resistance (SPR) Value is the number of blows per foot of penetration for the final 12 inches of driving. This value can be used to provide a qualitative indication of the in-place relative density of cohesionless soils. This indication is qualitative, since many factors can significantly affect the Standard Penetration Resistance Value and prevent direct correlation between samples obtained by various drill crews, drill rigs, drilling procedures, and hammer-rod-spoon assemblies.

A field log of the soils encountered in the borings was prepared by the geotechnical technician onsite. Field logs completed onsite contain information pertaining to soil

classification, relative moisture contents, groundwater levels, and unique site conditions (See Appendix II – Boring Logs). The soil samples obtained during split-spoon sampling are immediately sealed in glass containers and submitted to the KBJW soil laboratory for additional examination and testing.

An experienced geologist or geotechnical technician classified each soil sample on the basis of texture and plasticity in accordance with the Unified Soil Classification System, and ASTM D-2488. The USCS group symbols for each soil type are indicated in the parentheses following the soil descriptions on the boring logs. The geotechnical engineer grouped the various soil types into the major zones noted on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs are approximate. The actual contact between material types may be transitional unless specifically noted on the log.

3.3 Groundwater Level Determination

Outside water sources have not been utilized to aid in drilling operations at the site. Therefore, groundwater level observations are made after the completion of drilling operations. Groundwater elevations as noted on the attached borings logs are determined by water seepage into the open bore hole as well as the moisture content of samples removed during spilt-spoon sampling. It should be noted that, dependent on the permeability of the in-place soils, it could take several hours for the groundwater levels to stabilize within each borehole. Fluctuations in the location of the long-term water table may occur seasonally and are dependent upon variations in precipitation, evaporation, and surface run-off.

4.0 SUBSURFACE OBSERVATIONS

4.1 Regional Geology

The site is located within the Coastal Plain Physiographic Province of Virginia. The Coastal Plain is comprised of both unconsolidated and partially consolidated sediments and sedimentary rock that form and eastward thickening wedge. The Subject site appears to be underlain by Tertiary aged Bacons Castle Formation of gravel and sand.

4.2 Soil Conditions

Approximately 6" of topsoil was encountered throughout the site. Deposits of Sandy Lean Clays (CL) and Sandy Fat Clays (CH) underlain by Clayey Sands (SC) and Silty Sands (SM) were encountered below these surface materials.

The following is a generalized profile of the soils encountered within the test borings beneath the surface materials. For the exact profile at a specific boring location, please see Appendix II: Boring Logs.

Depth Below Grade:	**Soil Condition:**
0.5'- 14.0'	Stratum 1: Composition: light brown, reddish brown, gray, red, yellowish brown and yellowish red, plastic, damp to wet, soft to stiff, Sandy Lean Clay (CL) and Sandy Fat Clay (CH). Distribution: Stratum 1 was observed within all test borings from immediately below the surface materials to contact with Stratum 2 or boring termination. Relative Density: Blow counts (N-values) within this stratum ranged from 2 blows per foot to 25 blows per foot, with an average value of 13 blows per foot. These values indicate a "soft to stiff" consistency for the soils in Stratum 1. Soft/weak soils were encountered within the shallow soil profile. Engineering Concerns: Based upon laboratory analyses, the soils within Stratum 1 exhibit MODERATE plasticity and pose a MODERATE threat of structural damage due to shrink/swell action. The results of standard penetration testing indicate a bearing capacity of 2000 psf for the soils of Stratum 1. These soils are "fair" sources of controlled fill due to moderate maximum density values, moderate plasticity values and elevated moisture levels in select areas.

14.0'- 20.0' Stratum 2:

Composition: light brown, reddish brown, gray, yellowish brown and brown, friable, damp to wet, loose to medium dense, Clayey Sand (SC) and Silty Sand (SC).

Distribution: Stratum 2 was observed within test borings B-3 and B-6 through B-13 from immediately below the surface materials to contact with Stratum 2 or boring termination.

Relative Density: Blow counts (N-values) within this stratum ranged from 6 blows per foot to 28 blows per foot, with an average value of 11 blows per foot. These values indicate a "loose to medium dense" relative density for the soils in Stratum 2.

Engineering Concerns: Based upon laboratory analyses, the soils within Stratum 2 exhibit LOW TO MODERATE plasticity and pose a LOW TO MODERATE threat of structural damage due to shrink/swell action. The results of standard penetration testing indicate a bearing capacity of 1500-2000 psf for the soils of Stratum 2. These soils are "poor" sources of controlled fill due to elevated moisture levels in select areas.

4.3 General Groundwater Conditions

Groundwater was encountered within test borings B-1, B-2, B-7, B-8 and B-10 through B-13 at an average of 12 feet below grade. Additionally, damp to moist soils with redoximorphic and gleying features were encountered within the shallow soil profile which can indicate an elevated seasonal groundwater level. Based upon our observations, groundwater may pose problems to development at the site but will pose more problems during the wetter months of November through March. During construction, an effective drainage system should be implemented to control surface moisture and provide positive drainage from the construction area. All appropriate erosion control measures should also be installed onsite prior to land disturbance operations.

4.4 Laboratory Tests

Laboratory testing was performed to confirm field classification and to determine plasticity and clay fraction of the soils. Four split spoon samples and one composite sample from drill clippings were selected and submitted to the laboratory for testing. The split spoon samples were tested for natural moisture, Atterberg Limits and classification. The bulk composite samples were tested for Atterberg Limits, natural moisture content, sieve analysis, Standard

Proctor testing, and estimated CBR (See Appendix III, Laboratory Results). A brief description of the methods and procedures used to perform the various laboratory tests are presented below.

4.4.1 Natural Moisture Content

Moisture content measurement was made to determine the natural in-place soil moisture. The moisture content of the soil is the ratio, expressed as a percentage, of the weight of water in a given mass of soil to the weight of the dry soil particles. The test was performed in general accordance with ASTM D-2216.

4.4.2 Percent Passing #200 Sieve

The percentage of soil by weight that will pass through a #200 sieve was determined through this test. This method provides the percentage of sand versus silt and clay particles present within the sample. This test has been completed utilizing the general wash method in accordance with ASTM D-1140.

4.4.3 Atterberg Limits

In order to determine the plasticity characteristics of the soils and their behavior with changes in moisture content, tests to determine the Plastic Limit (PL) and Liquid Limit (LL) of the soils were performed. The Liquid Limit is the moisture content at which the soil passes from a plastic to a liquid state. The Plastic Limit is the lowest moisture content at which the soil remains plastic. The soil's Plasticity Index (PI = LL - PL) indicates the range of water contents in which the soil will behave plastically. These tests were performed in general accordance with ASTM D-4318.

4.4.4 Moisture/Density Relationship – Standard Proctor

One standard proctor was performed on a bulk sample submitted to the soil laboratory. This sample has been secured from drill clippings and therefore represents a composite sample of multiple stratums. This testing method is used to determine the relationship between water content and dry unit weight of soils to produce compaction in accordance with ASTM D-698 (See Appendix 3, Proctor results). The maximum dry density and optimum moisture content for the sample tested have been noted on the results form.

5.0 RECOMMENDATIONS AND CONCLUSIONS

5.1 Proposed Construction

This preliminary geotechnical study has been conducted based upon proposed land use as a 990,000 sq ft. moderately loaded warehouse building. Test borings were located within reasonable proximity to the boundary of the proposed footprint according to the site plan completed by E&A.

5.2 Soil Related Construction Concerns

- Topsoil was encountered throughout the site to a depth of 6" below grade. These materials are unsuitable for construction and should be stripped from all structural areas of the site prior to construction. Stripping depths should be estimated at 6 to 8 inches to ensure removal of deleterious materials.

- Observation of the soils recovered, review of available geologic information, and laboratory analyses indicate that the natural soils encountered exhibit low to moderate plasticity characteristics and pose a low to moderate potential threat for structural damage due to shrink/swell action.

- The soils of Stratum 1 are "fair" sources of controlled fill due to moderate maximum density values and elevated moisture content in select areas.

- The soils of Stratum 2 are "poor" sources of controlled fill due to elevated moisture level. However, due to depth, this stratum will most likely not be encountered.

- All footings should bear at a minimum depth of 30" below finished grade due to the moderate threat of shrink swell damage from Stratum 1.

- Moist/weak soils were encountered within the near surface profile within several borings mostly located on the eastern side of the parcel or in lower elevations of the property. Depending on the condition of these soils at the time of site work, undercutting or treatment of these materials may be necessary. High moisture content as seen during drilling will cause these soils to be extremely weak and yielding under pressure. If undercutting is selected, depths may range from 12-36 inches to suitably remove and bridge the soft soils. If treatment of the soils is selected, this may be accomplished via the introduction of lime, calcement, or Portland cement to the soil for stabilization. The exact percentage and depth of treatment should be determined at the time of work and based upon soil type, moisture content, and treatment material chosen.

5.3 Foundation Recommendations

Based upon the results of our study, the proposed buildings (moderately loaded) can be supported on conventional spread footing foundations or a monolithic slab. The spread footings for the proposed building may be designed for an allowable soil bearing pressure of 2,000 pounds per square foot, subject to field inspection and verification as detailed below. These bearing capacities are based on a maximum settlement of 1 inch with a differential settlement of 3/4 inch. In order to provide adequate protection from frost heaving, moderately expansive soils and compliance with local building standards, we recommend that all exterior footings be excavated to a minimum of 30 inches below the final exterior ground elevation.

Seismic Considerations: Based on our subsurface exploration and available geologic information, Section 1613.3.2 of the 2015 International Building Code and in accordance with Chapter 20 of ASCE 7, a site classification of "D" should be utilized in design.

5.4 Floor Slab Recommendations

The floor slabs are to be constructed on suitably compacted structural fill or undisturbed soil. Based upon soil conditions and SPT values obtained a correlating modulus of subgrade reaction (k) of 100psi/in should be utilized for slab design. The floor slab should be designed for the anticipated loading conditions and a suitable number of crack control joints should be installed. The slab should be nominally reinforced to maintain integrity should minor differential movement occur. Before the placement of any fill, the floor slab subgrade should be proof rolled using a loaded tandem axle dump truck. Refer to sections 5.8 and 5.9 respectively for details on proof rolling and engineered fills.

To protect the slab against the effects of capillary rise, we recommend that it be constructed on a layer (typically between 4 and 8 inches) of clean sand or gravel with a maximum nominal size of 1.5 inches (if gravel), and with a maximum fines content (passing #200 sieve) of 5%. A minimum 6 mil thickness vapor barrier placed should be utilized for additional moisture protection.

5.5 Below Grade Retaining Walls

We recommend that below-grade structure walls be designed to consider the linearly increasing lateral earth and water pressure influencing the wall. Additional surcharges should be applied based on anticipated temporary construction and permanent loadings near the perimeter of the structure. Hydrostatic pressure acting on the wall may be relieved with the

installation of adequate drainage. At a minimum, drains used in the alleviation of hydrostatic pressure should utilize a 6-inch perforated pipe. The pipe should be surrounded by a minimum of 6 inches of VDOT No. 57 aggregate and wrapped in a non-woven drainage geotextile, such as Amoco 4545, or equivalent.

The following parameters are recommended for evaluating lateral earth pressures on below grade walls with level backfill and adequate drainage.

USCS	Moist Unit Weight of Soil	Earth Pressure Coefficients			Equivalent at rest fluid pressure
		At Rest (Ko)	Active (Ka)	Passive (Kp)	
SC, ML, CL, MH	120 pcf	0.58	0.41	2.46	70.0 psf/LF
SW, SP, & SM	125 pcf	0.47	0.31	3.25	60.0 psf/LF
GW, GP, GM, & GC	130 pcf	0.43	0.27	3.69	55.0 psf/LF
No. 57 Agg.	115 pcf	0.26	0.15	6.79	30.0 psf/LF

*The coefficients of Passive Earth Pressure provided in the table above are the ultimate values; we recommend these values be reduced by a factor of safety of 3 for design.

Site Specific Information

USCS	Moist Unit Weight of Soil	Earth Pressure Coefficients			Equivalent at rest fluid pressure
		At Rest (Ko)	Active (Ka)	Passive (Kp)	
Upper Stratum CL	120 pcf	0.58	0.41	2.46	70.0 psf/LF
Lower Stratum SM/SC	125 pcf	0.47	0.31	3.25	60.0 psf/LF

5.6 Preliminary Pavement Recommendations

The previously identified surface materials encountered within the parking lot area are also unsuitable and should be stripped prior to the placement of stone subbase or grading. The subgrade for all proposed parking and driving areas should be cut to subgrade elevation and then inspected and proofrolled to determine their suitability for use. The designed pavement section should be constructed on undisturbed suitable natural soils, on a pad of engineered fill, provided that the fills are selected and suitably compacted as described below, or on the existing approved subgrade. The recommended pavement sections were designed according to VDOT Vaswani method for flexible pavements based upon an estimated CBR value of 6.0% and resiliency factor of 2.0 based upon the results of our laboratory testing. For the purpose of our preliminary pavement analyses, we will assume heavy-duty pavements for this development will be subject to 500 trucks per day, with an average of 750 lightweight

vehicles (automobiles) per day. Our analysis considers proper grading and underdrains to ensure the integrity of the pavement section.

Lot 10 Quality Way Warehouse Pavement Recommendations	
Pavement Classification	Pavement Section Recommended
Light Duty Pavement: Interior Parking Areas 0 – 200 Vehicles Per Day Less than 10% Heavy Vehicle Load	2.0" SM-9.5A Surface Asphalt 6.0" 21B Aggregate
Heavy Duty Pavement: Main Driving Lanes, Turn Lanes, and Entrance 0 – 750 Vehicles Per Day 25%-50% Heavy Vehicle Load	2.0" SM-9.5A Surface Asphalt 3.0" BM-25.0 Base Asphalt 8.0" 21B Aggregate

In addition, we recommend reinforced concrete be utilized for all dumpster pads, dumpster approach areas, loading docks, and trailer skid pads.

5.7 Excavation Inspection Recommendations

The condition of soils between test boring locations should be inspected and evaluated prior to the excavation of proposed footings. Inspections should be conducted through visual observation and proofrolling by qualified personnel. The details of proofroll inspections can be found in section 5.8. The condition of soils within footing excavations should also be inspected prior to the placement of concrete. Inspections should consist of visual observation and penetration testing to confirm suitable bearing capacity values throughout the excavation in accordance with the design recommendations. Penetration testing may be conducted with a pocket penetrometer or dynamic cone penetrometer. If unsuitable soils are discovered within the excavation, undercutting and backfilling may be required. The prepared foundation bearing soils should not be left exposed during inclement weather (rain or freezing). Saturation and subsequent disturbance of these soils can result in loss of strength and bearing capacity, leading to increased settlement.

5.8 Proof Rolling Inspection Procedures

After the removal of all materials deemed unsuitable, the proposed building envelope, driving lanes, turn lanes, and parking areas should be proof rolled using a loaded tandem axle dump truck. The proof rolling should be performed in order to aid in locating any areas of soft or unsuitable soils. Proof rolling of the exposed surface should consist of an adequate number of passes, evenly distributed in perpendicular directions, to characterize the entire surface. All proof rolling should be observed by experienced geotechnical personnel. Any areas found to be unsuitable (pumping and/or rutting) should be undercut to firm soil and replaced with suitable engineered fill.

5.9 Selection and Placement of Structural Fill

Upon stripping of unsuitable soils and completion of a proofroll inspection as detailed above, the placement of structural fill may begin. Any fill to be utilized at the site, except clean sand or gravel to be placed immediately beneath the floor slab for protection against capillary rise, should be selected on the basis of its plasticity characteristics and laboratory compaction tests. On-site soils which are found to contain deleterious material, including organic material and topsoil, should not be used as engineered fill for support of structures. In addition, soils having a Plasticity Index (PI) in excess of 20 and/or a Standard Proctor (ASTM D-698) maximum dry density of less than 90 pounds per cubic foot should not be used, without prior engineering evaluation and approval.

Fill placed within the proposed construction area should be compacted to a minimum of 95% of the maximum dry density obtained in accordance with ASTM Specification D-698 (Standard Proctor). All fill should be placed and mechanically compacted in uniform lifts not exceeding 12 inches in loose thickness. The moisture content of all fill at the time of placement should be within plus or minus 3% of the optimum moisture content established by the laboratory compaction test.

Fills placed against sloping surfaces should be "knit" or benched into the existing slope in horizontal layers in such a manner to provide satisfactory bond and to avoid planar surfaces of potential sliding. Materials should not be placed when either the fill material or the foundation surface is excessively wet, frozen, improperly compacted, or otherwise unsuitable.

We recommend that the fill be carefully observed and tested during placement to determine if proper compaction is being achieved within the building and parking areas. A minimum of one in-place density test should be performed for each 2500 square feet of lift area with a minimum of two tests per lift. Improper compaction may result in premature deterioration of

pavement and differential settlement of foundations.

Fill Material Use	Acceptable USCS Material Classifications	Index Property Limitations
Under Foundations or for use as Backfill	GW, GP, GC, GM, SW, SP, SC, SM, CL, & ML	Less than 65% passing the No. 200 sieve & L.L. < 50
General Site Grading	GW, GP, GC, GM, SW, SP, SC SM, CL, ML, CH, & MH	None

6.0 LIMITATIONS

This report has been prepared for the purpose of evaluating the existing subsurface conditions, identifying possible construction concerns and determining general design criteria for warehouse usage. The information and recommendations reported herein are presented to assist in the preliminary design of this project. The recommendations and conclusions herein are not a specific design for the footings, foundations, slabs, or pavements on the subject site. A licensed engineer should be contacted for design of these components based upon the recommendations and criteria provided within this report. In the event there are any significant changes in the size, design, or location of the project structures, changes in the planned construction from the concepts previously outlined, or changes of the design parameters stated in this report, the conclusions and recommendations contained in this report shall not be considered valid unless these changes have been reviewed and our conclusions and recommendations reaffirmed or appropriately modified, in writing.

There is a possibility that variations in soil conditions will be encountered during construction. In order to permit correlation between the preliminary data and the actual soil conditions encountered during construction and to insure conformance with plans and specifications as originally contemplated, it is recommended that this firm be retained to perform full time on-site construction review during the foundation phase of this project.

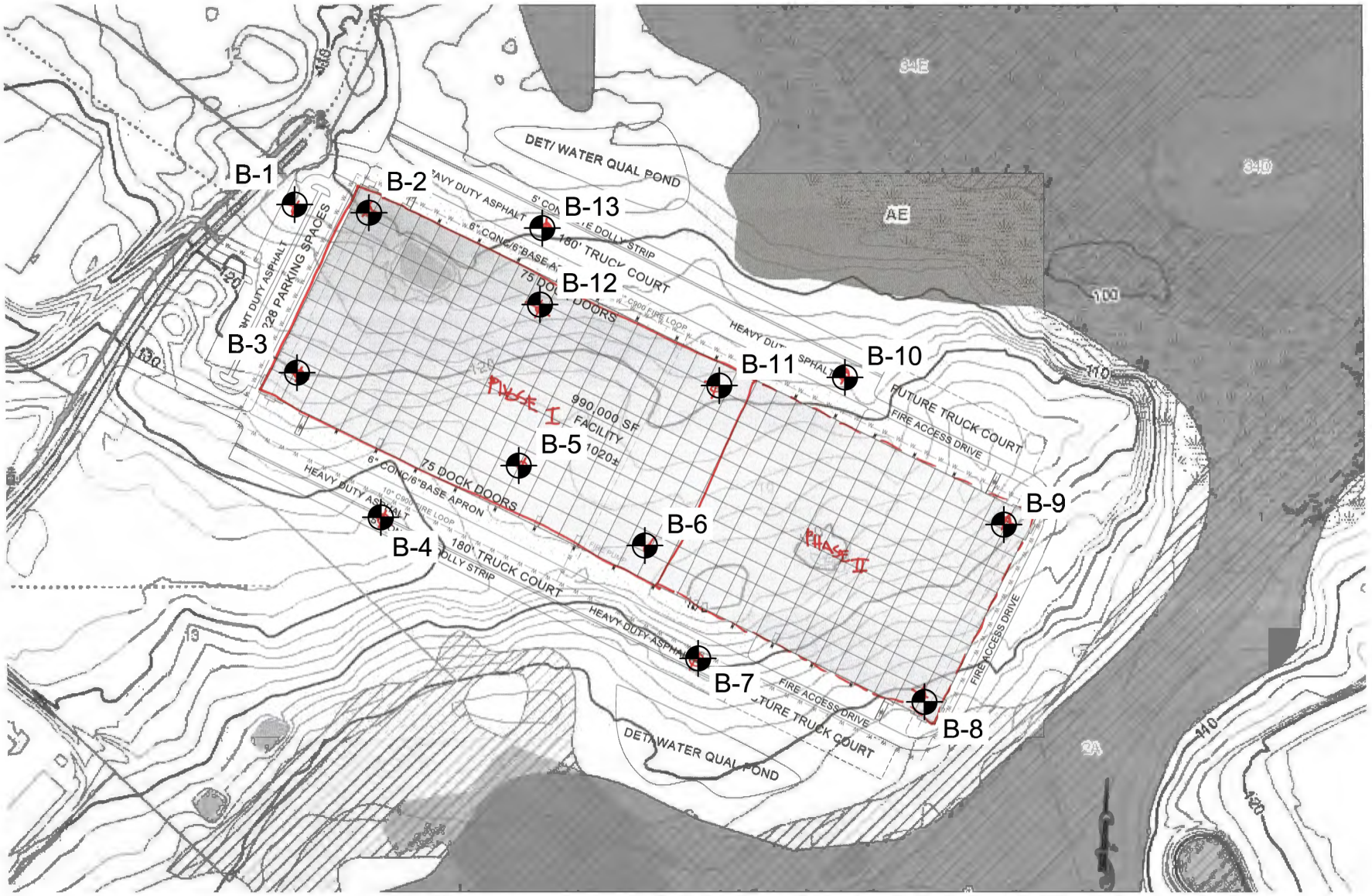
This report was prepared in accordance with generally accepted standards of practice for engineering geology services. No other warranty, either expressed or implied, is made. This report is not to be reproduced, either in whole or in part, without written consent from KBJW. Our conclusions and recommendations are based upon information provided to us by others, our site observations, and professional judgment. To the best of our knowledge, information provided by others is true and correct, unless otherwise noted; however, KBJW is not responsible for the accuracy of information provided by others. Our on-site observations pertain only to specific locations at specific times on specific dates. Our observations and conclusions do not reflect variations in subsurface conditions that may exist between sampling locations, in unexplored areas of the site, or at times other than those represented

by our observations.

The soil samples will be retained in our laboratory for a period of forty-five (45) days after the date of this report, after which they will be discarded unless instructions as to their disposition are received.

APPENDIX I

FIGURES



LEGEND:

B-1 BORING LOCATION

SOIL BORING LOCATION MAP

LOT 10, QUALITY WAY

PRINCE GEORGE COUNTY, VIRGINIA

N.T.S .

DATE: JUNE 18, 2020

KOONTZ BRYANT JOHNSON WILLIAMS

11901 Old Stage Road Chesterfield, Virginia 23836
(804) 541-1436 FAX (804) 541-1437 www.KBJWgroup.com

APPENDIX II

BORING LOGS

KOONTZ BRYANT
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REFERENCE NOTES FOR BORING LOGS

Drilling/Sampling Symbols		
BS- Bulk Sample	PA- Power Auger	SS- Split Spoon
DC – Dutch Cone Penetrometer	PM- Pressuremeter	ST- Shelby Tube
DCP- Dynamic Cone Penetrometer	RB- Rock Bit	WH- Weight of Hammer
HS- Hollow Stem Auger	RC- Rock Core	WS- Wash Sample

Correlation of Penetration Resistances to Soil Properties				
Relative Density – Sands, Silts		Consistency of Cohesive Soils		
SPT-N	Relative Density	Unconfined Compressive Strength, tsf	SPT-N	Consistency
0-3	Very Loose	Under 0.25	0-2	Very Soft
4-9	Loose	0.25-0.49	3-4	Soft
10-29	Medium Dense	0.50-0.99	5-8	Firm
30-49	Dense	1.00-1.99	9-16	Stiff
50-80	Very Dense	2.00-3.99	17-32	Very Stiff
> 80	Extremely Dense	4.00-8.00	33+	Hard

Standard Penetration (Blows/ft) refers to the blows per foot of a 140 lb hammer falling 30 inches on a 2 inch O.D. split spoon sampler, as specified in ASTM D-1586. The blow count is commonly referred to as the N value.

Unified Soil Classification Symbols		
CH – High Plasticity Clays	GP- Poorly Graded Gravels	OL – Low Plasticity Organic Soils
CL – Lean Plasticity Clays	GW- Well Graded Gravels	SC – Clayey Sands
CL/ML – Dual Classification (typical)	MH- High Plasticity Silts	SM – Silty Sands
GC- Clayey Gravels	ML- Low Plasticity Silts	SP- Poorly Graded Sands
GM- Silty Gravels	OH- High Plasticity Organic Soils	SW – Well Graded Sands

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Test Boring: B-1

Project:	Lot 10 Quality Way	Drilling Company:	Houff Drilling
Client:	The Hollingsworth Companies	Driller:	Mervin Houff
Location:	Prince George, VA	G S Technician:	John Paul Ligush
Date:	6/11/2020 Depth: 20'	Boring Method:	2 1/4" HS Auger

Depth	Soil Description	Blow Count	N Value	Remarks
1	**Topsoil ~ 6"**	1		
2	gray, fine, moist, Silty Sand (SM)	2 3	5	
3	gray, fine to medium grain, moist, Silty Sand (SM)	2 6		
4		8	14	
5	gray, fine to medium grain, moist, Silty Sand (SM)	9 8		
6		9	17	
7	gray, fine to medium grain, wet, Silty Sand (SM)	3 7		Groundwater contact at 6'
8		9	16	
9	light brown, medium grained, wet, Silty Sand (SM)	1 3		
10		3	6	
11				
12				
13				
14	light brown and reddish brown, moist, Sandy Lean Clay (CL)	1 1		
15		2	3	
16				
17				
18				
19	gray, moist, Sandy Lean Clay (CL) w/ shell fragments	5 8		
20	**Boring terminated @ 20'**	11	19	

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Test Boring: B-2

Project:	Lot 10 Quality Way	Drilling Company:	Houff Drilling
Client:	The Hollingsworth Companies	Driller:	Mervin Houff
Location:	Prince George, VA	G S Technician:	John Paul Ligush
Date:	6/11/2020 Depth: 20'	Boring Method:	2 1/4" HS Auger

Depth	Soil Description	Blow Count	N Value	Remarks
1	**Topsoil ~ 6"**	wh		
	Dark gray, moist, fine, loose, Clayey Sand	wh		
2	(SC)	2	2	
3	Dark gray, moist, fine, Clayey Sand (SC)	wh		
	w/ shell fragments	wh		
4		2	2	
5	light yellowish brown and gray, moist, Silty	1		
	Sand (SM)	2		
6		11	13	
7	light yellowish brown and gray, moist,	4		
	medium to coarse, Silty Sand (SM)	7		
8		16	23	
9	light yellowish brown and gray, moist,	11		
	medium to coarse, Silty Sand (SM)	10		
10		6	16	
11				
12				
13				
14	reddish brown, fine, wet, Clayey Sand (SC)	1		Groundwater contact
		2		at 13'
15		4	6	
16				
17				
18				
19	gray, moist, Sandy Lean Clay (CL) w/ shell	3		
	fragments	6		
20	**Boring terminated @ 20'**	6	12	

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Test Boring: B-3

Project:	Lot 10 Quality Way	Drilling Company:	Houff Drilling
Client:	The Hollingsworth Companies	Driller:	Mervin Houff
Location:	Prince George, VA	G S Technician:	John Paul Ligush
Date:	6/11/2020 Depth: 20'	Boring Method:	2 1/4" HS Auger

Depth	Soil Description	Blow Count	N Value	Remarks
1	**Topsoil ~ 6"**	2		
2	light yellowish brown, firm, Sandy Lean Clay (CL)	3 3	6	
3	light yellowish brown, firm, Sandy Lean Clay (CL)	2 3		
4		3	6	
5	light yellowish brown, firm, Sandy Lean Clay (CL)	5 9		
6		10	19	
7	red and gray, firm, Sandy Lean Clay (CL)	4 8		
8		5	13	
9	reddish brwn w/ gray, firm, Sandy Lean Clay (CL)	2 6		
10		9	15	
11				
12				
13				
14	reddish brown and yellowish brown, Silty Sand (SM)	4 6		
15		4	10	
16				
17				
18				
19	reddish brown and yellowish brown, medium to coarse, moist, Silty Sand (SM)	5 10		
20	**Boring terminated @ 20'**	18	28	

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Test Boring: B-4

Project:	Lot 10 Quality Way	Drilling Company:	Houff Drilling
Client:	The Hollingsworth Companies	Driller:	Mervin Houff
Location:	Prince George, VA	G S Technician:	John Paul Ligush
Date:	6/11/2020 Depth: 20'	Boring Method:	2 1/4" HS Auger

Depth	Soil Description	Blow Count	N Value	Remarks
1	**Topsoil ~ 6"**	4		
2	light brown, medium dense, fine, Silty Sand (SM)	5 8	13	
3	gray and yellowish brown, medium dense, Clayey Sand (SC)	5 6		
4		7	13	
5	gray and yellowish brown, medium dense, Clayey Sand (SC)	7 7		
6		9	16	
7	yellowish brown, medium dense, Silty Sand (SM)	10 9		
8		10	19	
9	yellowish brown, medium dense, Clayey Sand (SC)	2 14		
10		13	27	
11				
12				
13				
14	yellowish brown, damp, firm, Sandy Lean Clay (CL)	4 10		
15		10	20	
16				
17				
18				
19	yellowish brown, moist, firm, Sandy Lean Clay (CL)	6 7		
20	**Boring terminated @ 20'**	8	15	

KOONTZ BRYANT JOHNSON WILLIAMS

Test Boring: B-5

Project:	Lot 10 Quality Way	Drilling Company:	Houff Drilling
Client:	The Hollingsworth Companies	Driller:	Mervin Houff
Location:	Prince George, VA	G S Technician:	John Paul Ligush
Date:	6/12/2020 Depth: 20'	Boring Method:	2 1/4" HS Auger

Depth	Soil Description	Blow Count	N Value	Remarks
1	**Topsoil ~ 6"**	1		
2	yellowish brown, moist, soft, Sandy Lean Clay (CL)	1 2	3	
3	yellowish brown, moist, soft, Sandy Lean Clay (CL)	1		
4		1 2	3	
5	reddish brown, damp, medium dense, coarse, Clayey Sand (SC)	3 5		
6		7	12	
7	yellowish brown, damp, medium dense, coarse, Clayey Sand (SC)	4 10		
8		10	20	
9	light brown and gray, firm, Sandy Fat Clay (CH)	4 6		
10		11	17	
11				
12				
13				
14	light brown and gray, firm, Sandy Fat Clay (CH)	9 11		
15		13	24	
16				
17				
18				
19	light brown and gray, firm, moist, Sandy Lean Clay (CL)	3 5		
20	**Boring terminated @ 15'**	3	8	

KOONTZ BRYANT JOHNSON WILLIAMS

Test Boring: B-6

Project:	Lot 10 Quality Way	Drilling Company:	Houff Drilling
Client:	The Hollingsworth Companies	Driller:	Mervin Houff
Location:	Prince George, VA	G S Technician:	John Paul Ligush
Date:	6/12/2020 Depth: 20'	Boring Method:	2 1/4" HS Auger

Depth	Soil Description	Blow Count	N Value	Remarks
1	**Topsoil ~ 6"**	2		
2	brown, damp, Sandy Lean Clay (CL)	2 3	5	
3	brown, damp, firm, Sandy Fat Clay (CH)	3 4		
4		4	8	
5	reddish brown and red, stiff, Sandy Fat Clay (CH)	9 9		
6		9	18	
7	brown and gray, stiff, Sandy Fat Clay (CH)	7 10		
8		15	25	
9	brown and gray, stiff, Sandy Lean Clay (CL)	4 9		
10		11	20	
11				
12				
13				
14	brown, damp, Sandy Lean Clay (CL)	3 3		
15		9	12	
16				
17				
18				
19	brown, moist, medium dense, Clayey Sand (SC)	6 7		
20	**Boring terminated @ 20'**	11	18	

KOONTZ BRYANT JOHNSON WILLIAMS

Test Boring: B-7

Project:	Lot 10 Quality Way	Drilling Company:	Houff Drilling
Client:	The Hollingsworth Companies	Driller:	Mervin Houff
Location:	Prince George, VA	G S Technician:	John Paul Ligush
Date:	6/12/2020 Depth: 20'	Boring Method:	2 1/4" HS Auger

Depth	Soil Description	Blow Count	N Value	Remarks
1	**Topsoil ~ 6"**	3		
	light brown, firm, Sandy Lean Clay (CL)	3		
2		3	6	
3	reddish brown, firm, Sandy Fat Clay (CH)	4		
		4		
4		7	11	
5	reddish brown and gray, stiff, Sandy Fat Clay (CH)	6		
		9		
6		11	20	
7	reddish brown, stiff, Sandy Fat Clay (CH)	4		
		9		
8		10	19	
9	light reddish brown, firm, Sandy Lean Clay (CL)	4		
		6		
10		5	11	
11				
12				
13				
14	light reddish brown and light gray, wet, medium dense, Silty Sand (SM)	4		Groundwater contact at 13'
		5		
15		8	13	
16				
17				
18				
19	light reddish brown and light gray, wet, medium dense, Silty Sand (SM)	3		
		4		
20	**Boring terminated @ 20'**	2	6	

KOONTZ BRYANT JOHNSON WILLIAMS

Test Boring: B-8

Project:	Lot 10 Quality Way	Drilling Company:	Houff Drilling
Client:	The Hollingsworth Companies	Driller:	Mervin Houff
Location:	Prince George, VA	G S Technician:	John Paul Ligush
Date:	6/12/2020 Depth: 20'	Boring Method:	2 1/4" HS Auger

Depth	Soil Description	Blow Count	N Value	Remarks
1	**Topsoil ~ 6"**	1		
1	brown, damp, Sandy Lean Clay (CL)	2		
2		2	4	
3	light brown, stiff, Sandy Fat Clay (CH)	6		
3		8		
4		9	17	
5	reddish brown and gray, stiff, Sandy Fat	8		
5	Clay (CH)	10		
6		12	22	
7	light reddish brown, damp, slightly plastic,	4		
7	Clayey Sand (SC)	8		
8		6	14	
9	gray and light brown, firm, Sandy Lean Clay	3		
9	(CL)	5		
10		6	11	
11				
12				
13				
14	gray and light brown, moist, medium dense,	4		
14	Silty Sand (SM)	5		
15		5	10	
16				
17				
18				
19	light reddish brown, wet, medium dense,	5		Groundwater contact
19	coarse, Silty Sand (SM)	8		at 18'
20		8	16	
20	**Boring terminated @ 20'**			

KOONTZ BRYANT JOHNSON WILLIAMS

Test Boring: B-9

Project:	Lot 10 Quality Way	Drilling Company:	Houff Drilling
Client:	The Hollingsworth Companies	Driller:	Mervin Houff
Location:	Prince George, VA	G S Technician:	John Paul Ligush
Date:	6/12/2020 Depth: 20'	Boring Method:	2 1/4" HS Auger

Depth	Soil Description	Blow Count	N Value	Remarks
1	**Topsoil ~ 6"**	2		
	brown, moist, Clayey Sand (SC)	4		
2		3	7	
3	light brown and light gray, damp, firm, Sandy	2		
	Lean Clay (CL)	3		
4		4	7	
5	light brown and gray, damp, stiff, Sandy	4		
	Lean Clay (CL)	8		
6		8	16	
7	light gray and reddish brown, stiff, Sandy	9		
	Fat Clay (CH)	11		
8		10	21	
9	reddish brown and gray, stiff, Sandy Lean	6		
	Clay (CL)	9		
10		10	25	
11				
12				
13				
14	reddish brown and gray, firm, Sandy Lean	7		
	Clay (CL)	9		
15		9	18	
16				
17				
18				
19	reddish brown, damp, medium dense,	6		
	Clayey Sand (SC)	8		
20	**Boring terminated @ 20'**	8	16	

KOONTZ BRYANT JOHNSON WILLIAMS

Test Boring: B-10

Project:	Lot 10 Quality Way	Drilling Company:	Houff Drilling
Client:	The Hollingsworth Companies	Driller:	Mervin Houff
Location:	Prince George, VA	G S Technician:	John Paul Ligush
Date:	6/15/2020 Depth: 20'	Boring Method:	2 1/4" HS Auger

Depth	Soil Description	Blow Count	N Value	Remarks
1	**Topsoil ~ 6"**	3		
	brown, firm, Sandy Lean Clay (CL)	5		
2		7	12	
3	yellowish brown, damp, firm, Sandy Lean	6		
	Clay (CL)	10		
4		10	20	
5	reddish brown, coarse, slightly plastic,	5		
	Clayey Sand (SC)	7		
6		8	15	
7	reddish brown, firm, Sandy Lean Clay (CL)	4		
		4		
8		5	9	
9	gray, stiff, damp, Sandy Lean Clay (CL)	4		
		4		
10		5	9	
11				
12				
13				
14	yellowish brown, wet, loose, Silty Sand (SM)	4		groundwater contact
		5		at 13'
15		7	12	
16				
17				
18				
19	yellowish brown, wet, loose, Silty Sand (SM)	3		
		4		
20	**Boring terminated @ 20'**	2	6	

KOONTZ BRYANT JOHNSON WILLIAMS

Test Boring: B-11

Project:	Lot 10 Quality Way	Drilling Company:	Houff Drilling
Client:	The Hollingsworth Companies	Driller:	Mervin Houff
Location:	Prince George, VA	G S Technician:	John Paul Ligush
Date:	6/15/2020 Depth: 20'	Boring Method:	2 1/4" HS Auger

Depth	Soil Description	Blow Count	N Value	Remarks
1	**Topsoil ~ 6"**	5		
	brown, medium dense, Silty Sand (SM)	5		
2		4	9	
3	brown, firm, Sandy Lean Clay (CL)	3		
		5		
4		6	11	
5	light brown and red, firm, Sandy Lean Clay (CL)	9		
		12		
6		12	24	
7	light brown and red, firm, damp, Sandy Lean Clay (CL)	5		
		5		
8		5	10	
9	gray, moist, soft, Sandy Lean Clay (CL)	2		
		5		
10		4	9	
11				
12				
13				
14	light brown, wet, coarse, Silty Sand (SM)	4		groundwater contact at 13'
		4		
15		4	8	
16				
17				
18				
19	light brown, wet, medium dense, Silty Sand (SM)	5		
		5		
20	**Boring terminated @ 20'**	8	13	

KOONTZ BRYANT JOHNSON WILLIAMS

Test Boring: B-12

Project:	Lot 10 Quality Way	Drilling Company:	Houff Drilling
Client:	The Hollingsworth Companies	Driller:	Mervin Houff
Location:	Prince George, VA	G S Technician:	John Paul Ligush
Date:	6/15/2020 Depth: 20'	Boring Method:	2 1/4" HS Auger

Depth	Soil Description	Blow Count	N Value	Remarks
1	**Topsoil ~ 6"**	3		
	reddish brown, firm, Sandy Lean Clay (CL)	3		
2		5	8	
3	reddish brown and yellowish brown, firm,	4		
	Sandy Lean Clay (CL)	9		
4		11	20	
5	reddish brown and yellowish brown, firm,	4		
	Sandy Lean Clay (CL)	7		
6		10	17	
7	gray, firm, damp, Sandy Lean Clay (CL)	2		
		4		
8		7	11	
9	yellowish red, firm, Sandy Lean Clay (CL)	3		
		4		
10		20	24	
11				
12				
13				
14	light brown, medium dense, coarse, wet,	3		groundwater contact
	Well Graded Sand (SW)	5		at 13'
15		5	10	
16				
17				
18				
19	light brown, medium dense, coarse, wet,	3		
	Well Graded Sand (SW)	4		
20		4	8	
	Boring terminated @ 20'			

KOONTZ BRYANT JOHNSON WILLIAMS

Test Boring: B-13

Project:	Lot 10 Quality Way	Drilling Company:	Houff Drilling
Client:	The Hollingsworth Companies	Driller:	Mervin Houff
Location:	Prince George, VA	G S Technician:	John Paul Ligush
Date:	6/15/2020 Depth: 20'	Boring Method:	2 1/4" HS Auger

Depth	Soil Description	Blow Count	N Value	Remarks
1	**Topsoil ~ 6"**	4		
2	brown, medium dense, friable, Silty Sand (SM)	6 6	12	
3	light brown, wet, soft, Sandy Lean Clay (CL)	3 1		
4		1	2	
5	reddish brown and gray, firm, Sandy Lean Clay (CL)	1 4		
6		4	8	
7	light gray, wet, medium dense, friable, Silty Sand (SM)	13 22		Groundwater contact at 6'
8		21	43	
9	light gray, wet, medium dense, friable, Silty Sand (SM)	10 16		
10		15	31	
11				
12				
13				
14	yellowish brown, wet, medium dense, friable, Silty Sand (SM)	1 2		
15		4	6	
16				
17				
18				
19	reddish brown, wet, medium dense, friable, coarse, Silty Sand (SM)	3 5		
20	**Boring terminated @ 20'**	3	8	

APPENDIX III

LABORATORY TESTING

Table 1: Soil Analysis Results: Page 1
Lot 10 Quality Way

Sample	Percent Passing Sieve Number					Liquid Limit	Plasticity Index	USCS Classifi-Cation	Max. Dry Density (lbs/cu.ft.)	Optimum Moisture %	Estimated CBR Value	Swell %	R Factor	Mica
	10	40	60	100	200									
B-2	-	56.3	-	-	26.7	28.5	10.3	SC	-	-	-	-	-	None
B-6	-	90.4	-	-	71.4	70.8	44.2	CH	-	-	-	-	-	None
B-8	-	87.5	-	-	71.9	54.3	27.6	CH	-	-	-	-	-	None
B-10	-	82.6	-	-	70.3	47.1	19.5	CL	95.3	20.1	**6.0**	-	2.0	None

Sample	Location
B-2	2'-4'
B-6	2'-4'
B-8	2'-4'
B-10	2'-8'

Notes:
* All testing completed in accordance with ASTM Standards