



Cook, Flatt & Strobel Engineers  
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August 25, 2021

Vanguard Villas, LLC  
C/O: Dave Olson  
[daveolson@monarchprojectllc.com](mailto:daveolson@monarchprojectllc.com)

Re: Black Twig Road Development and Grading  
Lee's Summit, Missouri  
CFS Proposal # 21-5642

Mr. Olson:

CFS has evaluated the soil and rock stockpiles located along the proposed Black Twig Road development. The attached map provided by Emery Sapp & Sons, Inc. (ESS) shows the stockpiles separated into six areas. CFS understands the stockpiles have been in place for two years and consist of the materials as outlined below.

Area #1 – Topsoil. This material is comprised of dark brown silty clay with roots and other organic materials.

Area #2 – Red clay and blonde shale.

Area #3 – Asphalt Spoils

Area #4 – Clay and large limestone rock

Area #5 – Dark gray shale (varying size)

Area #6 – Clay with some gravel incorporated

## **RECOMMNDATIONS**

CFS understands that the stockpiles are to be used as fill in the Black Twig area and other areas adjacent to Black Twig. Recommendations for each areas material are summarized below.

Area #1 – Topsoil material should be stockpiled in an area out of the proposed construction to be used for landscaping later. Some of the larger organic material may need to be removed from the material prior to usage for landscaping.



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Area #2 – A maximum of three feet of the red clay/blonde shale may remain in place above the previous engineered fill elevation. This remaining material should be compacted using a sheep's foot roller and evaluated via proof-roll using a loaded tandem axle dump truck weighing in excess of 25 tons prior to additional fill placement. If soft zones are encountered, they will need to be over-excavated prior to additional fill placement. The removed material may be used as engineered fill in other areas following the recommendations in the engineered fill section of this report. Shale may require additional breaking and watering to meet compaction/moisture requirements.

Area #3 – Asphalt spoils may be broken up and used in fill areas, preferably in deeper fill areas.

Area #4 – A maximum of two feet of the rock/clay material may remain in place above the previous engineered fill elevation. This remaining material should be compacted using a sheep's foot roller and evaluated via proof-roll using a loaded tandem axle dump truck prior to additional fill placement. If soft zones are encountered, they will need to be over-excavated prior to additional fill placement. The removed material may be used as engineered fill following the engineered fill section of this report. No rock larger than 12 inches should be used as fill material.

Area #5 – A maximum of two feet of the dark gray shale material may remain in place above the previous engineered fill elevation. This remaining material should be compacted using a sheep's foot roller and evaluated via proof-roll using a loaded tandem axle dump truck prior to additional fill placement. If soft zones are encountered, they will need to be over-excavated prior to additional fill placement. The removed material may be used as engineered fill following the engineered fill section of this report. Shale may require additional breaking and watering to meet compaction/moisture requirements.

Area #6 – A maximum of three feet of the soil/gravel material may remain in place above the previous engineered fill elevation. This remaining material should be compacted using a sheep's foot roller and evaluated via proof-roll using a loaded tandem axle dump truck prior to additional fill placement. If soft zones are encountered, they will need to be over-excavated prior to additional fill placement. The removed material may be used as engineered fill following the engineered fill section of this report.

## **ENGINEERED FILL**

For the purpose of this report, engineered fill means fill placed in controlled layers and compacted and tested according to accepted geotechnical engineering practices to ensure that it meets the required specifications. While structural fill refers to any engineered fill placed within the footprint of the planned structures. Engineered fill materials should be free of organic matter. During placement, engineered fill materials should be within the specified moisture contents and compacted to the specified densities given below in



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Tables 2 and 3. Maximum dry density and optimum moisture content should be determined by the Standard Proctor test (ASTM D 698).

Fill should be placed in eight (8) inch loose lifts in mass fill areas, and as needed to obtain the proper compaction in utility trenches and behind walls. Structural fill should extend a minimum of two (2) feet beyond any structure lines.

*Table 3: Recommended Moisture Ranges*

ENGINEERED FILL MATERIAL	MAXIMUM BELOW OPTIMUM	MAXIMUM ABOVE OPTIMUM
Lean Clay (CL)	-2%	+3%
Fat Clay (CH)	0%	+4%
Compacted Base Rock (i.e. MODOT Type 5, AB3 or equivalent)	NA	NA

*Table 4: Compaction Requirements & Testing Frequency*

LOCATION OR AREA	REQUIRED COMPACTION (%) (ASTM D 698, DRY DENSITY)	TESTING FREQUENCY 3 PER LIFT PER ...
Building Walkways	95%	20,000 sf
Retaining Walls	95%	1,000 sf
Trenches	95%	150 lf
Lawn or Unimproved Areas	92%	20,000 sf
Building and Pavement Subgrades (Structural Fill)	95%	10,000 sf
Out-Parcels	95%	20,000 sf

A representative of the Geotechnical Engineer should monitor filling operations on a full-time basis. A sufficient number of density tests should be taken to verify that the specified compaction is obtained. If density testing is not feasible due to rock content, visual observation of rock placement should be performed.

## SETTLEMENT CONCERNS

CFS understands that areas to the west and between Areas #4 and #5 could have up to 14 feet of fill. Some of these areas do not have material stockpiled currently and therefore are not surcharged. A sub-surface exploration was not performed at the time of this report, however, this amount of fill would, typically, result in excessive settlements due to the newly imposed load. CFS anticipates this settlement may take up to 3 months to occur. CFS recommends settlement plates can be placed at the top of the fill in these areas when complete and be surveyed bi-weekly to determine when settlement achieves an acceptable range.



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## FOUNDATION RECOMMENDATIONS

If the recommendations in this report are followed, CFS anticipates that the townhomes planned along Black Twig can be designed using an allowable bearing pressure of 2,000 psf. Foundation excavations should be evaluated by a representative of CFS prior to the placement of any foundation elements.

## SLAB-ON-GRADE RECOMMENDATIONS

Due to the varying types of fill, CFS does not know which material will end up as slab sub-grade material. However, CFS understands that the client will assume treatment of the top 12 inches beneath the slab drainage stone with 5% Portland cement, or removal and replacement of 18 inches of sub-grade material with crushed stone will be necessary. The crushed stone screenings from the on-site crushing operation are suitable to use as the low volume change layer.

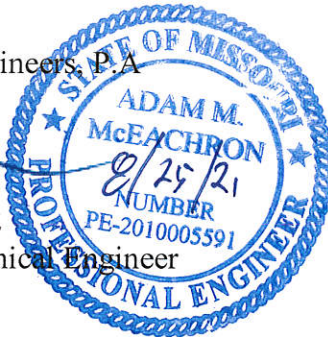
Please contact CFS with any questions. 913-627-9040

Respectfully,

Cook, Flatt & Strobel Engineers, P.A.

A handwritten signature in blue ink, appearing to read 'A. McEachron', written over the printed name and title.

Adam M. McEachron, P.E.  
Associate/Senior Geotechnical Engineer



Attachment: Stockpile Map

Area #1

Area #2

Area #3

Area #4

Unspecified Area

Area #5

Area #6

