CFS ENGINEERS
Cook, Flatt & Strobel Engineers
1100 W. Cambridge Circle Drive, Suite 700
Kansas City, Kansas 66103
913.627.9040

October 31, 2023

Dave Olson
Monarch Acquisitions, LLC
PO Box 24302
Overland Park, KS 66283

Re: Proposal for Special Inspection and Testing Services
Streets of West Pryor – Lot 13
Lee's Summit, Missouri

Mr. Olson:

Per your request, CFS performed 4 borings for the referenced project. The borings encountered undocumented fill material underlain by relatively shallow limestone and shale bedrock. The boring logs are attached.

Over-excavation of the undocumented fill material beneath foundations may be necessary to provide a uniform bearing material consisting of shale or limestone bedrock. The over-excavation can be replaced with flowable fill to bottom of foundation, or foundation concrete during foundation concrete placement. Otherwise, the recommendations in the original geotechnical report for the site *Geotechnical Exploration and Foundation Recommendations - West Pryor Village*, report #18-5125, dated June 15, 2018 can be utilized for this project.

It should be noted these recommendations were followed, observed and tested by CFS during site development construction.

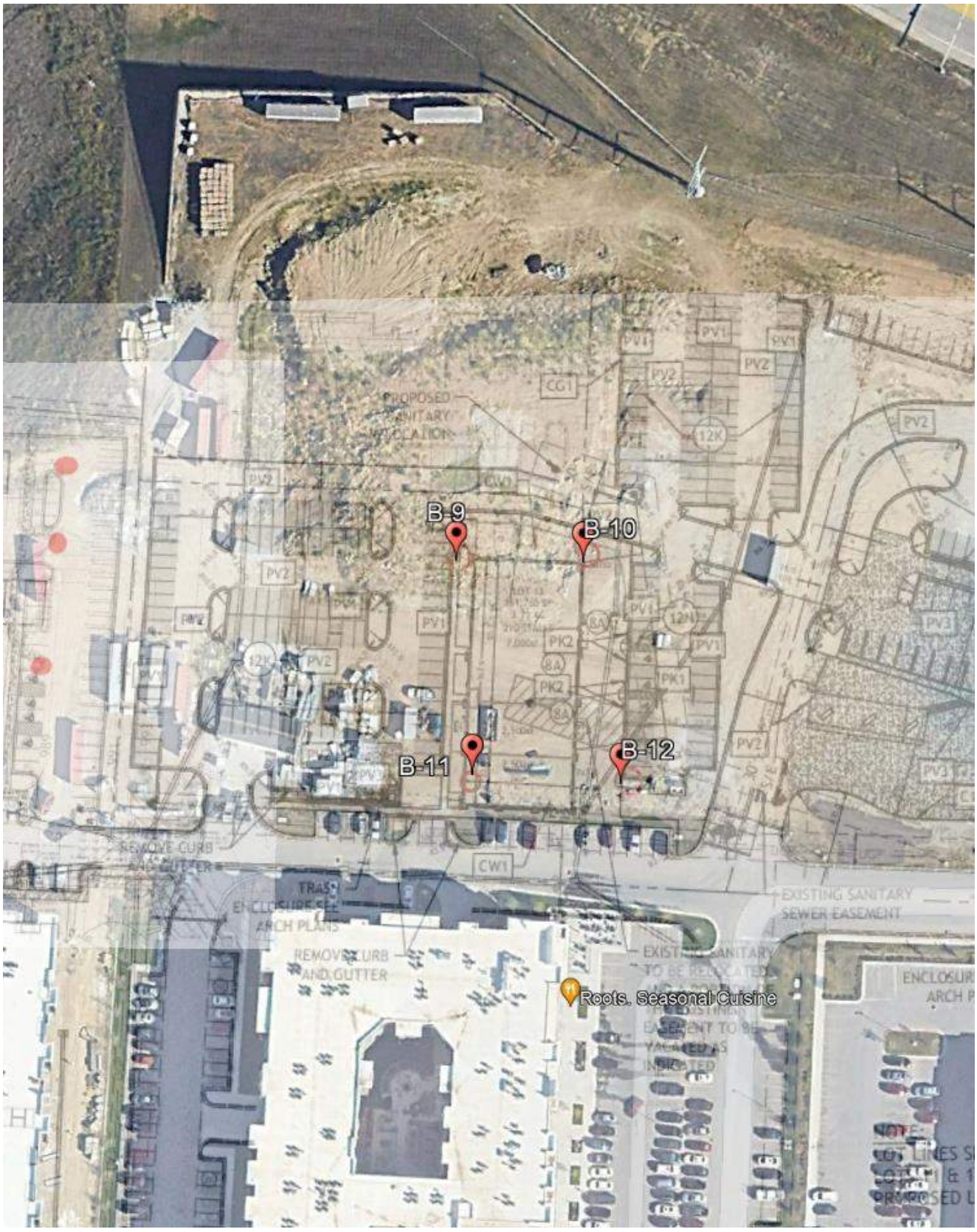
Please contact CFS with further questions. 913-627-9040

Respectfully,
Cook, Flatt & Strobel Engineers, P.A.

STATE OF MISSOURI
ADAM M. McEACHRON
10/31/23
NUMBER PE-2010005591
PROFESSIONAL ENGINEER

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

Attachments: Boring Location Plan
Boring Logs
West Pryor Village Report #18-5125



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Boring Location Plan
Lot 13 SOWP
Lee's Summit, MO
October 31, 2023

CFS Engineers

BORING NUMBER B9

CLIENT Streets of west Pryor, LLC
PROJECT NAME STREETS OF WEST PRYOR LOT 13
PROJECT NUMBER 23-5629
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 10/20/23 **COMPLETED** 10/20/23
GROUND ELEVATION _____ **HOLE SIZE** 4 inches
DRILLING CONTRACTOR CFS Engineers
GROUND WATER LEVELS:
DRILLING METHOD Solid Flight Augers
AT TIME OF DRILLING --- No Free Water Encountered
LOGGED BY CM **CHECKED BY** JE
AT END OF DRILLING --- No Free Water Encountered
NOTES LOT 13
AFTER DRILLING --- No Free Water Encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	UNCONFINED COMP (psf)
0		GRAVEL with clay mixed										
		LEAN CLAY, (CL) gray, moist, stiff, with trace fine sand and gravel (SHALE FILL)	SPT 1	94	4-6-5 (11)	4.0		19	40	20	20	
		LIMESTONE	SPT 2	82	4-50/5"							
5												

Bottom of borehole at 5.5 feet.

CFS Engineers

BORING NUMBER B10

CLIENT Streets of west Pryor, LLC
PROJECT NAME STREETS OF WEST PRYOR LOT 13
PROJECT NUMBER 23-5629
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 10/20/23 **COMPLETED** 10/20/23
GROUND ELEVATION _____ **HOLE SIZE** 4 inches
DRILLING CONTRACTOR CFS Engineers
GROUND WATER LEVELS:
DRILLING METHOD Solid Flight Augers
AT TIME OF DRILLING --- No Free Water Encountered
LOGGED BY CM **CHECKED BY** JE
AT END OF DRILLING --- No Free Water Encountered
NOTES LOT 13
AFTER DRILLING --- No Free Water Encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	UNCONFINED COMP (psf)
0		GRAVEL with clay mixed										
		FAT CLAY, (CH) brownish olive and gray, moist, stiff, with trace of gravel (FILL)	SPT 1	75	3-4-4 (8)	2.75		26				
			SPT 2	100	3-5-5 (10)	.75		55				
5		LIMESTONE, highly weathered										
		SHALE, unweathered, gray	SPT 3	67	9-50/3"	4.5+		16				
			GB 4	100				12				
10												
			GB 5	100				11				
15												
			GB 6	100				9				
20												

Bottom of borehole at 20.0 feet.

CFS Engineers

BORING NUMBER B11

CLIENT Streets of west Pryor, LLC
PROJECT NAME STREETS OF WEST PRYOR LOT 13
PROJECT NUMBER 23-5629
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 10/20/23 **COMPLETED** 10/20/23
GROUND ELEVATION _____ **HOLE SIZE** 4 inches
DRILLING CONTRACTOR CFS Engineers
GROUND WATER LEVELS:
DRILLING METHOD Solid Flight Augers
AT TIME OF DRILLING --- No Free Water Encountered
LOGGED BY CM **CHECKED BY** JE
AT END OF DRILLING --- No Free Water Encountered
NOTES LOT 13
AFTER DRILLING --- No Free Water Encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	UNCONFINED COMP (psf)
0		GRAVEL with clay mixed										
		FAT CLAY, (CH) olive and brown, moist, stiff, shaley with trace of gravel (FILL)	SPT 1	78	4-7-8 (15)	4.5+		20				
			SPT 2	92	5-5-50/1"	4.5		22				
5		LIMESTONE, moderately weathered										

Bottom of borehole at 5.0 feet.

CFS Engineers

BORING NUMBER B12

CLIENT Streets of west Pryor, LLC
PROJECT NAME STREETS OF WEST PRYOR LOT 13
PROJECT NUMBER 23-5629
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 10/20/23 **COMPLETED** 10/20/23
GROUND ELEVATION _____ **HOLE SIZE** 4 inches
DRILLING CONTRACTOR CFS Engineers
GROUND WATER LEVELS:
DRILLING METHOD Solid Flight Augers
AT TIME OF DRILLING --- No Free Water Encountered
LOGGED BY CM **CHECKED BY** JE
AT END OF DRILLING --- No Free Water Encountered
NOTES LOT 13
AFTER DRILLING --- No Free Water Encountered

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	UNCONFINED COMP (psf)
0		GRAVEL with clay mixed										
		LEAN CLAY, (CL) gray, moist, with gravel (FILL)										
		SHALE, moderately weathered to slightly weathered, gray	SPT 1	83	5-13-13 (26)	4.5+		11				
			SPT 2	86	28-50/1"	4.0		12				
		LIMESTONE										

Bottom of borehole at 4.3 feet.

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GEOTECHNICAL EXPLORATION
AND
FOUNDATION RECOMMENDATIONS

West Pryor Village
Lee's Summit, Missouri
CFS Project No. 18-5125

Prepared For

Monarch Acquisitions, LLC

June 15, 2018

Prepared by:
Cook, Flatt & Strobel Engineers, P.A.
1100 W. Cambridge Circle Drive Suite 700
Kansas City, Kansas 66103
913.627.9040

SYNOPSIS

An exploration and evaluation of the subsurface conditions have been made on the site of the proposed development located west of Pryor Road in Lee's Summit, Missouri.

Test borings have been drilled and selected soil samples submitted for laboratory tests. The data has been carefully analyzed in light of the project information provided by Monarch Acquisitions, LLC.

The results of the exploration and analysis indicate that conventional spread and continuous wall footings appear to be a suitable type of foundation for the support of the proposed structure. However, when differential settlement is a concern or loading conditions change, alternative foundation approaches may be appropriate.

Detailed analysis of subsurface conditions and pertinent design recommendations are included herein.

Groundwater conditions are not expected to cause any major difficulties. These conditions will be further discussed in the report.

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Geotechnical Exploration And Foundation Recommendations

WEST PRYOR VILLAGE
LEE'S SUMMIT, MISSOURI

Project Number: 18-5125
June 15, 2018

1.0 Introduction

1.1 Authorization

This report presents the results of a geotechnical exploration and foundation analysis for the proposed development, conducted for Monarch Acquisitions, LLC. The work for this project was performed in accordance with our Proposal dated May 17, 2018. Authorization to perform this exploration and analysis was received in the form of a signed copy of that proposal.

1.2 Purpose

The purpose of this exploration was to evaluate the soil and groundwater conditions at the site and to recommend a type and depth of foundation system suitable for the proposed structure as well as to provide criteria for the Architects and Design Engineers to use in preparing the foundation design. Also included were site preparation, earthwork, and pavement design recommendations.

1.3 Scope

The scope of the exploration and analysis included a reconnaissance of the immediate site, the subsurface exploration, field and laboratory testing, and an engineering analysis and evaluation of the foundation materials.

The scope of services did not include any environmental assessment for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site. Any statement in this report or on the boring logs regarding odors, colors, or unusual or suspicious items or conditions is strictly for the information of the client.

1.4 General

The general subsurface conditions used in the analysis were based upon interpolation of the subsurface data between the borings. There is a possibility that varying conditions may be encountered between boring locations. If deviations from the noted subsurface conditions are encountered during construction, they should be brought to the attention of the Geotechnical Engineer.

The recommendations submitted for the proposed structure are based on the available soil information and the preliminary design details. Any revision in the plans for the proposed structure, from those described in this report, should be brought to the attention of the Geotechnical Engineer to determine if changes in the foundation recommendations are required.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, and professional advice contained herein have been presented after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics and engineering geology. No other warranties are implied or expressed.

After the plans and specifications are complete, it is recommended that the Geotechnical Engineer be provided the opportunity to review the final design and specifications, in order to verify that the earthwork and foundation recommendations are properly interpreted and implemented. In particular, treatment of area of fill over 5 feet in depth, deep fills, should be evaluated. Impervious material including shale immediately below footing depth may result in unacceptably wet clay in the bearing zone requiring material be replaced with engineered fill.

2.0 Project Description

It is understood that this project consists of:

1. Two wood framed 4-story slab on grade hotels,
2. One wood framed 4-story slab on grade apartment building,
3. One CMU and Steel framed 60,000 square foot single story grocery store,
4. Several 12,000 or less wood framed single story slab on grade retail buildings,
5. Parking, access roads, and utilities for the above structures.
6. *Potential parking garage which is not included in the recommendations in this report and should be re-evaluated by CFS prior to construction.*

Foundation loads were not provided, but based on the building types and anticipated column spacing, we have assumed that maximum foundation loads will be less than 150 kips for isolated columns and 5 kips per lineal foot (klf) for load bearing walls.

Anticipated site work includes cuts, fills, detention ponds, retaining walls.

2.2 Site Location

The site is located in the southwest quadrant of the intersection of I-470 and NW Pryor Road in Lee's Summit, Missouri. It is located in the southeast corner of Section 35, Township 48N, Range 32W, as described in the PLSS.

2.3 Topography

It is understood that the site is relatively flat. Based on the existing contours shown on the preliminary site plan that was provided to CFS, it is anticipated that only a relatively minor amount of site work will be required in the proposed footprint area of the new building. Finally, it is possible that additional cuts and fill may be required to obtain improved surface drainage.

At the time the borings were performed, the site was a largely vacant, recently cleared tract. The existing ground surface sloped down 40 feet from the center elevation of 1,010 feet to the north and south edges at an approximate 4 percent grade.

2.4 Site Geology

Jackson County is located in the Central Lowland province of the Interior Plains and is near the middle of an approximate 150 mile-wide, north-south trending band of Pennsylvanian-Age Rocks that is located in western Missouri and eastern Kansas. Generally, the rock beds exhibit a subtle prevailing dip to the west-northwest of about 10 feet per mile. The region is underlain by rock units of the Pennsylvanian System, Missourian Series (Kansas City Group, Lansing Group, and Pleasanton Group) in the Time Stratigraphic Unit age classification. The Missouri Geological Survey lists surface material at the project location as residuum from limestone and shale over bedrock chert breccia limestone.

3.0 Site Exploration

3.1 Scope

The field exploration to evaluate the engineering characteristics of the foundation materials included a reconnaissance of the project site, drilling the test borings, performing standard penetration tests, and recovering split barrel samples.

Borings were drilled at 32 locations to depths ranging from three feet to 25 ½ feet below the existing ground surface at locations determined by Cook, Flatt & Strobel Engineers. Boring locations are shown on the accompanying Boring Location Plan (Figure 2, Appendix A).

After completion of the field testing, the excavations were backfilled with the excavated soil.

3.2 Drilling and Sampling Procedures

A drilling rig equipped with a rotary head was used to drill the test borings. Augers were used to advance the holes. Representative samples were obtained employing split-barrel sampling procedures in general accordance with the procedures for "Standard Test Methods for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils" (ASTM D 1586).

All of the samples recovered were identified, classified, and evaluated by the Geotechnical Engineer.

3.3 Field Tests and Measurements

Penetration Tests – During the soil boring procedure, standard penetration tests (SPT) were performed at pre-determined intervals to obtain the standard penetration value of the soil as outlined in the ASTM D1586 test method. The standard penetration value (N) is defined as the number of blows of a 140-pound hammer, falling thirty (30) inches, required to advance the split-barrel sampler one (1) foot into the soil. The sampler is lowered to the bottom of the previously cleaned drill hole and advanced by blows from the hammer.

The number of blows is recorded for each of three (3) successive increments of six (6) inches penetration. The "N" value is then obtained by adding the second and third incremental numbers. The results of the standard penetration test are shown on the Boring Logs and indicate the relative density of cohesionless soils and comparative consistency of cohesive soils, and thereby provide a basis for estimating the relative strength and compressibility of the soil profile components.

Ground Surface Elevations – The elevation of the ground surface shown on each test boring log was surveyed to within ± one (1) foot.

Boring logs are included in Appendix B. Field logs included visual classification of the materials encountered during drilling, as well as drilling characteristics. Boring logs represent the CFS engineer's interpretation of the field logs combined with laboratory observations and testing of the samples. The stratification boundaries indicated on the boring logs were based on field observations, an extrapolation of information obtained by examining samples from the borings and comparisons of soils and/or bedrock types with similar engineering characteristic. Boundary locations are approximate, and the transitions between soil and bedrock types may be gradual rather than clearly defined.

3.4 Laboratory Testing Program

In addition to the field exploration, a supplemental laboratory testing program was conducted to evaluate additional engineering characteristics of the on-site soils and rock necessary in analyzing the behavior of the foundation systems for the proposed structure.

The laboratory testing program included the following tests:

- Supplementary visual classification (ASTM D2488) of all samples
- Penetrometer tests of all samples
- Water content (ASTM D2216) of all samples
- Atterberg limit tests (ASTM D4318) on selected samples

All phases of the laboratory testing program were conducted in general accordance with applicable ASTM specifications. The results of these tests can be found on the Boring Logs (Appendix B) and in the Laboratory Test Results (Appendix C).

3.5 Subsurface Conditions

3.5.1 General

The types of foundation bearing materials encountered in the test borings have been classified according to the Unified Soil Classification System (USCS). They are described on the Boring Logs. The results of the field tests, water level observations, and laboratory tests are presented on the Boring Logs (Appendix B).

The following presents a general summary of the major strata encountered during our subsurface exploration and includes a discussion of the results of field and laboratory tests conducted. Specific subsurface conditions encountered—including field tests, lab tests, and water level observations—at the boring locations are also presented on the individual boring logs in Appendix B of this report

3.5.2 Overburden Material

A light grass cover and roots up to six (6) inches covered the site. Clay soils generally extend 10 feet below grade transitioning to light brown and gray shale.

3.5.3 Bedrock

Slightly- to un-weathered moderately soft limestone was encountered at the borings below the soil overburden. Based on the published data, in our opinion, the limestone encountered at the borings is the Winterset Limestone of the Dennis Limestone Formation, Kansas City Group, Pennsylvanian System. The Missouri Geological Survey shows bedrock elevations of 840 feet in the project area.

The elevation at the top of limestone was found to vary from 956 to 1,002 feet.

The approximate elevation of the limestone bedrock surface (auger refusal) at boring locations based on elevation data provided by CFS is presented below. The actual elevation could vary over at other locations.

Table 1: Approximate Bedrock Elevation

Boring	Thickness of Overburden Soil (feet)	Approx. Elevation of Limestone Bedrock Surface (feet)
B-1	11	960
B-2	12	957
B-3	15	956
B-4	19	961
B-5	23	961
B-6	24	960
B-7	20	970
B-8	20	965
B-9	16	962
B-10	19	964
B-11	25	966
B-12	19	974
B-13	14	988

B-14	19	975
B-15	19	980
B-16	19	990
B-17	9	1,002
B-18	9	992
B-19	10	1,001
B-20	12	990
B-21	24	962
B-22	18	988
B-23	14	964
B-24	5	984
B-25	19	986
B-26	4	1,000
B-27	15	972
B-28	22	958
B-29	12	987
B-30	13	983
B-31	3	984
B-32	9	956

3.5.4 Groundwater Conditions

Groundwater was not encountered in any of the borings. However, it is not unusual for seasonal groundwater to be encountered on top of the bedrock. The Missouri Geological Survey shows groundwater elevations of 970 feet in the project area.

3.5.5 Refusal Materials

Refusal materials generally consisted of sound limestone.

3.6 Testing Results

Standard Penetration Testing (SPT) was used to evaluate the consistency of the in-situ materials. The N-values for the site's materials were found to range from 3 to over 50 (refusal) blows/foot. Moisture content tests results on the SPT samples ranged from 6 to 33 percent.

Atterberg limits tests were run on three of the samples collected from the SPT sampler. The Plastic Limits were found to range from 20 to 26. The Liquid Limits ranged between 50 and 73, giving the samples Plasticity Indexes ranging between 28 and 47. The cohesive soils were classified using the USCS as CH based on these results.

Representative samples of the soils were placed in sample jars and bags. They are now stored in the laboratory for further analysis if desired. Unless a request to the contrary is received, all samples will be disposed of sixty (60) days from the issuance date of this report.

4.0 Geotechnical Discussion and Recommendations

4.1 Primary Geotechnical Concerns

1. Fat clays with Liquid Limits as high as 70 predominating over the project area are prone to significant variation in volume with changes in moisture and freezing.
2. Shallow rock areas shown in the boring logs may be encountered in excavations.
3. Isolated soft bearing soils may be encountered when excavating footings requiring removal and replacement.

4.2 Foundation Discussion

Subsurface Materials – The bearing capacity of the subsurface materials was evaluated from the results of the field tests. These test results indicate that soils have moderate strength and are uniform in thickness. Beneath the clays, the underlying bedrock limestone has a moderate to high bearing capacity. Project soil conditions and loading are compatible with the use of spread footings.

General – The foundation type selected for the proposed structures is conventional spread and continuous wall footings. Other foundation types including a raft or mat, a grid type beam and slab, and piles are less economical and unnecessary for this project. Conventional spread and continuous wall footings are generally, most economical when the existing soil conditions allow them to be founded at shallow depths. With economy, however, comes a risk of differential settlement that may not be reliably predicted. When elimination of settlement is essential, or loading conditions change, more expensive foundations may be required.

4.3 Foundation Recommendations

4.3.1 Conventional Spread Footings

Conventional spread footings and continuous wall footings are recommended for support of the proposed structure. The conventional spread footings and continuous wall footings should be designed as follows when founded on suitable clay:

Table 1: Conventional Footing Bearing Capacity

Foundation Type	Net Allowable Soil Bearing	Minimum Footing Width	Min. Depth Below Finish Grade for Exterior Ftgs.
Spread footings	3,000 psf	24 inches	36 inches
Continuous wall footings	2,500 psf	16 inches	36 inches

1. Footings should be suitably reinforced to reduce the effects of differential movement that may occur due to variations in the properties of the supporting soils. Top and bottom steel is recommended for continuous wall footings to reduce differential settlement due to possible varying bearing capacities of the existing fill soils. Where footings within a building or fifty (50) feet will bear on both soil and rock, precautions should be taken to control differential settlement. The rock may either be removed then replaced with a closed grade stone (such as MoDOT TYPE 5) or similar compacted soil, transitioning the thickness slowly over at least twenty (20) feet. If compacted structural soil fill is used to back fill the excavation, widening of the excavation one-half (1/2) the depth of the excavation on either side should be performed. All backfill should be compacted to 95% of ASTM D-698 density and +/- 3% of optimum moisture content. As an option, footings may be extended to the underlying rock and backfilled with lean concrete.

2. A representative of the Geotechnical Engineer should test the soils in the footing excavations to verify the design soils bearing pressure. If undercutting of any footing is required to reach design bearing capacity backfill of the undercut footing should be done with a closed grade stone (such as MoDOT TYPE 5 or lean concrete. If compacted structural soil fill is used to back fill the excavation, widening of the excavation one-half (1/2) the depth of the excavation on either side should be performed. All backfill should be compacted to at least 95% of ASTM D-698 density and +/- 3% of optimum moisture content.

3. Every effort should be made to keep the footing excavations dry as the soils will tend to soften when exposed to free water. Footing bottoms should be free of loose soil and concrete should be placed as soon as possible to prevent drying of the foundation soils.

4. Total settlement for the bearing value provided below should not exceed one (1) inch. Differential settlement over fifty (50) feet is estimated to be one-half (1/2) inch or less.

4.4 Lateral Earth Pressures

Lateral earth pressures are determined by multiplying the vertical applied pressure by the appropriate lateral earth pressure coefficient. If the walls are rigidly attached to the structure and not free to rotate or deflect at the top (such as basement walls), CFS recommends designing the walls for the *at-rest* earth pressure coefficient. Walls that are permitted to rotate and deflect at the top (such as retaining walls) can be designed for the *active* lateral earth pressure condition. Horizontal loads acting on shallow foundations are resisted by friction along the foundation base and by *passive* pressure against the footing face that is perpendicular to the line of applied force.

It is recommended that all retaining walls be backfilled with open graded stone (such as No. 57) from two (2) feet behind the wall rising at a 45 degree angle to within two (2) feet of the ground surface. The use of stone to backfill behind the walls will expedite construction, reduce potential settlement, and lower the pressure induced on the wall from the backfill thus potentially reducing the thickness of the walls.

Table 2: Earth Pressure and Friction Coefficients

	Active	Passive	At-Rest	Allowable Base Friction
Open-graded crushed limestone	0.27	3.69	0.43	0.47
In-situ lean clay soils	0.40	2.5	0.68	0.32
In-situ fat clay soils	0.49	2.04	0.66	0.24
Lean clay – conditioned and compacted	0.32	3.12	0.48	0.35
Fat clay – conditioned and compacted	0.45	2.2	0.63	0.27

These earth pressure coefficients do not include the effect of surcharge loads, hydrostatic loading, or a sloping backfill. Nor do they incorporate a factor of safety. Also, these earth pressure coefficients do not account for high lateral pressures that may result from volume changes when expansive clay soils are used as backfill behind walls with unbalanced fill depths. In addition, any disturbed soils that are relied upon to provide some level of passive resistance should be placed in lifts not exceeding six (6) inches in thickness and compacted to a minimum density of 95 percent of the Standard Proctor (ASTM D698) maximum dry density at a moisture content within +- 3 percent of the optimum moisture content. It is recommended that a representative of CFS should verify the compaction of any such materials relied upon to provide passive pressure.

The actual earth pressure on the walls will vary according to material types and backfill materials used and how the backfill is compacted. If the backfill conditions are different than the ones used above, CFS should be notified so the recommendations can be modified. The buildup of water behind a wall will increase the lateral pressure imposed on below-grade walls. Adequate drainage should be provided behind any below grade walls as described in this report. The walls should also be designed for appropriate surcharge pressures such as adjacent traffic, structures, and construction equipment.

Backfill of the below-grade walls may consist of well graded stone or on-site clay soils compacted to at least 95% of optimum dry density at a moisture content within 3% of optimum. We advise performing

field density tests on the backfill to monitor compliance with the recommendations provided. Care should be exercised during the backfilling operation to prevent overstressing and damaging the walls. Heavy compactors and grading equipment should not be allowed to operate within 5 to 10 feet of the walls during backfilling to avoid developing excessive temporary or long-term lateral soil pressures.

4.5 Engineering Analysis – Seismic

The Seismic Site Class was determined by the General Procedure in accordance with Section 1613.3.2 of the 2012 International Building Code. The soil properties were evaluated for the top 100 feet of the profile. The generalized profile at this site consists of soil to a depth of ten feet where shale was encountered. The seismic properties of the soil were interpolated from the standard penetration test values. A Seismic Site Class "C" was determined for this site. In addition, there is no significant risk of liquefaction or mass movement of the on-site soils due to a seismic event.

Higher soil shear wave velocities, and therefore a better Site Class, are sometimes obtained by direct testing of the subsurface materials. However, the cost of completing a site-specific seismic study including seismic shear wave velocity testing was beyond the scope of this exploration, however CFS can provide this service if requested.

5.0 Earthwork Discussion and Recommendations

5.1 Discussion – Earthwork

Groundwater – Groundwater that was not encountered in site in borings. Normal seasonal weather conditions should be anticipated and planned for during earthwork. It is recommended that the Contractor determine the actual groundwater levels at the site at the time of the construction activities to assess the impact groundwater may have on construction. Water should not be allowed to collect in the foundation excavation, on floor slab areas, or on prepared subgrades of the construction area either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of collected rainwater, groundwater, or surface runoff. Positive site drainage should be provided to reduce infiltration of surface water around the perimeter of the building and beneath the floor slabs. The grades should be sloped away from the building and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill and floor slab areas of the building.

Suitable Fill Material – All structural fill should be free of debris and defined by ASTM 2487 as CH, CL, ML, GW, GP, SM, SW, SC, and SP. The onsite soils do meet this requirement; however CH soils should NOT be used as structural fill within two (2) feet of the finished grade under the building slab and five (5) feet outside the building perimeter. Fat clays (CH) with Liquid Limits of greater than 55 should not be used in the upper one (1) foot beneath the pavement without being treated with lime, fly ash or cement as outlined later in this report in Section 6.4.

Depending upon the amount of weather in months preceding construction, it may be necessary to moisture adjust the soils prior to their being able to be properly compacted.

Unsuitable Fill Material – The topsoil contains organic material and is unsuitable for use as structural fill. Unsuitable materials are those defined by ASTM 2487 as MH, OL, OH, and PT.

Retaining Walls, Utility Trenches and Paved Areas – Subsurface materials in the area of retaining walls, utility trenches, and paved areas may encounter varying subsurface conditions which should be revaluated.

5.2 Recommendations – Earthwork

1. The grass and topsoil should be stripped from all structural areas and be stockpiled for later use in landscape areas or be discarded.
2. The surface of the site should be proof compacted to detect and compact any localized soft areas at the surface of the site.
3. Structural fill materials should be free of organic matter. Moisture contents should be within 0% and +4% of the optimum for soils with a liquid limit of greater than 40, and +/-3% of the optimum for soils with a liquid limit of less than 40. Maximum dry density and optimum moisture content should be determined by the Standard Proctor test (ASTM D 698).
4. Fill should be placed in six (6) inch lifts (compacted thickness) in mass fill areas and as needed to obtain proper compaction in utility trenches and behind walls.
5. Structural fill should extend a minimum of five (5) feet outside the building line. The top of slopes should also be a minimum of ten (10) feet outside the building line.
6. The site should be graded such that positive drainage (normally 2% minimum) is provided away from the building.
7. A representative of the Geotechnical Engineer should monitor filling operations. A sufficient number of density tests should be taken to verify that the specified compaction is obtained. See Table below for required testing frequency.

Table 3: Density Testing Frequency

Location or Area	Standard Proctor Density (ASTM D 698)	Testing Frequency One per lift per …
Structures and Walkways	95%	20,000 sf
Retaining Walls	95%	150 lf
Trenches	95%	150 lf
Lawn or Unimproved Areas	92%	20,000 sf
Building and Pavement Subgrades	95%	10,000 sf
Out-Parcels	95%	20,000 sf

5.3 Recommendations – Slab-on-Grade

After completion of earthwork in accordance with Section 5.2 above, a minimum 6-inch thick mat of well-graded crushed stone—equivalent to MoDOT Type 5 or ASTM C-33 No. 57 stone (1"minus)—should be placed beneath the floor slab. The granular layer will ease construction, provide capillary break, aid in drainage, and reduce slab curling due to differential cure. Prior to placement of concrete, the granular material should be compacted to a minimum dry density of 95 percent of the maximum dry density as determined by ASTM D 698 at moisture contents within ±3 percent of the optimum moisture content.

Proof-rolling and/or re-compaction of the subgrade soils should be accomplished just prior to placement of the base stone to identify soft/unstable soils and disturbance from utility excavations. Unsuitable soils should be removed and replaced with engineered controlled fill. Moisture conditioning of the upper soils may also be required prior to placement of the base stone and slab on grade. It is very important that the moisture content of the subgrade soils be maintained until concrete is placed. Rutted subgrade should be repaired prior to placement of base rock to avoid a potential water trap and subsequent subgrade heave.

The upper eighteen (18) inches below the six (6) inch (minimum) stone layer outlined above should consist of low volume change (LVC) material. Including the stone layer, there should be a minimum of 24 inches of LVC below all slabs-on-grade.

Low Volume Change (LVC) material is defined as soils or stone with liquid limits less than 45 and a plasticity index below 25. The on-site soils **do not** meet these requirements. Well graded stone such as MoDOT TYPE 5 or limestone screenings may be used as LVC material. It is not recommended to use limestone screenings in the winter months, as damage may occur from the screenings freezing. "Buckshot" (ag-lime waste byproduct) is not an approved LVC material.

As a substitute to the placement of LVC beneath the slab-on grade, the on-site clays can be mixed and compacted with 13% to 15% by weight class "C" fly-ash or 5% by weight hydrated lime for a minimum depth of eighteen (18) inches provided the minimum layer of stone is also provided. Five percent (5%) by weight Type 1/2 Portland cement for a minimum depth of twelve (12) inches may be substituted for the eighteen (18) inches of fly ash or lime treated or LVC soil with a minimum six (6) inch layer of stone. . Fly-ash should not be used during the winter months, or during any time where the ambient temperature may drop below 40°F before curing of the fly-ash can occur. See Appendix D for guidelines related to fly-ash stabilization of soils.

The LVC material or soil treatment should extend ten (10) feet outside the building walls plus all sidewalks and entries to the building.

Every floor slab-on-ground (on-grade or below-grade) should have a vapor retarder under the concrete that meets the requirements of ASTM E1745, or E1993, installed in accordance with the recommendations of ACI 302.2R. The slab designer should refer to ACI 302 and/or ACI 360 for procedures regarding the use and placement of a vapor retarder.

To reduce the effects of differential movement, slabs-on-grade should not be rigidly connected to columns, walls, or foundations unless it is designed to withstand the additional resultant forces. Floor slabs should not extend beneath exterior doors or over foundation grade beams, unless saw cut at the beam after construction. Expansion joints may be used to allow unrestrained vertical movement of the slabs. The floor slabs should be designed to have an adequate number of joints to reduce cracking resulting from differential movement and shrinkage. We suggest joints be provided on a minimum spacing of twelve (12) feet on center. For additional recommendations refer to the ACI Design Manual. The requirements for the slab reinforcement should be established by the designer based on experience and the intended slab use.

For prepared subgrade as recommended and placed on properly compacted LVC soil and six (6) inch stone base, a modulus of subgrade reaction, k value, of 100 (psi/in) may be used for slab design. If stone is used in the upper 24 inches for the LVC, a modulus of subgrade reaction, k value, of 200 (psi/in) may be used for slab design.

5.4 Excavations and Trenches

All temporary slopes and excavations should conform to Occupational Safety and Health Administration (OSHA) Standards for the Construction Industry (29 CFR Part 1926, Subpart P). Excavations at this site are *expected* to be made in "Type A" clayey soil. Soil types should be verified in the field by a competent individual.

Excavations through the very hard limestone and shale bedrocks may be necessary. The Boring Logs (Appendix B) and the Boring Location Plan (Figure 2, Appendix A) should be consulted in estimating the amount of rock to be excavated.

All excavations should be kept dry during subgrade preparation. Storm water runoff should be controlled and removed to prevent severe erosion of the subgrade and eliminate free standing water. Subgrade that has been rendered unsuitable from erosion or excessive wetting should be removed and replaced with controlled fill.

Trenches should be excavated so that pipes and culverts can be laid straight at uniform grade between the terminal elevations. Trench width should provide adequate working space and sidewall clearances. Trench subgrade should be removed and replaced with controlled fill if found to be wet, soft, loose, or frozen. Trench sub-grades should be compacted above 95% of the maximum dry density in accordance with ASTM D 698 at moisture contents between -3% to +3% of the optimum moisture content.

Granular bedding materials for pipes, such as well-graded sand or gravel, may be used provided that the bottom of the trench is graded so that water flows away from structure

Bedding material should be graded to provide a continuous support beneath all points of the pipe and joints. Embedment material should be deposited and compacted uniformly and simultaneous on each side of the pipe to prevent lateral displacement. Compacted control fill material will be required for the full depth of the trench above the embedment material except in area landscape area with the compaction may be reduced to 90% Standard Proctor ASTM D 698. No backfill should be deposited or compacted in standing water.

Precautions should be taken by the contractor to avoid undermining the newly constructed foundations. Shoring and excavations supports should be designed to account for the existing structure loads.

Permanent slopes greater than 3 horizontal to 1 vertical should not be used.

5.5 Drainage

The site should be graded so that surface water flows away from the building. Where sidewalks or paving do not immediately adjoin the structure, protective slopes of at least 5% for a minimum of 10 feet from the perimeter walls are recommended. Roof drains and downpours should also be directed away from the building. Open-graded stone is not recommended for use under sidewalks unless the stone is adequately drained to prevent collection of water under the walks.

The sites should also be graded to avoid water flows, concentrations, or pools behind retaining walls. If swales are designed at the top of the walls, proper line and slope should be considered to avoid any flow down behind walls. Special attention is needed for sources of storm water from building roofs, gutter downspouts, and paved areas draining to one point.

Perforated plastic pipes should be placed on the backfilled side of the walls near the bottom and day-lighted. Six inches of open graded crushed rock wrapped with geo-textile fabric should be placed behind the walls up to a depth of two feet below the finished grade. As an alternative to the open graded crushed rock, a manufactured geo-composite sheet drain such as Mirafi G100N, Contech C-Drain, or equivalent, may be used in conjunction with the perforated pipe.

5.6 Landscaping

Landscaping and irrigation should be limited adjacent to buildings and pavements to reduce the potential for large moisture changes. Trees and large bushes can develop intricate root systems that can draw moisture from the subgrade, resulting in shrinkage of the bearing material during dry periods of the year. Desiccation of bearing material below foundations may result in foundation settlement.

Landscaped areas near pavements and sidewalks should include a drainage system that prevents over saturation of the subgrade beneath asphalt and concrete surfaces. Drainage systems in irrigation areas should be incorporated into the storm drain system.

6.0 Pavement Recommendations

The American Association of State Highway and Transportation Officials (AASHTO) methods for design of flexible and rigid pavements were adopted in our design analyses. The light duty pavement design for the parking lots was based on the assumed traffic load of 2,000 ESAL's per year for 20 years and 10,000 ESAL's per year for heavy duty pavement.

The pavement subgrade is assumed to be on-site soils consisting of low plasticity clays. The assumed CBR value for the clayey soil that has been used in our design is 3.0. The use and placement of Tensar grid should be in accordance with manufactures specifications.

The performance of pavements is greatly dependent upon proper drainage. Proper sloping of the pavement at ¼ inch per foot or more should be provided.

6.1 Recommended Pavement Thickness

The pavement sections presented below are considered typical and minimum for the report basis parameters. The client should be aware that thinner pavement sections might result in increased maintenance costs and lower than anticipated pavement life. The pavement area subgrade consists of a moisture sensitive soil; yearly maintenance of the pavement will increase the pavement life.

CFS's preferred asphalt option is option 1 or 1A. Due to the moisture sensitivity of the soils and the increase in ESALs, the use of grid provides an increase safety factor from failure. For Light Duty, Option One has ESAL=63,000 and SN=2.83 and Option 3 ESAL=34,000 and SN=2.48. Similarly for Heavy Duty, Option One ESAL=374,000 and SN=3.57 and Option 3 is ESAL=220,000 and SN=3.30. Consideration should also be given to increasing the pavement thickness in the front third of the parking stalls where most of the customers will park.

In areas that will experience heavy parking volumes (typically those near to the building), an increase of one (1) inch of base is recommended (Option 1A). In these areas, the use of a grid provides the greatest benefit. As the pavement depresses due to consolidation, stripping, or densification of the subgrade with

time and automobile wheel loads, water starts to stand in the depression. As is stands it will eventually reach the subgrade and weaken the soils. The use of the grid helps reduce the wheel load depressions.

The use of concrete pavement is also recommended for these soils.

Table 4: Light Duty Pavement Thicknesses (Parking lots)

Asphalt Pavement	Option 1	Option 1A	Option 2	Option 3	Option 4
APWA Type 3-01 AC Surface	3.0"	2.0"	2.0"	2.0"	---
APWA Type 1-01 AC Base	---	---	4.0"	---	---
APWA Type 2-01 AC Base	---	2.0"	---	2.0"	---
Tensar Triax TX 5 Geogrid	yes	yes	no	no	no
Concrete	---	---	---	---	5.0"
Gravel Base (MoDOT Type 5 Type 5or equivalent)	6.0"	6.0"	---	6.0"	4.0"

Table 5: Heavy Duty Pavement Thicknesses (Truck areas and drives)

Asphalt Pavement	Option 1	Option 2	Option 3	Option 4
APWA Type 3-01 AC Surface	2.0"	2.0"	2.0"	---
APWA Type 1-01 AC Base	---	6.0"	4.0"	---
APWA Type 2-01 AC Base	3.0"	---	---	---
Tensar Triax TX 5 Geogrid	yes	no	no	no
Concrete	---	---	---	7.0"
Gravel Base (MoDOT Type 5 Type 5 or equivalent)	6.0"	---	6.0"	4.0"

Note: If base is to be placed in the fall and surface in the spring, then APWA Type 2-01 is recommended to improve performance of base due to lower permeability.

6.2 Asphalt Pavement Construction

The granular base course should be built at least 2 feet wider than the pavement on each side to support the tracks of the slip form paver. This extra width is structurally beneficial for wheel loads applied at pavement edge.

Asphalt cement (bitumen) used in the manufacture of asphalt pavement should conform to the Performance Grading system. In the project area, the provincial grade asphalt binder course is PG 64-22. The asphaltic mix for conventional roadway should be designed for 4% air voids. During production, the voids can be expected to vary ±1% of the design value of 4%. Under these conditions, the minimum allowable VMA for base and surface course shall be 12% and 14%, respectively.

Immediately after spreading, each course of the pavement mixture should be compacted by rolling. The initial or "breakdown" rolling shall be accomplished with a steel-wheeled vibratory roller. The motion of the roller should be slow enough at all times to avoid displacement of the hot mixture. The surface of the mixture after compaction should be smooth and true to established section and grade. The completed

asphalt concrete paving should have a density equal to or greater than 95% for the base and 96% for the surface of theoretical density.

All asphaltic concrete mix designs and Marshall Characteristics should be submitted to our office and reviewed in order to determine if they are consistent with the recommendations given in this report. All materials to be employed and field operations required in connection with the pavement reconstruction should follow requirements and procedural details as per APWA 2001. In addition, representative of CFS should observe and monitor the pavement construction to assure satisfactory compliance with our engineering recommendations.

6.3 Concrete Pavement Construction

The pavement on this site will be subjected to freeze-thaw cycles. Sufficient air entrainment in the range of 6% to 8% is required to provide freeze-thaw durability in the concrete. Concrete with a 28-day specified compressive strength of 4,000 psi is recommended. The concrete mix should contain at least 564 pounds of concrete per cubic yard. A mixture with a maximum slump of 4 inch +/- 1inch is acceptable. If a water-reducing admixture is specified, slump can be higher. For better performance and crack control, synthetic fiber reinforcement such as Fibermesh® 300 is recommended for the concrete instead of welded wire mesh. Add synthetic fiber reinforcement to concrete mixture in accordance with manufacturer's instructions.

6.4 Pavement Subgrade Preparation

Prior to placement of granular base or asphalt, proof roll and re-compact the exposed surfaces up to a minimum lateral distance of two (2) feet outside the pavement Any localized soft, wet, or loose areas identified during the proof rolling should be repaired prior to paving. Fill material should be placed in loose lifts up to a maximum of eight (8) inches in thickness and compacted to at least 95% of the maximum dry density in accordance with ASTM D698 at moisture contents outlined in the Earthwork section. Construction traffic, including foot traffic, should be minimized to prevent unnecessary disturbance of the pavement subgrade. Disturbed areas, as verified by CFS's geotechnical engineer, should be removed and replaced with properly compacted material.

Fat clays (CH) with Liquid Limits of greater than 55 should not be used in the upper one (1) foot beneath the pavement without being treated with a nine (9) inch layer of lime, fly ash or cement as outlined previously in Section 5.3 in this report. Consideration should be given to treating all non-LVC clays so as to extend the life of the pavement, improve performance and reduce maintenance costs.

The granular base should be placed in loose lifts up to a maximum of twelve (12) inches in thickness and compacted to at least 98% of the maximum dry density in accordance with ASTM D698.

If open graded stone is used under the pavement, the pavement subgrade should be graded to provide positive drainage of the granular base section. Provision should be made to provide drainage into the storm water system. The use of a granular blanket drain near storm water inlets that provides weep holes from the drain to the inlets is recommended.

7.0 General Comments

When the plans and specifications are complete, or if significant changes are made in the character or location of the proposed structure, a consultation should be arranged to review the changes with respect to the prevailing soil conditions. At that time it may be necessary to submit supplementary recommendations.

It is recommended that the services of Cook, Flatt & Strobel Engineers be engaged to test and evaluate the compaction of any additional fill materials and to test and evaluate the bearing value of the soils in the footing excavations.

Respectfully submitted,

COOK, FLATT & STROBEL ENGINEERS, P.A.

William J. Stafford, P.E.
Senior Geotechnical Engineer

Patrick Doyle, P.E.
Project Engineer

Appendix A: Figures

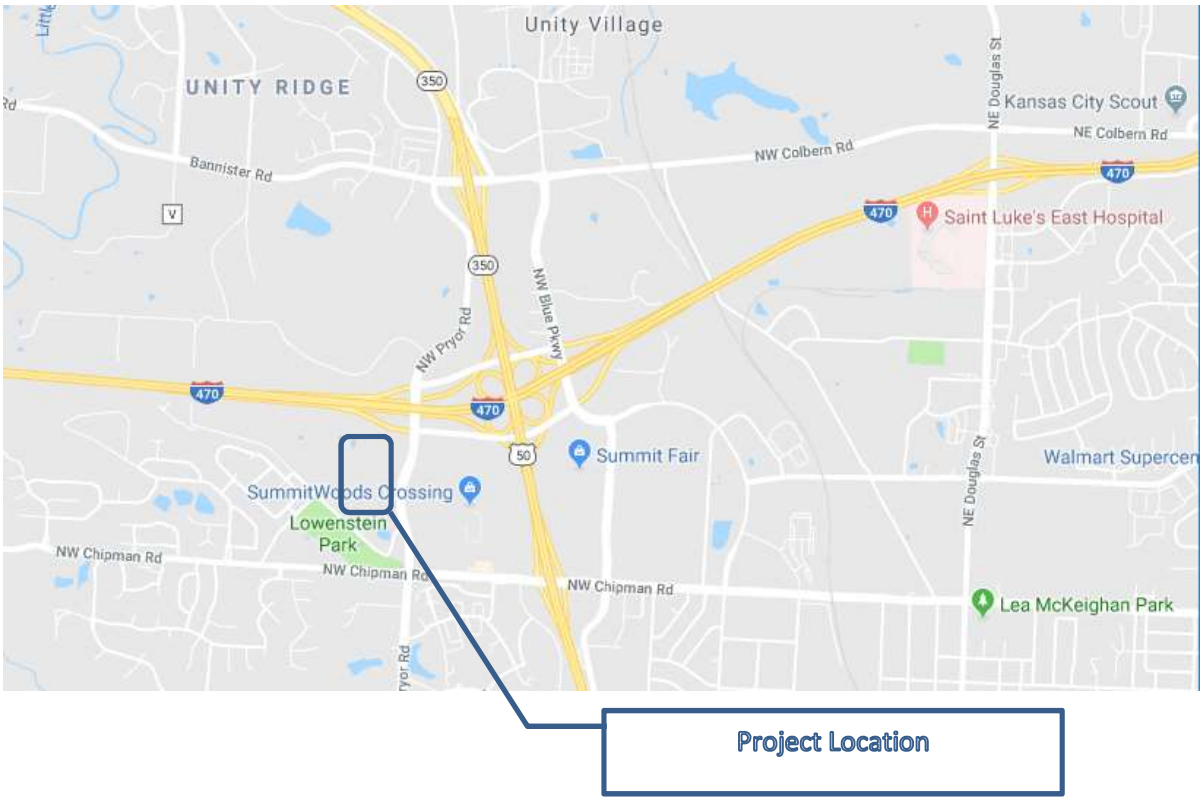

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Figure 1. Site Location Map
West Pryor Village
Lee's Summit, Missouri

Drawn By: PD Project #: 18-5125

Streets of West Pryor - Proposed Borings

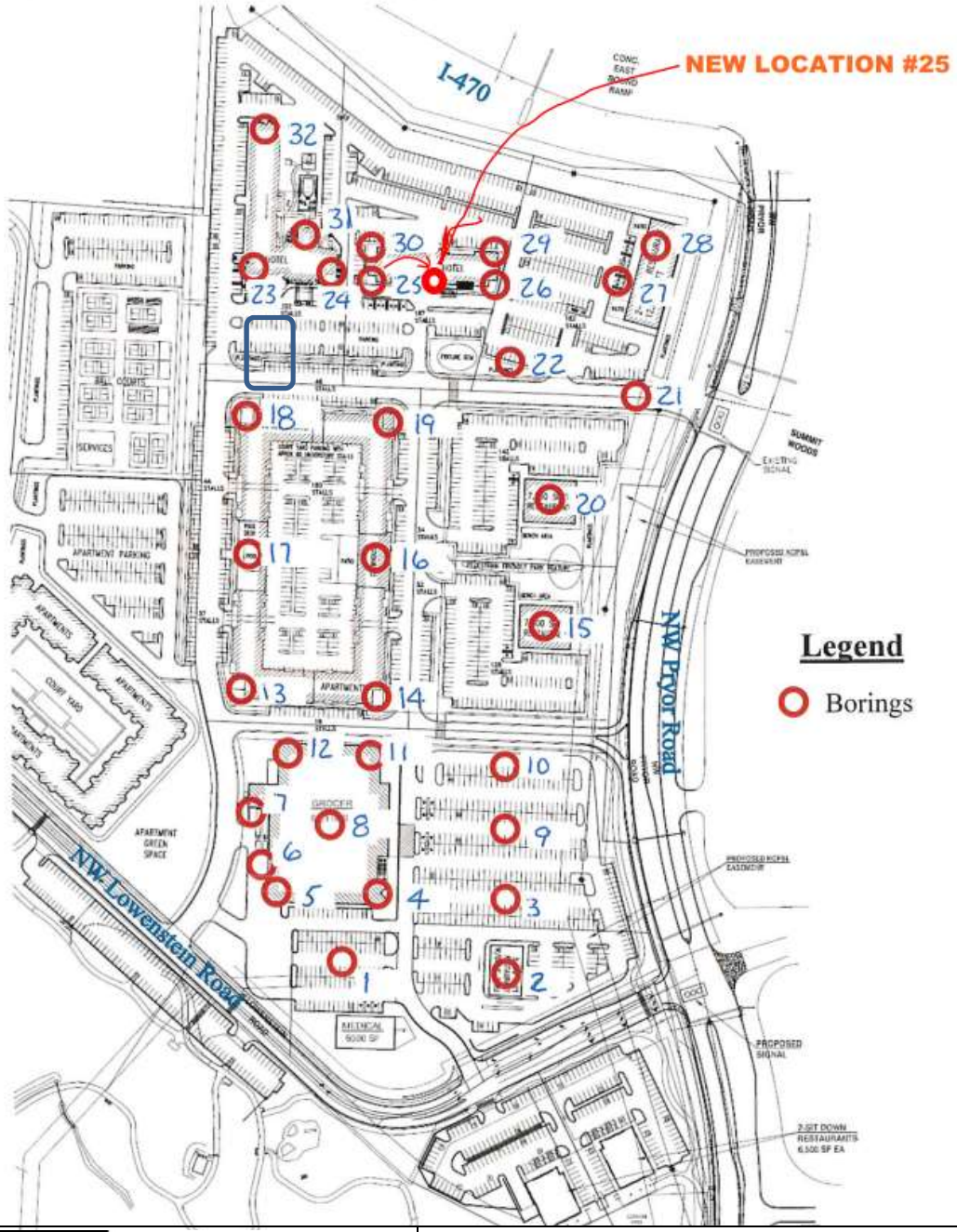

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Figure 2. Boring Location Map
West Pryor Village
Lee's Summit, Missouri

Drawn By: PD Project #: 18-5125

Appendix B: Boring Logs

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BORING NUMBER B-1

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/6/18 **COMPLETED** 6/6/18
GROUND ELEVATION 970.75 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 970.3
						Brown moist firm CLAY
	SS 1	89	2-2-3 (5)	PP = 2 tsf MC = 28.8%		
	SS 2	89	3-4-5 (9)	PP = 2.25 tsf MC = 24.6%		
5						
	SS 3	100	4-4-5 (9)	PP = 2.75 tsf MC = 26.5%		
	SS 4	100	3-4-6 (10)	PP = 2.75 tsf MC = 25.9%		
10						10.0 960.8
						10.5 Grey moist Firm Weathered LIMESTONE 960.3
						Auger Refusal at 10.5

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BORING NUMBER B-2

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/7/18 **COMPLETED** 6/7/18
GROUND ELEVATION 968.6 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 968.1
						Brown moist firm CLAY
	SS 1	56	3-2-2 (4)	PP = 3.75 tsf MC = 22.2%		
	SS 2	67	2-3-3 (6)	PP = 2 tsf MC = 30%		
5						6.0 962.6
	SS 3	100	8-3-4 (7)	PP = 3.5 tsf MC = 24.9%		Brown moist stiff CLAY
	SS 4	100	3-4-7 (11)	PP = 3 tsf MC = 32.1%		
10						10.5 958.1
						Grey moist Firm Weathered LIMESTONE
						11.2 957.4
						11.7 LIMESTONE grey moderately soft rock 956.9
						Auger Refusal at 11.7 feet

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BORING NUMBER B-3

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/7/18 **COMPLETED** 6/7/18
GROUND ELEVATION 971.7 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						0.5 TOPSOIL	971.2
	SS 1	56	5-3-2 (5)	PP >4.5 tsf MC = 20%		Brown moist firm CLAY	
	SS 2	67	3-3-3 (6)	PP = 4 tsf MC = 23%			
5						5.0 Brown moist stiff CLAY	966.7
	SS 3	100	4-4-5 (9)	PP = 3.25 tsf MC = 24.6%			
						8.5	963.2
	SS 4	100	5-29-10 (39)	PP = 2.25 tsf MC = 30.8%		9.0 Brown moist hard CLAY	962.7
10						Grey moist Firm Weathered LIMESTONE	
						12.0 Grey moist soft SHALE	959.7
	SS 5	78	20-21-24 (45)	PP >4.5 tsf MC = 16%			
15						14.7	957.0
						15.3 LIMESTONE grey moderately soft	956.4
						Auger refusal at 15.3	

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BORING NUMBER B-4

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/6/18 **COMPLETED** 6/6/18
GROUND ELEVATION 979.29 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 978.8
	SS 1	33	5-4-3 (7)	PP = 4.5 tsf MC = 20.2%		Brown moist stiff CLAY
						Brown moist firm CLAY
5	SS 2	78	4-3-3 (6)	PP >4.5 tsf MC = 19.5%		
						Brown moist stiff CLAY
	SS 3	89	3-3-6 (9)	PP = 2.25 tsf MC = 29.3%		
10	SS 4	100	3-4-5 (9)	PP = 2.25 tsf MC = 25.9%		
15	SS 5	100	4-4-6 (10)	PP = 2.5 tsf MC = 26.2%		
						18.0 961.3
						18.5 LIMESTONE grey moderately soft 960.8
						Auger refusal at 18.5

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BORING NUMBER B-5

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/7/18 **COMPLETED** 6/7/18
GROUND ELEVATION 984.04 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 983.5
	SS 1	56	4-4-5 (9)	PP = 4.5 tsf MC = 20.2%		Brown moist stiff CLAY
	SS 2	56	5-5-5 (10)	PP = 4 tsf MC = 22%		
5						
	SS 3	78	4-5-6 (11)	PP = 3.25 tsf MC = 24.4%		
	SS 4	100	3-3-5 (8)	PP = 2.5 tsf MC = 26.3%		
10						
	SS 5	100	4-5-8 (13)	PP = 3.5 tsf MC = 27.4%		Brown moist very stiff CLAY
15						
	SS 6	100	6-6-8 (14)	PP = 3.5 tsf MC = 23.8%		
20						21.1 962.9
						LIMESTONE grey moderately soft
						22.8 961.2
						Auger refusal at 22.8

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BORING NUMBER B-6

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/7/18 **COMPLETED** 6/7/18
GROUND ELEVATION 984.34 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 983.8
	SS 1	56	5-5-6 (11)	PP >4.5 tsf MC = 23%		Brown moist stiff CLAY
5	SS 2	67	6-5-5 (10)	PP = 4.25 tsf MC = 25%		
	SS 3	100	4-6-7 (13)	PP = 3.5 tsf MC = 22.7%		Brown moist very stiff CLAY
10	SS 4	100	5-7-8 (15)	PP = 4 tsf MC = 24.7%		
						13.5 970.8
15	SS 5	100	10-14-15 (29)	PP >4.5 tsf MC = 20.3%		Grey moist soft SHALE
20	SS 6	100	20-25-34 (59)	PP >4.5 tsf MC = 19.2%		
	SS 7	100	23-50/1"	MC = 16.2%		23.8 960.5 24.2 LIMESTONE grey moderately soft 960.1 Auger refusal at 24.2

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BORING NUMBER B-7

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/6/18 **COMPLETED** 6/6/18
GROUND ELEVATION 989.7 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 989.2
	SS 1	67	3-3-3 (6)	PP = 4 tsf MC = 22%		Brown moist firm CLAY
						Brown moist stiff CLAY
5	SS 2	89	3-4-4 (8)	PP = 4.25 tsf MC = 22.1%		
	SS 3	100	3-5-6 (11)	PP = 2.25 tsf MC = 24.9%		
10	SS 4	100	5-6-8 (14)	PP = 3 tsf MC = 20.8%		Brown moist very stiff CLAY
						10.0 979.7 Grey moist soft SHALE
15	SS 5	100	18-27-50 (77)	PP >4.5 tsf MC = 16.6%		
	SS 6	100	24-50/6"	PP >4.5 tsf MC = 17.6%		19.5 970.2 Spoon refusal at 19.5

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BORING NUMBER B-8

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/6/18 **COMPLETED** 6/6/18
GROUND ELEVATION 984.64 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 984.1
						Brown moist stiff CLAY
	SS 1	44	5-5-5 (10)	PP >4.5 tsf MC = 33.2%		
	SS 2	78	4-5-7 (12)	PP = 4.5 tsf MC = 23.5%		
5						
	SS 3	100	5-4-7 (11)	PP = 3 tsf MC = 23%		
	SS 4	100	5-6-8 (14)	PP = 3.25 tsf MC = 24.9%		9.0 975.6
10						Grey moist soft SHALE
	SS 5	100	14-22-50 (72)	PP >4.5 tsf MC = 16.8%		
15						
	SS 6	100	23-26-50 (76)	PP >4.5 tsf MC = 15.7%		
20						20.0 964.6
						Boring terminated at 20 ft

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BORING NUMBER B-9

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/6/18 **COMPLETED** 6/6/18
GROUND ELEVATION 977.32 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 976.8
	SS 1	44	3-3-2 (5)	PP = 3 tsf MC = 27.3%		Brown moist firm CLAY
						Brown moist stiff CLAY
5	SS 2	89	3-4-5 (9)	PP = 3.5 tsf MC = 23.9%		
	SS 3	100	4-5-5 (10)	PP = 4.25 tsf MC = 24.2%		
10	SS 4	100	5-5-6 (11)	PP >4.5 tsf MC = 23.7%		Grey moist soft SHALE
						13.5 963.8
	SS 5	100	6-50/4"	PP >4.5 tsf MC = 21%		14.0 Grey moist soft SHALE 963.3
15						Grey moist Firm Weathered LIMESTONE
						15.7 961.6
						Auger refusal at 15.7

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BORING NUMBER B-10

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/1/18 **COMPLETED** 6/1/18
GROUND ELEVATION 982.85 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 982.4 Brown moist very stiff CLAY
	SS 1	67	3-5-8 (13)	PP >4.5 tsf MC = 19.6%		
5	SS 2	89	7-9-9 (18)	PP >4.5 tsf MC = 19.3% LL = 55 PL = 20		
	SS 3	100	5-7-7 (14)	PP >4.5 tsf MC = 21.9%		
10	SS 4	100	7-6-8 (14)	PP >4.5 tsf MC = 22.3%		
						12.0 970.9 Grey moist soft SHALE
15	SS 5	33	17-19-50 (69)	PP >4.5 tsf MC = 14.5%		
	SS 6	100	50/4"	PP = 3.5 tsf MC = 15.3%		18.5 964.4 18.8 LIMESTONE grey moderately soft 964.0 Spoon refusal at 18.83

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BORING NUMBER B-11

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/1/18 **COMPLETED** 6/1/18
GROUND ELEVATION 990.51 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 990.0
						Brown moist stiff CLAY
	SS 1	78	3-4-4 (8)	PP = 3 tsf MC = 28.7%		
	SS 2	100	3-4-6 (10)	PP = 2.5 tsf MC = 26.8%		
5						
	SS 3	100	4-5-7 (12)	PP = 3.5 tsf MC = 24.4%		
						8.5 982.0
	SS 4	100	5-8-9 (17)	PP >4.5 tsf MC = 25.1%		Brown moist very stiff CLAY 9.3 981.3
10						Grey moist soft SHALE
	SS 5	100	11-13-17 (30)	PP >4.5 tsf MC = 17.1%		
15						
	SS 6	100	19-27-50/4"	PP >4.5 tsf MC = 16%		
20						
	SS 7	50	30-50/6"	MC = 11.6%		24.5 966.0
						Spoon refusal at 24.5

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BORING NUMBER B-11

CLIENT Monarch Acquisitions LLC **PROJECT NAME** West Pryor Village

PROJECT NUMBER 18-5125 **PROJECT LOCATION** Lee's Summit, MO

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION

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BORING NUMBER B-12

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/5/18 **COMPLETED** 6/5/18
GROUND ELEVATION 992.87 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 992.4
						Brown moist stiff CLAY
	SS 1	89	4-5-6 (11)	PP >4.5 tsf MC = 21.6%		
	SS 2	100	5-6-7 (13)	PP >4.5 tsf MC = 17.5%		
5						5.5 987.4
						Grey moist soft SHALE
	SS 3	67	7-8-8 (16)	PP >4.5 tsf MC = 16.8%		
	SS 4	78	9-9-11 (20)	PP >4.5 tsf MC = 17%		
10						
	SS 5	100	24-27-50 (77)	PP >4.5 tsf MC = 13.3%		
15						
	SS 6	100	50/6"	PP >4.5 tsf MC = 11.2%		19.0 973.9
						Spoon refusal at 19

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BORING NUMBER B-13

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/1/18 **COMPLETED** 6/1/18
GROUND ELEVATION 1002 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 1001.5
						Brown moist stiff CLAY
	SS 1	67	3-3-4 (7)	PP = 3.5 tsf MC = 30.2%		
	SS 2	100	4-6-6 (12)	PP = 3.5 tsf MC = 24.4%		
5						
	SS 3	100	3-4-5 (9)	PP = 3.5 tsf MC = 25.7% LL = 73 PL = 26		
						8.5 993.5
	SS 4	67	7-7-6 (13)	PP = 3.25 tsf MC = 16.8%		Grey moist soft SHALE
10						
						13.2 988.8
						13.7 LIMESTONE grey moderately soft 988.3
						Auger refusal at 13.7

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BORING NUMBER B-14

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/1/18 **COMPLETED** 6/1/18
GROUND ELEVATION 993.91 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 993.4
	SS 1	67	5-6-7 (13)	PP >4.5 tsf MC = 20.1%		Brown moist very stiff CLAY
						3.5 990.4
5	SS 2	78	5-6-6 (12)	PP >4.5 tsf MC = 20.2%		Brown moist stiff CLAY
						6.0 987.9
	SS 3	100	7-7-12 (19)	PP >4.5 tsf MC = 20.8%		Grey moist soft SHALE
10	SS 4	89	7-8-9 (17)	PP >4.5 tsf MC = 19.3%		
15	SS 5	100	17-25-50 (75)	PP >4.5 tsf MC = 16.8%		
	SS 6	100	50/6"	PP >4.5 tsf MC = 10.8%		19.0 974.9 Spoon refusal at 19

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BORING NUMBER B-15

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 5/31/18 **COMPLETED** 5/31/18
GROUND ELEVATION 998.59 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						0.5 TOPSOIL	998.1
						Brown moist stiff CLAY	
	SS 1	78	3-4-6 (10)	PP = 2.5 tsf MC = 28%			
	SS 2	100	3-5-4 (9)	PP = 2.25 tsf MC = 26.2%			
5							
	SS 3	100	4-5-6 (11)	PP = 2 tsf MC = 24.4%			
						8.5	990.1
	SS 4	78	6-9-5 (14)	PP = 3.5 tsf MC = 25.7%		Brown moist very stiff CLAY	
10						9.3	989.3
						Grey moist soft SHALE	
	SS 5	100	50/5"	PP >4.5 tsf MC = 10.3%			
15							
	SS 6	100	50/3"	PP >4.5 tsf MC = 10.3%		18.8	979.8
						Auger refusal at 18.75	

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BORING NUMBER B-16

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/4/18 **COMPLETED** 6/4/18
GROUND ELEVATION 1008.67 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 1008.2
						Brown moist stiff CLAY
	SS 1	78	4-5-6 (11)	PP = 2.5 tsf MC = 31.9%		
	SS 2	100	4-5-7 (12)	PP = 3 tsf MC = 22%		
5						5.5 1003.2
						Grey moist Firm Weathered LIMESTONE
	SS 3	100	4-50/4"	PP = 4.5 tsf MC = 17.6%		
	SS 4	78	8-9-11 (20)	PP >4.5 tsf MC = 15.7%		9.3 999.4
10						Grey moist soft SHALE
	SS 5	100	4-50/6"	PP >4.5 tsf MC = 12.8%		
15						
	SS 6	100	50/6"	PP >4.5 tsf MC = 12.1%		19.0 989.7
						Spoon refusal at 19

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BORING NUMBER B-17

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/4/18 **COMPLETED** 6/4/18
GROUND ELEVATION 1011.04 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						0.5 TOPSOIL	1010.5
						Brown moist very stiff CLAY	
	SS 1	78	4-6-8 (14)	PP = 3.5 tsf MC = 21.8%			
						3.5	1007.5
	SS 2	100	4-5-6 (11)	PP = 3.5 tsf MC = 22.6%		Brown moist stiff CLAY	
5							
	SS 3	100	50/4"	PP = 4 tsf MC = 27.5%		7.0	1004.0
						Grey moist Firm Weathered LIMESTONE	
						8.8	1002.2
						Auger refusal at 8.83	

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BORING NUMBER B-18

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/5/18 **COMPLETED** 6/5/18
GROUND ELEVATION 1001.04 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 1000.5
	SS 1	67	3-3-4 (7)	PP = 2.5 tsf MC = 21.8%		Brown moist firm CLAY
5	SS 2	78	4-3-4 (7)	PP = 2.5 tsf MC = 20.9%		5.5 995.5
	SS 3	100	9-28-50 (78)	PP >4.5 tsf MC = 5.5%		Grey moist soft SHALE
	SS 4	100	50/6"	PP >4.5 tsf MC = 12.3%		9.0 992.0 Spoon refusal at 9

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BORING NUMBER B-19

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/4/18 **COMPLETED** 6/4/18
GROUND ELEVATION 1011.23 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 1010.7
						Brown moist stiff CLAY
	SS 1	78	4-6-7 (13)	PP = 3 tsf MC = 21.7%		
	SS 2	100	4-5-6 (11)	PP = 3.5 tsf MC = 22.1%		
5						
	SS 3	100	5-5-6 (11)	PP >4.5 tsf MC = 18.5%		
	SS 4	100	50/6"			8.8 1002.5
						Grey moist Firm Weathered LIMESTONE
						9.8 1001.4
						Auger refusal at 9.8

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BORING NUMBER B-20

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 5/31/18 **COMPLETED** 5/31/18
GROUND ELEVATION 1002.49 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						0.5 TOPSOIL	1002.0
	SS 1	100	4-5-7 (12)	PP = 2.5 tsf MC = 27%		Brown moist stiff CLAY	
						3.5	999.0
5	SS 2	100	4-5-8 (13)	PP = 3.25 tsf MC = 27%		Brown moist very stiff CLAY	
	SS 3	100	7-13-11 (24)	PP >4.5 tsf MC = 19.4%		6.8	995.7
						Grey moist soft SHALE	
10	SS 4	100	8-10-8 (18)	PP >4.5 tsf MC = 18.2%			
						11.0	991.5
						Grey moist Firm Weathered LIMESTONE	
						12.1	990.4
						Auger refusal at 12.1	

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BORING NUMBER B-21

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/1/18 **COMPLETED** 6/1/18
GROUND ELEVATION 985.55 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 985.1
	SS 1	67	5-5-5 (10)	PP = 3.75 tsf MC = 24.4%		Brown moist stiff CLAY
5	SS 2	78	4-5-6 (11)	PP = 3.75 tsf MC = 22.8%		Brown moist very stiff CLAY
	SS 3	67	6-6-7 (13)	PP >4.5 tsf MC = 20.7%		6.0 979.6
10	SS 4	67	6-14-16 (30)	PP >4.5 tsf MC = 31.2%		6.8 978.8 Grey moist soft SHALE
15	SS 5	100	23-25-22 (47)	PP >4.5 tsf MC = 16%		
20	SS 6	100	16-25-50 (75)	PP >4.5 tsf MC = 15.9%		
	SS 7	100	50/6"	PP >4.5 tsf MC = 11.1%		24.0 961.6 Spoon refusal at 24

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BORING NUMBER B-22

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 5/31/18 **COMPLETED** 5/31/18
GROUND ELEVATION 1005.78 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 1005.3
	SS 1	67	4-6-8 (14)	PP = 3.5 tsf MC = 26.6%		SANDSTONE grey moderately soft
5	SS 2	100	24-30-8 (38)	PP >4.5 tsf MC = 27.4%		5.0 1000.8
	SS 3	100	5-9-10 (19)	PP >4.5 tsf MC = 19.3%		Brown moist very stiff CLAY 6.8 999.0
10	SS 4	100	5-5-10 (15)	PP >4.5 tsf MC = 22.6%		Grey moist soft SHALE
15	SS 5	100	17-22-50 (72)	PP >4.5 tsf MC = 18.4%		17.8 988.0
						18.1 987.7 Grey moist Firm Weathered LIMESTONE
						Auger refusal at 18.1

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BORING NUMBER B-23

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/4/18 **COMPLETED** 6/4/18
GROUND ELEVATION 978.03 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						0.5 TOPSOIL	977.5
						0.7 Brown moist stiff CLAY	977.4
	SS 1	78	4-4-5 (9)	PP = 2.5 tsf MC = 19.9%		1.0 Grey moist Firm Weathered LIMESTONE	977.0
						Grey moist soft SHALE	
	SS 2	78	4-5-5 (10)	PP = 4 tsf MC = 16.9%			
5							
	SS 3	100	20-29-28 (57)	PP >4.5 tsf MC = 11.7%			
	SS 4	100	18-24-50 (74)	PP >4.5 tsf MC = 12.3%			
10							
	SS 5	100	50/4"	PP >4.5 tsf MC = 7%		13.8	964.2
						Spoon refusal at 13.83	

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BORING NUMBER B-24

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/5/18 **COMPLETED** 6/5/18
GROUND ELEVATION 989.15 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						0.5 TOPSOIL	988.7
						Brown moist very stiff CLAY	
	SS 1	67	4-7-7 (14)	PP >4.5 tsf MC = 15.8%		1.8	987.4
						Grey moist soft SHALE	
						3.5	985.7
	SS 2	100	8-50/5"	PP >4.5 tsf MC = 12.9%		4.2 Brown moist hard CLAY	985.0
						4.8 LIMESTONE grey moderately soft	984.4
						Auger refusal at 4.8	

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BORING NUMBER B-25

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/5/18 **COMPLETED** 6/5/18
GROUND ELEVATION 1005 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 1004.5
				PP = 3 tsf MC = 25.5%		Brown moist stiff CLAY
	SS 1	56	4-4-4 (8)	PP = 3 tsf MC = 20.8%		
	SS 2	100	4-4-5 (9)	PP = 3 tsf MC = 20%		
5						
	SS 3	39	23-10-5 (15)	PP >4.5 tsf MC = 13.4%		6.8 998.3 Grey moist Firm Weathered LIMESTONE 7.5 997.5 Grey moist soft SHALE
	SS 4	100	6-6-8 (14)	PP >4.5 tsf MC = 10.7%		
10						
	SS 5	100	22-50/6"	PP >4.5 tsf MC = 7.5%		
15						
	SS 6	100	18-50/3"	PP >4.5 tsf MC = 11.3%		19.3 985.8 Spoon refusal at 19.25

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BORING NUMBER B-26

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 5/30/18 **COMPLETED** 5/30/18
GROUND ELEVATION 1004.29 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	
0							
						0.5 TOPSOIL	1003.8
						Grey moist soft SHALE	
	SS 1	61	10-9-13 (22)	PP = 1.5 tsf MC = 21.6%		1.8	1002.5
						Grey moist Firm Weathered LIMESTONE	
	SS 2	100	50/3"	PP = 3 tsf MC = 16.1%		4.0	1000.3
						Auger refusal at 4	

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BORING NUMBER B-27

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 5/30/18 **COMPLETED** 5/30/18
GROUND ELEVATION 986.67 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						0.5 TOPSOIL	986.2
						Brown moist soft CLAY	
	SS 1	78	2-2-1 (3)	PP = 2 tsf MC = 24%		1.8	984.9
						Grey moist soft SHALE	
						2.5	984.2
						Brown wet moist CLAY	
5	SS 2	78	1-2-4 (6)	PP = 1.25 tsf MC = 28.6%			
						6.0	980.7
	SS 3	89	3-6-9 (15)	PP = 3.5 tsf MC = 21.9%		Grey moist soft SHALE	
						7.5	979.2
						Brown wet moist CLAY	
						8.5	978.2
	SS 4	100	16-21-50/4"	PP >4.5 tsf MC = 17.7%		Grey moist soft SHALE	
10							
	SS 5	100	20-26-50/5"	PP >4.5 tsf MC = 14.9%		14.9	971.8
						Auger refusal at 14.92	

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BORING NUMBER B-28

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 5/31/18 **COMPLETED** 5/31/18
GROUND ELEVATION 979.77 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 979.3
	SS 1	67	4-5-6 (11)	PP = 3 tsf MC = 24.5%		Brown moist stiff CLAY
						3.5 976.3
5	SS 2	100	5-6-8 (14)	PP = 2.5 tsf MC = 26.1%		Grey moist very stiff CLAY
						6.0 973.8
	SS 3	100	4-5-6 (11)	PP = 2.5 tsf MC = 26.1%		Brown moist stiff CLAY
	SS 4	56	7-8-11 (19)	PP >4.5 tsf MC = 24.1%		9.3 970.5
10						Grey moist soft SHALE
	SS 5	100	15-23-32 (55)	PP >4.5 tsf MC = 15.7%		
15						
	SS 6	100	19-16-50 (66)	PP >4.5 tsf MC = 16.4%		
20						
						21.0 958.8
						LIMESTONE grey moderately soft
						22.2 957.6
						Auger refusal at 22.2

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BORING NUMBER B-29

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 5/30/18 **COMPLETED** 5/30/18
GROUND ELEVATION 999.4 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						0.5 TOPSOIL	998.9
	SS 1	33	3-3-2 (5)	PP = 1.5 tsf MC = 20.5%		Brown moist firm CLAY	
						2.5 Grey moist stiff CLAY	996.9
5	SS 2	89	2-4-4 (8)	PP = 2.5 tsf MC = 27.5%			
						6.0	993.4
	SS 3	67	10-2-1 (3)	PP = 2.5 tsf MC = 20.2%		Brown moist firm CLAY	
						8.5	990.9
	SS 4	89	7-8-8 (16)	PP = 3 tsf MC = 22.7%		9.3 Grey moist soft SHALE	990.2
10						Brown moist moderately soft SANDSTONE	
						10.3 Grey moist Firm Weathered LIMESTONE	989.1
						12.3	987.1
						Auger refusal at 12.3	

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BORING NUMBER B-30

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 5/30/18 **COMPLETED** 5/30/18
GROUND ELEVATION 995.24 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 994.7
	SS 1	89	3-3-5 (8)	PP = 25 tsf MC = 25%		Brown moist stiff CLAY
	SS 2	56	3-3-7 (10)	PP = 2.5 tsf MC = 23.5% LL = 50 PL = 22		
5	SS 3	67	3-6-9 (15)	PP = 3 tsf MC = 25.2%		
	SS 4	100	3-11-15 (26)	PP = 2 tsf MC = 32.3%		
10						10.3 985.0
						Grey moist Firm Weathered LIMESTONE
						12.5 982.7
						Auger refusal at 12.3

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BORING NUMBER B-31

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/4/18 **COMPLETED** 6/4/18
GROUND ELEVATION 986.97 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						0.5 TOPSOIL	986.5
						Brown moist very hard CLAY	
	SS 1	50	3-50	PP = 2 tsf		1.4 Grey moist Firm Weathered LIMESTONE	985.6
						2.8	984.2
						Auger refusal at 2.8 ft	

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BORING NUMBER B-32

CLIENT Monarch Acquisitions LLC
PROJECT NAME West Pryor Village
PROJECT NUMBER 18-5125
PROJECT LOCATION Lee's Summit, MO
DATE STARTED 6/5/18 **COMPLETED** 6/5/18
GROUND ELEVATION 964.65 ft MSL **HOLE SIZE** 6
DRILLING CONTRACTOR RC Drilling
GROUND WATER LEVELS:
DRILLING METHOD HSA
AT TIME OF DRILLING ---
LOGGED BY Luke **CHECKED BY** HM
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION
0						0.5 TOPSOIL 964.2
						Brown moist stiff CLAY
	SS 1	67	5-6-7 (13)	PP >4.5 tsf MC = 20.2%		
						3.5 961.2
	SS 2	100	6-7-9 (16)	PP >4.5 tsf MC = 15.2%		Grey moist soft SHALE
5						
	SS 3	100	13-23-50 (73)	PP >4.5 tsf MC = 13.9%		
	SS 4	100	50/6"	PP >4.5 tsf MC = 10.8%		9.0 955.7 Spoon refusal at 9

Appendix C: Laboratory Test Results

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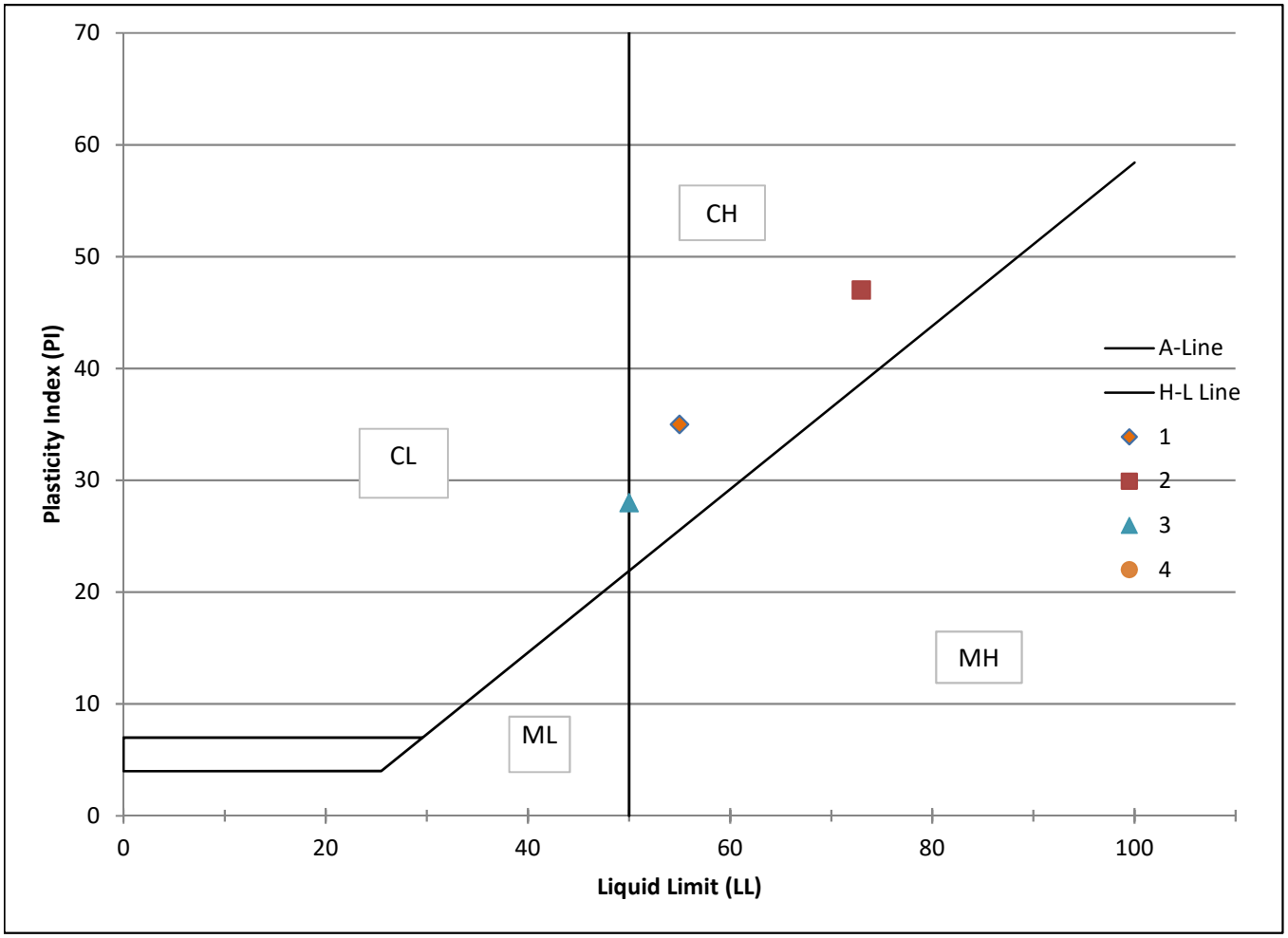
Liquid Limit, Plastic Limit, & Plasticity Index Test Report

Project:	Street West of Pryor	Job No.:	='Sample 1'!G6:H6
Location:	Lee's Summit	Sample Date:	6/1/2018
Tested By:	AB	Test Date:	6/12/2018



	Boring / Sample	Material Description	LL	PL	PI	USCS
1	10 / 2	Brown CLAY	55	20	35	CH
2	13 / 3	Light brown CLAY	73	26	47	CH
3	30 / 2	Gray CLAY	50	22	28	CL-CH
4						

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Water Content Determination

Project: Pryor
Location: Lee's Summit
Project #: 18-5125
Date: 13 June 2018

Test Performed By: AB
Checked By: PD

Boring	Sample	Can #	Wt. of Can	Wt can+wet	Wt can+dry	Wt water	Wt dry	M/C (%)
B-1	1		2303	6820	5811	1009	3508	28.8%
B-1	2		1569	8063	6782	1281	5213	24.6%
B-1	3		2276	8998	7588	1410	5312	26.5%
B-1	4		2250	8078	6878	1200	4628	25.9%
B-2	1		2232	7996	6950	1046	4718	22.2%
B-2	2		2234	8147	6783	1364	4549	30.0%
B-2	3		2258	6451	5614	837	3356	24.9%
B-2	4		2268	7689	6371	1318	4103	32.1%
B-3	1		2246	8007	7046	961	4800	20.0%
B-3	2		2269	8842	7615	1227	5346	23.0%
B-3	3		2248	8833	7533	1300	5285	24.6%
B-3	4		2240	8031	6668	1363	4428	30.8%
B-3	5		1653	8867	7872	995	6219	16.0%
B-4	1		2278	5608	5049	559	2771	20.2%
B-4	2		2282	6172	5537	635	3255	19.5%
B-4	3		1582	6852	5658	1194	4076	29.3%
B-4	4		2243	6442	5578	864	3335	25.9%
B-4	5		1565	8607	7144	1463	5579	26.2%
B-5	1		1486	4547	4032	515	2546	20.2%
B-5	2		2292	7050	6192	858	3900	22.0%
B-5	3		2297	6447	5634	813	3337	24.4%
B-5	4		2243	5950	5179	771	2936	26.3%
B-5	5		2265	8392	7074	1318	4809	27.4%
B-5	6		2242	8577	7360	1217	5118	23.8%
B-6	1		2254	9130	7843	1287	5589	23.0%
B-6	2		2254	7509	6459	1050	4205	25.0%
B-6	3		1467	6456	5532	924	4065	22.7%
B-6	4		1543	6980	5904	1076	4361	24.7%
B-6	5		2279	7496	6617	879	4338	20.3%
B-6	6		2282	6303	5655	648	3373	19.2%
B-6	7		1545	6837	6101	736	4556	16.2%
B-7	1		2235	8344	7241	1103	5006	22.0%
B-7	2		2249	7243	6339	904	4090	22.1%
B-7	3		2237	6334	5518	816	3281	24.9%
B-7	4		2267	7534	6628	906	4361	20.8%
B-7	5		1454	9619	8454	1165	7000	16.6%
B-7	6		1624	7783	6861	922	5237	17.6%
B-8	1		2254	7491	6187	1304	3933	33.2%

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Water Content Determination

Project: Pryor
Location: Lee's Summit
Project #: 18-5125
Date: 13 June 2018

Test Performed By: AB
Checked By: PD

Boring	Sample	Can #	Wt. of Can	Wt can+wet	Wt can+dry	Wt water	Wt dry	M/C (%)
B-8	2		2261	7465	6474	991	4213	23.5%
B-8	3		1563	7690	6545	1145	4982	23.0%
B-8	4		1567	5458	4682	776	3115	24.9%
B-8	5		1589	8713	7689	1024	6100	16.8%
B-8	6		1577	5483	4953	530	3376	15.7%
B-9	1		2286	7727	6560	1167	4274	27.3%
B-9	2		1568	6233	5333	900	3765	23.9%
B-9	3		1609	7580	6418	1162	4809	24.2%
B-9	4		1609	6909	5894	1015	4285	23.7%
B-9	5		1552	5361	4699	662	3147	21.0%
B-10	1		2260	6876	6120	756	3860	19.6%
B-10	2		2249	5852	5268	584	3019	19.3%
B-10	3		2234	8488	7363	1125	5129	21.9%
B-10	4		2252	8240	7149	1091	4897	22.3%
B-10	5		1469	8801	7874	927	6405	14.5%
B-10	6		2274	5865	5388	477	3114	15.3%
B-11	1		2237	6967	5912	1055	3675	28.7%
B-11	2		1451	5897	4956	941	3505	26.8%
B-11	3		2298	8521	7302	1219	5004	24.4%
B-11	4		1560	8541	7141	1400	5581	25.1%
B-11	5		2251	7446	6687	759	4436	17.1%
B-11	6		1544	4733	4292	441	2748	16.0%
B-11	7		2199	6387	5951	436	3752	11.6%
B-12	1		2290	5100	4601	499	2311	21.6%
B-12	2		2295	8508	7583	925	5288	17.5%
B-12	3		2235	7167	6458	709	4223	16.8%
B-12	4		2260	7216	6497	719	4237	17.0%
B-12	5		2268	7573	6951	622	4683	13.3%
B-12	6		2277	6268	5866	402	3589	11.2%
B-13	1		1567	6822	5604	1218	4037	30.2%
B-13	2		2276	8446	7234	1212	4958	24.4%
B-13	3		1585	7903	6611	1292	5026	25.7%
B-13	4		1570	6686	5952	734	4382	16.8%
B-14	1		2267	7670	6766	904	4499	20.1%
B-14	2		2245	7676	6762	914	4517	20.2%
B-14	3		2256	7185	6337	848	4081	20.8%
B-14	4		1570	6678	5850	828	4280	19.3%
B-14	5		2254	6538	5921	617	3667	16.8%

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Water Content Determination

Project: Pryor
Location: Lee's Summit
Project #: 18-5125
Date: 13 June 2018

Test Performed By: AB
Checked By: PD

Boring	Sample	Can #	Wt. of Can	Wt can+wet	Wt can+dry	Wt water	Wt dry	M/C (%)
B-14	6		1486	5064	4714	350	3228	10.8%
B-15	1		2286	6056	5232	824	2946	28.0%
B-15	2		2222	5419	4755	664	2533	26.2%
B-15	3		2291	7149	6195	954	3904	24.4%
B-15	4		2243	5311	4684	627	2441	25.7%
B-15	5		2240	6605	6197	408	3957	10.3%
B-15	6		2236	4538	4323	215	2087	10.3%
B-16	1		2285	6554	5521	1033	3236	31.9%
B-16	2		1468	6893	5916	977	4448	22.0%
B-16	3		2290	8010	7156	854	4866	17.6%
B-16	4		2243	7050	6396	654	4153	15.7%
B-16	5		2297	5601	5225	376	2928	12.8%
B-16	6		2242	6320	5879	441	3637	12.1%
B-17	1		1566	4373	3871	502	2305	21.8%
B-17	2		2272	6801	5965	836	3693	22.6%
B-17	3		1450	6608	5497	1111	4047	27.5%
B-18	1		2278	5712	5098	614	2820	21.8%
B-18	2		2243	7668	6732	936	4489	20.9%
B-18	3		2267	5843	5658	185	3391	5.5%
B-18	4		2275	5526	5170	356	2895	12.3%
B-19	1		1584	5970	5188	782	3604	21.7%
B-19	2		2252	5907	5246	661	2994	22.1%
B-19	3		2258	5898	5331	567	3073	18.5%
B-20	1		2273	6377	5505	872	3232	27.0%
B-20	2		2249	5918	5137	781	2888	27.0%
B-20	3		2234	8579	7549	1030	5315	19.4%
B-20	4		2248	7031	6295	736	4047	18.2%
B-21	1		2277	7455	6441	1014	4164	24.4%
B-21	2		2260	9395	8071	1324	5811	22.8%
B-21	3		2262	7007	6193	814	3931	20.7%
B-21	4		2269	6543	5527	1016	3258	31.2%
B-21	5		1467	4809	4349	460	2882	16.0%
B-21	6		1569	3955	3627	328	2058	15.9%
B-21	7		2250	5675	5333	342	3083	11.1%
B-22	1		2232	6377	5505	872	3273	26.6%
B-22	2		2287	5918	5137	781	2850	27.4%
B-22	3		2220	8579	7549	1030	5329	19.3%
B-22	4		2271	6968	6102	866	3831	22.6%

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Water Content Determination

Project: Pryor
Location: Lee's Summit
Project #: 18-5125
Date: 13 June 2018

Test Performed By: AB
Checked By: PD

Boring	Sample	Can #	Wt. of Can	Wt can+wet	Wt can+dry	Wt water	Wt dry	M/C (%)
B-22	5		2287	7031	6295	736	4008	18.4%
B-23	1		2241	6517	5807	710	3566	19.9%
B-23	2		2255	6987	6303	684	4048	16.9%
B-23	3		1559	5151	4776	375	3217	11.7%
B-23	4		2222	5601	5232	369	3010	12.3%
B-23	5		2256	4583	4430	153	2174	7.0%
B-24	1		2249	7788	7031	757	4782	15.8%
B-24	2		2272	6960	6425	535	4153	12.9%
B-25	1		1573	5691	4855	836	3282	25.5%
B-25	1		2271	4852	4408	444	2137	20.8%
B-25	2		2289	5012	4558	454	2269	20.0%
B-25	3		2271	6257	5787	470	3516	13.4%
B-25	4		1621	6198	5757	441	4136	10.7%
B-25	5		1544	4723	4502	221	2958	7.5%
B-25	6		2282	6111	5723	388	3441	11.3%
B-26	1		2276	6826	6018	808	3742	21.6%
B-26	2		2243	6910	6262	648	4019	16.1%
B-27	1		2293	4952	4437	515	2144	24.0%
B-27	2		2295	5512	4796	716	2501	28.6%
B-27	3		2277	5262	4726	536	2449	21.9%
B-27	4		2289	5251	4806	445	2517	17.7%
B-27	5		2243	5767	5309	458	3066	14.9%
B-28	1		2277	4806	4309	497	2032	24.5%
B-28	2		1455	4437	3820	617	2365	26.1%
B-28	3		2247	7167	6148	1019	3901	26.1%
B-28	4		2291	5372	4774	598	2483	24.1%
B-28	5		1622	5199	4713	486	3091	15.7%
B-28	6		2254	6142	5594	548	3340	16.4%
B-29	1		2292	4798	4372	426	2080	20.5%
B-29	2		2272	6165	5325	840	3053	27.5%
B-29	3		2273	7030	6231	799	3958	20.2%
B-29	4		2285	5558	4953	605	2668	22.7%
B-30	1		1653	5116	4424	692	2771	25.0%
B-30	2		2282	8541	7349	1192	5067	23.5%
B-30	3		2235	7112	6129	983	3894	25.2%
B-30	4		2258	5828	4956	872	2698	32.3%
B-31	1					0	0	
B-32	1		2220	7667	6753	914	4533	20.2%

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Water Content Determination

Project: Pryor
Location: Lee's Summit
Project #: 18-5125
Date: 13 June 2018

Test Performed By: AB
Checked By: PD

Boring	Sample	Can #	Wt. of Can	Wt can+wet	Wt can+dry	Wt water	Wt dry	M/C (%)
B-32	2		2244	6422	5870	552	3626	15.2%
B-32	3		2236	8437	7682	755	5446	13.9%
B-32	4		2286	7268	6783	485	4497	10.8%

Appendix D: Fly Ash, Lime and Cement Specifications

GUIDELINE FOR FLY ASH OR CEMENT STABILIZATION

Fly ash or cement stabilized soils should not be constructed without the presence of the geotechnical engineer's designated representative.

MATERIALS. The fly ash material used in stabilization should meet the physical characteristics of ASTM D 5239 6.4, with a minimum compressive strength of 500 psi at 7-days. The fly ash material should meet the chemical requirements of ASTM C 618, Class C. The source material should be identified and approved by the geotechnical engineer prior to delivery to the site.

Fly ash should be kept free from moisture prior to use. Fly ash stored on the project site should be placed in weatherproof bins or buildings with adequate protection from ground dampness.

CONSTRUCTION. The fly ash stabilized soil should be constructed as described herein. The fly ash should be spread uniformly across the prepared soil surface at the full application rate by using an agricultural seed or fly ash spreader or other equipment acceptable to the geotechnical engineer's designated representative.

Fly ash stabilized material should be placed in approximately horizontal layers not to exceed 12 inches in uncompacted thickness.

Subgrade Preparation. Prior to the beginning of fly ash treatment, the Contractor should construct the subgrade to an elevation that will provide a subgrade surface conforming to the contract documents upon completion of the fly ash treatment.

The fly ash should be spread with an approved spreader and added as a percentage by weight. The amount of fly ash should be approved by the geotechnical engineer and be based on laboratory testing with the soil materials.

If moisture content of the soil exceeds the specified limits, additional fly ash may be added to lower the moisture content. Lowering moisture contents by aeration after the application of fly ash should not be permitted.

Fly ash should be spread only on those areas where mixing operations can be completed during the same working day.

Weather Conditions. *Fly ash should not be applied when the atmospheric temperature is less than 40°F.*

When the temperature is predicted to drop below 40°F after completion of the fly ash treatment, the treated areas should be protected against freezing by a sufficient covering of straw, or by other approved methods, until the course has cured. Any areas of completed base course that are damaged by freezing, rainfall, or other weather conditions should be repaired by the contractor.

GUIDELINE FOR FLY ASH OR CEMENT STABILIZATION

No fly ash should be applied to soils that are frozen or contain frost, or when the underlying material is frozen. If the temperature falls below 40°F, completed fly ash-treated areas should be protected against the detrimental effects of freezing.

The fly ash should be distributed at a uniform rate and in such a manner to prevent the scattering of fly ash by wind. Fly ash should not be added when wind or weather conditions are not favorable in the opinion of the geotechnical engineer's designated representative. A motor grader should not be used to spread the fly ash.

Mixing. Mixing should begin within 1 hour of distribution of the fly ash. The fly ash, soil, and required water should be thoroughly mixed, blended, and pulverized by approved road mixers or by a depth-controlled rotary tiller. Except as provided hereinafter, the Contractor should continue mixing and applying water until all material will pass a 1-inch screen. Scarifying and mixing should be controlled to provide uniform depth within 0.1 ft of the depth specified. If, in the opinion of the geotechnical engineer's designated representative the material was mixed to a depth greater than indicated on the drawing or as specified herein, additional fly ash should be added to achieve the desired application rate. If in the opinion of the geotechnical engineer's designated representative, the material was mixed to a depth less than indicated on the drawing or specified, the material should be remixed.

Moisture content of the mixture should be determined in preparation for final mixing. Moisture in the mixture following final mixing should not be less than the water content determined to be optimum based on dry weight of soil and should not exceed the optimum water content by more than 5 percentage points. Water may be added in increments as large as the equipment will permit; however, such increment of water should be partially incorporated in the mix to avoid concentration of water near the surface. After the last increment of water has been added, mixing should be continued until the water is uniformly distributed throughout the full depth of the mixture, including satisfactory moisture distribution along the edges of the section.

Compaction. Compaction should begin within 2 hours of the start of mixing. The fly ash stabilized subgrade should be compacted in accordance with the requirements for controlled fill. The compaction should be a minimum of 95% of the maximum density in accordance with ASTM D698 and within –2% to +3% of the optimum moisture content of the fly ash-stabilized soil.

The compaction should be achieved using a vibratory pad-foot roller or other equipment approved by the geotechnical engineer's representative.

Protection and Curing. The Contractor should protect the finished treated subgrade from rapid drying, for 3 days, by sprinkling with water as often as is necessary to prevent drying of the surface of the fly ash-treated subgrade, or by application of the overlying base course. The Contractor should not allow any vehicles or operations that will distort the surface to the extent that proper curing will be affected on the treated subgrade during the curing period.

GUIDELINE FOR IN-PLACE LIME STABILIZATION
Reference: Standard Specification and Construction Manual – KDOT 2015

Lime stabilized soils should not be constructed without the presence of the geotechnical engineer's designated representative.

MATERIALS. The lime material used in stabilization should meet the chemical and physical characteristics of ASTM C977. Hydrated lime should be kept free from moisture prior to use. Lime stored on the project should be placed in weatherproof bins or buildings with adequate protection from ground dampness.

CONSTRUCTION. The lime stabilized soil should be constructed as described herein. The lime should be spread uniformly across the prepared soil surface at the full application rate by using an agricultural seed or lime spreader or other equipment acceptable to the geotechnical engineer's designated representative.

Lime stabilized material should be placed in approximately horizontal layers not to exceed 8 inches in uncompacted thickness.

Subgrade Preparation. Prior to the beginning of lime treatment, the Contractor should construct the subgrade to an elevation which will provide a subgrade surface conforming to the contract documents upon completion of the lime treatment. The subgrade should be scarified to a minimum depth of 4 inches and a maximum depth of approximately 1 inch less than the specified depth of lime treatment. Positive depth control equipment should be used to scarify the subgrade, do not use plow or disc. Proper drainage should be maintained at all times.

Lime should be spread only on those areas where mixing operations can be completed during the same working day. Mixing and spreading should not be performed during freezing temperatures. When the temperature is below 40 degrees F, the completed base course should be protected against freezing by a sufficient covering of straw, or by other approved methods, until the course has dried out. Any areas of completed base course that are damaged by freezing, rainfall, or other weather conditions should be repaired by the contractor. Lime should not be applied when the atmospheric temperature is less than 40 degrees F. No lime should be applied to soils that are frozen or contain frost, or when the underlying material is frozen. If the temperature falls below 35 degrees F, completed lime-treated areas should be protected against any detrimental effects of freezing.

The lime should be spread with an approved spreader and added as a percentage by weight. Apply hydrated lime to scaridfied areas as a slurry. The application and mixing of the hydrated lime slurry shall result in a uniform lime concentration. The amount of lime should be approved by the geotechnical engineer and based on laboratory testing with the soil materials.

The lime should be distributed at a uniform rate and in such a manner to prevent the scattering of lime by wind. If the application rate is not shown in contractor documents, assume a rate of 5% of the weight of soil. Lime should not be added when wind or

weather conditions are not favorable in the opinion of the geotechnical engineer's designated representative. A motor grader should not be used to spread the lime.

Preliminary Mixing. The lime, material, and required water should be thoroughly mixed, blended, and pulverized by approved road mixers or by a depth-controlled rotary tiller. Except as provided hereinafter, the Contractor should continue mixing and applying water until 95% of the material passes a 2-inch screen as determined by the geotechnical engineer. Scarifying and mixing should be controlled to provide uniform depth within 0.1 ft of the depth specified. If, in the opinion of the geotechnical engineer's designated representative the material was mixed to a depth greater than indicated on the drawing or as specified herein, additional lime should be added to achieve the desired application rate. If in the opinion of the geotechnical engineer's designated representative, the material was mixed to a depth less than indicated on the drawing or specified, the material should be remixed.

Moisture content of the mixture should be determined in preparation for final mixing. Moisture in the mixture following final mixing should not be less than the water content determined to be optimum based on dry weight of soil and should not exceed the optimum water content by more than 5 percentage points. Water may be added in increments as large as the equipment will permit; however, such increment of water should be partially incorporated in the mix to avoid concentration of water near the surface. After the last increment of water has been added, mixing should be continued until the water is uniformly distributed throughout the full depth of the mixture, including satisfactory moisture distribution along the edges of the section. A minimum of 2 passes should be performed with the mixer traveling in the primary direction.

Aging. Seal the mixture to prevent moisture loss by lightly rolling with a pneumatic-tired roller and blade the surface to shed water. Maintain the mixture in the sealed condition for a minimum of 24 hours prior to final misxing. Keep the surface moist by spraying water. If the final mixing is not completed with 14 days of preliminary mixing, add 1% lime by weight of raw soil in the final mixing operation.

Final Mixing. After initial mixing and ageing a minimum of 24 hours, the mixture should be re-mixed to the specified depth until 95% of the mixture passes the 1 ½ inch sieve and 40% passes the No. 4 sieve as determined by the geotechnical engineer. To breakdown particle size periodic mixing is allowed over an interval of time. Bring the mixture moisture content required for compaction with a minimum of 3% above optimum of the proctor density of the lime treated soil.

Compaction. The lime stabilized subgrade should be compacted in accordance with the requirements for controlled fill. The compaction should be a minimum of 95% of the maximum density in accordance with ASTM D698 and a moisture content with a minimum of +3% of the optimum moisture content of the lime-stabilized soil.

Protection and Curing. The Contractor should protect the finished treated subgrade from rapid drying, for 7 days, by sprinkling with water as often as is necessary to

prevent drying of the surface of the lime-treated subgrade. When an overlying base course is to be constructed the engineer may reduce the curing period to when the lime treated subgrade gains sufficient strength to support the construction and hauling equipment. Alternatively, an asphalt prime coat may be applied instead of keeping the finishe surface moist. If the asphalt prime coat is used, SS-1, CSS-1 or MC-250 should be applied at a rate of 0.22 gallons per square yard to achieve a minimum of 0.13 gallons per square yard residue. The use of a liquid membrane forming compound is also an acceptable curing medium. Multiple light applications may be required to obtain the specified rate of application without run-off.

The Contractor should not allow any vehicles or operations which will distort the surface to the extent that proper curing will be affected on the treated subgrade during the curing period.

GUIDELINE FOR CEMENT STABILIZATION

Cement stabilized soils should not be constructed without the presence of the J H R W H F K Q L F D O H Q J L Q H H U ¶ V G H V L J Q D W H G U H S U H V H Q W D W L

MATERIALS. The material used in stabilization should meet the chemical and physical characteristics of Type I cement ASTM C150. Cement should be kept free from moisture prior to use. Cement stored on the project should be placed in weatherproof bins or buildings with adequate protection from ground dampness.

CONSTRUCTION. The cement stabilized soil should be constructed as described herein. The cement should be spread uniformly across the prepared soil surface at the full application rate by using an agricultural seed spreader, mechanical bulk cement V S U H D G H U R U R W K H U H T X L S P H Q W D F F H S W D E O H W R W K H J I representative.

Cement stabilized material should be placed in approximately horizontal layers not to exceed 8 inches in uncompacted thickness.

Subgrade Preparation. Prior to the beginning of cement treatment, the Contractor should construct the subgrade to an elevation which will provide a subgrade surface conforming to the contract documents upon completion of the cement treatment.

The clay soils should be scarified and pulverized prior to application of the cement. A disc should be used to break up the surface of the material to be stabilized. The mixer or tiller should be used for the full depth of stabilization to break up the clay.

Application. Cement should be spread only on those areas where mixing operations can be completed during the same working day. Mixing and spreading should not be performed during freezing temperatures. When the temperature is below 40 degrees F, the completed stabilized fill should be protected against freezing by a sufficient covering of straw, or by other approved methods. Any areas of completed stabilized subgrade course that are damaged by freezing, rainfall, or other weather conditions should be repaired by the contractor.

The cement should be applied with an approved spreader at an application rate that has been established by the geotechnical engineer, based on laboratory tests with the site soils.

The cement should be distributed at a uniform rate and in such a manner to prevent the scattering of cement by wind. Cement should not be added when wind or weather F R Q G L W L R Q V D U H Q R W I D Y R U D E O H L Q W K H R S L Q L R Q R I W K representative. A motor grader should not be used to spread the cement.

Mixing. The cement, material, and required water should be thoroughly mixed, blended, and pulverized by approved road mixers or by a depth-controlled rotary tiller. Except as provided hereinafter, the Contractor should continue mixing and drying the

soil until all material will pass a 1-inch screen. Scarifying and mixing should be controlled to provide uniform depth within 0.1 ft of the depth specified. If, in the opinion of the engineer, the depth greater than indicated on the drawing or as specified herein, additional cement should be added to achieve the desired application rate. If in the opinion of the engineer, the depth less than indicated on the drawing or specified, the material should be remixed.

Moisture content of the mixture should be determined in preparation for final mixing. Moisture in the mixture following final mixing should not be less than the water content determined to be optimum based on dry weight of soil and should not exceed the optimum water content by more than 5 percentage points. Water may be added in increments as large as the equipment will permit; however, such increment of water should be partially incorporated in the mix to avoid concentration of water near the surface. After the last increment of water has been added, mixing should be continued until the water is uniformly distributed throughout the full depth of the mixture, including satisfactory moisture distribution along the edges of the section.

Compaction. The cement stabilized subgrade should be compacted in accordance with the requirements for controlled fill. The compaction should be a minimum of 95% of the maximum density in accordance with ASTM D698 and within +0% to +5% of the optimum moisture content of the cement-stabilized soil.

Not more than 60 minutes should elapse between the time of final mixing and the beginning of compaction.

Protection and Curing. The Contractor should protect the finished treated subgrade from rapid drying, for 7 days, by sprinkling with water as often as is necessary to prevent drying of the surface of the cement-treated subgrade, or by application of the overlying base course. The Contractor should not allow any vehicles or operations which will distort the surface onto the treated surface during the curing period.