ARKANSAS DEPARTMENT OF TRANSPORTATION

# SUBSURFACE INVESTIGATION

**STATE JOB NO.** 090580

**FEDERAL AID PROJECT NO.** STATE JOB

ARKANSAS WELCOME CENTER (I-49) (S)

**STATE HIGHWAY** I-49 **SECTION** 29

**IN** BENTON **COUNTY**

The information contained herein was obtained by the Department for design and estimating purposes only. It is being furnished with the express understanding that said information does not constitute a part of the Proposal or Contract and represents only the best knowledge of the Department as to the location, character and depth of the materials encountered. The information is only included and made available so that bidders may have access to subsurface information obtained by the Department and is not intended to be a substitute for personal investigation, interpretation and judgment of the bidder. The bidder should be cognizant of the possibility that conditions affecting the cost and/or quantities of work to be performed may differ from those indicated herein.

Grubbs, Hoskyn, Barton & Wyatt, INC.
CONSULTING ENGINEERS

P.O. Box 30970
Little Rock, Arkansas 72260-0970
# I Trigon Place 72209
(501) 455-2536
FAX (501) 455-4137

December 3, 2022
Job No. 22-003

Garver LLC
4701 Northshore Drive
North Little Rock, Arkansas 72118

Attn: Mr. John Ramsey, AIA
Senior Architect

# RESULTS of GEOTECHNICAL INVESTIGATION
# ARDOT 090580 WELCOME CENTER
# BENTON COUNTY, ARKANSAS

## INTRODUCTION

This report provides the results of the geotechnical investigation performed for the new ARDOT 090580 Welcome Center planned in Benton County, Arkansas. These services were authorized by Mr. John Ramsey on August 5, 2022. This study has been performed in general accordance with our proposal of October 26, 2021.

We understand that the project includes a single-story Welcome Center, a maintenance shed, pavilions, and light poles. It is expected that the structural loads of the buildings will be very light to light. Associated parking areas and drives are also planned. Finish floor of the Welcome Center is planned at El 1328.67. Site grading is expected to be minor, with cuts and fills of up to 2 ft anticipated.

The purposes of this study were to explore subsurface conditions at the Welcome Center site and to develop recommendations to guide design and construction of foundations and pavements. The results of the field and laboratory studies are discussed in the following report sections. Subsequent report sections provide recommendations for design and construction.

## SUBSURFACE EXPLORATION

The site is currently wooded and not accessible to conventional drilling equipment. Consequently, subsurface conditions at the Welcome Center project site were explored by excavating six (6) test pits from 3.5- to 6-ft depth. The test pit locations were selected to explore subsurface conditions at representative spots around the site. The site vicinity is shown on Plate 1. The approximate test pit locations are shown on the Plan of Test Pits, Plate 2. Test pit logs, presenting descriptions of the subsurface strata encountered and results of field and laboratory tests, are included as Plates 3 through 8. The approximate ground surface elevation, as inferred from the layout and topographic information provided by the Engineer, is also shown on the logs. It must be recognized that the elevations shown are approximate and actual elevations may vary. A key to the terms and symbols used on the logs is presented as Plate 9.

The test pits were excavated with a track-mounted Bobcat E42 mini-excavator equipped with a 2-ft-wide bucket and rock teeth. The test pits were excavated to practical refusal at depths of 3.5 to 6 feet. Representative samples were obtained from test pit side walls or excavation spoil. Undrained soil shear strength (cohesion) was estimated using a calibrated hand penetrometer on test pit side walls or intact pieces of excavation spoil. Estimated shear strength values are plotted on the logs, in tons per sq ft, as circles enclosing an "x".

All samples were removed from sampling tools in the field and visually classified by the field geologist. Samples were then placed in appropriate containers to prevent moisture loss and/or change in condition during transfer to our laboratory for further examination and testing.

Observations regarding groundwater were also obtained during test pit excavation. These observations are noted in the lower-right portion of each log and are discussed in subsequent sections of this report. All test pits were backfilled after obtaining final groundwater readings.

## LABORATORY TESTING

To evaluate pertinent physical and engineering characteristics of the foundation and subgrade soils, laboratory tests consisting of natural water content determinations and classification tests were performed on selected representative soil samples. A total of 14 natural water content determinations were performed to develop a water content profile for each test pit. The results of these tests are plotted on the logs as solid circles, in accordance with the scale and symbols shown in the legend located in the upper-right corner.

To verify field classification and to evaluate soil plasticity, seven (7) liquid and plastic (Atterberg) limit determinations and seven (7) sieve analyses were performed on selected representative samples. The Atterberg limits are plotted on the logs as small pluses inter-connected with a dashed line using the water content scale. The percent of soil passing the No. 200 Sieve is noted in the "Minus No. 200" column on the log forms. Classification test results, as well as soil classification by the Unified Soil Classification System and AASHTO Classification System, are summarized in Appendix A. Grain-size distribution curves are also included in Appendix A.

The moisture-density relationship of the on-site soils was evaluated by performing a Standard Proctor (AASHTO T 99) compaction test on a composite sample. Results of the compaction test are provided graphically in Appendix A.

## GENERAL SITE and SUBSURFACE CONDITIONS

### Site Conditions

The project site is located on an undeveloped tract at the northwest corner of the intersection of Interstate 49 and Highway 72 in Benton County, Arkansas. The site is bordered on the west by N.W. Pleasant Road, Highway 72 on the south, and Interstate 49 on the east and north. The future Welcome Center site is presently thickly wooded with mature trees and thick underbrush. Numerous chert fragments are scattered over the ground surface. The site terrain falls gently from the south to the northwest. Surface drainage is considered fair.

### Site Geology

The project site is located in the mapped exposure of the Boone Formation. The early and middle Mississippian Period Boone consists of fine- to coarse-grained limestone interbedded with chert. The chert content can vary widely, both horizontally and vertically, and limestone or chert may be predominant. The Boone Formation is known for dissolutional features such as sinkholes, caves, and enlarged fissures. Typically, the limestone/cherty limestone units of the Boone decompose (weather) to erratic blends of chert fragments and clay/silty clay. The residual soil mantle may extend to significant depths on higher terrain and may contain hard chert seams and/or layers. The thickness of the Boone Formation is reported to be 300- to 350-ft thick in northern Arkansas. The Boone is generally disconformable to the underlying Chattanooga Shale and St. Joe Limestone member, with some areas having a conformable contact.

### Seismic Conditions

The Benton County, Arkansas site is located in Seismic Zone 1, defined by the Arkansas Building Authority (2005) as the zone of least seismic potential. Based on the results of the test pits, the local geology, and our experience in the area, a Seismic Site Class C (very dense soil and soft rock profile) is considered suitable for the site in accordance with the criteria of IBC 2012. The liquefaction potential is considered negligible for the predominantly cohesive overburden soils and the weathered chert and limestone encountered in the test pits.

### Subsurface Conditions

Based on the results of the test pits, the overburden soils are variable units of dense tan silt and stiff to very stiff reddish tan, tan, gray, and reddish brown cherty clay and cherty, silty clay, extending to depths of 3.5 to 6.0 ft, with an average overburden depth of approximately 4 feet. The overburden clay and silty clay soils contain fine sand, numerous chert fragments and chert and limestone cobbles. Soft to firm dark brown clayey silt with chert fragments and organics is locally present at the surface, extending to about 6 inches. The clay and silty clay overburden soils have low to medium plasticity with moderate shear strength and low compressibility. The dense silt exhibits medium relative density and low compressibility at present soil water contents. However, the silt is moderately to highly moisture sensitive and will have significantly reduced strength when saturated and/or disturbed.

The overburden soils below about 3.5- to 6-ft depth are underlain by cherty limestone with discontinuous weathered chert seams and layers. Excavator refusal was encountered in this stratum between 3.5- to 6-ft depth. The weathered rock units typically have high shear strength and low compressibility.

Groundwater was not encountered within the exploration depths of the test pits in September 2022. Shallow perched groundwater could be present in the silty near-surface soils or fractured rock zones during wet seasons of the year. Shallow perched water, as well as the potential for seasonal seeps and springs, are particularly likely to develop during wet seasons as infiltrated surface water migrates downgradient from the areas of higher terrain to the south. Groundwater levels will vary with seasonal precipitation and surface runoff and infiltration.

## ANALYSES and RECOMMENDATIONS

### Foundation Design

Foundations for the welcome center buildings must satisfy two (2) basic and independent design criteria. First, the maximum bearing pressure must not exceed the allowable bearing pressure based on an adequate factor of safety with respect to shear strength. Secondly, foundation movements resulting from consolidation, shrinking, or swelling of the supporting soils must be within tolerable limits for the structure. Construction factors such as foundation construction, excavation procedures, and surface and groundwater conditions must also be considered.

Based on the subsurface conditions encountered in the test pits, we recommend that the foundation loads of the new welcome center and maintenance building be supported on shallow footings. The pavilions and light poles may be supported on shallow footings or mats. Recommendations for shallow foundation systems and floor slabs are discussed in the following report sections.

### Footing or Mat Foundation System

Foundation loads of the new welcome center and maintenance building may be supported on continuous or individual footings founded in the stiff to very stiff tan and reddish brown silty clay or clay with chert, the dense tan silt, the weathered chart or limestone, or compacted select fill at a minimum depth of 2 ft below final grade. Continuous footings founded as recommended may be sized based on maximum net allowable soil bearing pressures of 2000 lbs per sq ft for continuous footings and 2500 lbs per sq ft for individual footings. The allowable bearing values include a minimum factor of safety of 2.5. Long-term post-construction settlement of footings supported as recommended should be less than 1.0 inch.

The lightly loaded pavilions and light fixtures may be supported on continuous or individual footings or mats founded in the natural stiff to very stiff silty clay or compacted select fill at a minimum depth of 2 ft below final grade. For footings or a rigid mat founded in the natural stiff silty clay or engineered fill, a maximum net allowable bearing pressure of 2000 lbs per sq ft is recommended. Long-term post-construction settlement of a mat foundation supported as recommended should be less than 1.0 inch. For a properly-prepared mat bearing stratum of the stiff silty clay or compacted select fill, a modulus of subgrade reaction (k) value of 100 lbs per sq in. per in. may be utilized for design of the rigid mat.

Uplift resistance of footings or mats will be provided by the weight of the structure and the foundation units. Resistance to lateral forces will be developed by the passive resistance of the foundation soils and sliding resistance at the foundation bottom. The passive resistance of the soil within the upper 2 ft should be neglected. Below 2-ft depth, an ultimate passive resistance value of 350 lbs per sq ft may be assumed for the stable on-site soils and compacted select fill. Resistance to sliding may also be evaluated using an ultimate friction value (tan $\delta$) of 0.33 for concrete on the recommended bearing strata. An appropriate factor of safety must be included in analysis of sliding.

Continuous footings should have a minimum width of 18 in. and individual footings a minimum dimension of 24 inches. A minimum foundation depth of 2 ft below lowest adjacent grade is recommended. All foundation excavations should be observed by the Geotechnical Engineer to verify suitable bearing.

Floor Slabs

Slab-on-grade construction is recommended for building floor slabs. Where moisture transmission through concrete at-grade slabs is an operational or aesthetic concern, we recommend that at-grade slabs be supported on a 4- to 6-in.-thick, clean crushed stone or gravel layer placed on a properly prepared subgrade. The granular layer should be densified with vibrating equipment prior to placing the floor slab. Impervious sheeting should be placed between the slab and granular course to act as a vapor retarder

Pavements

In light of the results of the test pits and the laboratory tests, the on-site subgrade soils are comprised of dense silt and stiff to very stiff clay and silty clay. The AASHTO classification of the on-site subgrade soils varies from A-2-7, A-4, A-6, and A-7-6. In general, the results of the test pits indicate poor subgrade support. Compacted select fill will provide good subgrade support. Some undercut and/or re-working of the on-site soils is likely to be required to provide suitable subgrade support for new pavements.

For the on-site soils, the recommended subgrade support parameters are summarized below.

| | |
|---|---|
| • CBR value: | 5.6 |
| • Resilient Modulus ($M_R$): | 2900 lbs per sq in. |
| • R value: | 9 |
| • Modulus of Subgrade Reaction (k): | 100 lbs per cu in. |

The pavement subgrade should be prepared in accordance with the recommendations discussed in the Site Grading section of this report. Subgrade soils classifying as A-7-5 or A-7-6 per AASHTO M 145 should be undercut at least 12 in. below the plan subgrade elevation and replaced with select fill. We also recommend that where chert or limestone are encountered at the subgrade elevation these be scarified to at least 8-in. depth and recompacted or undercut and replaced.

Particular attention should be given to maintaining subgrade moisture and density until pavements are constructed. Immediately prior to base construction, the subgrade should be proof-rolled. All weak, unstable or otherwise unsuitable soils should be excavated, processed, and re-compacted or replaced with select fill, whichever is appropriate. Aggregate base should be compacted to a minimum of 98 percent of the AASHTO T 180 maximum dry density as per ARDOT criteria.

The importance of positive surface drainage for acceptable pavement performance cannot be overemphasized. Grades should direct water off paved areas and ditches or storm drains should be used to develop positive flow away from pavements. Periodic maintenance of pavements should include sealing of all joints and cracks to restrict surface water infiltration. Joint spacing for concrete pavements is typically on the order of 10 to 12 ft but should be based on specific design.

### Site Grading

Subgrade preparation and site grading in the building and pavement areas should include necessary clearing and grubbing of trees and underbrush and stripping the organic-containing surface soils. The depth of stripping will be variable, with deeper stripping depths in wooded areas. In general, the stripping depth is estimated to be about 18 to 24 in. or more in areas with thick underbrush and/or trees. The stripping depth in open, non-wooded areas is estimated to be about 6 to 9 inches.

After stripping, and prior to placing any fill, the subgrade should be proof-rolled with a loaded tandem-wheel dump truck or similar equipment. All soft, loose, or otherwise unsuitable soils encountered in the welcome center area should be excavated and replaced with select fill. Depending on seasonal site conditions and final grading plans, localized undercuts on the order of 2 to 3 ft, more or less, could be warranted.

In lieu of undercutting and replacing unsuitable soils, consideration may be given to using additives to improve soil workability and stabilize weak areas. Hydrated lime, quick lime, Portland cement, fly ash, or suitable alternate materials may be used as verified by appropriate testing and approved by the Engineer. Additives can be effective where the depth of unstable soils is relatively shallow. Treatment will be less effective in areas where the zone of unstable soils is deep. The optimum application rate of stabilization additive must be determined by specific laboratory tests performed on the alignment subgrade soils.

Subgrade preparation, including undercuts or stabilization, should extend at least 5 ft outside building limits and 3 ft back of curbs in pavement areas, to the extent possible.

The on-site silty clay with chert fragments and with a maximum plasticity index (PI) of 18 is suitable for use as fill and backfill in building and pavement areas. The on-site cherty silty clay and clay with a maximum of about 35 percent passing the No. 200 sieve but with a PI in excess of 18 is also suitable for select fill and backfill. Imported borrow for fill or backfill should consist of low-plasticity clayey sand (SC), sandy clay (CL), or clayey gravel (GC) with a liquid limit less than 40 and a maximum plasticity PI of 18, or an approved alternate. As with the on-site cherty clay, imported cherty silty clay and clay with a maximum of about 35 percent passing the No. 200 sieve and with a PI in excess of 18 is also suitable for select fill and backfill use. We recommend that soils classifying as A-7-5 or A-7-6 not be utilized within 12 in. of the plan subgrade elevation. Where the subgrade will be treated with quicklime, hydrated lime, or an approved alternate that will reduce the PI to 15 or less, this recommendation may be waived. All fill and backfill should be approved by the Geotechnical Engineer.

Subgrade preparation should generally comply with ARDOT Standard Specifications for Highway Construction, 2014 Edition, Section 212. Recompacted soils, fill, and backfill in building and pavement areas should be compacted to at least 98 percent of the Standard Proctor (AASHTO T 99) maximum dry density within a water content range of 2 percent below to 3 percent above the optimum value. Each lift of fill or backfill should be properly compacted, tested and approved prior to placing subsequent lifts. Density and water content of all earthwork should be maintained until the buildings and pavements are completed.

Fill and backfill should be placed in horizontal, nominal 6- to 8-in.-thick loose lifts. Fills placed against slopes should be benched into the existing slope face as the new fill is constructed. Each lift of backfill and fill should be tested and approved prior to placing subsequent lifts.

## CONSTRUCTION CONSIDERATIONS

Positive surface and subsurface drainage should be established at the start of construction, maintained during the work, and incorporated into final design to prevent surface water ponding and subsequent saturation of subgrade soils. Foundation or subgrade soils that become saturated by ponding water or runoff should be excavated to undisturbed soils.

Shallow groundwater was not encountered in September 2022. However, it is possible that some shallow perched water could be present during construction. Limited seepage into shallow excavations can probably be controlled by ditching or via sump-and-pump methods. If seepage infiltration cannot be controlled, construction of drains and/or the use of stone backfill (i.e., "B" stone or #57 stone) will be warranted. Stone backfill should be fully encapsulated in a geotextile filter fabric complying with the criteria of ARDOT Standard Specifications for Highway Construction, 2014 Edition, Subsection 625.02, Type 5 and vented to positive discharge into storm lines or to daylight.

All foundation excavations and undercuts should be observed by the Geotechnical Engineer to verify suitable bearing. Concrete should be placed in footing excavations expeditiously following final clean up and approval to limit changes in foundation conditions. Footing excavations should be clean and dry at the time of concrete placement. Where footing excavations will be left open for extended periods, the bearing stratum should be protected with a thin layer of seal concrete.

Cherty limestone was encountered between 3.5- to 6-ft depth. While highly weathered limestone can often be excavated with conventional heavy-duty equipment, rock excavation methods are expected to be required for the more competent limestone units at depth. Rock excavation methods could also be required where more resistant discontinuous chert seams and layers are encountered in cuts or trenches. Rock excavation methods such as hoerams, jackhammers, or blasting will be required to advance excavations into the competent weathered limestone and hard chert zones. Narrow excavations could be particularly difficult to advance.

We recommend that Contract Documents include an allowance for rock excavation for materials that cannot be removed by a Caterpillar 312 track excavator equipped with rock teeth, a Caterpillar D-7 bulldozer with single tooth ripper, or equipment of similar power and capability. Rock excavation quantities should be verified by the Engineer. If excavation is to be unclassified, the Contractor must be responsible for assessing rock excavation requirements.

## CLOSURE

The Engineer or a designated representative should monitor site grading, subgrade preparation, and foundation, floor slab, and pavement construction. Subsurface conditions significantly at variance with those encountered in the test pits should be brought to the attention of the Geotechnical Engineer and work delayed pending evaluation and/or preparation of additional recommendations, if warranted.

The following illustrations are attached and complete this submittal.

| | |
|---|---|
| Plate 1 | Site Vicinity |
| Plate 2 | Plan of Test Pits |
| Plates 3 through 8 | Test Pit Logs |
| Plate 9 | Key to Terms and Symbols |
| Appendix A | Laboratory Test Results |

* * * * *

We appreciate the opportunity to be of service to you during this phase of the project. Should you have any questions regarding this report, or if we may be of additional assistance during final design or construction, please call on us.

Sincerely,

**GRUBBS, HOSKYN,**
**BARTON & WYATT, INC.**

Velleta M. Scott, P.E.
Senior Project Engineer

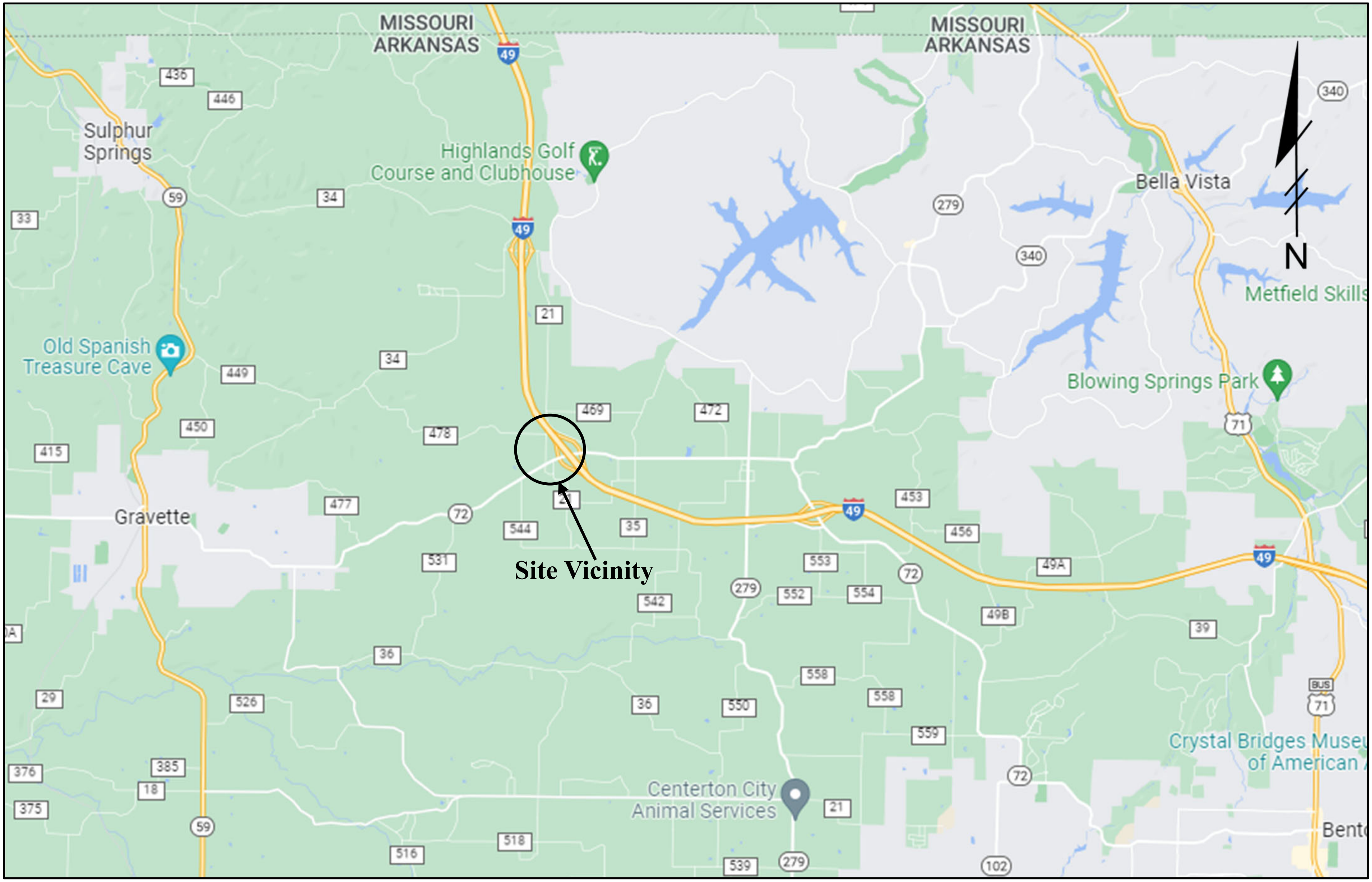
ME Wyatt

Mark E. Wyatt, P.E.
President

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 7791
MARK E. WYATT

VMS/MEW:jw

Copies submitted: Garver LLC
Attn: Mr. John Ramsey, AIA (1-email)
Attn: Mr. Thomas C. Graham II, P.E. (1-email)

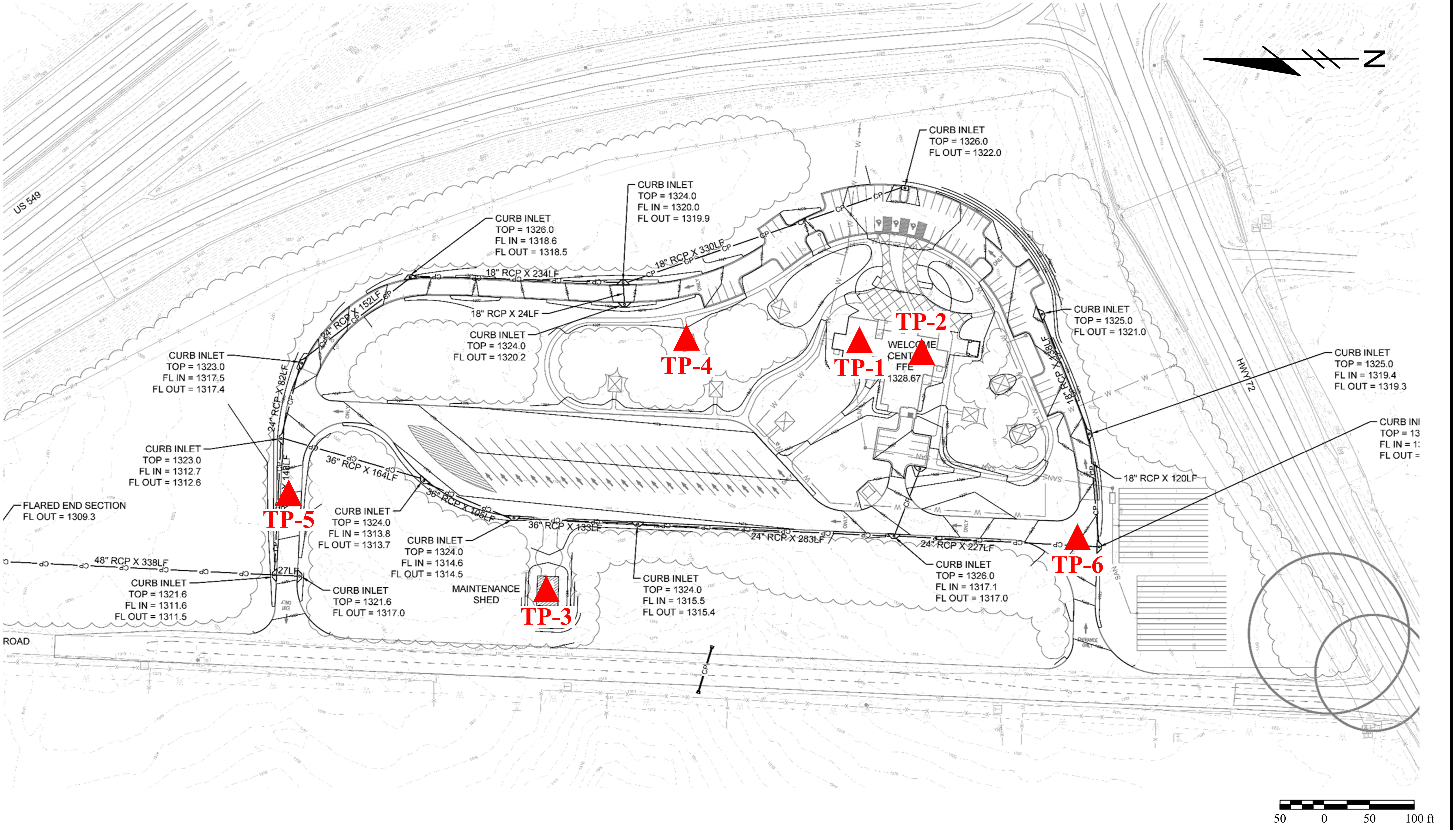


**Grubbs, Hoskyn, Barton & Wyatt, INC.**
CONSULTING ENGINEERS

## SITE VICINITY MAP
ARDOT 090580 Welcome Center
Benton County, Arkansas

**Job No. 22-003**

**Plate 1**



Grubbs, Hoskyn, Barton & Wyatt, INC.
CONSULTING ENGINEERS

# PLAN of TEST PITS
ARDOT 090580 Welcome Center
Benton County, Arkansas

Scale: As shown

Job No. 22-003

PLATE 2

22-003

**Grubbs, Hoskyn, Barton & Wyatt, Inc.**
**Consulting Engineers**

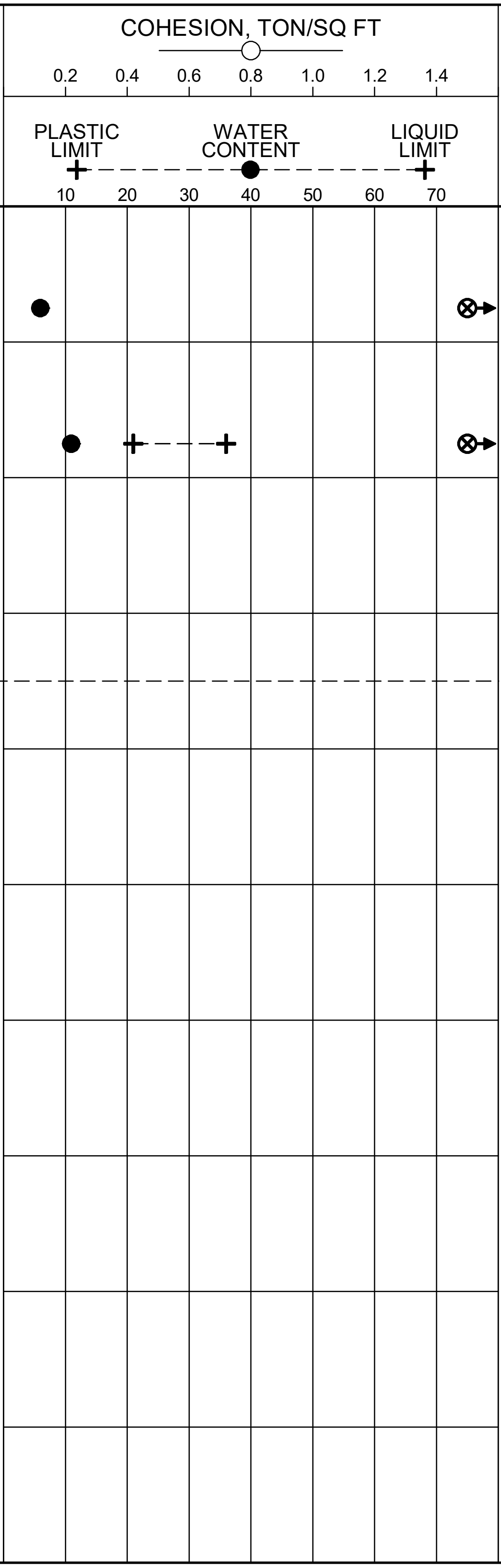
# LOG OF TEST PIT NO. 1

ARDOT 090580 Welcome Center
Benton Co., Arkansas

TYPE: Mini-Excavator

LOCATION: See Plate 2 - Building

| DEPTH, FT | DESCRIPTION OF MATERIAL<br>SURF. EL: 1328± | BLOWS PER FT | UNIT DRY WT LB/CU FT | - No. 200 % |
|---|---|---|---|---|
| 0 | Stiff to very stiff tan silty clay, sandy w/chert fragments and chert and limestone cobbles, dry | | | |
| 1.5 | - reddish brown below 1.5 ft | | | 67 |
| 3.5 | - refusal at 3.5 ft in chert and cherty limestone | | | |



COMPLETION DEPTH: 3.5 ft
DATE: 9-13-22

DEPTH TO WATER
IN TEST PIT: Dry

DATE: 9/13/2022

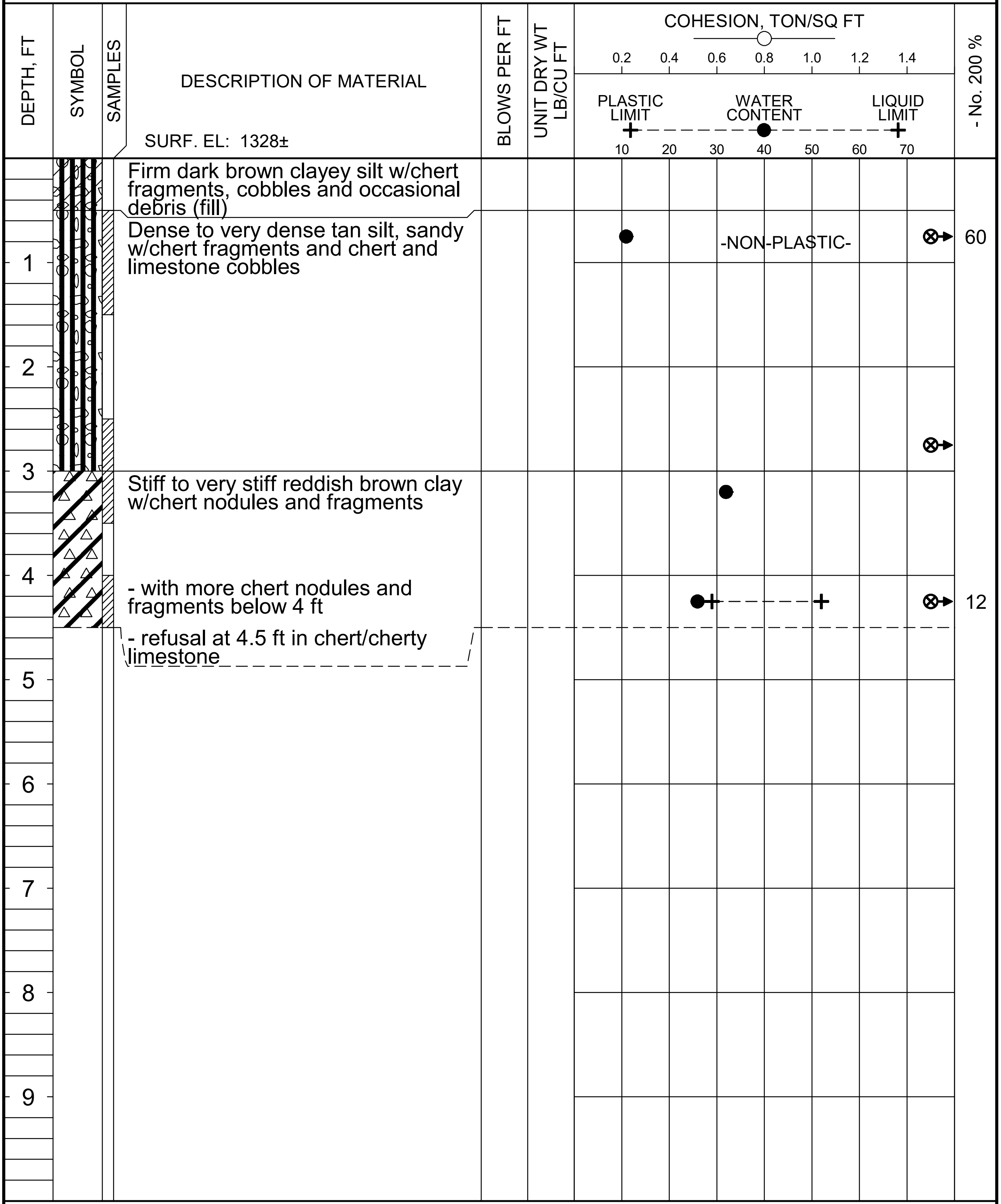
**Grubbs, Hoskyn, Barton & Wyatt, Inc.**
**Consulting Engineers**

# LOG OF TEST PIT NO. 2

ARDOT 090580 Welcome Center
Benton Co., Arkansas

TYPE: Mini-Excavator

LOCATION: See Plate 2 - Building



Firm dark brown clayey silt w/chert fragments, cobbles and occasional debris (fill)

Dense to very dense tan silt, sandy w/chert fragments and chert and limestone cobbles

Stiff to very stiff reddish brown clay w/chert nodules and fragments

- with more chert nodules and fragments below 4 ft

- refusal at 4.5 ft in chert/cherty limestone

COMPLETION DEPTH: 4.5 ft
DATE: 9-13-22

DEPTH TO WATER
IN TEST PIT: Dry

DATE: 9/13/2022

22-003

**Grubbs, Hoskyn, Barton & Wyatt, Inc.**
**Consulting Engineers**

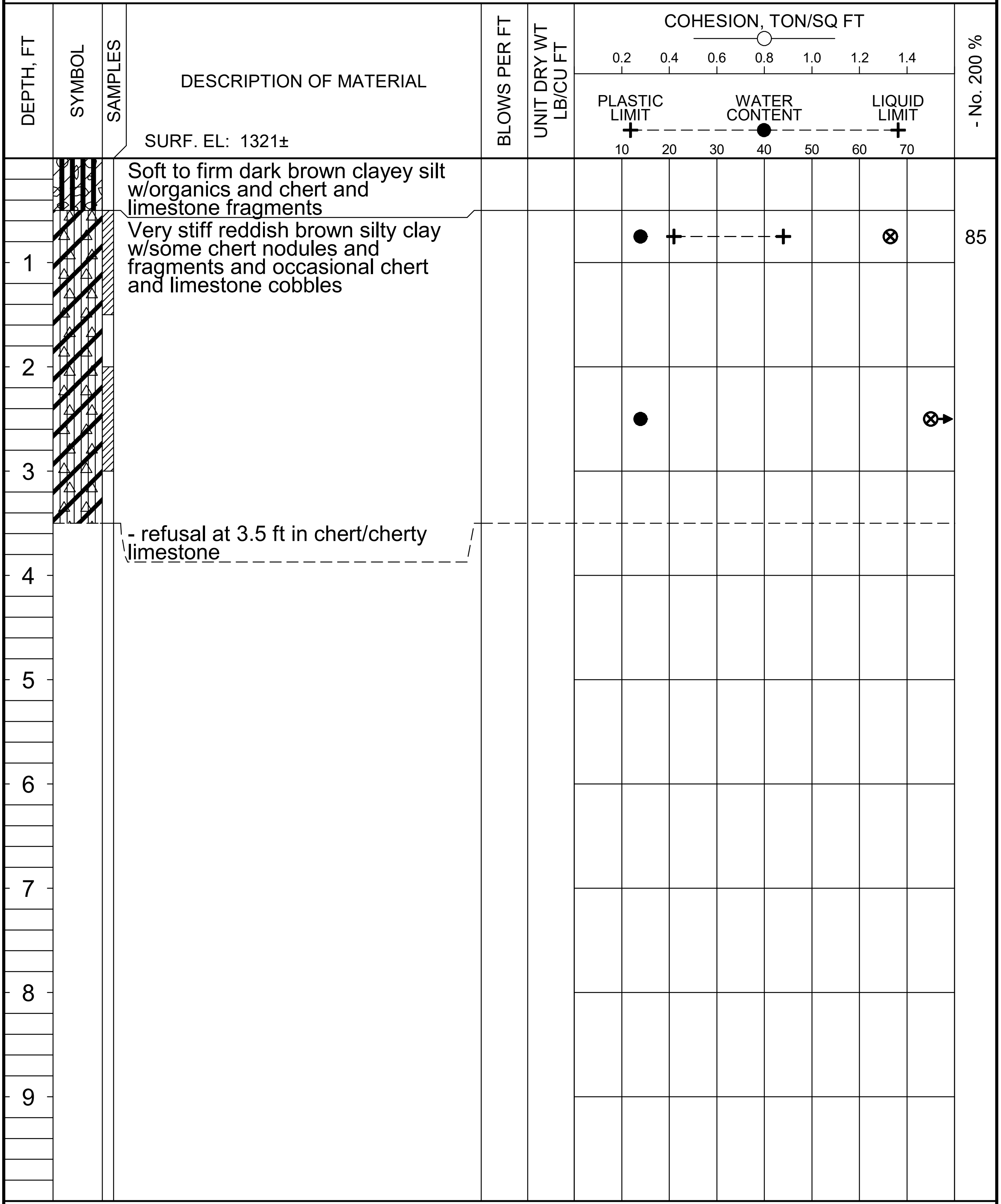
# LOG OF TEST PIT NO. 3

ARDOT 090580 Welcome Center
Benton Co., Arkansas

TYPE: Mini-Excavator

LOCATION: See Plate 2 - Maintenance

SURF. EL: 1321±



Soft to firm dark brown clayey silt w/organics and chert and limestone fragments

Very stiff reddish brown silty clay w/some chert nodules and fragments and occasional chert and limestone cobbles

- refusal at 3.5 ft in chert/cherty limestone

COMPLETION DEPTH: 3.5 ft
DATE: 9-13-22

DEPTH TO WATER
IN TEST PIT: Dry

DATE: 9/13/2022

**Grubbs, Hoskyn, Barton & Wyatt, Inc.**
**Consulting Engineers**

# LOG OF TEST PIT NO. 4

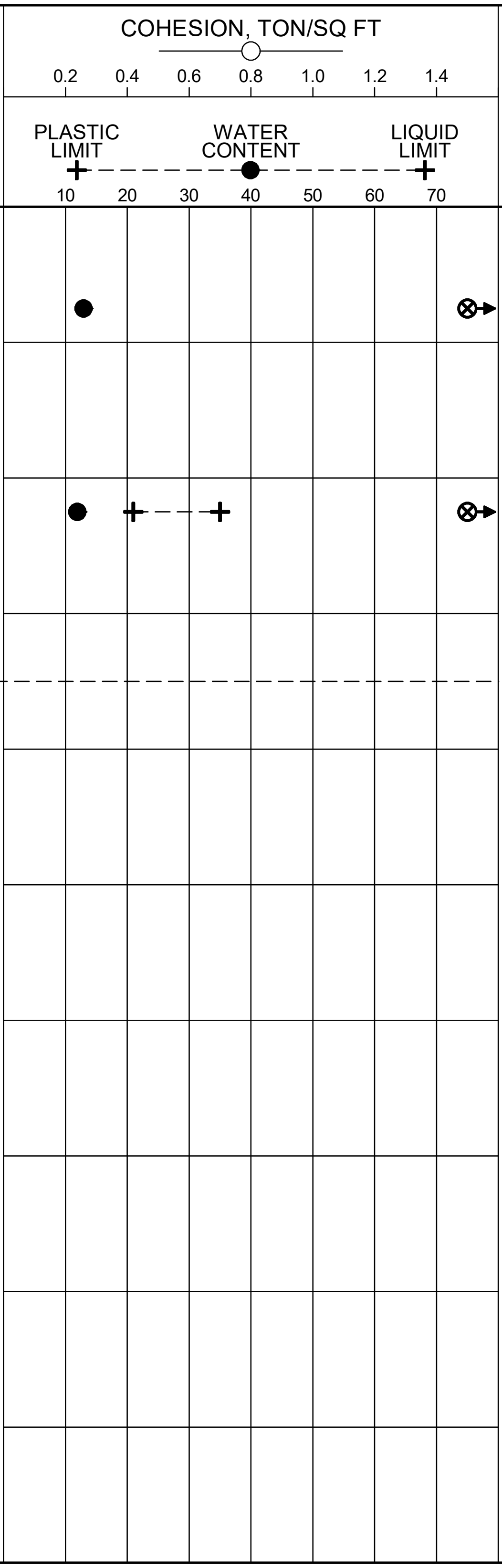
ARDOT 090580 Welcome Center
Benton Co., Arkansas

TYPE: Mini-Excavator

LOCATION: See Plate 2 - Pavilion

SURF. EL: 1327±

| DEPTH, FT | DESCRIPTION OF MATERIAL | BLOWS PER FT | UNIT DRY WT LB/CU FT | - No. 200 % |
|---|---|---|---|---|
| 0 | Stiff to very stiff tan silty clay, sandy w/chert nodules and fragments and limestone and chert cobbles | | | |
| 1.5 | - reddish brown below 1.5 ft | | | 54 |
| 3.5 | - refusal at 3.5 ft in chert/cherty limestone | | | |



COMPLETION DEPTH: 3.5 ft
DATE: 9-13-22

DEPTH TO WATER
IN TEST PIT: Dry

DATE: 9/13/2022

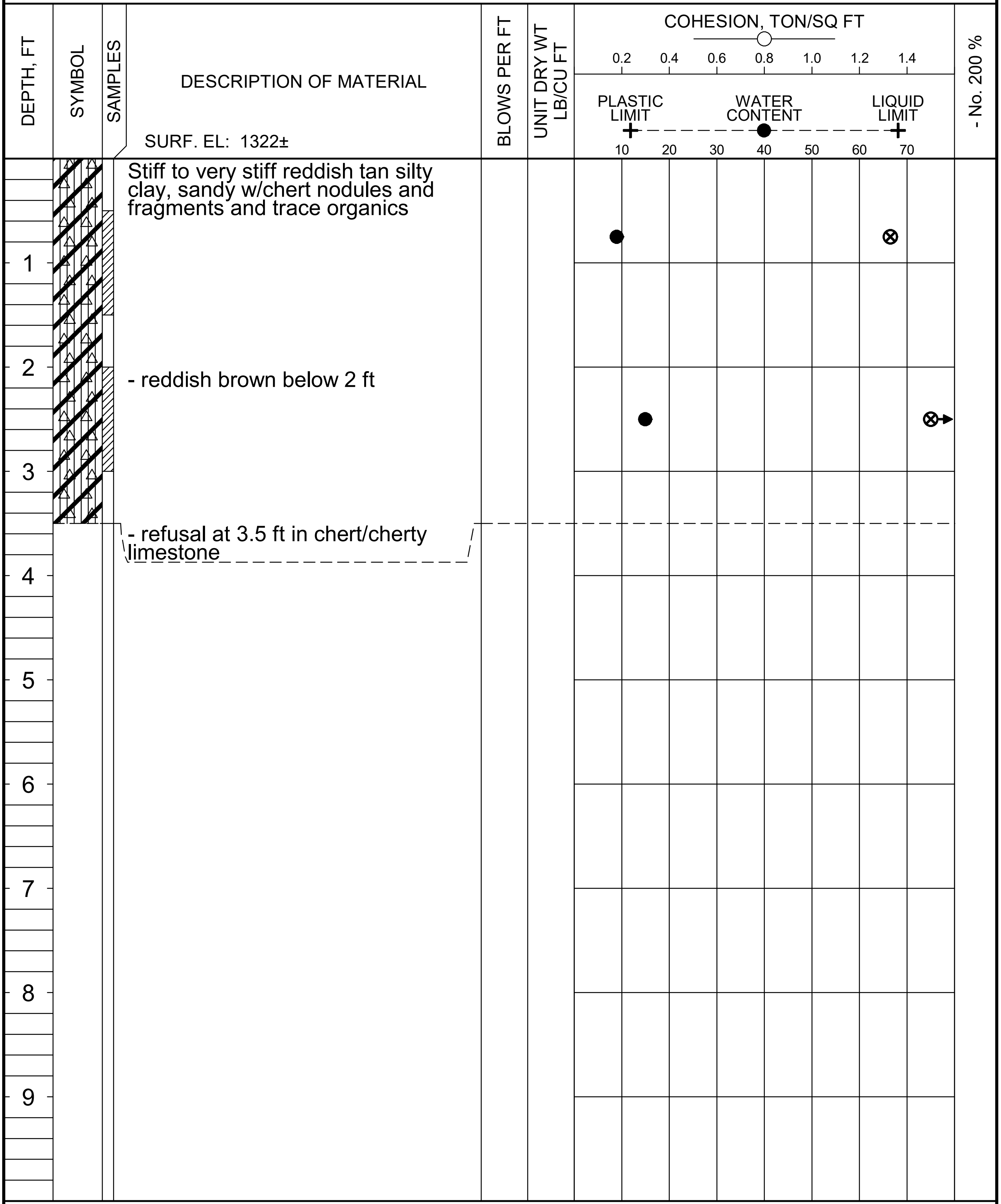
**Grubbs, Hoskyn, Barton & Wyatt, Inc.**
**Consulting Engineers**

# LOG OF TEST PIT NO. 5

ARDOT 090580 Welcome Center
Benton Co., Arkansas

TYPE: Mini-Excavator

LOCATION: See Plate 2 - Drive



Stiff to very stiff reddish tan silty clay, sandy w/chert nodules and fragments and trace organics

- reddish brown below 2 ft

- refusal at 3.5 ft in chert/cherty limestone

COMPLETION DEPTH: 3.5 ft
DATE: 9-13-22

DEPTH TO WATER
IN TEST PIT: Dry

DATE: 9/13/2022

22-003

**Grubbs, Hoskyn, Barton & Wyatt, Inc.**
**Consulting Engineers**

# LOG OF TEST PIT NO. 6

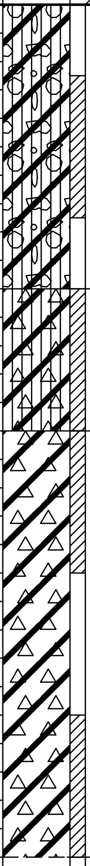
ARDOT 090580 Welcome Center
Benton Co., Arkansas

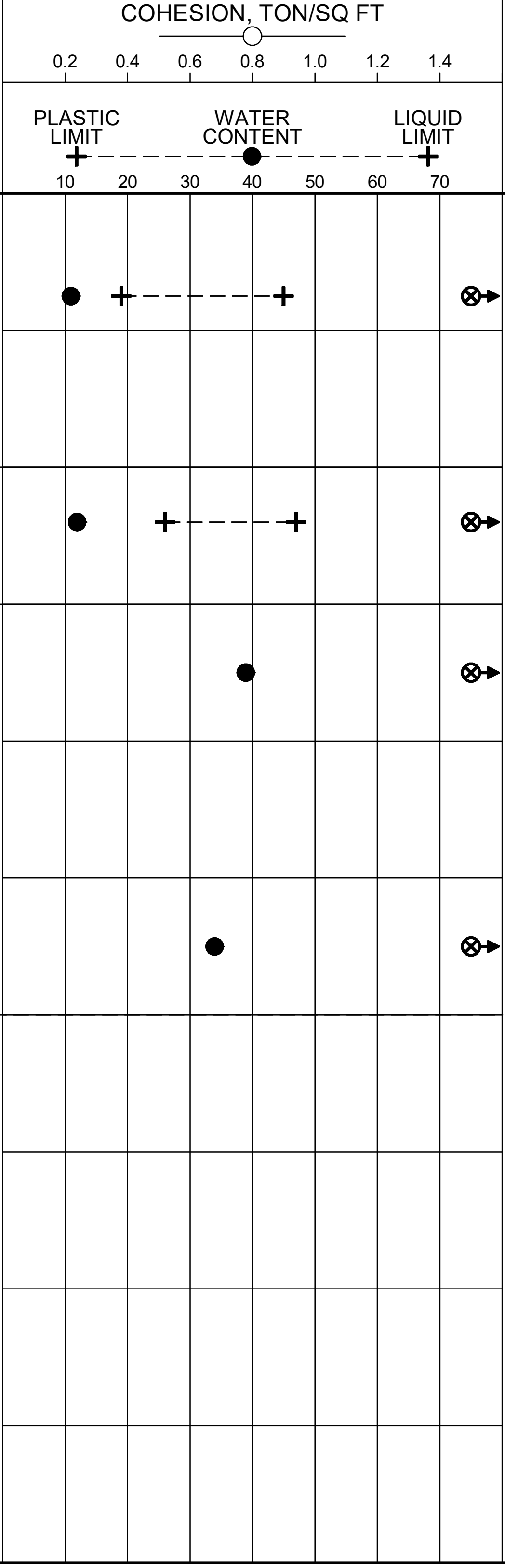
TYPE: Mini-Excavator

LOCATION: See Plate 2 - Drive

SURF. EL: 1326±

| DEPTH, FT | DESCRIPTION OF MATERIAL | BLOWS PER FT | UNIT DRY WT LB/CU FT | - No. 200 % |
|---|---|---|---|---|
| 0 – 2 | Stiff to very stiff tan silty clay, sandy w/chert fragments and cobbles and trace organics<br>- with numerous chert and limestone cobbles below 1 ft | | | 63 |
| 2 – 3 | Very stiff reddish brown silty clay w/numerous chert nodules and fragments and some small boulders | | | 38 |
| 3 – 6 | Very stiff gray and reddish brown clay, slightly blocky w/occasional chert fragments and chert and limestone cobbles<br>- refusal at 6 ft in chert/cherty limestone | | | |





COMPLETION DEPTH: 6.0 ft
DATE: 9-13-22

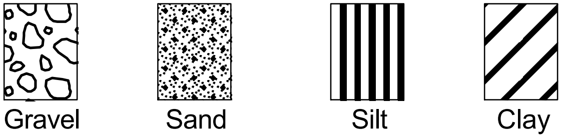
DEPTH TO WATER
IN TEST PIT: Dry

DATE: 9/13/2022

# SYMBOLS AND TERMS USED ON BORING LOGS

## SOIL TYPES

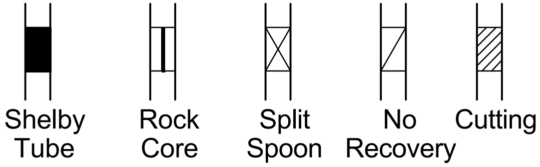
(SHOWN IN SYMBOLS COLUMN)



Predominant type shown heavy

## SAMPLER TYPES

(SHOWN ON SAMPLES COLUMN)



## TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on No. 200 sieve): Includes (I) Clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as determined by laboratory tests.

| DESCRIPTIVE TERM | N-VALUE | RELATIVE DENSITY |
|---|---|---|
| VERY LOOSE | 0-4 | 0-15% |
| LOOSE | 4-10 | 15-35% |
| MEDIUM DENSE | 10-30 | 35-65% |
| DENSE | 30-50 | 65-85% |
| VERY DENSE | 50 and above | 85-100% |

FINE GRAINED SOILS (major portion passing No. 200 sieve): Includes (1) Inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests.

| DESCRIPTIVE TERM | UNCONFINED COMPRESSIVE STRENGTH TON/SQ. FT. |
|---|---|
| VERY SOFT | Less than 0.25 |
| SOFT | 0.25-0.50 |
| FIRM | 0.50-1.00 |
| STIFF | 1.00-2.00 |
| VERY STIFF | 2.00-4.00 |
| HARD | 4.00 and higher |

NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil. The consistency ratings of such soils are based on penetrometer readings.

## TERMS CHARACTERIZING SOIL STRUCTURE

SLICKENSIDED - having inclined planes of weakness that are slick and glossy in appearance.
FISSURED - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
LAMINATED - composed of thin layers of varying color and texture.
INTERBEDDED - composed of alternate layers of different soil types.
CALCAREOUS - containing appreciable quantities of calcium carbonate.
WELL GRADED - having a wide range in grain sizes and substantial amounts of all intermediate particle sizes.
POORLY GRADED - predominantly of one grain size, or having a range of sizes with some intermediate sizes missing.

Terms used on this report for describing soils according to their texture or grain size distribution are in accordance with the UNIFIED SOIL CLASSIFICATION SYSTEM, as described in Technical Memorandum No.3-357, Waterways Experiment Station, March 1953

KEY 3-14-12

# APPENDIX A

# SUMMARY of CLASSIFICATION TEST RESULTS

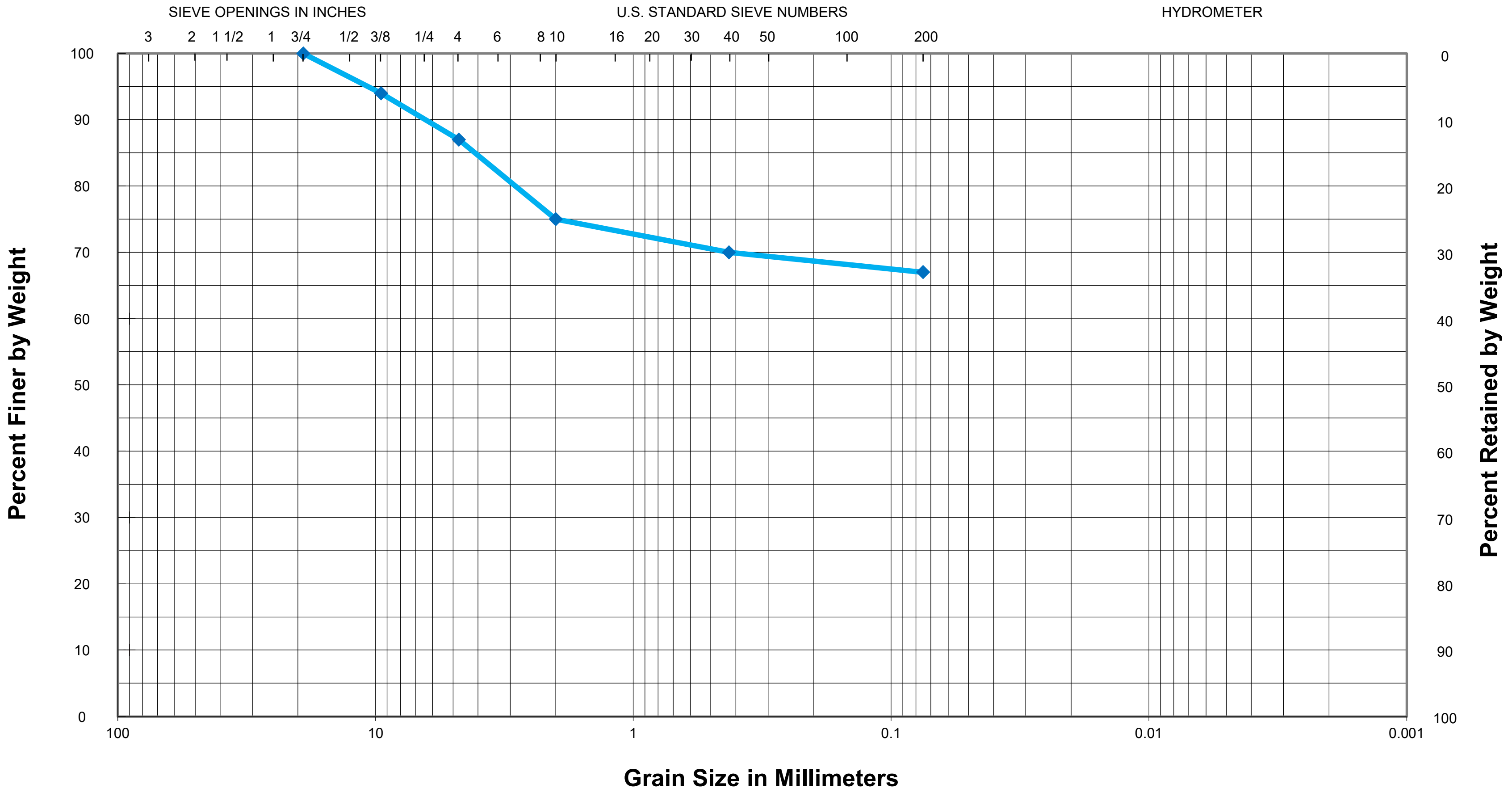
PROJECT: ArDOT 090580 Welcome Center
LOCATION: Benton County, Arkansas
GHBW JOB NUMBER: 22-003

| TEST PIT No. | SAMPLE DEPTH (ft) | WATER CONTENT (%) | ATTERBERG LIMITS | | | SIEVE ANALYSIS PERCENT PASSING | | | | | | | USCS CLASS. | AASHTO CLASS. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | LIQUID LIMIT | PLASTIC LIMIT | PLASTICITY INDEX | 1 in. | 3/4 in. | 3/8 in. | #4 | #10 | #40 | #200 | | |
| 1 | 1.5-2.5 | 11 | 36 | 21 | 15 | 100 | 100 | 94 | 87 | 75 | 70 | 67 | CL | A-6 |
| | | | | | | | | | | | | | | |
| 2 | 0.5-1.5 | 11 | NON-PLASTIC | | | --- | --- | --- | 76 | --- | --- | 60 | ML | A-4 |
| 2 | 4-4.5 | 26 | 52 | 29 | 23 | --- | --- | --- | 22 | --- | --- | 12 | GM-GP | A-2-7 |
| | | | | | | | | | | | | | | |
| 3 | 0.5-1.5 | 14 | 44 | 21 | 23 | --- | --- | --- | 98 | --- | --- | 85 | CL | A-7-6 |
| | | | | | | | | | | | | | | |
| 4 | 2-3 | 12 | 35 | 21 | 14 | 100 | 86 | 76 | 70 | 63 | 57 | 54 | CL | A-6 |
| | | | | | | | | | | | | | | |
| 6 | 0.5-1.5 | 11 | 45 | 19 | 26 | --- | --- | --- | 81 | --- | --- | 63 | CL | A-7-6 |
| 6 | 2-3 | 12 | 47 | 26 | 21 | --- | --- | --- | 57 | --- | --- | 38 | GC | A-7-6 |

**Grubbs, Hoskyn,**
**Barton & Wyatt, Inc.**
CONSULTING ENGINEERS

PLATE

# GRAIN SIZE CURVE



| GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | |

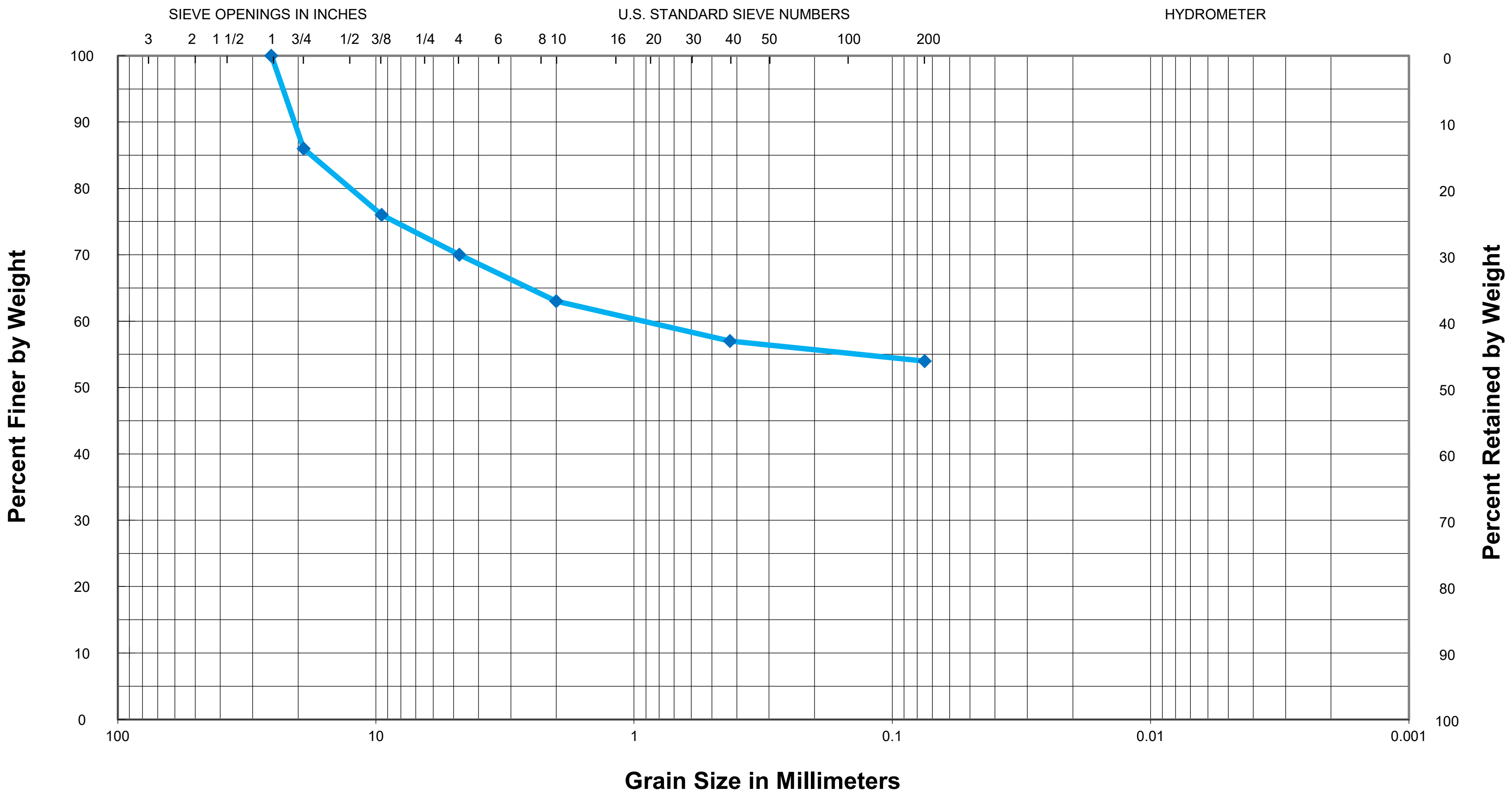
**Sample:** Test Pit 1, 1.5-2.5 ft; LL = 36, PL = 21, PI = 15
**Description:** Reddish brown silty CLAY, sandy w/ chert fragments

**USCS Classification = CL**
**AASHTO Classification = A-6**

**22-003**

# GRAIN SIZE CURVE

**Grubbs, Hoskyn, Barton & Wyatt**, INC.
CONSULTING ENGINEERS



| GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | |

**Sample:** Test Pit 4, 2-3 ft; LL = 35, PL = 21, PI = 14
**Description:** Reddish brown silty CLAY, sandy w/ chert fragments

**USCS Classification = CL**
**AASHTO Classification = A-6**

**Grubbs, Hoskyn, Barton & Wyatt, INC.**
CONSULTING ENGINEERS

P.O. Box 30970
Little Rock, Arkansas 72260-0970
#1 Trigon Place 72209
(501) 455-2536
FAX (501) 455-4137

# REPORT OF STANDARD PROCTOR TEST
## (AASHTO T 99)

Project: ARDOT 090580 Welcome Center - Benton County, Arkansas Job No: 22-003
Material Description: Tan and reddish tan silty CLAY w/ chert fragments
Location Sampled/Depth: TP-5 / 0.5-3 ft
Date Sampled: 9/13/2022
Date Tested: 9/20/2022
Tested By: JW

| LAB COMPACTION PROCEDURE:<br>AASHTO T 99 Method C | |
|---|---|
| **Maximum Unit Dry Wt. (pcf):** | 105.8 |
| **Optimum Water Content (%):** | 16.6 |

| **ATTERBERG LIMITS<br>AASHTO T 89/T 90** |
|---|
| Liquid Limit: 31 |
| Plastic Limit: 20 |
| Plasticity Index: 11 |

| USCS Classification: |
|---|
| CL |

| AASHTO Classification: |
|---|
| A-6 |

As Received Water Content: 9.5 %

| **GRADATION AASHTO T 88** | |
|---|---|
| Sieve Number | Percent Passing |
| 3 in. | 100 |
| 2 in. | 99 |
| 3/4 in. | 92 |
| 3/8 in. | 90 |
| #4 | 86 |
| #10 | 81 |
| #40 | 77 |
| #200 | 74 |