CTL|THOMPSON INCORPORATED

December 3, 2019
Revised February 18, 2020
Revised April 24, 2020

Richmond American Homes
4350 South Monaco Street
Denver, Colorado 80237

Attention: Mr. Matt Childers
Land Acquisition Specialist – Central Division

Subject: Due Diligence Geotechnical Investigation and Geologic Hazard Evaluation
Hannah Ridge (AKA Feathergrass)
El Paso County, Colorado
CTL|T Project No. CS19005-115

This letter presents the results of our Due Diligence Geotechnical Investigation and Geologic Hazard Evaluation for the Hannah Ridge (AKA Feathergrass) parcel. The site is located on the east and west side of Hannah Ridge Drive, south of the intersection of Hannah Ridge Drive and Constitution Avenue, in El Paso County Colorado (Fig. 1).

The purpose of our investigation was to evaluate potential geologic hazards that may impact development of the site and to evaluate the subsurface conditions within the parcel to assist in your due diligence assessment. This letter contains descriptions of subsurface and groundwater conditions found in our exploratory borings, our opinion of the potential influence of the geologic conditions on planned structures and other site improvements, and preliminary discussions of residential construction concepts as influenced by geologic and geotechnical considerations. The report was prepared based on conditions found in our borings, results of laboratory tests, engineering analysis of field and laboratory data, and our experience. Development and site grading plans were not provided to us during the time of the investigation. The information contained in this letter is intended for due diligence assessment purposes only. Additional investigations will be required to develop design-level criteria for building construction and pavement design. The scope was described in our proposal dated October 19, 2018 (CTL|T Proposal No. CS-18-0163).

We understand Richmond plans to construct a single-family attached (duplex) product at this site. Structures are expected to have a structural floor system with a crawl space and no below-grade levels. Attached garages are anticipated at some lots.

SUBSURFACE INVESTIGATION

Subsurface conditions in the area of the subject lots were investigated by our firm by drilling ten exploratory borings spread across the site, to depths between 20 and 30 feet. The approximate locations of the borings are shown in Fig. 1. Our representative observed drilling operations, logged soils found in the borings, and obtained samples for laboratory testing. Graphical logs of the borings, including the results of field penetration resistance tests and some laboratory test data are presented in Figs. 4 and 5.

Samples obtained during drilling were visually classified and laboratory testing was assigned. Gradation test results are presented in Appendix A. Laboratory test data are summarized in Table A-I. The following sections describe the existing soil and bedrock materials found at the site.

Fill

Approximately 6 to 7 feet of sandy to very sandy clay and very clayey sand fill was identified in seven of the borings. Field penetration resistance test results indicated the sand and clay fill was very stiff. Six samples of the fill contained 40 to 78 percent silt and clay-sized particles (passing the No. 200 sieve). Samples of the fill subjected to swell-consolidation testing in our laboratory exhibited measured swells of between 0.2 and 7.2 percent when wetted under approximate overburden pressure (the weight of the overlying soils).

Based on historic aerial photos, we believe the fill may have been placed during site grading of the subdivision located south of the site. No documentation regarding the construction of the fill, such as the results of field density testing, was available for our review at the time of this study. Because of the lack of documentation regarding the placement and compaction of the existing fill, along with high measured swell, we must consider this material to be of suspect quality and unsuitable to underlie the proposed structures, in its current condition. Recommendations regarding removal and replacement of undocumented fill are set forth herein.

Natural Sand and Clay Soils

Natural, clayey to very clayey sand with very sandy clay lenses was encountered at the ground surface or below the fill. The sand was medium dense to dense. Eight samples of the sand and clay tested in our laboratory contained 14 to 53 percent silt and clay-sized particles (passing the No. 200 sieve). Samples of the sand and clay subjected to swell-consolidation testing in our laboratory exhibited measured swells of between 0.1 to 0.8 percent when wetted under approximate overburden pressure. One sample consolidated 0.4 percent.

Bedrock

Claystone and sandstone bedrock was encountered in three of the borings below the fill and natural soils at depth of 6 to 14 feet below the existing ground surface. The sandstone was very hard. Based on our experience, we believe the sandstone to be

non-expansive or have low swell potential. The claystone was medium hard to hard. Three claystone samples subjected to swell-consolidation testing in our laboratory exhibited measured swells of 1.6 to 6.6 percent when wetted under approximate overburden pressure.

Groundwater

At the time of drilling, groundwater was not encountered in any of the borings. When water levels were checked again eight days after the completion of drilling operations, groundwater was present in two of the borings (TH-7 and TH-10) at depths of 14 and 17 feet below the existing ground surface. The groundwater elevation should be expected to rise during the traditionally wetter months of late spring and early summer, and as a result of landscaping irrigation that is associated with residential development. Potential seasonal and post-construction rises in groundwater are expected to be less than 5 feet.

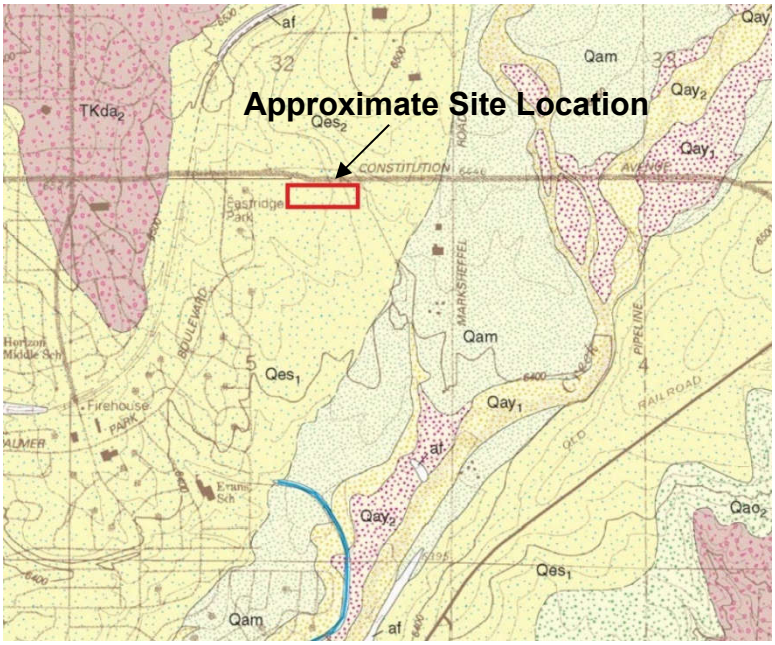
GEOLOGIC HAZARDS AND ENGINEERING CONSTRAINTS

We did not identify geologic hazards that we believe preclude development of the project. Conditions we identified that may pose hazards or constraints to development include expansive soil and bedrock, shallow groundwater, and existing undocumented fill. Regional geologic conditions that impact the site include and seismicity and radioactivity. We believe these conditions can be mitigated with engineering design and construction methods commonly employed in this area. These conditions are discussed in greater detail in the sections that follow.

Site Geology

The surficial geology at the site was evaluated by reviewing published geologic maps. The Geologic Map of the Elsmere Quadrangle published by the Colorado Geological Survey in (Madole and Thorson, 2002) covers the project site.

The site is mapped as late Pleistocene-age eolian sand (wind-deposited sediment) consisting of very pale-brown, pale-brown, and light yellowish-brown sand with silt deposited as sand sheets, overlying the Dawson Formation. The Dawson



Geologic Map

Formation typically consists of sandstone interbedded with claystone in this area. Our subsurface investigation and observations generally confirm the mapping. A map of the site specific surficial geologic conditions is shown on Figure 2.

Expansive Soils and Bedrock

One of the more significant geologic hazards in Colorado is the presence of swelling clays in bedrock and surficial deposits. Moisture changes to bedrock or surficial deposits containing swelling clays can result in volumetric expansion and collapse of those units. Changes in soil moisture content can result from precipitation, irrigation, pipeline leakage, surface drainage, perched groundwater, drought, or other factors. Swelling of expansive soil and bedrock may cause excessive cracking and heaving of structures with shallow foundations, concrete slabs-on-grade, or pavements supported on these materials.

Samples were testing in the laboratory for swell consolidation characteristics. Generally, sites are rated as low, medium, high or very high swell potential based on heave calculations utilizing swell test results. The rating of a site as low or high swell potential is not absolute. Rather, this represents a judgement. The approximate extent of expansive claystone bedrock is shown on Figure 3. We believe expansive claystone bedrock, where encountered, can be mitigated with engineering design and construction methods commonly employed in the area.

Collapsible Soils

Eolian soils are occasionally susceptible to collapse. Soil collapse (or hydro-collapse) is a phenomenon where soils undergo a significant decrease in volume upon an increase in moisture content, with or without an increase in external loads. Buildings, structures, and other improvements may be subject to excessive settlement-related distress when collapsible soils are present. The results of the subsurface evaluation and laboratory testing indicate the collapse potential of the eolian deposits is low.

Undocumented Fill

The site has been previously disturbed by construction activity likely associated with development of Hannah Ridge Road and the residential community to the south. Based on Google Earth® aerial imagery construction of Hannah Ridge Road commenced during spring or early summer of 2005. The approximate extents of undocumented fill are shown on Figure 2. Undocumented fill should be removed and re-worked or replaced, according to the recommendations set forth in the **Fill Placement and Compaction** section of this report. Design-level geotechnical studies should be undertaken to confirm the presence of fill and depths of fill and to provide recommendations for reworking. If documentation of the fill, such as density test records are found, we should review them to determine if they are adequate for the proposed construction.

Shallow Bedrock

Based on our investigation shallow bedrock is generally not a concern at the site with the exception of the weathered claystone encountered in boring TH-10 at 6 feet below the ground surface. The risk of damage to structures is significantly higher where expansive bedrock is exposed at the ground surface as a result of site grading. Depending on development plans for the site, shallow bedrock could be exposed as result of site grading in localized areas east of Hannah Ridge Drive.

Shallow Groundwater

Groundwater was measured in two of our borings at depths of 14 and 17 feet below the existing ground surface. It is recommended that crawl space construction be utilized for this project. We do not recommend basement construction unless additional subsurface investigation and analysis are performed to further evaluate groundwater levels.

Debris Flow and Debris Fans

The geologic mapping does not indicate the presence of debris flows, or debris fans on this property.

Rockfall

The project is not located within areas mapped as rockfall susceptible, as mapped in the Colorado Geological Survey Open-File Report 06-3 (2006) by Jonathan L. White and T.C. Wait, and does not appear susceptible per our observations.

Subsidence and Abandoned Mining Activity

The site is not included in the “Colorado Springs Subsidence Investigation” completed by Dames & Moore of the State of Colorado, Division of Mine Reclamation, dated April 1985. We understand the investigation reported areas that have been or could potentially be affected by mine subsidence activity. The subject site was not located within the investigated area. We observed no evidence of subsurface mining at the site. Based upon the results of the State’s investigation, the project site is not underlain by underground mine workings.

Flooding

Information presented on “Flood Insurance Rate Map” (FIRM), Map Number 08041C0752G, with an effective date of December 7, 2018, indicates the project site is in Zone X, an area of minimal flood hazard. The project Civil Engineer should address localized flood potential.

Faults

The geologic mapping does not indicate the presence of faulting on the project site. The nearest fault is the Rampart Range fault approximately 10 miles west of the site.

Steeply Dipping Bedrock

We reviewed mapping of “Areas Susceptible to Differential Heave in Expansive, Steeply Dipping Bedrock, City of Colorado Springs, Colorado” (1999) by John W. Himmelreich, Jr., and David C. Noe published by the Colorado Geologic Survey. Mapping the site is well outside of areas mapped as having steeply dipping bedrock.

Elevated Radioactivity and Radon

We believe no unusual hazard exists from naturally occurring sources of radioactivity on the site. However, the materials found in this area are often associated with the production of radon gas and concentrations in excess of those currently accepted by the EPA can occur. Passive and active mitigation procedures are commonly employed in this region to effectively reduce the buildup of radon gas. Measures that can be taken after a structure is enclosed during construction include installing a blower connected to the foundation drain and sealing the joints and cracks in concrete floors and foundation walls. If the occurrence of radon is a concern, we recommend structures be tested after they are enclosed. Commonly utilized mitigation techniques may minimize risk.

DISCUSSION

Expansive soils and bedrock, potentially shallow groundwater, and existing undocumented fill could impact development at the site. These constraints can be mitigated by commonly employed construction methods. Because of the lack of documentation regarding the placement and compaction of the existing fill, along with the high measured swell potential, we must consider this material to be of suspect quality and unsuitable to support the proposed structures, in its current condition. The existing fill should be excavated to expose the underlying natural soils and if free of deleterious materials, reused as new, densely compacted fill to achieve desired building pad elevations and site grades. Deeper sub-excavation may be required for the eastern quarter of the site where expansive, claystone bedrock was encountered at shallow depths. The results of the swell-consolidation testing are summarized below in Table 1.

TABLE 1

SUMMARY OF SWELL-CONSOLIDATION TEST RESULTS

Soil Type	Compression	Range of Measured Swell (%)*			
		0 to <2	2 to <4	4 to <6	≥6
	Number of Samples and Percent				
Fill	0	1	2	1	2
	0%	17%	33%	17%	33%
Natural Clayey Sand	1	4	0	0	0
	20%	80%	0%	0%	0%
Claystone	0	1	0	1	1
	0%	33%	0%	33%	33%
Overall Sample Number	1	6	2	2	3
Overall Percent	8%	43%	14%	14%	21%

CONCLUSIONS AND RECOMMENDATIONS

The following discussions are preliminary and are not intended for design or construction. Additional site-specific investigations will be required to evaluate the subsurface conditions on each lot within the filing, and to provide design and construction recommendations for foundations and floor systems.

Based on conditions encountered in our exploratory borings, we anticipate the proposed residences can be constructed on spread footing foundations designed to apply minimum deadload pressure to the subgrade soils, underlain by new, densely compacted fill, natural sand, and/or sandstone bedrock. Due to the potential for shallow groundwater, crawl space construction is recommended with no below grade levels. Suspect quality fill was encountered in seven of the ten borings. These borings were generally spread across the site. The depth of fill encountered was about 6 to 7 feet from the existing ground surface. This material should be removed and compacted as new fill, prior to placing site grading fill, or construction of the residences.

Expansive claystone bedrock was encountered at depths of 6 to 9 feet below the existing ground surface. Sub-excavation of up to 6 feet below footing elevation, based on existing grade, may be required on the eastern quarter of the site where shallow claystone bedrock is encountered. In our opinion, drilled pier foundations are a viable alternative to sub-excavation and spread footings where expansive bedrock is present at or near shallow foundation levels. We understand Richmond American Homes has historically preferred the use of sub-excavation and spread footing foundations in the Colorado Springs market. Our firm can provide design criteria for both approaches at the time of the site-specific Soils and Foundation Investigations, if requested.

We anticipate about 70 to 80 percent of the site might require removal of existing fill, based on our borings and about 20 to 30 percent might require additional sub-excavation to mitigate swell of the claystone. Figure 2 indicates the approximate extents of existing fill and Figure 3 indicates the approximate extents of expansive claystone bedrock.

Based on our borings, we estimate total potential ground heave will be up to about 4.6 inches. After sub-excavation is performed, we believe the total potential ground heave may be reduced to between 0.5 and 1 inch. A depth of wetting of 24 and 26 feet was considered for the heave evaluation. Research suggests there is about a 90 percent probability that wetting will be less than 24 feet[1] and 95 percent for less than 26 feet. We judge the risk of poor garage floor slab performance to be low after sub-excavation. We understand structurally supported floors will be constructed for the proposed residences. Garage slabs and driveways may settle and crack. Construction details designed to mitigate the potential for damage caused by movement of slabs-on-grade will be needed.

FILL PLACEMENT AND COMPACTION

Significant sub-excavation and replacement of undocumented fill will be necessary for construction of this project. In addition, areas of grade raise fill and two stormwater detention basins are planned at the site. We understand the majority of the detention basins will be cut into the existing site grades. Where new fill is needed to raise site grades, replace excavated undocumented fill, or to establish earthen embankments for the proposed detention basins, the onsite soils may be reused as compacted fill provided debris, vegetation, organics, and other deleterious materials are substantially removed prior to placement. Areas to receive new fill should be scarified to a depth of about 8 inches prior to fill placement, moisture conditioned to near optimum moisture content and densely compacted. Subsequent fill materials should be placed in thin (8 inches or less) loose lifts. Granular fill materials should be moisture conditioned to within 2 percent of optimum moisture content and compacted to at least 95 percent of a standard Proctor dry density (ASTM D 698). Fill consisting of cohesive materials (clay and excavated claystone) should be moisture conditioned to between 1 and 4 percent over optimum moisture content and compacted to at least 95 percent of the standard Proctor dry density (ASTM D 698). Placement and compaction of fill and backfill should be observed and tested by a representative of our firm during construction.

CONCRETE

Concrete in contact with soil can be subject to sulfate attack. We measured water-soluble sulfate concentrations of less than 0.1 percent in two soil samples of the native sands obtained during this study. For this level of sulfate concentration, ACI 332-

[1] "Method for Evaluation of Depth of Wetting in Residential Area," Walsh, Colby, Houston and Houston, ASCE, February 2009.

08 Code Requirements for Residential Concrete indicates there are no special requirements for sulfate resistance.

We measured water-soluble sulfate concentrations of 0.14 percent in one sample of the weathered claystone bedrock from this site. Water-soluble sulfate concentrations between 0.1 and 0.2 percent indicate Class 1 exposure to sulfate attack, according to the American Concrete Institute (ACI) *Guide to Durable Concrete (ACI 201.2R-01)*. ACI 201 indicates adequate sulfate resistance can be achieved by using Type II cement with a water-to-cementitious material ratio of 0.50 or less. In addition, ACI 318 indicates concrete in Class 1 exposure environments should have a minimum compressive strength of 4,000 psi.

In our experience, superficial damage may occur to the exposed surfaces of highly permeable concrete, even though sulfate levels are relatively low. To control this risk and to resist freeze-thaw deterioration, the water-to-cementitious materials ratio should not exceed 0.50 for concrete in contact with soils that are likely to stay moist due to surface drainage or high water tables. Concrete should be air entrained where exposed to freeze/thaw conditions. We recommend all foundation walls and grade beams in contact with the subsoils (including the inside and out- side faces of garage and crawl space grade beams) be damp-proofed.

LIMITATIONS

Our boring locations were selected to provide a general characterization of subsurface conditions beneath the investigated development for a due diligence assessment. Conditions between borings will vary. Individual site-specific investigations will be necessary on each lot to provide design-level criteria.

We believe this investigation was conducted in a manner consistent with that level of care and skill ordinarily used by geotechnical engineers practicing under similar conditions. No warranty, express or implied, is made.

If we can be of further service in discussing either the contents of this letter or the analysis of the influence of subsurface conditions on the design of the proposed residences, please call.

Sincerely,

CTL | THOMPSON, INC.

COLORADO LICENSED
JEFFREY MARK JONES
47539
4-24-20
PROFESSIONAL ENGINEER

Jeffrey M. Jones, P.E.
Associate Engineer

Reviewed by:

Timothy A. Mitchell, P.E.
Division Manager

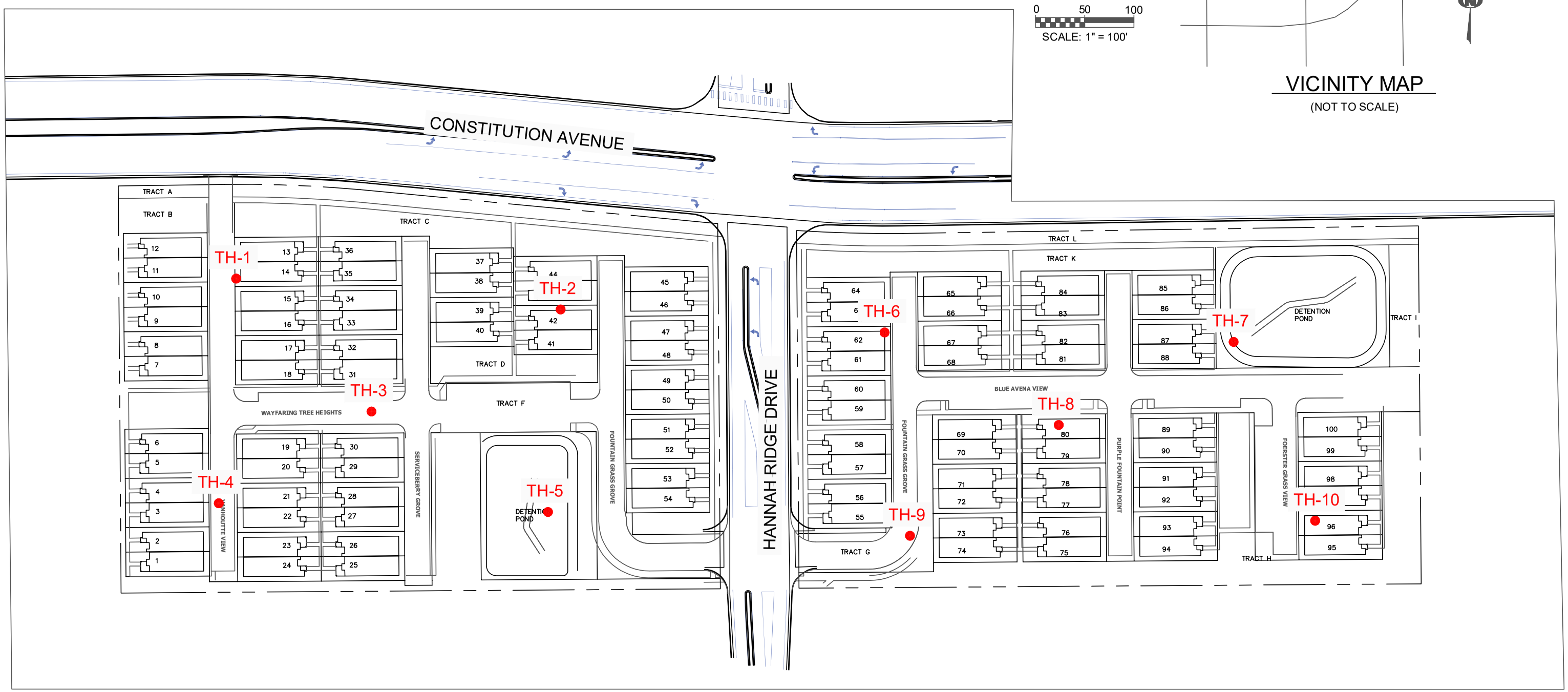
MBR:WCH:JMJ:TAM:cw

Via Email: Matt.Childers@mdch.com

LEGEND:

— - - — PROJECT BOUNDARY

TH-1 ● APPROXIMATE LOCATION OF EXPLORATORY BORING.



Location of Exploratory Borings

FIG. 1

RICHMOND AMERICAN HOMES
HANNAH RIDGE
CTL|T PROJECT NO. CS19005-115

LEGEND:

— - - — PROJECT BOUNDARY

GEOLOGIC UNITS AND (MODIFIERS)

SURFICIAL GEOLOGIC CONTACTS

APPROXIMATE AREA DISTURBED IN 2005

Qes EOLIAN DEPOSITS

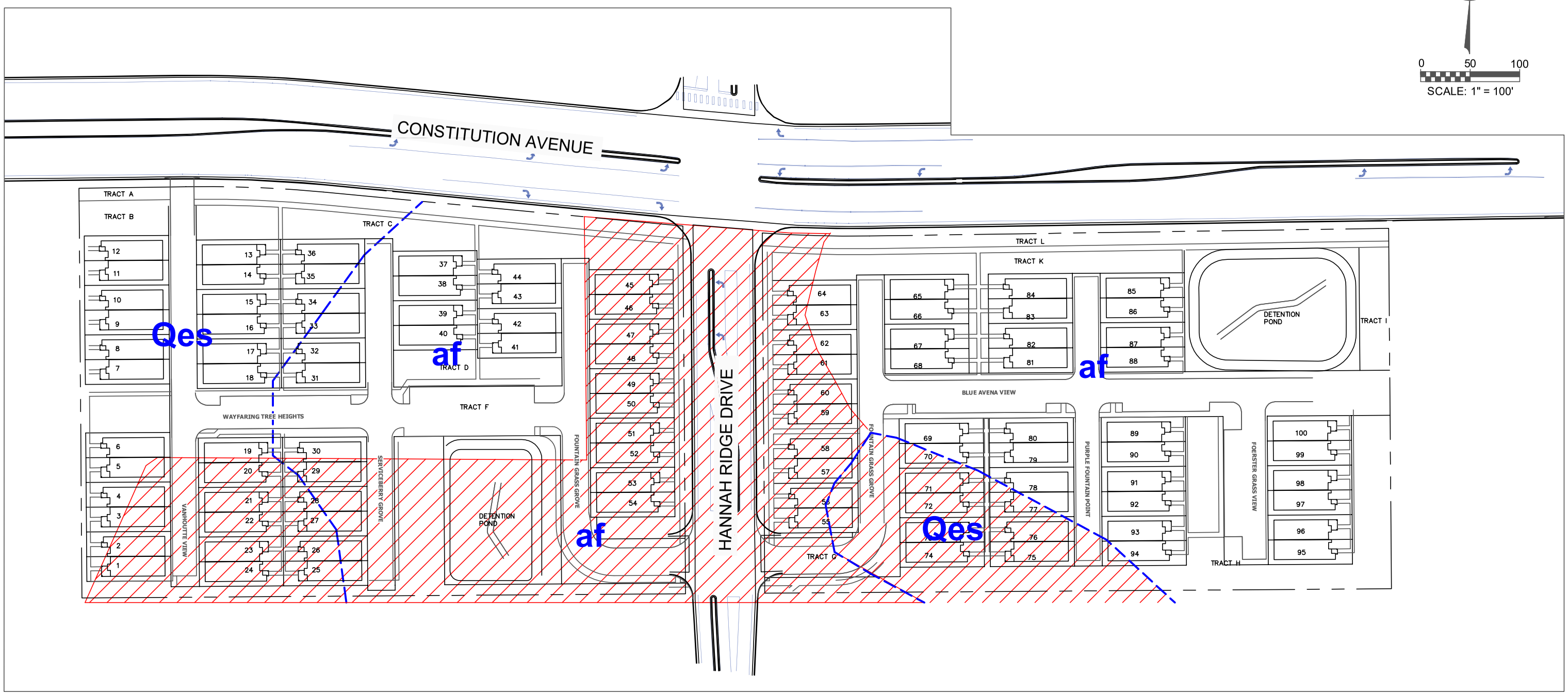
af ARTIFICIAL FILL

NOTES:

1. ALL BOUNDARIES SHOWN SHOULD BE CONSIDERED APPROXIMATE. THEY ARE BASED UPON A SUBJECTIVE INTERPRETATION OF PUBLISHED MAPS, AERIAL PHOTOGRAPHS AND AN INITIAL FIELD RECONNAISSANCE. CHANGES IN THE MAPPED BOUNDARIES SHOWN ARE POSSIBLE AND SHOULD BE EXPECTED WITH MORE DETAILED WORK AND FURTHER INFORMATION. ALL INTERPRETATIONS AND CONDITIONS SHOWN ARE PRELIMINARY AND FOR LAND-USE PLANNING ONLY.

0 50 100

SCALE: 1" = 100'



RICHMOND AMERICAN HOMES
HANNAH RIDGE
CTL|T PROJECT NO. CS19005-115

Surficial Geologic Conditions

FIG. 2

LEGEND:

— - - — PROJECT BOUNDARY

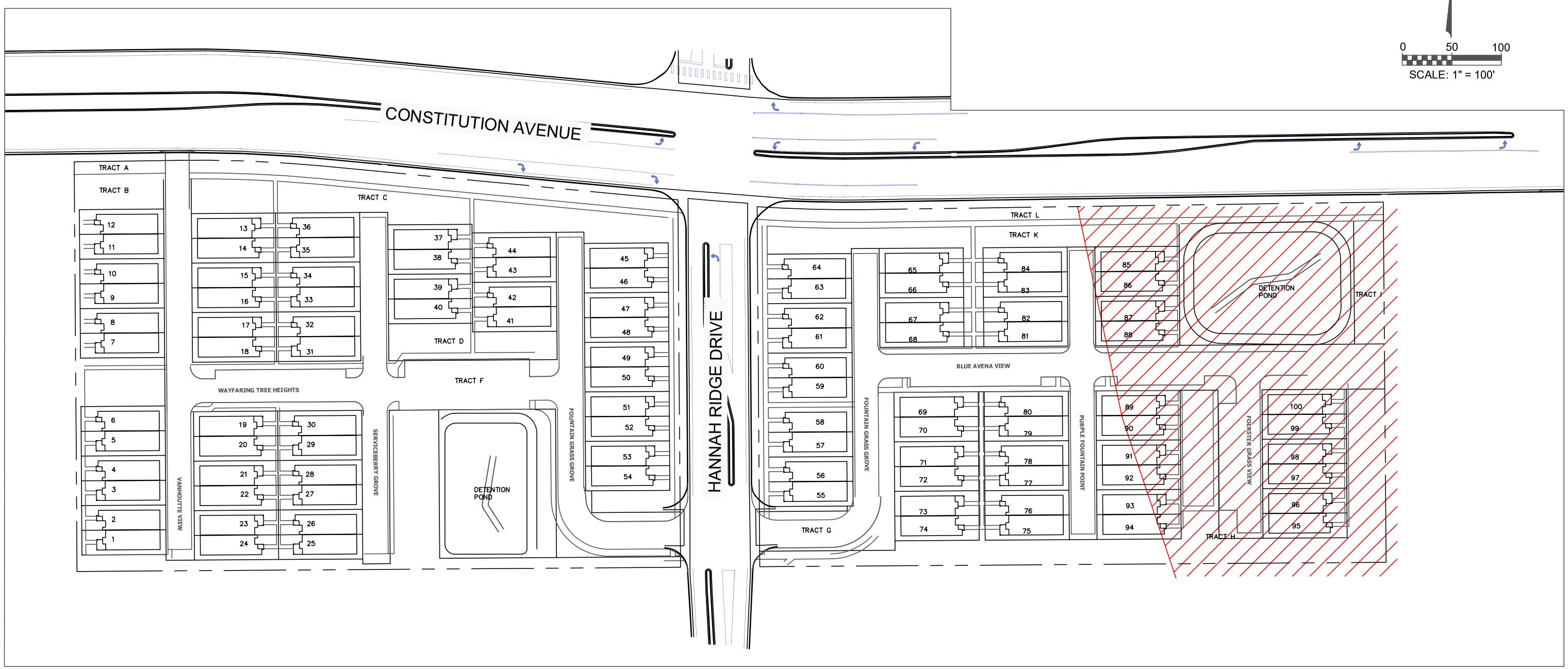
TH-1 ● APPROXIMATE LOCATION OF EXPLORATORY BORING.

ENGINEERING UNITS AND (MODIFIERS)

APPROXIMATE AREA OF EXPANSIVE CLAYSTONE BEDROCK.

NOTES:

ALL BOUNDARIES SHOWN SHOULD BE CONSIDERED APPROXIMATE. IT IS BASED UPON A LIMITED NUMBER OF EXPLORATORY BORINGS. UNCERTAINTIES RELATIVE TO LOCATIONS, DEPTH, AND EXTENTS OF EXPANSIVE BEDROCK CAN BE REDUCED THROUGH ADDITIONAL SUBSURFACE EXPLORATION.



RICHMOND AMERICAN HOMES
HANNAH RIDGE
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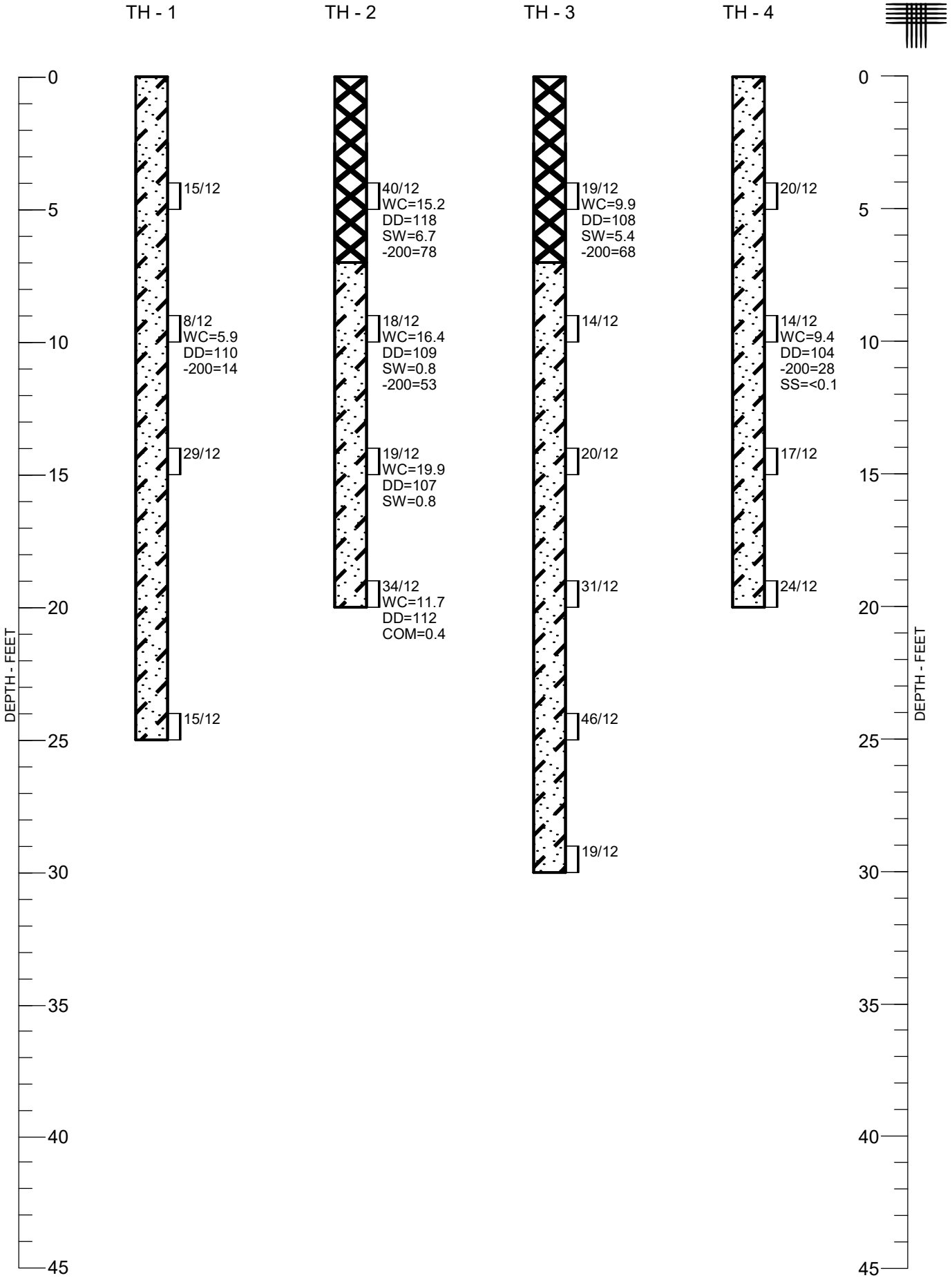
Map of Geologic Hazard Areas

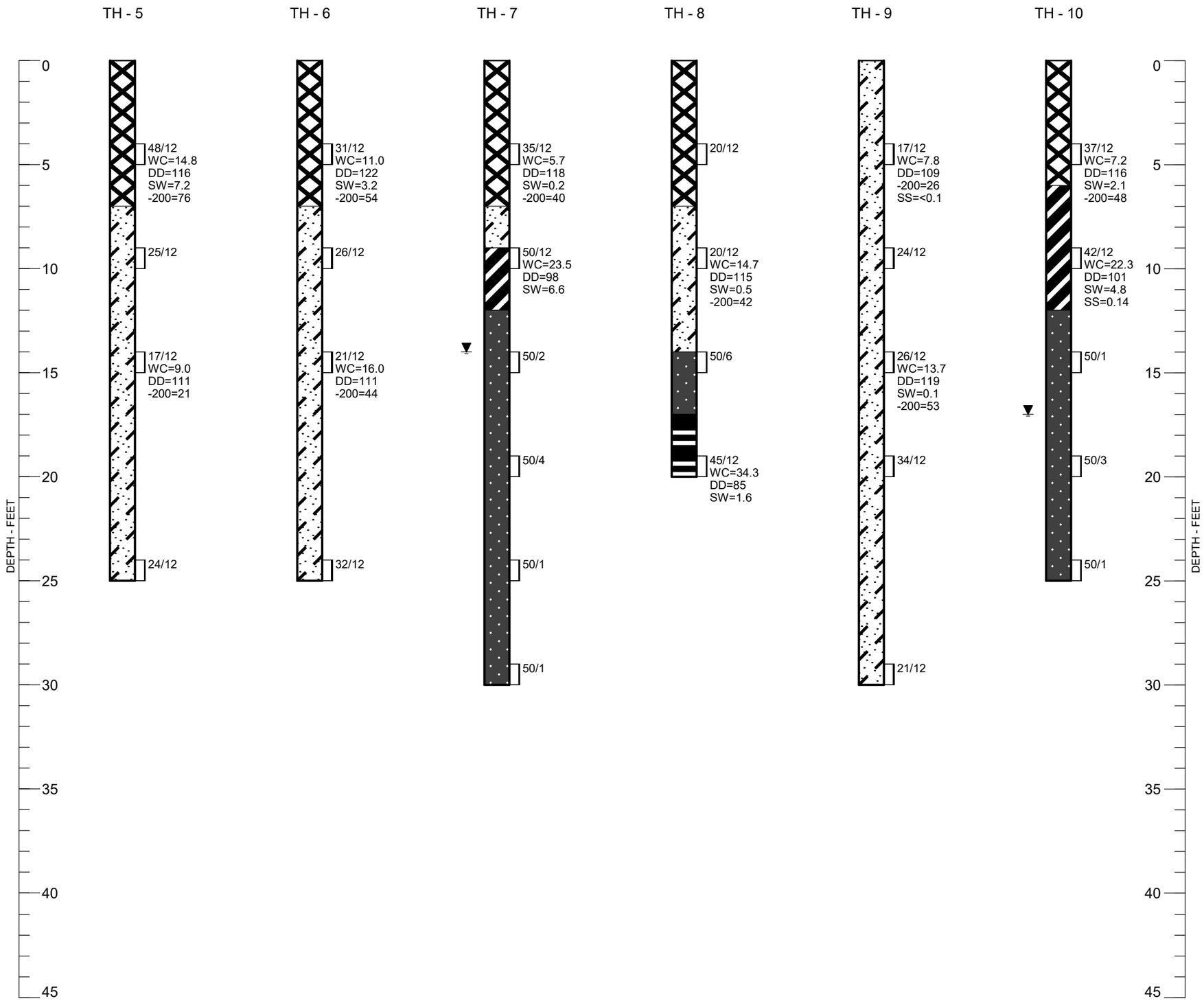
FIG. 3



RICHMOND AMERICAN HOMES
HANNAH RIDGE
CTL|T PROJECT NO. CS19005-115

Summary Logs of Exploratory Borings

FIG. 4



LEGEND:

- FILL, CLAY, SANDY TO VERY SANDY AND SAND, VERY CLAYEY, VERY STIFF, SLIGHTLY MOIST TO MOIST, BROWN, DARK BROWN.
- SAND, CLAYEY TO VERY CLAYEY, WITH CLAY, VERY SANDY LENSES, MEDIUM DENSE TO DENSE, MOIST, BROWN. (SC)
- WEATHERED CLAYSTONE, SANDY, MEDIUM HARD TO HARD, MOIST, BROWN.
- BEDROCK. SANDSTONE, CLAYEY, VERY HARD, MOIST, GRAY, BROWN.
- BEDROCK. CLAYSTONE, SANDY, MEDIUM HARD, VERY MOIST, YELLOWISH BROWN.
- DRIVE SAMPLE. THE SYMBOL 15/12 INDICATES 15 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.
- GROUNDWATER LEVEL MEASURED EIGHT DAYS AFTER DRILLING.

NOTES:

1. THE BORINGS WERE DRILLED NOVEMBER 6, 2018 USING A 4-INCH DIAMETER, CONTINUOUS-FLIGHT AUGER AND A CME-55, TRUCK-MOUNTED DRILL RIG.
2. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS, AND CONCLUSIONS AS CONTAINED IN THIS REPORT.
3. WC - INDICATES MOISTURE CONTENT. (%)
   DD - INDICATES DRY DENSITY. (PCF)
   SW - INDICATES SWELL WHEN WETTED UNDER ESTIMATED OVERBURDEN PRESSURE. (%)
   COM - INDICATES COMPRESSION WHEN WETTED UNDER ESTIMATED OVERBURDEN PRESSURE. (%)
   -200 - INDICATES PASSING NO. 200 SIEVE. (%)
   SS - INDICATES WATER-SOLUBLE SULFATE CONTENT. (%)

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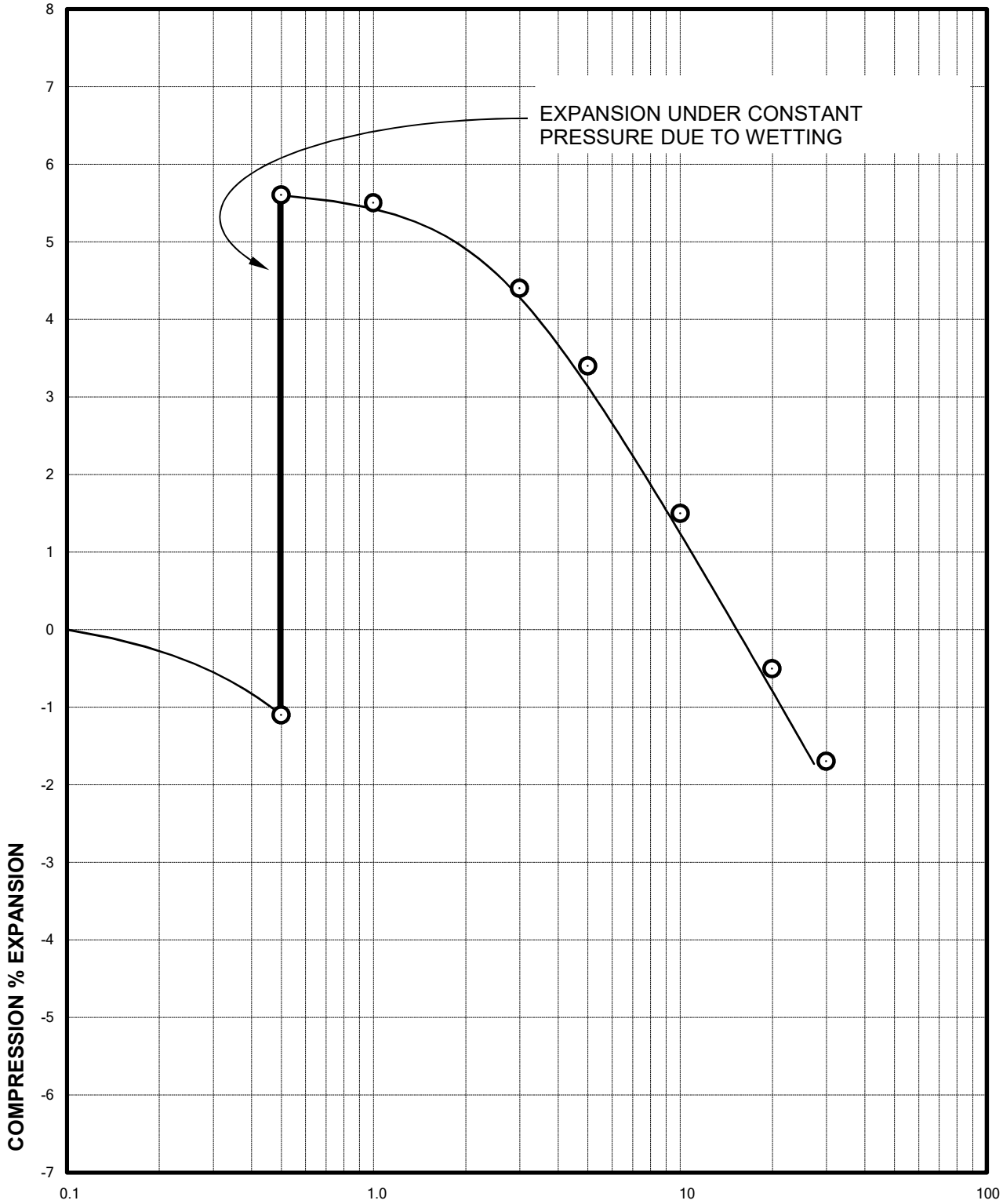
Summary Logs of Exploratory Borings

FIG. 5

APPENDIX A

SWELL-CONSOLIDATION TEST RESULTS
GRADATION TEST RESULTS
TABLE A-1 – SUMMARY OF LABORATORY TESTING



Sample of FILL, CLAY, SANDY

From TH-2 AT 4 FEET

DRY UNIT WEIGHT= 118 PCF

MOISTURE CONTENT= 15.2 %

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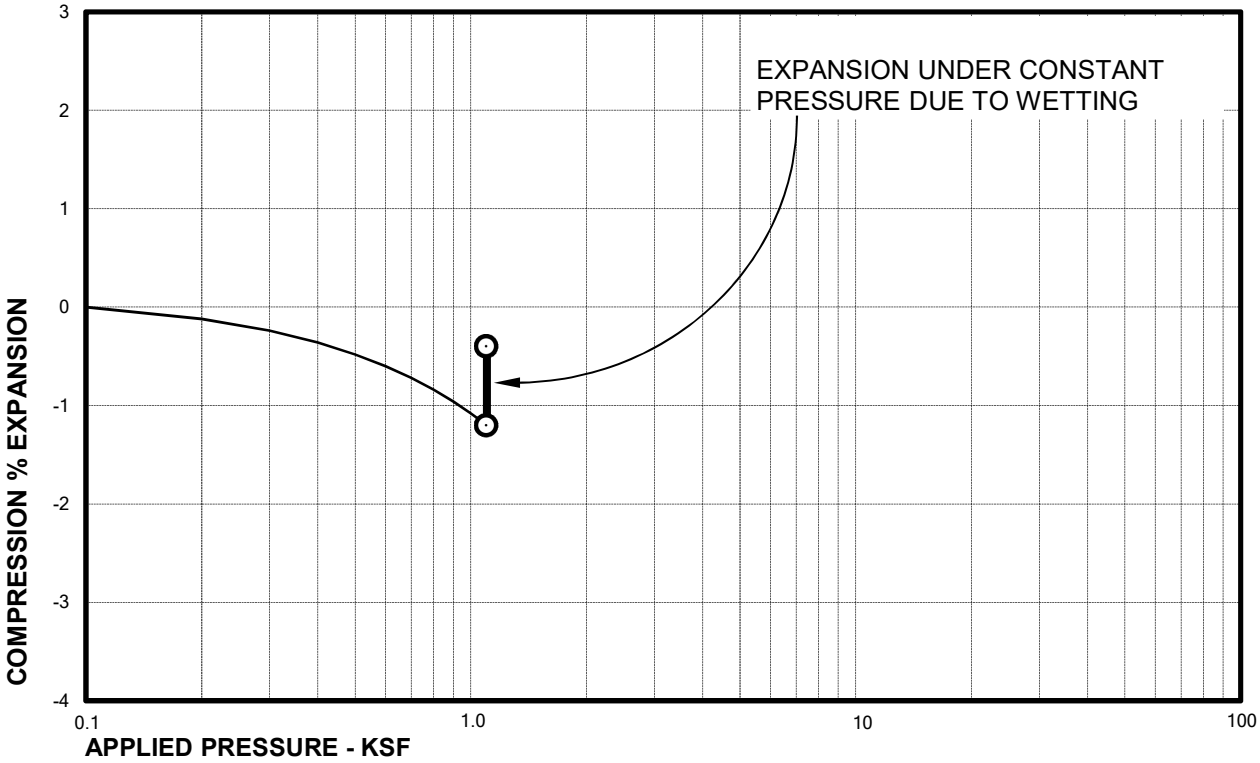
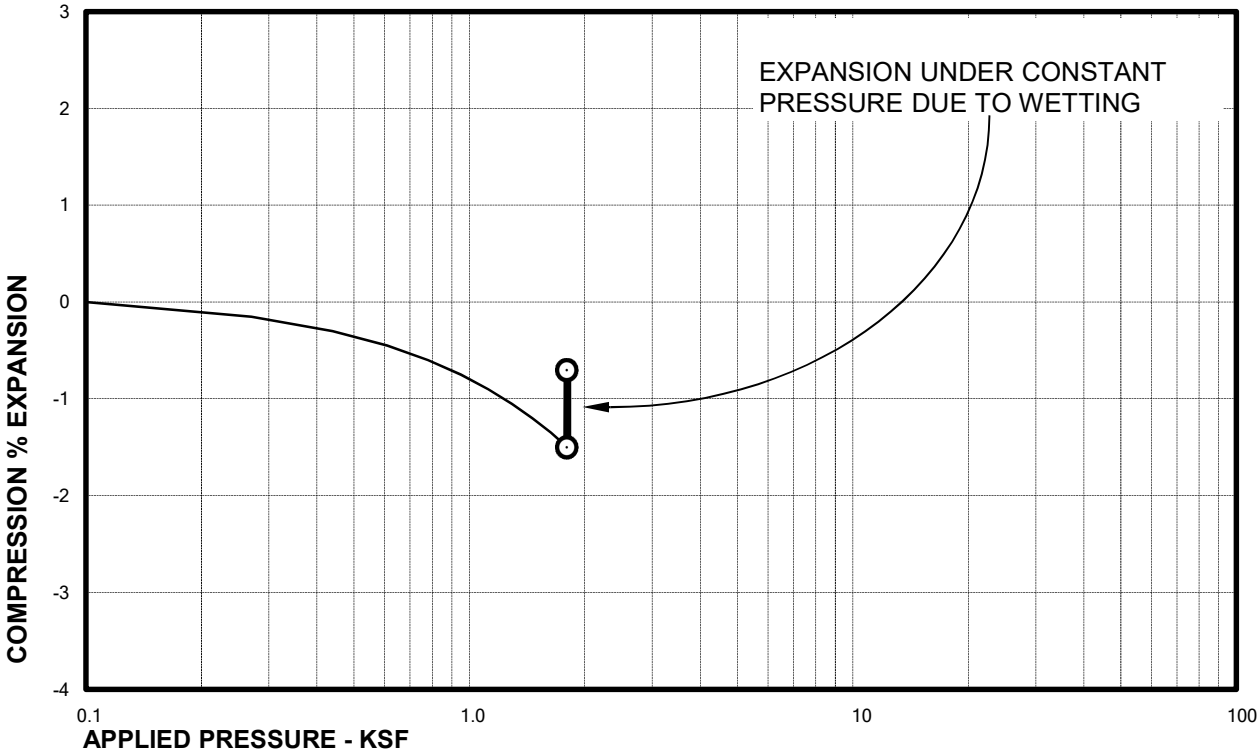
Swell Consolidation Test Results

FIG. A-1



Sample of CLAY, VERY SANDY (CL)
From TH-2 AT 9 FEET

DRY UNIT WEIGHT= 109 PCF
MOISTURE CONTENT= 16.4 %



Sample of SAND, CLAYEY (SC)
From TH-2 AT 14 FEET

DRY UNIT WEIGHT= 107 PCF
MOISTURE CONTENT= 19.9 %

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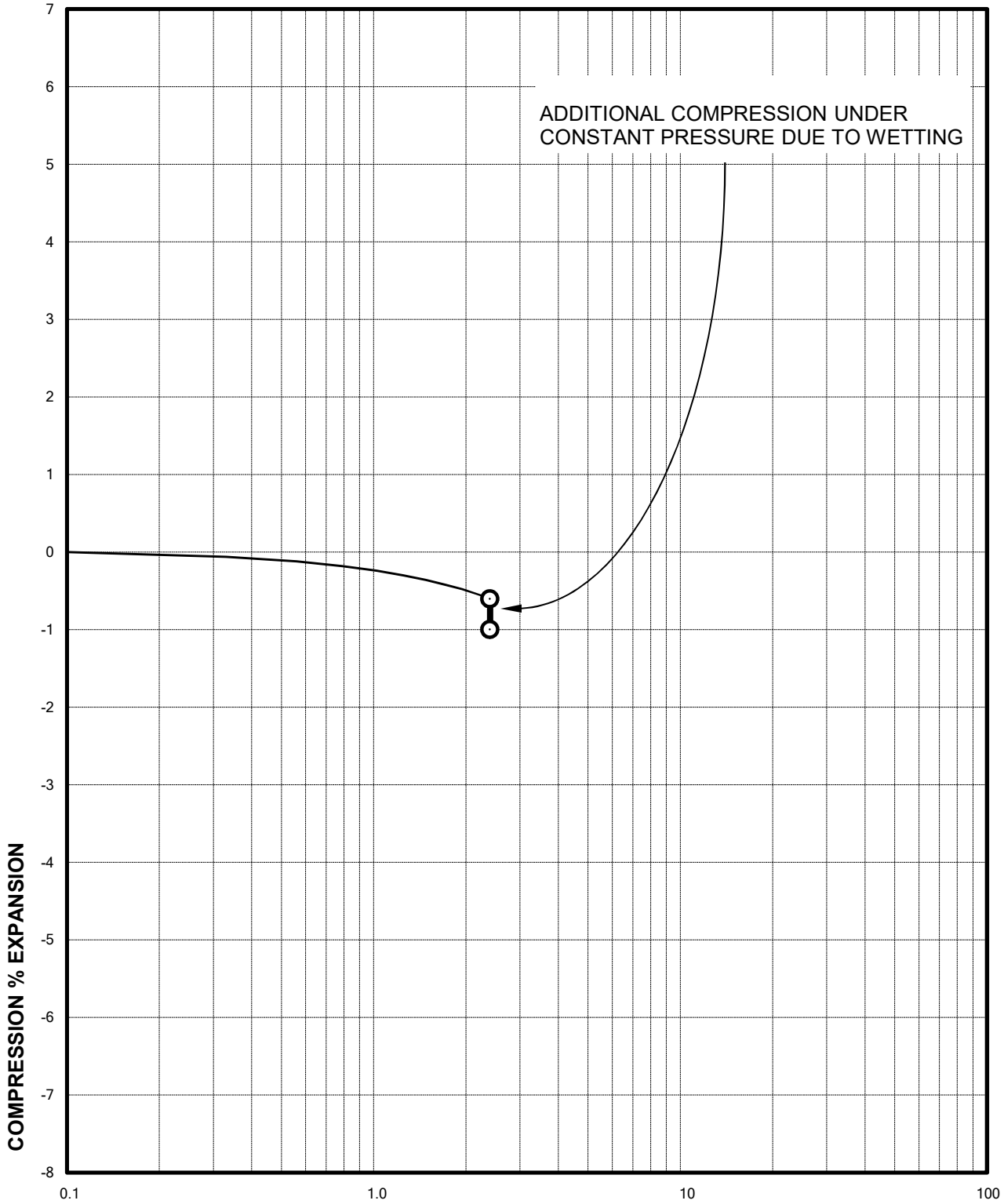
Swell Consolidation

FIG. A-2



Sample of SAND, CLAYEY (SC)

From TH-2 AT 19 FEET

DRY UNIT WEIGHT= 112 PCF

MOISTURE CONTENT= 11.7 %

RICHMOND AMERICAN HOMES
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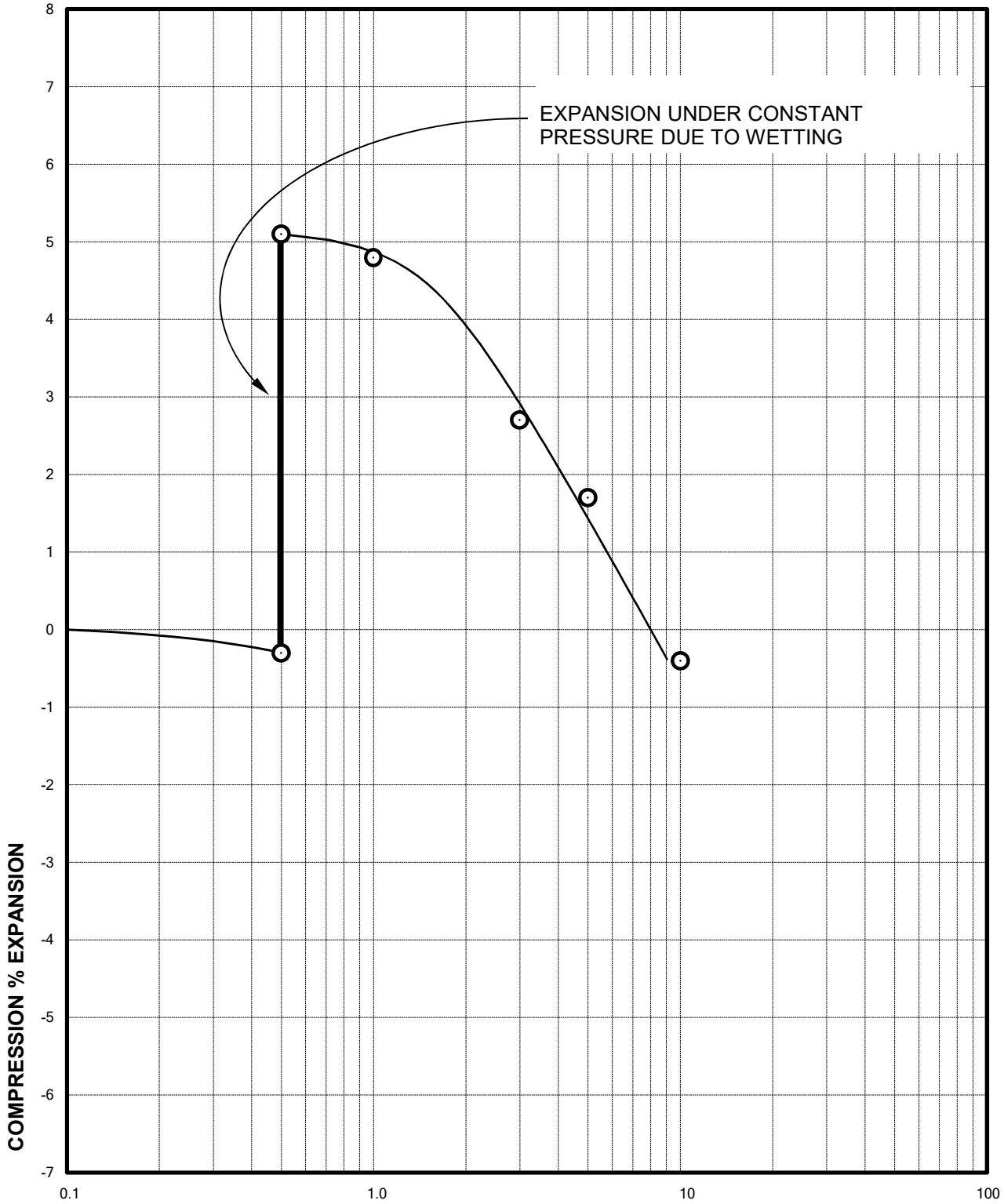
Swell Consolidation Test Results

FIG. A-3



Sample of FILL, CLAY, SANDY

From TH-3 AT 4 FEET

DRY UNIT WEIGHT= 108 PCF

MOISTURE CONTENT= 9.9 %

RICHMOND AMERICAN HOMES
HANNAH RIDGE
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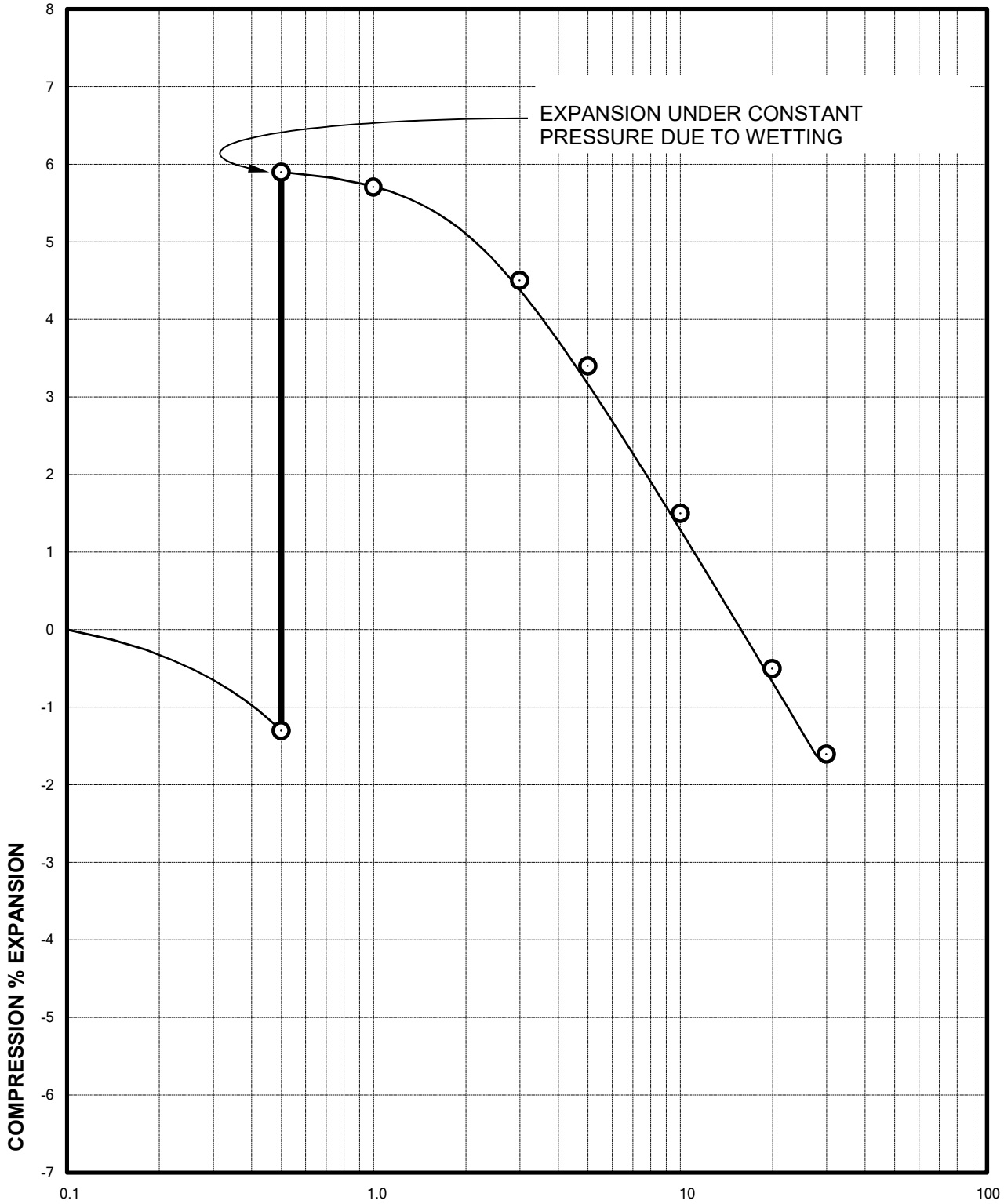
Swell Consolidation Test Results

FIG. A-4



Sample of FILL, CLAY, SANDY

From TH-5 AT 4 FEET

DRY UNIT WEIGHT= 116 PCF

MOISTURE CONTENT= 14.8 %

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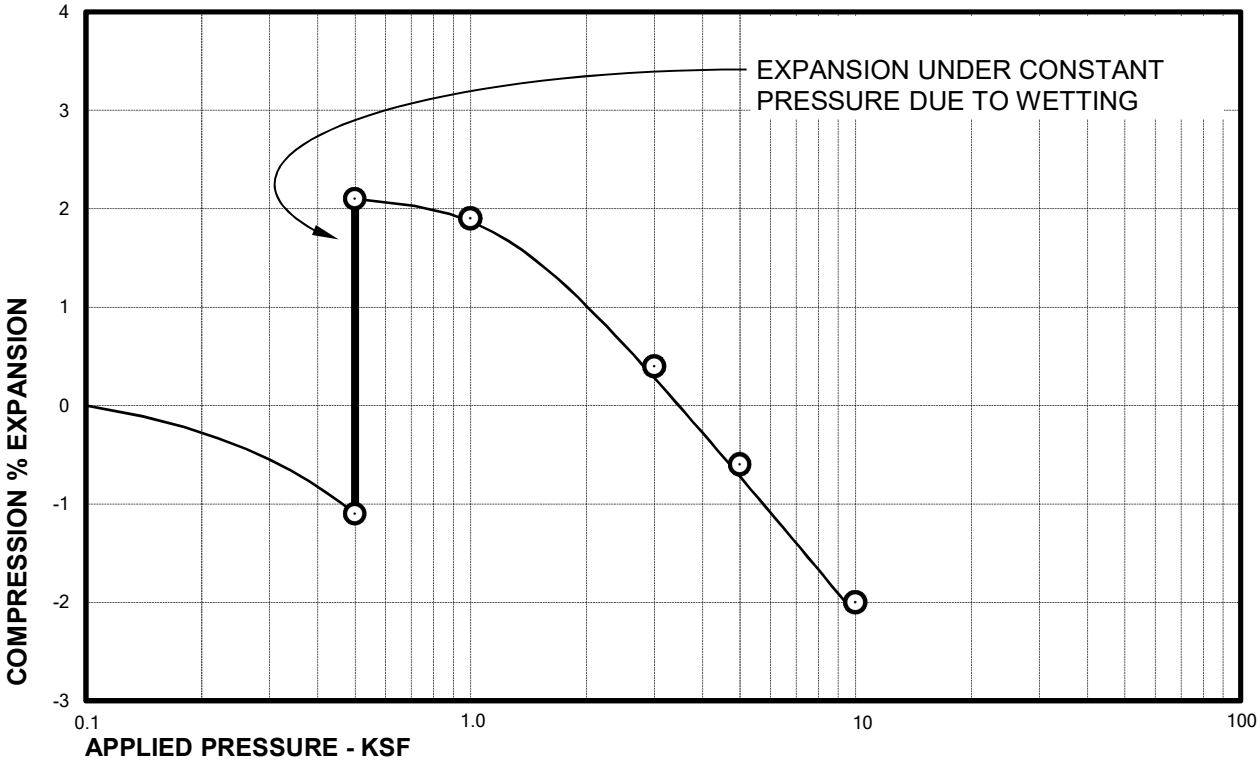
Swell Consolidation Test Results

FIG. A-5

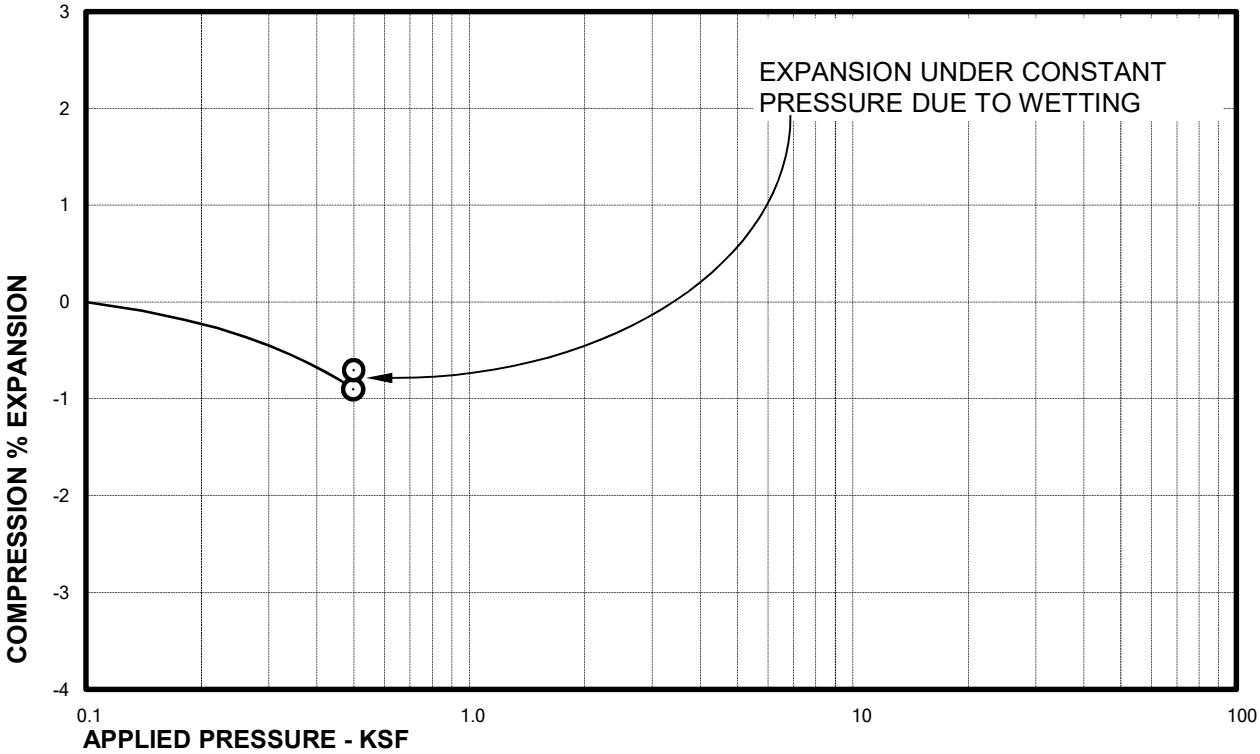


Sample of FILL, CLAY, VERY SANDY

From TH-6 AT 4 FEET

DRY UNIT WEIGHT= 122 PCF

MOISTURE CONTENT= 11.0 %



Sample of FILL, SAND, VERY CLAYEY

From TH-7 AT 4 FEET

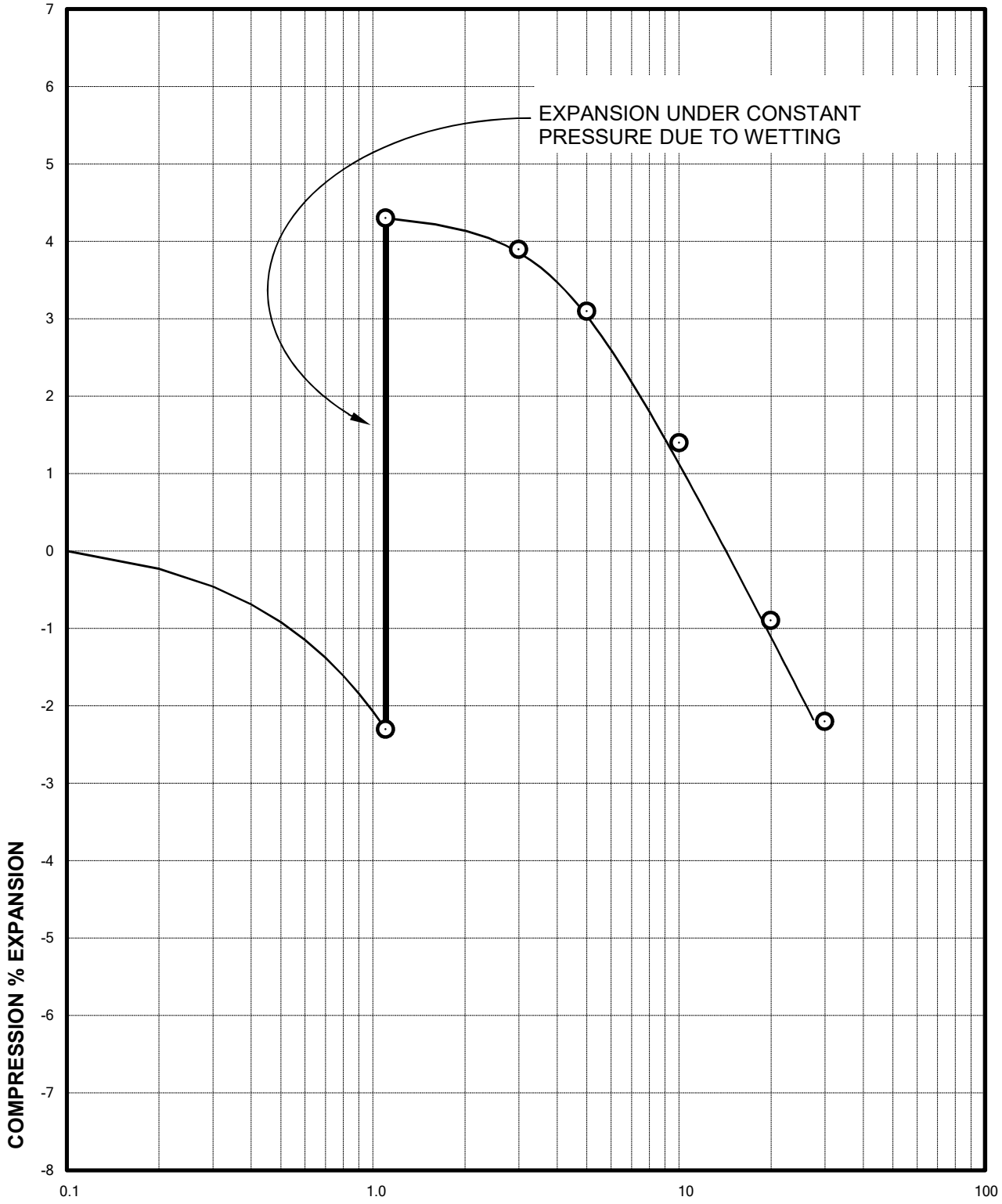
DRY UNIT WEIGHT= 118 PCF

MOISTURE CONTENT= 5.7 %

RICHMOND AMERICAN HOMES
HANNAH RIDGE
CTL|T PROJECT NO. CS19005-115

Swell Consolidation

FIG. A-6



Sample of CLAYSTONE, WEATHERED

From TH-7 AT 9 FEET

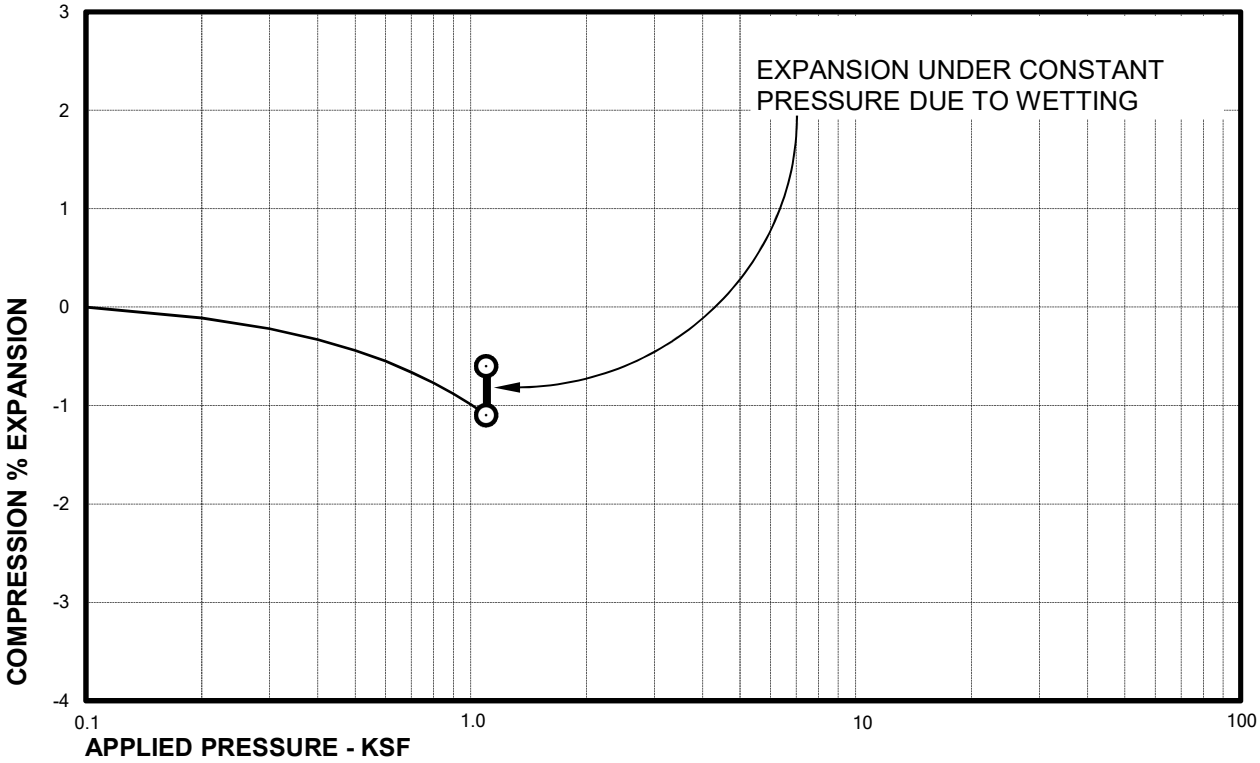
DRY UNIT WEIGHT= 98 PCF

MOISTURE CONTENT= 23.5 %

RICHMOND AMERICAN HOMES
HANNAH RIDGE
CTL|T PROJECT NO. CS19005-115

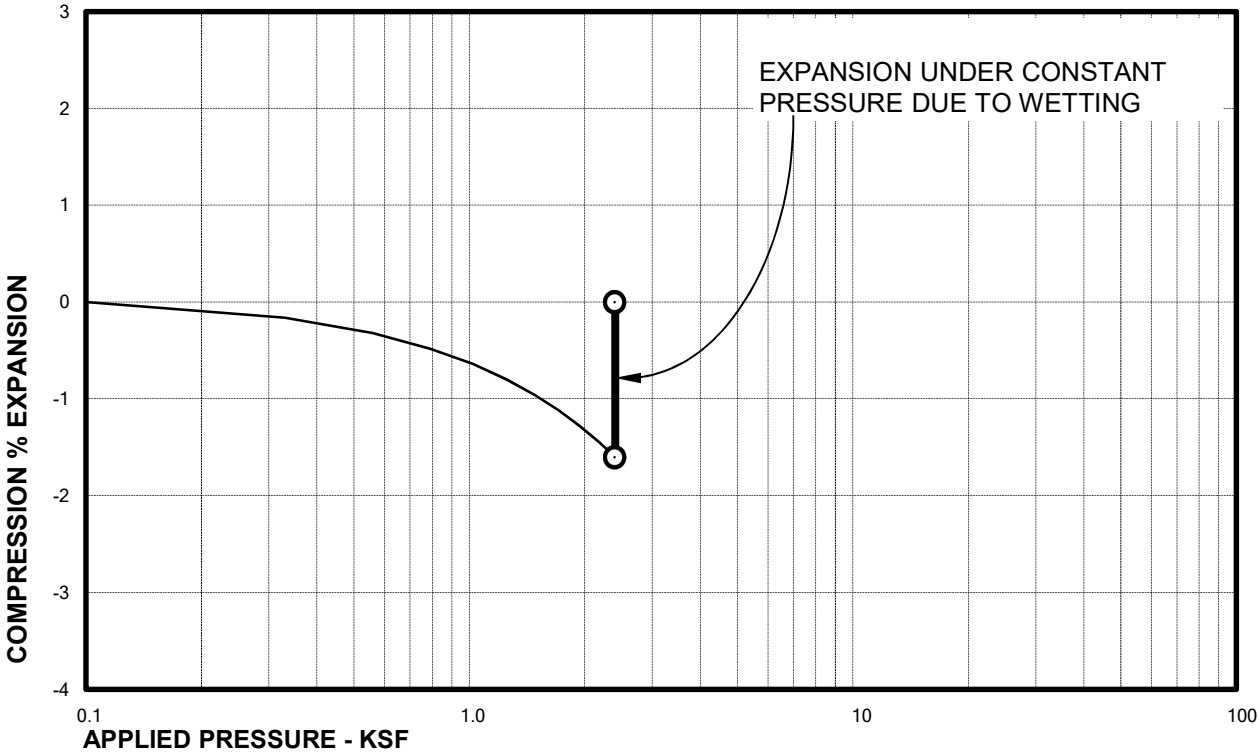
Swell Consolidation Test Results

FIG. A-7



Sample of SAND, VERY CLAYEY (SC)
From TH-8 AT 9 FEET

DRY UNIT WEIGHT= 115 PCF
MOISTURE CONTENT= 14.7 %



Sample of CLAYSTONE, SANDY
From TH-8 AT 19 FEET

DRY UNIT WEIGHT= 85 PCF
MOISTURE CONTENT= 34.3 %

RICHMOND AMERICAN HOMES
HANNAH RIDGE
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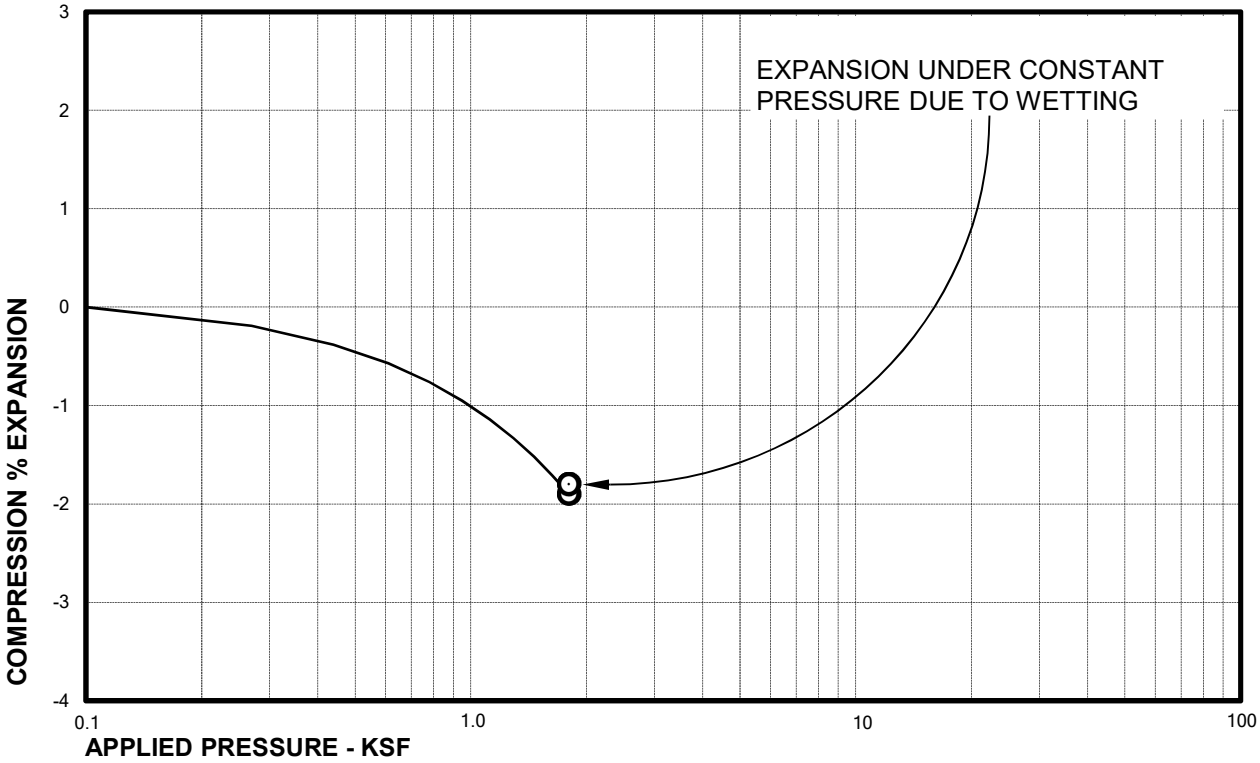
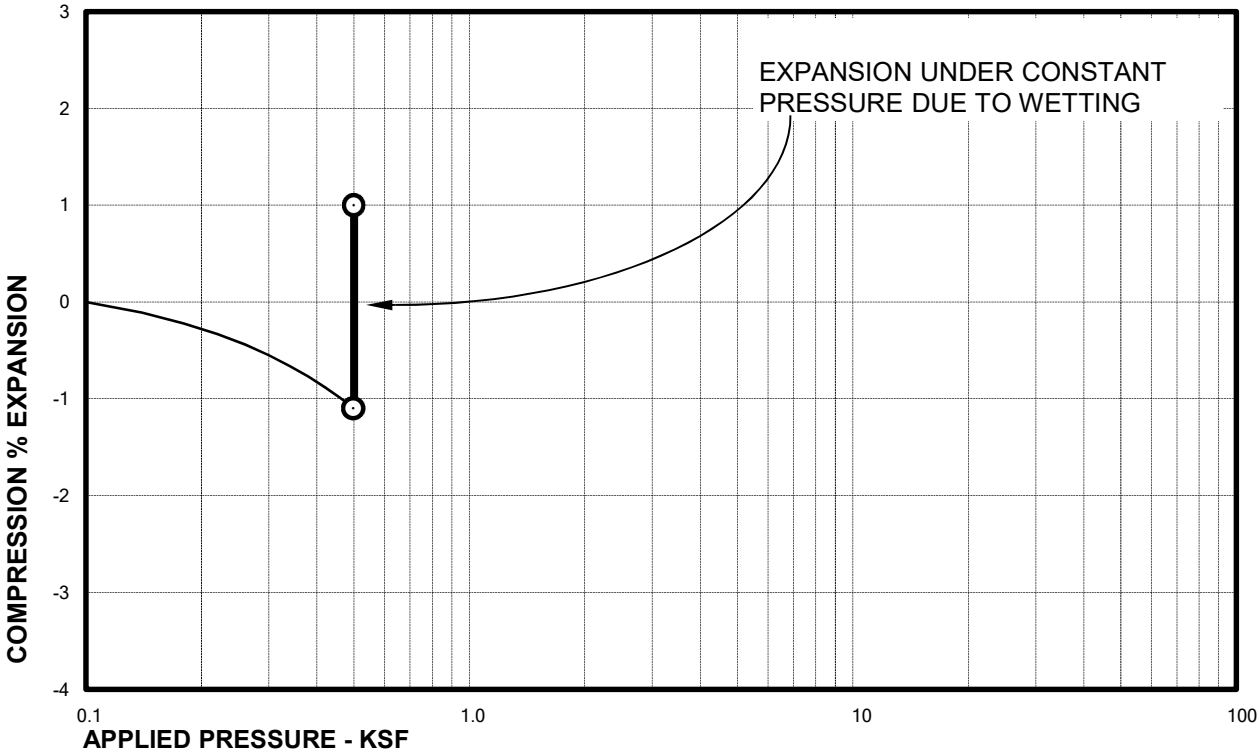
Swell Consolidation

FIG. A-8



Sample of CLAY, VERY SANDY (CL)
From TH-9 AT 14 FEET

DRY UNIT WEIGHT= 119 PCF
MOISTURE CONTENT= 13.7 %



Sample of FILL, SAND, VERY CLAYEY
From TH-10 AT 4 FEET

DRY UNIT WEIGHT= 116 PCF
MOISTURE CONTENT= 7.2 %

RICHMOND AMERICAN HOMES
HANNAH RIDGE
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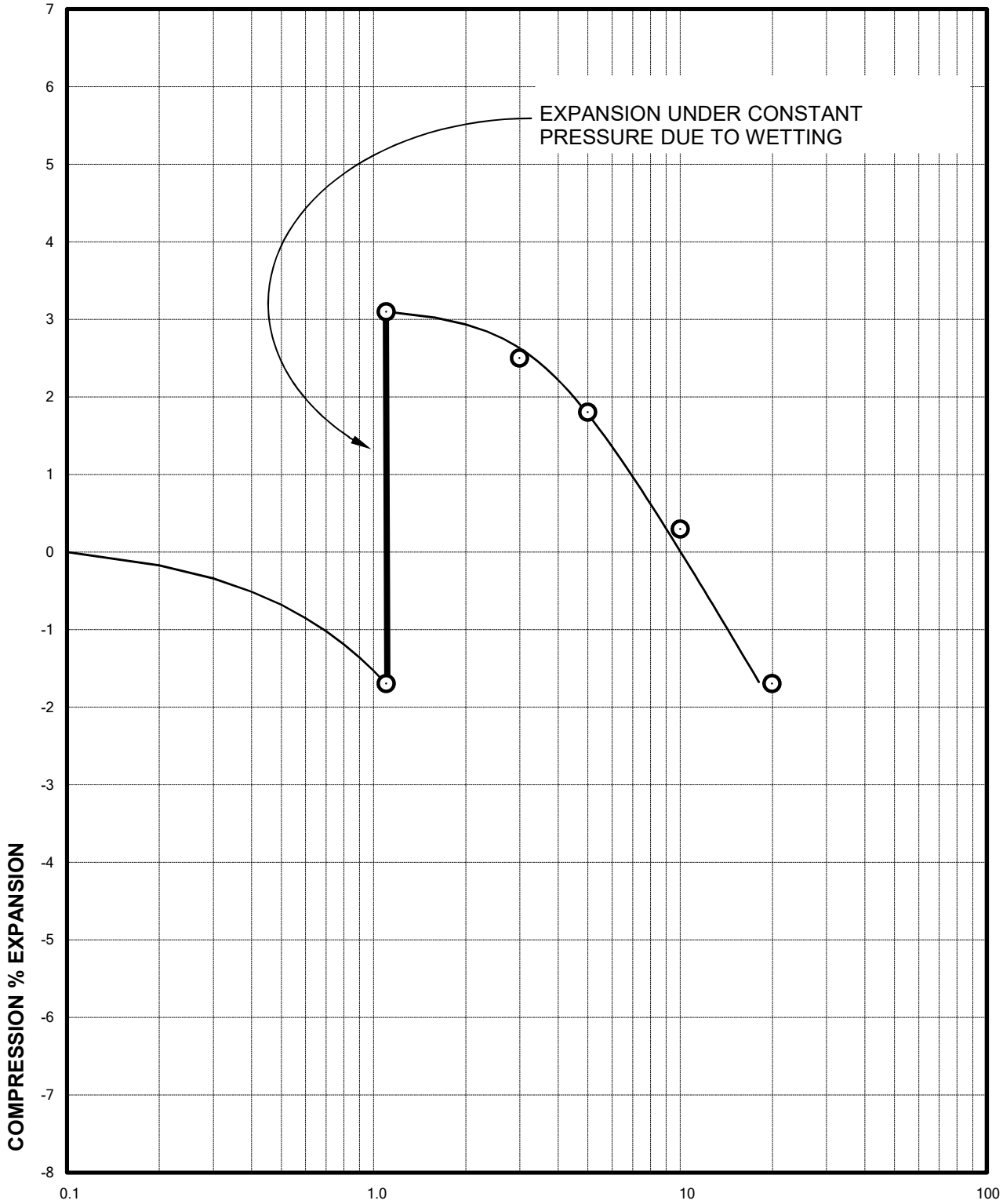
Swell Consolidation

FIG. A-9



Sample of CLAYSTONE, WEATHERED

From TH-10 AT 9 FEET

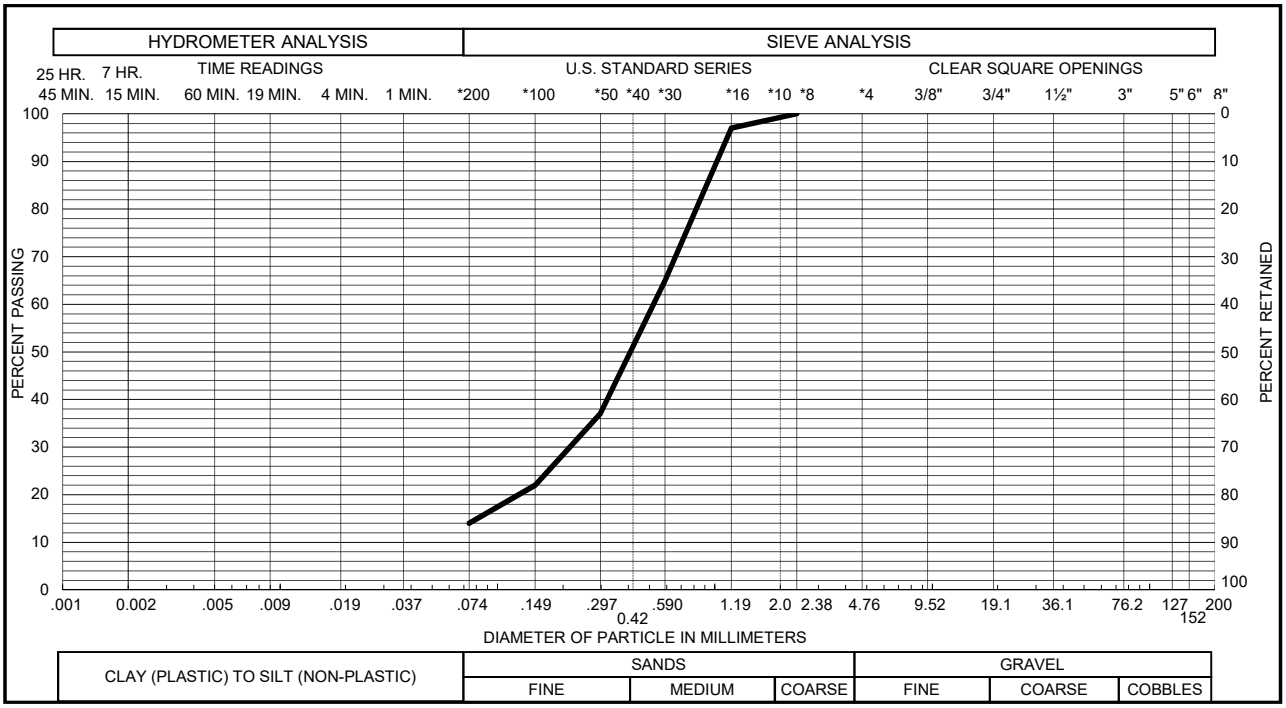
DRY UNIT WEIGHT= 101 PCF

MOISTURE CONTENT= 22.3 %

RICHMOND AMERICAN HOMES
HANNAH RIDGE
CTL|T PROJECT NO. CS19005-115

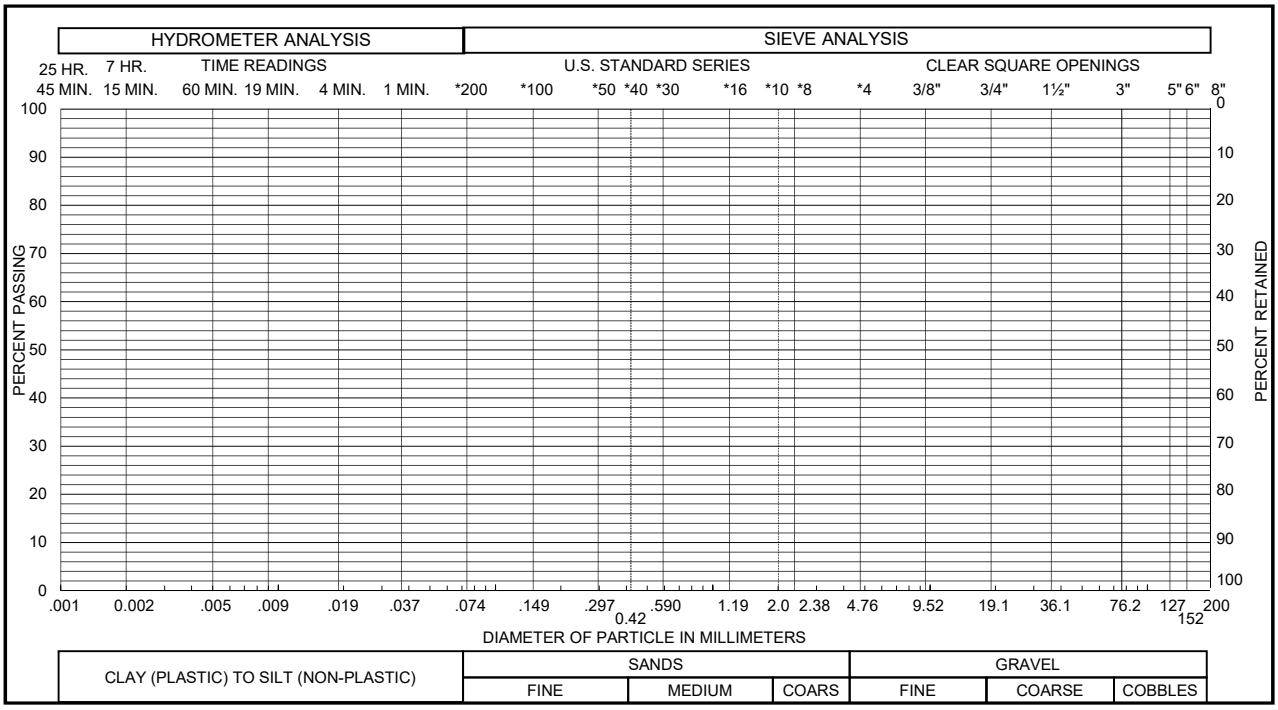
Swell Consolidation Test Results

FIG. A-10



Sample of SAND, CLAYEY (SC)
From TH - 1 AT 9 FEET

GRAVEL 0 %
SILT & CLAY 14 %
PLASTICITY INDEX %
SAND 86 %
LIQUID LIMIT %



Sample of
From

GRAVEL %
SILT & CLAY %
PLASTICITY INDEX %
SAND %
LIQUID LIMIT %

RICHMOND AMERICAN HOMES
HANNAH RIDGE
CTL|T PROJECT NO. CS19005-115

Gradation Test Results

FIG. A-11

TABLE A-1

SUMMARY OF LABORATORY TESTING
CTL|T PROJECT NO. CS19005-115

BORING	DEPTH (FEET)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	ATTERBERG LIMITS		SWELL TEST RESULTS*			PASSING NO. 200 SIEVE (%)	WATER SOLUBLE SULFATES (%)	DESCRIPTION
				LIQUID LIMIT (%)	PLASTICITY INDEX (%)	SWELL (%)	APPLIED PRESSURE (PSF)	SWELL PRESSURE (PSF)			
TH-1	9	5.9	110						14		SAND, CLAYEY (SC)
TH-2	4	15.2	118			6.7	500	20,500	78		FILL, CLAY, SANDY
TH-2	9	16.4	109			0.8	1100		53		CLAY, VERY SANDY (CL)
TH-2	14	19.9	107			0.8	1800				SAND, CLAYEY (SC)
TH-2	19	11.7	112			-0.4	2400				SAND, CLAYEY (SC)
TH-3	4	9.9	108			5.4	500	9,000	68		FILL, CLAY, SANDY
TH-4	9	9.4	104						28	<0.1	SAND, CLAYEY (SC)
TH-5	4	14.8	116			7.2	500	21,000	76		FILL, CLAY, SANDY
TH-5	14	9.0	111						21		SAND, CLAYEY (SC)
TH-6	4	11.0	122			3.2	500	6,000	54		FILL, CLAY, VERY SANDY
TH-6	14	16.0	111						44		SAND, VERY CLAYEY (SC)
TH-7	4	5.7	118			0.2	500		40		FILL, SAND, VERY CLAYEY
TH-7	9	23.5	98			6.6	1100	30,000			CLAYSTONE, WEATHERED
TH-8	9	14.7	115			0.5	1100		42		SAND, VERY CLAYEY (SC)
TH-8	19	34.3	85			1.6	2400				CLAYSTONE, SANDY
TH-9	4	7.8	109						26	<0.1	SAND, CLAYEY (SC)
TH-9	14	13.7	119			0.1	1800		53		CLAY, VERY SANDY (CL)
TH-10	4	7.2	116			2.1	500		48		FILL, SAND, VERY CLAYEY
TH-10	9	22.3	101			4.8	1100	20,000		0.1	CLAYSTONE, WEATHERED

* SWELL MEASURED UNDER ESTIMATED IN-SITU OVERBURDEN PRESSURE.
NEGATIVE VALUE INDICATES COMPRESSION.