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PRELIMINARY
GEOTECHNICAL INVESTIGATION
RIDGEGATE SOUTHWEST VILLAGE
SOUTHEAST OF RIDGEGATE PARKWAY
AND INTERSTATE 25
LONE TREE, COLORADO

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Project No. DN49,935 -115-R2

April 24, 2019

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SCOPE

This report presents the results of our Preliminary Geotechnical Investigation for the Ridgegate Southwest Village in Lone Tree, Colorado (Fig. 1). The purpose of our investigation was to evaluate the subsurface conditions to assist in due diligence assessment and planning of site development. The report includes descriptions of subsurface strata and groundwater found in our exploratory borings, identification of geologic hazards and geotechnical concerns, and discussions of site development and construction as influenced by geotechnical considerations. The scope was described in a Proposal dated February 11, 2019 (DN 19-0079). Environmental Site Assessment and a Biological and Cultural Assessment were recently completed by our firm.

This report is based on our understanding of the planned construction, site reconnaissance, subsurface conditions disclosed by exploratory drilling and sampling, results of field and laboratory tests, engineering analysis of field and laboratory data, and our experience. The report contains descriptions of the soil and groundwater found in our exploratory borings, preliminary recommendations for site development, and preliminary discussion of foundations, floor systems, pavements, and surface and subsurface drainage. The discussions of foundation, floor system and pavement alternatives are intended for planning purposes only. Additional investigation may be necessary to evaluate merits of sub-excavation. Site-specific investigations will be necessary to design structures, pavements, and other improvements. A summary of our conclusions and recommendations follows, with more detailed discussion in the report.

SUMMARY OF CONCLUSIONS

1. The site is judged suitable for development. The primary geotechnical concern is expansive soil and bedrock. The soils and bedrock were erratic and borings indicate much of the site is underlain by

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expansive materials, a geologic hazard. Moderate to steep slopes are also present, along with regional issues of seismicity and potential radon. These concerns can be mitigated with proper planning, engineering, design and construction. We believe there are no geotechnical constraints that would preclude development.

2. Strata found in our borings were erratic and consisted of about 1 to more than 25 feet of sand and/or clay underlain by weathered and comparatively unweathered claystone, sandstone and interbedded claystone and sandstone bedrock. Bedrock was not encountered in three borings. Clay and claystone samples exhibited variable swelling characteristics.

3. Groundwater was encountered during drilling in one boring at a depth of about 33 feet. When the holes were checked after drilling, water was measured in seven borings at depths of about 18 to 47 feet below existing grades, or 16 to 26 feet below proposed grades. Groundwater may be encountered during deep sub-excavation and utility installation. Groundwater may fluctuate seasonally and rise in response to development, precipitation, landscape irrigation and water levels in Happy Canyon Creek and Badger Gulch.

4. We estimate total potential ground heave could range from less than 0.5-inch to about 11.5 inches considering wetting depths of 20 and 24 feet below proposed grades. We believe the estimates are conservative (high).

5. The site is judged to have variable risk of damage due to expansive soil and bedrock. Footing foundations may be used where low swelling soil and bedrock are present within depths likely to influence performance of foundations. Drilled piers or other deep foundation systems should be anticipated in areas with moderate to high swelling soil or claystone are present. Sub-excavation can be considered for a wider use of shallow foundations and slab-on-grade basement floors. The variability of soils and bedrock conditions and presence of sandstone imply depth of sub-excavation could be variable, or you could elect to sub-excavate all lots to 10 feet below basements, 13 feet below structure foundations where no basements are planned, or to massive sandstone. <u>Further investigation is recommended if you wish to use the variable approach.</u>

6. Slopes greater than 20 percent will need to be benched prior to placement of fill. Sub-fill drains are recommended along the alignment of the existing drainages where about 15 or more feet of fill is planned.

7. The clayey soils are anticipated to possess poor pavement support qualities. For planning purposes, we estimate a 4-inch thick asphaltic concrete and 6-inch base course section for local residential streets. Mitigation of expansive soils will likely be required, such as placement of an extra 12 inches of base course. Minimum pavement sections are provided in the report. A subgrade investigation and pavement design should be performed after grading is complete.

8. Control of surface and subsurface drainage will be critical to the performance of foundations, slabs-on-grade, pavements and other improvements. Overall surface drainage should be designed to provide rapid run-off of surface water away from structures and off pavements and flatwork. Water should not be allowed to pond near structures or on pavements and flatwork, or on the crests of slopes. Conservative irrigation practices should be employed to reduce the risk of subsurface wetting.

SITE CONDITIONS

Ridgegate Southwest Village includes about 2,000 acres (+/-) southeast of Ridgegate Parkway and I-25 in southeastern Lone Tree, Colorado (Fig. 1 and Photo 1). The site is vacant rangeland and bordered by Happy Canyon Creek to the West, vacant land and Ridgegate Parkway to the north, Badger Gulch to the east and vacant land to the south. The site generally slopes north, with moderate grades on the south portion flattening to the north. There are several ephemeral drainages which flow toward Happy Canyon Creek to the west, Badger Gulch to the east, and to the north. The old Arapahoe Canal traverses the central portion of the site east to west. The ground surface is covered with grass, weeds, bushes and trees. The bushes and trees are concentrated near the drainages. Historical aerial photographs dating to 1936 indicate the site has remained relatively unchanged.

PROPOSED DEVELOPMENT

Preliminary plans indicate the site may be developed for a mix of about 1860 single-family residences. A school site, recreational area and a small commercial component are planned. The residences will include a mix of attached and detached products ranging from one to three-story. Basements are anticipated for some of the residences. The development will be served by paved roadways and buried utilities. Plans dated March 13, 2018 indicate retaining wall heights range from 10 to 31 feet. Plans dated February 22, 2019 suggest cuts up to about 50 feet and fills up to about 34 feet (Fig. 2). The deepest cuts will be in the southeastern portion of the site near TH-37 and TH-38. The deeper fills are planned within existing drainages and in the north-central portion of the site. Some lots are planned over drainages, such as near TH-6, 9, 11, 22, 25, 26, and 38-40.

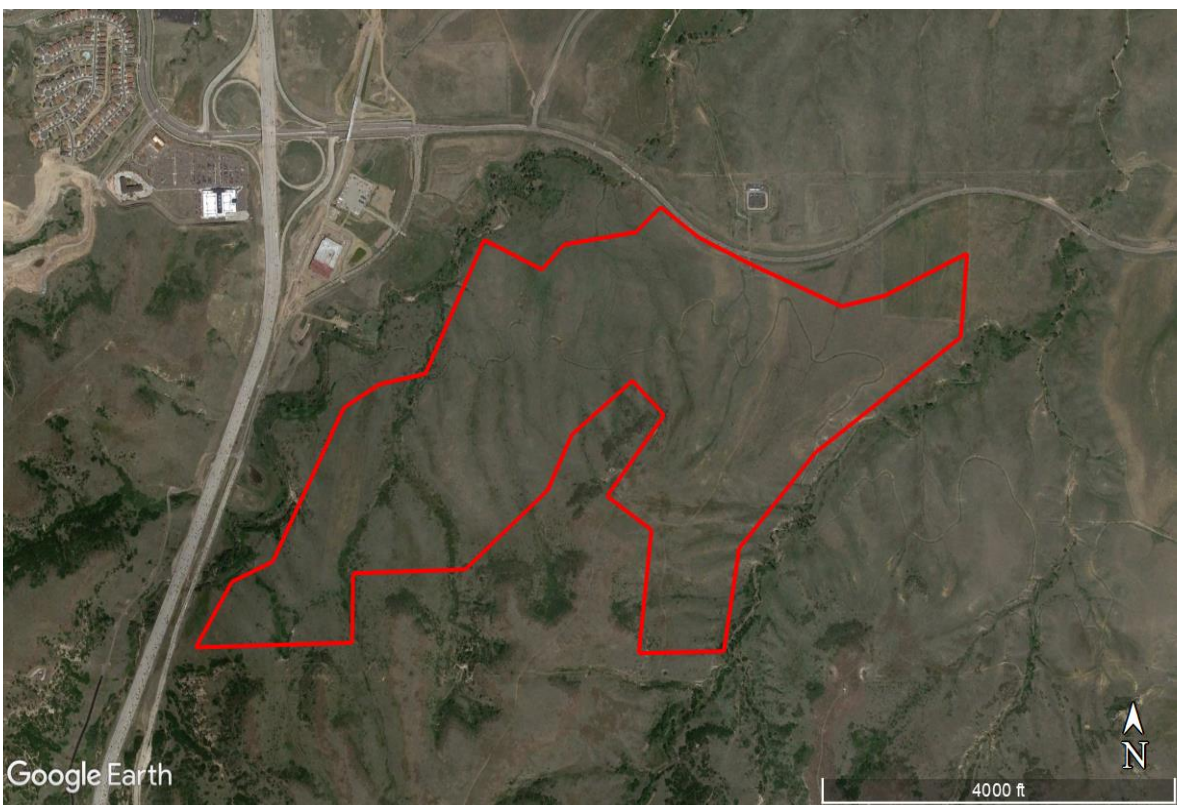


Photo 1 – Google Earth© Aerial Site Photo – June 2017

INVESTIGATION

Subsurface conditions were investigated by drilling 42 exploratory borings at the locations shown on Fig. 1. The locations were selected to provide spacing of about 600 to 750 feet. Boring locations were surveyed by others. Prior to drilling, we contacted the Utility Notification Center of Colorado and local sewer and water districts to identify locations of buried utilities. The borings were drilled to depths of about 20 to 30 feet below proposed grades using 4-inch diameter, continuous-flight solid-stem augers and truck-mounted drill rigs.

Samples of the soil and bedrock were obtained at approximate 5-feet intervals using a 2.5-inch diameter (O.D.) modified California barrel sampler driven by an automatic 140-pound hammer falling 30 inches. Our field representatives were present to observe drilling, log the soil and bedrock, obtain samples and measure the depth to groundwater. Bulk samples were collected from auger cuttings at select borings. Summary logs of exploratory borings are presented in Appendix A.

Samples were returned to our laboratory where they were examined. Laboratory tests included dry density, moisture content, particle size analysis, Atterberg limits, swell-consolidation, standard Proctor (ASTM D 698 or AASHTO T99) and water-soluble sulfate concentration. Swell-consolidation tests were performed by wetting the samples under approximate post-construction overburden pressures (the pressure exerted by overlying soils after proposed grading). Results of laboratory tests are presented in Appendix B.

SUBSURFACE CONDITIONS

Strata encountered in our exploratory borings were erratic and consisted of 1 to more than 25 feet of sand and/or clay underlain by weathered and comparatively unweathered bedrock to the maximum depth explored of 55 feet. Bedrock was not encountered in three borings. Pertinent engineering characteristics of the soil and bedrock are described in the following paragraphs. Table I summarizes the results of swell-consolidation tests.

TABLE I
SUMMARY OF SWELL TEST RESULTS

Soil Type	Compression	Range of Measured Swell (%)			
		0 to <2	2 to <4	4 to <6	≥6
	Number and Fraction of Samples				
Clay	6 16%	7 19%	7 19%	4 11%	13 35%
Sand	0 0%	0 0%	1 100%	0 0%	0 0%
Claystone/Interbedded Claystone and Sandstone	5 6%	49 57%	21 24%	8 9%	3 4%
Sandstone	2 67%	1 33%	0 0%	0 0%	0 0%
Overall	13 10%	57 45%	29 23%	12 9%	16 13%

*Swell measured after wetting under approximate future overburden pressure

Sand and Clay

Overburden soils consisted of clean to clayey sand and silty to sandy clay and were generally thicker near or within drainages. Clay was predominant. It contained occasional sand lenses and gravel and was calcareous at times. The sand was generally found near drainages in the west-central and east to south-east-central areas and the cleaner sand contained gravel. Based on the results of field penetration resistance tests, the sand was medium dense to very dense and the clay was stiff to very stiff. Of the clay samples that swelled, nearly 75 percent swelled more than 2 percent. Eighteen clay samples developed load-back swelling pressures ranging from 900 to 31,000 psf. One clayey sand sample swelled 2.7 percent. Fourteen clay samples contained 50 to 94 percent silt and clay sized particles and three exhibited high or very high plasticity. Eleven sand samples contained 6 to 48 percent fines, five contained 1 to 10 percent gravel, and one exhibited moderate plasticity. Testing indicates the clay is predominantly expansive. We judge the sand to be non-expansive or low-swelling.

Standard Proctor moisture-density relationships were conducted on bulk samples of sandy clay obtained from the surficial soils in TH-23 and TH-31. Results of laboratory testing are summarized in Table II.

TABLE II
SUMMARY OF BULK SAMPLE TEST RESULTS

Boring	Depth (ft)	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Percent Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index
TH-23	0-5	107.5	16.0	59	40	23
TH-31	0-10	105.0	20.0	78	55	34

<u>Bedrock</u>

Bedrock was encountered in 39 borings at depths of about 1 to 24 feet. The approximate depth to and elevation of bedrock are presented on Fig. 3. Bedrock was not encountered in TH-4, 9, and 25. Bedrock consisted of weathered and comparatively unweathered claystone, sandstone and interbedded claystone/sandstone bedrock. Weathered layers were identified in three borings about 3 to 13 feet thick. The comparatively unweathered bedrock was medium hard to very hard. Of the bedrock samples that swelled, 38 developed load-back swelling pressures of 1,300 to 30,000 and about 40 percent swelled 2 percent or more. Sixteen samples contained 15 to 97 percent silt and clay and eight exhibited moderate to very high plasticity. The claystone is expansive and the sandstone is non-expansive or low-swelling.

Groundwater

Groundwater was encountered during drilling in one boring at a depth of about 33 feet. When the holes were checked after drilling on March 25, 2019, water was measured in seven borings at depths of about 18 to 47 feet below existing grades or 16 to 26 feet below proposed grades. Groundwater may be encountered during deep sub-excavation and utility installation. Groundwater may fluctuate seasonally and rise in response to development, precipitation, landscape irrigation and water levels in Happy Canyon Creek and Badger Gulch.

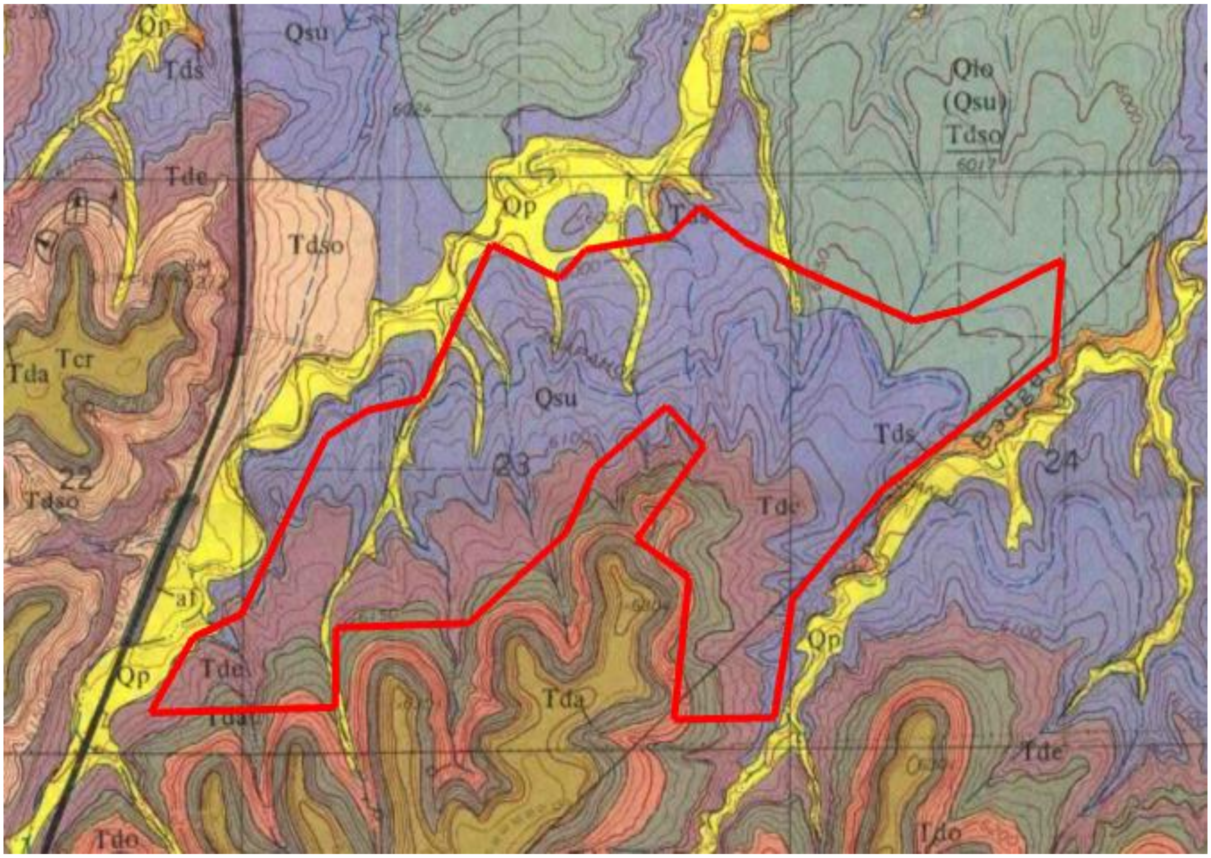
SITE GEOLOGY AND GEOLOGIC HAZARDS

We reviewed a map by Maberry, J.O. and Lindvall, R.M. (Map I-770-A, Geologic Map of the Parker Quadrangle, Arapahoe and Douglas Counties, Colorado, 1972). The map indicates the site is underlain by the Dawson and Arapahoe Formations. Surficial soils are a mixture of clay and sand alluvium. An excerpt from the geologic map is shown below.

Geologic hazards and geotechnical concerns at this site include expansive soil and bedrock, some compressible soils, moderate slopes, erosion and the regional geologic hazards of seismicity and naturally occurring radioactive materials. These concerns can be mitigated with proper planning, engineering, design and construction. No geologic hazards or geotechnical concerns that would preclude development were noted. The following sections provide site development recommendations.

Expansive Soil and Bedrock and Compressible Soils

The presence of expansive/compressible soil and bedrock implies risk that ground heave or settlement will damage foundations, slabs-on-grade floors, and pavements. Covering the ground with structures, streets, driveways, patios, etc., coupled with lawn irrigation and changing drainage patterns, leads to an increase in subsurface moisture conditions. Thus, some soil movement due to heave or settlement is inevitable. Expansive soils and bedrock are present at this site, which constitutes a geologic hazard. There is risk that foundations and slab-on-grade floors will experience heave and subsequent damage. It is critical that precautions are taken to increase the chances that proposed improvements will perform satisfactorily. Engineered planning, design and construction of grading, pavements, foundations, slabs-on-grade, and drainage can mitigate, but not eliminate, the effects of expansive and compressible soils. Sub-excavation is a ground improvement method that can be used to reduce the impacts of swelling soils.



Excerpt from the Geologic Map of the Parker Quadrangle, Arapahoe and Douglas Counties, Colorado by Maberry, J.O. and Lindvall, R.M. (Map I-770-A, 1972)

Legend: Qp – Piney Creek Alluvium (Holocene): Poorly sorted silt, clay, sand and interbedded gravel.
Qsu – Slocum Alluvium (Pleistocene), upper part: Quartz-and-feldspar sand and silty clay; bouldery gravels at the base of the upper and lower parts.
Tda – Dawson Arkose, Upper Part (Paleocene) – Arkosic sandstone with clay binder; fine to coarse-grained; crossbedded.
Tdo – Dawson Arkose, Upper Part (Paleocene) – Claystone with thin interbeds of arkosic sandstone common throughout in varying intervals.
Tds – Dawson Arkose, Upper Part (Paleocene) – Sandstone with crossbedded lens- and tabular-shaped beds of fine-grained quartz, feldspar, and mica in abundant clay binder. Silty, clayey.
Tde – Denver Formation, Upper Tongue (Paleocene) – Claystone, silty, commonly has extremely high swelling-pressure potential.

Seismicity

The soil and bedrock are not expected to respond unusually to seismic activity. According to the 2015 International Residential Code (IRC, Standard Penetration Resistance method of Section 1613.5.2) and based upon the results of our investigation, we judge the site classifies as Seismic Site Class C or D.

Steep Slopes and Erosion

Existing slopes appear to be stable. Some steeper slopes approaching 1H:1V (horizontal:vertical) were observed along the drainages and in the southern portion of the site. Slopes will require erosion control during and after construction. The granular soils are considered highly erodible. Soil cut and fill slopes no steeper than 3H:1V (horizontal:vertical) should be stable. Slopes of 4H:1V are preferable. Re-vegetation or other erosion control measures should be employed to control erosion.

Water is expected to flow onto the site from the south. During peak precipitation events, some accumulation of surface sheet flow in drainages is expected. Development will increase the amount of impervious surfaces, which can lead to drainage problems and erosion if surface water flow is not adequately designed. Surface drainage design and evaluation of flood potential should be performed by a Civil Engineer as part of the project design.

Radioactivity

It is normal in the Front Range of Colorado and nearby eastern plains area to measure radon gas in poorly ventilated spaces (e.g., crawl spaces, if any) in contact with soil or bedrock. Radon 222 gas is considered a health hazard and is just one of several radioactive products in the chain of the natural decay of uranium into lead. Radioactive nuclides are common in the soil and bedrock underlying the subject site. Because these sources exist or will exist on most sites in the area, there is a potential for radon gas accumulation in poorly ventilated spaces. The concentration of radon that can develop is a function of many factors, including the radionuclide activity of the soil and bedrock, construction methods and materials, soil gas pathways, and accumulation areas. The only reliable method to determine if a hazard exists is to perform radon testing of completed residential structures. Typical mitigation methods consist of sealing soil gas entry areas, ventilation of below-grade spaces, and venting from foundation drain systems. We recommend provision for ventilation of foundation drain systems to allow venting if a radon problem is discovered.

Other Considerations

Site grading will include filling of existing drainages. Subsurface drainage may follow these drainages. We recommend installation of drains below drainages where more than about 15 feet of fill is planned as discussed in Sub-Fill Drain.

ESTIMATED POTENTIAL HEAVE

Based on the subsurface profiles, swell-consolidation test results and our experience, we calculated the potential heave at the proposed ground surface for each boring, as shown in Table III. The analysis involves dividing the soil profile into layers and modeling the heave of each layer from representative swell tests. We assumed an average swell of 0.5 percent for fill placed during site grading. We estimated potential proposed ground surface heave may range from <0.5 to about 11.5 inches. Wetting depths of 20 and 24 feet below proposed grades were considered for the analysis. Variations from our estimates should be anticipated. Our estimates are generally conservative; it is not certain whether the full estimated heave will occur. Based on the heave estimates and our experience, we assessed the risk of potential damage due to expansive soils as shown on Fig. 4. Sub-excavation can be used to mitigate the risk.

TABLE III
ESTIMATED POTENTIAL PROPOSED GROUND SURFACE HEAVE BASED ON
20- AND 24-FEET DEPTHS OF WETTING

Boring	Estimated Potential Heave at Proposed Ground Surface (inches)		Boring	Estimated Potential Heave at Proposed Ground Surface (inches)	
	Depth of Wetting 20 Feet	Depth of Wetting 24 Feet		Depth of Wetting 20 Feet	Depth of Wetting 24 Feet
TH-1	3.3	3.3	TH-22	8.4	8.7
TH-2	2.0	2.6	TH-23	1.0	2.1
TH-3	2.4	2.7	TH-24	3.7	4.2
TH-4	2.1	2.1	TH-25	2.0	2.1
TH-5	2.7	3.0	TH-26	7.6	7.6
TH-6	0.2	0.7	TH-27	8.0	8.0
TH-7	3.0	3.2	TH-28	7.4	7.4
TH-8	3.2	3.7	TH-29	9.5	9.5
TH-9	1.2	1.2	TH-30	3.9	3.9
TH-10	4.4	4.5	TH-31	7.1	7.4
TH-11	1.2	1.8	TH-32	3.8	3.9
TH-12	2.9	3.4	TH-33	10.9	11.5
TH-13	1.7	1.8	TH-34	1.2	1.6
TH-14	3.2	3.2	TH-35	4.5	5.1
TH-15	<0.5	0.5	TH-36	5.8	7.0
TH-16	10.4	10.8	TH-37	3.7	4.2
TH-17	4.4	4.4	TH-38	3.3	3.9
TH-18	2.1	2.4	TH-39	4.2	4.8
TH-19	3.7	4.0	TH-40	0.8	1.1
TH-20	0.9	1.4	TH-41	7.5	8.4
TH-21	9.1	10.0	TH-42	6.2	6.6

SITE DEVELOPMENT

The following sections provide site development recommendations based on our current understanding of the planned construction.

Excavation

We believe the soils penetrated by our exploratory borings can be excavated with typical heavy-duty equipment. Contractors should be familiar with applicable local, state and federal safety regulations, including the current Occupational Safety and Health Administration (OSHA) Excavation and Trench Safety Standards. Based on our investigation and OSHA standards, we anticipate the clay and bedrock will classify as Type B soil and the sand as Type C. Type B and C soils require maximum slope inclinations of 1:1 and 1½:1 (horizontal:vertical), respectively, for temporary excavations in dry conditions. Excavation side slopes specified by OSHA are dependent upon soil types and groundwater or seepage conditions encountered. The contractor's "competent person" is required to identify the soils encountered in excavations and refer to OSHA standards to determine appropriate slopes. Stockpiles of soils and equipment should not be placed within a horizontal distance equal to one-half the excavation depth, from the edge of the excavation. A professional engineer should design excavations deeper than 20 feet. Excavations should not compromise stability of adjacent improvements.

Site Grading

Prior to fill placement, the ground surface in areas to be filled should be stripped of debris, vegetation/organics and other deleterious materials, scarified and moisture conditioned to between 1 and 4 percent above optimum moisture content for clay or within 2 percent of optimum for sand and gravel, and compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698). Fill should be moisture conditioned and compacted in accordance with criteria shown in Table IV. Based on Douglas County specifications, utility trench backfill should be moistened between optimum and 4 percent wetter and compacted to at least 95 percent of standard Proctor maximum dry density for clay and moistened within 2 percent of optimum and compacted to 100 percent of standard Proctor for sand.

TABLE IV
SUMMARY OF COMPACTION AND MOISTURE CONTENT SPECIFICATIONS

Soil Type	Depth of Site Grading Fill		Utility Trench Backfill
	≤20 Feet	>20 Feet	
Clay (CL, CH)	95% STD, 1 to 4 percent above optimum	98% STD, 2 percent below to 1 percent above optimum	95% STD, 0 to 4 percent above optimum
Granular Soils (Sand and Gravel)	95% STD, -2 to +2 percent from optimum	98% STD, 2 percent below to 1 percent above optimum	100% STD, within 2 percent of optimum

*Compaction and moisture content percentage specifications based on standard Proctor maximum dry density (STD, ASTM D 698) and optimum moisture content (optimum).

The properties of fill will affect the performance of foundations, slabs-on-grade, utilities, pavements, flatwork and other improvements. The on-site soils are suitable for use as new fill provided they are substantially free of debris, vegetation/organics and other deleterious materials. Fill should be placed in thin loose lifts, moisture conditioned and compacted prior to placement of the next lift. The placement and compaction of fill should be observed and tested by a representative of our firm during construction. Guideline site grading specifications are presented in Appendix C.

Our experience indicates fill will settle under its own weight. We estimate potential settlement of about 1 to 2 percent of the fill thickness even if the fill is compacted to the specified criteria. Most of this settlement usually occurs during and soon after construction; for clayey fill, it may continue for longer. Heave or additional settlement may occur after development in response to wetting. If fill will be placed on slopes of 20 percent or steeper the slopes should be benched prior to placing fill (Fig. 5).

There are some areas where proposed grading will create non-uniform depths of fill below residence sites. Where the depth varies more than about 5 feet, sub-excavation or benching of existing slopes should be considered to create more uniform fill depth. We recommend additional review of these conditions as grading and sub-excavation plans are formalized.

Sub-Excavation

Our investigation indicates expansive soil and bedrock are present at depths likely to influence the performance of shallow foundations and slabs-on-grade for most of the site. Sub-excavation may be used to create more stable soil conditions and control risk of excessive movements. The variability of soil and bedrock materials implies that depth of sub-excavation could be variable, and that sub-excavation may not be merited for some of the site. You could elect to excavate all building areas to about 10 feet below lowest foundations for basements and 13 feet for no basements, or to massive sandstone (whichever is less) or use a variable depth approach. Further investigation is recommended in individual parcels to better assess the merits of sub-excavation.

The bottom of sub-excavation areas should extend laterally at least 5 feet outside the largest possible foundation footprint to ensure foundations are constructed over moisture-conditioned fill. The sub-excavation areas should be staked by a surveyor, and we recommend periodic surveying verification of the "as-built" bottom of the excavations. Conceptual sub-excavation profiles are shown on Figs. 6 and 7.

The excavation contractor(s) should be chosen carefully to assure they have experience with fill placement at over-optimum moisture and have the necessary compaction equipment. The contractors should provide a construction disc to break down fill materials and anticipate use of push-pull scraper operations and dozer assistance. The operation will be relatively slow. The contractor should provide a construction disc to break down fill materials. For the procedure to be performed properly, strict contractor control of fill placement to specifications is required. Sub-excavation fill should be moisture-conditioned between 1 and 4 percent above optimum moisture content with an average test moisture content each day of at least 1.5 percent above optimum.

Special precautions should be taken for compaction of fill at corners, access ramps and along the perimeters of sub-excavated areas due to equipment access constraints. The contractors should have appropriate equipment to reach and compact these areas. Our representative should observe placement procedures and test compaction of the fill. The fill should be tested after placement to evaluate swell. Guideline sub-excavation grading specifications are presented in Appendix D. We recommend a surveyor document the actual limits of treatment and create "as-built" plans to verify that the buildings are over the treated areas.

If the fill dries excessively prior to construction, it may be necessary to rework the upper, drier materials just prior to constructing foundations. We judge the fill should retain adequate moisture for about two to three years.

Slopes

We recommend permanent cut and fill slopes be designed with a maximum slope of 3:1 (horizontal to vertical); use of 4:1 would be better to control erosion. If site constraints (property boundaries and streets) do not permit construction with recommended slopes, we should be contacted to evaluate the subsurface soils and steeper slopes. Slopes greater than 20 feet high should be evaluated by our office on a case-by-case basis. Concentrated surface drainage should not be allowed to sheet flow across slopes or pond near the crest of slopes. All slopes should be re-vegetated soon after grading to reduce erosion.

Utilities

Water and sewer lines are usually constructed beneath paved roads. Compaction of trench backfill can have a significant effect on the life and serviceability of pavements. Trench backfill should be placed in thin (8 inches or less) loose lifts and moisture conditioned and compacted to the specifications provided in Site Grading.

For utility installation, we recommend use of a self-propelled compactor. Special attention should be paid to backfill placed adjacent to manholes as we have seen instances where settlement in excess of 2 percent has occurred. Any improvements placed over backfill should be designed to accommodate movement. The placement and compaction of utility trench backfill should be observed and tested by a qualified representative during construction.

Subsurface Drainage

With long term development and subsequent irrigation, groundwater may develop and rise. Our firm generally advocates an underdrain system below sanitary sewer mains and services to control groundwater that may accumulate in response to development. The underdrain may help to control unusually deep wetting which results in heave-related foundation and floor problems and frequent pumping from basement foundation drain systems.

If an underdrain system is not installed, individual house foundation drains would discharge into sumps with pumps. Sump discharge can result in ponding and recycling if slopes between lots are not adequately graded and well-drained. Problems with chronic ice or algae formation on sidewalks have also developed from sump discharge.

If selected, the underdrain should consist of ¾ to 1½-inch clean, free-draining gravel surrounding a perforated PVC pipe (Fig. 7). We believe use of perforated pipe below sanitary sewer mains is the most effective approach. The pipe should be sized for anticipated flow. The line should consist of smooth, perforated or slotted, rigid PVC pipe placed at a grade of at least 0.5 percent. A concrete cutoff should be constructed around the sewer pipe and underdrain pipe immediately downstream of the point where the underdrain pipe exits the sewer trench and transitions from perforated to solid (Fig. 8). Solid pipe should be used down gradient of this cutoff wall. The underdrains should be designed to discharge to a gravity outfall and be provided with a permanent concrete headwall and trash rack. If the underdrain discharges into a detention pond, the risk of flood water backflow through the underdrain into basements should be evaluated. A check valve or backflow preventer can be considered.

Where feasible, the underdrain services should be installed deep enough so that the lowest point of the basement foundation drain can be connected to the underdrain service as a gravity outlet (Fig. 9). For non-walkout basements, the low point of the basement foundation drain may be about 2 to 3 feet deeper than the foundation excavation. For buildings with walkout basements, the low point of the basement foundation drain will be below the frost stem wall in the rear portion of the basement. The foundation drain in a walkout basement would require a deeper underdrain service for a gravity discharge and may not be practical. For these conditions, we suggest the front portion of the foundation drain be connected to the underdrain and a sump pit used for the rear portion.

Sub-Fill Drain

A sub-fill drain is recommended along the bottom of the existing drainages where more than about 15 feet of site grading fill is planned. The drain should slope with the grade of the existing drainages and have a minimum slope of 0.5

percent. A typical sub-fill drain detail is provided as Fig. 11. A perforated pipe should be connected to the end of the drain and protected with a concrete head-wall. The alignment and profile of the sub-fill drain should be shown in the development plans. Potential deep locations are shown on Fig. 2. We recommend re-routing the drainages to avoid installation of sub-fill drains below proposed building/structure footprints.

Retaining Walls

Retaining walls may be planned. Retaining walls should be designed to resist lateral earth pressures. Mechanically Stabilized Earth (MSE) are commonly used in residential developments. <u>Residence foundations should not be constructed on retaining wall backfill.</u>

MSE Walls

MSE walls include geosynthetic-reinforced structural fill. Internal and global stability should be analyzed as part of the design process. Surcharge pressures from slopes, backfill and vehicular loads should also be considered.

Some movement of MSE walls must occur to mobilize the shear strength of the soil and reinforcement. We assume retained soil and backfill behind the reinforced zone will be native soil or fill derived from similar materials. The on-site soil should not be used in the reinforced zone. We recommend the reinforced zone be constructed with imported sand and gravel meeting CDOT Class 5 or 6 Aggregate Road Base or Class I Structural fill specifications (or better). Angular gravel meeting AASHTO No. 57 or 67 may also be used for the reinforced soil and is recommended for the leveling pad and drainage material. Most MSE block retaining wall design programs require input of soil parameters for foundation soil, leveling pad, reinforced soil and retained soil. We anticipate the parameters in Table V.

TABLE V
PRELIMINARY MSE SOIL INPUT PARAMETERS

Material Use	Material Description & Classification	Cohesion (psf)	Internal Friction Angle (degrees)	Unit Weight (pcf)
Foundation Soil	Clay (CH)	100	21	110
Leveling Pad	Gravel (imported) AASHTO #57 or 67 Coarse Concrete Aggregate	0	40	135
Reinforced Soil (import recommended)	Sand, Gravelly, Silty, CDOT Class 6 Road Base (or better)	0	34	125
Retained Soil	Clay (CH)	100	21	110

Free-draining granular backfill should be used behind the block face to relieve hydrostatic pressure and provide drainage. We recommend a material with less than 5 percent fines (passing No. 200 sieve) within at least 1 foot behind the walls. The free-draining gravel layer should be placed in thin, loose lifts, and compacted to at least 70 percent of maximum relative dry density (ASTM D 4253 and ASTM D 4254). Fill should be placed and compacted to the criteria provided in <u>Site Grading</u>. Special precautions should be taken to avoid over-stressing the walls during compaction. We recommend use of small, hand-operated compactors.

We recommend weep holes and/or installation of a drain pipe at the base of the free-draining backfill zone. If a drain is installed, it should consist of a 4-inch perforated, rigid PVC pipe encased in free-draining gravel. The drain should slope at least 1 percent to a positive gravity outlet at either or both ends of the wall or be connected to outfall more than 5 feet in front of the wall. Any pipe installed beneath a wall should be strong enough to withstand the applied pressure and should be a solid pipe extending at least 5 feet beyond the toe of the wall or within a concrete pan.

Pavements

Pavement subgrade soils are variable and may consist of clay, sand, bedrock or fill of similar composition. The City of Lone Tree has adopted Douglas County pavement design standards. Douglas County minimum pavement section alternatives are presented in Table V. For planning purposes, we estimate a 4-inch thick asphaltic concrete and 6-inch base course section for local residential streets. Douglas County requires swell mitigation consisting of 12 inches of aggregate base course when pavement subgrade samples swell more than 2 percent under an applied pressure of 100-150 psf. This base course is in addition to any base course that is part of the pavement section. Additionally, sub-excavation (3 to 5 feet) may also be merited. Minimum pavement sections are summarized in Table VI. We suggest assuming an additional inch of asphalt for budgeting. Subgrade investigation and pavement designs should be performed after grading is complete.

TABLE VI
DOUGLAS COUNTY MINIMUM PAVEMENT SECTIONS*

Traffic Classification	Hot Mix Asphalt (HMA)	Hot Mix Asphalt (HMA) + Aggregate Base (ABC)	Portland Cement Concrete (PCC) + Prepared Subgrade
Local Residential	5.0” HMA	3” HMA + 6” ABC	5” PCC
Local Commercial	5.0” HMA	3” HMA + 6” ABC	6” PCC
Minor Collector Residential	5.0” HMA	3” HMA + 6” ABC	6” PCC
Minor Collector Commercial	6.0” HMA	4” HMA + 6” ABC	6” PCC

*Placement of 12 inches of additional base course may be necessary

BUILDING CONSTRUCTION CONSIDERATIONS

The following discussions are preliminary and are not intended for design or construction. After grading is completed, design-level investigations should be performed on a structure-specific basis.

Foundations

Footing foundations may be used for sites where low swelling soil and bedrock are present within depths likely to influence performance of foundations. Where moderate to high swelling clay and claystone are present, drilled piers or other deep foundation systems would be best to control risk of heave. Long (25 to 35 feet) drilled piers should be anticipated unless sub-excavation is performed. Sub-excavation should allow footing foundations and slab-on-grade basement floors on most or all treated sites.

Slab-On-Grade Construction

Slab-on-grade basement floors may be considered on low and some moderate risk sites where potential heave is acceptable to builders and home buyers. Structurally supported basement floors should be used on all sites with high or very high risk of poor basement slab performance. We judge risk is moderate or high for most of this site. Sub-excavation should result in low or possibly moderate risk conditions. A structurally supported basement floor should also be used where a buyer cannot tolerate potential movement. Structurally supported floor systems should be anticipated in all non-basement residences and finished living areas. Post-tensioned slab-on-grade foundations may also be considered where no basements are planned.

The performance of garage floors, driveways, sidewalks and other surface flatwork will likely be poor at this site, unless sub-excavation is performed. The following precautions will be required to reduce the potential for damage due to movement of slabs-on-grade placed at this site:

1. Isolation of the slabs from foundation walls, columns and other slab penetrations;

2. Voiding of interior partition walls to allow slab movement without transferring the movement to the structure;

3. Proper surface grading and foundation drain installation to reduce water availability to sub-slab and foundation soils; and

4. Performance of surface improvements such as sidewalks and driveways will likely be poor for portions of the site where sub-excavation is not performed.

Below-Grade Areas

Surface water can penetrate relatively permeable loose backfill soils located adjacent to structures and collect at the bottom of relatively impermeable basement or crawl space excavations, causing wet or moist conditions. Foundation walls which retain earth should be designed for lateral earth pressures. Foundation drains should be constructed around the lowest excavation levels and ideally should be connected to an underdrain system to provide a gravity outlet. The drains can be connected to a sump pit where water can be removed by pumping if an underdrain is not provided.

Surface Drainage

The performance of improvements will be influenced by surface drainage. When developing an overall drainage scheme, consideration should be given to drainage around each unit/residence and building. The ground surface around the residences and townhome buildings should be sloped to provide positive drainage away from the foundations. We recommend a slope of at least 10 percent for the first 10 feet surrounding each residence with basements, where practical. For non-basement developments, we recommend a slope of at least 5 percent for the first 10 feet surrounding each building. If the distance between houses is less than 20 feet, the recommended slope in this area should be installed to the swale between buildings. Where possible, drainage swales should slope at least 2 percent. Variations from these criteria are acceptable in some areas. For example, for lots graded to direct drainage from the rear yard to the front, it is difficult to achieve the recommended slope at the high point behind a house. We believe it is acceptable to use a slope of about 6 inches in the first 10 feet (5 percent) in this instance and others when achieving 10 percent is not practical. Roof downspouts and other water collection systems should discharge beyond the limits of all backfill around structures.

Proper control of surface runoff is also important to control the erosion of surface soils. Concentrated sheet flow should not be directed over unprotected slopes. Water should not be allowed to pond at the crest of slopes. Permanent slopes should be prepared to reduce erosion.

Attention should be paid to compaction of the soils behind curbs and gutters adjacent to streets and in utility trenches during the construction and development. If surface drainage between preliminary development and construction phases is neglected, performance of the roadways, flatwork and foundations may be poor.

Concrete

Concrete in contact with soil can be subject to sulfate attack. Water-soluble sulfate concentrations were predominantly less 0.1 percent. We measured water-soluble sulfate concentrations of 0.07 percent or less in 16 samples and 0.72 percent in one sample from this site. For sulfate concentrations less than 0.1 percent, ACI 332-08 *Code Requirements for Residential Concrete* indicates there are no special requirements for sulfate resistance. Additional testing should be performed during design-level investigations.

Superficial damage may occur to the exposed surfaces of highly permeable concrete. 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 shallow groundwater. Concrete should have a total air content of 6 percent ± 1.5 percent.

RECOMMENDED FUTURE INVESTIGATIONS

We recommend the following investigations and services:

1. Additional investigation to evaluate the extent and depth of sub-excavation (if selected).

2. Review of grading and sub-excavation plans to evaluate merits of benching under sites where variable fill depth will occur.

3. Construction testing and observation during site development, and building and pavement construction; including compaction testing of grading fill, utility trench backfill, and pavements;

4. Subgrade investigation and pavement design after grading;

5. Design-level Soils and Foundation Investigations after grading; and

6. Foundation installation observations.

CONSTRUCTION OBSERVATIONS

This report has been prepared for the exclusive use of Shea Homes and your team to provide geotechnical information for development planning. The information, conclusions, and recommendations presented herein are based upon consideration of many factors including, but not limited to, the type of structures proposed, the geologic setting, and the subsurface conditions encountered.

We recommend that CTL | Thompson, Inc. provide construction observation services to allow us the opportunity to verify whether soil conditions are consistent with those found during this investigation. If others perform these observations, they must accept responsibility to judge whether the recommendations in this report remain appropriate.

GEOTECHNICAL RISK

The concept of risk is an important aspect with any geotechnical evaluation, primarily because the methods used to develop geotechnical recommendations do not comprise an exact science. We never have complete knowledge of subsurface conditions. Our analysis must be tempered with engineering judgment and experience. Therefore, the recommendations presented in any geotechnical evaluation should not be considered risk-free. Our recommendations represent our judgment of those measures that are necessary to increase the chances that the development improvements will perform satisfactorily. It is critical that all recommendations in this and future reports are followed.

LIMITATIONS

Our borings were widely spaced to provide a general picture of subsurface conditions for due diligence assessment and preliminary planning of development and residential and commercial construction. Variations from our borings should be anticipated. We believe this investigation was conducted in a manner consistent with the 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 report or the analysis of the influence of subsurface conditions on the project, please call.

CTL | THOMPSON, INC.

Mark Gayeski, E.I.T.
Staff Engineer

Reviewed by:

Ronald M. McOmber, P.E.
Chairman, Senior Principal

MG:RMM/bg

Via e-mail: ryan.mcdermed@sheahomes.com
jennifer.miller@sheahomes.com

DRAFT

LEGEND:

TH–1 LOCATION OF EXPLORATORY BORING

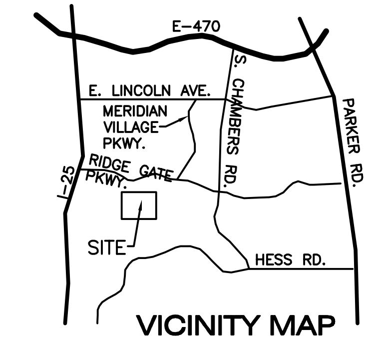
6010 INDICATES EXISTING GROUND SURFACE ELEVATION (FEET)

6000 INDICATES PROPOSED GROUND SURFACE ELEVATION (FEET)

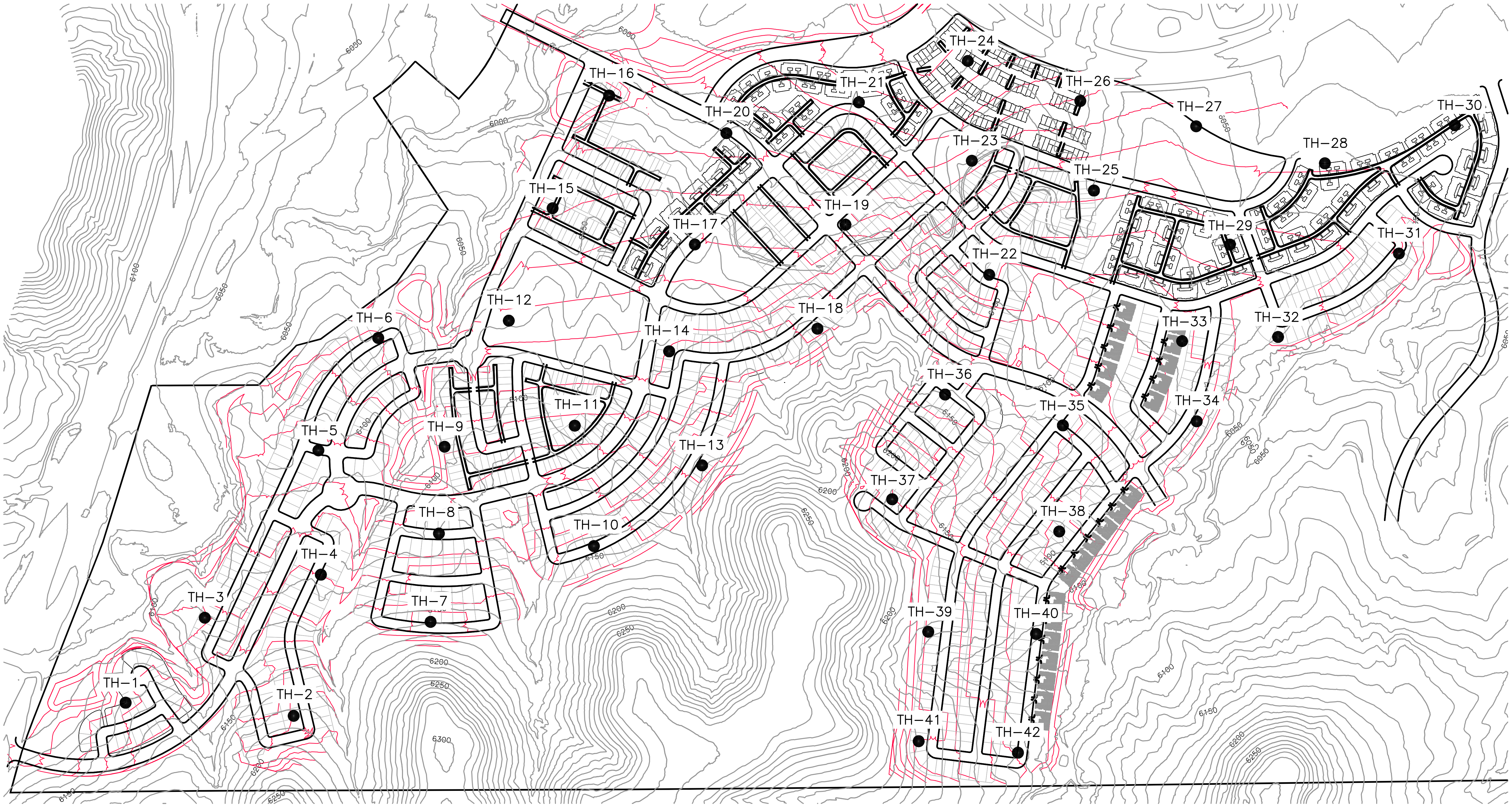
NOTE: EXISTING AND PROPOSED GRADES BASED ON PLANS DATED 2/22/2019.

0 300 600

SCALE: 1" = 600'



VICINITY MAP
NOT TO SCALE



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RIDGEGATE SOUTHWEST VILLAGE

CTL\T Project No. DN49,935-115-R1

Locations of Exploratory Borings

Fig. 1

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LEGEND:

TH-1 LOCATION OF EXPLORATORY BORING

6010 INDICATES EXISTING GROUND SURFACE ELEVATION (FEET)

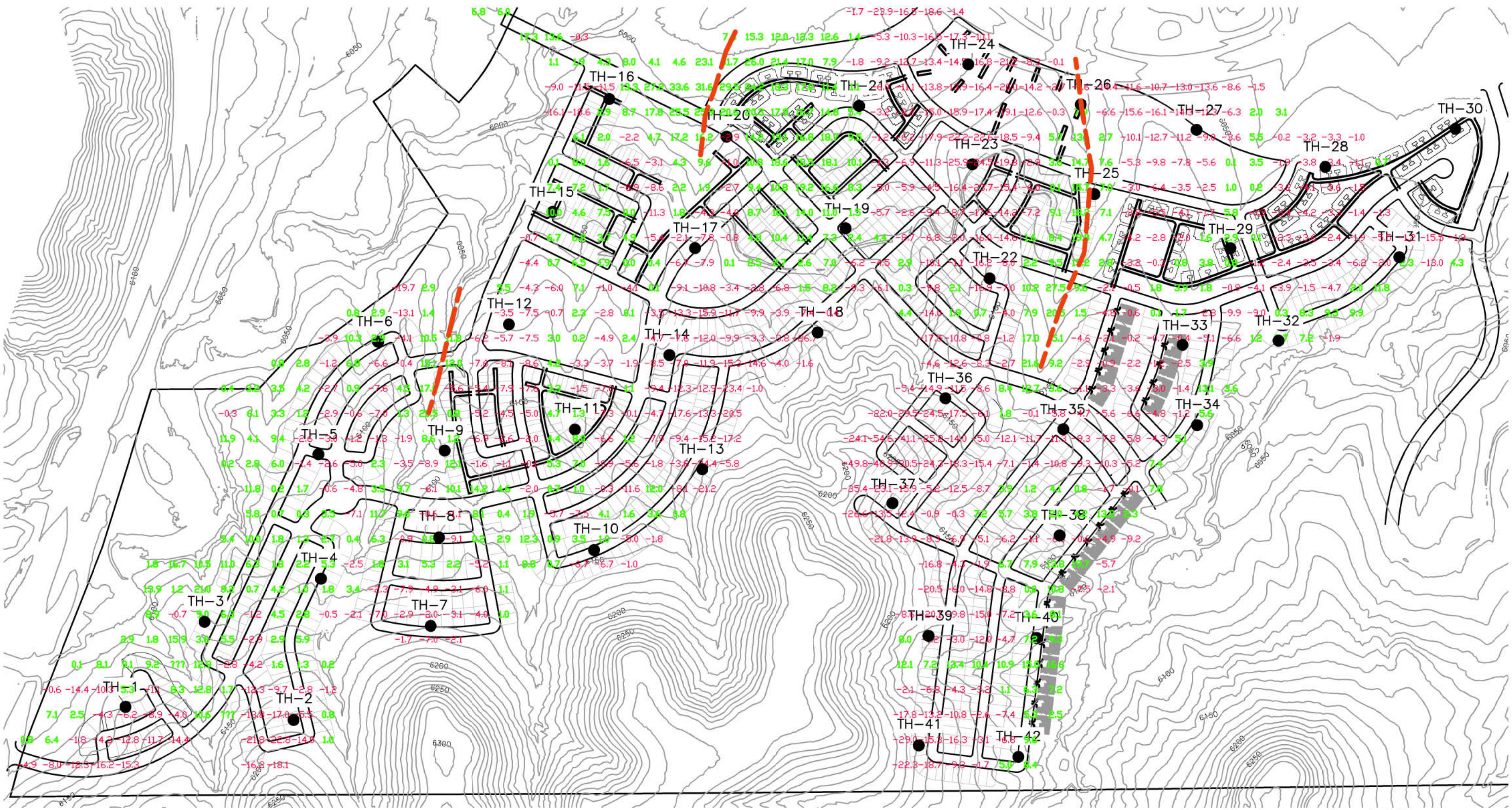
6.8 INDICATES 6.8 FEET FILL PLANNED

−9.0 INDICATES 9.0 FEET CUT PLANNED

POTENTIAL SUB-DRAIN (FIG. 11)

NOTE: BASED ON PLANS DATED 2/22/2019.

SCALE: 1" = 600'



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Preliminary Cut/Fill Depths

Fig. 2

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LEGEND:

TH–1 ● LOCATION OF EXPLORATORY BORING

6010 INDICATES EXISTING GROUND SURFACE ELEVATION (FEET)

6000 INDICATES PROPOSED GROUND SURFACE ELEVATION (FEET)

{5.8} INDICATES APPROXIMATE DEPTH TO BEDROCK AT PROPOSED GRADE (FEET)

(7) INDICATES APPROXIMATE DEPTH TO BEDROCK IN BORING (FEET)

[6119] INDICATES APPROXIMATE BEDROCK SURFACE ELEVATION (FEET)

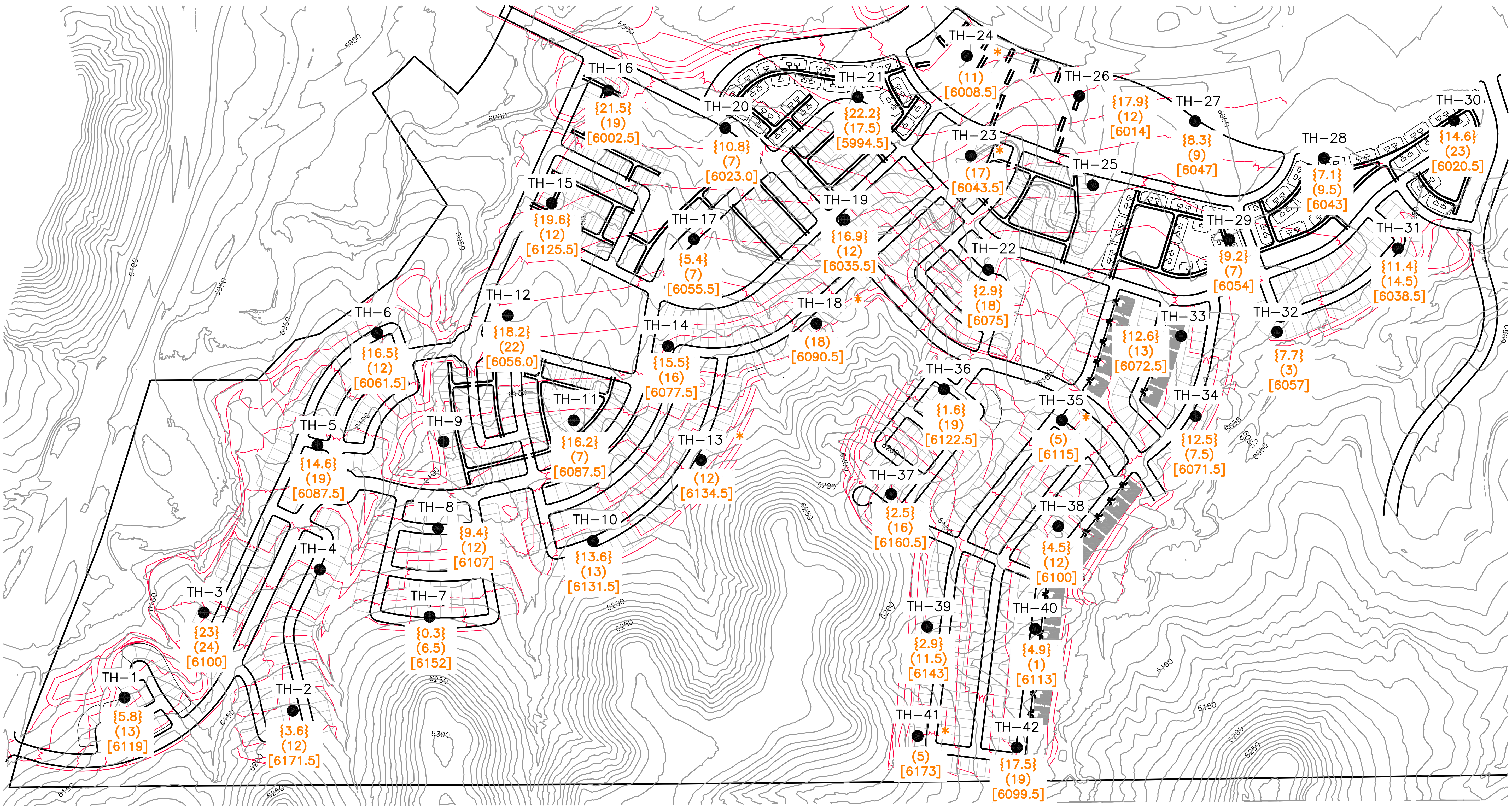
* INDICATES PROPOSED GRADE IS WITHIN BEDROCK

NOTE: THIS ESTIMATE WAS BASED UPON A SUBJECTIVE ANALYSIS OF DRILL HOLE DATA AND MAY NOT REFLECT LOCAL VARIATIONS.

N

0 300 600

SCALE: 1" = 600'



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Approximate Depth and Elevation of Bedrock

Fig. 3

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LEGEND:

TH-1 ● LOCATION OF EXPLORATORY BORING

6010 INDICATES EXISTING GROUND SURFACE ELEVATION (FEET)

6000 INDICATES PROPOSED GROUND SURFACE ELEVATION (FEET)

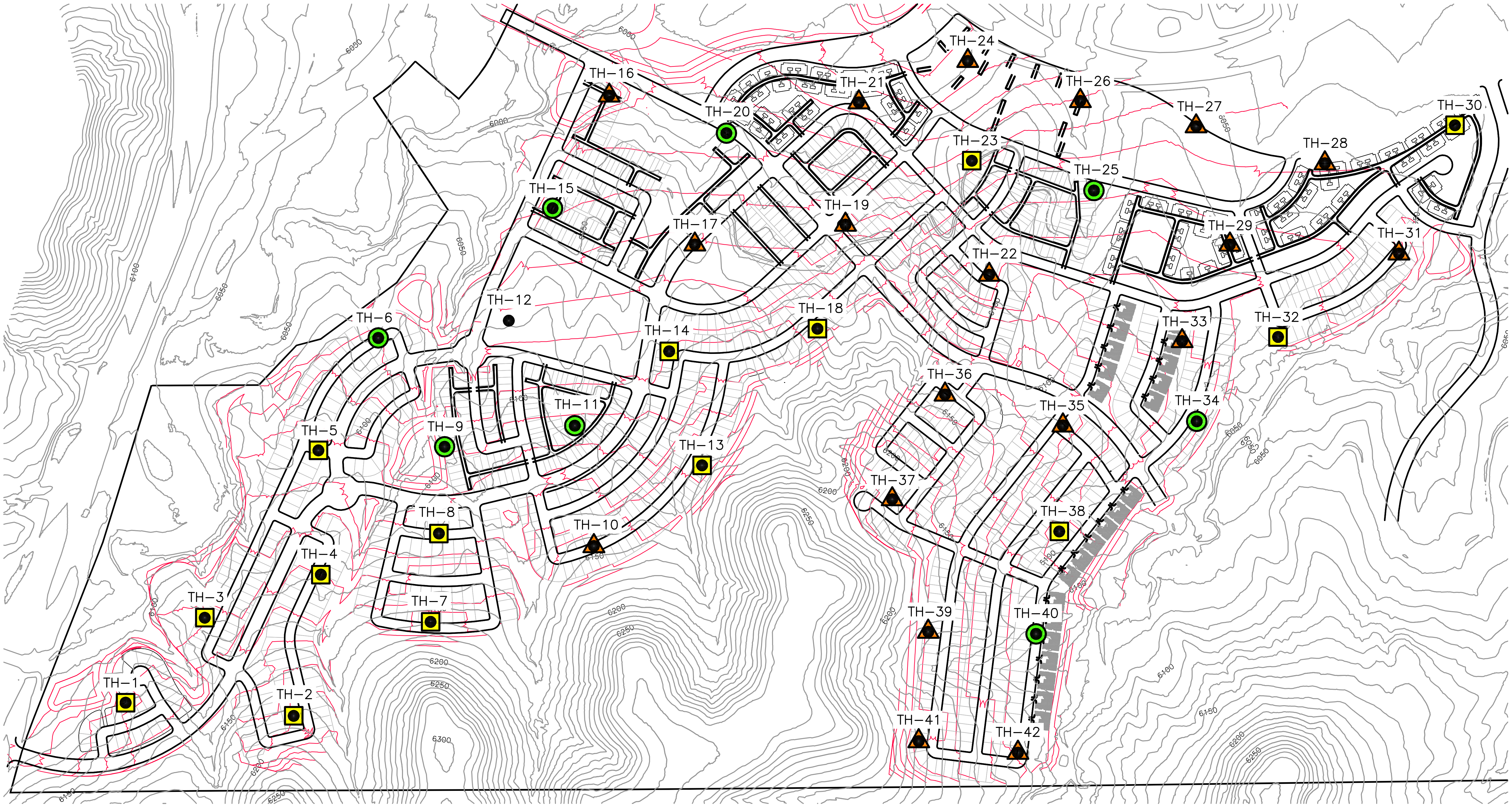
LOW RISK

MODERATE RISK

HIGH RISK

0 300 600

SCALE: 1" = 600'



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Preliminary Risk Assessment for Expansive Soils

Fig. 4

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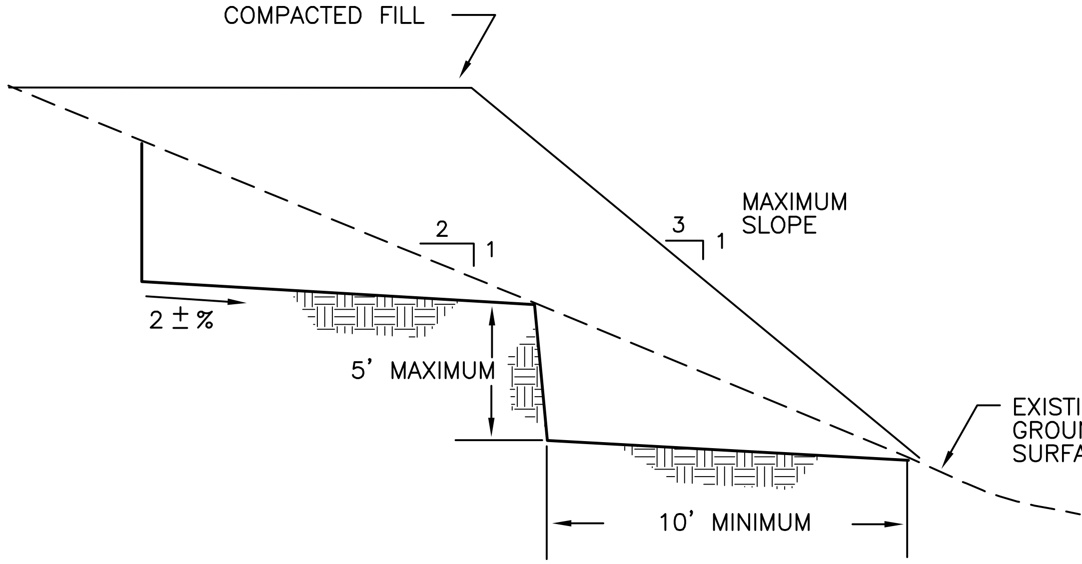


NOTES:

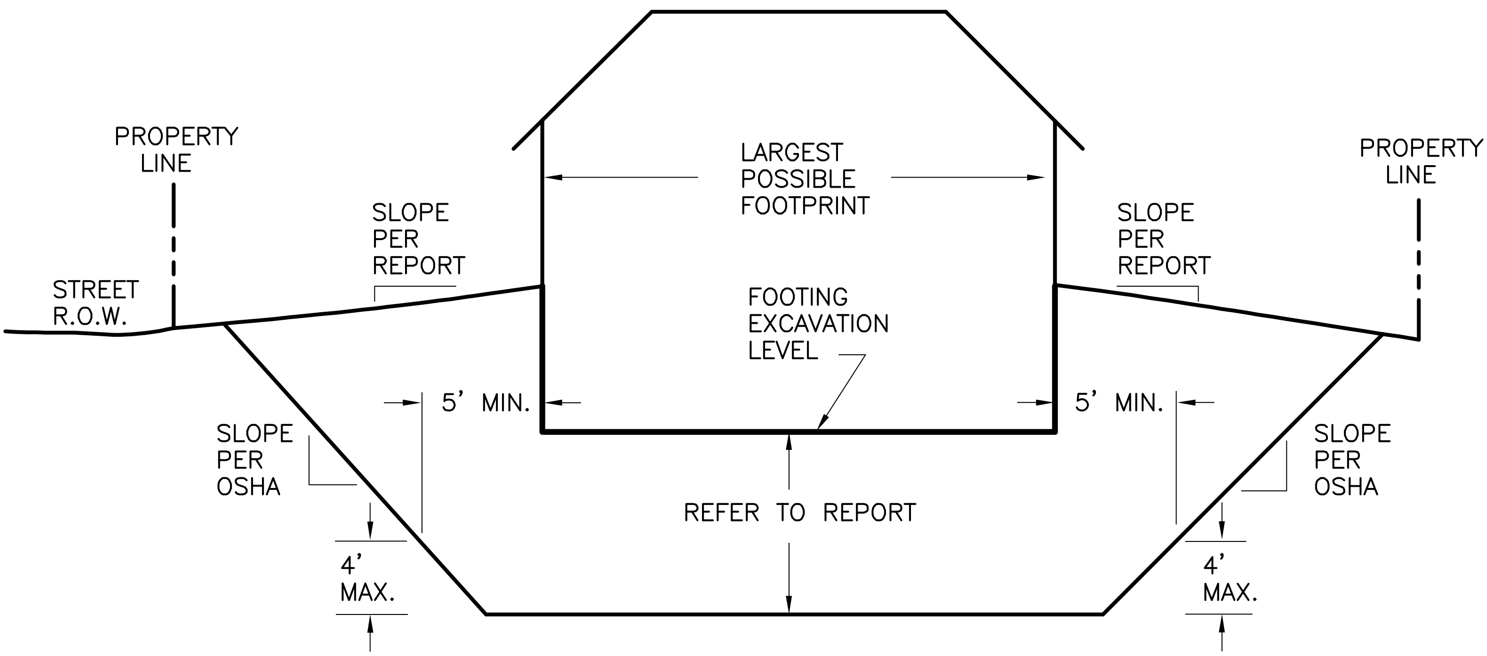
1) NATURAL SLOPES OF 20 PERCENT OR STEEPER ARE TO BE BENCHED PRIOR TO FILL PLACEMENT.

2) SLOPE BENCHES TO OUTSLOPE AT 2± PERCENT.

Benched Fill Detail

Fig. 5

95-SUB-EXC_01



NOT TO SCALE

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Conceptual Sub-excavation Profile

Fig. 6

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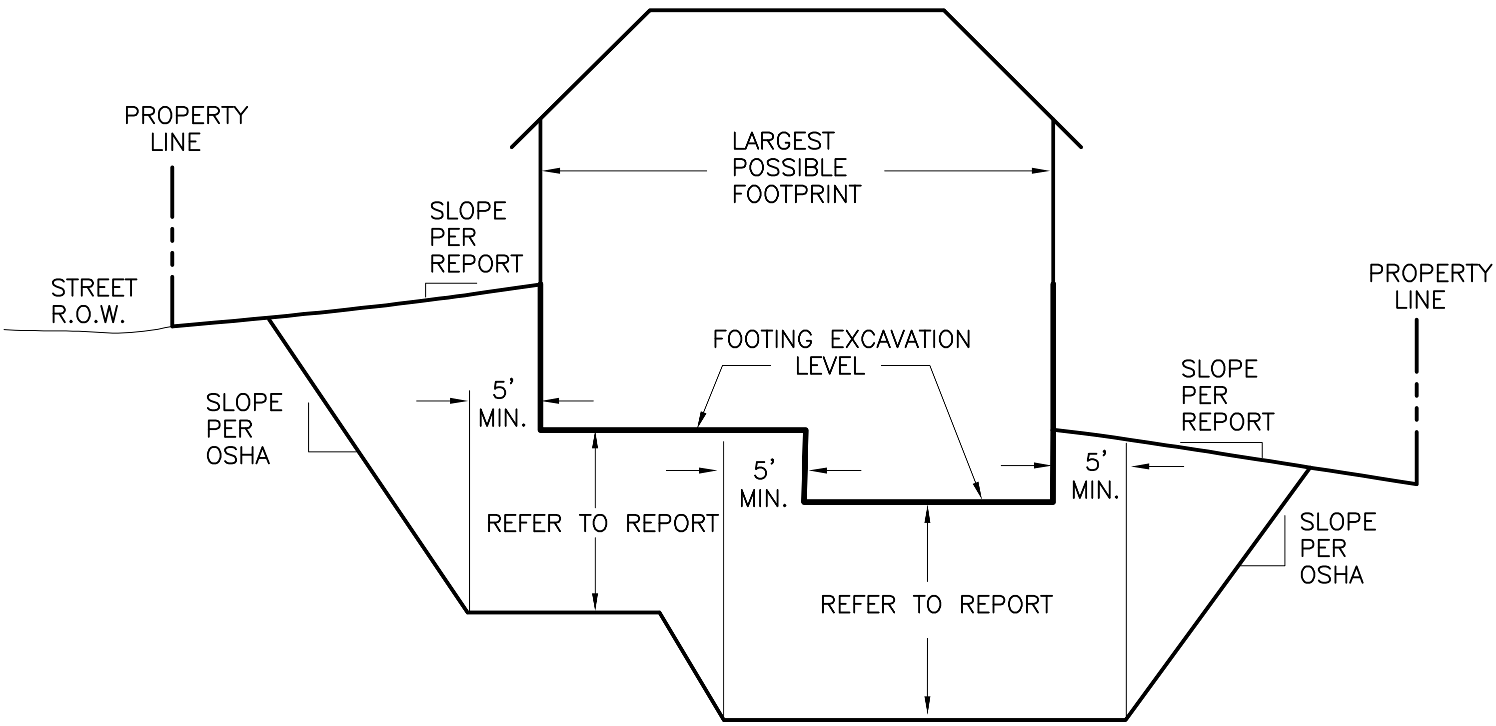
95-SUB-EXCAVATION_03



NOT TO SCALE

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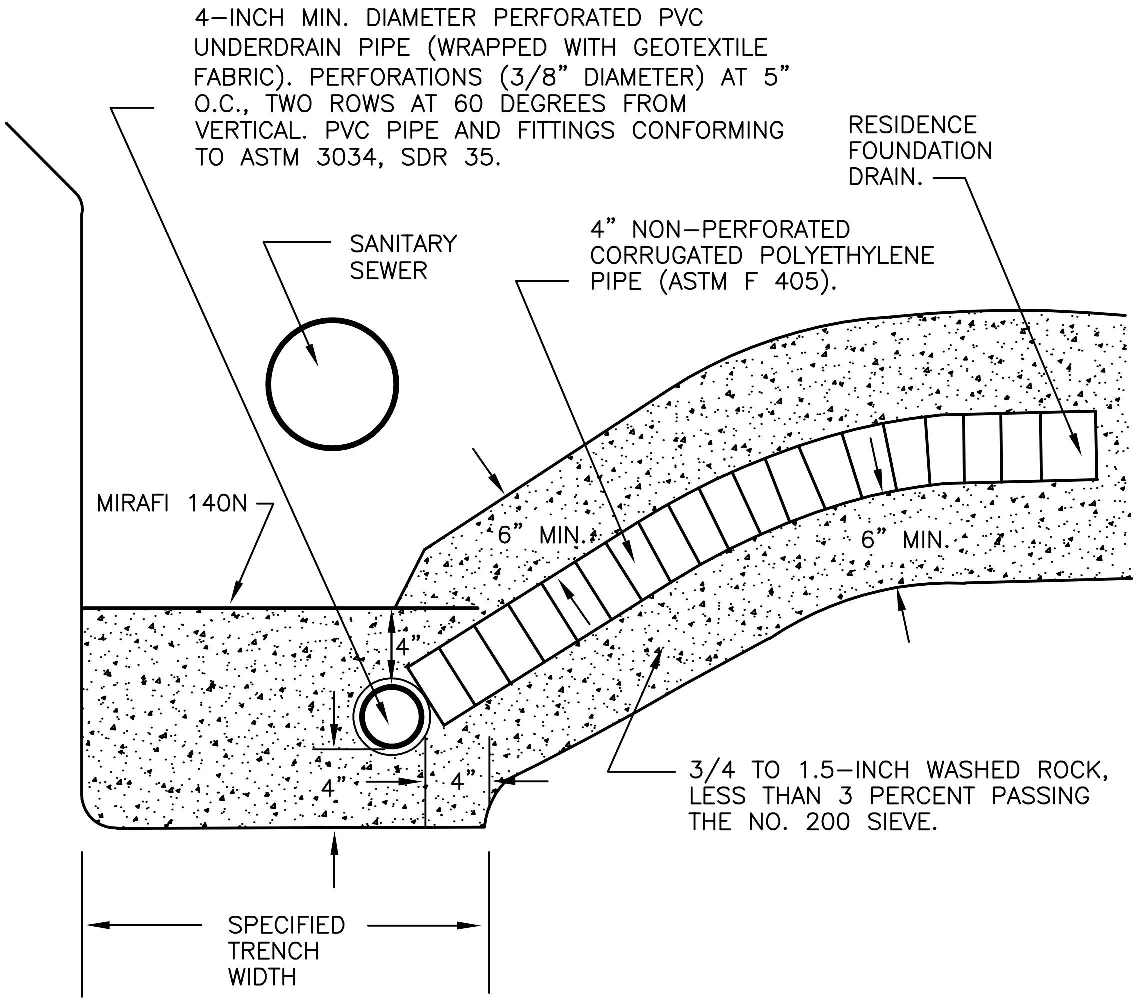
Conceptual Sub-excavation Profile
(Walk-out Basement)

Fig. 7

DRAFT



NOTE: NOT TO SCALE

50-UNDERDRAIN_02

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Conceptual Sewer Underdrain Detail

Fig. 8

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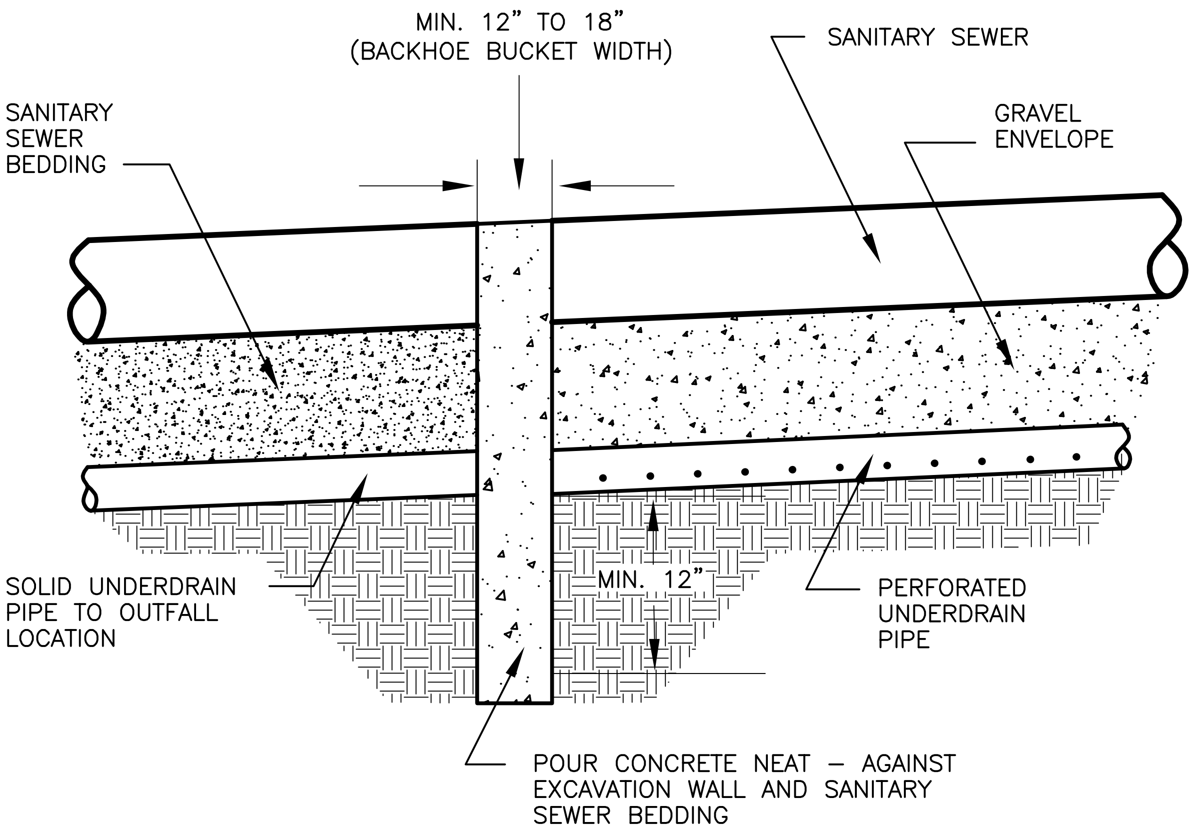

NOTE:
THE CONCRETE CUTOFF WALL SHOULD EXTEND INTO THE UNDISTURBED SOILS OUTSIDE THE UNDERDRAIN AND SANITARY SEWER TRENCH A MINIMUM DISTANCE OF 12 INCHES.

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Underdrain Cutoff Wall Detail

Fig. 9

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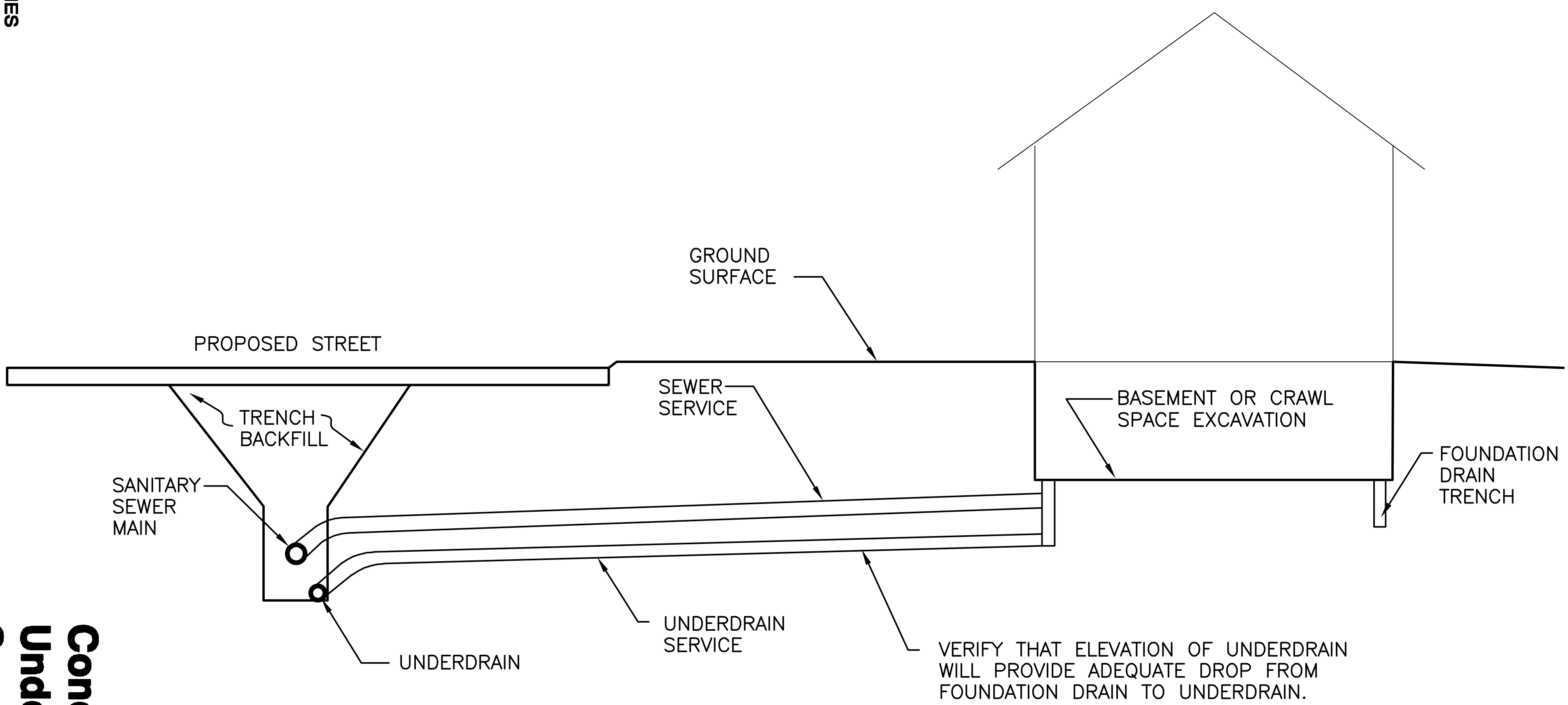
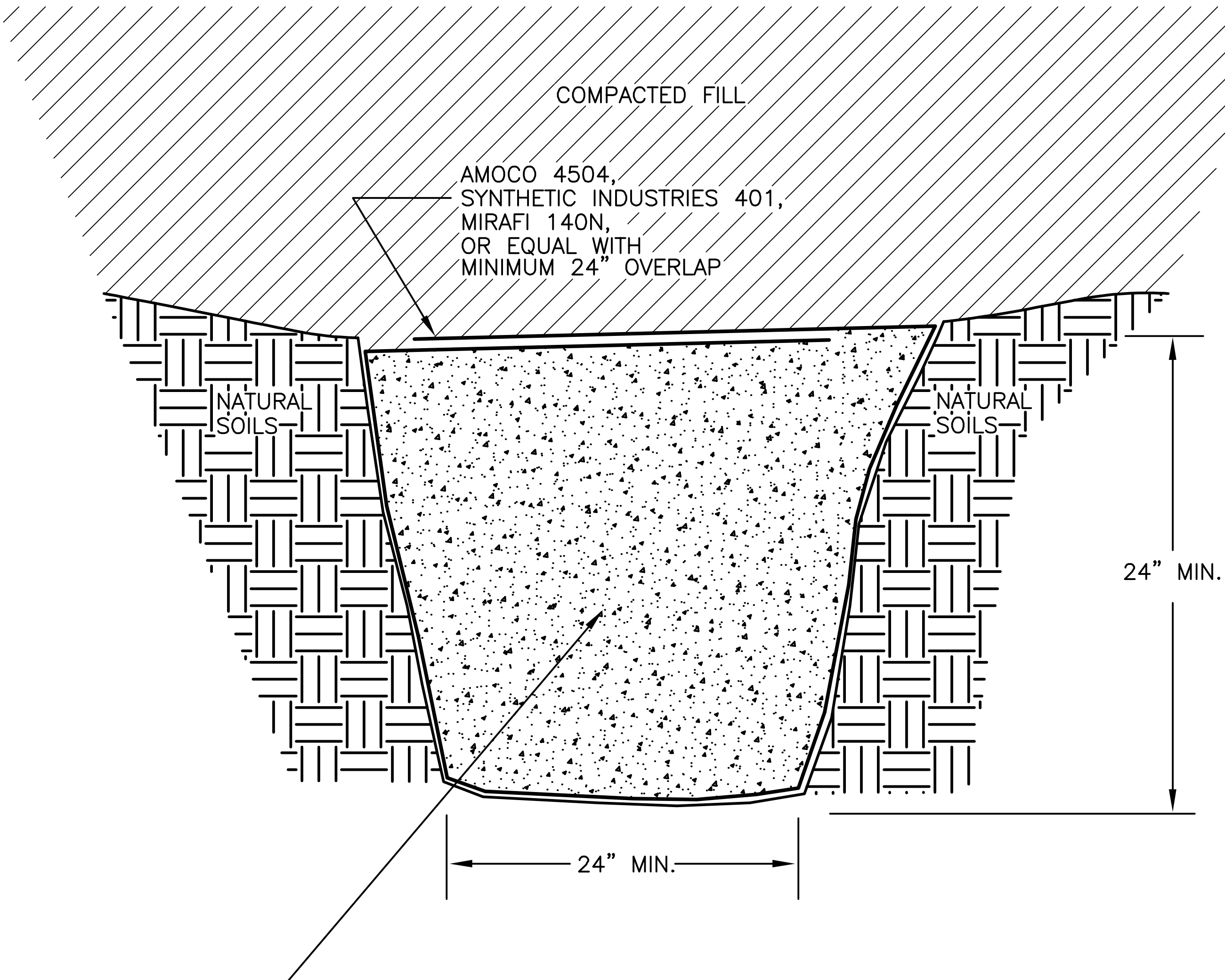
Conceptual Underdrain Service Profile

Fig. 10



NOT TO SCALE

40-SUBDRAIN_01



GRAVEL AND SAND
GRADED AS FOLLOWS

SIEVE SIZE	% PASSING
1 1/2"	100
3/4"	82-100
3/8"	64-80
#4	46-64
#8	34-52
#16	25-42
#30	12-30
#50	5-15
#100	1-3
#200	0-1

NOTE:
THE SAND AND GRAVEL GRADATION CAN BE MET BY MIXING COURSE CONCRETE AGGREGATE NO. 57 AND FINE CONCRETE AGGREGATE NO. 67 IN EQUAL PARTS BY WEIGHT.

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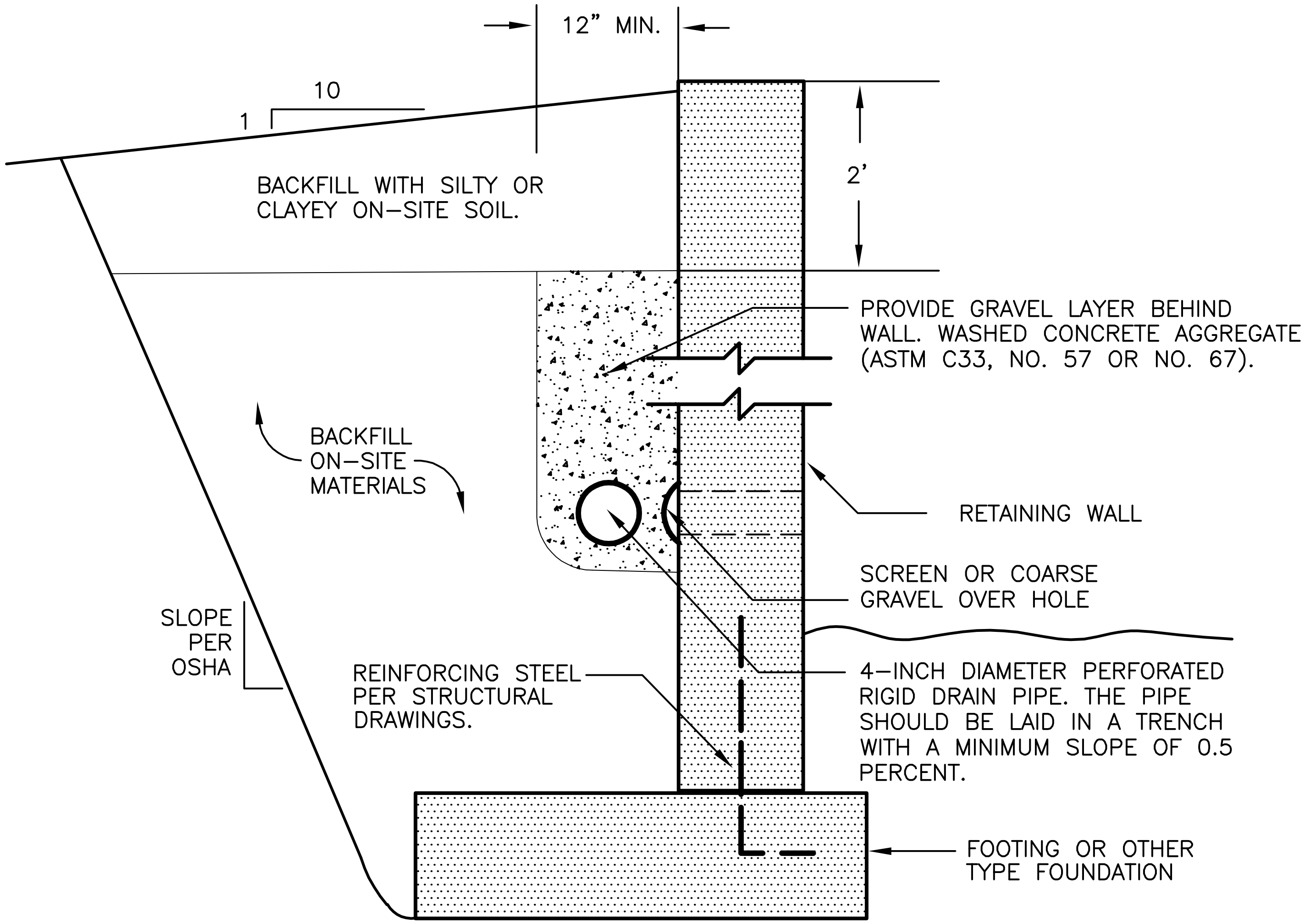
Drainage Sub-Drain

Fig. 11

35-RETAINING-WALL_01



NOTE:
DRAIN PIPE TO GRAVITY OUTLET OR WEEP HOLES MAY BE USED.

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Typical Earth Retaining Wall Drain

Fig. 12

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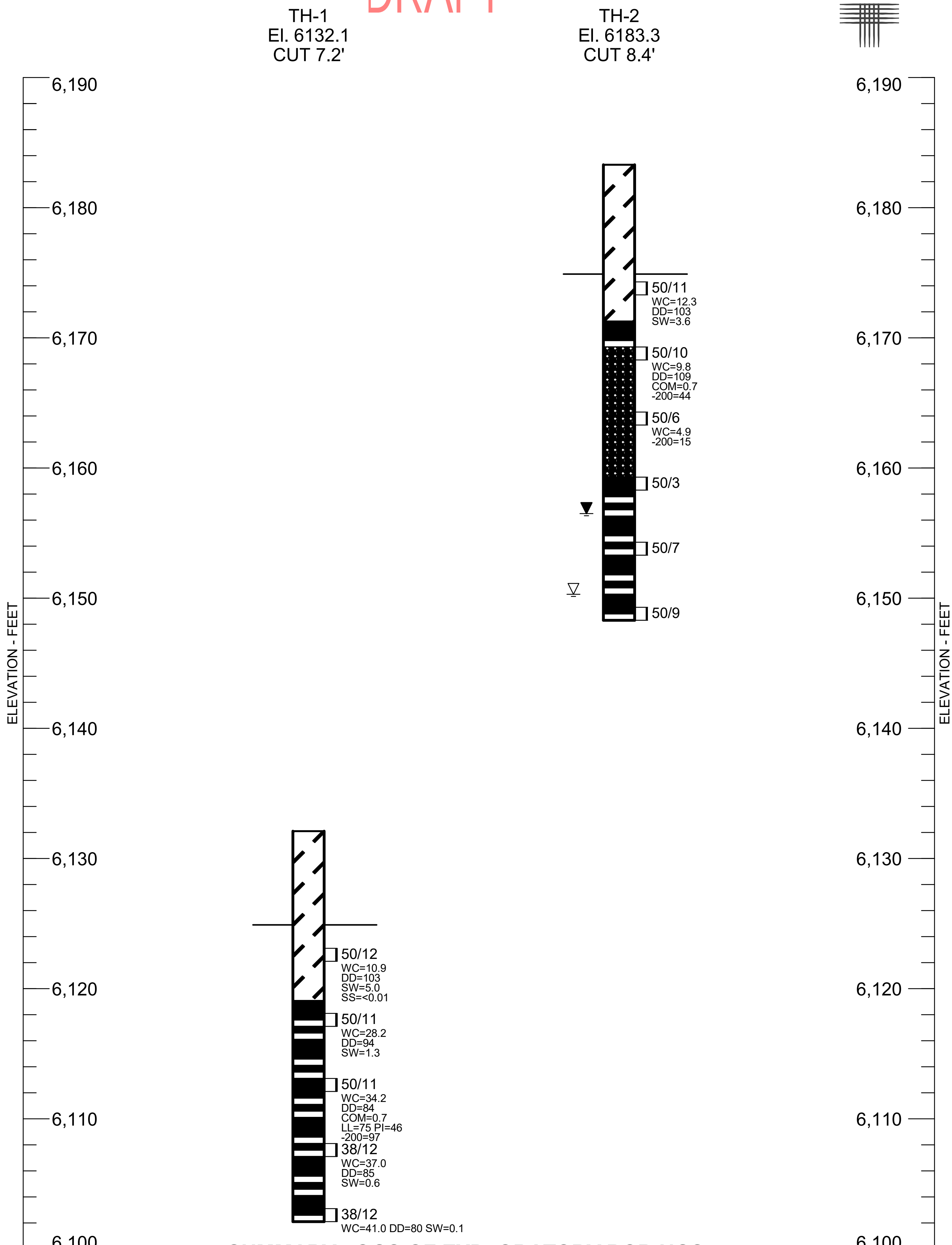
APPENDIX A

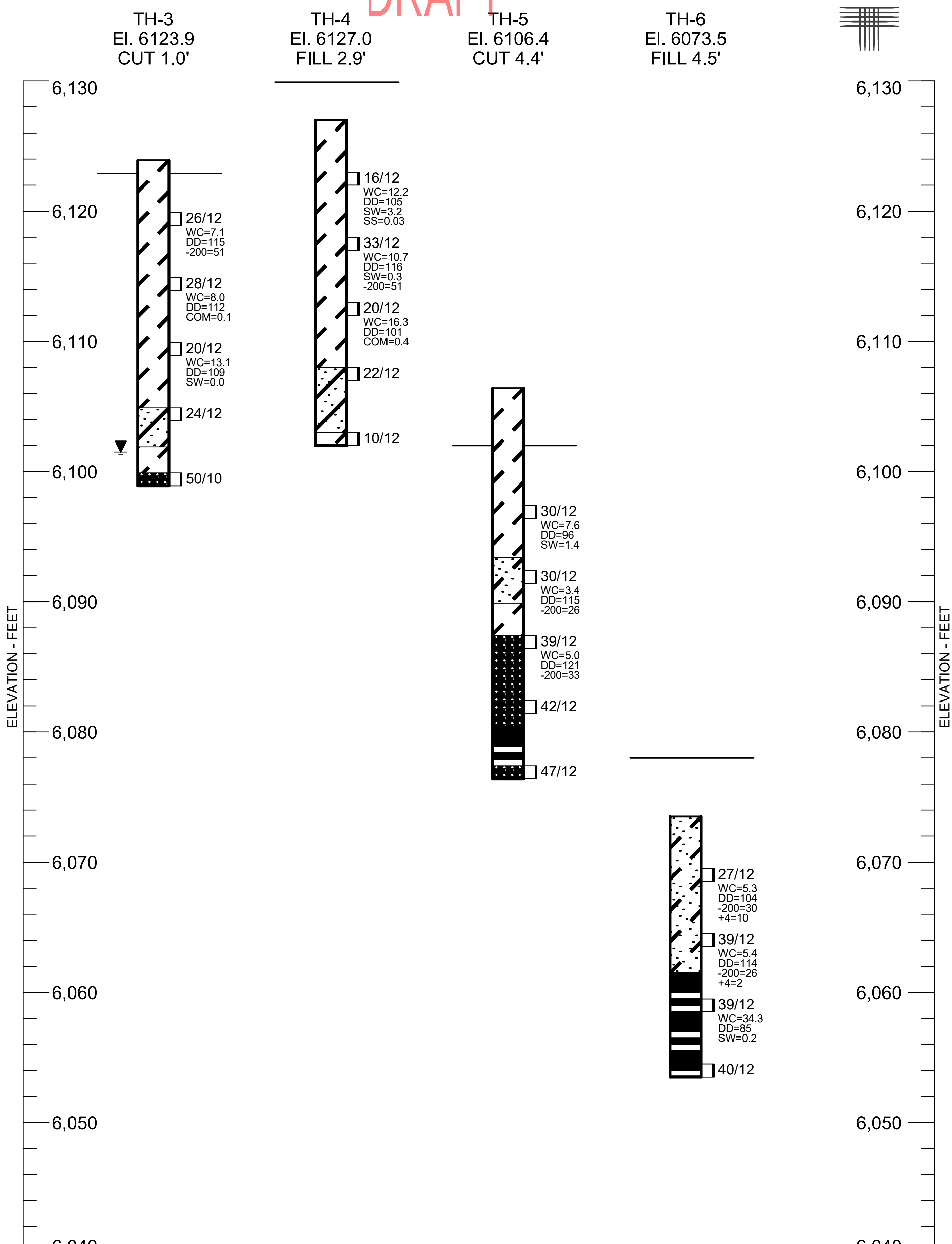
SUMMARY LOGS OF EXPLORATORY BORINGS



SUMMARY LOGS OF EXPLORATORY BORINGS

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

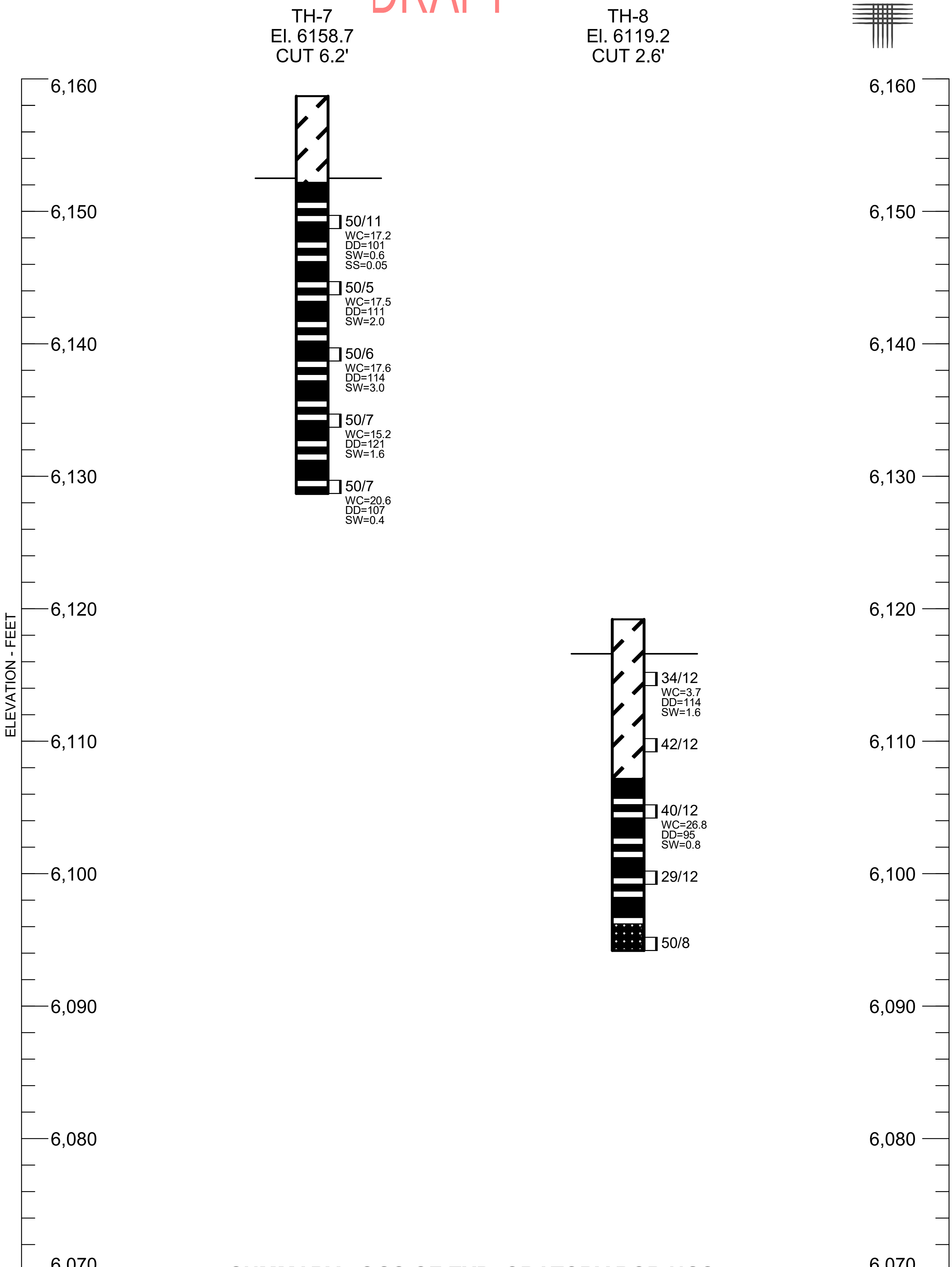
FIG. A- 1



SUMMARY LOGS OF EXPLORATORY BORINGS

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

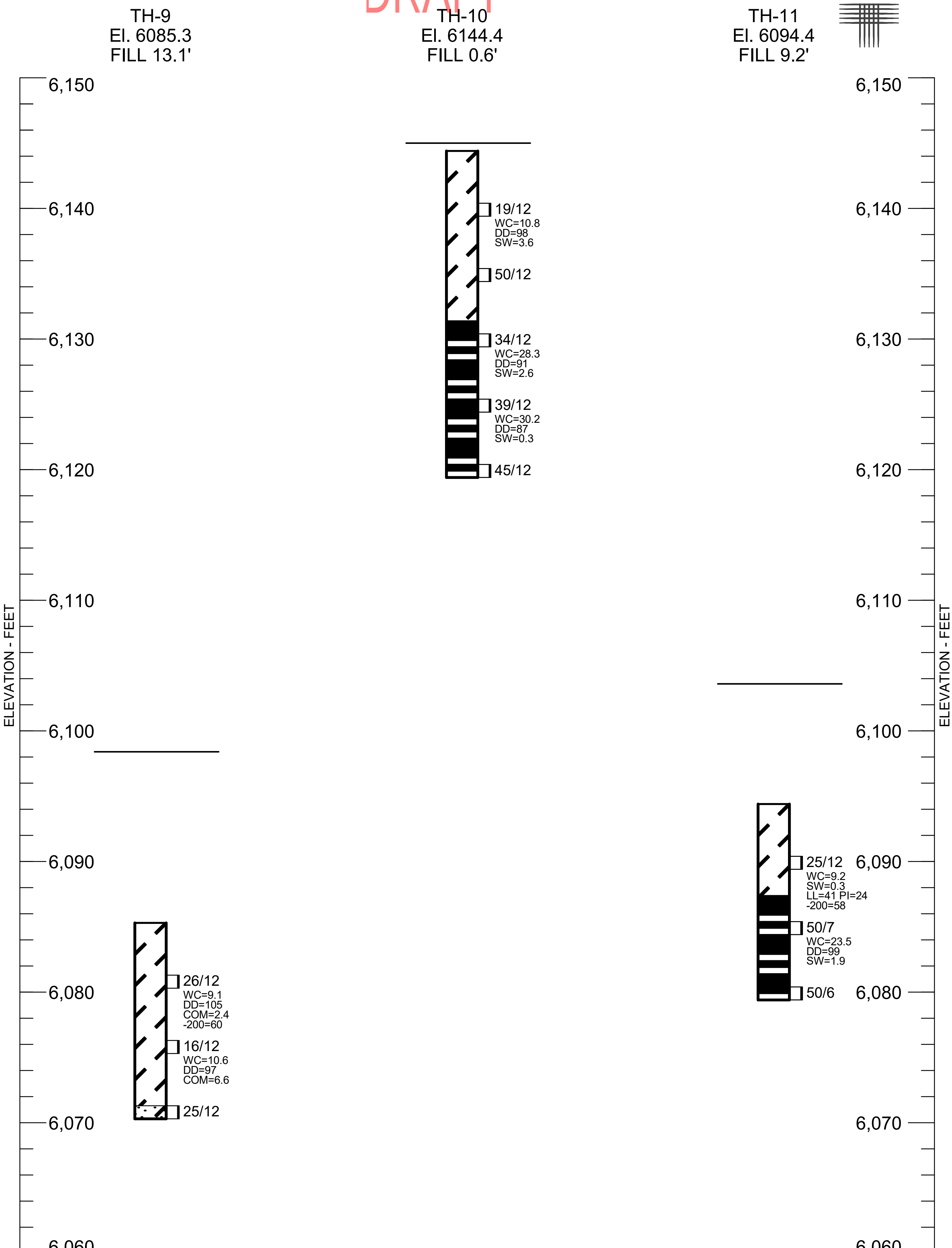
FIG. A- 2



SUMMARY LOGS OF EXPLORATORY BORINGS

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

FIG. A- 3



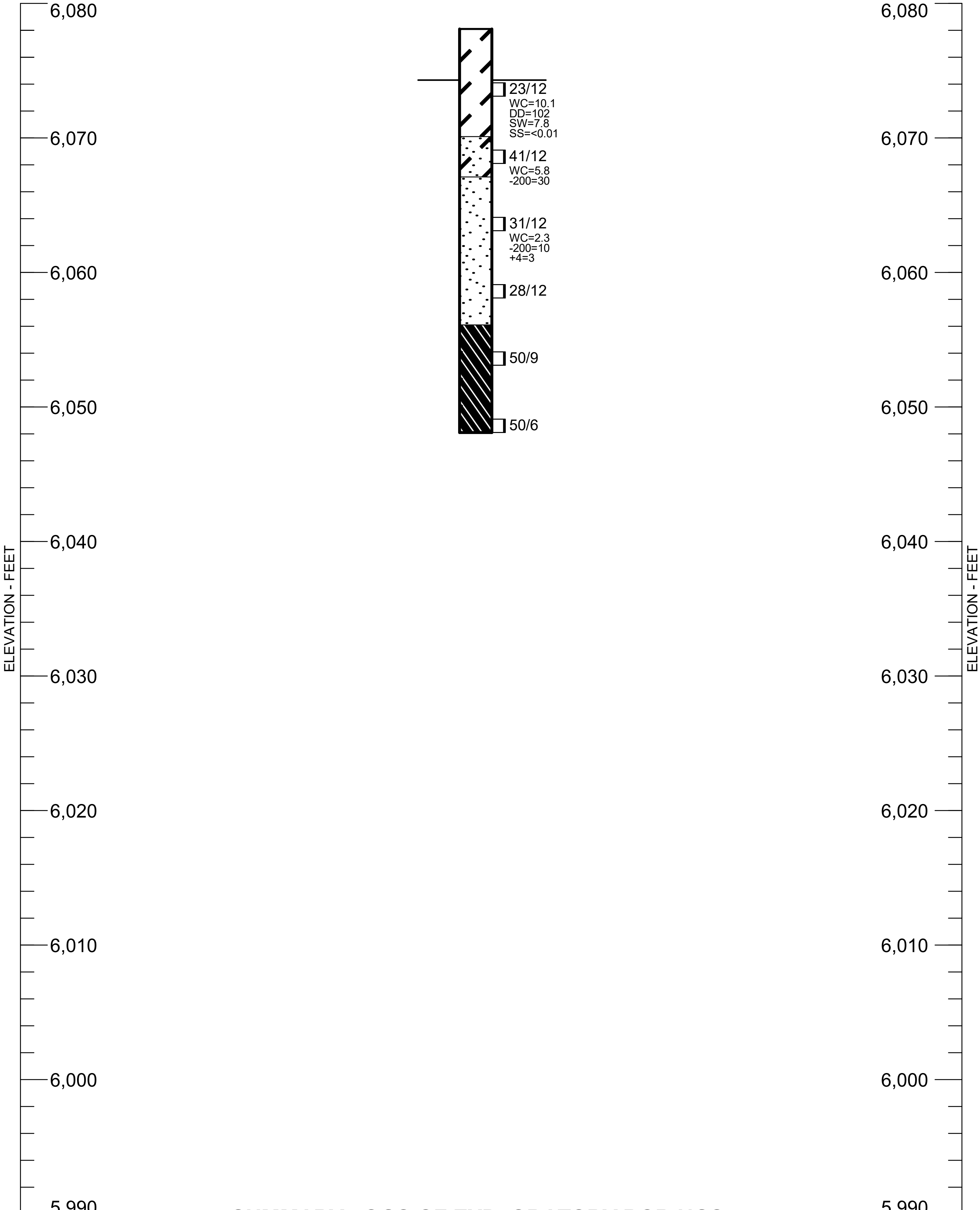
SUMMARY LOGS OF EXPLORATORY BORINGS

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

FIG. A- 4

DRAFT

TH-12
El. 6078.1
CUT 3.8'



SUMMARY LOGS OF EXPLORATORY BORINGS

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

FIG. A- 5

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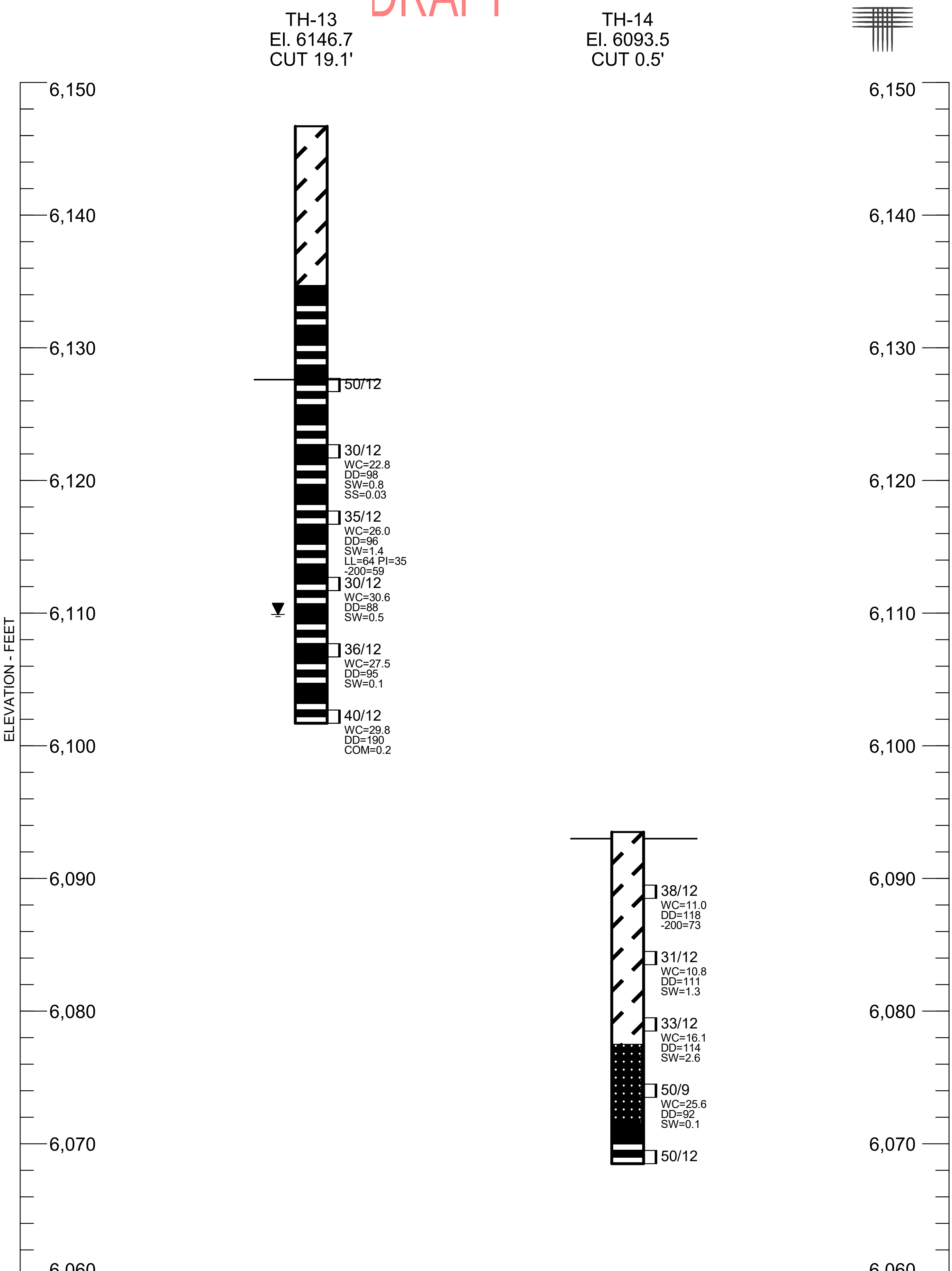
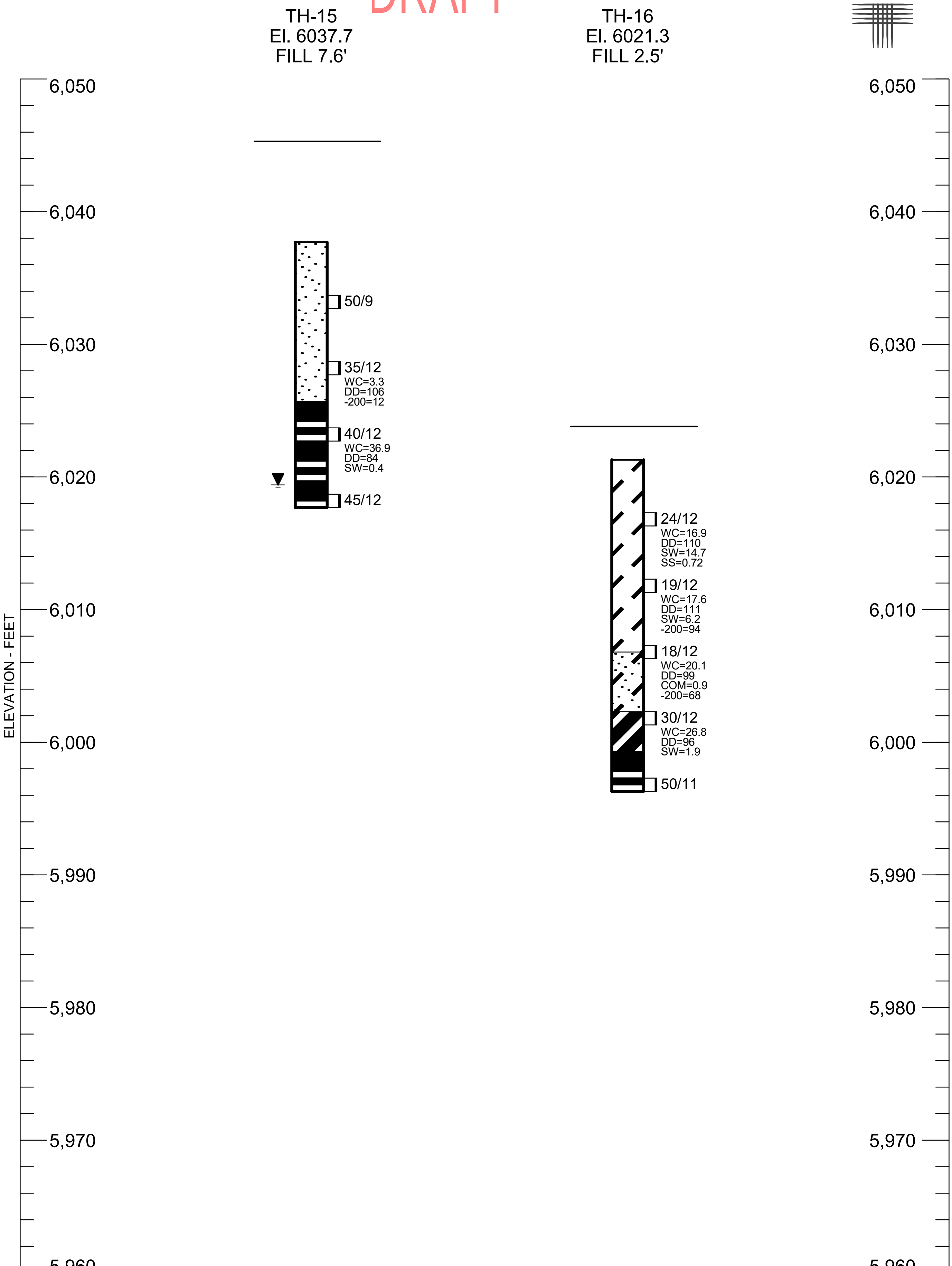


SUMMARY LOGS OF EXPLORATORY BORINGS

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

FIG. A- 6

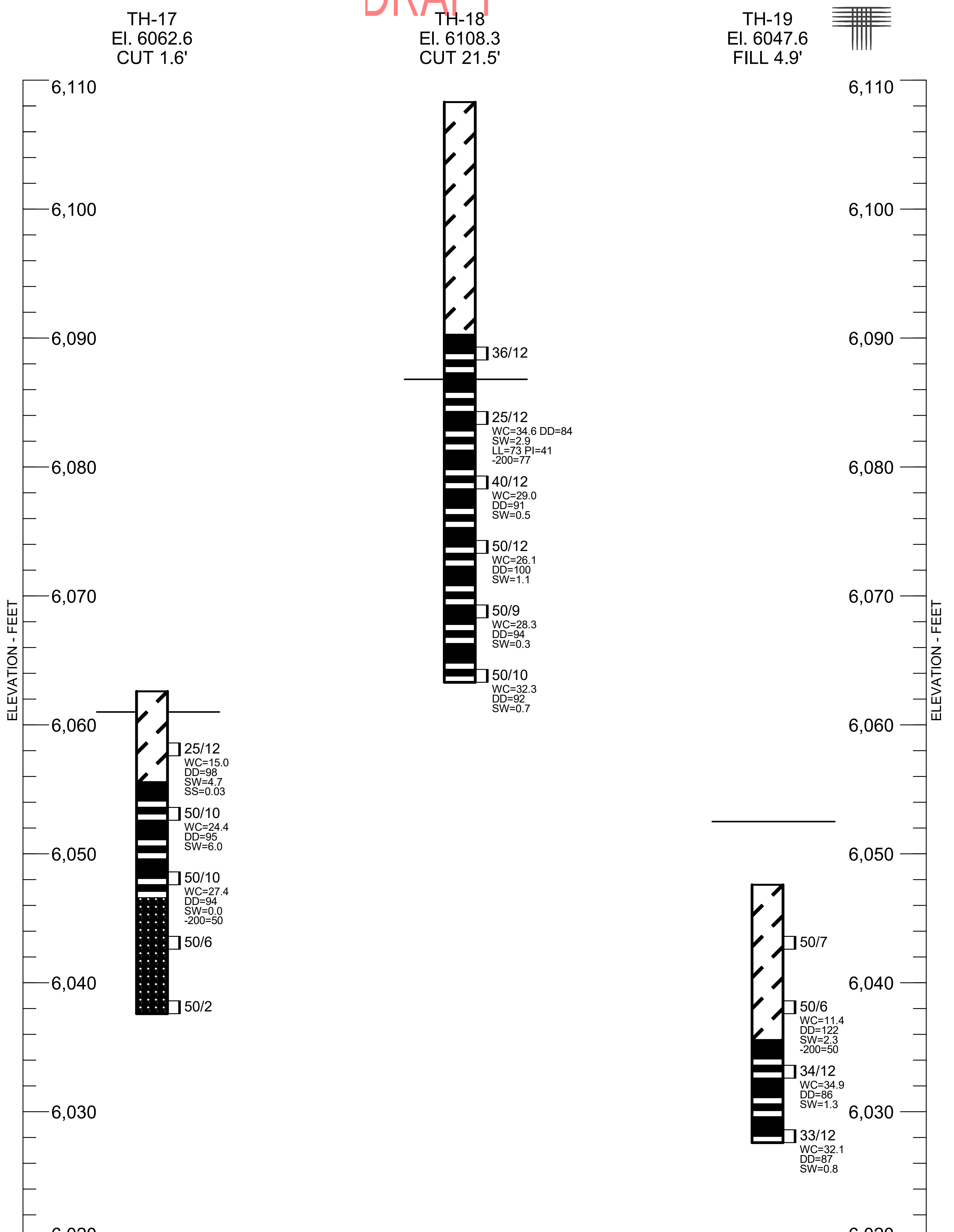
DRAFT



SUMMARY LOGS OF EXPLORATORY BORINGS

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

FIG. A- 7

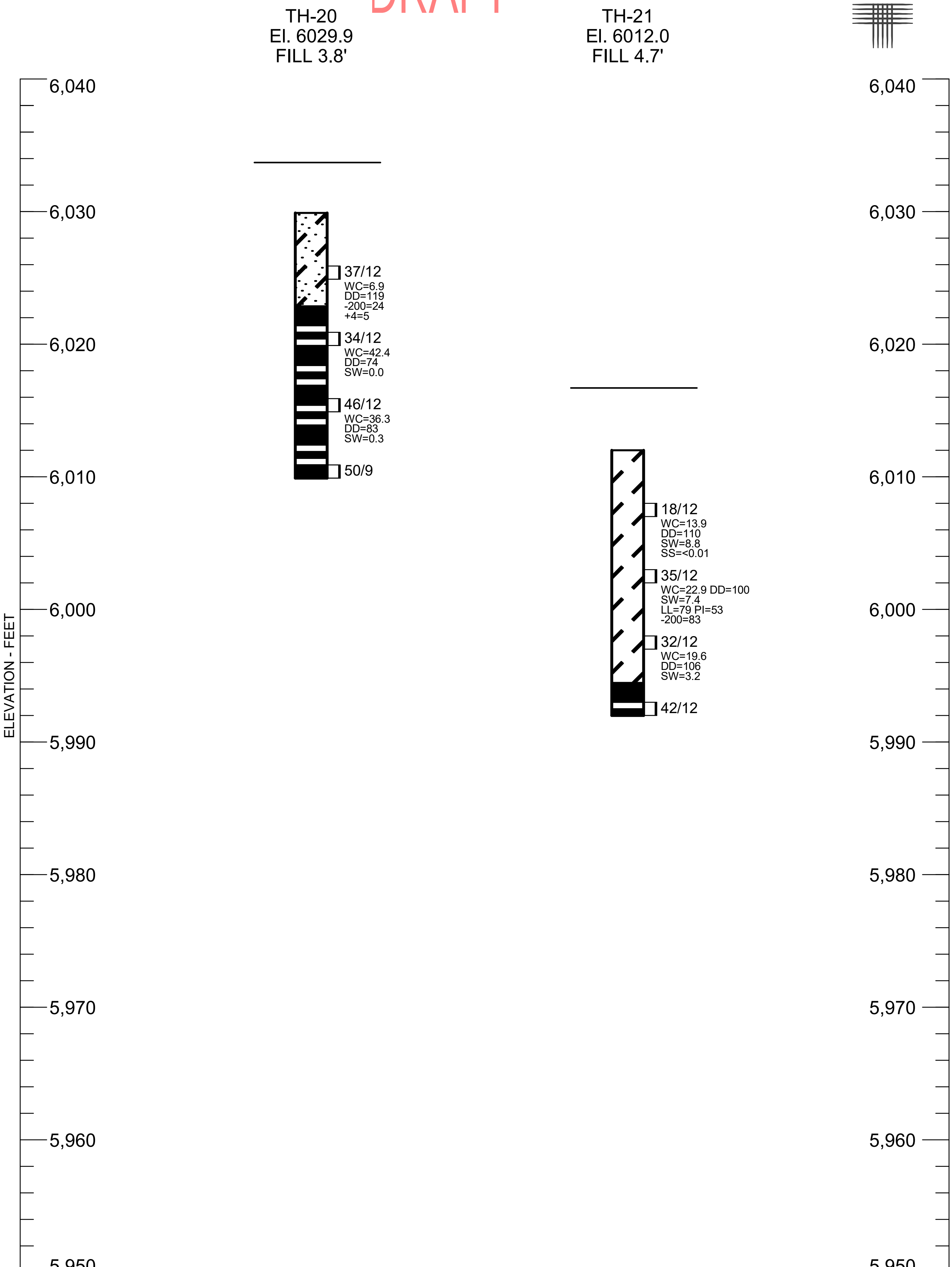


SUMMARY LOGS OF EXPLORATORY BORINGS

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

FIG. A- 8

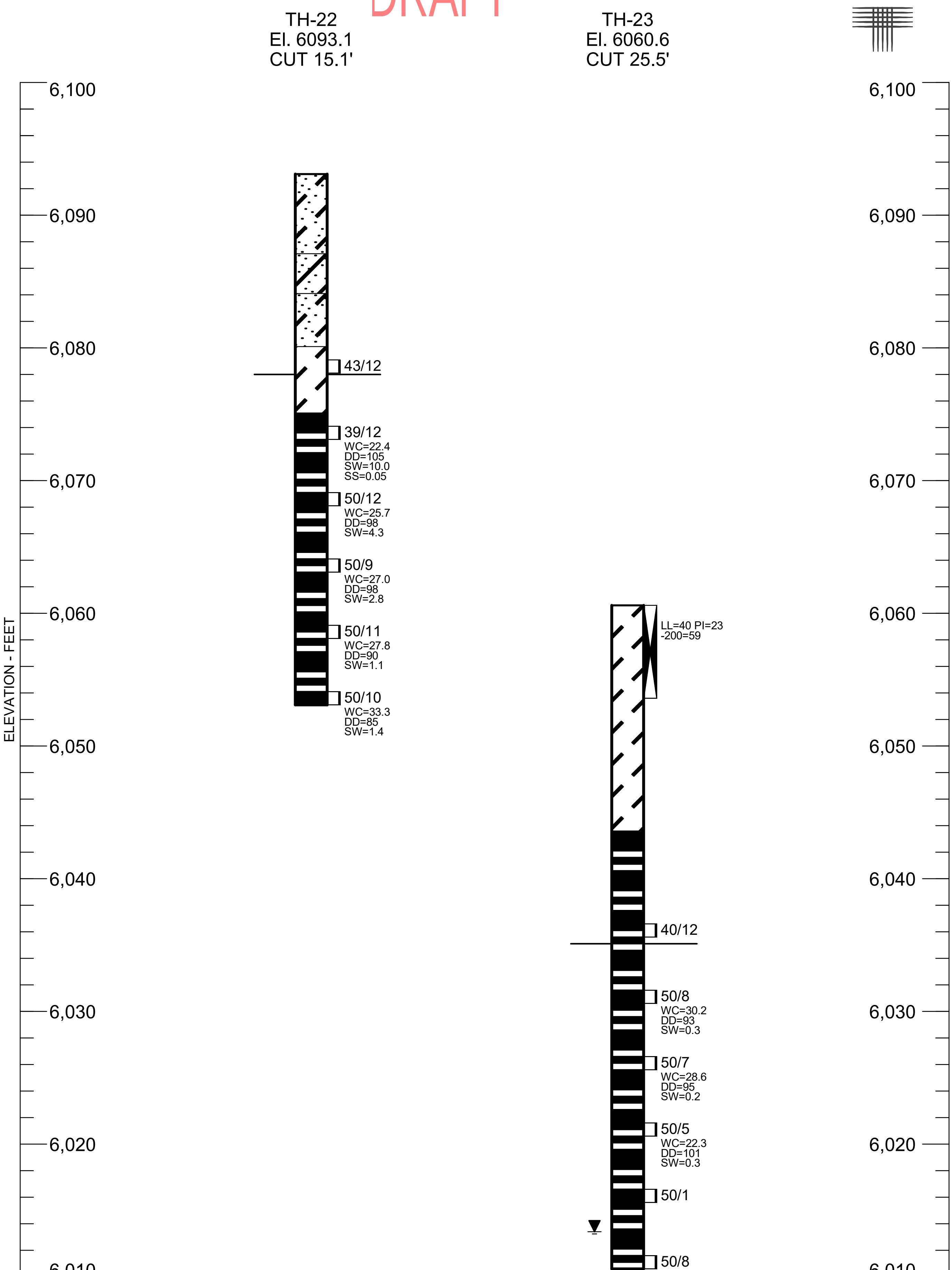
DRAFT



SUMMARY LOGS OF EXPLORATORY BORINGS

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

FIG. A- 9

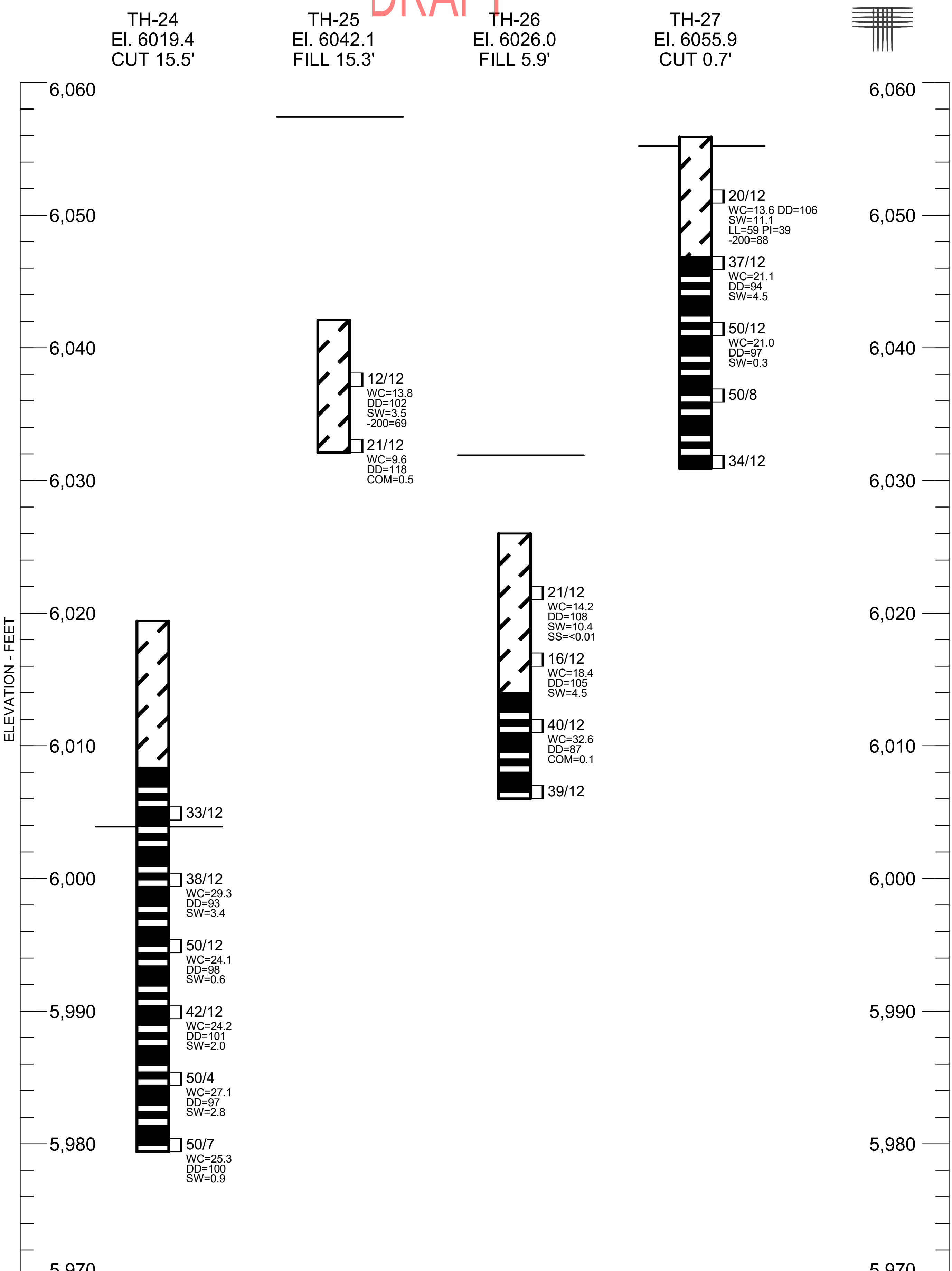


SUMMARY LOGS OF EXPLORATORY BORINGS

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

FIG. A- 10

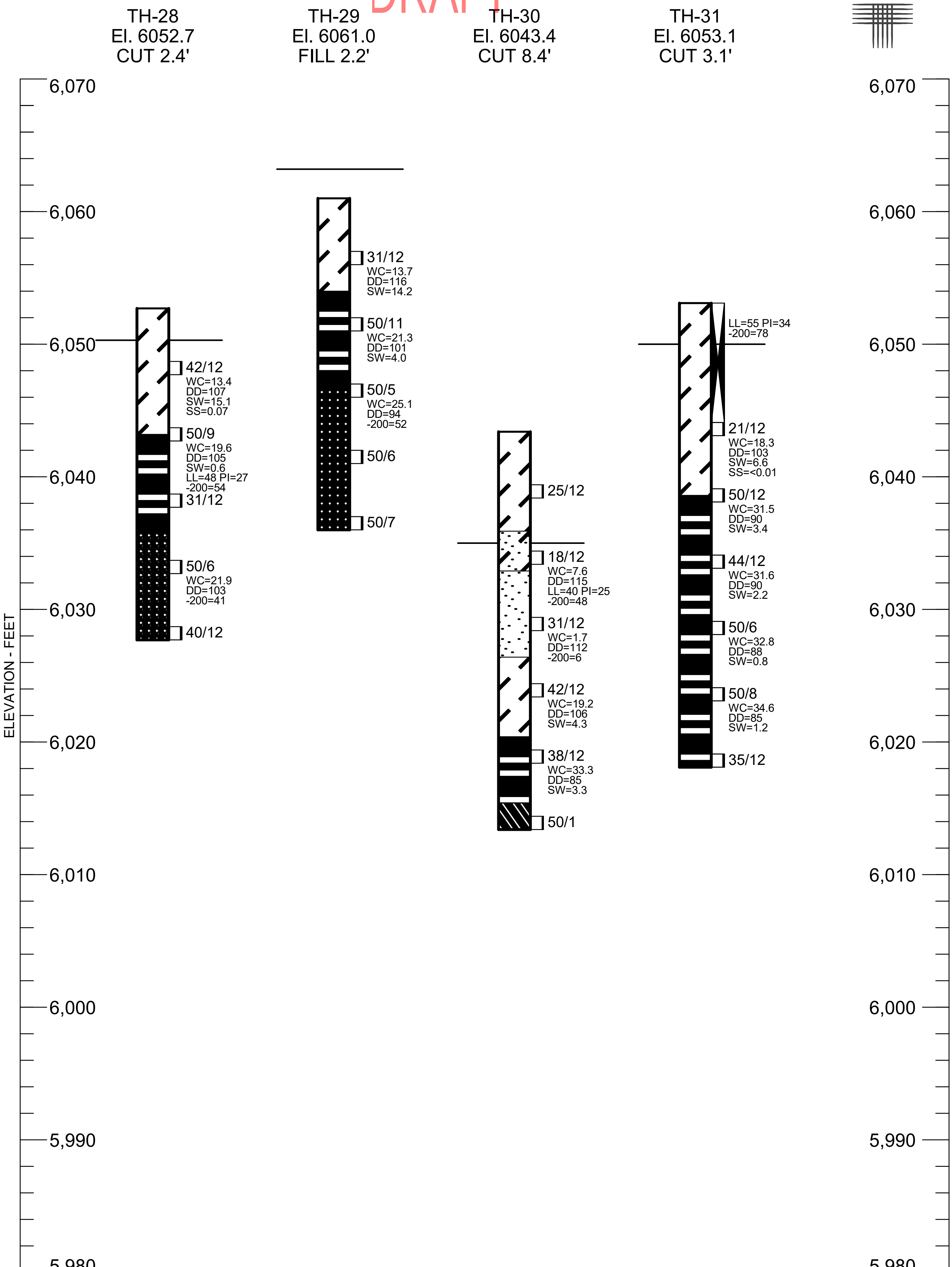
DRAFT



SUMMARY LOGS OF EXPLORATORY BORINGS

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

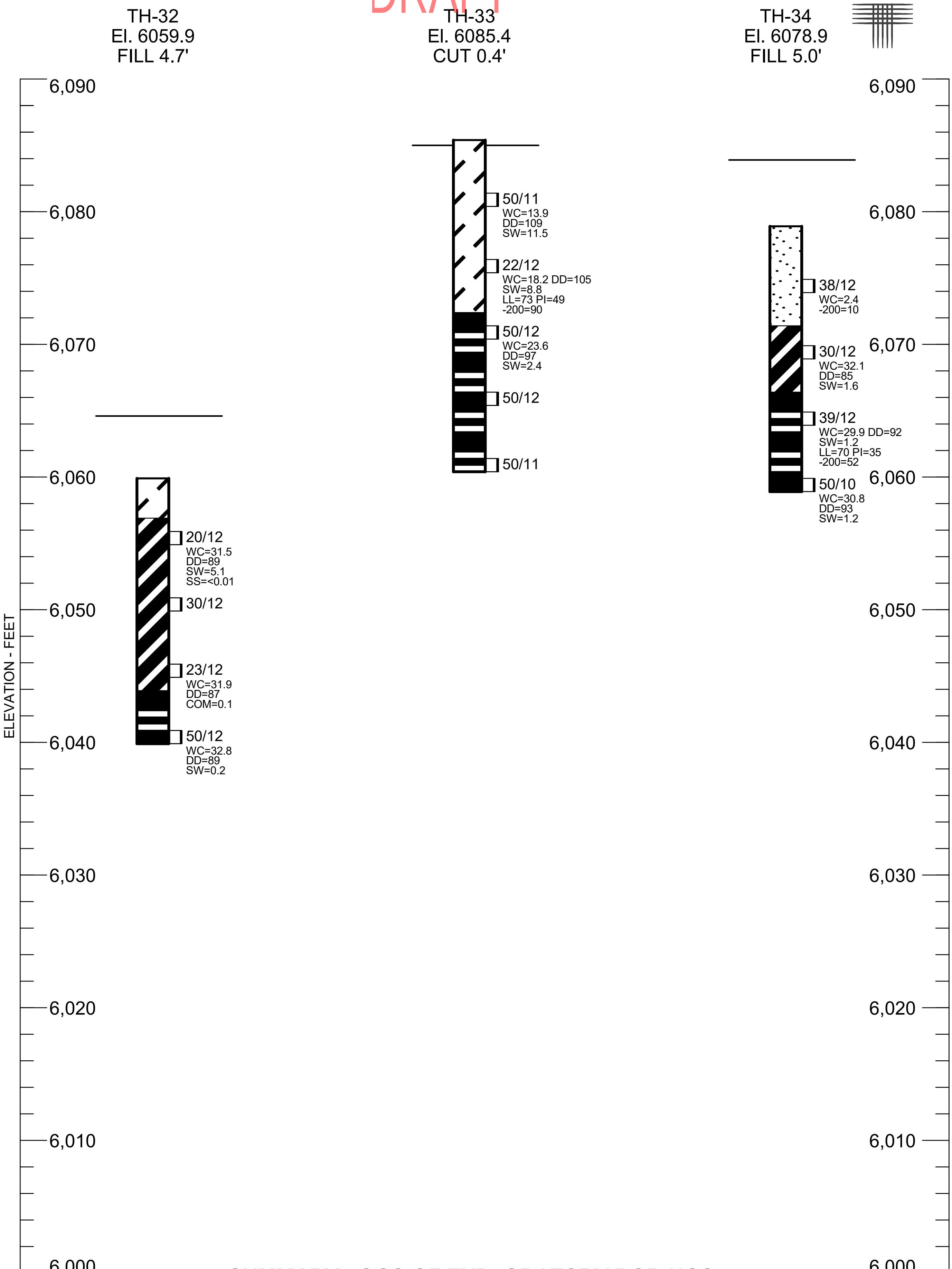
FIG. A- 11



SUMMARY LOGS OF EXPLORATORY BORINGS

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

FIG. A- 12

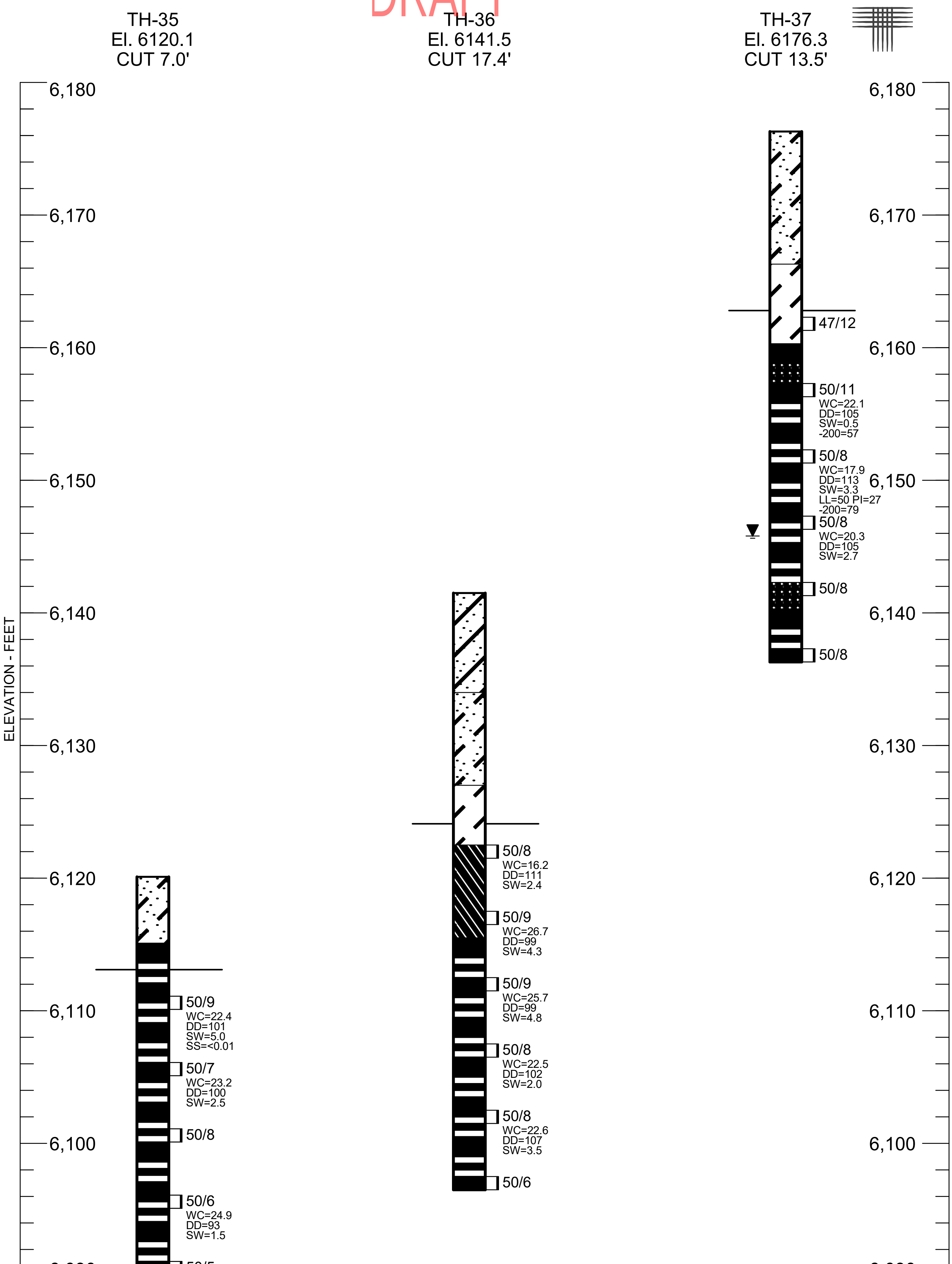


SUMMARY LOGS OF EXPLORATORY BORINGS

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

FIG. A- 13

DRAFT

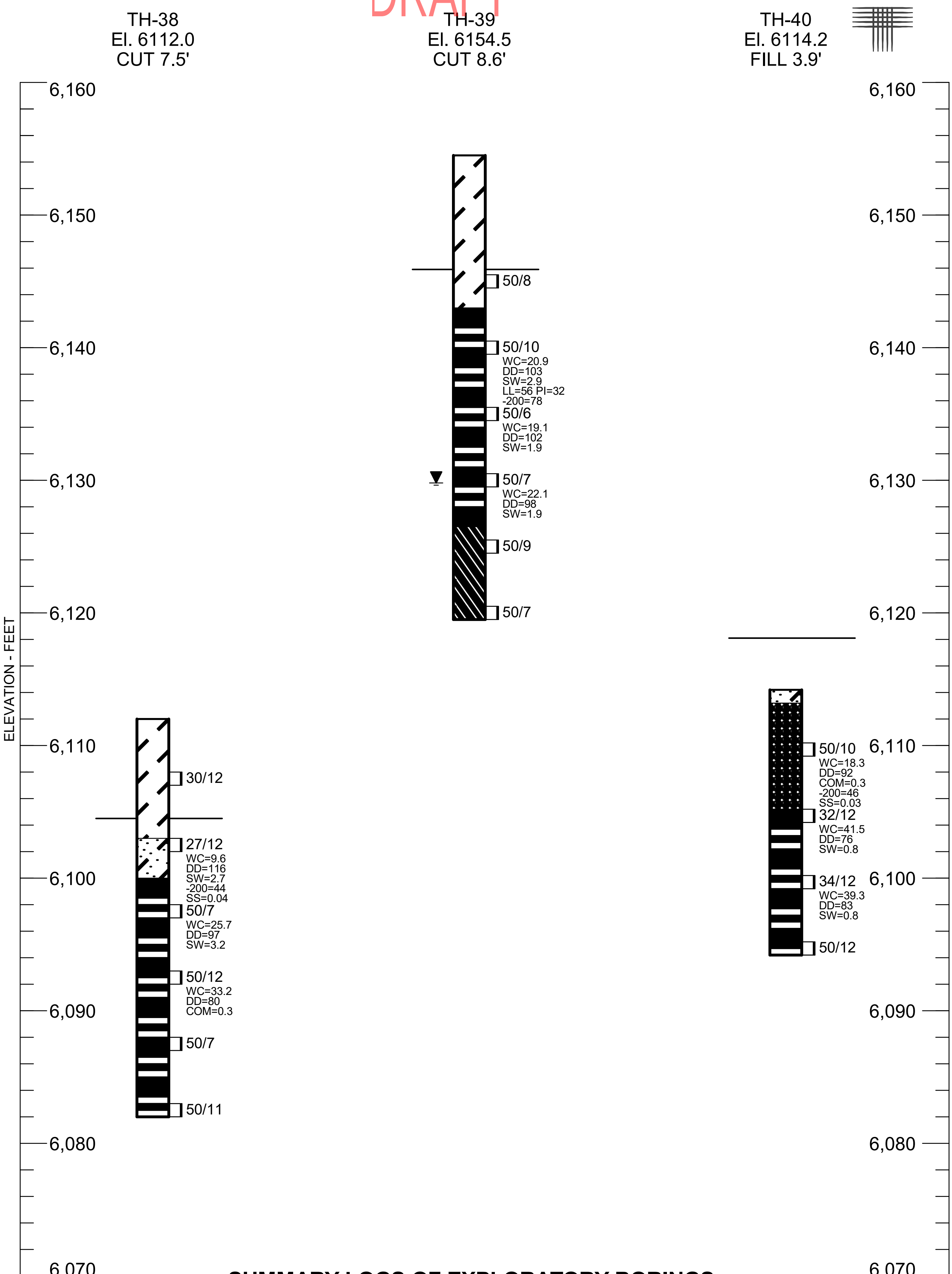


SUMMARY LOGS OF EXPLORATORY BORINGS

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

FIG. A- 14

DRAFT

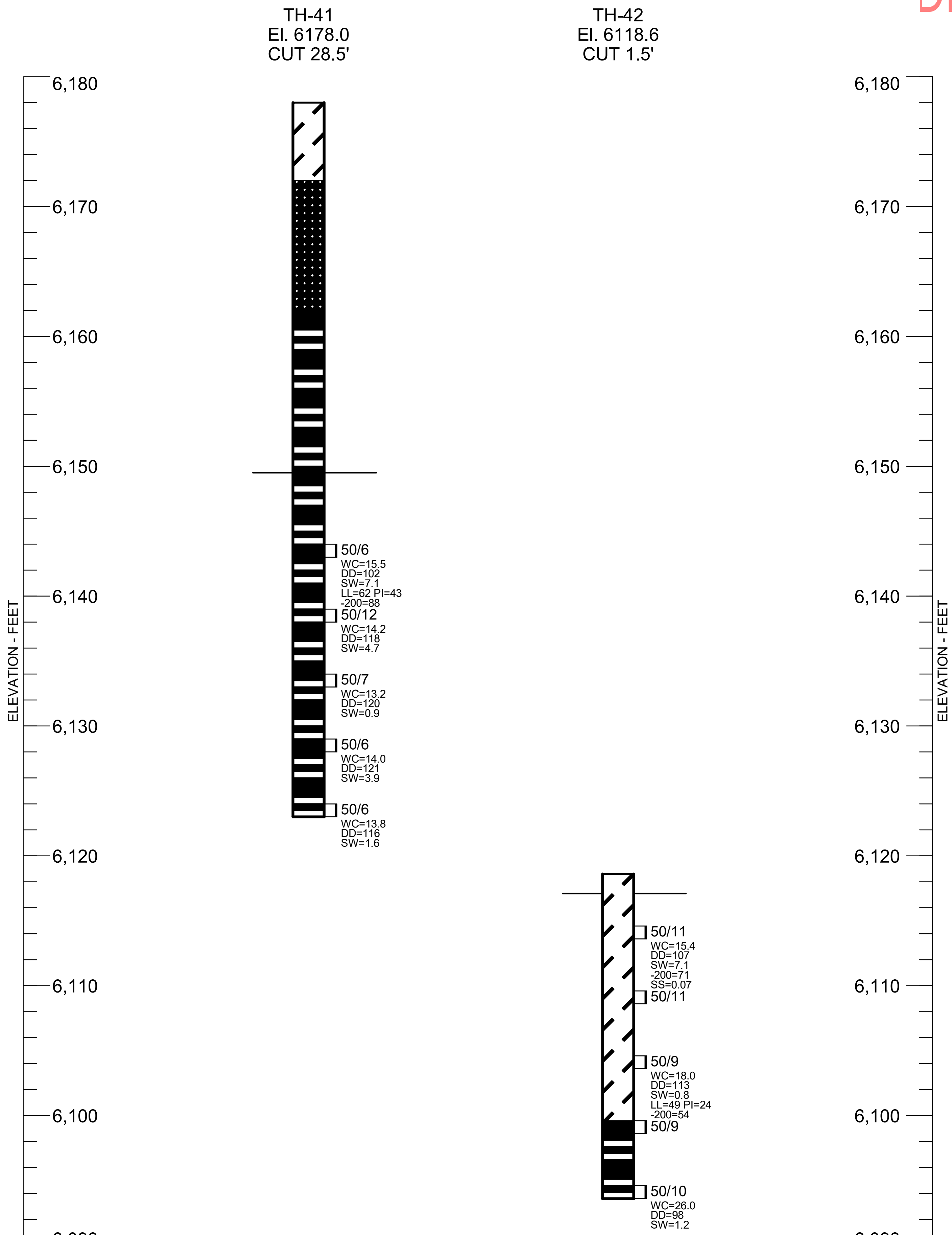


SUMMARY LOGS OF EXPLORATORY BORINGS

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

FIG. A- 15

DRAFT



SUMMARY LOGS OF EXPLORATORY BORINGS

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

LEGEND:

CLAY, SANDY, SILTY WITH OCCASIONAL SAND LENSES AND GRAVEL, CALCAREOUS AT TIMES, STIFF TO VERY STIFF, SLIGHTLY MOIST, BROWN, LIGHT BROWN, BLACK, GRAY, WHITE (CL).

SAND, CLAYEY, SILTY, MEDIUM DENSE TO DENSE, SLIGHTLY MOIST TO MOIST, BROWN, TAN (SC, SM).

SAND, SILTY, MEDIUM DENSE, SLIGHTLY MOIST TO MOIST, BROWN, TAN, GRAY, WHITE (SM).

SAND, CLEAN TO SLIGHTLY SILTY WITH GRAVEL, MEDIUM DENSE TO VERY DENSE, SLIGHTLY MOIST TO MOIST, BROWN, TAN, GRAY (SP, SP-SM).

WEATHERED CLAYSTONE, MOIST, BROWN, RUST.

BEDROCK, CLAYSTONE, MEDIUM HARD TO VERY HARD, MOIST, BROWN, LIGHT GRAY, GRAY, RUST.

BEDROCK, SANDSTONE, MEDIUM HARD TO VERY HARD, MOIST, TAN, GRAY, WHITE.

BEDROCK, INTERBEDDED CLAYSTONE/SANDSTONE, HARD TO VERY HARD, MOIST, GRAY, ORANGE.

DRIVE SAMPLE. THE SYMBOL 50/12 INDICATES 50 BLOWS OF AN AUTOMATIC 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.

BULK SAMPLE COLLECTED FROM AUGER-CUTTINGS.

WATER LEVEL MEASURED AT TIME OF DRILLING.

WATER LEVEL MEASURED AFTER DRILLING ON MARCH 25, 2019.

INDICATES PROPOSED CUT OR FILL DEPTH.

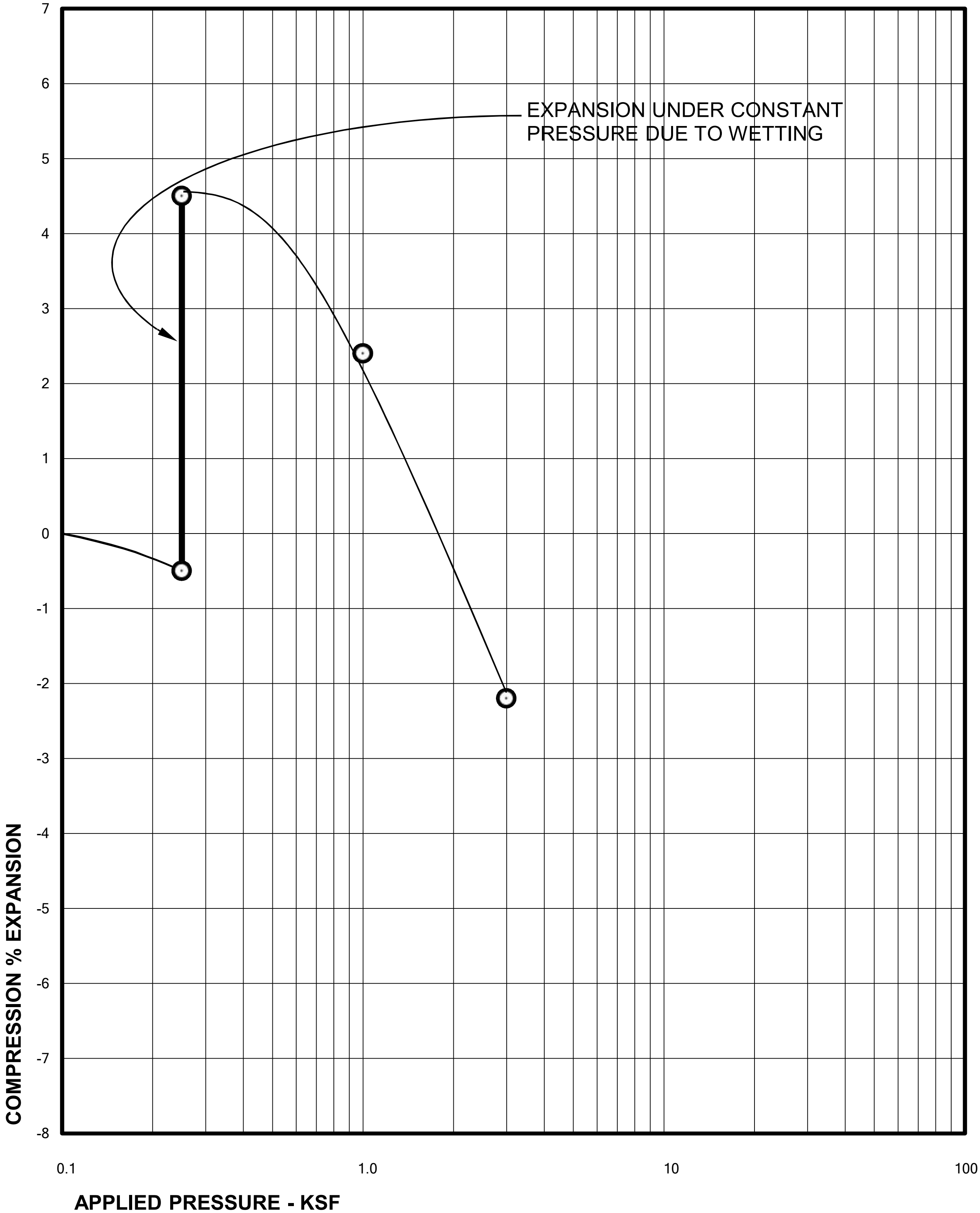
NOTES:

1. THE BORINGS WERE DRILLED BETWEEN FEBRUARY 29 AND MARCH 20, 2019 USING 4-INCH DIAMETER, CONTINUOUS-FLIGHT SOLID-STEM AUGER AND TRUCK-MOUNTED CME-45 DRILL RIGS.
2. BORING LOCATIONS AND ELEVATIONS WERE STAKED AND SURVEYED BY OTHERS.
3. WC - INDICATES MOISTURE CONTENT (%).
   DD - INDICATES DRY DENSITY (PCF).
   SW - INDICATES SWELL WHEN WETTED UNDER APPLIED PRESSURE (%).
   COM- INDICATES COMPRESSION WHEN WETTED UNDER APPLIED PRESSURE (%).
   LL - INDICATES LIQUID LIMIT.
   PI - INDICATES PLASTICITY INDEX.
   -200 - INDICATES PASSING NO. 200 SIEVE (%).
   +4 - INDICATES RETAINED ON NO. 4 SIEVE (%).
   SS - INDICATES WATER-SOLUBLE SULFATE CONTENT (%).
4. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS AND CONCLUSIONS CONTAINED IN THIS REPORT.

APPENDIX B

LABORATORY TEST RESULTS
TABLE B-I – SUMMARY OF LABORATORY TEST RESULTS

DRAFT

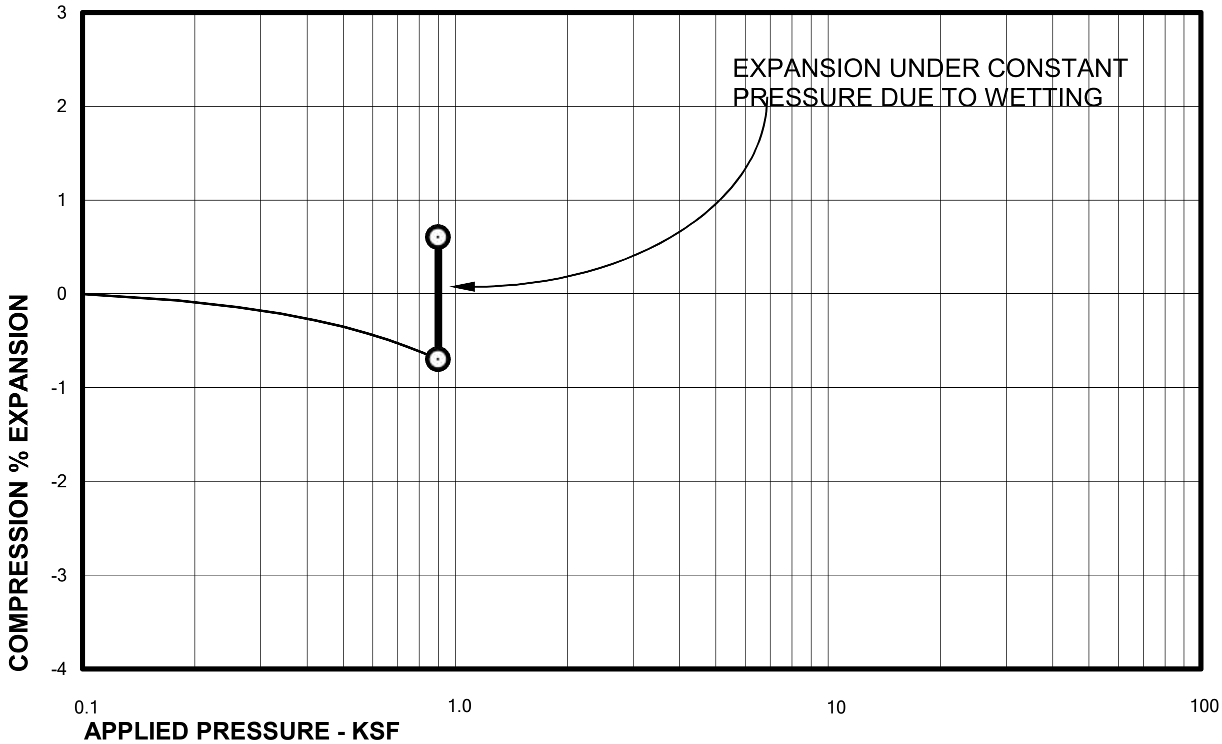


Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	103	PCF
From	TH-1 AT 9 FEET	MOISTURE CONTENT=	10.9	%

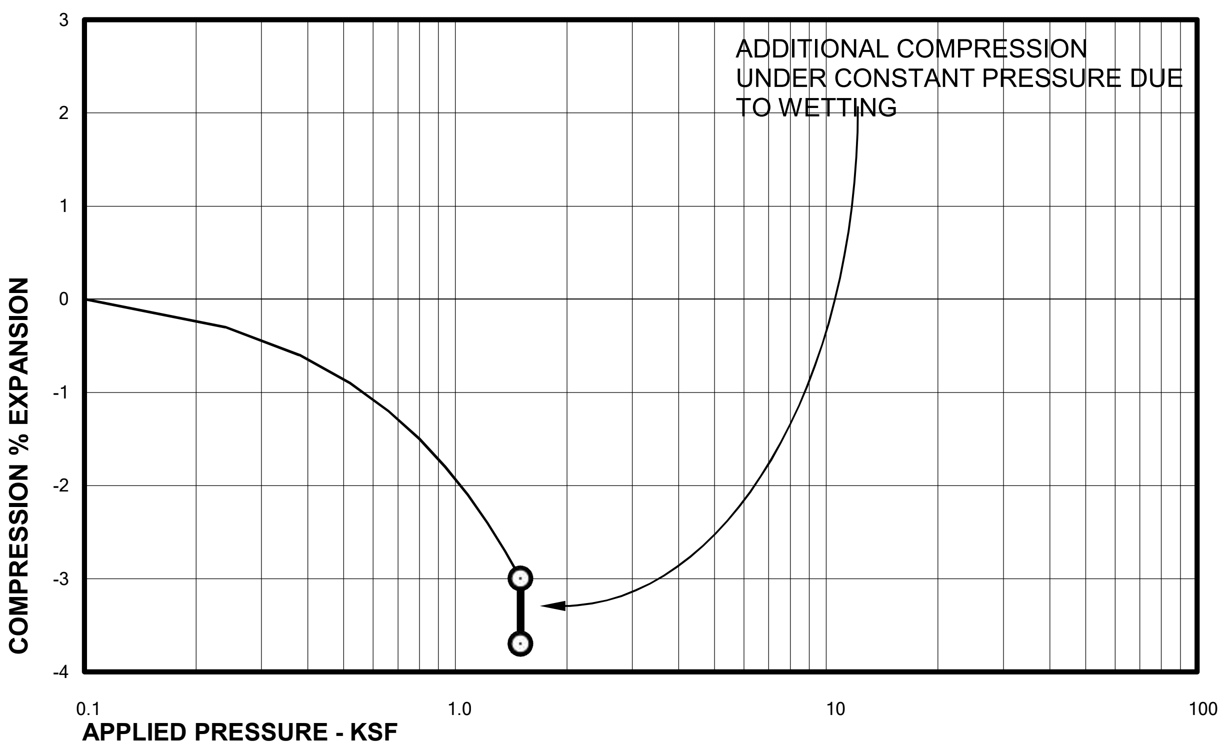
SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-1



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	94	PCF
From	TH-1 AT 14 FEET	MOISTURE CONTENT=	28.2	%



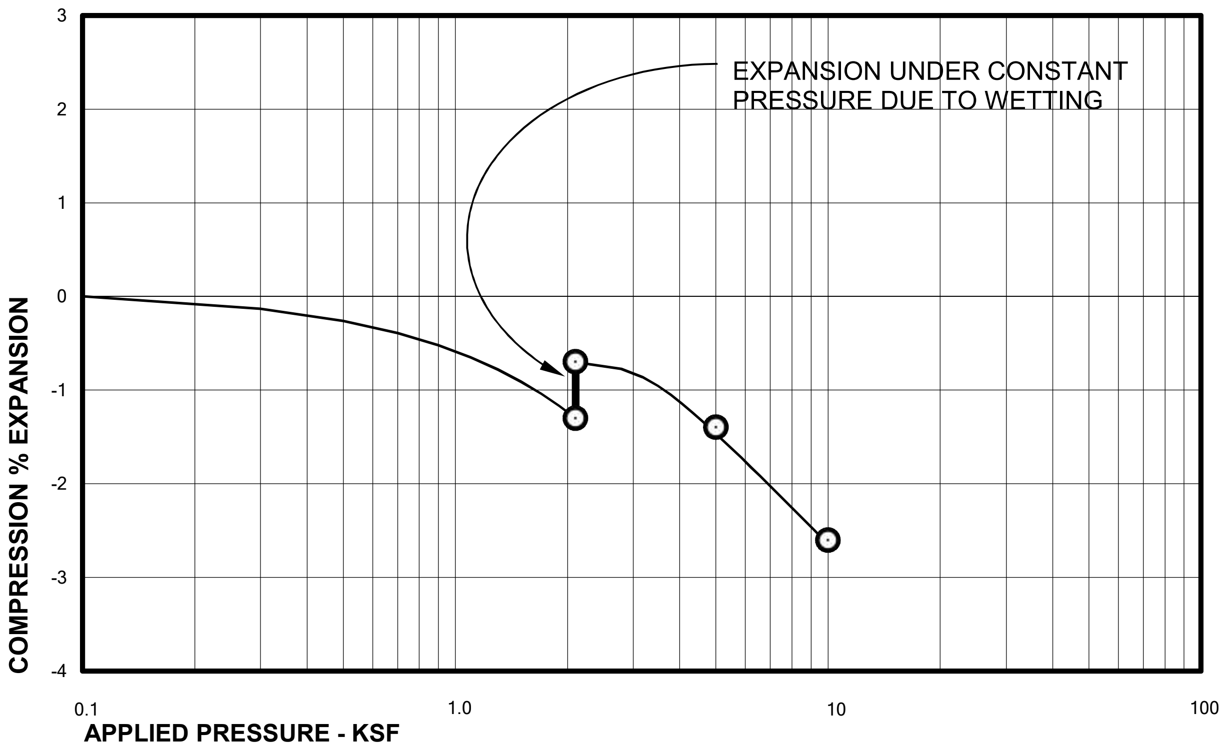
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	84	PCF
From	TH-1 AT 19 FEET	MOISTURE CONTENT=	34.2	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

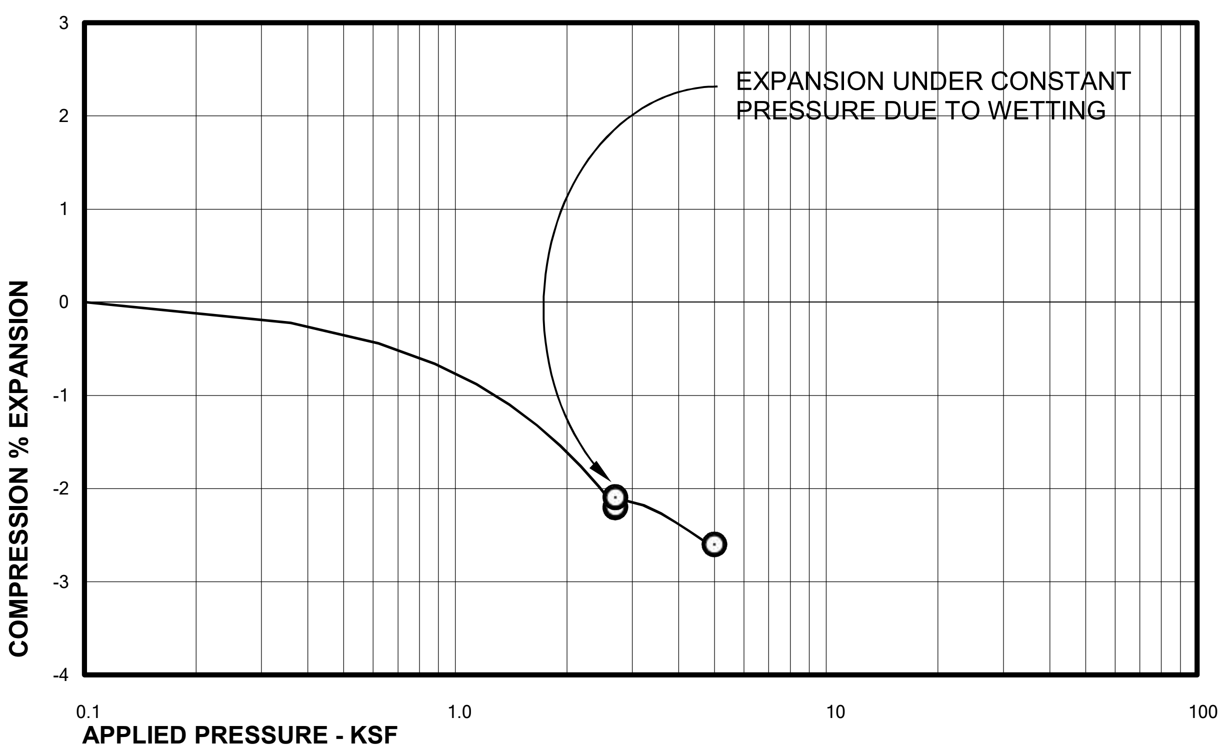
Swell Consolidation Test Results

FIG. B-2

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	85	PCF
From	TH-1 AT 24 FEET	MOISTURE CONTENT=	37.0	%



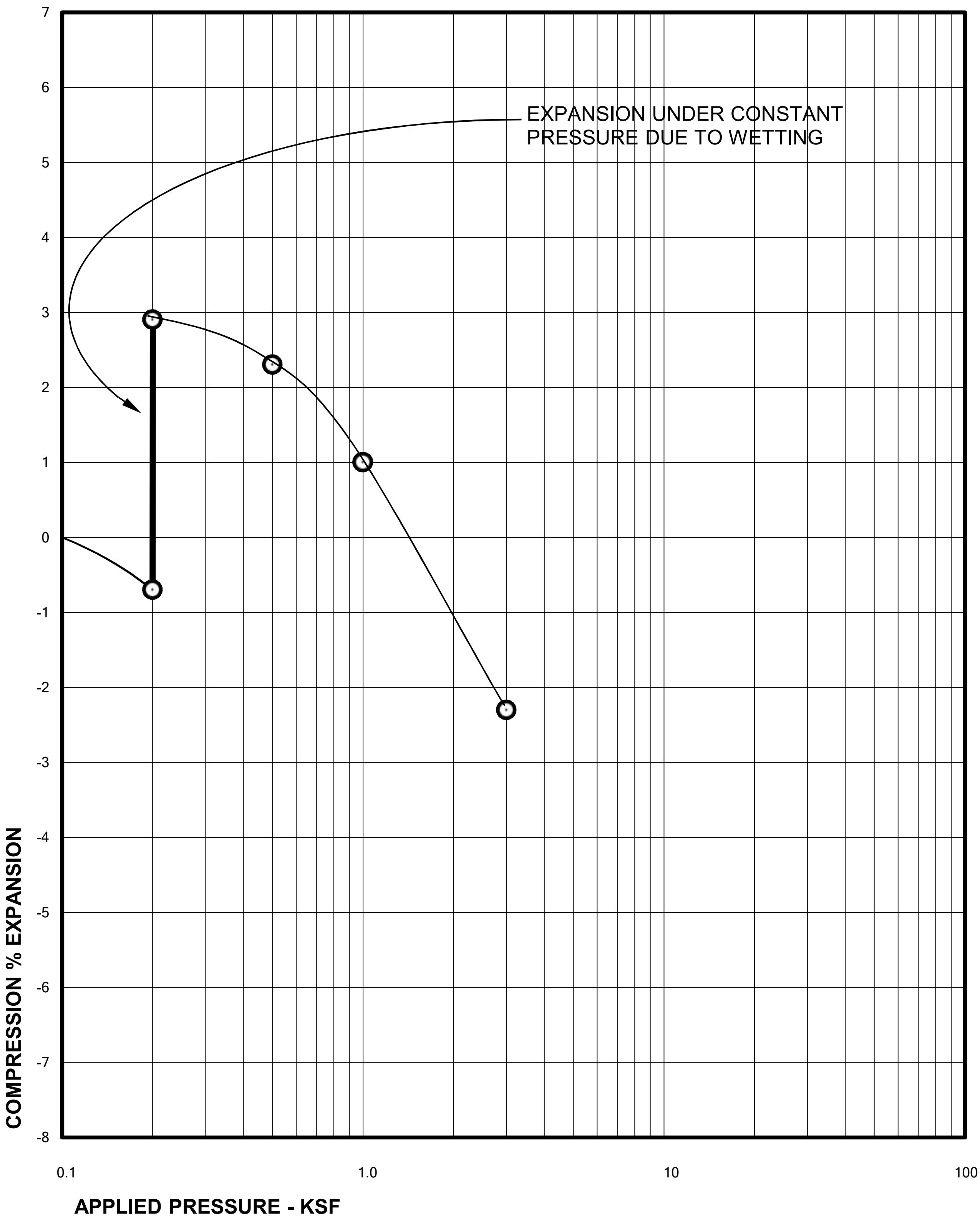
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	80	PCF
From	TH-1 AT 29 FEET	MOISTURE CONTENT=	41.0	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-3

DRAFT



Sample of CLAY, SANDY (CL)

From TH-2 AT 9 FEET

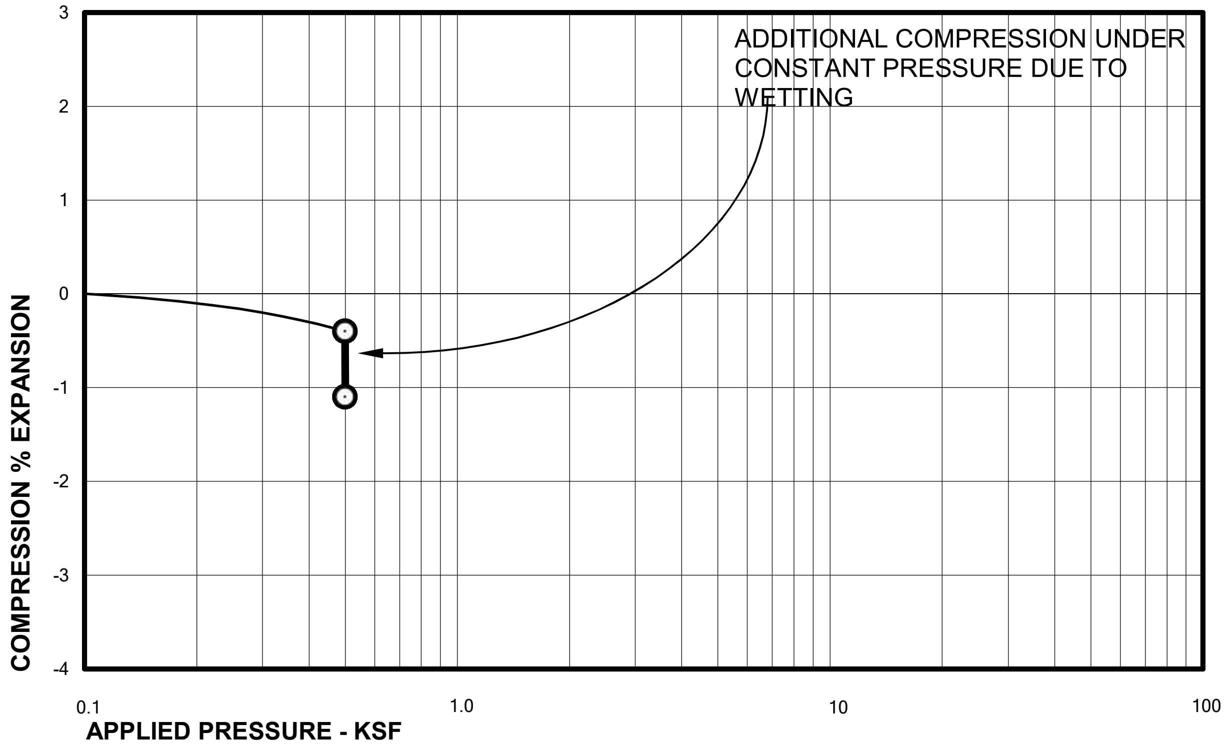
DRY UNIT WEIGHT= 103 PCF

MOISTURE CONTENT= 12.3 %

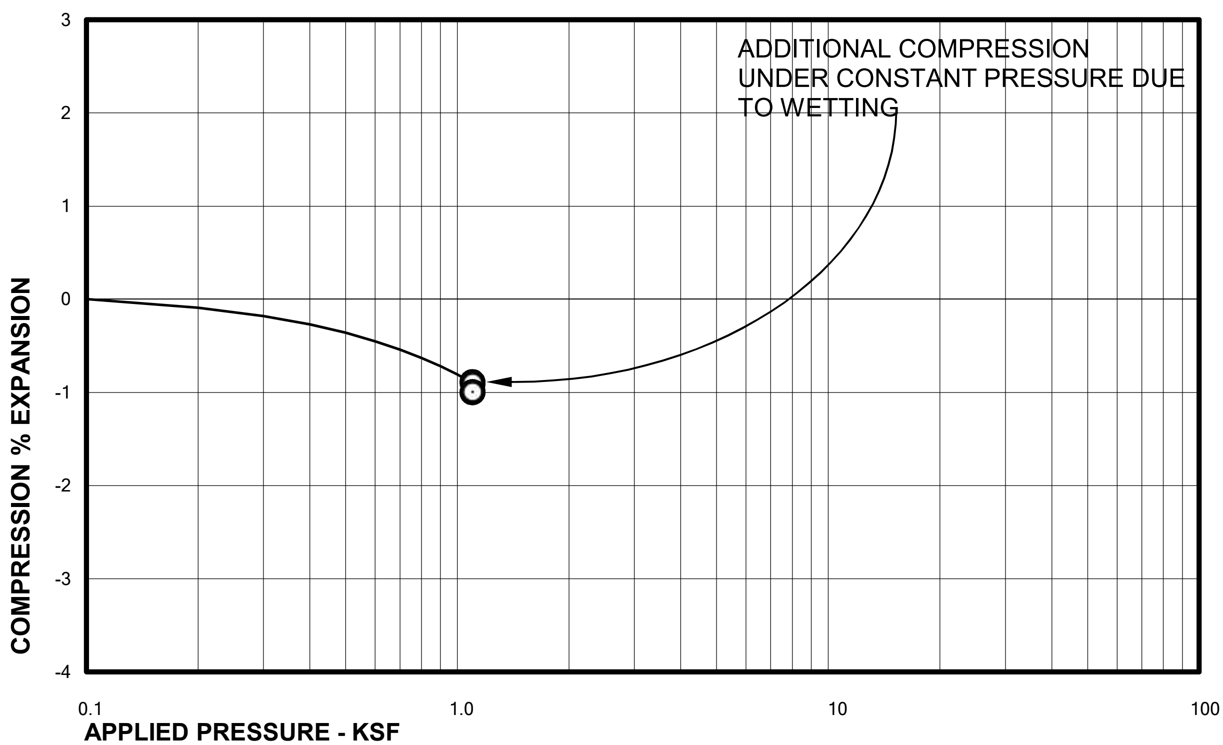
SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-4



Sample of	SANDSTONE	DRY UNIT WEIGHT=	109	PCF
From	TH-2 AT 14 FEET	MOISTURE CONTENT=	9.8	%



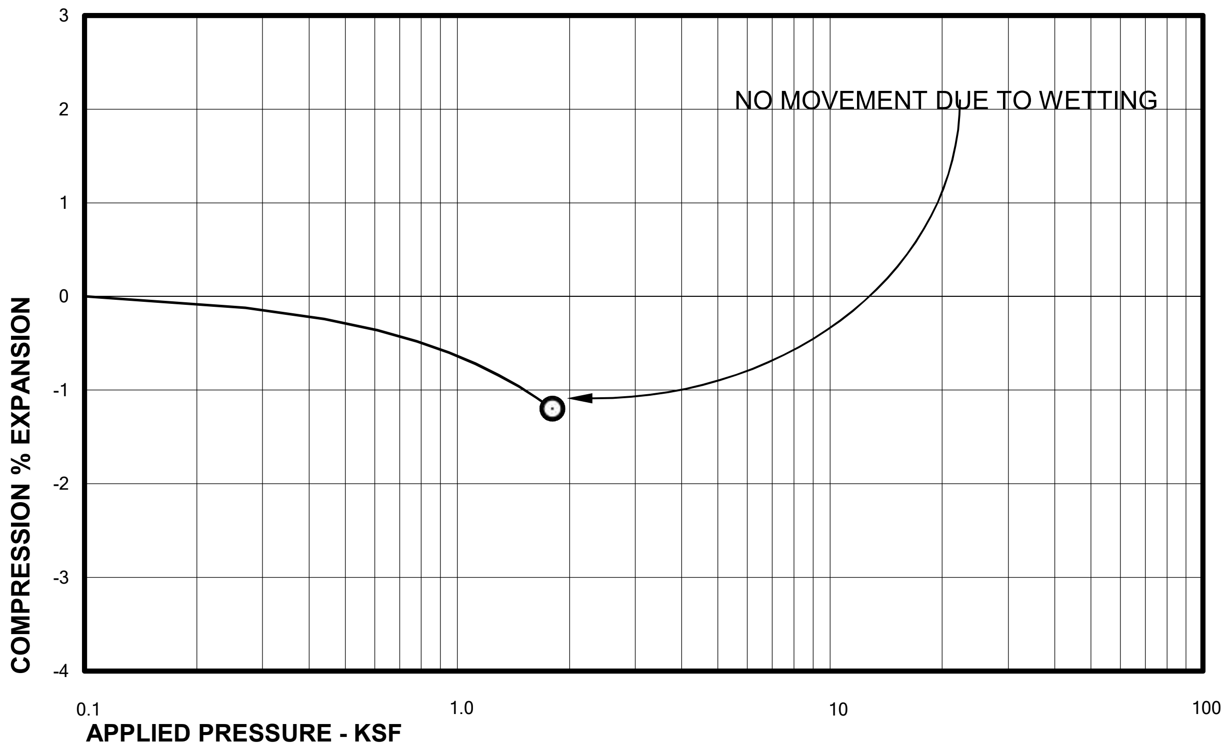
Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	112	PCF
From	TH-3 AT 9 FEET	MOISTURE CONTENT=	8.0	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

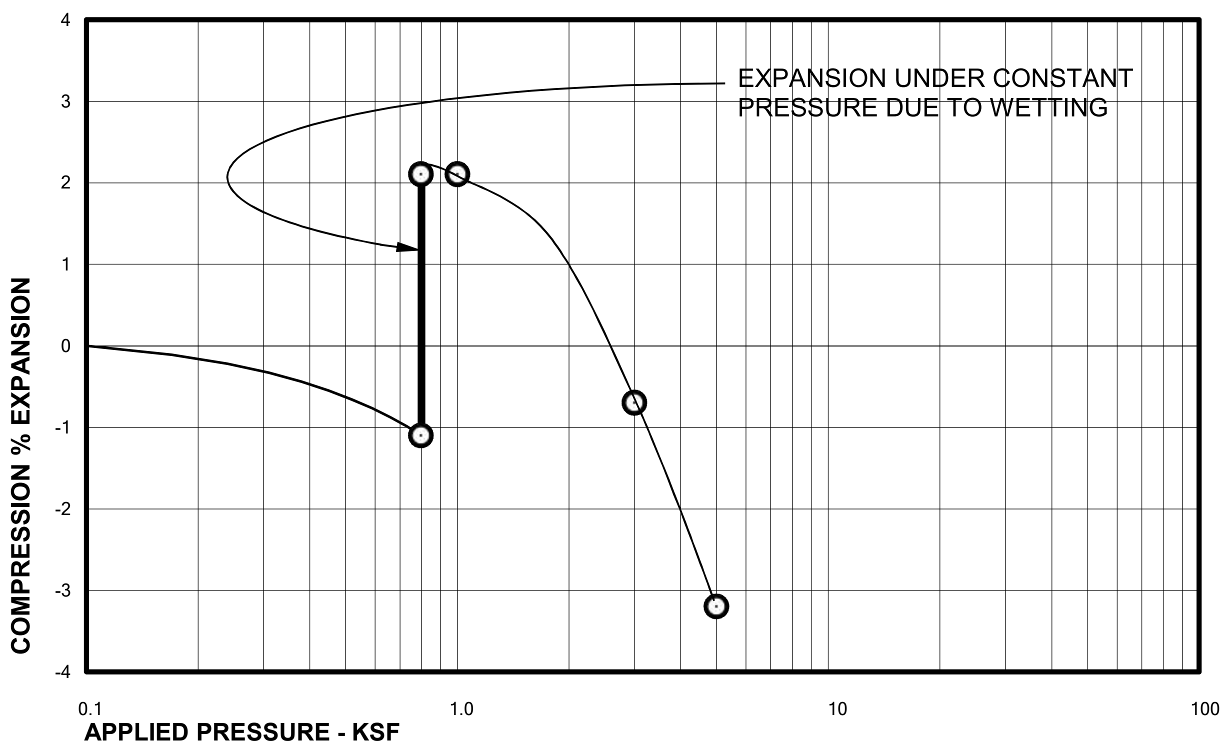
Swell Consolidation Test Results

FIG. B-5

DRAFT



Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	109	PCF
From	TH-3 AT 14 FEET	MOISTURE CONTENT=	13.1	%



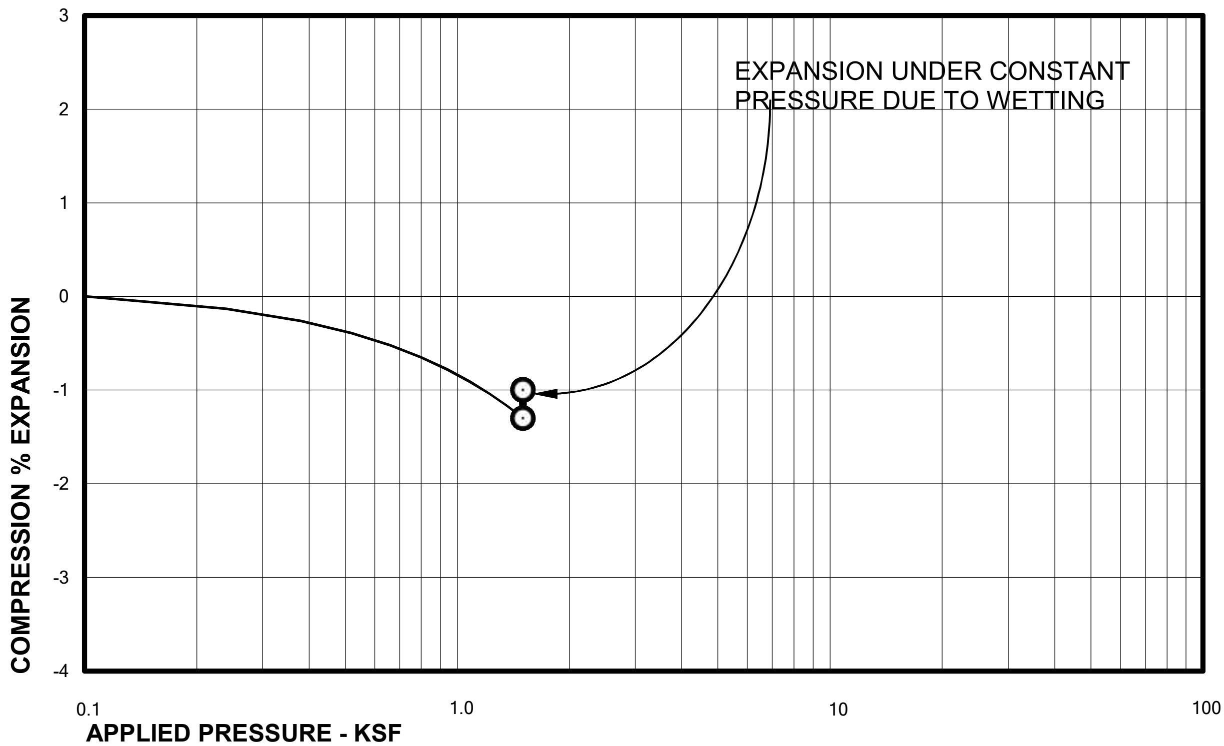
Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	105	PCF
From	TH-4 AT 4 FEET	MOISTURE CONTENT=	12.2	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

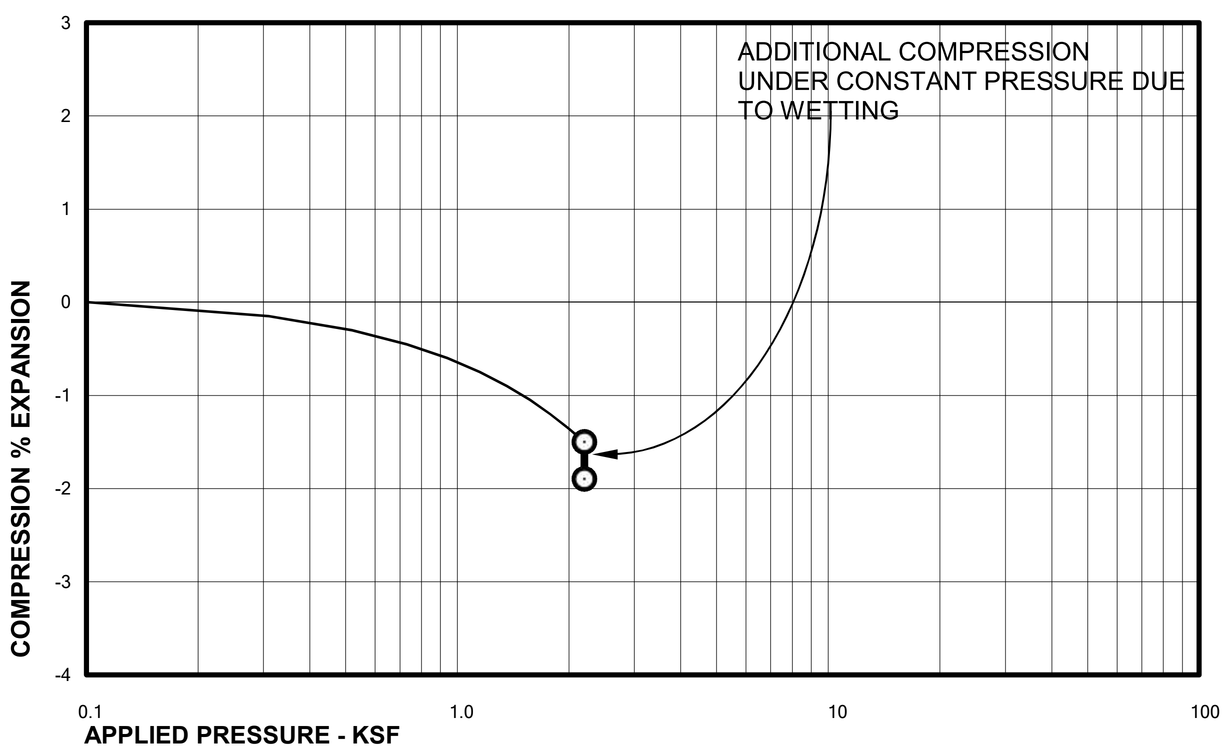
FIG. B-6

DRAFT



Sample of CLAY, SANDY (CL) DRY UNIT WEIGHT= 116 PCF

From TH-4 AT 9 FEET MOISTURE CONTENT= 10.7 %



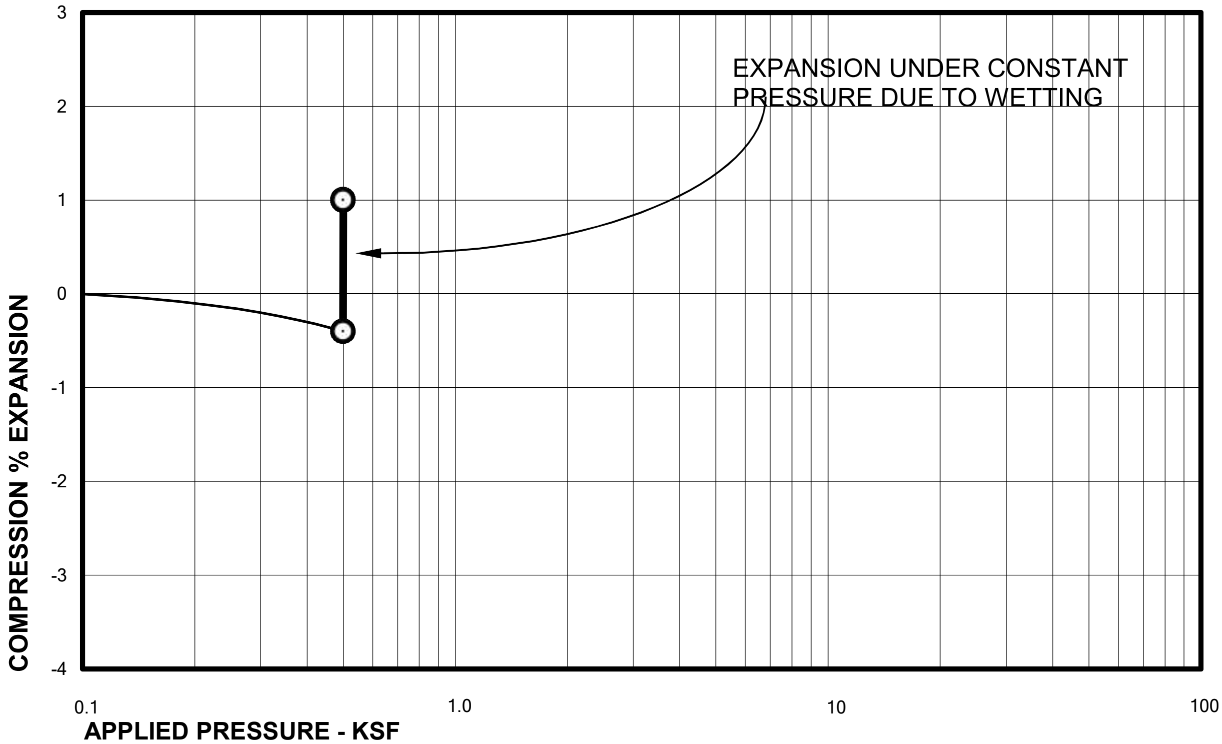
Sample of CLAY, SANDY (CL) DRY UNIT WEIGHT= 101 PCF

From TH-4 AT 14 FEET MOISTURE CONTENT= 16.3 %

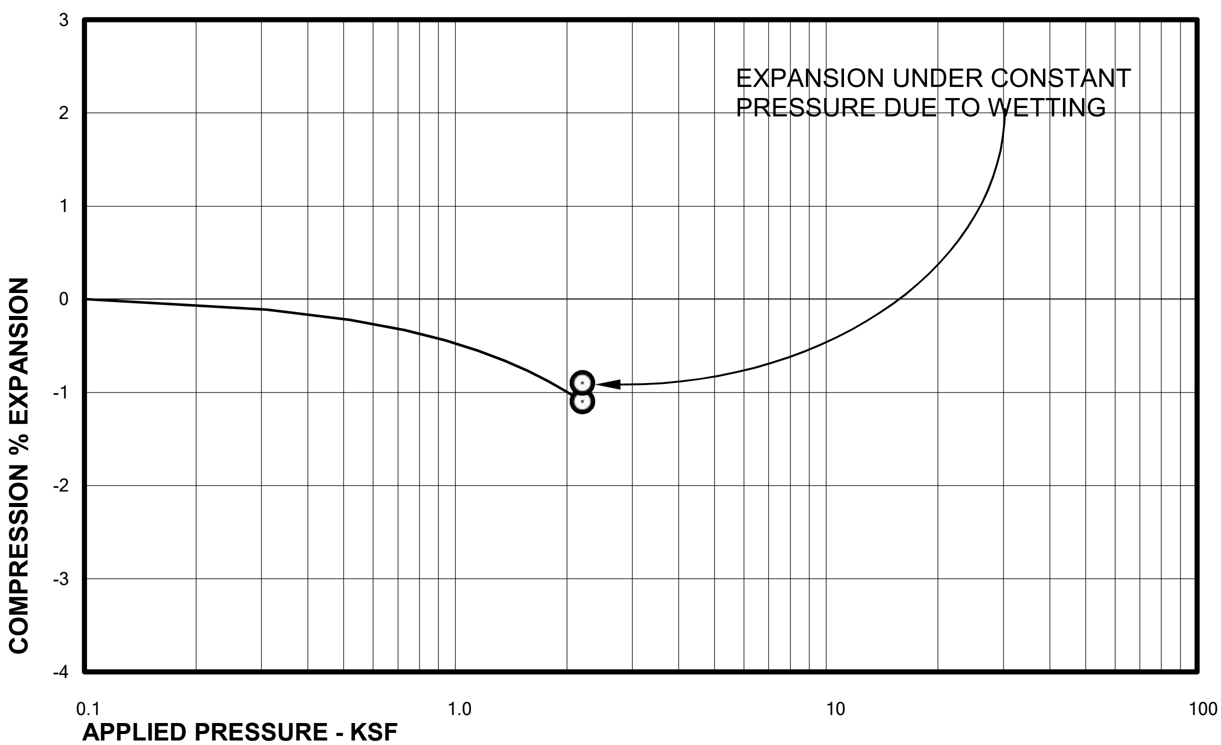
SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-7



Sample of CLAY, SANDY (CL) DRY UNIT WEIGHT= 96 PCF
From TH-5 AT 9 FEET MOISTURE CONTENT= 7.6 %

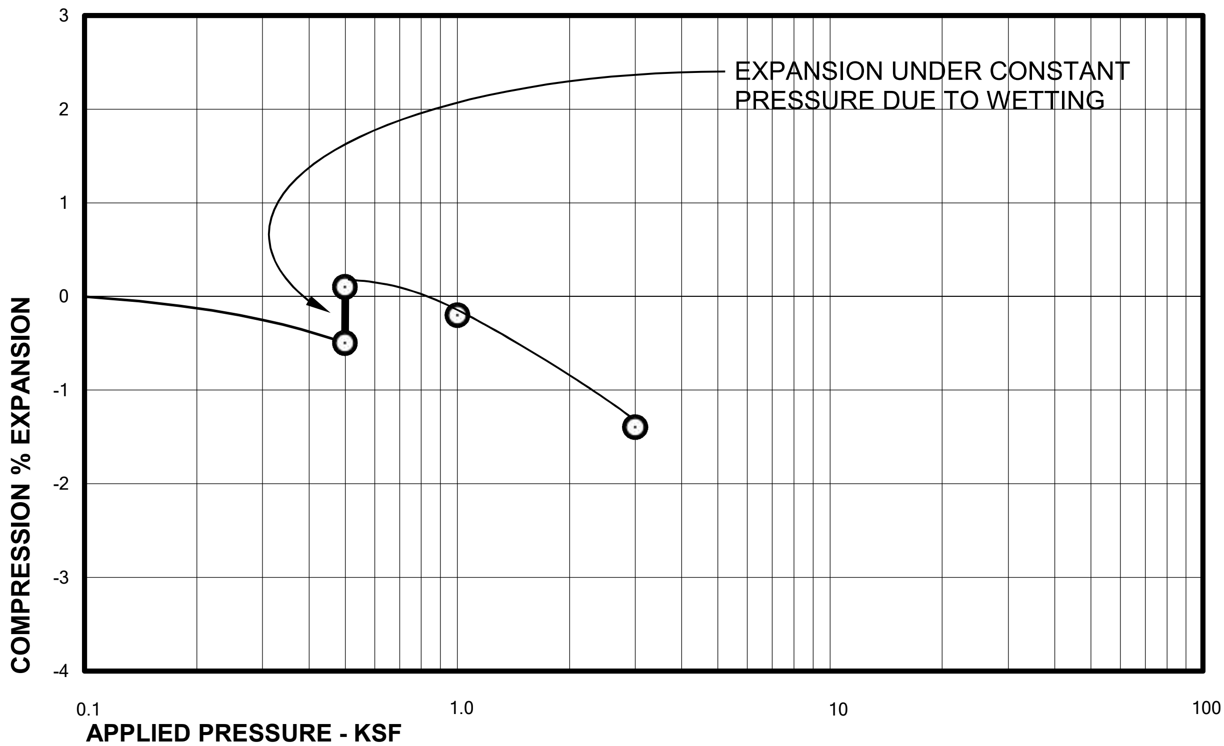


Sample of CLAYSTONE DRY UNIT WEIGHT= 85 PCF
From TH-6 AT 14 FEET MOISTURE CONTENT= 34.3 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

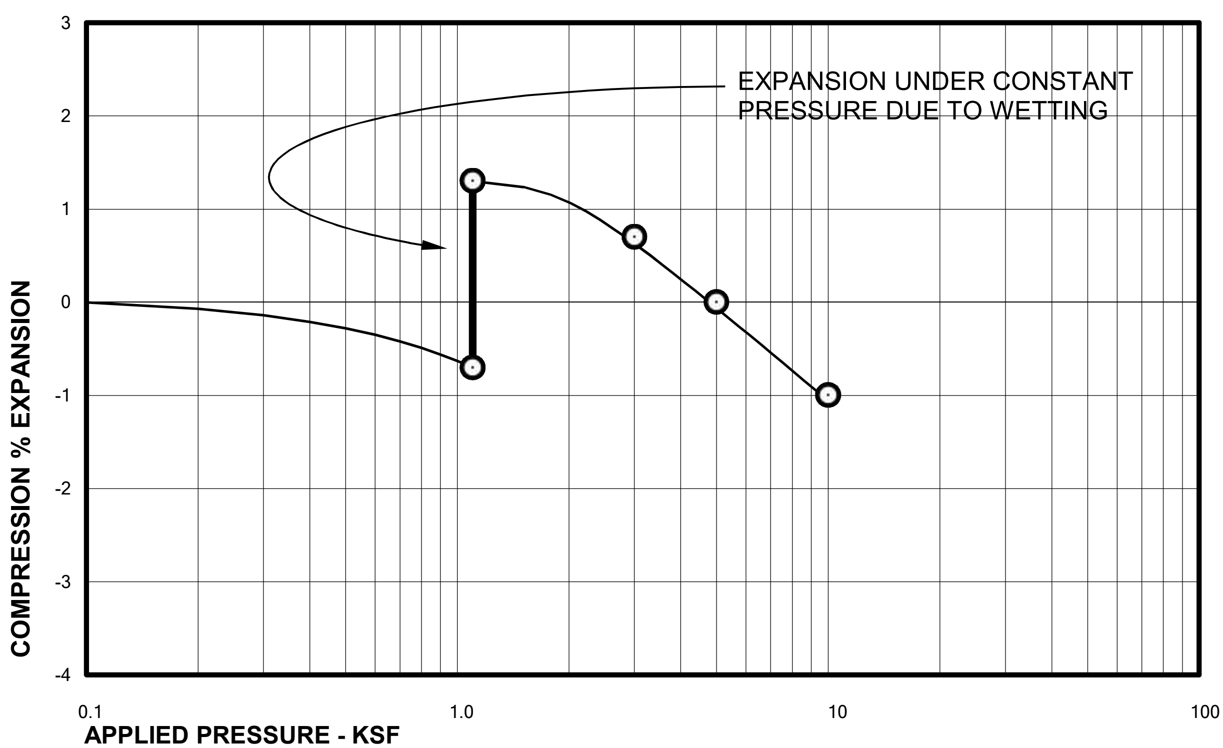
Swell Consolidation Test Results

FIG. B-8



Sample of CLAYSTONE
From TH-7 AT 9 FEET

DRY UNIT WEIGHT= 101 PCF
MOISTURE CONTENT= 17.2 %



Sample of CLAYSTONE
From TH-7 AT 14 FEET

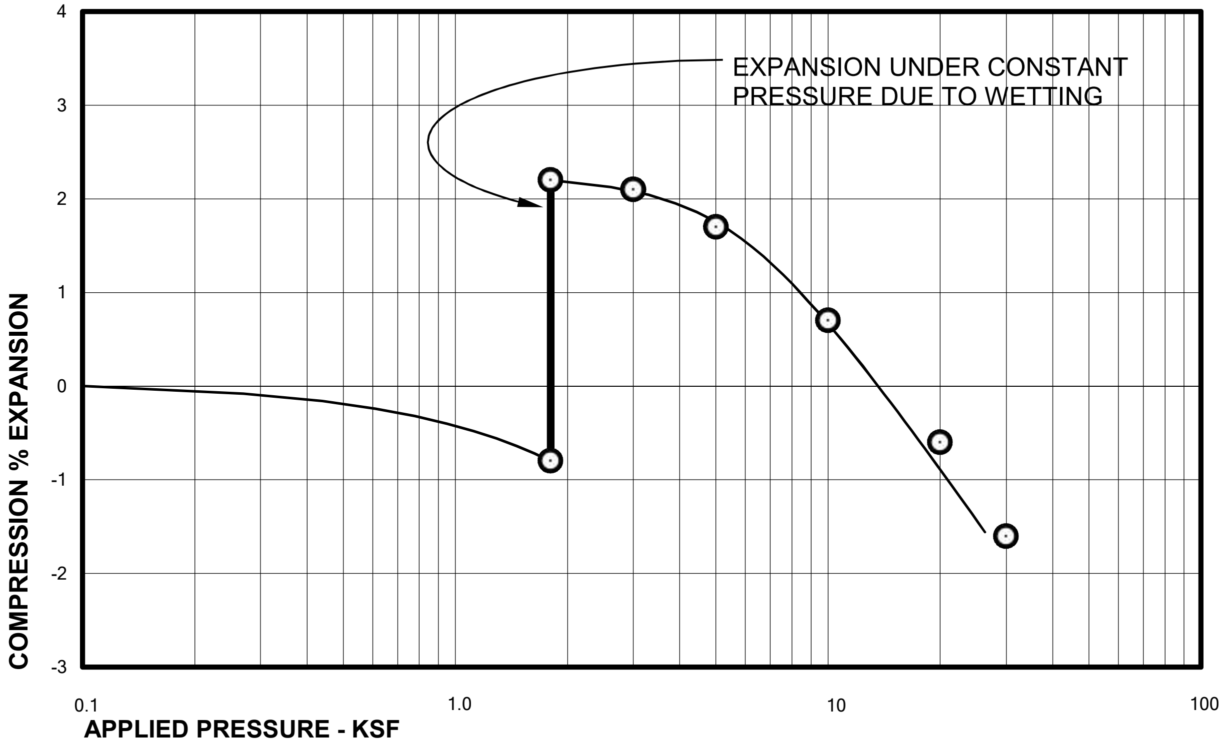
DRY UNIT WEIGHT= 111 PCF
MOISTURE CONTENT= 17.5 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

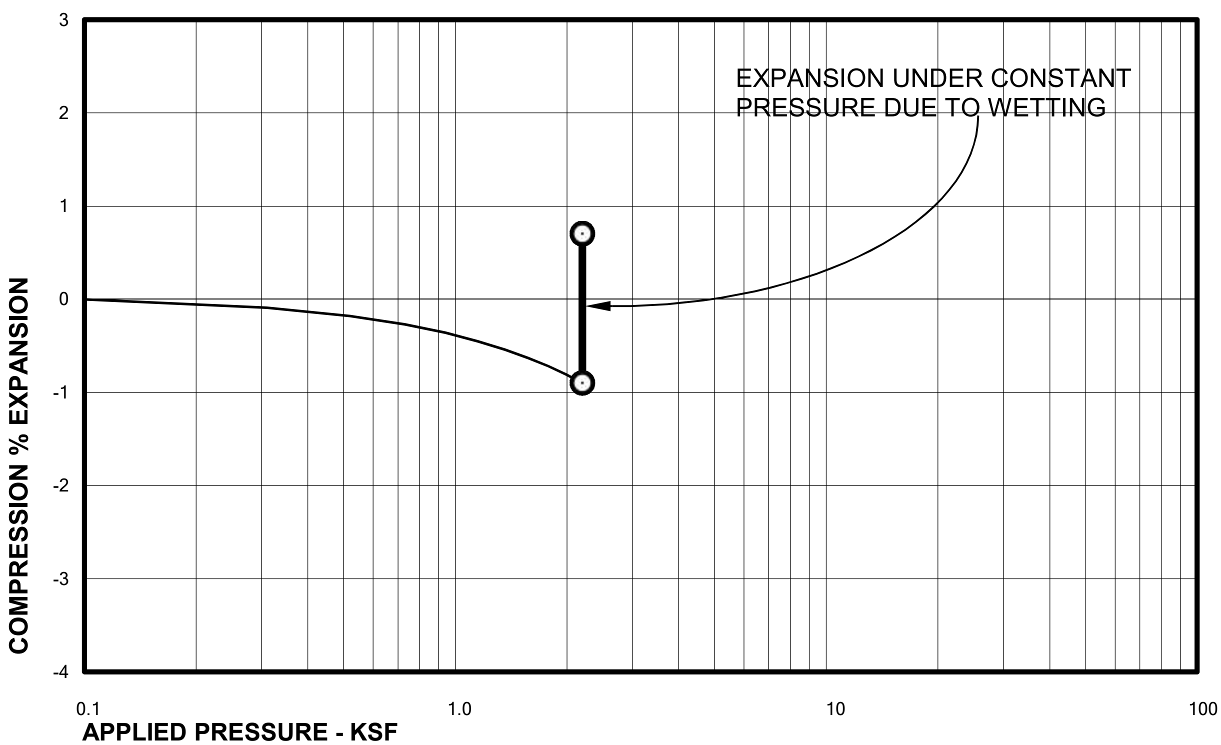
FIG. B-9

DRAFT



Sample of CLAYSTONE
From TH-7 AT 19 FEET

DRY UNIT WEIGHT= 114 PCF
MOISTURE CONTENT= 17.6 %



Sample of CLAYSTONE
From TH-7 AT 24 FEET

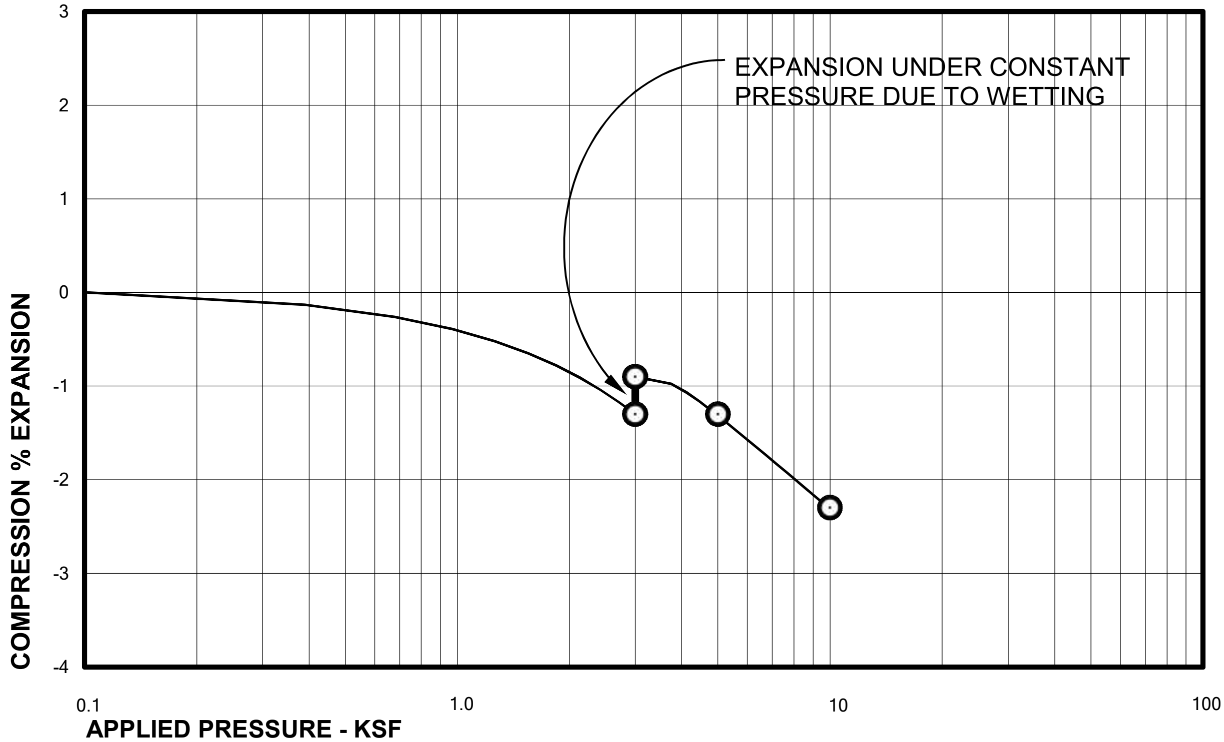
DRY UNIT WEIGHT= 121 PCF
MOISTURE CONTENT= 15.2 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

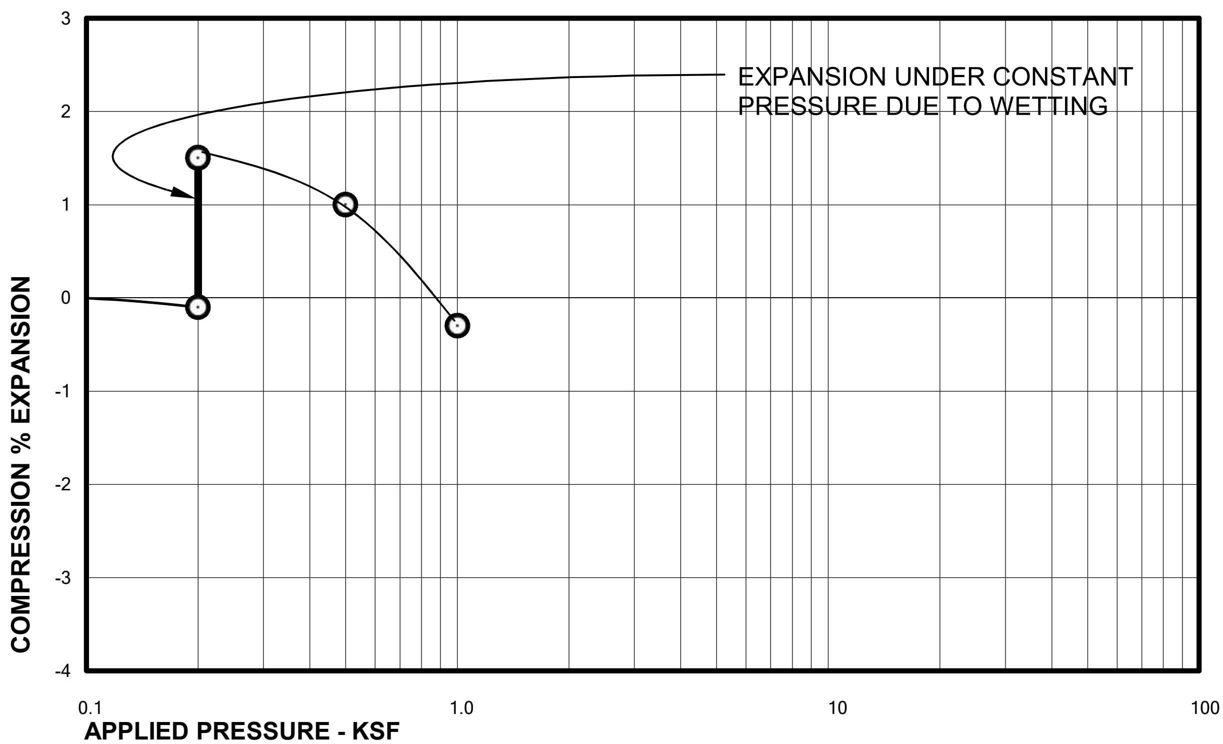
Swell Consolidation Test Results

FIG. B-10

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	107	PCF
From	TH-7 AT 29 FEET	MOISTURE CONTENT=	20.6	%



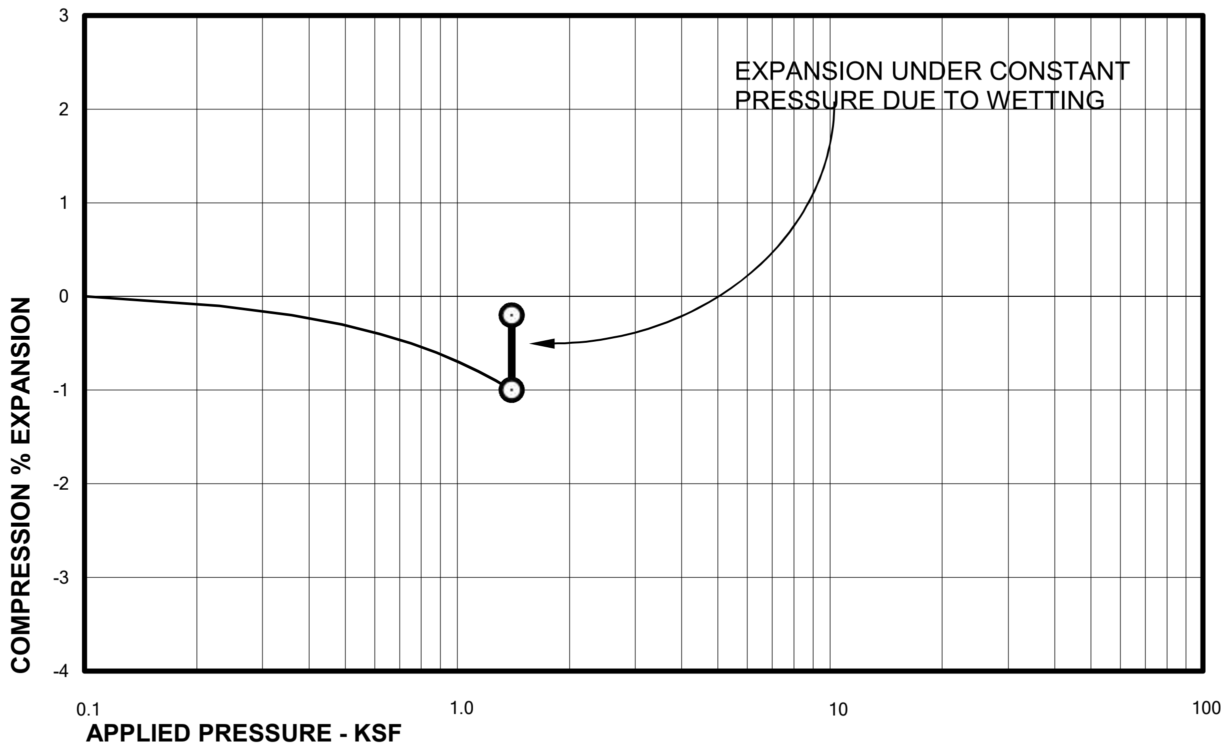
Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	114	PCF
From	TH-8 AT 4 FEET	MOISTURE CONTENT=	3.7	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

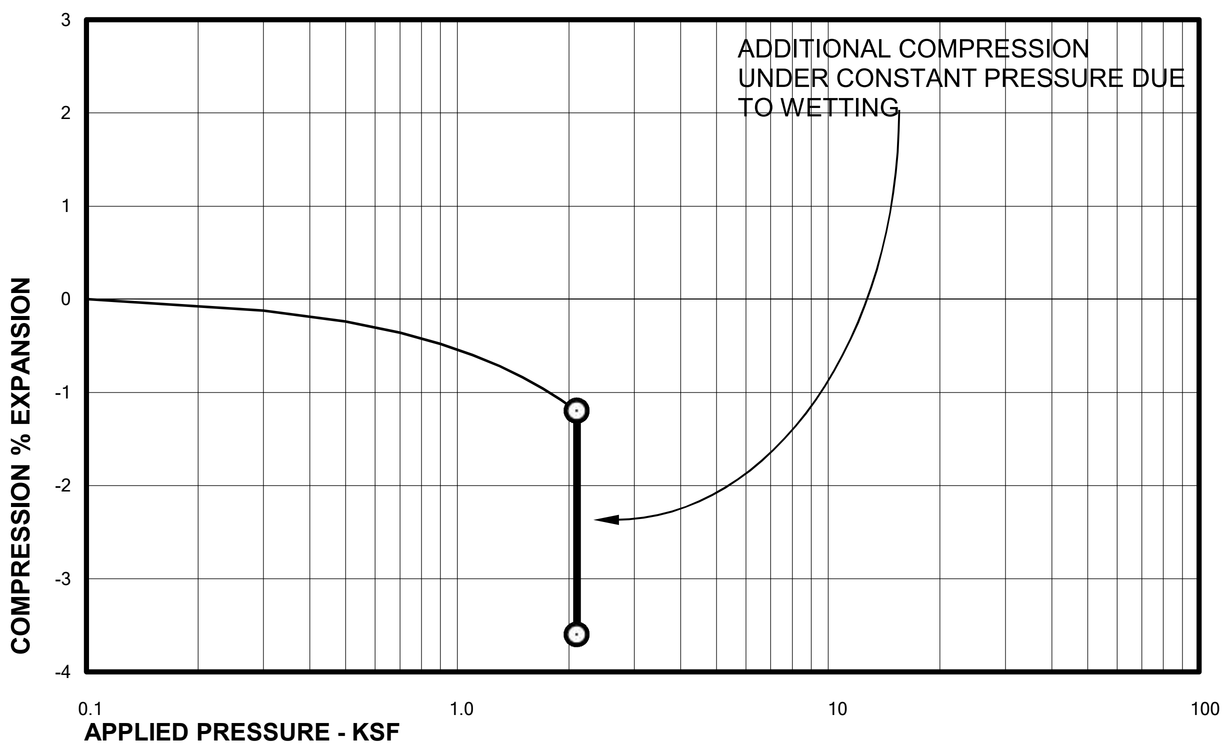
Swell Consolidation Test Results

FIG. B-11

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	95	PCF
From	TH-8 AT 14 FEET	MOISTURE CONTENT=	26.8	%



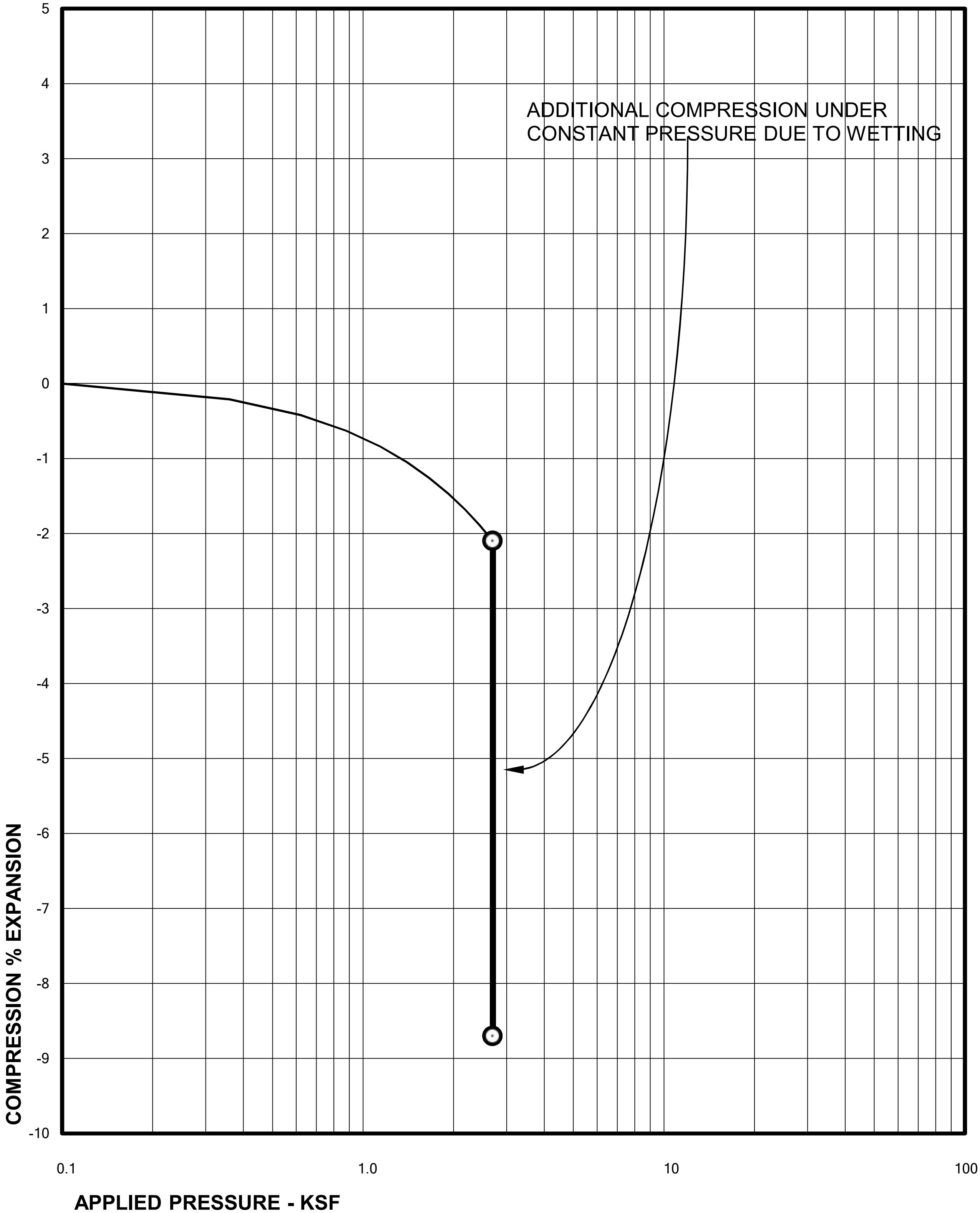
Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	105	PCF
From	TH-9 AT 4 FEET	MOISTURE CONTENT=	9.1	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-12

DRAFT

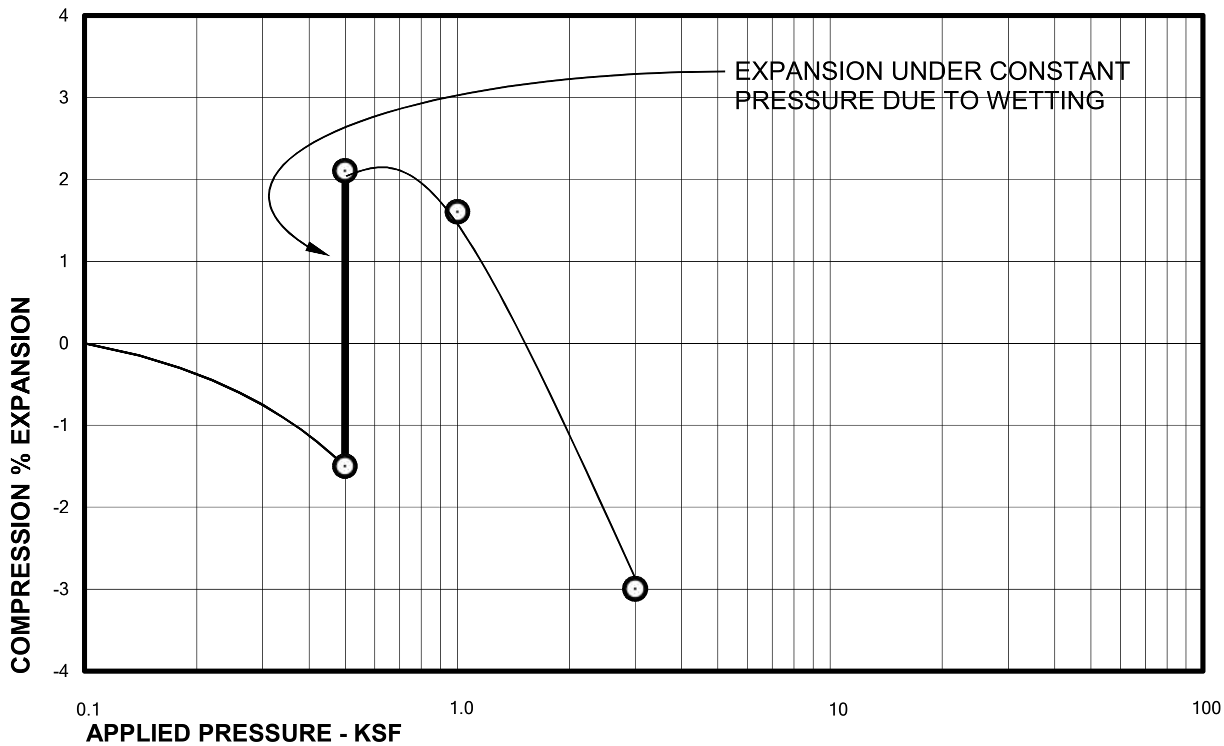


Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	97	PCF
From	TH-9 AT 9 FEET	MOISTURE CONTENT=	10.6	%

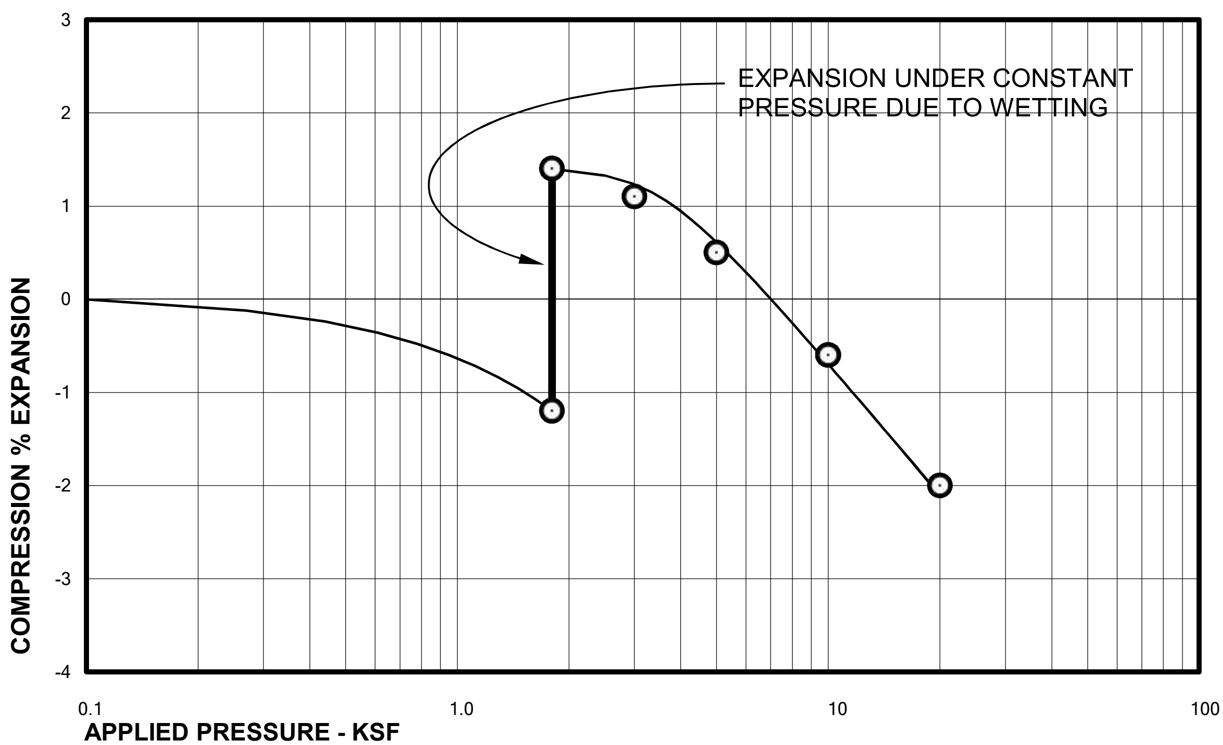
SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-13



Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	98	PCF
From	TH-10 AT 4 FEET	MOISTURE CONTENT=	10.8	%



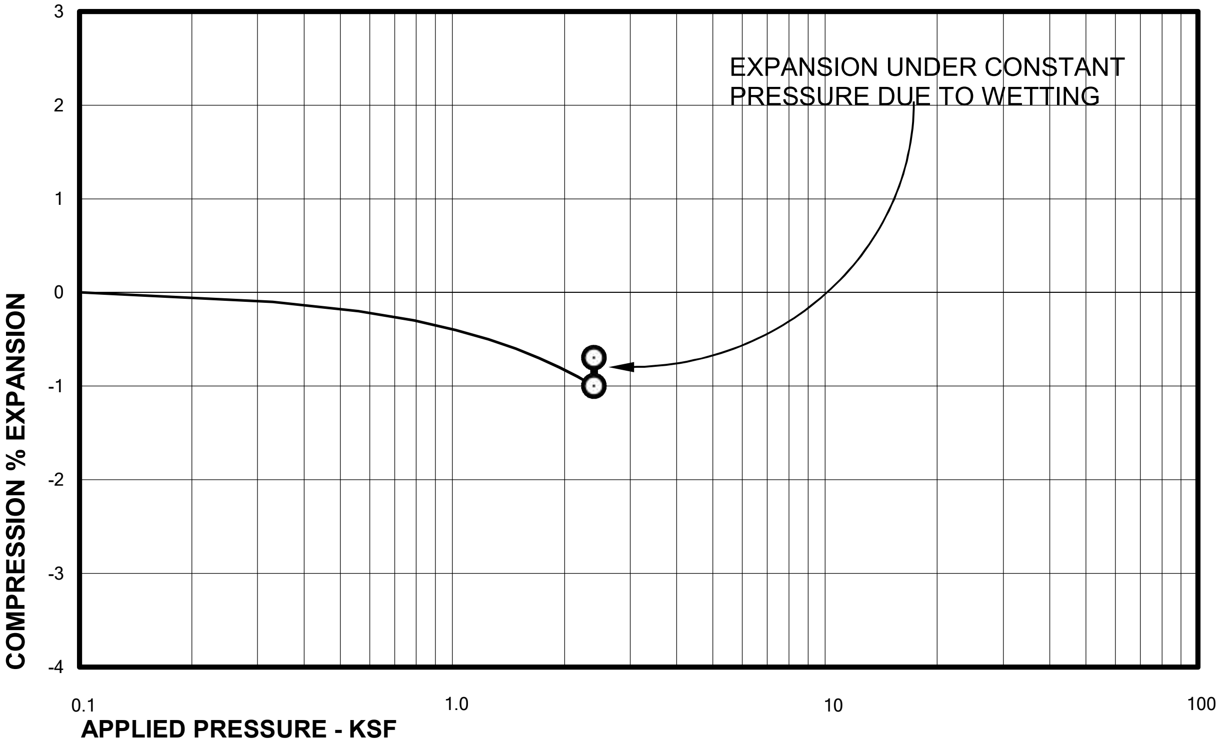
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	91	PCF
From	TH-10 AT 14 FEET	MOISTURE CONTENT=	28.3	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-14

DRAFT

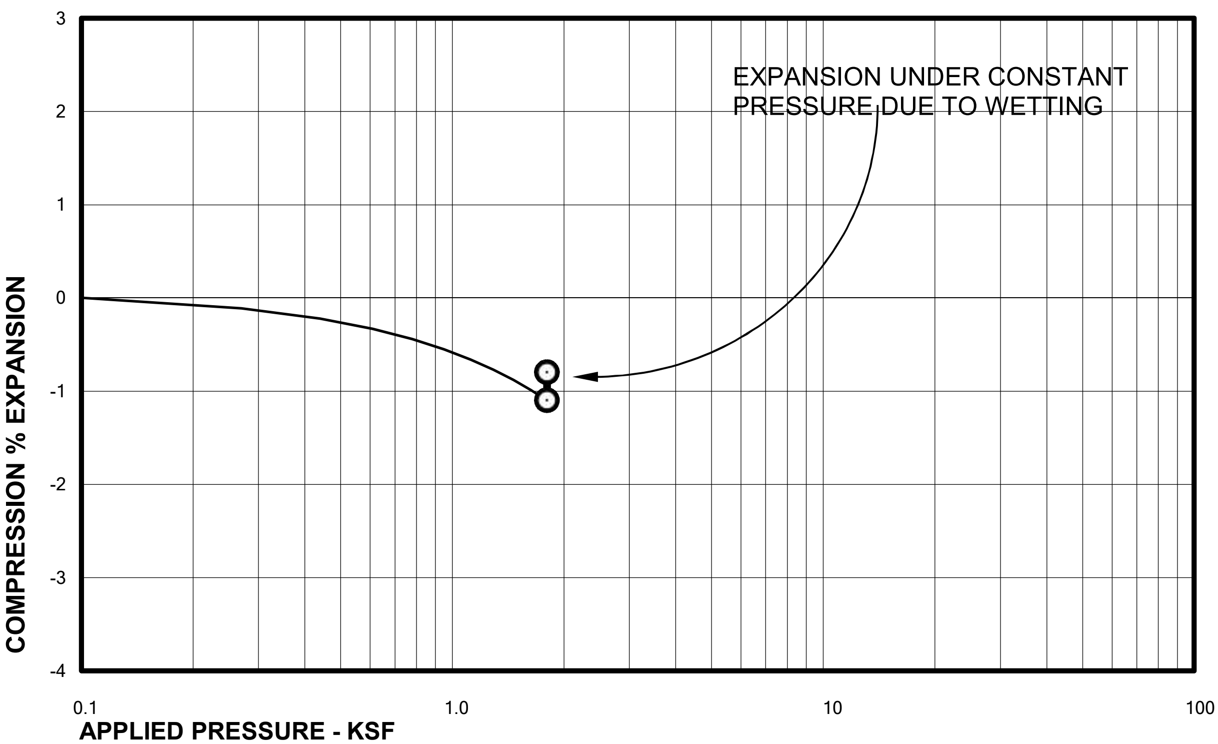


Sample of CLAYSTONE

From TH-10 AT 19 FEET

DRY UNIT WEIGHT= 87 PCF

MOISTURE CONTENT= 30.2 %



Sample of CLAY, SANDY (CL)

From TH-11 AT 4 FEET

DRY UNIT WEIGHT= PCF

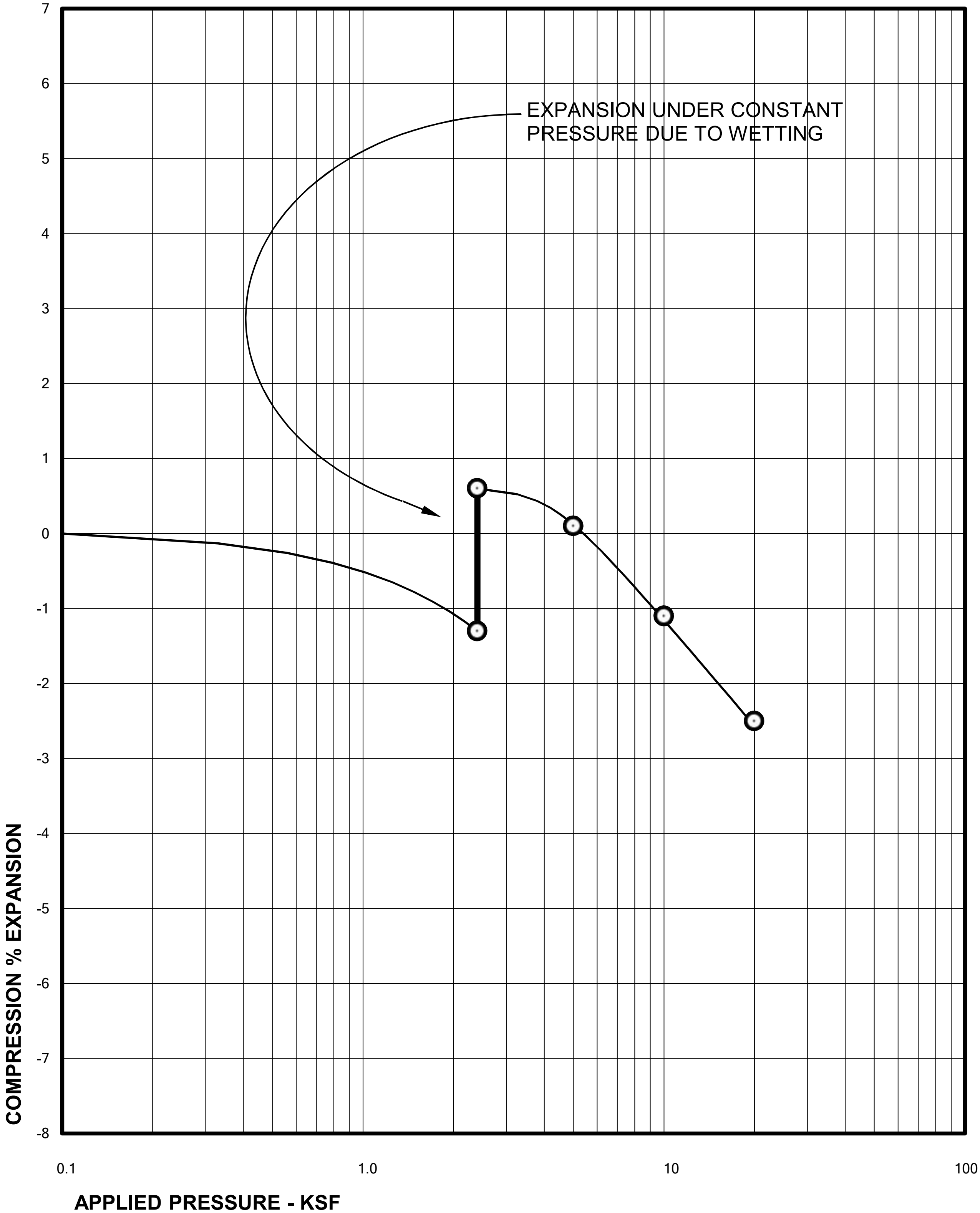
MOISTURE CONTENT= 9.2 %

Swell Consolidation Test Results

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

FIG. B-15

DRAFT



Sample of CLAYSTONE

From TH-11 AT 9 FEET

DRY UNIT WEIGHT= 99 PCF

MOISTURE CONTENT= 23.5 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
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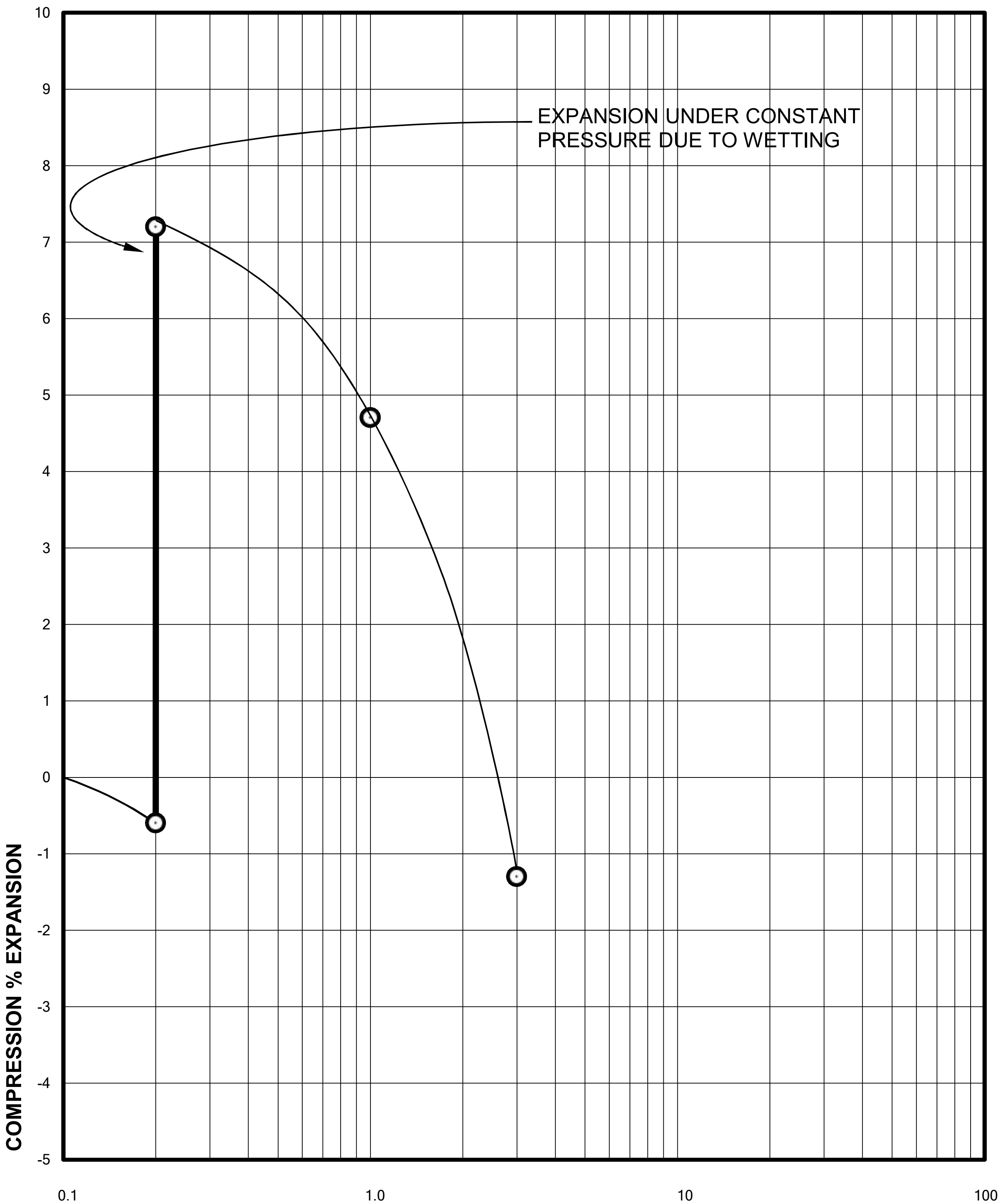
Swell Consolidation Test Results

FIG. B-16

DRAFT



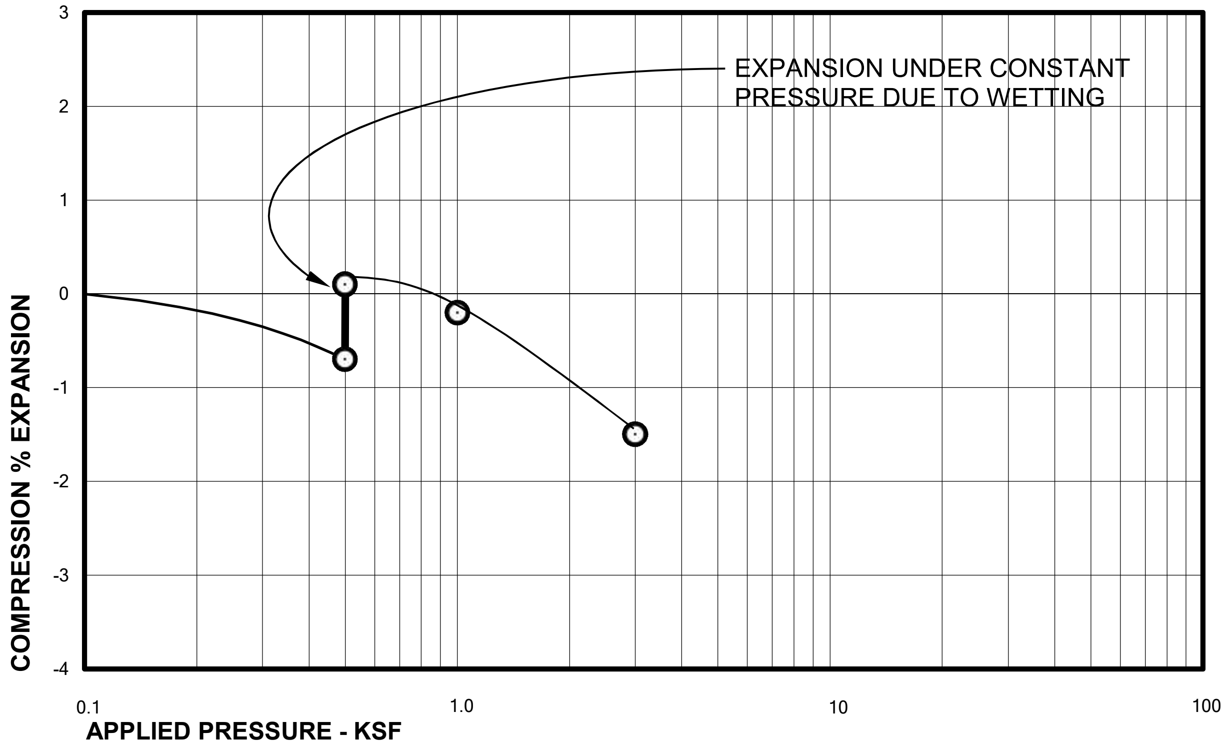
Sample of CLAY, SANDY (CL)
From TH-12 AT 4 FEET

DRY UNIT WEIGHT= 102 PCF
MOISTURE CONTENT= 10.1 %

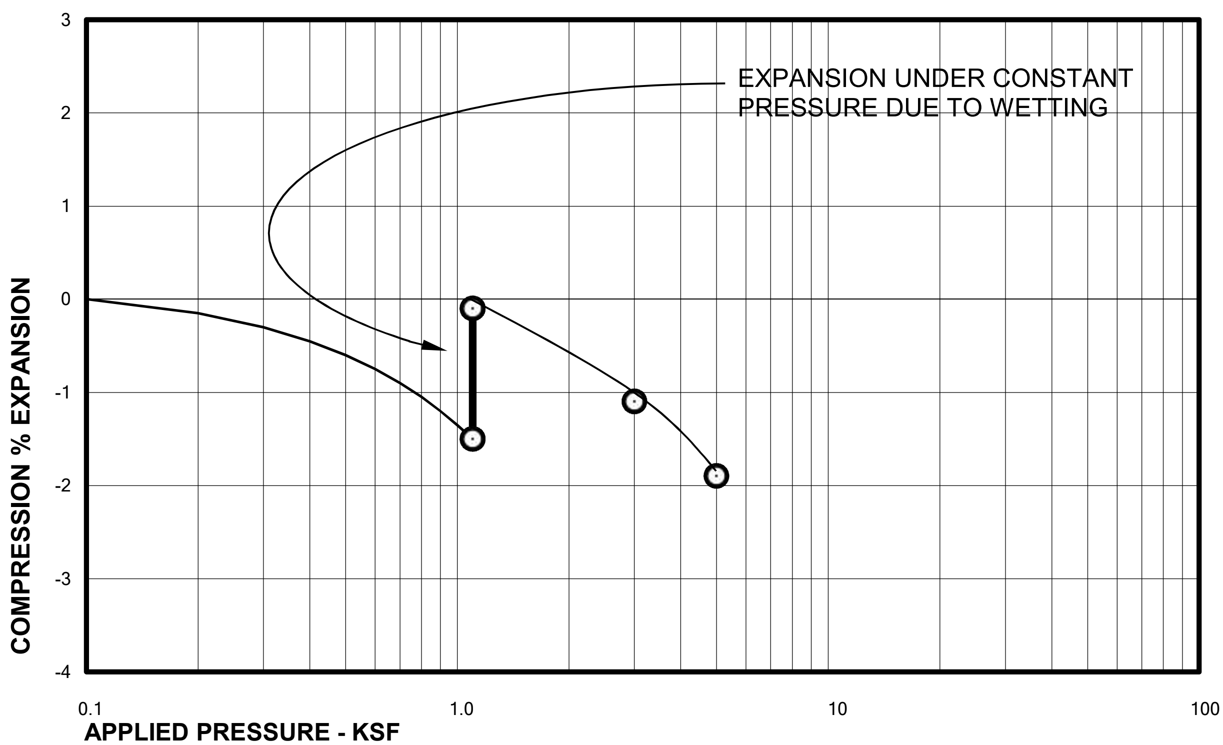
SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-17



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	98	PCF
From	TH-13 AT 24 FEET	MOISTURE CONTENT=	22.8	%



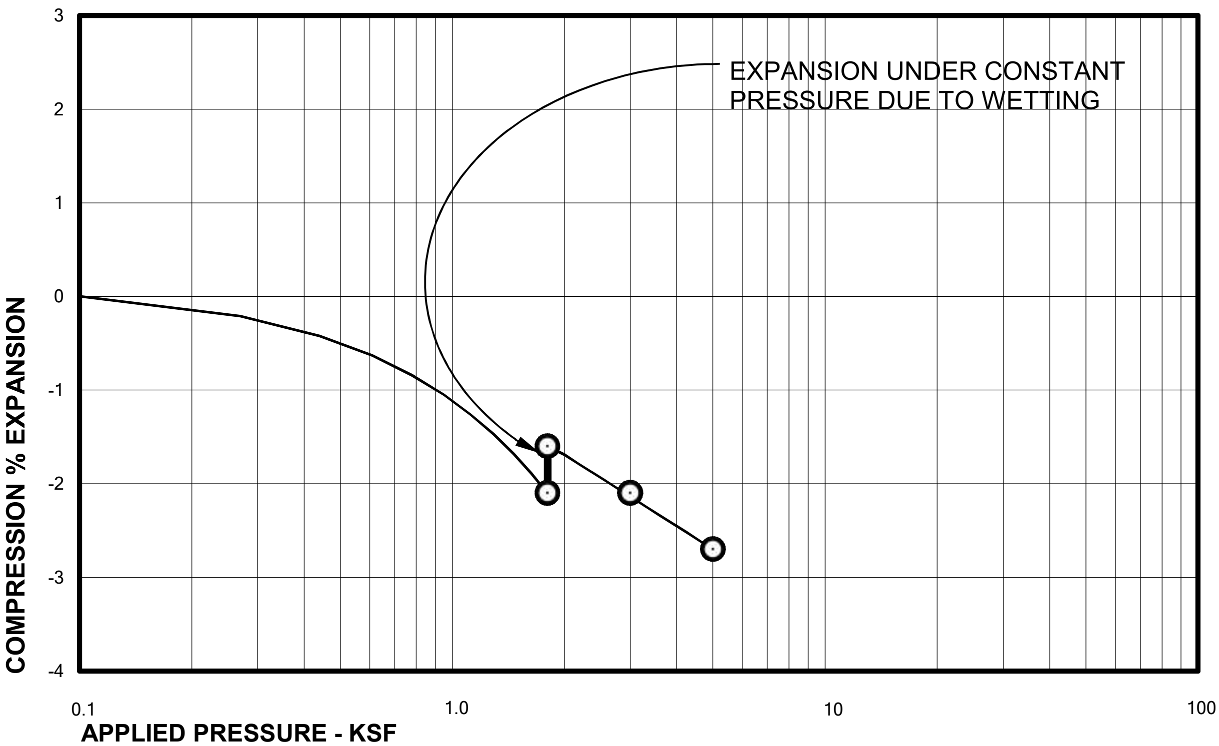
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	96	PCF
From	TH-13 AT 29 FEET	MOISTURE CONTENT=	26.0	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

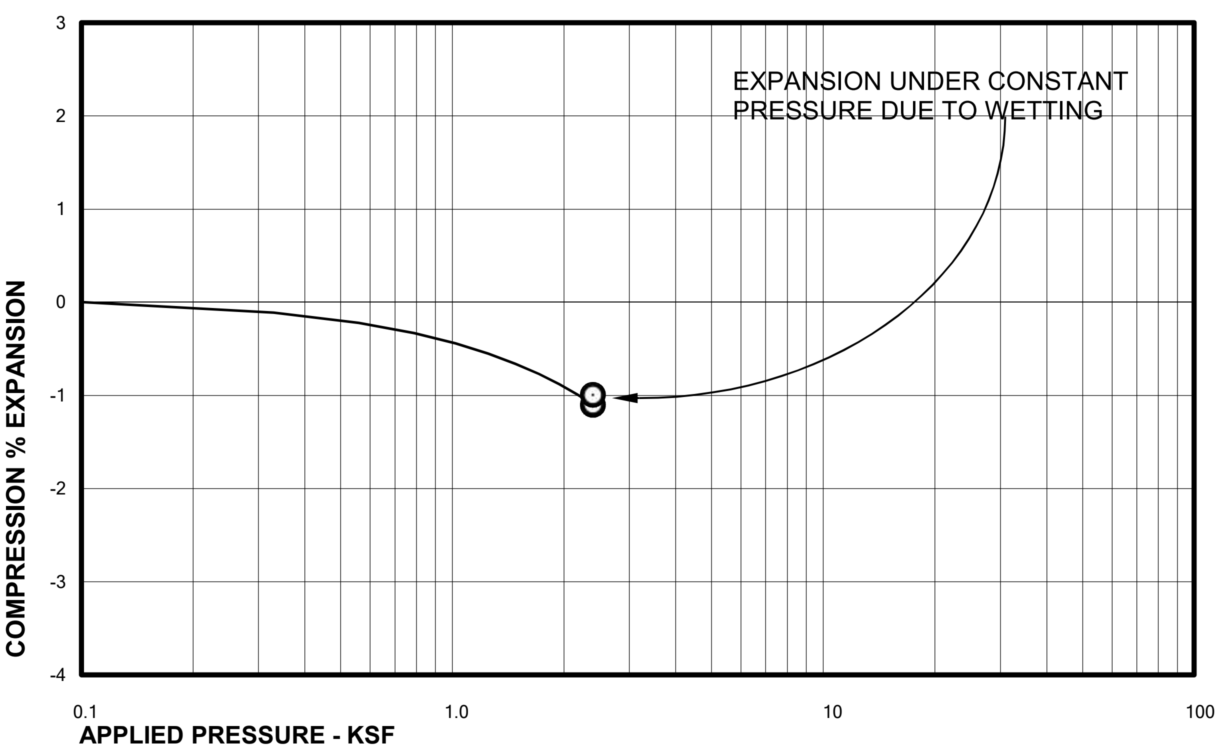
Swell Consolidation Test Results

FIG. B-18

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	88	PCF
From	TH-13 AT 34 FEET	MOISTURE CONTENT=	30.6	%



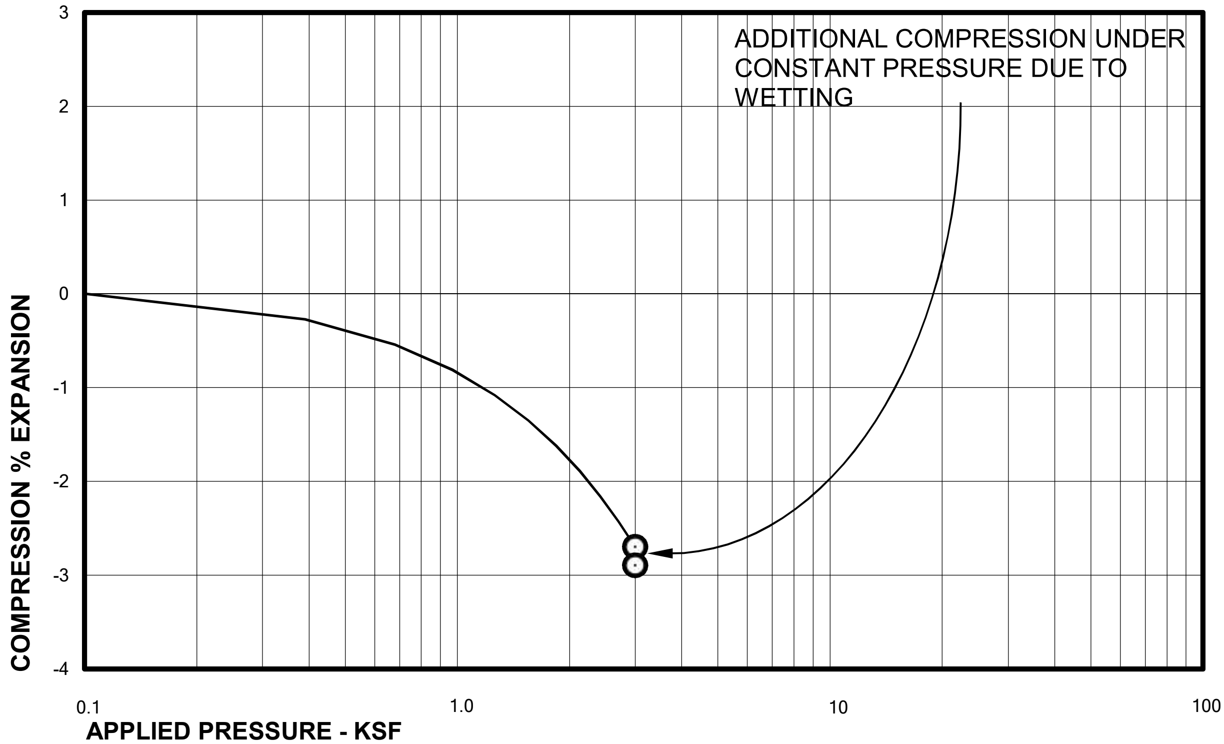
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	95	PCF
From	TH-13 AT 39 FEET	MOISTURE CONTENT=	27.5	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

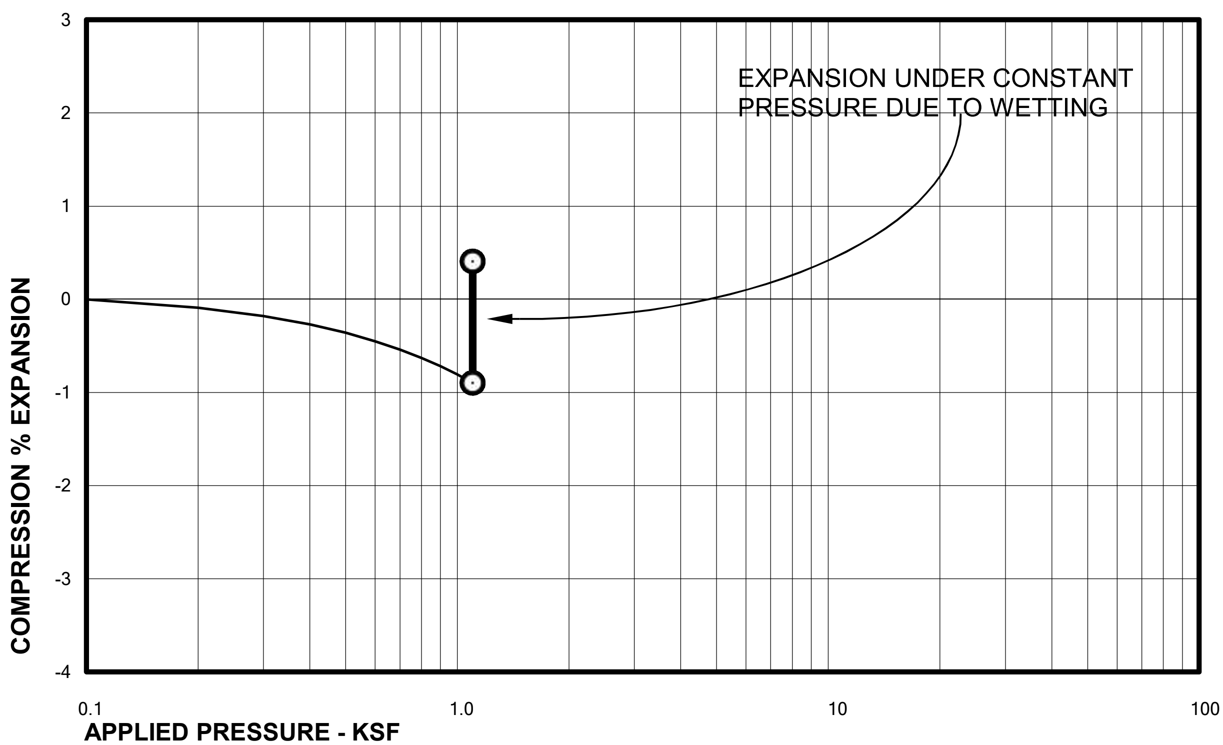
FIG. B-19

DRAFT



Sample of CLAYSTONE
From TH-13 AT 44 FEET

DRY UNIT WEIGHT= 190 PCF
MOISTURE CONTENT= 29.8 %



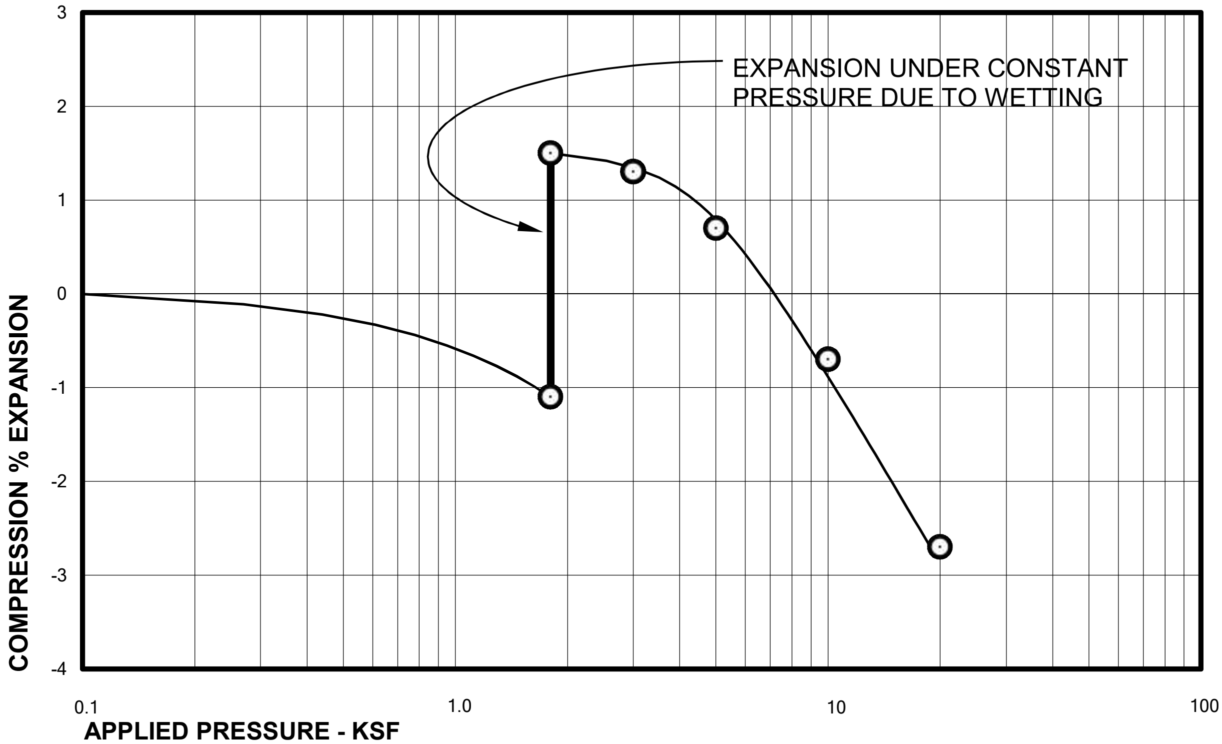
Sample of INTERLAYERED CLAY/SAND
From TH-14 AT 9 FEET

DRY UNIT WEIGHT= 111 PCF
MOISTURE CONTENT= 10.8 %

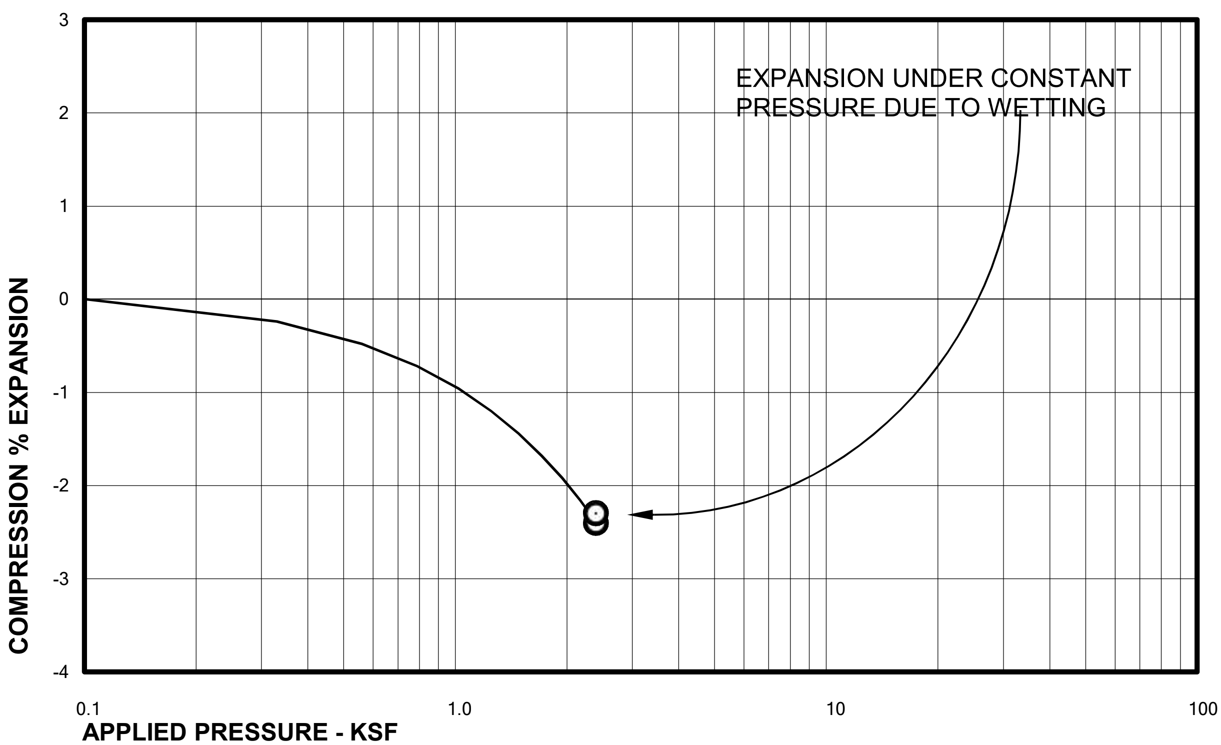
SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-20



Sample of	INTERLAYERED CLAY/SAND	DRY UNIT WEIGHT=	114	PCF
From	TH-14 AT 14 FEET	MOISTURE CONTENT=	16.1	%



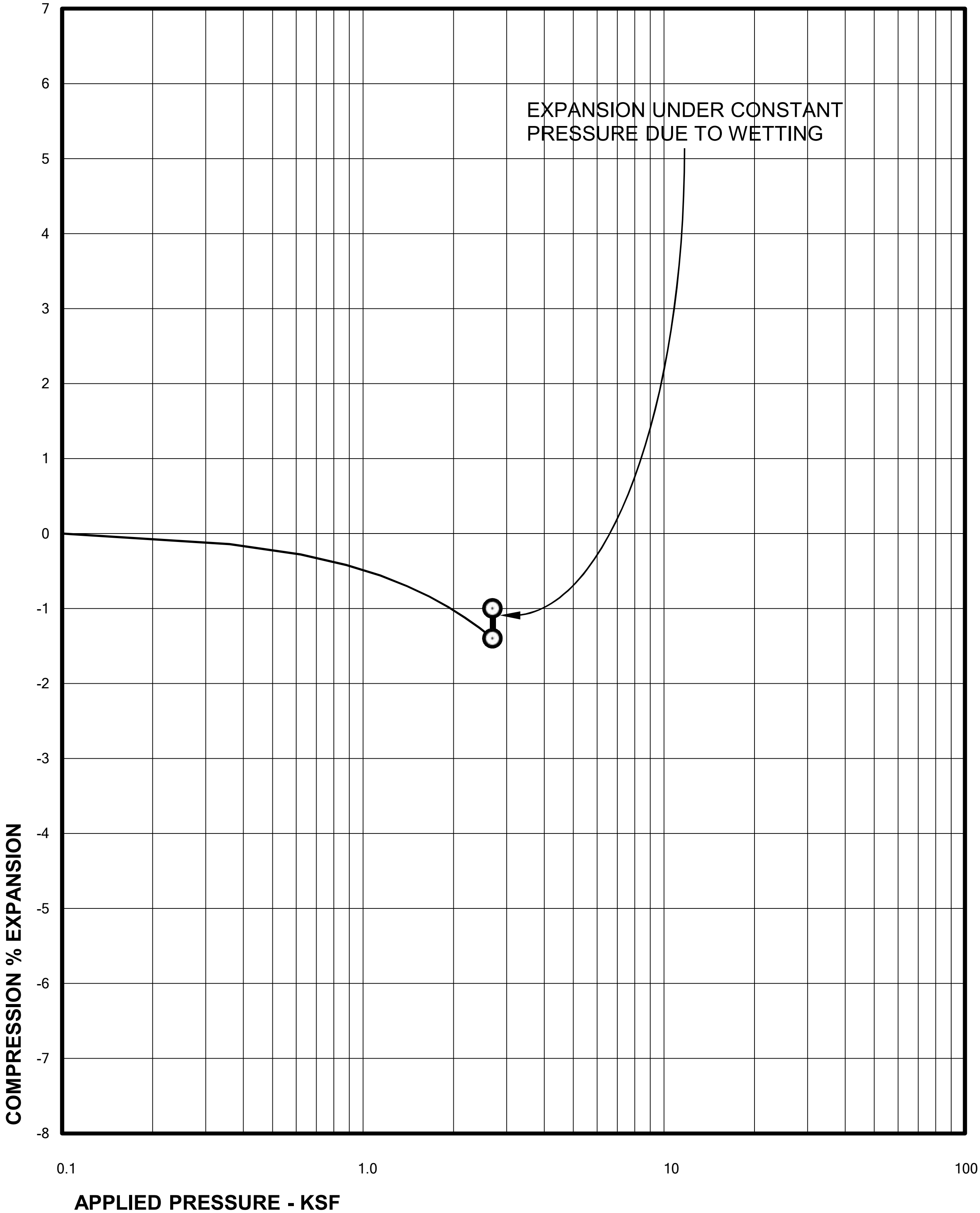
Sample of	SANDSTONE	DRY UNIT WEIGHT=	92	PCF
From	TH-14 AT 19 FEET	MOISTURE CONTENT=	25.6	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-21

DRAFT



Sample of CLAYSTONE

From TH-15 AT 14 FEET

DRY UNIT WEIGHT= 84 PCF

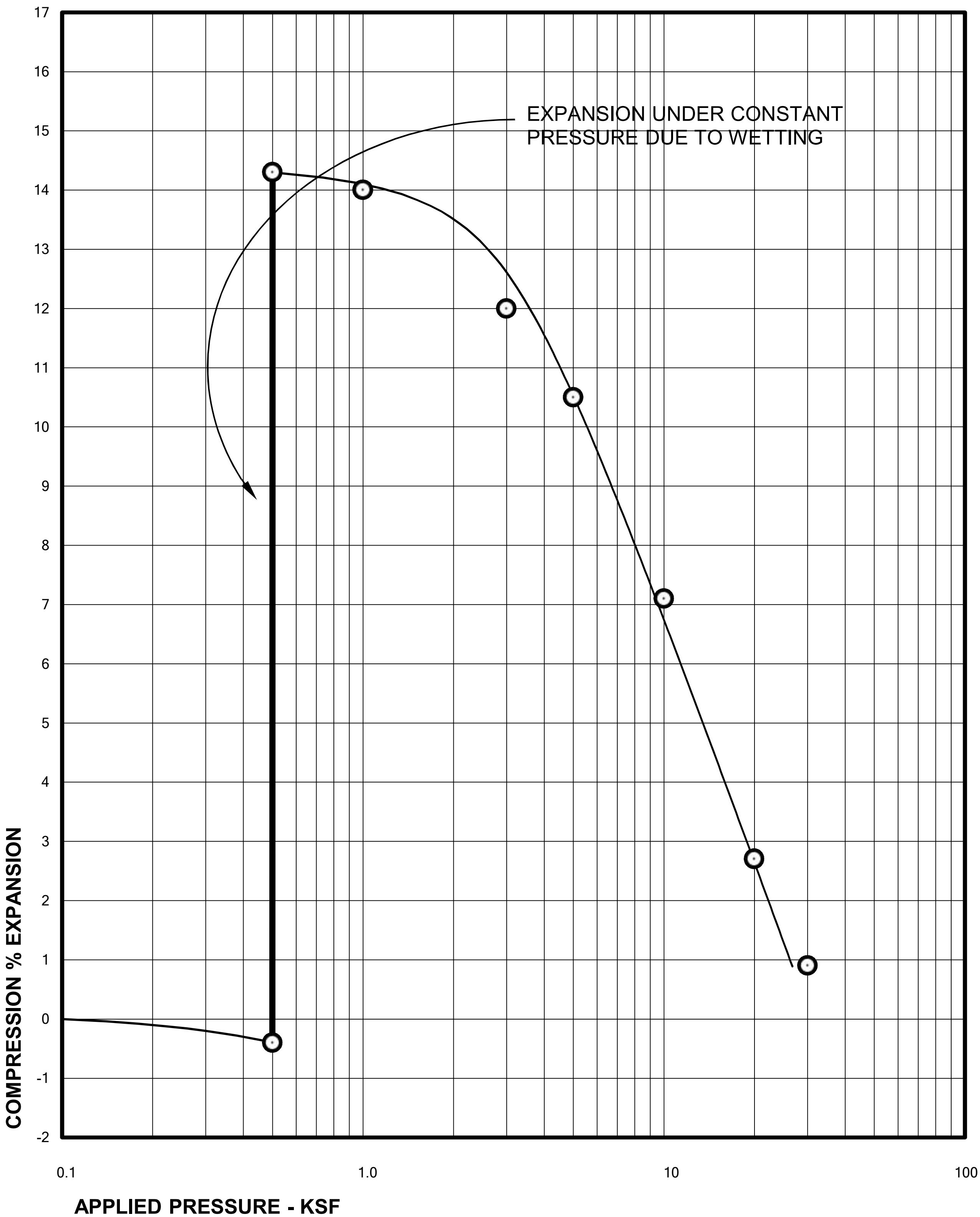
MOISTURE CONTENT= 36.9 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-22

DRAFT



Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	110	PCF
From	TH-16 AT 4 FEET	MOISTURE CONTENT=	16.9	%

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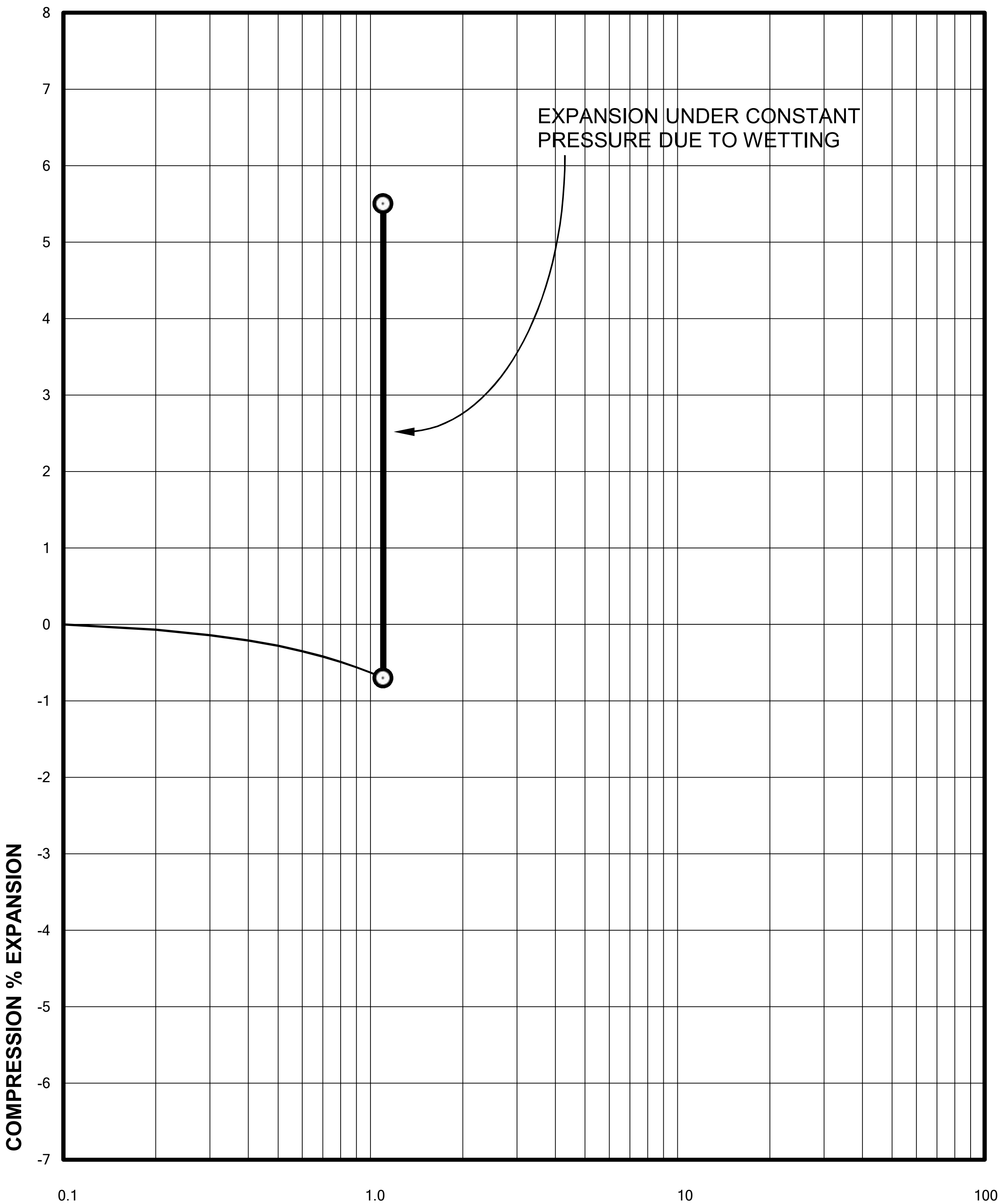
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-23

DRAFT

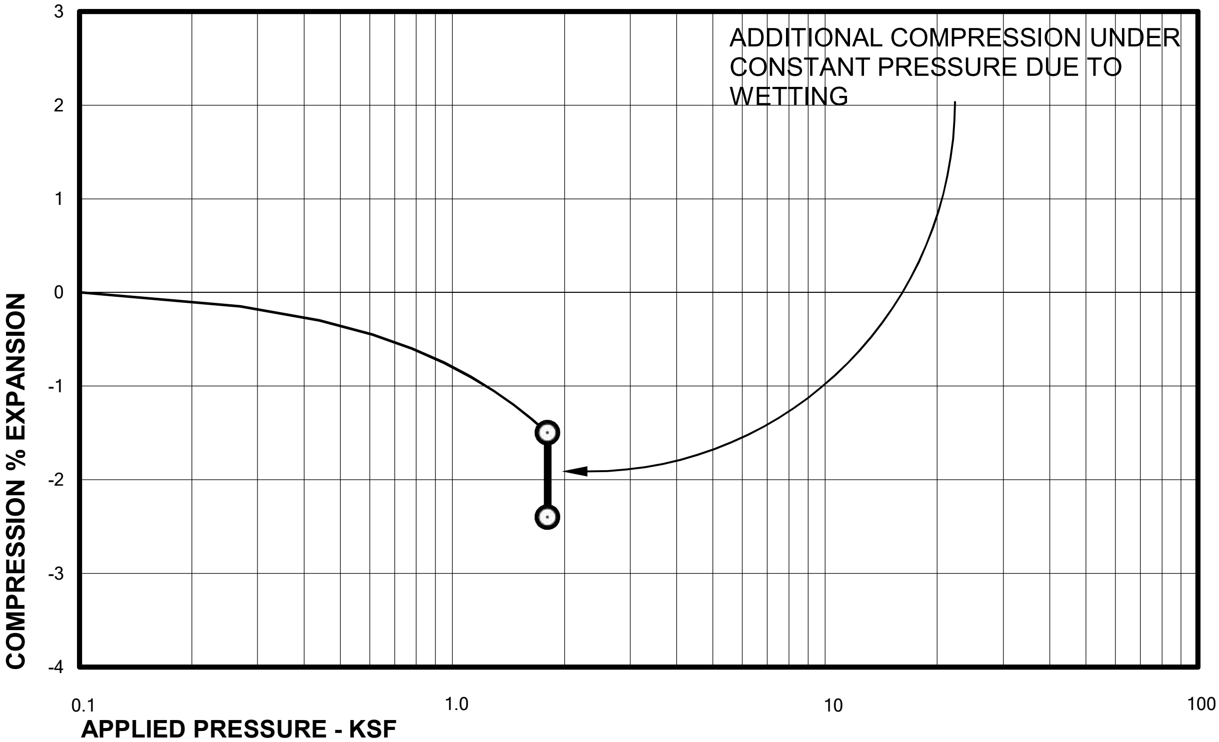


Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	111	PCF
From	TH-16 AT 9 FEET	MOISTURE CONTENT=	17.6	%

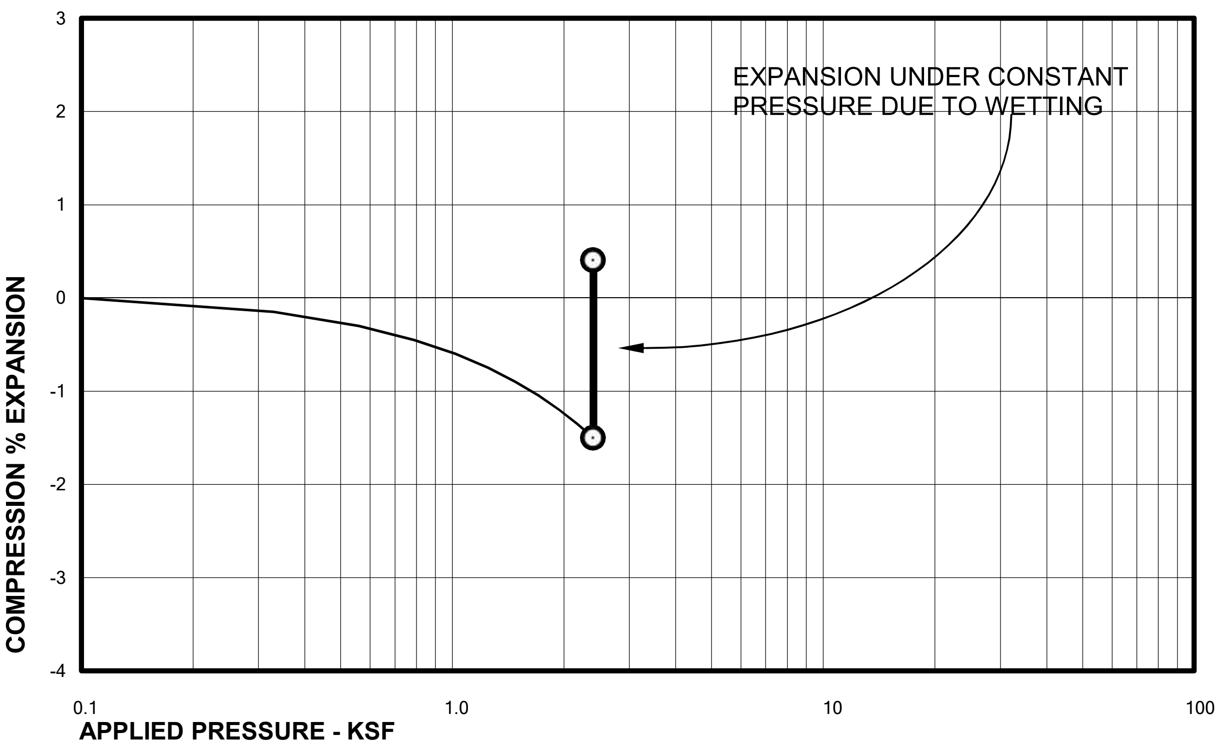
SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-24



Sample of	SAND, CLAYEY (SC)	DRY UNIT WEIGHT=	99	PCF
From	TH-16 AT 14 FEET	MOISTURE CONTENT=	20.1	%



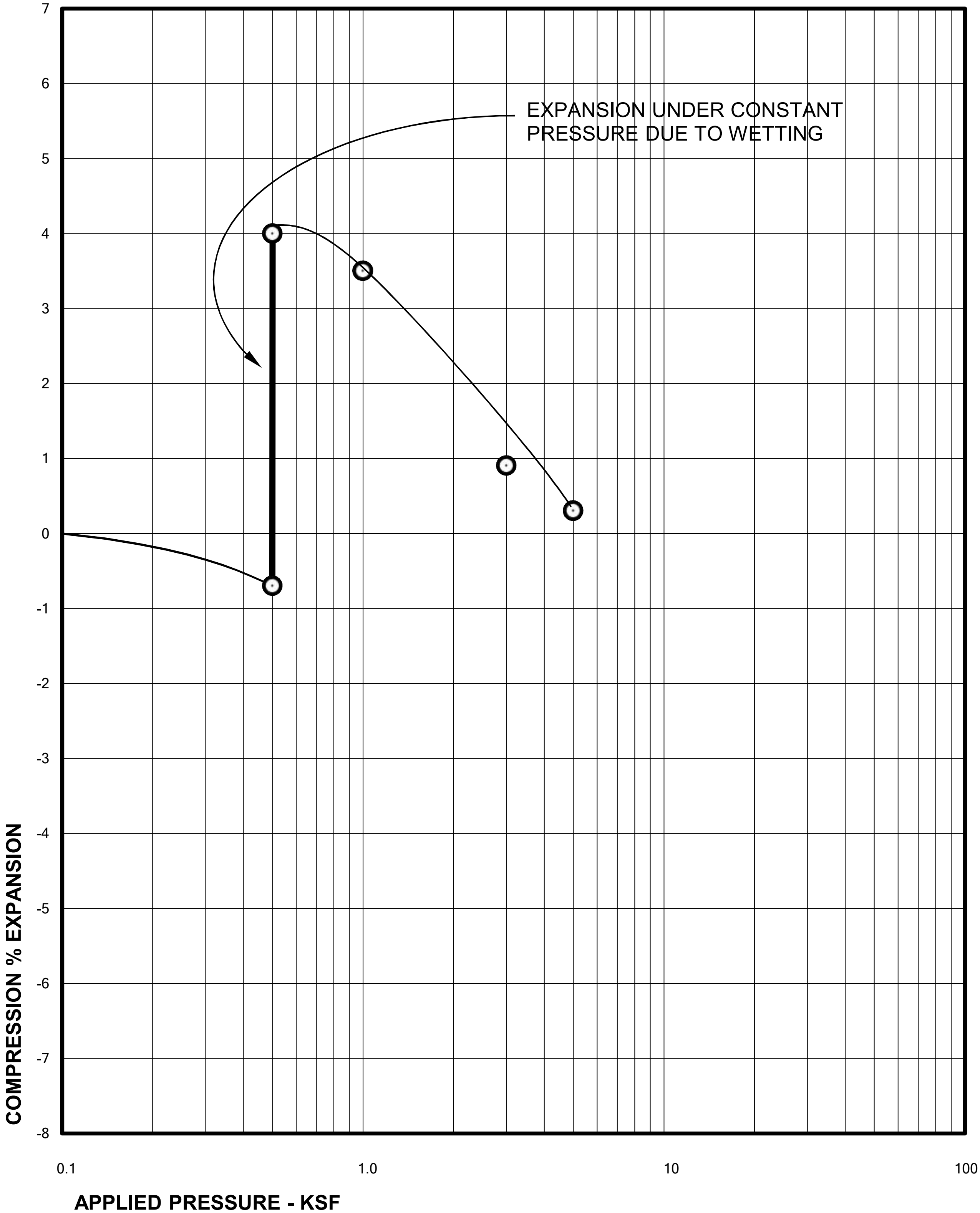
Sample of	WEATHERED CLAYSTONE	DRY UNIT WEIGHT=	96	PCF
From	TH-16 AT 19 FEET	MOISTURE CONTENT=	26.8	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-25

DRAFT



Sample of CLAY, SANDY (CL)

From TH-17 AT 4 FEET

DRY UNIT WEIGHT= 98 PCF

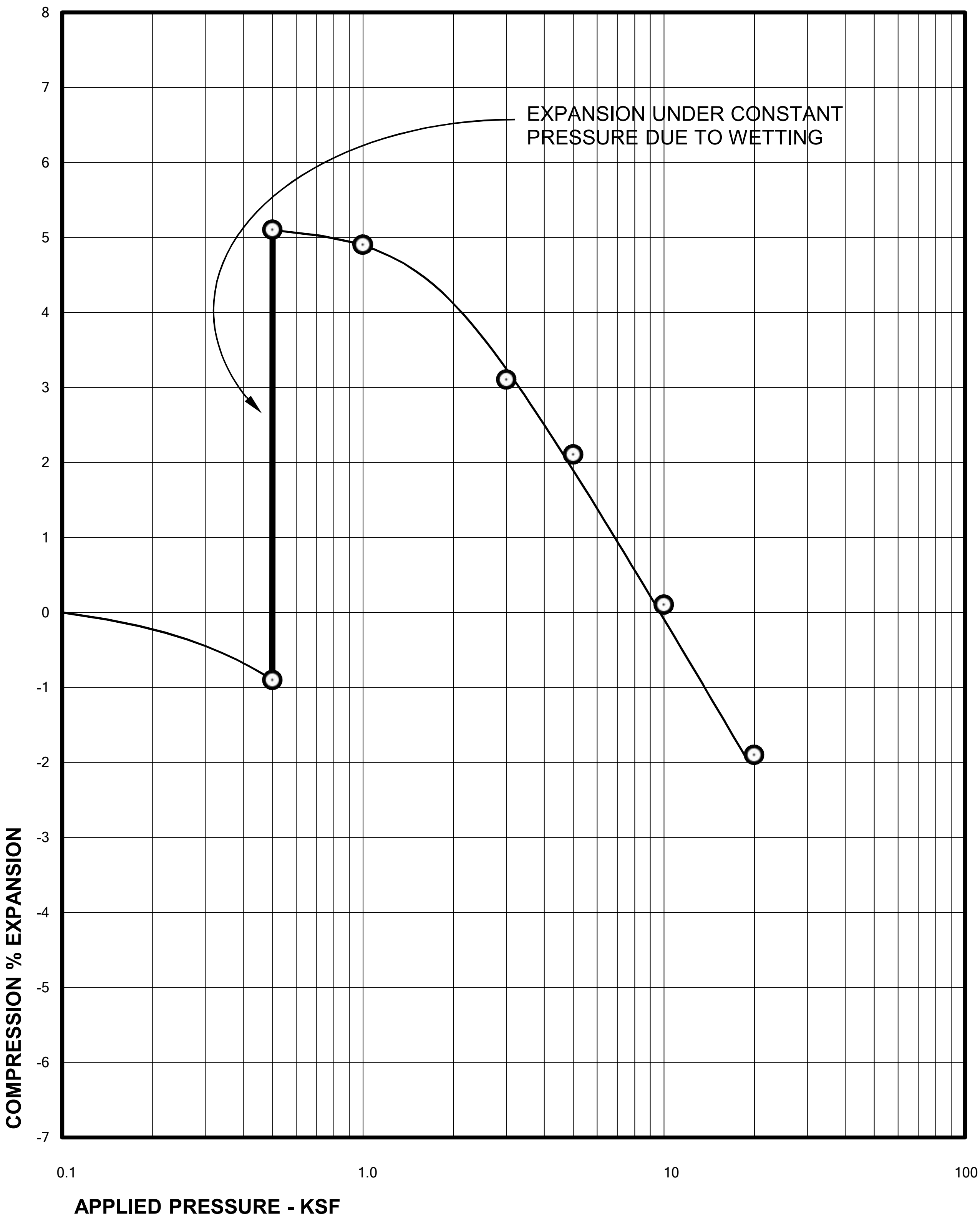
MOISTURE CONTENT= 15.0 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-26

DRAFT



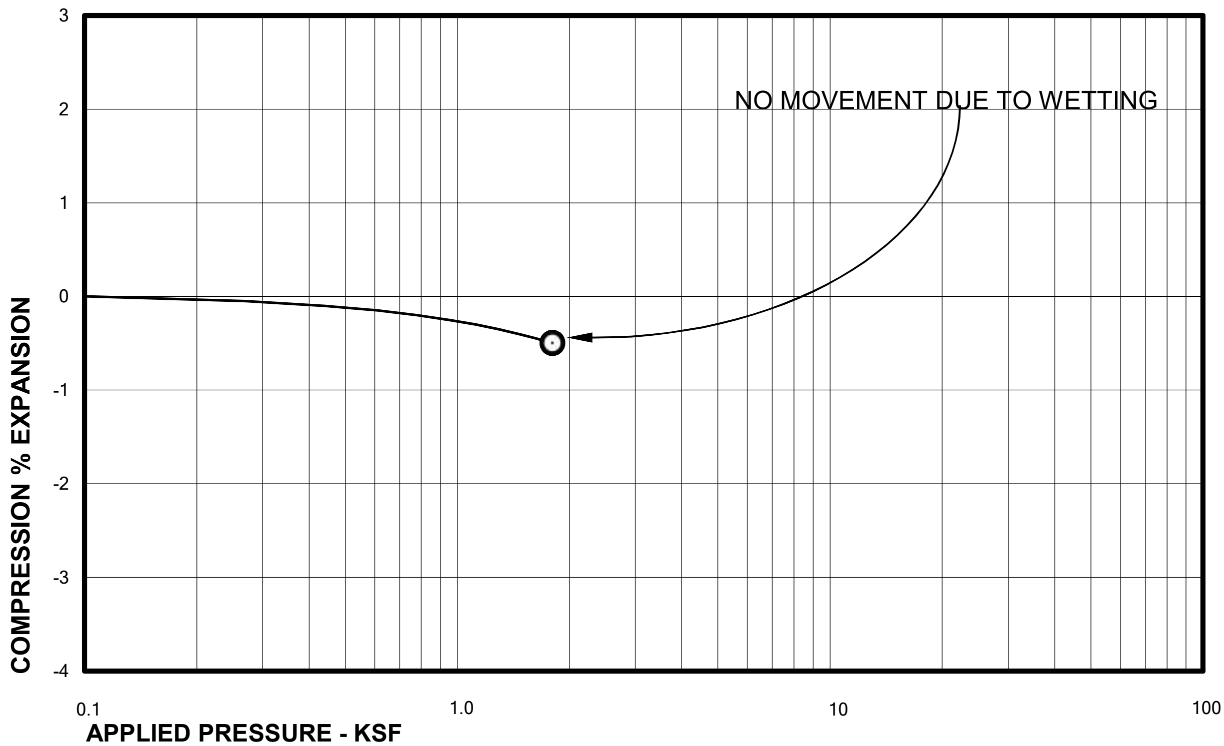
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	95	PCF
From	TH-17 AT 9 FEET	MOISTURE CONTENT=	24.4	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

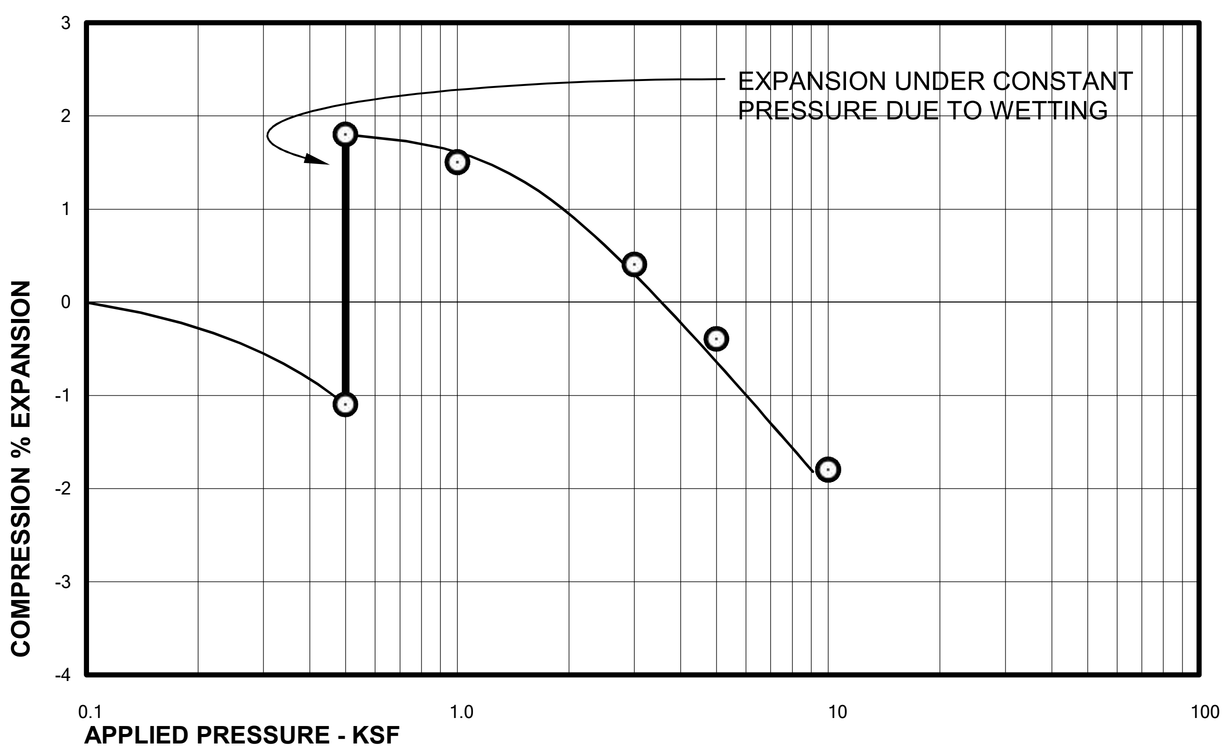
Swell Consolidation Test Results

FIG. B-27

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	94	PCF
From	TH-17 AT 14 FEET	MOISTURE CONTENT=	27.4	%

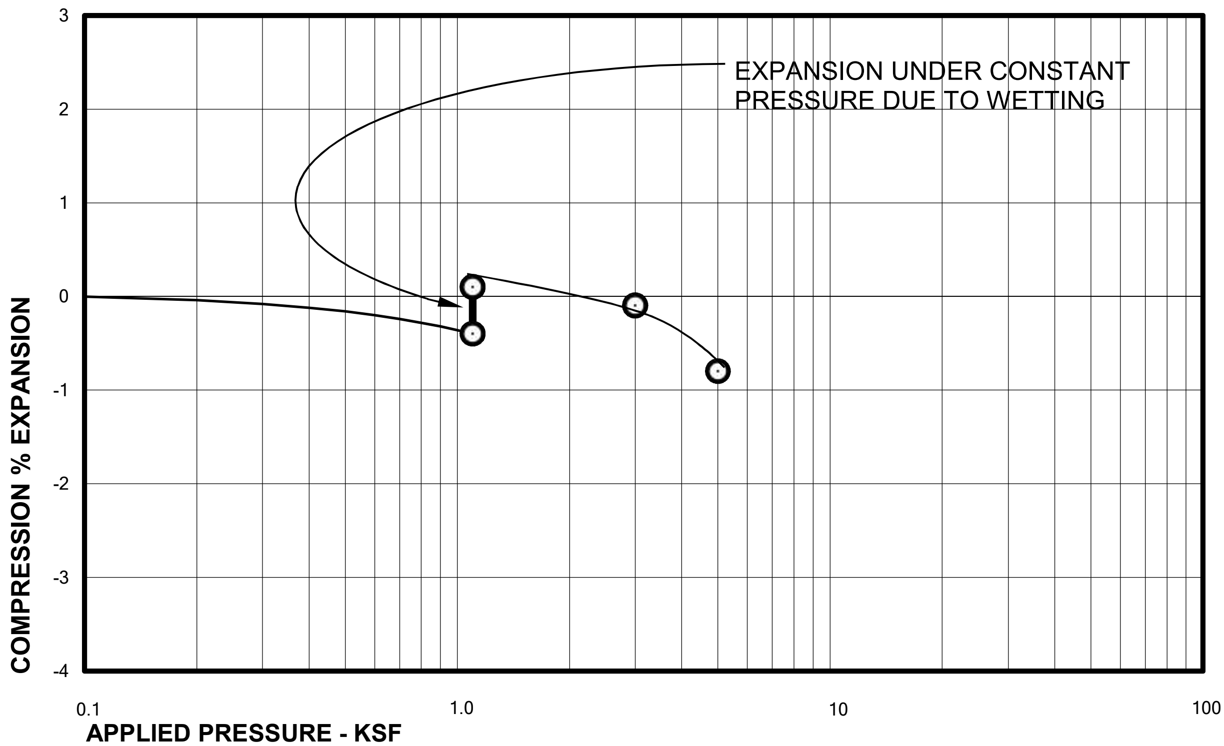


Sample of	CLAYSTONE	DRY UNIT WEIGHT=	84	PCF
From	TH-18 AT 24 FEET	MOISTURE CONTENT=	34.6	%

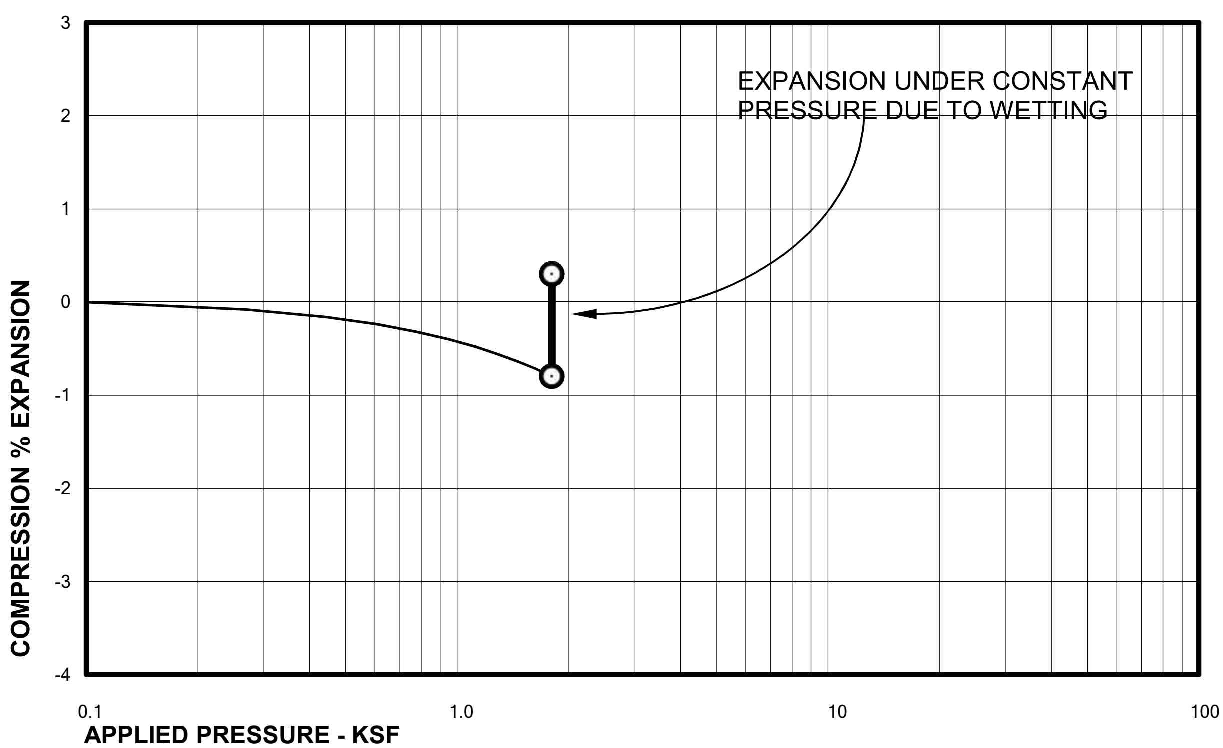
SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-28



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	91	PCF
From	TH-18 AT 29 FEET	MOISTURE CONTENT=	29.0	%



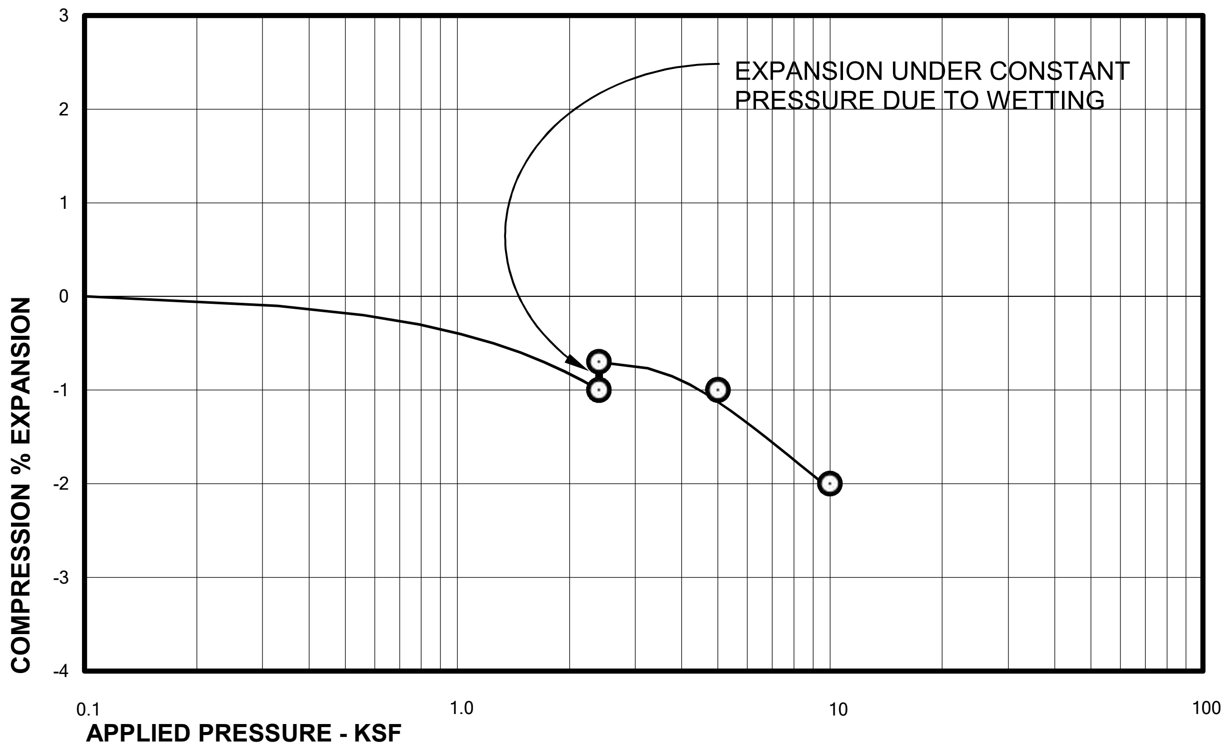
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	100	PCF
From	TH-18 AT 34 FEET	MOISTURE CONTENT=	26.1	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

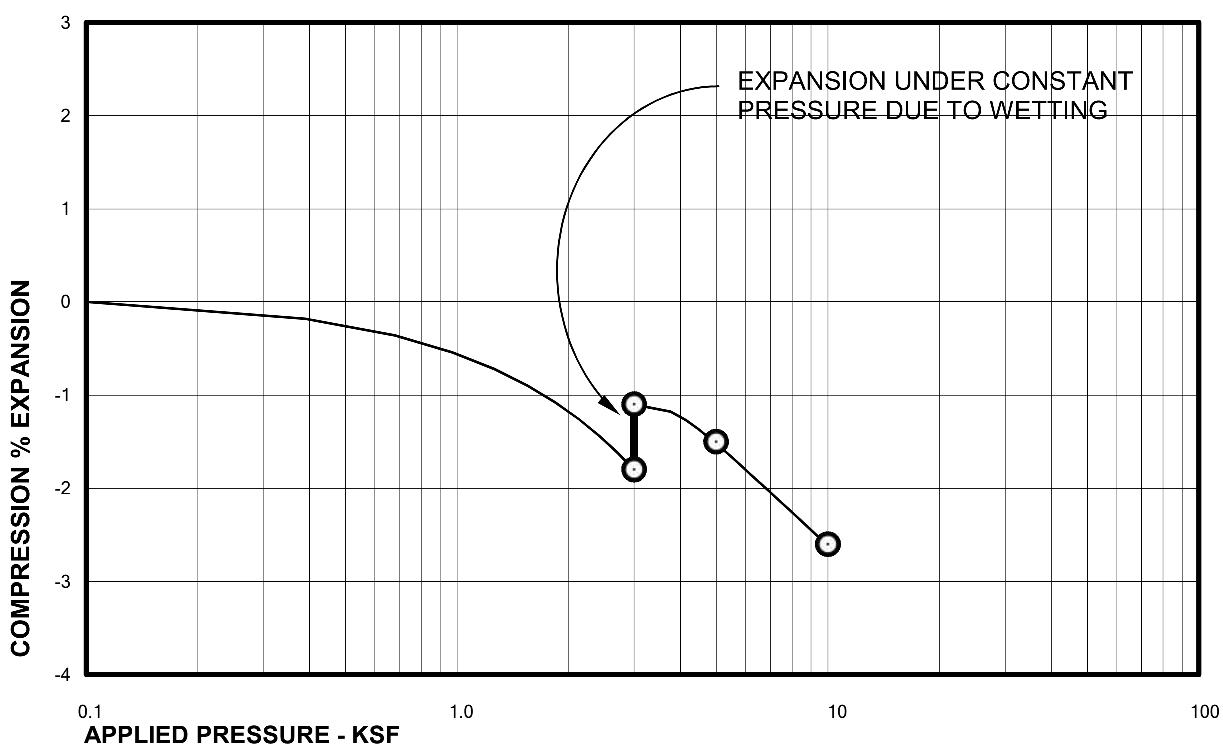
Swell Consolidation Test Results

FIG. B-29

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	94	PCF
From	TH-18 AT 39 FEET	MOISTURE CONTENT=	28.3	%



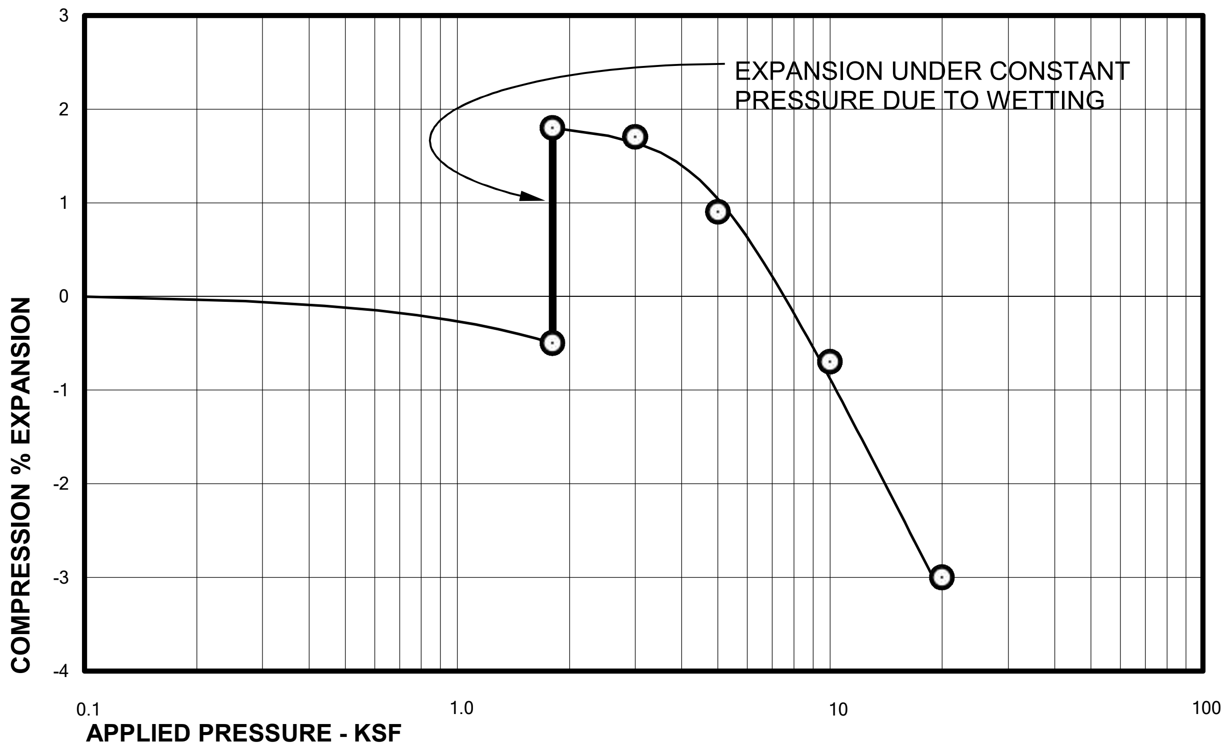
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	92	PCF
From	TH-18 AT 44 FEET	MOISTURE CONTENT=	32.3	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-30

DRAFT

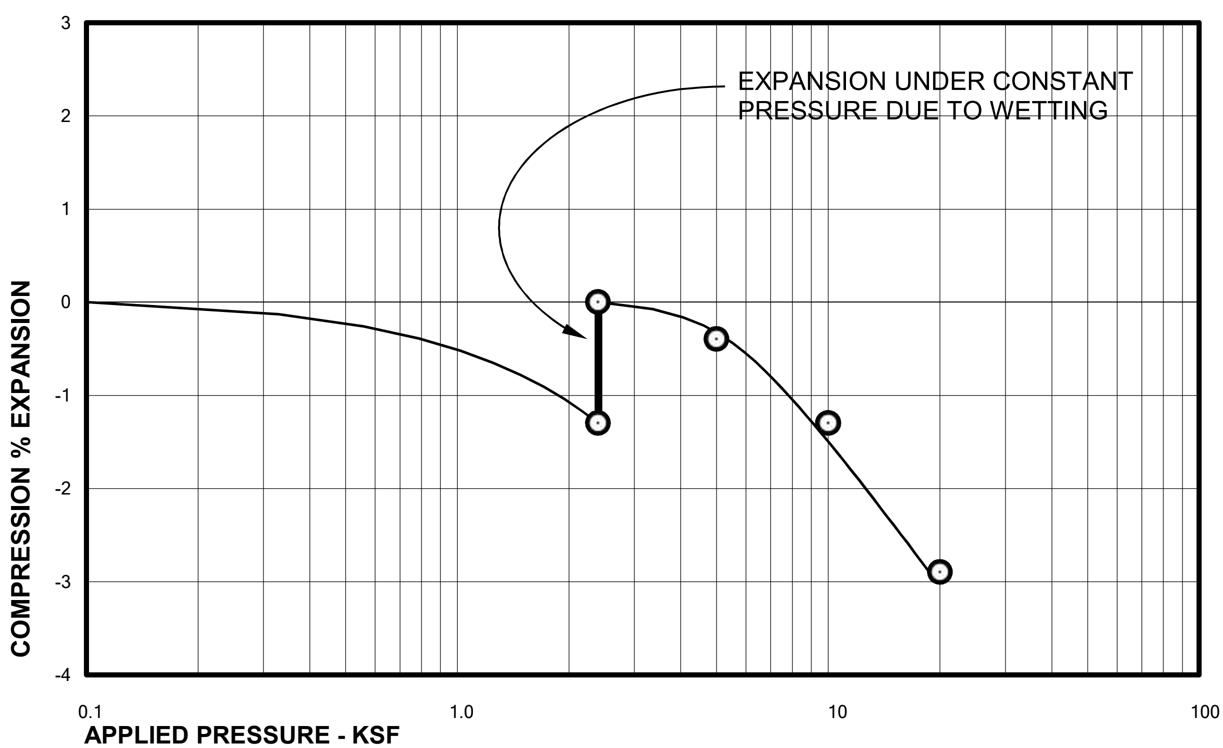


Sample of CLAY, SANDY (CL)

From TH-19 AT 9 FEET

DRY UNIT WEIGHT= 122 PCF

MOISTURE CONTENT= 11.4 %



Sample of CLAYSTONE

From TH-19 AT 14 FEET

DRY UNIT WEIGHT= 86 PCF

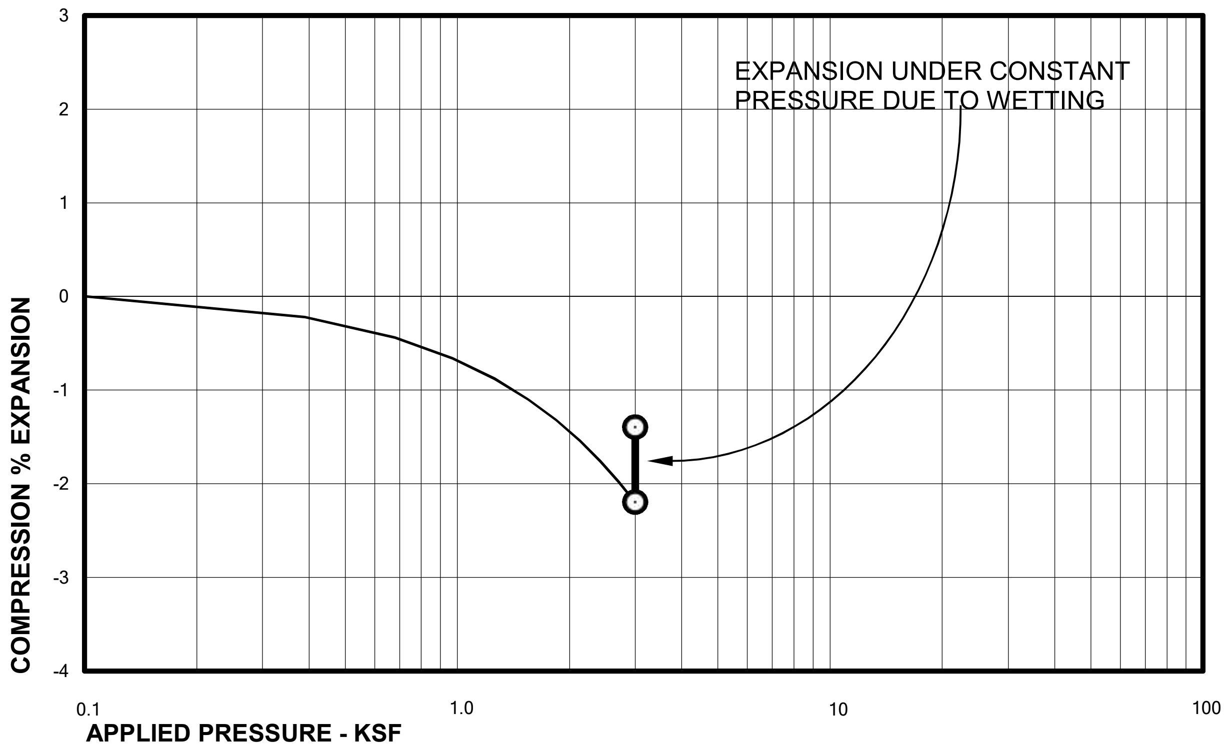
MOISTURE CONTENT= 34.9 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

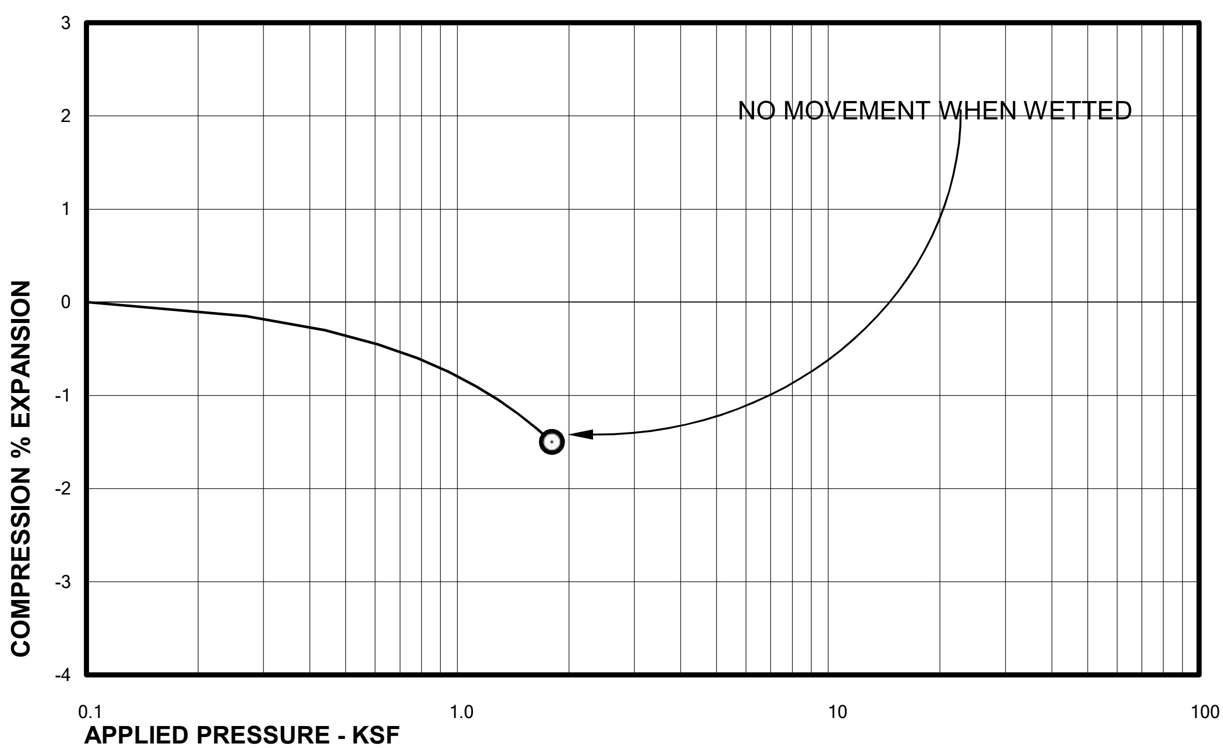
Swell Consolidation Test Results

FIG. B-31

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	87	PCF
From	TH-19 AT 19 FEET	MOISTURE CONTENT=	32.1	%



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	74	PCF
From	TH-20 AT 9 FEET	MOISTURE CONTENT=	42.4	%

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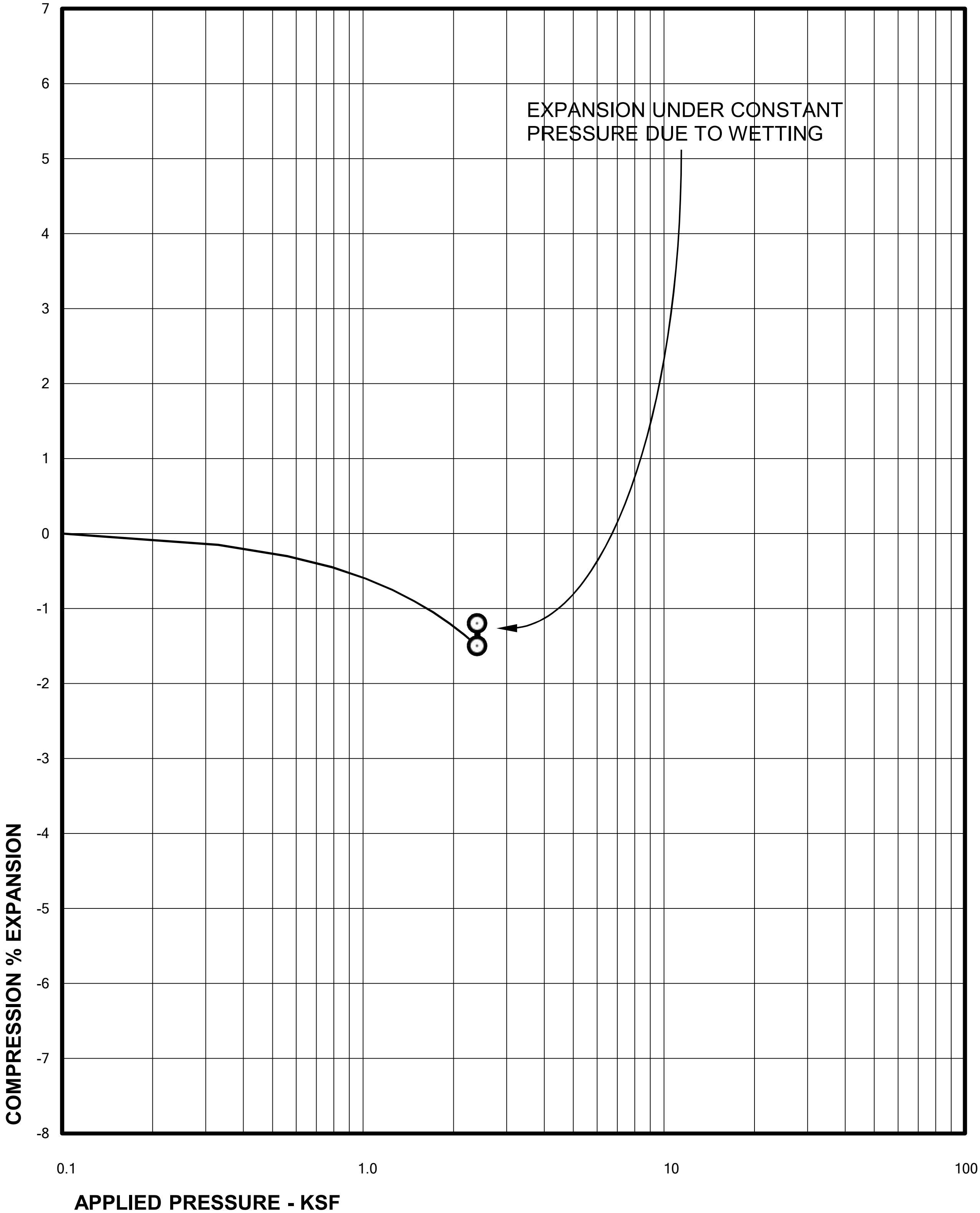
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-32

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	83	PCF
From	TH-20 AT 14 FEET	MOISTURE CONTENT=	36.3	%

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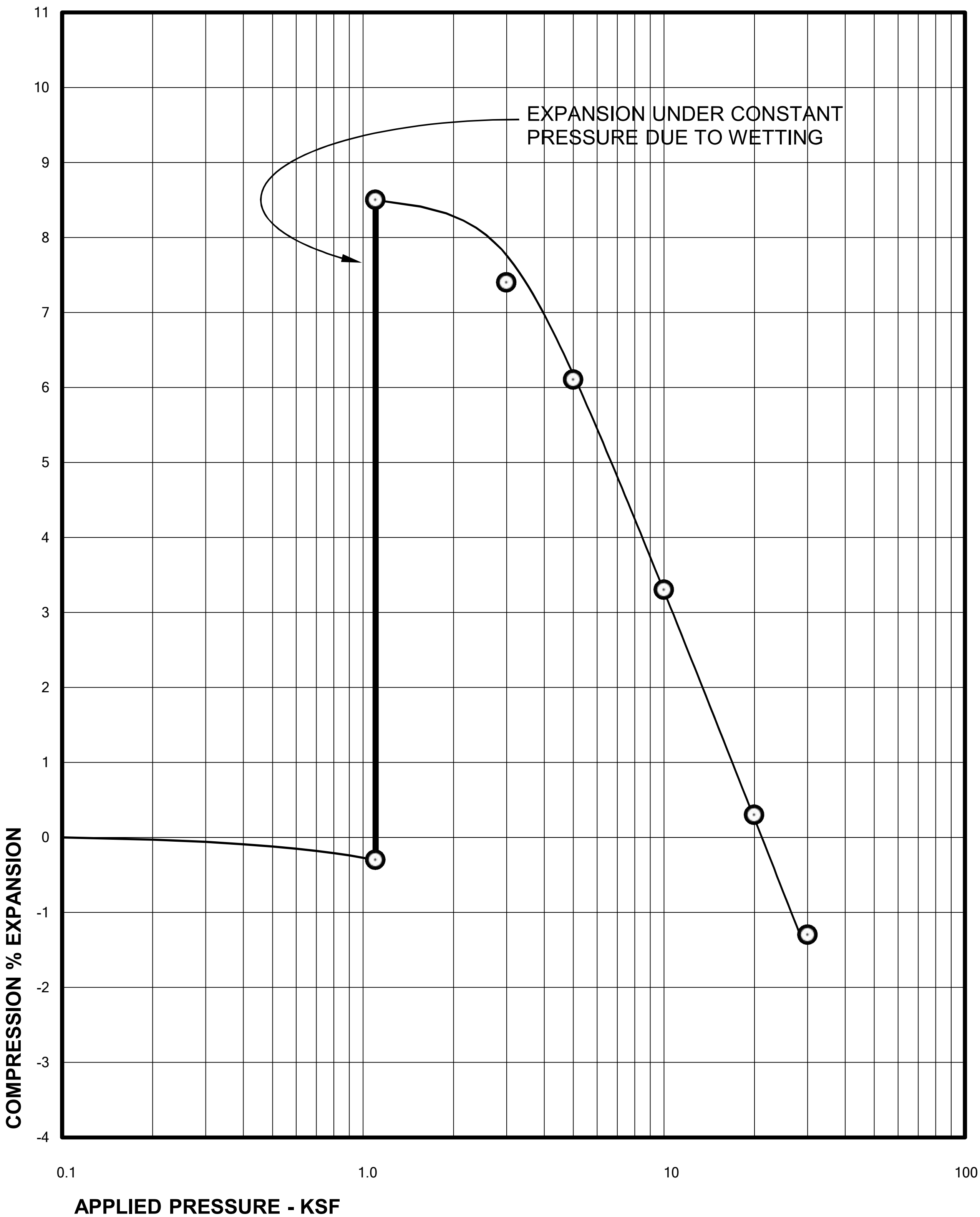
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-33

DRAFT



Sample of CLAY, SANDY (CL)

From TH-21 AT 4 FEET

DRY UNIT WEIGHT= 110 PCF

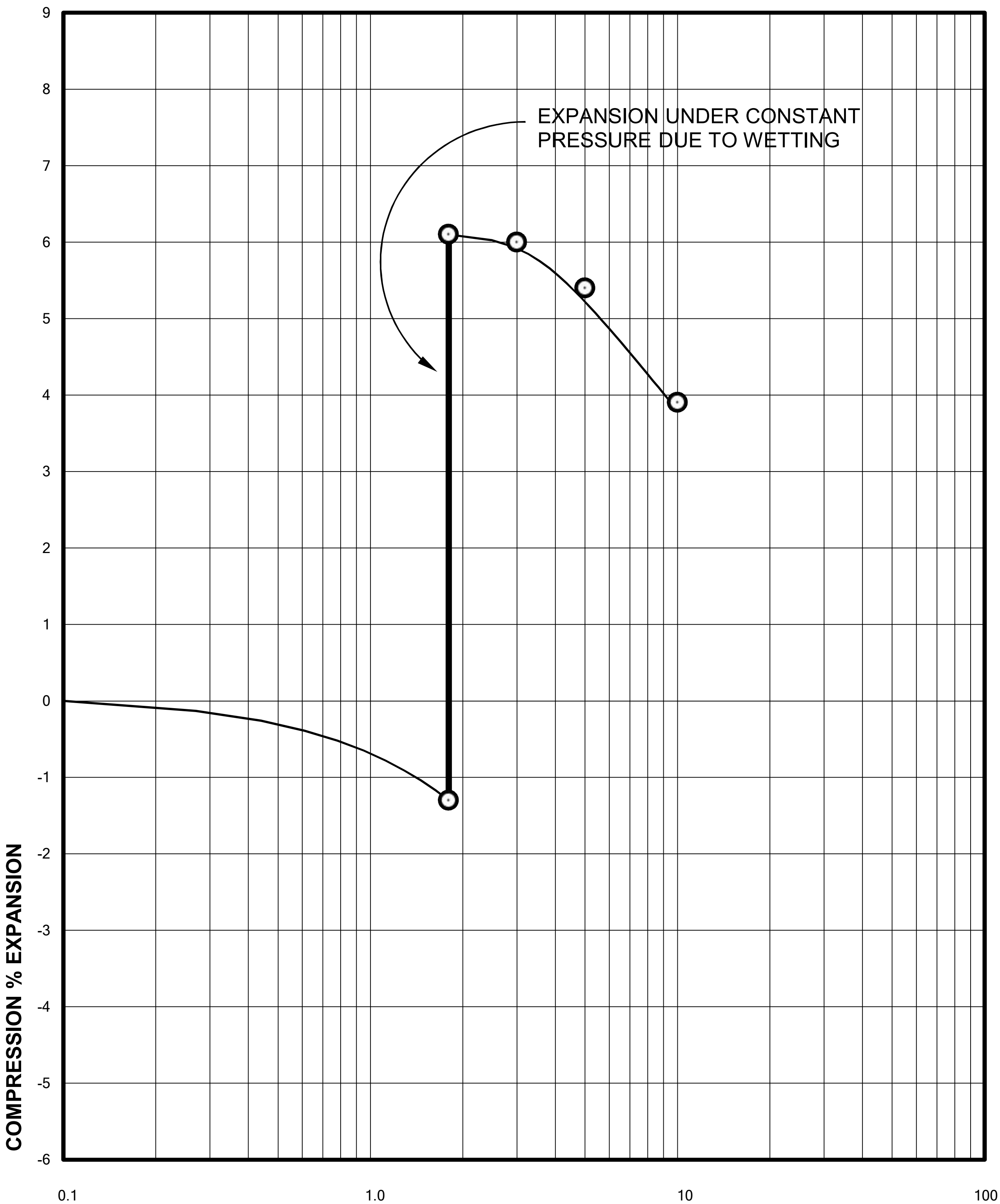
MOISTURE CONTENT= 13.9 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-34

DRAFT



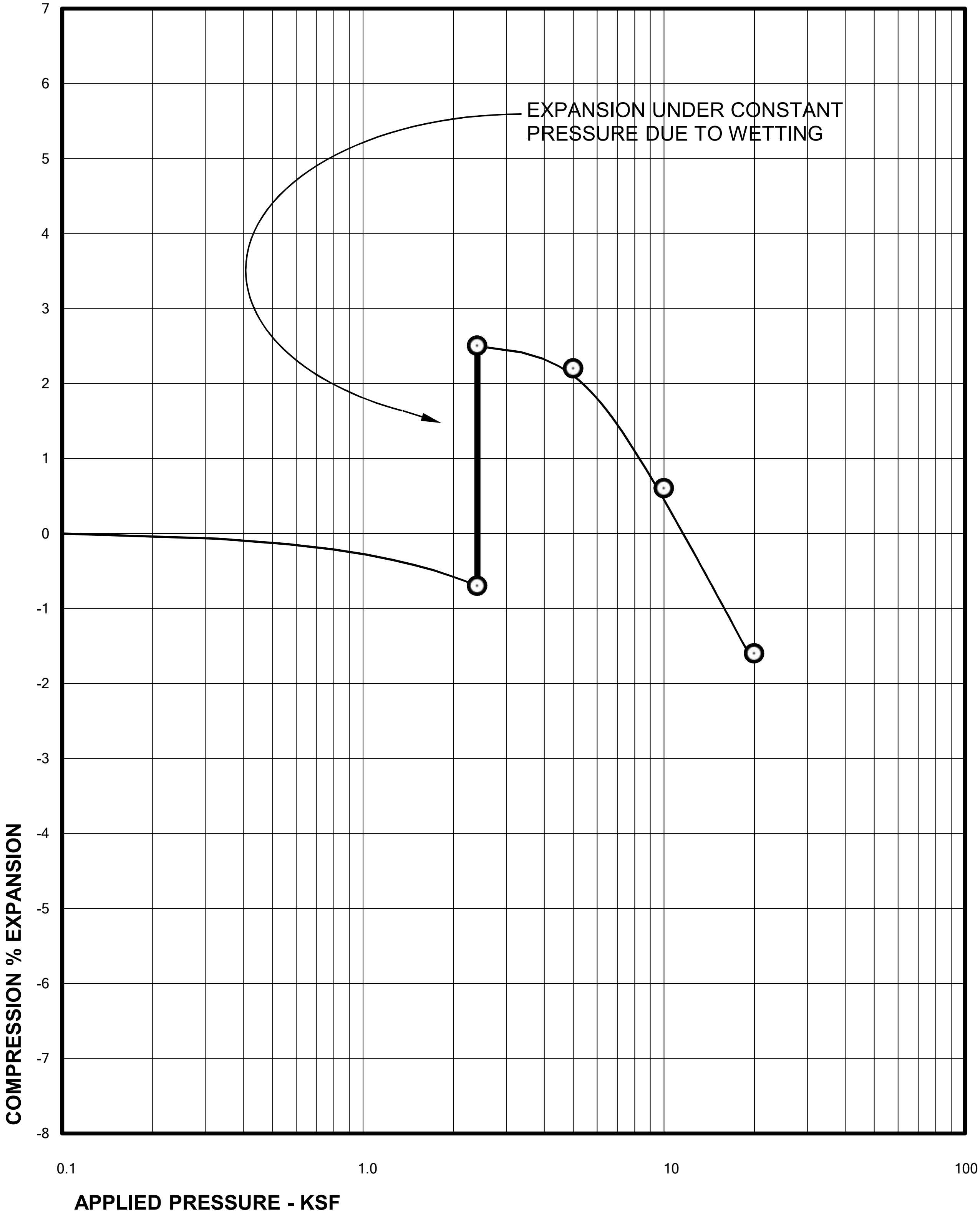
Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	100	PCF
From	TH-21 AT 9 FEET	MOISTURE CONTENT=	22.9	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-35

DRAFT



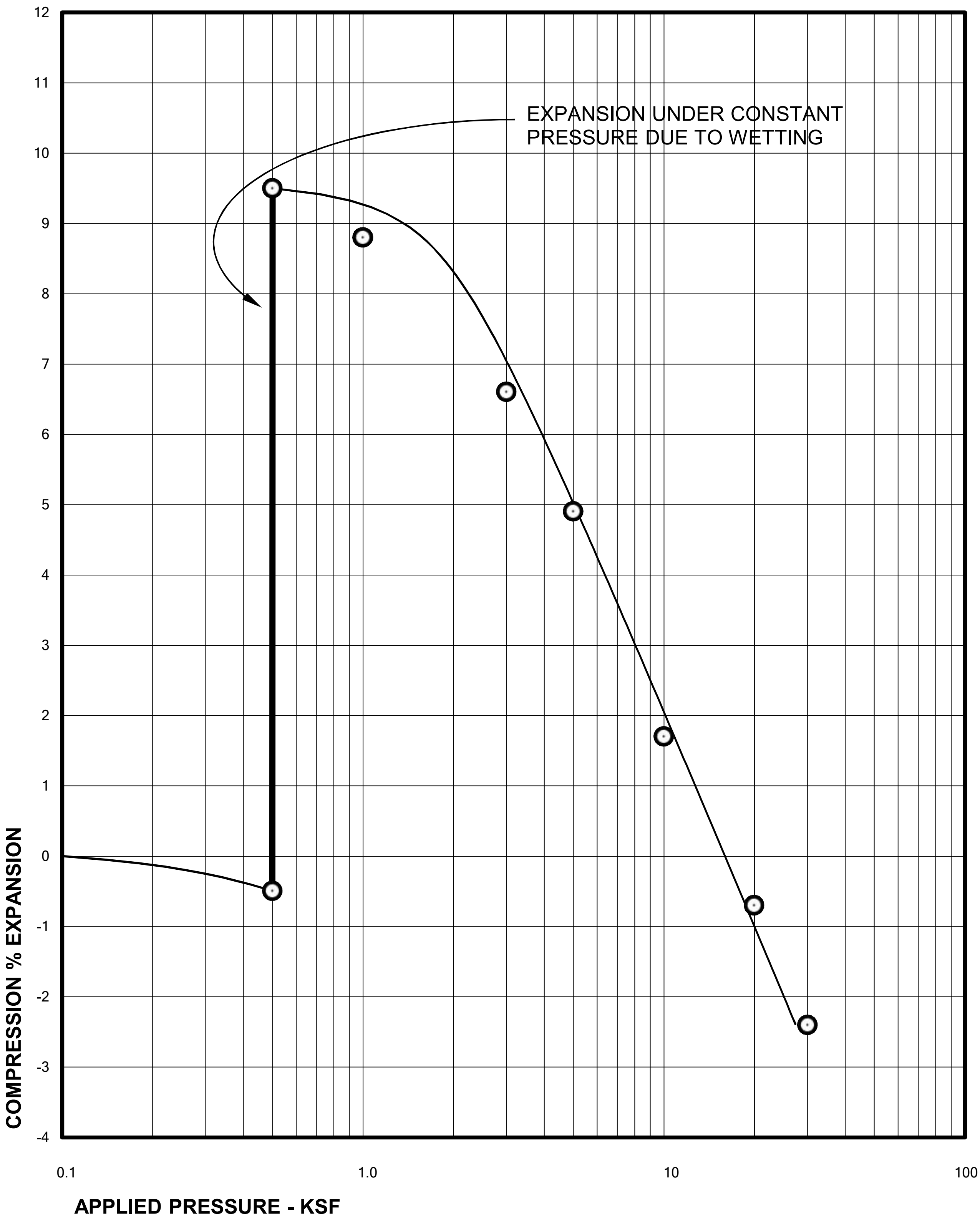
Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	106	PCF
From	TH-21 AT 14 FEET	MOISTURE CONTENT=	19.6	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-36

DRAFT



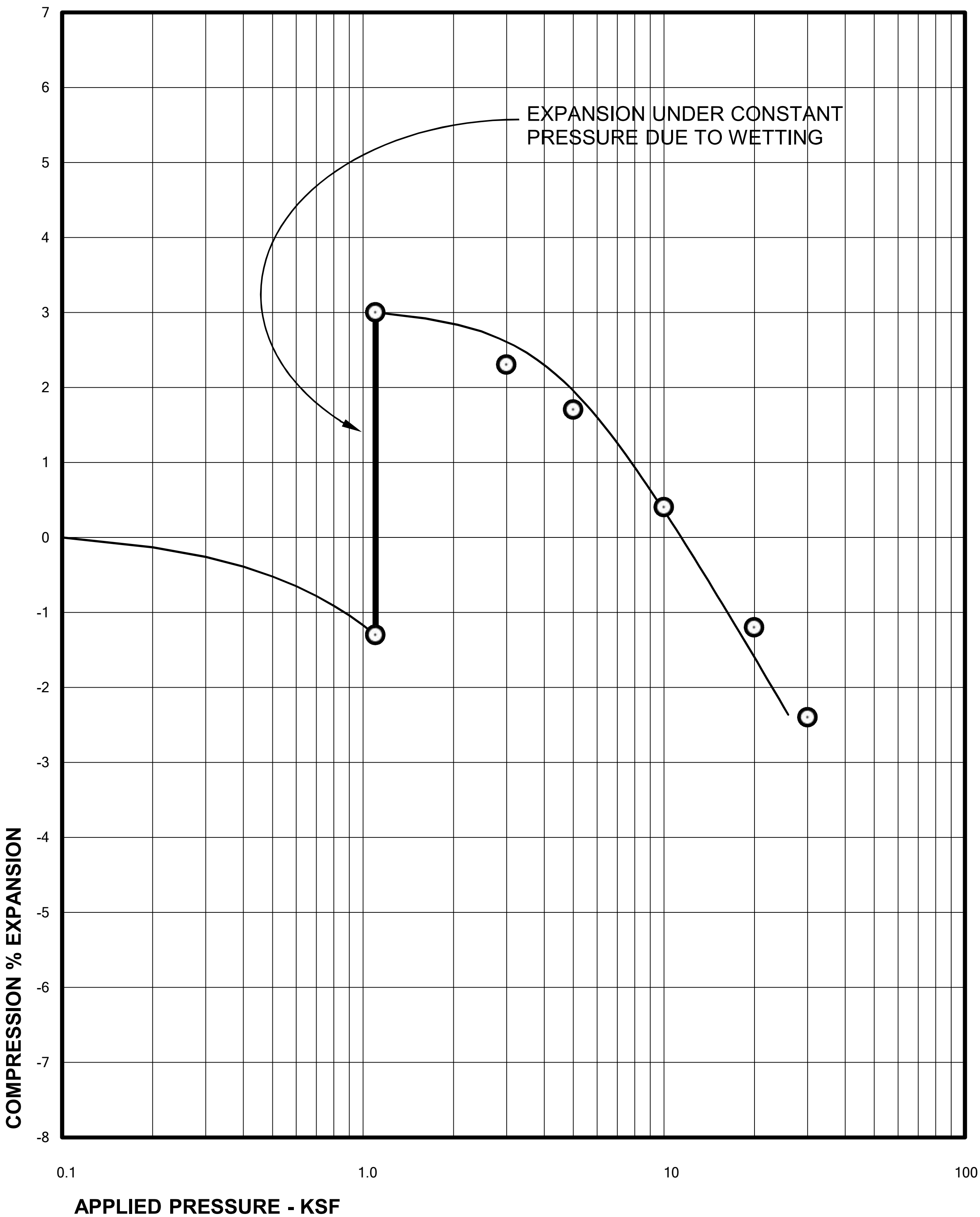
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	105	PCF
From	TH-22 AT 19 FEET	MOISTURE CONTENT=	22.4	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-37

DRAFT



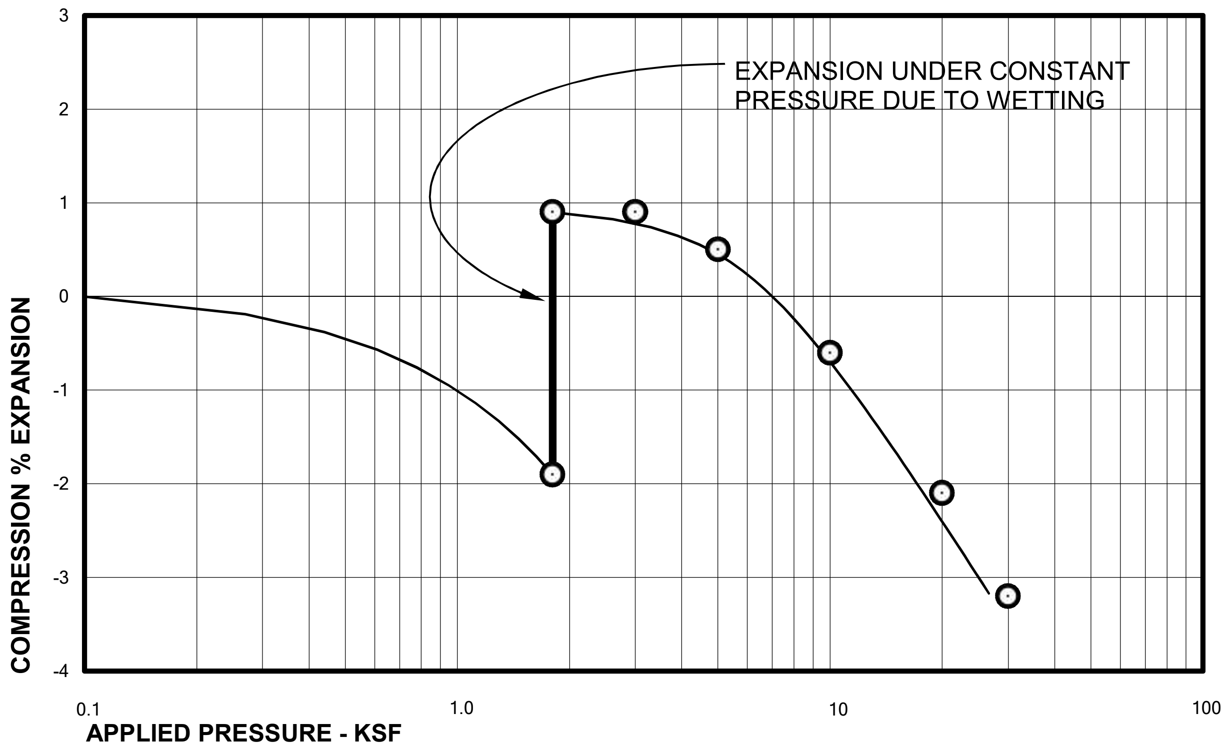
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	98	PCF
From	TH-22 AT 24 FEET	MOISTURE CONTENT=	25.7	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

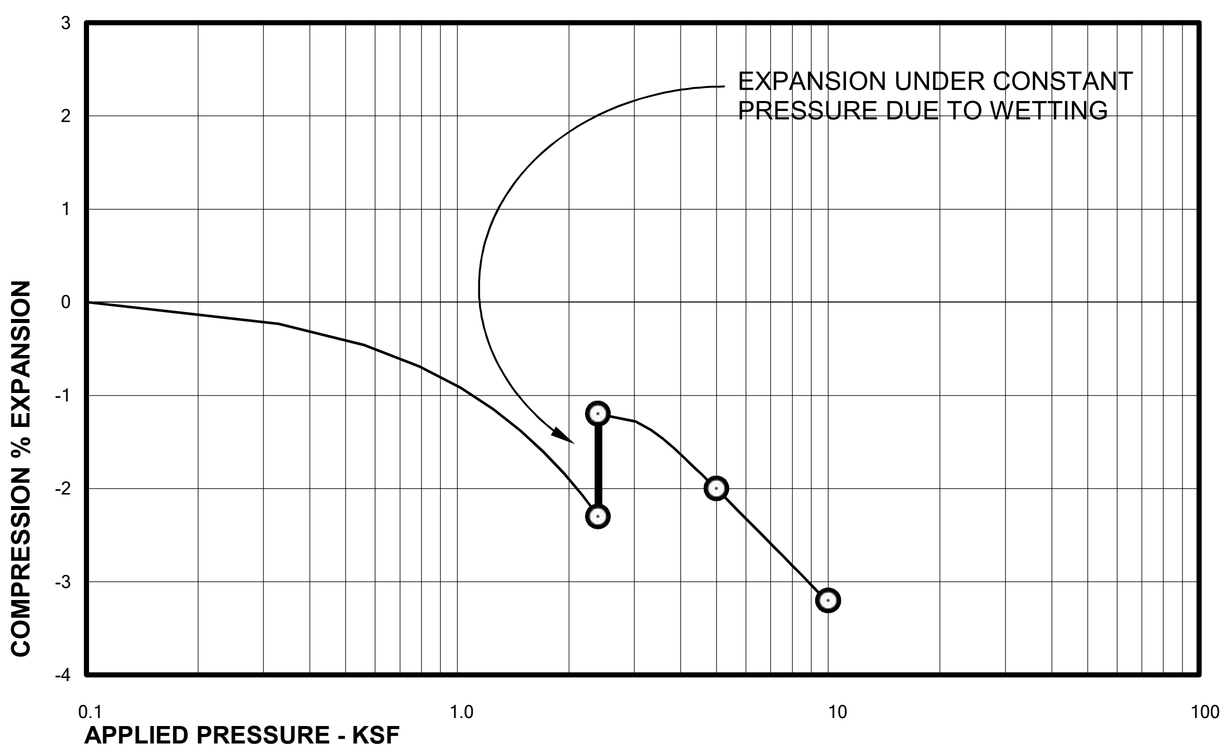
Swell Consolidation Test Results

FIG. B-38

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	98	PCF
From	TH-22 AT 29 FEET	MOISTURE CONTENT=	27.0	%



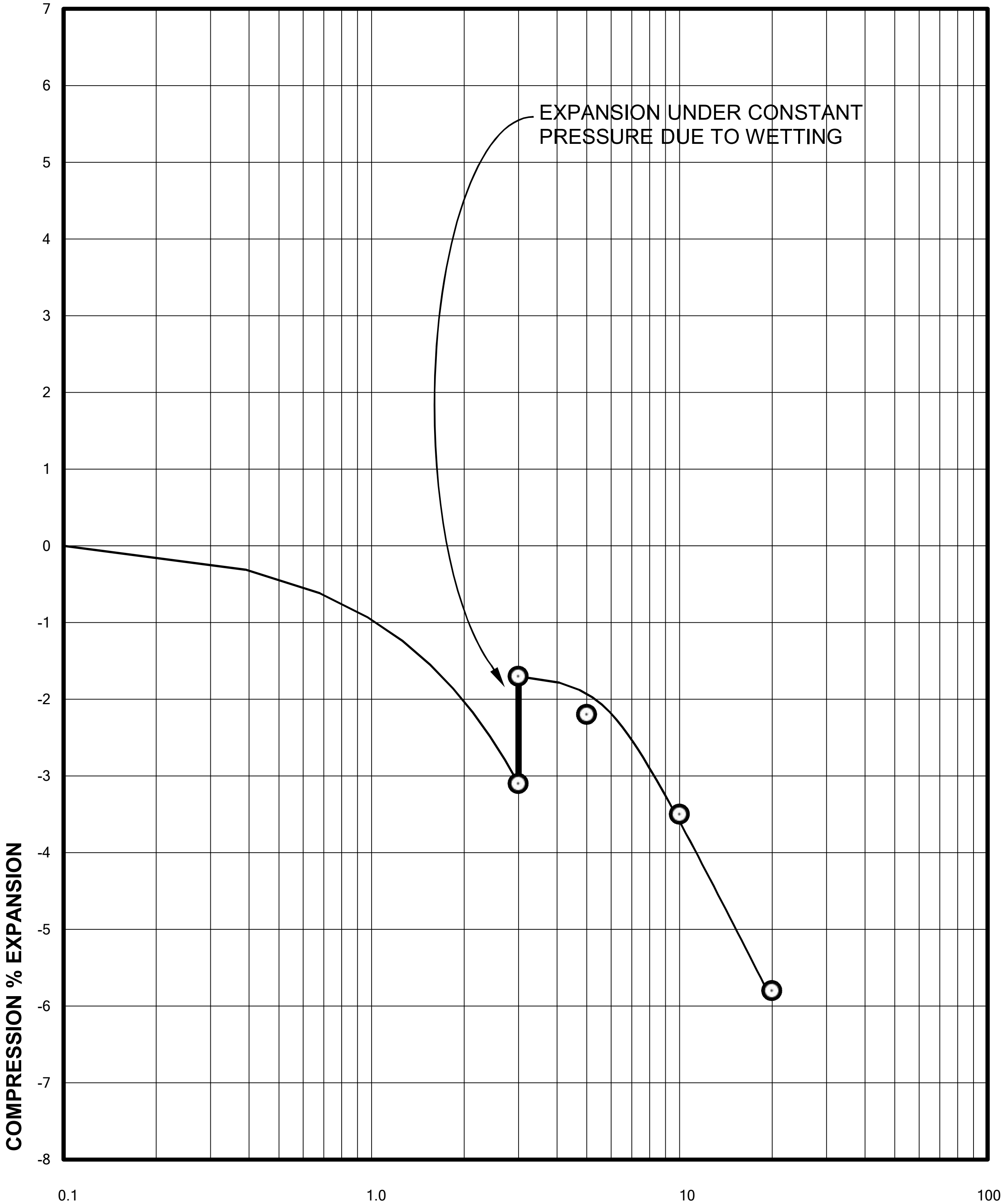
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	90	PCF
From	TH-22 AT 34 FEET	MOISTURE CONTENT=	27.8	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-39

DRAFT



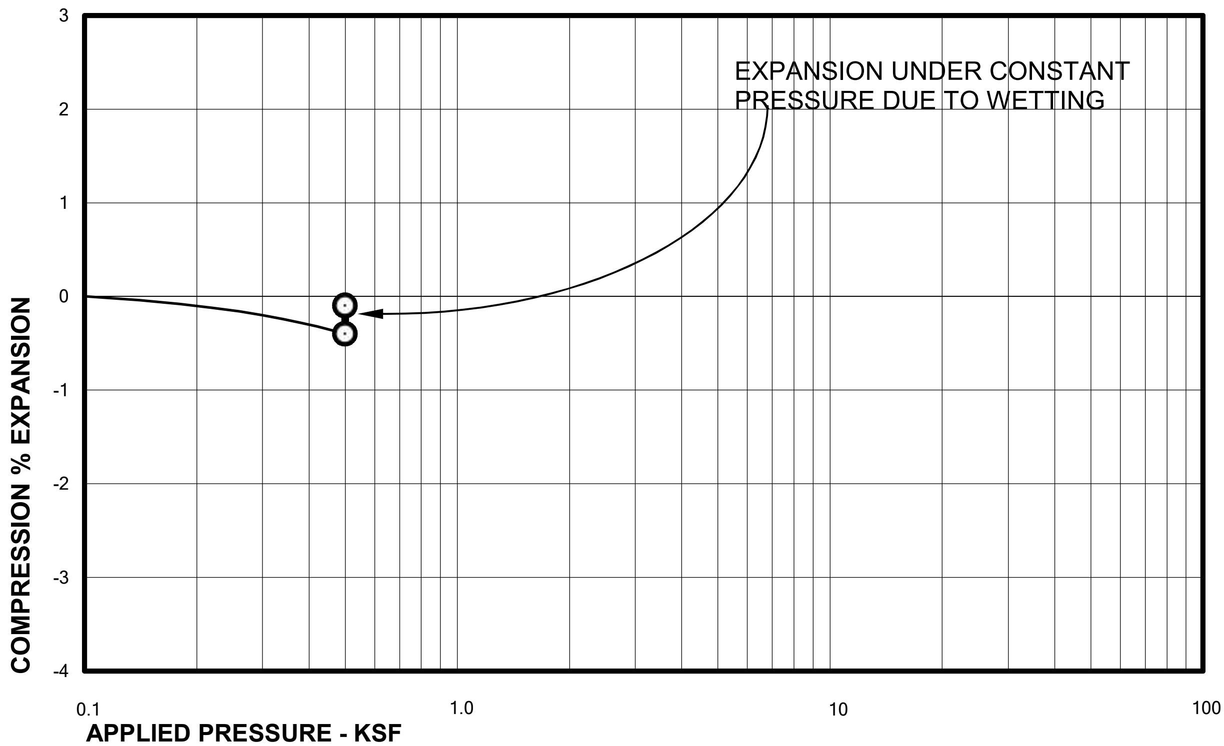
Sample of	CLAYSTONE		DRY UNIT WEIGHT=	85	PCF
From	TH-22 AT 39 FEET		MOISTURE CONTENT=	33.3	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

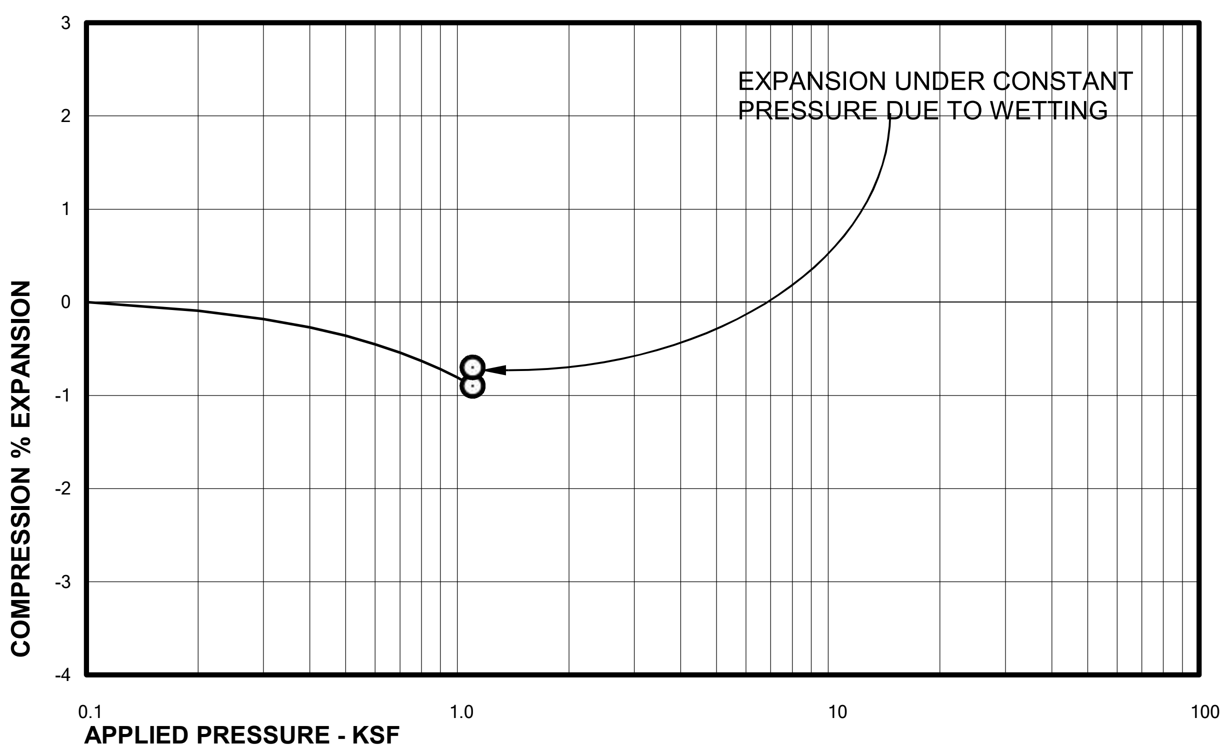
Swell Consolidation Test Results

FIG. B-40

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	93	PCF
From	TH-23 AT 29 FEET	MOISTURE CONTENT=	30.2	%



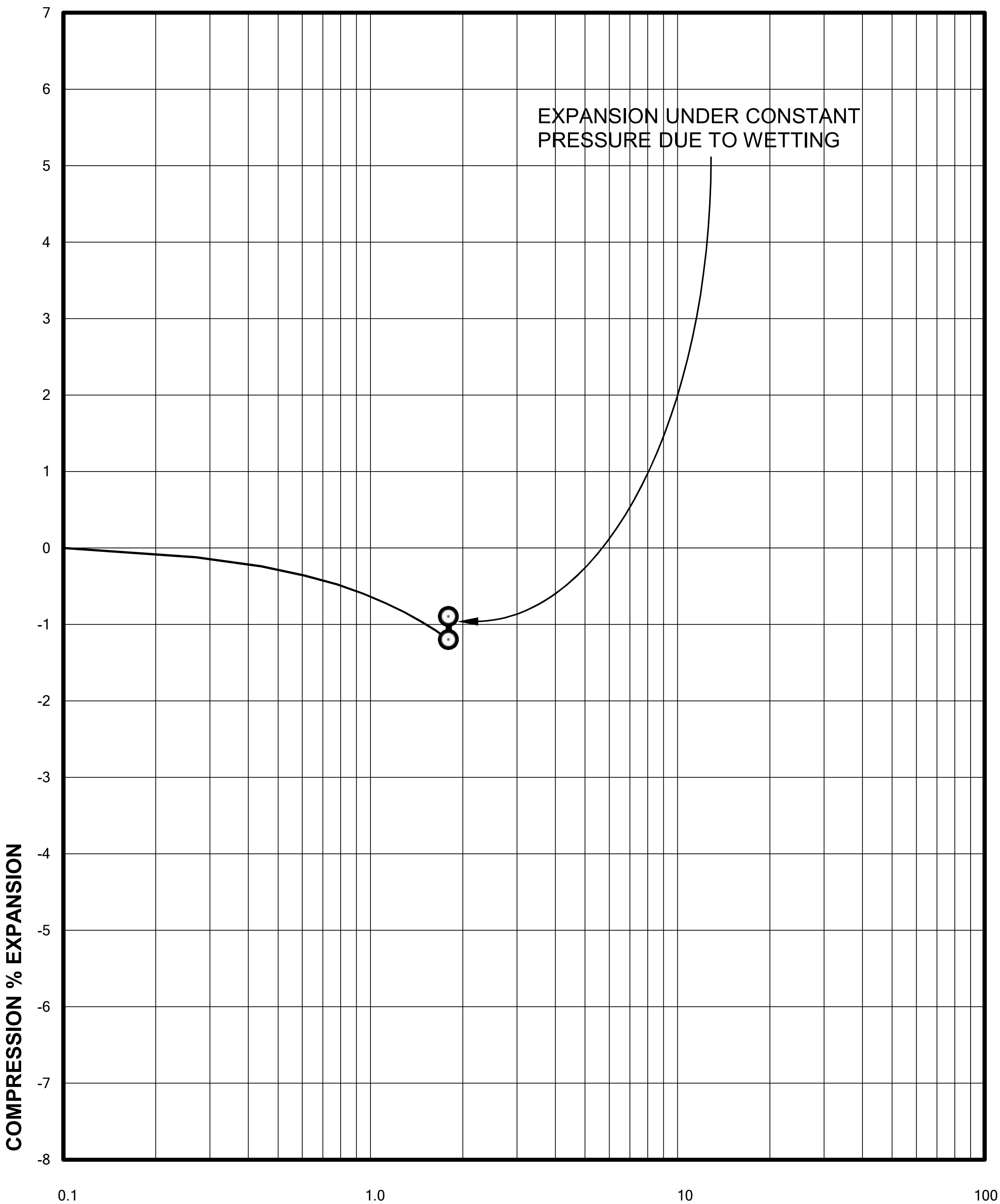
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	95	PCF
From	TH-23 AT 34 FEET	MOISTURE CONTENT=	28.6	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-41

DRAFT



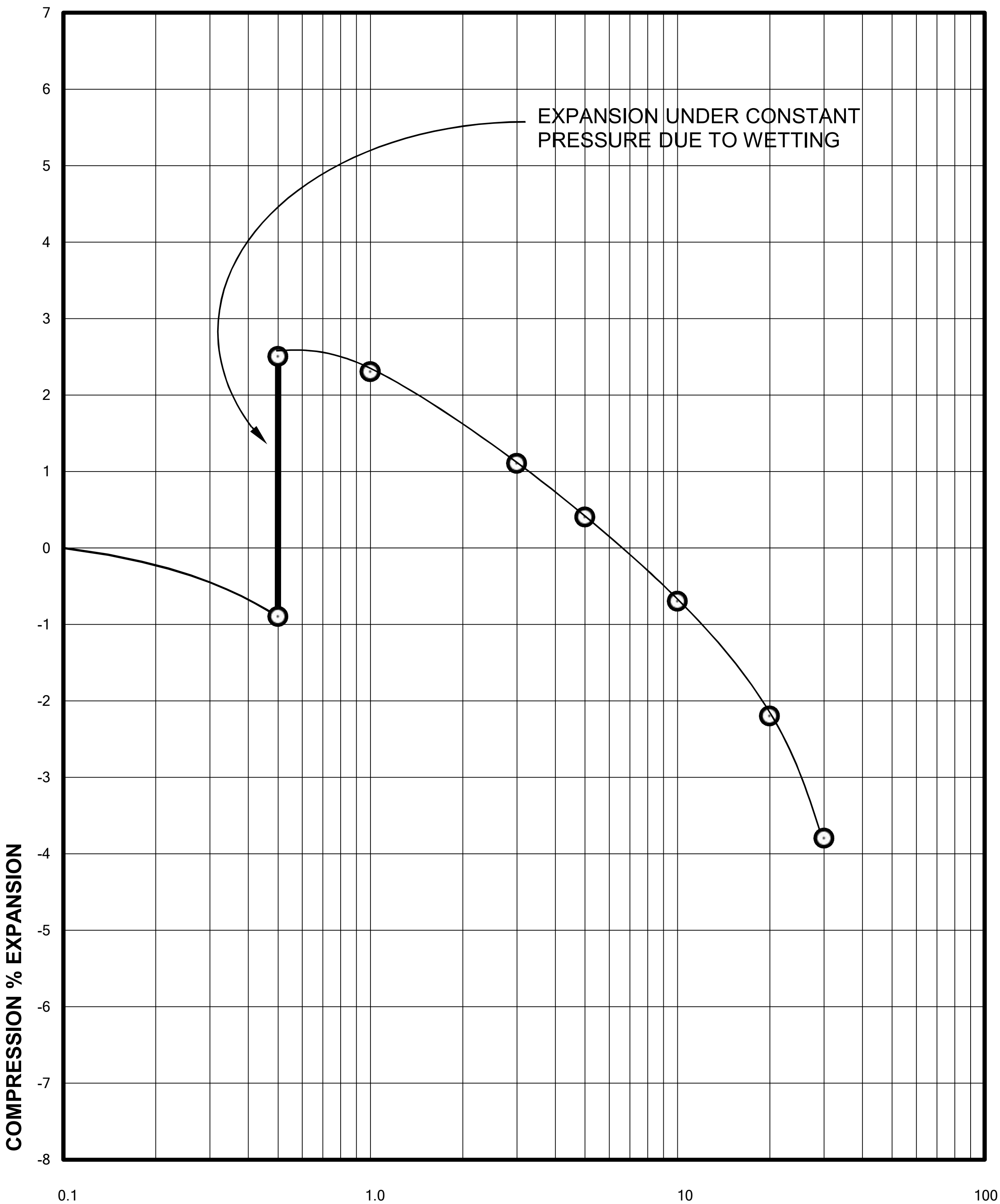
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	101	PCF
From	TH-23 AT 39 FEET	MOISTURE CONTENT=	22.3	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-42

DRAFT

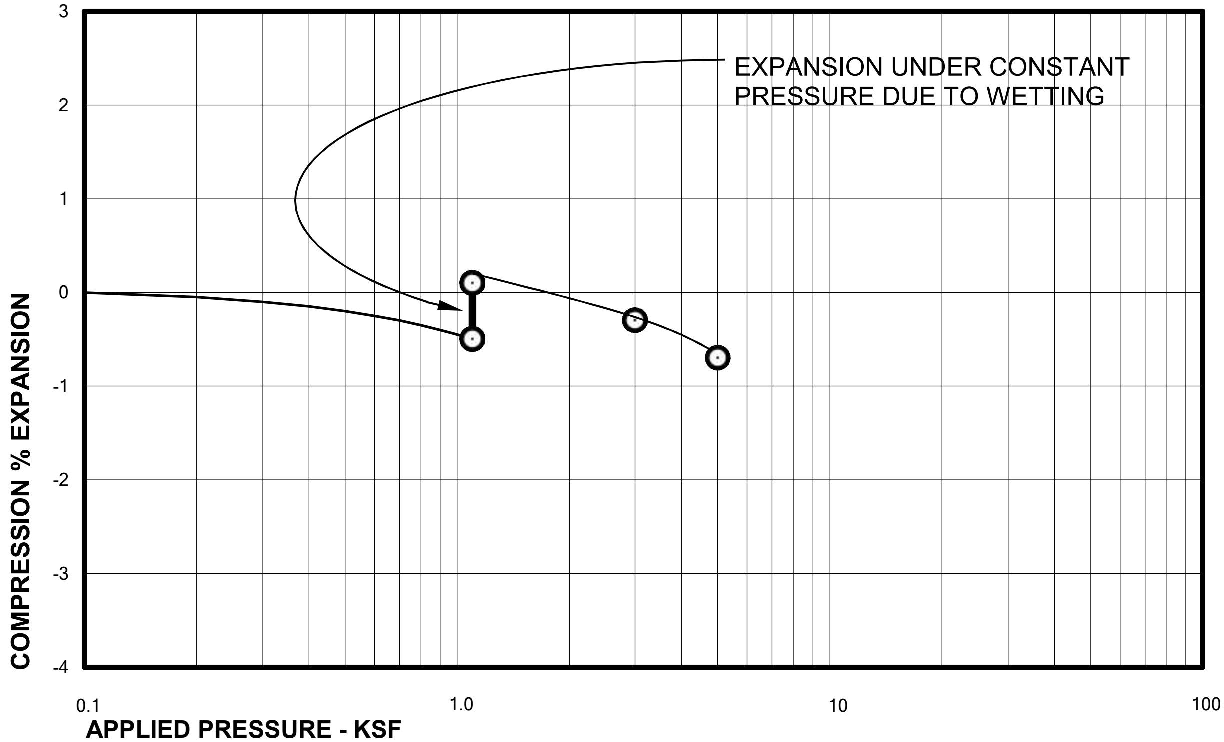


Sample of	CLAYSTONE	DRY UNIT WEIGHT=	93	PCF
From	TH-24 AT 19 FEET	MOISTURE CONTENT=	29.3	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

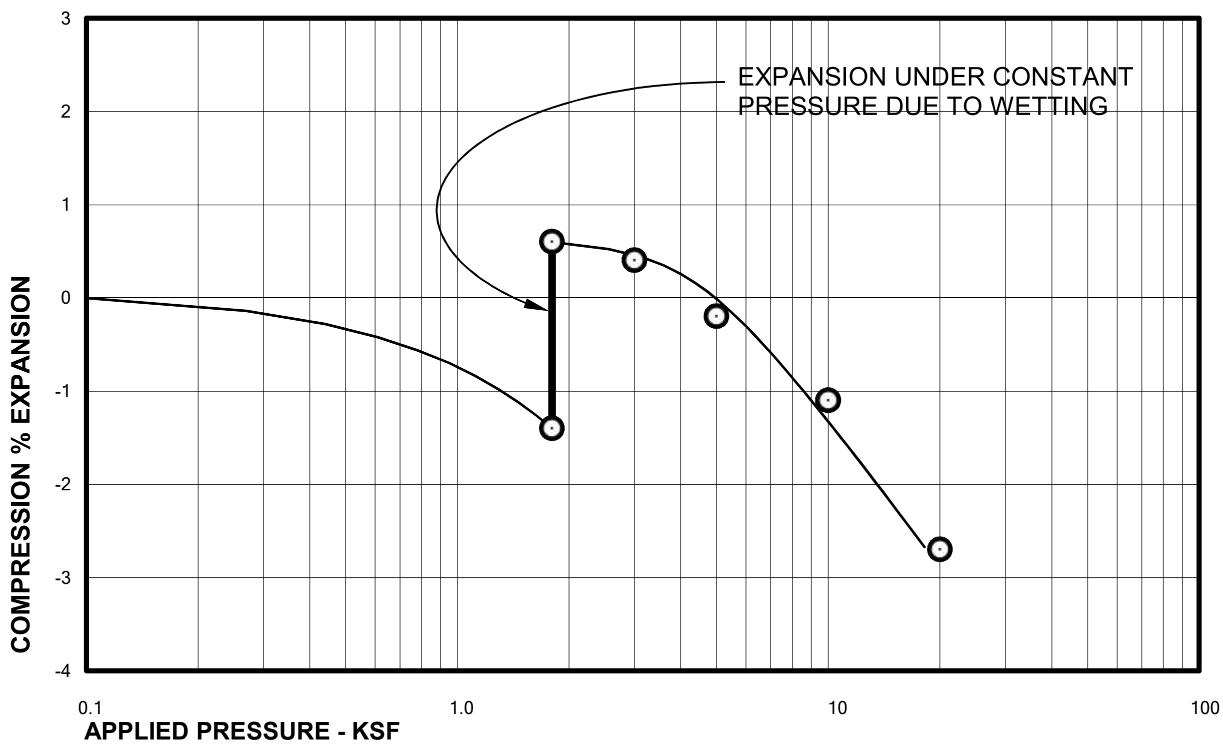
Swell Consolidation Test Results

FIG. B-43



Sample of CLAYSTONE
From TH-24 AT 24 FEET

DRY UNIT WEIGHT= 98 PCF
MOISTURE CONTENT= 24.1 %



Sample of CLAYSTONE
From TH-24 AT 29 FEET

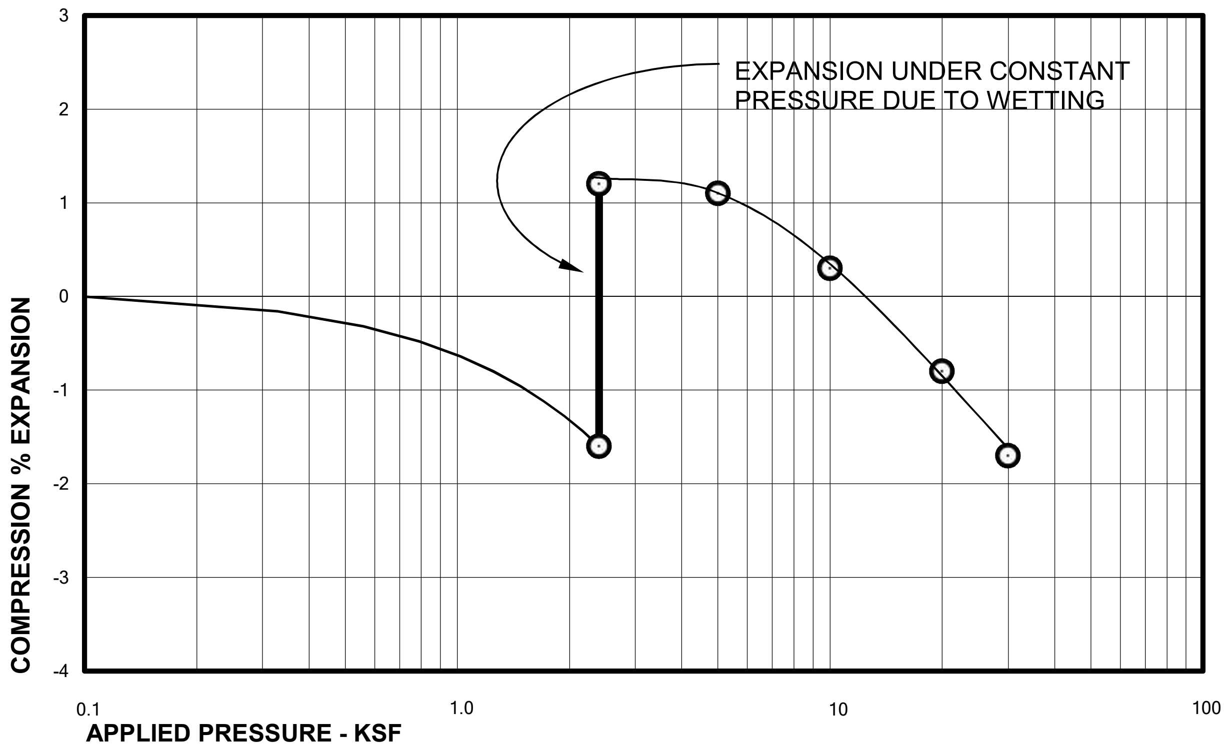
DRY UNIT WEIGHT= 101 PCF
MOISTURE CONTENT= 24.2 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

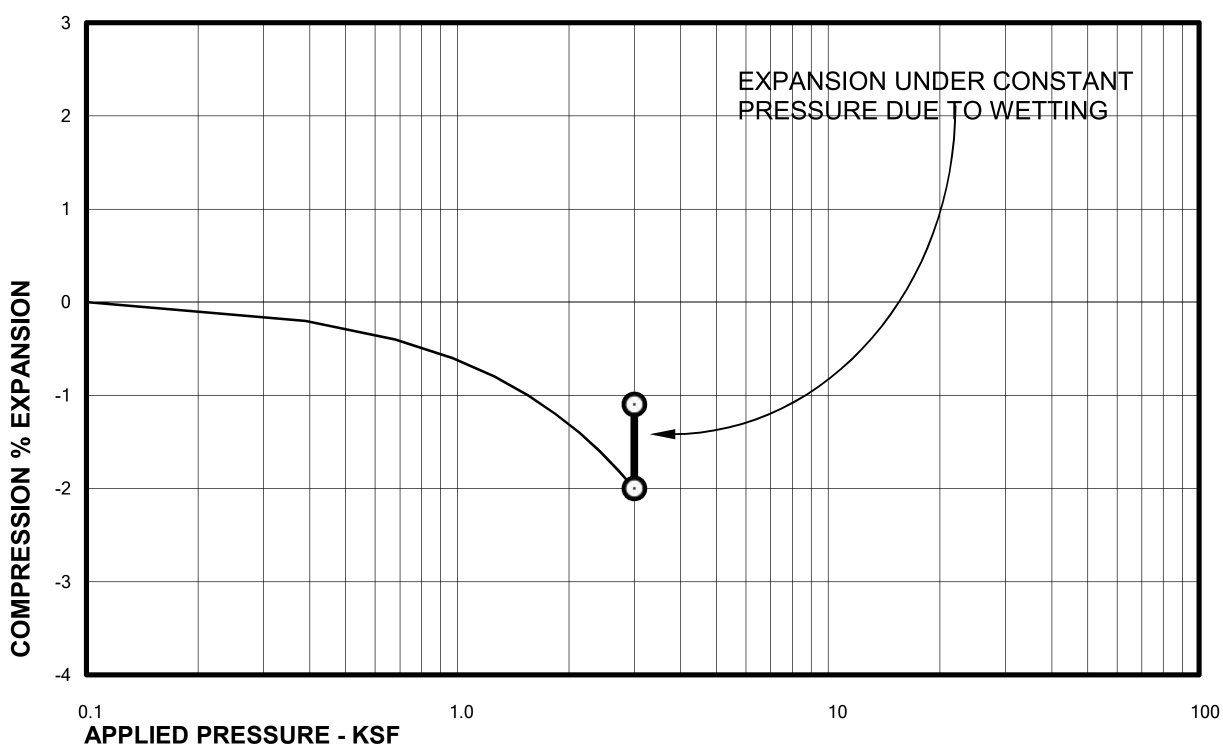
FIG. B-44

DRAFT



Sample of CLAYSTONE
From TH-24 AT 34 FEET

DRY UNIT WEIGHT= 97 PCF
MOISTURE CONTENT= 27.1 %



Sample of CLAYSTONE
From TH-24 AT 39 FEET

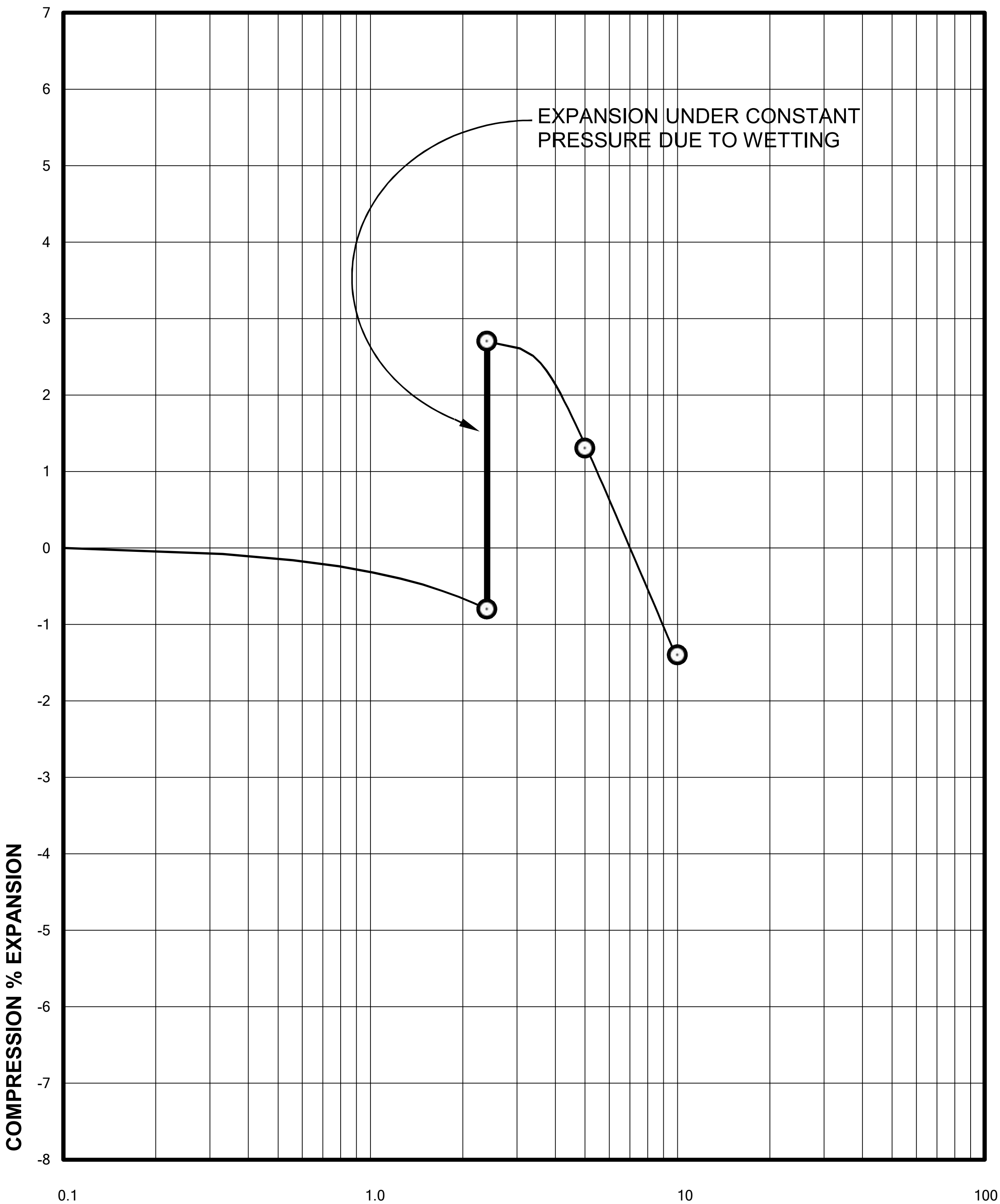
DRY UNIT WEIGHT= 100 PCF
MOISTURE CONTENT= 25.3 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-45

DRAFT



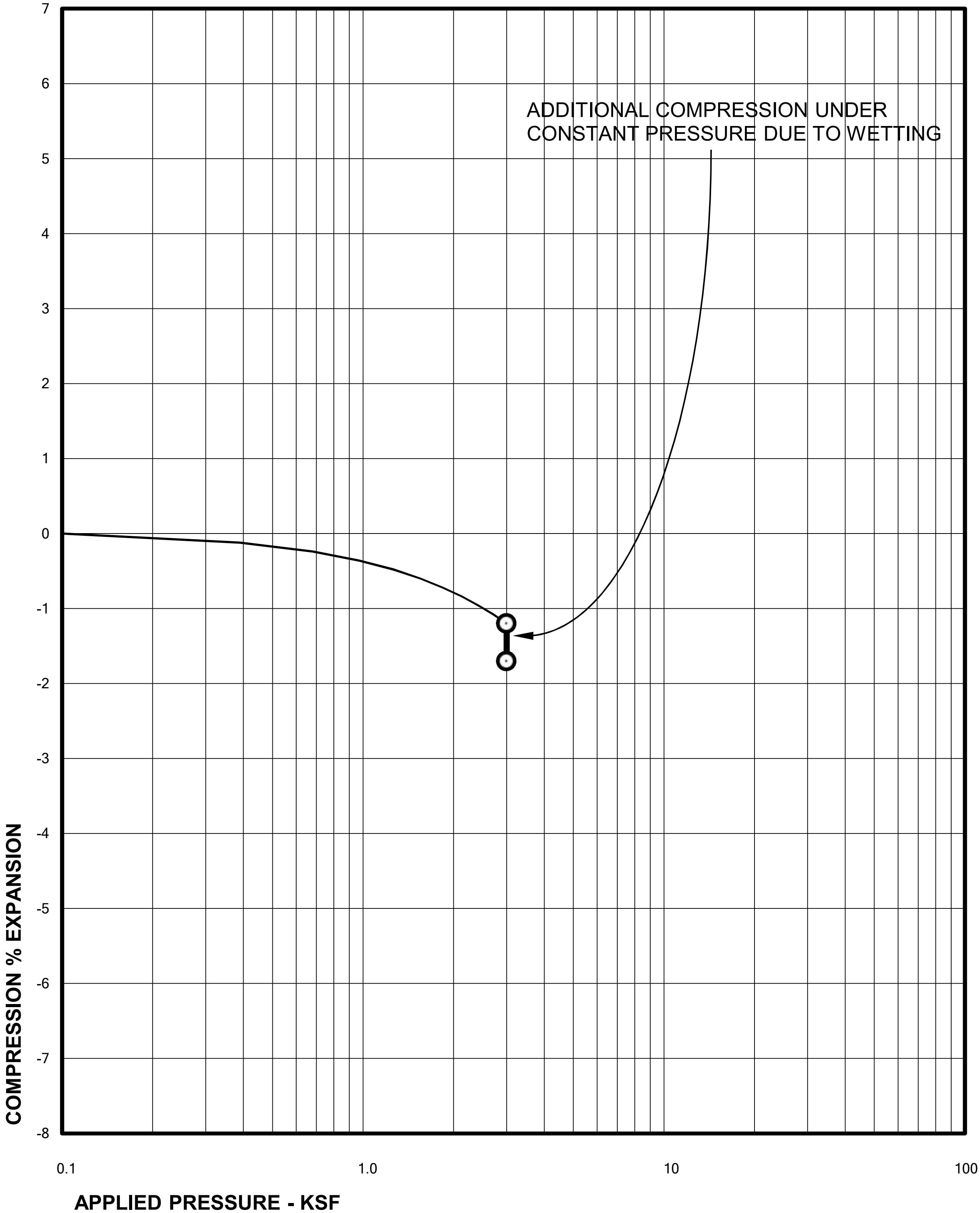
Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	102	PCF
From	TH-25 AT 4 FEET	MOISTURE CONTENT=	13.8	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-46

DRAFT



Sample of CLAY, SANDY (CL)

From TH-25 AT 9 FEET

DRY UNIT WEIGHT= 118 PCF

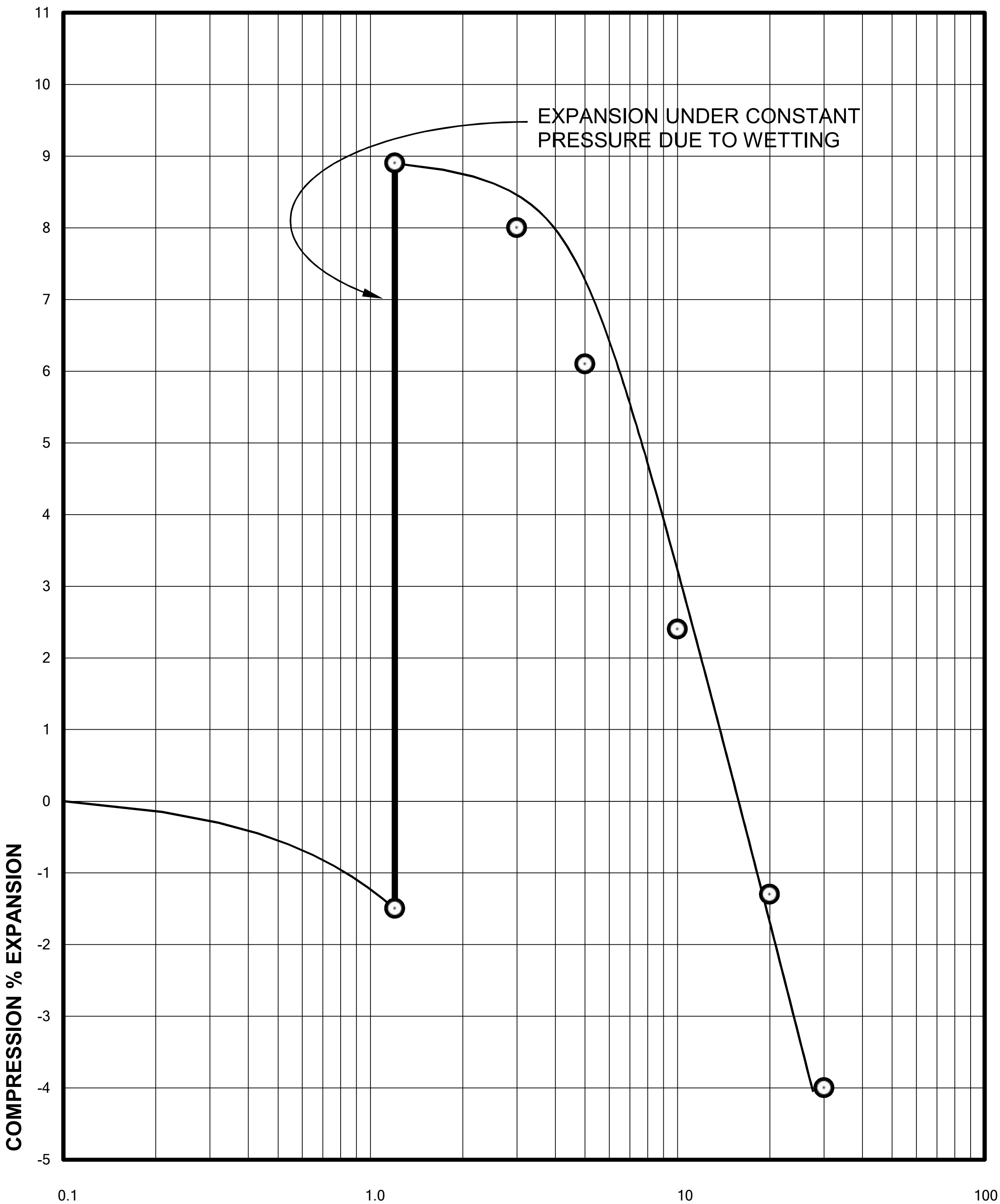
MOISTURE CONTENT= 9.6 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-47

DRAFT



Sample of CLAY, SANDY (CL)

From TH-26 AT 4 FEET

DRY UNIT WEIGHT= 108 PCF

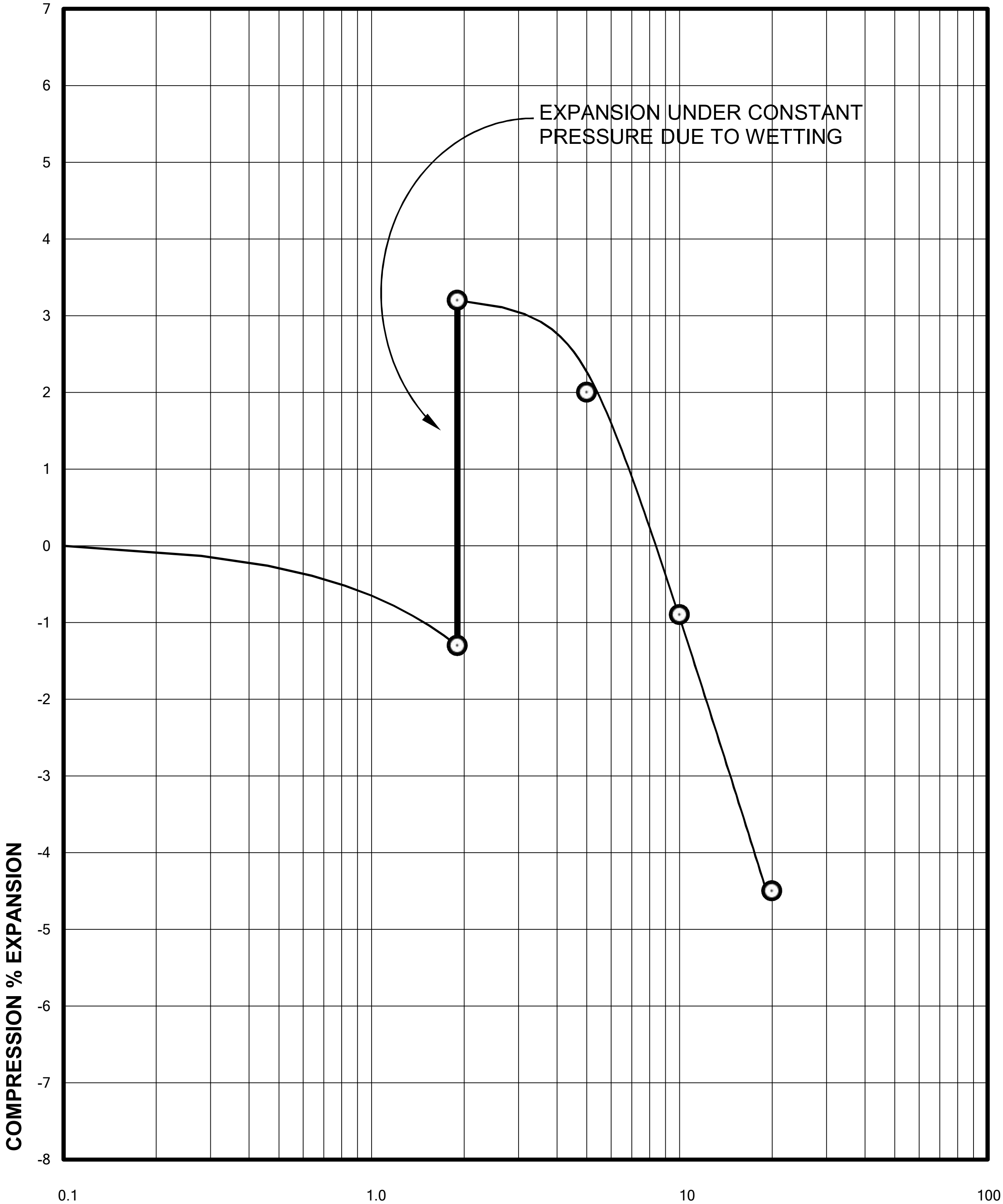
MOISTURE CONTENT= 14.2 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-48

DRAFT



Sample of CLAY, SANDY (CL)
From TH-26 AT 9 FEET

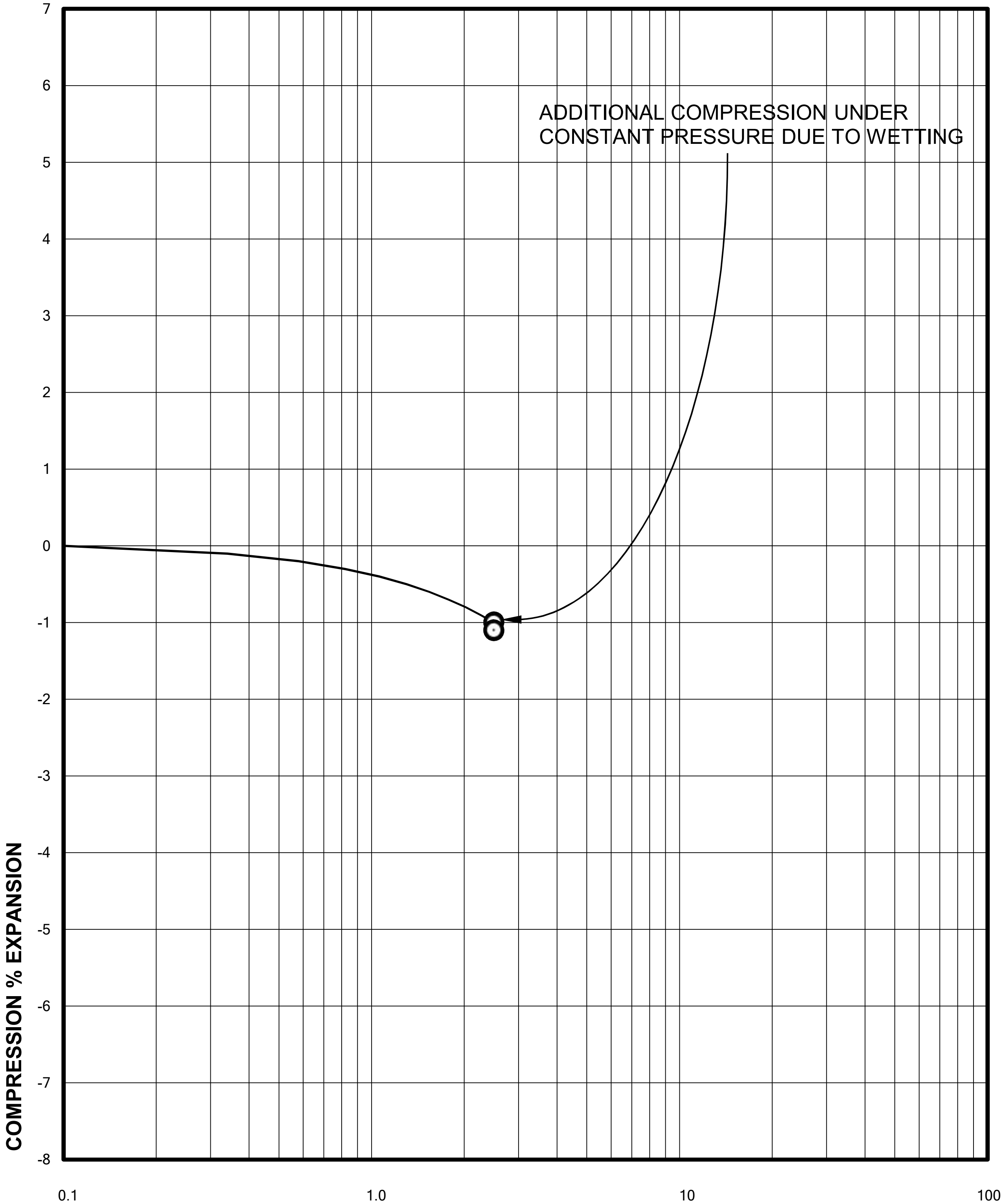
DRY UNIT WEIGHT= 105 PCF
MOISTURE CONTENT= 18.4 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-49

DRAFT



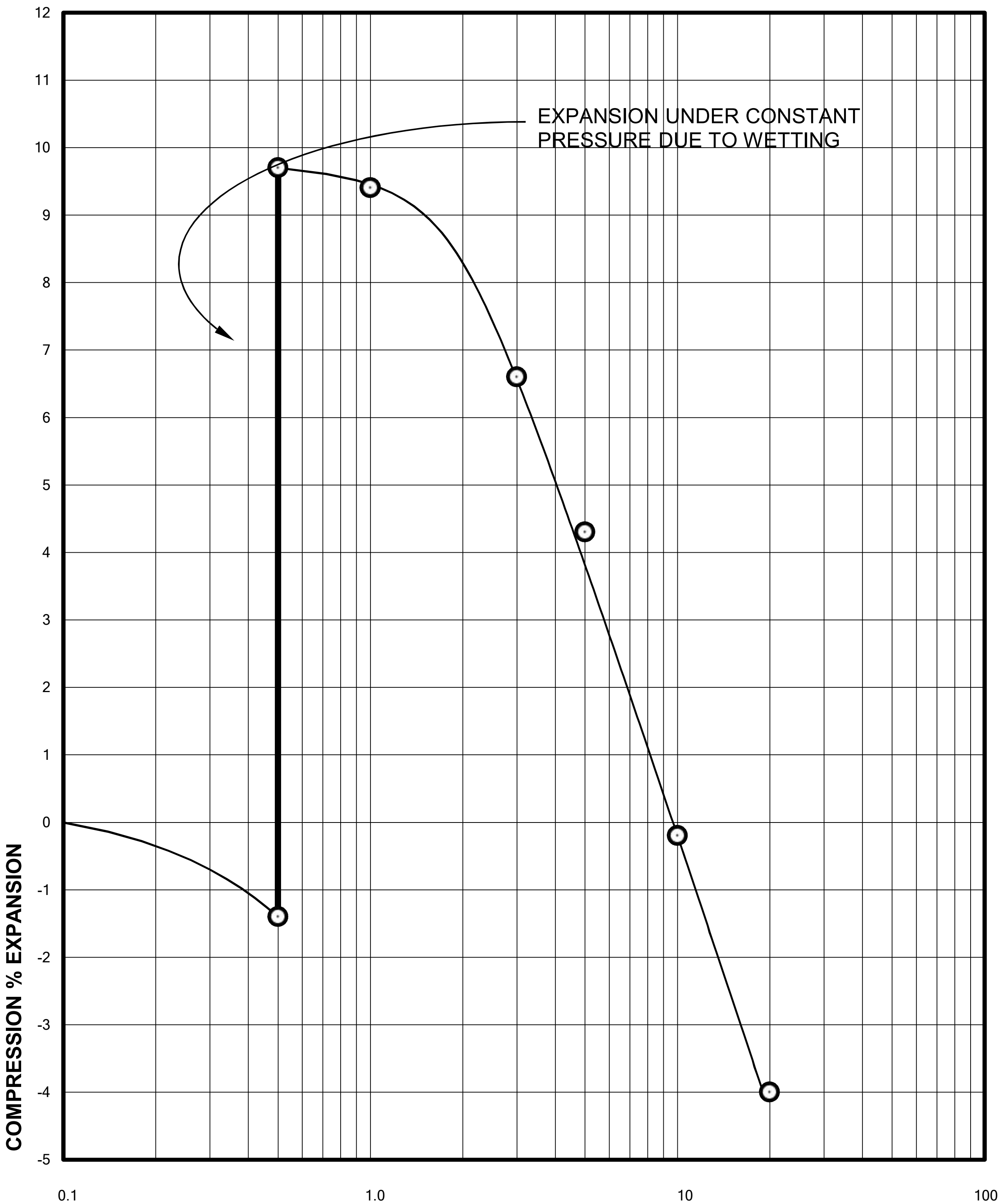
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	87	PCF
From	TH-26 AT 14 FEET	MOISTURE CONTENT=	32.6	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-50

DRAFT



Sample of CLAY, SANDY (CL)

From TH-27 AT 4 FEET

DRY UNIT WEIGHT= 106 PCF

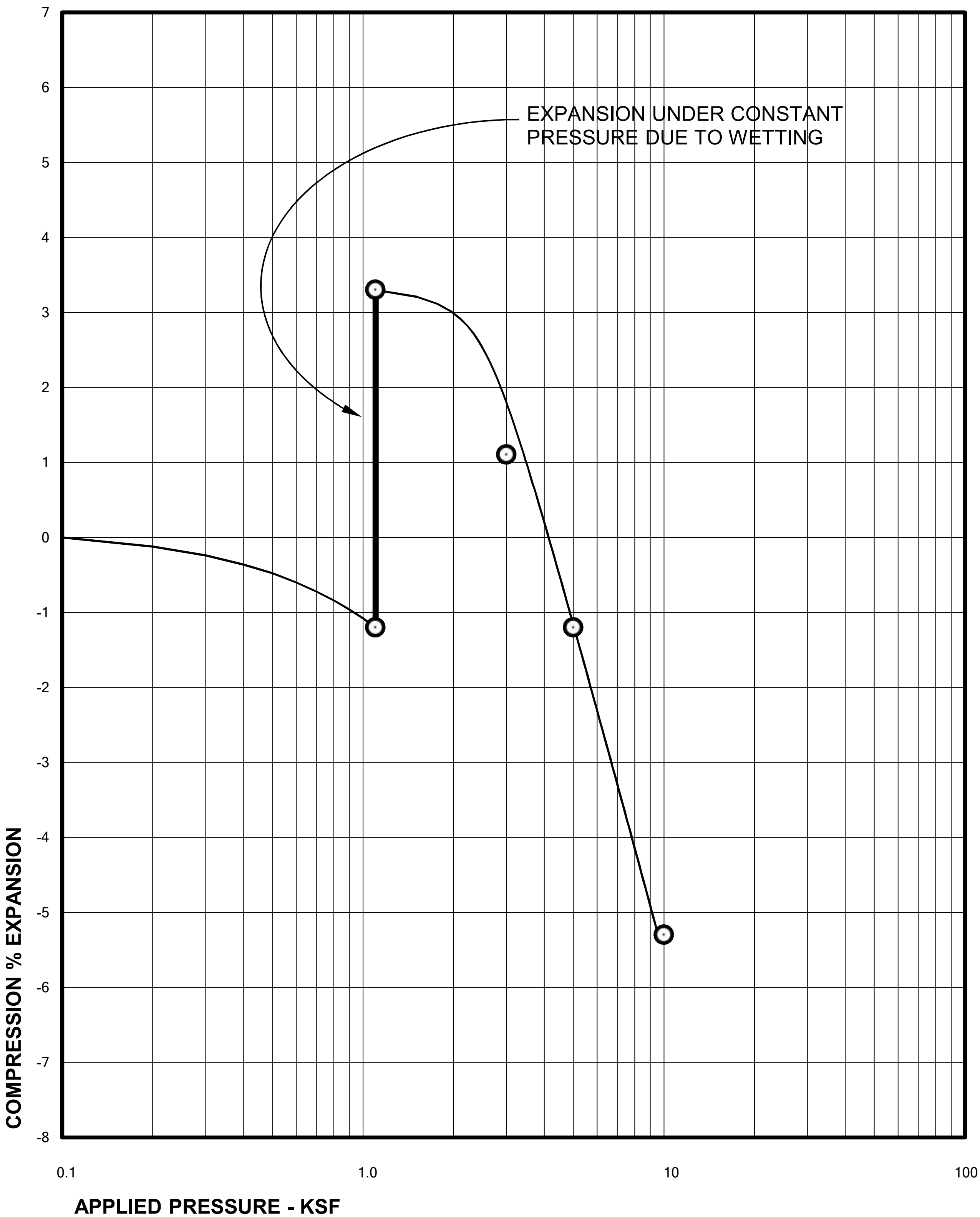
MOISTURE CONTENT= 13.6 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-51

DRAFT



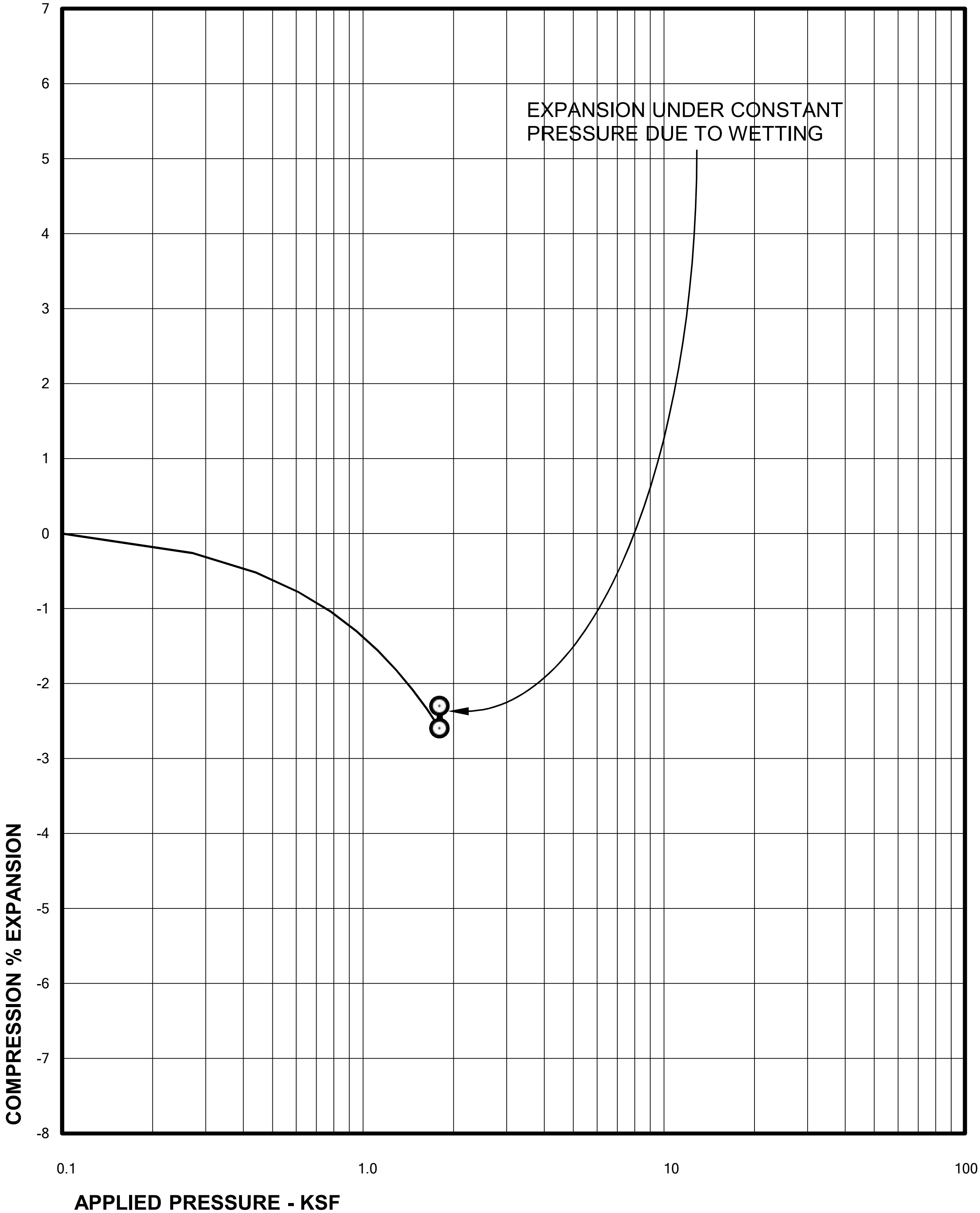
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	94	PCF
From	TH-27 AT 9 FEET	MOISTURE CONTENT=	21.1	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-52

DRAFT



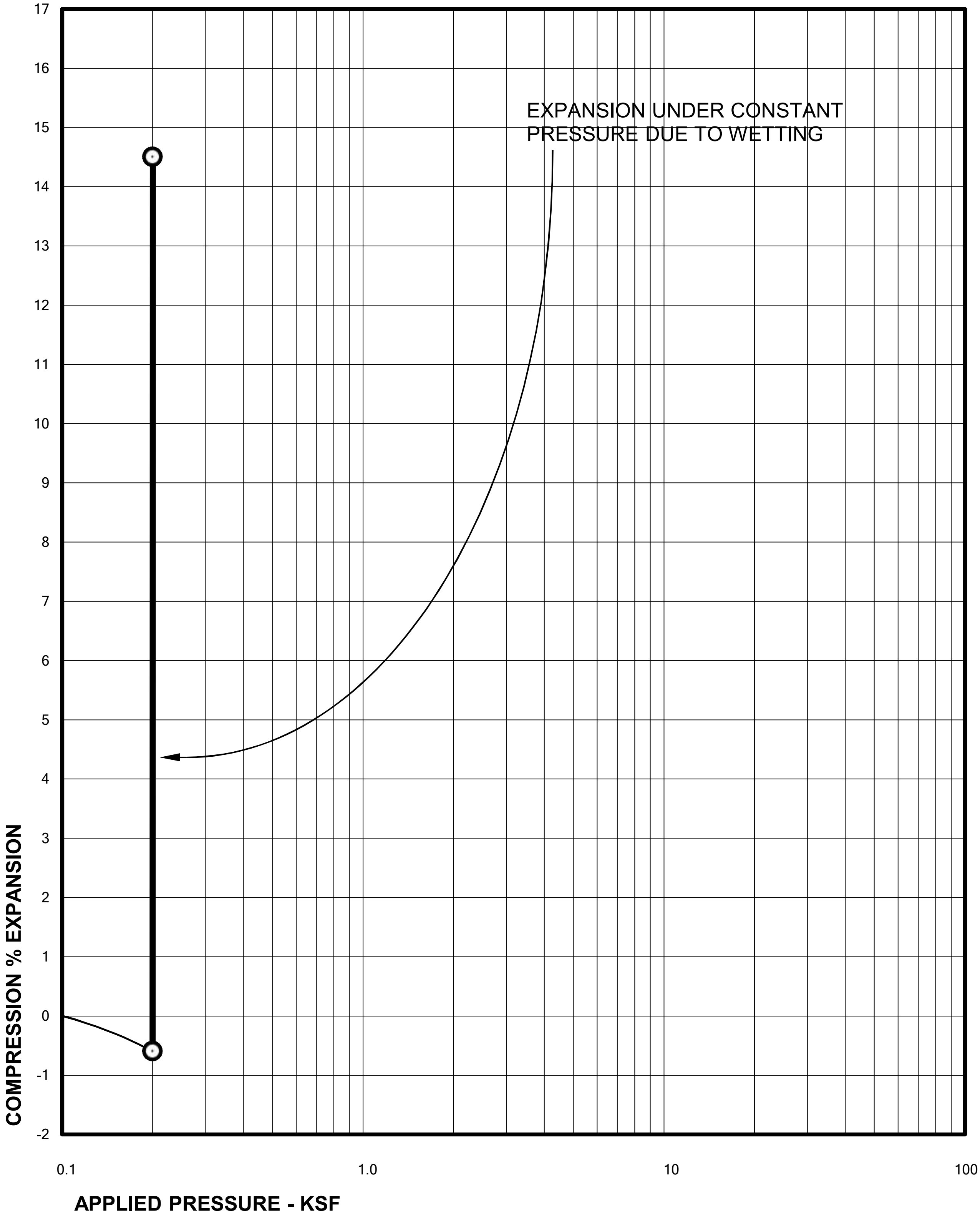
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	97	PCF
From	TH-27 AT 14 FEET	MOISTURE CONTENT=	21.0	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-53

DRAFT



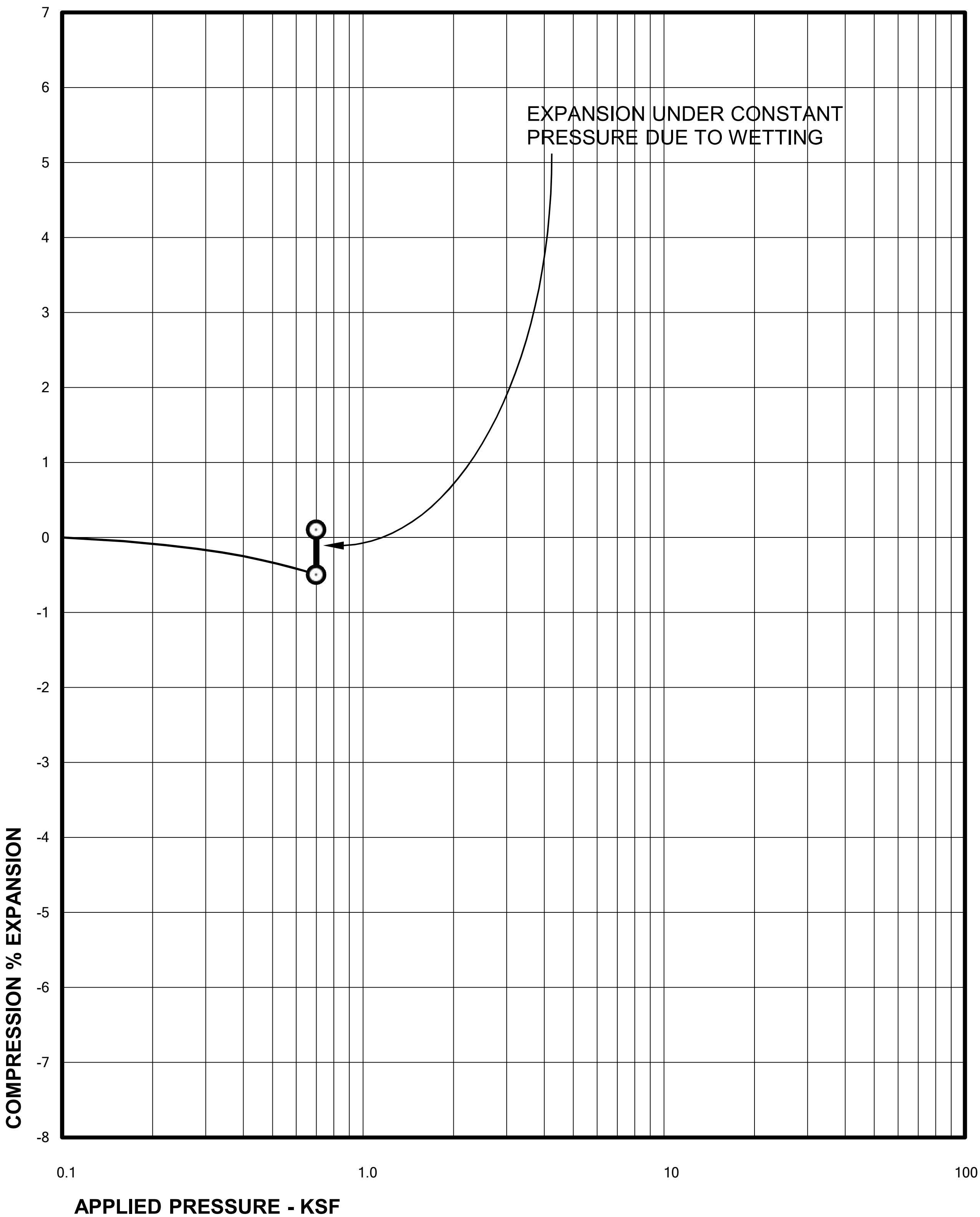
Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	107	PCF
From	TH-28 AT 4 FEET	MOISTURE CONTENT=	13.4	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-54

DRAFT



Sample of CLAYSTONE
From TH-28 AT 9 FEET

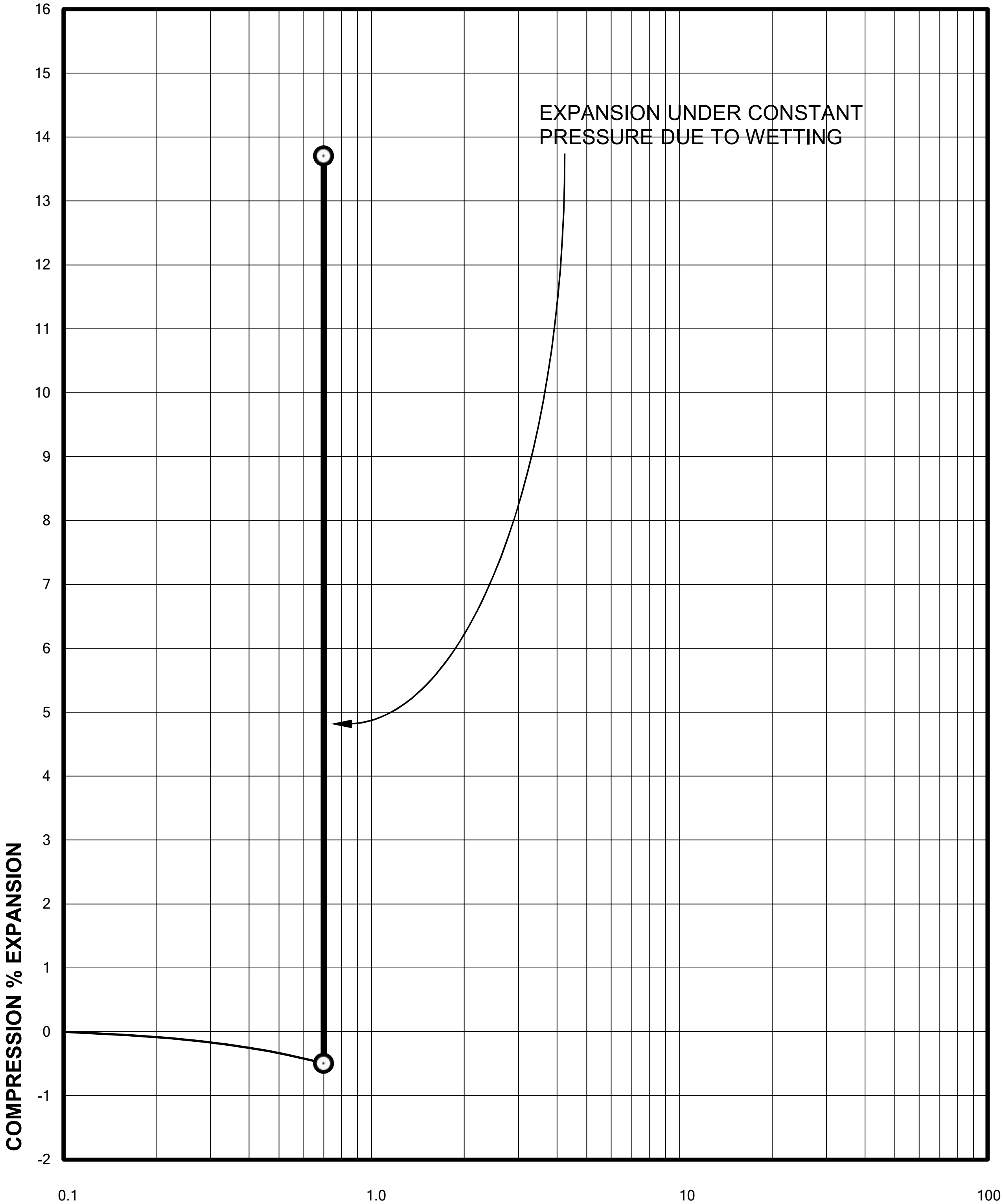
DRY UNIT WEIGHT= 105 PCF
MOISTURE CONTENT= 19.6 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-55

DRAFT



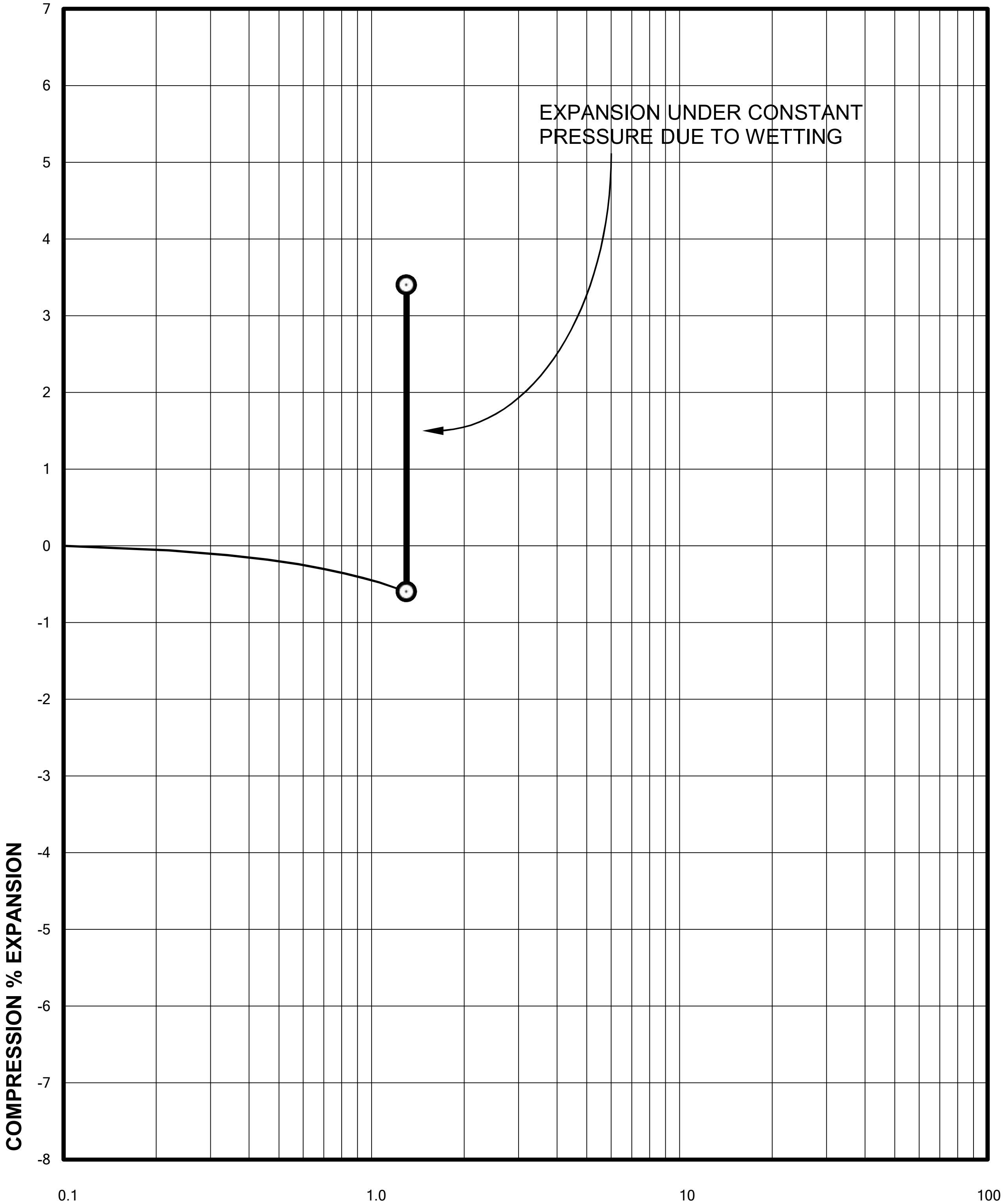
Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	116	PCF
From	TH-29 AT 4 FEET	MOISTURE CONTENT=	13.7	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-56

DRAFT



Sample of CLAYSTONE

From TH-29 AT 9 FEET

DRY UNIT WEIGHT= 101 PCF

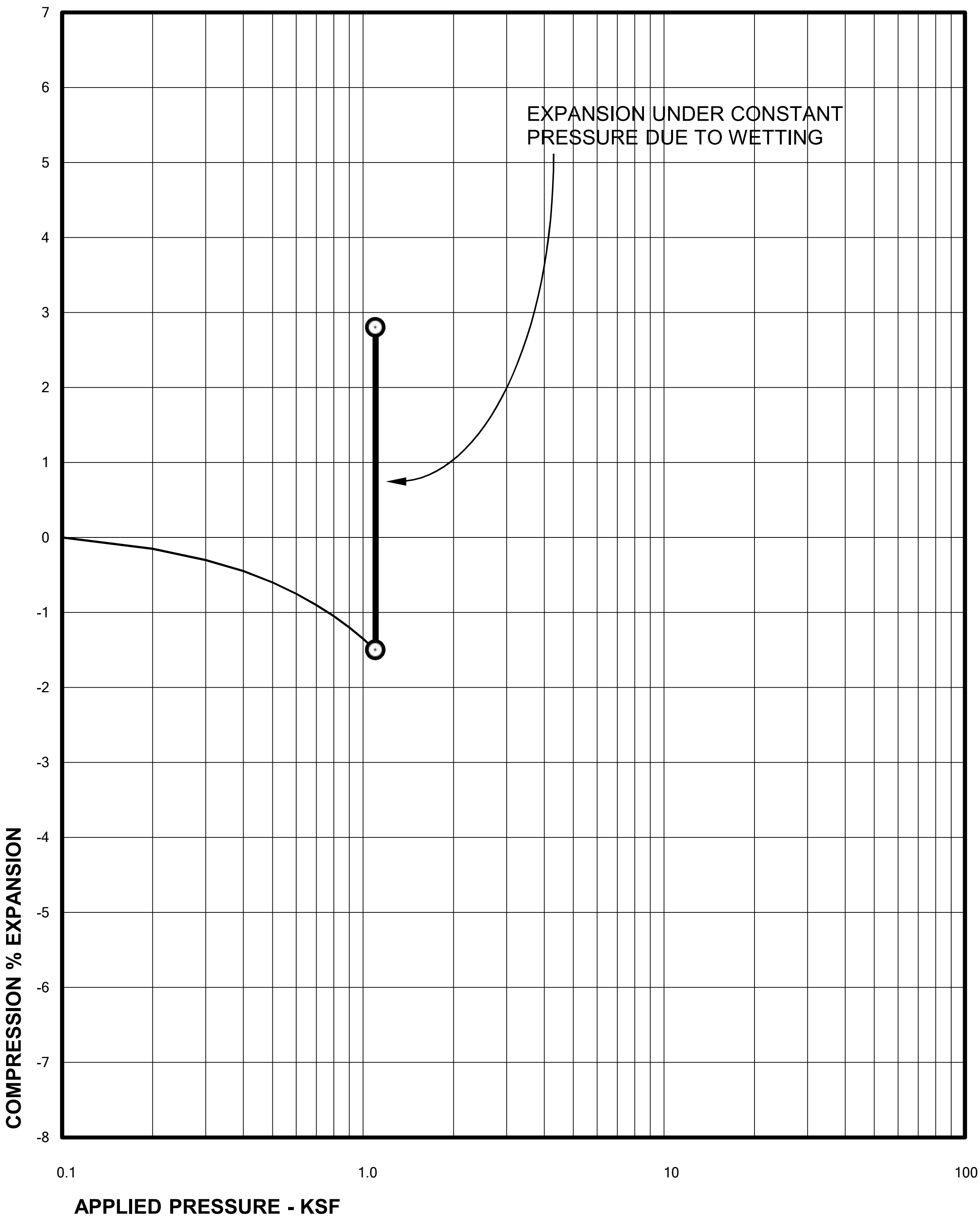
MOISTURE CONTENT= 21.3 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-57

DRAFT



Sample of CLAY, SANDY (CL)

From TH-30 AT 19 FEET

DRY UNIT WEIGHT= 106 PCF

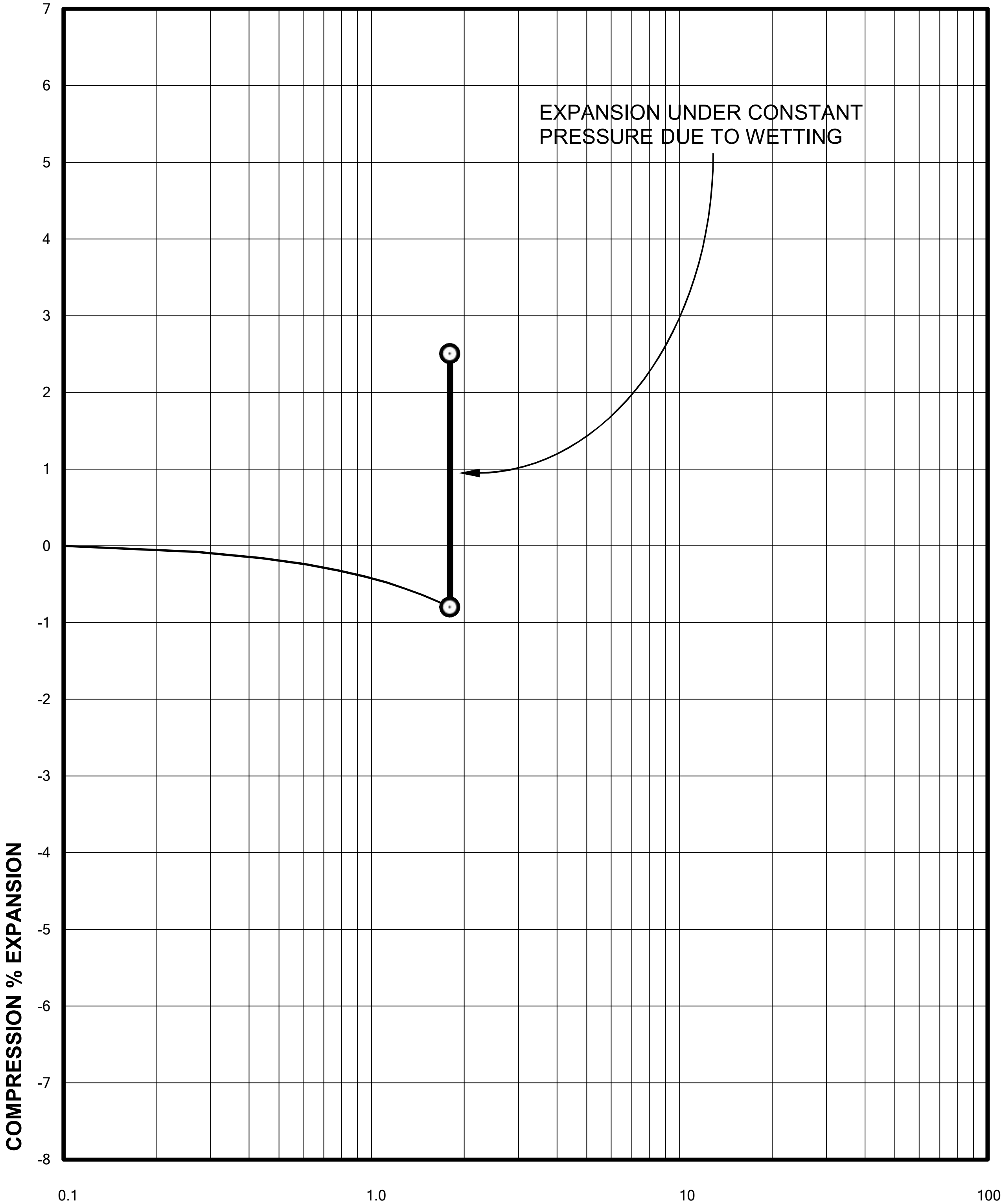
MOISTURE CONTENT= 19.2 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-58

DRAFT

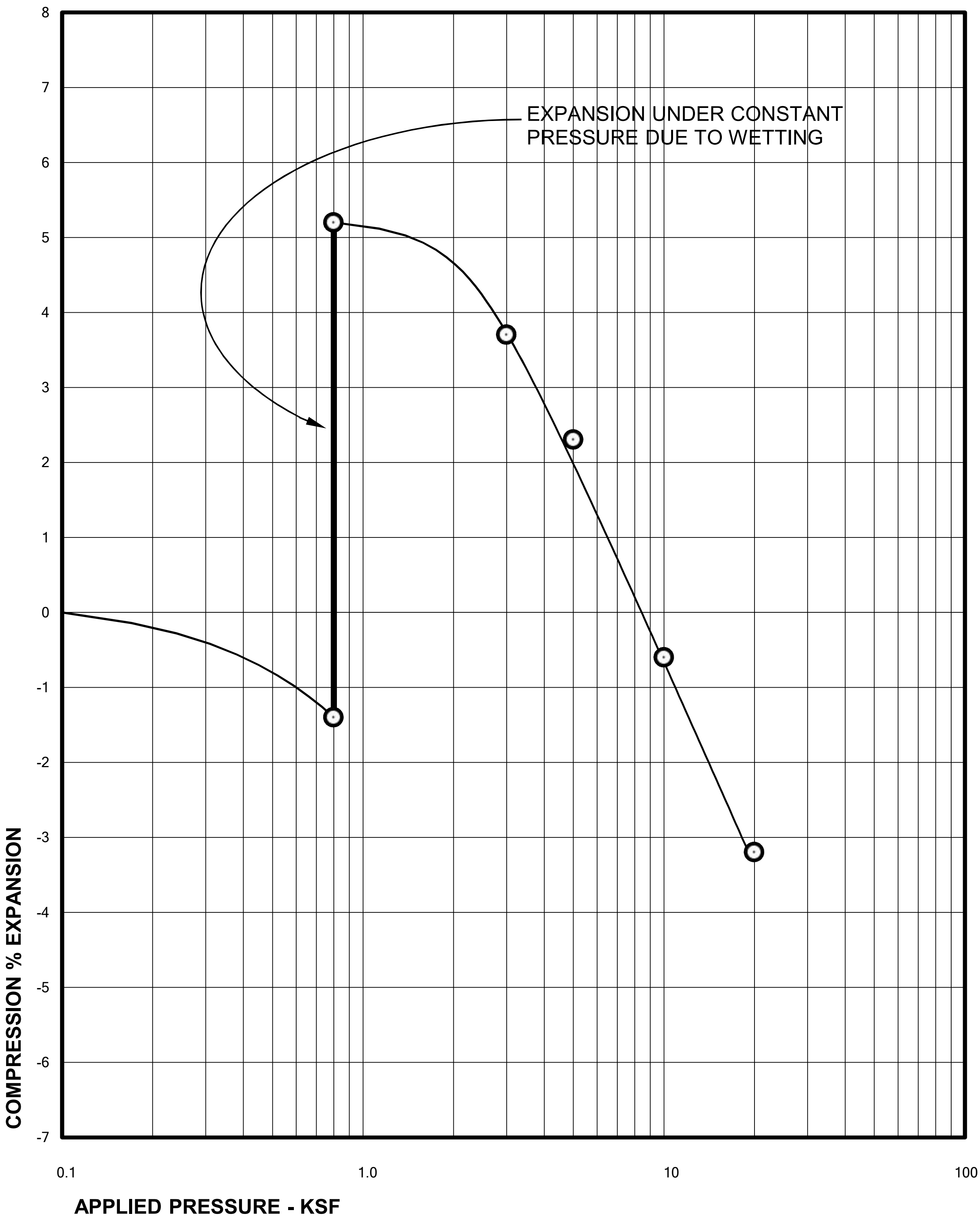


Sample of	CLAYSTONE	DRY UNIT WEIGHT=	85	PCF
From	TH-30 AT 24 FEET	MOISTURE CONTENT=	33.3	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-59



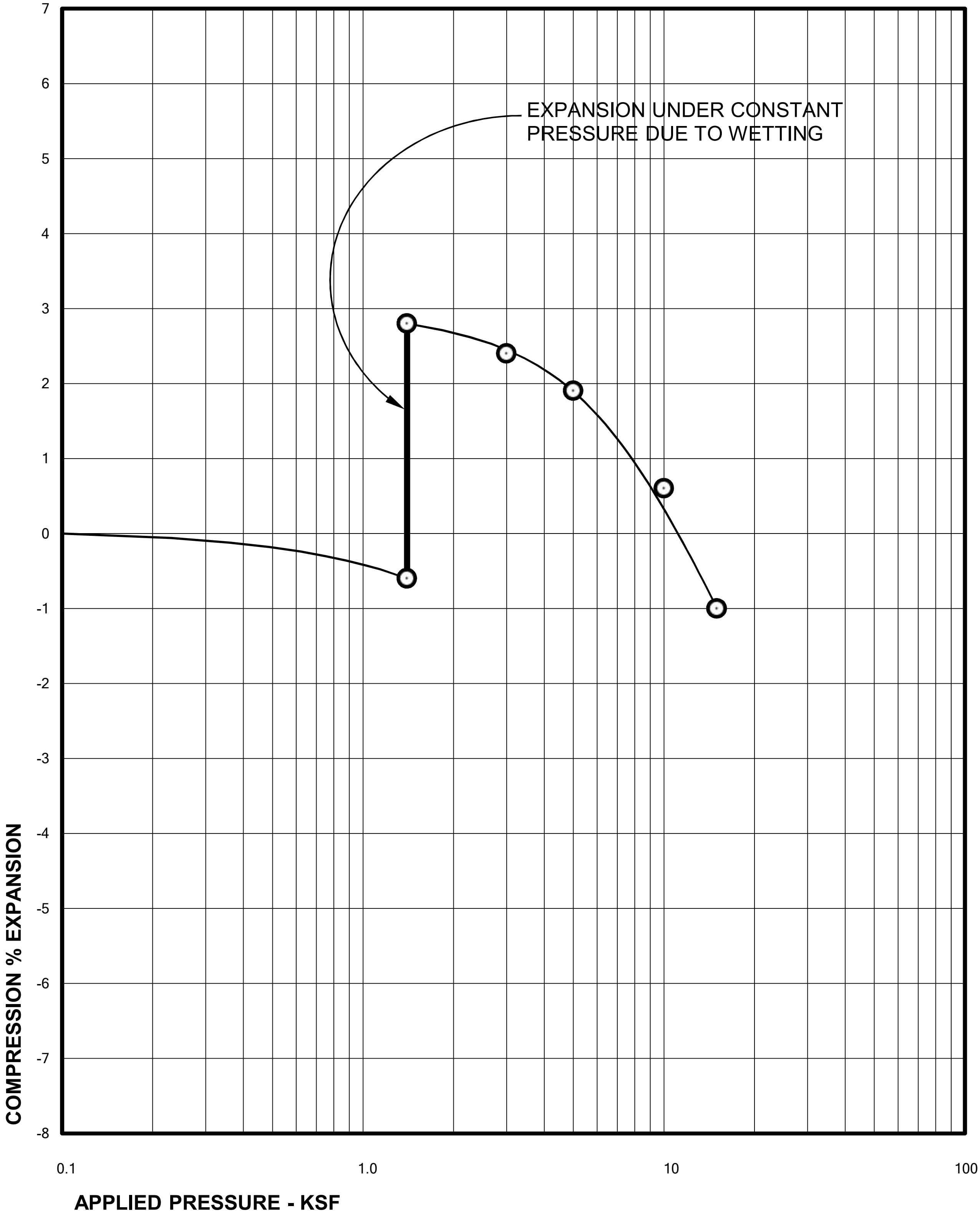
Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	103	PCF
From	TH-31 AT 9 FEET	MOISTURE CONTENT=	18.3	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-60

DRAFT

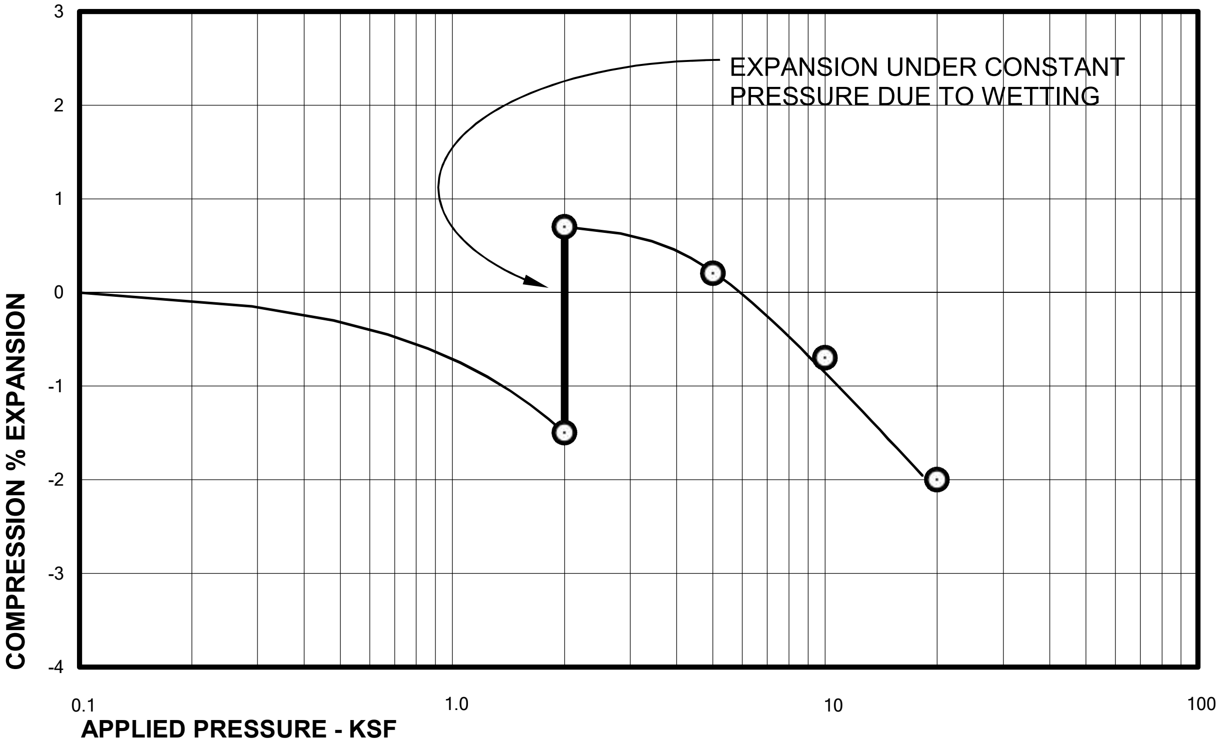


Sample of	CLAYSTONE		DRY UNIT WEIGHT=	90	PCF
From	TH-31 AT 14 FEET		MOISTURE CONTENT=	31.5	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-61

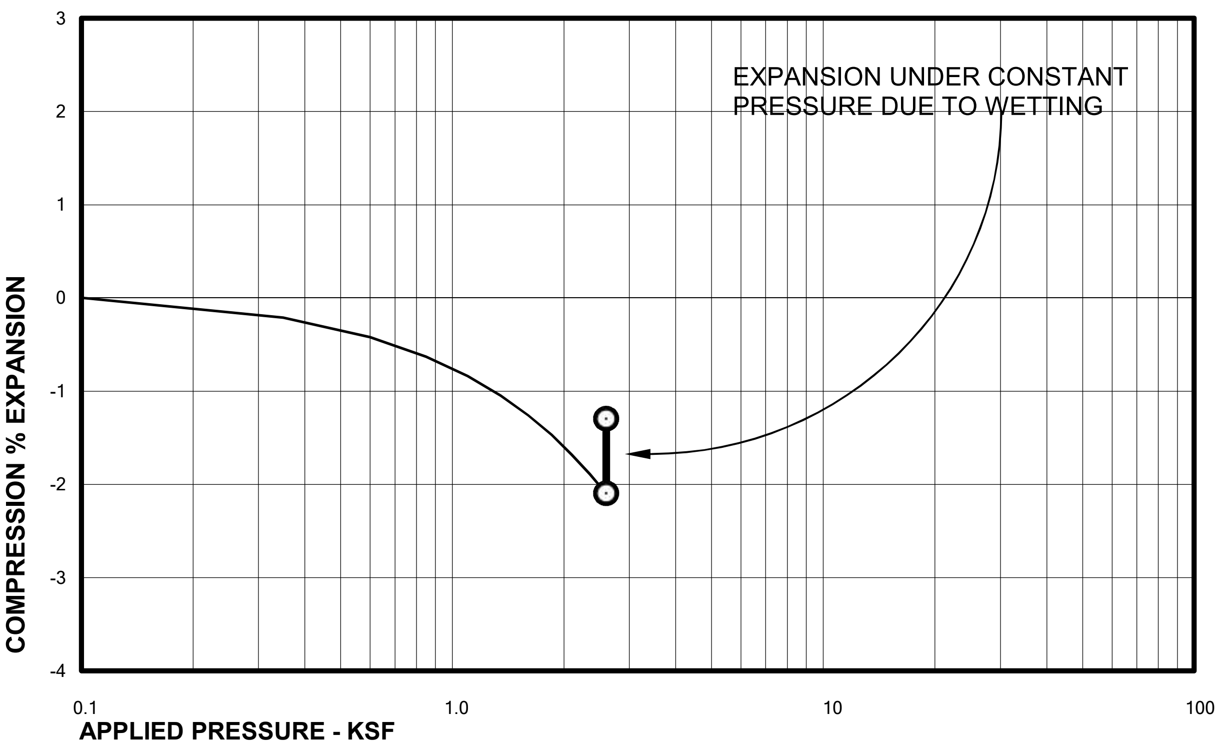


Sample of CLAYSTONE

From TH-31 AT 19 FEET

DRY UNIT WEIGHT= 90 PCF

MOISTURE CONTENT= 31.6 %



Sample of CLAYSTONE

From TH-31 AT 24 FEET

DRY UNIT WEIGHT= 88 PCF

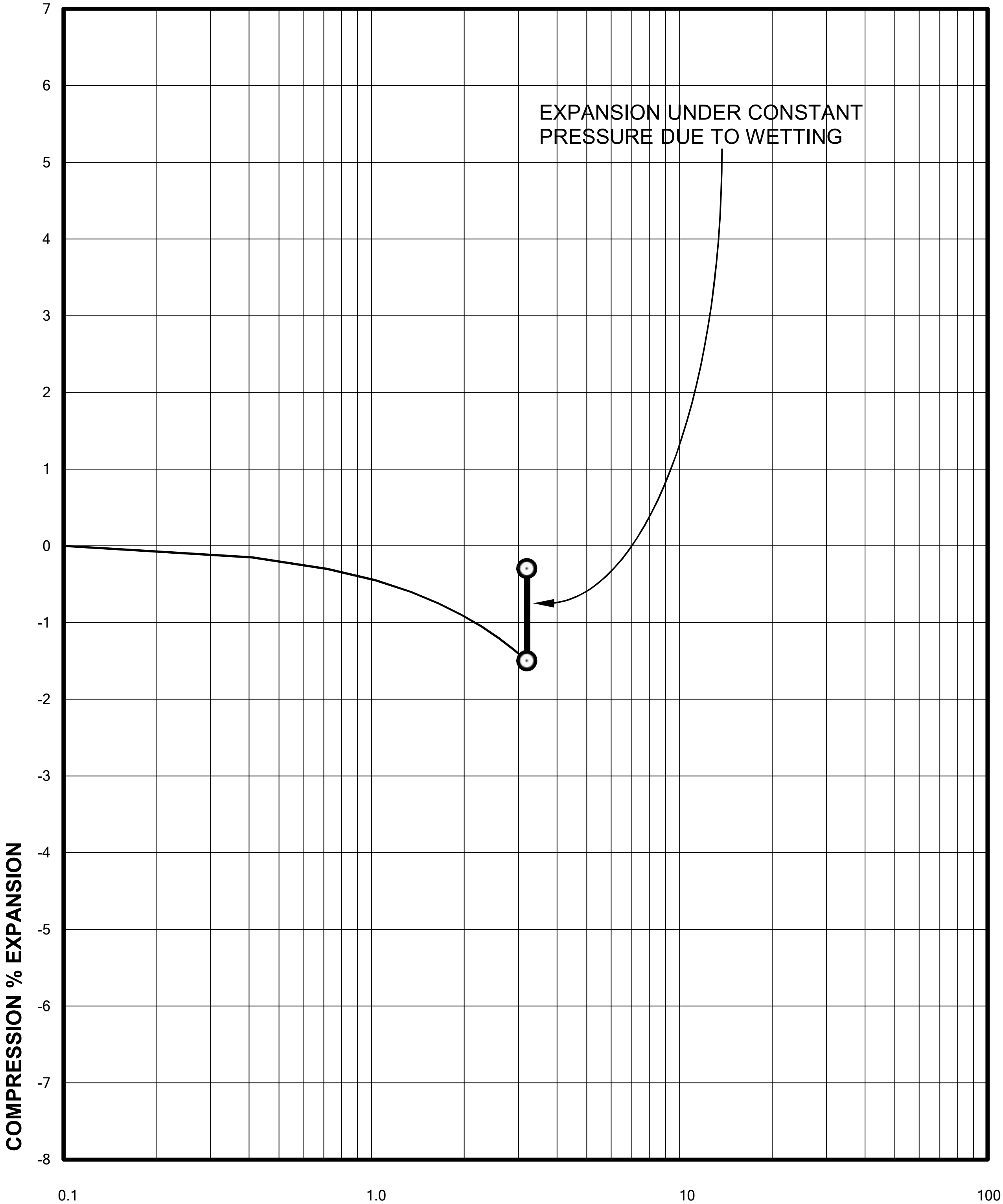
MOISTURE CONTENT= 32.8 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-62

DRAFT



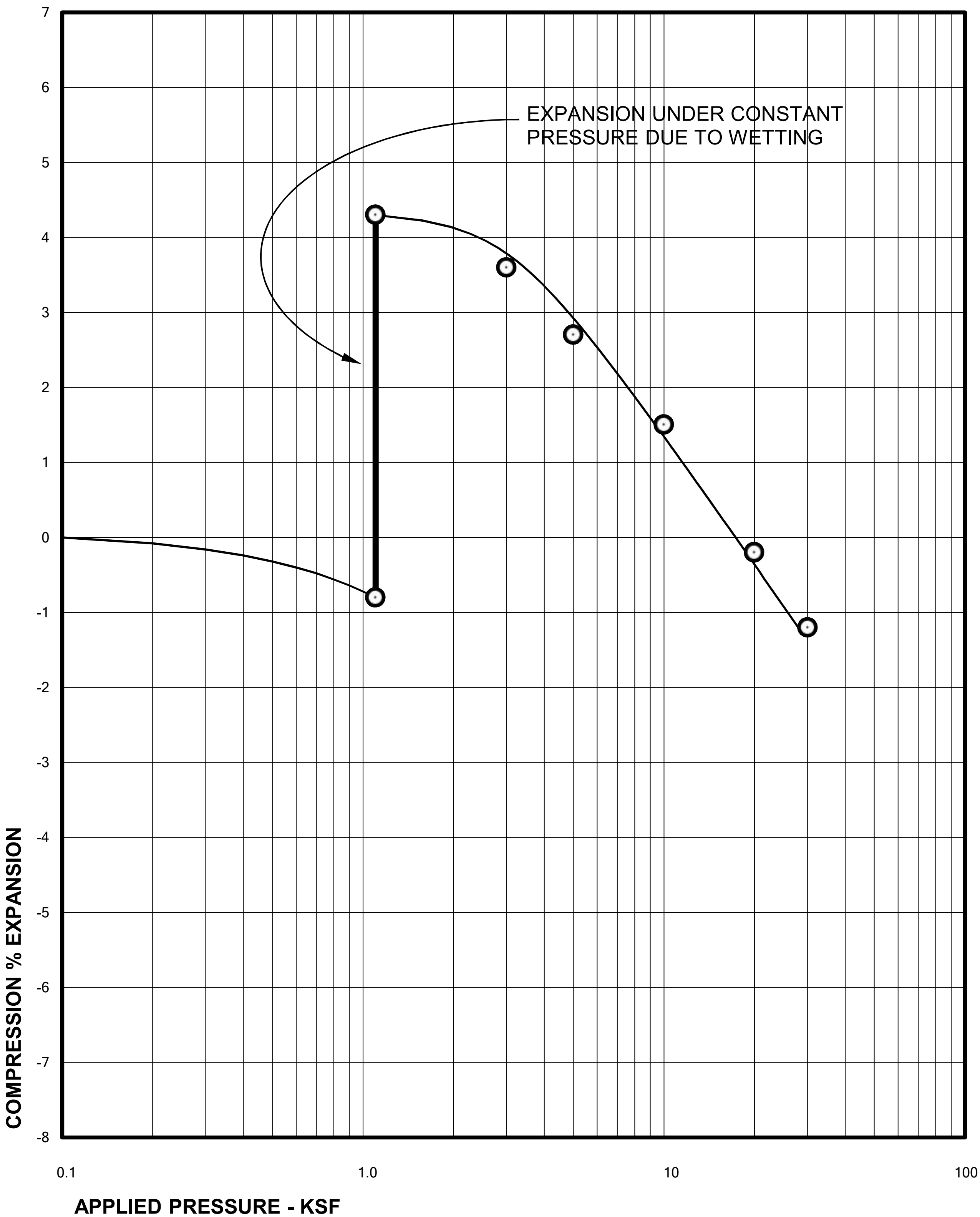
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	85	PCF
From	TH-31 AT 29 FEET	MOISTURE CONTENT=	34.6	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-63

DRAFT



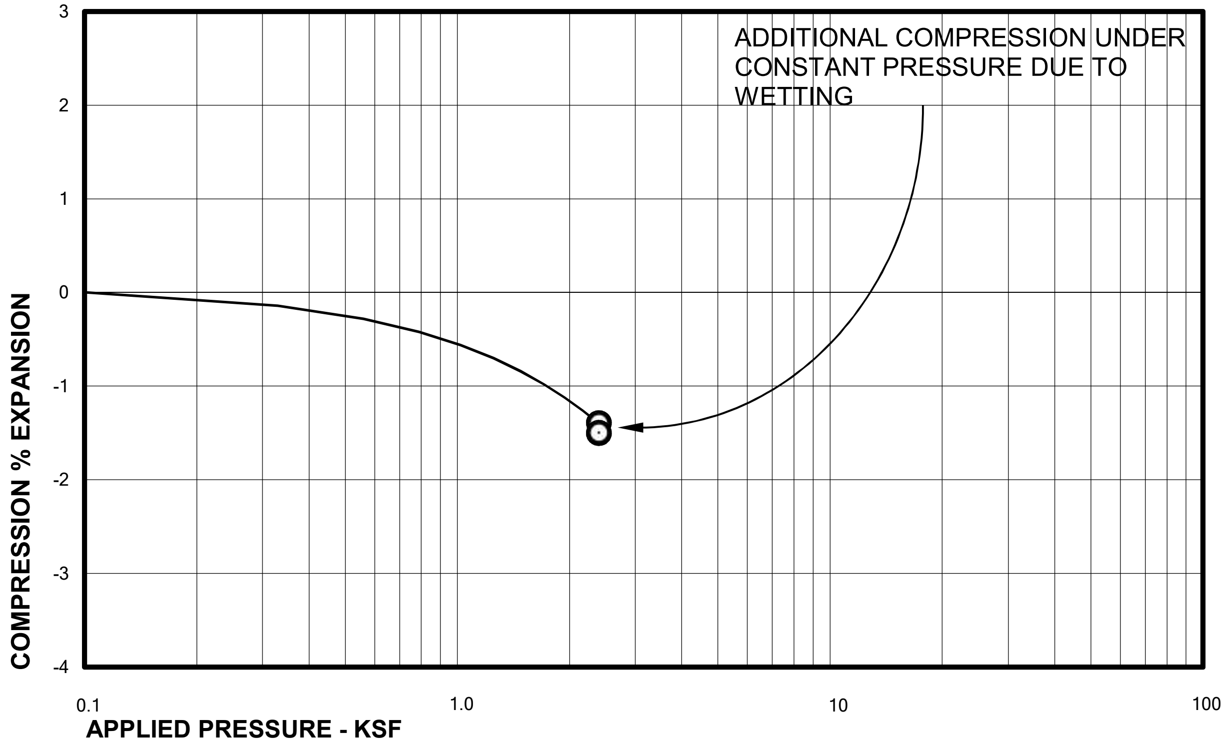
Sample of	WEATHERED CLAYSTONE	DRY UNIT WEIGHT=	89	PCF
From	TH-32 AT 4 FEET	MOISTURE CONTENT=	31.5	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

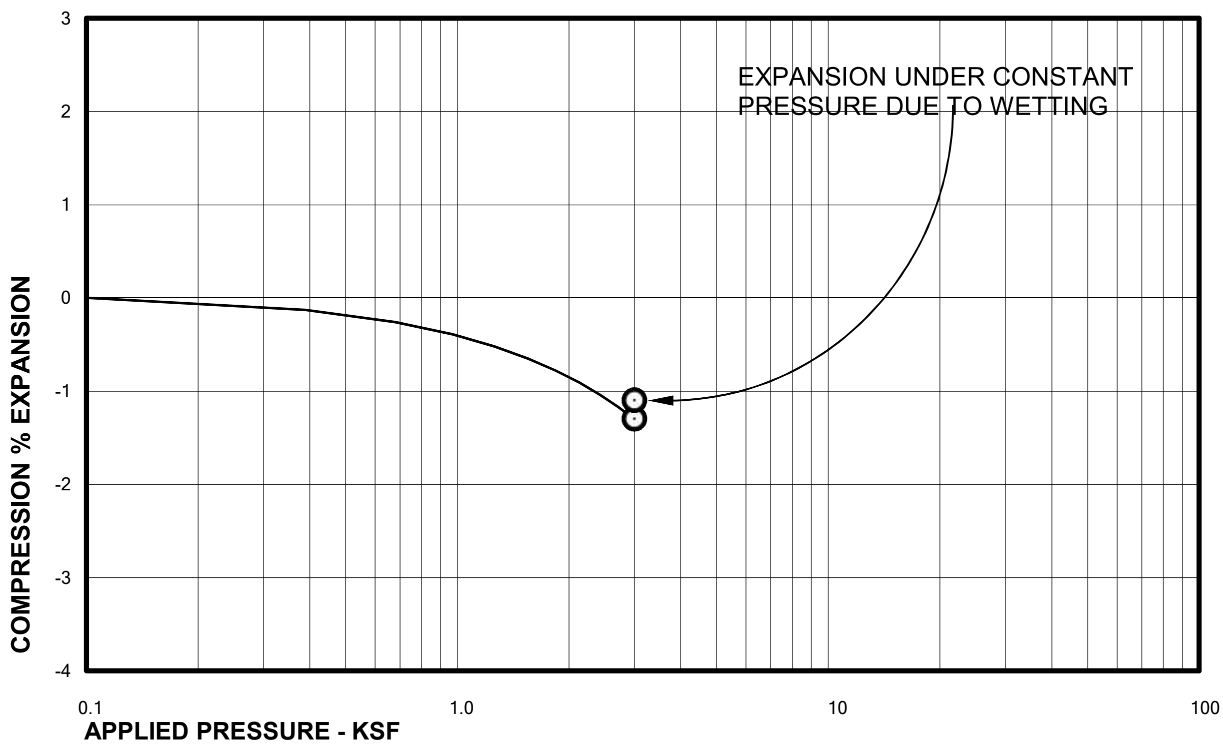
Swell Consolidation Test Results

FIG. B-64

DRAFT



Sample of	WEATHERED CLAYSTONE	DRY UNIT WEIGHT=	87	PCF
From	TH-32 AT 14 FEET	MOISTURE CONTENT=	31.9	%



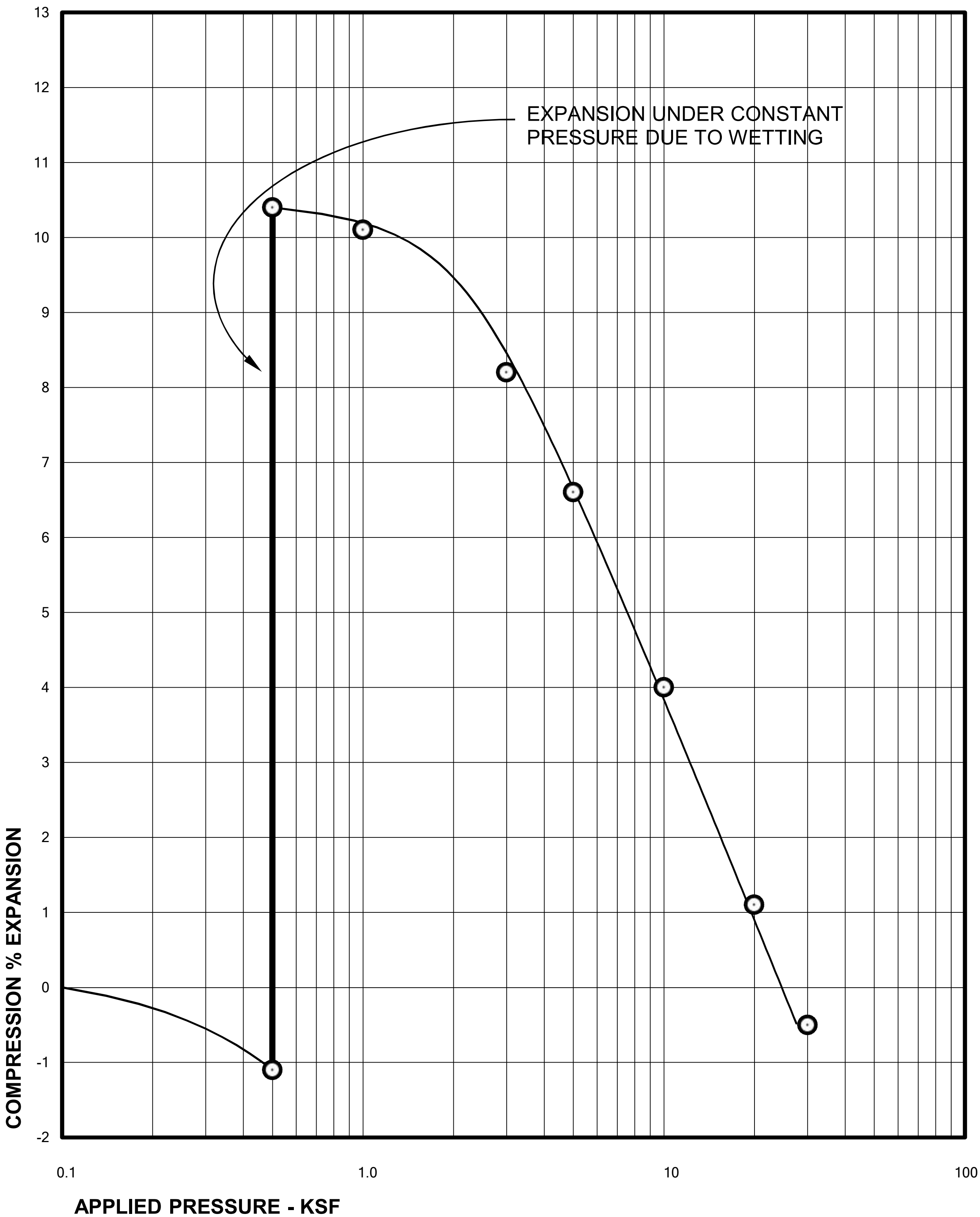
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	89	PCF
From	TH-32 AT 19 FEET	MOISTURE CONTENT=	32.8	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-65

DRAFT



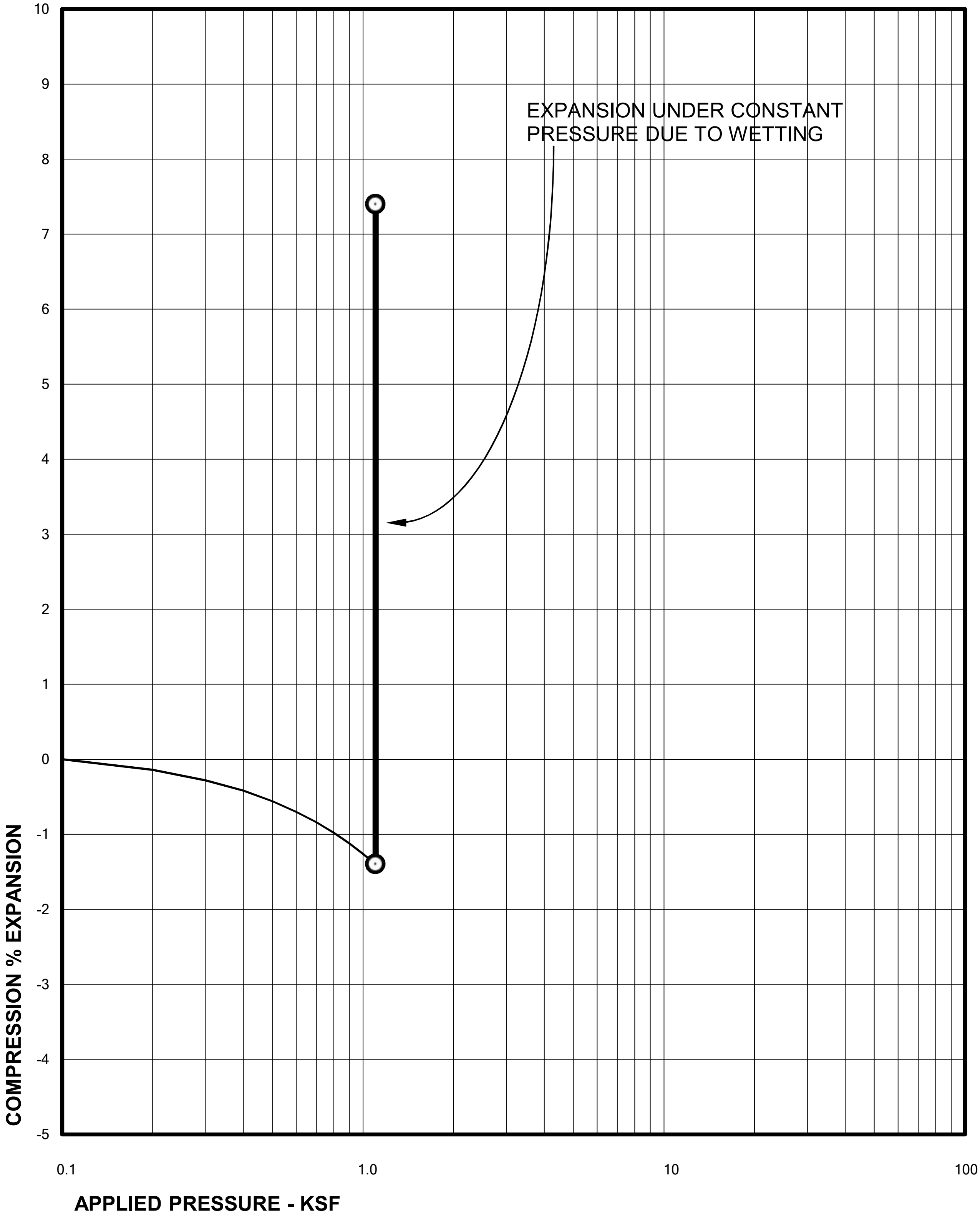
Sample of	CLAY, SANDY (CL)		DRY UNIT WEIGHT=	109	PCF
From	TH-33 AT 4 FEET		MOISTURE CONTENT=	13.9	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-66

DRAFT



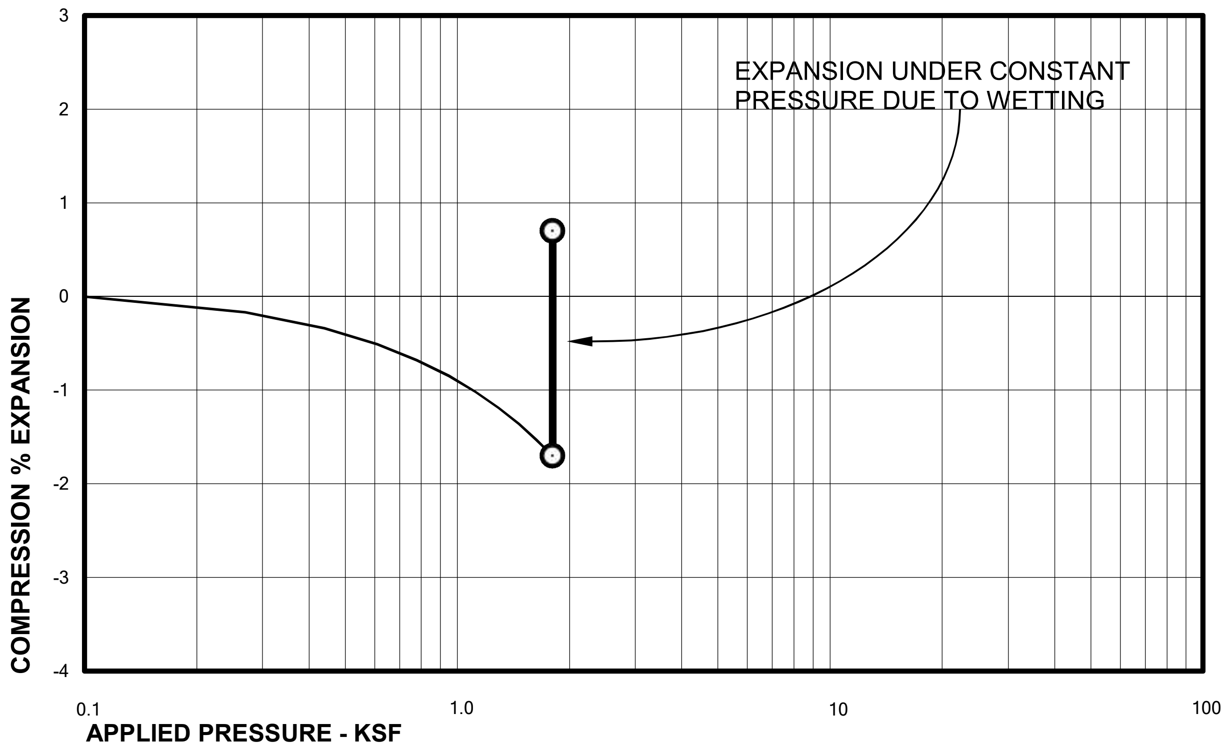
Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	105	PCF
From	TH-33 AT 9 FEET	MOISTURE CONTENT=	18.2	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

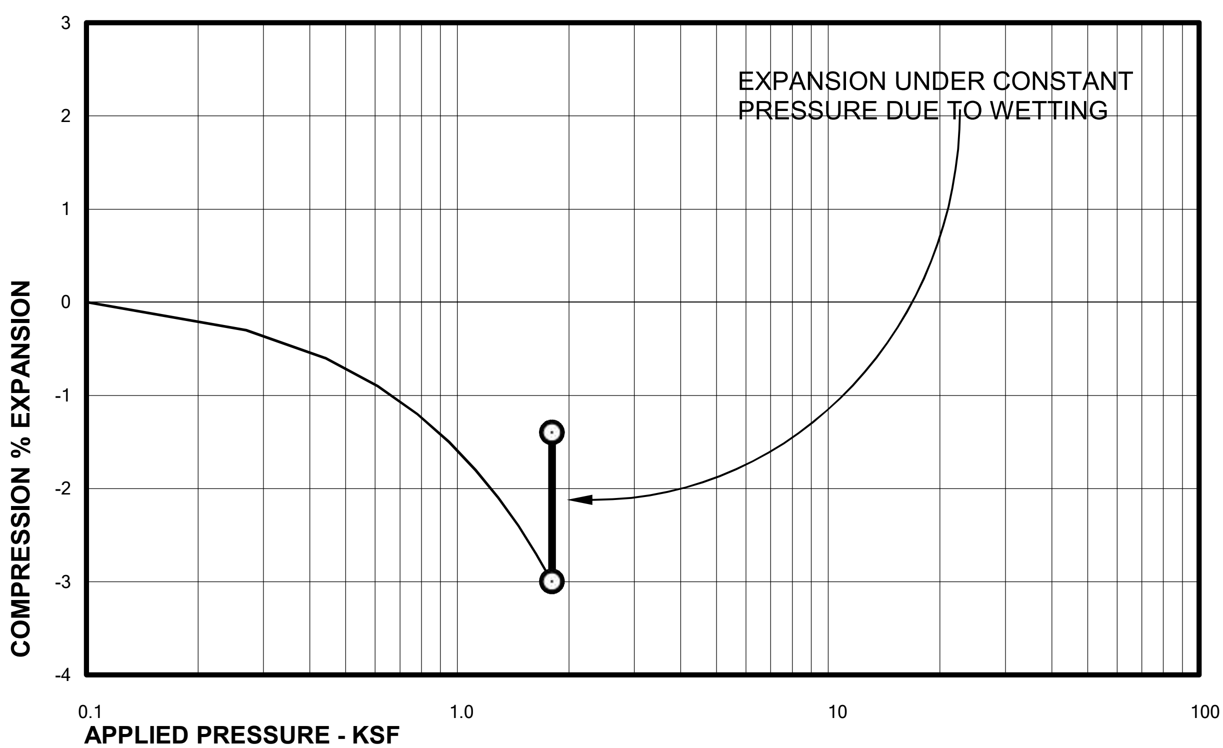
Swell Consolidation Test Results

FIG. B-67

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	97	PCF
From	TH-33 AT 14 FEET	MOISTURE CONTENT=	23.6	%



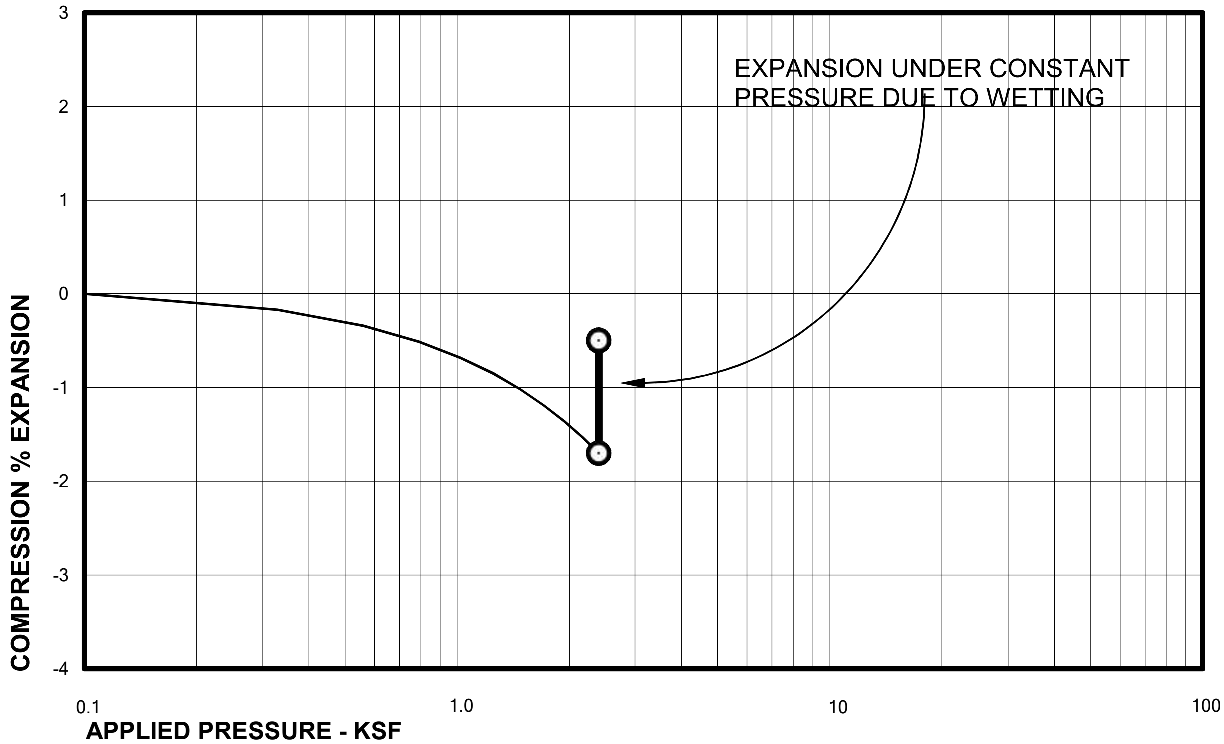
Sample of	WEATHERED CLAYSTONE	DRY UNIT WEIGHT=	85	PCF
From	TH-34 AT 9 FEET	MOISTURE CONTENT=	32.1	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

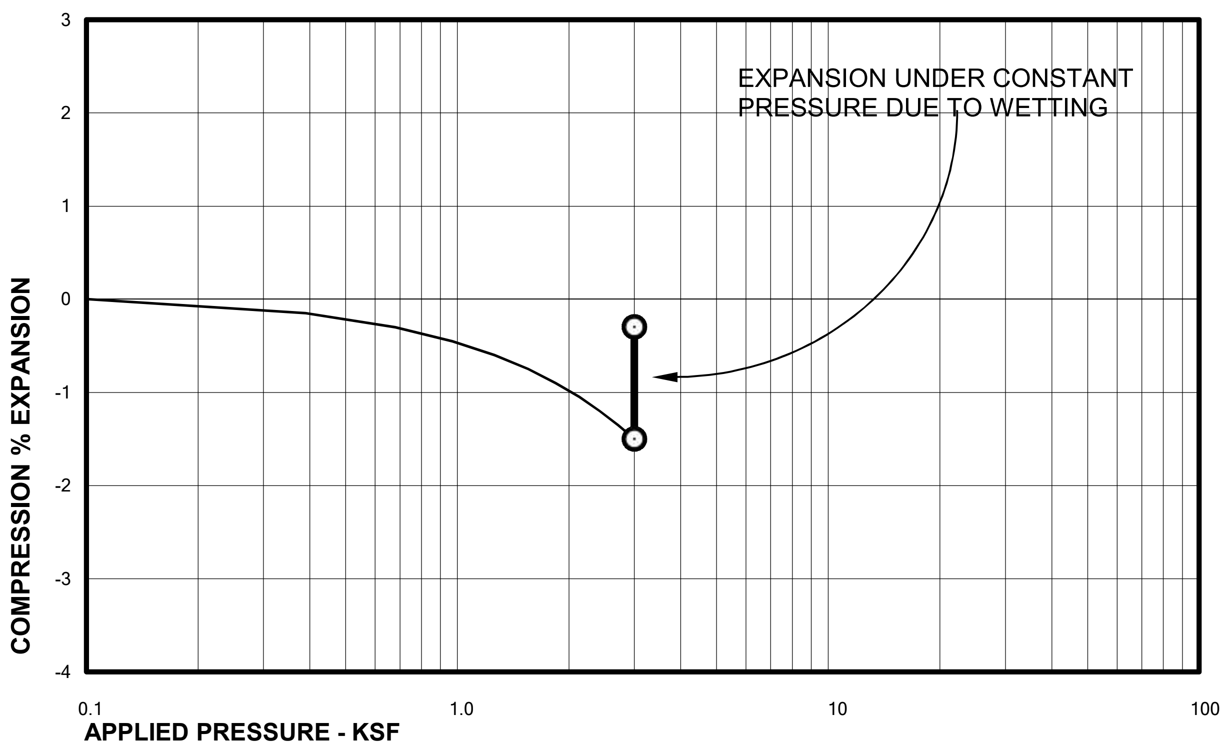
Swell Consolidation Test Results

FIG. B-68

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	92	PCF
From	TH-34 AT 14 FEET	MOISTURE CONTENT=	29.9	%



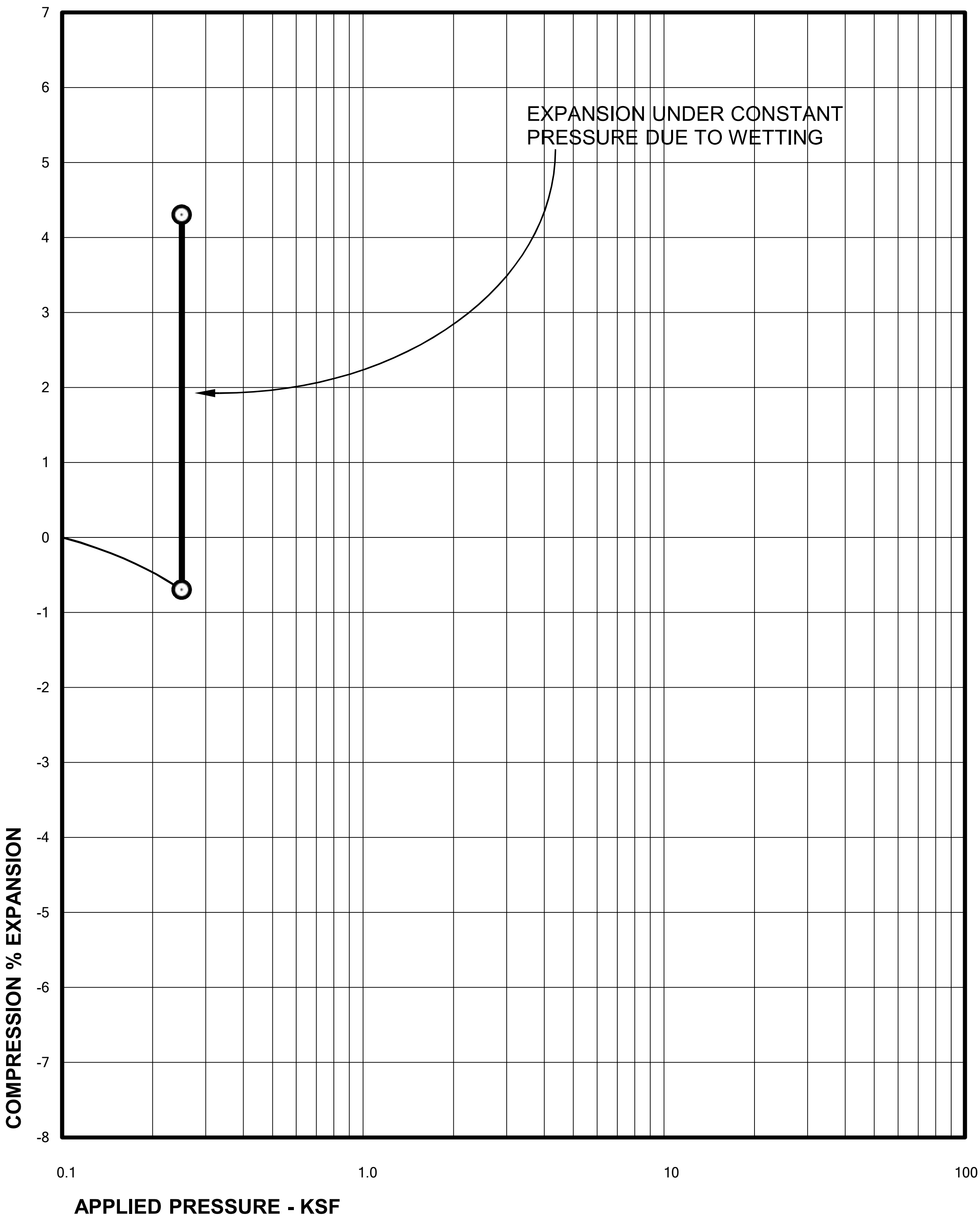
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	93	PCF
From	TH-34 AT 19 FEET	MOISTURE CONTENT=	30.8	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-69

DRAFT



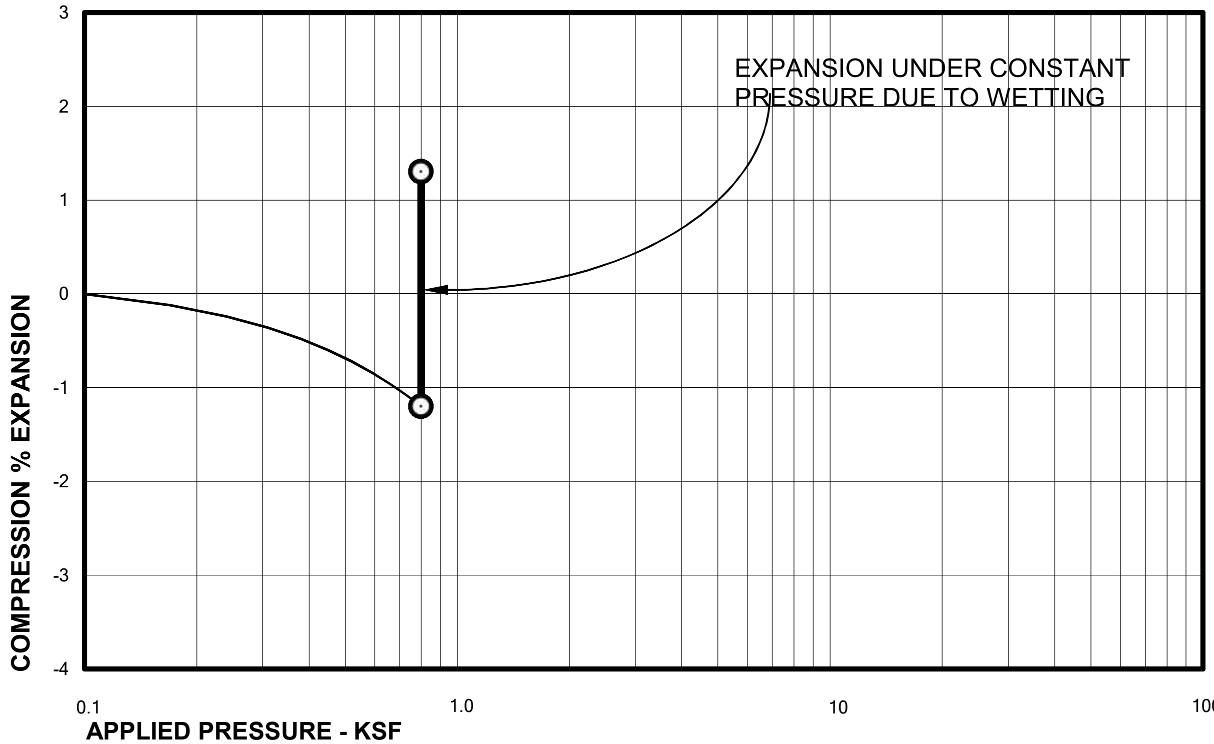
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	101	PCF
From	TH-35 AT 9 FEET	MOISTURE CONTENT=	22.4	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

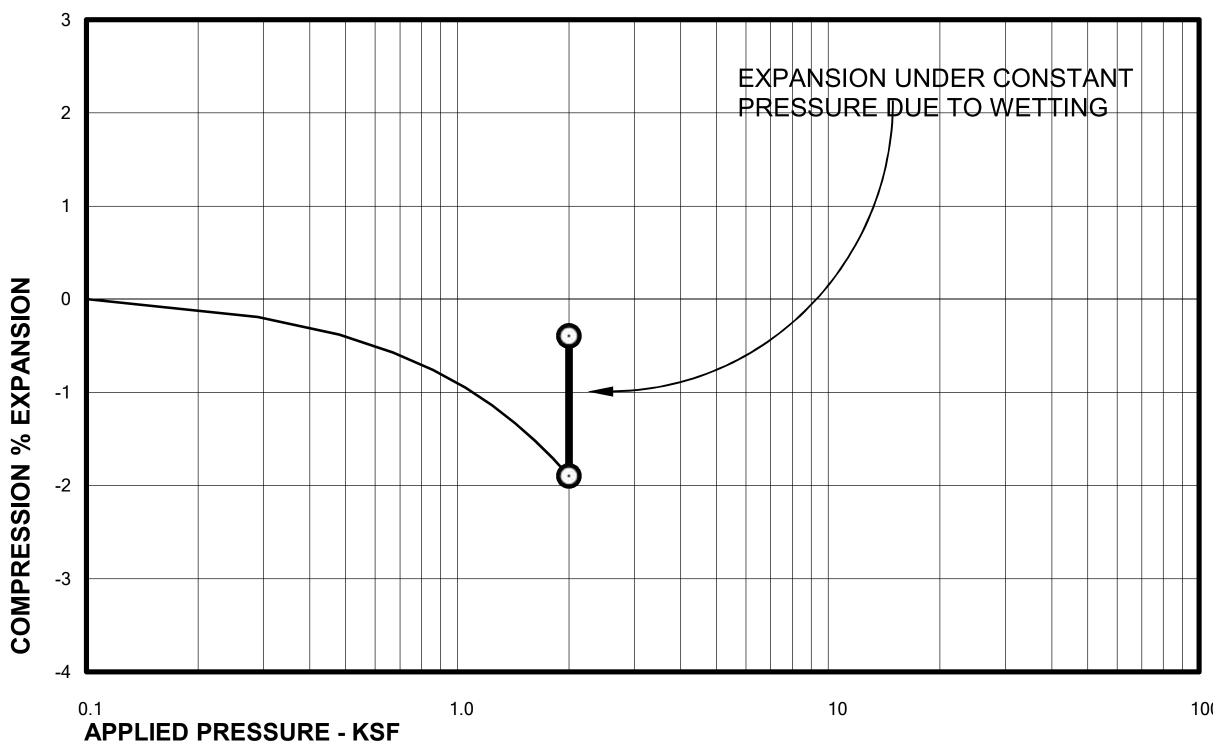
Swell Consolidation Test Results

FIG. B-70

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	100	PCF
From	TH-35 AT 14 FEET	MOISTURE CONTENT=	23.2	%



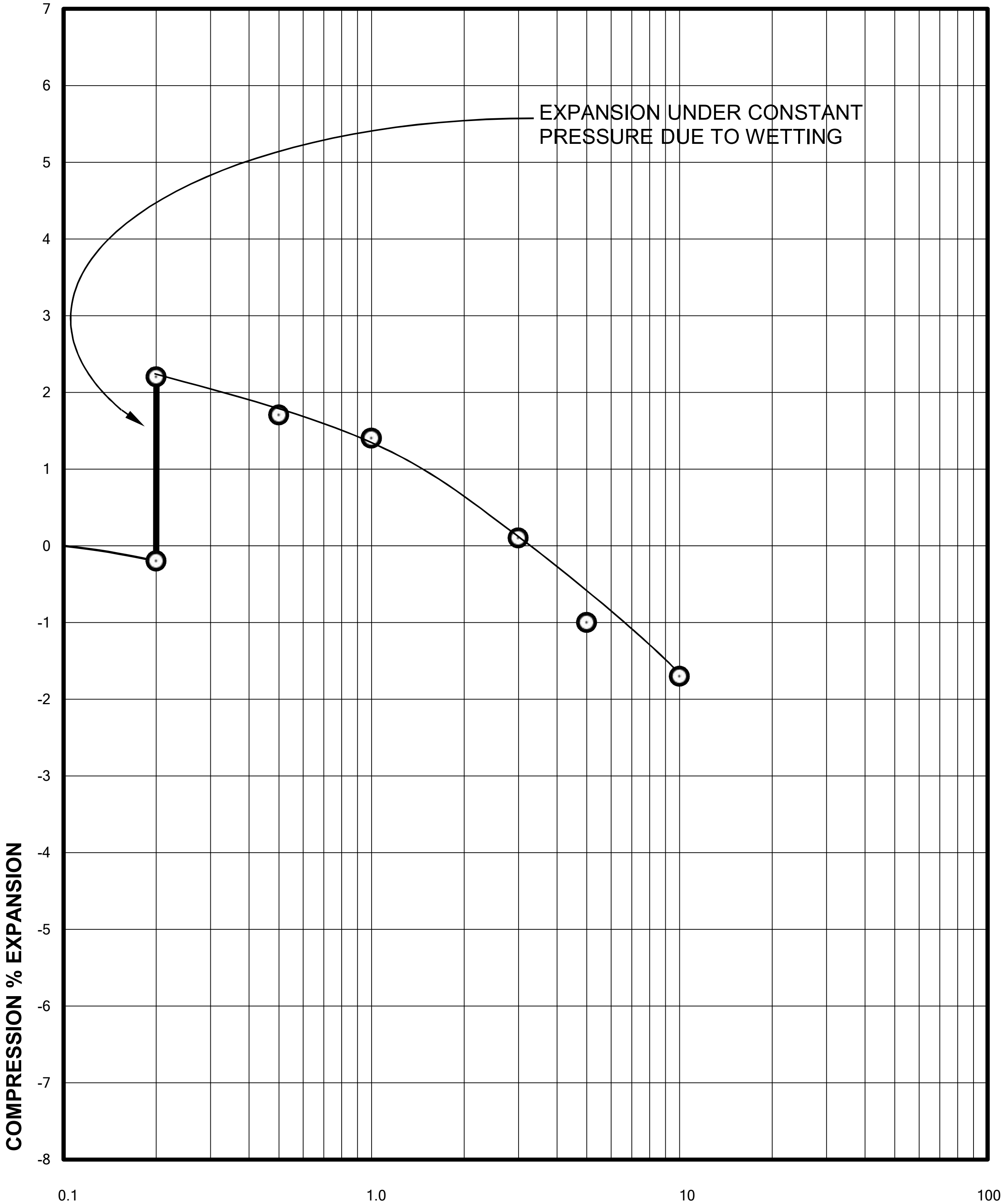
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	93	PCF
From	TH-35 AT 24 FEET	MOISTURE CONTENT=	24.9	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-71

DRAFT



APPLIED PRESSURE - KSF

Sample of INTERBEDDED CLAYSTONE/SANDSTONE

From TH-36 AT 19 FEET

DRY UNIT WEIGHT= 111 PCF

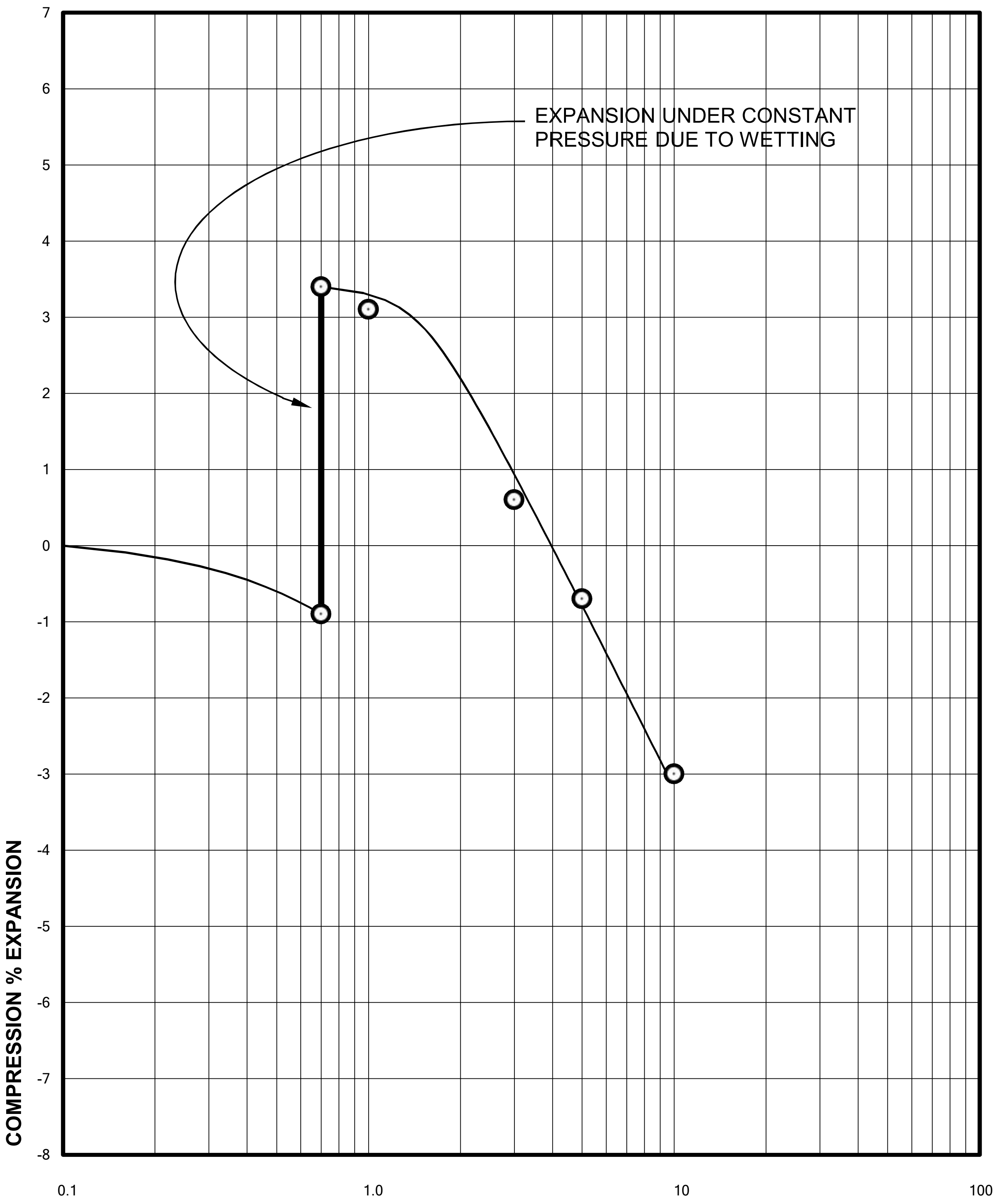
MOISTURE CONTENT= 16.2 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-72

DRAFT



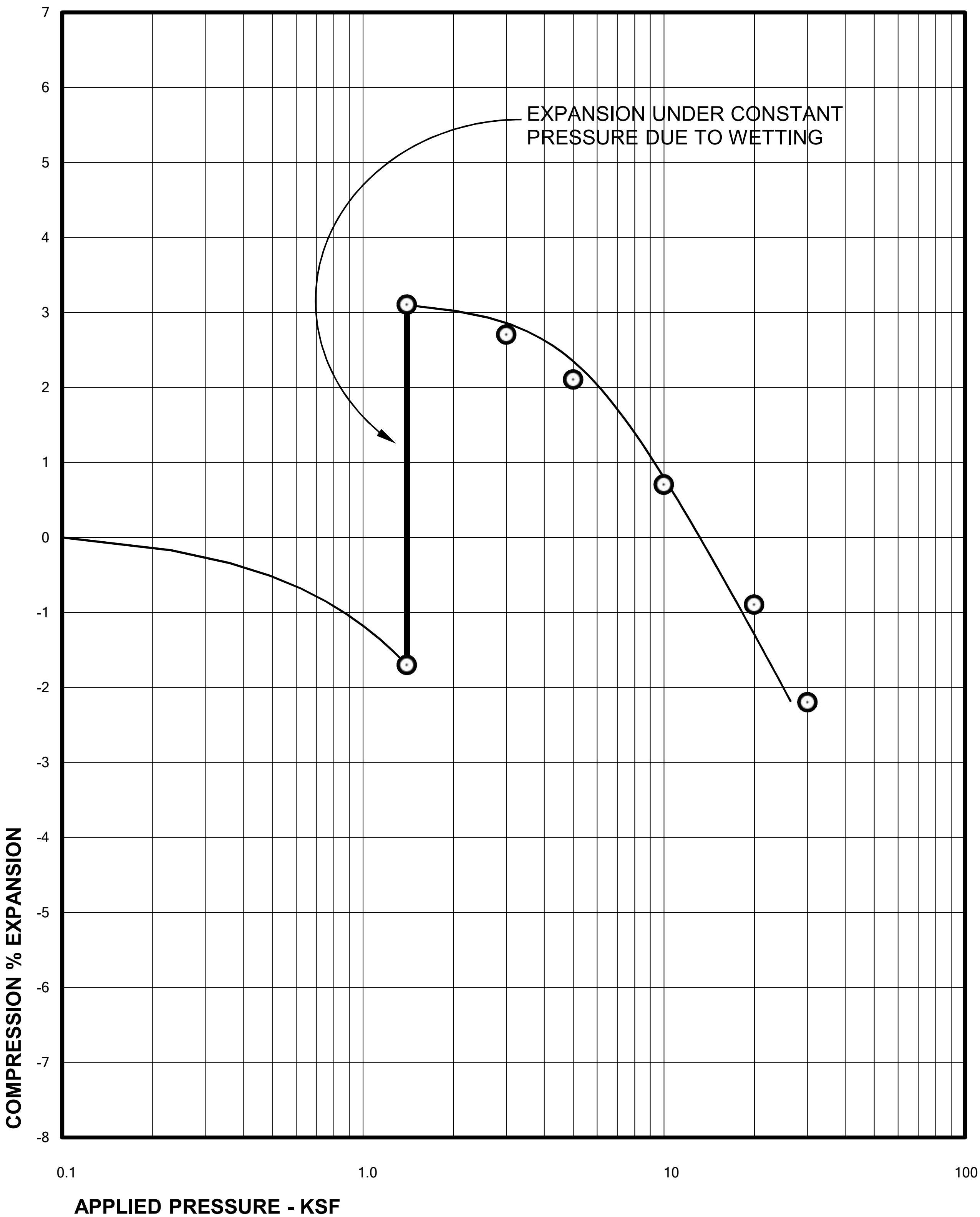
Sample of	INTERBEDDED CLAYSTONE/SANDSTONE	DRY UNIT WEIGHT=	99	PCF
From	TH-36 AT 24 FEET	MOISTURE CONTENT=	26.7	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-73

DRAFT



Sample of CLAYSTONE
From TH-36 AT 29 FEET

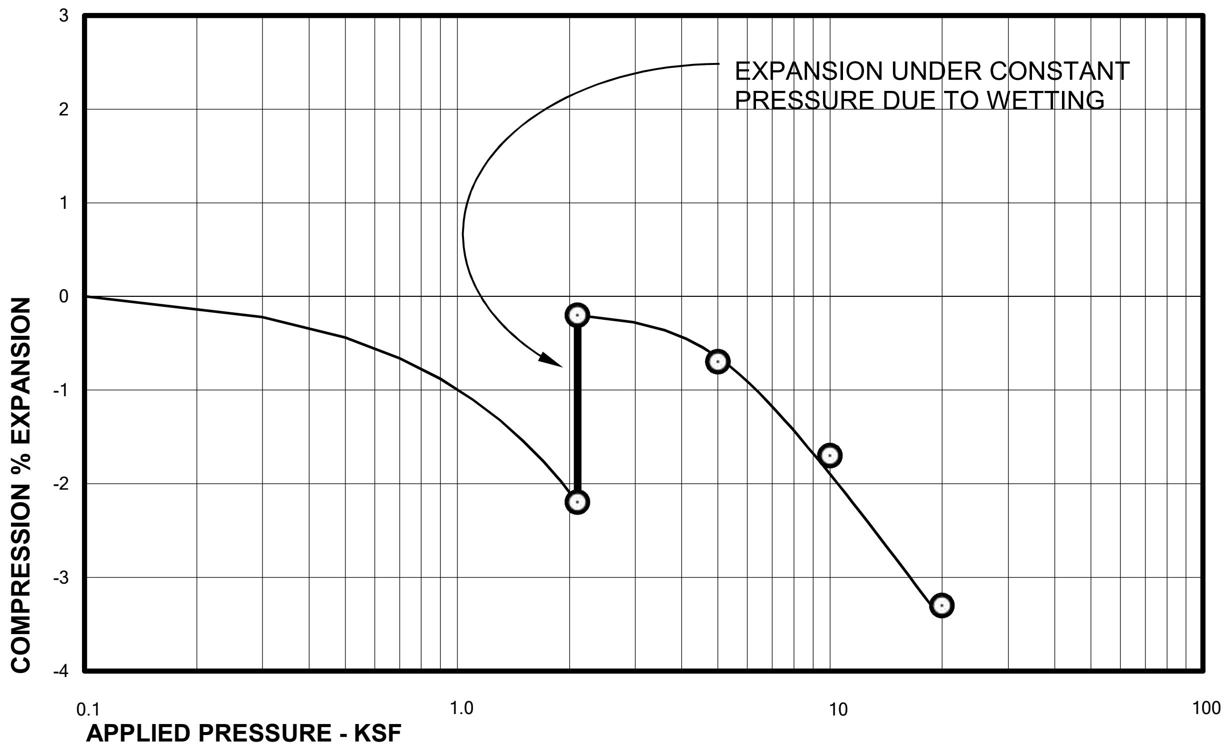
DRY UNIT WEIGHT= 99 PCF
MOISTURE CONTENT= 25.7 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

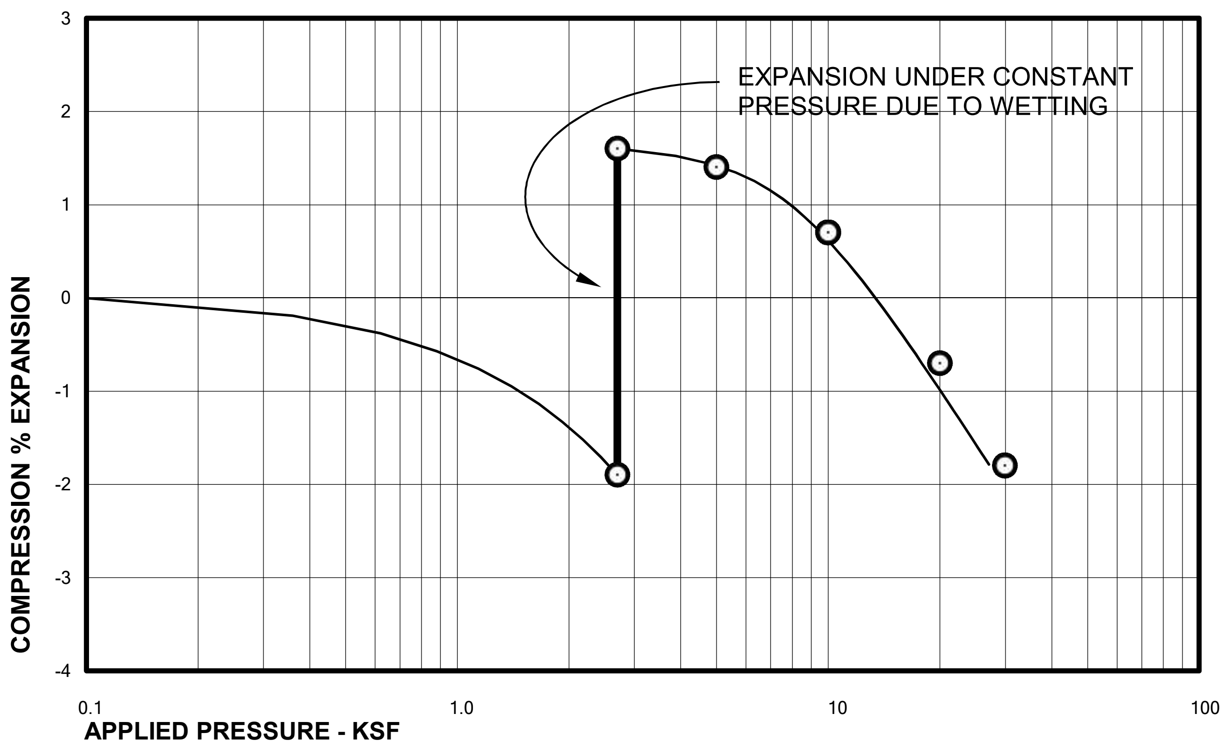
FIG. B-74

DRAFT



Sample of CLAYSTONE
From TH-36 AT 34 FEET

DRY UNIT WEIGHT= 102 PCF
MOISTURE CONTENT= 22.5 %



Sample of CLAYSTONE
From TH-36 AT 39 FEET

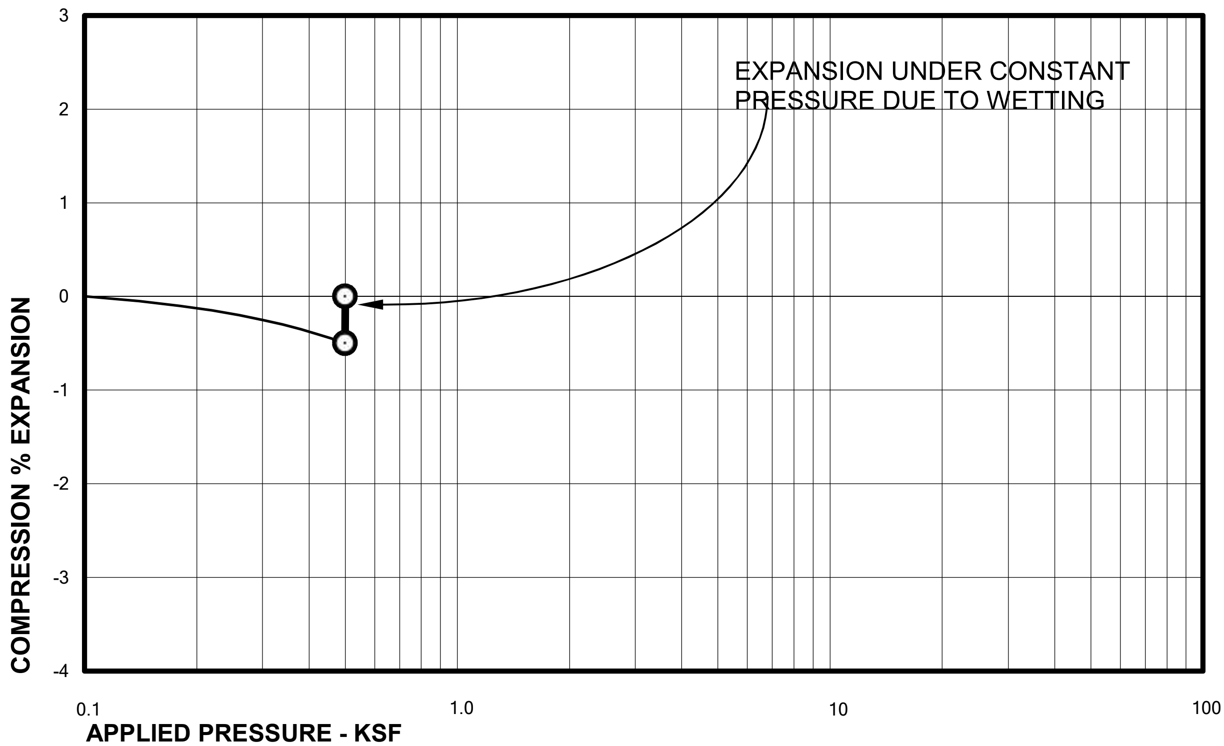
DRY UNIT WEIGHT= 107 PCF
MOISTURE CONTENT= 22.6 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

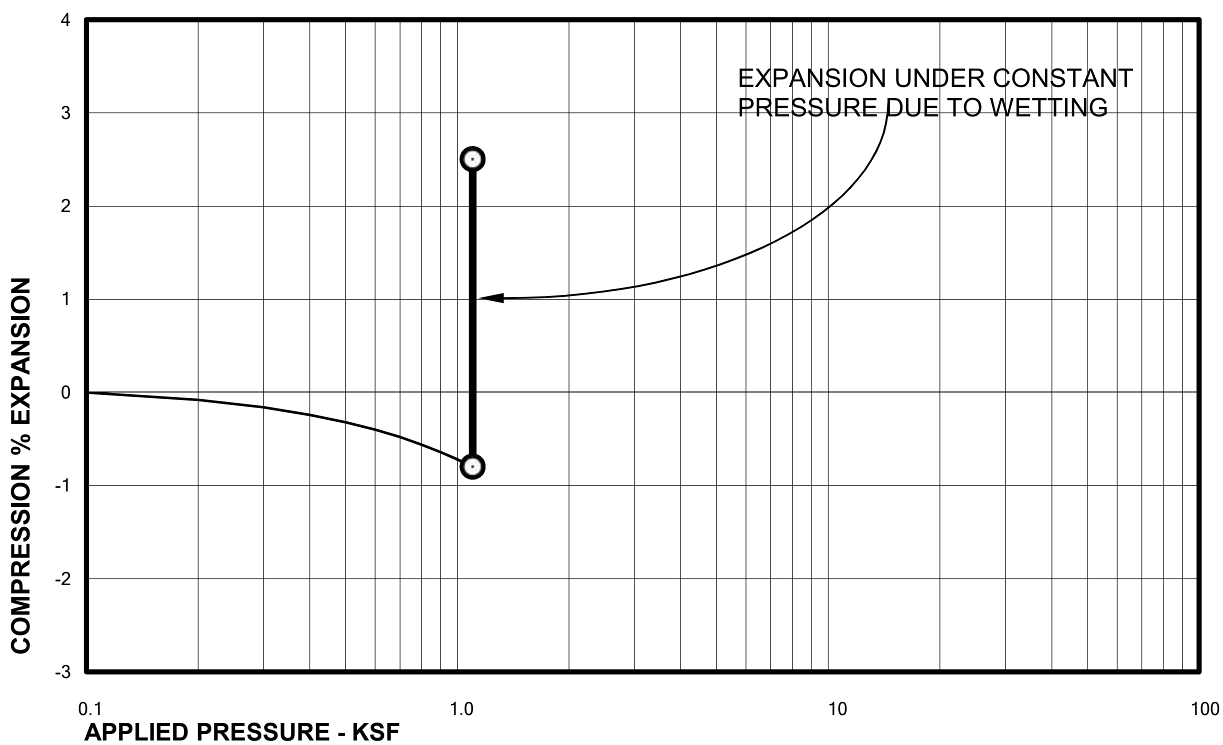
Swell Consolidation Test Results

FIG. B-75

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	105	PCF
From	TH-37 AT 19 FEET	MOISTURE CONTENT=	22.1	%



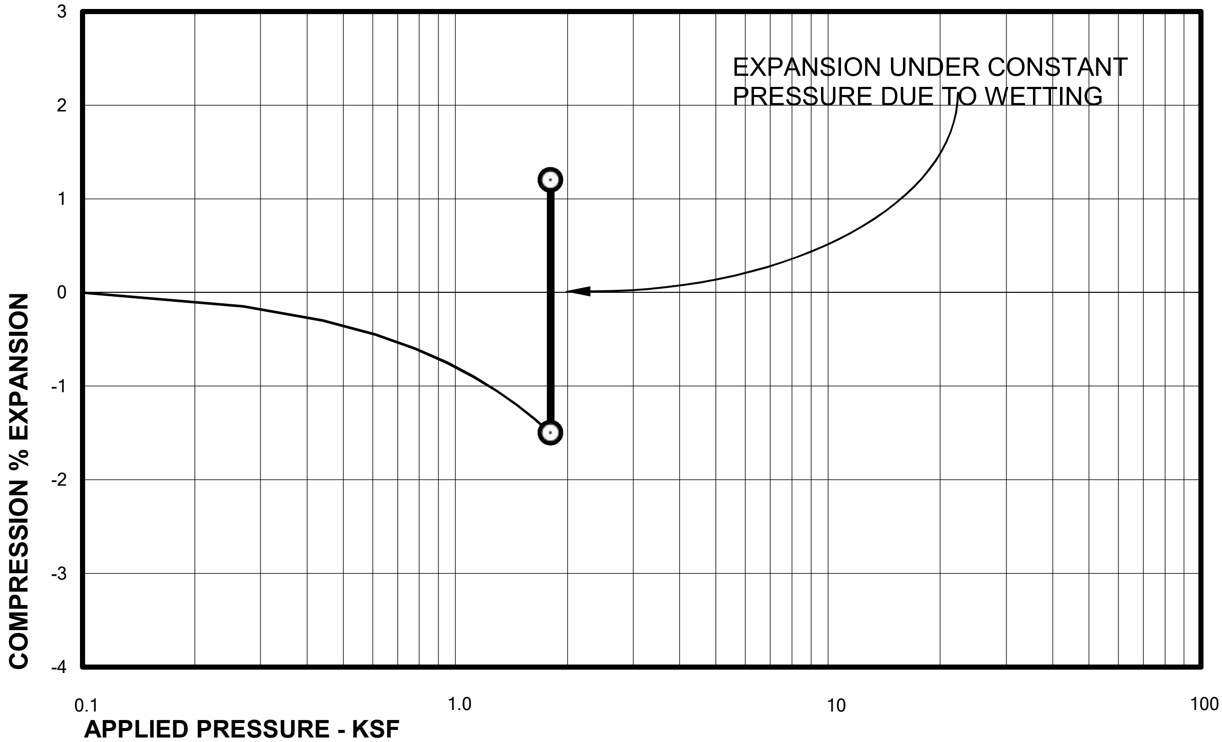
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	113	PCF
From	TH-37 AT 24 FEET	MOISTURE CONTENT=	17.9	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

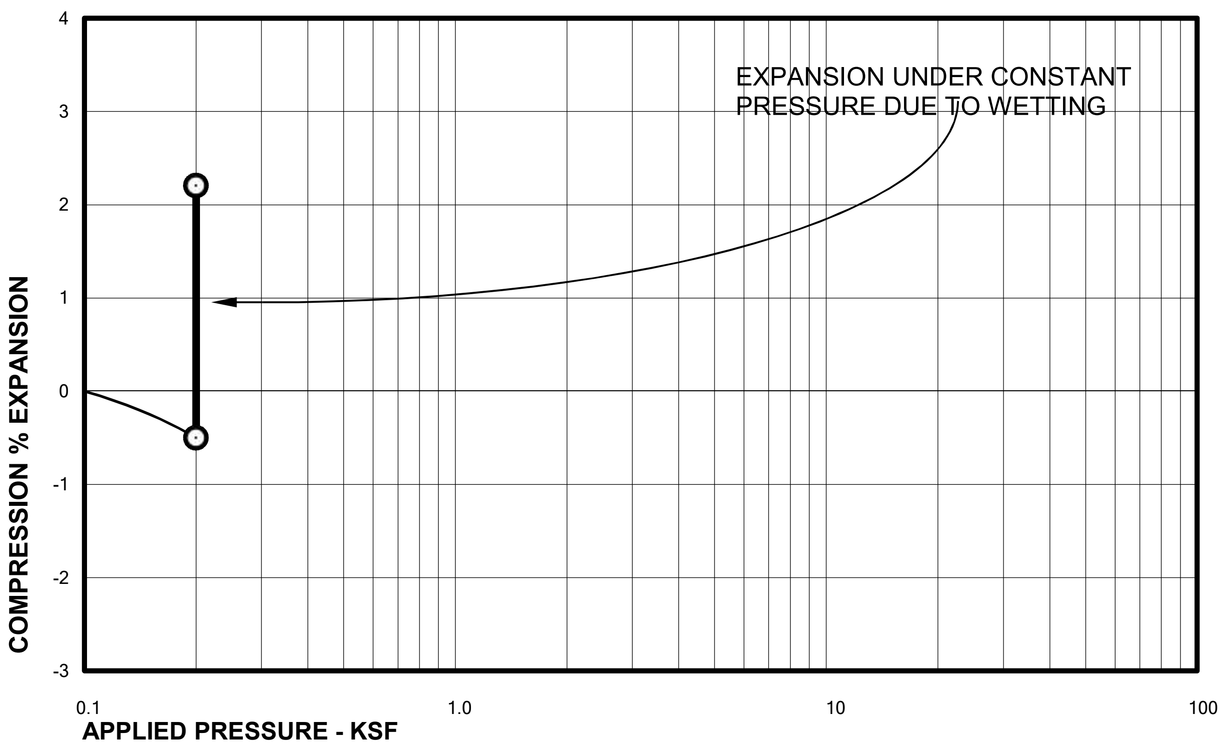
Swell Consolidation Test Results

FIG. B-76

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	105	PCF
From	TH-37 AT 29 FEET	MOISTURE CONTENT=	20.3	%



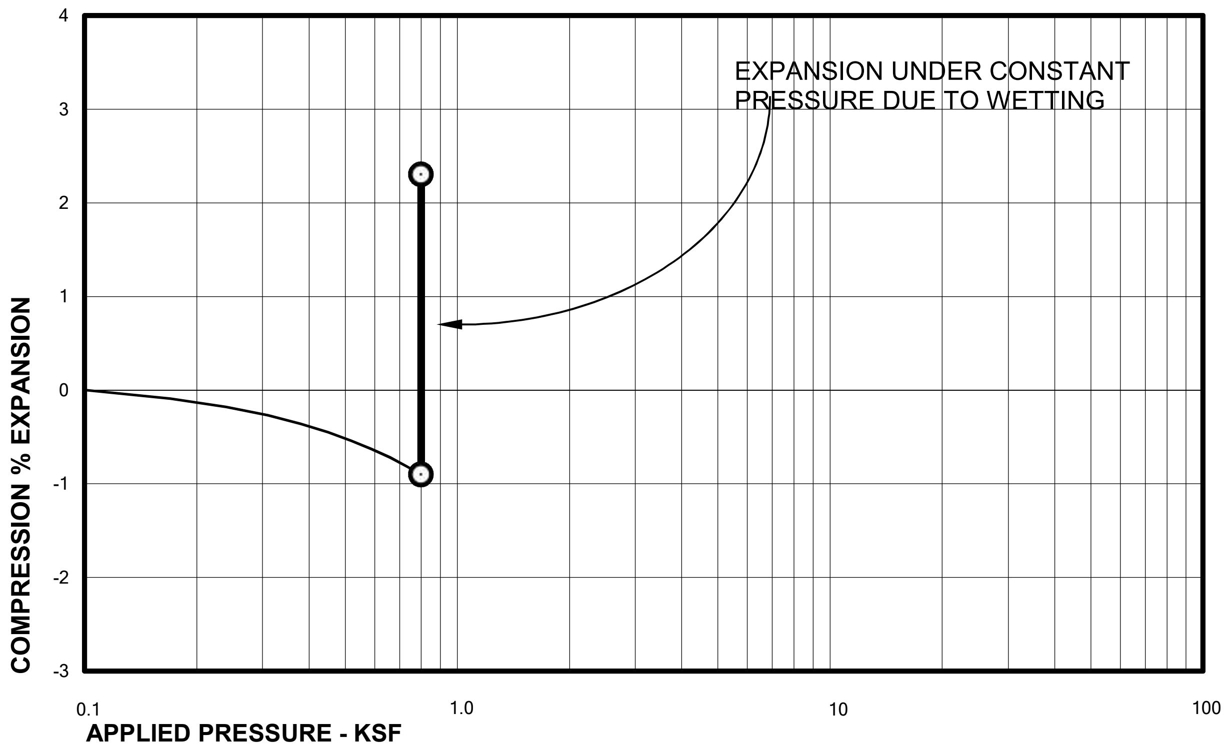
Sample of	SAND, CLAYEY (SC)	DRY UNIT WEIGHT=	116	PCF
From	TH-38 AT 9 FEET	MOISTURE CONTENT=	9.6	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

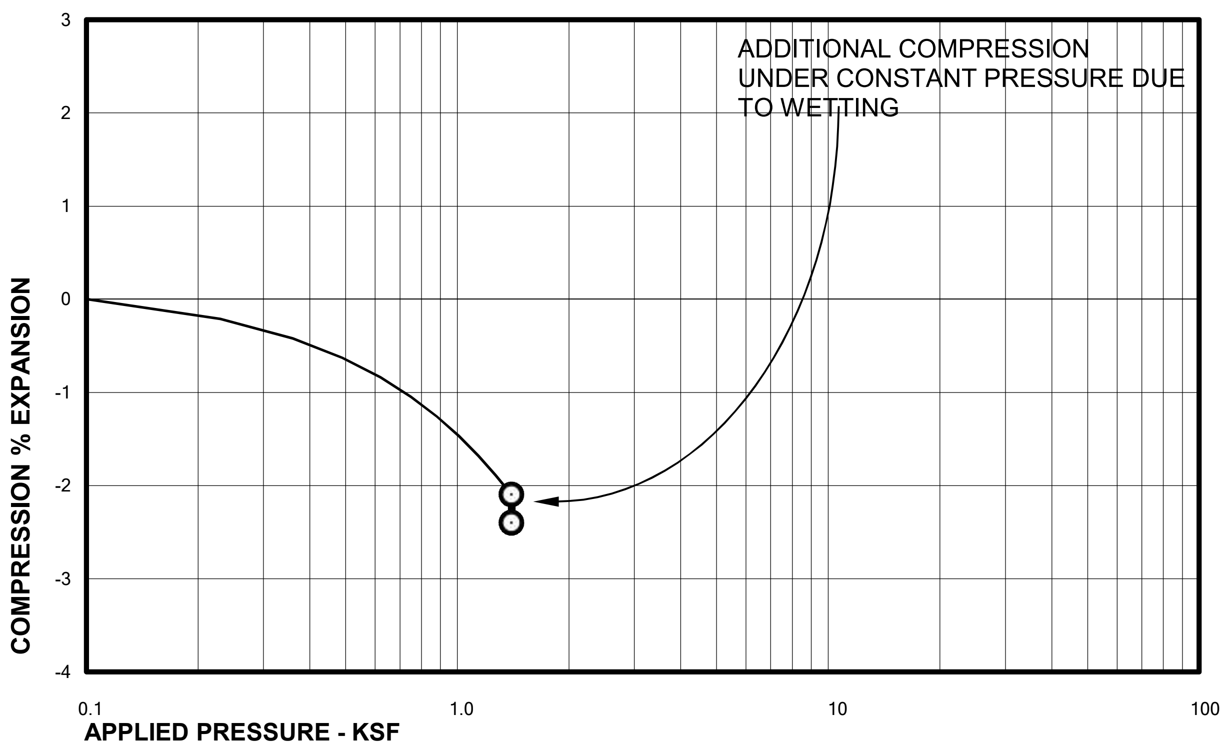
Swell Consolidation Test Results

FIG. B-77

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	97	PCF
From	TH-38 AT 14 FEET	MOISTURE CONTENT=	25.7	%



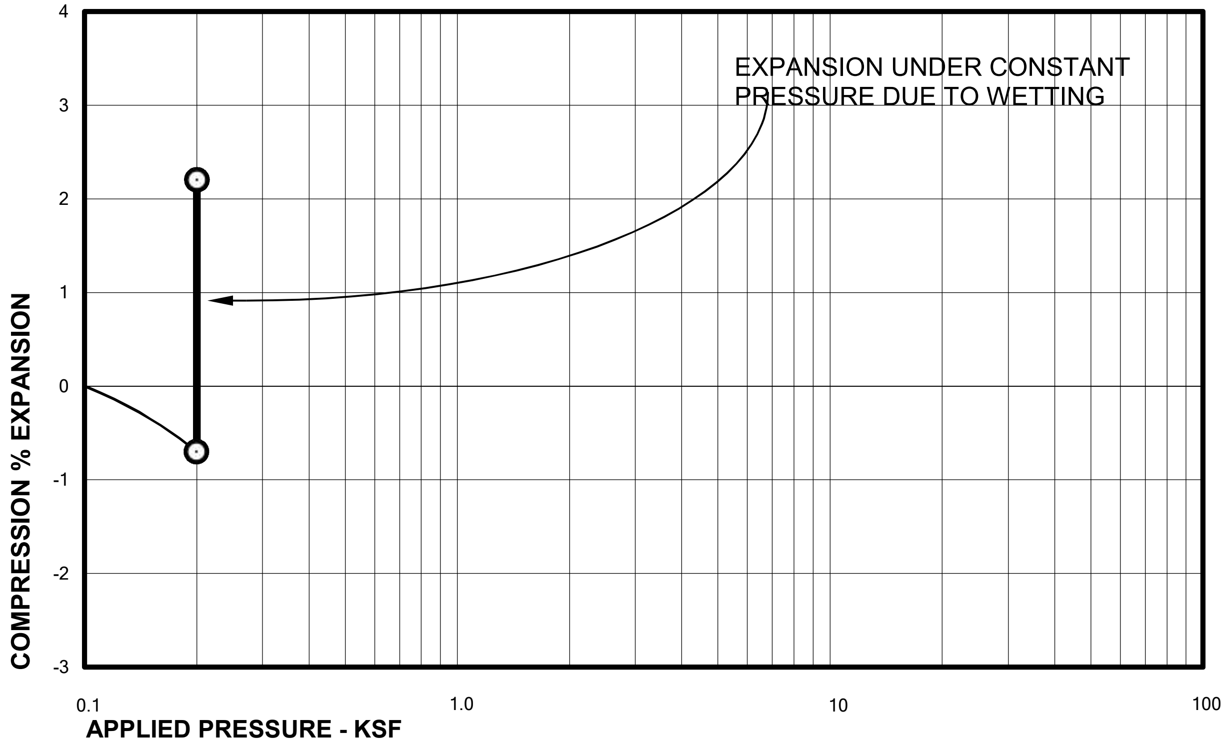
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	80	PCF
From	TH-38 AT 19 FEET	MOISTURE CONTENT=	33.2	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

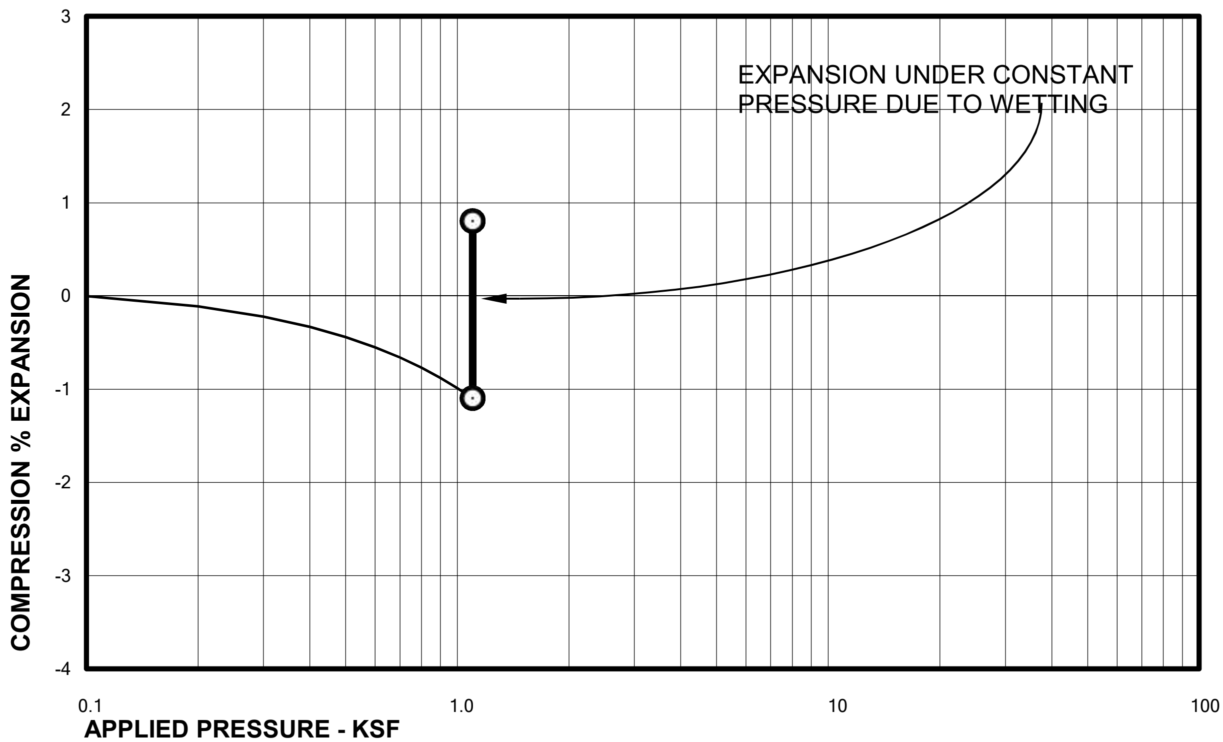
Swell Consolidation Test Results

FIG. B-78

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	103	PCF
From	TH-39 AT 14 FEET	MOISTURE CONTENT=	20.9	%



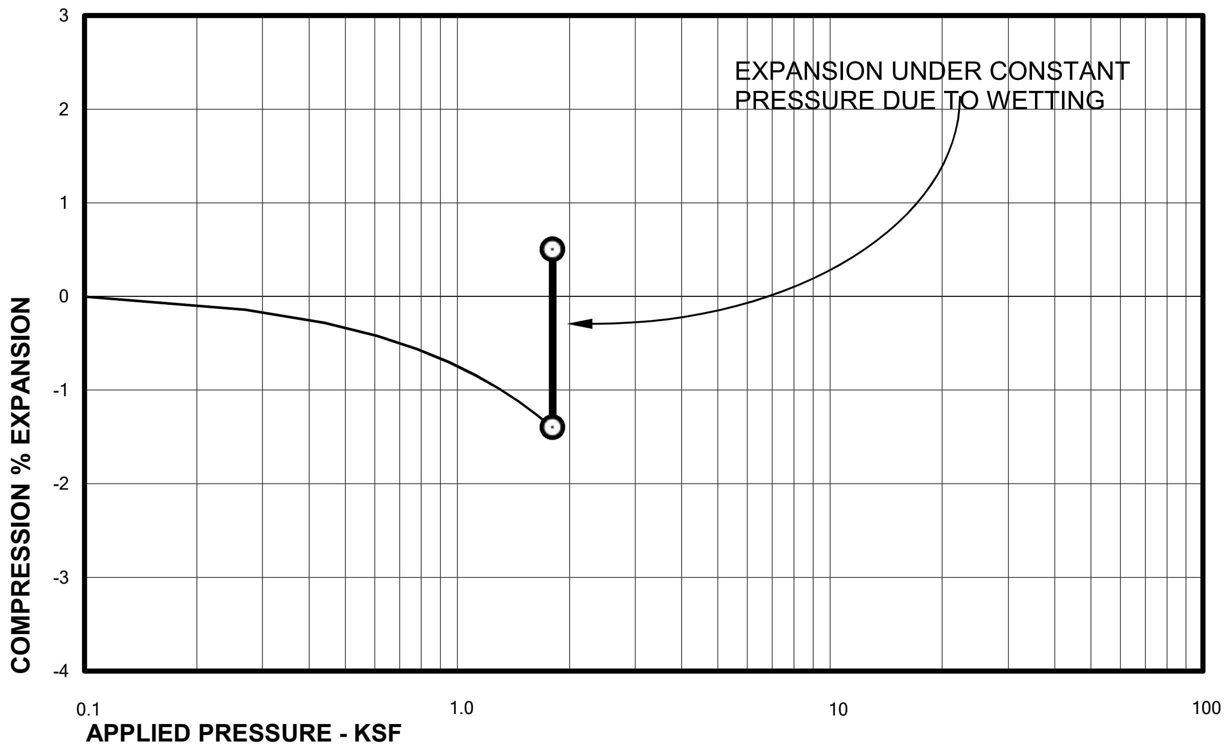
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	102	PCF
From	TH-39 AT 19 FEET	MOISTURE CONTENT=	19.1	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

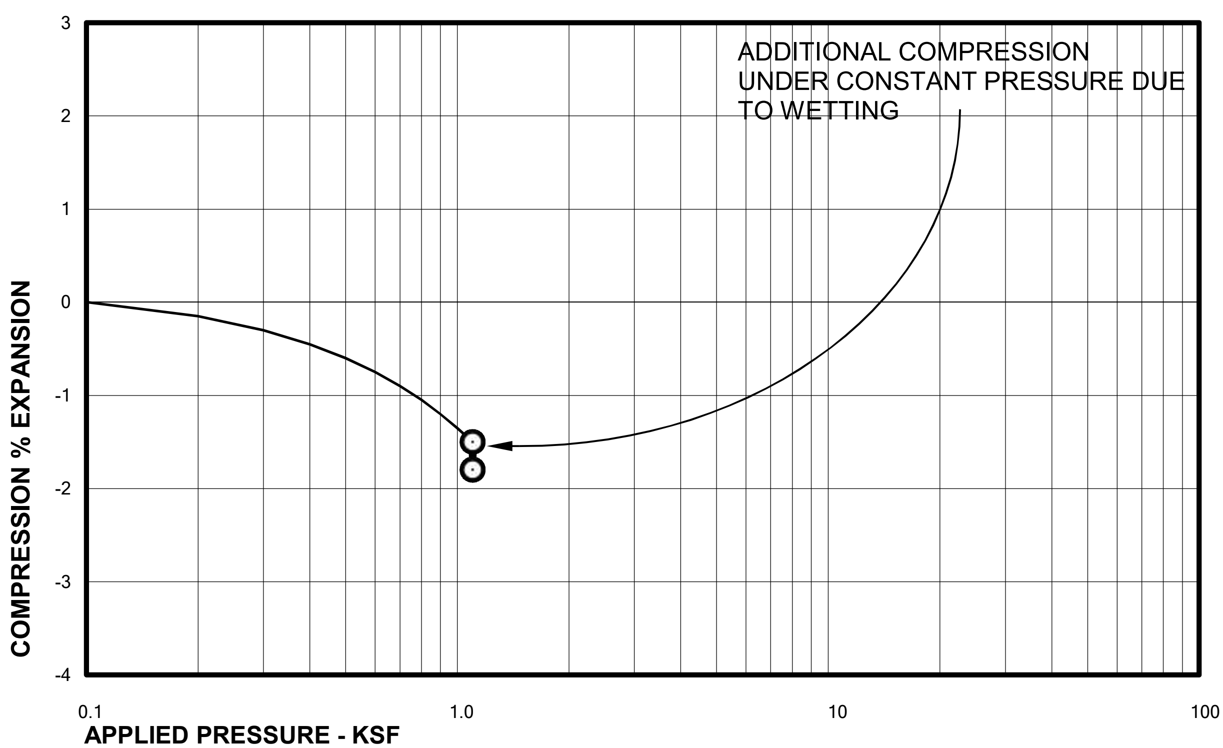
Swell Consolidation Test Results

FIG. B-79

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	98	PCF
From	TH-39 AT 24 FEET	MOISTURE CONTENT=	22.1	%



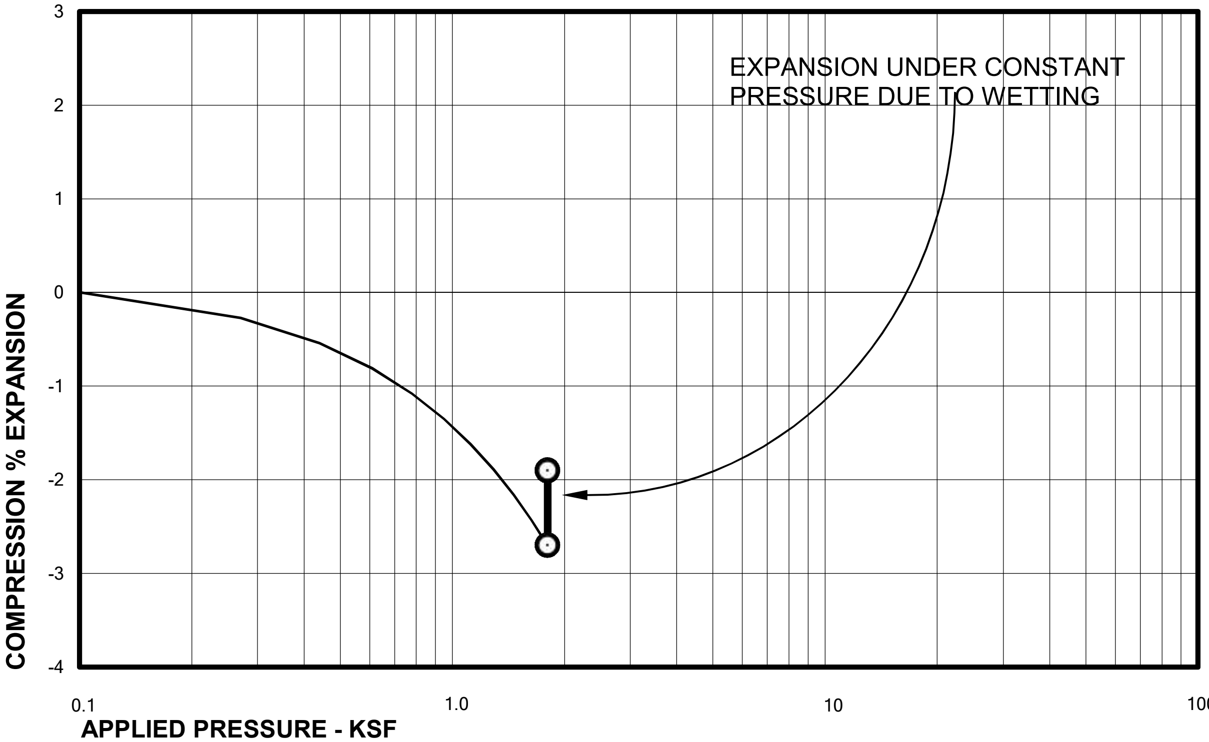
Sample of	SANDSTONE	DRY UNIT WEIGHT=	92	PCF
From	TH-40 AT 4 FEET	MOISTURE CONTENT=	18.3	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

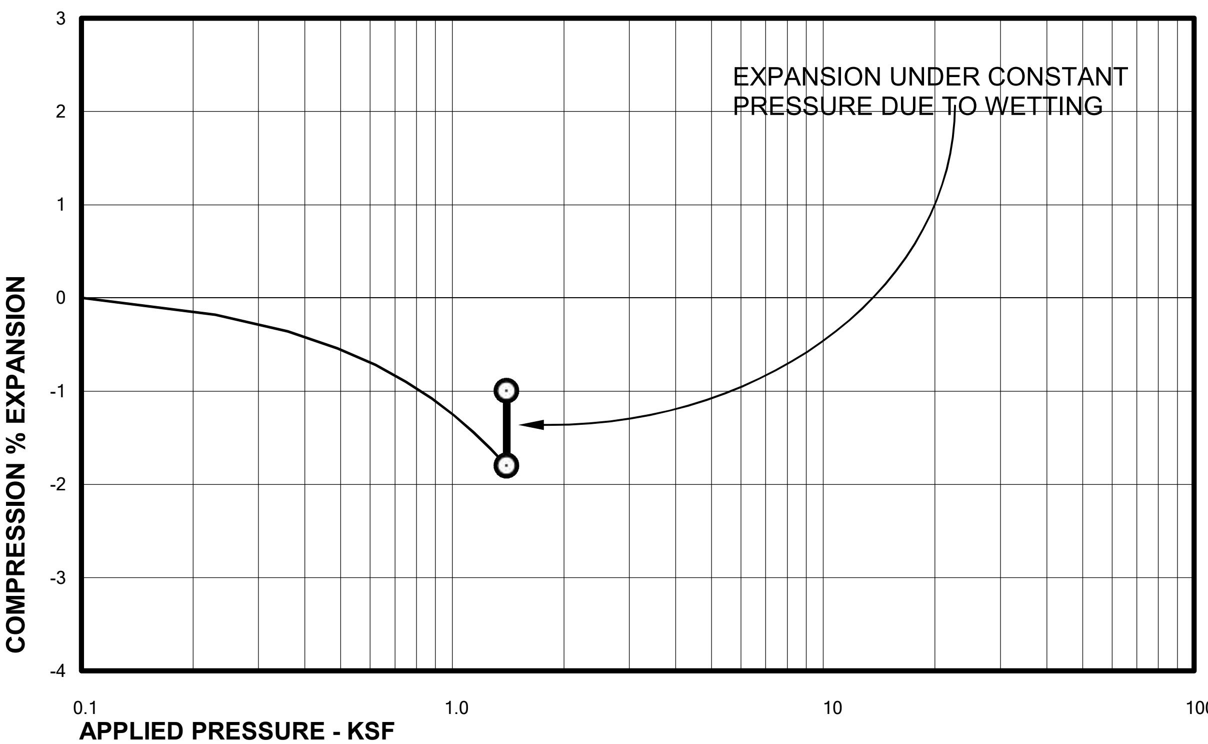
Swell Consolidation Test Results

FIG. B-80

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	76	PCF
From	TH-40 AT 9 FEET	MOISTURE CONTENT=	41.5	%

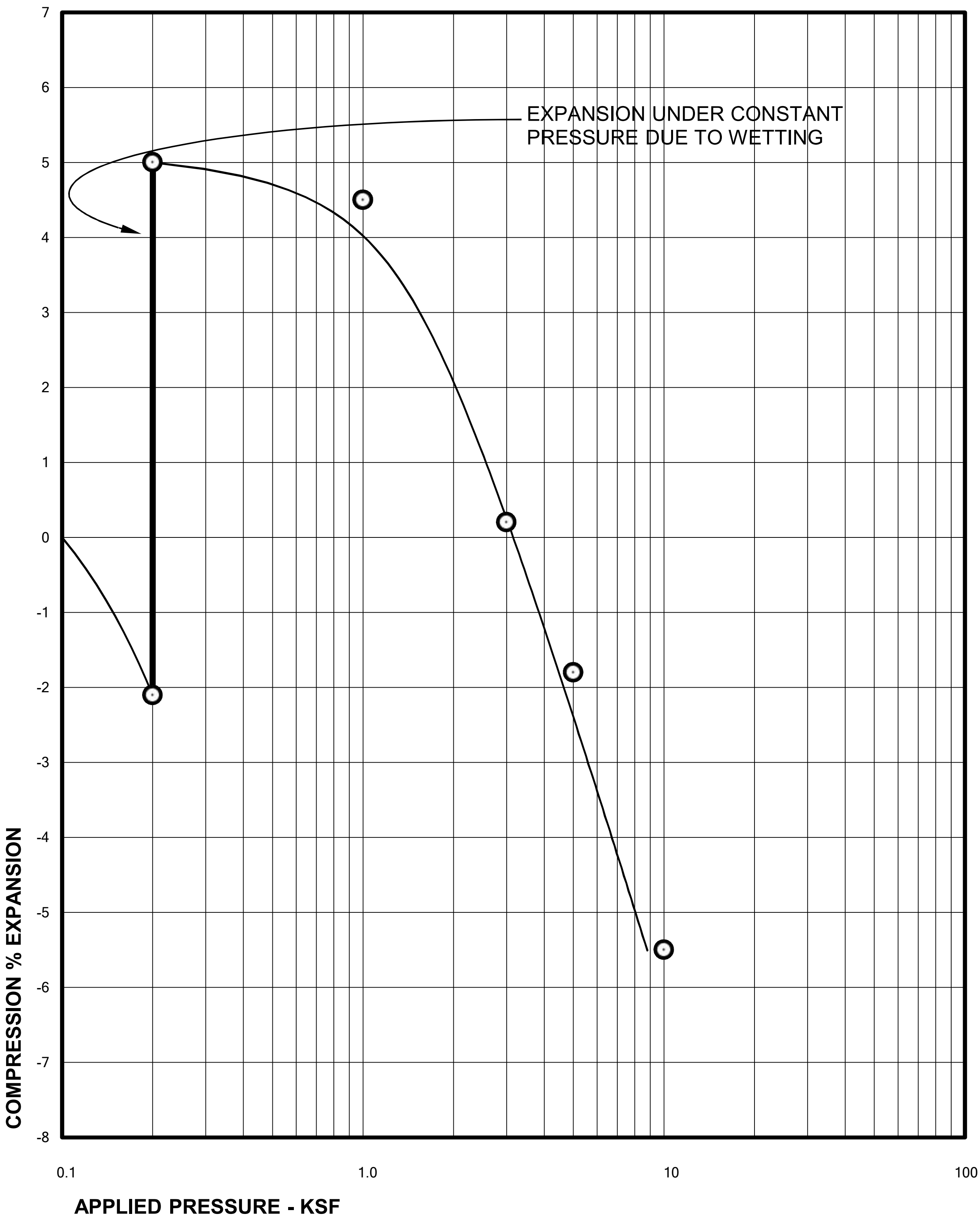


Sample of	CLAYSTONE	DRY UNIT WEIGHT=	83	PCF
From	TH-40 AT 14 FEET	MOISTURE CONTENT=	39.3	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-81



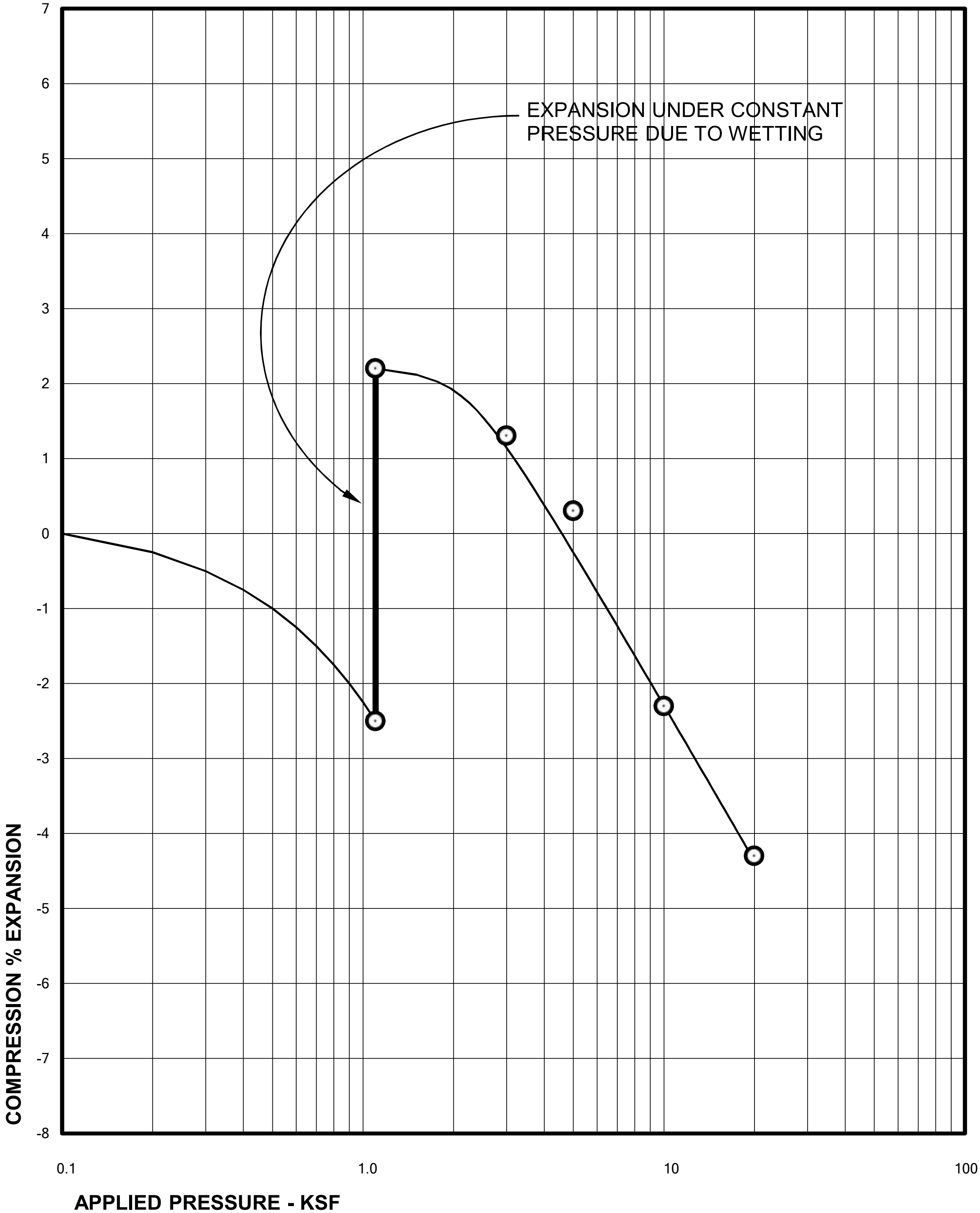
Sample of	CLAYSTONE	DRY UNIT WEIGHT=	102	PCF
From	TH-41 AT 34 FEET	MOISTURE CONTENT=	15.5	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-82

DRAFT



Sample of CLAYSTONE

From TH-41 AT 39 FEET

DRY UNIT WEIGHT= 118 PCF

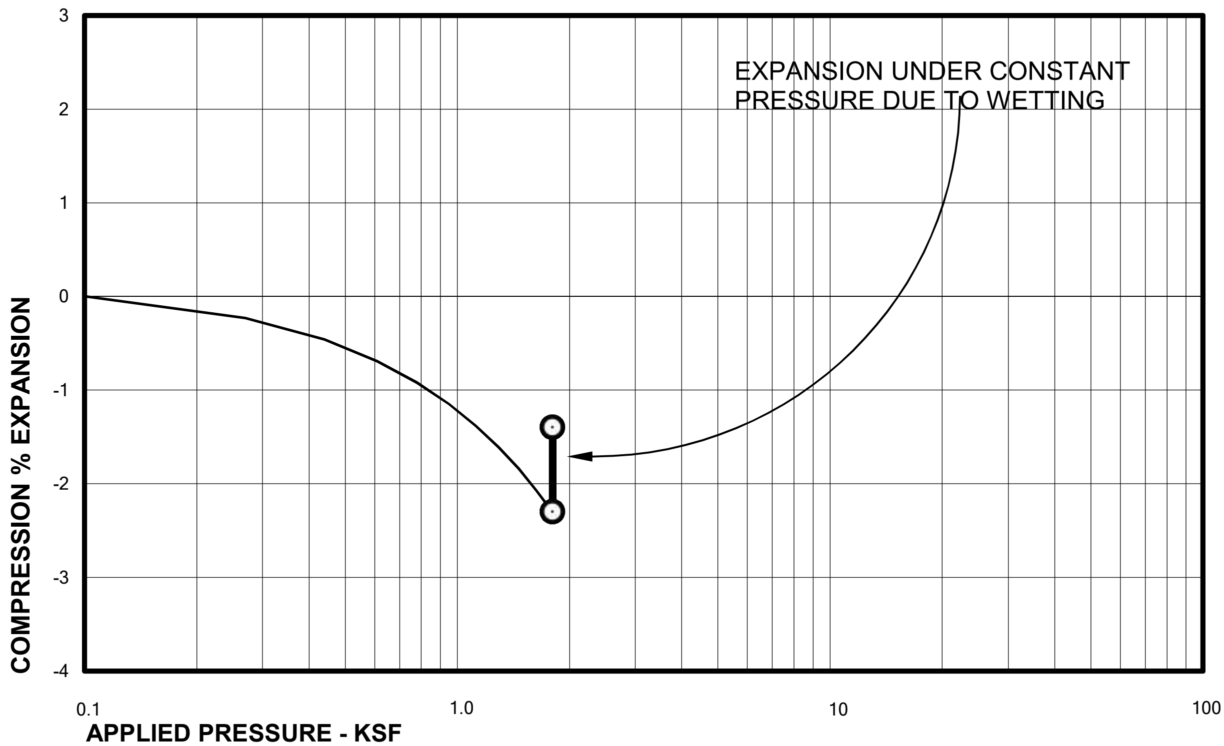
MOISTURE CONTENT= 14.2 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-83

DRAFT

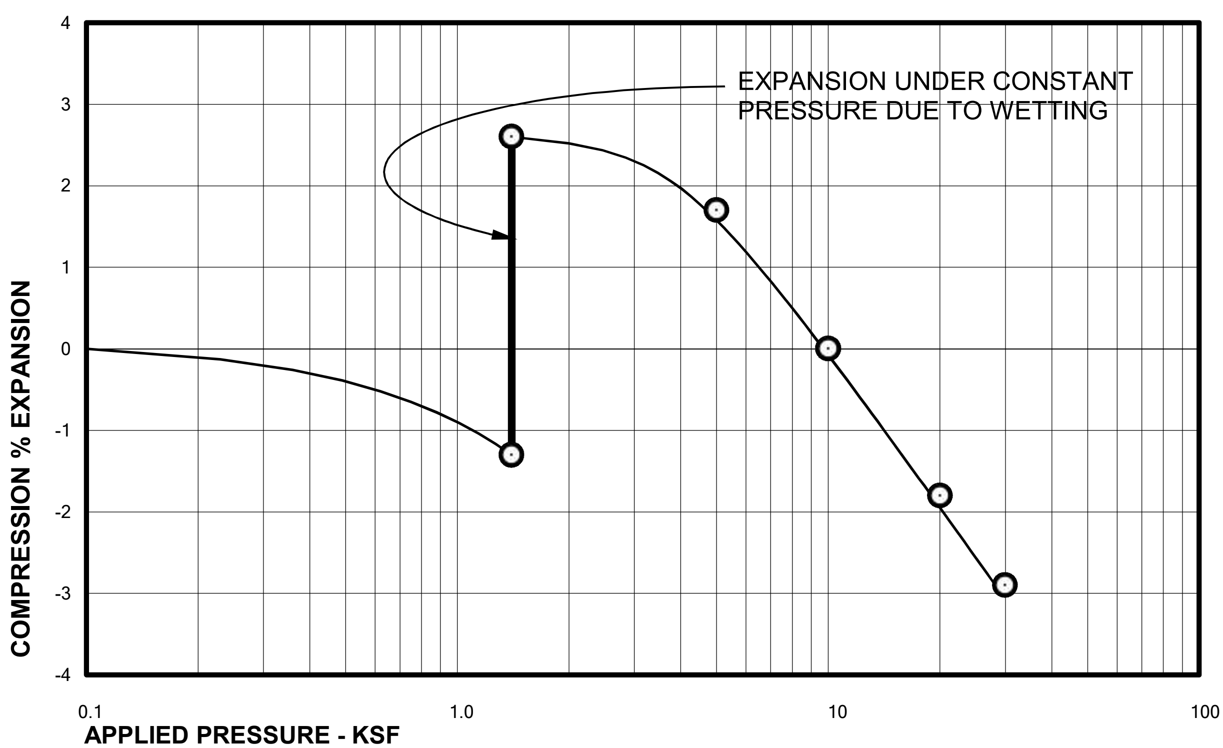


Sample of CLAYSTONE

From TH-41 AT 44 FEET

DRY UNIT WEIGHT= 120 PCF

MOISTURE CONTENT= 13.2 %



Sample of CLAYSTONE

From TH-41 AT 49 FEET

DRY UNIT WEIGHT= 121 PCF

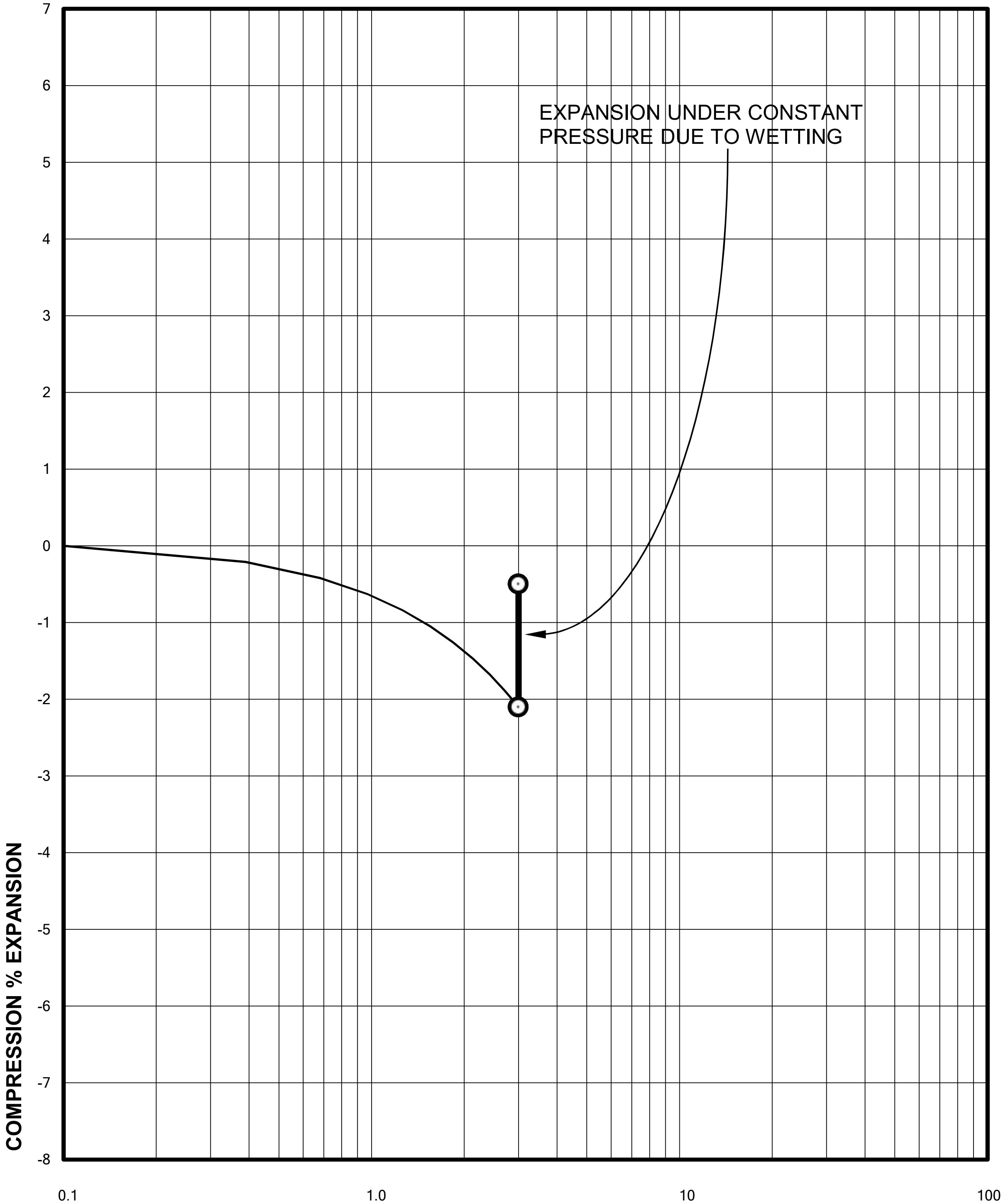
MOISTURE CONTENT= 14.0 %

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-84

DRAFT



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	116	PCF
From	TH-41 AT 54 FEET	MOISTURE CONTENT=	13.8	%

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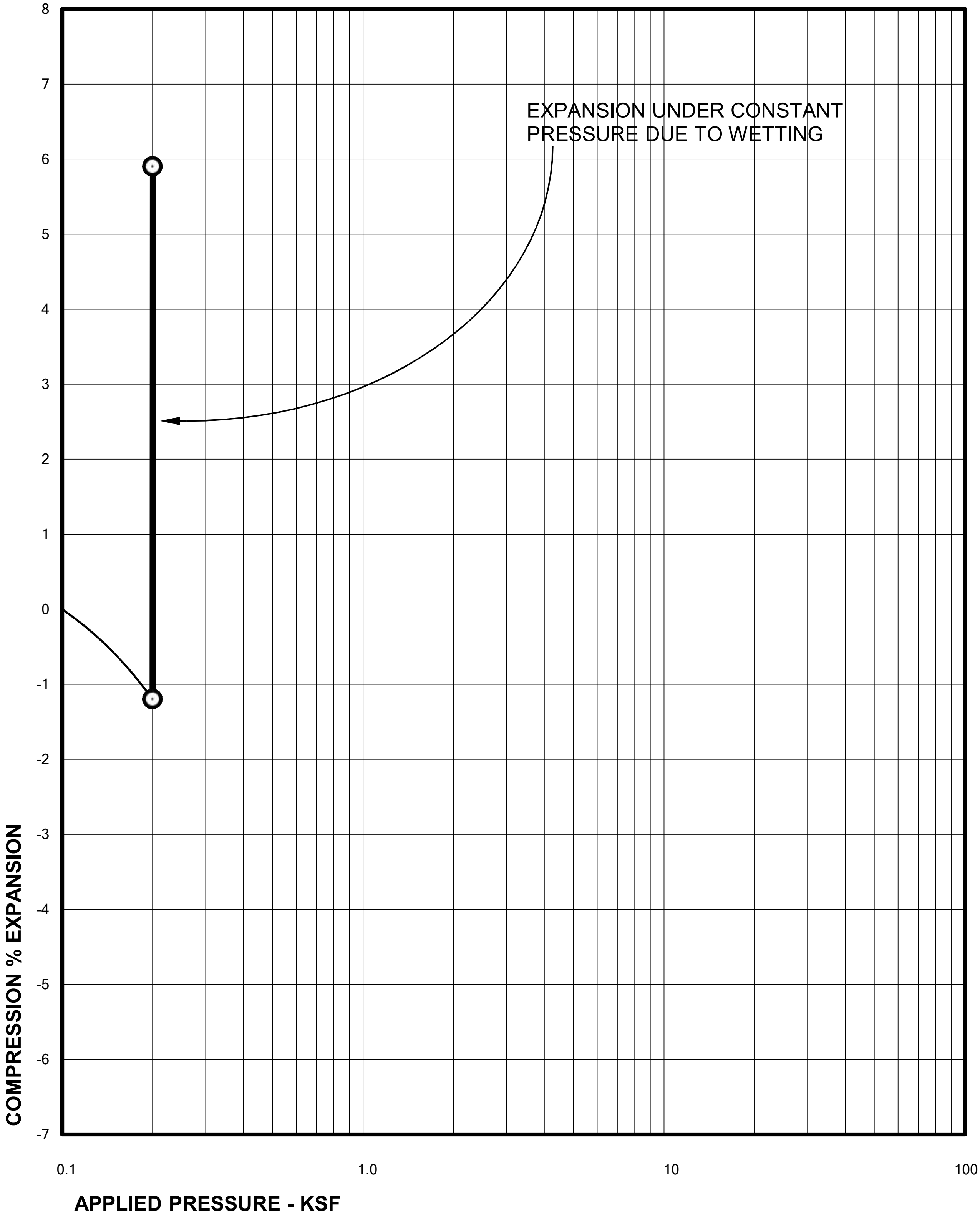
CTL|T PROJECT NO. DN49,935-115-R1

Swell Consolidation Test Results

FIG. B-85

DRAFT



Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	107	PCF
From	TH-42 AT 4 FEET	MOISTURE CONTENT=	15.4	%

SHEA HOMES
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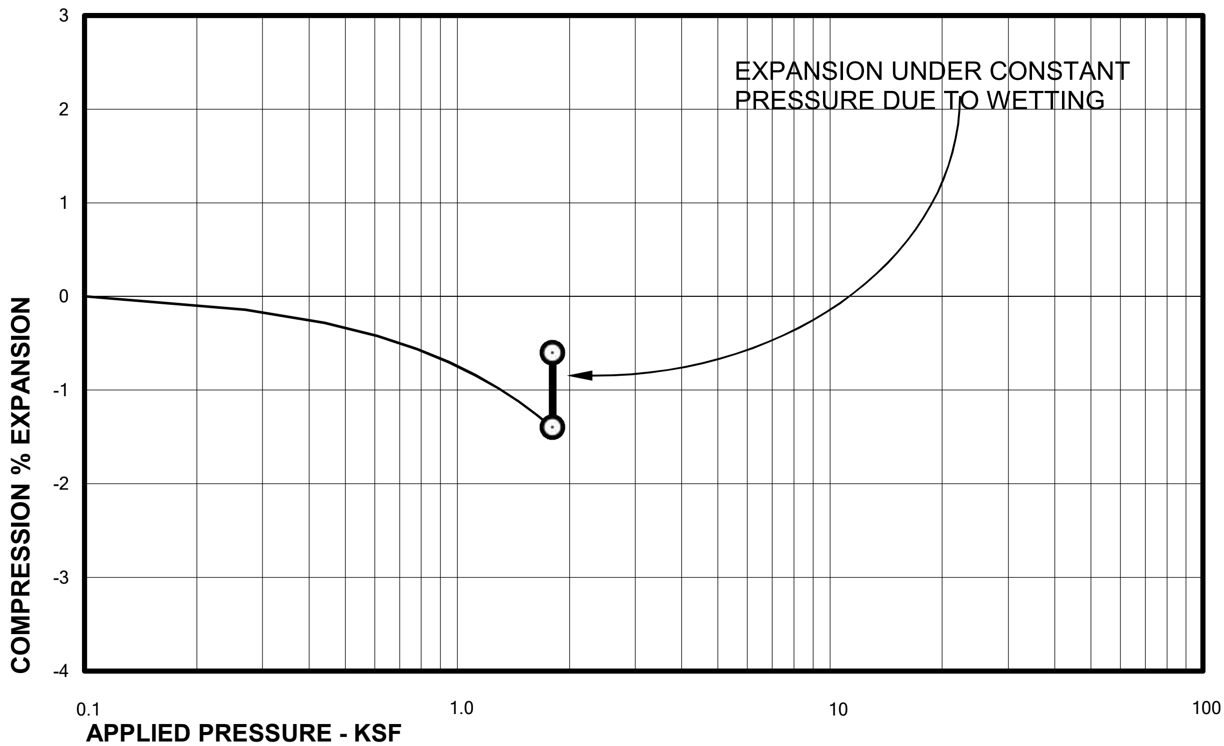
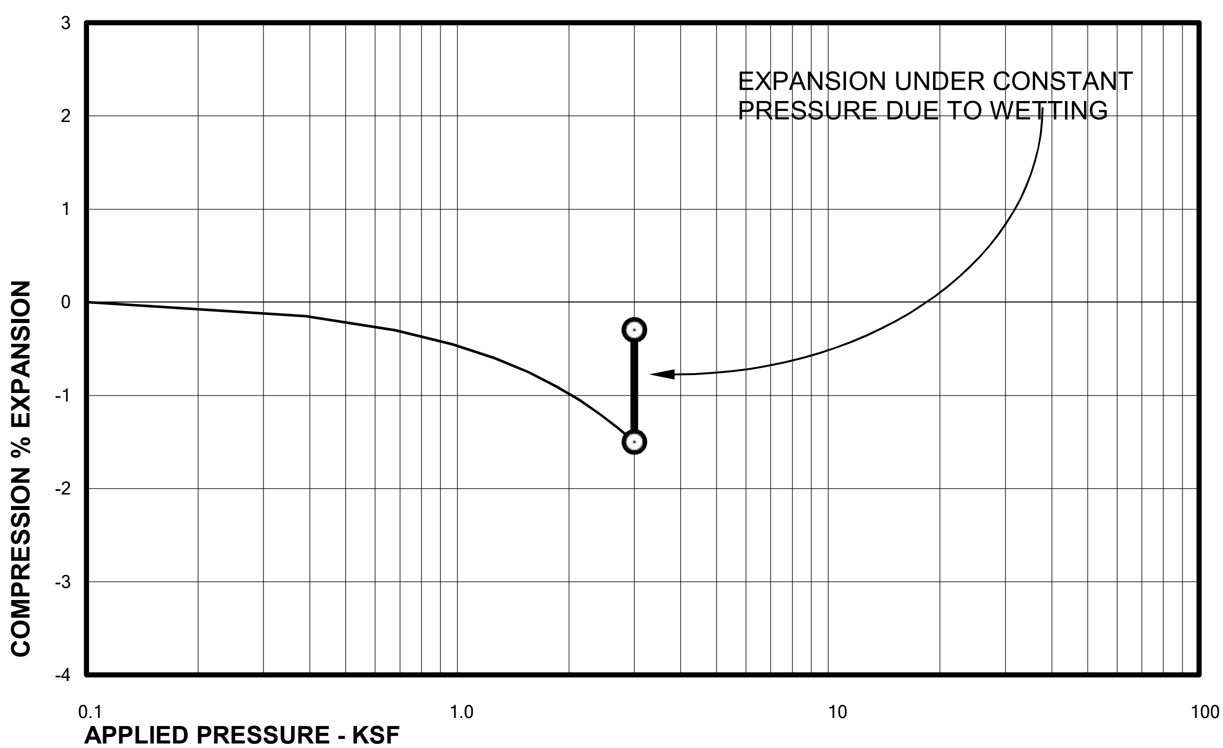
Swell Consolidation Test Results

FIG. B-86

DRAFT



Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	113	PCF
From	TH-42 AT 14 FEET	MOISTURE CONTENT=	18.0	%



Sample of	CLAYSTONE	DRY UNIT WEIGHT=	98	PCF
From	TH-42 AT 24 FEET	MOISTURE CONTENT=	26.0	%

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
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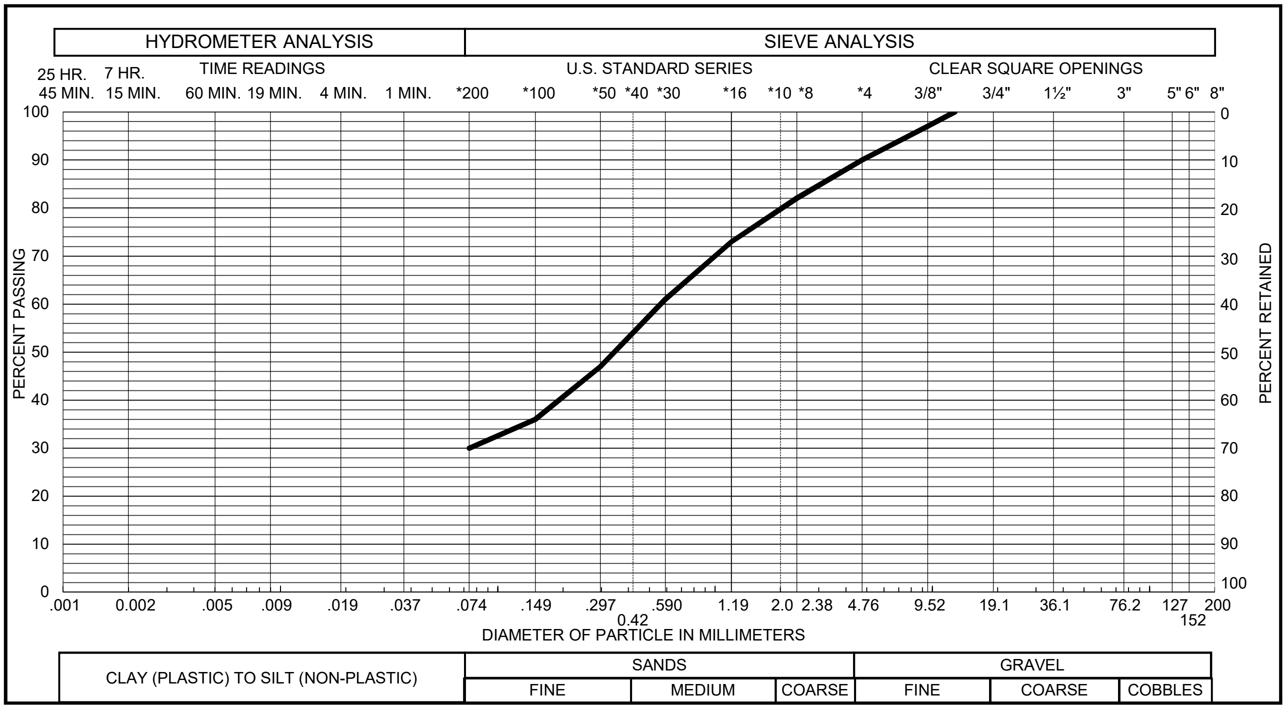
Swell Consolidation Test Results

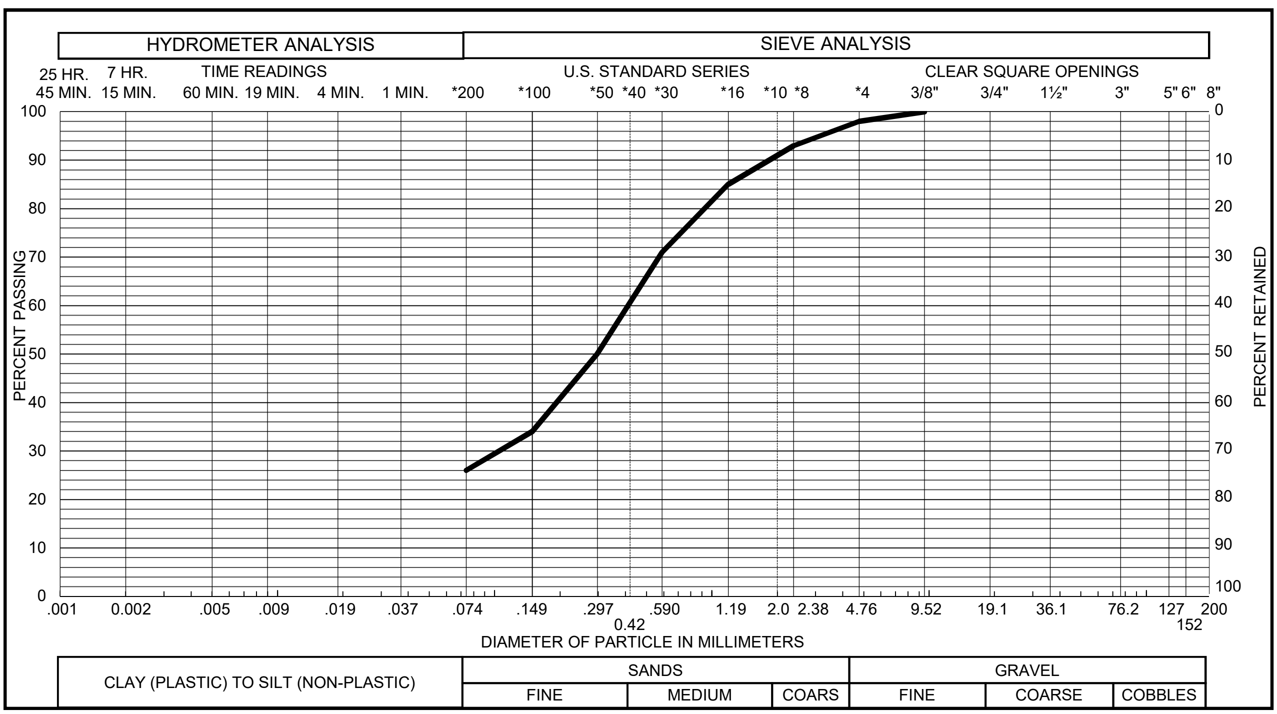
FIG. B-87

DRAFT



Sample of SAND, CLAYEY, SLIGHTLY GRAVELLY (SC)
From TH - 6 AT 4 FEET

GRAVEL 10 % SAND 60 %
SILT & CLAY 30 % LIQUID LIMIT
PLASTICITY INDEX



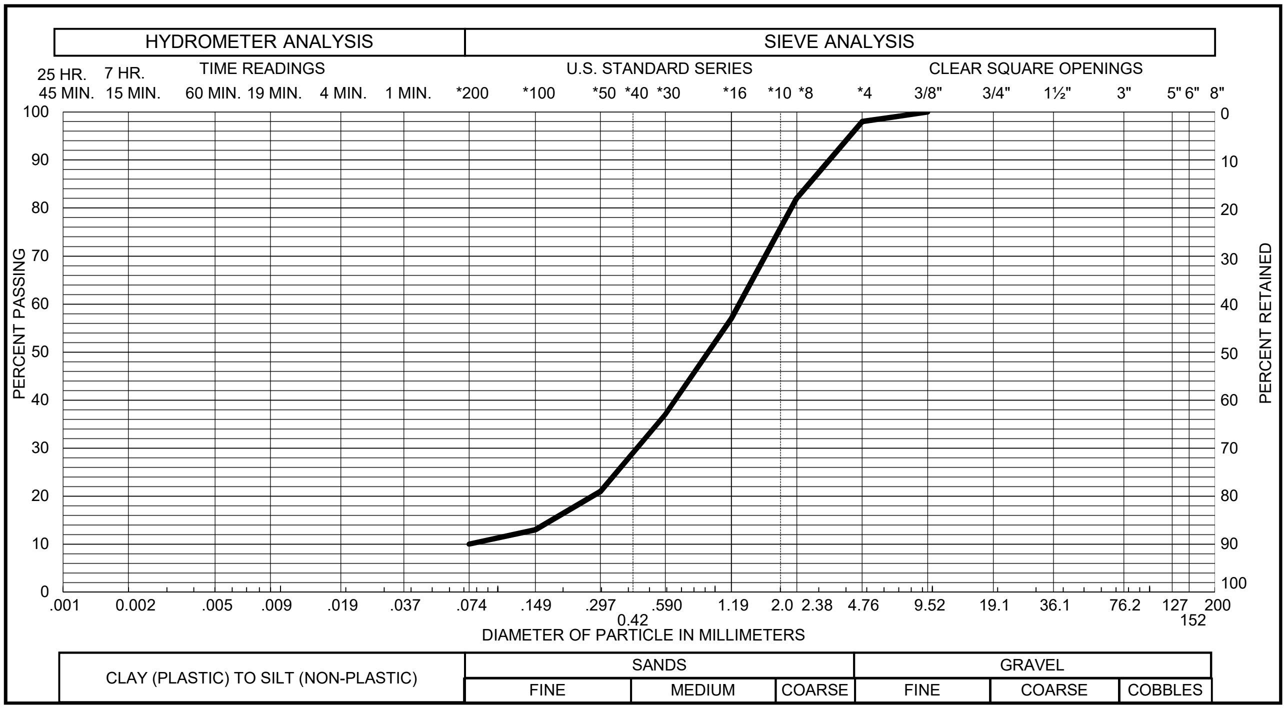
Sample of SAND, CLAYEY WITH TRACE GRAVEL (SC)
From TH - 6 AT 9 FEET

GRAVEL 2 % SAND 72 %
SILT & CLAY 26 % LIQUID LIMIT
PLASTICITY INDEX

Gradation Test Results

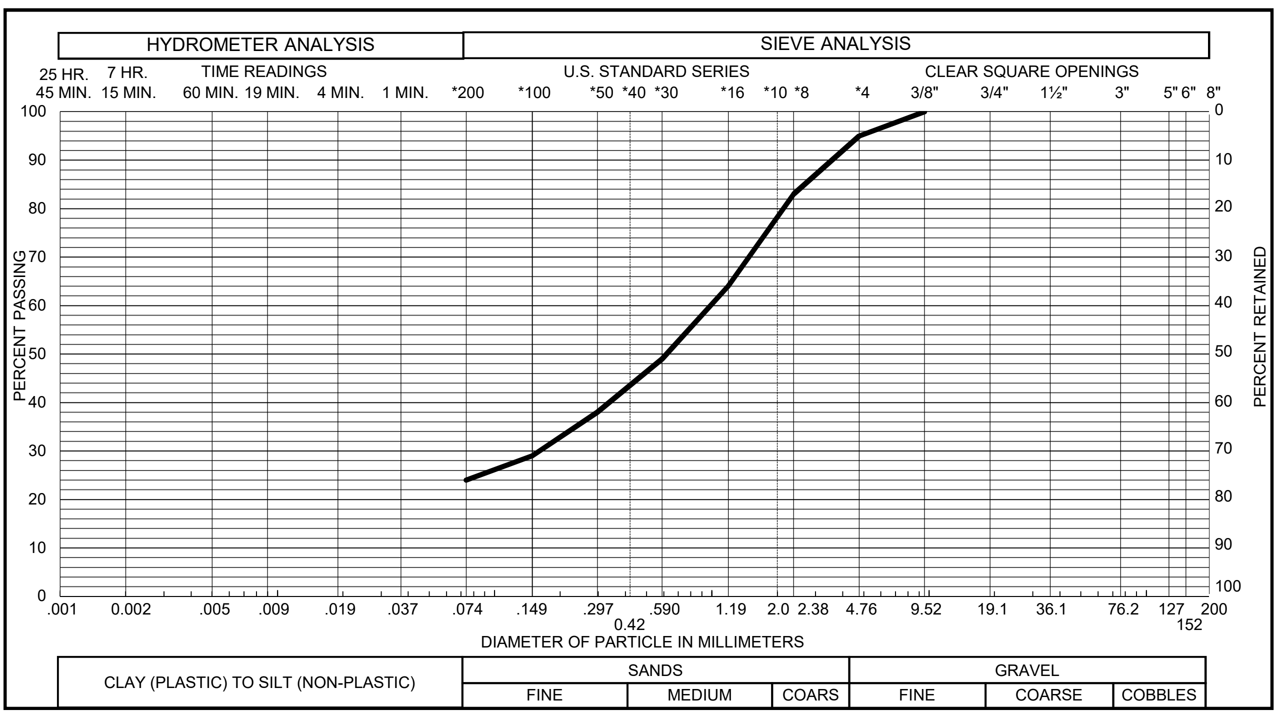
FIG. B-88

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1



Sample of SAND, SL. SILTY WITH TRACE GRAVEL (SP-SM)
From TH - 12 AT 14 FEET

GRAVEL 2 %
SAND 88 %
SILT & CLAY 10 %
LIQUID LIMIT
PLASTICITY INDEX



Sample of SAND, SILTY, SLIGHTLY GRAVELLY (SM)
From TH - 20 AT 4 FEET

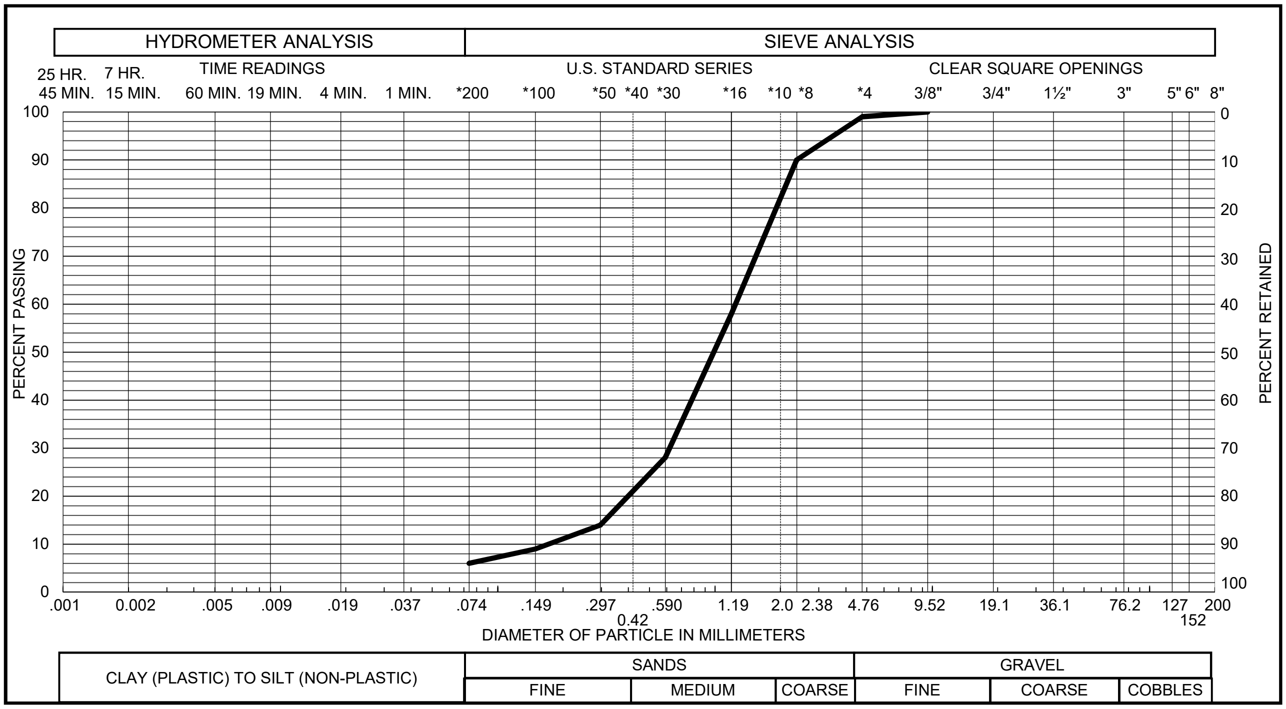
GRAVEL 5 %
SAND 71 %
SILT & CLAY 24 %
LIQUID LIMIT
PLASTICITY INDEX

Gradation Test Results

FIG. B-89

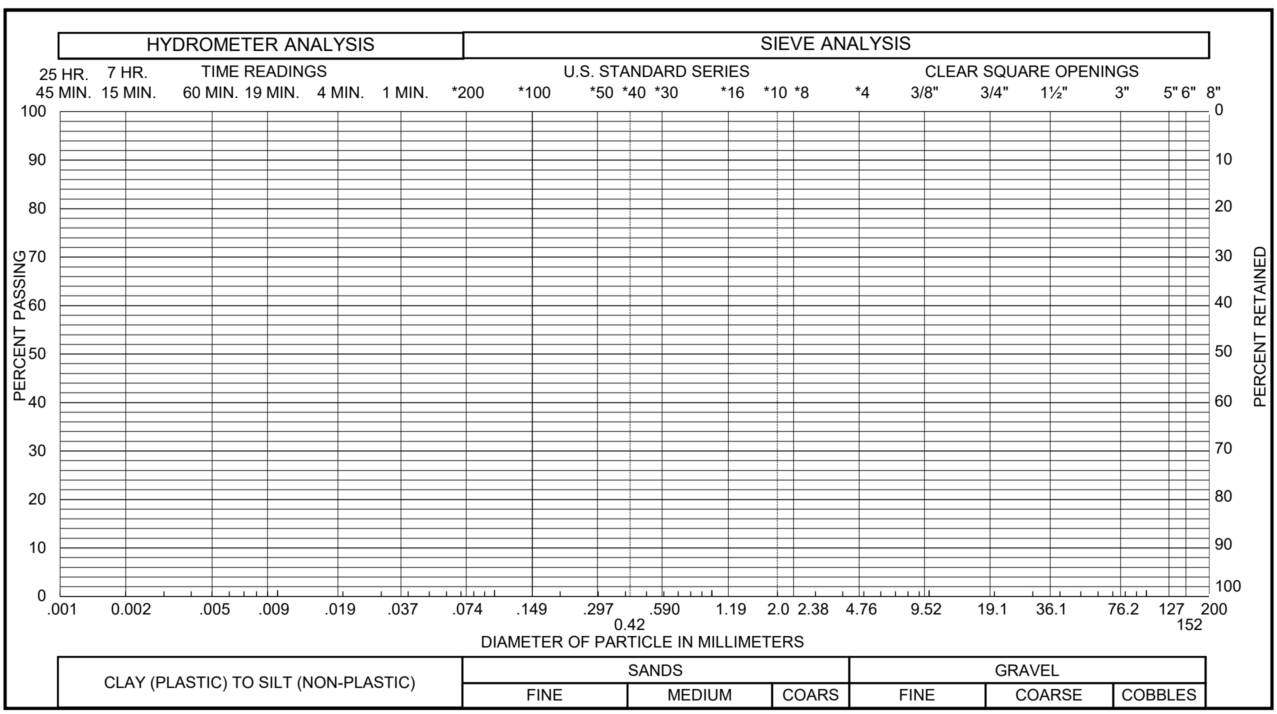
SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

DRAFT



Sample of SAND, SLIGHTLY SILTY (SP-SM)
From TH - 30 AT 14 FEET

GRAVEL 1 % SAND 93 %
SILT & CLAY 6 % LIQUID LIMIT
PLASTICITY INDEX



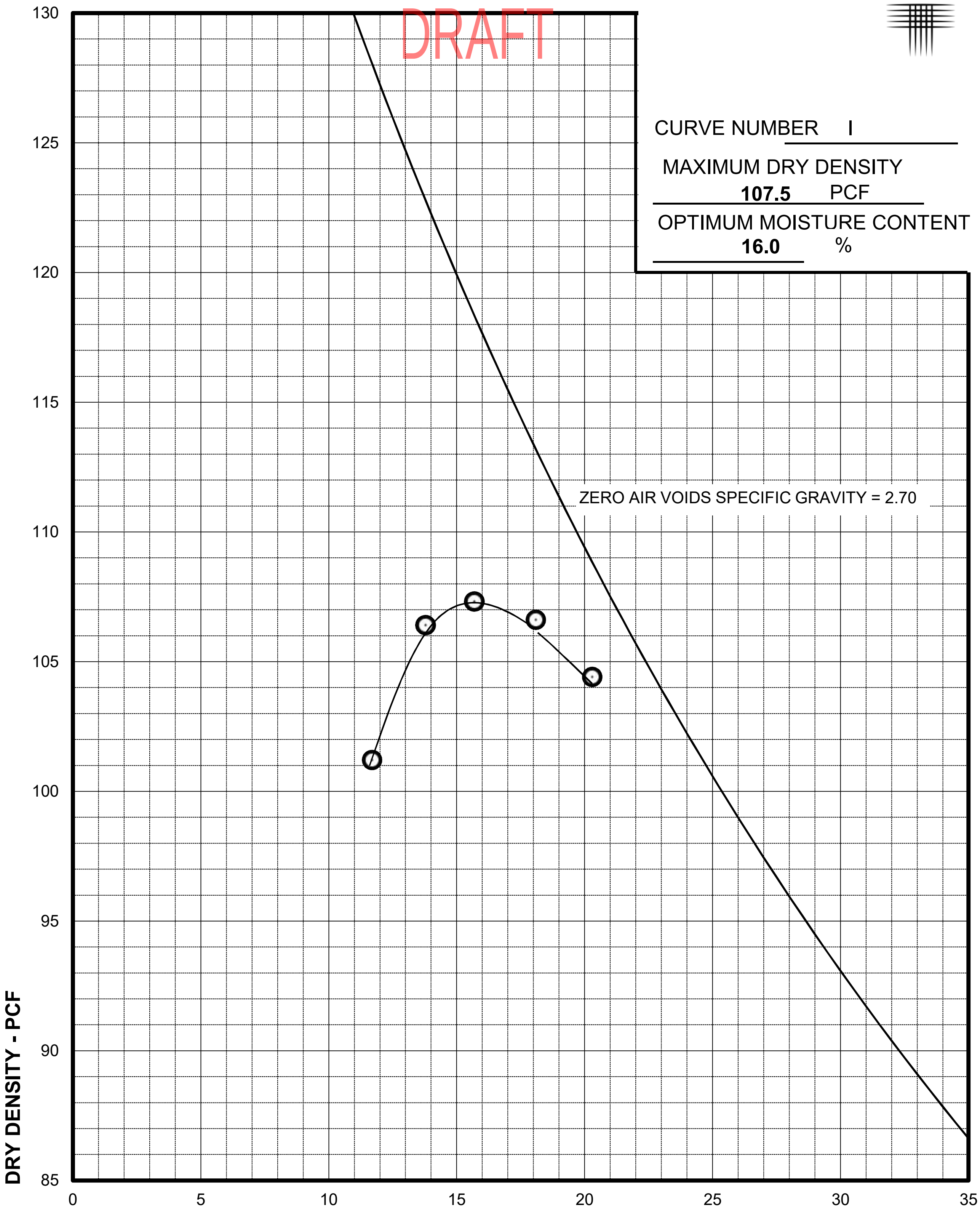
Sample of
From

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

Gradation Test Results

FIG. B-90

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1



MOISTURE CONTENT - %

Sample Description Clay, Sandy (CL)

Location TH-23 at 0-5 feet

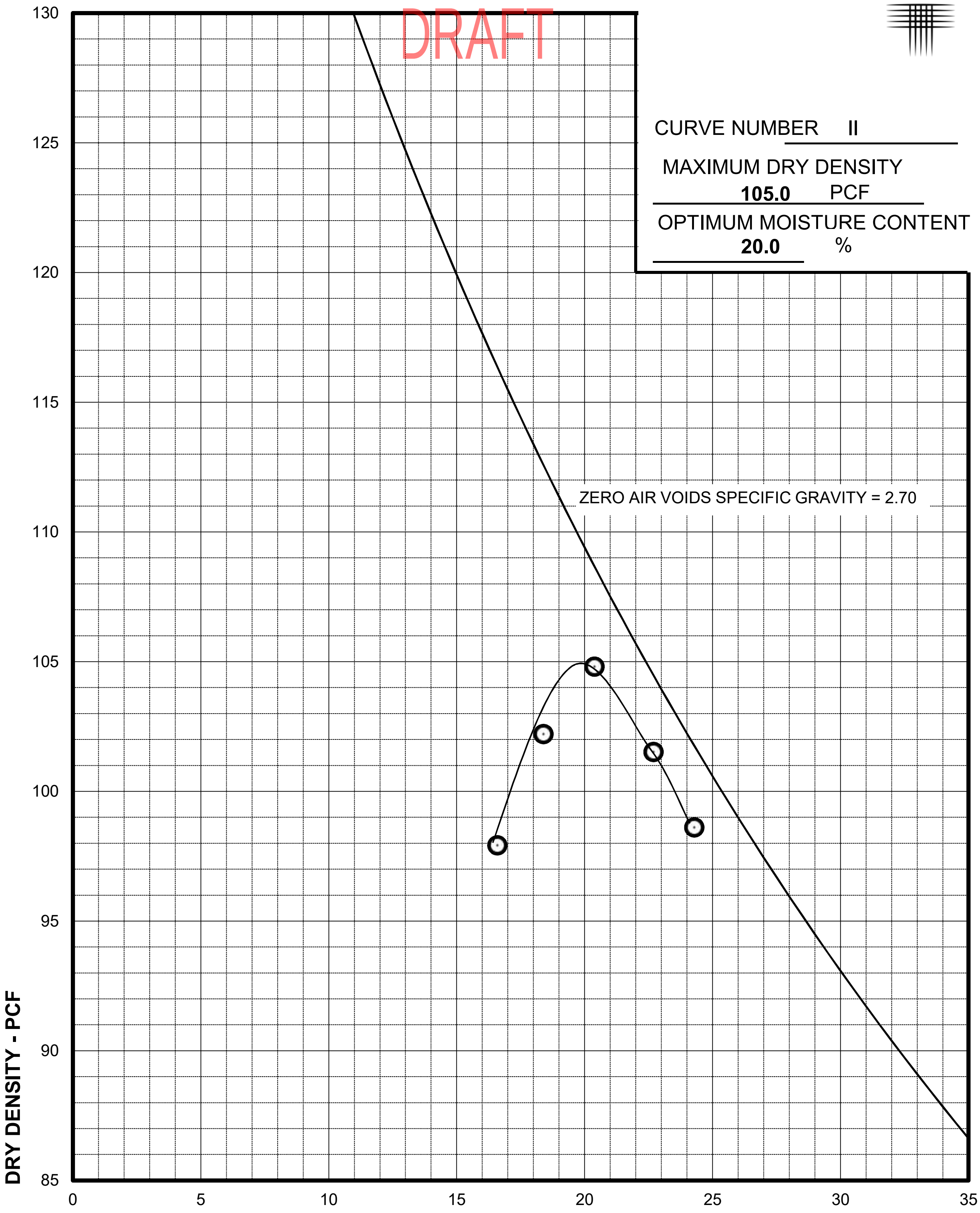
Compaction Test Procedure ASTM D 698
METHOD "A"

LIQUID LIMIT	40	
PLASTICITY INDEX	23	
GRAVEL	-	%
SAND	-	%
SILT AND CLAY	59	%

Compaction Test Results

FIG. B-91

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1



MOISTURE CONTENT - %

Sample Description Clay, Sandy (CL)

Location TH-31 at 0-10 feet

Compaction Test Procedure ASTM D 698
METHOD "A"

LIQUID LIMIT	55	
PLASTICITY INDEX	34	
GRAVEL	-	%
SAND	-	%
SILT AND CLAY	78	%

Compaction Test Results

FIG. B-92

SHEA HOMES
RIDGEGATE SOUTHWEST VILLAGE
CTL|T PROJECT NO. DN49,935-115-R1

TABLE B - I

SUMMARY OF LABORATORY TEST RESULTS

BORING	DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SWELL TEST DATA				ATTERBERG LIMITS		SOLUBLE SULFATE CONTENT (%)	RETAINED ON NO. 4 SIEVE (%)	PASSING NO. 200 SIEVE (%)	SOIL TYPE
				SWELL (%)	COMPRESSION (%)	APPLIED PRESSURE (psf)	SWELL PRESSURE (psf)	LIQUID LIMIT	PLASTICITY INDEX				
TH-1	9	10.9	103	5.0		250	2,000			<0.01			CLAY, SANDY (CL)
TH-1	14	28.2	94	1.3		900							CLAYSTONE
TH-1	19	34.2	84		0.7	1,500		75	46			97	CLAYSTONE
TH-1	24	37.0	85	0.6		2,100	4,600						CLAYSTONE
TH-1	29	41.0	80	0.1		2,700	3,800						CLAYSTONE
TH-2	9	12.3	103	3.6		200	1,800						CLAY, SANDY (CL)
TH-2	14	9.8	109		0.7	500						44	SANDSTONE
TH-2	19	4.9										15	SANDSTONE
TH-3	4	7.1	115									51	CLAY, SANDY (CL)
TH-3	9	8.0	112		0.1	1,100							CLAY, SANDY (CL)
TH-3	14	13.1	109	0.0		1,800							CLAY, SANDY (CL)
TH-4	4	12.2	105	3.2		800	3,200			0.03			CLAY, SANDY (CL)
TH-4	9	10.7	116	0.3		1,500						51	CLAY, SANDY (CL)
TH-4	14	16.3	101		0.4	2,200							CLAY, SANDY (CL)
TH-5	9	7.6	96	1.4		500							CLAY, SANDY (CL)
TH-5	14	3.4	115									26	SAND, CLAYEY (SC)
TH-5	19	5.0	121									33	SANDSTONE
TH-6	4	5.3	104								10	30	SAND, CLAYEY, SLIGHTLY GRAVELLY (SC)
TH-6	9	5.4	114								2	26	SAND, CLAYEY WITH TRACE GRAVEL (SC)
TH-6	14	34.3	85	0.2		2,400							CLAYSTONE
TH-7	9	17.2	101	0.6		500	1,300			0.05			CLAYSTONE
TH-7	14	17.5	111	2.0		1,100	8,000						CLAYSTONE
TH-7	19	17.6	114	3.0		1,800	19,000						CLAYSTONE
TH-7	24	15.2	121	1.6		2,400							CLAYSTONE
TH-7	29	20.6	107	0.4		3,000	5,000						INTERBEDDED CLAYSTONE/SANDSTONE
TH-8	4	3.7	114	1.6		200	900						CLAY, SANDY (CL)
TH-8	14	26.8	95	0.8		1,400							CLAYSTONE
TH-9	4	9.1	105		2.4	2,100						60	CLAY, SANDY (CL)
TH-9	9	10.6	97		6.6	2,700							CLAY, SANDY (CL)
TH-10	4	10.8	98	3.6		500	2,200						CLAY, SANDY (CL)
TH-10	14	28.3	91	2.6		1,800	13,000						CLAYSTONE
TH-10	19	30.2	87	0.3		2,400							CLAYSTONE
TH-11	4	9.2	68	0.3		1,800		41	24			58	CLAY, SANDY (CL)
TH-11	9	23.5	99	1.9		2,400	11,000						CLAYSTONE
TH-12	4	10.1	102	7.8		200	2,800			<0.01			CLAY, SANDY (CL)
TH-12	9	5.8										30	SAND, CLAYEY (SC)
TH-12	14	2.3									3	10	SAND, SLIGHTLY SILTY WITH TRACE GRAVEL (SP-SM)
TH-13	24	22.8	98	0.8		500	1,800			0.03			CLAYSTONE
TH-13	29	26.0	96	1.4		1,100	4,100	64	35			59	CLAYSTONE
TH-13	34	30.6	88	0.5		1,800	2,900						CLAYSTONE
TH-13	39	27.5	95	0.1		2,400							CLAYSTONE
TH-13	44	29.8	190		0.2	3,000							CLAYSTONE
TH-14	4	11.0	118									73	CLAY, SANDY (CL)
TH-14	9	10.8	111	1.3		1,100							CLAY, SANDY (CL)
TH-14	14	16.1	114	2.6		1,800	11,000						CLAY, SANDY (CL)
TH-14	19	25.6	92	0.1		2,400							SANDSTONE
TH-15	9	3.3	106									12	SAND, SLIGHTLY SILTY (SP-SM)
TH-15	14	36.9	84	0.4		2,700							CLAYSTONE
TH-16	4	16.9	110	14.7		500	31,000			0.72			CLAY, SANDY (CL)
TH-16	9	17.6	111	6.2		1,100						94	CLAY, SANDY (CL)
TH-16	14	20.1	99		0.9	1,800						68	CLAY, SANDY (CL)
TH-16	19	26.8	96	1.9		2,400							WEATHERED CLAYSTONE
TH-17	4	15.0	98	4.7		500	8,000			0.03			CLAY, SANDY (CL)
TH-17	9	24.4	95	6.0		500	13,000						CLAYSTONE
TH-17	14	27.4	94	0.0		1,800						50	CLAYSTONE

TABLE B - I

SUMMARY OF LABORATORY TEST RESULTS

BORING	DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SWELL TEST DATA: SWELL (%)	SWELL TEST DATA: COMPRESSION (%)	SWELL TEST DATA: APPLIED PRESSURE (psf)	SWELL TEST DATA: SWELL PRESSURE (psf)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	SOLUBLE SULFATE CONTENT (%)	RETAINED ON NO. 4 SIEVE (%)	PASSING NO. 200 SIEVE (%)	SOIL TYPE
TH-18	24	34.6	84	2.9		500	6,100	73	41			77	CLAYSTONE
TH-18	29	29.0	91	0.5		1,100	4,100						CLAYSTONE
TH-18	34	26.1	100	1.1		1,800							CLAYSTONE
TH-18	39	28.3	94	0.3		2,400	5,000						CLAYSTONE
TH-18	44	32.3	92	0.7		3,000	6,000						CLAYSTONE
TH-19	9	11.4	122	2.3		1,800	8,900					50	CLAY, SANDY (CL)
TH-19	14	34.9	86	1.3		2,400	9,000						CLAYSTONE
TH-19	19	32.1	87	0.8		3,000							CLAYSTONE
TH-20	4	6.9	119								5	24	SAND, SILTY WITH GRAVEL (SM)
TH-20	9	42.4	74	0.0		1,800							CLAYSTONE
TH-20	14	36.3	83	0.3		2,400							CLAYSTONE
TH-21	4	13.9	110	8.8		1,100	22,000			0.01			CLAY, SANDY (CL)
TH-21	9	22.9	100	7.4		1,800		79	53			83	CLAY, SANDY (CL)
TH-21	14	19.6	106	3.2		2,400	13,000						CLAY, SANDY (CL)
TH-22	19	22.4	105	10.0		500	18,000			0.05			CLAY, SANDY (CL)
TH-22	24	25.7	98	4.3		1,100	17,000						CLAYSTONE
TH-22	29	27.0	98	2.8		1,800	18,000						CLAYSTONE
TH-22	34	27.8	90	1.1		2,400	6,000						CLAYSTONE
TH-22	39	33.3	85	1.4		3,000	8,500						CLAYSTONE
TH-23	29	30.2	93	0.3		500							CLAYSTONE
TH-23	34	28.6	95	0.2		1,100							CLAYSTONE
TH-23	39	22.3	101	0.3		1,800							CLAYSTONE
TH-23	0-5							40	23			59	CLAY, SANDY (CL)
TH-24	19	29.3	93	3.4		500	11,000						CLAYSTONE
TH-24	24	24.1	98	0.6		1,100	4,200						CLAYSTONE
TH-24	29	24.2	101	2.0		1,800	11,000						CLAYSTONE
TH-24	34	27.1	97	2.8		2,400	30,000						CLAYSTONE
TH-24	39	25.3	100	0.9		3,000							CLAYSTONE
TH-25	4	13.8	102	3.5		2,400	8,500					69	CLAY, SANDY (CL)
TH-25	9	9.6	118		0.5	3,000							CLAY, SANDY (CL)
TH-26	4	14.2	108	10.4		1,200	19,000			<0.01			CLAY, SANDY (CL)
TH-26	9	18.4	105	4.5		1,900	11,000						CLAY, SANDY (CL)
TH-26	14	32.6	87		0.1	2,500							CLAYSTONE
TH-27	4	13.6	106	11.1		500	12,000	59	39			88	CLAY, SANDY (CL)
TH-27	9	21.1	94	4.5		1,100	5,000						CLAYSTONE
TH-27	14	21.0	97	0.3		1,800							CLAYSTONE
TH-28	4	13.4	107	15.1		200				0.07			CLAY, SANDY (CL)
TH-28	9	19.6	105	0.6		700		48	27			54	CLAYSTONE
TH-28	19	21.9	103									41	SANDSTONE
TH-29	4	13.7	116	14.2		700							CLAY, SANDY (CL)
TH-29	9	21.3	101	4.0		1,300							CLAYSTONE
TH-29	14	25.1	94									52	CLAYSTONE
TH-30	9	7.6	115					40	25			48	SAND, CLAYEY (SC)
TH-30	14	1.7	112								1	6	SAND, SLIGHTLY SILTY (SP-SM)
TH-30	19	19.2	106	4.3		1,100							CLAY, SANDY (CL)
TH-30	24	33.3	85	3.3		1,800							CLAYSTONE
TH-31	0-10							55	34			78	CLAY, SANDY (CL)
TH-31	9	18.3	103	6.6		800	12,000			<0.01			CLAYSTONE
TH-31	14	31.5	90	3.4		1,400	13,000						CLAYSTONE
TH-31	19	31.6	90	2.2		2,000	13,000						CLAYSTONE
TH-31	24	32.8	88	0.8		2,600							CLAYSTONE
TH-31	29	34.6	85	1.2		3,200							CLAYSTONE
TH-32	4	31.5	89	5.1		1,100	23,000			<0.01			WEATHERED CLAYSTONE
TH-32	14	31.9	87		0.1	2,400							WEATHERED CLAYSTONE
TH-32	19	32.8	89	0.2		3,000							CLAYSTONE

TABLE B - I

SUMMARY OF LABORATORY TEST RESULTS

BORING	DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SWELL TEST DATA: SWELL (%)	COMPRESSION (%)	APPLIED PRESSURE (psf)	SWELL PRESSURE (psf)	ATTERBERG LIMITS: LIQUID LIMIT	PLASTICITY INDEX	SOLUBLE SULFATE CONTENT (%)	RETAINED ON NO. 4 SIEVE (%)	PASSING NO. 200 SIEVE (%)	SOIL TYPE
TH-33	4	13.9	109	11.5		500	31,000						CLAY, SANDY (CL)
TH-33	9	18.2	105	8.8		1,100		73	49			90	CLAY, SANDY (CL)
TH-33	14	23.6	97	2.4		1,800							CLAYSTONE
TH-34	4	2.4										10	SAND, SLIGHTLY SILTY (SP-SM)
TH-34	9	32.1	85	1.6		1,800							WEATHERED CLAYSTONE
TH-34	14	29.9	92	1.2		2,400		70	35			52	CLAYSTONE
TH-34	19	30.8	93	1.2		3,000							CLAYSTONE
TH-35	9	22.4	101	5.0		250				<0.01			CLAYSTONE
TH-35	14	23.2	100	2.5		800							CLAYSTONE
TH-35	24	24.9	93	1.5		2,000							CLAYSTONE
TH-36	19	16.2	111	2.4		200	4,000						INTERBEDDED CLAYSTONE/SANDSTONE
TH-36	24	26.7	99	4.3		700	5,100						INTERBEDDED CLAYSTONE/SANDSTONE
TH-36	29	25.7	99	4.8		1,400	21,000						CLAYSTONE
TH-36	34	22.5	102	2.0		2,100	12,000						CLAYSTONE
TH-36	39	22.6	107	3.5		2,700	28,000						CLAYSTONE
TH-37	19	22.1	105	0.5		500						57	CLAYSTONE
TH-37	24	17.9	113	3.3		1,100		50	27			79	CLAYSTONE
TH-37	29	20.3	105	2.7		1,800							CLAYSTONE
TH-38	9	9.6	116	2.7		200				0.04		44	SAND, CLAYEY (SC)
TH-38	14	25.7	97	3.2		800							CLAYSTONE
TH-38	19	33.2	80		0.3	1,400							CLAYSTONE
TH-39	14	20.9	103	2.9		500		56	32			78	CLAYSTONE
TH-39	19	19.1	102	1.9		1,100							CLAYSTONE
TH-39	24	22.1	98	1.9		1,800							CLAYSTONE
TH-40	4	18.3	92		0.3	1,100				0.03		46	SANDSTONE
TH-40	9	41.5	76	0.8		1,800							CLAYSTONE
TH-40	14	39.3	83	0.8		2,400							CLAYSTONE
TH-41	34	15.5	102	7.1		500	4,800	62	43			88	CLAYSTONE
TH-41	39	14.2	118	4.7		1,100	11,000						CLAYSTONE
TH-41	44	13.2	120	0.9		1,800							CLAYSTONE
TH-41	49	14.0	121	3.9		2,400	15,000						CLAYSTONE
TH-41	54	13.8	116	1.6		3,000							CLAYSTONE
TH-42	4	15.4	107	7.1		500				0.07		71	CLAY, SANDY (CL)
TH-42	14	18.0	113	0.8		1,800		49	24			54	CLAY, SANDY (CL)
TH-42	24	26.0	98	1.2		3,000							CLAYSTONE

APPENDIX C

GUIDELINE SITE GRADING SPECIFICATIONS
Ridgegate Southwest Village
Lone Tree, Colorado

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GUIDELINE SITE GRADING SPECIFICATIONS
Ridgegate Southwest Village
Lone Tree, Colorado

1. DESCRIPTION

This item shall consist of the excavation, transportation, placement and compaction of materials from locations indicated on the plans, or staked by the Engineer, as necessary to achieve preliminary street and overlot elevations. These specifications shall also apply to compaction of excess cut materials that may be placed outside of the development boundaries.

2. GENERAL

The Soils Engineer shall be the Owner's representative. The Soils Engineer shall approve fill materials, method of placement, moisture contents and percent compaction, and shall give written approval of the completed fill.

3. CLEARING JOB SITE

The Contractor shall remove all vegetation and debris before excavation or fill placement is begun. The Contractor shall dispose of the cleared material to provide the Owner with a clean, neat appearing job site. Cleared material shall not be placed in areas to receive fill or where the material will support structures of any kind.

4. SCARIFYING AREA TO BE FILLED

All topsoil and vegetable matter shall be removed from the ground surface upon which fill is to be placed. The surface shall then be plowed or scarified until the surface is free from ruts, hummocks or other uneven features, which would prevent uniform compaction.

5. COMPACTING AREA TO BE FILLED

After the foundation for the fill has been cleared and scarified, it shall be disked or bladed until it is free from large clods, brought to the proper moisture content (1 to 4 percent above optimum moisture content for clay and within 2 percent of optimum moisture content for sand) and compacted to not less than 95 percent of maximum dry density as determined in accordance with ASTM D698.

6. FILL MATERIALS

Fill soils shall be free from organics, debris or other deleterious substances, and shall not contain rocks or clods having a diameter greater than three (3) inches. Fill materials shall be obtained from cut areas shown on the plans or staked in the field by the Engineer.

On-site materials classifying as CL, CH, SC, SM, SW, SP, GP, GC and GM are acceptable. Concrete, asphalt, organic matter and other deleterious materials or debris shall not be used as fill.

7. MOISTURE CONTENT

Fill material shall be moisture-conditioned in accordance with specifications summarized below. Sufficient laboratory compaction tests shall be made to determine the optimum moisture content for the various soils encountered in borrow areas.

SUMMARY OF MOISTURE CONTENT REQUIREMENTS

Soil Type	Depth of Site Grading Fill	
	≤20 Feet	>20 Feet
Clay (CL, CH)	1 to 4 percent above optimum	2 percent below to 1 percent above optimum
Granular Soils (SC, SM, SW, SP, GP, GC, GM	Within 2 percent of optimum	2 percent below to 1 percent above optimum

*Percentage specification based on optimum moisture content (optimum).

The Contractor may be required to add moisture to the excavation materials in the borrow area if, in the opinion of the Soils Engineer, it is not possible to obtain uniform moisture content by adding water on the fill surface. The Contractor may be required to rake or disc the fill soils to provide uniform moisture content through the soils.

The application of water to embankment materials shall be made with any type of watering equipment approved by the Soils Engineer, which will give the desired results. Water jets from the spreader shall not be directed at the embankment with such force that fill materials are washed out.

Should too much water be added to any part of the fill, such that the material is too wet to permit the desired compaction from being obtained, rolling and all work on that section of the fill shall be delayed until the material has been allowed to dry to the required moisture content. The Contractor will be permitted to rework wet material in an approved manner to hasten its drying.

8. COMPACTION OF FILL AREAS

Selected fill material shall be placed and mixed in evenly spread layers. After each fill layer has been placed, it shall be uniformly compacted to not less than the specified percentage of maximum density. Fill materials shall be placed such that the thickness of loose materials does not exceed 10 inches and the compacted lift thickness does not exceed 6 inches.

SUMMARY OF MINIMUM COMPACTION SPECIFICATIONS

Soil Type	Depth of Site Grading Fill	
	≤20 Feet	>20 Feet
Clay (CL, CH)	95% STD	98% STD
Granular Soils (SC, SM, SW, SP, GP, GC, GM	95% STD	98% STD

*Compaction percentage specifications based on standard Proctor maximum dry density (STD).

Compaction shall be obtained by the use of sheepsfoot rollers, multiple-wheel pneumatic-tired rollers, or other equipment approved by the Engineer for soils classifying as CL, CH, or SC. Granular fill shall be compacted using vibratory equipment or other equipment approved by the Soils Engineer. Compaction shall be accomplished while the fill material is at the specified moisture content. Compaction of each layer shall be continuous over the entire area. Compaction equipment shall make sufficient trips to ensure that the required density is obtained.

9. COMPACTION OF SLOPES

Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compaction operations shall be continued until slopes are stable, but not too dense for planting, and there is not appreciable amount of loose soils on the slopes. Compaction of slopes may be done progressively in increments of three to five feet (3' to 5') in height or after the fill is brought to its total height. Permanent fill slopes shall not exceed 3:1 (horizontal to vertical).

10. PLACEMENT OF FILL ON NATURAL SLOPES

Where natural slopes are steeper than 20 percent in grade and the placement of fill is required, benches shall be cut at the rate of one bench for each 5 feet in height (minimum of two benches). Benches shall be at least 10 feet in width. Larger bench widths may be required by the Engineer. Fill shall be placed on completed benches as outlined within this specification.

11. DENSITY TESTS

Field density tests shall be made by the Soils Engineer at locations and depths of his choosing. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density tests shall be taken in compacted material below the disturbed surface. When density tests indicate that the density or moisture content of any layer of fill or portion thereof is not within specification, the particular layer or portion shall be reworked until the required density or moisture content has been achieved.

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12. SEASONAL LIMITS

No fill material shall be placed, spread or rolled while it is frozen, thawing, or during unfavorable weather conditions. When work is interrupted by heavy precipitation, fill operations shall not be resumed until the Soils Engineer indicates that the moisture content and density of previously placed materials are as specified.

13. NOTICE REGARDING START OF GRADING

The Contractor shall submit notification to the Soils Engineer and Owner advising them of the start of grading operations at least three (3) days in advance of the starting date. Notification shall also be submitted at least 3 days in advance of any resumption dates when grading operations have been stopped for any reason other than adverse weather conditions

14. REPORTING OF FIELD DENSITY TESTS

Density tests made by the Soils Engineer, as specified under "Density Tests" above, shall be submitted progressively to the Owner. Dry density, moisture content, and percentage compaction shall be reported for each test taken.

15. DECLARATION REGARDING COMPLETED FILL

The Soils Engineer shall provide a written declaration stating that the site was filled with acceptable materials, and was placed in general accordance with the specifications.

APPENDIX D

GUIDELINE SUB-EXCAVATION SPECIFICATIONS
Ridgegate Southwest Village
Lone Tree, Colorado

Note: This guideline is intended for use with sub-excavation, If sub-excavation is not selected, the guidelines in Appendix C should be followed.

GUIDELINE SUB-EXCAVATION SPECIFICATIONS
Ridgegate Southwest Village
Lone Tree, Colorado

1. DESCRIPTION

This item shall consist of the excavation, transportation, placement and compaction of materials from locations indicated on the plans, or staked by the Engineer, as necessary to achieve preliminary street and overlot elevations. These specifications shall also apply to compaction of materials that may be placed outside of the development boundaries.

2. GENERAL

The Soils Engineer shall be the Owners representative. The Soils Engineer shall approve fill materials, method of placement, moisture content and percent compaction, and shall give written approval of the completed fill.

3. CLEARING JOB SITE

The Contractor shall remove all vegetation and debris before excavation or fill placement is begun. The Contractor shall dispose of the cleared material to provide the Owner with a clean, neat appearing job site. Cleared material shall not be placed in areas to receive fill where the material will support structures of any kind.

4. SCARIFYING AREA TO BE FILLED

All topsoil and vegetable matter shall be removed from the ground surface upon which fill is to be placed. The surface shall then be plowed or scarified until the surface is free from ruts, hummocks or other uneven features which would prevent uniform compaction.

5. COMPACTING AREA TO BE FILLED

After the foundation for the fill has been cleared and scarified, it shall be disked or bladed until it is free from large clods, brought to the proper moisture content, (1 to 4 percent above optimum) and compacted to not less than 95 percent of maximum density as determined in accordance with ASTM D 698.

6. FILL MATERIALS

Fill soils shall be free from vegetable matter or other deleterious substances, and shall not contain rocks having a diameter greater than three (3) inches. Fill materials shall be obtained from cut areas shown on the plans or staked in the field by the Engineer.

On-site materials classifying as CL, CH, SC, SM, SP, GP, GC and GM are acceptable. Concrete, asphalt, and other deleterious materials or debris shall not be used as fill.

7. MOISTURE CONTENT

Fill materials shall be moisture treated to within limits of optimum moisture content specified in "Moisture Content and Density Criteria". Sufficient laboratory compaction tests shall be made to determine the optimum moisture content for the various soils encountered in borrow areas or imported to the site.

The Contractor may be required to add moisture to the excavation materials in the borrow area if, in the opinion of the Soils Engineer, it is not possible to obtain uniform moisture content by adding water on the fill surface. The Contractor will be required to rake or disc the fill to provide uniform moisture content throughout the fill.

The application of water to embankment materials shall be made with any type of watering equipment approved by the Soils Engineer, which will give the desire results. Water jets from the spreader shall not be directed at the embankment with such force that fill materials are washed out.

Should too much water be added to any part of the fill, such that the material is too wet to permit the desired compaction from being obtained, rolling and all work on that section of the fill shall be delayed until the material has been allowed to dry to the required moisture content. The Contractor will be permitted to rework wet material in an approved manner to hasten its drying.

8. COMPACTION OF FILL MATERIALS

Selected fill material shall be placed and mixed in evenly spread layers. After each fill layer has been placed, it shall be uniformly compacted to not less than the specified percentage of maximum density given in "Moisture Content and Density Criteria". Fill materials shall be placed such that the thickness of loose material does not exceed 8 inches and the compacted lift thickness does not exceed 6 inches.

Compaction, as specified above, shall be obtained by the use of sheepsfoot rollers, multiple-wheel pneumatic-tired rollers, or other equipment approved by the Soils Engineer for soils classifying as CL, CH or SC. Granular fill shall be compacted using vibratory equipment or other equipment approved by the Soils Engineer. Compaction shall be accomplished while the fill material is at the specified moisture content. Compaction of each layer shall be continuous over the entire area. Compaction equipment shall make sufficient trips to ensure that the required density is obtained.

9. MOISTURE CONTENT AND DENSITY CRITERIA

Fill material shall be substantially compacted to at least 95 percent of maximum ASTM D 698 (AASHTO T 99) dry density at 1 to 4 percent above optimum moisture content. Additional criteria for acceptance are presented in DENSITY TESTS.

10. DENSITY TESTS

Field density tests shall be made by the Soils Engineer at locations and depths of his choosing. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density tests shall be taken in compacted material below the disturbed surface. When density tests indicate the density or moisture content of any layer of fill or portion thereof not within specifications, the particular layer or portion shall be reworked until the required density or moisture content has been achieved.

Allowable ranges of moisture content and density given in MOISTURE CONTENT AND DENSITY CRITERIA are based on design considerations. The moisture shall be controlled by the Contractor so that moisture content of the compacted earth fill, as determined by tests performed by the Soils Engineer, shall be within the limits given. The Soils Engineer will inform the Contractor when the placement moisture is less than or exceeds the limits specified and the Contractor shall immediately make adjustments in procedures as necessary to maintain placement moisture content within the specified limits, to satisfy the following requirements.

A. Moisture

1. The average moisture content of material tested each day shall not be less than 1.5 percent over optimum moisture content.

2. Material represented by samples tested having moisture lower than 1 percent over optimum will be rejected. Such rejected materials shall be reworked until moisture equal to or greater than 1 percent above optimum is achieved.

B. Density

1. The average dry density of material tested each day shall not be less than 95 percent of maximum ASTM D 698 dry density.

2. No more than 10 percent of the material represented by the samples tested shall be at dry densities less than 95 percent of maximum ASTM D 698 dry density.

3. Material represented by samples tested having dry density less than 94 percent of maximum ASTM D 698 dry density will be rejected. Such rejected materials shall be reworked until a dry

density equal to or greater than 95 percent of maximum ASTM D 698 dry density is obtained.

11. INSPECTION AND TESTING OF FILL

Inspection by the Soils Engineer shall be sufficient during the placement of fill and compaction operations so that they can declare the fill was placed in general conformance with specifications. All inspections necessary to test the placement of fill and observe compaction operations will be at the expense of the Owner.

12. SEASONAL LIMITS

No fill material shall be placed, spread or rolled while it is frozen, thawing, or during unfavorable weather conditions. When work is interrupted by heavy precipitation, fill operations shall not be resumed until the Soils Engineer indicates the moisture content and density of previously placed materials are as specified.

13. REPORTING OF FIELD DENSITY TESTS

Density tests made by the Soils Engineer, as specified under “Density Tests” above, shall be submitted progressively to the Owner. Dry density, moisture content and percentage compaction shall be reported for each test taken

July 15, 2020

Shea Homes
9380 Hamilton Station Street, Suite 600
Lone Tree, Colorado 80124

Attention: Ryan McDermed

Subject: Preliminary Slope Evaluation
Ridgegate Southwest Village
Southeast of Ridgegate Parkway
And Interstate 25
Lone Tree, Colorado
Project No. DN49,935-115-L1

At your request, we have conducted an initial observation of the existing slopes in the southern portion of the site. The purpose of our observations was to assess the potential for slope stability issues for the existing slopes relative to planned cut and fill slopes and retaining wall construction for the Ridgegate Southwest Village property. The work was conducted in accordance with our proposal dated May 13, 2020 (Proposal No. DN 19-0229-CM2). The site was visited with Mr. Alan Lisowy. P.E. and Mr. Chris Fitzsimmons on June 22, 2020, and by Mr. David Glater, PE, CPG on June 23, 2020. This letter summarizes the results of our field reconnaissance.

Previous Investigation:

CTL-Thompson, Inc. previously conducted a Preliminary Geotechnical Investigation for the site under our Project No. DN49,935-115R2, dated April 24, 2019. Our previous study described the site geology as surficial soils having a mixture of clay and sand alluvium underlain by bedrock of the Dawson and Arapahoe Formations. Colluvial soils appears to cover the flanks of the steeper slopes in the southern portion of the site. Geologic hazards that were identified consisted of expansive soil and bedrock, moderately to steep slopes, erosion, and the regional geologic hazards of seismicity and naturally occurring radioactive materials. No geologic hazards were found that would preclude development. Bedrock was observed at several locations, including cemented outcrops near the tops of slopes and in the southwest portion of the site, and uncemented bedrock was exposed in the banks of many of the drainages.

Slope Observations:

The site is vacant rangeland and bordered by Happy Canyon Creek to the West, vacant land and Ridgegate Parkway to the north, Badger Gulch to the east and vacant land to the south. The site generally slopes north, with moderate to very steep grades on the south portion flattening to the north. Several incised drainages that flow generally to the northeast were observed. The slopes generally steepen to the south, approaching 1H:1V (horizontal:vertical), with some localized slopes steeper than 1H:1V). Vertical cemented bedrock outcrops were observed at a few locations. Slopes along the banks of the drainages varied from about 1H:1V, with frequent areas of over-steepening due to erosion. The ground surface in the area of the steep slopes was generally covered with grass, small bushes and scrub oak.

Slope Stability:

The natural slopes on the hillsides in the southern portion of the property are very steep. While, there is evidence of erosion, we observed no signs of unstable slopes. There were no observable tension cracks or signs of old scarps, nor did we observe evidence of seepage on the slopes or springs at the bottom of the slopes.

Based on the relatively shallow bedrock, a soil matrix with significant cobble and gravel, and the lack of evidence of slope movement, preliminarily, we believe the slopes in the southern portion of the site to be globally stable. We are currently conducting a supplemental study, including borings and laboratory testing, to allow a more in-depth evaluation of slope stability at the site.

If we can be of further service in discussing the contents of this letter or provide additional analysis, please call.

Very truly yours,

CTL | THOMPSON, INC.

Alan J. Lisowy, P.E.
Principal

AJL/nn

Via e-mail: ryan.mcdermed@sheahomes.com
jennifer.miller@sheahomes.com