CTL | THOMPSON
INCORPORATED

PRELIMINARY GEOTECHNICAL INVESTIGATION
WATER'S EDGE, SECOND FILING
PHASES 1A AND 4
FORT COLLINS, COLORADO

Prepared For:

ACTUAL COMMUNITIES, INC.
5935 South Zang Street, Suite 230
Littleton, Colorado 80127

Attention: Joe Knopinski

Project No. FC08010.001-115

February 9, 2018

400 North Link Lane | Fort Collins, Colorado 80524
Telephone: 970-206-9455 Fax: 970-206-9441

TABLE OF CONTENTS

SCOPE ... 1

SUMMARY OF CONCLUSIONS ... 1

SITE DESCRIPTION ... 3

PROPOSED DEVELOPMENT ... 3

PREVIOUS INVESTIGATIONS ... 4

FIELD AND LABORATORY INVESTIGATIONS ... 4

SITE GEOLOGY ... 4

GEOLOGIC HAZARDS ... 5

Expansive Soils and Bedrock ... 5
Hard Bedrock and Difficult Excavation ... 6
Groundwater ... 6
Seismicity ... 6
Radioactivity ... 7
Erosion ... 7

SUBSURFACE CONDITIONS ... 7

Existing Fill ... 8
Natural Sandy Clay ... 8
Bedrock ... 9

DEVELOPMENT RECOMMENDATIONS ... 10

Over-Excavation ... 10
Site Grading ... 12
Imported Fill ... 12
Permanent Cut and Fill Slopes ... 13
Utility Construction ... 13
Underdrain ... 14

PAVEMENTS ... 15

Subgrade Preparation ... 15

BUILDING CONSTRUCTION CONSIDERATIONS ... 16

Foundations ... 16
Slabs-on-Grade and Basement Floor Construction ... 16
Below-Grade Construction ... 17
Surface Drainage ... 17
CONCRETE ... 18

RECOMMENDED FUTURE INVESTIGATIONS ... 18

LIMITATIONS ... 18

TABLE OF CONTENTS cont'd

FIGURE 1 – LOCATIONS OF EXPLORATORY BORINGS
FIGURE 2 – GEOLOGIC MAP
FIGURE 3 – ELEVATION OF BEDROCK SURFACE
FIGURE 4 – ELEVATION OF GROUNDWATER SURFACE
FIGURE 5 – ESTIMATED EXTENT OF POTENTIAL OVER-EXCAVATION
FIGURE 6 – CONCEPTUAL OVER-EXCAVATION PROFILE
FIGURE 7 – OVER-EXCAVATION PROFILE (WALKOUT BASEMENT)
FIGURE 8 – SEWER UNDERDRAIN DETAIL
FIGURE 9 – UNDERDRAIN CUTOFF WALL DETAIL
FIGURE 10 – CONCEPTUAL UNDERDRAIN SERVICE PROFILE

APPENDIX A – SUMMARY LOGS OF EXPLORATORY BORINGS
APPENDIX B – LABORATORY TEST RESULTS
APPENDIX C – GUIDELINE SITE GRADING SPECIFICATIONS
APPENDIX D – OVER-EXCAVATION SPECIFICATIONS

SCOPE

This report presents the results of our Preliminary Geotechnical Investigation for a portion of Water's Edge, Second Filing in Fort Collins, Colorado (Fig. 1). The purpose was to identify geologic hazards and geotechnical concerns which exist at the site and to evaluate the subsurface conditions to assist in planning and budgeting for the proposed development. The report includes descriptions of site geology, our analysis of the impact of geologic conditions on site development, a description of subsoil, bedrock and ground water conditions found in our exploratory borings, recommendations for site development and a discussion of anticipated foundation and floor systems.

This report was prepared based upon our understanding of the development plans. The recommendations are considered preliminary and can be used as guidelines for further planning of development and design of grading. Additional sampling and testing may be considered to provide a more reliable estimate of the potential extent of over-excavation. We should review final development and grading plans to determine if additional investigation is merited, or if we need to revise our recommendations. Additional investigations will be required to design building foundations and pavements. A summary of our findings and recommendations is presented below. More detailed discussions of the data, analysis and recommendations are presented in the report.

SUMMARY OF CONCLUSIONS

1. The site contains geologic hazards that should be mitigated during planning and development. No geologic or geotechnical conditions were identified which would preclude development of this site. Expansive soils and bedrock and difficult soil and rock excavation are the primary geotechnical concerns pertaining to development.

2. The subsurface conditions encountered in our borings were variable and consisted of nil to 22 feet of fill and sandy clay over bedrock. Claystone, sandstone and interbedded claystone and sandstone were encountered. Sand and gravel layers were encountered in borings TH-114, TH-115 and TH-117 through TH-120 between the sandy clay and bedrock. Groundwater was encountered at depths ranging from 14 to 27 feet below the existing ground surface in 12 borings. Most groundwater levels will not likely affect residence construction, but may affect installation of buried utilities and over-excavation.

3. The clay soils and claystone bedrock are expansive. The range of calculated potential ground heave is <0.5 to 5.2 inches. Over-excavation can be performed to likely allow the use of footing foundations. Over-excavation will also improve the performance of flatwork and slabs-on-grade.

4. We anticipate over-excavation up to 8 feet below basement footing foundations or to gravel or sandstone will be necessary in the portions of the site nearest borings TH-106 through TH-108 and 116 to 120 if use of footing foundations is desired. In the remaining areas of proposed construction, we anticipate footings can be supported on native sandstone or low swelling soils. It may be necessary to extend all footings to basement level on some lots, or to remove and replace expansive soils below footings.

5. Preliminary data suggest that local residential streets will likely require swell mitigation by moisture treatment or fly ash application. A design-level subgrade investigation and pavement design should be performed after grading is complete.

6. Asphaltic pavement sections on the order of 5 to 6 inches for local streets are anticipated for preliminary planning purposes. Higher traffic volumes will likely require thicker sections, on the order of 6 to 8 inches. Chemical stabilization of clay subgrade will likely be required.

7. Control of surface and subsurface drainage will be critical to the performance of foundations, slabs-on-grade and pavements. Overall surface drainage should be designed to provide rapid runoff of surface water away from structures, and off pavements and flatwork.

SITE DESCRIPTION

The site is located north of Brightwater Drive and West of Turnberry Road in Fort Collins, Colorado (Fig. 1). The 70+/- acre site is primarily vegetated with grasses and weeds. At the time of our investigation the site was predominately undeveloped, with some buried utilities serving finished residences to the north and south. Brightwater Drive and Morningstar Way (west of the proposed roundabout) were paved; no other roadways were in place. A playground was located on the neighborhood park parcel within the proposed development. The ground surface slopes south and west toward Richard Lake in the western portion, and southeast for the eastern portion. Small, local ridges and valleys are present. Two piles of apparent fill are present at the site, located northwest of the park and north of the existing Brightwater Court, in the vicinity of borings TH-116 through TH-120. Based upon our review of historical aerial imagery, the fill was generated during site grading activities in the development to the south, between 1999 and 2002. Directly west of these piles, we observed a field of boulder-sized sandstone bedrock fragments and an out-of-service oil well and pad. The boulders appear to have been placed during the construction of the pad surrounding the well. An existing pumphouse was also present in the northeast corner of the site.

PROPOSED DEVELOPMENT

We understand the parcel is planned for development of single-family residences. The project will be accessed via paved streets and serviced by buried utilities. We assume the residences will be 1 to 2-story, wood frame structures with loads of 1-3 kips per linear foot of foundation wall. The homes are likely to have full depth or walkout basements.

PREVIOUS INVESTIGATIONS

We were provided a Preliminary Geotechnical and Geological Engineering Report prepared by Terracon (Project No. 20055201) dated November 23, 2005. Three borings were drilled in the area of the lots included in this investigation. The soils encountered included 16 feet of clay over claystone, siltstone or sandstone bedrock in the eastern portion, and 5 to 13 feet of clay over shallow siltstone/sandstone in the western portion. No swell tests were performed on clay samples, and one swell test was performed on a bedrock sample.

FIELD AND LABORATORY INVESTIGATIONS

We investigated subsurface conditions by drilling twenty-one exploratory borings at the locations shown on Figure 1. The locations were surveyed after drilling. The holes were drilled using a truck-mounted drill rig and 4-inch diameter, continuous-flight auger. Our field representative observed drilling, logged the soils found in the borings and obtained samples. Summary logs of the soils found in the borings are presented in Appendix A.

Samples of soil and bedrock were obtained during drilling by driving a modified California-type sampler (2.5-inch O.D.) into the subsoils and bedrock using a 140-pound hammer falling 30 inches. Samples were returned to our laboratory and visually classified by our engineer. Laboratory testing included moisture content and dry density, swell-consolidation, Atterberg limits, particle-size analysis, and water-soluble sulfate content. Laboratory test results are presented in Appendix B.

SITE GEOLOGY

The geology of the site was investigated through review of mapping by Ogden Tweto (Geologic Map of Colorado, 1979). As shown on Figure 2, the map indicates the eastern third of the proposed construction is underlain by eolian (wind-blown) soil. The upper Pierre Shale formation is mapped below the west portion, and is below the windblown soil.

GEOLOGIC HAZARDS

Our investigation identified several geologic hazards that must be considered during the planning and development phases of this project. Expansive soils and bedrock are the primary hazard. Some very hard bedrock is also present. None of the geologic hazards identified will preclude development of the property. No economically valuable extractable minerals are known to occur in the immediate area of the site. The regional concerns of seismicity and radioactivity should also be considered.

<u>Expansive Soils and Bedrock</u>

The soils and bedrock at this site include expansive clay and claystone bedrock. Approximately 40 percent of the site is judged to have moderate risk of damage due to expansive soils. There is risk that ground heave will damage pavements, slabs-on-grade, and foundations. Engineered design of grading, pavements, foundations, slabs and drainage can mitigate but not eliminate the effects of expansive soils and bedrock. We used the results of swell tests to evaluate the potential future heave of the soil and bedrock. The analysis involves dividing the soil profile into layers and modeling the swell characteristics of each layer from representative tests. Based on the swell-consolidation test results and our experience, we have estimated the potential heave at ground and basement-level, and risk at each boring location as shown in Table B-II. The estimates were based upon 24 feet of wetting below proposed grade.

Hard Bedrock and Difficult Excavation

Layers of cemented sandstone are present below the site. These layers will be relatively difficult to excavate. While not strictly considered a geologic hazard, difficult excavation may be encountered. Excavation methods may include heavy ripping, chiseling or possibly blasting. Some oversize material may result, which should not be used in trench backfill or under structures.

Groundwater

Groundwater was encountered in six borings, from depths of 22 to 27 feet during drilling and fifteen borings at depths of 14 to 18 feet when checked several days after drilling. We do not expect current ground water levels will affect residence construction, but may complicate utility installation and, possibly, over-excavation. Groundwater may rise due to irrigation after development.

Seismicity

This area, like most of central Colorado, is subject to a low degree of seismic risk. No indications of recent movements of any of the faults in the Larimer County area have been reported in the available geologic literature. As in most areas of recognized low seismicity, the record of the past earthquake activity in Colorado is somewhat incomplete.

Based on the subsurface conditions encountered in our borings and our understanding of the geology, the site classifies as a Seismic Site Class C or D (2015 International Residential Code, Section 1613.5.2). Only minor damage to relatively new, properly designed and built buildings would be expected. Wind loads, not seismic considerations, typically govern dynamic structural design in this area.

Radioactivity

It is normal in the Front Range of Colorado and nearby eastern plains to measure radon gas in poorly ventilated spaces in contact with soil or bedrock. Radon 222 gas is considered a health hazard and is one of several radioactive products in the chain of the natural decay of uranium into stable lead. Radioactive nuclides are common in the soils and sedimentary rocks underlying the subject site. Because these sources exist on most sites, there is potential for radon gas accumulation in poorly ventilated spaces. The amount of soil gas that can accumulate is a function of many factors, including the radio-nuclide activity of the soil and bedrock, construction methods and materials, pathways for soil gas and existence of poorly-ventilated accumulation areas. The only reliable method to determine the concentration of radon is to perform testing after construction.

If required, typical mitigation methods for residential construction may consist of sealing soil gas entry areas and periodic ventilation of below-grade spaces and perimeter drain systems. It is relatively economical to provide for ventilation of perimeter drain systems or underslab gravel layers at the time of construction, compared to retrofitting a structure after construction.

Erosion

Erosion potential is considered low. The potential will increase during construction, but should return to pre-construction rates or less if proper grading practices, surface drainage, and re-vegetation efforts are implemented.

SUBSURFACE CONDITIONS

Subsurface conditions encountered in the borings included nil to 22 feet of sandy clay and/or fill, underlain by claystone or sandstone bedrock. Sand and gravel layers were encountered in borings TH-114, TH-115 and TH-117 through TH-120 between the sandy clay and bedrock. Cemented sandstone lenses were encountered in fourteen percent of the borings. Claystone was encountered in 3 of the 21 borings. The claystone was sandy, and possessed occasional sandstone interbeds. Sandstone was identified in nine borings, containing occasional claystone interbeds. Of the nine remaining borings, eight contained interbedded claystone and sandstone and one boring was terminated in sand and gravel before bedrock was encountered. Groundwater was encountered at depths ranging from 14 to 28 feet below the existing found surface in twelve borings. Measured depth to groundwater and bedrock are presented on Figures 3 and 4.

Existing Fill

Existing fill was encountered in nine of the borings during this investigation to depths of 2 to 7 feet. Three samples of the fill swelled from 0.5 to 7 percent. The results are summarized in Table A. There are existing stockpiles on site to the east near borings TH-116 through TH-120. The locations where fill was encountered are indicated on Figure 1. We recommend all existing fill be removed and replaced as compacted fill.

Natural Sandy Clay

Field penetration resistance tests indicated the sandy clay was medium-stiff to very stiff. Seventeen samples of the sandy clay were selected for swell-consolidation testing. Approximately 25% of the samples swelled 4 percent or more.

Table A

Summary of Swell Test Results

Soil Type	Compression	Range of Measured Swell (%)*			
		0 to <2	2 to <4	4 to <6	>6
	Number of Samples and Percent				
Fill	0	1	1	0	1
	0%	33%	33%	0%	33%
Sandy Clay	3	7	3	3	1
	18%	41%	18%	18%	6%
Interbedded Bedrock	8	7	2	0	0
	47%	41%	12%	0%	0%
Sandstone	8	5	0	0	0
	62%	38%	0%	0%	0%
Claystone	0	2	1	0	0
	0%	67%	33%	0%	0%
Overall Sample Number	19	22	7	3	2
Overall Sample Percent	36%	42%	13%	6%	4%

* Swell measured after wetting under overburden pressure

Bedrock

Bedrock was encountered in twenty of twenty-one test holes at 0 to 24 feet below the existing ground surface. Our estimate of the elevation of bedrock is shown on Figure 3. The majority of bedrock encountered was interbedded claystone and sandstone. Sandstone with occasional claystone interbeds was encountered in ten borings. The sandstone was encountered in the borings along proposed Barn Swallow Circle and south of Cruiser Lane. The bedrock was hard to very hard; cemented sandstone layers were encountered in three borings (TH-102, TH-103, and TH-113.) Claystone with occasional sandy interbeds was encountered in three borings within the eastern portion of the site. The remaining borings encountered interbedded sandstone and claystone. Approximately 90% of the samples compressed or swelled less than two percent. All samples swelled 4 percent or less. Sandstone samples exhibited slight compression or less than 1 percent swell. Three samples of claystone exhibited swells of 1.4 to 2.2 percent.

DEVELOPMENT RECOMMENDATIONS

We believe the primary geotechnical factor that will influence site development and residence performance is expansive soil and bedrock. This concern can be mitigated with proper planning, engineering, design and construction. We believe there are no geologic or geotechnical constraints that would preclude development. We judge about 40 percent of the investigated lots will require over-excavation if use of footing foundations is desired, and to create low-risk conditions for slab-on-grade basement floor performance.

Over-Excavation

We calculated potential ground heave of <0.5 to 5.2 inches for an assumed depth of wetting of 24 feet below proposed grade. Cut and fill site grading will affect ground heave estimates. The largest values of estimated heave were calculated for borings TH-106 through TH-108 and TH-116 to TH-120) We judge over-excavation to 10 feet below basement footings will be necessary to use footings and create low-risk conditions in these areas. The estimated extent of over-excavation is shown on Figure 5. In most instances, expansive clay is underlain by low-swelling bedrock or non-expansive sand and gravel. Over-excavation can be terminated at depths where low swelling or non-expansive materials are encountered. Additional borings and testing may be considered to refine the estimated extent of over-excavation.

Excavations should be sloped or shored to meet local, State and federal safety regulations. Based on our investigation, we anticipate the clay and bedrock classify as Type B soil based on OSHA standards. These classifications are based on widely spaced borings. Excavation slopes specified by OSHA are dependent upon soil types and ground water conditions encountered. Seepage and ground water conditions in excavations may downgrade the soil type. The contractor's "competent person" is required to identify the soils encountered in the 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. Excavations deeper than 20 feet should be designed by a professional engineer.

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

Excavation contractors should be experienced with fill placement at over-optimum moisture and have the necessary compaction equipment. The contractor should provide a construction disc to break down fill materials and anticipate push-pull scraper operations and bulldozer assistance. For the over-excavated sites to perform properly, close control of fill placement to specifications is required. Over-excavation fill should be moisture conditioned to 1 to 4 percent above optimum moisture content, and compacted to at least 95 percent of maximum ASTM D698 dry density. Guidelines for over-excavation are provided in Appendix D.

Special precautions should be taken for compaction of fill at corners, access ramps and along the perimeters of the over-excavation due to equipment access constraints. The contractor should have the appropriate equipment to reach and compact these areas. A representative of our firm should test the compaction of the fill. The fill should also be tested after placement to evaluate swell.

Site Grading

Excavation at this site will likely encounter very hard bedrock, and may require rock excavation techniques or blasting. The on-site soils are suitable for re-use as fill material provided debris or deleterious organic materials are removed. Prior to fill placement, all trash and debris should be removed from fill areas and properly disposed. The ground surface in areas to be filled should be stripped of vegetation, topsoil and other deleterious materials, scarified to a depth of at least 8 inches, moisture conditioned and compacted as recommended below. The depth of any topsoil is not anticipated to be more than 2 to 4 inches in most areas.

Site grading fill should be placed in thin, loose lifts, moisture conditioned and compacted. In areas of deep fill, we recommend higher compaction criteria to help reduce settlement. The placement and compaction of fill should be observed and density tested during construction. Guideline site grading specifications are presented in Appendix C.

Imported Fill

At the time of our investigation, two large fill piles were present at the site. We judge this material is the result of on-site or nearby grading and excavation, due to the similarity between stockpiles and the native sandy clay soils encountered in the investigation. It is anticipated this material will be the primary borrow source for fill operations. This material is suitable, provided organic and deleterious materials are removed before placement and compaction. If import material is required, samples from each source should be provided for our review.

Permanent Cut and Fill Slopes

We recommend permanent cut and fill slopes be designed with a maximum inclination of 3:1 (horizontal to vertical); 4:1 slopes are preferable to help control erosion. If fills will be placed on slopes exceeding 20 percent (5:1) the slope should be benched. Structures should be set back from the top or bottom of cut and fill slopes. 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.

Utility Construction

We believe excavations for utility installation in the overburden soils can be performed with conventional heavy-duty trenchers or large backhoes. The underlying bedrock is hard to very hard and occasionally well-cemented, which may cause difficulty for excavation operations. The excavation contractor should anticipate rock excavation techniques. If ground water is encountered during construction, dewatering may be accomplished by sloping excavations to occasional sumps where water can be removed by pumping. Utility trenches should be sloped or shored to meet local, State and federal safety regulations as discussed in <u>Over-Excavation</u>

Water and sewer lines are usually constructed beneath paved roads. Compaction of trench backfill can have significant effect on the life and serviceability of pavements. We believe trench backfill should be placed in thin, loose lifts, and moisture conditioned to between optimum and 3 percent above optimum content for clay soils and within 2 percent of optimum moisture content for sand. Trench backfill should be compacted to at least 95 percent of maximum dry density (ASTM D 698). Our experience indicates the use of a self-propelled compactor results in more reliable performance compared to backfill compaction by a sheepsfoot attachment on a backhoe. Special attention should be paid to backfill placed adjacent to manholes as we have seen instances where excessive settlement has occurred. Improvements placed over backfill should be designed to accommodate movement. The placement and compaction of fill and backfill should be observed and tested by our firm during construction.

Underdrain

Based on existing groundwater levels measured during this investigation, an underdrain system below or adjacent to sanitary sewer mains and services (a.k.a. area drain) is not required. We advocate underdrains because they provide a gravity outlet for foundation drains and may help control post-construction wetting. If used, the underdrain should consist of 0.75 to 1.5-inch clean, free draining gravel surrounding a perforated PVC pipe (Figure 8). We believe use of perforated pipe below sanitary sewer mains is the most effective approach; Fort Collins may require solid pipe below streets. The line should consist of rigid PVC pipe placed at a grade of at least 0.5 percent. A positive cutoff (concrete) should be constructed around the sewer pipe and underdrain pipe immediately downstream of the point where the underdrain pipe leaves the sewer trench (Figure 9). Solid pipe should be used down gradient of this cutoff wall. It appears a pumped system may be required. The underdrain should be installed with clean-outs. To reduce the risk of cross-connecting sewer and underdrain services, we recommend using a 4-inch diameter pipe for sewer services and a 3-inch diameter pipe for the underdrain services.

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 (Figure 10). For non-walkout basements, the low point of the basement foundation drain may be about 2 to 3 feet deeper than foundation excavations. 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.

PAVEMENTS

Subgrade Preparation

Our investigation indicates the near surface soils will consist of swelling sandy clay with an AASHTO subgrade classification as A-6. These soils are expected to be moderately plastic and will provide relatively poor subgrade support below the pavements. The City of Fort Collins typically requires Lime or fly ash stabilization of these soils to improve their subgrade support characteristics, and reduce potential expansion.

Pavement subgrades should be prepared by scarifying to depths of 6 to 8 inches followed by mixing with fly ash or lime. Our experience suggests 8 to 10 percent fly ash treatment will be required as determined by the dry weight of the soil, or 5 to 7 percent lime. Deeper application of fly ash or lime, or subgrade over-excavation and moisture-controlled recompaction may be used to further attenuate swelling in the subgrade. Site specific testing should be performed to determine the percent admixture for the various development areas of the site. The stabilized subgrades should be compacted to a minimum density of 95 percent of the maximum density determined by ASTM D 698 in a moisture range of +3 to +6 percent of the lime/soil mixtures optimum moisture content.

We anticipate asphalt pavement sections for local residential streets will be on the order of 5 to 6 inches thick. Collectors and other higher volume pavement will likely require thicker pavement sections, estimated on the order 6 to 8 inches. A subgrade investigation and pavement design should be performed after site grading.

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 building-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 another deep foundation system will be merited to control risk of heave. Long (25 to 35 feet) drilled piers should be anticipated unless over-excavation is performed. As discussed previously, we estimate over-excavation will be merited for approximately 50 percent of the investigated lots if use of footings is desired. It may be necessary to extend footings to basement level or perform over-excavation in individual foundation excavations in parts of the site.

Slabs-on-Grade and Basement Floor Construction

The use of slab-on-grade floors for basements should be limited to areas where risk of poor slab performed is low or moderate. After over-excavation, we believe most of the lots will be rated with low risk of poor slab performance. Structurally supported floor systems should be planned in all non-basement finished living areas and in basements where slab risk is judged high or very high. Our firm also generally recommends structurally supported basement floors for moderate, high and very high-risk sites where walkout and garden level basements are planned. Slab performance risk should be more thoroughly defined during the design level soils and foundation investigation.

Below-Grade Construction

Ground water was encountered during this investigation at depths of 14 to 27 feet in most borings. With long-term development and associated landscaping groundwater may rise. To reduce the risk of hydrostatic pressure developing on foundation walls, foundation drains will be necessary around the lowest below-grade areas of all residences. We suggest foundation drains be tied to a sewer underdrain system. They may also discharge to sumps where water can be removed by pumping. In our opinion, underdrain systems offer more comprehensive control of ground water and better mitigate impacts of ground water and swelling soils on foundations, slabs and pavements. Foundation walls and grade beams should be designed to withstand lateral earth pressures. The design pressure should be established during design-level soils investigations.

Surface Drainage

The performance of foundations will be influenced by surface drainage. The ground surface around proposed residences should be shaped to provide runoff of surface water away from the structure and off pavements. We generally recommend slopes of at least 12 inches in the first 10 feet where practical in the landscaping areas surrounding residences with basements. There are practical limitations on achieving these slopes. Irrigation should be minimized to control wetting. Roof downspouts should discharge beyond the limits of backfill. Water should not be allowed to pond on or adjacent to pavements. Proper control of surface runoff is also important to limit 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 re-vegetated to reduce erosion.

CONCRETE

Concrete in contact with soils can be subject to sulfate attack. We measured water-soluble sulfate concentrations in six samples from this site. Concentrations were measured between less than 0.01 and 0.03 percent. For this level of sulfate concentration, ACI 332-08 *Code Requirements for Residential Concrete* indicates there are no special requirements for sulfate resistance. Superficial damage may occur to the exposed surfaces of highly permeable concrete, even though sulfate levels are relatively low. To control this risk and to resist freeze-thaw deterioration, the water-to-cementitious material 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 be air entrained.

RECOMMENDED FUTURE INVESTIGATIONS

Based on the results of this investigation and the proposed development, we recommend the following investigations:

1. Design-level soils and foundation investigations after grading;
2. Subgrade investigation and pavement design after site grading is complete;
3. Construction testing and observation for site development and residential building construction.

LIMITATIONS

Our exploratory borings were located to obtain preliminary subsoil data indicative of conditions on this site. Variations in the subsoils not indicated in our borings are always possible. We believe this investigation was conducted in a manner consistent with that level of skill and care ordinarily used by members of the profession currently practicing under similar conditions. No warranty, express or implied, is made.

This report was prepared from data developed during our field exploration, laboratory testing, engineering analysis and experience with similar conditions. The recommendations contained in this report were based upon our understanding of the planned construction. If plans change or differ from the assumptions presented herein, we should be contacted to review our recommendations.

If we can be of further service in discussing the contents of this report or in the analysis of the building and pavement from the geotechnical point of view, please call.

Very truly yours,

CTL | THOMPSON, INC.

Taylor H. Ray, EI
Staff Geotechnical Engineer

Reviewed by:

COLORADO LICENSED
RONALD M McOMBER
20243
PROFESSIONAL ENGINEER

Ronald M. McOmber, P.E.
Chairman & CEO

Ronald M. McOmber
Feb 12 2018

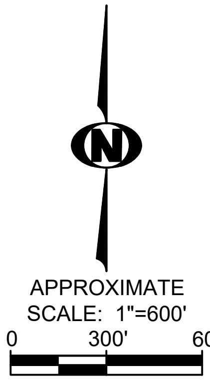
THR:RMM

via email: joep@actuallp.com

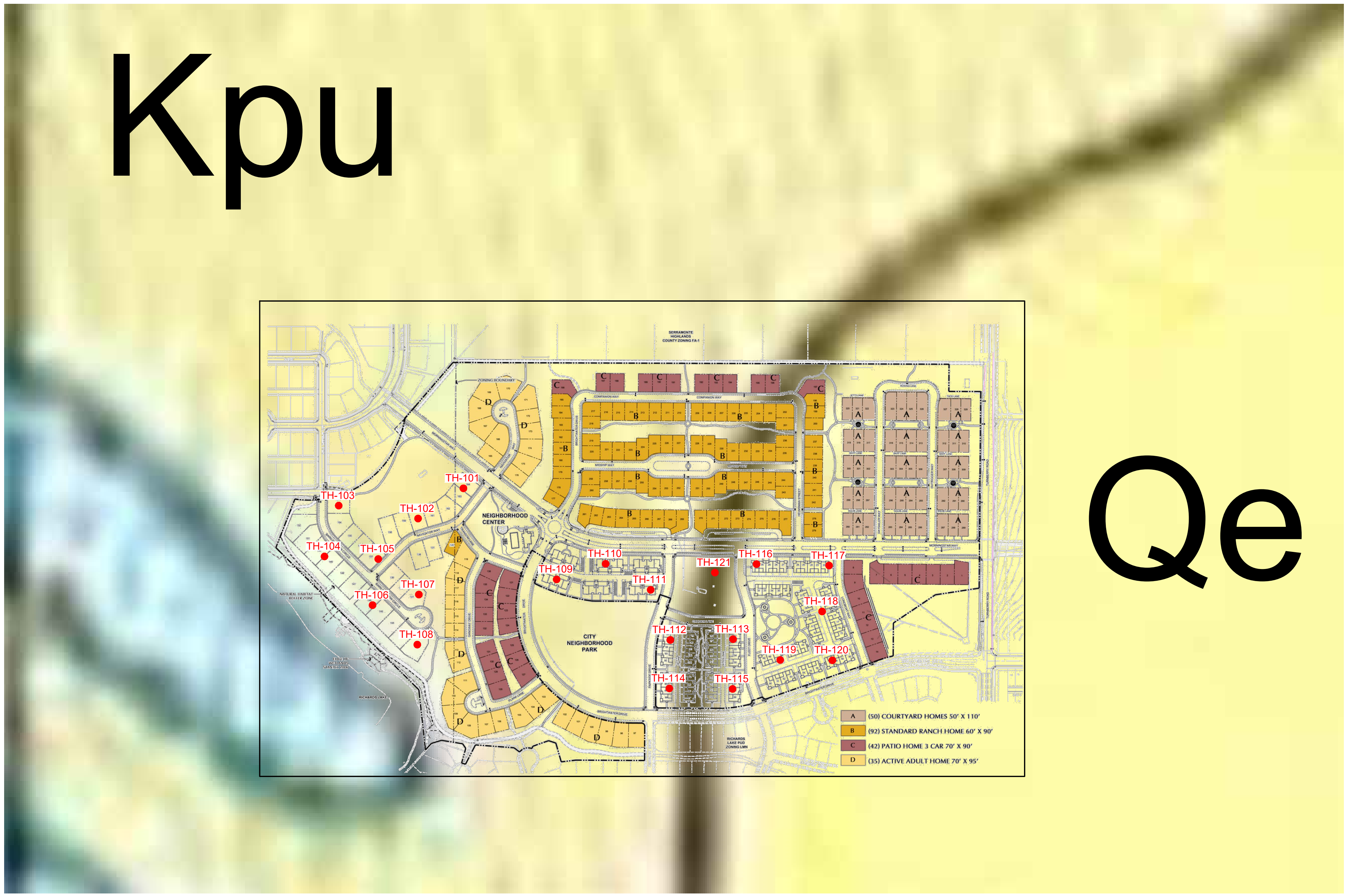
ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL I T PROJECT NO. FC08010.001-115

Locations of Exploratory Borings

FIGURE 1



APPROXIMATE
SCALE: 1"=600'
0 300' 600'



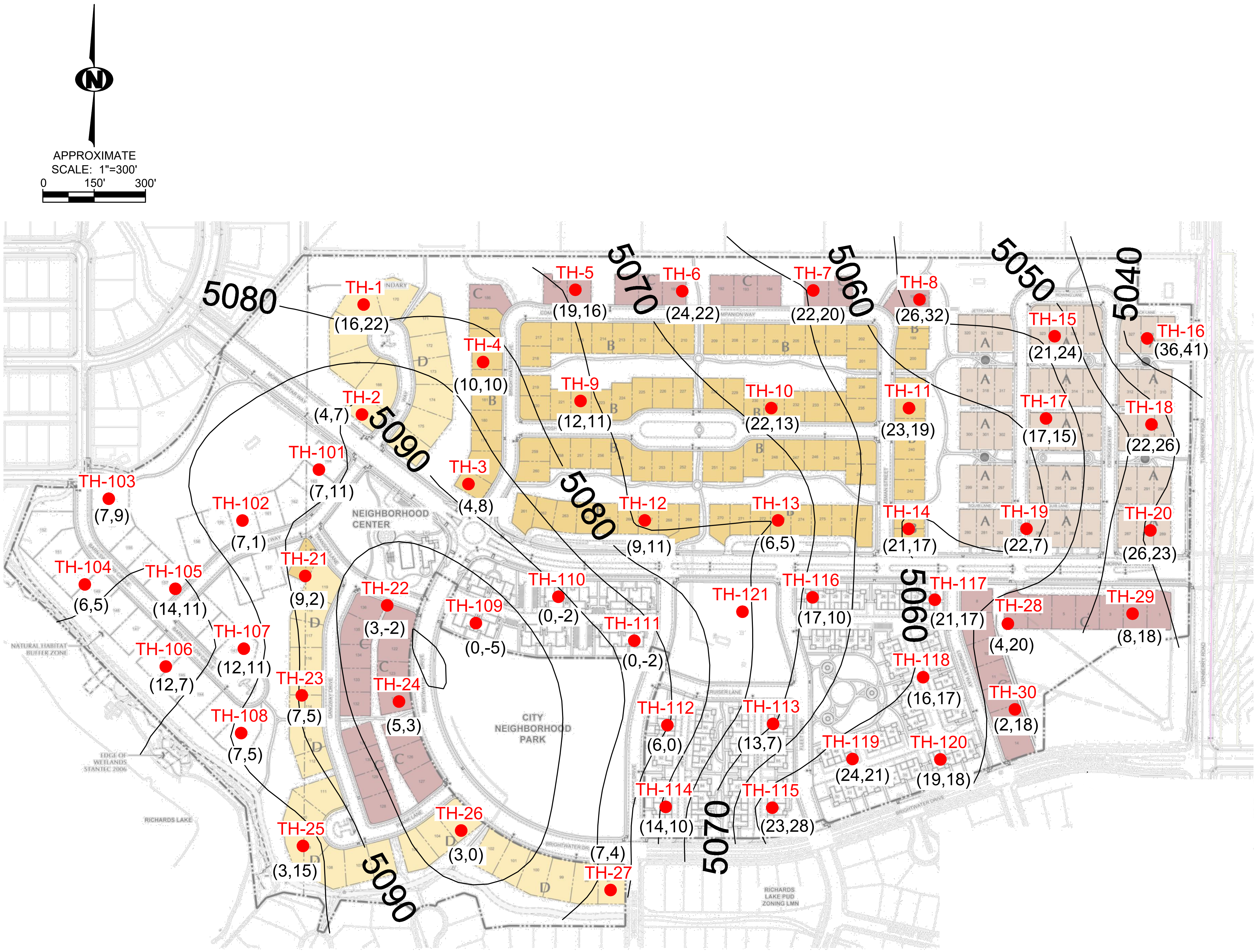
LEGEND:

TH-101 ●	INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORINGS
Qe	EOLIAN DEPOSITS - INCLUDES DUNE SAND AND SILT, PEORIA LOESS
Kpu	PIERRE SHALE FORMATION, UPPER UNIT

Geologic Map

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL I T PROJECT NO. FC08010.001-115

FIGURE 2



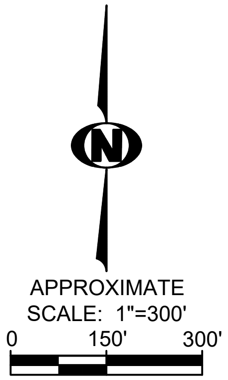
LEGEND:

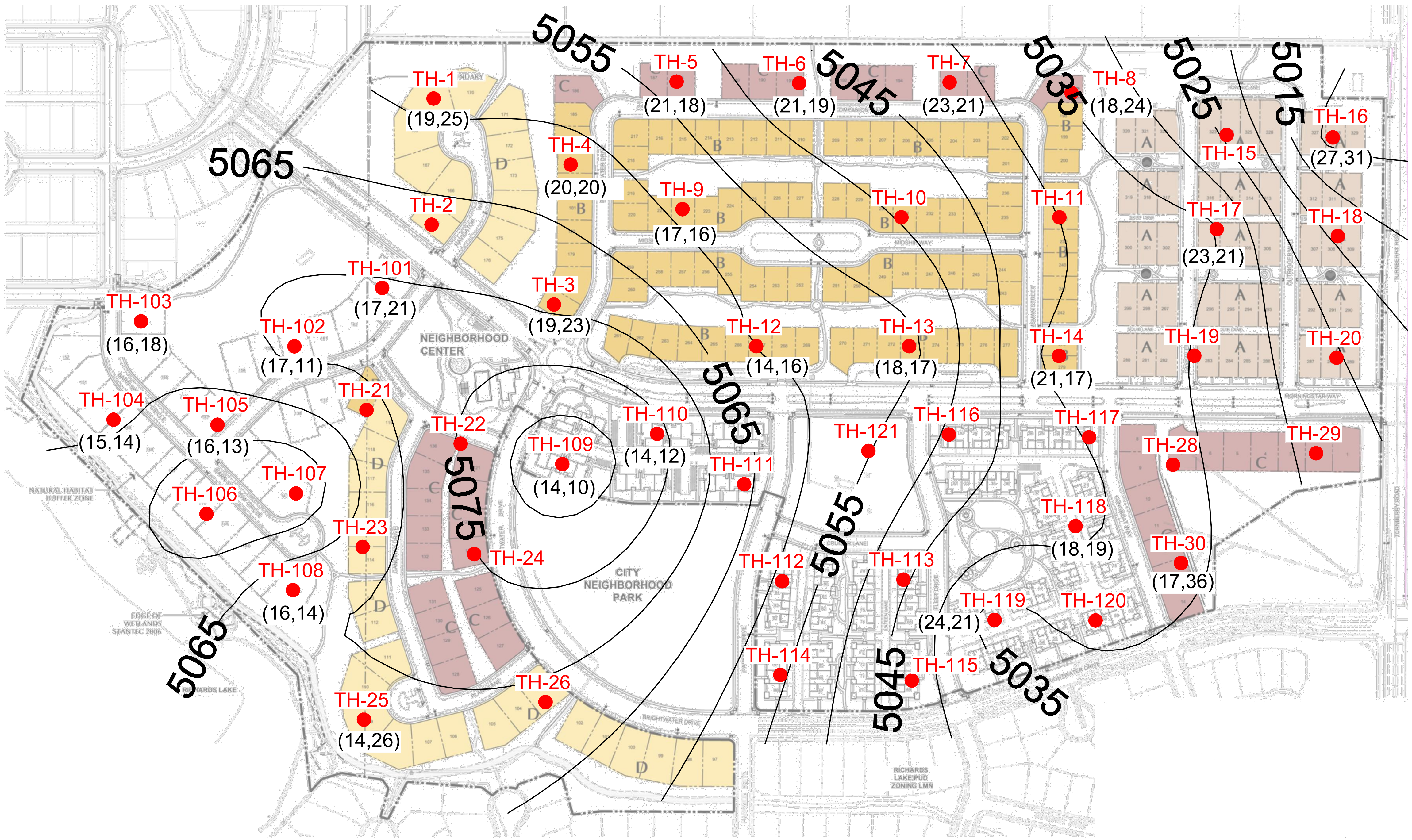
TH-101 ●	INDICATES LOCATION OF EXPLORATORY BORING
—5060—	INDICATES ESTIMATED BEDROCK ELEVATION CONTOUR
(12,10)	INDICATES ESTIMATED DEPTH TO BEDROCK SURFACE IN FEET (EXISTING GRADE, PROPOSED OVERLOT GRADE)

NOTE: BORINGS TH-1 THROUGH TH-30 WERE DRILLED DURING A PREVIOUS INVESTIGATION

Estimated Elevation of and Depth to Bedrock Surface

FIGURE 3



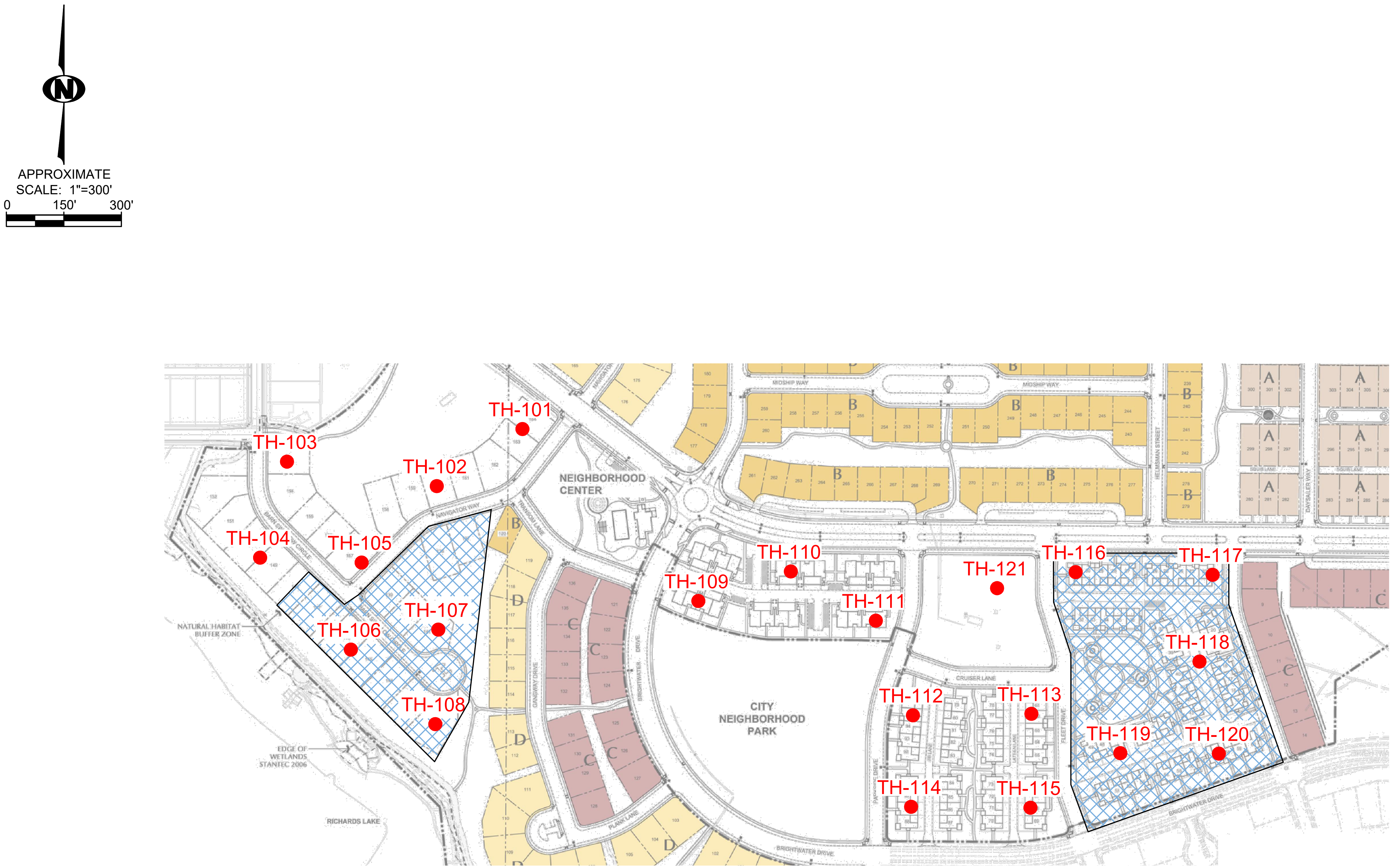


LEGEND:

TH-101 ●	INDICATES LOCATION OF EXPLORATORY BORING
—5060—	INDICATES ESTIMATED GROUNDWATER ELEVATION CONTOUR
(18,16)	INDICATES ESTIMATED DEPTH TO GROUNDWATER SURFACE IN FEET, WHERE ENCOUNTERED. (EXISTING GRADE, PROPOSED OVERLOT GRADE)

NOTE: BORINGS TH-1 THROUGH TH-30 WERE DRILLED DURING A PREVIOUS INVESTIGATION

Estimated Elevation of and Depth to Groundwater Surface



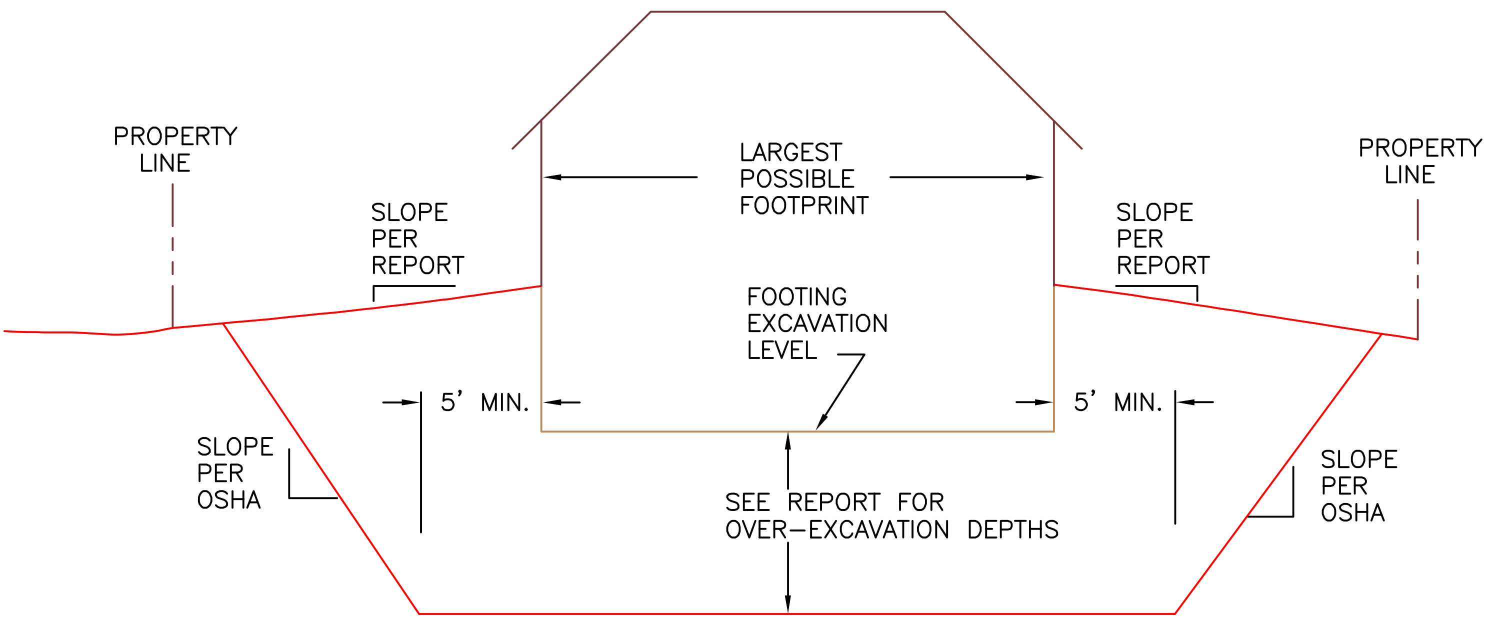
LEGEND:

TH-101 INDICATES LOCATION OF EXPLORATORY BORING

INDICATES ESTIMATED EXTENT OF POTENTIAL OVER-EXCAVATION

NOTE: THIS ESTIMATE IS BASED ON A SUBJECTIVE EVALUATION OF DATA FROM WIDELY SPACED BORINGS. ADDITIONAL TESTING MAY REFINE LIMITS OF OVER-EXCAVATION

Estimated Extent of Potential Over-Excavation



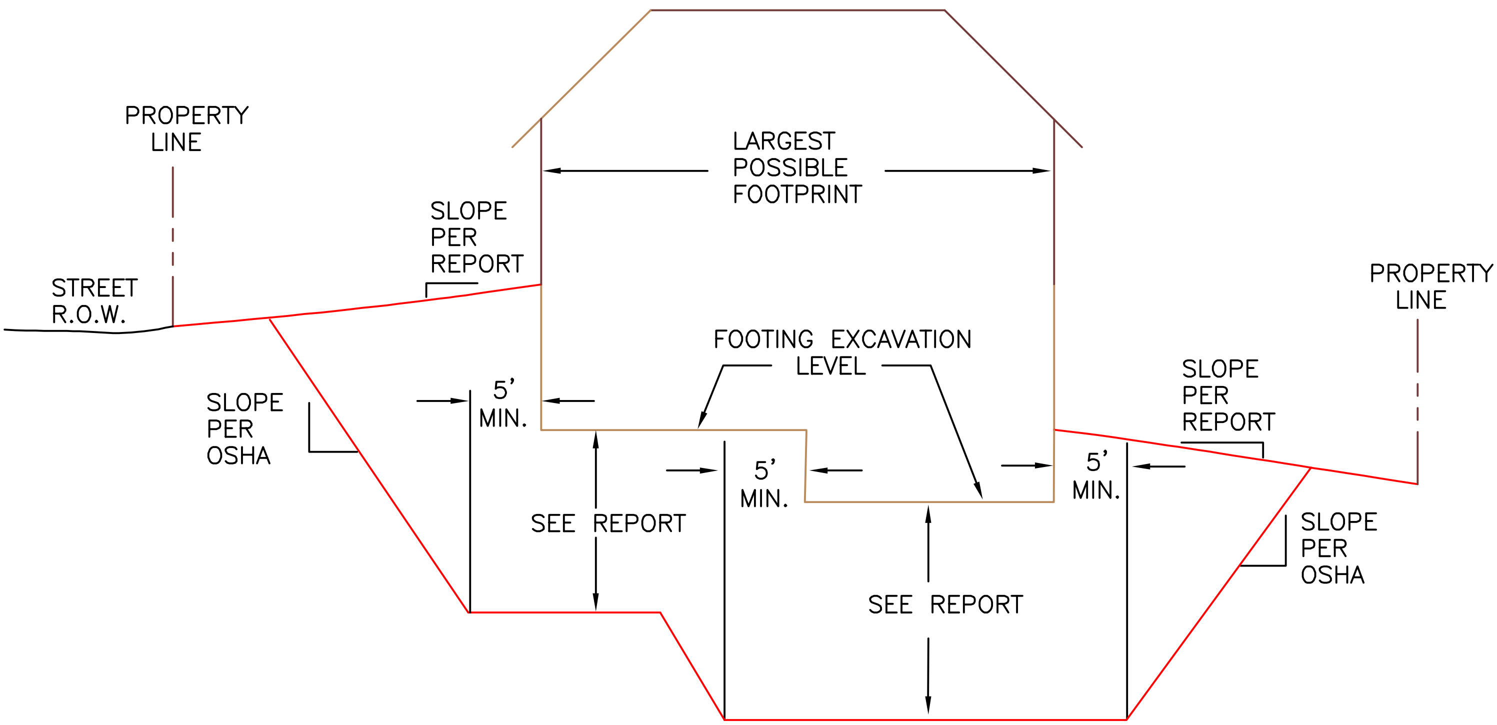
NOT TO SCALE

ACTUAL COMMUNITIES, INC
WATER'S EDGE, SECOND FILING, PHASES 1A AND 4
CTL\T Project No. FC08010.001-115-R1

Conceptual Over-Excavation Profile

FIGURE 6

95-SUB-EXCAVATION_03

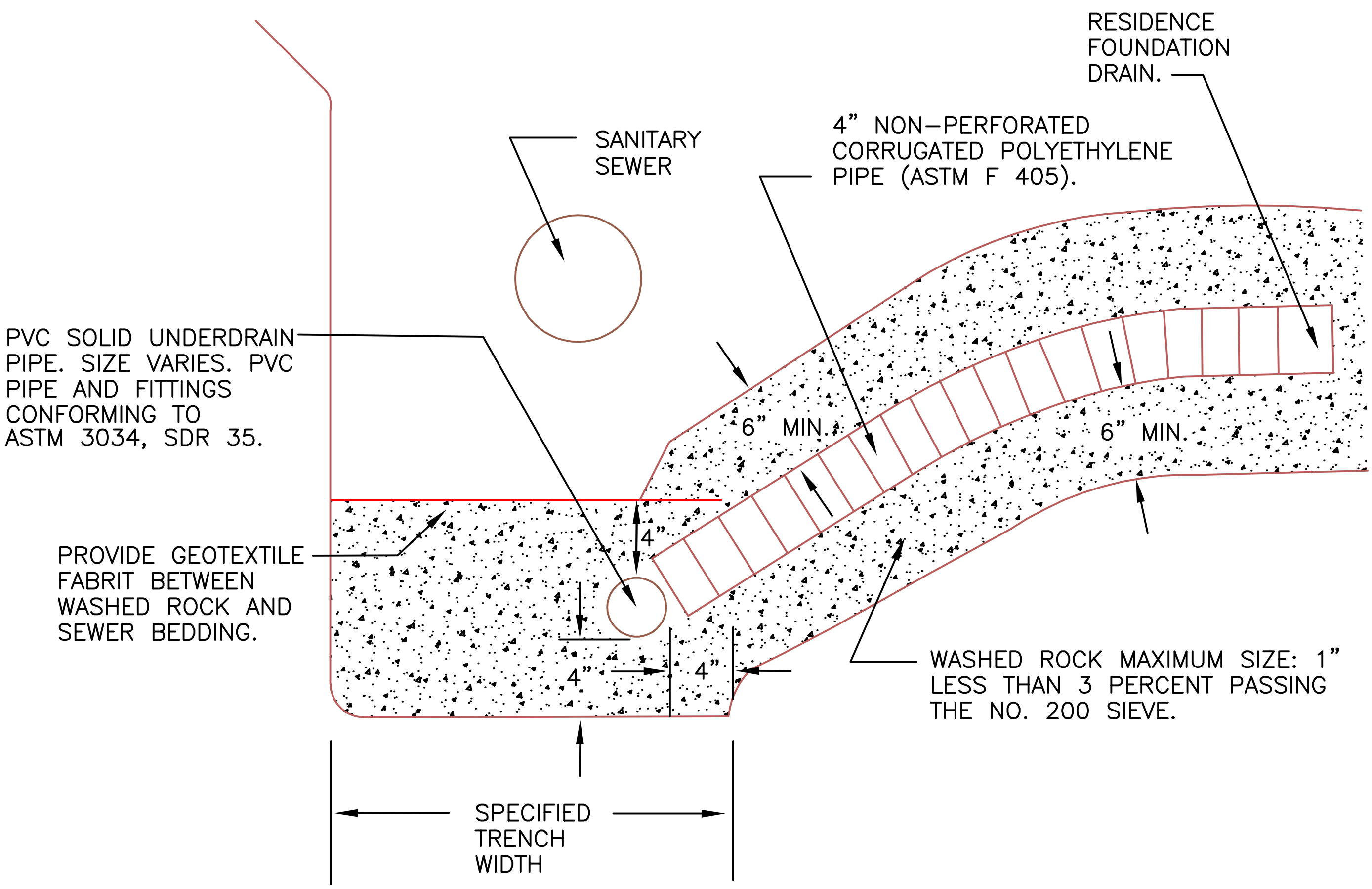


NOT TO SCALE

ACTUAL COMMUNITIES, INC
WATER'S EDGE, SECOND FILING, PHASES 1A AND 4
CTL\T Project No. FC08010.001-115-R1

Conceptual Over-Excavation Profile (Walk-out Basement)

FIGURE 7

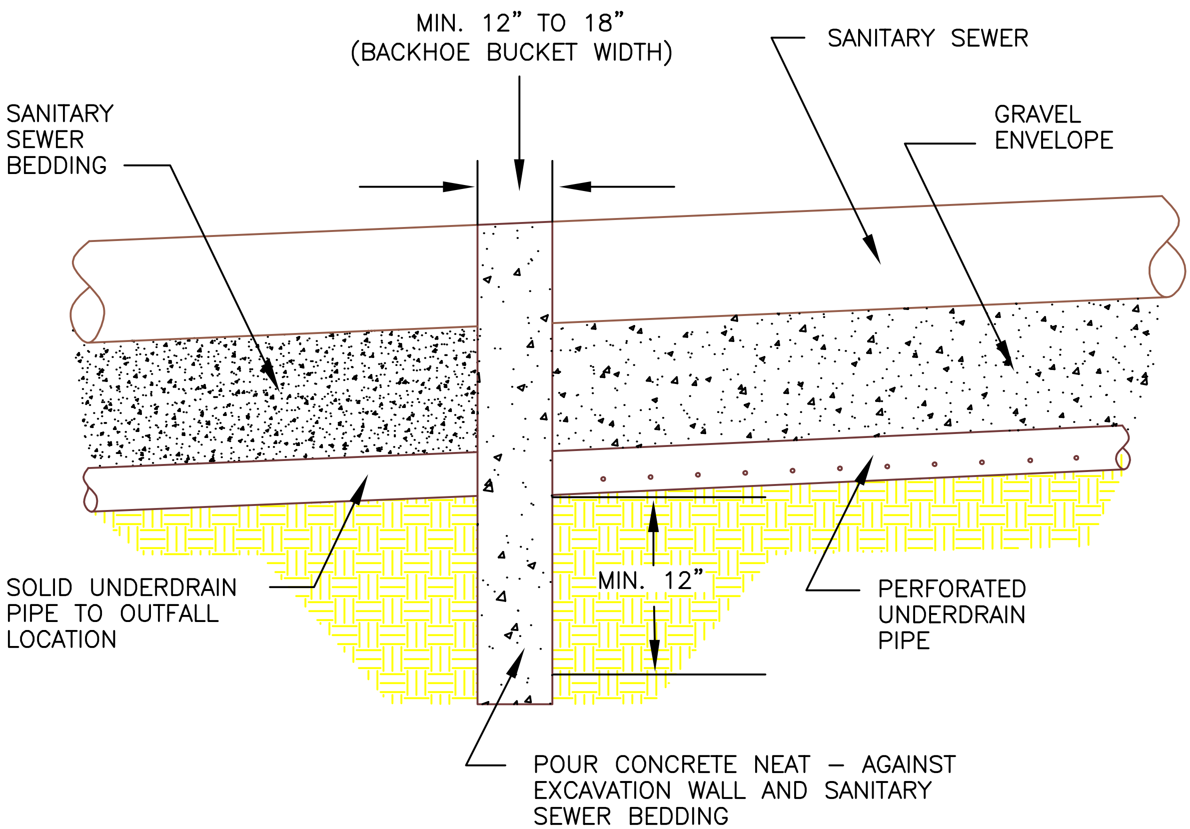


NOTE: NOT TO SCALE.

Sewer Underdrain Detail

FIGURE 8

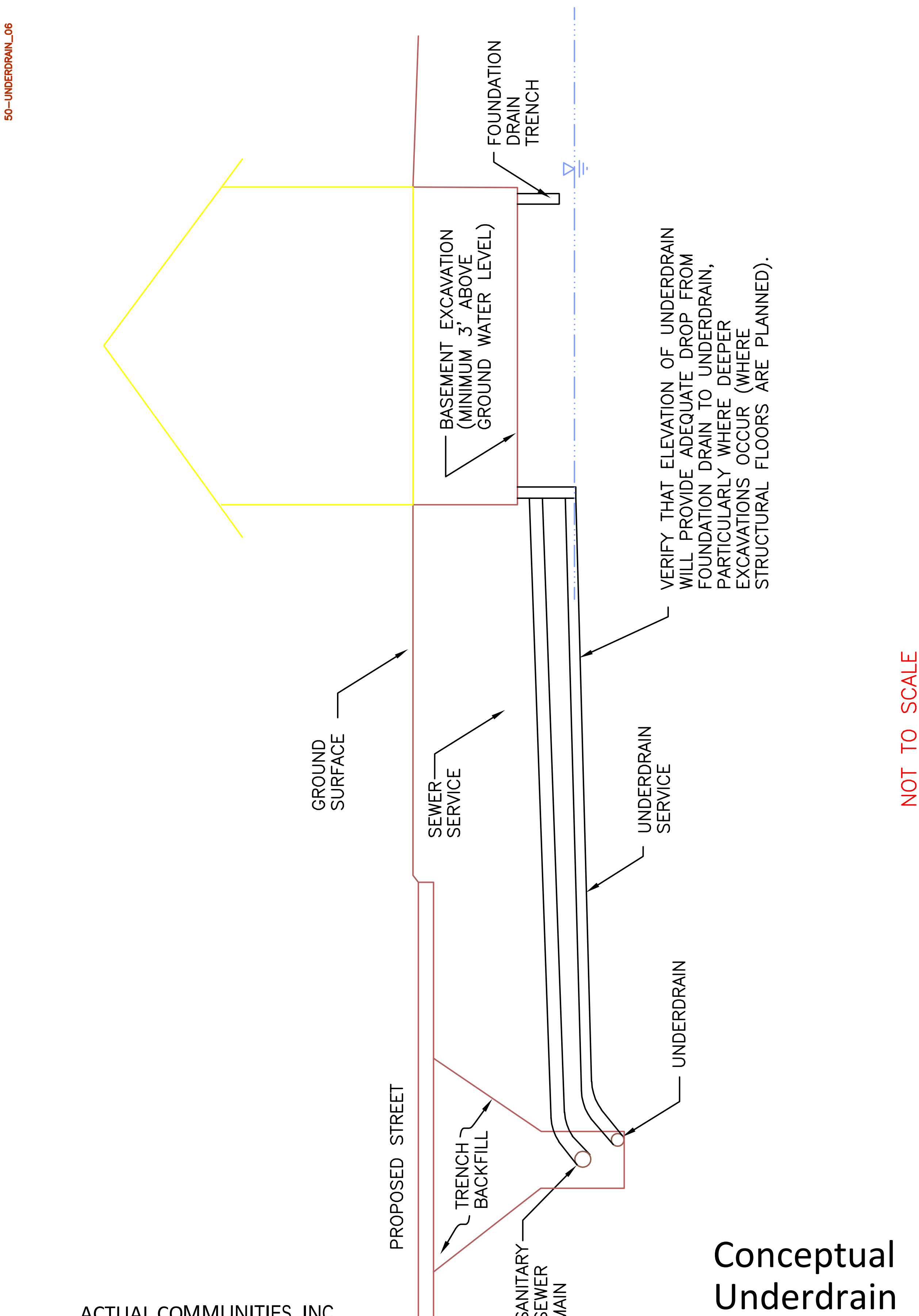
50-UNDERDRAIN_05



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

Underdrain Cutoff Wall Detail

FIGURE 9



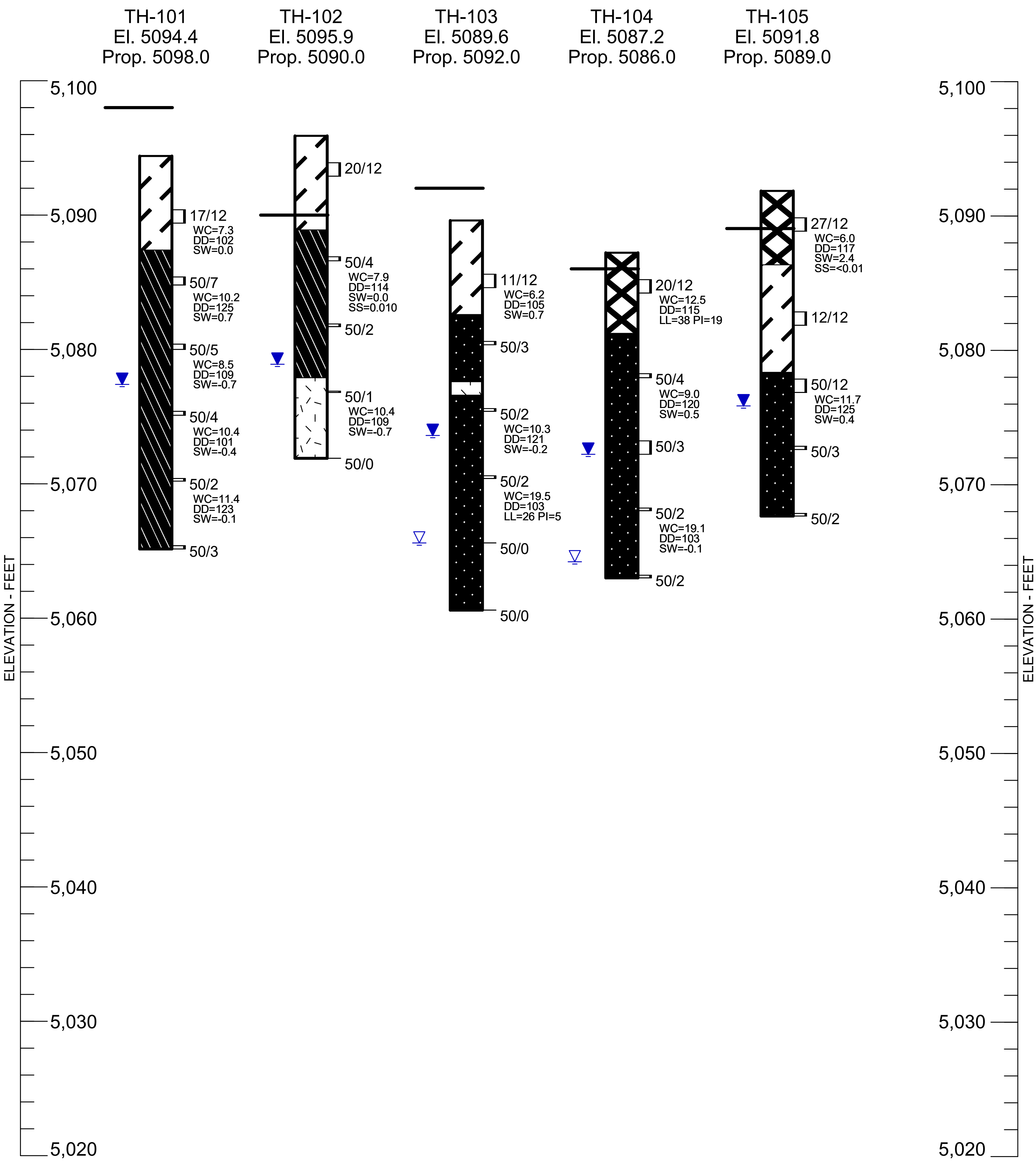
ACTUAL COMMUNITIES, INC
WATER'S EDGE, SECOND FILING, PHASES 1A AND 4
CTL\T Project No. FC08010.001-115-R1

Conceptual Underdrain Service Profile

FIGURE 10

APPENDIX A

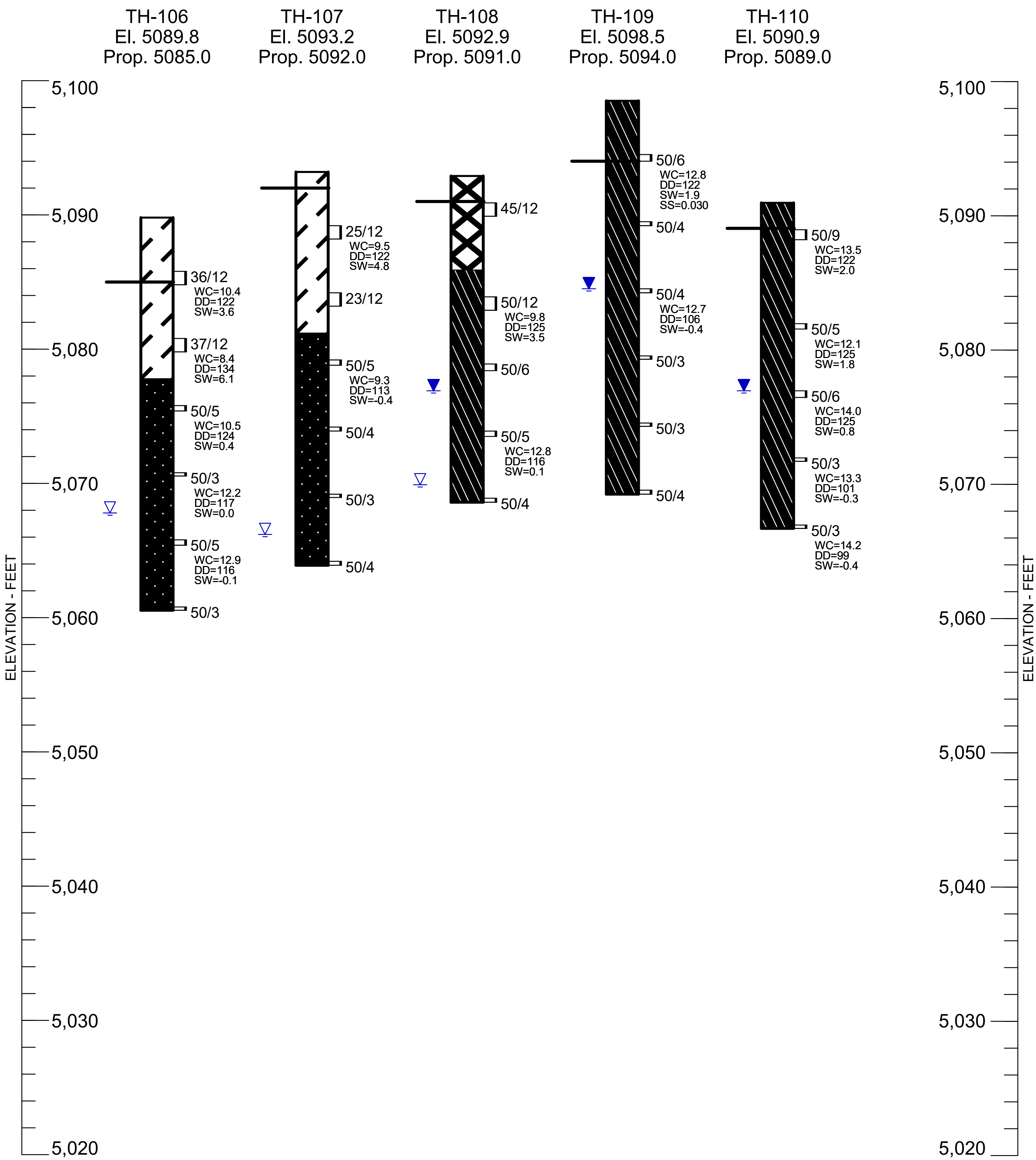
LOGS OF EXPLORATORY BORINGS



Summary Logs of Exploratory Borings

FIGURE A-1

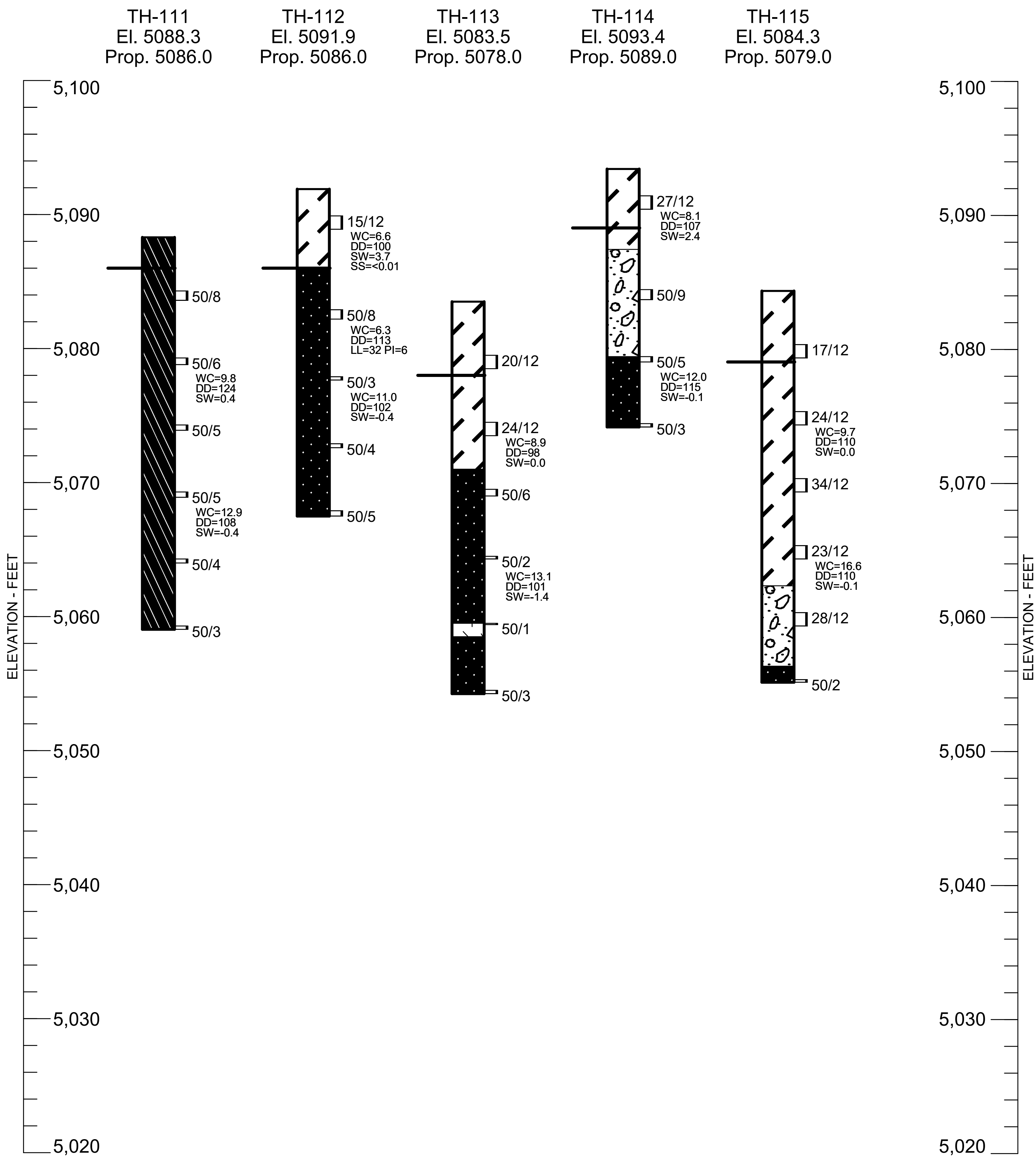
ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115



Summary Logs of Exploratory Borings

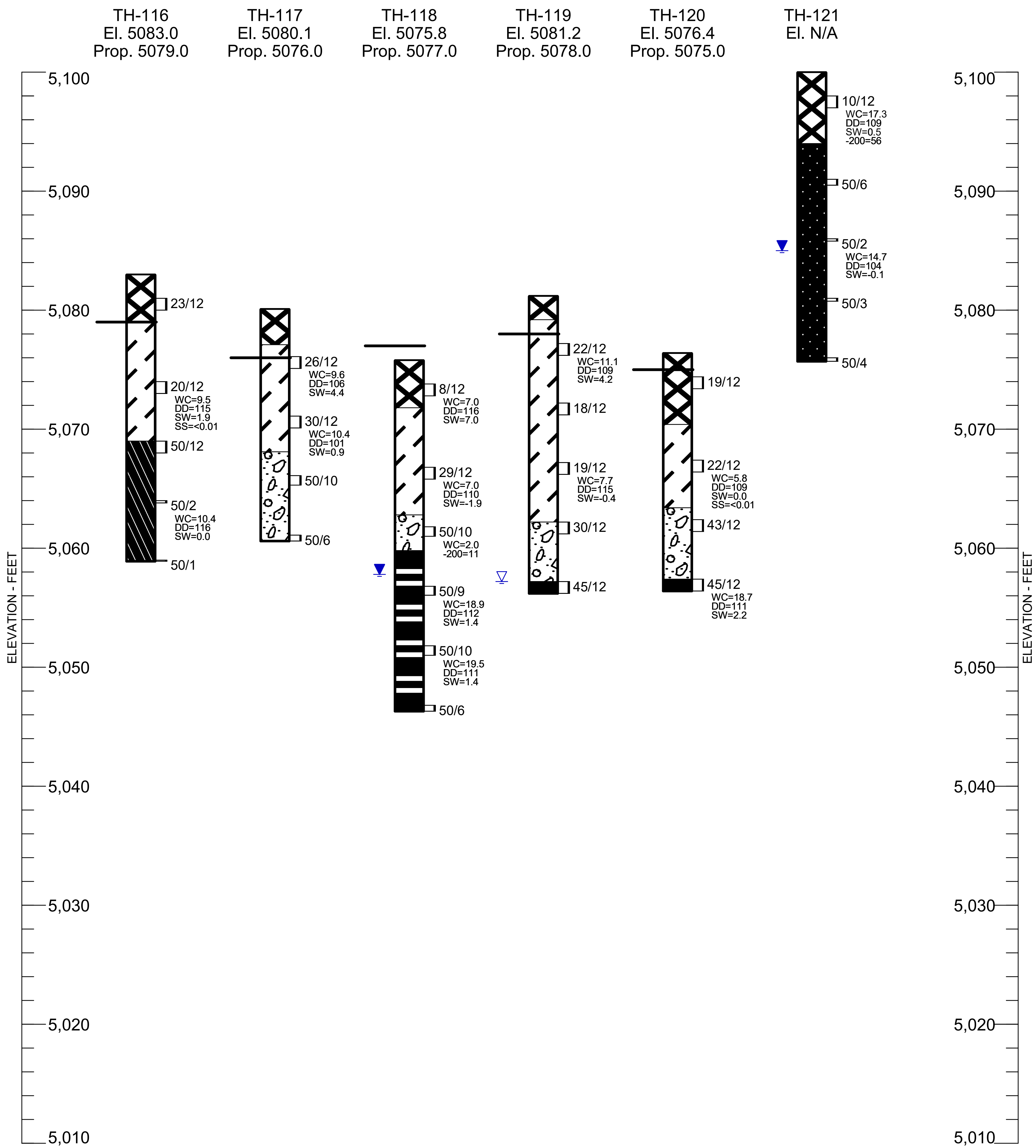
FIGURE A-2

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115



Summary Logs of Exploratory Borings

FIGURE A-3



ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

LEGEND:

- FILL, CLAY, SAND, OCCASIONAL GRAVEL, BROWN, DARK BROWN, OLIVE, WHITE
- CLAY, SANDY, SILTY, OCCASIONAL GRAVEL AND SILT, MOIST, STIFF TO VERY STIFF, LIGHT BROWN, BROWN, OLIVE (CL)
- SAND AND GRAVEL, MOIST TO WET, VERY DENSE, REDDISH BROWN, BROWN, WHITE (SP, GP)
- CLAYSTONE, SANDY, MOIST, HARD, BROWN, GRAY
- SANDSTONE, CLAYEY, MOIST, HARD TO VERY HARD, BROWN, GRAY
- INTEREBDDED CLAYSTONE, SANDY AND SANDSTONE, CLAYEY, HARD TO VERY HARD, BROWN, GRAY, OLIVE
- CEMENTED SANDSTONE, CLAYEY, SLIGHTLY MOIST, VERY HARD, BROWN, TAN, OLIVE
- DRIVE SAMPLE. THE SYMBOL 23/12 INDICATES 23 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.
- WATER LEVEL MEASURED AT TIME OF DRILLING.
- WATER LEVEL MEASURED SEVERAL DAYS AFTER DRILLING.
- INDICATES PROPOSED OVERLOT GRADE.

NOTES:

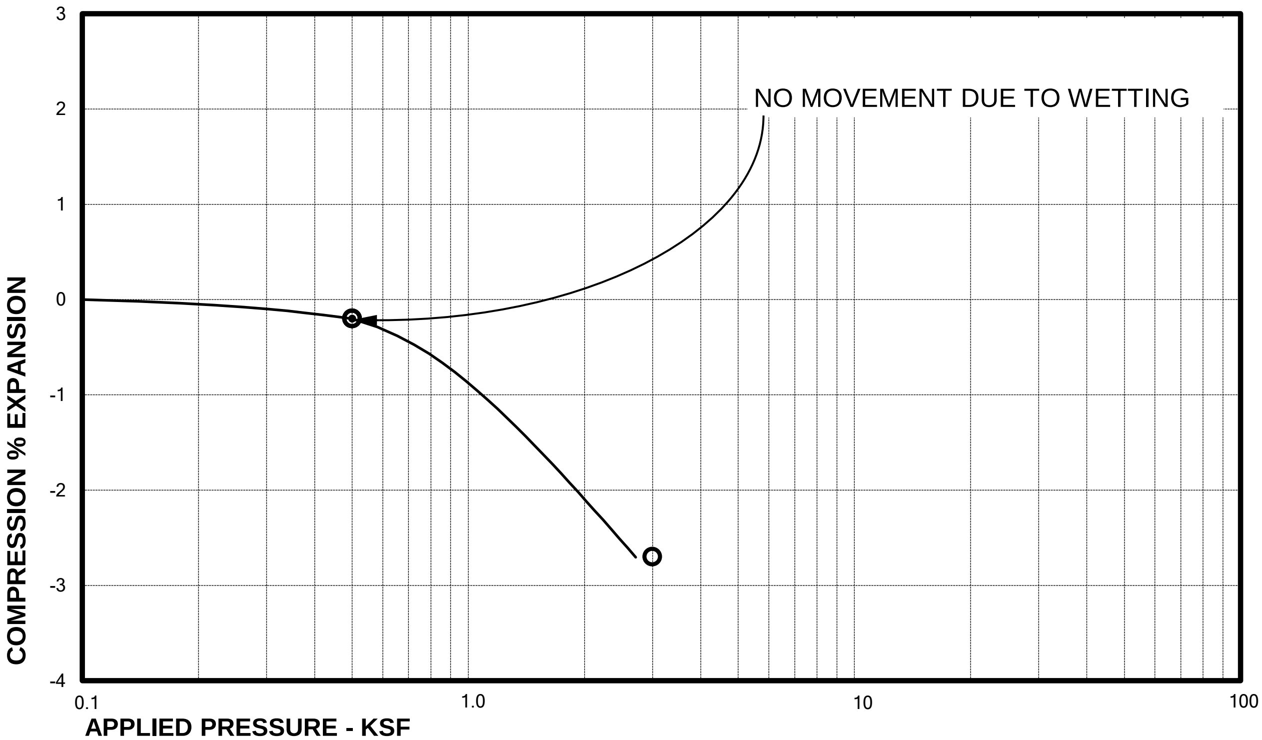
1. THE BORINGS WERE DRILLED ON DECEMBER 26, 27, AND 28, 2017 USING 4-INCH DIAMETER CONTINUOUS-FLIGHT AUGERS AND A TRUCK-MOUNTED DRILL RIG.
2. BORING LOCATIONS AND ELEVATIONS WERE SURVEYED AND PROVIDED BY OTHERS.
3. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS AND CONCLUSIONS IN THIS REPORT.
4. WC - INDICATES MOISTURE CONTENT (%).
   DD - INDICATES DRY DENSITY (PCF).
   SW - INDICATES SWELL WHEN WETTED UNDER OVERBURDEN PRESSURE (%).
   -200 - INDICATES PASSING NO. 200 SIEVE (%).
   LL - INDICATES LIQUID LIMIT.
   PI - INDICATES PLASTICITY INDEX.
   UC - INDICATES UNCONFINED COMPRESSIVE STRENGTH (PSF).
   SS - INDICATES SOLUBLE SULFATE CONTENT (%).

Summary Logs of Exploratory Borings

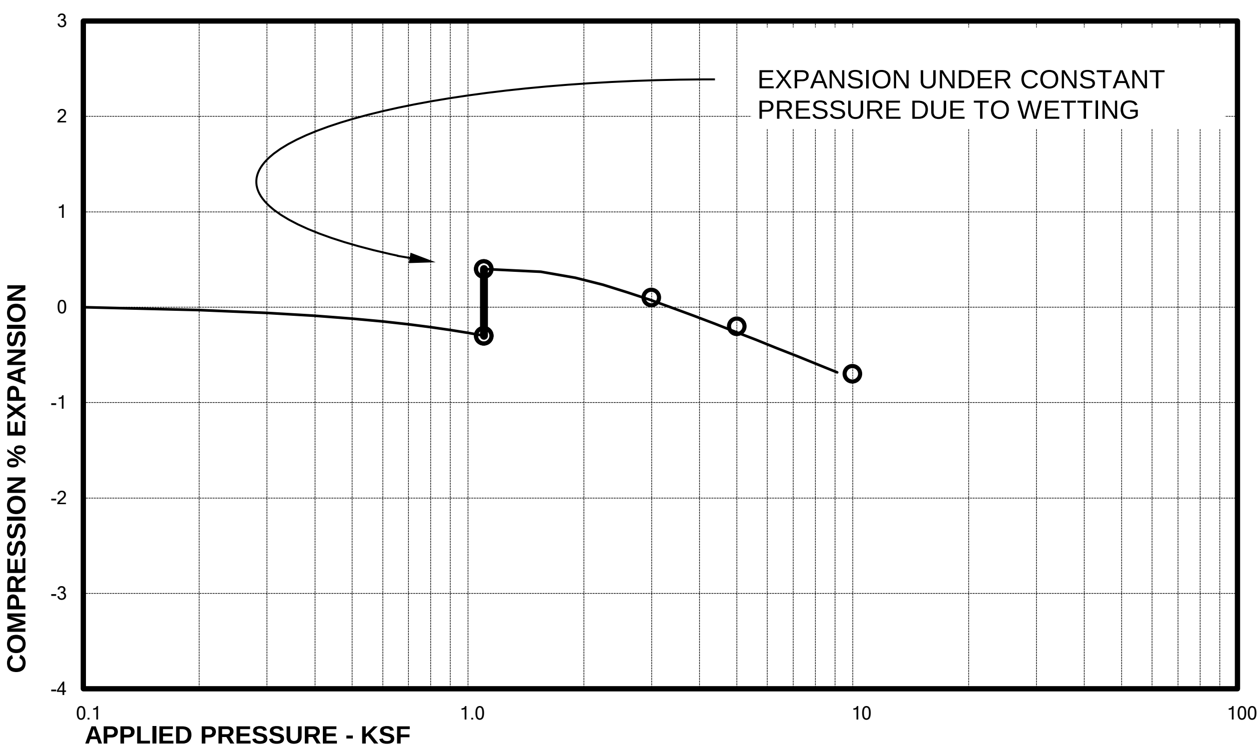
FIGURE A-4

APPENDIX B

LABORATORY TEST RESULTS



Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	102	PCF
From	TH - 101 AT 4 FEET	MOISTURE CONTENT=	7.3	%

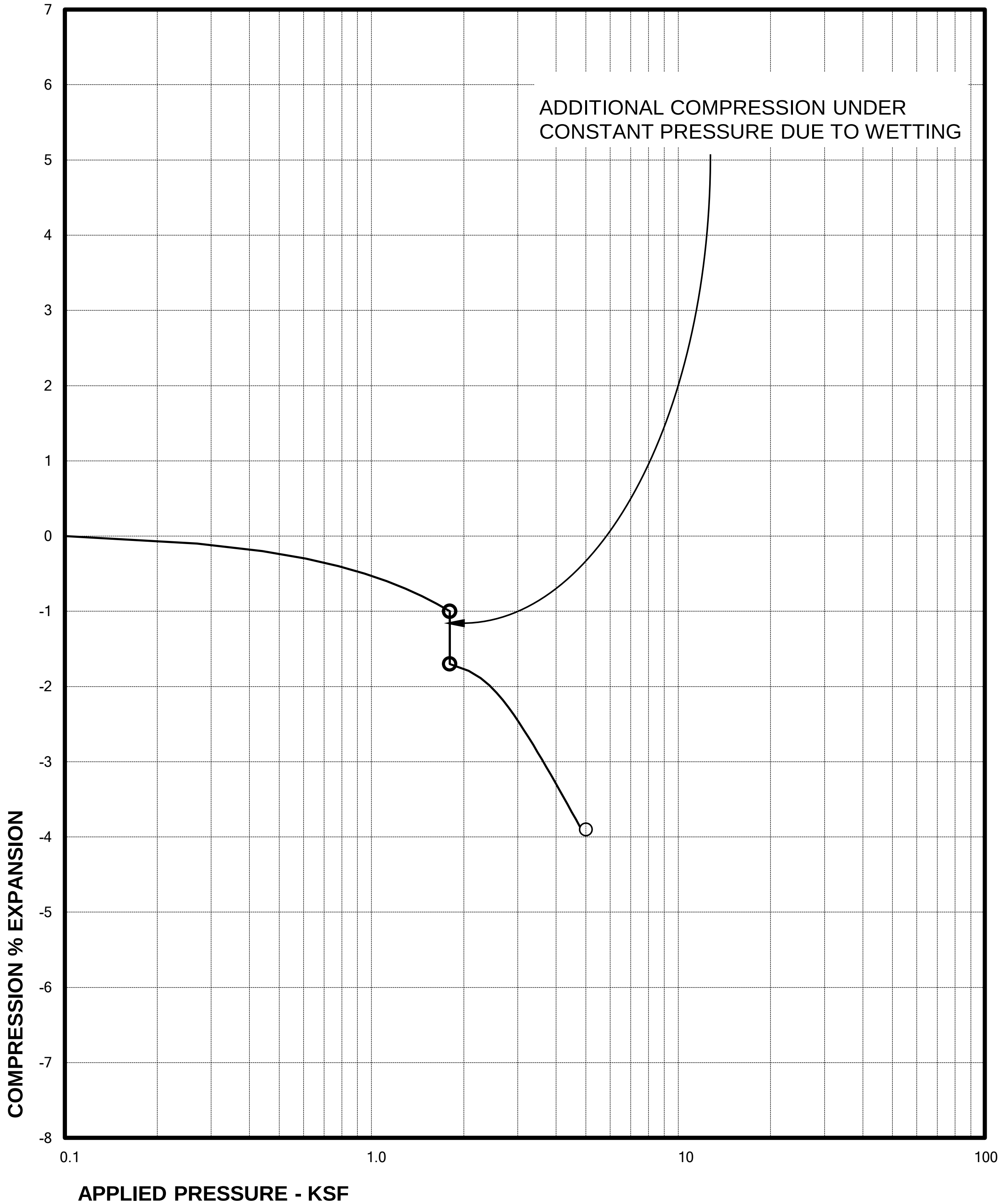


Sample of	INTERBEDDED SANDSTONE AND CLAYSTONE	DRY UNIT WEIGHT=	125	PCF
From	TH - 101 AT 9 FEET	MOISTURE CONTENT=	10.2	%

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation

FIGURE B-1



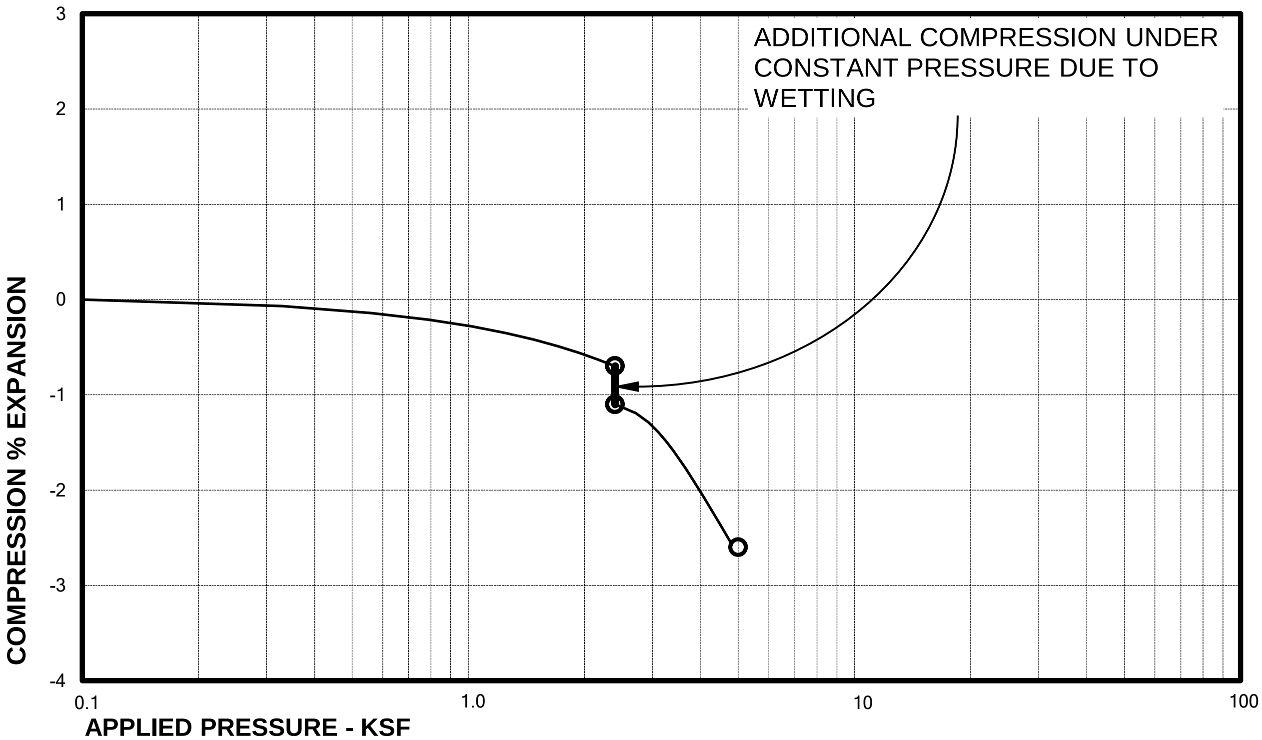
Sample of INTERBEDDED SANDSTONE AND CLAYSTONE
From TH - 101 AT 14 FEET

DRY UNIT WEIGHT= 109 PCF
MOISTURE CONTENT= 8.5 %

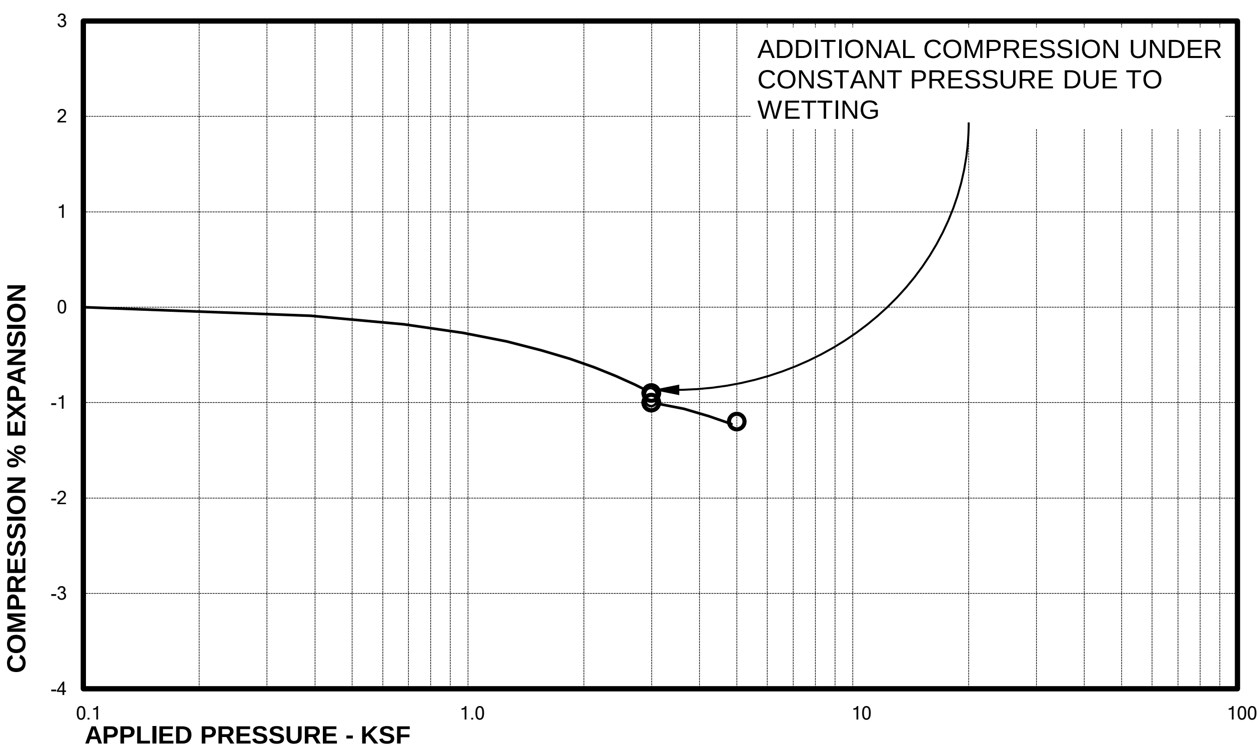
ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation Test Results

FIGURE B-2

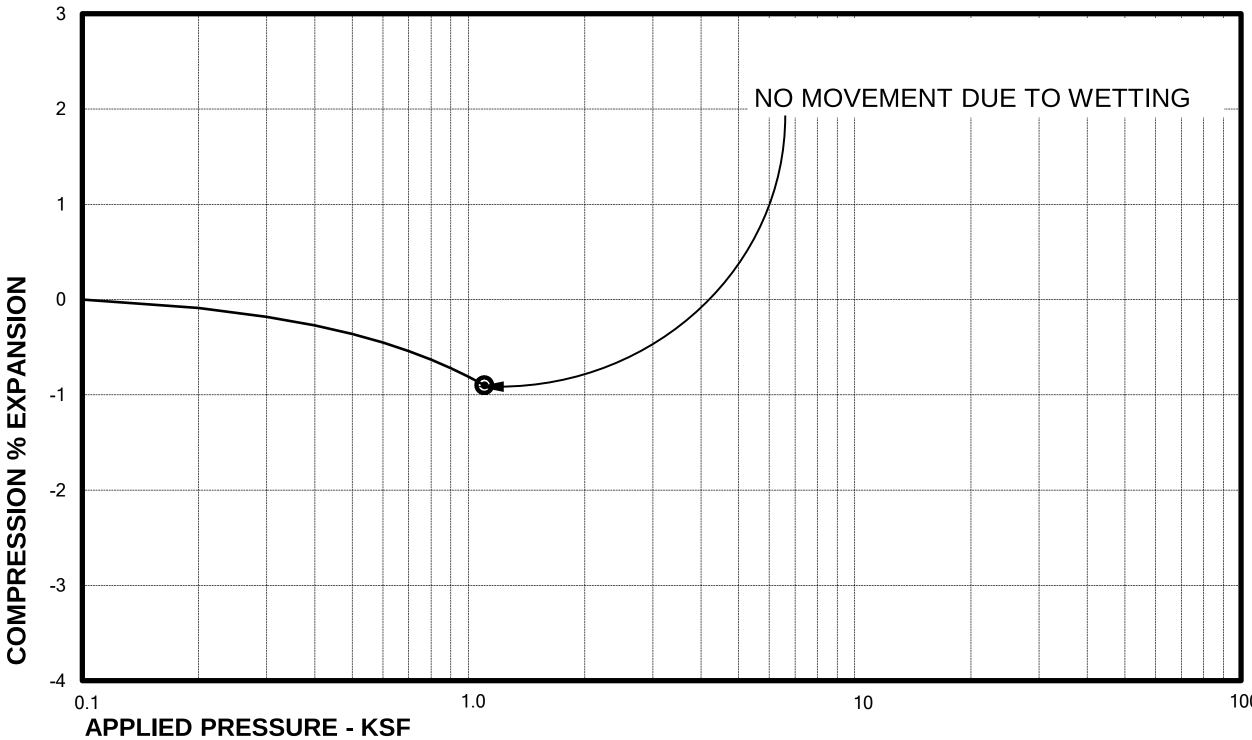


Sample of	INTERBEDDED SANDSTONE AND CLAYSTONE	DRY UNIT WEIGHT=	101	PCF
From	TH - 101 AT 19 FEET	MOISTURE CONTENT=	10.4	%



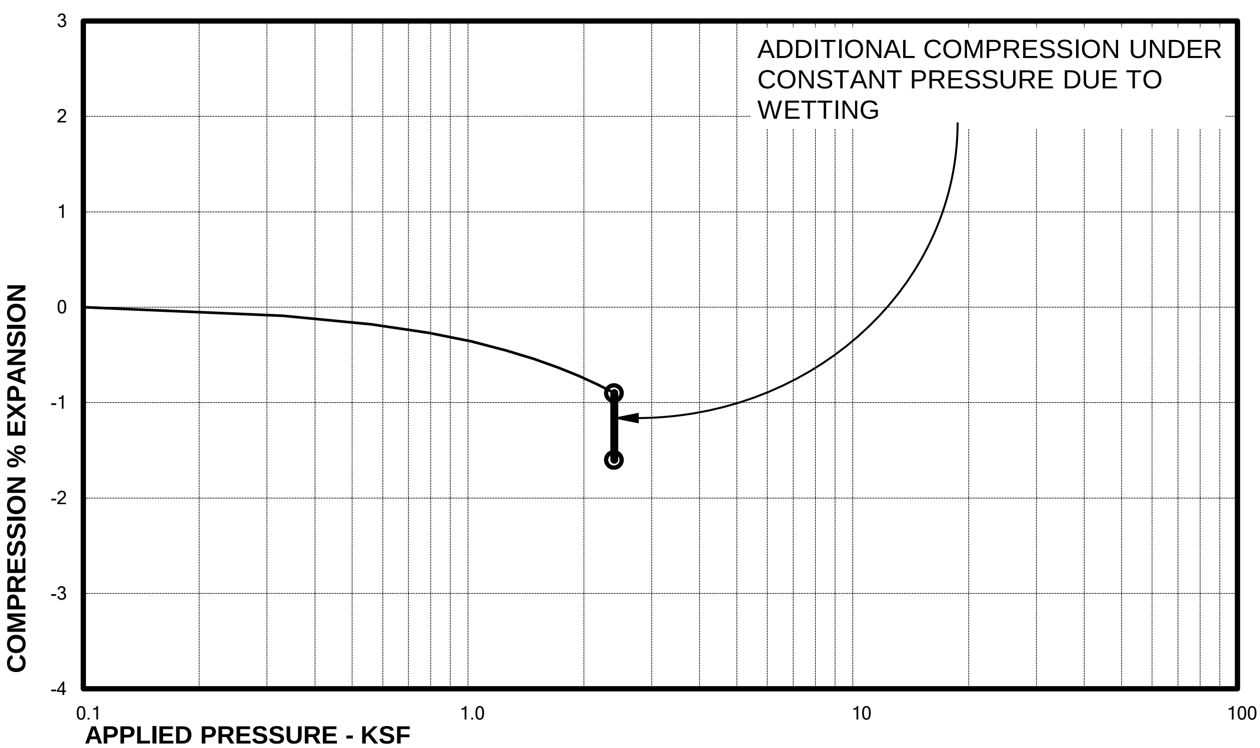
Sample of	INTERBEDDED SANDSTONE AND CLAYSTONE	DRY UNIT WEIGHT=	123	PCF
From	TH - 101 AT 24 FEET	MOISTURE CONTENT=	11.4	%

Swell Consolidation



Sample of INTERBEDDED SANDSTONE AND CLAYSTONE
From TH - 102 AT 9 FEET

DRY UNIT WEIGHT= 114 PCF
MOISTURE CONTENT= 7.9 %



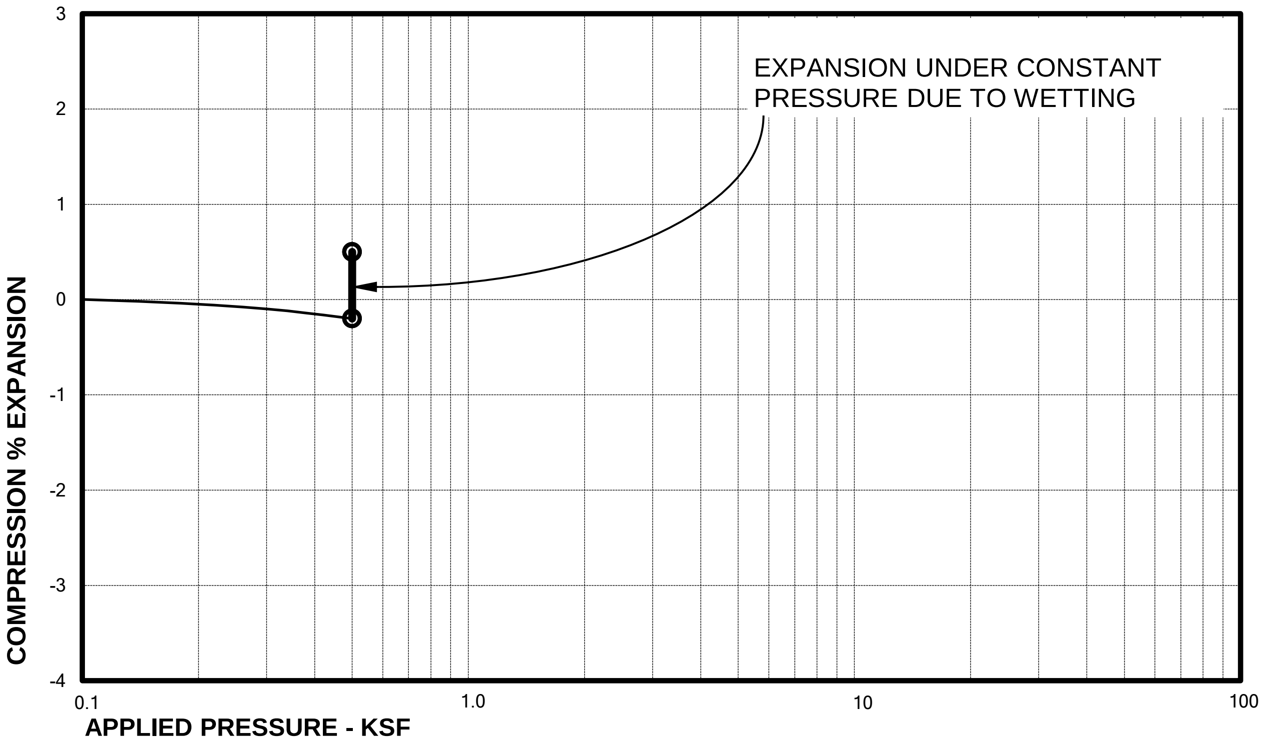
Sample of INTERBEDDED SANDSTONE AND CLAYSTONE
From TH - 102 AT 19 FEET

DRY UNIT WEIGHT= 109 PCF
MOISTURE CONTENT= 10.4 %

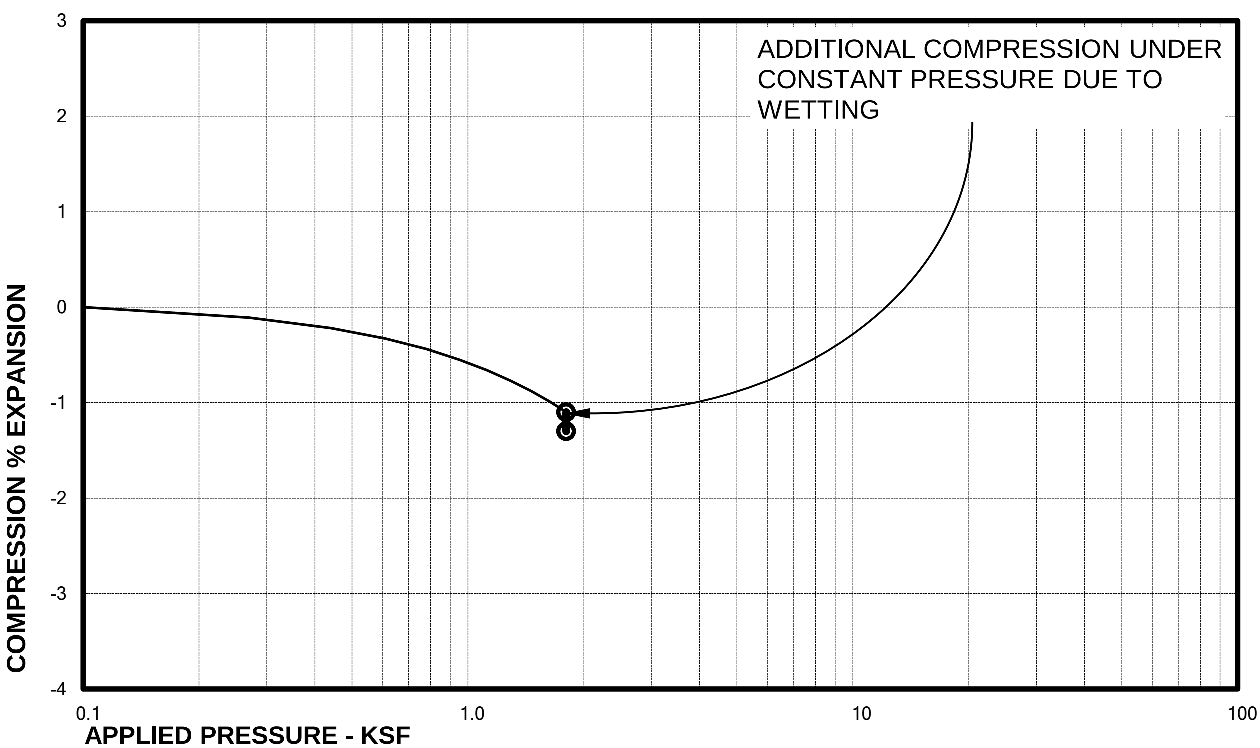
ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation

FIGURE B-4



Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	105	PCF
From	TH - 103 AT 4 FEET	MOISTURE CONTENT=	6.2	%

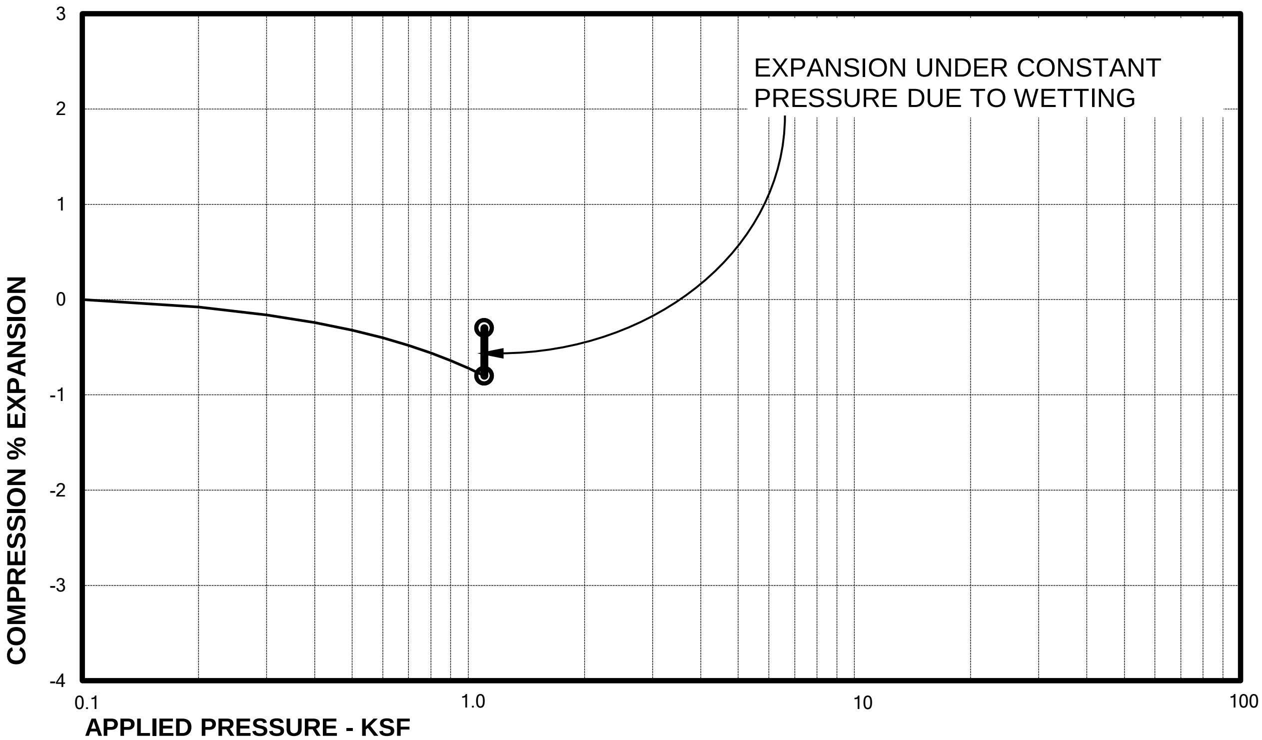


Sample of	SANDSTONE, CLAYEY	DRY UNIT WEIGHT=	121	PCF
From	TH - 103 AT 14 FEET	MOISTURE CONTENT=	10.3	%

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation

FIGURE B-5

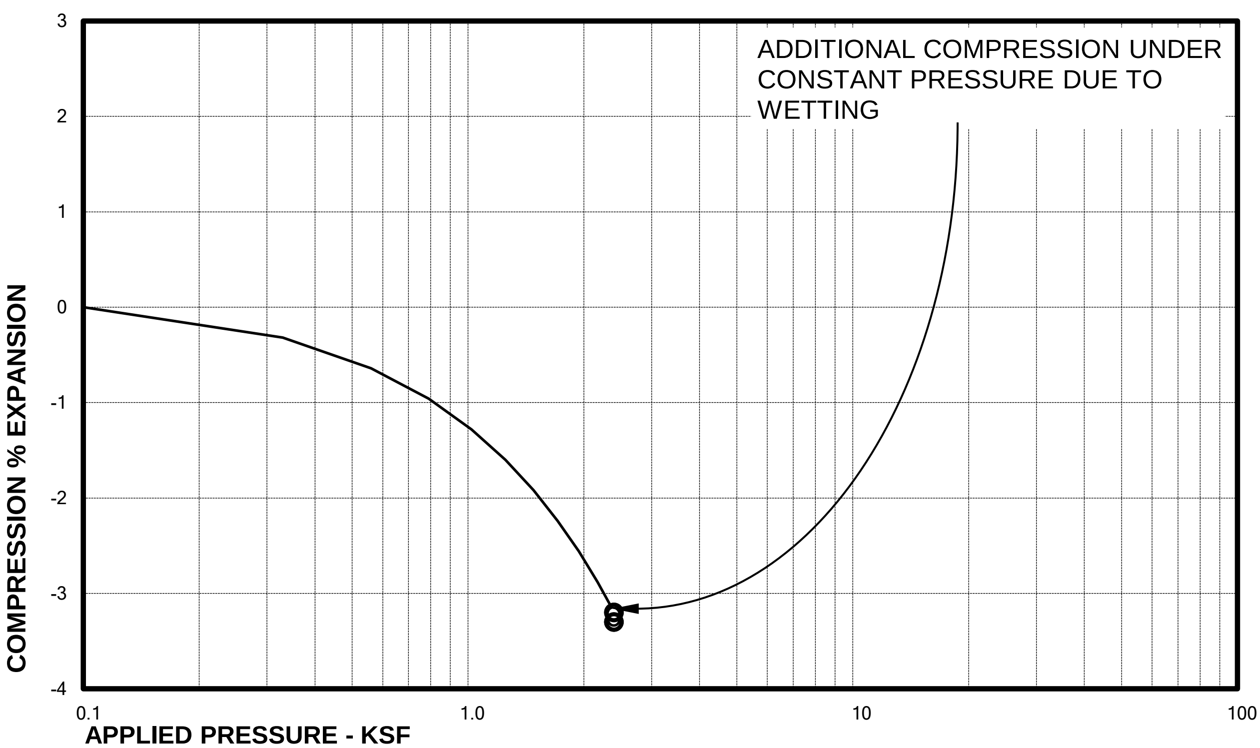


Sample of SANDSTONE, CLAYEY

From TH - 104 AT 9 FEET

DRY UNIT WEIGHT= 120 PCF

MOISTURE CONTENT= 9.0 %



Sample of SANDSTONE, CLAYEY

From TH - 104 AT 19 FEET

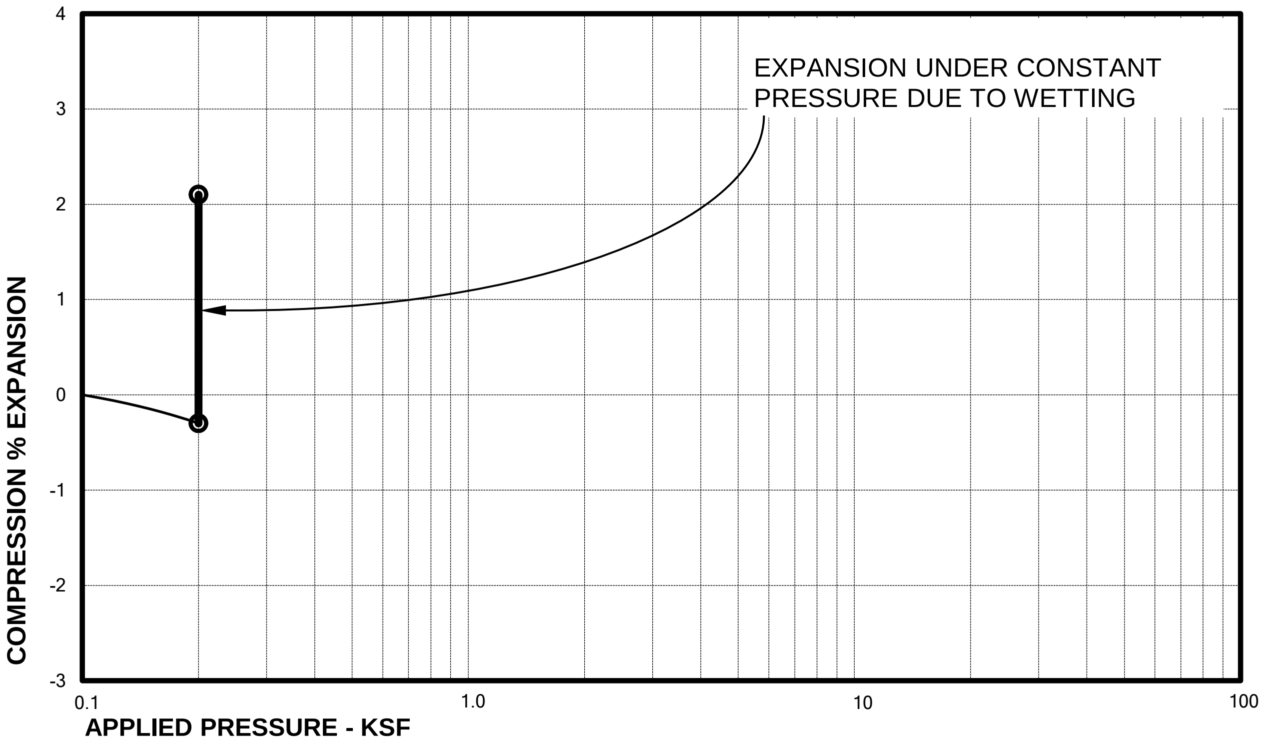
DRY UNIT WEIGHT= 103 PCF

MOISTURE CONTENT= 19.1 %

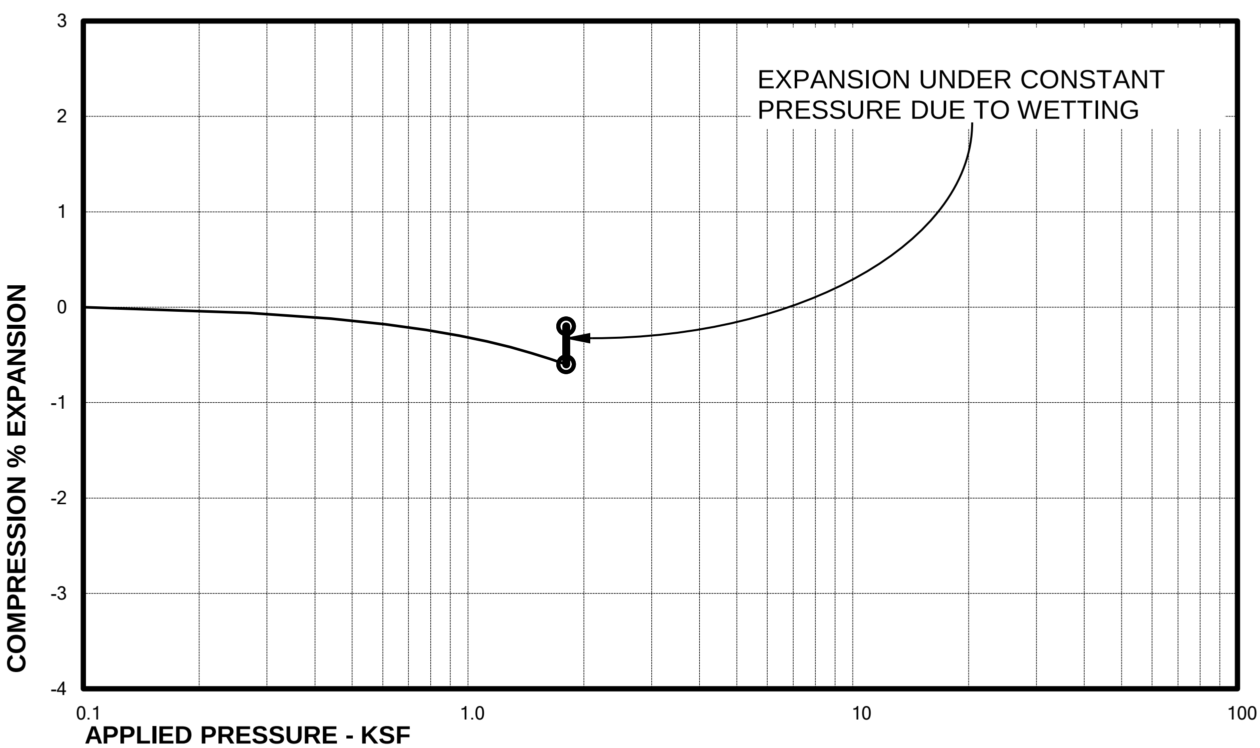
ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation

FIGURE B-6



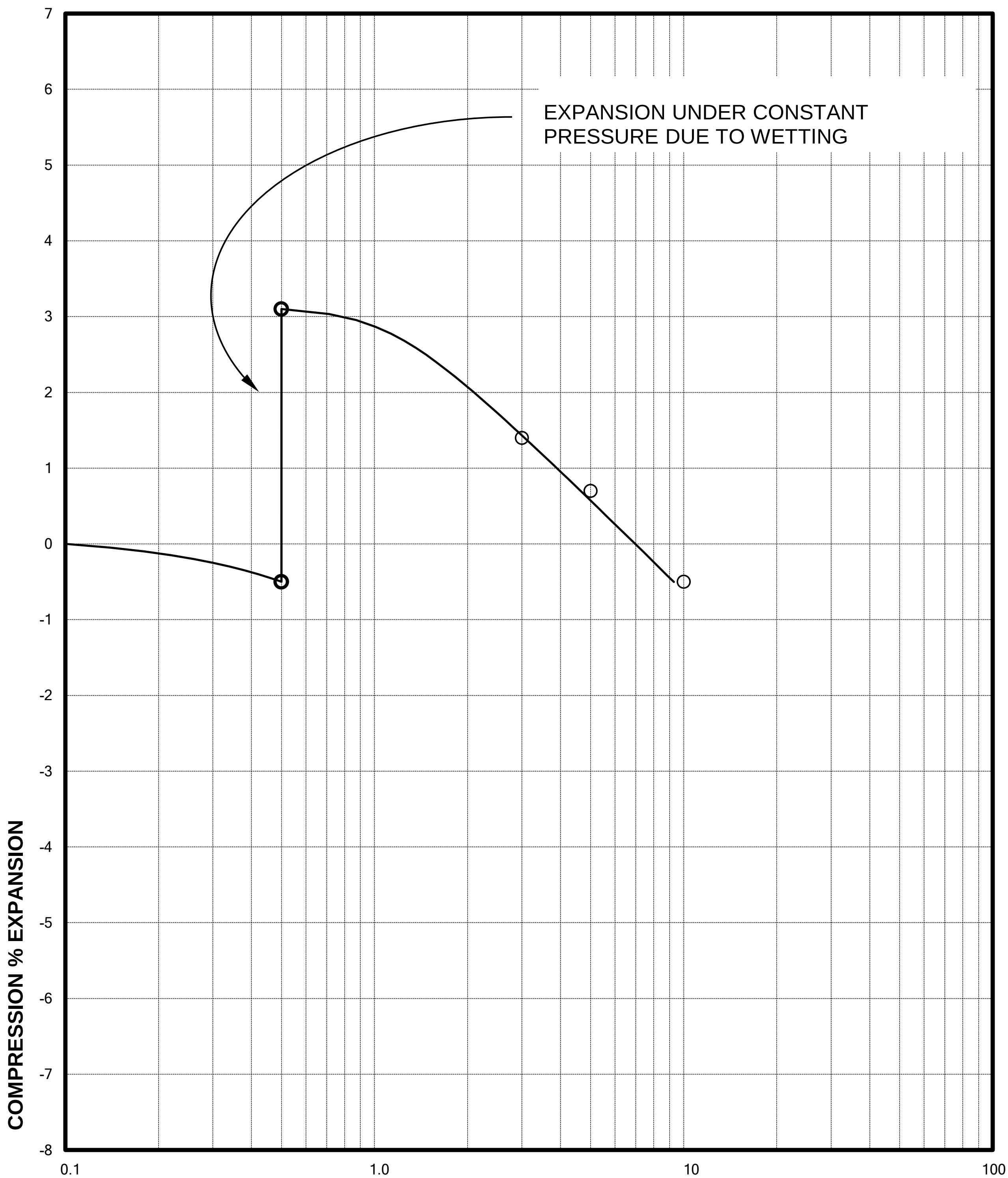
Sample of	FILL, CLAY, SANDY (CL)	DRY UNIT WEIGHT=	117	PCF
From	TH - 105 AT 2 FEET	MOISTURE CONTENT=	6.0	%



Sample of	SANDSTONE, CLAYEY	DRY UNIT WEIGHT=	125	PCF
From	TH - 105 AT 14 FEET	MOISTURE CONTENT=	11.7	%

Swell Consolidation

FIGURE B-7



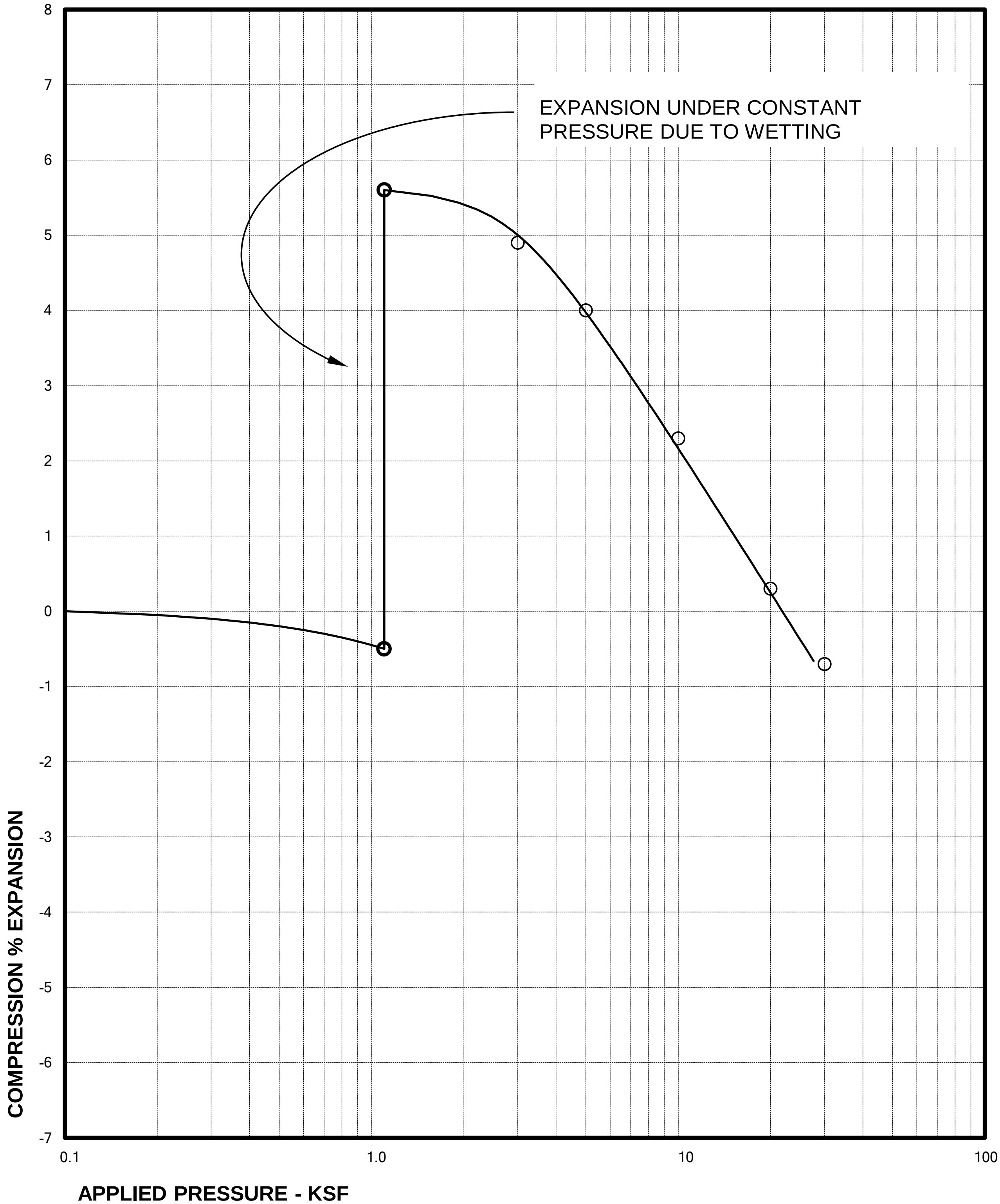
Sample of CLAY, SANDY (CL)
From TH - 106 AT 4 FEET

DRY UNIT WEIGHT= 122 PCF
MOISTURE CONTENT= 10.4 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation Test Results

FIGURE B-8



Sample of CLAY, SANDY (CL)

From TH - 106 AT 9 FEET

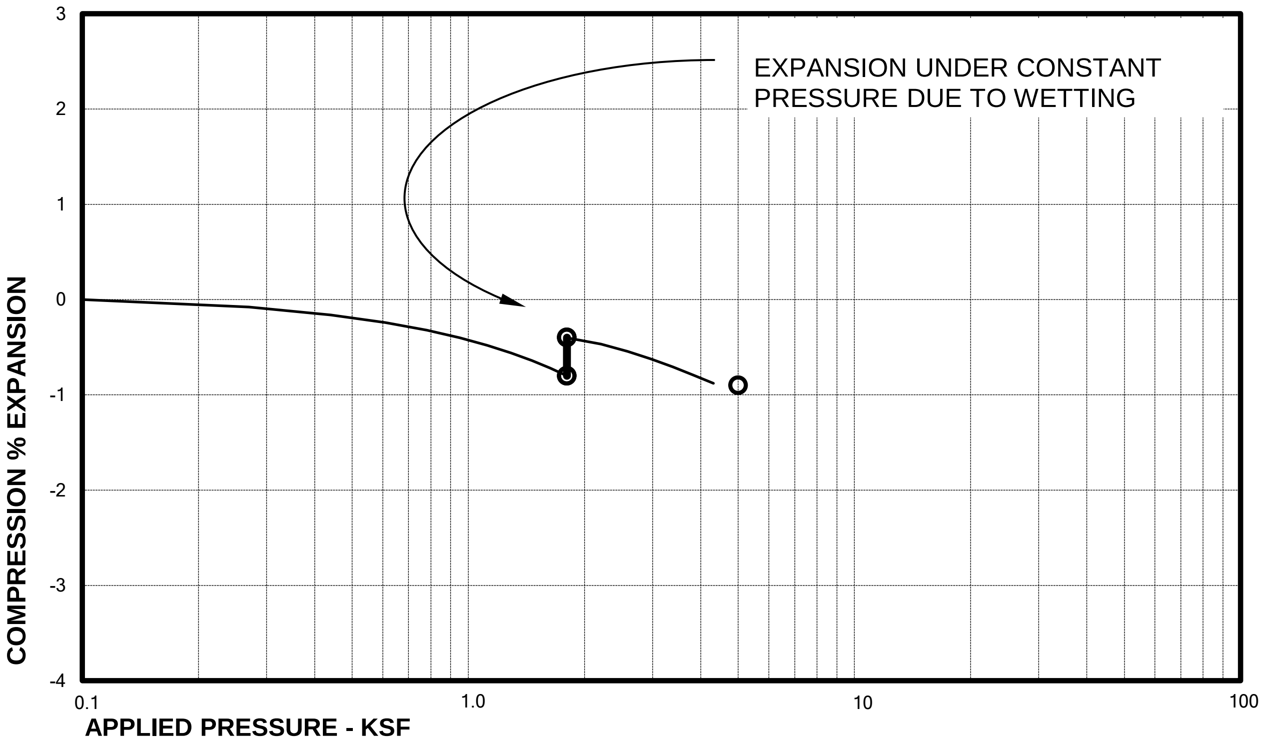
DRY UNIT WEIGHT= 134 PCF

MOISTURE CONTENT= 8.4 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation Test Results

FIGURE B-9

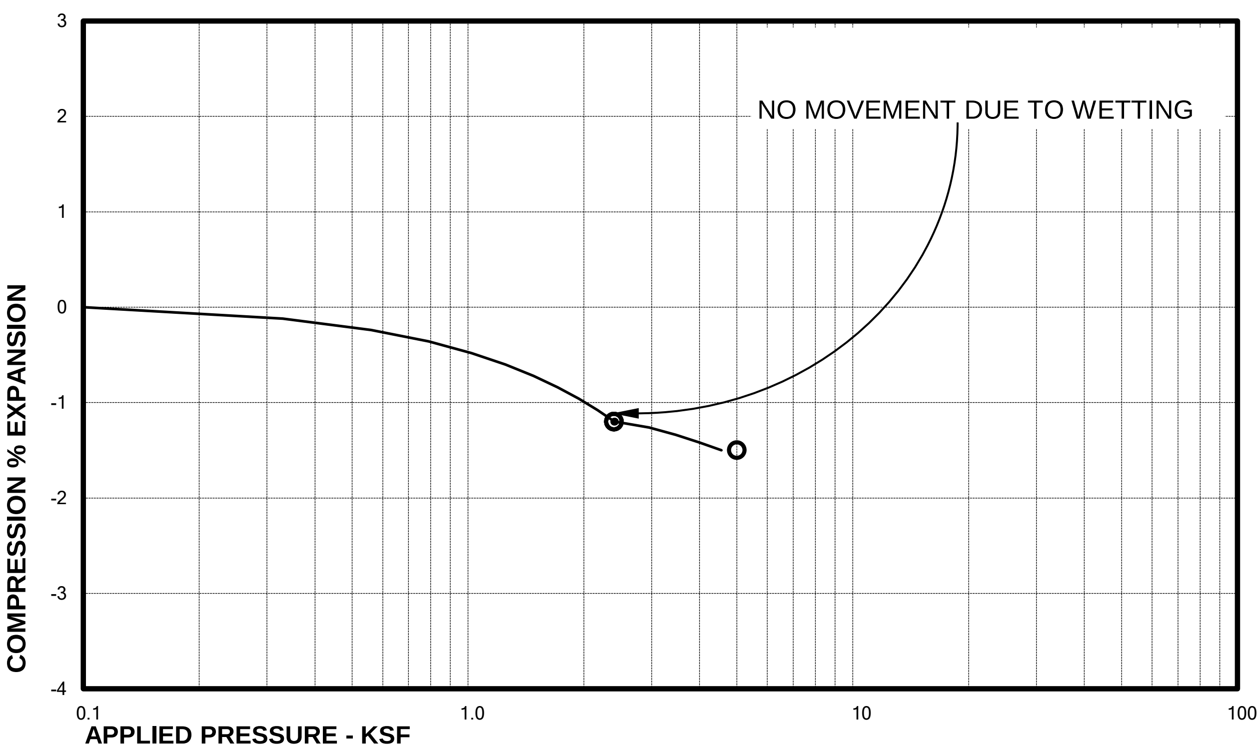


Sample of SANDSTONE, CLAYEY

From TH - 106 AT 14 FEET

DRY UNIT WEIGHT= 124 PCF

MOISTURE CONTENT= 10.5 %



Sample of SANDSTONE, CLAYEY

From TH - 106 AT 19 FEET

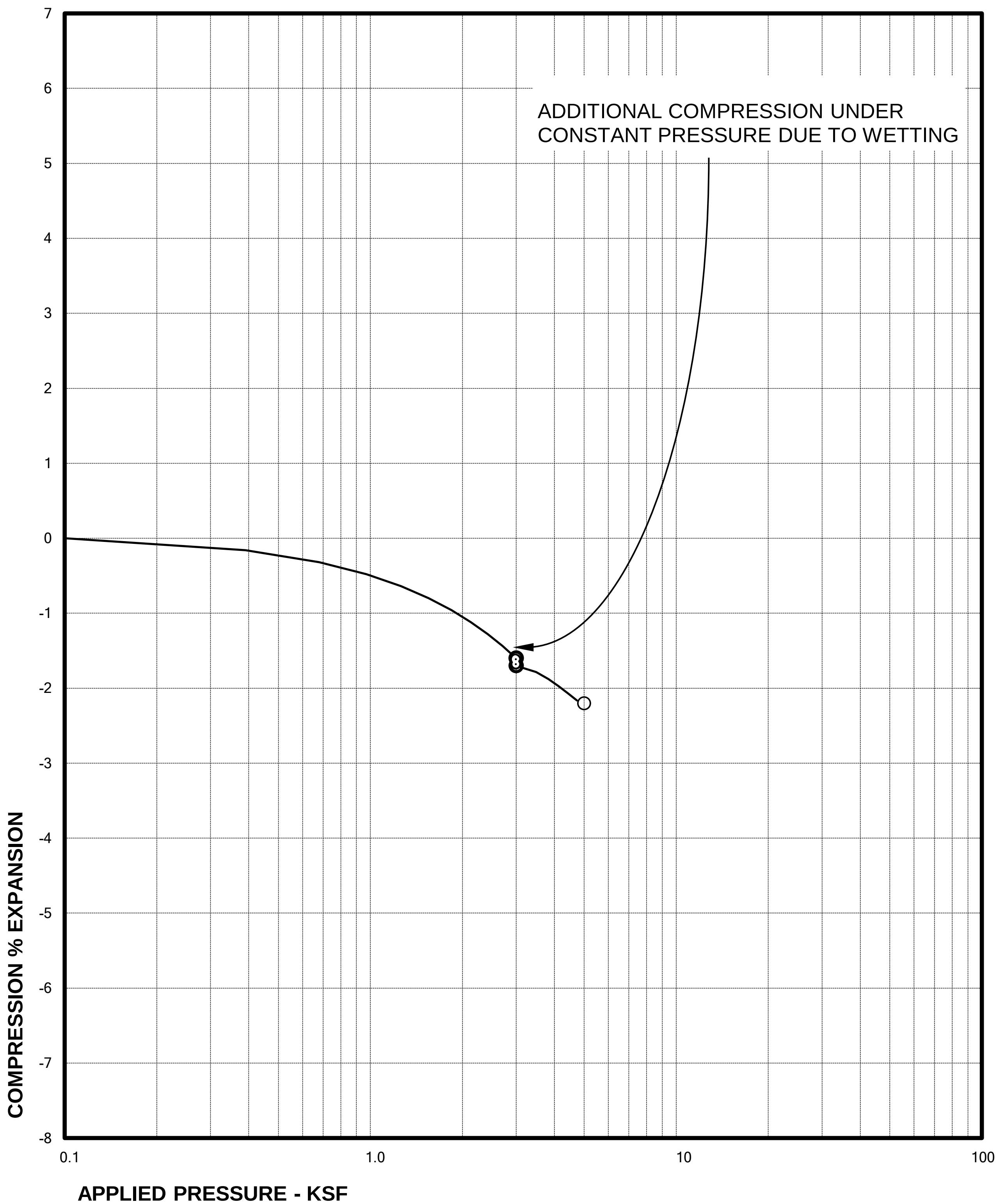
DRY UNIT WEIGHT= 117 PCF

MOISTURE CONTENT= 12.2 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation

FIGURE B-10

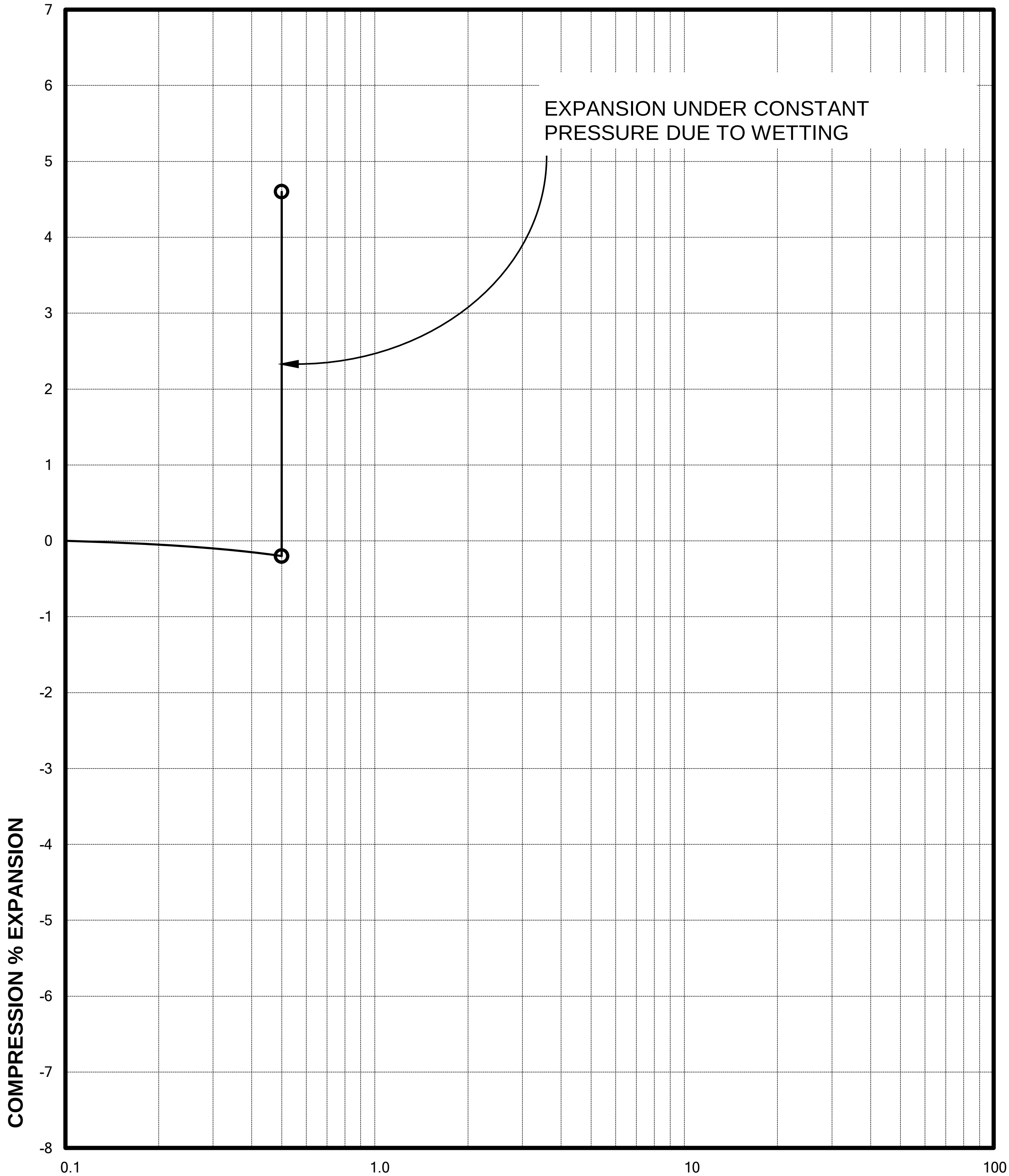


Sample of	SANDSTONE, CLAYEY		DRY UNIT WEIGHT=	116	PCF
From	TH - 106 AT 24 FEET		MOISTURE CONTENT=	12.9	%

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation Test Results

FIGURE B-11



Sample of CLAY, SANDY (CL)

From TH - 107 AT 4 FEET

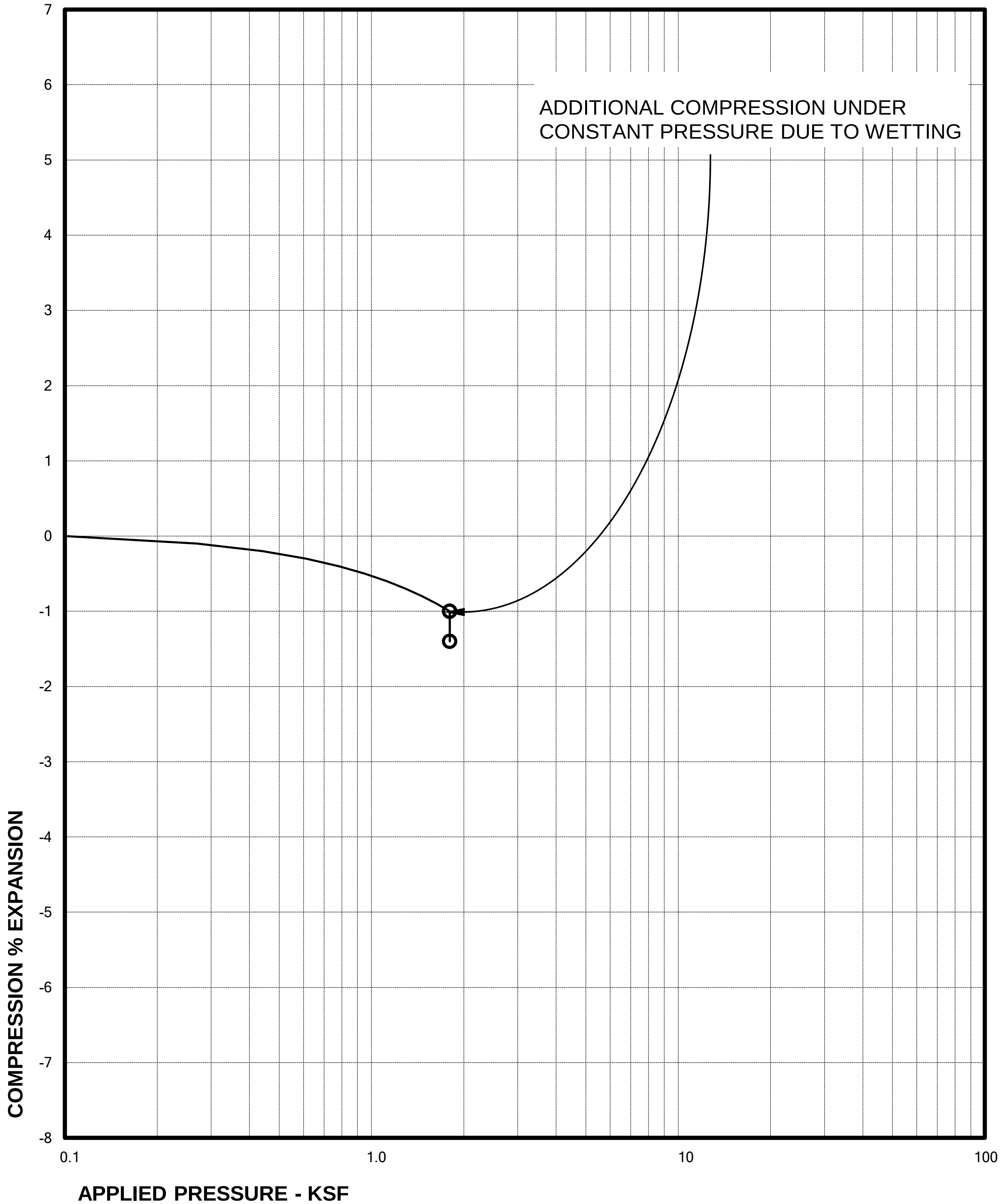
DRY UNIT WEIGHT= 122 PCF

MOISTURE CONTENT= 9.5 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation Test Results

FIGURE B-12

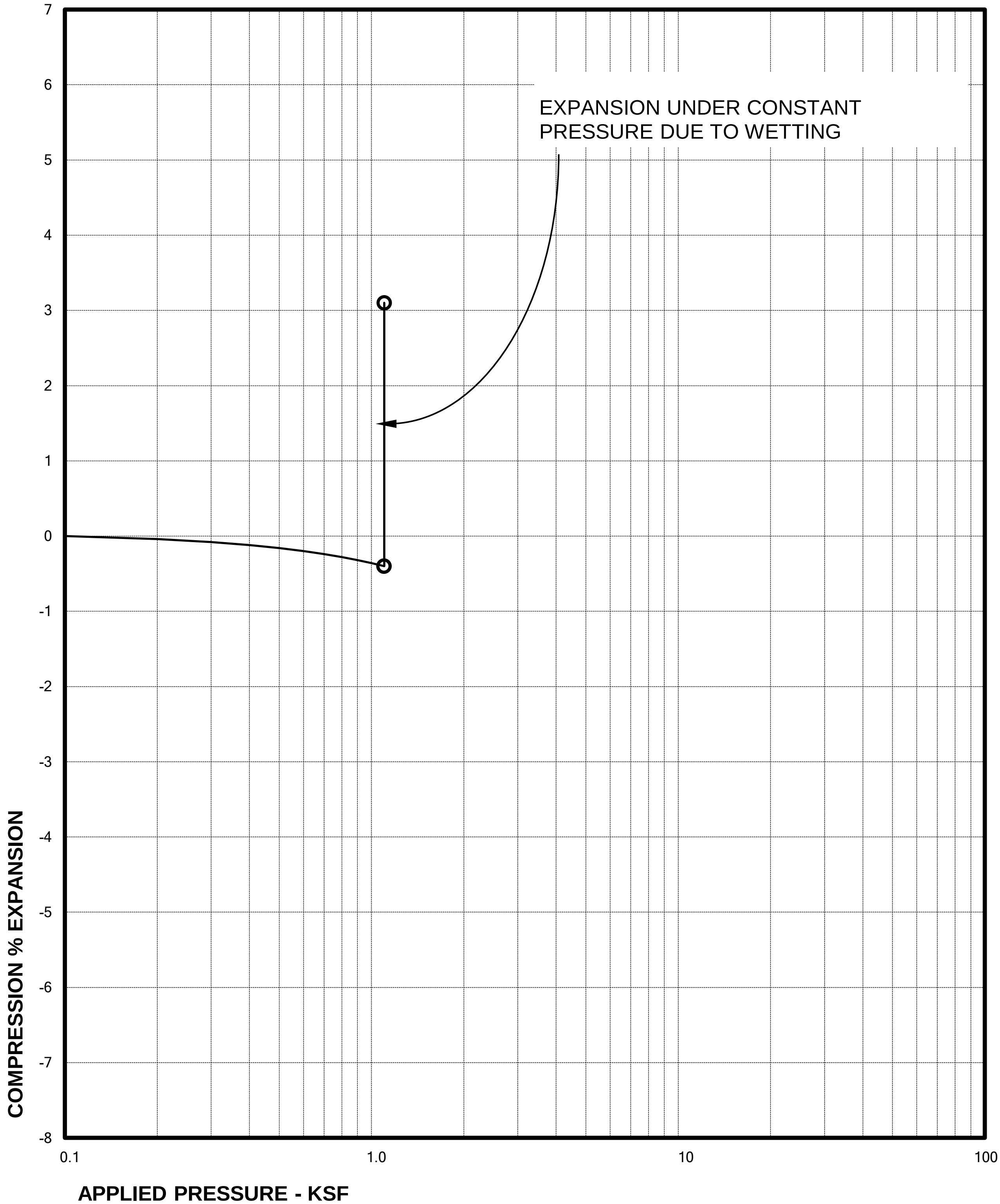


Sample of	SANDSTONE, CLAYEY	DRY UNIT WEIGHT=	113	PCF
From	TH - 107 AT 14 FEET	MOISTURE CONTENT=	9.3	%

Swell Consolidation Test Results

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

FIGURE B-13



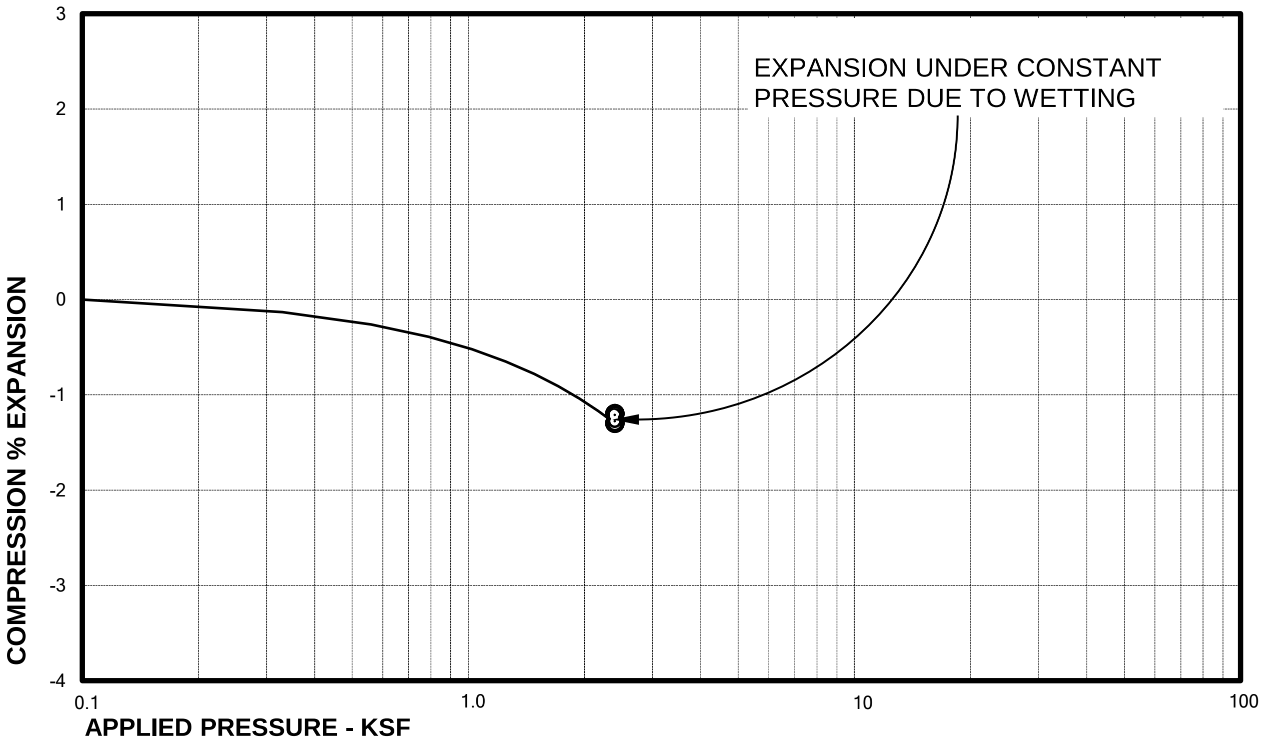
Sample of INTERBEDDED SANDSTONE AND CLAYSTONE
From TH - 108 AT 9 FEET

DRY UNIT WEIGHT= 125 PCF
MOISTURE CONTENT= 9.8 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

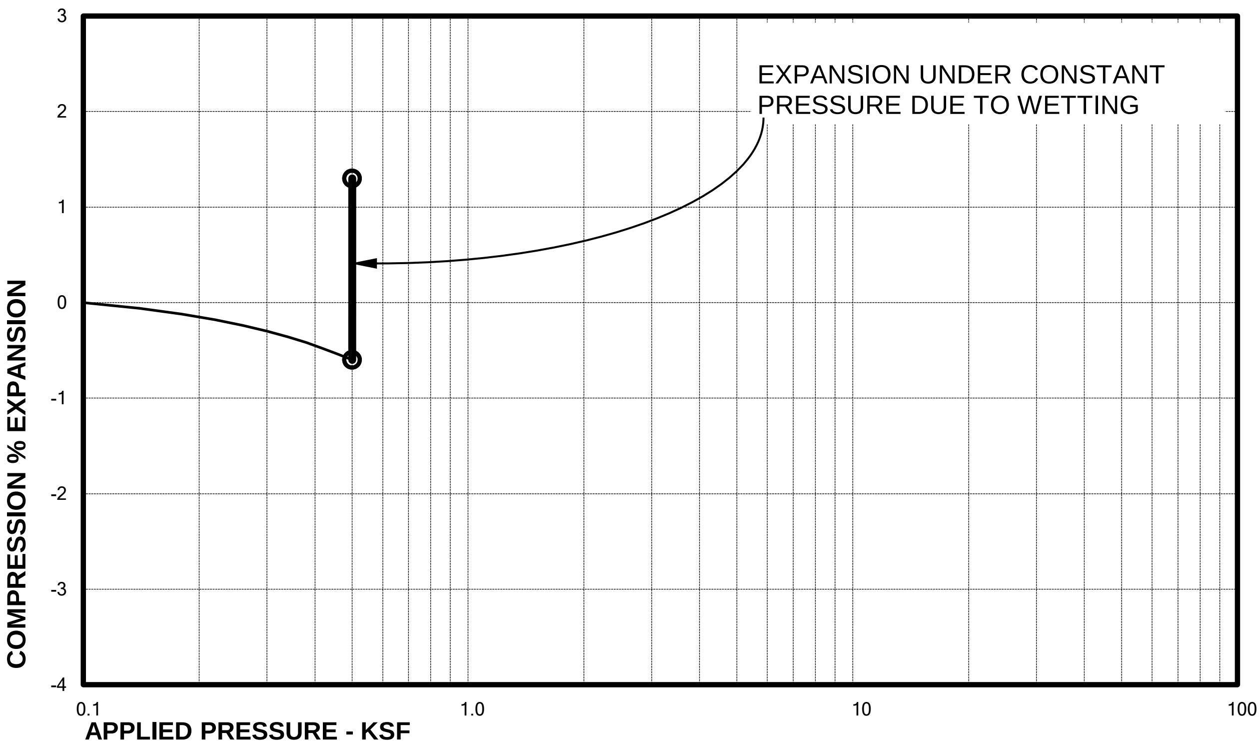
Swell Consolidation Test Results

FIGURE B-14



Sample of INTERBEDDED SANDSTONE AND CLAYSTONE
From TH - 108 AT 19 FEET

DRY UNIT WEIGHT= 116 PCF
MOISTURE CONTENT= 12.8 %



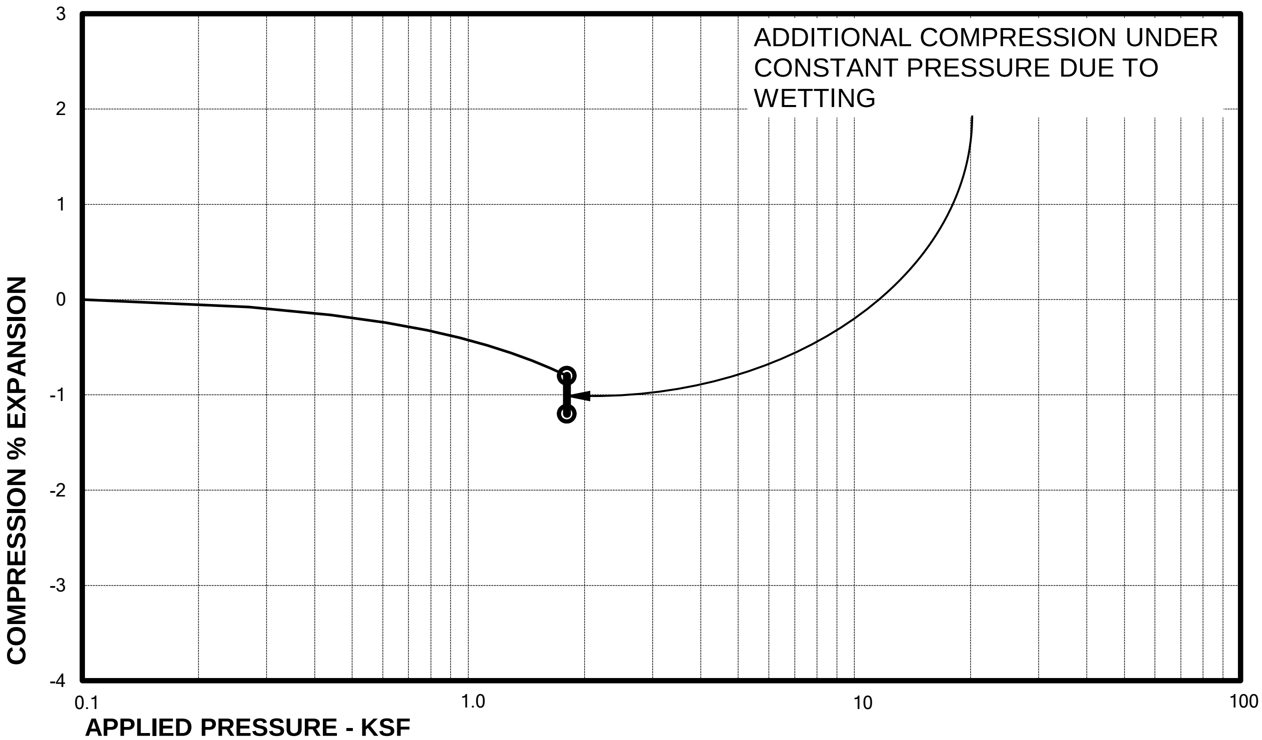
Sample of INTERBEDDED SANDSTONE AND CLAYSTONE
From TH - 109 AT 4 FEET

DRY UNIT WEIGHT= 122 PCF
MOISTURE CONTENT= 12.8 %

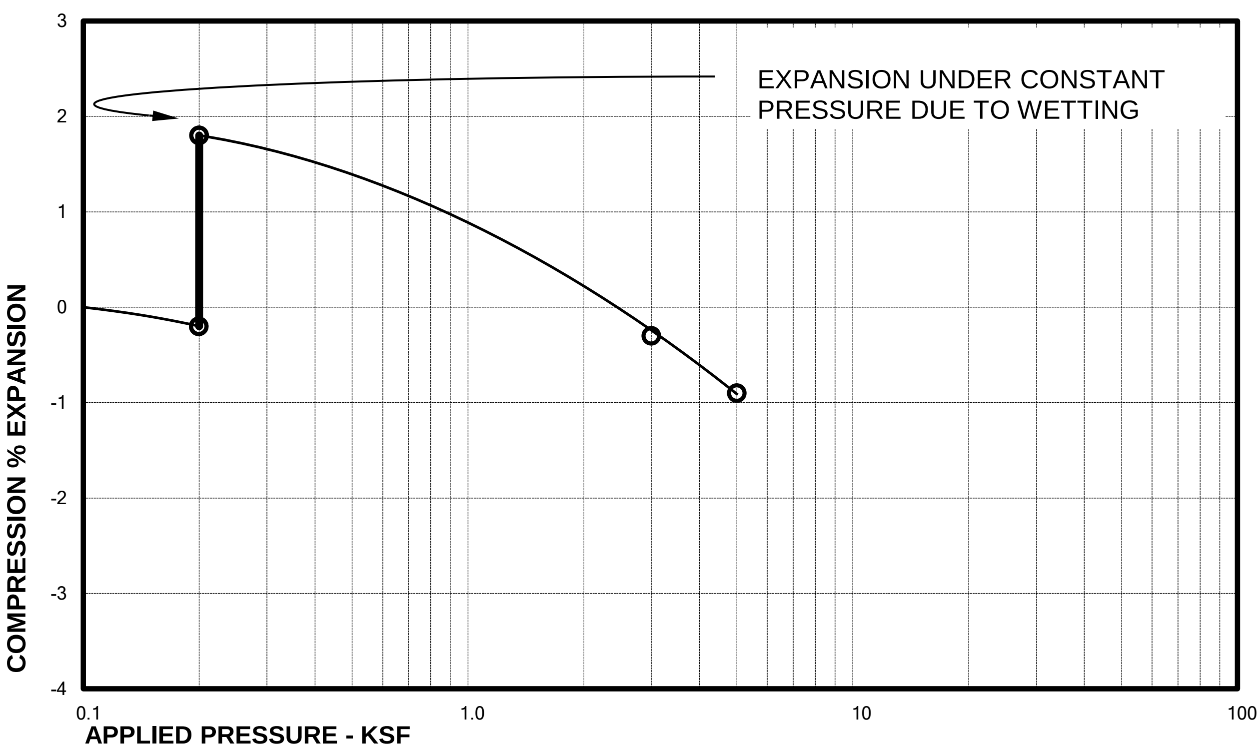
ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation

FIGURE B-15



Sample of	INTERBEDDED SANDSTONE AND CLAYSTONE	DRY UNIT WEIGHT=	106	PCF
From	TH - 109 AT 14 FEET	MOISTURE CONTENT=	12.7	%

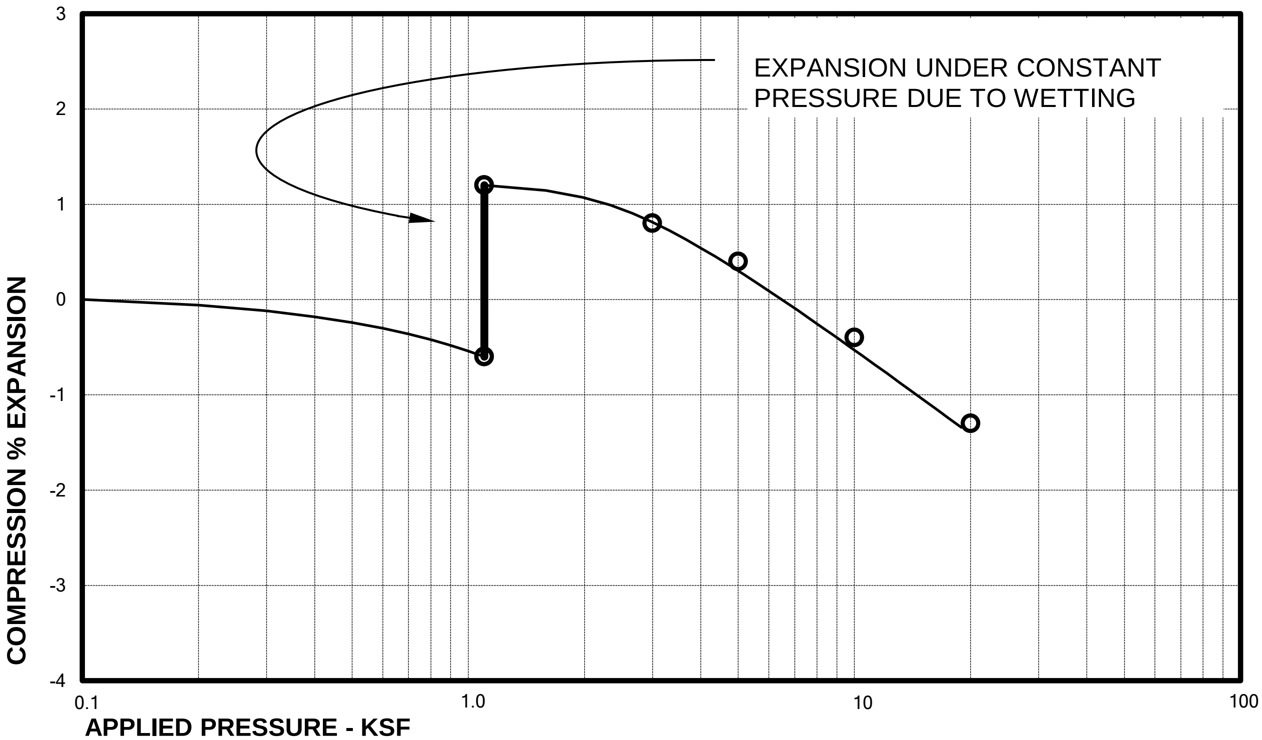


Sample of	INTERBEDDED SANDSTONE AND CLAYSTONE	DRY UNIT WEIGHT=	122	PCF
From	TH - 110 AT 2 FEET	MOISTURE CONTENT=	13.5	%

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

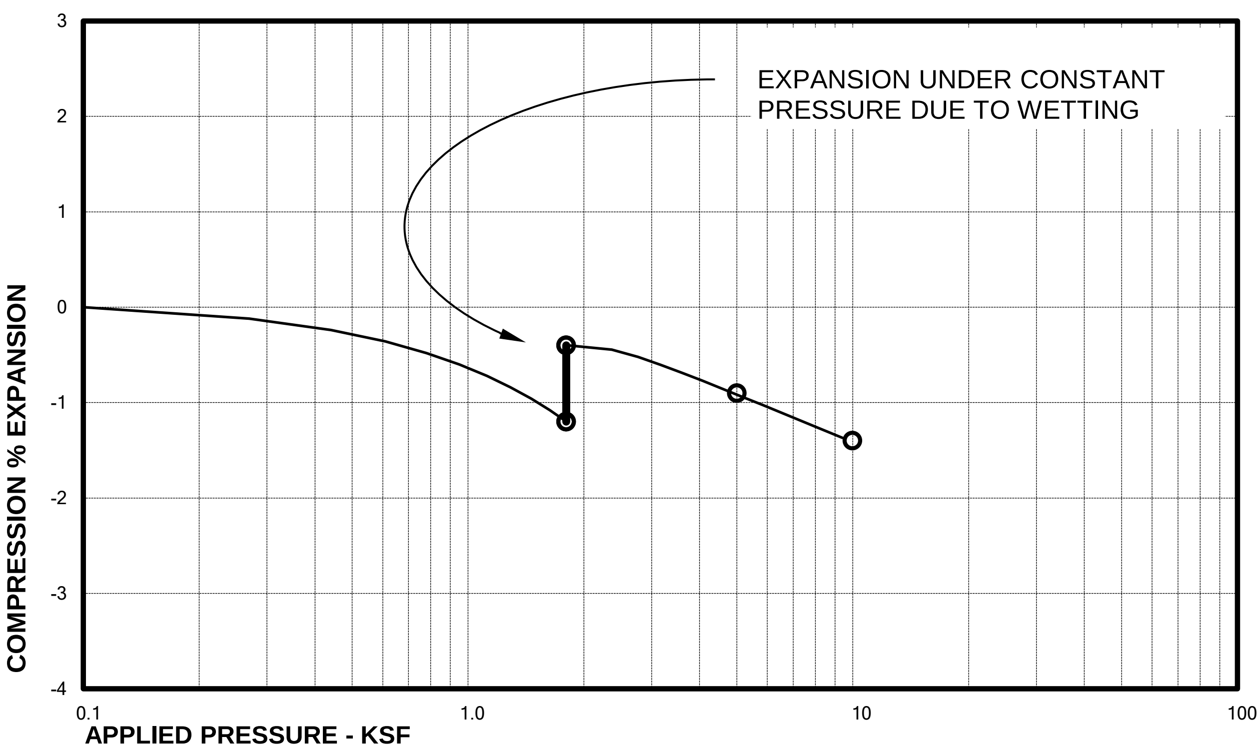
Swell Consolidation

FIGURE B-16



Sample of INTERBEDDED SANDSTONE AND CLAYSTONE
From TH - 110 AT 9 FEET

DRY UNIT WEIGHT= 125 PCF
MOISTURE CONTENT= 12.1 %



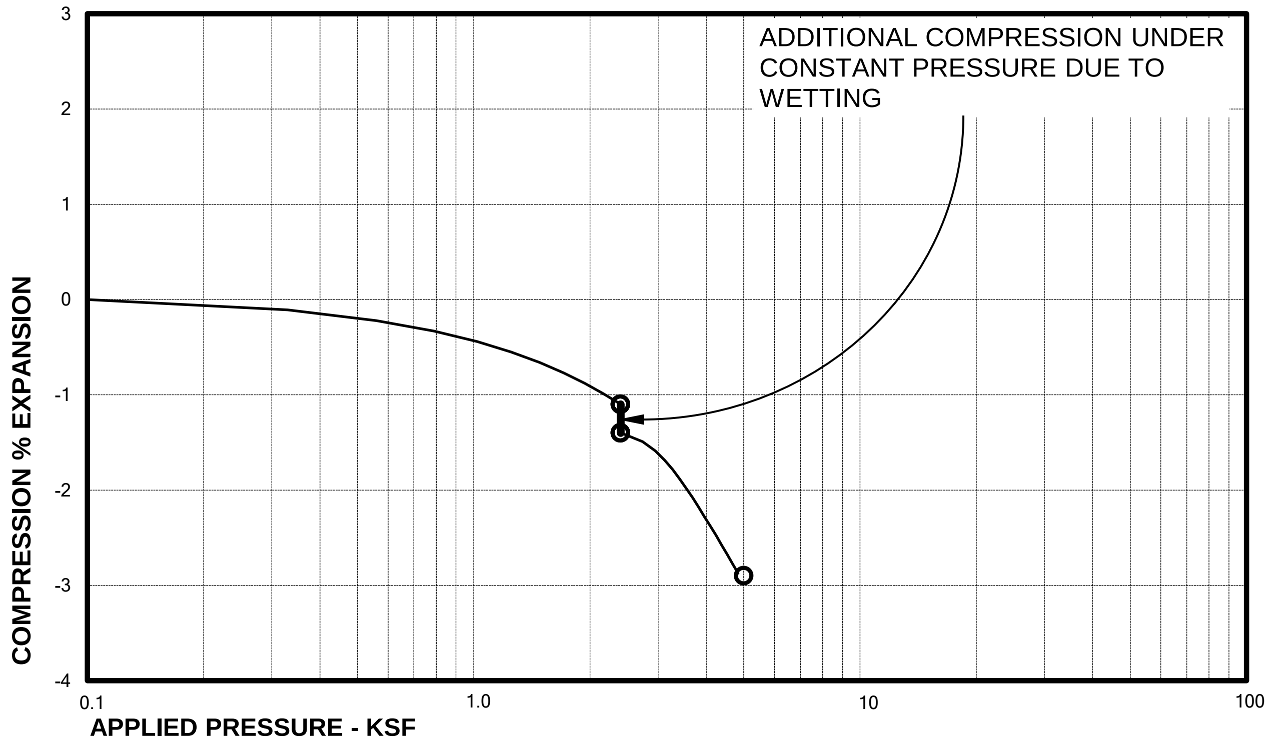
Sample of INTERBEDDED SANDSTONE AND CLAYSTONE
From TH - 110 AT 14 FEET

DRY UNIT WEIGHT= 125 PCF
MOISTURE CONTENT= 14.0 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

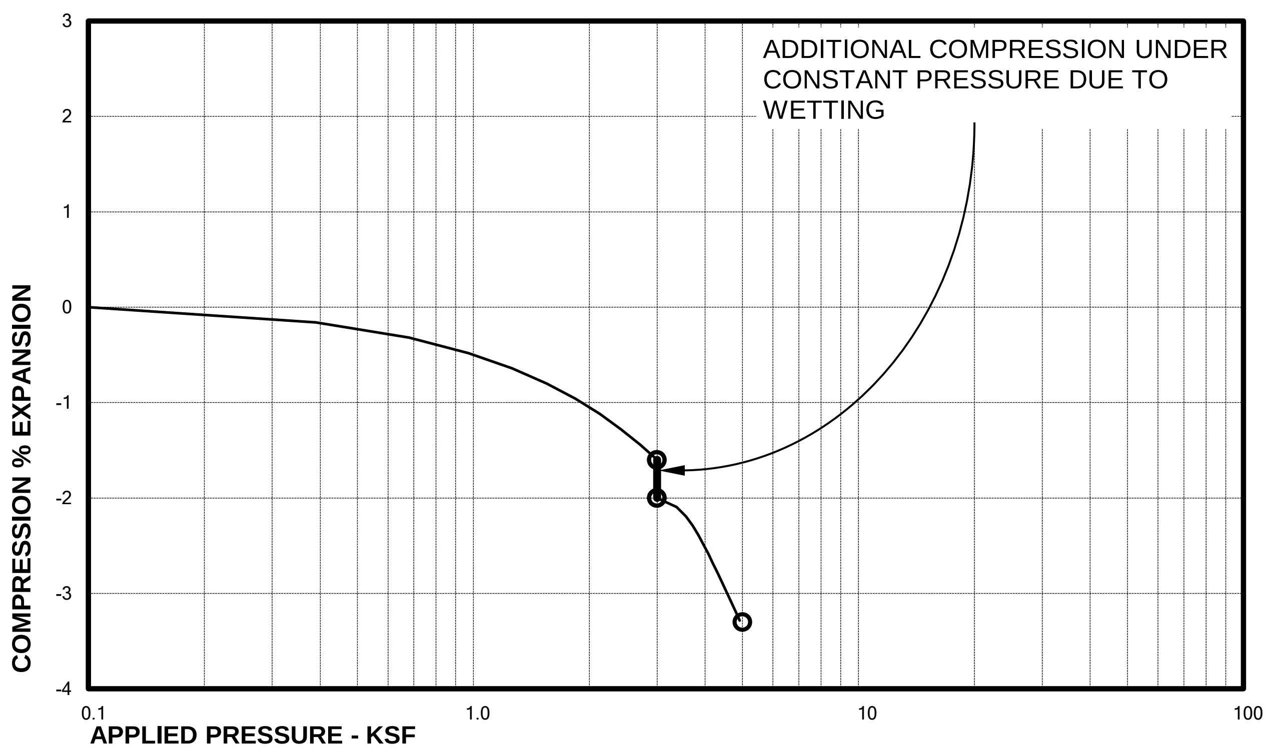
Swell Consolidation

FIGURE B-17



Sample of INTERBEDDED SANDSTONE AND CLAYSTONE
From TH - 110 AT 19 FEET

DRY UNIT WEIGHT= 101 PCF
MOISTURE CONTENT= 13.3 %



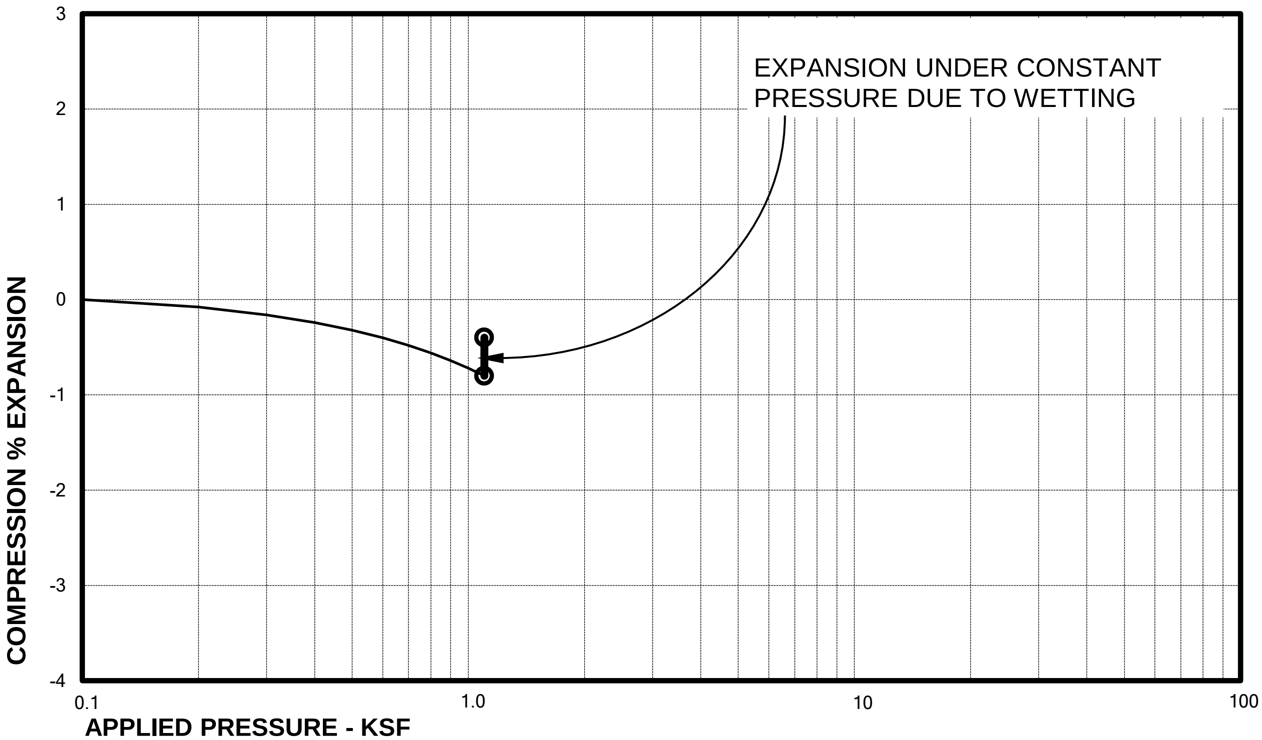
Sample of INTERBEDDED SANDSTONE AND CLAYSTONE
From TH - 110 AT 24 FEET

DRY UNIT WEIGHT= 99 PCF
MOISTURE CONTENT= 14.2 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation

FIGURE B-18

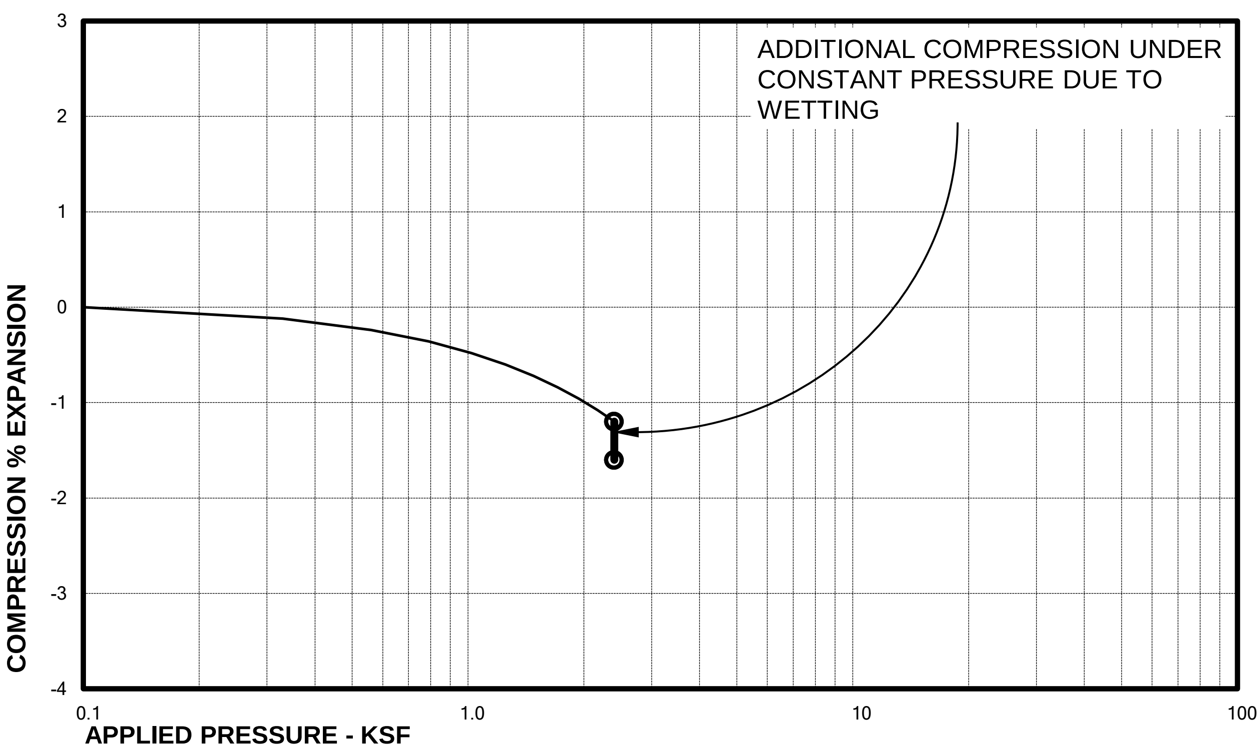


Sample of INTERBEDDED SANDSTONE AND CLAYSTONE

From TH - 111 AT 9 FEET

DRY UNIT WEIGHT= 124 PCF

MOISTURE CONTENT= 9.8 %



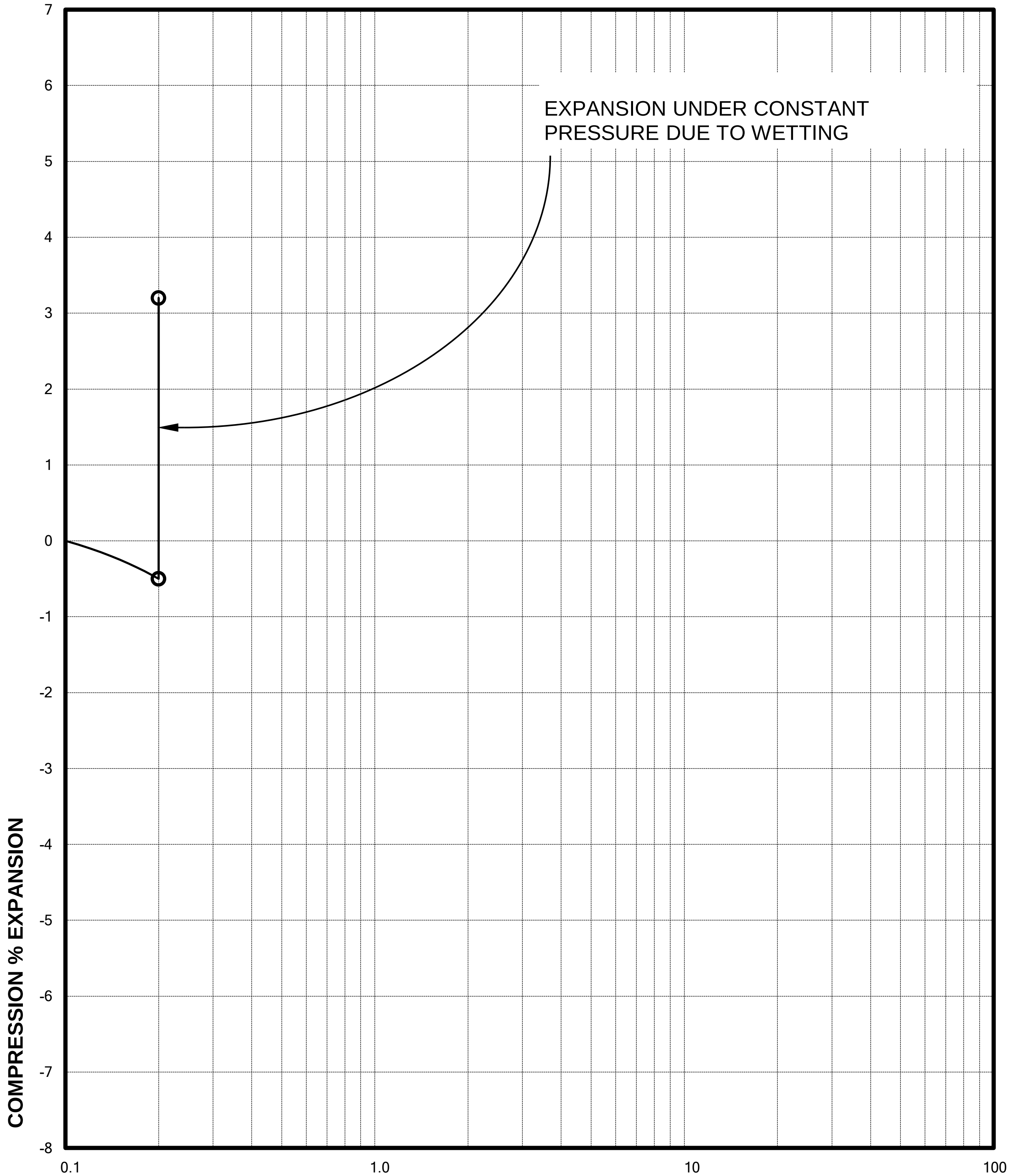
Sample of INTERBEDDED SANDSTONE AND CLAYSTONE

From TH - 111 AT 19 FEET

DRY UNIT WEIGHT= 108 PCF

MOISTURE CONTENT= 12.9 %

Swell Consolidation



APPLIED PRESSURE - KSF

Sample of CLAY, SANDY (CL)

From TH - 112 AT 2 FEET

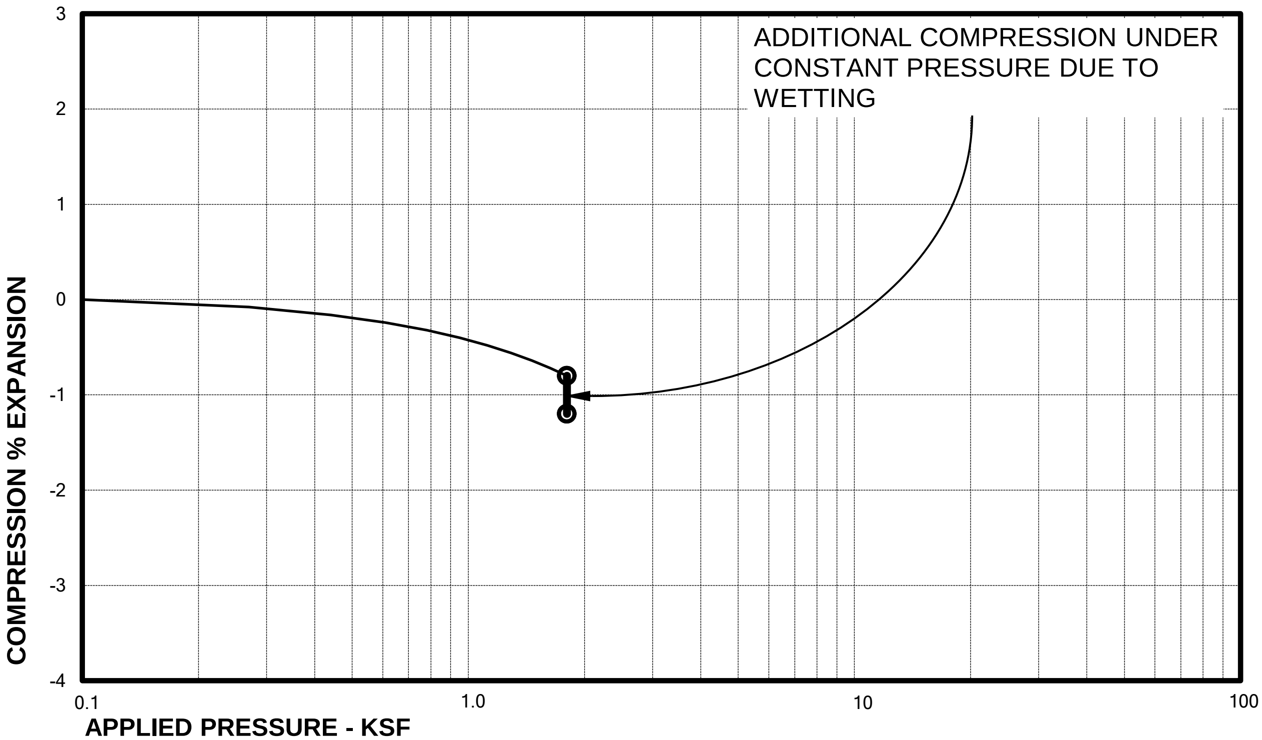
DRY UNIT WEIGHT= 100 PCF

MOISTURE CONTENT= 6.6 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

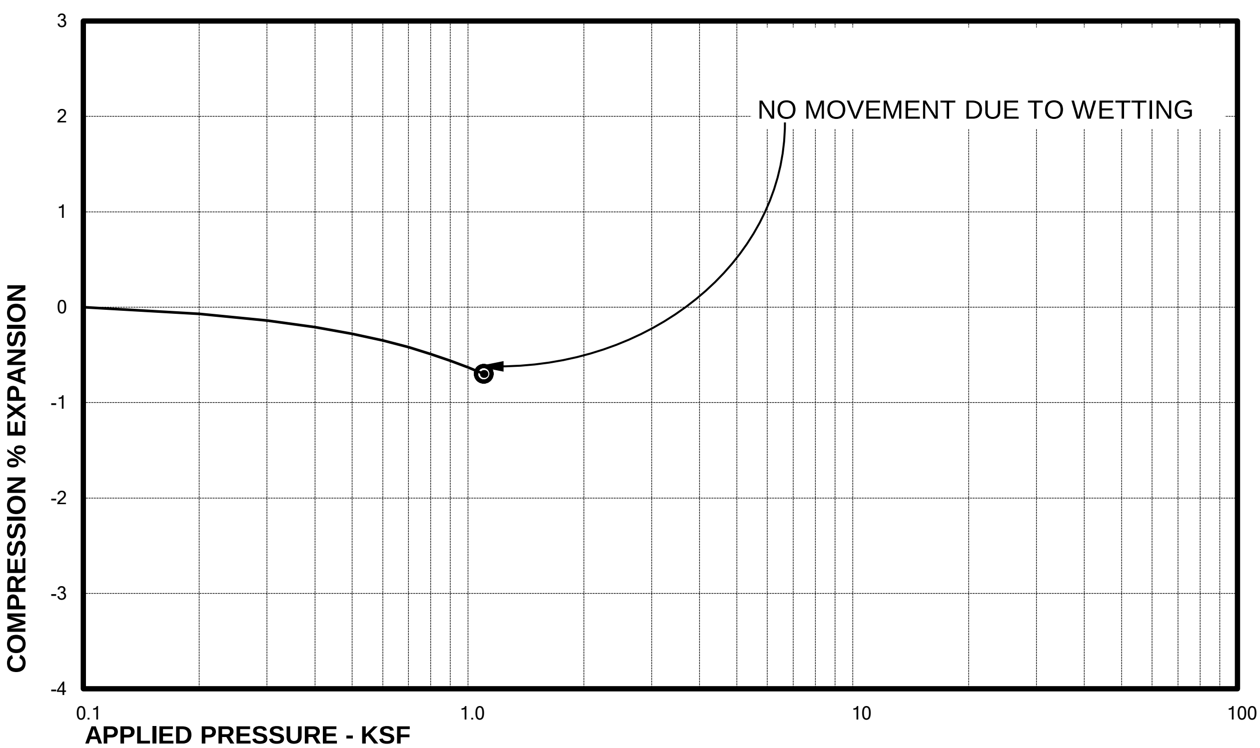
Swell Consolidation Test Results

FIGURE B-20



Sample of SANDSTONE, CLAYEY
From TH - 112 AT 14 FEET

DRY UNIT WEIGHT= 102 PCF
MOISTURE CONTENT= 11.0 %



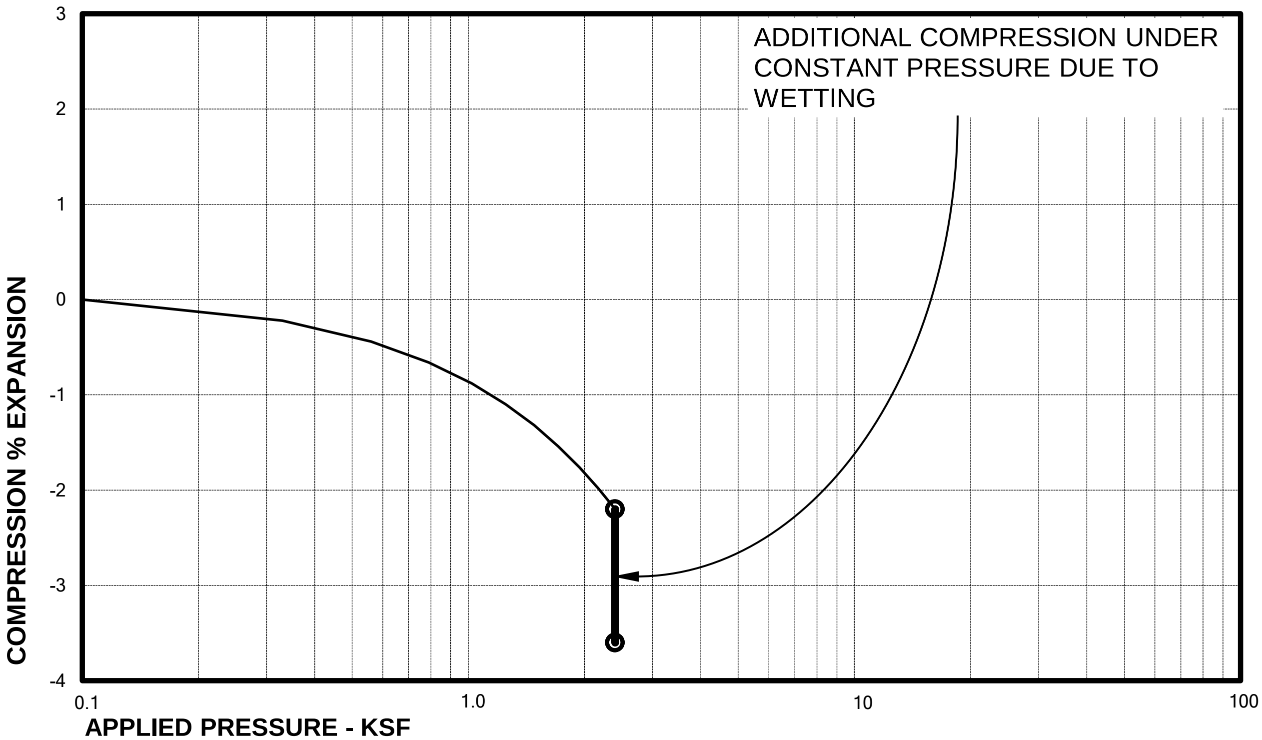
Sample of CLAY, SANDY (CL)
From TH - 113 AT 9 FEET

DRY UNIT WEIGHT= 98 PCF
MOISTURE CONTENT= 8.9 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

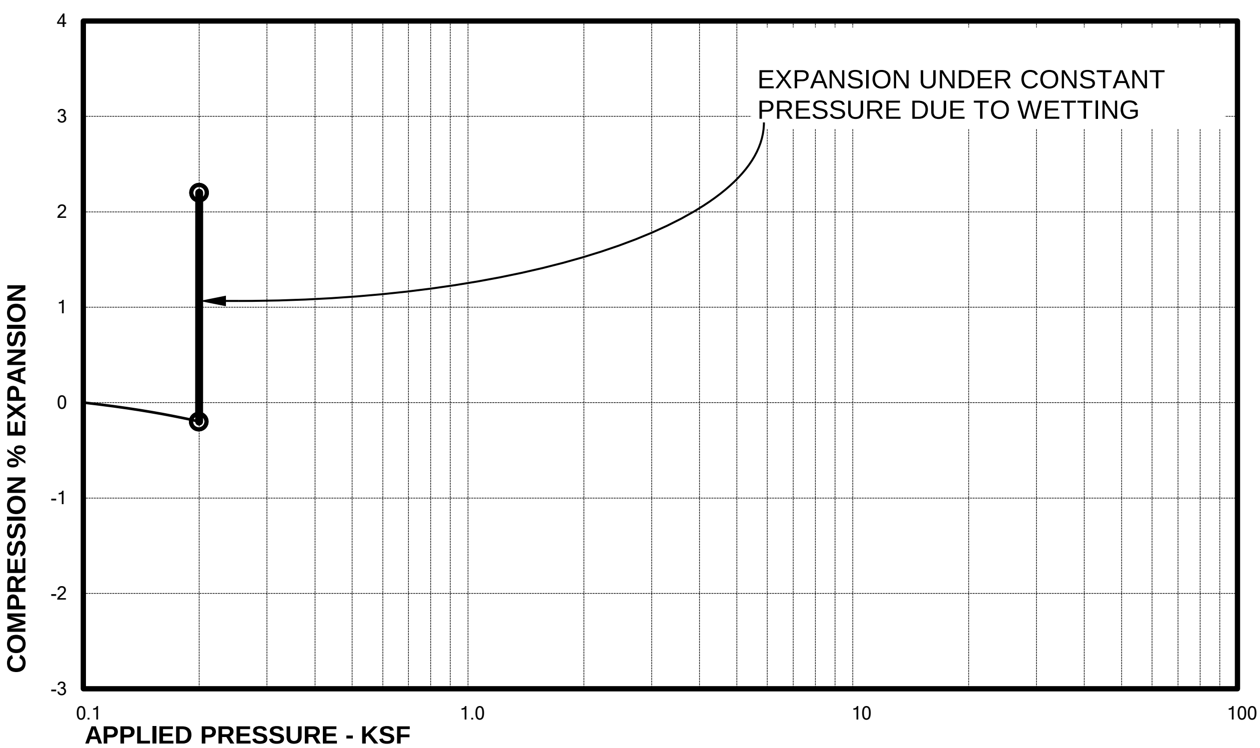
Swell Consolidation

FIGURE B-21



Sample of SANDSTONE, CLAYEY
From TH - 113 AT 19 FEET

DRY UNIT WEIGHT= 101 PCF
MOISTURE CONTENT= 13.1 %



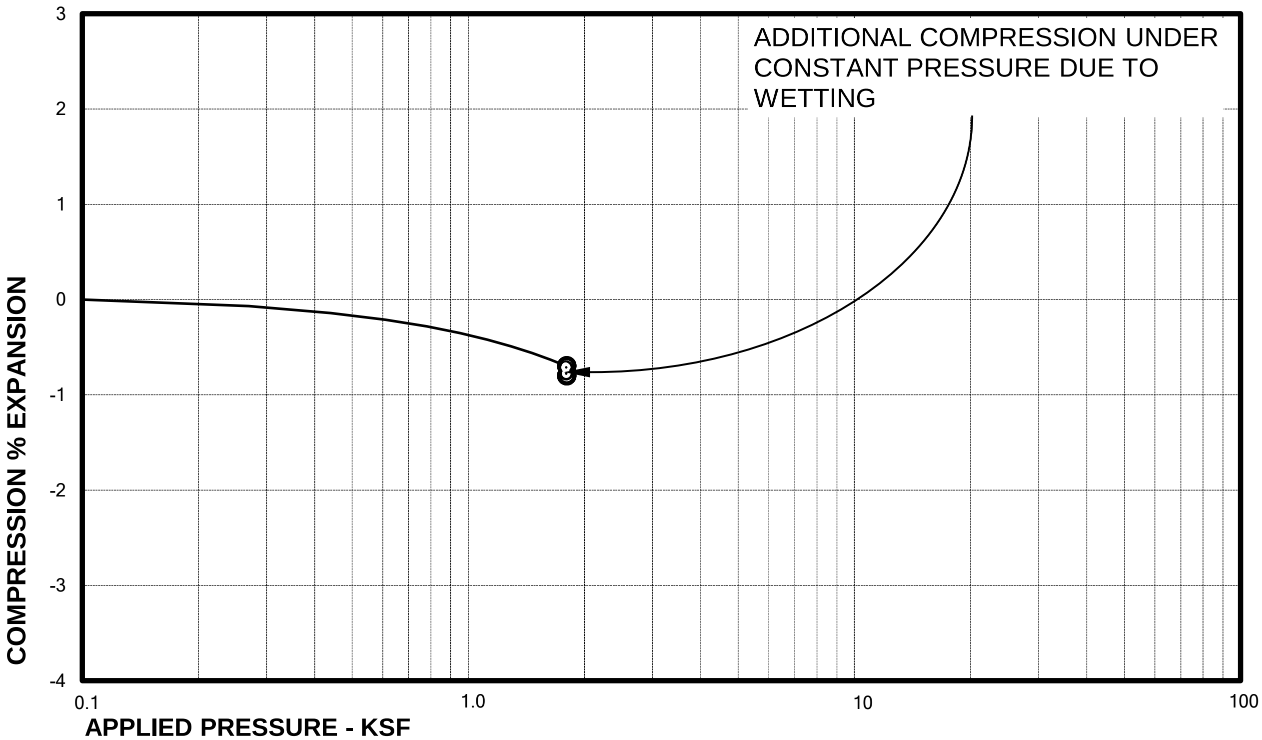
Sample of CLAY, SANDY (CL)
From TH - 114 AT 2 FEET

DRY UNIT WEIGHT= 107 PCF
MOISTURE CONTENT= 8.1 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

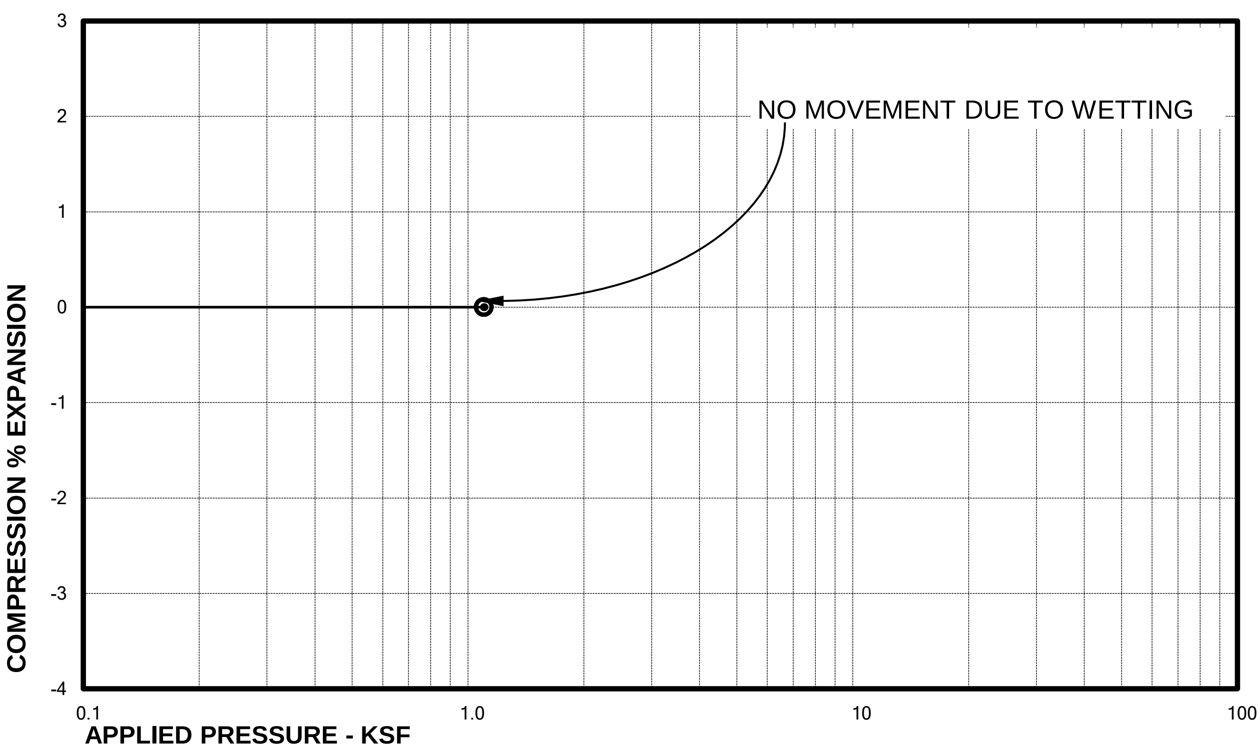
Swell Consolidation

FIGURE B-22



Sample of SANDSTONE, CLAYEY
From TH - 114 AT 14 FEET

DRY UNIT WEIGHT= 115 PCF
MOISTURE CONTENT= 12.0 %



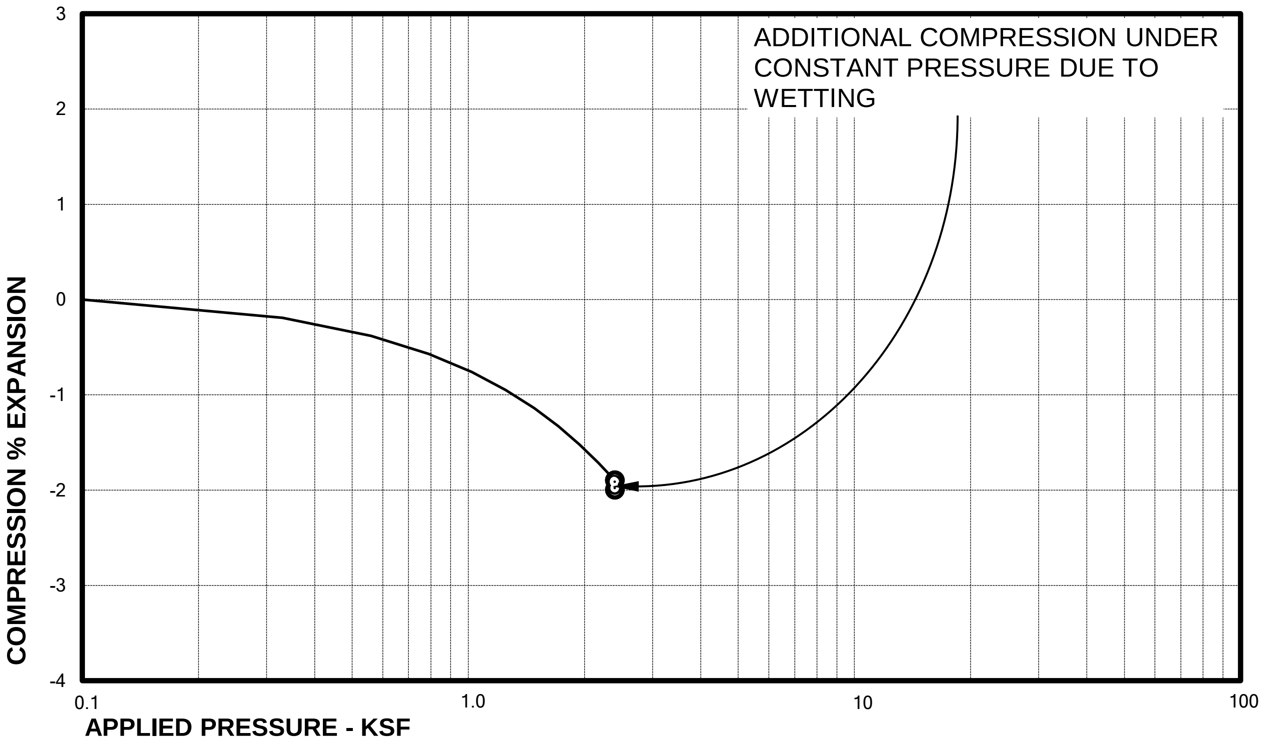
Sample of CLAY, SANDY (CL)
From TH - 115 AT 9 FEET

DRY UNIT WEIGHT= 110 PCF
MOISTURE CONTENT= 9.7 %

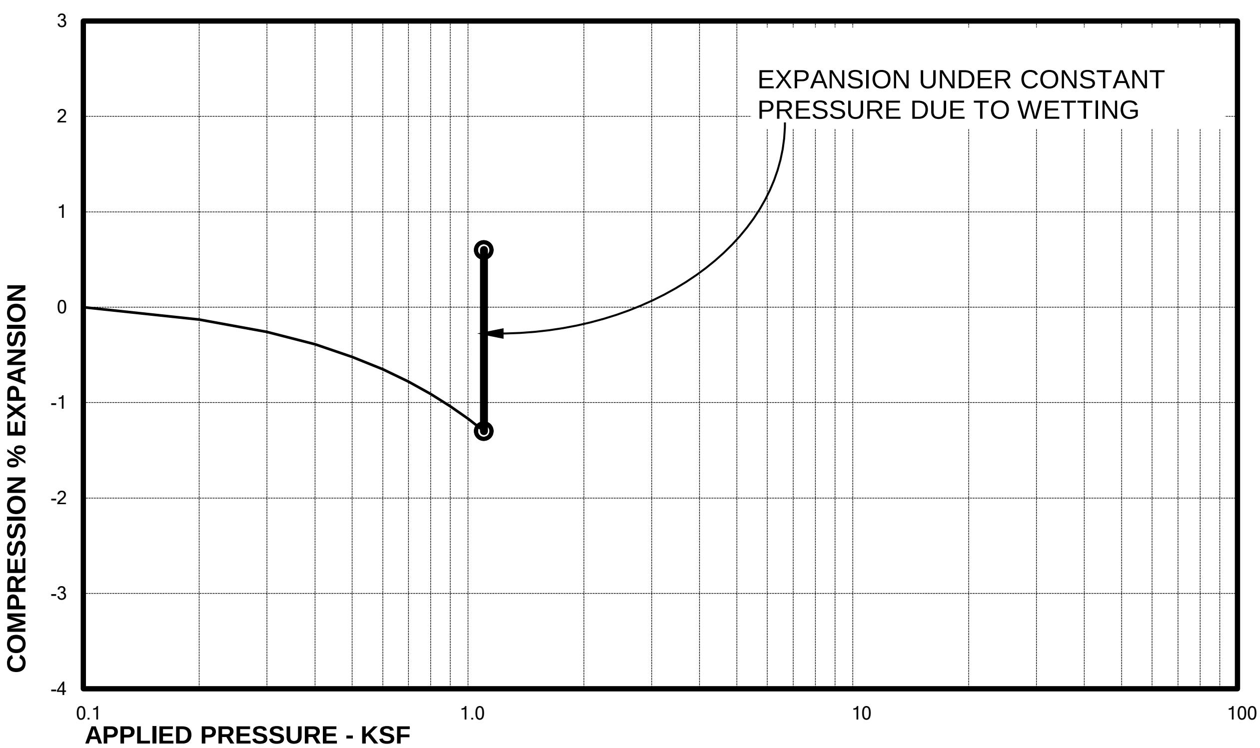
ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation

FIGURE B-23

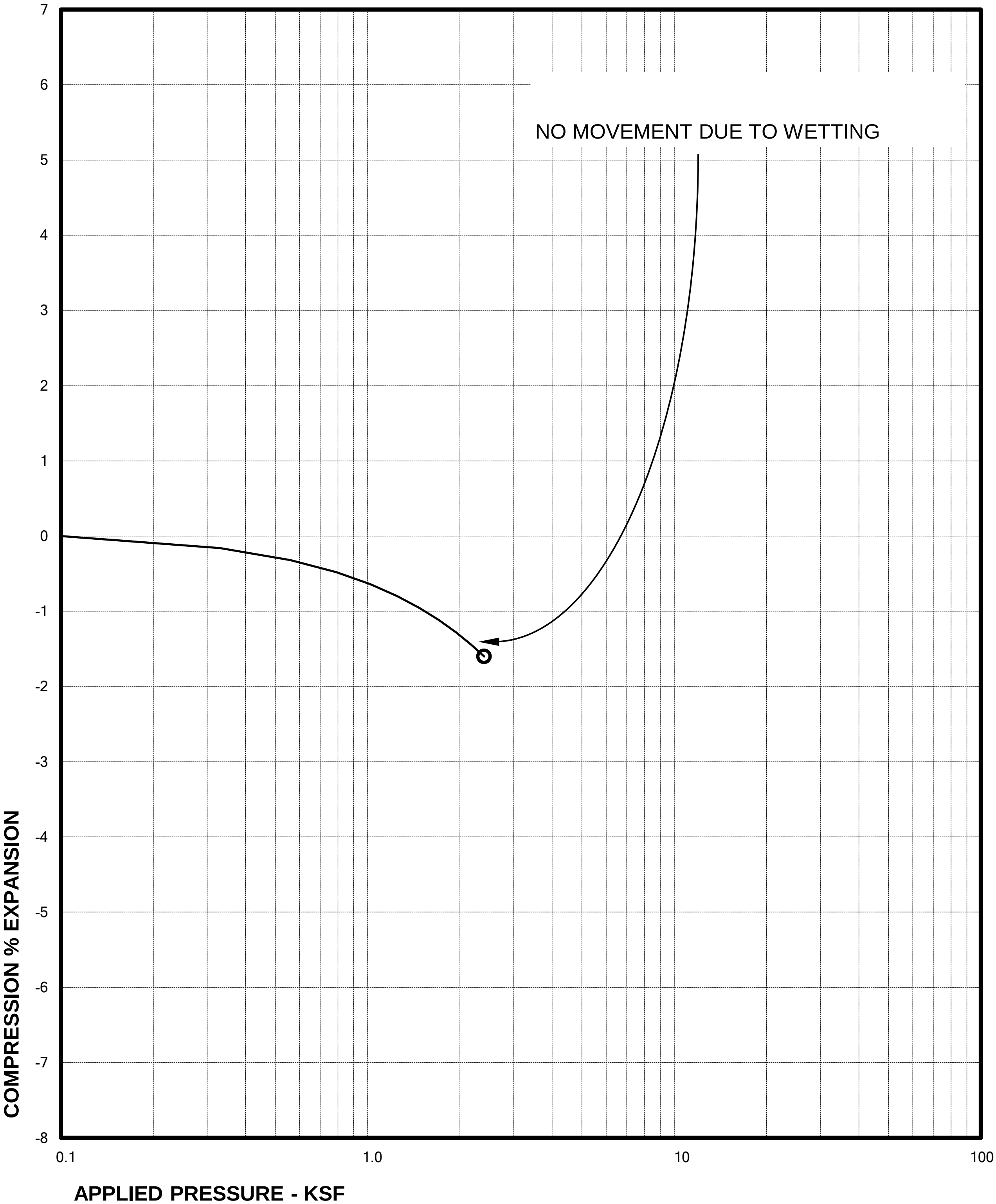


Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	110	PCF
From	TH - 115 AT 19 FEET	MOISTURE CONTENT=	16.6	%



Sample of	CLAY, SANDY (CL)	DRY UNIT WEIGHT=	115	PCF
From	TH - 116 AT 9 FEET	MOISTURE CONTENT=	9.5	%

Swell Consolidation



Sample of SANDSTONE, CLAYEY

From TH - 116 AT 19 FEET

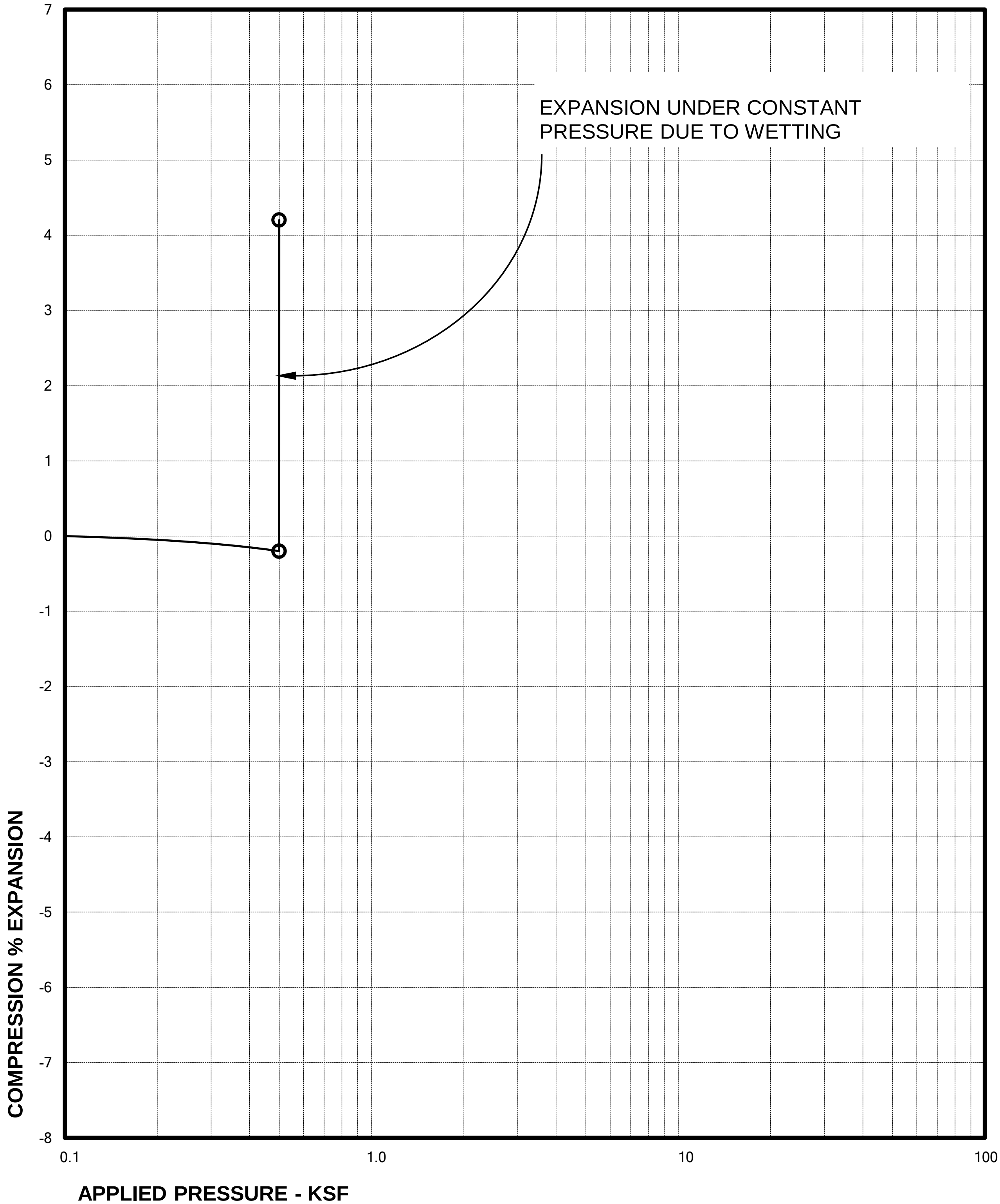
DRY UNIT WEIGHT= 116 PCF

MOISTURE CONTENT= 10.4 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation Test Results

FIGURE B-25



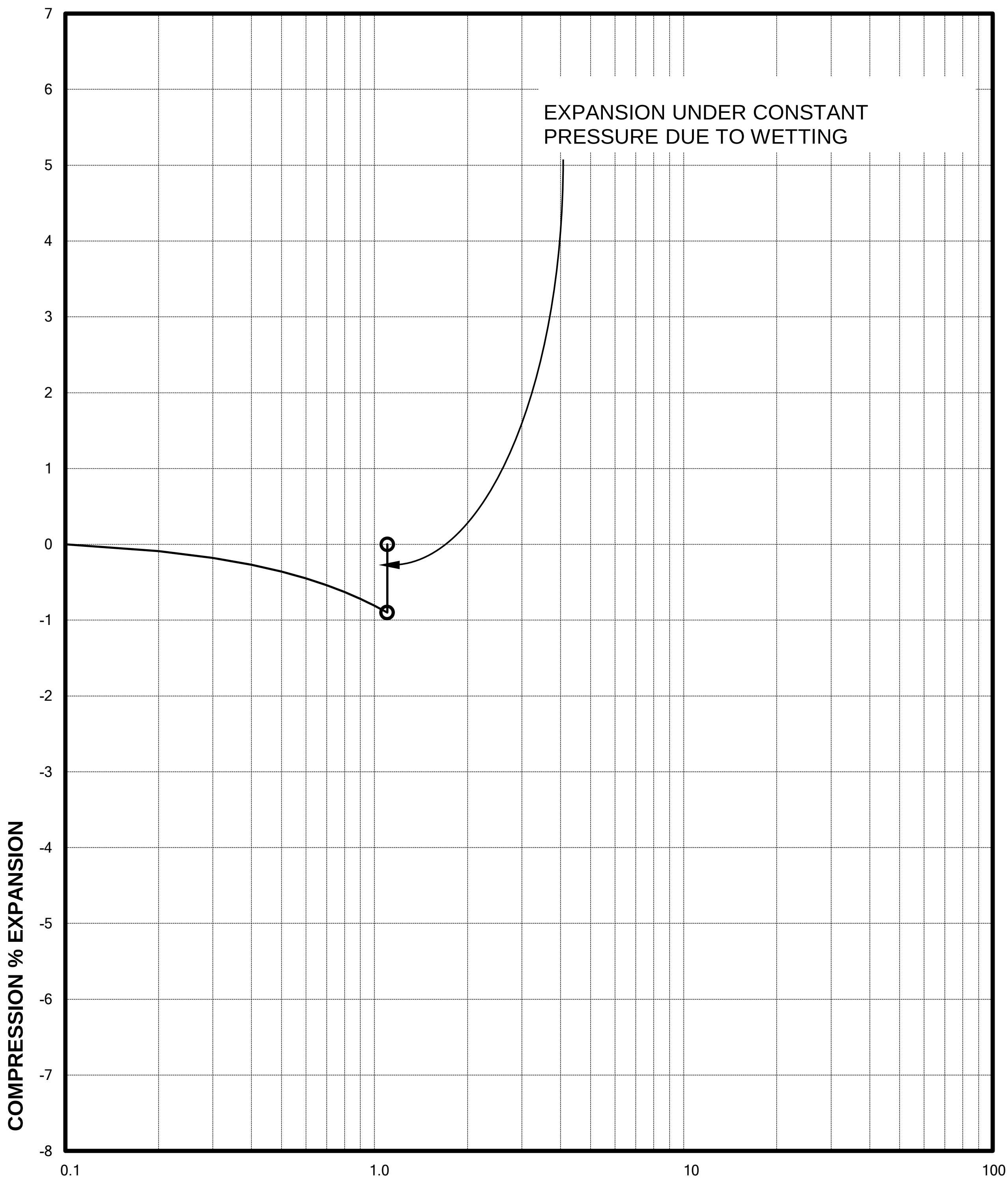
Sample of CLAY, SANDY (CL)
From TH - 117 AT 4 FEET

DRY UNIT WEIGHT= 106 PCF
MOISTURE CONTENT= 9.6 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation Test Results

FIGURE B-26



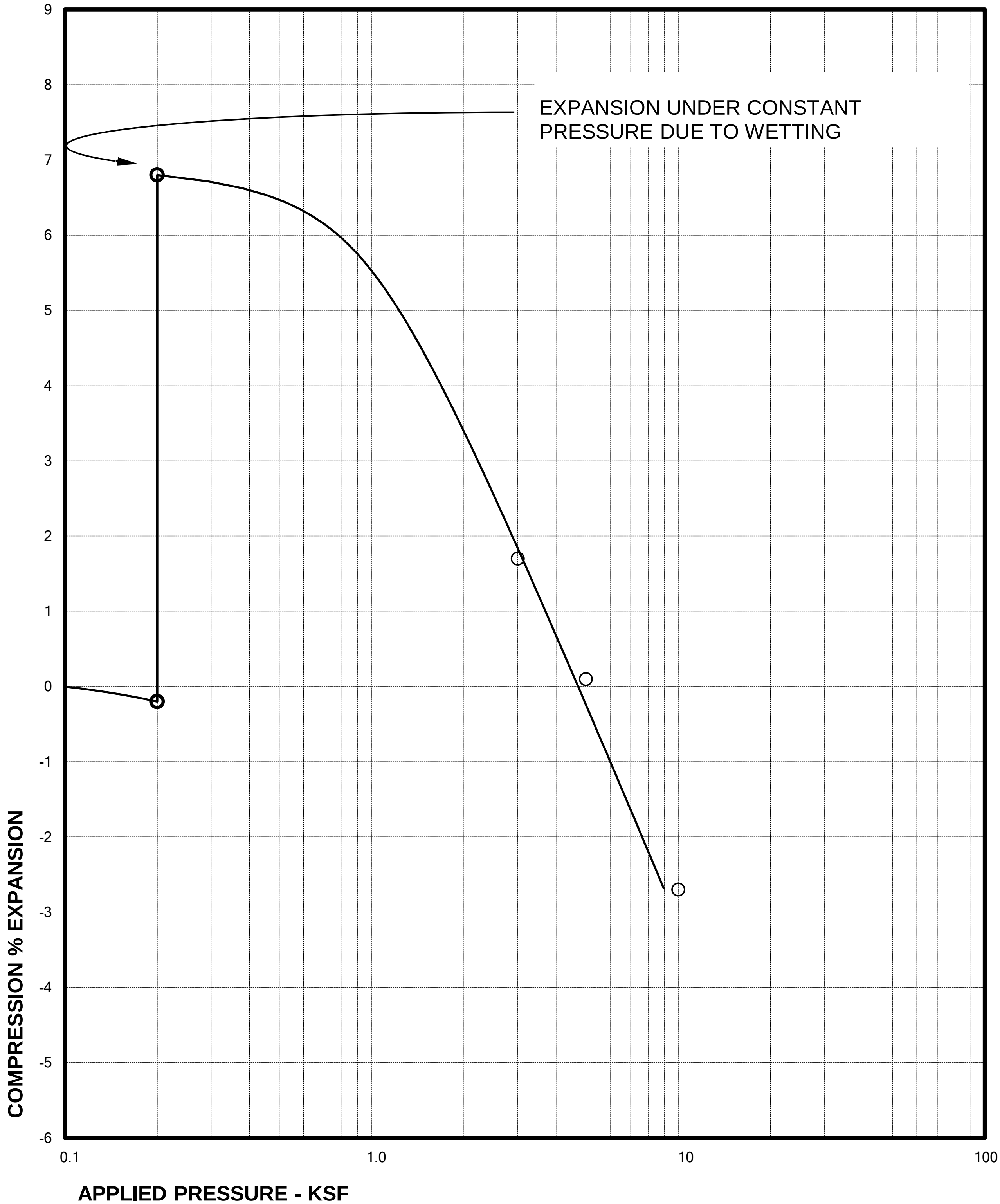
Sample of CLAY, SANDY (CL)
From TH - 117 AT 9 FEET

DRY UNIT WEIGHT= 101 PCF
MOISTURE CONTENT= 10.4 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation Test Results

FIGURE B-27



Sample of FILL, CLAY, SANDY (CL)

From TH - 118 AT 2 FEET

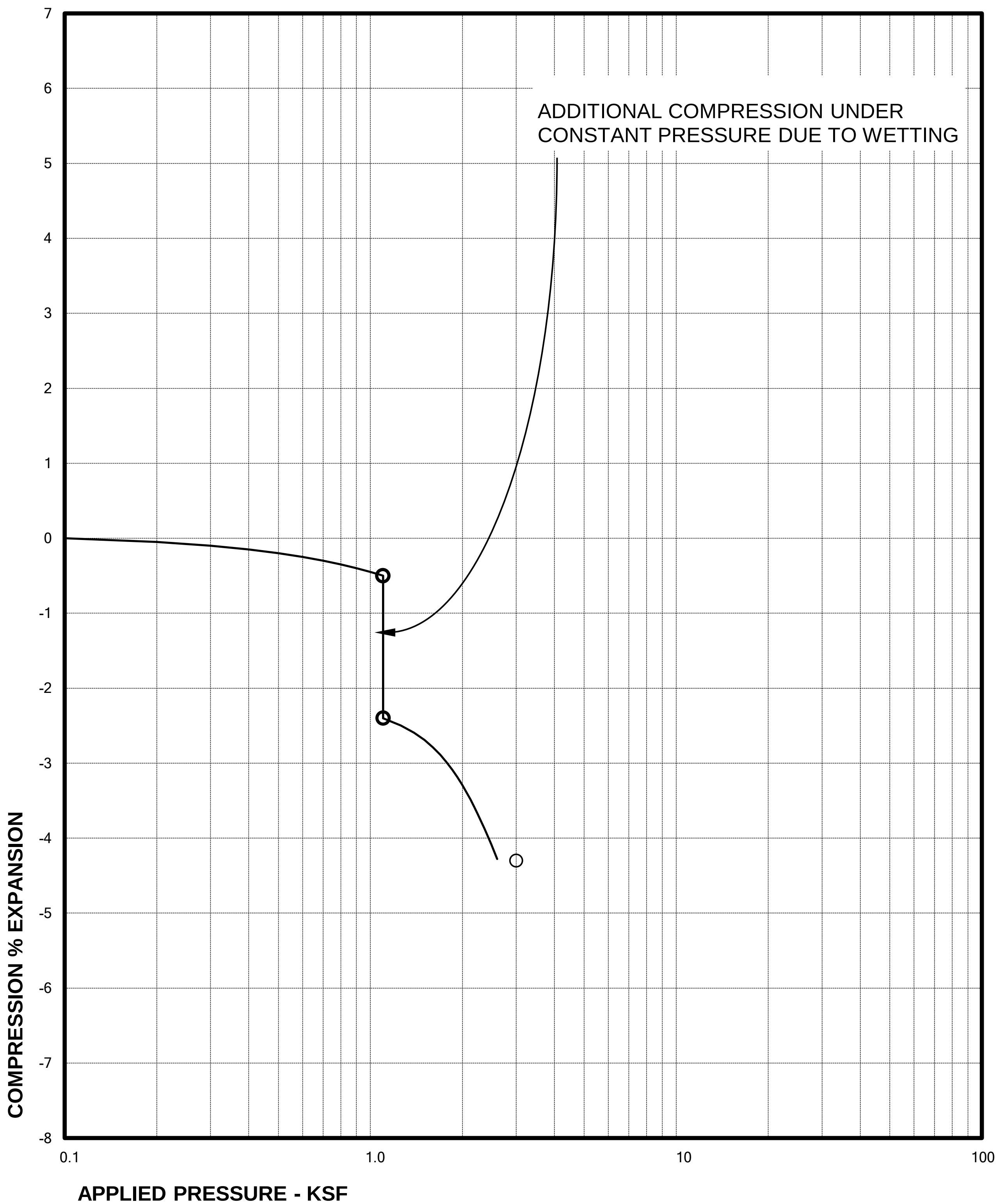
DRY UNIT WEIGHT= 116 PCF

MOISTURE CONTENT= 7.0 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation Test Results

FIGURE B-28



Sample of CLAY, SANDY (CL)

From TH - 118 AT 9 FEET

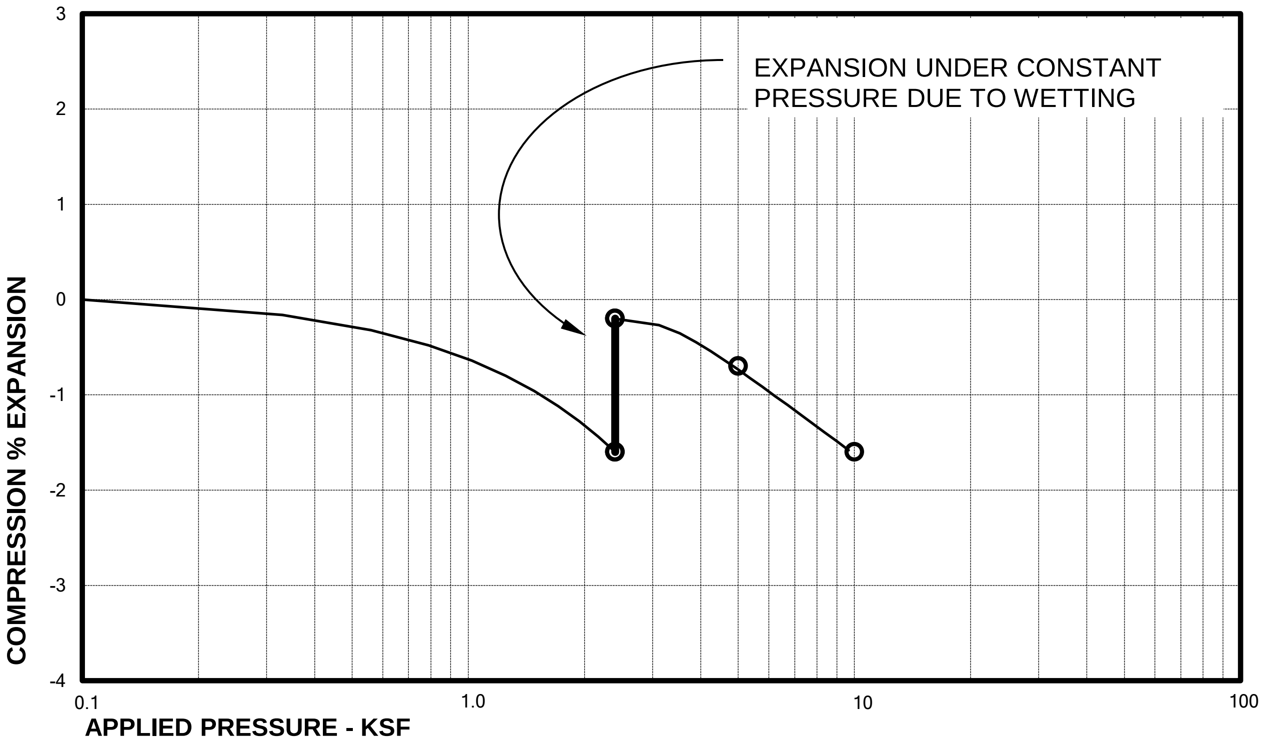
DRY UNIT WEIGHT= 110 PCF

MOISTURE CONTENT= 7.0 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

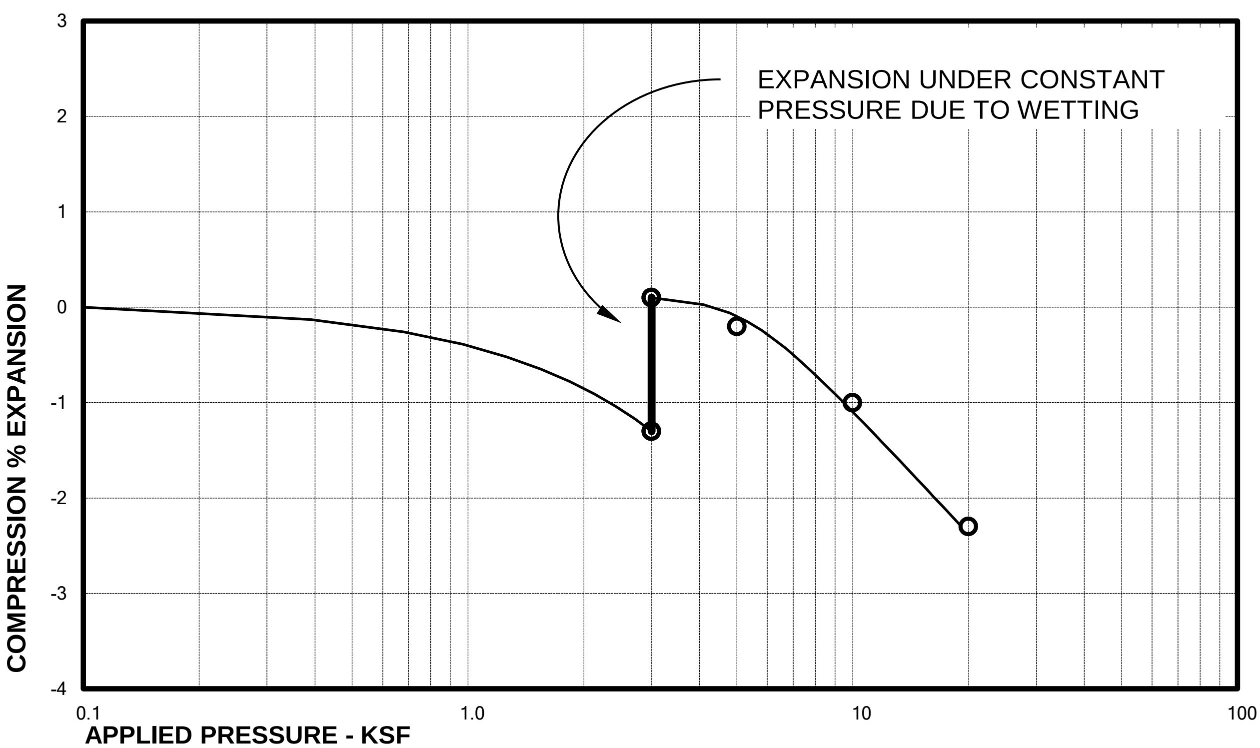
Swell Consolidation Test Results

FIGURE B-29



Sample of CLAYSTONE, SANDY
From TH - 118 AT 19 FEET

DRY UNIT WEIGHT= 112 PCF
MOISTURE CONTENT= 18.9 %



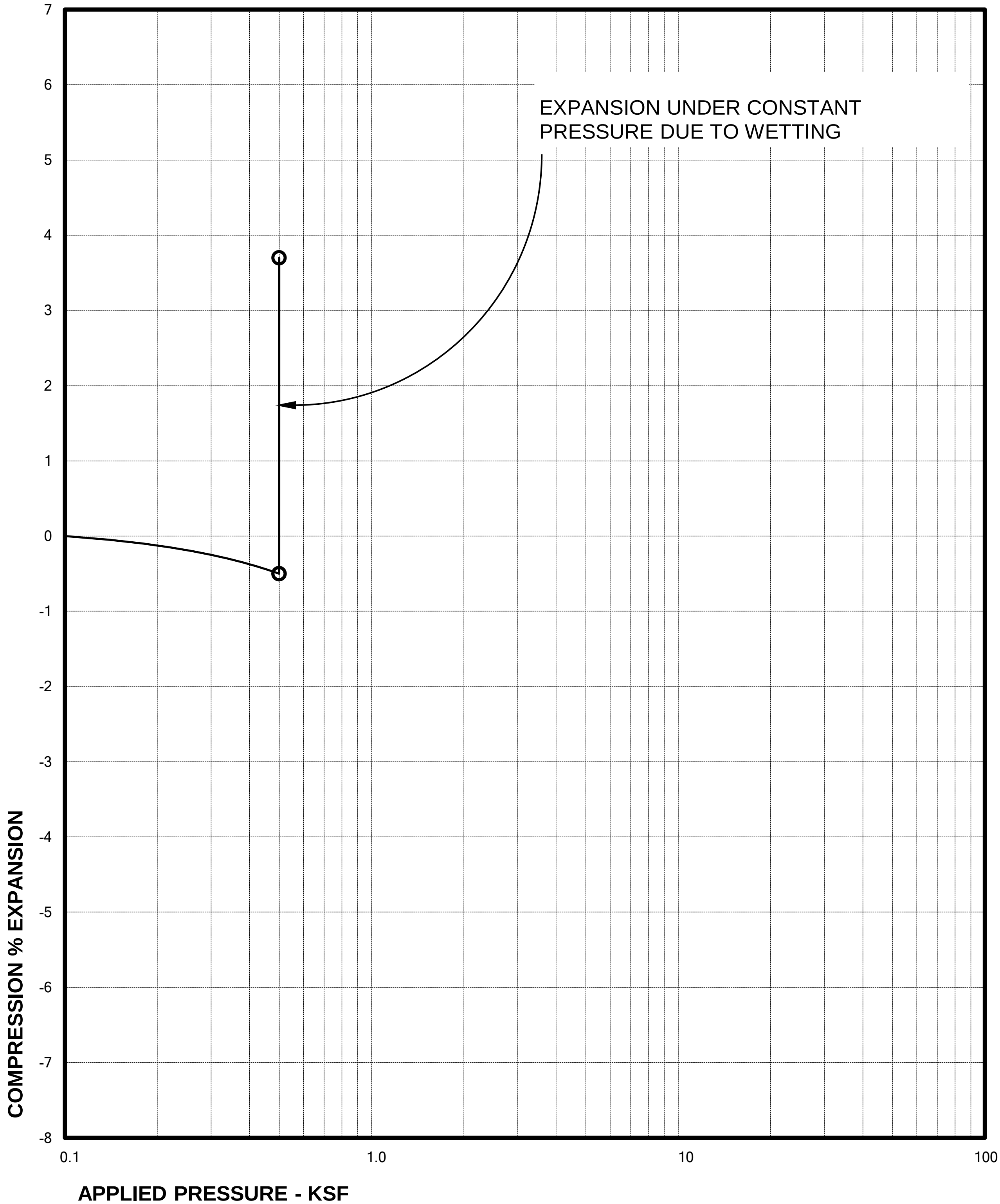
Sample of CLAYSTONE, SANDY
From TH - 118 AT 24 FEET

DRY UNIT WEIGHT= 111 PCF
MOISTURE CONTENT= 19.5 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation

FIGURE B-30



Sample of CLAY, SANDY (CL)

From TH - 119 AT 4 FEET

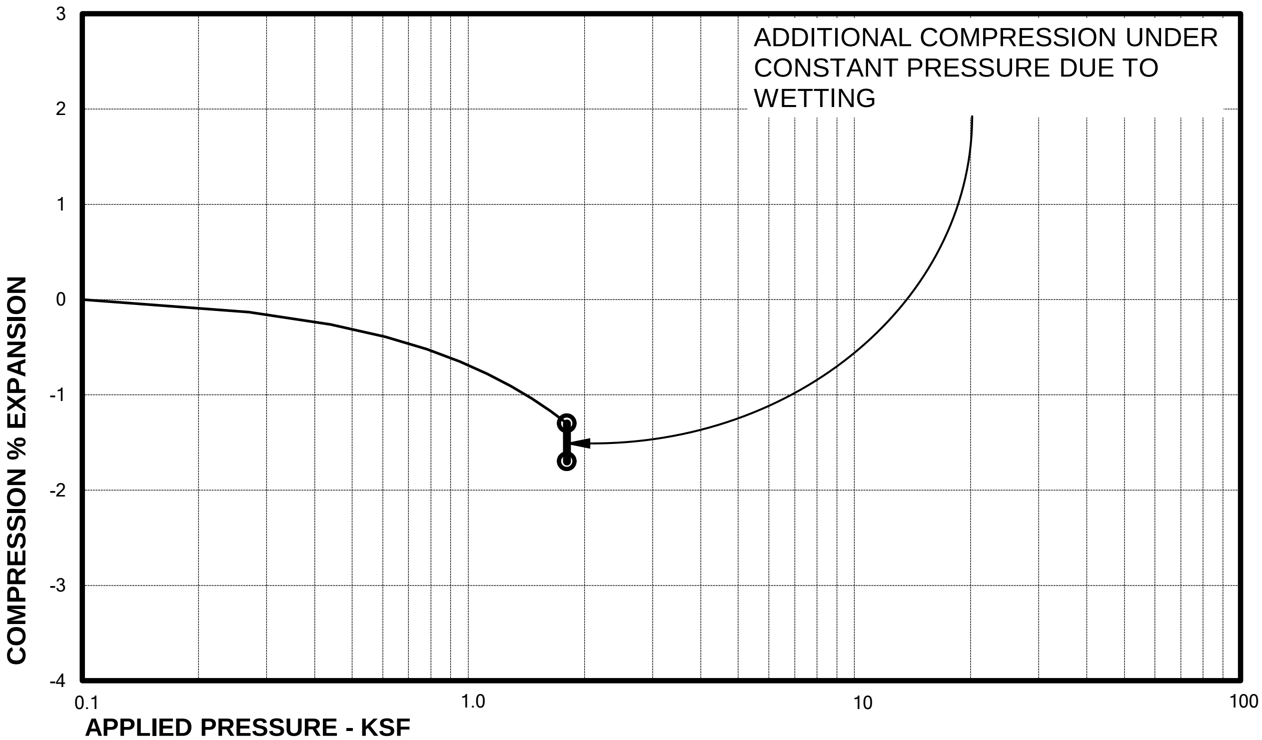
DRY UNIT WEIGHT= 109 PCF

MOISTURE CONTENT= 11.1 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

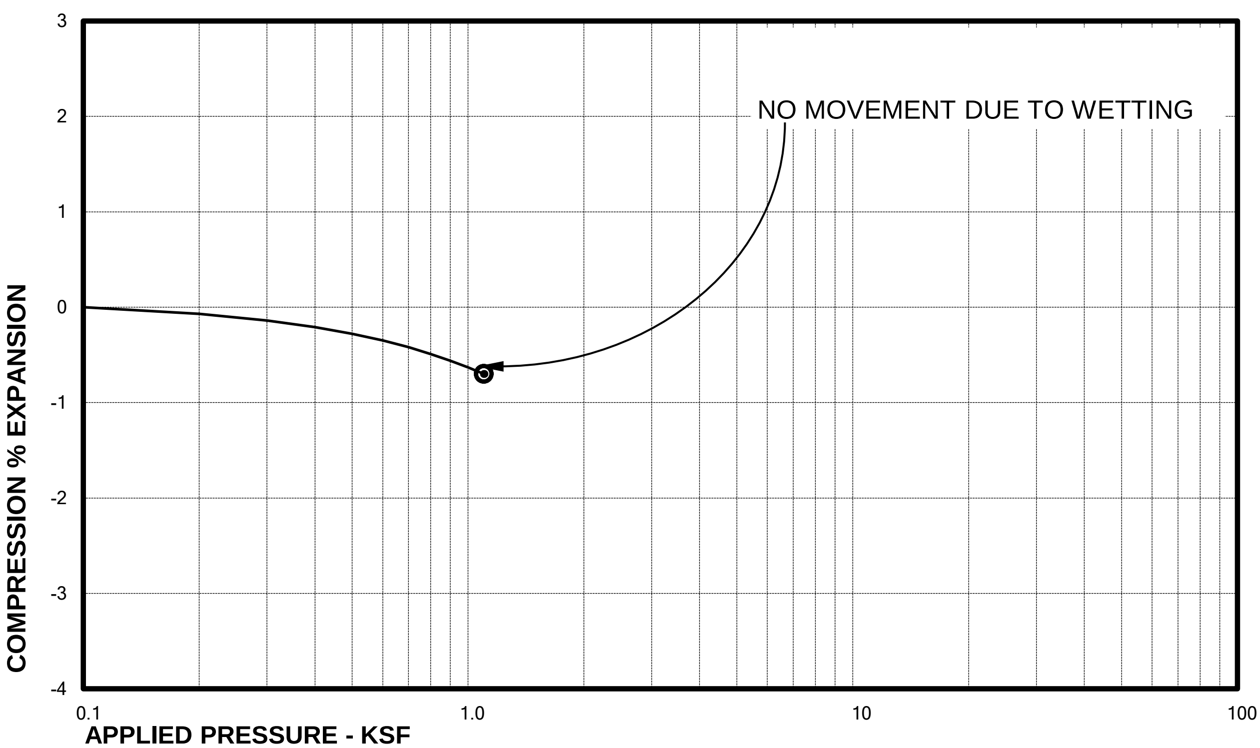
Swell Consolidation Test Results

FIGURE B-31



Sample of CLAY, SANDY (CL)
From TH - 119 AT 14 FEET

DRY UNIT WEIGHT= 115 PCF
MOISTURE CONTENT= 7.7 %



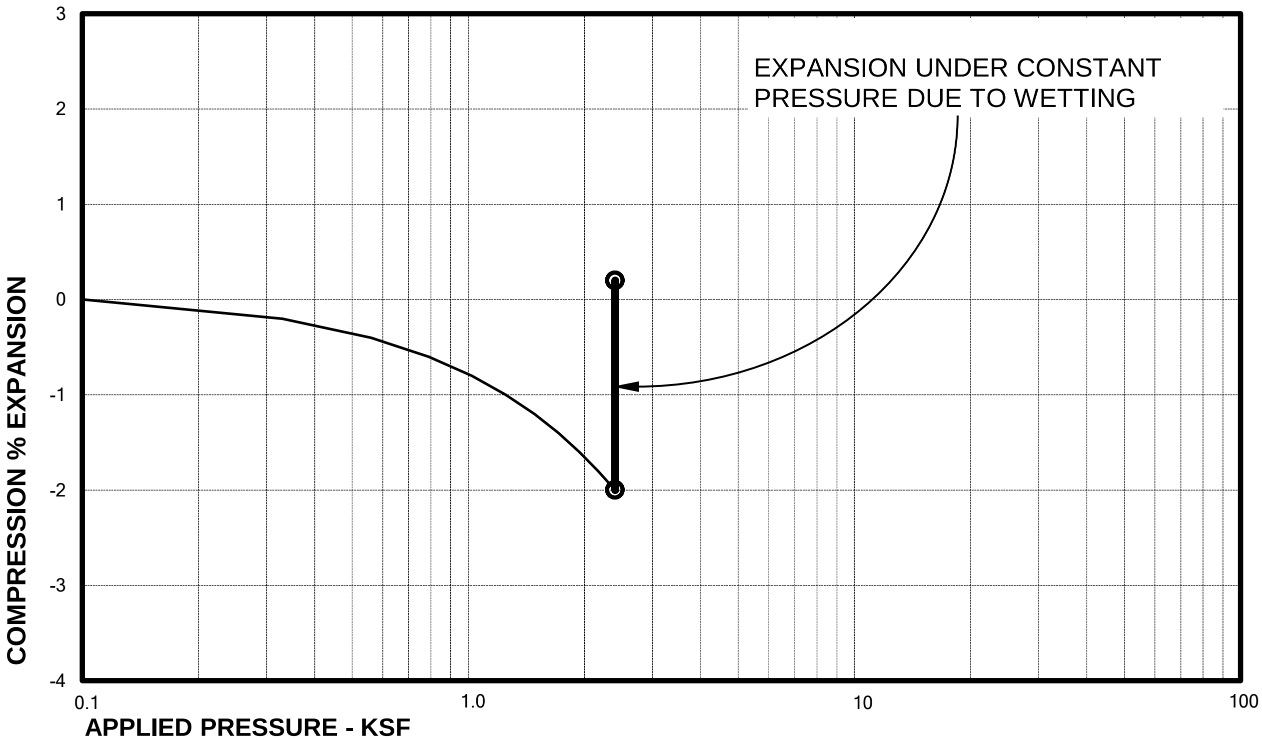
Sample of CLAY, SANDY (CL)
From TH - 120 AT 9 FEET

DRY UNIT WEIGHT= 109 PCF
MOISTURE CONTENT= 5.8 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

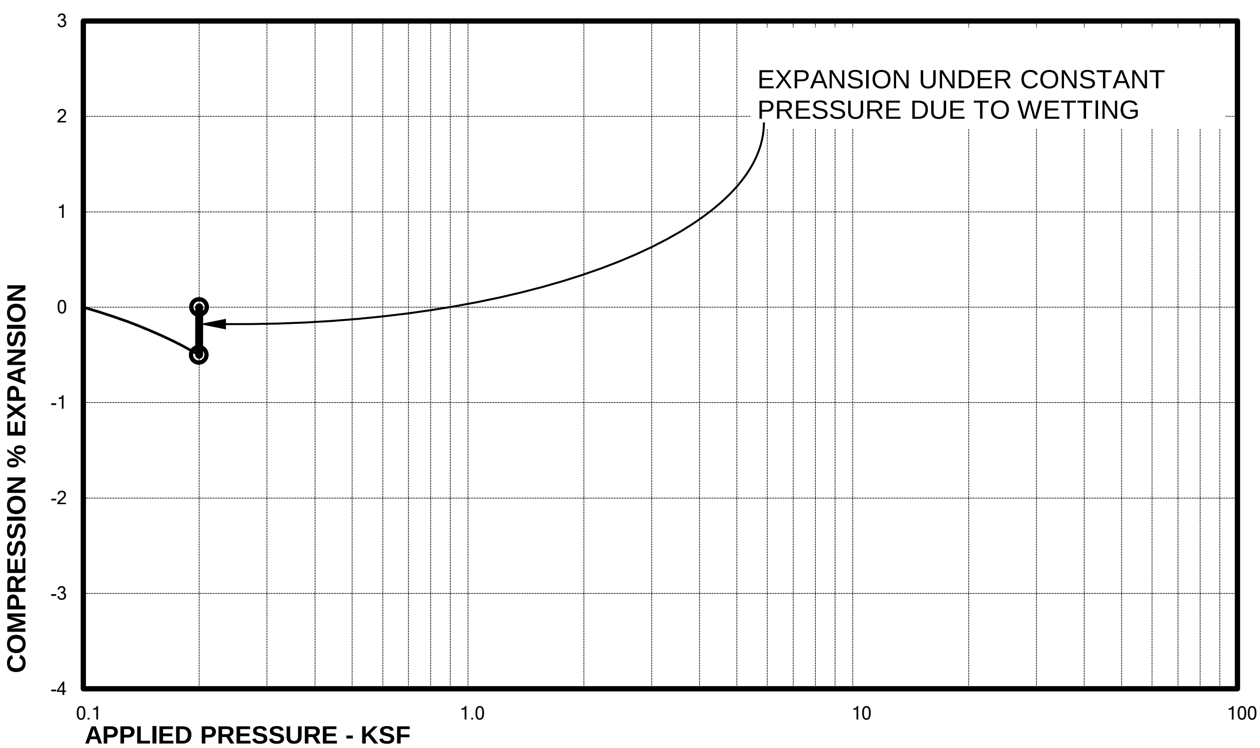
Swell Consolidation

FIGURE B-32



Sample of CLAYSTONE, SANDY
From TH - 120 AT 19 FEET

DRY UNIT WEIGHT= 111 PCF
MOISTURE CONTENT= 18.7 %



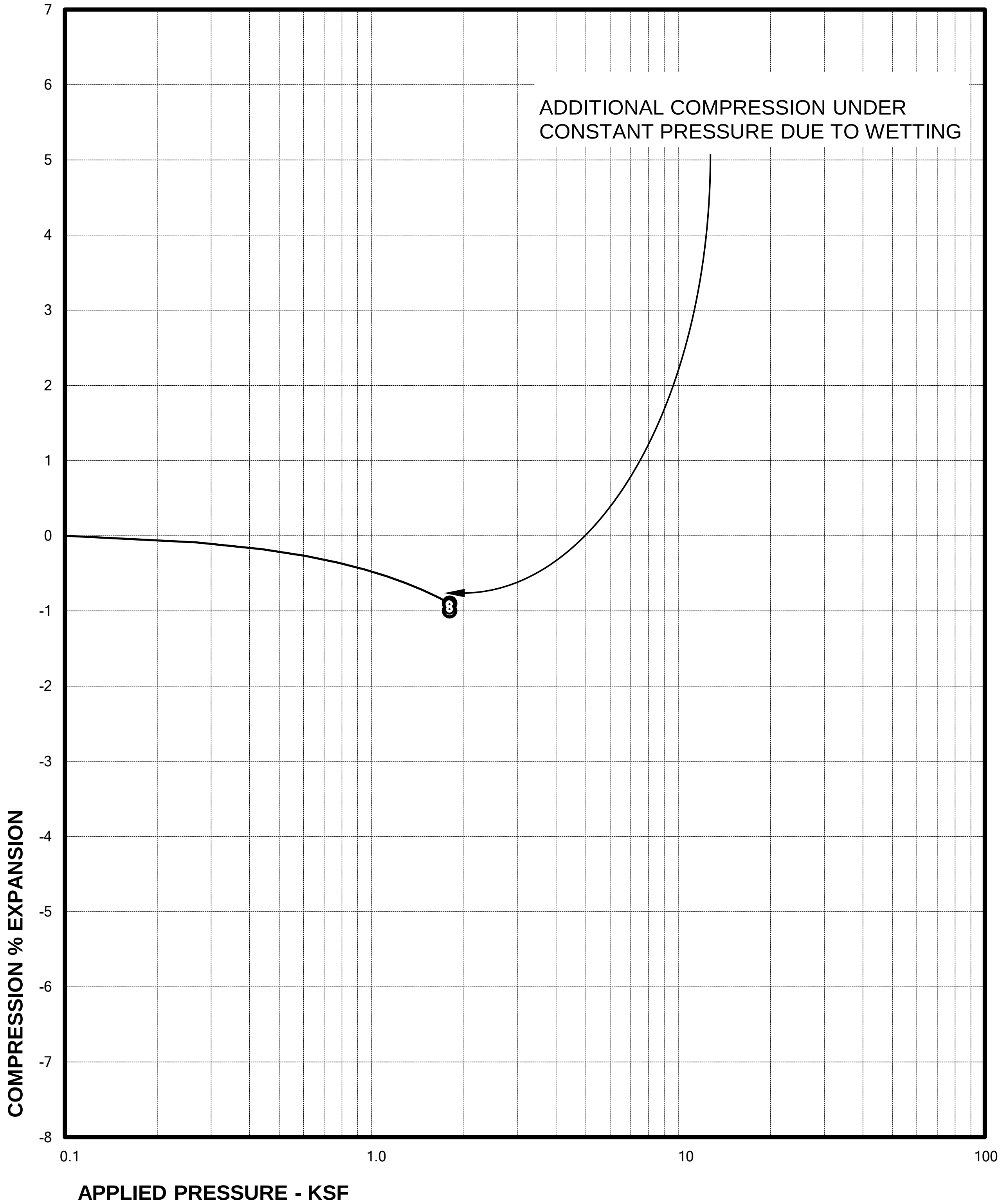
Sample of FILL, CLAY, SANDY (CL)
From TH - 121 AT 2 FEET

DRY UNIT WEIGHT= 109 PCF
MOISTURE CONTENT= 16.5 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation

FIGURE B-33



Sample of SANDSTONE, CLAYEY

From TH - 121 AT 14 FEET

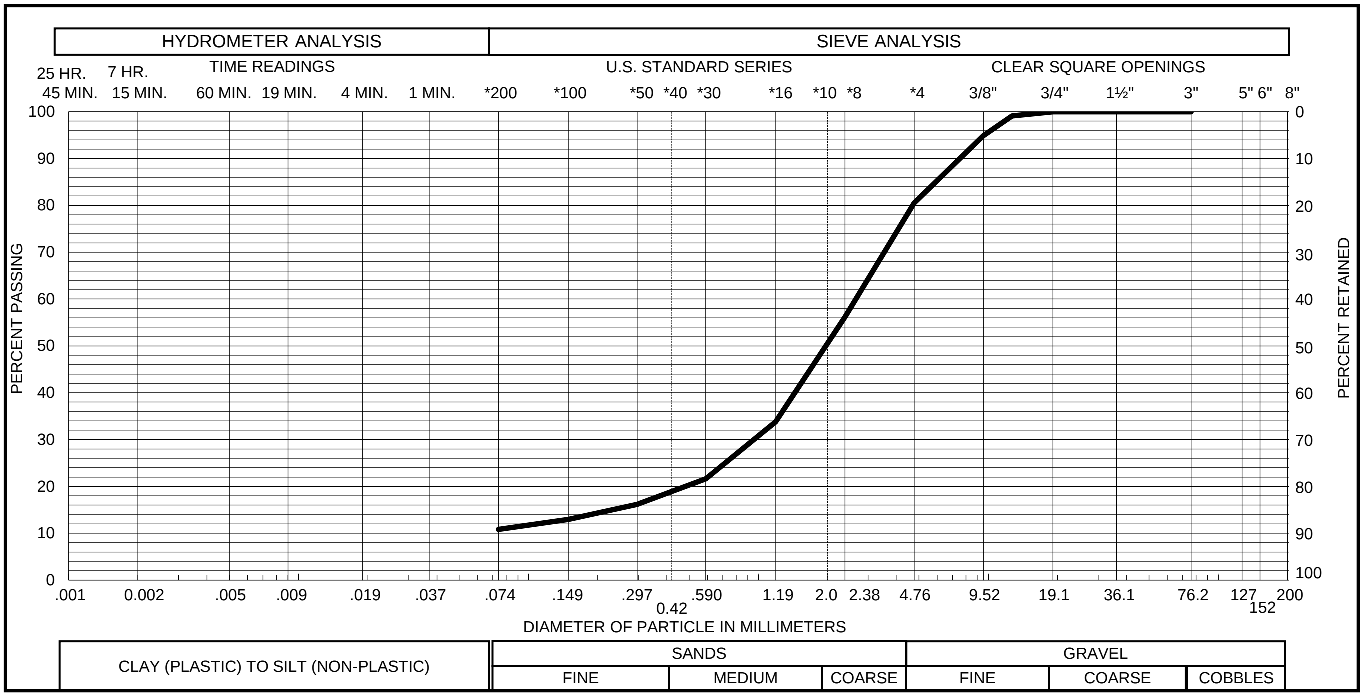
DRY UNIT WEIGHT= 104 PCF

MOISTURE CONTENT= 14.7 %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Swell Consolidation Test Results

FIGURE B-34



Sample of SAND, SLIGHTLY CLAYEY, GRAVELLY (SP-SC)
From TH - 118 AT 14 FEET

GRAVEL 19 % SAND 70 %
SILT & CLAY 11 % LIQUID LIMIT %
PLASTICITY INDEX %

ACTUAL COMMUNITIES, INC.
WATERS EDGE, SECOND FILING, PHASES 1A AND 4
CTL | T PROJECT NO. FC08010.001-115

Gradation Test Results

FIGURE B-35

TABLE B-I

SUMMARY OF LABORATORY TESTING

BORING	DEPTH (FEET)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	ATTERBERG LIMITS LIQUID LIMIT	ATTERBERG LIMITS PLASTICITY INDEX	SWELL TEST RESULTS* SWELL* (%)	SWELL TEST RESULTS* APPLIED PRESSURE (PSF)	SWELL TEST RESULTS* SWELL PRESSURE (PSF)	SUCTION (PF)	PASSING NO. 200 SIEVE (%)	WATER-SOLUBLE SULFATES (%)	DESCRIPTION
TH-101	4	7.3	102			0.0	500					CLAY, SANDY (CL)
TH-101	9	10.2	125			0.7	1,100	5,600				INTERBEDDED SANDSTONE AND CLAYSTONE
TH-101	14	8.5	109			-0.7	1,800					INTERBEDDED SANDSTONE AND CLAYSTONE
TH-101	19	10.4	101			-0.4	2,400					INTERBEDDED SANDSTONE AND CLAYSTONE
TH-101	24	11.4	123			-0.1	3,000					INTERBEDDED SANDSTONE AND CLAYSTONE
TH-102	9	7.9	114			0.0	1,100				0.01	INTERBEDDED SANDSTONE AND CLAYSTONE
TH-102	19	10.4	109			-0.7	2,400					INTERBEDDED SANDSTONE AND CLAYSTONE
TH-103	4	6.2	105			0.7	500					CLAY, SANDY (CL)
TH-103	14	10.3	121			-0.2	1,800					SANDSTONE, CLAYEY
TH-103	19	19.5	103	26	5							SANDSTONE, CLAYEY
TH-104	2	12.5	115	38	19							FILL, CLAY, SANDY (CL)
TH-104	9	9.0	120			0.5	1,100					SANDSTONE, CLAYEY
TH-104	19	19.1	103			-0.1	2,400					SANDSTONE, CLAYEY
TH-105	2	6.0	117			2.4	200				<0.01	FILL, CLAY, SANDY (CL)
TH-105	14	11.7	125			0.4	1,800					SANDSTONE, CLAYEY
TH-106	4	10.4	122			3.6	500	9,300				CLAY, SANDY (CL)
TH-106	9	8.4	134			6.1	1,100	27,000				CLAY, SANDY (CL)
TH-106	14	10.5	124			0.4	1,800	4,300				SANDSTONE, CLAYEY
TH-106	19	12.2	117			0.0	2,400					SANDSTONE, CLAYEY
TH-106	24	12.9	116			-0.1	3,000					SANDSTONE, CLAYEY
TH-107	4	9.5	122			4.8	500					CLAY, SANDY (CL)
TH-107	14	9.3	113			-0.4	1,800					SANDSTONE, CLAYEY
TH-108	9	9.8	125			3.5	1,100					INTERBEDDED SANDSTONE AND CLAYSTONE
TH-108	19	12.8	116			0.1	2,400					INTERBEDDED SANDSTONE AND CLAYSTONE
TH-109	4	12.8	122			1.9	500				0.03	INTERBEDDED SANDSTONE AND CLAYSTONE
TH-109	14	12.7	106			-0.4	1,800					INTERBEDDED SANDSTONE AND CLAYSTONE
TH-110	2	13.5	122			2.0	200					INTERBEDDED SANDSTONE AND CLAYSTONE
TH-110	9	12.1	125			1.8	1,100	11,000				INTERBEDDED SANDSTONE AND CLAYSTONE
TH-110	14	14.0	125			0.8	1,800	8,300				INTERBEDDED SANDSTONE AND CLAYSTONE
TH-110	19	13.3	101			-0.3	2,400					INTERBEDDED SANDSTONE AND CLAYSTONE
TH-110	24	14.2	99			-0.4	3,000					INTERBEDDED SANDSTONE AND CLAYSTONE
TH-111	9	9.8	124			0.4	1,100					INTERBEDDED SANDSTONE AND CLAYSTONE
TH-111	19	12.9	108			-0.4	2,400					INTERBEDDED SANDSTONE AND CLAYSTONE
TH-112	2	6.6	100			3.7	200				<0.01	CLAY, SANDY (CL)
TH-112	9	6.3	113	32	6							SANDSTONE, CLAYEY
TH-112	14	11.0	102			-0.4	1,800					SANDSTONE, CLAYEY
TH-113	9	8.9	98			0.0	1,100					CLAY, SANDY (CL)
TH-113	19	13.1	101			-1.4	2,400					SANDSTONE, CLAYEY
TH-114	2	8.1	107			2.4	200					CLAY, SANDY (CL)

* NEGATIVE VALUE INDICATES COMPRESSION.

TABLE B-I

SUMMARY OF LABORATORY TESTING

				ATTERBERG LIMITS		SWELL TEST RESULTS*						
BORING	DEPTH (FEET)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASTICITY INDEX	SWELL* (%)	APPLIED PRESSURE (PSF)	SWELL PRESSURE (PSF)	SUCTION (PF)	PASSING NO. 200 SIEVE (%)	WATER-SOLUBLE SULFATES (%)	DESCRIPTION
TH-114	14	12.0	115			-0.1	1,800					SANDSTONE, CLAYEY
TH-115	9	9.7	110			0.0	1,100					CLAY, SANDY (CL)
TH-115	19	16.6	110			-0.1	2,400					CLAY, SANDY (CL)
TH-116	9	9.5	115			1.9	1,100				<0.01	CLAY, SANDY (CL)
TH-116	19	10.4	116			0.0	2,400					SANDSTONE, CLAYEY
TH-117	4	9.6	106			4.4	500					CLAY, SANDY (CL)
TH-117	9	10.4	101			0.9	1,100					CLAY, SANDY (CL)
TH-118	2	7.0	116			7.0	200	5,100				FILL, CLAY, SANDY (CL)
TH-118	9	7.0	110			-1.9	1,100					CLAY, SANDY (CL)
TH-118	14	2.0								11		SAND, SLIGHTLY CLAYEY, GRAVELLY (SP-SC)
TH-118	19	18.9	112			1.4	2,400					CLAYSTONE, SANDY
TH-118	24	19.5	111			1.4	3,000	11,000				CLAYSTONE, SANDY
TH-119	4	11.1	109			4.2	500					CLAY, SANDY (CL)
TH-119	14	7.7	115			-0.4	1,800					CLAY, SANDY (CL)
TH-120	9	5.8	109			0.0	1,100				<0.01	CLAY, SANDY (CL)
TH-120	19	18.7	111			2.2	2,400					CLAYSTONE, SANDY
TH-121	2	17.3	109			0.5	200			56		FILL, CLAY, SANDY (CL)
TH-121	14	14.7	104			-0.1	1,800					SANDSTONE, CLAYEY

* NEGATIVE VALUE INDICATES COMPRESSION.

TABLE B-II: HEAVE ESTIMATES

Boring	Basement Slab Performance Risk	Total Heave Estimate (Inches)	
		Basement	Ground Surface
TH-101	Low	1.1	0.8
TH-102	Low	0.7	0.7
TH-103	Low	0.9	0.7
TH-104	Low	1.0	<0.5
TH-105	Low	1.4	0.8
TH-106	Moderate	4.2	0.6
TH-107	Moderate	5.2	2.4
TH-108	Moderate	3.5	2.2
TH-109	Low	1.7	0.6
TH-110	Low	2.0	0.9
TH-111	Low	1.2	<0.5
TH-112	Low	0.6	<0.5
TH-113	Low	0.8	<0.5
TH-114	Low	<0.5	<0.5
TH-115	Low	1.0	<0.5
TH-116	Low	2.2	1.1
TH-117	Low	1.7	<0.5
TH-118	Low	4.4	1.5
TH-119	Low	2.9	<0.5
TH-120	Low	3.5	1.1
TH-121	Low	0.6	<0.5

APPENDIX C

GUIDELINE SITE GRADING SPECIFICATIONS

GUIDELINE SITE GRADING SPECIFICATIONS

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 (0 to 3 percent above optimum moisture content for clays and within 2 percent of optimum moisture content for sands) 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 lumps having a diameter greater than six (6) 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 AND DENSITY

Fill material shall be moisture conditioned and compacted to the criteria in the table, below. Maximum density and optimum moisture content shall be determined from the appropriate Proctor compaction tests. Sufficient laboratory compaction tests shall be made to determine the optimum moisture content for the various soils encountered in borrow areas.

FILL COMPACTION AND MOISTURE REQUIREMENTS

Soil Type	Depth from Final Grade (feet)	Moisture Requirement (% from optimum)	Density Requirement
Clay	0 to 20 feet	0 to +3	95% of ASTM D 698
Sand		-2 to +2	95% of ASTM D 698
Clay	Greater than 20 feet	-2 to +1	98% of ASTM D 698
Sand		-2 to +1	95% of ASTM D 1557

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 shall be compacted to the criteria above. At the option of the Soils Engineer, soils classifying as SW, GP, GC, or GM may be compacted to 95 percent of maximum density as determined in accordance with ASTM D 1557 or 70 percent relative density for cohesionless sand soils. Fill materials shall be placed such that the thickness of loose materials does not exceed 12 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 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.

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 OVER-EXCAVATION SPECIFICATIONS
Water’s Edge Subdivision
Fort Collins, Colorado

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

GUIDELINE OVER-EXCAVATION SPECIFICATIONS

Water's Edge Subdivision
Fort Collins, 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 grade 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 Representative shall be the Owner's Representative. The Soils Representative 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 substantially remove all debris, vegetation, organics and other deleterious materials before excavation or fill placement. 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

   Debris, vegetation, organics and other deleterious materials shall be substantially 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 clays and within 2 percent of optimum moisture content for sands) and compacted to at least 95 percent of maximum dry density as determined in accordance with ASTM D 698.

6. FILL MATERIALS

Fill soils shall be substantially free from debris, vegetation, organics and other deleterious materials, and shall not contain rocks or lumps having a diameter greater than six (6) inches. Claystone bedrock should be broken down to about three inches or smaller in size. 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, and other deleterious materials or debris shall not be used as fill.

7. MOISTURE CONTENT

Fill materials shall be moisture-conditioned 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 that 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 suitable equipment. 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 standard Proctor maximum dry density (ASTM D 698, AASHTO T 99) 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 standard Proctor maximum dry density (ASTM D 698).

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

3. Material represented by samples tested having dry density less than 94 percent of standard Proctor maximum dry density (ASTM D 698) will be rejected. Such rejected materials shall be reworked until a dry density equal to or greater than 95 percent of standard Proctor maximum dry density (ASTM D 698) is obtained.

11. OBSERVATION AND TESTING OF FILL

Observation 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 observations 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.