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GEOLOGIC AND PRELIMINARY GEOTECHNICAL INVESTIGATION MENARDS AT DEL RANGE BOULVARD AND WINDMILL ROAD CHEYENNE, WYOMING

MENARDS, INC.
5101 Menard Drive
Eau Claire, Wisconsin 54703

Attention: Mr. Thomas Broker

Project No. WY00645-125

July 11, 2011

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SCOPE

This report presents the results of our geologic and preliminary geotechnical investigation for the proposed Menards located southeast of Del Range Boulevard and Windmill Road in Cheyenne, Wyoming. The purpose of our investigation was to identify geologic hazards that may exist on the site and to evaluate the subsurface conditions to assist in planning for development. The report includes descriptions of site geology, a description of soil, bedrock and groundwater conditions found in our exploratory borings, and discussions of site development as influenced by geologic and geotechnical considerations.

During our investigation, site grading was not completed and proposed elevations were unknown. Due to the large amount of site grading anticipated at this site, this report was prepared as a preliminary investigation. This report can be used to assist in design level recommendations when site grading has been completed.

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. We should review 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. 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. The primary geologic concerns pertaining to development of the site include: expansive soils and uncontrolled fill. We believe proper engineering design and construction practices can substantially mitigate the effects of geologic and geotechnical concerns identified above.

2. Subsurface conditions encountered at this site were variable. In general, soils encountered consisted of silty to clayey sand and sandy to silty clay

to depths explored. Sandy clay and clayey sand fill was encountered in the upper 2 to 15 feet in sixteen of our borings. No ground water was encountered during our investigation.

3. Based on the expansive soils encountered at the site, we anticipate a design level geotechnical investigation will recommend all structures be founded on footings constructed on a type of ground modification; likely an over-excavation consisting of removal and replacement of the bearing soils to provide adequate support. A deep foundation is another alternative.

4. The main building will likely be constructed with a slab-on-grade floor. Ground modification below the building will likely be necessary to eliminate potential movements of the slab due to the expansive soils at this site. Other building floors will also likely require ground modification or can be constructed as a structural floor.

5. Based on the expansive soils encountered at the site, we anticipate a design level geotechnical investigation will recommend all access drives and parking areas be constructed as hot mix asphaltic pavement sections on the order of 4 to 6 inches over at least 6 inches of aggregate base course underlain by a moisture conditioned subgrade or chemically stabilized subgrade. The stabilized subgrade thickness could be up to 2 feet thick. Thicker pavement sections may be necessary depending on traffic pattern and traffic loads. Rigid pavement should be considered for higher volume traffic areas including dumpster and loading dock areas.

6. Good surface drainage design and control of irrigation will be important to enhance performance of ground-supported improvements and reduce potential erosion.

SITE CONDITIONS

The proposed construction site is located southeast of the intersection of Dell Range Boulevard and Windmill Road in Cheyenne, Wyoming. During our investigation, the site was vacant with ground cover consisting primarily of natural grasses and weeds. Asphaltic and gravel roadways and an asphaltic parking lot were located on the lot. The site has a general slope to the north with a hill located on the southern portion of the site.

PROPOSED DEVELOPMENT

Based on site plans provided, we understand the proposed construction will consist of a Menards building, warehouse, parking and other possible out buildings. The Menards will be approximately ±757,000 square feet and the warehouse will be approximately ±43,000 square feet. The parking lot is planned on the northern portion of the site and the Menards building and warehouse are planned on the southern portion of the site.

SITE GEOLOGY

The local geology was investigated by reviewing Geology and Ground-Water Resources for Laramie County Wyoming (Lowry and Crist and Schneider, 1967), available satellite and/or aerial imagery, and from our experience of the area. The Site is located in the High Plains section of the Great Plains Physiographic Province. The High Plains is a high, eastward sloping surface underlain by Tertiary sediments. The surface of the High Plains has gently rolling topography with ephemeral and intermittent streams.

Structurally, the site is located in the Cheyenne Basin, an area filled with a thick accumulation of sediments that filled the basin during down warping that occurred as the Laramie Range to the west was uplifted. Specifically, the Site is located approximately 21 miles east of the eastern flank of the Laramie Range. The site is mapped as the Miocene and Pliocene Ogallala Formation. The Ogallala Formation consists of heterogeneous deposits of silt, sand, and gravel that are unconsolidated to well-cemented. The general trend of the bedrock in this area dips to the east. The thickness of the Ogallala in this area is estimated to be up to 400 feet. Borings that we recently drilled at the site indicate sands and clays to depths of at least 30 feet.

GEOLOGIC HAZARDS

Our investigation identified no geologic hazards that would preclude the proposed development or significantly affect the planning and development of this site.

Erosion

We believe the erosion potential is low for the majority of this site. Areas in drainages and on steep slopes have an increased potential for erosion. The erosion potential can be expected to increase during construction, but should return to preconstruction rates or less if proper grading practices, surface drainage design, storm water management, and re-vegetation efforts are implemented.

Steep Slopes

Slopes on the property are typically less than 5 percent with the exception of the edge of the terraced hill side. Based on topography provided, slopes approach approximately 15 percent. We recommend restricting development to areas with slopes of 30 percent or less. Development of areas with steeper slopes should be evaluated on a case-by-case basis. Development on slopes steeper than 30 percent will likely require slope stability analysis as it pertains to the planned improvements. Deep foundations may be required for structures placed on slopes of 20 percent or greater. Temporary and/or permanent shoring may be required do to significant cuts at this site (5 feet or greater).

We believe it is prudent to design cut and fill slopes to be as gentle as practical, to enhance stability, and decrease erosion potential. We recommend maximum cut and fill slopes of 3:1 (horizontal:vertical). If steeper slopes are necessary, we should evaluate slope stability.

Uncontrolled Fill

Existing fill was encountered in sixteen of our borings at depths of up to 15 feet. Deeper fill areas may exist. Shallow foundations and slabs-on-grade should not be supported on existing fill. The fill should be removed and replaced as describe in the Site Grading section of this report. When site grading is completed, uncontrolled fill encountered in areas of pavements may need to be removed and recompacted in the upper 1 to 2 feet of subgrade soils.

Ground Water

Ground water was not encountered during our investigation. Groundwater levels will vary seasonally and may rise as development of the site progresses. We do not expect groundwater levels will affect site development.

Surface Drainage

The Civil Engineer should evaluate and quantify the potential flow in each drainage during peak precipitation events and design surface drainage and storm collection systems to accommodate the water. Storm drainage should be collected in detention basins and released at historic rates or less. Development in the steeper areas should be carefully situated and engineered so as not to contribute to or become damaged by erosion.

Expansive Soils

Expansive soils are present at this site. Samples of the soils tested during swell-consolidation testing exhibited low to very high swell after wetting under a confining pressure of 150 pounds per square foot in potential pavement areas and 1,000 pounds per square foot (psf) in potential building areas. We believe the risk of expansive soils is moderate to high for this site.

Seismicity

According to the 2009 International Building Code (2009 IBC) and the subsurface conditions encountered in our borings, this site classifies as a Site Class D. Only minor damage to relatively new, properly designed and built structures would be expected. Wind loads, not seismic considerations, typically govern dynamic structural design in this area. A Remi Survey can be used to determine the shear wave velocities at the sites. A survey of this type may result in a lower seismic site class (Site Class C). However, in our experience this is unlikely.

Radioactivity

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 underlying the site. Because these sources exist, 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. It is difficult to predict the concentration of radon gas in finished construction.

We recommend testing for radiation to evaluate radon levels after construction is completed. 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. Radon rarely accumulates to significant levels in above-grade, heated and ventilated spaces.

FIELD AND LABORATORY INVESTIGATIONS

Subsurface conditions were investigated by drilling thirty three exploratory borings at the approximate locations shown on Figure 1. The test holes were drilled using a truck-mounted, CME-45 drill rig and 4-inch diameter, continuous-flight auger. Our field representative observed drilling, logged the subsurface conditions encountered in the borings and obtained samples. Summary logs of the soils sampled from the borings and field penetration resistance values are presented in Appendix A.

Samples of soil were obtained during drilling and returned to our laboratory and visually classified by the geotechnical engineer for the project. Laboratory testing included moisture content, dry density, swell-consolidation, Atterberg limits, gradation, and water-soluble sulfate tests. Laboratory test results are presented in Appendix B.

SUBSURFACE CONDITIONS

Subsurface conditions encountered at this site were variable. In general, soils encountered consisted of silty to clayey sand and sandy to silty clay to depths explored. Sandy clay and clayey sand fill was encountered in the upper 2 to 15 feet in sixteen of our borings. No ground water was encountered during our investigation. Further description of the subsurface conditions is presented on our boring logs and in our laboratory testing.

DEVELOPMENT RECOMMENDATIONS

Site Grading

At the time of this investigation, site grading plans were not available for review in conjunction with this subsurface exploration program. We anticipate larger cuts and fill will be required at this site. It is important that deep fills be constructed as far in advance of surface construction as possible. It is our experience that fills compacted in accordance with the Compaction section of this report may settle about 1 percent of its height under its own weight. Most of this settlement usually occurs during and soon after construction. Some additional settlement is possible after development and as landscape irrigation increases the soil moisture content.

The existing on-site soils are suitable for re-use as fill provided debris or deleterious organic materials are removed. 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.

Site grading fill should be placed in thin, loose lifts, moisture conditioned and compacted. In areas of deep fill, we recommend increasing compactive effort to achieve higher density and help reduce settlement of the fill. Compaction and moisture requirements are described in the Compaction section of this report. 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

If import material is required, samples from each source should be provided for our review. Import fill should contain no particles larger than 3 inches, have 10 to 40 percent silt and clay-sized particles (percent passing No. 200 sieve) and exhibit a liquid limit less than 30 and a plasticity index less than 15.

Compaction

Any material placed as fill in areas planned for improvements such as structures, roadways, and other paved areas should be placed in loose horizontal lifts, less than 8-inches thick, and be uniformly moisture conditioned and compacted. If the fill is less than 10-feet thick, it should be compacted to a minimum of 95 percent of standard Proctor maximum dry density within 2 percent of its optimum moisture content as determined by ASTM D 698 or AASHTO T 99.

Fill areas greater than 10-feet thick will have a higher risk of settlement. For these areas, we recommend placing the fill as described above compacted to a minimum of 98 percent of the modified proctor maximum dry density within 2 percent of optimum moisture content as determined by ASTM D1557 or AASHTO T 180. Thicker fills will tend to settle more than thinner fills of similar material. Based on our experience, we anticipate settlement will equal about 0.5 percent of the total fill thickness.

Permanent Cut and Fill Slopes

We recommend permanent cut and fill slopes be designed with a maximum inclination of 3:1 (horizontal to vertical). Structures should be setback 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 excavators. Ground water is not anticipated in excavations. Utility trenches should be sloped or shored to meet local, State and Federal safety regulations. Based on our investigation, we believe the sand at this site classifies as Type C soil and the clay classifies as Type B soil based on OSHA standards. Type C soils require a maximum slope inclination of 1.5:1 (horizontal:vertical). Type B soils require a maximum slope inclination of 1:1 (horizontal:vertical) in dry conditions. The contractor's "competent person" should identify the soil encountered in the excavation and refer to OSHA standards to determine appropriate slopes. Excavations deeper than 20 feet should be designed by a professional engineer.

The width of the top of an excavation may be limited in some areas. Bracing or "trench box" construction may be necessary. Bracing systems include sheet piling, braced sheeting, and others. Lateral loads on bracing depend on the depth of excavation, slope of excavation above the bracing, surface loads, hydrostatic pressures, and allowable movement. For trench boxes and bracing allowed to move enough to mobilize the strength of the soils, with associated cracking of the ground surface, the "active" earth pressure conditions are appropriate for design. If movement is not tolerable, the "at rest" earth pressures are appropriate. We suggest an equivalent fluid density of 40 pcf for the "active" earth pressure condition and 50 pcf for the "at rest" earth pressure condition, assuming level backfill. These pressures do not include allowances for surcharge loading or for hydrostatic conditions. We are available to assist further with bracing design if desired.

Water and sewer lines are usually constructed beneath paved roads. Compaction of trench backfill can have significant affect on the life and serviceability of pavements. We believe trench backfill should be placed in thin, loose lifts, and moisture conditioned to within 2 percent of optimum moisture content for sand. Trench backfill should be compacted to at least 95 percent of standard proctor maximum dry density (ASTM D 698, AASHTO T 99). The placement and compaction of fill and backfill should be observed and tested by our firm during construction. If deep excavations (greater than 10 feet) are necessary for planned utilities, our office should be contacted for the compaction requirements.

PRELIMINARY RECOMMENDATIONS FOR STRUCTURES

Structures planned at this site include the Menards building, a warehouse, and possible other out structures. Our field and laboratory data indicate the soil conditions vary across the site. The following discussions are preliminary and are not intended for design or construction. After grading is completed, a design-level Geotechnical Investigation should be performed.

Foundations

Based on the expansive soils encountered at the site, we anticipate a design level geotechnical investigation will recommend all structures be founded on footings constructed over a type of ground modification; likely an over-excavation consisting of removal and replacement of the bearing soils to provide adequate support. A deep foundation is another possible alternative. Allowable bearing values for footings at this site are likely to vary between 1,500 pounds per square foot (psf) and 3,500 psf. Depths of deep foundations can not accurately be determined due to potential site grading. A design-level geotechnical investigation may identify potential constraints for specified areas not indicated by our borings which may suggest the need for other types of foundation systems.

Slabs-on-Grade Construction

We anticipate the main building will likely be constructed with a slab-on-grade floor. Ground modification below the building will likely be necessary to eliminate potential movements of the slab due to the expansive soils at this site. Other building floors will also likely require ground modification or can be constructed as structural floors. Based on subsurface conditions encountered at this site, we believe most of the site will have a moderate risk site for poor slab performance. Slab movement of 1 to 3 inches is considered “normal” for this level of risk. Slab performance risk should be more thoroughly defined during the design-level geotechnical investigation.

Surface Drainage

The performance of foundations will be influenced by surface drainage. The ground surface around proposed structures should be shaped to provide runoff of surface water away from the structures and off of pavements. We generally recommend slopes of at least 12 inches in the first 10 feet where practical in the landscaping areas surrounding residences. 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. 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.

PRELIMINARY PAVEMENT RECOMMENDATIONS

Subgrade Preparation

Based on our borings, surbsurface conditions in the area of portions of the access drives and parking areas will be underlain by expansive soils and uncontrolled fill. One option would be chemical stabilization of the subgrade. Another option would be over-excavation and replacement of materials considered unsuitable for pavement subgrade and recompacted as described in the Site Grading section of this report. We anticipate subgrade stabilization will be in the upper 2 feet. A geogrid system may be incorporated into the final pavement design to reduce the overall section.

Preliminary Pavement Thickness Design

Preliminary guidelines for pavement systems on this site are provided. Final pavement sections should be determined based on a design level geotechnical investigation and the anticipated frequency of truck load applications and other traffic on the pavement during the desired design life. Flexible hot mixed asphaltic concrete pavement (HMA) or rigid Portland cement concrete (PCC) pavements can be used at this site for automobile and light truck traffic use. Rigid pavements are recommended in any areas subject to heavy truck traffic. We anticipate asphalt pavement sections access drives and parking areas will be on the order of 4 to 6 inches thick. Collectors and other higher volume pavement will likely require thicker pavement sections.

Portland cement concrete (PCC) pavement is recommended in areas subject to any heavy truck traffic such as dumpster or loading dock areas trucks. We anticipate the use of 6 inches of Portland cement concrete for general area pavements which are not subject to truck traffic. A minimum 6 inch thick section is anticipate in main drives and any areas subject to some moderately heavy truck traffic. Any areas subject to frequent heavy trucks should be designed based on frequency and wheel loads. PCC pavements in this area are typically reinforced due to the underlying active soils. Properly designed control joints and other joints systems are required to control cracking and allow pavement movement.

WATER-SOLUBLE SULFATES

Concrete that comes into contact with soils can be subject to sulfate attack. We measured water-soluble sulfate concentrations in three samples from this site. Concentrations were 0.06 percent or less. Sulfate concentrations less than 0.1 percent indicate Class 0 exposure to sulfate attack for concrete that comes into contact with the subsoils, according to the American Concrete Institute (ACI). For this level of sulfate concentration, ACI indicates any type of cement can be used for concrete that comes into contact with the soils. In our experience, superficial damage may occur to the exposed surfaces of highly permeable concrete, even though sulfate levels are relatively low. To control this risk and to resist freeze-thaw deterioration, the water-to-cementitious material ratio should not exceed 0.50 for concrete in contact with soils that are likely to stay moist due to surface drainage or high water tables. Concrete should be air entrained.

RECOMMENDED FUTURE INVESTIGATIONS

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

1. Review of final site grading plans by our firm;
2. A design-level Geotechnical Investigation to determine appropriate foundation systems for structures;
3. Construction observation and materials testing during site development.

LIMITATIONS

Our exploratory borings were located to obtain preliminary subsurface data indicative of conditions on this site. Although our borings were spaced to obtain a reasonably accurate picture of subsurface conditions, variations in the soil and bedrock 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 in the locality of this project. No warranty, express or implied, is made.

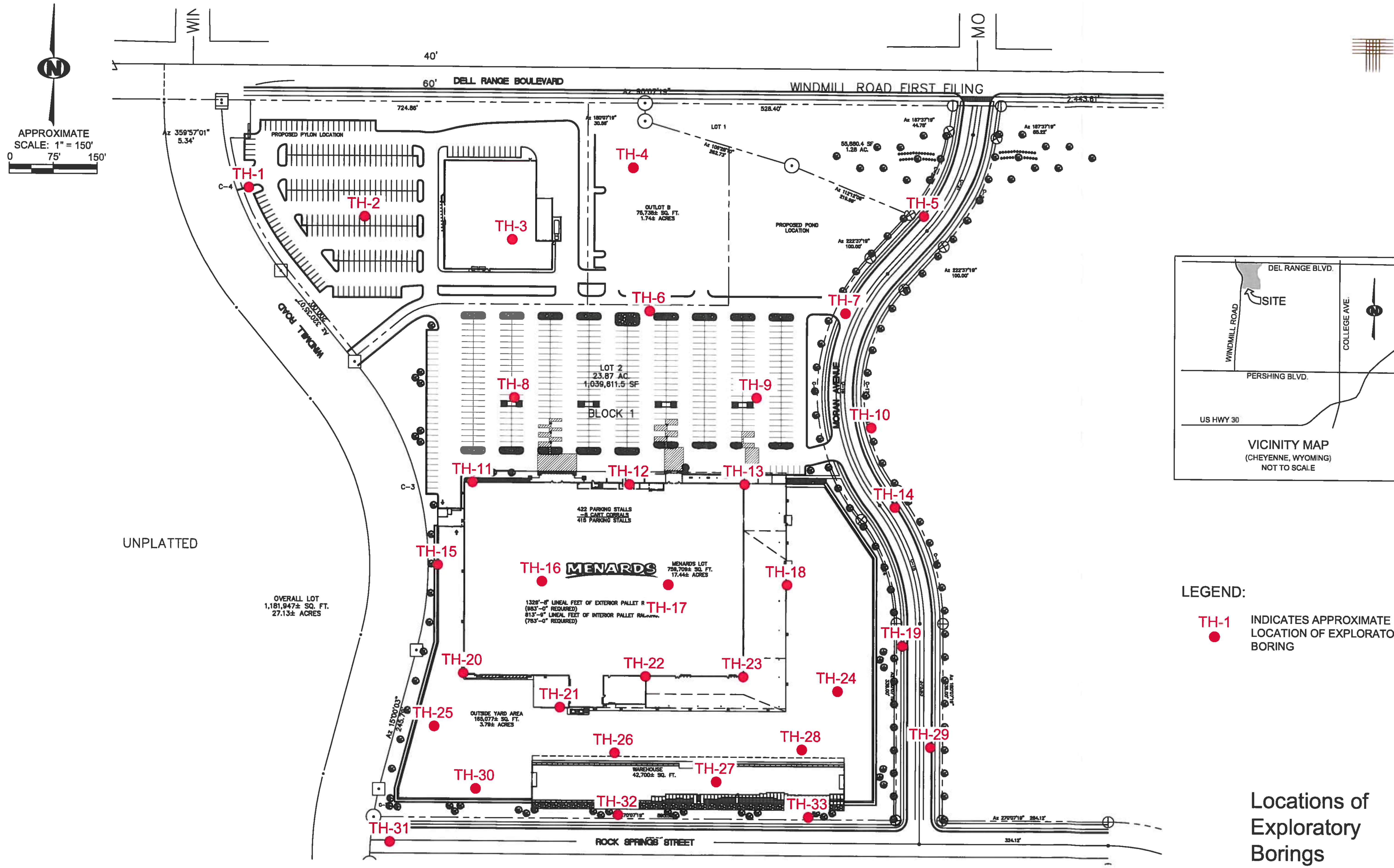
If we can be of further service in discussing the contents of this report or in the analysis of the building and pavement from the geotechnical point of view, please contact the undersigned.

Very truly yours,
CTL | THOMPSON, INC.

Spencer Schram, EI
Project Engineer

R.B. "Chip" Leadbetter, III, PE
Division Manager

COLORADO REGISTERED PROFESSIONAL ENGINEER
ROBERT B. LEADBETTER III
35516
JUL 11 2019



LEGEND:

TH-1 ● INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING

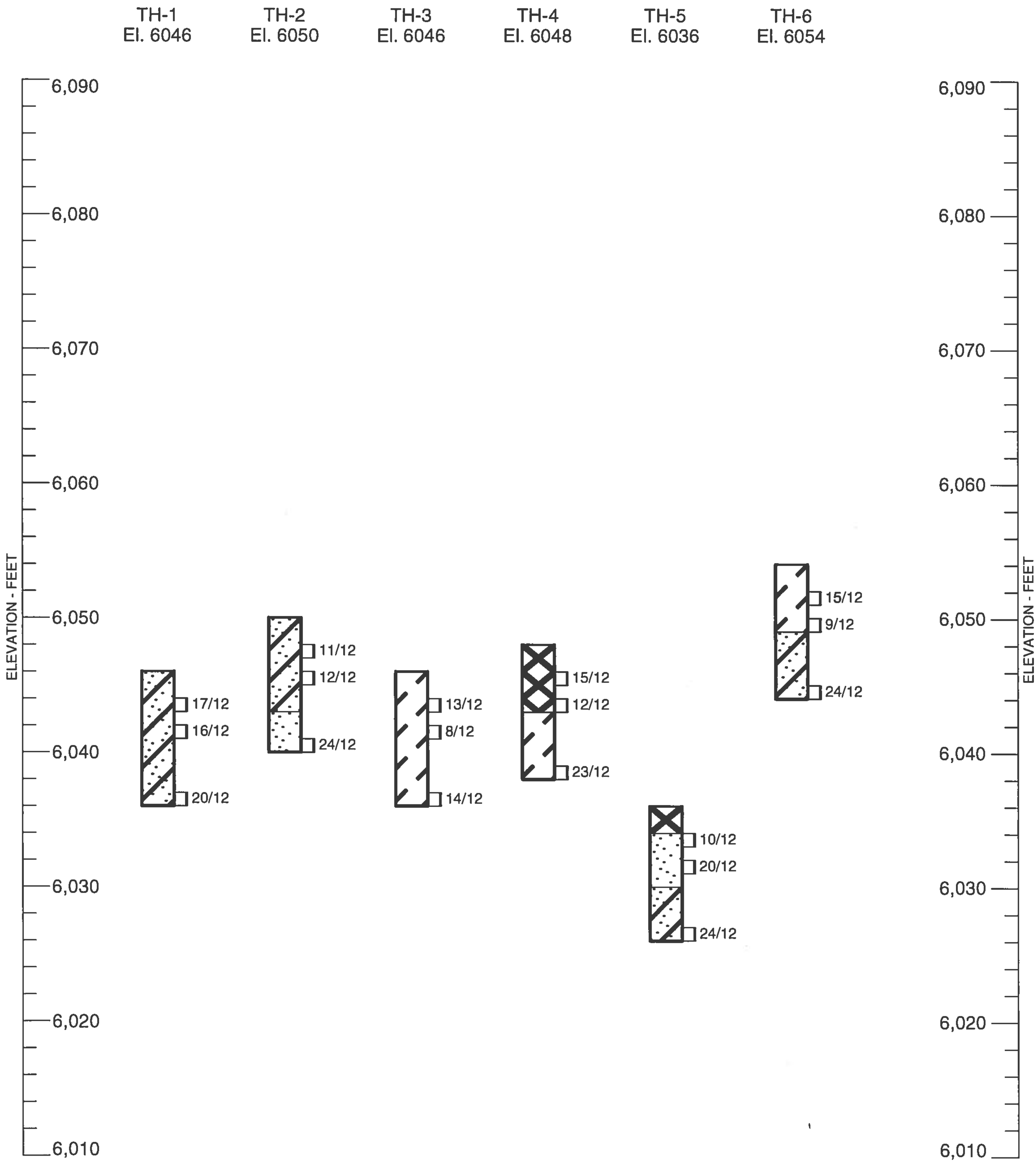
MENARDS, INC.
MENARDS AT DEL RANGE AND WINDMILL
CTL I T PROJECT NO. WY00645-125

Locations of Exploratory Borings

FIGURE 1

APPENDIX A

SUMMARY LOGS OF EXPLORATORY BORINGS

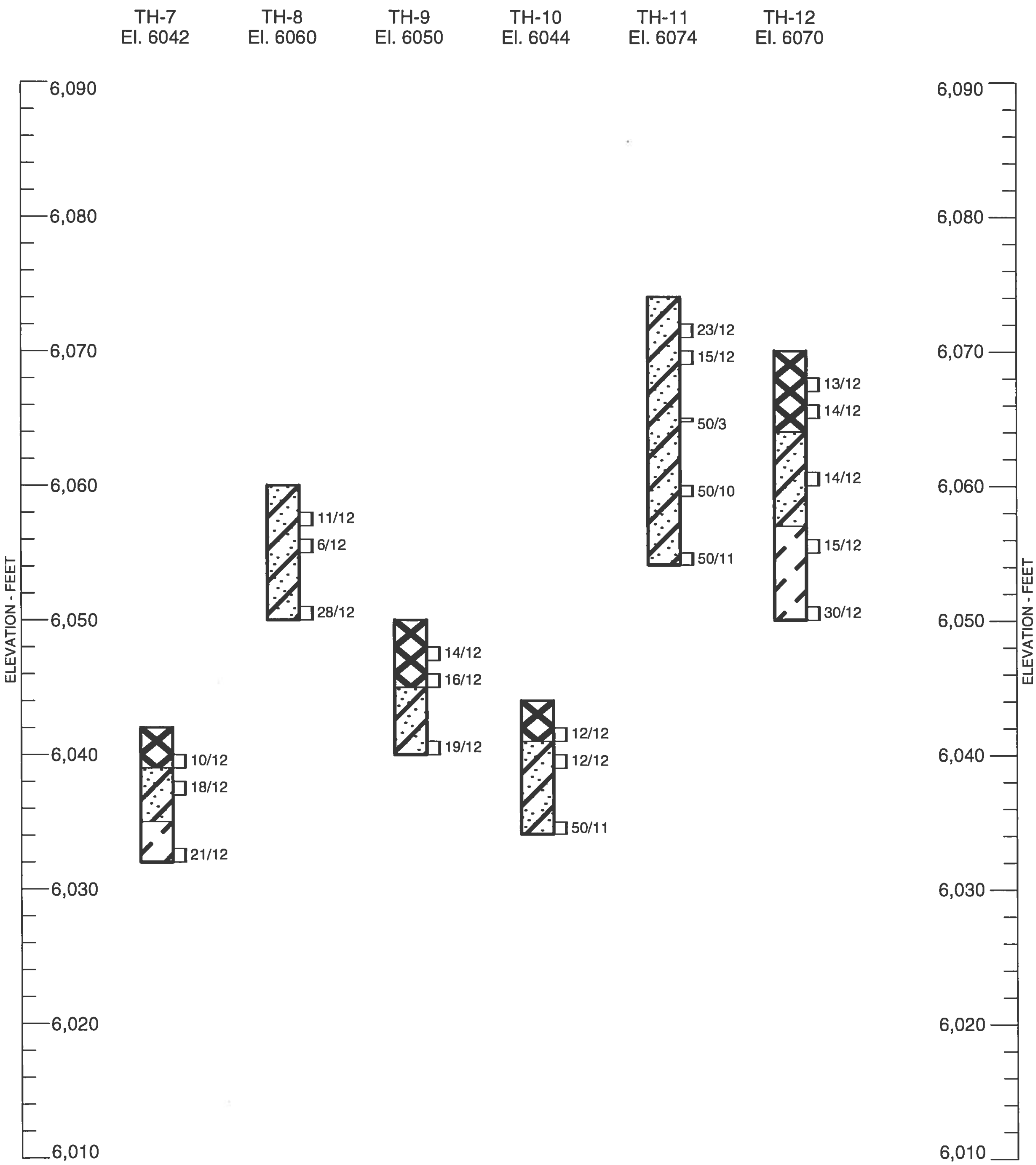


LOGS BY ELEVATION-LETTER WY00645 BORING LOGS.GPJ CTLMAIN.GDT 6/27/11

Summary Logs of Exploratory Borings

MENARDS, INC.
MENARDS - DELL RANGE AND WINDMILL ROAD
CTL | T PROJECT NO. WY00645-125

FIGURE A-1

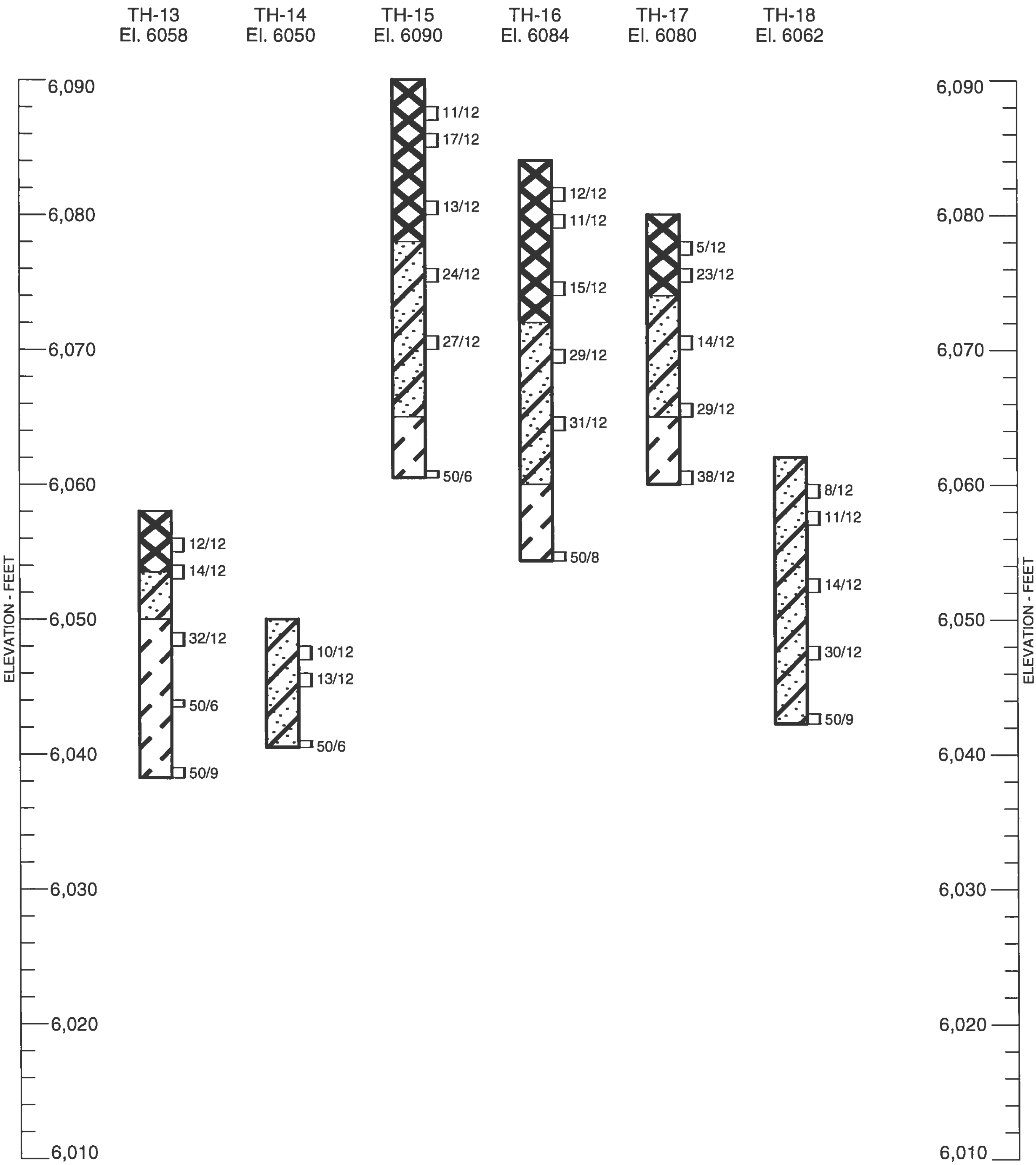


LOGS BY ELEVATION-LETTER WY00645 BORING LOGS.GPJ CTLMAIN.GDT 6/27/11

Summary Logs of Exploratory Borings

FIGURE A-2

MENARDS, INC.
MENARDS - DELL RANGE AND WINDMILL ROAD
CTL | T PROJECT NO. WY00645-125



Summary Logs of Exploratory Borings

FIGURE A-3

MENARDS, INC.
MENARDS - DELL RANGE AND WINDMILL ROAD
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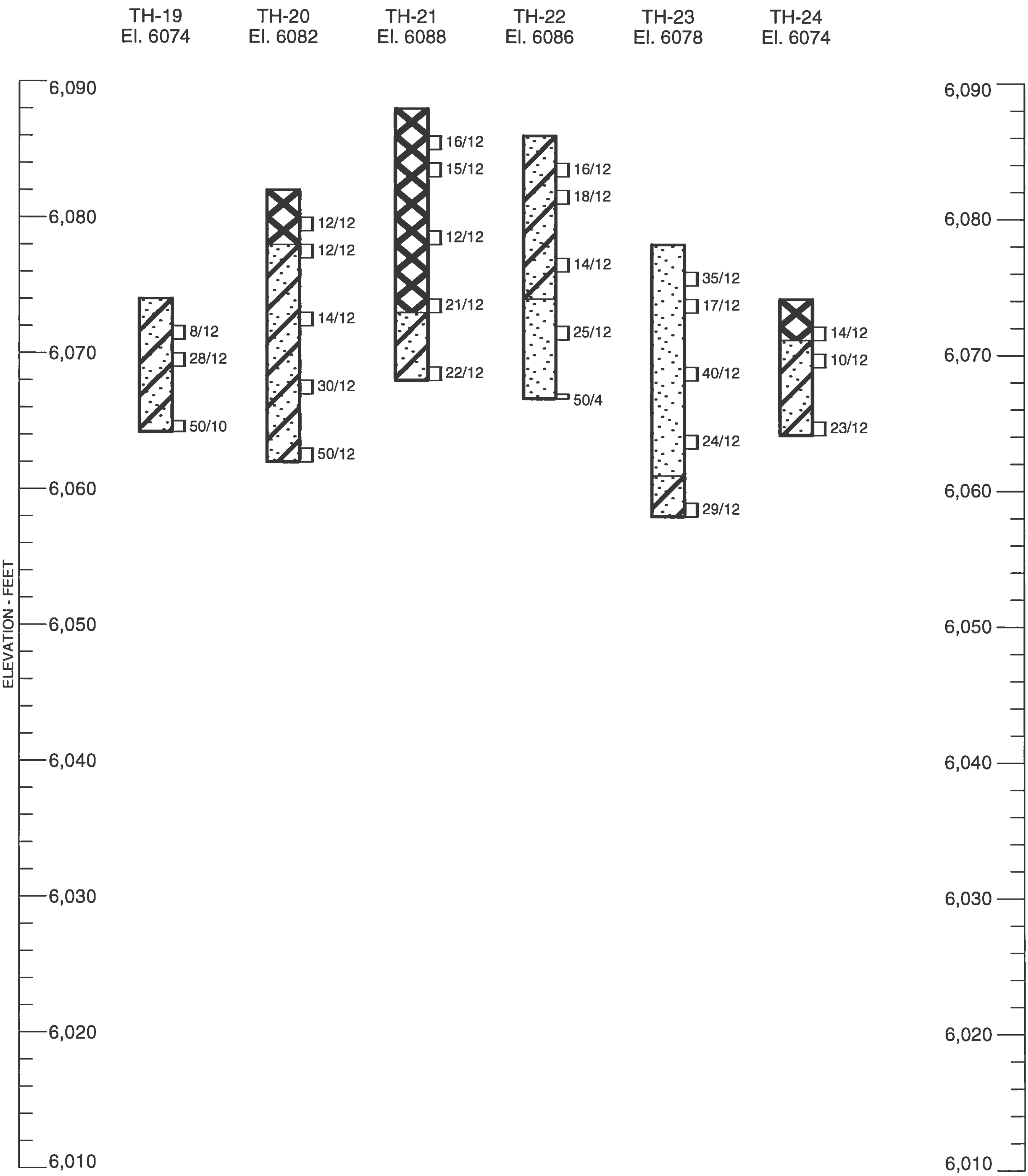
LOGS BY ELEVATION-LETTER WY00645 BORING LOGS.GPJ CTLMAIN.GDT 6/27/11



Summary Logs of Exploratory Borings

FIGURE A-4

MENARDS, INC.
MENARDS - DELL RANGE AND WINDMILL ROAD
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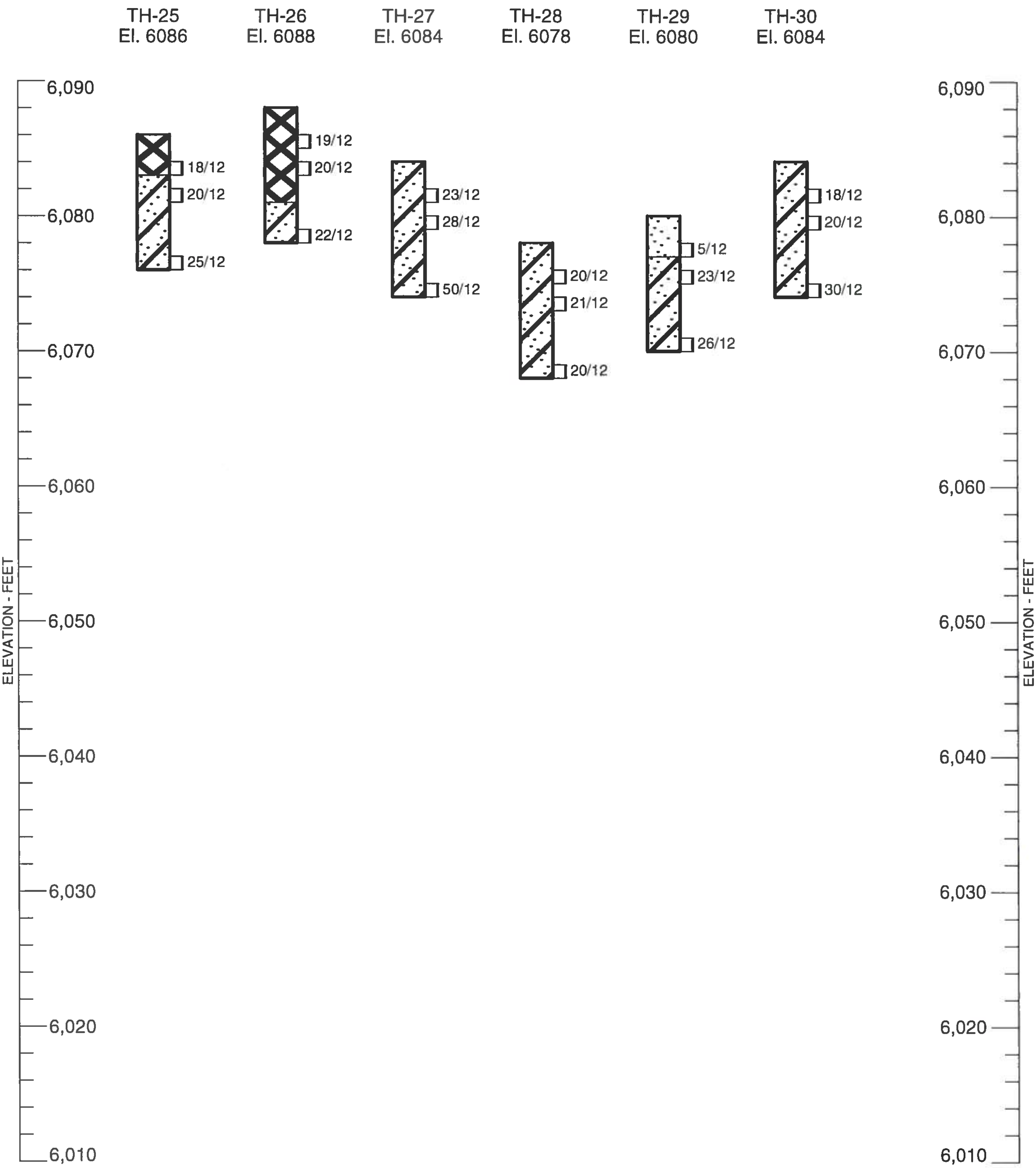
LOGS BY ELEVATION-LETTER WY00645 BORING LOGS.GPJ CTLMAIN.GDT 6/27/11



Summary Logs of Exploratory Borings

FIGURE A-5

MENARDS, INC.
MENARDS - DELL RANGE AND WINDMILL ROAD
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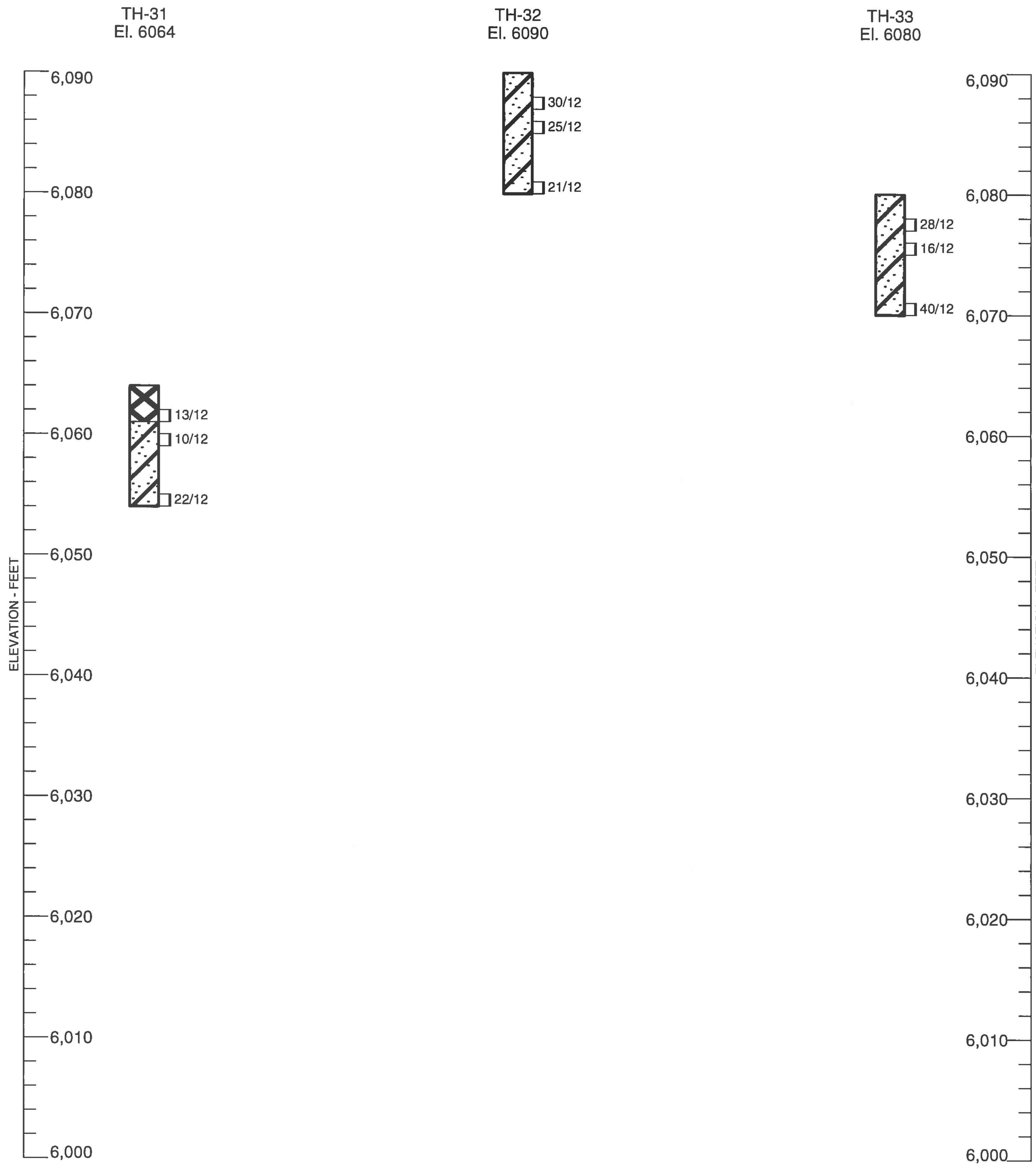
LOGS BY ELEVATION-LETTER WY00645 BORING LOGS.GPJ CTLMAIN.GDT 6/27/11



MENARDS, INC.
MENARDS - DELL RANGE AND WINDMILL ROAD
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LEGEND:

FILL, CLAY, SANDY TO SAND CLAYEY, MOIST, STIFF TO VERY STIFF, MEDIUM DENSE, BROWN, DARK BROWN (CL, SC)

SAND, SILTY, CLAYEY WITH OCCASIONAL CLAY LAYERS, MOIST, LOOSE TO MEDIUM DENSE, BROWN, GRAYISH BROWN (SM, SC)

CLAY, SANDY, SILTY WITH OCCASIONAL SAND LAYERS, MOIST, STIFF TO VERY STIFF, BROWN, GRAYISH BROWN (CL)

DRIVE SAMPLE. THE SYMBOL 17/12 INDICATES 17 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.

NOTES:

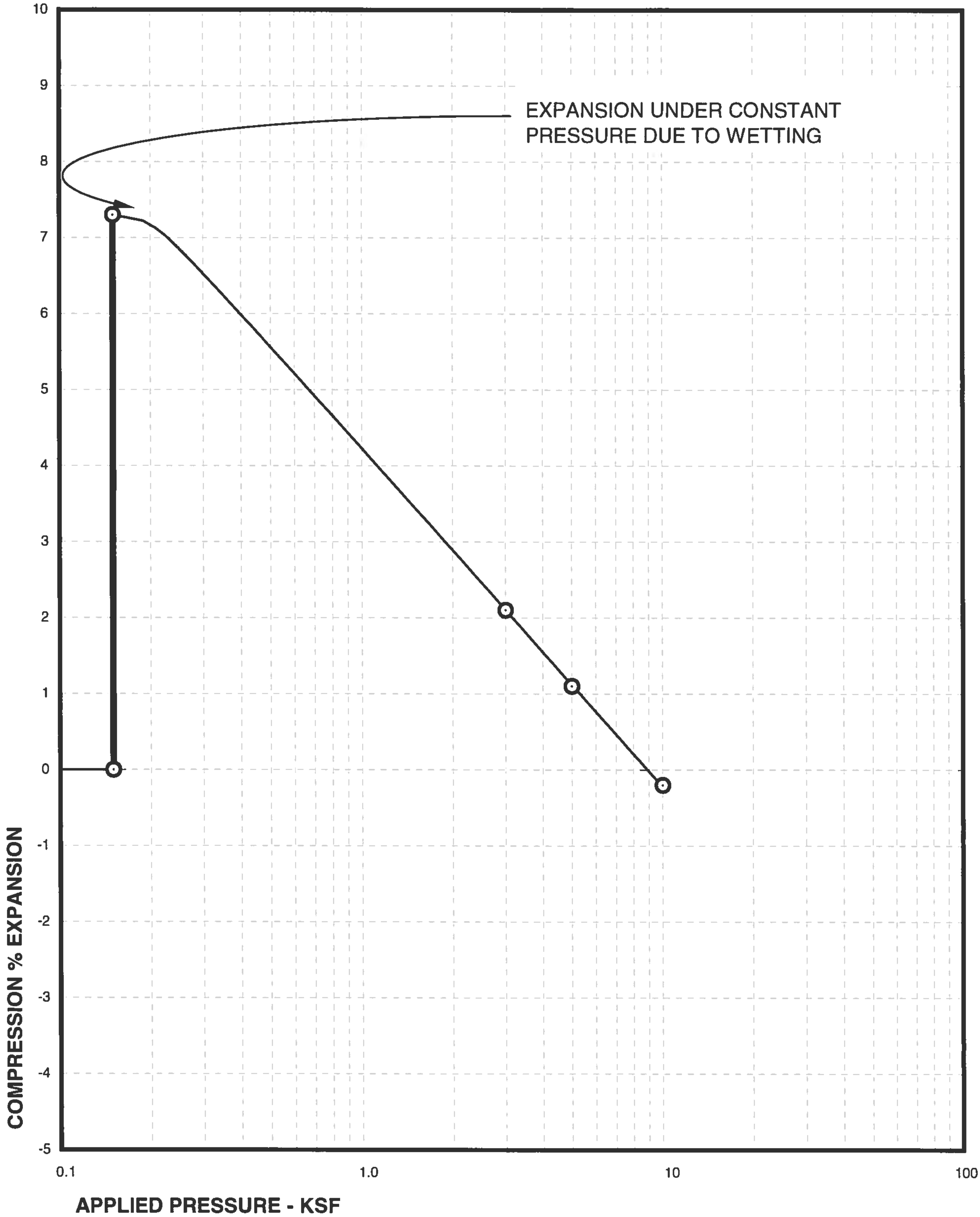
1. THE BORINGS WERE DRILLED ON JUNE 21 AND 22, 2011, USING 4-INCH DIAMETER CONTINUOUS-FLIGHT AUGER AND A TRUCK-MOUNTED DRILL RIG.
2. BORING ELEVATIONS ARE APPROXIMATE AND ARE BASED ON TOPOGRAPHY PROVIDED BY
3. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS AND CONCLUSIONS IN THIS REPORT.

Summary Logs of Exploratory Borings

FIGURE A-6

APPENDIX B

RESULTS OF LABORATORY TESTING



Sample of SAND, CLAYEY (SC)
From TH - 1 AT 2 FEET

DRY UNIT WEIGHT= 110 PCF
MOISTURE CONTENT= 11.9 %

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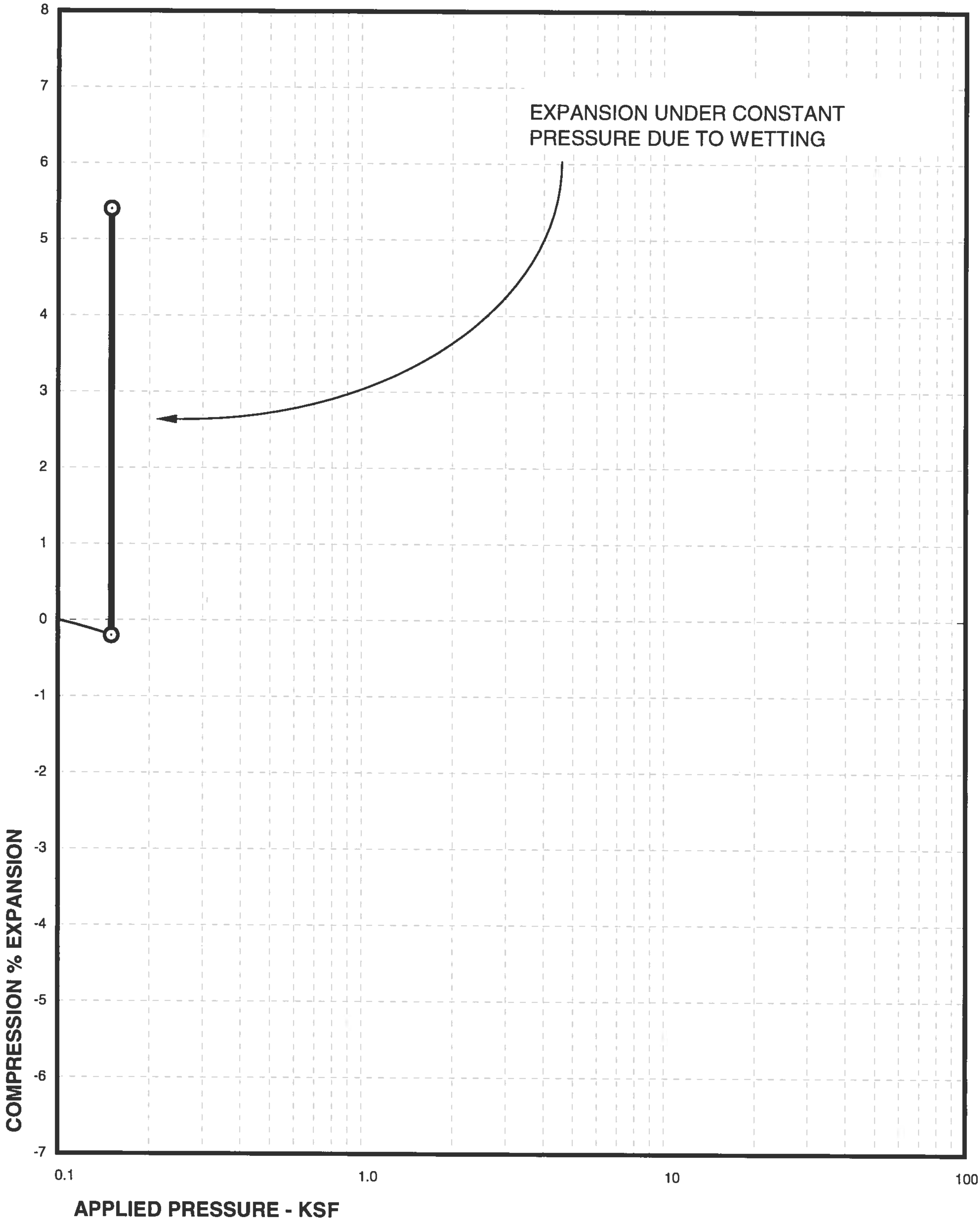
Swell Consolidation Test Results

FIGURE B-1



Sample of CLAY, SANDY (CL)

From TH - 4 AT 9 FEET

DRY UNIT WEIGHT= 106 PCF

MOISTURE CONTENT= 19.9 %

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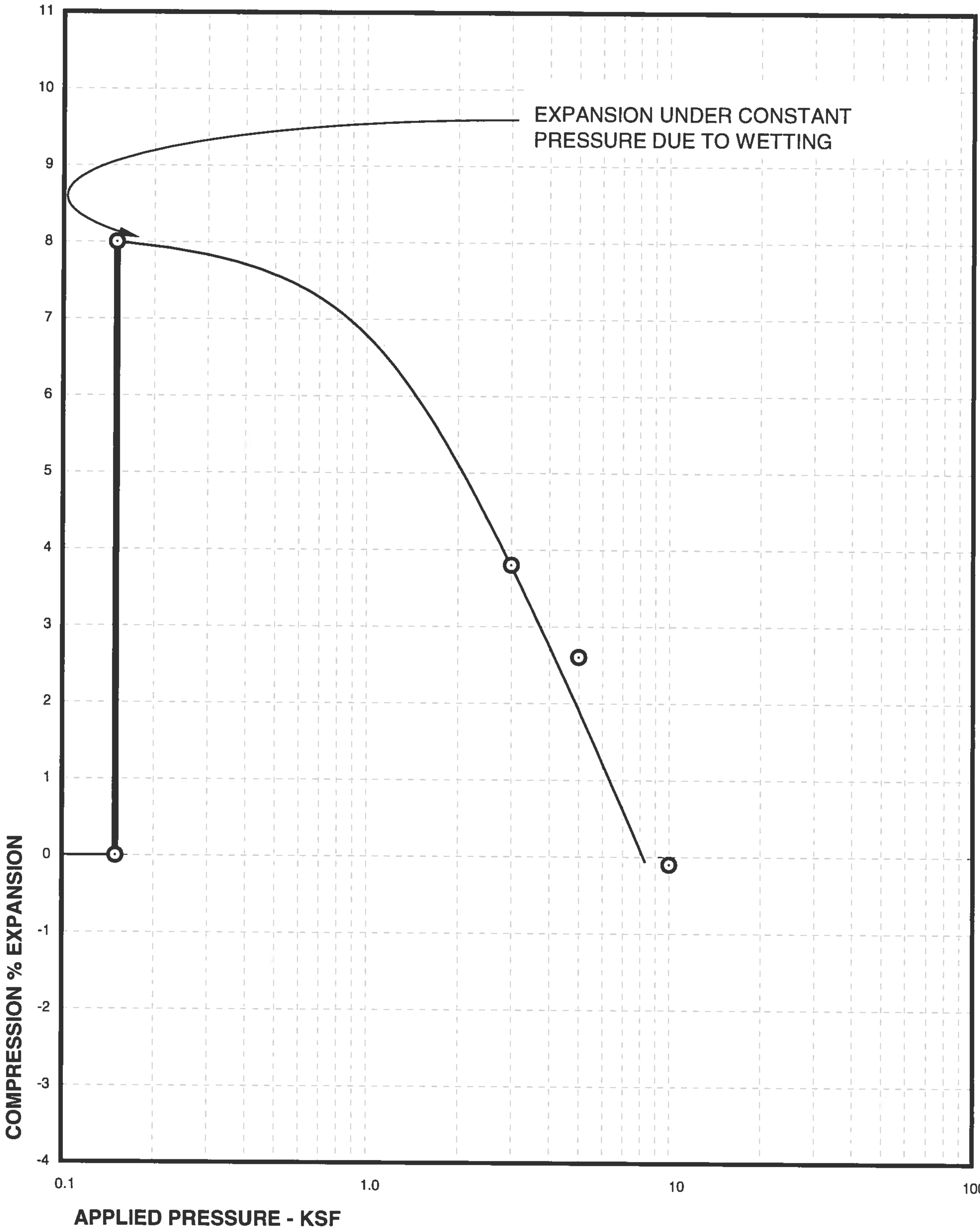
Swell Consolidation Test Results

FIGURE B-2



Sample of CLAY, SANDY (CL)
From TH - 6 AT 2 FEET

DRY UNIT WEIGHT= 113 PCF
MOISTURE CONTENT= 16.2 %

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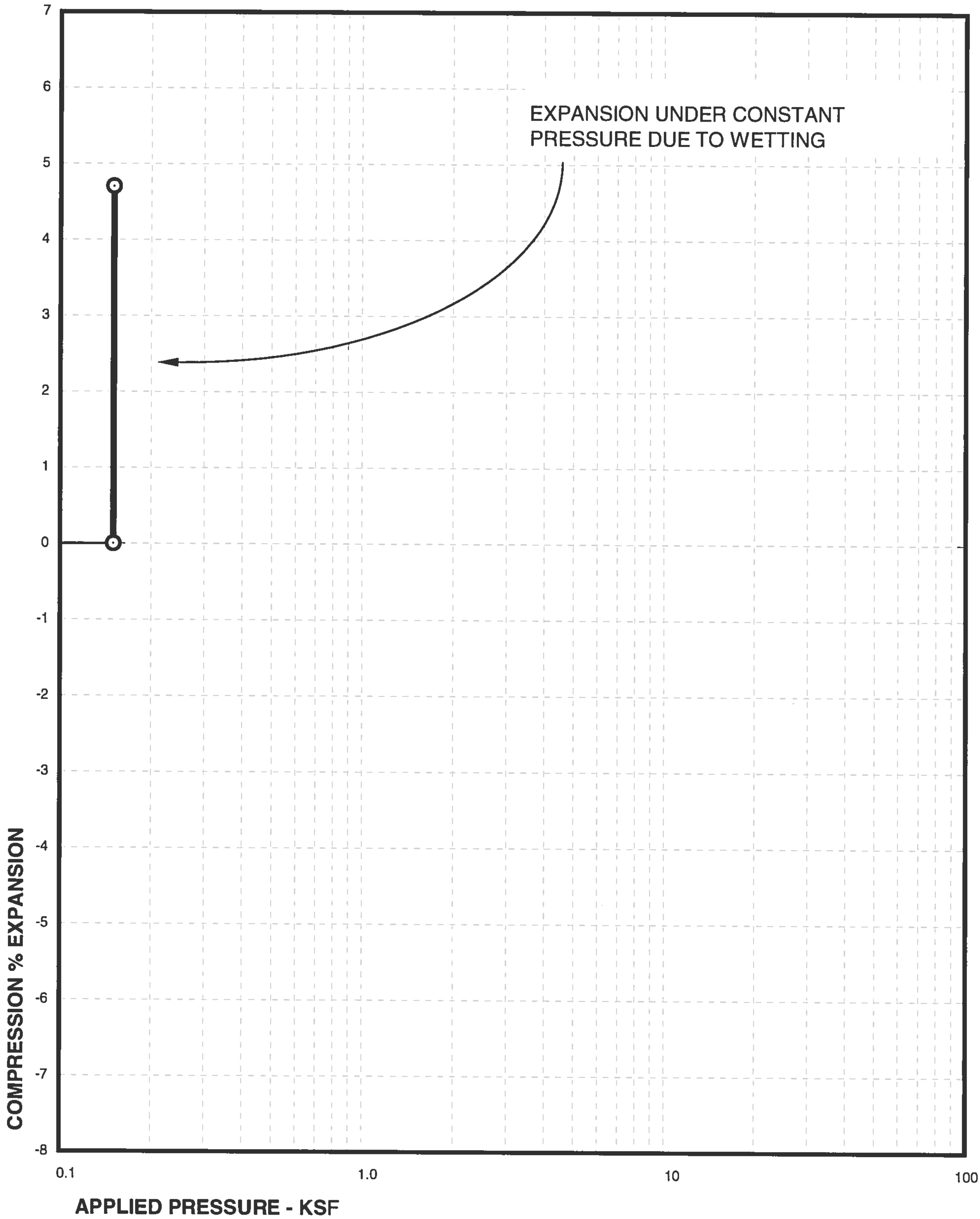
Swell Consolidation Test Results

FIGURE B-3



Sample of FILL, CLAY, SANDY (CL)
From TH - 7 AT 2 FEET

DRY UNIT WEIGHT= 109 PCF
MOISTURE CONTENT= 8.1 %

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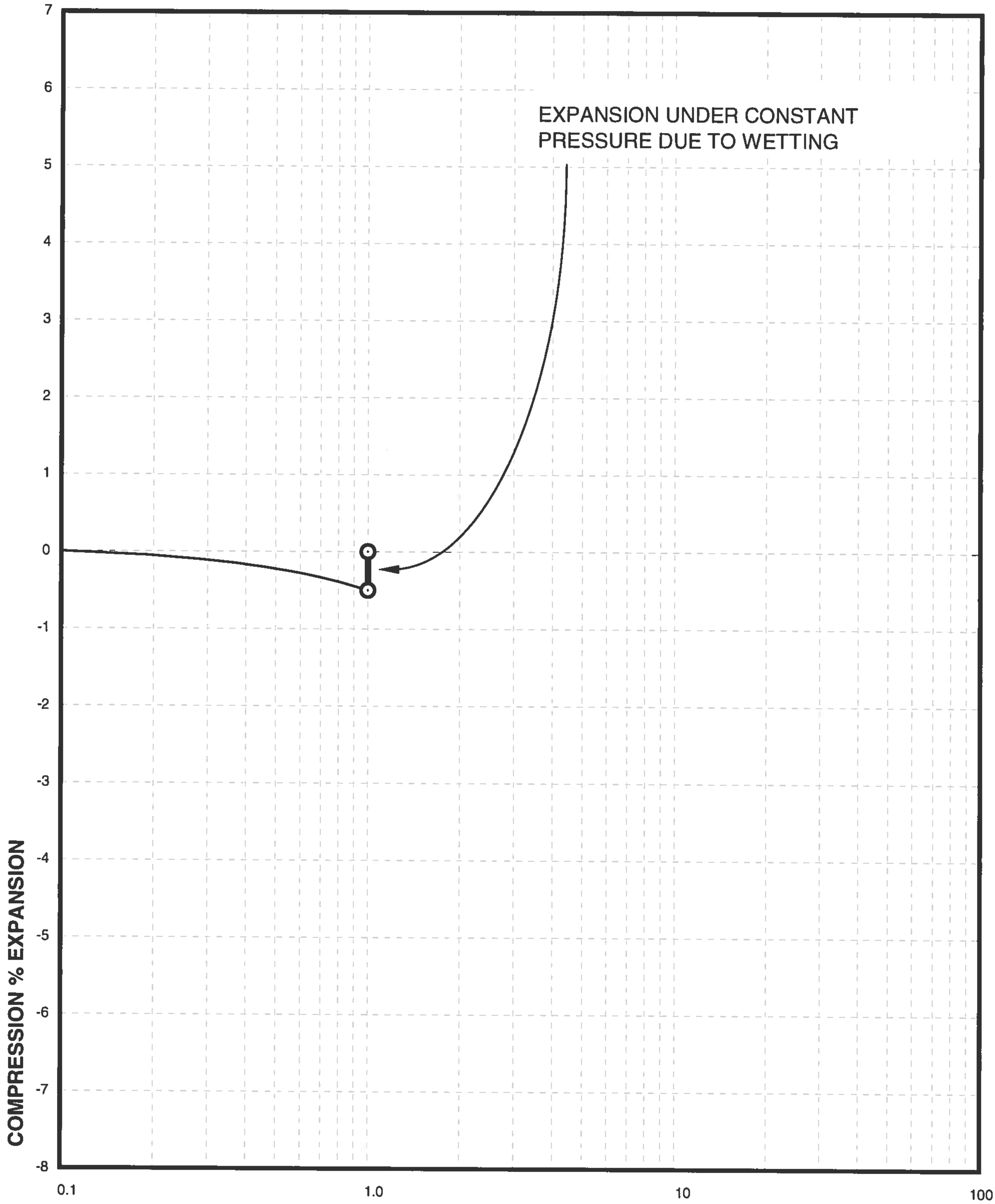
Swell Consolidation Test Results

FIGURE B-4



Sample of CLAY, SANDY (CL)
From TH - 12 AT 19 FEET

DRY UNIT WEIGHT= 119 PCF
MOISTURE CONTENT= 10.7 %

MENARDS, INC.
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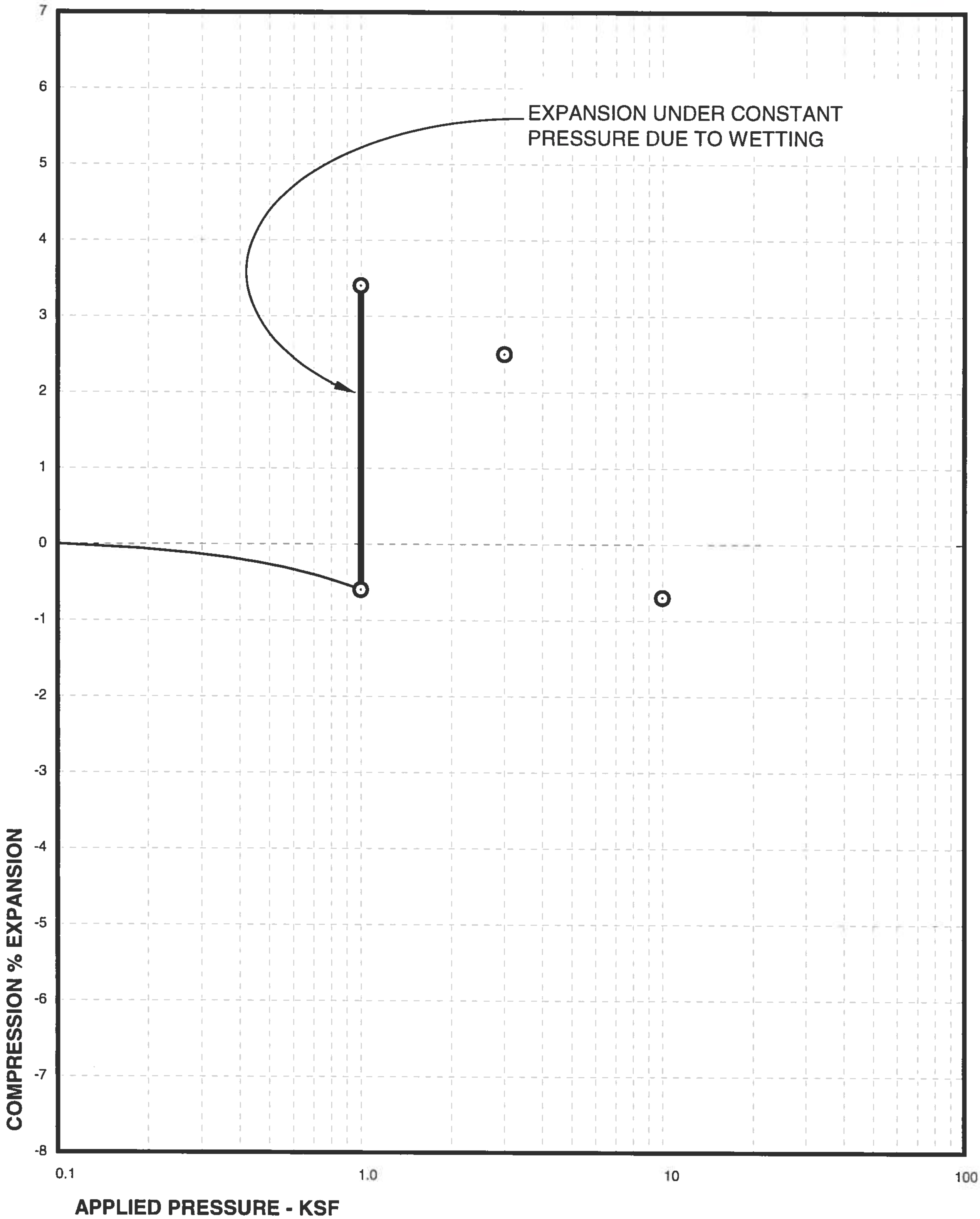
Swell Consolidation Test Results

FIGURE B-5



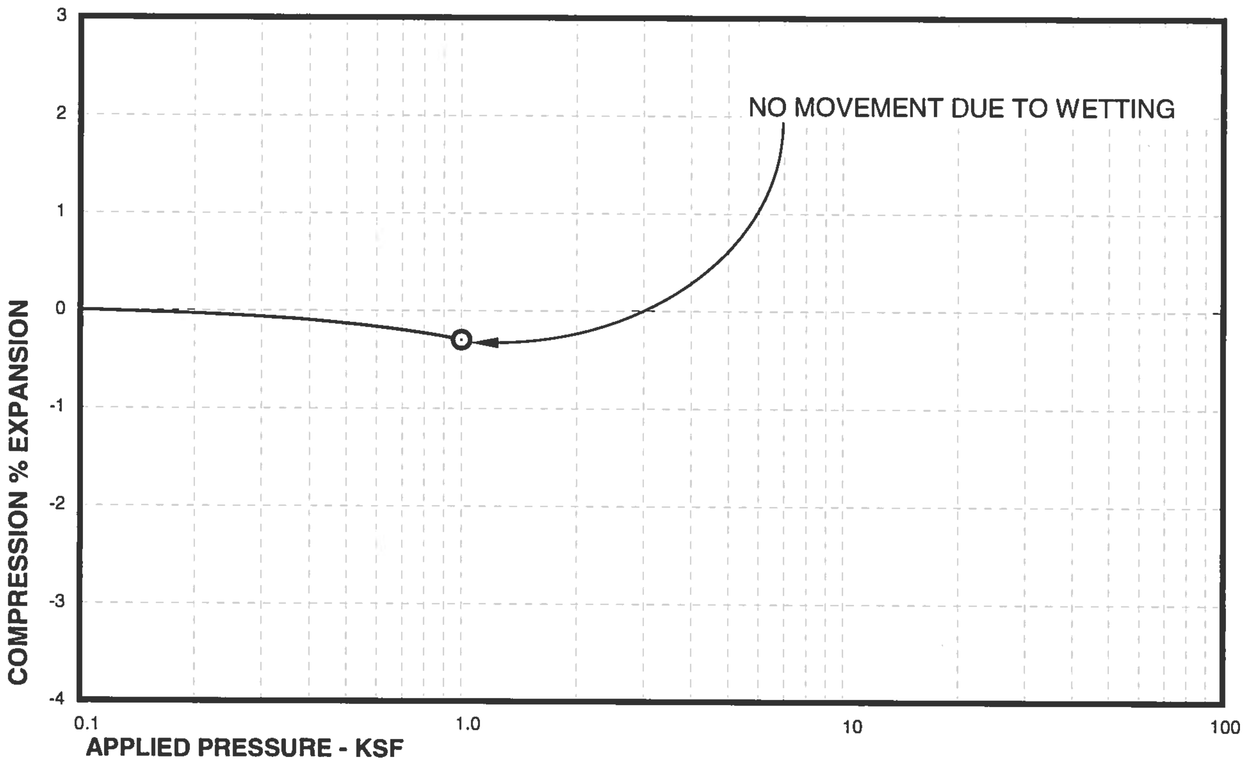
Sample of CLAY, SANDY (CL)
From TH - 13 AT 9 FEET

DRY UNIT WEIGHT= 111 PCF
MOISTURE CONTENT= 15.1 %

MENARDS, INC.
MENARDS AT DEL RANGE AND WINDMILL
CTL | T PROJECT NO. WY00645-125

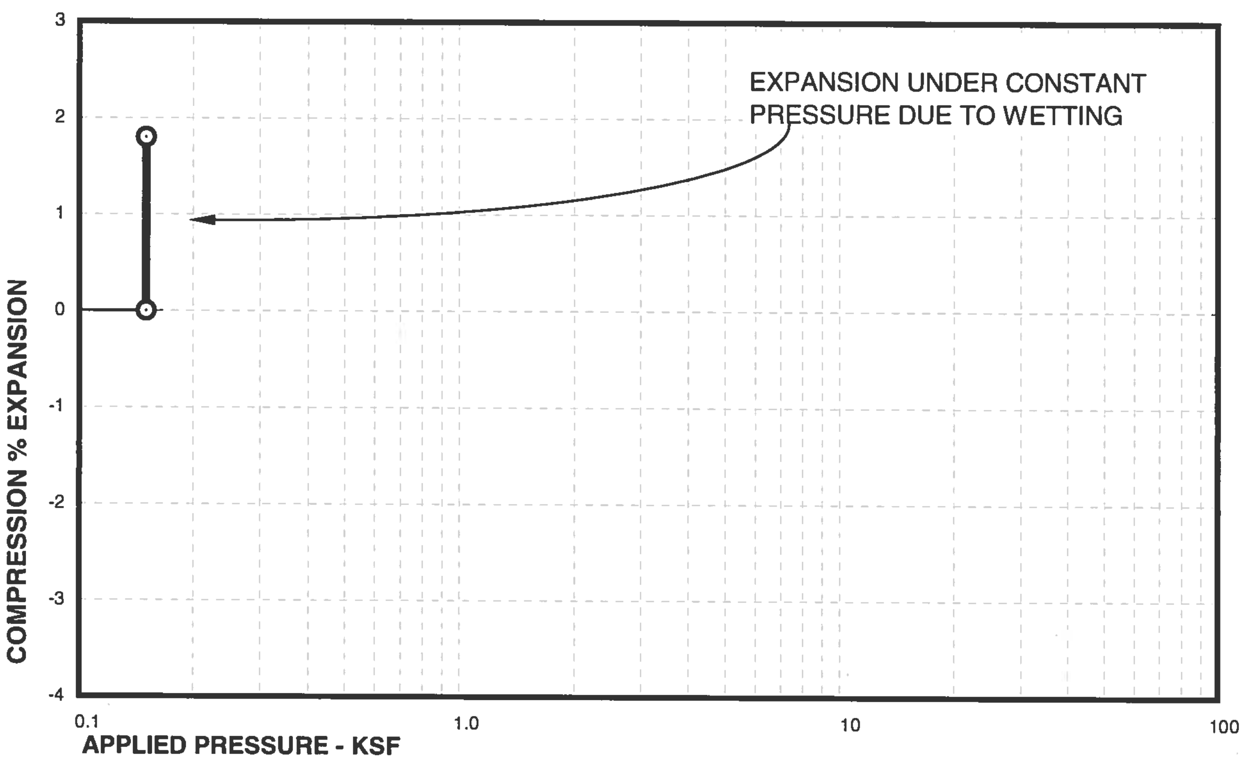
Swell Consolidation Test Results

FIGURE B-6



Sample of FILL, SAND, CLAYEY (SC)
From TH - 16 AT 4 FEET

DRY UNIT WEIGHT= 115 PCF
MOISTURE CONTENT= 9.2 %



Sample of SAND, CLAYEY (SC)
From TH - 19 AT 2 FEET

DRY UNIT WEIGHT= 108 PCF
MOISTURE CONTENT= 9.2 %

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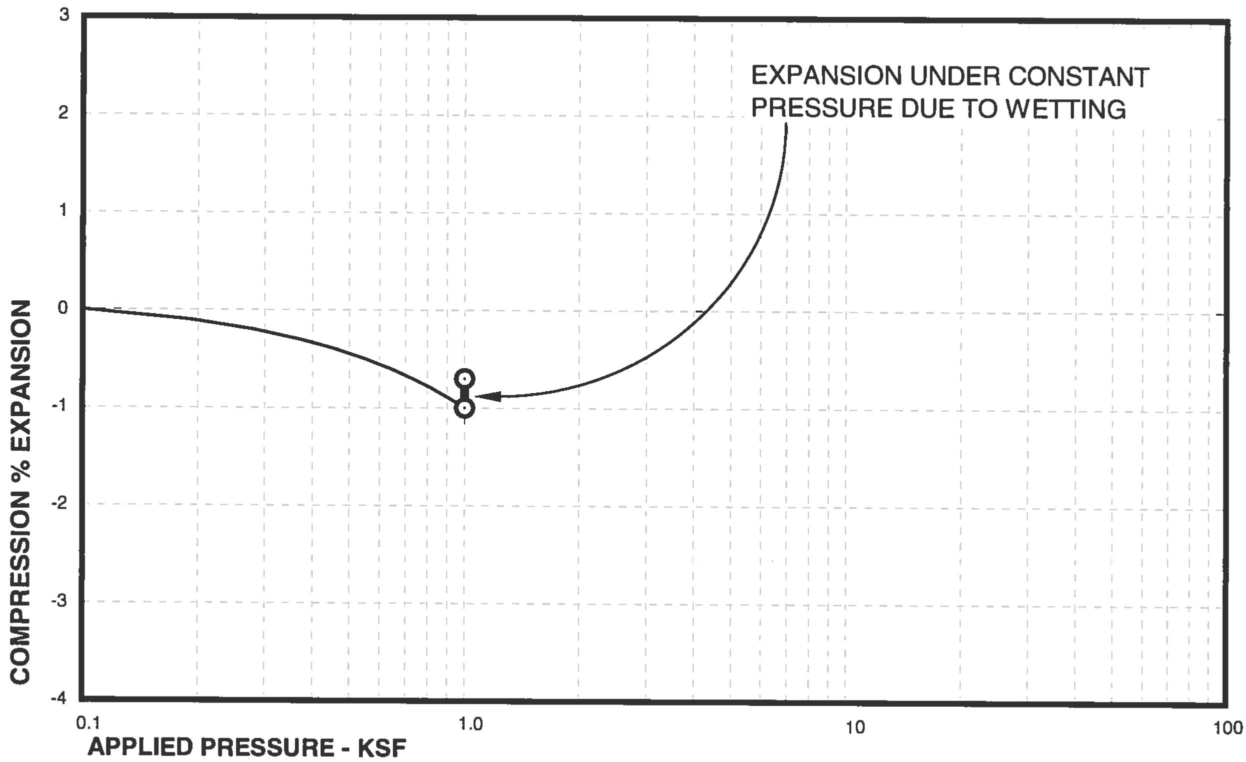
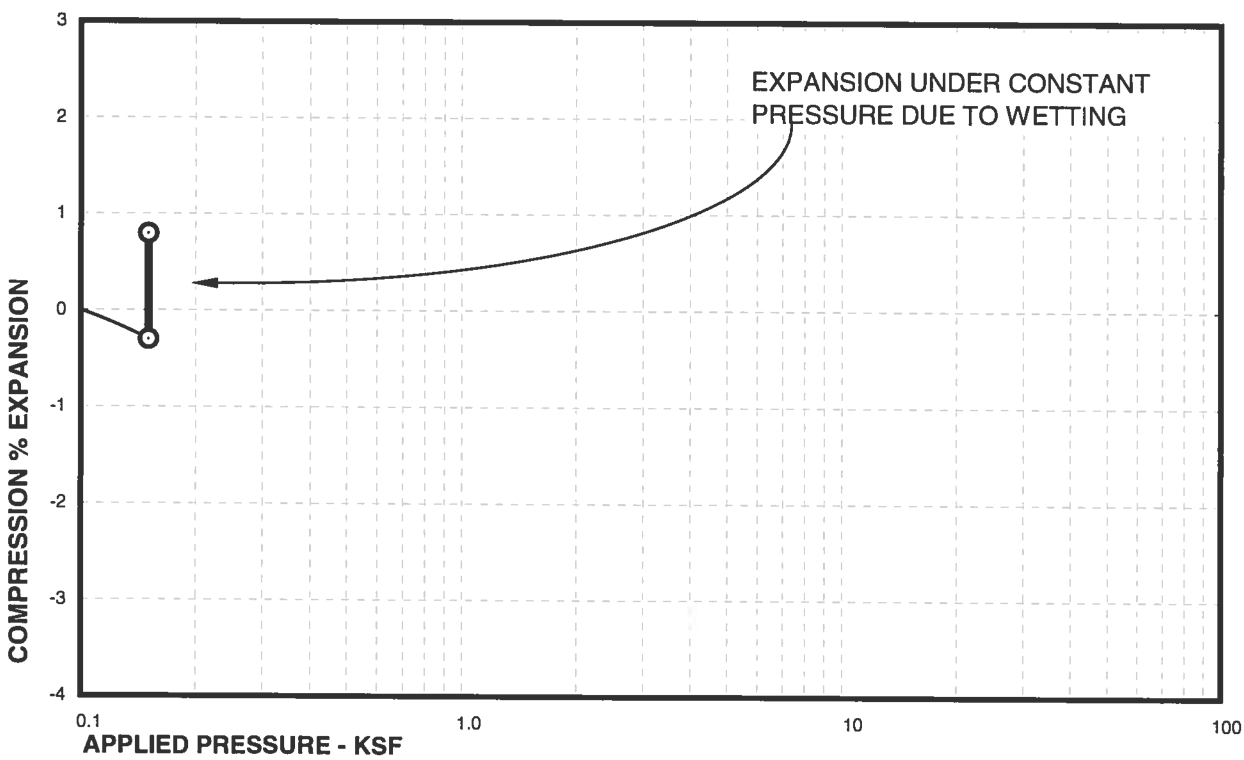
Swell Consolidation Test Results

FIGURE B-7



Sample of FILL, SAND, CLAYEY (SC)
From TH - 21 AT 4 FEET

DRY UNIT WEIGHT= 112 PCF
MOISTURE CONTENT= 14.7 %



Sample of FILL, CLAY, SANDY (CL)
From TH - 25 AT 2 FEET

DRY UNIT WEIGHT= 109 PCF
MOISTURE CONTENT= 18.5 %

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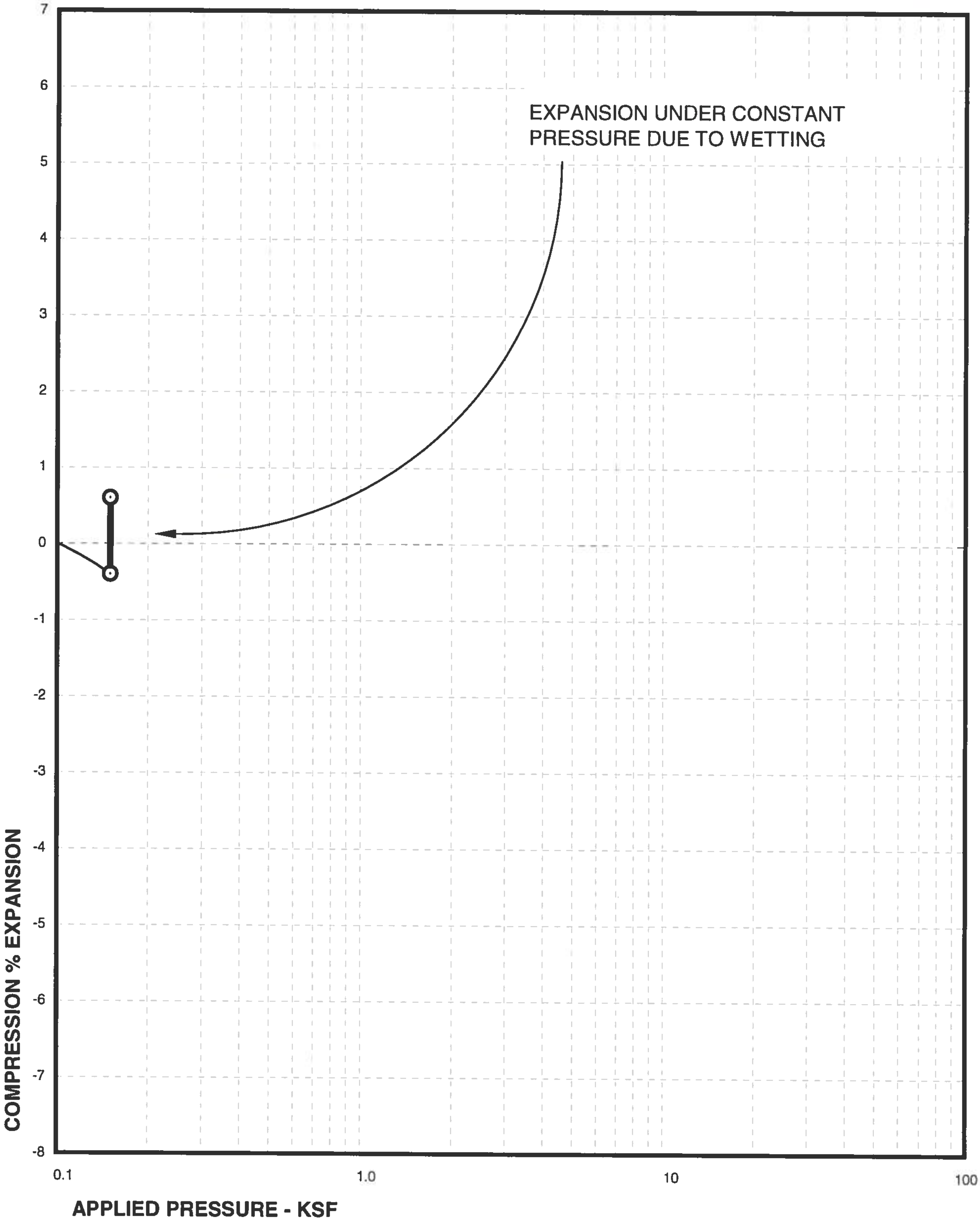
Swell Consolidation Test Results

FIGURE B-8



Sample of SAND, CLAYEY (SC)
From TH - 28 AT 2 FEET

DRY UNIT WEIGHT= 111 PCF
MOISTURE CONTENT= 17.3 %

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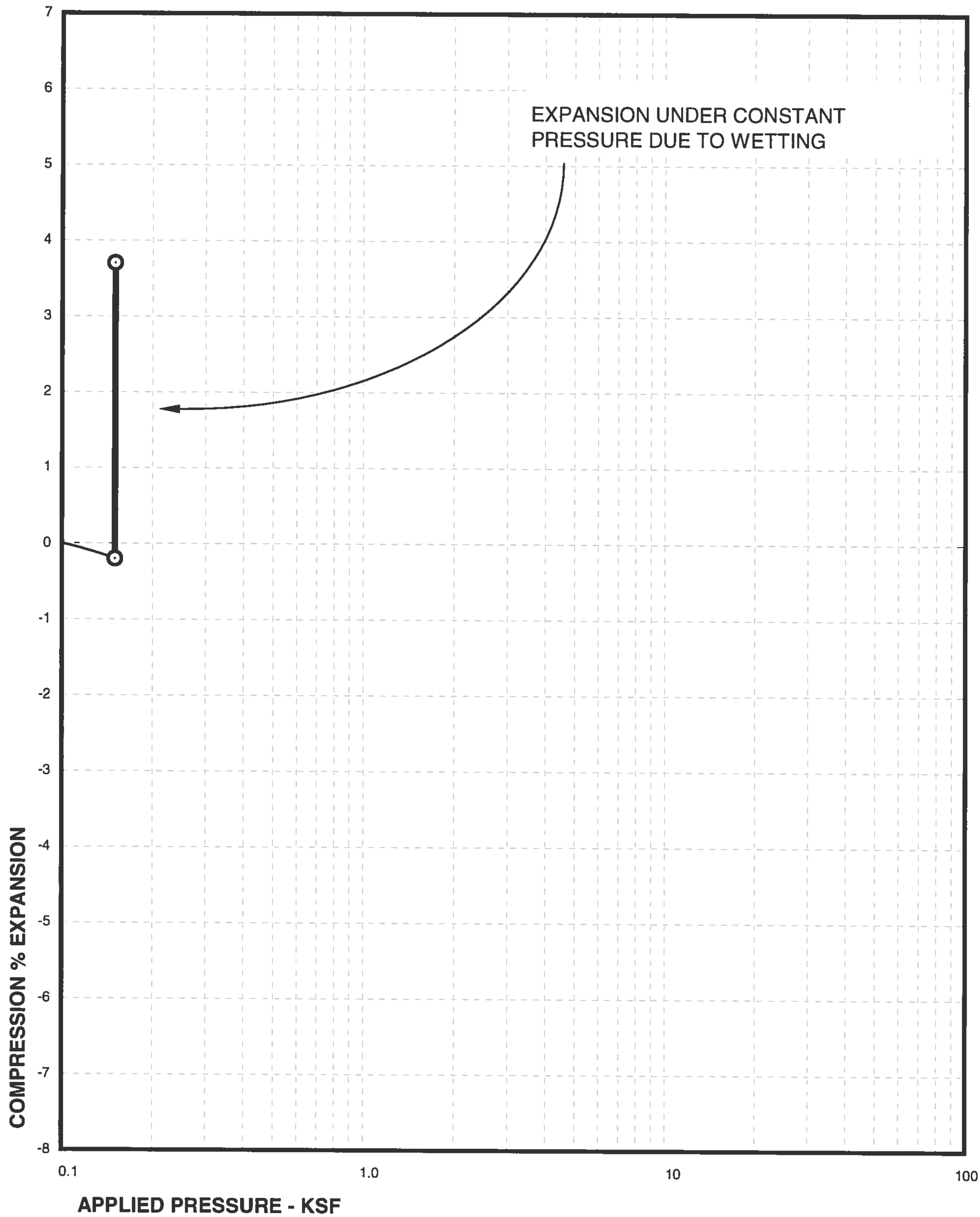
Swell Consolidation Test Results

FIGURE B-9



Sample of SAND, CLAYEY (SC)
From TH - 33 AT 2 FEET

DRY UNIT WEIGHT= 110 PCF
MOISTURE CONTENT= 10.5 %

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Swell Consolidation Test Results

FIGURE B-10

TABLE B-I

SUMMARY OF LABORATORY TESTING

BORING	DEPTH (FEET)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	ATTERBERG LIMITS		SWELL TEST RESULTS			PASSING NO. 200 SIEVE (%)	WATER-SOLUBLE SULFATES (%)	DESCRIPTION
				LIQUID LIMIT	PLASTICITY INDEX	SWELL (%)	APPLIED PRESSURE (PSF)	SWELL PRESSURE (PSF)			
TH-1	2	11.9	110			7.3	150	9,300			SAND, CLAYEY (SC)
TH-2	4	9.4	104						39.9		SAND, CLAYEY (SC)
TH-3	2	11.1	108	36	22				52.1		CLAY, SANDY (CL)
TH-4	9	19.9	106			5.6	150				CLAY, SANDY (CL)
TH-6	2	16.2	113			8.0	150	8,300			CLAY, SANDY (CL)
TH-7	2	8.1	109			4.7	150				FILL, CLAY, SANDY (CL)
TH-9	2	11.4	106						45.4		FILL, SAND, CLAYEY (SC)
TH-11	4	15.3	108							0.06	SAND, CLAYEY (SC)
TH-12	19	10.7	119			0.5	1,000				CLAY, SANDY (CL)
TH-13	9	15.1	111			4.0	1,000				CLAY, SANDY (CL)
TH-14	2	11.6	102	37	22				49.7		SAND, CLAYEY (SC)
TH-16	4	9.2	115			0.0	1,000				FILL, SAND, CLAYEY (SC)
TH-17	9	13.5	114						29.6		SAND, SILTY (SM)
TH-18	4	6.3	104							0.01	SAND, CLAYEY (SC)
TH-19	2	9.2	108			1.8	150				SAND, CLAYEY (SC)
TH-21	4	14.7	112			0.3	1,000				FILL, SAND, CLAYEY (SC)
TH-24	9	10.4	112						28.8		SAND, CLAYEY (SC)
TH-25	2	18.5	109			1.1	150				FILL, CLAY, SANDY (CL)
TH-27	4	13.6	114	31	14				42.4		SAND, CLAYEY (SC)
TH-28	2	17.3	111			1.0	150				SAND, CLAYEY (SC)
TH-30	2	10.9	112							<0.01	SAND, CLAYEY (SC)
TH-32	2	11.8	117	28	10				41.6		SAND, CLAYEY (SC)
TH-33	2	10.5	110			3.9	150				SAND, CLAYEY (SC)

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 or AASHTO T 99.

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 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 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 laboratory 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 10 feet	0 to +3	95% of ASTM D 698 or AASHTO T 99
Sand		-2 to +2	95% of ASTM D 698 or AASHTO T 99
Clay	Greater than 10 feet	-2 to +2	98% of ASTM D 698 or AASHTO T 99
Sand		-2 to +2	98% of ASTM D 1557 or AASHTO T 180

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 dry density as determined in accordance with ASTM D 1557 or AASHTO T 180 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. <u>COMPACTION OF SLOPES</u>

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. <u>PLACEMENT OF FILL ON NATURAL SLOPES</u>

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. <u>DENSITY TESTS</u>

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. <u>SEASONAL LIMITS</u>

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.