Junior Seminary Storm Drain Fee

DATE: May 27, 1998

Area (ac.)	Basin Fee /ac.	Subtotal	Past Payment Credit (1.72%)	Future Payment Credit	Total Fee
0.690	$6,926.00	$4,778.94	($82.20)	($59.99)	$4,636.75

Post-it® Fax Note 7671

To Paul Evans	Date 5/27/98	# of pages ▶		
Co./Dept. Dennis Bowker	From Ivan Hooker			
Phone #	Co. Riverton City			
Fax # 424-3217	Phone #			
	Fax #			

RECEIPT NO: 2.608 MARCH 30, 1998

DENIS BUTLER ASSOC-JR SEMINARY

PLANNING FEES-76000		760.00
PLANNING FEES-13508 S 4000 W		75.00
PLANNING FEES-ADVERTIS FEES		1.00
TOTAL:	$	836.00
CHECK CHK NO: 3454		836.00
AMOUNT APPLIED:		836.00
CHANGE TENDERED	$	.00

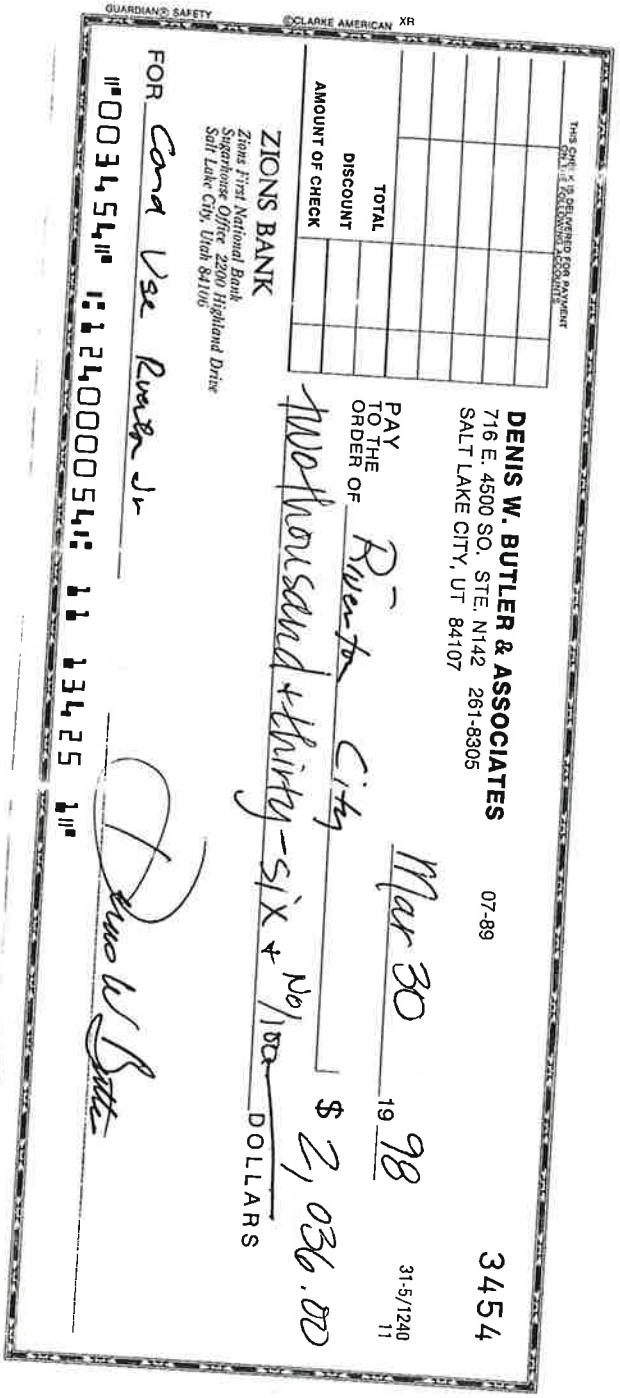
RIVERTON CITY CORPORATION
12765 SOUTH 1400 WEST
P.O. BOX 429
RIVERTON UT 84065 PHONE: 254-0704

RECEIPT NO: 2.609 MARCH 30, 1998

DENIS BUTLER JR SEMINARY

ENGINEERING FEES-SITE PLAN FEES		1,200.00
TOTAL:	$	1,200.00
CHECK CHK NO: 3454		1,200.00
AMOUNT APPLIED:		1,200.00
CHANGE TENDERED	$	.00

Eng.



CONSULTING ENGINEERS
AND LANDSURVEYORS

GREAT BASIN ENGINEERING - NORTH
3544 Lincoln Avenue • Suite #11 • P.O. Box 9307 • Ogden, Utah 84409
(801) 394-4515 • (801) 521-0222 • Fax (801) 392-7544

Calculated by: R. Jefferies
March 25, 1998

Riverton UT Junior Seminary
Storm Water Study

Drainage Areas

Drainage Area No. 1 includes the parking lot , the building, and any landscaping which will runoff into the parking lot. The undetained area is the area which will freely flow off the site (primarily the South and East part of the property).

Area No. 1	-	0.250 ac
Undetained Area	-	0.436 ac
Overall Area	-	0.686 ac

Coefficient of Runoff (use *ASCE Manual No.37*)

Asphalt Paving	-	Use C = 0.9
Landscaping	-	Use C = 0.1

Composite C for Area 1 w/ 18% landscaping	-	Use C = 0.76
Undetained Area w/ 100% landscaping	-	Use C = 0.1

Time of Concentration (use *Design* by Seelye)

Area No. 1	-	33' ± over grass @ S = 3.0%±	t_c = 7.7 min
	-	44' ± over paving @ S = 1.25%±	t_c = 3.5 min
			t_c = 11.2 min
Undetained Area	-	87'± over paving @ S = 6.67%±	t_c = 9.7 min

Rainfall Intensities (use data from *208 Report Precipitation – Duration & Return Period Analysis – Salt Lake County, Jan. 1977* - Weather Bank, Inc.)

Time	10-yr	100-yr	Time	10-yr	100-yr
9.7 min.	2.0 in./hr.	3.20 in./hr.	1 hr.	0.80 in./hr.	1.22 in./hr.
11.2 min	1.97 in./hr.	3.04 in./hr.	6 hr.	0.21 in./hr.	0.31 in./hr.
15 min	1.80 in./hr.	2.80 in./hr.	12 hr.	0.14 in./hr.	0.21 in./hr.
30 min	1.28 in./hr.	2.00 in./hr.	24 hr.	0.09 in./hr.	0.13 in./hr.

Peak Flows (use "Rational Method", Q=CiA , for 10-yr)

Area No. 1 - (0.76)(1.97)(0.250) = 0.37 cfs
Undetained Area - (0.1)(2.0)(0.436) = 0.09 cfs

Allowable Discharge

Use standard of 0.2 cfs/acre.
Allowable Discharge = 0.686 acres @ 0.2 cfs/acre = 0.14 cfs
Less Peak Flow from Undetained Area 0.09 cfs
Net Allowable Discharge = 0.05 cfs

Volume of Runoff (use "Rational Method", V=CiAt , for 10-yr)

Area No. 1: C = 0.76 A = 0.250 ac

Time (min)	Accumulated Volume (cf)	Allowable Discharge (@ 0.05 cfs) (cf)	Needed Detention (cf)	Comments
5	137	15	122	
9.7	221	29	192	
11.2	252	34	218	
15	308	45	263	
30	438	90	348	
60	547	180	367	peak detention
360	862	1,080	-218	(> 175 cf !!)
720	1,149	2,160	-1,011	
1440	1,477	4,320	-2,843	

With no changes made, the current parking lot capacity is 175 cubic feet. The needed capacity is greater than this amount.

Pipe Sizing (use "Manning's Equation" for full flowing pipes)

$$Q = \frac{1.486}{n} AR^{2/3}S^{1/2}$$

Pipe Segment	Pipe Size	Pipe Slope (%)	Pipe Capacity	Design Flow	Comments
AB	8" PVC	0.5	1.01 cfs	0.05 cfs	ok

Outlet Control

Bolt ¼" thick galvanized steel plate to wall of catch basin B over discharge pipe with a 1.0 – inch diameter hole cut in plate concentric with discharge pipe.

Use Orifice Equation: $Q = C_d A_o \sqrt{2gh}$

$$0.05 \text{ cfs} = 0.62 A_o \sqrt{2(32.2 \text{ ft/s}^2)(4.07 \text{ ft})}$$
$$A_o = 0.00498 \text{ ft}^2 = 0.717 \text{ in}^2$$
$$\pi d^2/4 = 0.717 \text{ in}^2$$
$$d = 0.96\text{in.} \sim \underline{1.0 \text{ inches}}$$

Recommendations

The parking lot storage capacity must be increased to at least 367 cubic feet. To do this, raise the ponding depth of the parking lot 0.2 feet by raising the south top of curb elevation in the entrance by 0.2 feet, making it 58.90. This will allow a 0.5 foot ponding depth in the lot and provide a 587 cubic feet capacity. Also note that the discharge pipe can be an 8" size instead of the 10".

Applied Geotechnical Engineering Consultants, Inc.

GEOTECHNICAL INVESTIGATION

RIVERTON UTAH JUNIOR SEMINARY

13508 SOUTH 4000 WEST

RIVERTON, UTAH

CITY COPY

PREPARED FOR:

THE CHURCH OF JESUS CHRIST OF LATTER-DAY SAINTS
c/o DENIS W. BUTLER AND ASSOCIATES
2061 EAST MURRAY-HOLLADAY ROAD
SALT LAKE CITY, UTAH 84117

ATTENTION: DENIS BUTLER

PROJECT NO. 983025

FEBRUARY 10, 1998

600 West Sandy Parkway • Sandy, Utah 84070 • (801) 566-6399 • FAX (801) 566-6493

TABLE OF CONTENTS

CONCLUSIONS

1. The subsurface soils encountered at the site consist of approximately 1 foot of topsoil in Borings B-3 and B-4 and approximately ½ to 1½ feet of fill in Borings B-1, B-2 and B-5. The fill and topsoil are underlain by clay which extends to depths ranging from approximately 3 to 6 feet below the existing ground surface. Gravel was encountered below the clay and extends the full depth investigated, approximately 20½ feet.

2. No subsurface water was encountered to the maximum depth investigated.

3. The proposed building may be supported on spread footings bearing on the undisturbed natural soil or on compacted structural fill and may be designed for a net allowable bearing pressure of 2,000 pounds per square foot. Footings bearing on at least 2 feet of compacted structural fill may be designed for a net allowable bearing pressure of 3,500 pounds per square foot.

4. A pavement section consisting of 3 inches of asphaltic concrete overlying 6 inches of high quality base course may be used for the pavement section. A rigid pavement section consisting of 5 inches of Portland cement concrete may be used as an alternative.

5. Geotechnical information related to foundations, subgrade preparation, pavement design and materials are included in the report.

SCOPE

This report presents the results of a Geotechnical Investigation for the proposed Riverton Utah Junior Seminary building to be constructed at approximately 13508 South 4000 West in Riverton, Utah. The report presents the subsurface conditions encountered, laboratory test results and recommendations for foundations and pavement. The study was conducted in general accordance with our proposal dated January 16, 1998.

Field exploration was conducted to obtain information on the subsurface conditions and to obtain samples for laboratory testing. Information obtained from the field and laboratory was used to define conditions at the site and to develop recommendations for the proposed foundations and pavement.

This report has been prepared to summarize the data obtained during the study and to present our conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. Design parameters and a discussion of geotechnical engineering considerations related to construction are included in the report.

SITE CONDITIONS

At the time of our field investigation, the site was being used as a staging area for construction of the middle school to the north of the site. There were piles of fill, up to approximately 10 feet in height, located in the southwest portion of the property and lesser thicknesses of fill scattered throughout much of the property. There are construction trailers parked in the area proposed for the building and construction materials stored on the property.

The ground surface of the site is relatively flat and slopes gently down toward the east. The U.S. Geological Survey map of the site indicates that a representative elevation of the site is 4,660. However, the topography of the southwest portion of the site has been significantly modified by the fill which has been stockpiled on the property.

Most of the vegetation has been removed from the site. There was some topsoil encountered in Borings B-3 and B-4.

There is a field to the south of the property, piles of fill to the west and the middle school, which is under construction, to the north. The east edge of the property is bordered by 4000 West Street which is an asphalt paved road in good condition.

FIELD STUDY

The field study was conducted on January 27, 1998. Four borings were drilled in the general area of the proposed building and one boring was drilled in the area of proposed parking. A second boring could not be drilled in the area of the parking due to the large amount of fill which has been stockpiled in this area.

The borings were drilled with 8-inch diameter hollow stem auger powered by an all-terrain drill rig. The borings were logged and soil samples obtained by an engineer from AGEC. Logs of the subsurface conditions encountered in the borings are graphically shown on Figure 2 with Legend and Notes of Figure 3.

SUBSURFACE CONDITIONS

The subsurface soils encountered at the site consist of approximately 1 foot of topsoil in Borings B-3 and B-4 and approximately ½ to 1½ feet of fill in Borings B-1, B-2 and B-5. The fill and topsoil are underlain by clay which extends to depths of approximately 3 to 6 feet below the existing ground surface. Gravel was encountered below the clay and extends the full depth investigated.

A description of the soil encountered follows:

Fill - The fill consists of lean clay with sand and gravel. It is moist and brown in color.

Topsoil - The topsoil consists of lean clay which is moist, brown in color and contains roots and organics.

Clay - The clay contains a small to large amount of sand and some silt layers. It is stiff to very stiff, moist and light brown to brown in color.

Laboratory tests performed on samples of the clay indicate that it has natural moisture contents ranging from 12 to 20 percent and natural dry densities ranging from 101 to 106 pounds per cubic foot (pcf). Consolidation tests performed on samples of the clay indicate that it will compress a small to moderate amount with the addition of light to moderate loads. Results of the consolidation tests are presented on Figures 4 and 5. An unconfined compressive strength of 2,450 pounds per square foot (psf) was measured for a sample of the clay tested in the laboratory.

Gravel - The gravel is silty and contains a moderate amount of sand, occasional cobbles and occasional clay layers. A sand layer was encountered in Boring B-1 between depths of approximately 14 to 17½ feet. The sand and gravel is medium dense to dense, moist and light brown in color.

Laboratory tests performed on samples of the sand and gravel indicate that it has natural moisture contents ranging from 8 to 19 percent and a natural dry density of 110 pcf. Results of a gradation test performed on a sample of the gravel are presented on Figure 6.

A summary of the laboratory test results is presented on Table I. Test results are included on the Logs of the Exploratory Borings.

SUBSURFACE WATER

No subsurface water was encountered to the maximum depth investigated, approximately 20½ feet.

PROPOSED CONSTRUCTION

We understand that a seminary building will be constructed at the site. We anticipate that the structure will be a single-story building with slab on grade. We have assumed wall loads will be less than 3 kips per lineal foot and column loads will be less than 50 kips. We have assumed traffic in proposed parking areas will consist predominantly of cars with occasional trucks and 2 garbage trucks per week.

If the building loads or traffic are significantly different from those described above, we should be notified so that we can re-evaluate the recommendations given.

RECOMMENDATIONS

Based on the subsurface conditions encountered, laboratory test results, and the proposed construction, the following recommendations are given:

A. Site Grading

Based on the site grading plans provided, the building pad area will be raised approximately 5 to 7 feet above the existing grade. The site grading fill should be placed as soon as practical prior to building construction.

1. Excavation

We anticipate that excavation at the site can be accomplished with typical excavation equipment. Difficult excavation can be expected in the gravel, particularly for confined excavations such as for utilities and may required heavy-duty excavation equipment.

2. Subgrade Preparation

Prior to placing grading fill or base course, all topsoil, organics, existing fill and other deleterious material should be removed. The subgrade should be scarified to a depth of 8 inches, the moisture adjusted to within 2 percent of the optimum moisture content and compacted to at least 90 percent of the maximum dry density as determined by ASTM D-1557. The subgrade should then be proof-rolled to identify soft areas. Soft areas should be removed and replaced with gravel with less than 15 percent passing the No. 200 sieve.

The near surface soil consists of clay which may result in access difficulties at times where the upper soil is very moist or wet, such as during the winter or spring or after periods of rainfall. The subgrade should not be scarified when the upper soil is very moist, but should be cut to undisturbed natural soil. Placement of granular fill will improve site access during times when the upper soil is very moist.

3. Materials

Listed below are materials recommended for structural fill.

Fill to Support	Recommendation
Footings	Non-expansive granular soil -200 <35%, LL < 30% Maximum size 4 inches
Floor Slabs (Upper 4 inches)	Sand and Gravel -200 <5% Maximum size 2 inches

Fill to Support	Recommendation
Slab Support	Non-expansive granular soil -200 < 50%, LL < 30% Maximum size 6 inches

The upper on-site soil consists predominately of clay and is not suitable for use as structural fill below the proposed building. It may be used below pavement or as utility trench backfill if the topsoil, organics and other deleterious materials are removed or it may be used in landscaped areas. The natural sand and gravel exclusive of over-sized material may be used as structural fill below the building and also for site grading fill.

4. Compaction

Compaction of materials placed at the site should equal or exceed the minimum densities as indicated below when compared to the maximum dry density as determined by ASTM D-1557.

Fill to Support	Compaction
Foundations	≥ 95%
Concrete Flatwork and Pavement	≥ 90%
Landscaping	≥ 85%
Retaining Wall Backfill	85 to 90%

To facilitate the compaction process, the fill should be compacted at a moisture content within 2 percent of the optimum moisture content.

The base course should be compacted to at least 95 percent of the maximum dry density as determined by ASTM D-1557.

5. Drainage

The ground surface surrounding the proposed building should be sloped away from the building in all directions. Roof down spouts and drains should discharge beyond the limits of backfill.

The collection and diversion of drainage away from the pavement surface is important to the satisfactory performance of the pavement section. Proper drainage should be provided.

B. Foundations

1. Bearing Material

With the proposed construction and the subsurface conditions encountered, we recommend that the building be supported on the undisturbed natural soil or on compacted structural fill extending down to the undisturbed natural soil. The topsoil and any fill should be removed from below proposed building areas. Structural fill placed below foundations should extend out away from the edge of footings a distance equal to the depth of fill beneath footings.

2. Bearing Pressure

Spread footings bearing on the undisturbed natural soil or on compacted structural fill may be designed for a net allowable bearing pressure of 2,000 psf. Spread footings bearing on at least 2 feet of compacted structural fill may be designed for a net allowable bearing pressure of 3,500 psf. Footings should have a width of at least 18 inches and a depth of embedment of at least one foot.

3. Temporary Loading Conditions

The allowable bearing pressure may be increased by one-half for temporary loading conditions such as wind or seismic loads.

D. Lateral Earth Pressure

1. Lateral Resistance for Footings

Lateral resistance for footings placed on the natural soil or on compacted structural fill is controlled by sliding resistance between the footing and the foundation soils. A friction value of 0.3 may be used in design for ultimate lateral resistance for footings.

2. Subgrade Walls and Retaining Structures

The following equivalent fluid weights are given for the design of subgrade walls and retaining structures. The active condition is where the wall moves away from the soil. The passive condition is where the wall moves into the soil and the at-rest condition is where the wall does not move. The values listed below assume a horizontal surface adjacent the wall.

Soil Type	Active	At-Rest	Passive
Sand and Gravel	35 pcf	50 pcf	350 pcf
Clay	40 pcf	55 pcf	250 pcf

3. Seismic Conditions

Under seismic conditions, the lateral earth pressure should be increased by 20 pcf for active and at rest conditions and decreased by 20 pcf for passive conditions. This assumes a horizontal ground acceleration of 0.22g. This acceleration corresponds to a 10 percent probability that the acceleration will be exceeded in 50 years.

4. Safety Factors

The values recommended above assume full mobilization of the soil to achieve ultimate soil strength. Conventional safety factors used for structural analysis for such items as overturning and sliding resistance should be used in design.

E. Seismicity and Liquefaction

The site is located in an area mapped as having a "very low" liquefaction potential. The subsurface conditions encountered are consistent with this designation. Liquefaction is not considered a hazard for the proposed development.

Based on the location of the site, we recommend that the building be designed and constructed to at least meet the Uniform Building Code Seismic Zone 3 criteria using a soil profile type "S_D".

F. Water Soluble Sulfates

One sample of the natural soil was tested in the laboratory for water soluble sulfate content. Based on the results of the test and published literature, the natural soil possesses negligible sulfate attack potential on concrete. No special cement type is required for concrete placed in contact with the natural soil. Other conditions may dictate the type of cement to be used in concrete for the project.

G. Pavement

Based on the subsoil conditions encountered, laboratory test results and the assumed traffic the following pavement support recommendations are given.

1. Subgrade Support

   The near surface soil consists of clay. A California Bearing Ratio (CBR) of 3 percent was used for the pavement analysis.

2. Pavement Thickness

   Based on the subsurface conditions encountered, anticipated traffic consisting predominantly of car traffic with occasional delivery trucks and 2 garbage trucks per week, a design life of 20 years and methods presented by the Utah Department of

Transportation and the Portland Cement Concrete Association, a pavement section consisting of 3 inches of asphaltic concrete overlying 6 inches of high quality base course is recommended. As an alternative, a rigid pavement consisting of 5 inches of Portland cement concrete placed on a prepared subgrade could be used.

3. Pavement Material

a. Flexible Pavement (asphaltic concrete)

The pavement material should meet the Utah Department of Transportation specifications for gradation and quality. The pavement thicknesses indicated above assumes that the base course is high quality material with a CBR of at least 80 percent. Other material may be considered for use in the pavement section. The use of other materials may result in different pavement material thicknesses.

b. Rigid Pavement (Portland cement concrete)

The design assumed that a concrete shoulder or curb will be placed at the edge of the pavement and that the pavement will have aggregate interlock joints. Pavement materials should meet the Utah Department of Transportation specifications. The pavement thicknesses indicate above assume that the concrete will have a 28 day compressive strength of 4,000 psi. Concrete should be air entrained with approximately 6 percent air. Maximum allowable slump will depend on the method of placement, but should not exceed 4 inches.

4. Jointing

All joints for concrete pavement should be laid out in square or rectangular patterns. Joint spacings should not exceed 30 times the thickness of the slab. The depth of the joints should be approximately one-quarter of the slab thickness.

H. Topsoil Testing

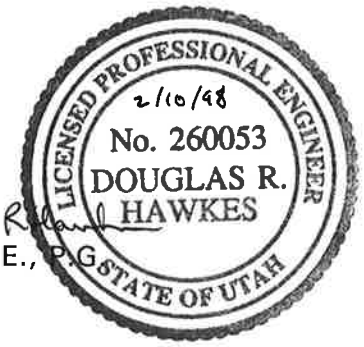
Testing of the upper soil for use as topsoil is in progress and results will be submitted once they become available.

LIMITATIONS

This report has been prepared in accordance with generally accepted soil and foundation engineering practices in the area for the use of the client for design purposes. The conclusions and recommendations included in the report are based on the information obtained from the borings drilled at the locations indicated on Figure 1 and the data obtained from laboratory testing. Variations in the subsurface conditions may not become evident until additional excavation is conducted. If the subsurface conditions or groundwater level are found to be significantly different from those described above, we should be notified to re-evaluate our recommendations.

We recommend that on-site observation of footing excavations and pavement subgrade be conducted by a representative of Applied Geotechnical Engineering Consultants, Inc. Fill placed for the project should be frequently tested for compaction.

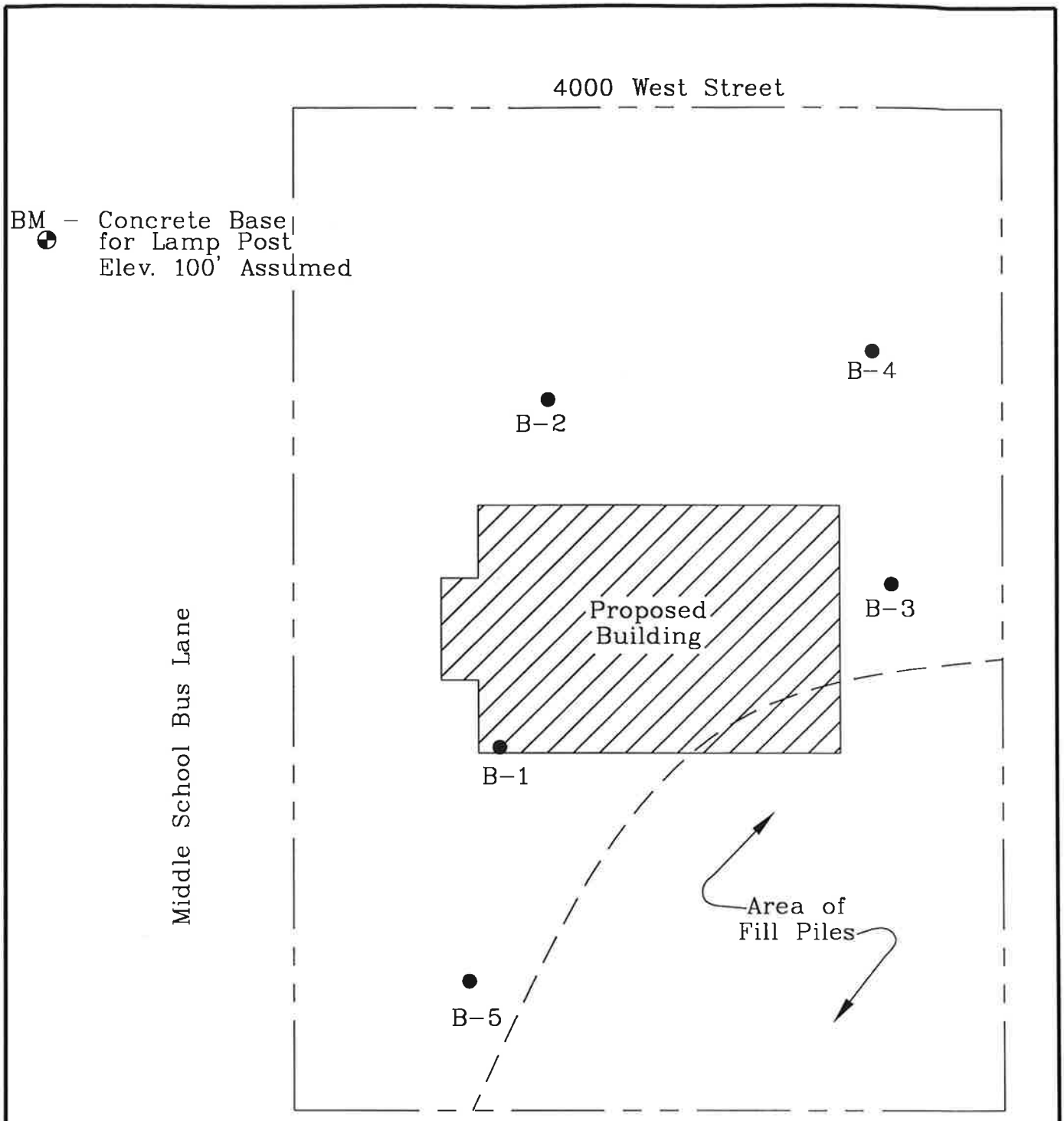
APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.



Douglas R. Hawkes, P.E., P.G.

Reviewed by Jay R. McQuivey, P.E.

DRH/cs

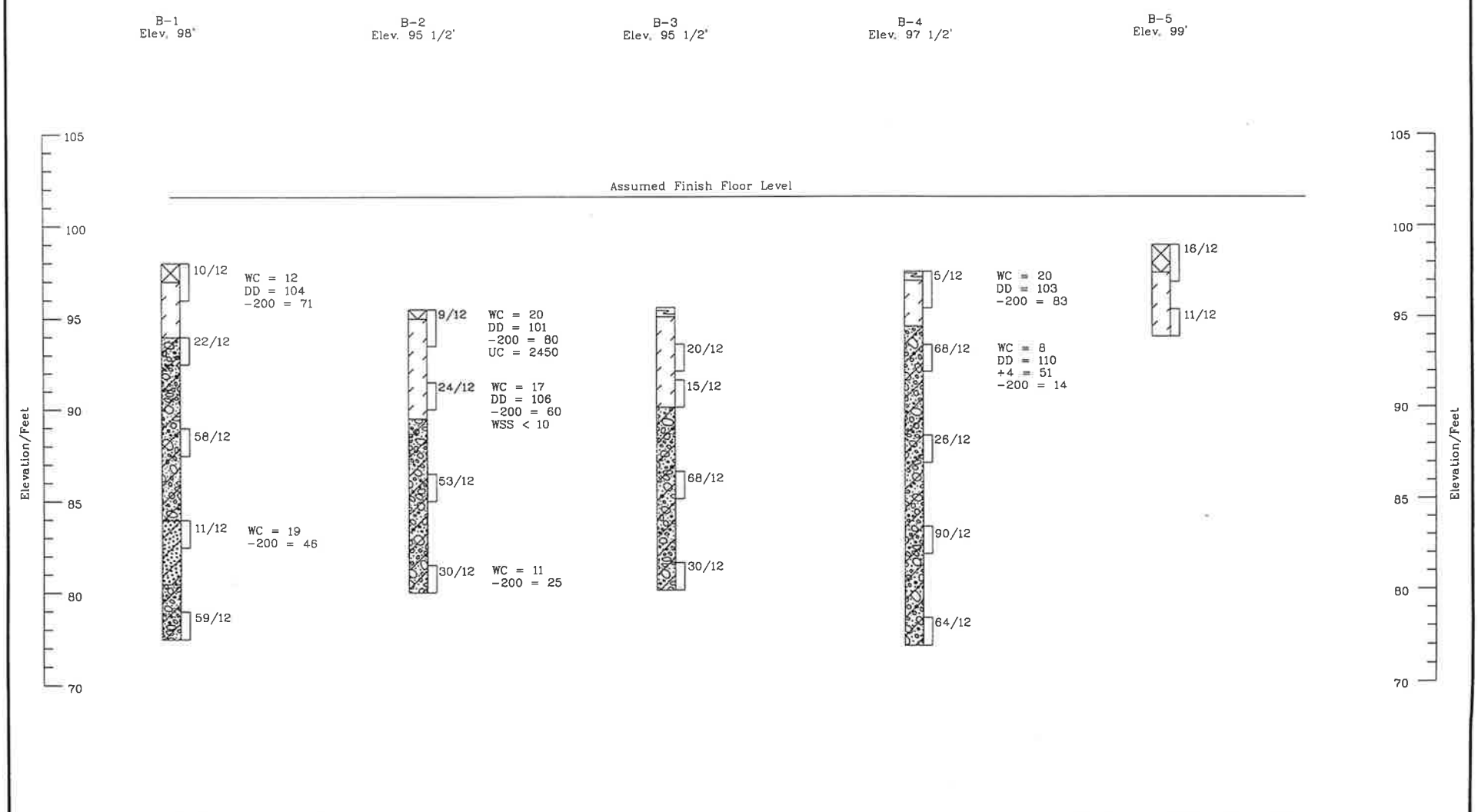


PROPOSED RIVERTON, UTAH JUNIOR SEMINARY
13508 SOUTH 4000 WEST
RIVERTON, UTAH

N

0 30 60 feet
Approximate Scale

983025	AGEC	Locations of Exploratory Borings	Figure 1



Approximate Vertical Scale 1" = 8'

See Figure 3 for Legend and Notes

983025 | AGES | Logs of Exploratory Borings | Figure 2

LEGEND:

Fill; lean clay with sand and gravel, moist, brown.

Topsoil; lean clay, moist, brown, roots, organics.

Lean Clay (CL); small to large amount of sand, some silt layers, stiff to very stiff, moist, light brown to brown.

Silty Sand (SM); medium dense, moist, light brown.

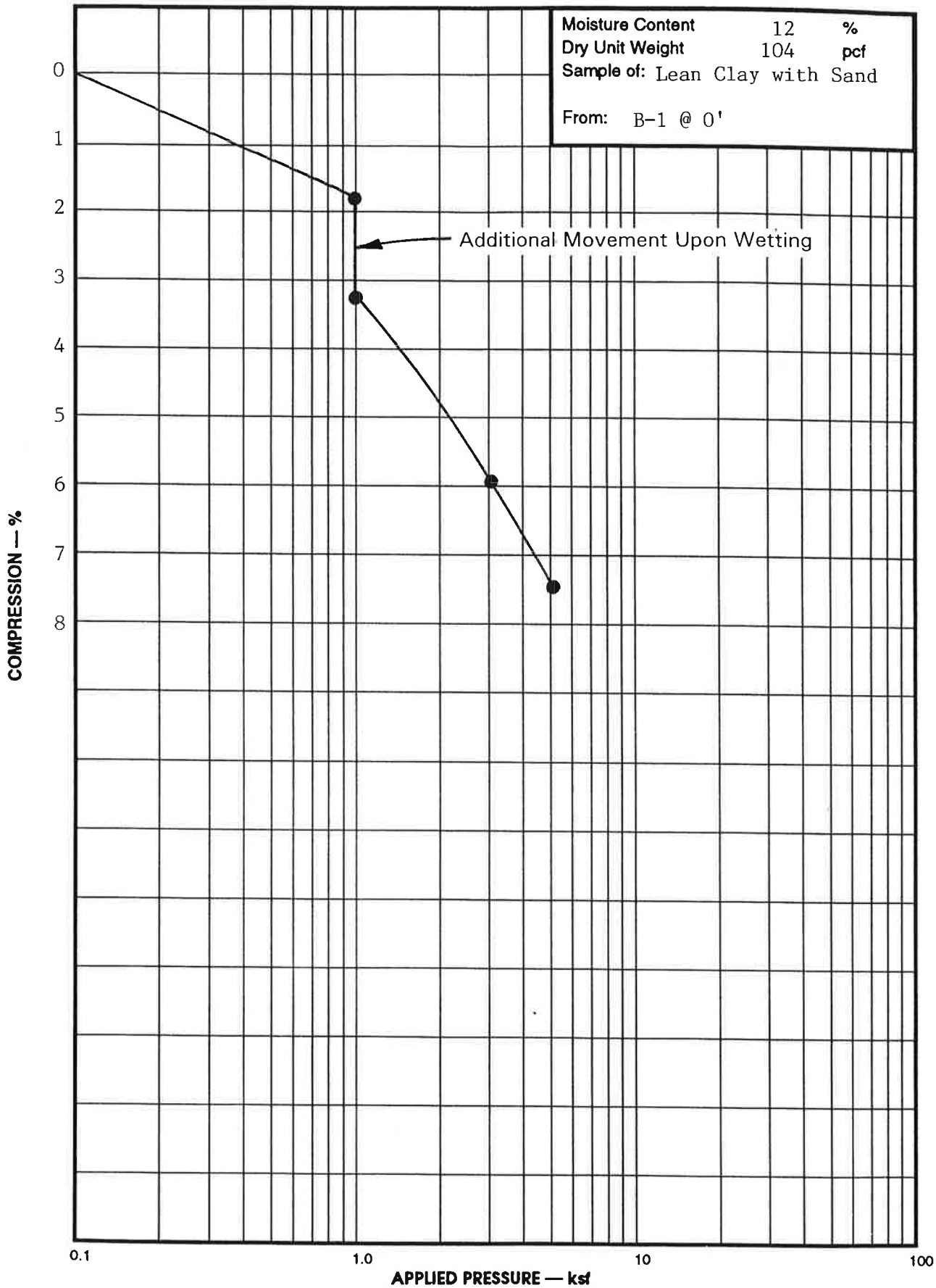
Silty Gravel with Sand (GM); occasional cobbles, occasional clay layers, medium dense to dense, moist, light brown.

10/12 California Drive sample taken. The symbol 10/12 indicates that 10 blows from a 140 pound automatic hammer falling 30 inches were required to drive the sampler 12 inches.

NOTES:

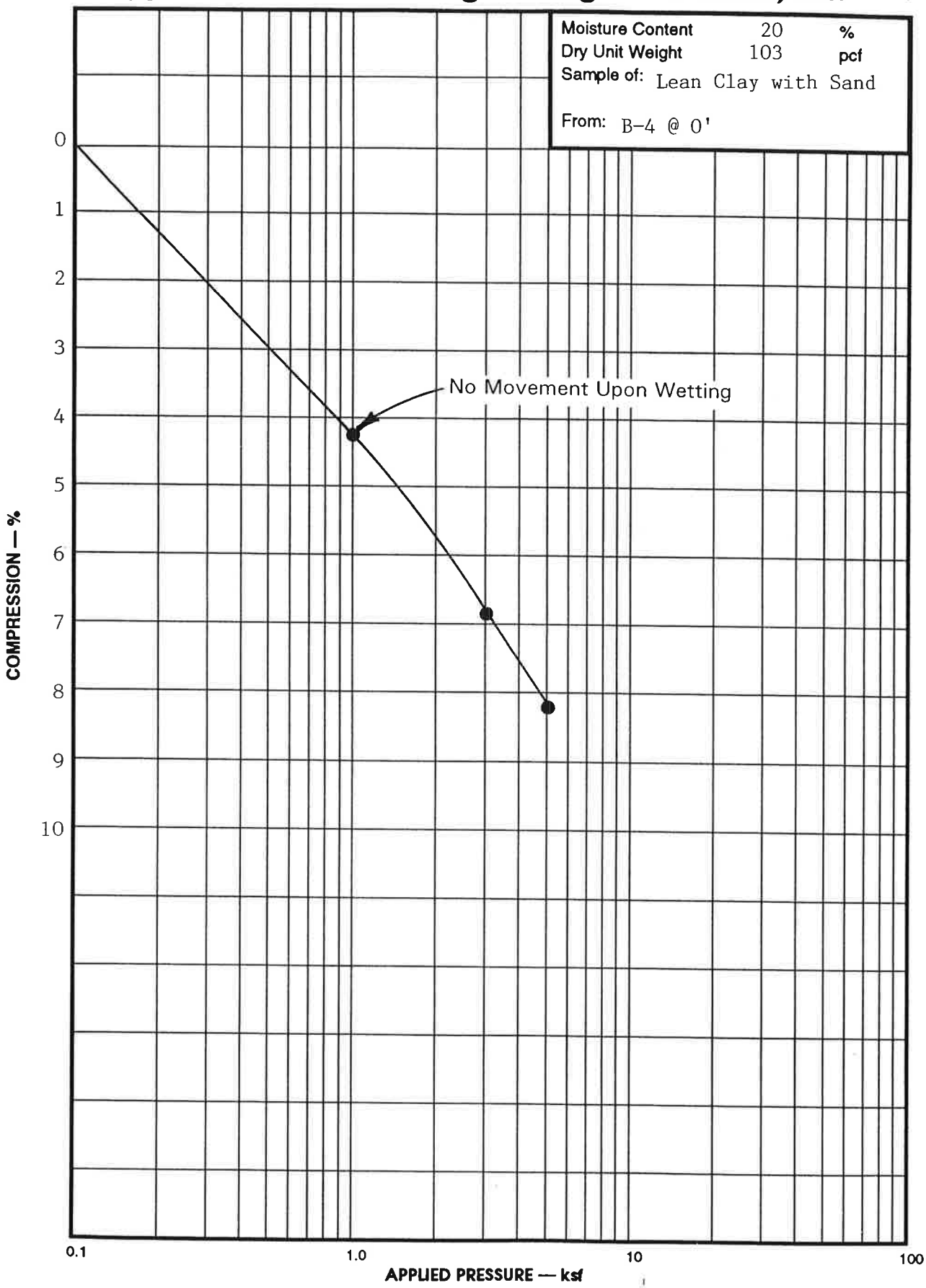
1. Borings were drilled on January 27, 1998 with 8-inch diameter hollowstem auger.
2. Locations of borings were measured approximately by pacing from features shown on the site plan provided.
3. Elevations of borings were measured by hand level and refer to the bench mark shown on Figure 1.
4. The boring locations and elevations should be considered accurate only to the degree implied by the method used.
5. The lines between the materials shown on the boring logs represent the approximate boundaries between material types and the transitions may be gradual.
6. No free water was encountered in borings at the time of drilling.
7. WC = Water Content (%);
   DD = Dry Density (pcf);
   +4 = Percent Retained on No. 4 Sieve;
   −200 = Percent Passing No. 200 Sieve;
   UC = Unconfined Compressive Strength (psf);
   WSS = Water Soluble Sulfates (ppm).

Applied Geotechnical Engineering Consultants, Inc.



Project No. 983025 **CONSOLIDATION TEST RESULTS** Figure 4

Applied Geotechnical Engineering Consultants, Inc.



Project No. 983025 **CONSOLIDATION TEST RESULTS** Figure 5