Applied GeoTech

GEOTECHNICAL INVESTIGATION

PROPOSED WRESTLING ROOM
AND SHOP BUILDING ADDITIONS

MANTI HIGH SCHOOL

100 WEST 500 NORTH
MANTI, UTAH

PREPARED FOR:

SOUTH SANPETE SCHOOL DISTRICT
C/O NAYLOR WENTWORTH LUND ARCHITECTS
723 WEST PACIFIC AVENUE, SUITE 101
SALT LAKE CITY, UTAH 84104

ATTENTION: RICHARD JUDKINS

PROJECT NO. 1240698 SEPTEMBER 17, 2024

SECTION 02000

Geotechnical Investigation

Manti High School Additions

Manti, Utah

August 1997

RB&G ENGINEERING INC.

Professional Engineers

Photograph A

Photograph B

Photograph C

RB&G ENGINEERING INC.
Provo, Utah

Figure 3. PHOTOGRAPHS

Manti High School Additions
Manti, Utah

RB&G
ENGINEERING
INC.
1435 WEST 820 NORTH
PROVO, UT 84601-1343
801 374-5771 Provo
801 521-5771 SLC

August 12, 1997

South Sanpete School District
c/o Kirk Walker
Naylor Wentworth Architects
175 West 200 South, Suite 1000
Salt Lake City, UT 84101

Gentlemen:

This report outlines the results of a geotechnical investigation performed for the proposed additions to the Manti High School in Manti, Utah. The purpose of this investigation was to determine the characteristics of the subsurface material throughout the proposed site so that satisfactory substructures could be designed to support the proposed facility. The investigation has been completed in accordance with a written proposal submitted to your organization for the work, and the results of the investigation, along with pertinent recommendations for foundation design, are outlined in the following sections of this report.

The information contained in the report is discussed under the following headings: (1) Geological and Existing Site Conditions, (2) Subsurface Soil and Water Conditions, (3) Foundation Considerations and Recommendations, (4) Site Preparation and Compacted Fill Requirements, and (5) The Results of Field and Laboratory Tests.

1. GEOLOGICAL AND EXISTING SITE CONDITIONS

Figure 1 is a portion of a USGS quadrangle map showing Manti and the surrounding area. The valley is approximately 4 miles wide, and is underlain by quaternary alluvial pediments and stream deposits consisting of sands, silts and gravels. The valley has been eroded and structurally lowered to an approximate elevation of 5,500 feet above sea level. The valley had its origin many years ago as compressional stresses folded the underlying stratigraphy forming the initial folds making up the Wasatch and Gunnison Plateaus, the valley being the trough of the fold. Latter extensional stresses related to Basin and Range extension superimposed graben, forming faults near the margins of the valley. This graben faulting resulted in the further elevation of the Gunnison and

Wasatch Plateaus relative to the valley floor. As a consequence of the faulting throughout the area, the general area is located in Seismic Zone 2B according to the Uniform Building Code.

The topography is presented in Figure 1, and it will be observed that the topography throughout the area slopes downward to the north and west. The San Pitch River, which drains the San Pete Valley is located west of Manti. City Creek and South Creek pass through Manti and discharge into the San Pitch River. Other features characteristic of the area are shown on the USGS quadrangle map.

Manti High School is located on the north side of 500 North Street between 100 West and 200 West in Manti, Utah, as shown in Figure 2. The topography where the proposed facilities will be located is relatively flat, and the vegetative cover in the area for the classroom and the administration/wrestling room is grass. Tennis courts presently exist in the area where the gymnasium/locker room will be located. We understand that several feet of fill has been placed in the past at the gymnasium site. Figure 3 shows photographs of the three building sites. The general conditions throughout these three areas are evident from these photographs.

Other than the information provided above, no conditions appear to exist at this site which would adversely effect foundation performance.

2. SUBSURFACE SOIL AND WATER CONDITIONS

The general layout of the proposed additions is shown in Figure 2. The characteristics of the subsurface material were defined by drilling 10 borings to depths of between 15 and 20 feet below the existing ground surface at the locations as shown in Figure 2. The logs for the 10 borings are presented in Figures 4 through 8, and it will be observed that except for Test Hole 1, the subsurface profile generally consists of a surface layer of clay varying in thickness from 4 to 11.5 feet, underlain by gravelly material. In Test Hole 1, the clay extends to a depth of 19 feet below the existing ground surface. It appears that at least a part of the surface clay layer is fill.

During the subsurface investigation, sampling was performed at three-foot intervals throughout the depth investigated. Both disturbed and undisturbed samples were obtained during the field investigations. Disturbed samples were obtained by driving a 2-inch split spoon sampling tube through a distance of 18 inches using a 140-pound weight dropped from a distance of 30 inches. The number of blows to drive the sampling spoon through each 6 inches of penetration is shown on the boring logs. The sum of the last two blow counts, which represents the number of blows to drive the sampling spoon through 12 inches, is defined as the standard penetration value. The standard penetration value provides a good indication of the in-place density of sandy material; however, it only provides an indication of the relative stiffness of the cohesive material, since the penetration resistance of materials of this type is a function of the moisture content. Considerable care must be exercised in interpreting the standard penetration value in gravelly-type soils, particularly where the size of the granular particle exceeds the inside diameter of the sampling spoon. If the spoon can be driven through the full 18 inches with a reasonable core recovery, the standard penetration value provides a good indication of the in-place density of gravelly-type material.

It will be noted that it was not possible to drive the sampling spoon through the full 18 inches near the bottom of some of the test borings. Where the sampling tube could not be driven through the full 18 inches, the number of blows to drive the spoon through a given depth of penetration is shown on the boring logs. The results of the standard penetration tests generally indicate that the gravelly material throughout the soil profile is in a medium dense state. An exception to this general statement is located between 6 and 11.5 feet in Test Hole 4 where the brown sandy gravel appears to be in a low density state. Based upon the standard penetration values, the clay material in the upper portion of the soil profile appears to be in a relatively soft to medium stiff condition.

Undisturbed samples were obtained in Test Holes 1, 2, 4, 8 and 10 by pushing a thin-walled sampling tube into the subsurface material using the hydraulic pressure on the drill rig. The location at which the undisturbed samples were obtained are shown on the boring logs.

Each sample obtained in the field was classified in the laboratory according to the Modified Unified Soil Classification System. The symbol designating the soil type according to this system, is presented on the boring logs. A description of the Modified Unified Soil Classification System is presented in Figure 9, and the meaning of the various symbols shown on the boring logs can be obtained from this figure. It will be observed that the cohesive material throughout the site generally classified as a CL-I-type soil, while the gravel generally classified as a GM- or GP-type material.

No groundwater was encountered within the depth investigated at this site, except in Test Hole 5, where groundwater appeared to exist at a depth of 20 feet below the existing ground surface. It is possible that some groundwater may exist in the gravel strata in the lower portion of the profile at some time when precipitation throughout the area is especially heavy.

3. FOUNDATION CONSIDERATIONS AND RECOMMENDATIONS

A. FOUNDATION TYPES AND BEARING CAPACITIES

The additions to the Manti High School are divided into three wings as follows. A classroom wing involving 10,355 sq ft; an administration/wrestling room involving 9,222 sq ft; and a gymnasium/lock room involving 23,686 sq ft. All of the structures will be single story reinforced masonry buildings with long spans at the gymnasium.

Insofar as we are aware, the grading plan has not been completed for these three structures. It has been assumed, therefore, that the finished grade will be relatively close to the existing ground surface. In providing recommendations for foundation design, the three additions will be discussed in the following order: (1) gymnasium/locker room, (2) classroom, and (3) administration/wrestling room. Recommendations for foundation design are discussed separately for each of these facilities as follows.

(1) Gymnasium/Locker Room

We understand that the gymnasium/locker room will be approximately 125 feet wide and 189 feet long. The magnitude of the structural loads are not known as of the preparation of this report; however, it is assumed that the wall loads will not likely exceed 6 klf and that column loads will not likely exceed 200 kips.

The characteristics of the subsurface material at the gymnasium/locker room are defined by Test Holes 1 through 5. If the foundations for the proposed facility are located at a depth below ground surface just sufficient to provide frost protection, which is about 2.5 feet in this area, most of the zone of significant stress will exist within the clay material.

The results of unconfined compression tests for Test Holes 1, 2 and 4 are presented in Table 1, Summary of Test Data, and it will be observed that the unconfined compressive strength varies from about 538 to 969 psf. It is readily apparent that continuous footings would be approximately 7 feet wide in order to satisfy the bearing capacity with respect to shear failure. If the column loads are 200 kips per column and the allowable bearing capacity with respect the shear failure is only 0.8 kips, columns approximately 15.8 feet square would be required to support the column loads. It appears likely that for footings of this size the settlement would be intolerable. Both the continuous and column footings would be located around the periphery of the building, where a thin clay layer approximately 7 to 8 feet thick is underlain by sandy gravel in a medium dense state.

We recommend that consideration be given to supporting the proposed facility using spread foundations on compacted sandy gravel. This means that if the footings are located at a depth of 2.5 feet below finished grade and if 4 feet of the clay material is excavated and replaced with compacted sandy gravel, the depth of the excavation would be 6.5 feet. For these conditions, the compacted fill would extend to within 1 or 2 feet of the granular layer which exists beneath the surface clay layer. The width of the compacted fill supporting structural foundations should be equal to twice the width of the footing, except that in no case should the width of the compacted fill be less than the width of the footing plus the depth of the fill.

In order to size the foundations for the proposed facility, bearing capacity charts have been prepared for both continuous and spot footings. Figure 10 is applicable for continuous footings, while Figure 11 is valid for spot footings. It has also been assumed that at least 4 feet of compacted fill will exist beneath both continuous and spot footings. It will be noted from these figures that the allowable soil bearing pressure is a function of the width of the footing, and that the bearing pressure decreases as the footing width increases. This condition occurs because as the width of the footing increases, the portion of the zone of significant stress within the cohesive material increases.

Based upon the information obtained during this investigation, no groundwater will exist within the depth of the excavation required for the compacted fill beneath the footings. We recommend that the compacted sandy gravel supporting structural foundations should be well-graded with a maximum size less than 3 inches and with not more than 15% passing a 200 sieve. All sandy gravel supporting structural foundations should be densified to an in-place unit weight equal to 95% of the maximum laboratory density as determined by ASTM D 1557-91. The specifications pertaining to the sandy gravel to be used as compacted fill should not be changed unless approved by the soil engineer.

It should be noted that the foundation recommendations outlined above generally assume that the amount of clay beneath the bottom of the compacted fill will be relatively small, as shown by the boring logs. We recommend, however, that prior to construction, a series of test pits be excavated with a backhoe around the periphery of the building to determine if the granular layer is continuous as the test borings seem to indicate.

(2) Classroom

We understand that the classroom building will be a single-story structure having a width of about 79 feet and a length of about 130 feet. The magnitude of the structural loads are not known as of the preparation of this report; however, it is assumed that the wall loads will not likely exceed 3 klf and that the column loads will not likely exceed 75 kips.

The characteristics of the subsurface material in the vicinity of the classroom area are defined by Test Holes 8, 9 and 10. It is apparent that if the foundations for the proposed facility are located at a depth below ground surface just sufficient to provide frost protection, which is about 2.5 feet in this area, the zone of significant stress will exist primarily within the brown clay. The results of the unconfined compressive strengths for Test Hole 8 are slightly less than 800 psf.

We recommend that this facility be supported using spread foundations on 3 feet of compacted sandy gravel. This means that 3 feet of the clay material beneath the bottom of the footings should be excavated and replaced with compacted sandy gravel. An excavation approximately 5.5 feet deep would be required at this site. The width of the compacted fill supporting structural foundations should be equal to twice the width of the footing, except that in no case should the width of the compacted fill be less than the width of the footing plus the depth of the fill.

In order to size the foundations for the proposed facility, bearing capacity charts have been prepared for both continuous and spot footings. Figure 12 is applicable for continuous footings, while Figure 13 is valid for spot footings. It has also been assumed that at least 3 feet of compacted fill will exist beneath both continuous and spot footings. It will be noted from these figures that the allowable soil bearing pressure is a function of the width of the footing, and that the bearing pressure decreases as the footing width increases. This condition occurs because as the width of the footing increases, the portion of the zone of significant stress within the cohesive material increases. It will also be noted that in most of the areas for this facility, 3 or 4 feet of clay will exist beneath the bottom of the compacted fill.

(3) Administration/Wrestling Room

The configuration of the administration/wrestling room is presented in Figure 2. We understand that this facility will be a single-story structure having 9,222 sq ft of floor space. The magnitude of the structural loads are not known as of the preparation of this report; however, it is assumed that the wall loads will not likely exceed 3 or 4 klf, and that column loads will not likely exceed 75 kips.

Test Holes 6 and 7 define the characteristics of the subsurface material where this facility will be located. It will be observed from Test Holes 6 and 7 that a relatively dense sandy gravel is within 4 to 4.5 feet of the ground surface at this location. If the foundations are located below ground surface sufficient to provide frost protection, which is about 2.5 feet in this area, the bottom of the footings will be within about 2 feet of the relatively dense sandy gravel.

We recommend that the foundations either extend to the sandy gravel zone, or that the material be excavated to the gravel layer and replaced with compacted sandy gravel. The compacted sandy gravel should be twice the width of the footing and should be densified to an in-place unit weight equal to 95% of the maximum laboratory density as determined by ASTM D 1557-91. It should be recognized that the allowable soil bearing pressure of spread foundations on compacted sandy gravel is a function of the width of the footing. For the width of footings contemplated for this structure, we recommend that the footings be sized using an allowable soil bearing pressure of 2000 psf, except that in no case should the width of any footing be less than 24 inches.

If the foundations for each of the three structures contemplated for the proposed development are designed in accordance with the recommendations outlined above, the maximum settlement of any footing should not exceed one inch and differential settlement throughout the structures should not exceed 0.5 inch. It is generally recognized that the tolerable differential settlement for steel and concrete structures is about 0.002 times the column spacing. This criteria is tantamount to a differential settlement of about 0.5 inch for column spacings of 20 feet and 0.7 inch for column spacings of 30 feet. Since it is not anticipated that the column spacing for these structures will be less than 20 feet, a differential settlement of 0.5 inch should be satisfactory for the proposed facilities.

B. LATERAL EARTH PRESSURES

It is not anticipated that any earth retaining structures will be required for the proposed facilities. If earth retaining structures are required, however, and if backfilling is performed using granular material, and if the backfill behind the wall is horizontal, we recommend that the earth pressures be calculated using the following equation, along with the earth pressure coefficient outlined below:

$$P = \tfrac{1}{2} K \gamma H^2$$

where P = total lateral force on the wall, plf
K = earth pressure coefficient
γ = unit weight of the soil (120 pcf)
H = height of the wall

The earth pressure coefficient used in designing the walls will depend upon whether the wall is free to move during backfilling operations, or whether the wall is restrained during backfilling. If the wall is free to move during backfilling operations and the backfill material is granular soil, we recommend an earth pressure coefficient of 0.30 be used in the above equation to calculate the lateral earth pressures. If the walls are restrained from any movement during backfilling and the backfill material is granular soil, we recommend an earth pressure coefficient of 0.45 be used to calculate the lateral earth pressures. It should be recognized that the pressure calculated by the above equation are earth pressures only and do not include hydrostatic pressures. Where hydrostatic pressures may exist behind a retaining structure, we recommend either the wall be designed to resist hydrostatic pressure, or that a drainage system be placed behind the wall to prevent the development of hydrostatic pressures.

C. SEISMIC CONSIDERATIONS

As indicated earlier in this report, the proposed site is located in Seismic Zone 2B according to the 1994 edition of the Uniform Building Code, and we recommend that the proposed facility be designed and constructed in compliance with the code. The allowable soil bearing pressure indicated above may be increased by one-third where seismic forces are involved in the structural loads. If the passive pressures associated with footings and walls are used to resist seismic forces, and if backfilling is performed using granular material, we recommend that the passive pressures be calculated from the lateral earth pressure equation using an earth pressure coefficient of 2.0. If the frictional resistance of the footings and floor slabs are used to resist seismic forces, we recommend a coefficient of friction of 0.40 be used to calculate these forces.

Since no groundwater exists in the upper 20 feet of the profile at this site, and since the subsurface materials are generally a relatively dense gravel or clay, the liquefaction potential of the subsurface material at this site is very low.

4. SITE PREPARATION, COMPACTED FILL REQUIREMENTS, AND FLEXIBLE PAVEMENT DESIGN

A. SITE PREPARATION AND COMPACTED FILL REQUIREMENTS

Photograph A in Figure 3 shows the area where the gymnasium will be located. Most of the gymnasium will exist in the area where the tennis courts are now located. A small portion of the building will be located where the lawn now exists. Site preparation will principally involve the removal of the concrete in the tennis court area. We recommend that at least 6 inches of the sod be stripped from the grass area to remove any excess organic matter which may exist in the upper portion of the soil profile. It appears from Photograph A that some grading will be required to provide the level pad for the proposed facility; however, it is anticipated that the finished grade will be relatively close to the elevation of the existing tennis courts. If any fill is placed throughout the gymnasium area to provide the finished grade, we recommend that all fill be densified to an in-place unit weight equal to 95% of the maximum laboratory density as determined by ASTM D 1557-91.

If the foundation recommendations outlined earlier in this report are followed, the proposed structure will be supported using spread foundations on 4 feet of compacted sandy gravel. We recommend that the compacted sandy gravel be well-graded with a maximum size less than 3 inches and with not more than 15% passing a 200 sieve. All sandy gravel supporting structural foundations should be densified to an in-place unit weight equal to 95% of the maximum laboratory density as determined by ASTM D 1557-91. The specifications pertaining to the sandy gravel to be used as compacted fill should not be changed unless approved by the soil engineer.

The general area where the classroom facility will be located is presented in Photograph B. It will be observed that the ground surface in this area is relatively flat, and it is not anticipated that any large amount of grading will be required in this area to provide the level pad. We recommend that 6 inches of the surface material throughout the site be stripped to remove the organic matter which exists throughout the proposed site. It is also recommended that any fill placed throughout the site to provide the finished grade be densified to an in-place unit weight equal to 95% of the maximum laboratory density indicated above.

If the foundation recommendations outlined in the previous section of this report are followed, the classroom facility will be supported using spread foundations on compacted fill. We recommend that the compacted fill placed in the classroom area follow the same specifications outlined for the compacted fill for the gymnasium area.

Figure 3, Photograph C shows the general area where the administration/wrestling room will be located. It is apparent from the photograph that the topography of the site is relatively flat and that site preparation will be limited to the removal of the sod and trees throughout the site. If the foundation recommendations outlined herein are followed, the footings will either extend to the dense granular layer at a depth of about 4 feet below ground surface, or the material beneath the bottom of the footings will be excavated to the dense granular zone and replaced with compacted sandy gravel. The compacted sandy gravel should follow the specifications outlined for the gymnasium.

Grading around all structures should be performed in such a manner that all surface water will flow freely from the area and that no ponding will occur adjacent to the structure which will permit deep percolation into the foundation area. Roof drains should extend well beyond the building lines to prevent seepage into the foundation soils. Sprinkler heads located adjacent to the buildings should be directed away from the structure to prevent the percolation of water into the foundation zone.

We recommend that a free-draining granular layer be placed beneath all floor slabs for all buildings. The free-draining granular layer should be at least 6 inches thick and should have a maximum size less than 1 inch and with not more than 5% passing a 200 sieve and should be densified to an in-place unit weight equal to 95% of the maximum laboratory density indicated above. If the above specifications are followed, the granular layer will prevent the accumulation of moisture beneath the floor slab and will also serve adequately as a base beneath the floor slabs.

Backfilling around the foundation walls for all structures should be performed using granular material densified to an in-place unit weight equal to 90% of the maximum laboratory density indicated above.

B. FLEXIBLE PAVEMENT DESIGN

In providing recommendations for flexible pavement design for parking areas, it is assumed that traffic using the areas will be limited to passenger-type vehicles and light trucks. The flexible pavement thickness has been determined using the AASHTO Structural Number Procedure.

The results of the analysis indicates that a flexible pavement consisting of 3 inches of an asphalt surface course plus 8 inches of untreated granular base will be adequate to support the contemplated traffic. In performing the analysis, it has been assumed that the upper 10 inches of the natural material will be scarified and re-densified to an in-place unit weight equal to 95% of the maximum laboratory density as determined by ASTM D 1557-91.

The flexible pavement design indicated above is adequate to support the traffic distribution as indicated; however, it should be recognized that if construction is performed during periods when the subsurface material throughout the site is in a wet condition, the subsurface material is not capable of supporting the wheel loads associated with construction equipment, and as a consequence of this condition, the pavement cannot be constructed as designed. It is recommended, therefore, that the pavement for the development be constructed during the summer months when the surface moisture content is at a minimum. If the pavement must be constructed during periods when the surface moisture is high, it may be necessary to increase the base thickness by 8 inches in order to accommodate the loads associated with the construction equipment.

All base material should be densified to an in-place unit weight equal to 95% of the maximum laboratory density indicated above and all untreated granular base should conform to the following gradation specifications:

SIEVE SIZE	PERCENT PASSING
1 INCH	100
½ INCH	70-100
NO. 4	41-68
NO. 16	21-41
NO. 50	10-27
NO. 200	4-13

In order to preserve the gradation of the granular base, we recommend that the percent wear of this material be less than 50 percent when tested in accordance with AASHTO T-96. Mineral aggregates used in the asphalt surface course should conform to Section 402 of the standard specifications of the Utah State Department of Transportation. Mixing, placing, and densification of all asphalt materials should also conform to UDOT standards.

5. THE RESULTS OF FIELD AND LABORATORY TESTS

Field and laboratory tests performed during this investigation to define the characteristics of the subsurface material throughout the proposed building areas included standard penetration tests, in-place dry unit weight, natural moisture content, Atterberg Limits, unconfined compressive strength, and consolidation tests.

The standard penetration tests have been previously discussed and the results of these tests indicate that the clay material is in a soft to medium stiff condition, while the sandy gravel in the lower portion of the soil profile throughout all areas is in a medium to relatively dense state.

A summary of all test data performed during this investigation, with the exception of the consolidation tests, is presented in Table 1 Summary of Test Data. It will be observed from Table 1 that the plasticity index of the cohesive material throughout the soil profile generally varies from about 4 to 16%, which indicates that the clay material does not have expansive characteristics. The unconfined compressive strength, which provides an indication of the bearing capacity of the subsurface clays, is low, except for Test Hole 10 where some unusual material existed. It will be observed that in most of the locations throughout the profile, the unconfined compressive strength varied from about 538 to 987 psf. The dry unit weight of the cohesive material in Test Holes 2 and 4 varied from 93.7 to 114.2 pcf.

The compressibility characteristics of the subsurface material throughout the site were determined by performing five consolidation tests on samples obtained at depths of 3 and 6 feet from Test Hole 2, and at depths of 3, 12 and 15 feet in Test Hole 4. The results of these tests are presented in Figures 14 through 18. During the performance of the consolidation tests, each sample was permitted to absorb water at the beginning of the tests to determine the effect of moisture on the compressibility characteristics of these materials. Expansive soils always experience an increase in void ratio on absorbing water. It will be observed from these tests that no increase in the void ratio occurred as the sample absorbed moisture. It is concluded from the consolidation tests that the subsurface materials at this site do not have expansive characteristics, and that they do not have high compressibility characteristics.

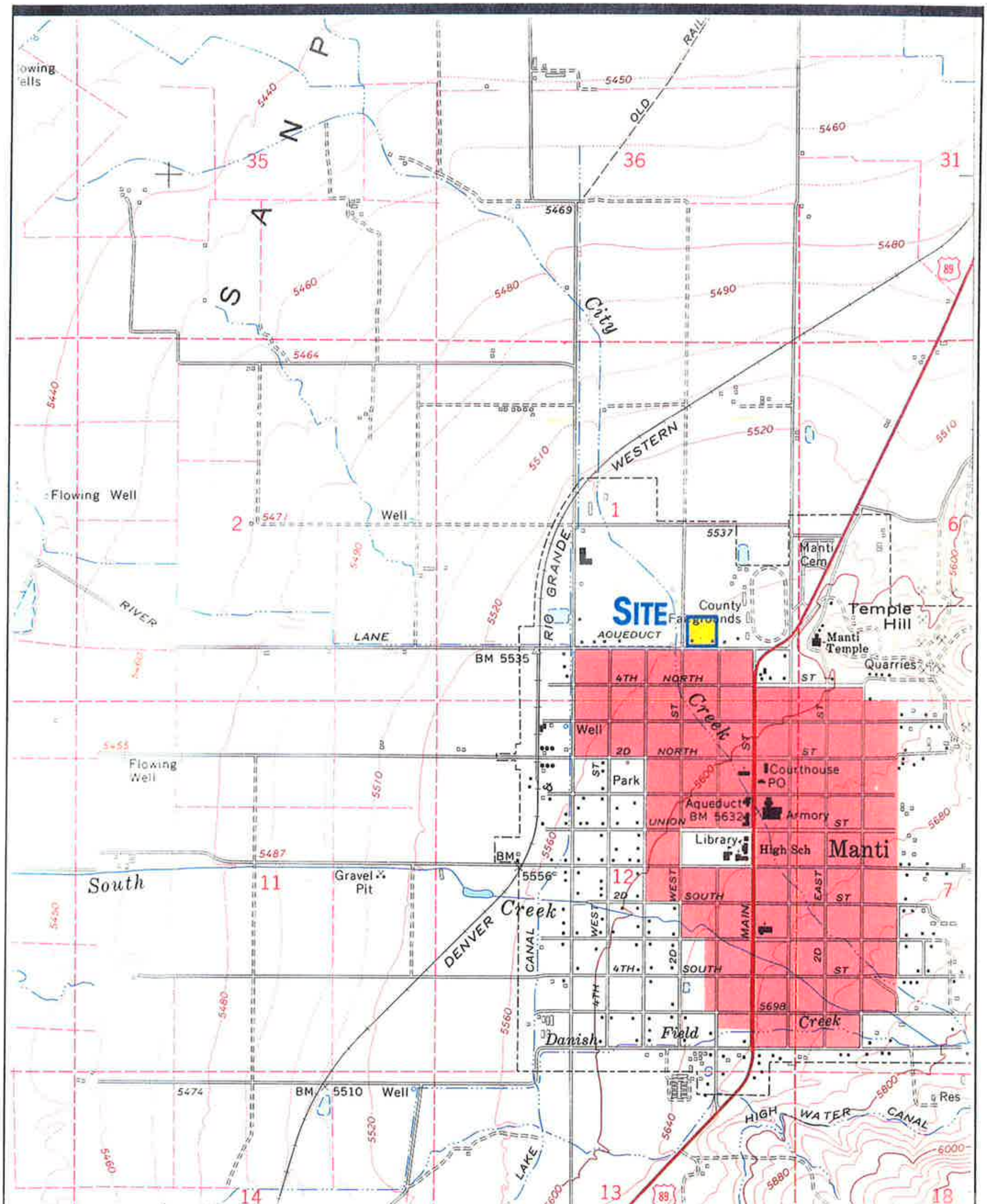
The conclusions and recommendations presented in this report are based upon the results of the field and laboratory tests, which in our opinion, define the characteristics of the subsurface material throughout the site in a satisfactory manner. It should be recognized that soil materials are inherently heterogeneous and that conditions may exist throughout this site which could not be defined during this investigation. If during construction, conditions are encountered which appear to be different than those presented in this report, it is requested that we be advised in order that appropriate action may be taken.

Sincerely,

RB&G ENGINEERING, INC.

Ralph L. Rollins

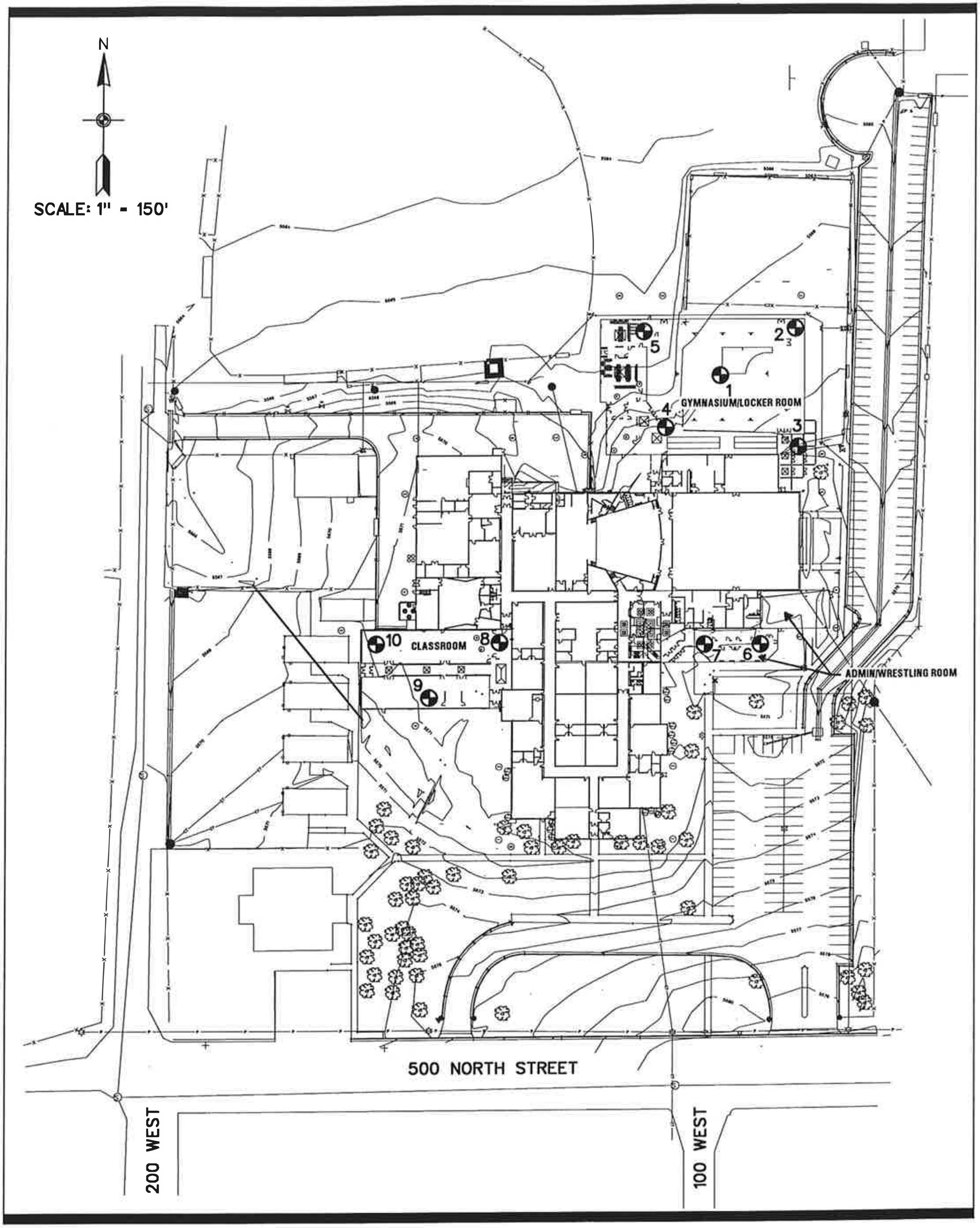
Ralph L. Rollins, Ph.D., P.E.
rlr/jag



RB&G ENGINEERING INC.
Provo, Utah

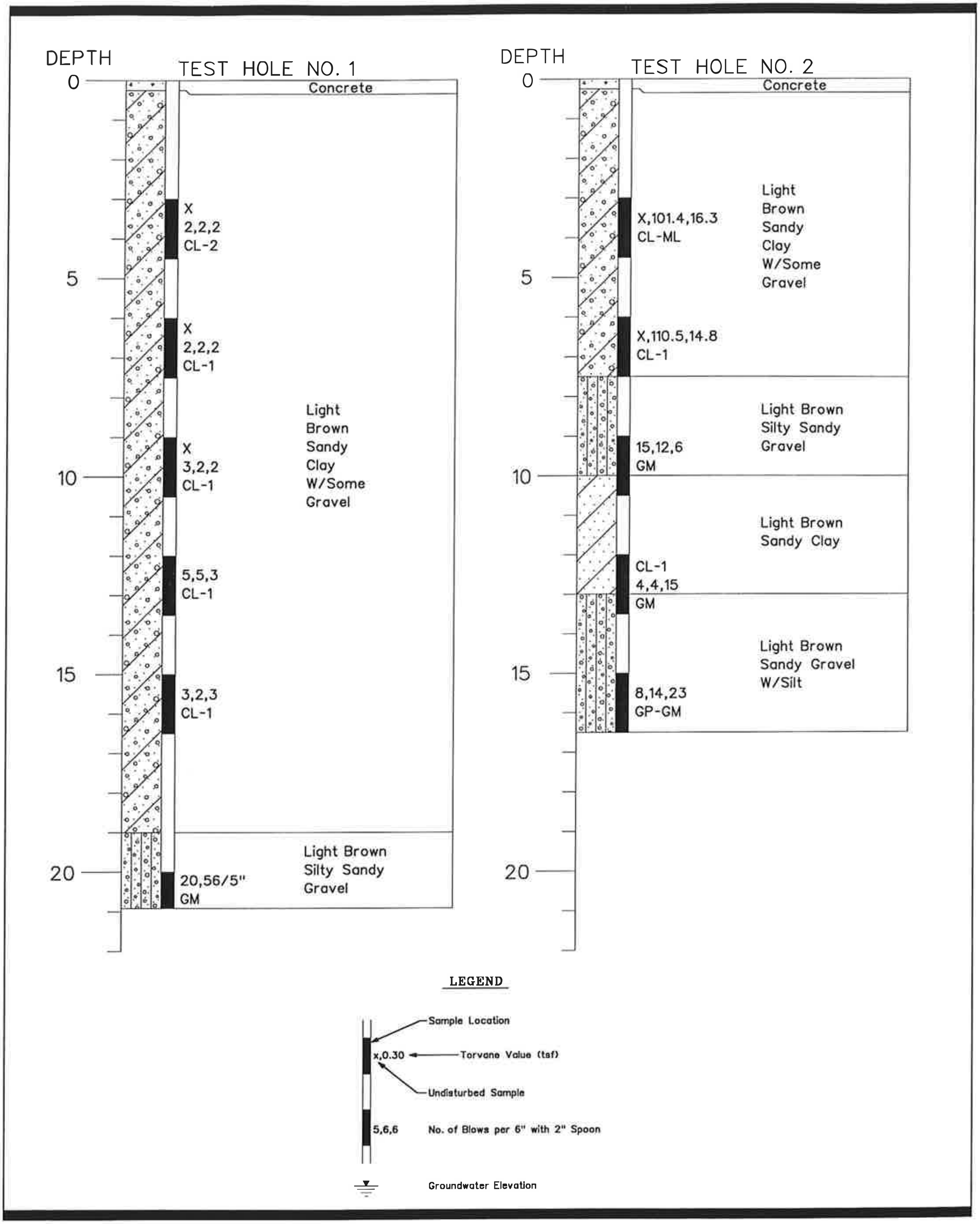
Figure 1. VICINITY MAP

Manti High School Additions
Manti, Utah



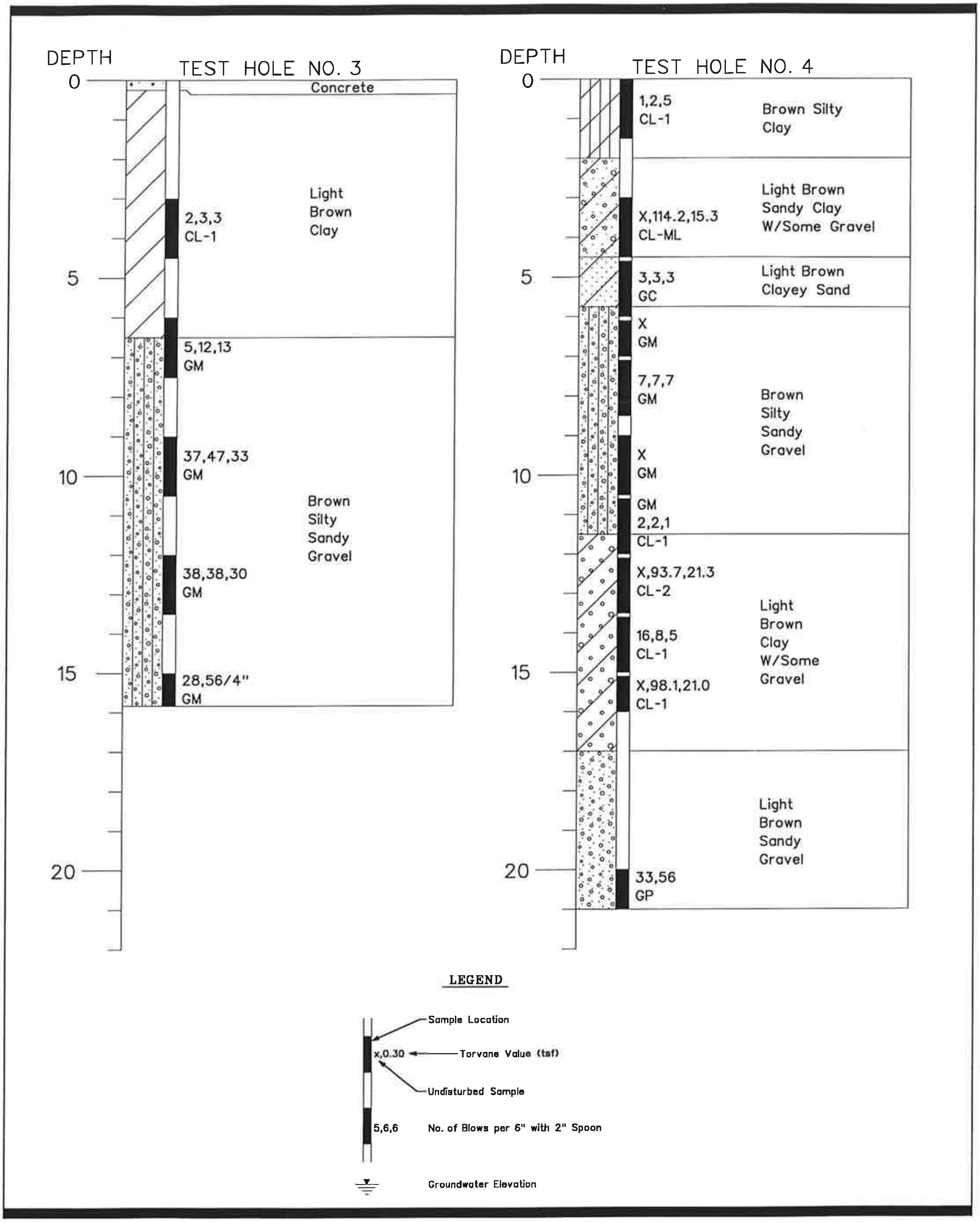
RB&G ENGINEERING INC.
Provo, Utah

Figure 2 **SITE PLAN AND TEST HOLE LOCATIONS**
Manti High School Additions
Manti, Utah



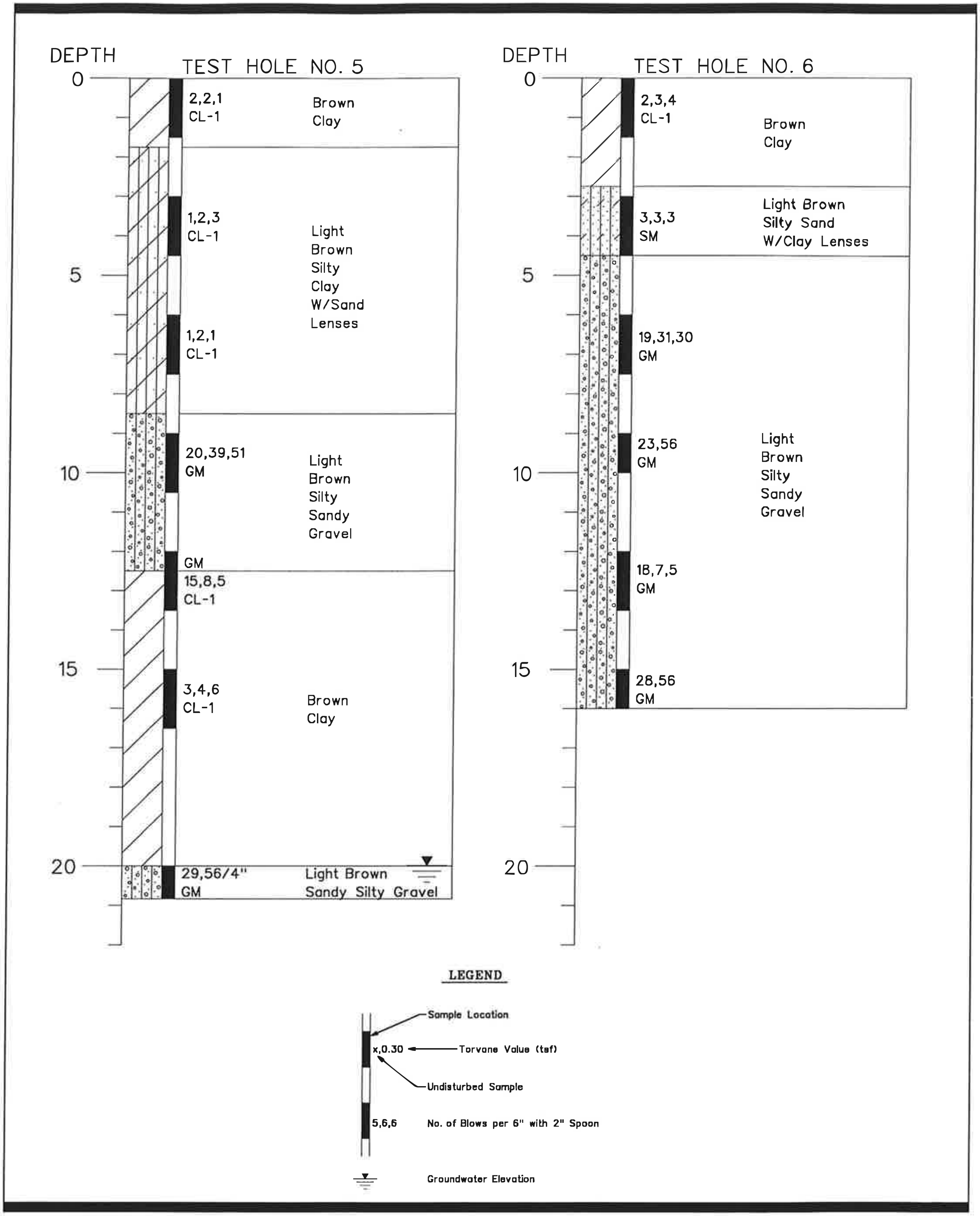
RB&G ENGINEERING INC.
Provo, Utah

Figure 4 **TEST HOLE LOGS**
Manti High School Additions
Manti, Utah



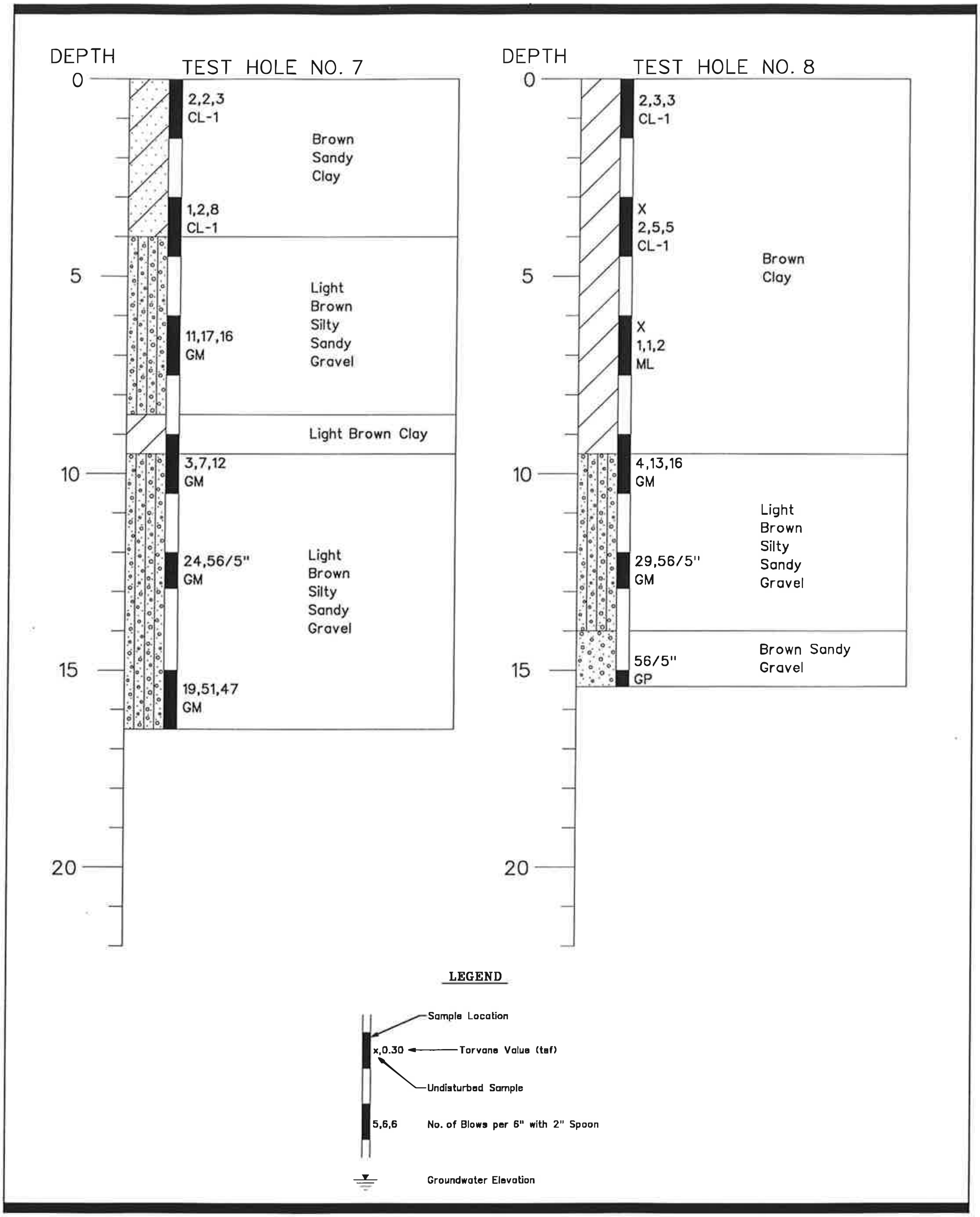
RB&G ENGINEERING INC.
Provo, Utah

Figure 5 **TEST HOLE LOGS**
Manti High School Additions
Manti, Utah



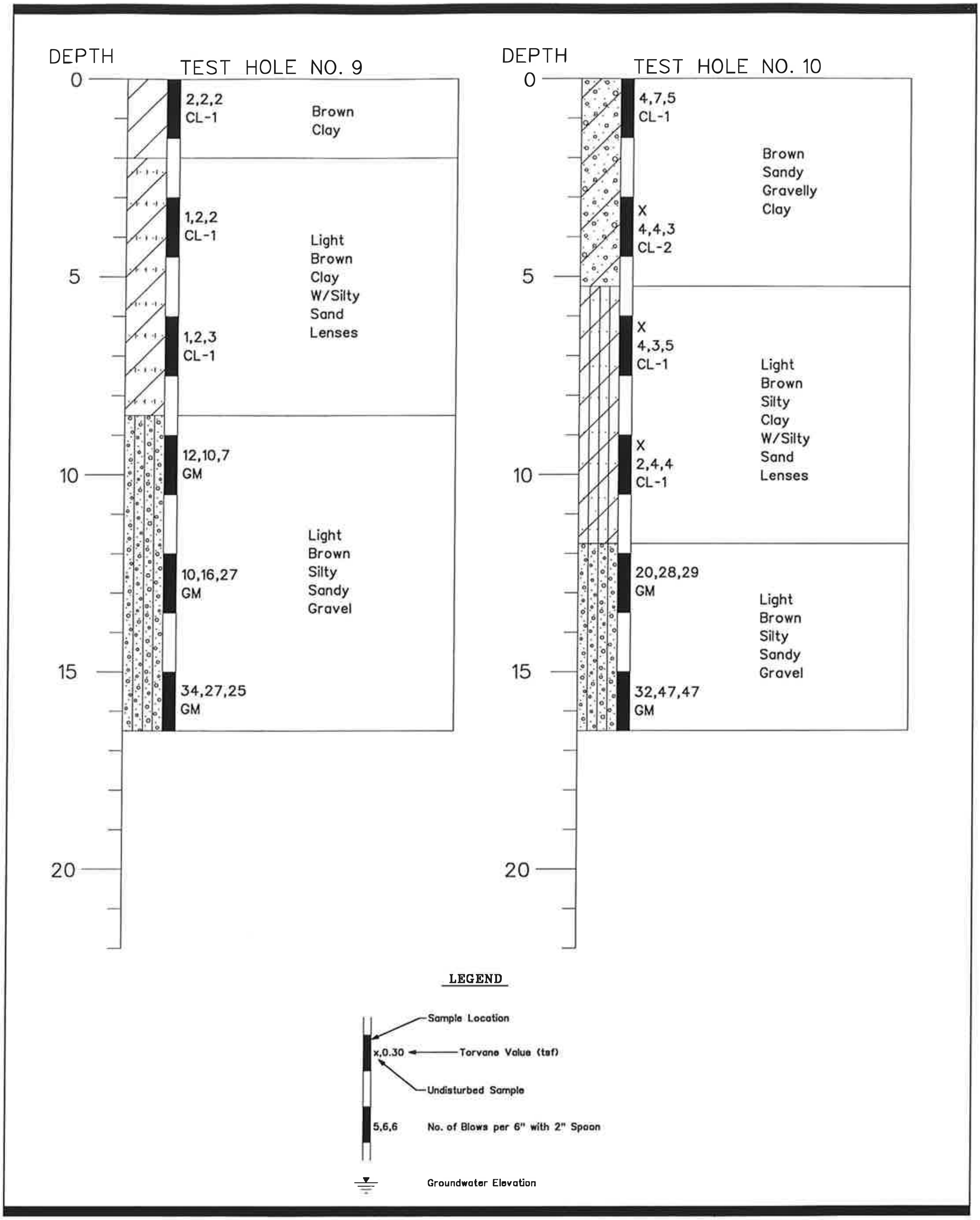
RB&G ENGINEERING INC.
Provo, Utah

Figure 6 **TEST HOLE LOGS**
Manti High School Additions
Manti, Utah



RB&G ENGINEERING INC.
Provo, Utah

Figure 7 **TEST HOLE LOGS**
Manti High School Additions
Manti, Utah

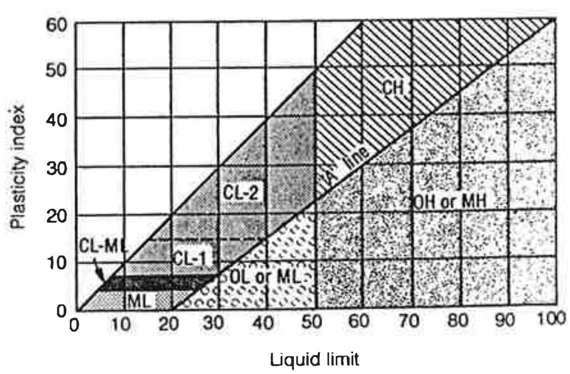


RB&G ENGINEERING INC.
Provo, Utah

Figure 8 **TEST HOLE LOGS**
Manti High School Additions
Manti, Utah

Unified Soil Classification System

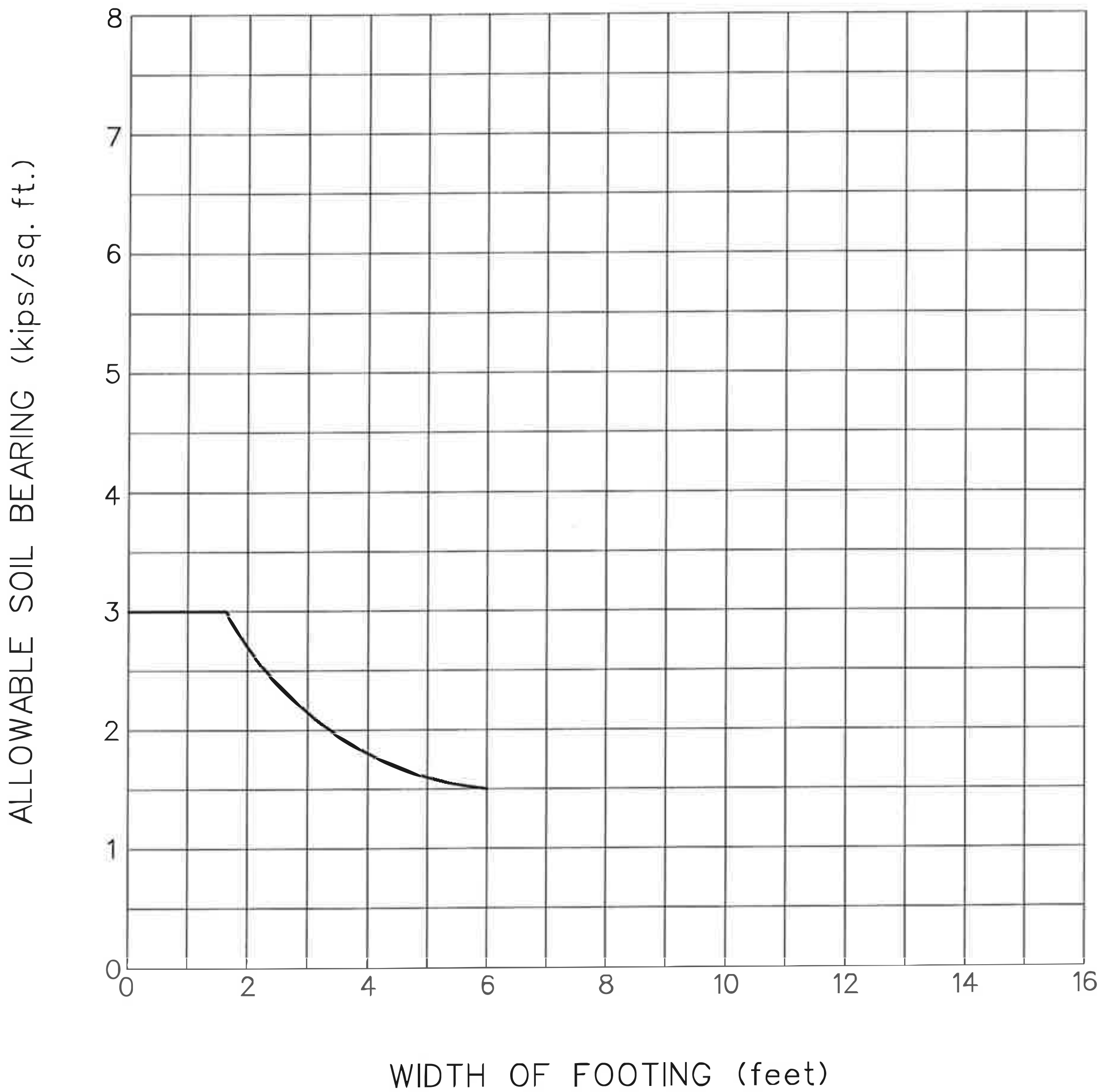
Major Divisions			Group Symbols		Typical Names	Laboratory Classification Criteria		
Coursa-grained Soils More than half of material is *larger* than No. 200 sieve	Gravels More than half of coarse fraction is larger than No. 4 sieve size	Clean Gravels (Little or no fines)	*GW*		Well graded gravels, gravel-sand mixtures, little or no fines.	Determine percentage of gravel and sand from grain size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5% .... *GW, GP, SW, SP*; More than 12% .... *GM, GC, SM, SC*; 5% to 12% .... *Borderline cases requiring use of dual symbols***	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			GP		Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for *GW*	
		Gravels with fines (Appreciable amount of fines)	*GM**	d	Silty gravels, poorly graded gravel-sand-clay mixtures		Atterberg limits below "A" line, or *PI* less than 4	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring uses of dual symbols
				u				
			GC		Clayey gravels, poorly graded gravel-sand-clay mixtures		Atterberg limits above "A" line, or *PI* greater than 7	
	Sands More than half of coarse fraction is smaller than No. 4 sieve size	Clean Sands (Little or no fines)	SW		Well graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			SP		Poorly graded sands, gravelly sands, little or no fines.		Not meeting all gradation requirements for *SW*	
		Sands with fines (Appreciable amount of fines)	*SM**	d	Silty sands, poorly graded sand-silt mixtures		Atterberg limits below "A" line, or *PI* less than 4	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring uses of dual symbols
				u				
			SC		Clayey sands, poorly graded sand-clay mixtures		Atterberg limits above "A" line, or *PI* greater than 7	
Fine-grained Soils More than half of material is *smaller* than No. 200 sieve	Silt and Clays Liquid limit less than 50		*ML*		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity			
			CL	1	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
				2				
			OL		Organic silts and organic silt-clays of low plasticity			
	Silts and Clays Liquid limit greater than 50		*MH*		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH		Inorganic clays of high plasticity, fat clays			
			OH		Organic clays of medium to high plasticity, organic silts			
Highly Organic Soils			*Pt*		Peat and other highly organic soils			



Plasticity Chart
For laboratory classification of fine-grained soils

*Division of *GM* and *SM* groups into subdivisions of d and u for roads and airfields only. Subdivision is based on Atterberg limits; suffix d used when liquid limit is 28 or less and the *PI* is 6 or less, the suffix u used when liquid limit is greater than 28.

***Borderline classification*: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example *GW-GC*, well graded gravel-sand mixture with clay binder.



Recommended allowable soil bearing pressures on:

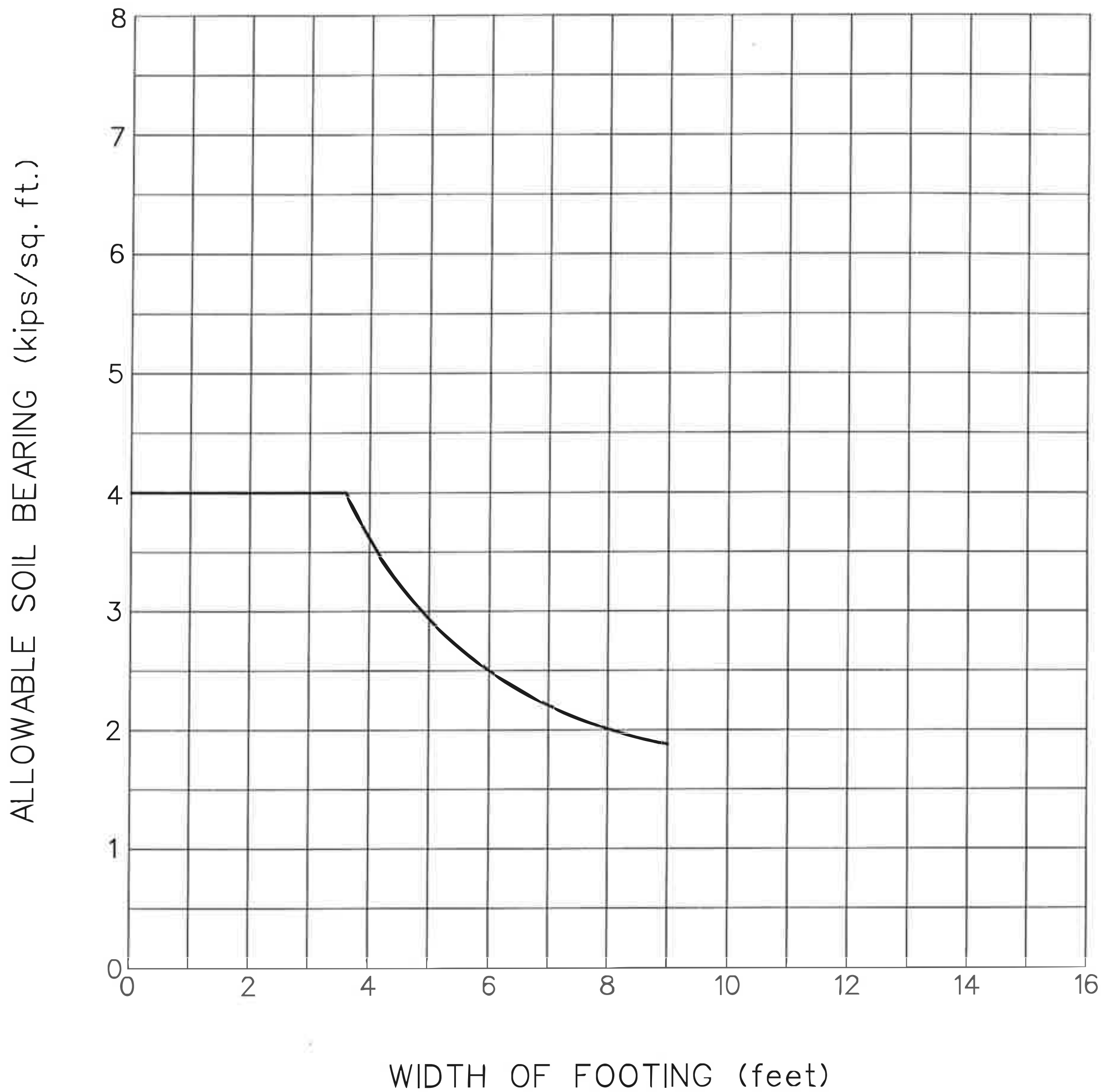
- ☐ natural material
- ☒ compacted fill

Type of footings:

- ☒ spread (where D=Depth of surcharge adjacent to bottom of footing)
- ☐ spot
- ☒ continuous

RB&G ENGINEERING INC.
Provo, Utah

Figure 10
BEARING CAPACITY CHART
Manti High School Additions (Gymnasium)
Manti, Utah



Recommended allowable soil bearing pressures on:

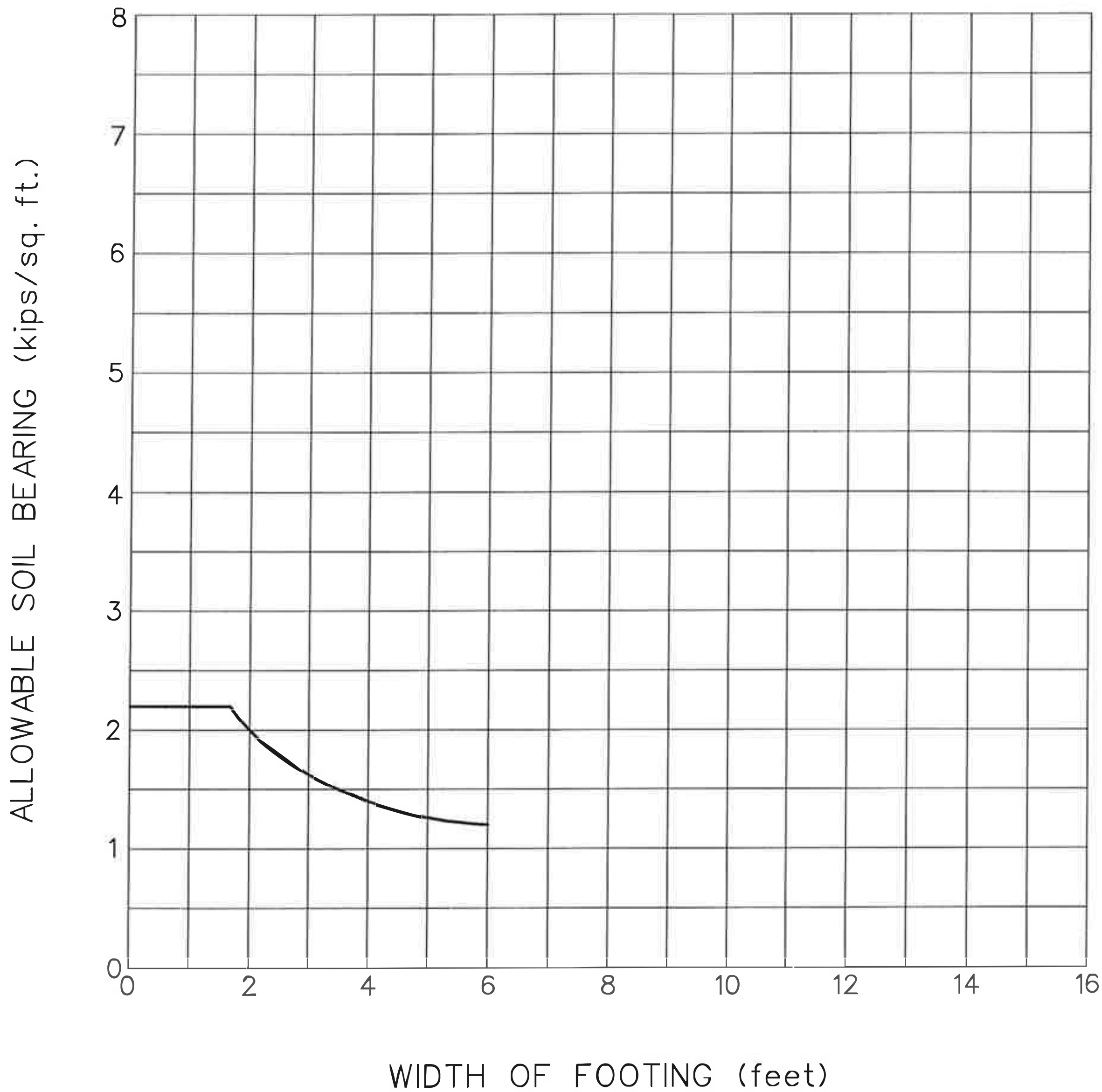
- ☐ natural material
- ☒ compacted fill

Type of footings:

- ☒ spread (where D=Depth of surcharge adjacent to bottom of footing)
- ☒ spot
- ☐ continuous

RB&G ENGINEERING INC.
Provo, Utah

Figure 11
BEARING CAPACITY CHART
Manti High School Additions (Gymnasium)
Manti, Utah



Recommended allowable soil bearing pressures on:

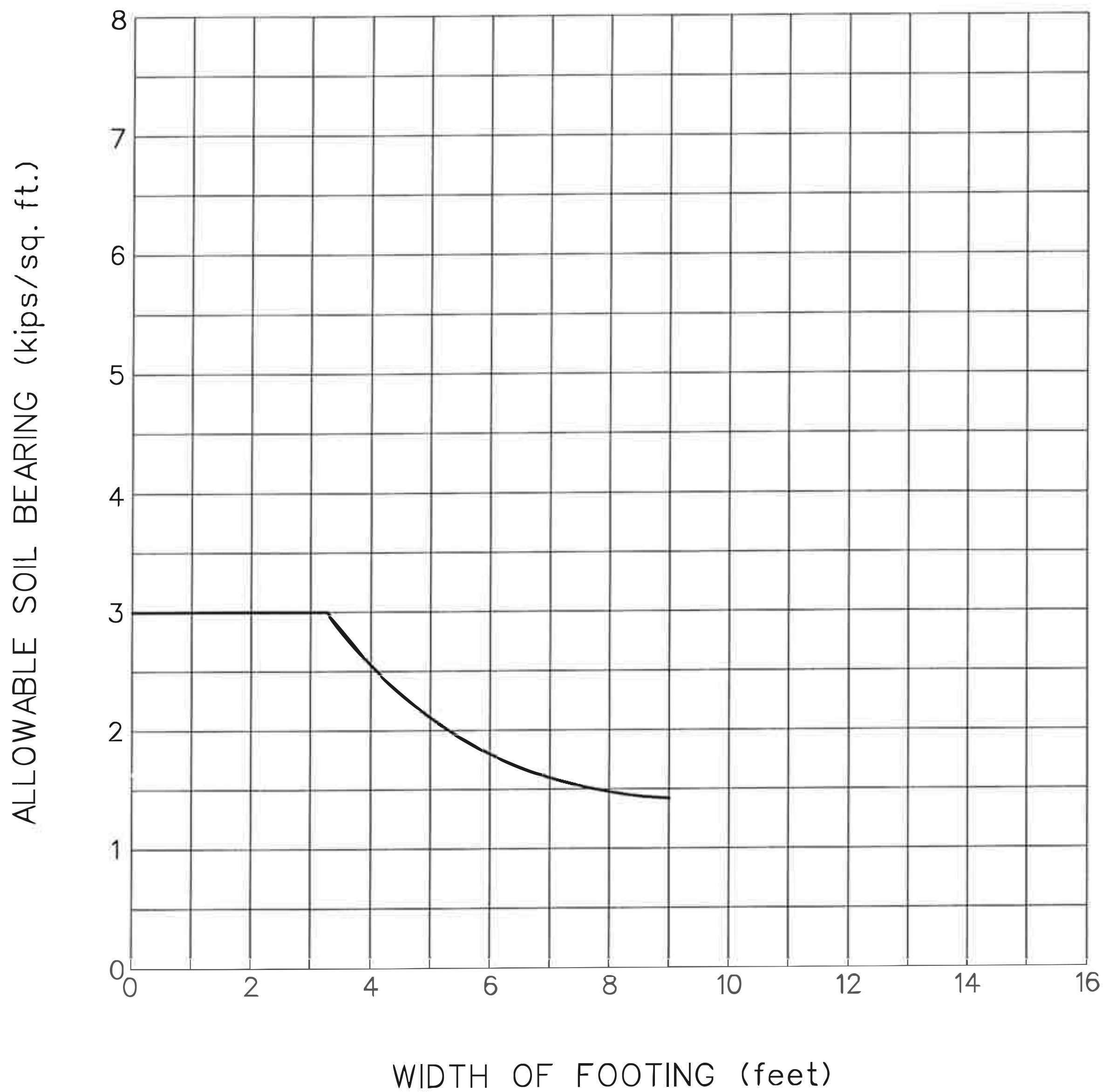
- ☐ natural material
- ☒ compacted fill

Type of footings:

- ☒ spread (where D=Depth of surcharge adjacent to bottom of footing)
- ☐ spot
- ☒ continuous

RB&G ENGINEERING INC.
Provo, Utah

Figure 12
BEARING CAPACITY CHART
Manti High School Additions (Classrooms)
Manti, Utah



Recommended allowable soil bearing pressures on:

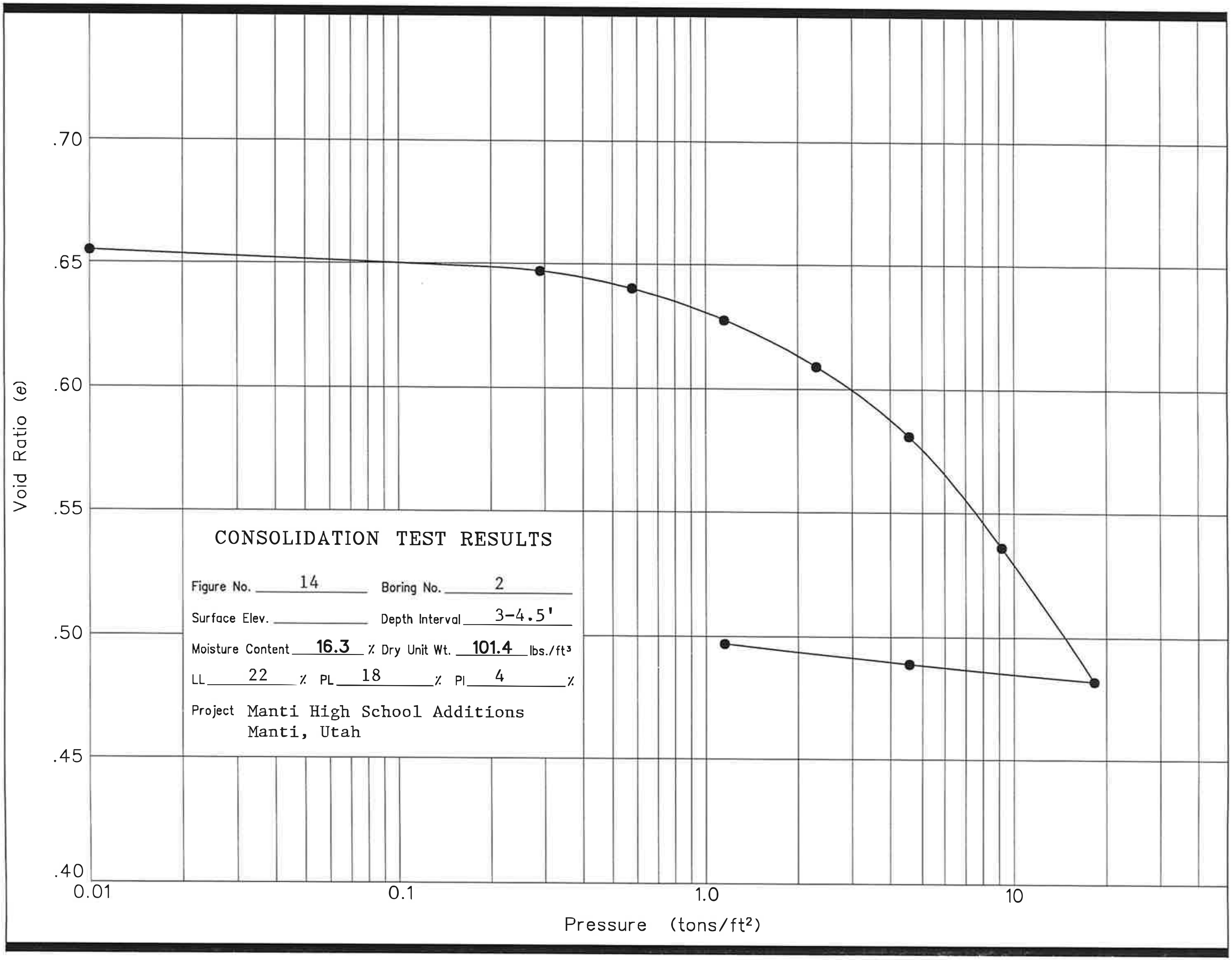
- ☐ natural material
- ☒ compacted fill

Type of footings:

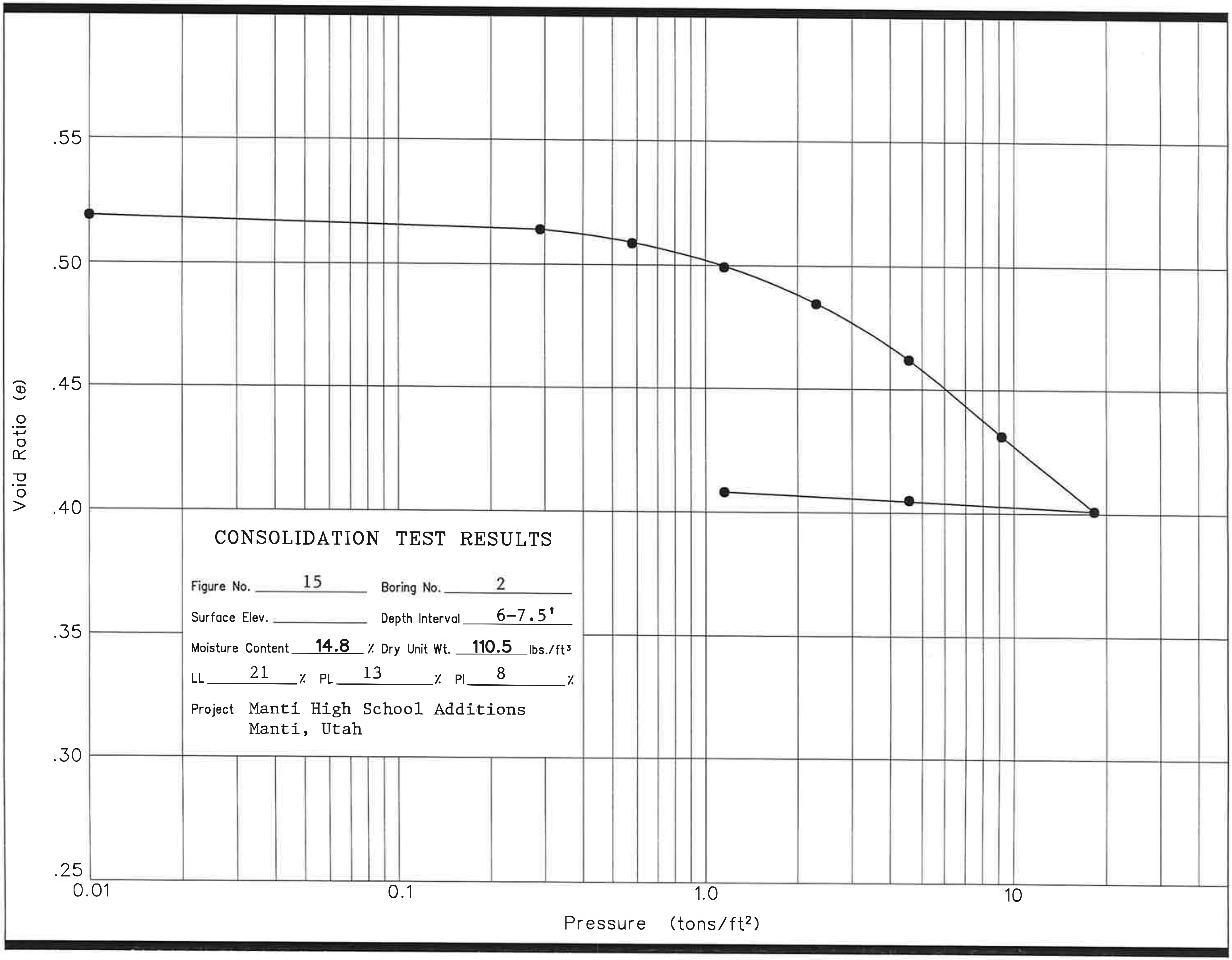
- ☒ spread (where D=Depth of surcharge adjacent to bottom of footing)
- ☒ spot
- ☐ continuous

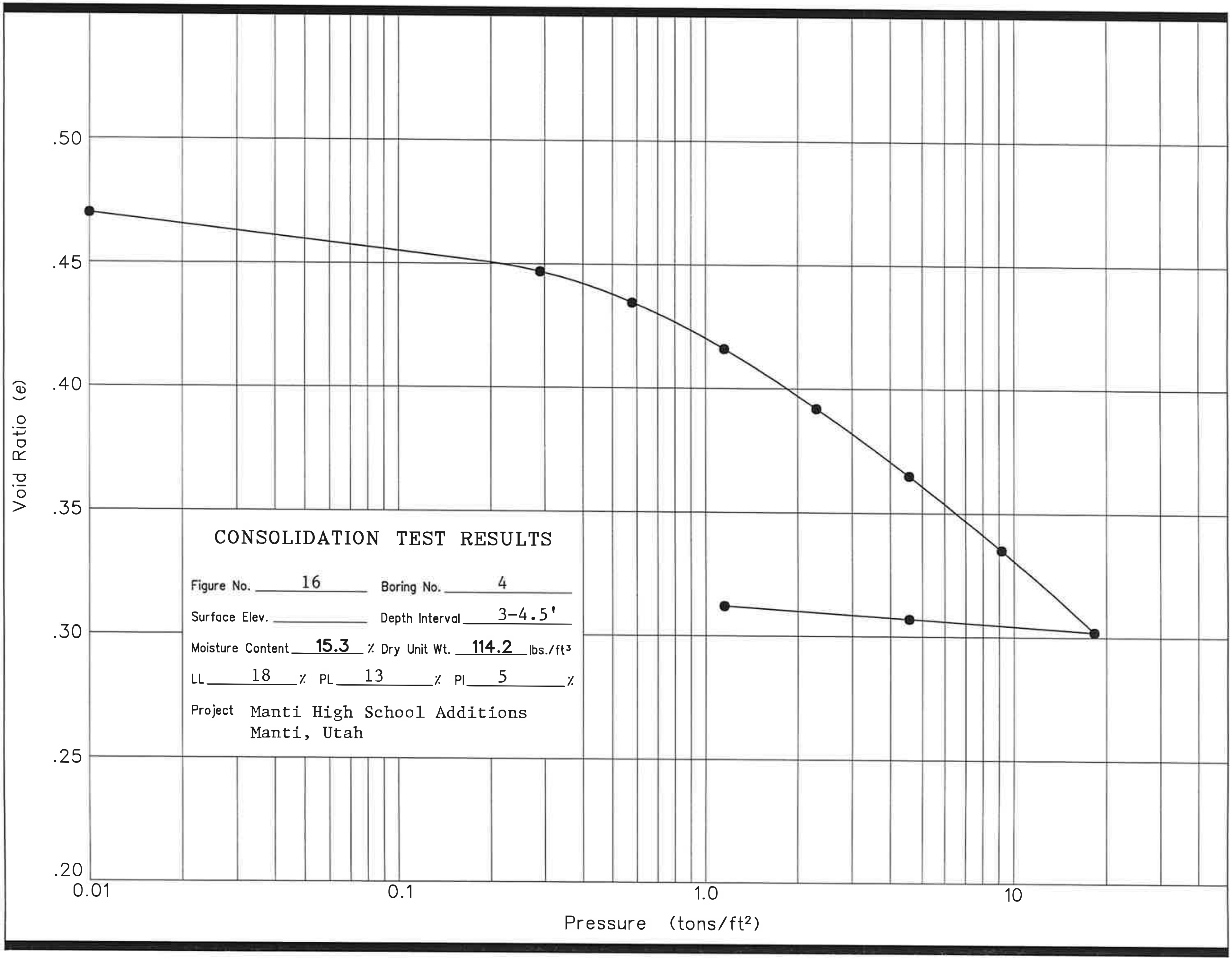
RB&G ENGINEERING INC.
Provo, Utah

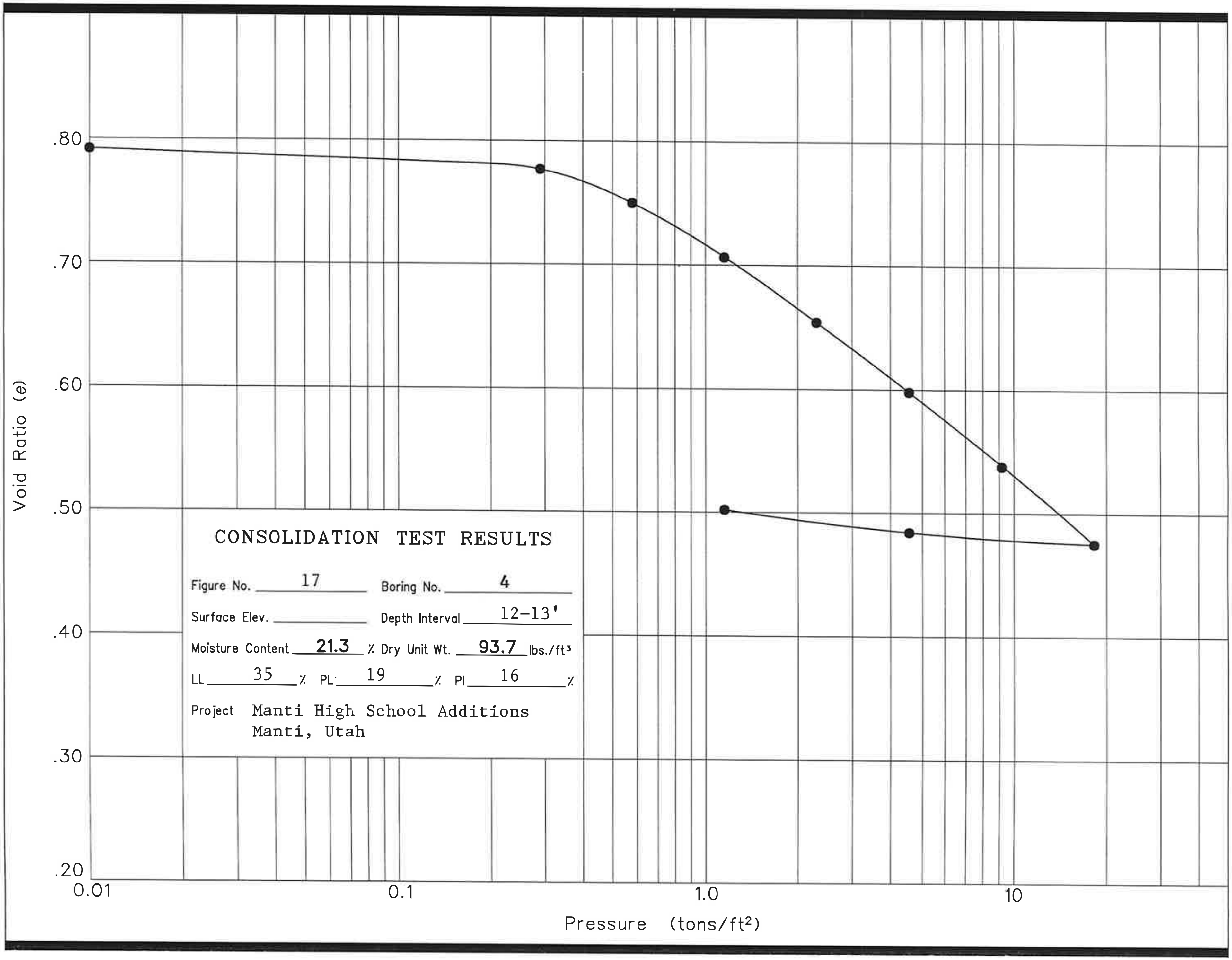
Figure 13
BEARING CAPACITY CHART
Manti High School Additions (Classrooms)
Manti, Utah

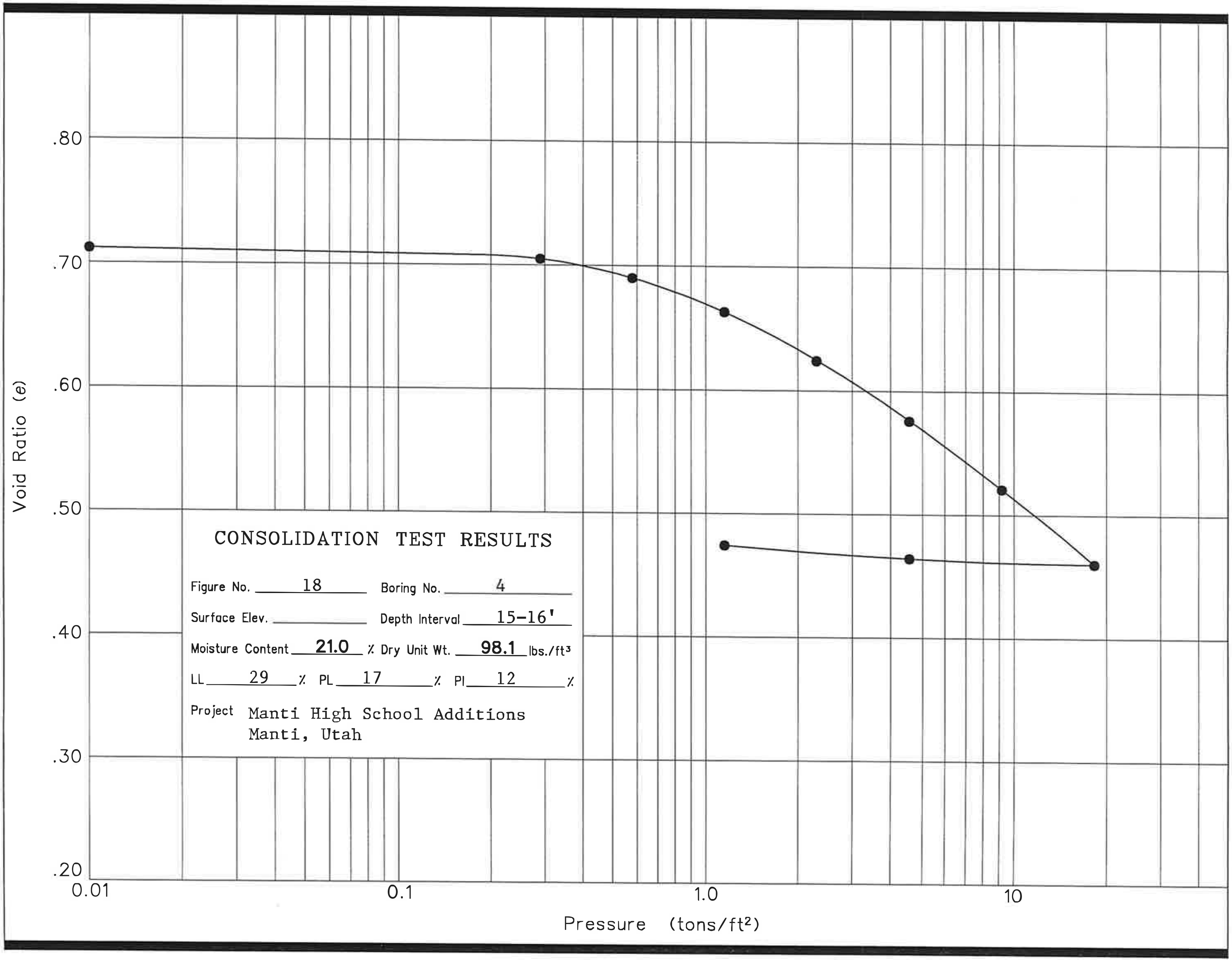


CONSOLIDATION TEST RESULTS
Figure No. 14
Boring No. 2
Surface Elev.
Depth Interval 3-4.5'
Moisture Content 16.3 %
Dry Unit Wt. 101.4 lbs./ft³
LL 22 %
PL 18 %
PI 4 %
Project Manti High School Additions
Manti, Utah
Void Ratio (e)
.70
.65
.60
.55
.50
.45
.40
0.01
0.1
1.0
10
Pressure (tons/ft²)


.55
.50
.45
.40
.35
.30
.25
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
CONSOLIDATION TEST RESULTS
Figure No. 15 Boring No. 2
Surface Elev.
Depth Interval 6-7.5'
Moisture Content 14.8 % Dry Unit Wt. 110.5 lbs./ft³
LL 21 % PL 13 % PI 8 %
Project Manti High School Additions
Manti, Utah


CONSOLIDATION TEST RESULTS
Figure No. 16
Boring No. 4
Surface Elev.
Depth Interval 3-4.5'
Moisture Content 15.3 %
Dry Unit Wt. 114.2 lbs./ft³
LL 18 %
PL 13 %
PI 5 %
Project Manti High School Additions
Manti, Utah
Void Ratio (e)
.50
.45
.40
.35
.30
.25
.20
0.01
0.1
1.0
10
Pressure (tons/ft²)


.80
.70
.60
.50
.40
.30
.20
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
CONSOLIDATION TEST RESULTS
Figure No. 17
Boring No. 4
Surface Elev.
Depth Interval 12-13'
Moisture Content 21.3 %
Dry Unit Wt. 93.7 lbs./ft³
LL 35 %
PL 19 %
PI 16 %
Project Manti High School Additions
Manti, Utah



.80
.70
.60
.50
.40
.30
.20
Void Ratio (e)
0.01
0.1
1.0
10
Pressure (tons/ft²)
CONSOLIDATION TEST RESULTS
Figure No. 18
Boring No. 4
Surface Elev.
Depth Interval 15-16'
Moisture Content 21.0 %
Dry Unit Wt. 98.1 lbs./ft³
LL 29 %
PL 17 %
PI 12 %
Project Manti High School Additions
Manti, Utah

Table 1

SUMMARY OF TEST DATA

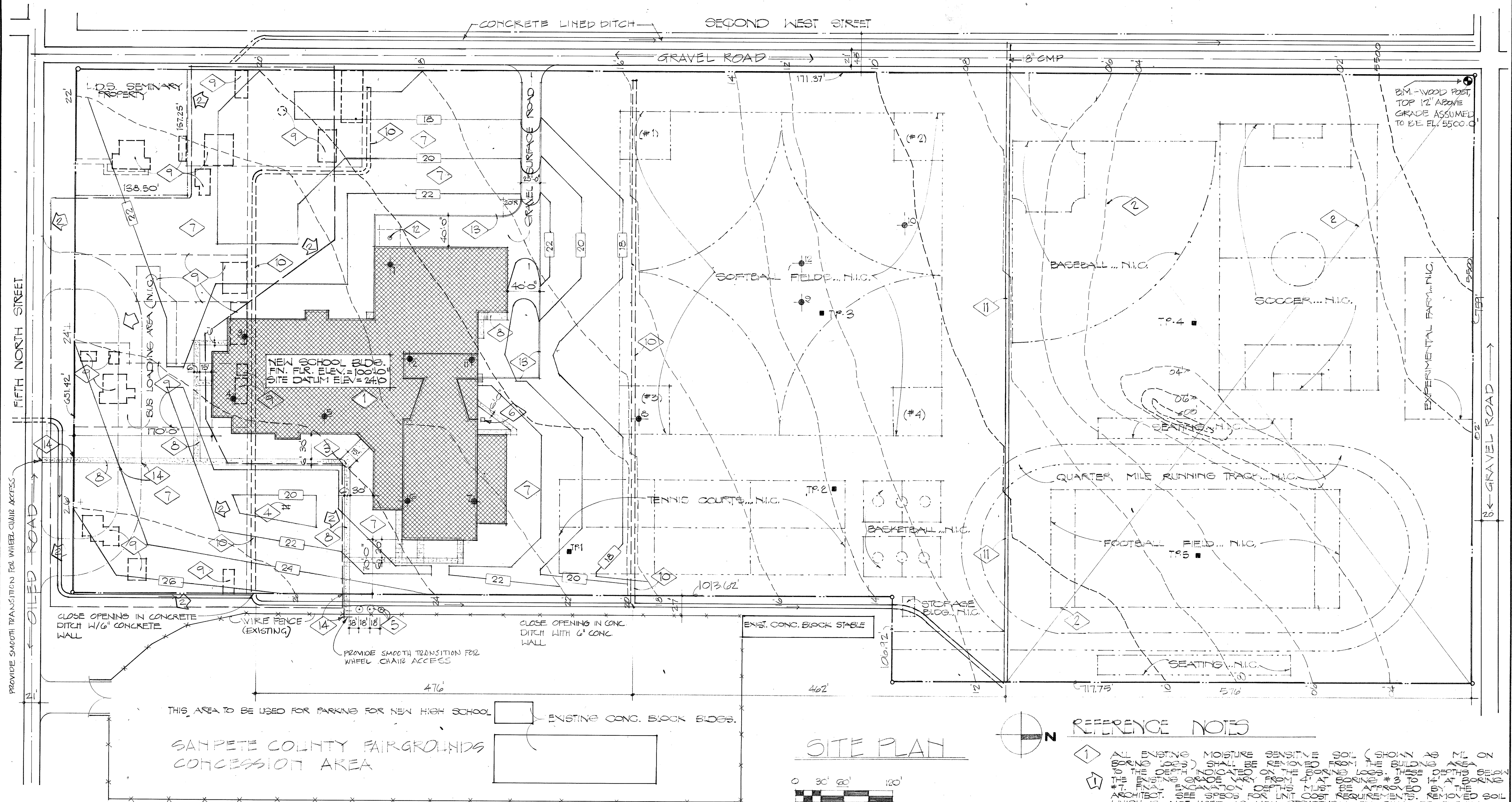
PROJECT Manti High School Additions

LOCATION Manti, Utah FEATURE Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE (ft)	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	ATTERBERG LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM (modified)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
1	3-4.5				878	22	17	15				CL-2
	6-7.5				618	24	14	10				CL-1
	9-10.5				538	24	16	8				CL-1
2	3-4.5		101.4	16.3	877	22	18	4				CL-ML
	6-7.5		110.5	14.8	933	21	13	8				CL-1
4	3-4.5		114.2	15.3	918	18	13	5				CL-ML
	12-13.5		93.7	21.3	969	35	19	16				CL-2
	15-16		98.1	21.0	987	29	17	12				CL-1
8	3-4.5				787	29	15	14				CL-1
	6-7.5				387	18	16	2				ML
10	3-4.5				4492	34	19	15				CL-2
	6-7.5				3167	23	16	7				CL-1
	9-10.5				1535	28	14	14				CL-1

NP=Nonplastic

MONSEN ENG. 3-78 MC7707



SITE PLAN

0 30' 60' 120'

NOTES:

1. SEE SHEET A-3A FOR BORING LOGS.
2. SEE MECHANICAL AND ELECTRICAL DRAWINGS FOR ALL EXISTING AND NEW UTILITIES.
3. ALL TREES WHICH ARE NOT WITHIN THE BUILDING AREA SHALL REMAIN AND SHALL BE PROTECTED DURING THE CONSTRUCTION PROCESS.
4. UNLESS OTHERWISE SHOWN, THE PROPERTY LINE IS THE CONTRACT LIMIT LINE.
5. SLOPE OF CONCRETE ENTRANCE PAD SHALL NOT EXCEED 1/8"/FT WITH IN 5'-0" OF DOOR

RECORD DRAWINGS - 8.27.80

1. MOISTURE SENSITIVE SOIL REMOVED TO LINE 4' MIN. OUT FROM EXTERIOR BLDG. LINE - (ADDM. #1)
2. NEW CONTOURS, PAVED AREAS & WALKS - SEE SHEET AP-1 DATED 9/14/79 (CHANGE ORDER No. 6)

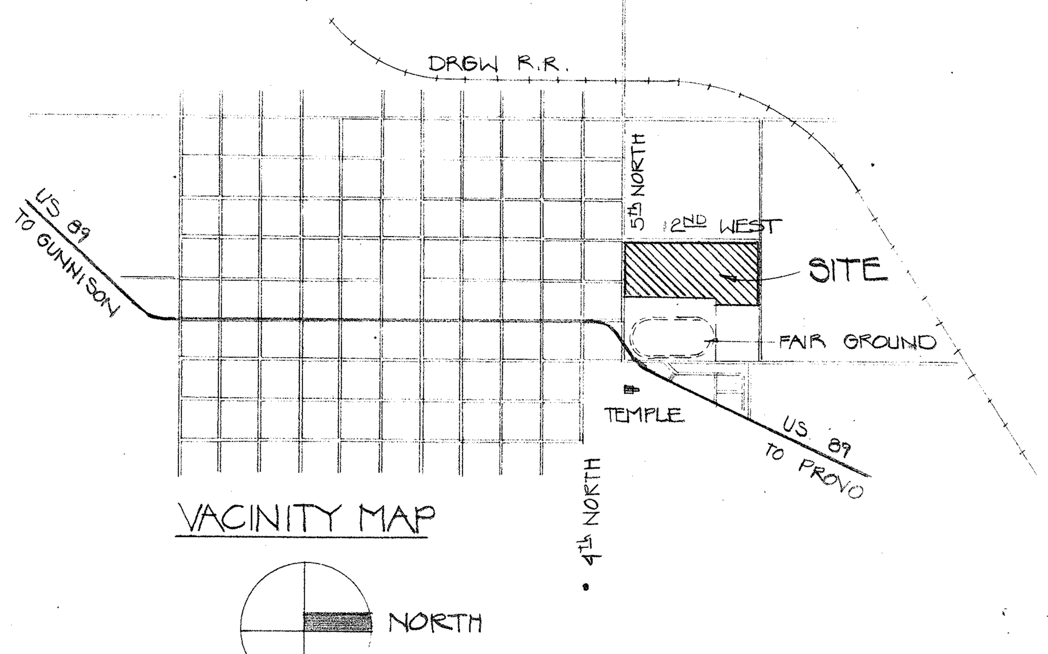
LEGEND

PROPERTY LINE
EXISTING CONTOURS
22 NEW CONTOURS
NOTE: ELEV 22 EQUALS 5522
CONC. SIDEWALKS
SOIL BORING LOCATION
TP-1 TEST PIT

SITE INFORMATION TAKEN FROM SURVEY BY C. LEE BROWN DATED MARCH 22, 1978. EXISTING CONTOURS SHALL BE CONSIDERED TO BE NO MORE ACCURATE THAN ONE-HALF THE CONTOUR INTERVAL.

REFERENCE NOTES

1. ALL EXISTING MOISTURE SENSITIVE SOIL (SHOWN AS ML ON BORING LOGS) SHALL BE REMOVED FROM THE BUILDING AREA TO THE DEPTH INDICATED ON THE BORING LOGS. THESE DEPTHS BELOW THE EXISTING GRADE VARY FROM 4' AT BORING #3 TO 14' AT BORING #7. FINAL EXCAVATION DEPTHS MUST BE APPROVED BY THE ARCHITECT. SEE SPECS FOR UNIT COST REQUIREMENTS. REMOVED SOIL WHICH IS NOT USED AS NON-STRUCTURAL FILL SHALL BE EVENLY DISTRIBUTED AT THE NORTH END OF THE SITE AS DIRECTED BY THE ARCHITECT. THE BUILDING EXCAVATION AREA SHALL BE BROUGHT UP TO UNDER SIDE OF FLOOR SLAB W/ IMPORTED REPLACEMENT FILL AS SPECIFIED
2. EXCESS SOIL REMOVED FROM THE BUILDING AREA SHALL BE EVENLY DISTRIBUTED IN THIS AREA AS DIRECTED BY THE ARCHITECT.
3. FLAG POLE. SEE 2/A-2
4. CATCH BASIN. TOP ELEV. 19.5' SEE MECH. DRAWINGS.
5. HANDICAPPED SIGN. SEE 1/A2
6. ELECTRICAL TRANSFORMER. SEE ELEC. DRAWINGS. E-3 THRU E-10
7. PLANTING AREA (N.I.C.)
8. CONC. WALK. SEE 4/A2 & 5/A-2 & SHEET A-4
9. EXISTING STRUCTURES TO BE DEMOLISHED BY THE OWNER.
10. EXISTING CONC. LINED DITCH TO BE REMOVED.
11. EXISTING CONC. LINED DITCH TO REMAIN IN SERVICE. KEEP CLEAN DURING CONSTRUCTION PROCESS.
12. COAL STORAGE BIN. SEE SHEETS S-3 & M-5
13. CONCRETE CURB. SEE 3/A-2
14. PROVIDE 6" THICK CONC. WALK, BETWEEN THIS POINTS



VACINITY MAP

MANTI, UTAH

MONTMORENCY HAYES AND TALBOT Architects Inc

a high school in manti, utah

for the south sanpete school district

SITE PLAN

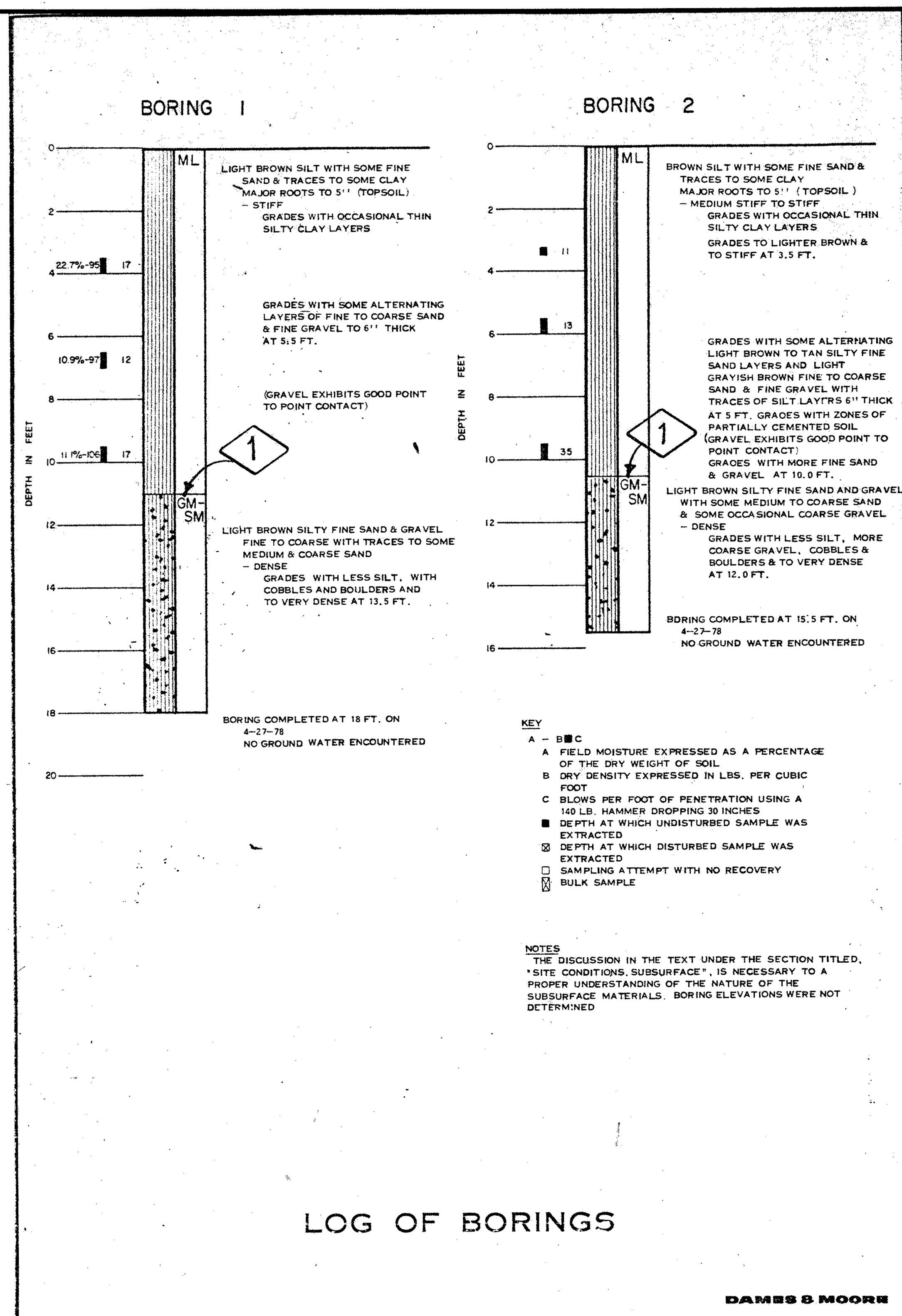
drawn: S.E. G.A. checked: L.A.J.

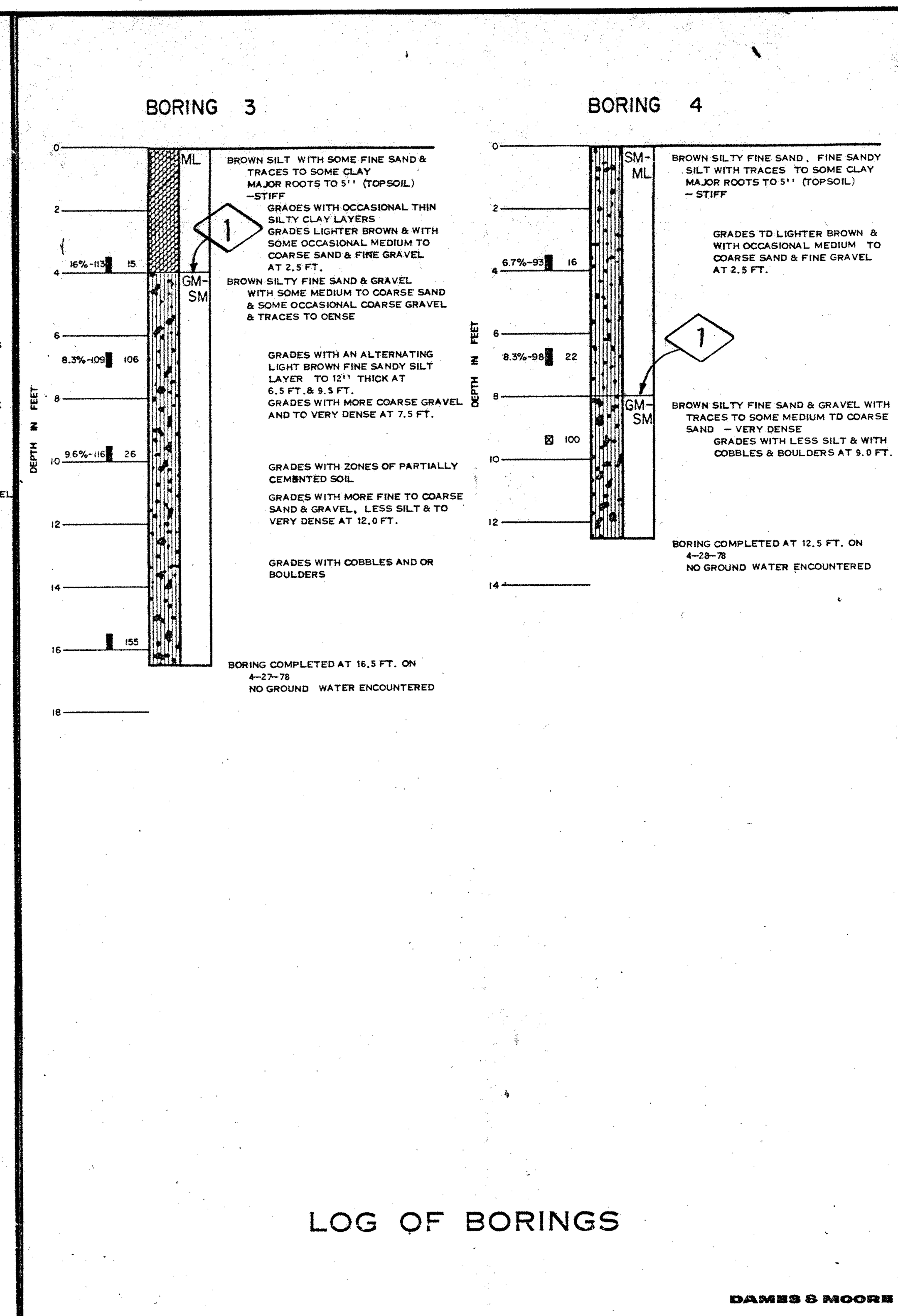
issue date: 7-12-78

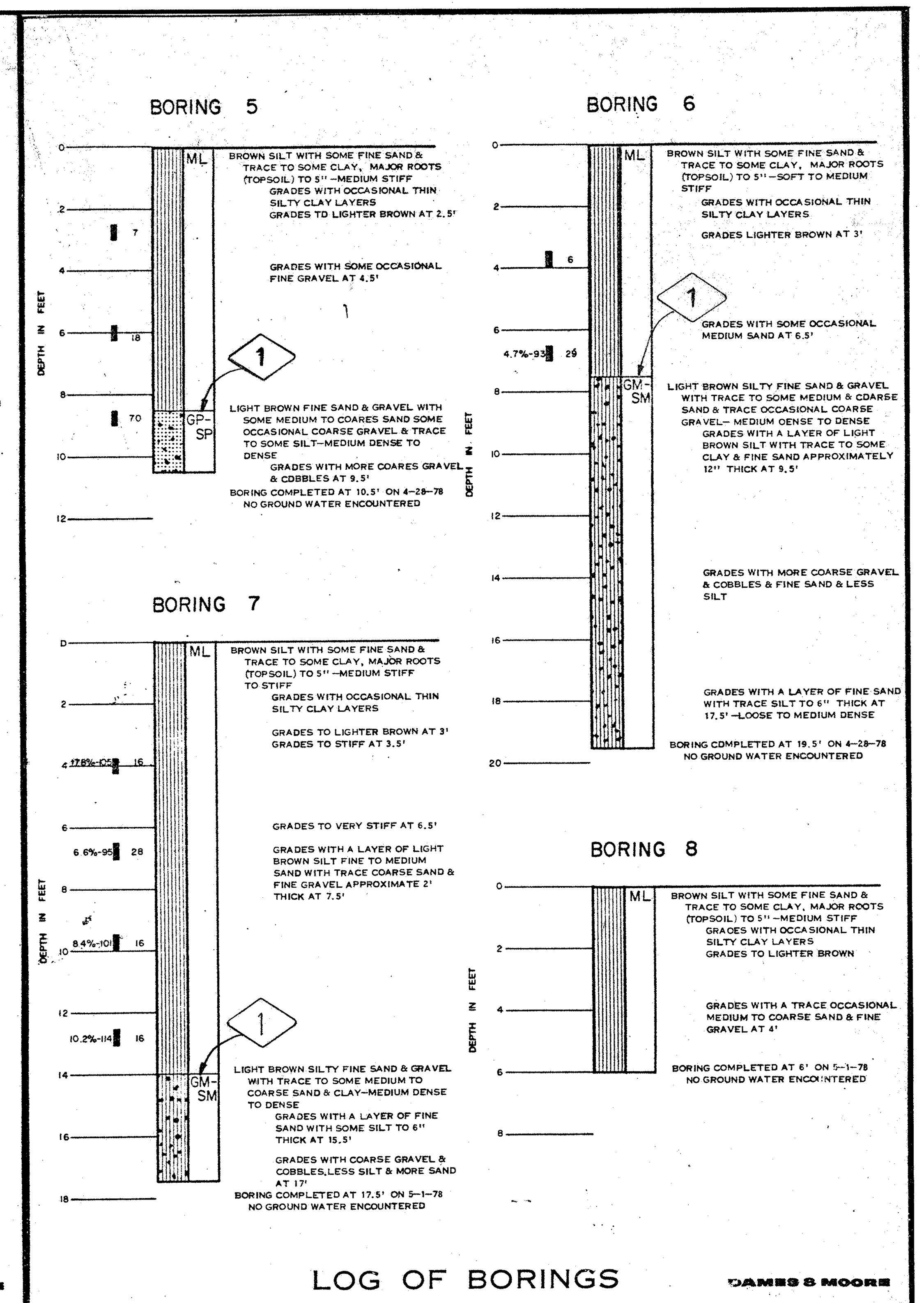
RECORD DRAWINGS AUG. 27, 1980

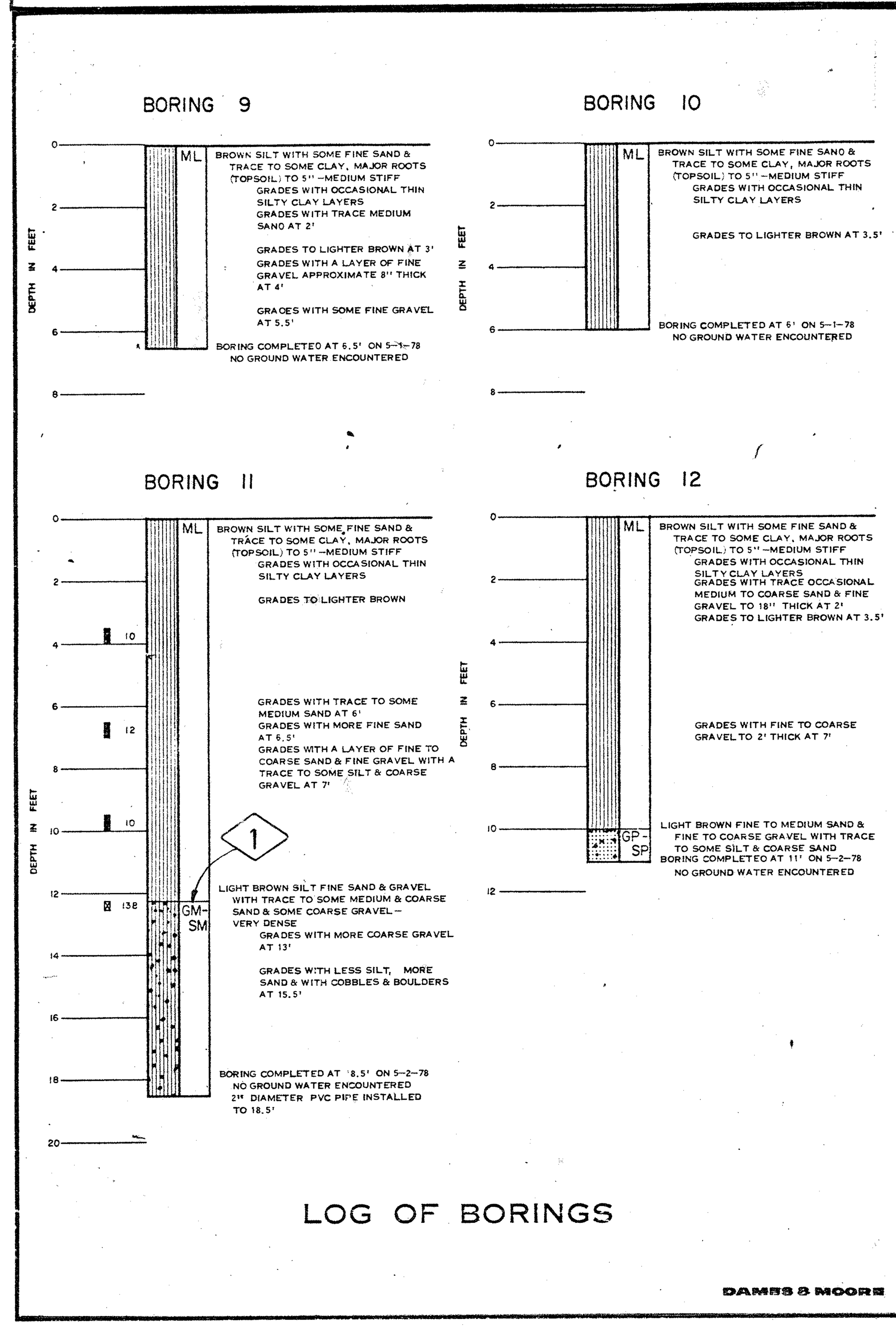
A-3

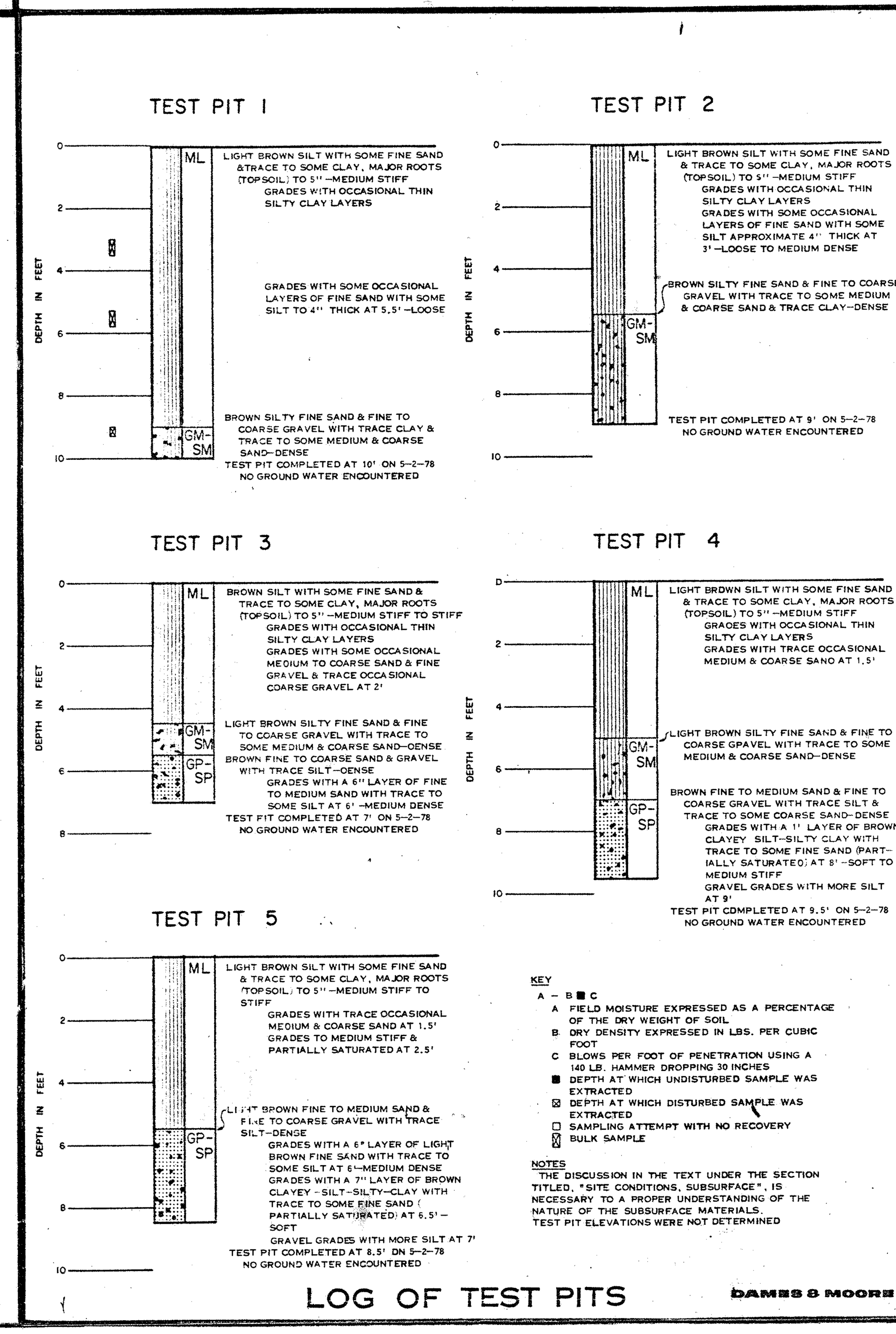
MONSEN ENG. 3-78 MC7707











MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS.

SOIL CLASSIFICATION CHART

UNIFIED SOIL CLASSIFICATION SYSTEM

DAMES & MOORE

REFERENCE NOTES

(1) MOISTURE SENSITIVE SOILS (NOTED AS ML) SHALL BE REMOVED TO THIS DEPTH.

MONTMORENCY HAYES AND TALBOT Architects Inc

a high school in manti, utah

for the south sanpete school district

LOG OF BORINGS

drawn: checked:

issue date: 7-12-78

A-3A

TABLE OF CONTENTS

EXECUTIVE SUMMARY

1. No field work was performed for this study. We were provided with boring logs by Dames and Moore in 1978 for the proposed high school building and a geotechnical report prepared by RB&G dated August 1997 for proposed building additions to the high school.

   The logs indicate there is 6½ to 14 feet of moisture-sensitive soil overlying sand and gravel in the general area of the two proposed building additions. Additional subsurface investigation can be performed to better define the thickness of the moisture-sensitive soil at the two proposed building additions.

2. No subsurface water was reported to be encountered in the borings.

3. We understand the building additions will be single-story wood or steel-frame structures. We have assumed maximum column loads of 100 kips and maximum wall loads of 5 kips per foot.

4. The building additions may be supported on spread footings bearing on the natural undisturbed gravel or on structural fill extending down to the natural undisturbed gravel. The moisture-sensitive soil should be removed from below the proposed building additions. Footings may be designed for a net allowable bearing pressure of 3,500 pounds per square foot.

   Deep foundations that extend a sufficient depth into the non-moisture-sensitive soil or aggregate piers that adequately improve the condition of the moisture-sensitive soil for support of the building additions may be considered as alternative methods to mitigate the moisture-sensitive soil hazard.

5. Geotechnical information relating to foundations, subgrade preparation, materials and pavement is included in the report.

SCOPE

This report presents the results of a geotechnical study for the proposed building additions to the Manti High School located at 100 West 500 North in Manti, Utah. The study was conducted in general accordance with our proposal dated September 4, 2024. No field work was performed as part of this study. Recommendations are based on the provided boring logs by Dames and Moore in 1978 for the proposed high school building and a geotechnical report prepared by RB&G dated August 1997 for proposed building additions to the high school.

Information obtained from the information provided was used to define conditions at the site and to develop recommendations for the proposed foundations. The boring locations from the previous studies are presented on Figure 1. Boring logs are included in the appendix.

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 relating to construction are included in the report.

SITE CONDITIONS

Based on a review of Google Earth images of the site, the shop building addition is currently an asphalt-paved drive and the proposed wrestling building addition is in a landscaped area.

Lidar data obtained from the Utah GRC website indicate both areas are relatively flat with a gentle slope away from the high school building.

SUBSURFACE CONDITIONS

No field work was performed for this study. We were provided with boring logs by Dames and Moore in 1978 for the proposed high school building and a geotechnical report prepared by RB&G dated August 1997 for proposed building additions to the high school.

The logs indicate there is 6½ to 14 feet of moisture-sensitive soil overlying sand and gravel in the general area of the two proposed building additions. Additional subsurface investigation can be performed to better define the thickness of the moisture-sensitive soil at the two proposed building additions.

Dames and Moore describe the moisture-sensitive soil to consist of silt with sand and a small amount of clay with occasional sand and gravel layers. They describe the underlying soil to consist of silty sand and gravel. RB&G describe the moisture-sensitive soil to consist of clay, sandy gravelly clay and silty clay with silty sand lenses. They describe the underlying soil to consist of silty sandy gravel.

SUBSURFACE WATER

No subsurface water was reported to be encountered in the borings.

PROPOSED CONSTRUCTION

We understand the building additions will be single-story wood or steel-frame structures. We have assumed maximum column loads of 100 kips and maximum wall loads of 5 kips per foot.

If the proposed construction or building loads are significantly different from those described above, we should be notified so that we can reevaluate the recommendations given.

RECOMMENDATIONS

Based on the subsurface conditions described by others and our understanding of the proposed construction, the following recommendations are given:

A. Site Grading

1. Subgrade Preparation

   If deep foundations or soil improvement to mitigate the moisture-sensitive soil at the site are not provided then the moisture-sensitive soil, unsuitable fill, topsoil, organics and other deleterious materials should be removed from below the proposed building additions. We anticipate that the moisture-sensitive soil was removed for an unknown distance from beyond the existing building and replaced with compacted structural fill. Thus, structural fill is expected near the existing building and this fill will not need to be removed from below the proposed building additions. This should be evaluated at the time of construction.

2. Temporary Excavation Slopes

   We anticipate that excavation at the site can be accomplished with typical excavation equipment.

   Temporary unretained excavation slopes may be constructed at 1 ½ horizontal to 1 vertical or flatter.

3. Materials

   Listed below are recommendations for imported structural fill.

Fill to Support	Recommendations
Footings	Non-expansive granular soil Passing No. 200 Sieve < 35% Liquid Limit < 30% Maximum size 4 inches
Floor Slab (Upper 4 inches)	Sand and/or Gravel Passing No. 200 Sieve < 5% Maximum size 2 inches
Slab Support	Non-expansive granular soil Passing No. 200 Sieve < 50% Liquid Limit < 30% Maximum size 6 inches

Materials placed as fill to support structures should be non-expansive granular soil. The fill and natural soil meeting the imported structural fill criteria given above may be used as structural fill, site grading fill and as utility and wall backfill if the over-sized particles, organics, topsoil, debris and other deleterious materials are removed. The moisture-sensitive soil is expected to have a high fines content and is not recommended for use as structural fill.

The natural soil and fill will likely require moisture conditioning prior to use as fill. Drying of the soil may not be practical during cold or wet periods of the year.

4. <u>Compaction</u>

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 Criteria
Foundations	≥ 95%
Concrete Slabs	≥ 90%
Pavement	
Base Course	≥ 95%
Fill placed below Base Course	≥ 90%
Landscaping	≥ 85%
Retaining Wall Backfill	85 - 90%

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

The fill should be placed and compacted in thin enough lifts to allow for proper compaction. Fill placed for the project should be frequently tested for compaction.

5. Drainage

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

B. Foundations

1. Bearing Material

With the proposed construction and the subsurface conditions encountered, the building additions may be supported on spread footings bearing on the undisturbed natural gravel or on structural fill extending down to the natural undisturbed gravel. Structural fill should extend out away from the edge of the footings at least a distance equal to the depth of fill placed beneath footings. The existing structural fill for the high school building that has been adequately compacted need not be removed to meet this criteria.

Deep foundations that extend a sufficient depth into the non-moisture-sensitive soil or aggregate piers that adequately improve the condition of the moisture-sensitive soil for support of the building additions may be considered as alternative methods to mitigate the moisture-sensitive soil hazard.

The moisture-sensitive soil, topsoil, unsuitable fill, organics, debris and other deleterious materials should be removed from below footing areas.

2. Bearing Pressure

Footings may be designed using a net allowable bearing pressure of 3,500 pounds per square foot.

Footings should have a width of at least 1½ feet and an embedment depth of at least 1 foot.

3. Settlement

We estimate that total and differential settlements will be less than ½ inch for footings designed as indicated above.

4. Temporary Loading Conditions

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

5. Frost Depth

Exterior footings and footings beneath unheated areas should be placed at least 30 inches below grade for frost protection.

6. Foundation Base

The base of foundation excavations should be cleared of loose or deleterious material prior to fill or concrete placement.

7. Construction Observation

A representative of the geotechnical engineer should observe footing excavations prior to structural fill or concrete placement.

C. Concrete Slab-on-Grade

1. Slab Support

Concrete slabs may be supported on the undisturbed natural gravel or on compacted structural fill extending down to the undisturbed natural gravel.

The moisture-sensitive soil, topsoil, organics, unsuitable fill, debris and other deleterious materials should be removed from below proposed slab areas. Alternatively, soil improvement or deep foundations may be considered below concrete slabs.

2. Underslab Sand and/or Gravel

A 4-inch layer of free-draining sand and/or gravel (less than 5 percent passing the No. 200 sieve) should be placed below floor slabs for ease of construction and to promote even curing of the slab concrete.

3. Vapor Barrier

A vapor barrier should be placed under the concrete floor if the floor will receive an impermeable floor covering. The barrier will reduce the amount of water vapor passing from below the slab to the floor covering.

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 0.45 may be used in design for ultimate lateral resistance. The passive resistance of the soil adjacent footings may be added to the friction resistance.

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
Clay and Silt	50 pcf	65 pcf	250 pcf
Sand and Gravel	40 pcf	55 pcf	300 pcf

3. Seismic Conditions

Under seismic conditions, the equivalent fluid weight should be increased by 23 pcf for the active condition and 8 pcf for the at-rest condition. A decrease of 23 pcf is recommended for the passive condition. This assumes a peak ground acceleration of 0.38g which represents a 2 percent probability of exceedance in a 50-year period.

4. Safety Factors

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

E. Seismicity, Faulting and Liquefaction

1. Seismicity

Listed below is a summary of the site parameters that may be used with the 2021 International Building Code:

Description	Value[1]
Site Class	D[2]
S_s - MCE_R ground motion (period = 0.2s)	0.64g
S_1 - MCE_R ground motion (period = 1.0s)	0.20g
F_a - Site amplification factor at 0.2s	1.29
F_v - Site amplification factor at 1s	2.20
PGA - MCE_G peak ground acceleration	0.29g
PGA_M - Site modified peak ground acceleration	0.38g

[1]Values obtained from information provided by the Applied Technology Council at https://hazards.atcouncil.org.

[2]Site Class D is selected based on the subsurface conditions reported and our understanding of the geology of the area. Site Class C may be representative of the site but the shear wave velocity of the upper 100 feet of soil below the site would need to be measured to determine this.

2. Faulting

There are no mapped active faults extending through the project site. The closest mapped fault, which is considered active, is the Gunnison Fault located approximately 4.5 miles northwest of the site (Utah Geological Survey, 2024).

3. Liquefaction

The site is located in an area mapped as having a “very low” liquefaction potential (Anderson and others, 1994). Liquefaction is not considered to be a hazard at this site based on the subsurface conditions encountered.

F. Water Soluble Sulfates

Based on our experience in the area, the natural soil is not expected to have significant water soluble sulfates. The soil could be tested to confirm this. No special cement type is needed for concrete placed in contact with soil not containing significant water soluble sulfates.

G. Preconstruction Meeting

A preconstruction meeting should be held with representatives of the owner, project architect, geotechnical engineer, general contractor, earthwork contractor and other members of the design team to review construction plans, specifications, methods and schedule.

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 provided. No subsurface investigation was performed for this project. Variations in the subsurface conditions may not become evident until exploration or excavation is conducted. If the subsurface conditions, proposed construction or groundwater level is found to be significantly different from what is described above, we should be notified to reevaluate the recommendations given.

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

PROFESSIONAL ENGINEER
9-17-2024
No. 260053
DOUGLAS R.
HAWKES
STATE OF UTAH

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

Reviewed by Jay R. McQuivey, P.E.

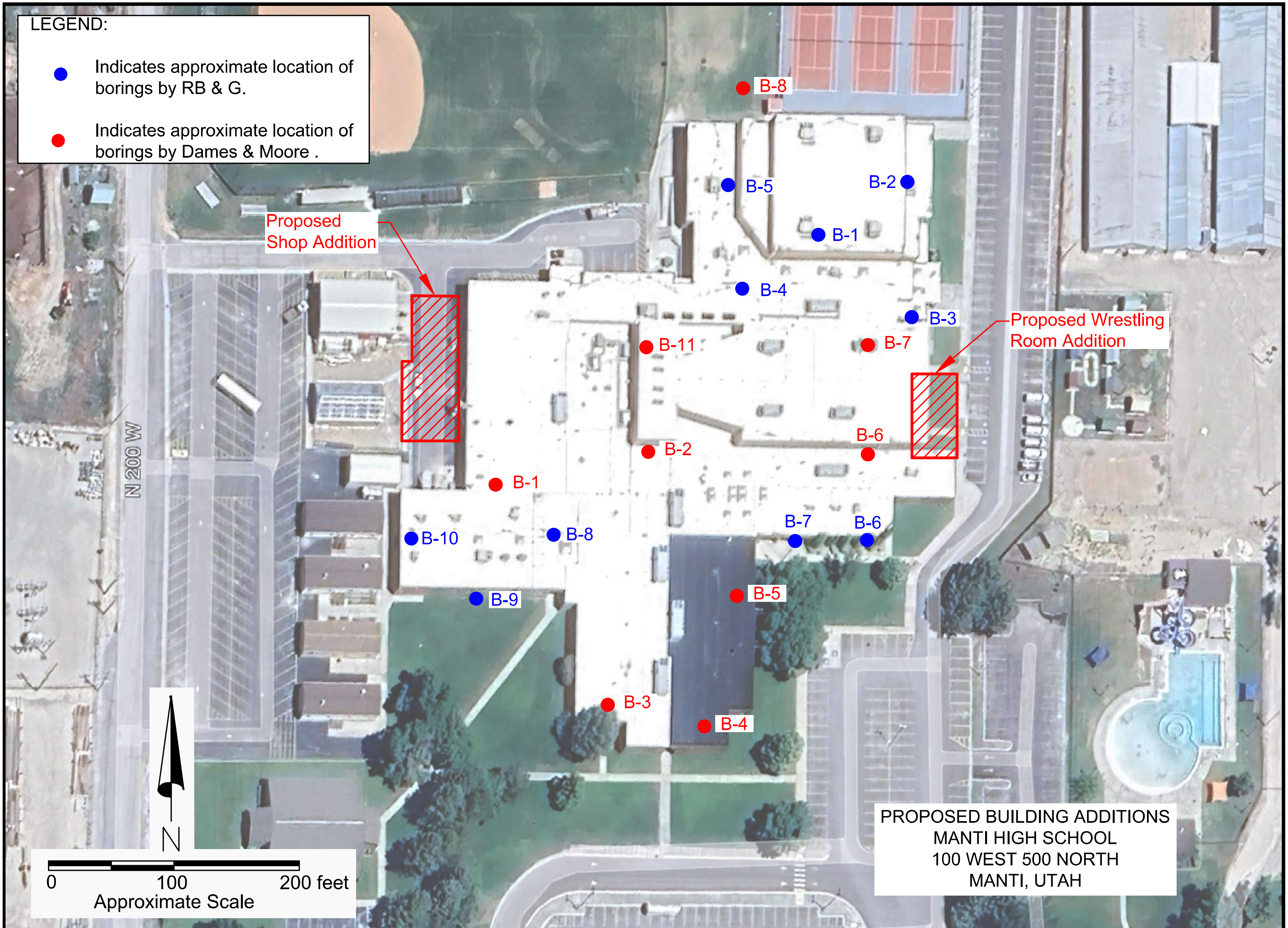
DRA/rs

REFERENCES

Anderson, L.R., Keaton, J.R., and Rice, J.D., 1994; Liquefaction Potential map for Central Utah, Utah Geological Survey, Contract Report 94-10.

International Code Council, 2020; 2021 International Building Code, Falls Church, Virginia.

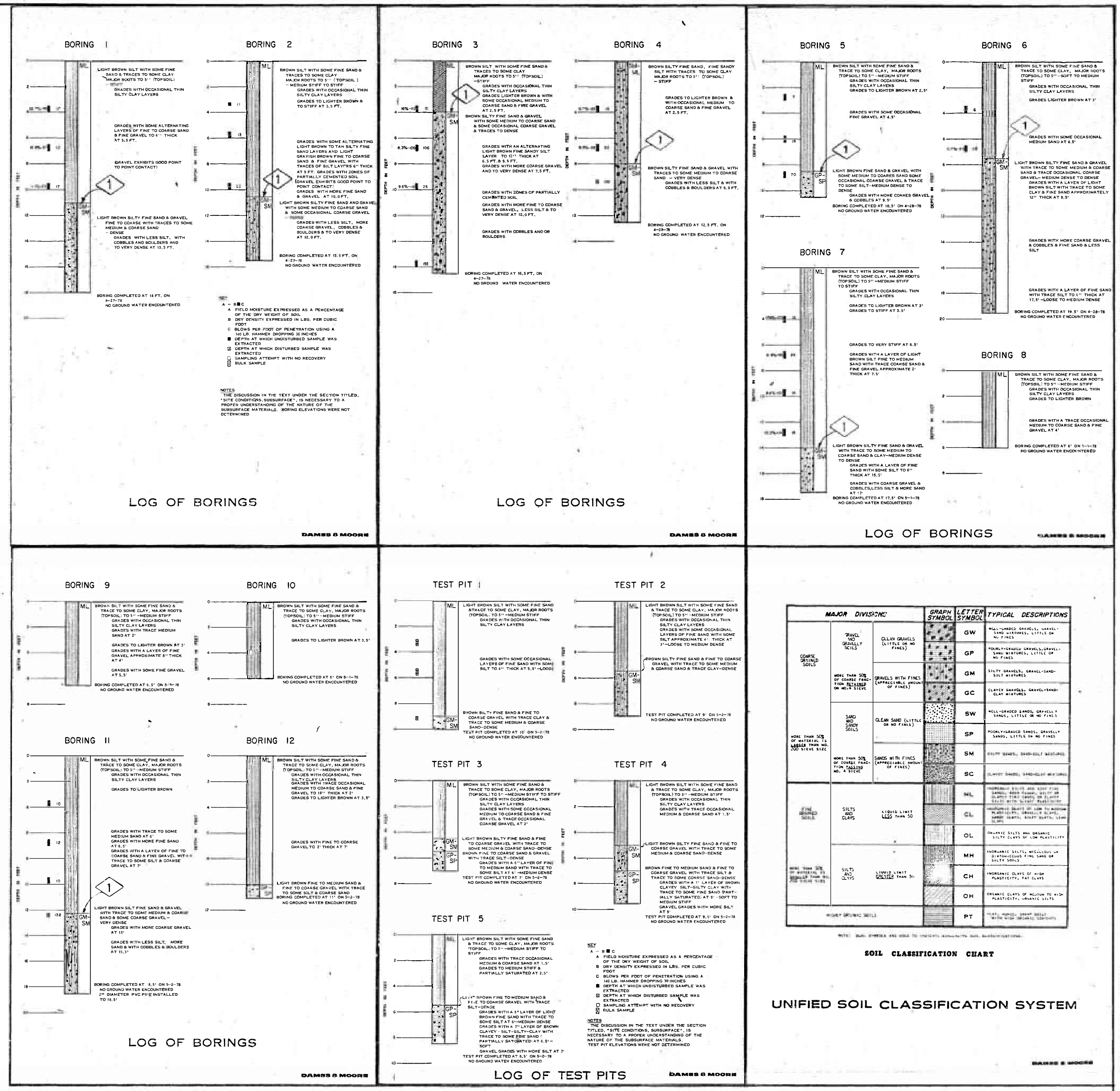
Utah Geological Survey, 2024; Utah geologic hazards portal accessed on September 16, 2024 at https://geology.utah.gov/apps/hazards/.



1240698	AGEC	Boring Locations	Figure 1

APPENDIX

1978 & 1997 SOILS REPORT BORING LOGS



REFERENCE NOTES

(1) MOISTURE SENSITIVE SOILS (NOTED AS ML) SHALL BE REMOVED TO THIS DEPTH.

1978 - Dames and Moore Boring Logs

MONTMORENCY HAYES AND TALBOT Architects Inc

a high school in manti, utah

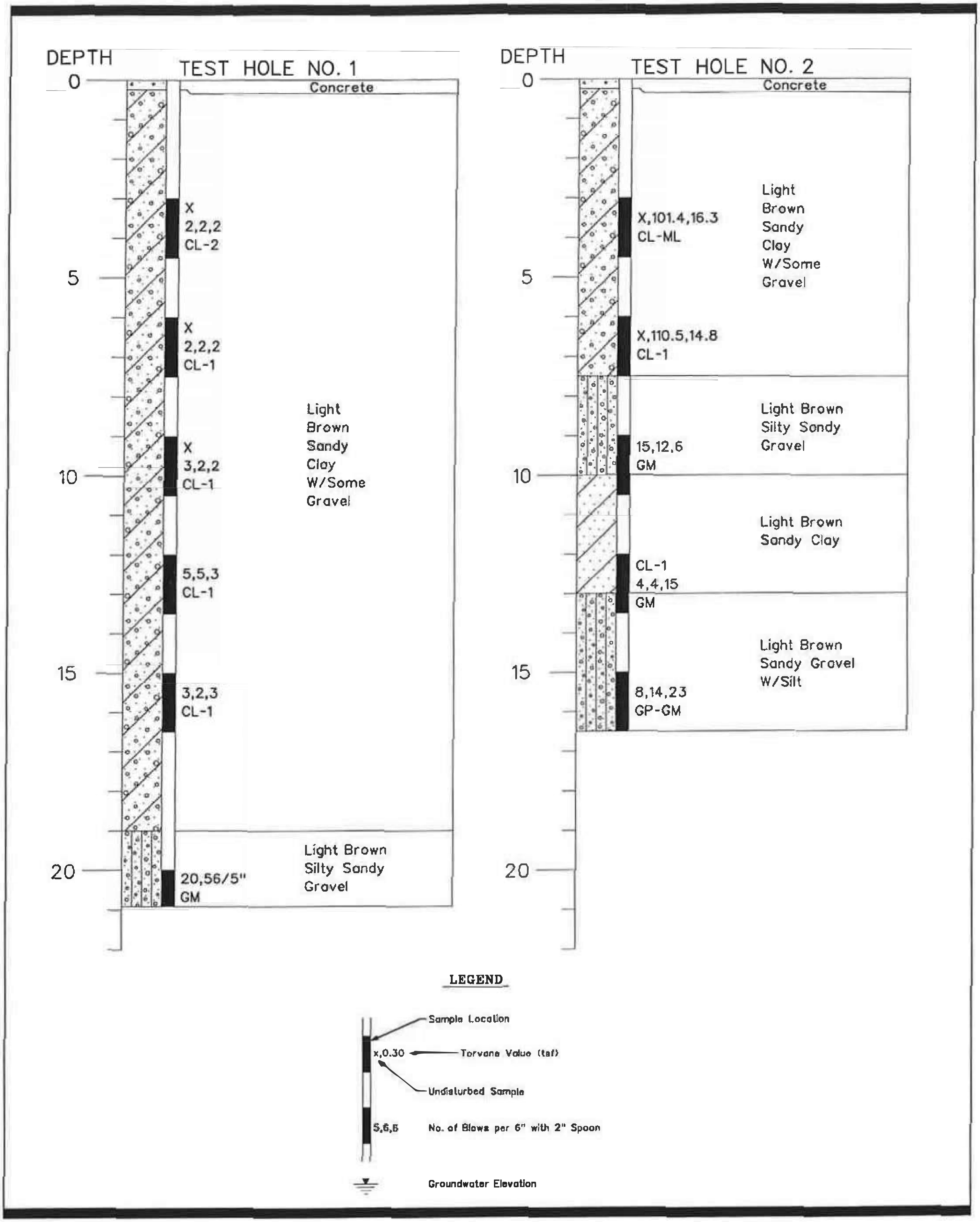
for the south sanpete school district

LOG OF BORINGS

drawn: checked:

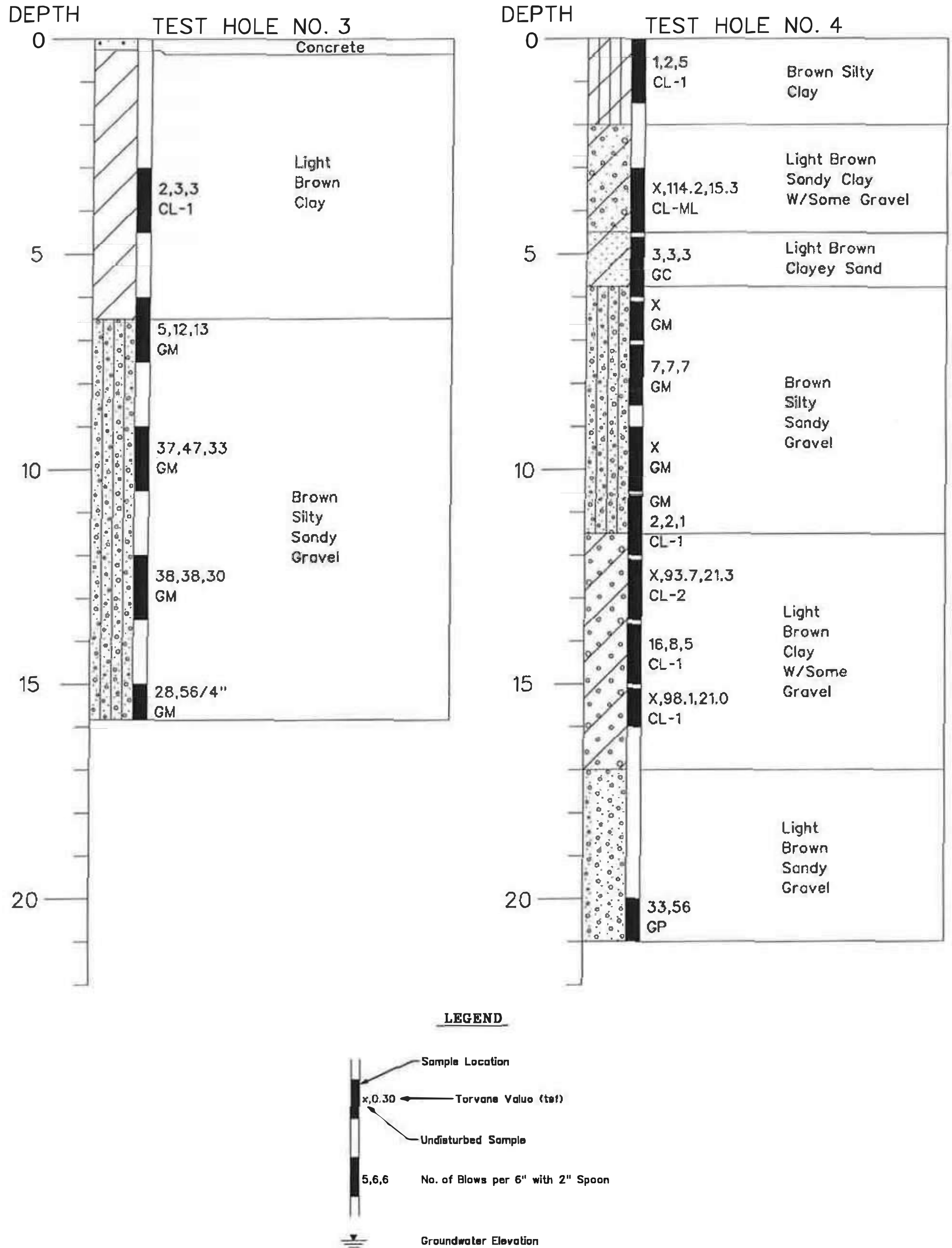
issue date: 7-12-78

A·3A



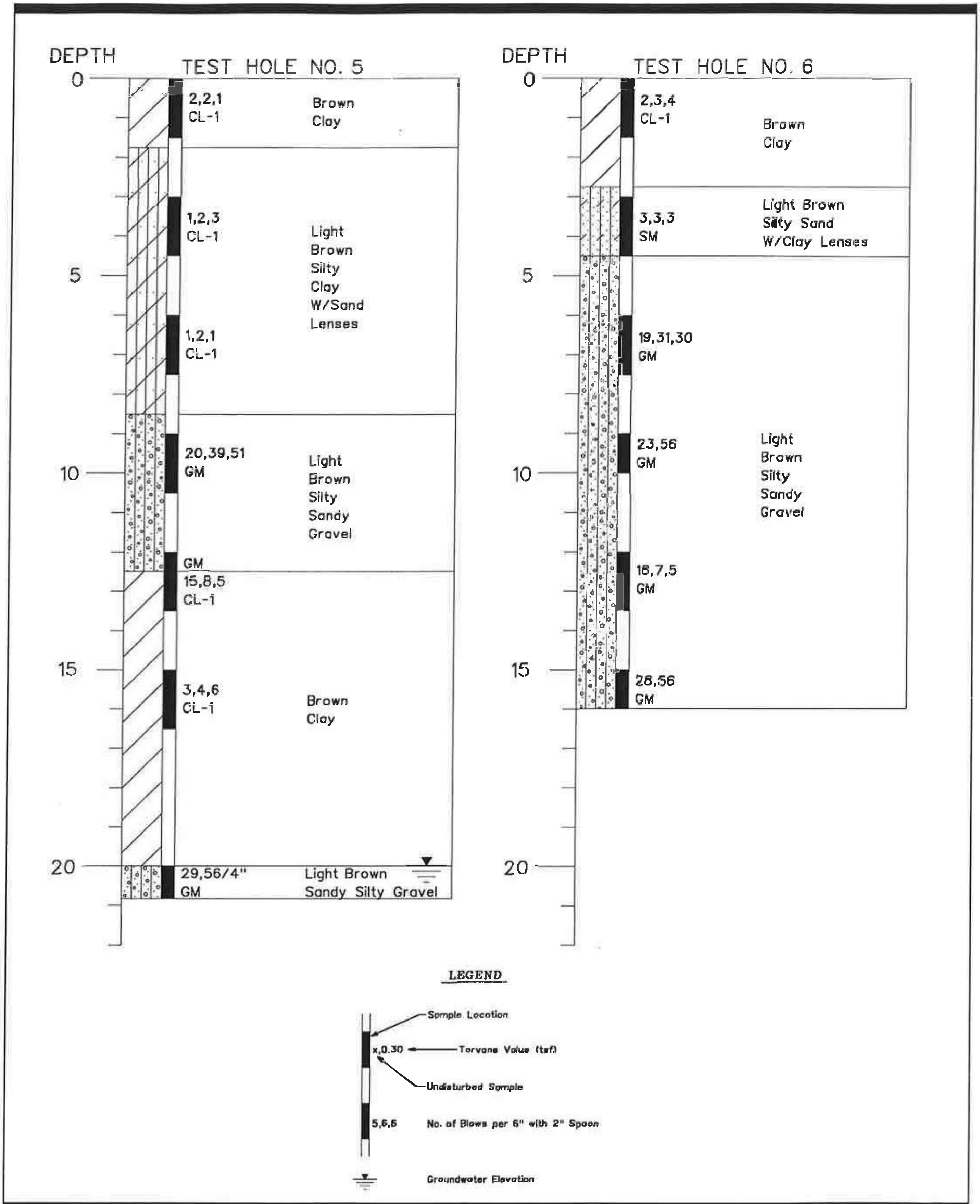
RB&G ENGINEERING INC.
Provo, Utah

Figure 4 **TEST HOLE LOGS**
Manti High School Additions
Manti, Utah



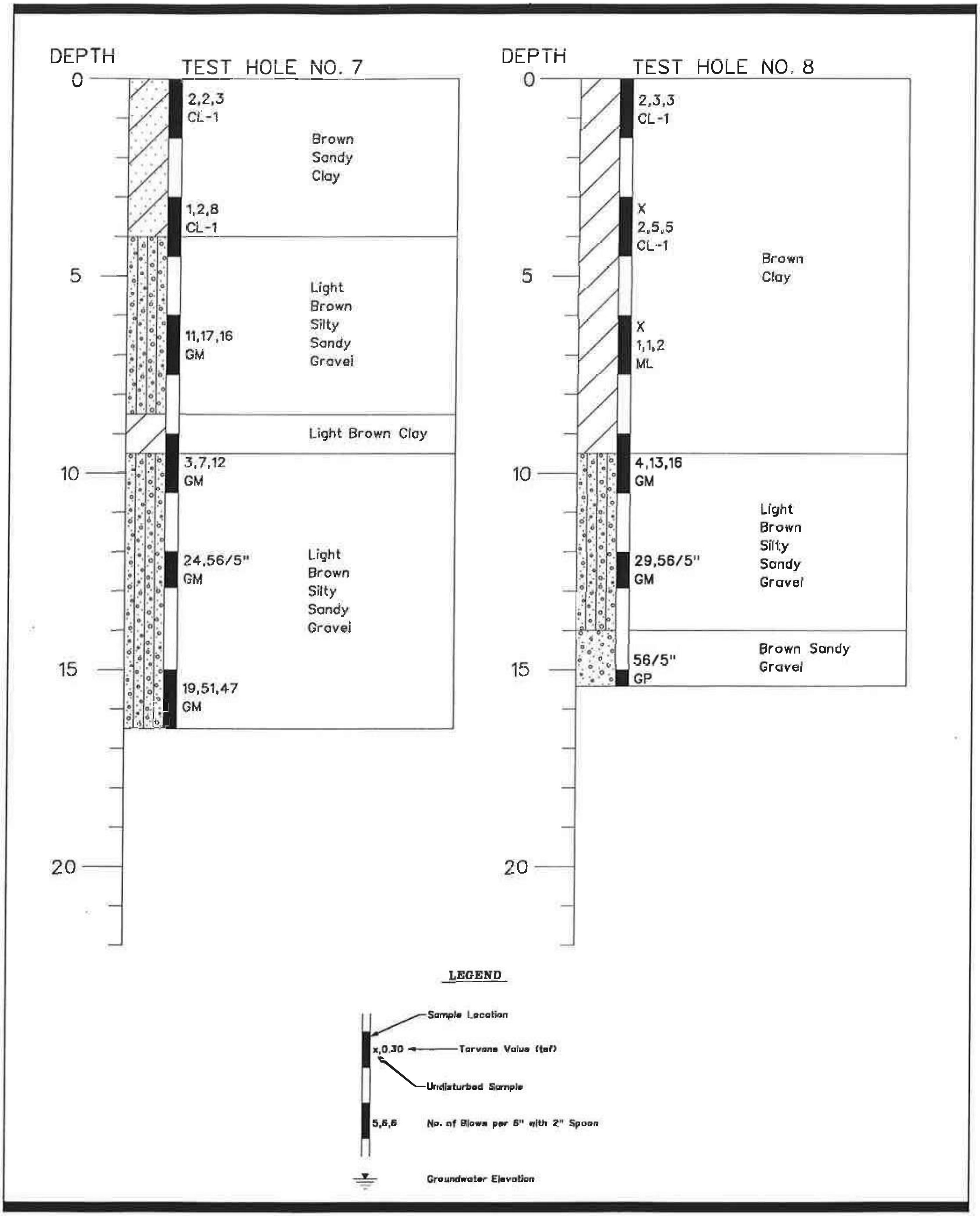
RB&G ENGINEERING INC.
Provo, Utah

Figure 5 **TEST HOLE LOGS**
Manti High School Additions
Manti, Utah



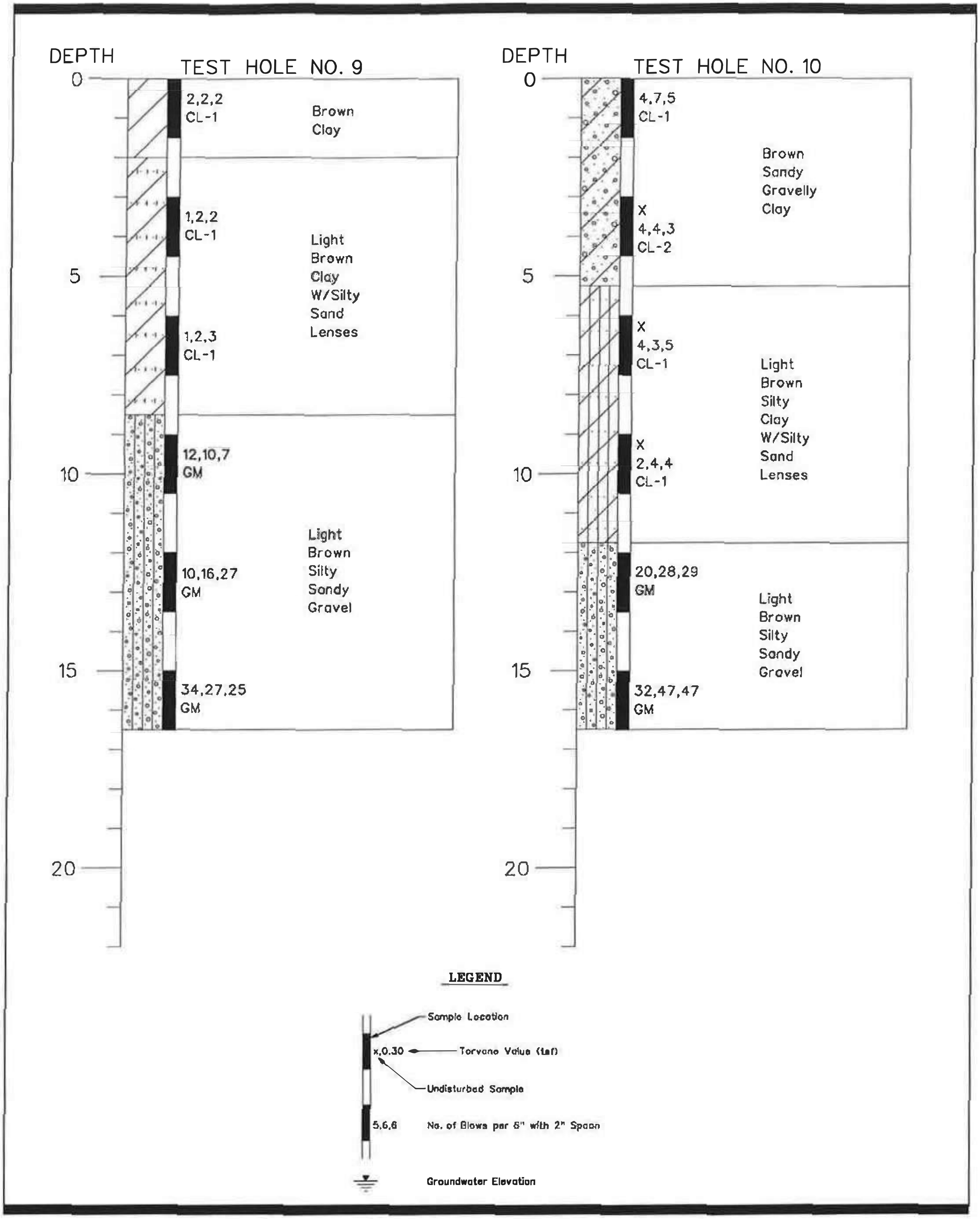
RB&G ENGINEERING INC.
Provo, Utah

Figure 6 **TEST HOLE LOGS**
Manti High School Additions
Manti, Utah



RB&G ENGINEERING INC.
Provo, Utah

Figure 7 **TEST HOLE LOGS**
Manti High School Additions
Manti, Utah



RB&G ENGINEERING INC.
Provo, Utah

Figure 8 **TEST HOLE LOGS**
Manti High School Additions
Manti, Utah