Gordon Spilker Huber
Geotechnical Consultants, Inc.

REPORT
GEOTECHNICAL STUDY
PROPOSED DISTRICT ELEMENTARY SCHOOL ADDITION
1950 MONROE BOULEVARD
OGDEN, UTAH

Submitted To:

Ogden City School District
1950 Monroe Boulevard
Ogden, Utah 84401

Submitted By:

Gordon Spilker Huber Geotechnical Consultants, Inc.
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Salt Lake City, Utah 84123

March 9, 2007

Job No. 0436-003-06

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Geotechnical Consultants, Inc.

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Ogden City School District
1950 Monroe Boulevard
Ogden, Utah 84401

Attention: Mr. Ron Worwood

Gentlemen:

Re: Report
Geotechnical Study
Proposed District Elementary School Addition
1950 Monroe Boulevard
Ogden, Utah

1. INTRODUCTION

1.1 GENERAL

This report presents the results of our geotechnical study performed at the site of the existing District Elementary school, which is located at 1950 Monroe Boulevard in Ogden, Utah. Several classroom buildings and a gymnasium are proposed to be constructed on the campus of the existing facility. The general location of the overall site with respect to major topographic features and existing facilities, as of 1998, is presented on Figure 1, Vicinity Map. A more detailed layout of the new school with respect to adjoining structures, roadways, and other facilities, on an aerial photo base, is presented on Figure 2, Area Map. A map showing the detailed layout of the proposed building with respect to the existing school is presented on Figure 3, Site Plan. The locations of the borings drilled in conjunction with this study are also presented on Figure 3.

1.2 OBJECTIVES AND SCOPE

The objectives and scope of our study were planned in discussions between Mr. Ron Worwood of Ogden City School District; Mr. Dave Nilson of MHTN Architects, Inc.; Mr. Brent L. White of ARW Engineers; and Messrs. Bill Gordon and Hogan Wright of Gordon Spilker Huber Geotechnical Consultants, Inc. (GSH).

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In general, the objectives of this study were to:

1. Accurately define and evaluate the subsurface soil and groundwater conditions across the site.

2. Provide appropriate foundation, earthwork, and pavement recommendations to be utilized in the design and construction of the proposed facility.

In accomplishing these objectives, our scope has included the following:

1. A field program consisting of the drilling, logging, and sampling of 3 exploration borings extending to depths ranging from 15.5 of 31.5 feet.

2. A laboratory testing program.

3. An office program consisting of the correlation of available data, engineering analyses, and the preparation of this summary report.

1.3 AUTHORIZATION

Authorization was provided by returning a signed copy of our Professional Services Agreement No. 06-1032 dated October 31, 2006. In addition, Purchase Order No. 78293 dated November 21, 2006 was issued.

1.4 PROFESSIONAL STATEMENTS

Supporting data upon which our recommendations are based are presented in subsequent sections of this report. Recommendations presented herein are governed by the physical properties of the soils encountered in the exploration borings, projected groundwater conditions, and the layout and design data discussed in Section 2., Proposed Construction, of this report. If subsurface conditions other than those described in this report are encountered and/or if design and layout changes are implemented, GSH must be informed so that our recommendations can be reviewed and amended, if necessary.

Our professional services have been performed, our findings developed, and our recommendations prepared in accordance with generally accepted engineering principles and practices in this area at this time.

2. PROPOSED CONSTRUCTION

General information provided by Mr. Dave Nilson of MHTN Architects, Inc. and Mr. Brent L. White of ARW Engineers indicates that the proposed building will be one, one-extended, and two stories in height and basically of block/masonry wall and steal truss roof construction. Real wall loads will be on the order of 8 kips per lineal foot. Maximum real column loads will be approximately 150 kips. Real loads are defined as the total of all dead plus frequently applied (reduced) live loads. It is not anticipated that loads associated with the new facility will be imposed upon the existing structure to the west.

The existing ground surface in the area of the proposed building is relatively level with a slight downward slope to the west with a relief of less than one foot.

Site grading cuts and fills one to three feet are anticipated.

3. SITE INVESTIGATIONS

3.1 FIELD PROGRAM

In order to define and evaluate the subsurface soil and groundwater conditions within the immediate area of the proposed elementary school footprint, 3 borings were drilled to depths ranging from 15.5 to 31.5 feet with an all-terrain drill rig equipped with hollow-stem augers. Locations of the borings drilled in conjunction with this study are presented on Figure 3.

The field portion of our study was under the direct control and continual supervision of an experienced member of our geotechnical staff. During the course of the drilling operations, a continuous log of the subsurface conditions encountered was maintained. In addition, relatively undisturbed and small disturbed samples of the typical soils encountered were obtained for subsequent laboratory testing and examination. The soils were classified in the field based upon visual and textural examination. These classifications have been supplemented by subsequent inspection and testing in our laboratory. Detailed graphical representation of the subsurface conditions encountered is presented on Figures 4A through 4C, Log of Borings. Soils were classified in accordance with the nomenclature described on Figure 5, Unified Soil Classification System.

A 3.25-inch outside diameter, 2.42-inch inside diameter drive sampler (Dames & Moore) was utilized in the majority of the subsurface sampling at the site. The blow-counts recorded on the boring logs were those required to drive the sampler 12 inches with a 140-pound hammer dropping 30 inches.

Following completion of drilling operations, one and one-quarter-inch diameter slotted PVC pipe was installed in Boring B-1 in order to provide a means of monitoring the groundwater fluctuations.

3.2 LABORATORY TESTING

3.2.1 General

In order to provide data necessary for our engineering analyses, a laboratory testing program has been performed. The testing program included moisture and density, consolidation, and chemical tests. The following paragraphs describe the tests and summarize the test data.

3.2.2 Moisture and Density Tests

To aid in classifying the soils and to help correlate the consolidation test data, moisture and density tests were performed on selected undisturbed samples. The results of these tests are presented on the boring logs, Figures 4A through 4C.

3.2.3 Consolidation Tests

To provide data necessary for our settlement analyses, a consolidation test was performed on a representative sample of the near-surface fine-grained cohesive soils. The results of the tests indicate that the soils are moderately over-consolidated and when loaded below the over-consolidation pressure will exhibit relatively low compressibility characteristics. Detailed results of the tests are maintained within our files and can be transmitted to you, at your request.

3.2.4 Chemical Tests

To provide data used in determining whether the site soils will react detrimentally with concrete, pH and water soluble sulfate tests were performed. The results of the tests are tabulated below:

Boring No.	Depth (feet)	Soil Classification	pH	Total Water Soluble Sulfate (ppm)
B-2	2.0	CL	7.88	<5

4. SITE CONDITIONS

4.1 SURFACE

The site is located at 1950 Monroe Boulevard in Ogden, Utah. The Ogden City School District Campus is currently approximately 20 acres in size and is mostly developed with several buildings that are one to two stories in height. The campus buildings are surrounded by driveways, parking lots, walkways, and landscaping.

The proposed building is to be located just east of an existing school building as shown on Figure 3. The ground surface in the area of the proposed building is relatively level with an overall downward slope to the west. Overall relief in the proposed building area is less than one foot. The ground surface in the proposed building area is landscaped with grass, small trees, and shrubs.

Monroe Street and 20th Street form the west and south property lines of the campus, respectively. The property to the east of the campus is occupied by several brick buildings that are part of the National Guard complex. The property to the north of the campus is presently vacant. The majority of other property in the area is developed with single-family homes.

4.2 SUBSURFACE SOIL AND GROUNDWATER

Soils encountered at the exploration boring locations are relatively consistent. The grass-covered ground surface is underlain by silty fine to coarse sand and silty fine sands. To depths of three to five feet, these soils are possible fills. These soils are brown to dark brown and except for the upper three to six inches are medium dense.

From 3.0 to 5.0 feet and extending to depths of 12.0 to 17.5 feet, natural medium dense silty sand and silty sands were encountered. These soils will exhibit high strength and low compressibility characteristics. At the time of the site drilling operations, groundskeepers informed the drilling operators that previous structures with basements existed within the area and were removed. It is possible that basement foundations and utilities may still exist within the proposed building area.

Beneath the granular soils in Borings B-1 and B-2 at depths of 17.5 and 12.0 feet, respectively, brown and grayish-brown stiff silty clays were penetrated. These soils will also exhibit good engineering characteristics.

The lines designating the interface between soil types on the boring logs generally represent approximate boundaries. In-situ, the transition between soil types may be gradual.

Groundwater was encountered within Boring B-1 at a depths ranging from approximately 12.0 to 14.0 feet, during drilling operations and stabilized at a depth of approximately 16.3 feet after drilling in Boring B-1. Seasonal and longer-term groundwater fluctuations on the order of one to two feet are projected with the highest seasonal levels that generally occur during the late spring and early summer months.

5. DISCUSSIONS AND RECOMMENDATIONS

5.1 SUMMARY OF FINDINGS

The proposed structure can be supported upon conventional spread and continuous wall foundations established directly upon suitable near-surface granular soils and/or granular structural fill extending to suitable natural soils.

The most significant geotechnical aspects of the site are possible non-engineered fill soils that were encountered to depths of three to five feet at the boring locations and possible deeper fill and old foundations and slabs. During our drilling operations, groundskeepers informed us that previous structures with basements may have existed within the proposed building areas. During initial earthwork some shallow test pits are recommended to further define the presence of and characteristics of possible fills.

The possible fills encountered in the borings are suitable to support floor slabs and pavements. Under footings, however, the soils, if fills, must be removed and then replaced as structural fills. The on-site granular soils, fills or natural, can be re-utilized as structural fill.

Another significant aspect of the site is the lack of a shallow groundwater table. Stabilized groundwater was measured within Boring B-1 at 16.3 feet below the existing ground surface. Since basements are not proposed, groundwater should not impede grading operations and subdrains will not be required.

In the following sections, detailed discussions pertaining to earthwork, foundations, lateral resistances and pressures, floor slabs, pavements, and the geoseismic setting of the site are provided.

5.2 EARTHWORK

5.2.1 Site Preparation

Prior to initiation of earthwork site preparation operations, all utility lines which pass through the site must be abandoned or relocated. Subsequently, all surface vegetation, topsoil, and other deleterious material must be stripped from an area extending out at least three feet from the perimeter of all areas which will be structurally loaded. This includes the building footprint and areas of proposed outside flatwork and pavements. Topsoil is defined as the zone of soil containing major roots. Field data indicates that the depth of the topsoil is generally two to three inches. As part of the stripping operations where trees are encountered, the major root bulb must be removed.

After initial stripping, a few shallow test pits should be excavated to determine if in fact non-engineered fills are present. To aid in this operation, we are ordering older aerial photographs of the site area.

If fills are encountered, density tests can be performed to determine their in-situ compaction densities.

At this time, it is our opinion that the possible fills will not need to be removed from beneath floor slabs and pavements but should be removed from beneath footings. The removed soils can be re-utilized as structural fill.

Before placement of structural fill, floor slab, and pavements, the subgrade, if determined to be suitable, should be proofrolled by running moderate-weight rubber tire-mounted construction equipment over the surface at least twice. Loose soils, if encountered, must be recompacted.

5.2.2 Excavations

Temporary construction excavations not exceeding four feet in depth through the granular soils should be constructed with sideslopes no steeper than one-half horizontal to one vertical. For excavations up to eight feet through granular soils above the water table, sideslopes should be no steeper than one horizontal to one vertical.

All excavations must be inspected periodically by qualified personnel. If any signs of instability or excessive sloughing are noted, immediate remedial action must be initiated.

5.2.3 Structural Fill

Structural fill will be required as site grading fill, possibly as replacement fill below some foundations, and as backfill over foundations and utilities. All structural fill should be free of sod, rubbish, construction debris, frozen soil, and other deleterious materials. The maximum particle size within structural site grading fill should generally not exceed four inches; although, occasional particles up to six to eight inches may be incorporated provided that they do not result in "honeycombing" or preclude the obtainment of the desired degree of compaction. Structural site grading fill is defined as fill placed over relatively large areas to raise overall site grade. In confined areas, the maximum particle size should not exceed two and one-half inches. The on-site granular soils will be ideal for utilization as structural fill.

The maximum amount of fines within granular imported material should generally be restricted to 18 percent. Fine-grained soils utilized as structural site grading fill should have a plasticity index of 18 percent or less. In confined areas, the maximum particle size should generally not exceed two and one-half inches.

5.2.4 Fill Placement and Compaction

All structural fill placed beneath the building footprint must to be compacted to at least 95 percent of the maximum dry density as determined by the AASHTO[1] T-180 (ASTM[2] D-1557) compaction criteria. In proposed pavements and outside flatwork areas, fills can be compacted to 92 percent of the above-defined criteria provided that the fill thicknesses do not exceed 8 feet. The moisture content during placement and compaction of fine-grained soils should be maintained within 2 percent of optimum. Moisture content of granular soils should be such that the compaction criteria can be achieved.

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1 American Association of State Highway and Transportation Officials

2 American Society for Testing and Materials

5.2.5 Utility Trenches

All utility trench backfill material below structurally loaded facilities (flatwork, floor slabs, roads, etc.) should be placed at the same density requirements established for structural fill. If the surface of the backfill becomes disturbed during the course of construction, the backfill should be proofrolled and/or properly compacted prior to the construction of any exterior flatwork over a backfilled trench. Proofrolling may be performed by passing moderately loaded rubber tire-mounted construction equipment uniformly over the surface at least twice. If excessively loose or soft areas are encountered during proofrolling, they should be removed to a maximum depth of two feet below design finish grade and replaced with structural fill.

Most utility companies and City-County governments are now requiring that Type A-1 or A-1a (AASHTO Designation – basically granular soils with limited fines) soils be used as backfill over utilities. These organizations are also requiring that in public roadways the backfill over major utilities be compacted over the full depth of fill to at least 96 percent of the maximum dry density as determined by the AASHTO T-180 (ASTM D-1557) method of compaction. We recommend that as the major utilities continue onto the site that these compaction specifications are followed.

The granular site soils can be utilized as backfill.

5.3 SPREAD AND CONTINUOUS WALL FOUNDATIONS

5.3.1 Design Data

Our analyses indicate that the proposed structure may be supported upon conventional spread and continuous wall foundations. The footings can be established directly upon suitable granular soil, natural or structural fill. For design, the following parameters are provided:

Minimum Recommended Depth of Embedment for Frost Protection	- 30 inches
Minimum Recommended Depth of Embedment for Non-frost Conditions	- 15 inches
Recommended Minimum Width for Continuous Wall Footings	- 18 inches
Minimum Recommended Width for Isolated Spread Footings	- 24 inches

Recommended Net Bearing Pressure for Real Load Conditions

Footings having minimum recommended width	- 2,500 pounds per square foot*
Footings having minimum width of four feet or greater	- 4,000 pounds per square foot*
Bearing Pressure Increase for Seismic Loading	- 50 percent**

* For intermediate-sized footings, the appropriate bearing pressure may be interpolated on a straightline basis from these values.

** Does not apply to edge bearing loading condition.

The term "net bearing pressure" refers to the pressure imposed by the portion of the structure located above lowest adjacent final grade. Therefore, the weight of the footing and backfill to lowest adjacent final grade need not be considered. Real loads are defined as the total of all dead plus frequently applied live loads. Total load includes all dead and live loads, including seismic and wind.

5.3.2 Installation

Under no circumstances should the footings be established upon loose or disturbed soil, sod, rubbish, construction debris, non-engineered fill, frozen soil, or other deleterious materials. If fine-grained soils become loose or disturbed, they must be totally removed and replaced with compacted granular fill. If granular soils become loose and disturbed, they must be recompacted to the requirements for structural fill before the footings are poured. The width of the replacement fill below footings should be equal to the width of the footing plus one foot for each foot of fill thickness.

5.3.3 Settlements

Settlements of foundations designed and installed in accordance with the above recommendations and supporting various loads are tabulated below:

Footing Type	Load	Net Bearing Pressure (psf)	Projected Maximum Settlements (inches)
Spread	Up to 150 kips	2,500 to 4.000	¼ to ½
Continuous Wall	Up to 6 kips per lineal foot	2,500 to 4,000	¼ to ½

Settlements will occur fairly rapidly with approximately 50 to 60 percent of the quoted settlements occurring during construction.

5.4 LATERAL RESISTANCE

Lateral loads imposed upon foundations due to wind or seismic forces may be resisted by the development of passive earth pressures and friction between the base of the footings and the supporting soils. In determining frictional resistance, a coefficient of 0.50 should be utilized for footings established upon natural granular soils. Passive resistance provided by properly placed and compacted granular structural fill above the water table may be considered equivalent to a fluid with a density of 300 pounds per cubic foot. Below the water table, this granular soil should be considered equivalent to a fluid with a density of 150 pounds per cubic foot.

A combination of passive earth resistance and friction may be utilized provided that the friction component of the total is divided by 1.5.

5.5 LATERAL PRESSURES

The lateral pressure parameters, as presented within this section, assume that the backfill will consist of a drained granular soil placed and compacted in accordance with the recommendations presented herein. The lateral pressures imposed upon subgrade facilities will, therefore, be basically dependent upon the relative rigidity and movement of the backfilled structure. For active walls, such as retaining walls which can move outward (away from the backfill), granular backfill may be considered equivalent to a fluid with a density of 35 pounds per cubic foot in computing lateral pressures. For more rigid basement walls that are not more than 10 inches thick and 12 feet or less in height, granular backfill may be considered equivalent to a fluid with a density of 45 pounds per cubic foot. For very rigid non-yielding walls, granular backfill should be considered equivalent to a fluid with a density with at least 60 pounds per cubic foot. The above values assume that the surface of the soils slope behind the wall is horizontal, that the granular fill has been placed and lightly compacted, not as a structural fill. If the fill is placed as a structural fill, the values should be increased to 45 pounds per cubic foot, 60 pounds per cubic foot, and 120 pounds per cubic foot, respectively. If the slope behind the wall is two horizontal to one vertical the values for purely active walls and basement walls should increase to 57 pounds per cubic foot and 67 pounds per cubic foot, respectively.

For seismic loading, a uniform pressure of 150 pounds per square foot should be added.

5.6 FLOOR SLABS

Floor slabs may be established upon properly prepared existing near-surface soils, suitable undisturbed natural soils, and/or upon structural fill extending to suitable natural soils. To act as a capillary break, it is recommended that floor slabs be directly underlain by at least four inches of "free-draining" fill, such as "pea" gravel or three-quarters to one-inch minus clean gap-graded gravel. Settlements of lightly to moderately loaded floor slabs are anticipated to be minor (less than one-quarter inch).

5.7 PAVEMENTS

The existing natural granular soils encountered at the site will exhibit excellent pavement support characteristics when saturated or near saturated. With these subgrade soils and the traffic discussed below, the following pavement sections are recommended:

Parking Areas

(Light Volume of Automobiles and Light Trucks,
Occasional Medium-Weight Trucks,
and No Heavy-Weight Trucks)
[1 equivalent 18-kip axle load per day]

Flexible:

2.5 inches	Asphalt concrete
6.0 inches	Aggregate base
Over	Properly prepared natural soils and/or structural site grading fill extending to suitable natural soils

Rigid:

5.0 inches	Portland cement concrete (non-reinforced)
4.0 inches	Aggregate base
Over	Suitable natural soils and/or structural site grading fill extending to suitable natural soils

Primary Roadway Areas

(Moderate Volume of Automobiles and Light Trucks,
Light to Moderate Volume of Medium-Weight Trucks and Buses,
and Occasional Heavy-Weight Trucks)
[8 equivalent 18-kip axle load per day
5 buses twice a day]

Flexible:

3.5 inches	Asphalt concrete
6.0 inches	Aggregate base
Over	Properly prepared natural soils and/or structural site grading fill extending to suitable natural soils

Rigid:

6.0 inches	Portland cement concrete (non-reinforced)
6.0 inches	Aggregate base
Over	Suitable natural soils and/or structural site grading fill extending to suitable natural soils

For dumpster pads, we recommend a pavement section consisting of six and one-half inches of Portland cement concrete, four inches of aggregate base, over properly prepared natural subgrade or site grading structural fills.

These rigid pavement sections are for non-reinforced Portland cement concrete. Construction of the rigid pavement should be in sections 10 to 12 feet in width with construction or expansion joints or one-quarter depth saw-cuts on no more than 12-foot centers. Saw-cuts must be completed within 24 hours of the "initial set" of the concrete and should be performed under the direction of the concrete paving contractor. The concrete should have a minimum 28-day unconfined compressive strength of 4,000 pounds per square inch and contain 6 percent ±1 percent air-entrainment.

5.8 GEOSEISMIC SETTING

5.8.1 General

Utah municipalities adopted the International Building Code (IBC) 2006 on January 1, 2007. The IBC 2006 code determines the seismic hazard for a site based upon 2002 mapping of bedrock accelerations prepared by the United States Geologic Survey (USGS) and the soil site class. The USGS values are presented on maps incorporated into the IBC code and are also available based on latitude and longitude coordinates (grid points).

The structure must be designed in accordance with the procedure presented in Section 1613, Earthwork Loads, of the IBC 2006 edition.

5.8.2 Faulting

Based upon our review of available literature, no active faults are known to pass through or immediately adjacent to the site. The site is located outside fault investigation zones identified by Weber County. The nearest active fault is the Ogden portion of the Wasatch fault approximately 1.7 mile from the site. The Wasatch fault zone is considered capable of generating earthquakes as large as magnitude 7.3[3].

5.8.3 Soil Class

For dynamic structural analysis, the Site Class D - Stiff Soil Profile as defined in Table 1613.5.2, Site Class Definitions, of the IBC 2006 can be utilized.

5.8.4 Ground Motions

The IBC 2006 code is based on 2002 USGS (United States Geologic Survey) mapping, which provides values of short and long period accelerations for the Site Class B-C boundary for the Maximum Considered Earthquake (MCE). This Site Class B-C boundary represents a hypothetical bedrock surface and must be corrected for local soil conditions. The following table summarizes the peak ground and short and long period accelerations for a MCE event and incorporates a soil amplification factor for a Site Class D soil profile in the second column. Based on the site latitude and longitude (41.2574 degrees north and 111.9806 degrees west, respectively), the values for this site are tabulated on the following page.

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3 Arabasz, W.J., Pechmann, J.C., and Brown, E.D., 1992, Observational seismology and the evaluation of earthquake hazards and risk in the Wasatch Front area, Utah, in Gori, P.L., and Hays, W.W., eds., Assessment of regional earthquake hazards and risk along the Wasatch Front, Utah: U.S. Geological Survey Professional Paper 1500-D, 36 p.

Spectral Acceleration Value, T Seconds	Site Class B-C Boundary [mapped values] (% g)	Site Class D [adjusted for site class effects] (% g)
Peak Ground Acceleration	56.8	56.8
0.2 Seconds, (Short Period Acceleration)	$S_S = 142.1$	$S_{MS} = 142.1$
1.0 Seconds (Long Period Acceleration)	$S_1 = 59.1$	$S_{M1} = 88.7$

The IBC 2006 code design accelerations (S_{DS} and S_{D1}) are based on multiplying the above accelerations (adjusted for site class effects) for the MCE event by two-thirds (⅔).

5.8.5 Liquefaction

The site is located in an area that has been identified by Weber County as having a "high" liquefaction potential. Liquefaction is defined as the condition when saturated, loose, finer-grained sand-type soils lose their support capabilities because of excessive pore water pressure which develops during a seismic event. Groundwater was measured at approximately 19 feet. The granular soils beneath the water table are dense. Because of the density of the saturated granular soils our analysis indicates that they will not liquefy.

Calculations performed used the procedures described in NCEER-97-0022 entitled, "Proceedings of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils," and only apply to the saturated cohesionless deposits.

GSH
Gordon Spilker Huber
Geotechnical Consultants, Inc.

We appreciate the opportunity of providing this service for you. If you have any questions or require additional information, please do not hesitate to contact us.

Respectfully submitted,

GSH Geotechnical Consultants, Inc.

Hogan R. Wright

Hogan R. Wright, State of California No. 64276
State of Utah No. Pending
Professional Engineer

Reviewed by:

William J. Gordon, State of Utah No. 146417
Professional Engineer

LICENSED PROFESSIONAL ENGINEER
#146417
WILLIAM JAMES
GORDON
STATE OF UTAH

HRW/WJG:sn

Encl.	Figure	1,	Vicinity Map
	Figure	2,	Area Map
	Figure	3,	Site Plan
	Figures	4A	through 4C, Log of Borings
	Figure	5,	Unified Soil Classification System

Addressee (2)

c: Mr. Dave Nilson (1)
MHTN Architects, Inc.
420 East South Temple, Suite 100
Salt Lake City, Utah 84111

Mr. Gary Reed (1)
Ogden City School District
1950 Monroe Boulevard
Ogden, Utah 84401

Mr. Ron Bain (1)
Ogden City School District
1950 Monroe Boulevard
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Mr. Jerel Newman (1)
ARW Engineers
1594 West Park Circle
Ogden, Utah 84404

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: District Elementary School Addition
Project No.: 0436-003-06
Location: 1950 Monroe Boulevard, Ogden, Utah
Client: Ogden City School District
Drilling Method: 3-3/4" ID Hollow-Stem Auger
Date Drilled: 12-20-06
Elevation: Approximately 4420' +/-
Water Level: 12.0' (12-20-06)
Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
		Ground Surface									
		SILTY SAND, POSSIBLE FILL? with occasional fine and coarse gravel; major roots (topsoil) to 2" to 3"; fine sand; brown and mottled brown and dark brown, POSSIBLE FILL? (SM)	0								loose 3" to 6" moist medium dense
				33		8.1		117			
		SILTY SAND with occasional fine and coarse gravel; fine sand; brown (SM)	5	33		10.6		110			moist medium dense
			10	62		5.0		105			
		SILTY SAND with occasional layers up to 4" thick of silty clay with some fine sand; fine sand; oxidation mottling; brown (SM)									saturated medium dense
			15	61			90.7				
		SILTY CLAY with some fine sand; grayish-brown (CL)									saturated stiff
			20	16							
			25								very stiff

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: District Elementary School Addition

Project No.: 0436-003-06

Location: 1950 Monroe Boulevard, Ogden, Utah

Client: Ogden City School District

Drilling Method: 3-3/4" ID Hollow-Stem Auger

Date Drilled: 12-20-06

Elevation: Approximately 4420' +/-

Water Level: 12.0' (12-20-06)

Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
		grades silty clay with some fine sand; occasional layers up to 4" thick of silty fine sand; gray		24			95.9				
		grades silty clay with some fine sand; gray	30	11							medium stiff
		Stopped drilling at 30.0'.									
		Stopped sampling at 31.5'.									
		Installed 1-1/4" diameter slotted PVC pipe at 31.5'.	35								
			40								
			45								
			50								

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4A
(con't)

BOREHOLE B-2

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: District Elementary School Addition
Location: 1950 Monroe Boulevard, Ogden, Utah
Drilling Method: 3-3/4" ID Hollow-Stem Auger
Elevation: Approximately 4420' +/-
Remarks:

Project No.: 0436-003-06
Client: Ogden City School District
Date Drilled: 12-20-06
Water Level: 14.0' (12-20-06)

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
		Ground Surface	0								
		SILTY SAND, POSSIBLE FILL? major roots (topsoil) to 2" to 3"; fine sand; brown, POSSIBLE FILL? (SM)									loose 3" to 6" moist
				18							
		SILTY SAND fine sand; brown (SM)									moist dense
			5								
				70		4.7		102			
		grades silty fine sand; brown	10								medium dense
				49							
		SILTY CLAY with some fine sand; occasional layers up to 4" thick of silty fine sand; brown (CL)									stiff
	■										saturated
			15	22		23.9		100			
		Stopped drilling at 15.0'. Stopped sampling at 16.5'.									
			20								
			25								

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4B

Gordon Spilker Huber Geotechnical Consultants, Inc.
Salt Lake City, Utah 84123

Project Name: District Elementary School Addition
Project No.: 0436-003-06
Location: 1950 Monroe Boulevard, Ogden, Utah
Client: Ogden City School District
Drilling Method: 3-3/4" ID Hollow-Stem Auger
Date Drilled: 12-20-06
Elevation: Approximately 4420' +/-
Water Level: 13.0' (12-20-06)
Remarks:

Graphical Log	Water Level	DESCRIPTION	DEPTH FT.	BLOWS/FT	SAMPLE SYMBOL	MOISTURE (%)	% PASSING 200	DRY DENSITY (PCF)	Liquid Limit (%)	Plastic Limit (%)	REMARKS
		Ground Surface	0								
		SILTY SAND AND GRAVEL, POSSIBLE FILL? major roots (topsoil) to 2" to 3"; fine to coarse sand; fine and coarse gravel; brown, POSSIBLE FILL? (SM/GM)									loose 3" to 6" moist medium dense
				36		6.4		112			
		SILTY SAND AND GRAVEL fine to coarse sand; fine and coarse gravel; brown (SM/GM)									moist medium dense
			5								
				48							
			10	38							
	▪										saturated
		grades silty fine sand; brown		28			16.2				
			15								
		Stopped drilling at 14.0'.									
		Stopped sampling at 15.5'.									
			20								
			25								

The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary for a proper understanding of the nature of the subsurface material.

FIGURE 4C

UNIFIED SOIL CLASSIFICATION SYSTEM

FIELD IDENTIFICATION PROCEDURES				LETTER SYMBOL ‡	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS More than half of material is larger than No. 200 sieve size. ‡ (The No. 200 sieve size is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size. (For visual classifications, the 1/4" size may be used as equivalent to the No. 4 sieve size.)	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			Predominantly one size or a range of sizes with some intermediate sizes missing.	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).	GM	Silty gravels, poorly graded gravel-sand-silt mixtures.
			Plastic fines (for identification procedures see CL below).	GC	Clayey gravels, poorly graded gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction is smaller than No. 4 sieve size. (For visual classifications, the 1/4" size may be used as equivalent to the No. 4 sieve size.)	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.	SW	Well graded sands, gravelly sands, little or no fines.
			Predominantly one size or a range of sizes with some intermediate sizes missing.	SP	Poorly graded sands, gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below).	SM	Silty sands, poorly graded sand-silt mixtures.
			Plastic fines (for identification procedures see CL below).	SC	Clayey sands, poorly graded sand-clay mixtures.

IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN No. 40 SIEVE SIZE

		DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)	LETTER SYMBOL	TYPICAL DESCRIPTIONS
FINE GRAINED SOILS More than half of material is smaller than No. 200 sieve size. (The No. 200 sieve size is about the smallest particle visible to the naked eye)	SILTS AND CLAYS Liquid limit less than 50	None to slight	Quick to slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sand with slight plasticity.
		Medium to high	None to very slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		Slight to medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity.
	SILTS AND CLAYS Liquid limit greater than 50	Slight to medium	Slow to none	Slight to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		High to very high	None	High	CH	Inorganic clays of high plasticity, fat clays.
		Medium to high	None to very slow	Slight to medium	OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS		Readily identified by color, odor, spongy feel and frequently by fibrous texture.			Pt	Peat and other highly organic soils.

‡ Boundary classifications: —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.
‡ All sieve sizes on this chart are U.S. standard.

GSG

GENERAL NOTES

1. In general, Unified Soil Classification Designations presented on the logs were evaluated by visual methods only. There rore, actual designations (based on laboratory testing) may differ.

2. Lines seperating strata on the logs represent approximate boundaries only Actual transitions may be gradual.

3. Logs represent general soil conditions observed at teh point of exploration onthe date indicated.

4. No warranty is provided as to the continuity of soil conditions between individual sample locations.

FINE - GRAINED SOIL

CONSISTENCY	SPT (blows/ft)	TORVANE: UNDRAINED SHEAR STRENGTH (tsf)	POCKET PENETROMETER: UNCONFINED COMPRESSIVE STRENGTH (tsf)	FIELD TEST
Very Soft	<2	<0.125	<0.25	Easily penetrated several inches by Thumb. Squeezes through fingers.
Soft	2 - 4	0.125 - 0.25	0.25 - 0.5	Easily penetrated 1 " by Thumb . Molded by light finger pressure.
Medium Stiff	4 - 8	0.25 - 0.5	0.5 - 1.0	Penetrated over 1/2 " by Thumb with moerate effort. Molded by strong finger pressure.
Stiff	8 - 15	0.5 - 1.0	1.0 - 2.0	Indented about 1/2 " by Thumb but penetrated only with great effort
Very Stiff	15 - 30	1.0 - 2.0	2.0 - 4.0	Readily indented by Thumbnail
Hard	>30	>2.0	>4.0	Indented with difficulty by Thumbnail

LOG KEY SYMBOLS

- Bulk / Bag Sample
- Thin Wall
- Standard Penetration Split Spoon Sampler
- No Recovery
- Rock Core
- 3-3/4" ID D&M Sampler
- 3" ID D&M Sampler
- Water Level
- California Sampler

COARSE -GRAINDE SOIL

APPERENT DENSITY	SPT (blows/ft)	RELATIVE DENSITY (%)	FIELD TEST
Very Loose	<4	0 - 15	Easily penetrated with 1/2 " reinforcing rod pushed by hand
Loose	4 - 10	15 - 35	Difficult to penetrated with 1/2 " reinforcing rod pushed by hand
Medium Dense	10 - 30	35 - 65	Easily penetrated a foot with 1/2 " reinforcing rod driven with 5-lb hammer
Dense	30 - 50	65 - 85	Difficult to penetrated a foot with 1/2 " reinforcing rod driven with 5-lb hammer
Very Dense	>50	85 - 100	Penetrated only a few inches with 1/2 " reinforcing rod driven with 5-lb hammer

STRATIFICATION

DESCRIPTION	THICKNESS
SEAM	1/16 - 1/2 "
LAYER	1/2 - 12 "

DESCRIPTION	THICKNESS
Occasional	One or less per foot of thickness
Frequent	More than on per foot of thichness

CEMENTATION

DESCRIPTION	DESCRIPTION
Weakely	Crumbles or breaks with handling of slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumbles or breaks with finger pressure

MODIFIERS

DESCRIPTION	%
Trace	<5
Some	5 - 12
With	>12

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible water, usually soil below Water Table

FIGURE 5

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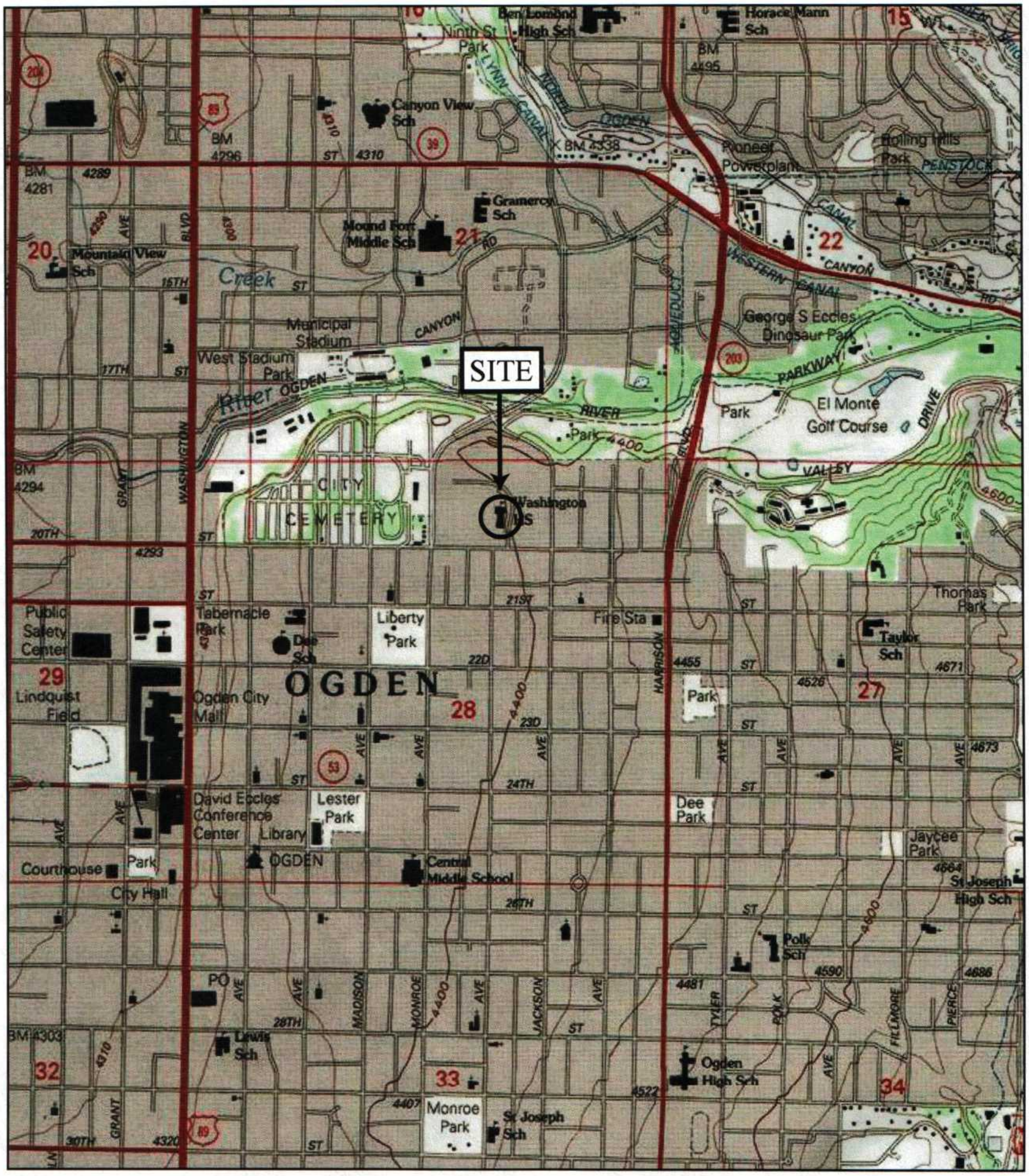
JOB NO. 0436-003-06



SCALE IN FEET

1000 0 1000 2000

FIGURE 1
VICINITY MAP

REFERENCE:
USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE MAP
TITLED "OGDEN, UTAH" DATED 1998

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NOT TO SCALE

FIGURE 2
AREA MAP

REFERENCE:
ADAPTED FROM AERIAL PHOTOGRAPH
GOOGLE EARTH 2005

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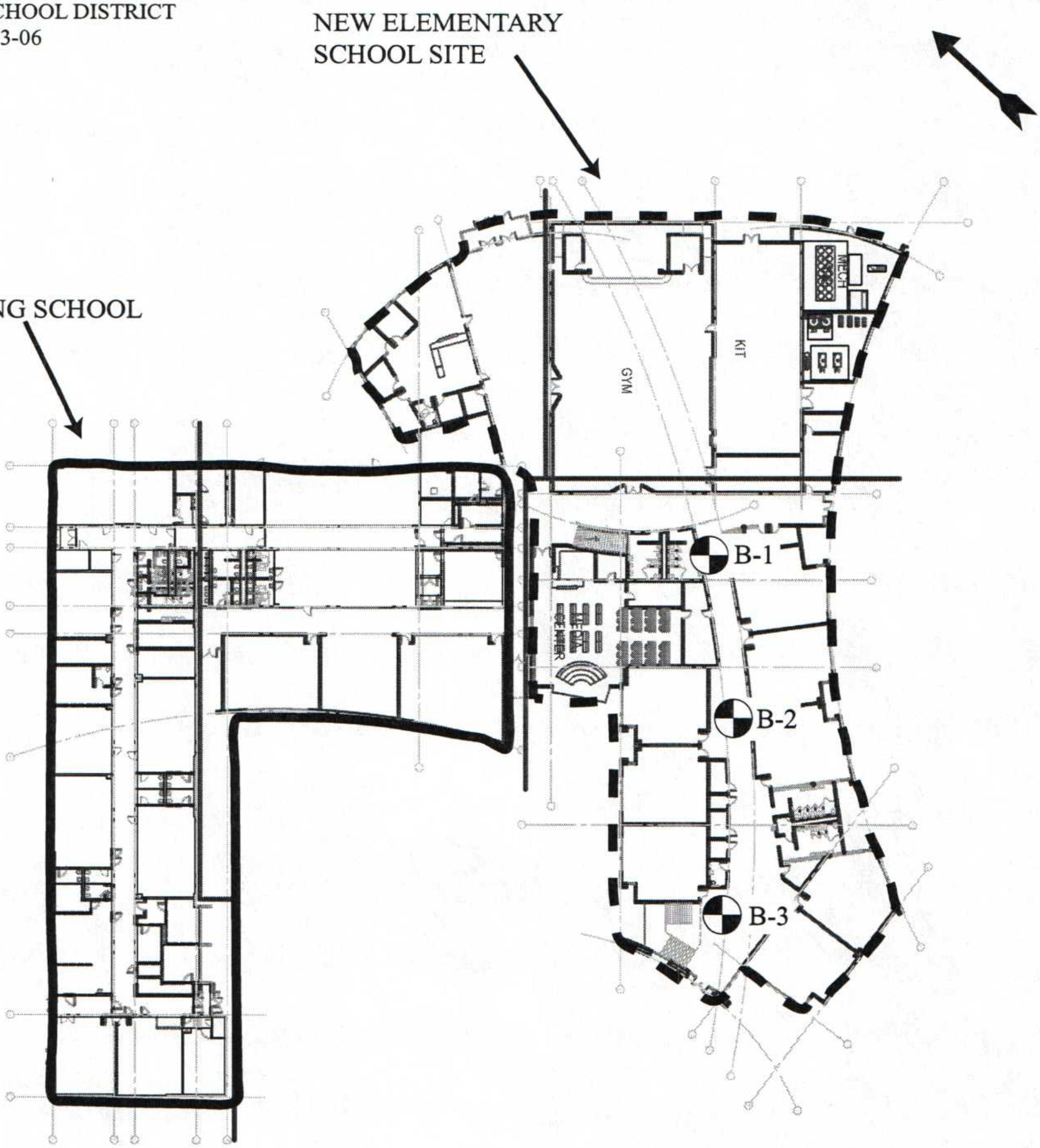

SCALE UNKNOWN

FIGURE 3
SITE PLAN

REFERENCE:
ADAPTED FROM DRAWING ENTITLED
"CAMPUS ELEMENTARY, OGDEN CITY SCHOOLS,
OVERAL FIRST FLOOR PLAN, SCHEMATIC DESIGN,
SHEET NO. A1.1 " BY MHTN ARCHITECTS, INC.

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