SUBSURFACE EXPLORATION AND FOUNDATION RECOMMENDATIONS PROPOSED INDUSTRIAL PARK SITE MARION, ILLINOIS

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File H-08120

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SUBSURFACE EXPLORATION AND FOUNDATION RECOMMENDATIONS

PROPOSED INDUSTRIAL PARK SITE

MARION, ILLINOIS

1.0 Introduction

The City of Marion is developing a lot in the Robert L. Butler Industrial Park west of Marion, Illinois. It is understood this site may be used for a new facility of unknown scope. This report provides a summary of the subsurface exploration and engineering recommendations for foundation and pavement design of the proposed facility. The City of Marion authorized this project on June 5, 2008.

2.0 Scope and Purpose of Report

The purpose of this geotechnical exploration is to determine subsurface conditions at the specific locations of six soil borings, conduct field and laboratory tests to gather data necessary to perform an evaluation of the subsurface conditions, and prepare engineering recommendations relative to the following items:

- Subsurface conditions encountered in the soil borings, including material types to be expected at existing grades and their impact on the construction scheme.
- Testing and an assessment of fill soils previously placed on site.
- Site preparation considerations relative to the subsurface conditions.
- Foundation support of the proposed structure, including acceptable bearing pressures, anticipated bearing levels, and settlement estimates.
- Floor slab support and construction.
- Anticipation and management of ground water during construction.
- Soil material and compaction requirements to construct the proposed building pad.

- Seismic design recommendations for the proposed structure.
- Presence of mining activity as indicated on the Illinois State Geological Survey underground mine maps.
- Pavement design recommendations for light and heavy duty pavements.

3.0 Site Description

This site lies on the south side of Cardinal Drive, in Lot C at the Robert L. Butler Industrial Park in Marion. The site was relatively level at the time of our field exploration due to a drainage swale in the center of this site being filled prior to our field exploration. The Boring Location Diagram also indicates the borehole locations at this site in relation to the property lines.

4.0 Project Description

This project is to consist of construction of a new industrial building which the dimensions and configuration have not been determined at the time of this report. However, we estimate the structure will be a one story building with a slab on grade. Maximum column loads are estimated at about 80 kips with wall loadings of less than 4 kips per lineal foot. These estimated weights are used to determine approximate settlements of the structure.

5.0 Field Exploration

On June 12, 2008, we drilled six soil borings at this site. Boring locations were staked by Holcomb Foundation Engineering personnel using a site plan provided by Clarida Engineering Company, Consulting Engineers.

5.1 Drilling and Sampling Procedures

The soil borings were drilled with a CME-750 all terrain drilling rig. Conventional 3.25 inch inside diameter hollow stem augers were used to advance the boreholes. Representative soil samples were obtained on 2.5 foot intervals employing split barrel sampling procedures in accordance with ASTM D-1586 and Shelby tube sampling per ASTM D-1587. Upon completion of drilling, the boreholes were backfilled with the soil cuttings.

5.2 Field Tests and Measurements

The following field tests and measurements were performed during the course of exploration activities at the site:

- Ground water readings were obtained during and upon completion of drilling at all soil boring locations.
- Standard penetration tests were performed and penetration resistances recorded during the recovery of all split barrel samples.
- Approximate measurements of undrained shear strength were taken on all cohesive soil samples with a calibrated hand penetrometer.
- Bag samples of the typical fill soils were taken at Borings #2, #5, and #6 for laboratory testing.
- All samples were visually classified, according to the Unified Classification System, by the boring technician in preparation of the field boring logs. The samples were then placed into glass jars for transport to our laboratory.

The field test data and measurements are summarized in the Boring Logs located in the appendix to this report.

6.0 Laboratory Tests

In addition to the field exploration, a laboratory-testing program was conducted to determine additional engineering characteristics of the foundation subsoils. All tests were performed in general accordance with applicable ASTM specifications. The laboratory-testing program included the following tests:

6.1 Natural Moisture Content

Natural moisture content determinations were performed on all samples. Moisture content determinations aid in estimating the settlement potential of a soil stratum. The in-situ moistures also yield information as to the workability of a soil type. Moisture content results are graphically presented on the Boring Logs.

6.2 Visual Classifications

All soil samples were visually classified by the geotechnical engineer in accordance with the Unified Classification System. The visual classifications are noted on the Boring Logs.

6.3 Unconfined Compressive Strengths

Cohesive soil samples were subjected to unconfined compressive strength tests. Unconfined compressive strengths are used to determine the maximum allowable bearing capacity of a soil. Results of the compressive strength tests are plotted on the Boring Logs.

6.4 Standard Proctor Test

A standard Proctor test was performed on the typical fill soils encountered in the upper elevations of Borings #2, #5, and #6. This test determined the maximum dry density and optimum moisture content of a soil type.

6.5 Dry Unit Weight Tests

Dry unit weight tests of the fill material have been determined using the Shelby tube soil samples. The diameter, height, and weight of the soils sampled in these tubes have been determined to figure the dry unit weight of the fill material. When compared to the standard Proctor test, the degree of compaction of the fill can be determined.

6.6 Sample Disposal

The soil samples are stored in our laboratory for further analysis, if desired. Unless notified to the contrary, the samples will be disposed of six months after the date of this report.

7.0 Subsurface Conditions

The types of subsurface materials encountered in the soil borings are briefly described on the Boring Logs in the appendix to this report. The general characteristics are described in the following paragraphs. The conditions represented by these test borings should be considered applicable only at the test boring locations on the dates shown. It is possible the conditions encountered may be different at other locations or at other times.

7.1 General Subsurface Profile

Subsurface conditions encountered at this site consist of about five to six feet of gray mottled brown silty clay (CL classification) fill material in Borings #2, #3, #5, and #6 overlying two to five feet of brown to gray silty clay (CL). Below the silty clay lies a brown mottled gray sandy clay (CL) that extends down to at least the bottom of the soil borings.

7.2 Fill Material

The silty clay fill soils vary from soft to stiff, with unconfined compressive strengths ranging from 0.4 to 1.7 tons per square foot, averaging 1.1 tsf. Moisture contents vary from 18 to 33 percent, averaging 25 percent. The standard Proctor test indicates these soils have a maximum dry density of 111.7 pounds per cubic foot at an optimum moisture content of 15.1 percent. Based upon the Shelby tube soil samples, the upper two feet of fill soil has been compacted to about 85 to 88 percent of the maximum standard laboratory dry density, averaging about 86 percent compaction. Below about two feet in depth at this site, the fill soil compaction ranges from 93 to 100 percent compaction, averaging about 97 percent. These test results indicate the upper two to three feet of fill is considered poorly compacted, and below three feet is considered fairly well compacted. The settlement potential of these soils below three feet in depth is considered moderate to low, with a high potential above three feet deep.

7.3 Silty Clay

The naturally deposited silty clay encountered at this site has unconfined compressive strengths ranging from 1.0 to 2.1 tons per square foot, averaging 1.4 tsf. Moisture contents vary from 20 to 30 percent, averaging about 24 percent. These soils have a moderate to low settlement potential.

7.4 Sandy Clay

The sandy clay is a glacial till stratum. These soils have unconfined compressive strengths ranging from 0.5 to 5.4 tons per square foot, averaging 2.0 tsf. Moisture contents vary from 13 to 28 percent, averaging 20 percent. These soils have a low settlement potential.

7.5 Ground Water

Ground water was encountered at depths ranging from 9 feet in Boring #3 to about 14 to 15 feet in Borings #1 and #2. The remaining soil borings were dry during and upon completion of drilling operations.

7.6 Undermining

Although the area north of Illinois Route #13 has been surface mined, it does not appear that this site was surface mined. This site lies south of the Herrin Coal seam that outcrops in this area. Therefore, subsidence from coal mining does not appear to be a concern at this site.

8.0 Grading Considerations

8.1 Site Preparation

Prior to site preparation procedures, any upper topsoil should be stripped, and either wasted or used for fill in landscaped areas of this site.

Upon stripping the topsoil, due to the loose upper fill soils, the proposed building pad and areas within five feet of the outside dimensions of the building should be undercut about 18 inches. These soils may be pushed off to the side of the building pad and stockpiled. A large sheepsfoot roller may be used to compact the exposed subgrade to a minimum of 95% of the maximum standard laboratory dry density as determined by ASTM Method of Test D-698. The upper fill that was pushed to the side may then be replaced in two 9 inch loose lifts, and compacted to the same specifications as the underlying soils.

The exposed parking lot areas may be proofrolled with a loaded tandem dump truck. During proofrolling operations, areas that pump or rut should either be disced and aerated, or excavated from the site and replaced. Upon drying any pumping soils encountered, they should be compacted to a minimum of 95% of the maximum standard laboratory dry density as determined by ASTM Method of Test D-698.

If at all possible the site grading should be performed during hot, dry months of the year. If site grading is performed when the soils are wet, the silty subgrade may pump to such a degree that it may have to be removed and replaced, or require hydrated lime incorporated for drying prior to compaction.

8.2 Fill Placement

After recompacting the upper fill in the building pad and proofrolling the parking lot subgrade, fill soils may be placed to grade the site. The fill should consist of low plastic silty clay, sandy clay, or crushed limestone. It is recommended the fill soils are placed in maximum eight inch loose lifts, with each lift compacted to a minimum of 95% compaction.

A sufficient number of in-place field density tests should be performed by an engineering technician to evaluate the contractor's performance during fill soil placement and compaction. The tests will also aid in determining whether project specifications are being met. A minimum of four compaction tests per every lift are recommended, with not less than one test per 5000 square feet of fill soil placed.

8.3 Subgrade Preparation of Floor Slabs

Environmental conditions and construction traffic often disturb even a well prepared soil surface at the final grade elevation. Provisions should be made in the construction specifications for the contractor to restore the subgrade soils to a stable condition prior to placing the granular mat. Backfilling of utility trenches is often accomplished in an uncontrolled manner, leading to cracking of floor slabs and pavements. We recommend the utility trenches are backfilled with acceptable fill in eight inch lifts and compacted with piston tampers to the project requirements.

The concrete floor slabs may be supported upon a four inch layer of free draining granular material. Generally, CA-7 or CA-11 crushed limestone is used in Illinois for this purpose. This is to provide a capillary break and a uniform leveling course beneath the slab.

8.4 Ground Water Control

During preparation of the subgrade near the existing ground surface, no ground water is anticipated. However, if free water is encountered in the footing excavations, the contractor should make provisions for temporary drainage through the use of sumps and interceptor ditches.

9.0 Engineering Recommendations

9.1 Building Foundations

Based upon results of the field and laboratory tests, the proposed structure may be supported upon shallow foundations consisting of isolated column and continuous wall footings. It is recommended a maximum allowable soil bearing pressure of up to 2000 pounds per square foot be used to dimension the foundations. Exterior footings should be founded at a minimum depth of 2.5 feet for frost protection. Interior footings in heated areas may be founded at one foot below the final subgrade elevation. It is also recommended the footings have a minimum width of 24 inches to avoid a punching type failure of the foundation subsoils.

There is the possibility of encountering foundation soils with less than the required bearing pressure at the foundation elevation. Due to marginal compaction of the upper soils at this site, it is recommended a piston tamper is used to tamp the footing subsoils prior to placement of concrete. After tamping the exposed foundation soils, we recommend <u>all</u> foundation excavations are tested for bearing capacity with a static cone penetrometer prior to placement of concrete. Should soils with less than the specified bearing capacity be encountered, it is recommended they are excavated and replaced with a properly compacted granular fill soil or lean concrete.

Total settlements of an 80 kip column are estimated to range from about 0.5 to 1.0 inch, with maximum differential settlements of approximately 0.5 inch.

9.2 Seismic Design

Based upon the seismic design criteria provided by the I.B.C., this site has a site classification type "D" profile. Based upon this profile, the spectral response acceleration coefficients have been determined as follows:

0.2 Second Period: S_s = 1.13 g x 1.048 (Soil Factor F_a) = 1.184

1.0 Second Period: S_1 = 0.31 g x 1.779 (Soil Factor F_v) = 0.552

The recommended design spectral response factors are as follows:

S_{DS} = 0.789 g

S_{D1} = 0.368 g

These values were obtained from the IBC Section 1615 and the USGS Earthquake Hazards Program based upon the latitude and longitude of this site.

9.3 Retaining Wall Design

Coefficients for active and passive pressures acting upon retaining walls in the upper ten feet of this site are estimated as follows:

Coefficient of Active Pressure:	0.36
Coefficient of Passive Pressure:	2.77
Coefficient of At-Rest Pressure:	0.53

The silty clay to clayey silt subsoils encountered on this site have a wet soil density of approximately 125 pounds per cubic foot. It is recommended the retaining walls be backfilled with a free draining sand or crushed stone up to within one foot of the final ground line, with perforated PVC pipe at the base of the wall sloped to gravity drain or drain to a sump.

The recommended coefficient of friction between the concrete and soils which may be used for design is 0.33.

9.4 Floor Slab Design

The proposed concrete slabs on grade may be designed using a modulus of subgrade reaction estimated at approximately 100 psi per inch. The soil subgrade beneath the crushed stone and concrete slab should be properly compacted per the recommendations in Section 8 of this report.

9.5 Surface Drainage

The subsoils at this site have a high percentage of silt. This silt will tend to soften and become unstable when saturated. Therefore, we recommend the roof drains are placed to expel water well away from the building pad area.

10.0 Pavement Design

The following pavement designs are based upon an estimated Illinois bearing ratio of 3.0 for the soil subgrade, and the subgrade being compacted to a minimum of 95% of the maximum standard laboratory dry density. Recommended pavement designs are as follows:

10.1 Automobile Parking Lot Pavement

Traffic Loadings:	500 Passenger Cars/Day
Design Life:	20 Years
Illinois Bearing Ratio:	3.0

Pavement Design - Automobile Parking Lots

Bituminous Concrete Surface:	2.0"
Crushed Stone Basecourse:	8.0"

10.2 Heavy Duty Pavement (Trash/Delivery Truck Drives)

Traffic Loadings:	500 Passenger Cars/Day 2 Single Unit Trucks 2 Semi or Trash Trucks
Design Life:	20 Years
Illinois Bearing Ratio:	3.0

Pavement Design - Heavy Duty Pavement

Bituminous Concrete Surface:	2.0"
Bituminous Concrete Binder:	2.5"
Crushed Stone Basecourse:	10.0"

Or

Portland Cement Concrete:	7.0"
Granular Subbase: `	4.0"

Due to the heavy point loadings of steel dumpster wheels, the dumpster storage areas should be paved with Portland Cement Concrete.

The Illinois Department of Transportation "Standard Specifications for Road and Bridge Construction" adopted on January 1, 2007 indicates the materials to be used in the following sections:

Bituminous Concrete Surface and Binder
Section 406 (Pages 195-208)

Portland Cement Concrete
Section 420 (Pages 223-239)

Crushed Stone Basecourse
Section 351 (Pages 167-170)

Granular Subbase, Type A
Section 311 (Pages 148-152)

11.0 Summary

This subsurface exploration has been conducted at the site of a proposed facility at the Robert L. Butler Industrial Park in Marion, Illinois. The report has been prepared for the exclusive use of the City of Marion for the specific application to this project.

Design and construction criteria have been suggested and potential problems have been discussed.

The following information has been discussed in this report:

- Soils encountered on the site consist of five to six feet of fill soil in a swale area at the center of the site that was filled in, overlying naturally deposited silty clay and sandy clay soils.
- The fill material is poorly compacted in the upper two to three feet of the site, and appears fairly well compacted below about three feet in depth. We have recommended the upper 18 inches of fill soils are removed from the building pad, the exposed subgrade compacted, and the stripped fill be replaced in lifts and properly compacted.
- Site grading outside of the building pad in paved areas includes stripping any topsoil, proofrolling the subgrade, and grading the site for the proposed pavement.
- Foundation design criteria have been discussed, and allowable soil bearing pressures have been recommended for shallow foundations.

- The shallow foundations may be dimensioned using a maximum allowable soil bearing pressure of up to 2000 pounds per square foot.

- The International Building Code indicates this site has a type "D" site classification, based upon the soil borings. The recommended design spectral response factors for this site are S_{DS} = 0.789 g and S_{D1} = 0.368 g.

- Recommendations for heavy and light duty pavement designs have been presented.

The analyses, conclusions, and recommendations contained in this report are professional opinions based on the site conditions and project scope described herein. It is assumed the conditions observed in the exploratory borings are representative of subsurface conditions throughout the site. If during construction, subsurface conditions differ from those encountered in the exploratory borings are observed or appear to be present beneath excavations, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. Unless specifically noted, the scope of our services did not include an assessment of the effects of flooding and natural erosion of creeks or rivers adjacent to the project site.

If there is a substantial lapse in time between the submittal of this report and the start of work at this site, or if site conditions are changed due to natural causes or construction operations, we recommend that this report be reviewed to determine the applicability of conclusions and recommendations considering the changed conditions and time lapse.

In order for us to provide a complete professional geotechnical engineering service, we should be retained to observe construction, particularly site grading, earthwork and foundation construction.

The scope of our services for this phase of the project does not include any environmental assessment or investigation for the presence or absence of wetlands or hazardous or toxic material in the soil, surface or ground water or air, on or below this site. Any statements in this report or on the boring logs regarding any odors or unusual or suspicious items or conditions observed are strictly for the information of our client.

This report was prepared for the exclusive use of the owner, architect, or engineer for evaluating the design of the project as it relates to the geotechnical aspects discussed herein. It should be made available to prospective contractors for information on factual data only and not as a warranty of subsurface conditions included in this report. Unanticipated soil conditions or rock may require that additional expense be made to attain a properly constructed project. Therefore, some contingency fund is recommended to accommodate such potential extra costs.

It is recommended that we be retained to review final project layout and those portions of plans and specifications which pertain to foundations and earthwork to determine if they are consistent with our findings and recommendations.

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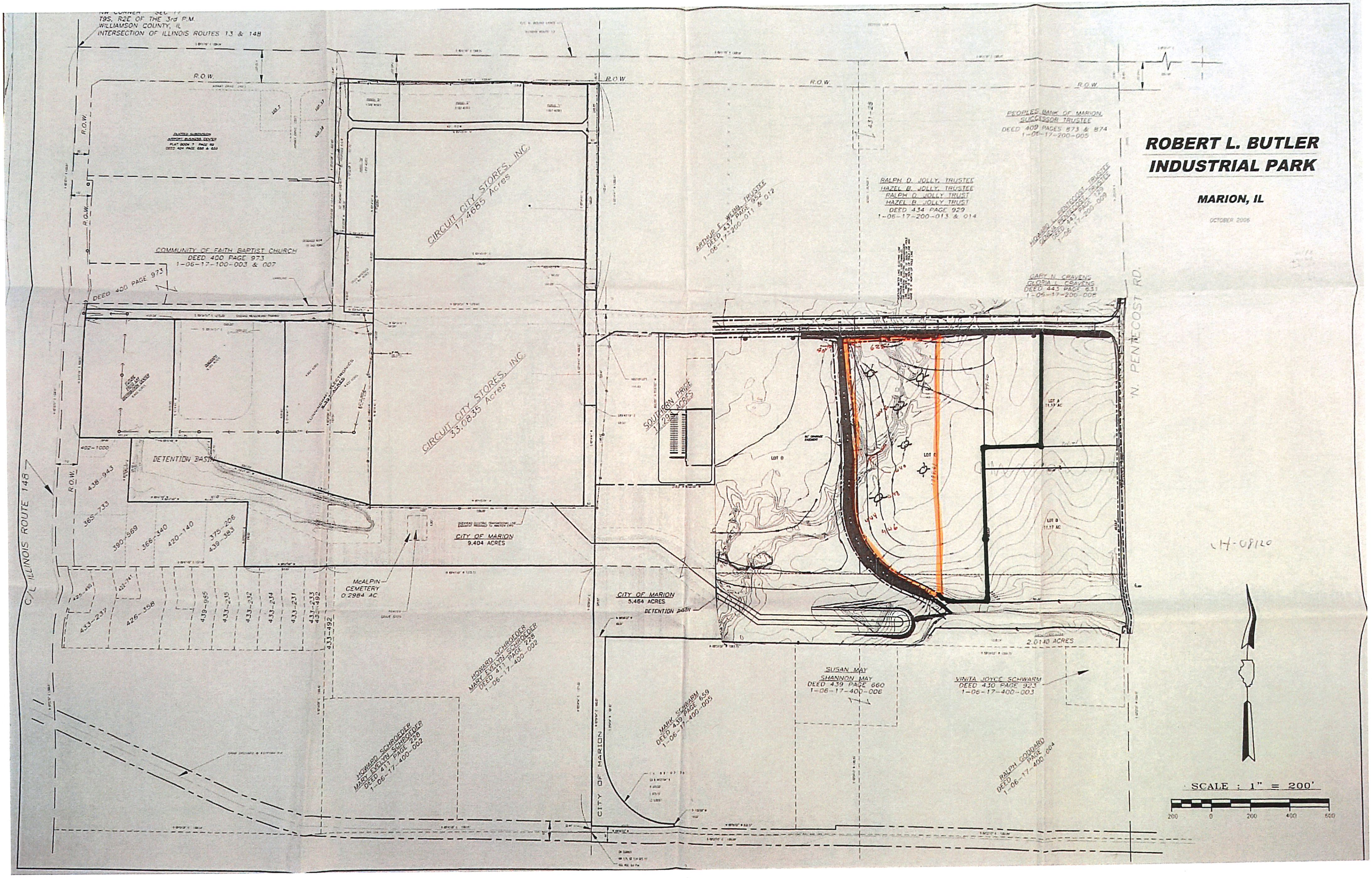
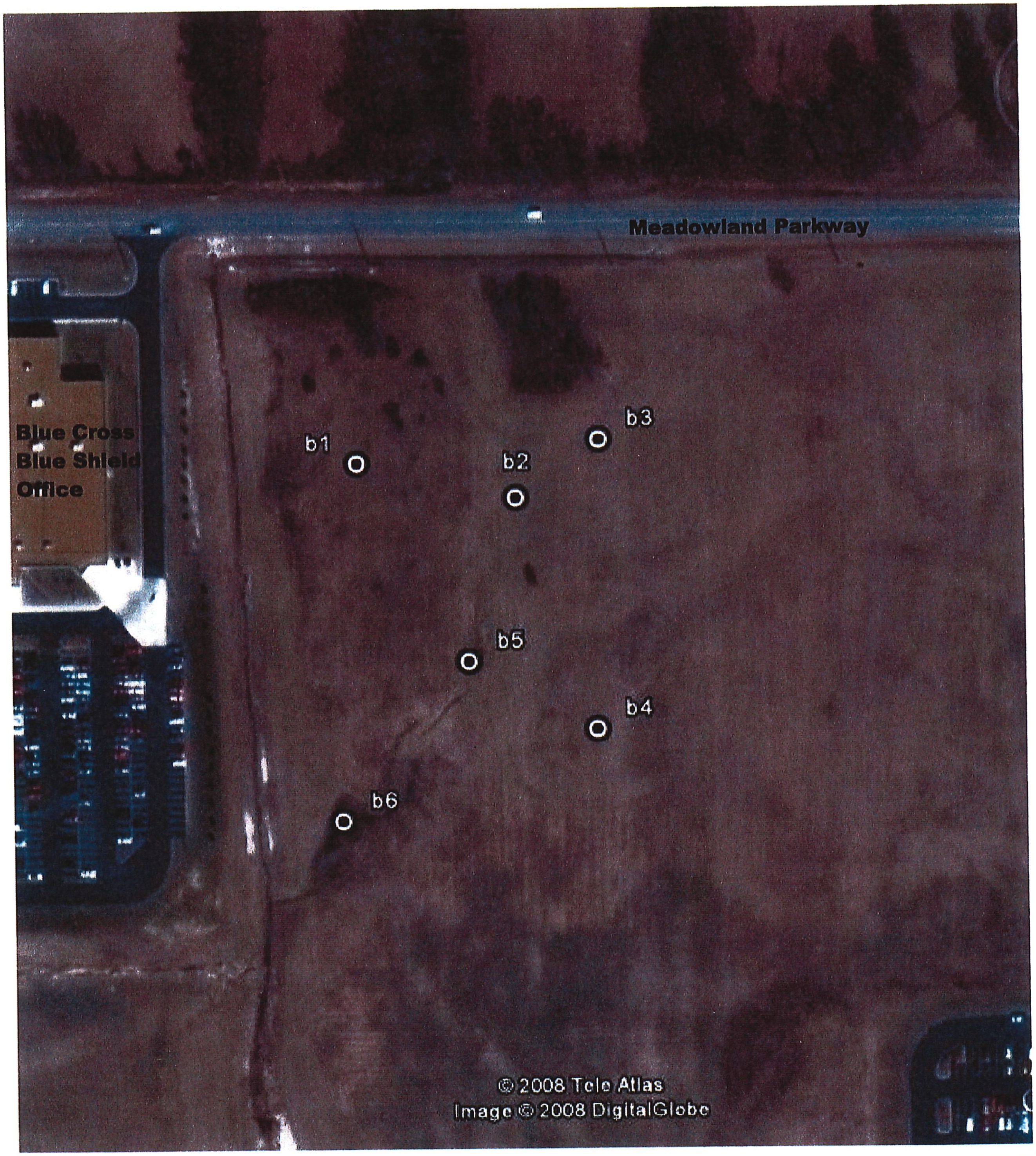
Timothy J. Holcomb, P.E.


ROBERT L. BUTLER
INDUSTRIAL PARK
MARION, IL
OCTOBER 2006
SCALE : 1" = 200'
200 0 200 400 600
N. PENTECOST RD.
C/L ILLINOIS ROUTE 148
R.O.W.
T9S, R2E OF THE 3rd P.M.
WILLIAMSON COUNTY, IL
INTERSECTION OF ILLINOIS ROUTES 13 & 148
PEOPLES BANK OF MARION,
SUCCESSOR TRUSTEE
DEED 409 PAGES 873 & 874
1-06-17-200-005
RALPH D. JOLLY, TRUSTEE
HAZEL B. JOLLY, TRUSTEE
RALPH D. JOLLY TRUST
HAZEL B. JOLLY TRUST
DEED 434 PAGE 929
1-06-17-200-013 & 014
GARY N. CRAVENS
GLORIA L. CRAVENS
DEED 443 PAGE 531
1-06-17-200-008
ARTHUR E. WEBB, TRUSTEE
DEED 437 PAGE 952
1-06-17-200-011 & 012
COMMUNITY OF FAITH BAPTIST CHURCH
DEED 400 PAGE 973
1-06-17-100-003 & 007
DEED 400 PAGE 973
CIRCUIT CITY STORES, INC.
17.4685 Acres
CIRCUIT CITY STORES, INC.
33.0835 Acres
SOUTHERN PRIDE
DETENTION BASIN
CITY OF MARION
9.404 ACRES
McALPIN
CEMETERY
0.2984 AC
CITY OF MARION
5.464 ACRES
DETENTION BASIN
CITY OF MARION
2.0140 ACRES
SUSAN MAY
SHANNON MAY
DEED 439 PAGE 660
1-06-17-400-006
VINITA JOYCE SCHWARM
DEED 430 PAGE 923
1-06-17-400-003
HOWARD SCHROEDER
MARY EVELYN SCHROEDER
DEED 411 PAGE 228
1-06-17-400-002
MARK SCHWARM
DEED 439 PAGE 659
1-06-17-400-005
RALPH GODDARD
DEED PAGE 604
1-06-17-400-004
LOT A
LOT B
LOT C
LOT D
433-492
433-231
433-232
433-215
439-955
426-358
433-237
438-943
365-733
390-569
366-340
420-140
375-206
439-383
402-1000
431-28
14-08120



Robert L. Butler Industrial Park **Marion, Illinois** **The City of Marion** **Marion, Illinois**	**Boring Location Diagram**	**Project No. H-08120** **North** **Not to Scale** **June 12, 2008**

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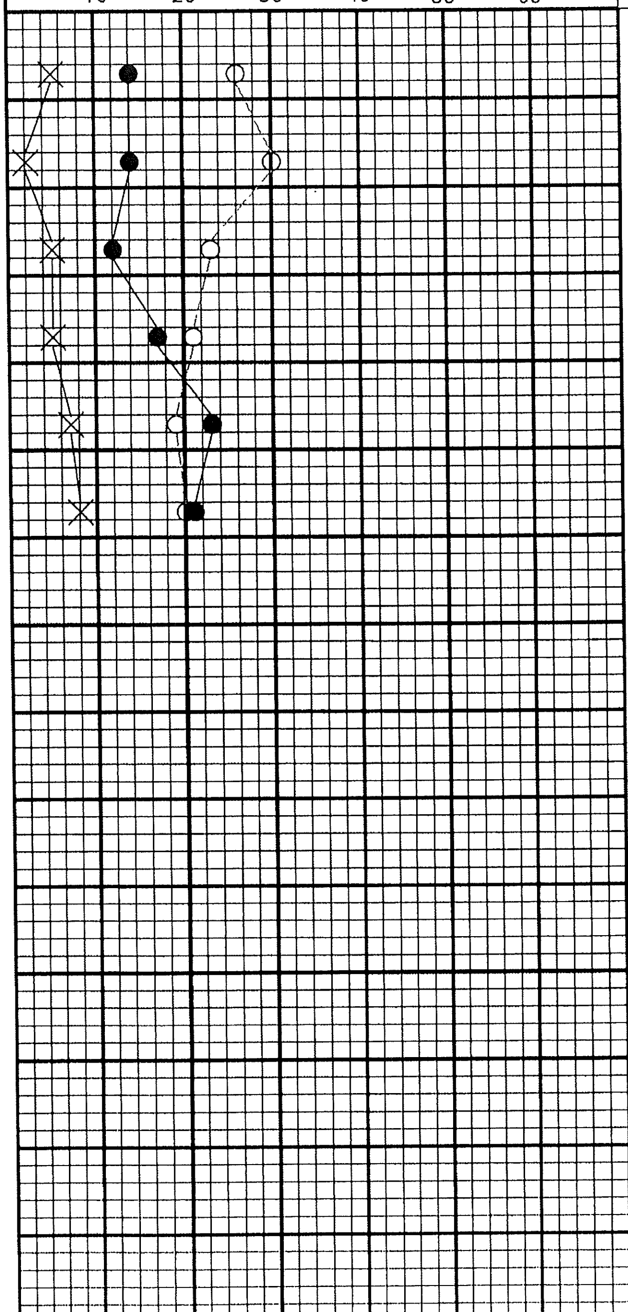
PO Box 88 Carbondale, Illinois

LOG of BORING 1

Unconfined Compressive Strength (Tons/Sq. Ft.) ●
1 2 3 4 5 6

Water Content (%) ○

Standard N Penetration, Blows/Ft. ×
10 20 30 40 50 60



Sample No.	Type Sample	Description of Material
		Surface Elevation
		5" Topsoil
1	ss	Gray Mottled Brown Silty CLAY to CLAY (CL) with organics
2	ss	Gray CLAY (CL–CH)
3	ss	Gray Silty CLAY (CL)
4	ss	Gray Mottled Brown Silty CLAY (CL) with sand
5	ss	Brown Mottled Gray Sandy CLAY(CL)
6	ss	Brown Mottled Gray Silty CLAY (CL)
		End of Boring @ –15.0'

Depth in Feet: 5, 10, 15, 20, 25, 30, 35

Ground Water Data
Ground Water Encountered @ –14.0' During Drilling.

Project: Robert L. Butler Industrial Park
Marion, Illinois

Date of Boring: June 12, 2008

Client: The City of Marion
Marion, Illinois

Project No. H–08120

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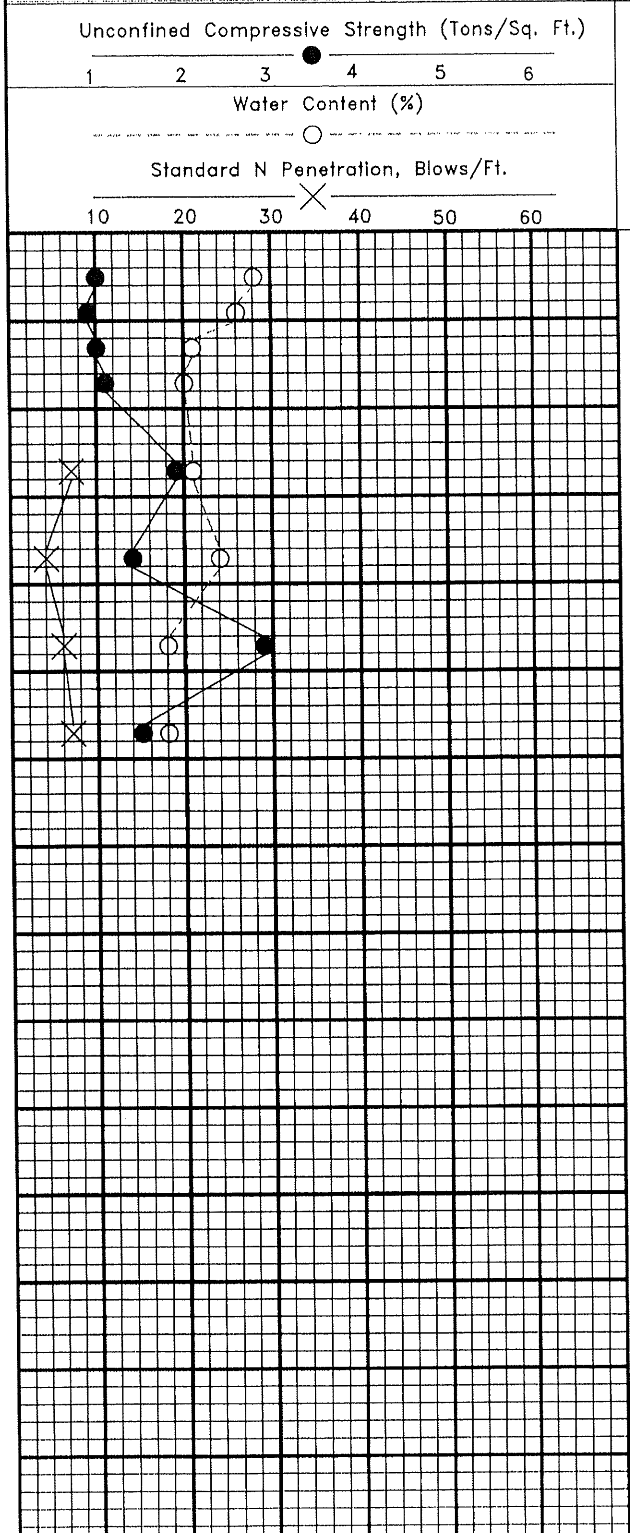
PO Box 88 Carbondale, Illinois

LOG of BORING 2



Sample No.	Type Sample	Description of Material
		Surface Elevation
		5" Topsoil
1	st	Gray Mottled Brown CLAY (CL)
2	st	Gray Mottled Brown Silty CLAY (CL) with sand
3	ss	Brown Mottled Gray Silty CLAY (CL) with sand and pebbles
4	ss	
5	ss	
6	ss	Brown Mottled Gray Sandy CLAY(CL)
		End of Boring @ −15.0'

Ground Water Data
Ground Water Encountered @ −15.0' During Drilling.

Project:	Robert L. Butler Industrial Park Marion, Illinois	Date of Boring	June 12, 2008
Client:	The City of Marion Marion, Illinois	Project No.	H-08120

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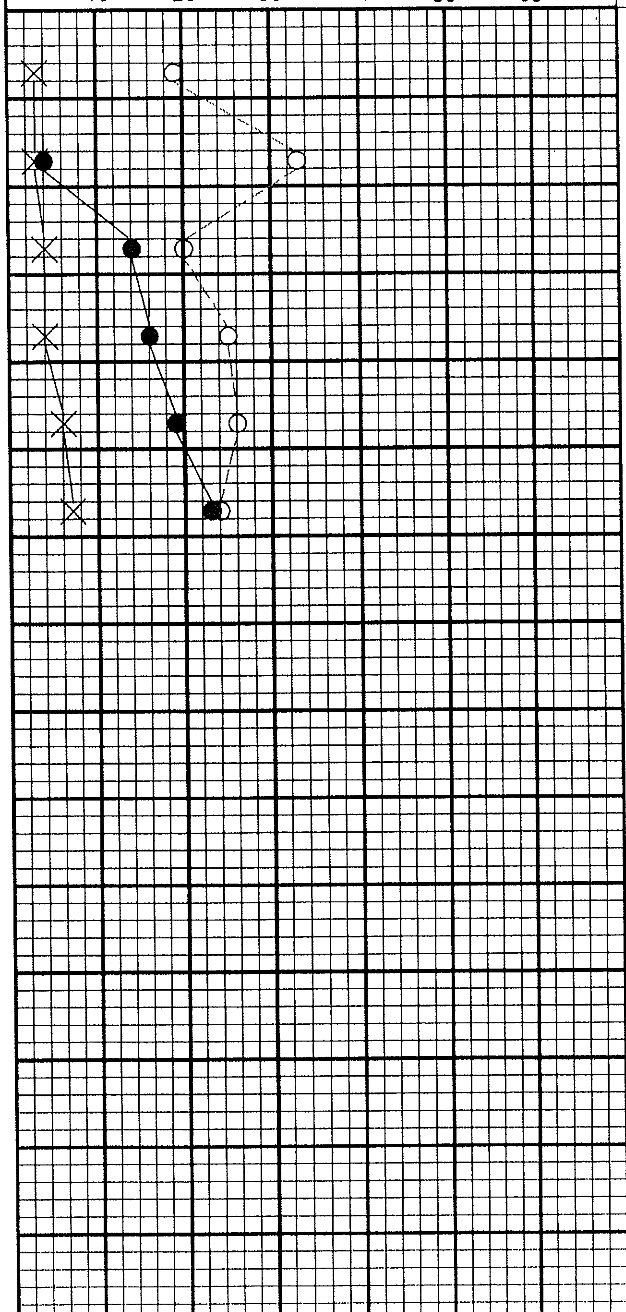
LOG of BORING 3

Unconfined Compressive Strength (Tons/Sq. Ft.) ●
1 2 3 4 5 6

Water Content (%) ○

Standard N Penetration, Blows/Ft. ✕
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				5" Topsoil
	1	ss	/	Brown Sandy CLAY (CL)
5	2	ss	/	Gray Silty CLAY (CL)
	3	ss	/	Gray Mottled Brown Silty CLAY (CL) with sand
10	4	ss	/	
	5	ss	/	
15	6	ss	/	
				End of Boring @ −15.0'
20				
25				
30				
35				

Ground Water Data
Ground Water Encountered @ −9.0' During Drilling and @ −8.0' Upon Completion.

Project: Robert L. Butler Industrial Park
Marion, Illinois

Date of Boring
June 12, 2008

Client: The City of Marion
Marion, Illinois

Project No.
H-08120

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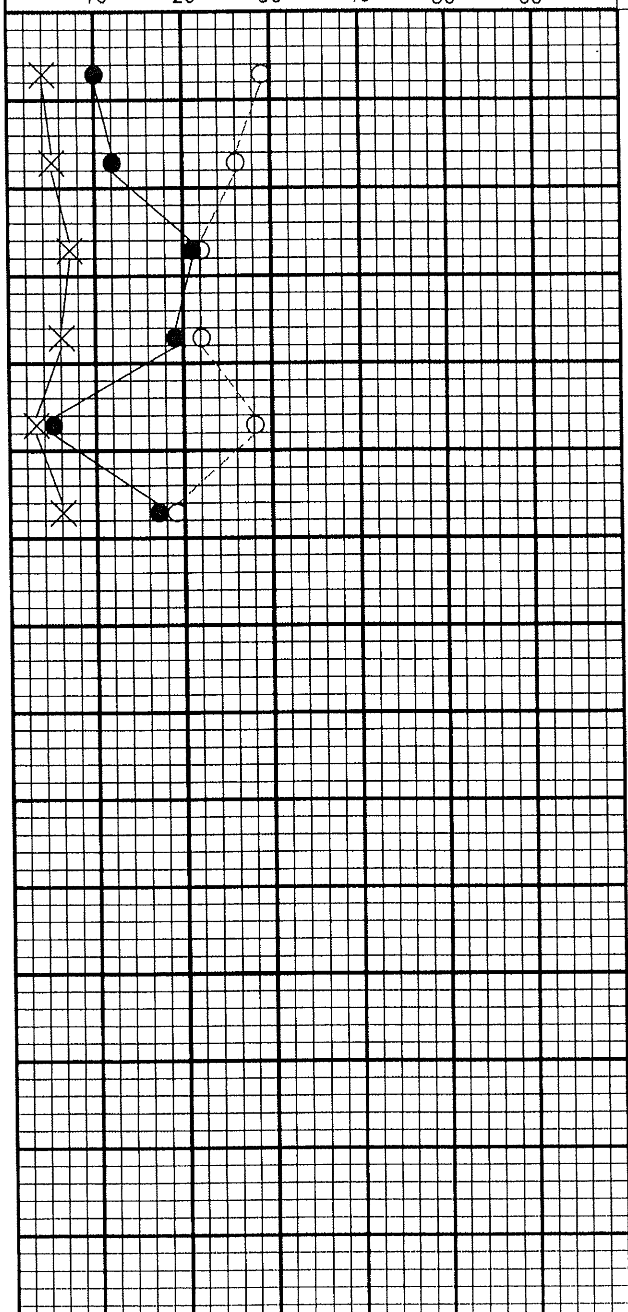
PO Box 88 Carbondale, Illinois

LOG of BORING 4

Unconfined Compressive Strength (Tons/Sq. Ft.) ●
1 2 3 4 5 6

Water Content (%) ○

Standard N Penetration, Blows/Ft. ✕
10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				5" Topsoil
	1	ss	/	Gray Silty CLAY to CLAY (CL-CH) with sand
5	2	ss	/	
	3	ss	/	
10	4	ss	/	
	5	ss	/	Brown Mottled Gray Silty CLAY (CL) with sand
15	6	ss	/	Brown Silty CLAY (CL) with sand
				End of Boring @ -15.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Robert L. Butler Industrial Park Marion, Illinois	Date of Boring June 12, 2008
Client: The City of Marion Marion, Illinois	Project No. H-08120

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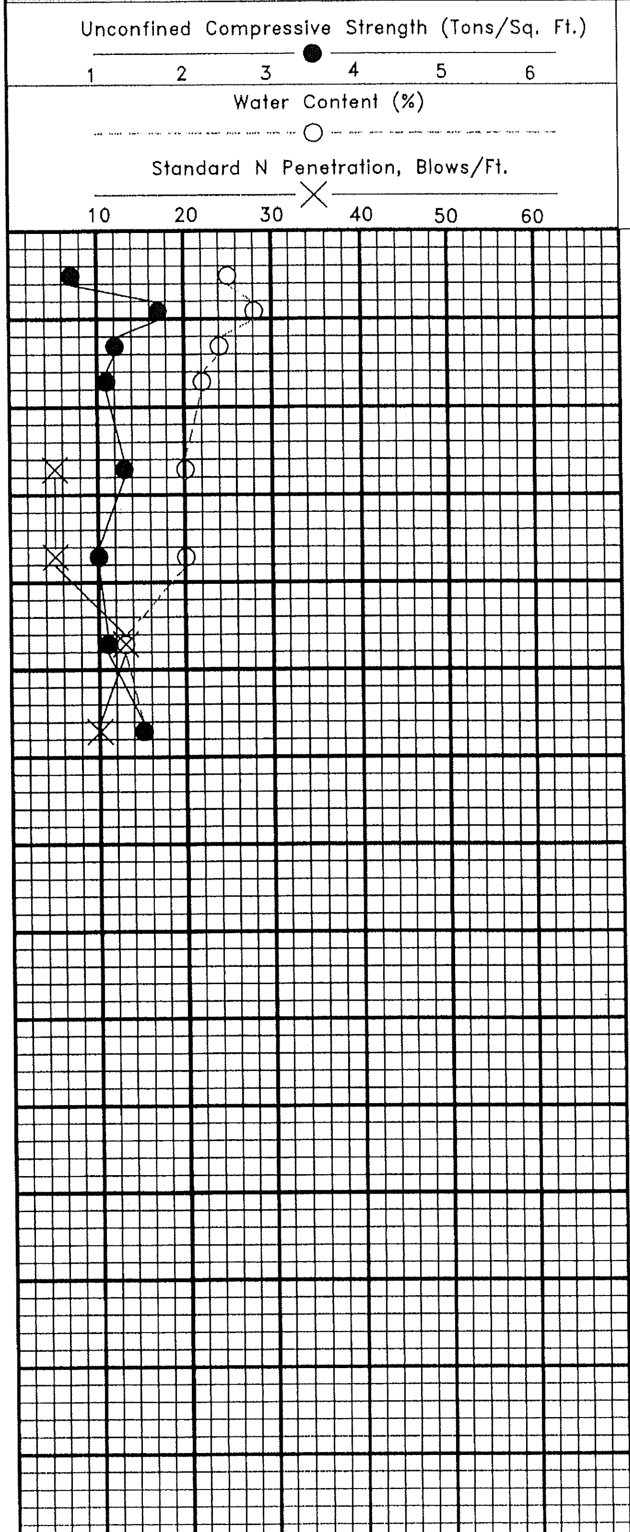
LOG of BORING 5



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				5" Topsoil
	1	st		Gray Mottled Brown Silty CLAY (CL) with organics
				Gray Mottled Brown CLAY (CL-CH)
	2	st		Gray Mottled Brown Silty CLAY (CL) with organics
5				Gray Mottled Brown Silty CLAY (CL) with sand
	3	ss		
	4	ss		Brown Mottled Gray Sandy CLAY(CL)
10				
	5	ss		Brown Sandy CLAY (CL)
	6	ss		
15				End of Boring @ -15.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Robert L. Butler Industrial Park Marion, Illinois	Date of Boring June 12, 2008
Client: The City of Marion Marion, Illinois	Project No. H-08120

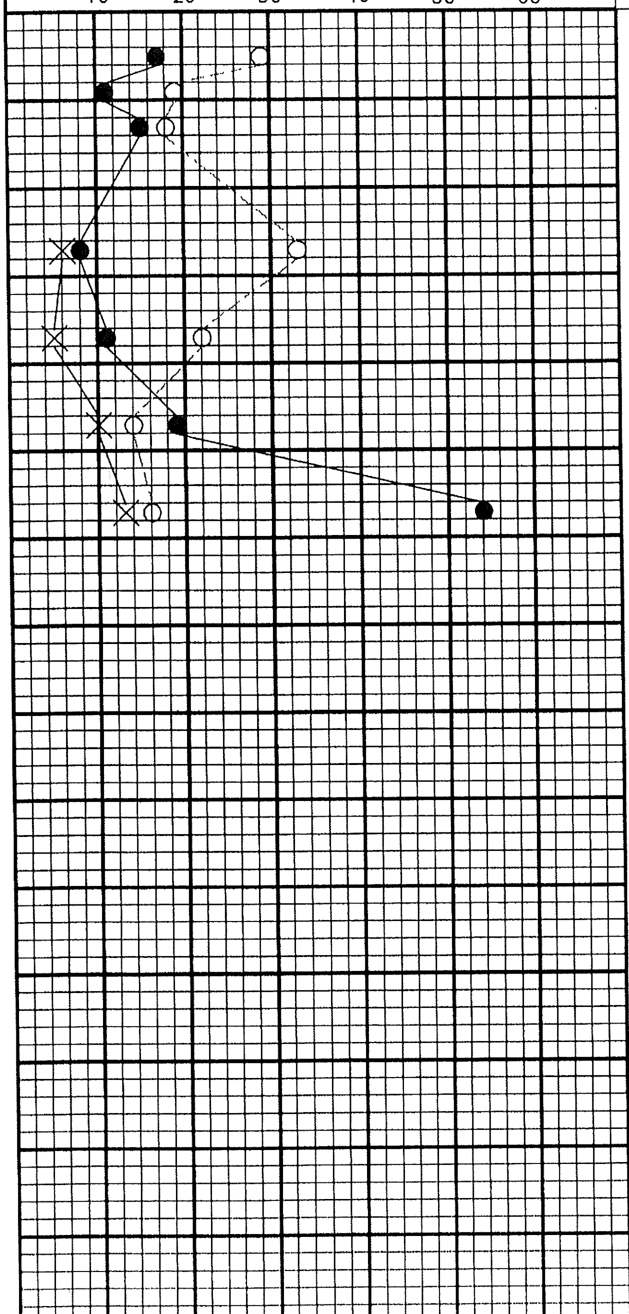
Holcomb Foundation
Engineering Co.
PO Box 88 Carbondale, Illinois

LOG of BORING 6

Unconfined Compressive Strength (Tons/Sq. Ft.) ● 1 2 3 4 5 6

Water Content (%) ○

Standard N Penetration, Blows/Ft. ✕ 10 20 30 40 50 60



Depth in Feet	Sample No.	Type Sample	Sample Distance	Description of Material
				Surface Elevation
				5" Topsoil
	1	st	/	Gray Mottled Brown CLAY (CL-CH) with organics
	2	st	/	Gray Mottled Brown Silty CLAY (CL) with sand and pebbles
5				
	3	ss	/	Brown Mottled Gray Silty CLAY (CL) with sand and pebbles
	4	ss	/	
10				
	5	ss	/	Brown Sandy CLAY (CL)
	6	ss	/	Brown-Gray CLAY (CL) with sand
15				End of Boring @ -15.0'
20				
25				
30				
35				

Ground Water Data
No Ground Water Encountered During Drilling.

Project: Robert L. Butler Industrial Park
Marion, Illinois

Date of Boring
June 12, 2008

Client: The City of Marion
Marion, Illinois

Project No.
H-08120

Holcomb Foundation Engineering

Moisture Density Relationship

Project: Robert L. Butler Industrial Park
Marion, Illinois

Location: Borings 2, 5 and 6
Composite Sample

Depth: -1' to -6'

Project No.: H-08120

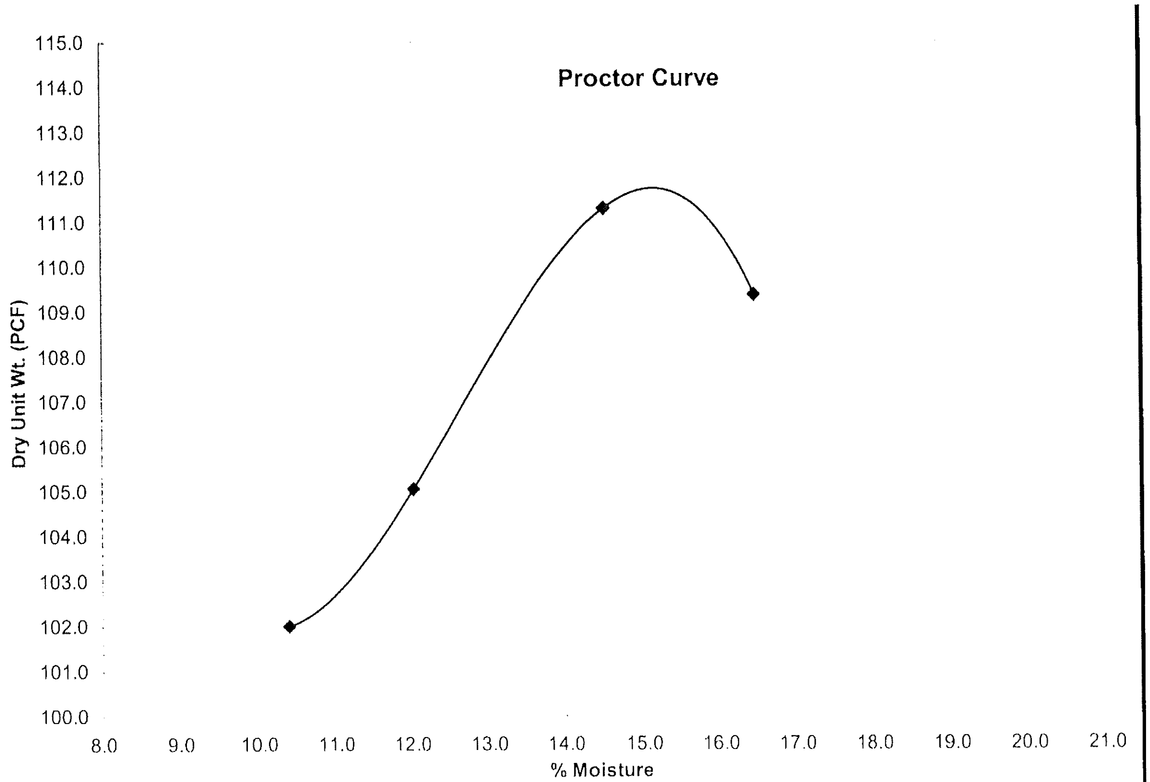
Date: 6/19/2008

Proctor Test Results

Soil Classification:	**Gray Silty CLAY to CLAY**
Maximum Dry Density (PCF)	**111.7**
Optimum Moisture Content (%)	**15.1**

Test Data ASTM D-698 (standard)

Moisture Content (%)	Dry Unit Wt. (PCF)
14.5	111.3
16.5	109.4
12.0	105.1
10.4	102.0



Holcomb Foundation Engineering Company

P. O. Box 88

Carbondale, IL 62903

(618) 529-5262

Moisture Content/Unit Weight Worksheet

Project: Robert L. Butler Industrial Park Marion, Illinois   Date: 6/20/2008

Project No.: H-08120

Boring	Depth (Ft.)	Wet Wt. g	Pan g	Dry Wt. g	Mc. (%)	Length in	Diameter in	Unit Wt. pcf	Compaction
2	1-1.5	1215.3	119.6	977.5	27.7	5.525	2.8	96.1	86.0
2	2-2.5	1254.6	134.8	1022.1	26.2	5.56	2.8	98.8	88.4
2	3-3.5	1297.6	107.2	1089.0	21.2	5.525	2.8	110.0	98.5
2	4-4.5	1340.1	145.9	1140.8	20.0	5.52	2.8	111.6	99.9
5	1-1.5	1194.3	135.0	982.6	25.0	5.509	2.8	95.2	85.3
5	2-2.5	1217.6	115.7	974.2	28.4	5.571	2.8	95.4	85.4
5	3-3.5	1256.4	103.1	1035.7	23.7	5.553	2.8	104.0	93.1
5	4-4.5	1267.1	104.0	1060.4	21.6	5.545	2.8	106.8	95.6
6	1-1.5	1210.3	102.7	964.6	28.5	5.574	2.8	95.7	85.7
6	2-2.5	1231.5	138.1	1056.6	19.0	5.243	2.8	108.4	97.1
6	3-3.5	1182.3	65.3	1015.8	17.5	5.258	2.8	111.9	100.2

GENERAL NOTES

SAMPLE IDENTIFICATION

The Unified Classification System is used to identify the soil unless otherwise noted.

RELATIVE DENSITY & CONSISTENCY CLASSIFICATION

TERM (NON-COHESIVE SOILS)	BLOWS PER FOOT
Very Loose	0 - 4
Loose	5 - 10
Firm	11 - 30
Dense	31 - 50
Very Dense	Over 50

TERM (COHESIVE SOILS)	QU (tsf)
Very Soft	0 - 0.25
Soft	0.25 - 0.50
Firm	0.50 - 1.00
Stiff	1.00 - 2.00
Very Stiff	2.00 - 4.00
Hard	4.00+

DRILLING & SAMPLING SYMBOLS

ss: Split Spoon - 1 3/8" I.D., 2" O.D.
st: Shelby Tube - 2.80"I.D., 3" O.D.
au: Auger Samples
cs: Continuous Sampling - 2.0" I.D.

SOIL PROPERTY SYMBOLS

● Unconfined Compressive Strength, Qu, (tsf)

\+ Penetrometer Value, (tsf)

Plastic Limit (%)

O Water Content (%)

Liquid Limit (%)

X Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2" O.D. Split Spoon

PARTICLE SIZE

Boulders	8 in. +	Medium Sand	0.6 mm to 0.2 mm
Cobbles	8 in. to 3 in.	Fine Sand	0.2 mm to 0.74 mm
Gravel	3 in. to 5 mm	Silt	0.074 mm to 0.0005 mm
Coarse Sand	5 mm to 0.6 mm	Clay	less than 0.005 mm

UNIFIED SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS	GW	Well graded gravels, gravel-sand mixtures
			GP	Poorly graded gravels, gravel-sand mixtures
		GRAVELS WITH FINES	GM	Silty gravels, gravel-sand silt mixtures
			GC	Clayey gravels, gravel-sand clay mixtures
	SANDS AND SANDY SOILS	CLEAN SANDS	SW	Well-graded sands, gravelly sands
			SP	Poorly graded sands, gravelly sands
		SANDS WITH FINES	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, clay-sand mixtures
FINE GRAINED SOILS	SILTS AND CLAYS LOW PLASTICITY		ML	Inorganic silts of clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS HIGH PLASTICITY		MH	Inorganic silts of high plasticity
			CH	Inorganic clays of high plasticity
			OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS			PT	Peat, humus, swamp soils with high organic contents