Alt & Witzig Engineering, Inc.
4105 West 99th Street • Carmel, Indiana 46032
(317) 875-7000 • Fax (317) 876-3705

November 16, 2015

40th Parallel Surveying
555 Market Road
Tipton, Indiana 46072
Attention: Ms. Elaine Phelps

Report of Subsurface Investigation and Geotechnical Recommendations

RE: Kokomo Sonic Restaurant
Markland Avenue
Kokomo, Indiana
A&W Project No.: 15IN0779

Dear Ms. Phelps:

In compliance with your request, Alt & Witzig Engineering, Inc. has completed a subsurface investigation the above mentioned Site. The Statement of Objectives, Scope of Work, and results of our investigation are presented in the following report. It is our pleasure to transmit one (1) electronic (.pdf) copy of our report.

The results of our test borings and laboratory tests are presented in the appendix of the report. Our recommendations for the project are presented in the "Geotechnical Analysis and Recommendations" section of the report. If you have any questions or comments regarding this matter, please contact us at your convenience.

Sincerely,
ALT & WITZIG ENGINEERING, INC.

Chris M. Kubic, E.I
Project Engineer

DAVID C. HARNESS REGISTERED No. 19800337 STATE OF INDIANA PROFESSIONAL ENGINEER

David C. Harness, P.E.
Geotechnical Service Manager

SUBSURFACE INVESTIGATION & GEOTECHNICAL RECOMMENDATIONS

KOKOMO SONIC RESTAURANT
MARKLAND AVENUE
KOKOMO, INDIANA
A&W PROJECT NO.: 15IN0779

PREPARED FOR:
40th PARALLEL SURVEYING
TIPTON, INDIANA

PREPARED BY:
ALT & WITZIG ENGINEERING, INC.
GEOTECHNICAL DIVISION

NOVEMBER 16, 2015

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EXECUTIVE SUMMARY

Alt & Witzig Engineering, Inc. has performed a subsurface investigation and geotechnical analysis for the Sonic Restaurant to be constructed at Markland Avenue in Kokomo, Indiana. Our investigation was completed in conformance with the scope and limitations of our proposal dated October 14th, 2015 (*A&W Proposal 1510G023*).

In compliance with your request, we have completed a total of 9 soil borings for the Sonic restaurant at the above referenced site. The majority of the soil borings encountered brown and gray silty sandy clays with intermittent sand layers extending from beneath the thin topsoil layer to the termination depths of our borings. Sand layers were found as shallow as five (5) below grade. Groundwater was encountered in boring B-2, C-2, and C-4 ranging from eleven (11) to fourteen (14).

Site plans indicate the FFE will be within 1-2 feet of current elevations. The shallow soils appear suitable to support foundations for the lightly loaded structure. We recommend net allowable bearing pressures of 2,500 and 2,000 psf for a spread and continuous foundations for the building, respectively. In areas where the canopy foundations are to be placed, a bearing capacity of 2,500 psf is recommended. If sand seams are found within the foundation subgrade, a vibratory compactor should be used to densify the soils prior to placing concrete.

INTRODUCTION

In compliance with your request, we have completed a subsurface investigation and geotechnical analysis at the above referenced site for the proposed Sonic Restaurant to be constructed at Markland Avenue in Kokomo, Indiana.

Structural loads were not available at the time of the investigation. However based on the building type, it is anticipated that light structural loads will be transferred to the soil by conventional spread foundations if possible. If the final design loads differ significantly from those enumerated above, some revisions to this report may become necessary.

Site Location

The site is located approximately 600 feet west of the intersection of E Markland Ave. and South Goyer Rd. in Kokomo, Indiana. The site is located east of the main entrance of Meijer.

Exhibit 1: Aerial Photograph of the Site (outlined in red)

Google Earth 9/28/2014

Site Description

The proposed building pad location is flat, with the outer portion of the property sloping towards the roadways with a relief of two (2) feet. As seen in Exhibit 1, a post sign for Meijer is located within the northwest corner of the site. Drainage of the site flows north towards the drainage ditch running parallel with Markland Ave.

Regional Setting

Soils

A review of the Soil Survey Map of Howard County indicates that the majority of soils encountered over the project area consist of Brookston silty clay loam (Br) and Crosby silt loam (CsA). The Custom Soil Resource Report for Howard County has been included in the Appendix of this report

Bedrock Geology

Bedrock at this site is mapped as a Silurian limestone with a depth range of 750 – 800 msl.

WORK PERFORMED

Boring Locations

Alt & Witzig Engineering staked the locations of the borings using the provided project plans. The borings were projected onto aerials provided by the Google Earth website allowing for the correlation of the approximate latitude and longitude coordinates with each boring. These coordinates were then assigned as waypoints and uploaded into a handheld GPS unit. The borings referred to on our boring logs were then staked in the field using the handheld GPS unit.

Soil Sampling

The soil borings were performed with a drilling rig equipped with a rotary head. Conventional hollow-stem augers were used to advance the holes. Borings were accessed by a truck mounted drilling rig. During the sampling procedure, standard penetration tests were performed at regular intervals to obtain the standard penetration value of the soil. The standard penetration value is defined as the number of blows a 140 lb hammer, falling 30 inches, required to advance the split-spoon sampler 12 inches into the soil. The results of the standard penetration tests indicate the relative density and comparative consistency of the soils, and thereby provide a basis for estimating the relative strength and compressibility of the soil profile components.

Soil samples were field classified and placed in unpreserved glass jars with Teflon-lined lids for transport to our geotechnical laboratory for further analysis.

Laboratory Analyses for Soil Samples

A supplementary laboratory investigation was conducted to ascertain additional pertinent engineering characteristics of the subsurface materials necessary in analyzing the behavior of the proposed restaurant. All phases of the laboratory investigation were conducted in accordance with applicable ASTM Specifications. The laboratory-testing program also included:

- Classification of soils in accordance with ASTM D 2488
- Moisture content tests in accordance with ASTM D 2216.

Groundwater Elevation

Initial depths to groundwater were estimated based on where water was observed on the sampling rods. Upon completion of drilling activities, the depth to water was measured using a 100-foot tape measure with a weighted end. It shall be noted that in noncohesive soils, borings often experience caving or ‘plugging’ of the borehole opening due to sloughing of the granular soils. The depth of cave/plug is also recorded on the Boring Logs. The depths presented on the Boring Logs are accurate only for the day on which they were recorded. The exact location of the water table shall be anticipated to fluctuate depending upon normal seasonal variations in preparation and surface runoff.

INVESTIGATION RESULTS

The types of foundation materials encountered have been visually classified and are described in detail on the *Boring Logs*. The results of the field penetration tests, strength tests, water level observations and laboratory water contents are presented on the *Boring Logs* in numerical form. Representative samples of the soils encountered in the field were placed in sample jars and are now stored in our laboratory for further analysis if desired. Unless notified to the contrary, all samples will be disposed of after 2 months.

Geologic Results

Soil borings throughout the site encountered approximately three (3) to four (4) inches of topsoil. Underneath the topsoil layer the majority of soil borings indicate cohesive soils with sand layers extending to termination depths. All boring locations exhibited silty sandy clays extending to a depth of at least five (5) feet prior to encountering sand layers. The cohesive soils found throughout the site are comprised of brown and gray, medium stiff to very stiff soil. The granular soils encountered throughout the site are comprised of brown and gray, dry to moist fine, loose to medium dense sand with gravel at corresponding locations.

Groundwater Depth

Borings B-2, C-2, and C-4 encountered groundwater ranging eleven (11) to fourteen (14) feet during and at completion of drilling operations.

Seismic Parameters

Based on the field and laboratory tests performed on the encountered subsurface materials and an assumption of similar soil conditions present at depths below the boring termination depth, this site should be considered a Site Class D in accordance with the 2012 International Building Code.

Maximum spectral response acceleration values of Ss=0.124 g and S1=0.072 g are recommended for seismic design.

GEOTECHNICAL ANALYSES AND RECOMMENDATIONS

Project Information

The building is anticipated to be single story, wood framed, slab-on-grade structure. Loading is anticipated to be light with maximum wall loads anticipated to be three (3) kips or less per linear foot. Maximum column loads of 50 kip or less are anticipated.

Building and Canopy Recommendations

Shallow Spread Footings

The following table should be used for the design of conventional spread and wall footings for the proposed restaurant structure and canopy area at this site. The canopy foundation are assumed to be either a standard spread with compacted back fill or a drilled concrete pier foundation.

Table 1: Net Allowable Soil Bearing Pressures

Structure	Foundation Depth	Spread/Mat Foundations	Continuous Wall Footings
Building	3-5 feet	2,500 psf	2,000 psf
Canopy	3-7 feet	2,500 psf	N/A

Unless otherwise indicated the above-recommended bearing pressures are assuming the footings will be founded on the natural soils. If granular material is encountered at canopy foundation load depths, vibratory plate compaction is required. The above recommended bearing pressures are "net allowable soil pressures". In utilizing these net allowable pressures for dimensioning footings, it is necessary to consider only those loads applied above the finished floor elevations.

In order to alleviate the effects of seasonal variation in moisture content on the behavior of the footings and eliminate the effects of frost action, all exterior foundations should be founded a minimum of three (3) feet below the final grade.

It is recommended that all foundation excavations be inspected by Alt & Witzig Engineering to verify that adequate bearing soils exist in the base of all footings. Wherever soft or loose soils are encountered, these footing areas must be undercut. The exact depth of undercut should be determined at the time of footing excavation. After excavation to an adequate bearing material, the footing areas should be re-established to the proposed bottom of footing elevation by placing a lean or regular strength concrete. An example of an undercut footing is shown in the *Excavation Details* found with the Appendix.

Special Canopy Foundation Considerations

The canopy foundations will be subjected to high over-turning moments due to high wind loads. In order to resist these loads, the backfill over the canopy footings should be compacted to a minimum of 95% of maximum dry density in accordance with ASTM D1557.

Floor Slab Recommendations

The ground floor for this structure may be constructed as a slab-on-grade supported by firm natural soils. In the areas where the existing grade is above the anticipated finished floor elevation, the area should be undercut to allow six (6) inches of granular fill beneath the slab. Prior to the placement of new fill materials, the existing subgrade should be proof-rolled.

If soft soils are encountered during proof-rolling operations, any unsuitable soils should be partially scarified and recompacted. If earthmoving operations are performed during the wet portion of the year, some subgrade stabilization should be anticipated. After the building pad areas have been raised to the proper elevation, a six (6) inch layer of granular fill should be placed immediately beneath the floor slab. This granular fill will provide a uniform surface on which the floor slab may be constructed. Recommendations for proper filling procedures are presented in the Appendix.

CONSTRUCTION CONSIDERATIONS

Site Preparation

Excessively organic topsoil and loose dumped fill materials will generally undergo high volume changes which are detrimental to the behavior of pavements, floor slabs, structural fills, and foundations placed upon them. Therefore, it is recommended that all loose materials be stripped from the construction areas and wasted or stockpiled for later use.

The soil borings encountered several inches of topsoil. It is recommended that the topsoil be stripped from the site and wasted. The condition of the subgrade and the methods used by the contractor will also influence the amount of stripping. If stripping takes place when the subgrade is wet the construction equipment may push unsuitable soils deeper into the subgrade and influence the actual depth of stripping.

It is recommended that the final depth of stripping should be determined by a representative of Alt & Witzig Engineering, Inc. in the field, at the time of the stripping operations. It is recommended that after the above-mentioned stripping has been performed, the exposed subgrade should be proof-rolled with approved equipment. This proof-rolling will assist in identifying areas where soft soil exist. If pockets of soft materials are encountered, these soils should be removed and replaced with a well-compacted material. It is recommended that a representative of Alt & Witzig Engineering, Inc. be present for this phase of this project. It should be noted that considerable heavy construction traffic over the exposed subgrade may cause rutting and pumping. Caution should be exercised to direct construction traffic such that the subgrade does not fail due to construction activities.

After the existing subgrade soils are raised to design grade, proper control of subgrade compaction and fill, and structural fill replacement should be maintained by a representative of the soils engineer as per the *Recommended Specifications for Compacted Fills and Backfills* presented in the Appendix. This will minimize volume changes and differential settlements which are detrimental to behavior of shallow foundations, floor slabs and pavements.

Groundwater

Groundwater level measurements taken during and upon completion of the boring operations indicated water at a depth of eleven feet below existing grade. However, the *Custom Soil Resource Report for Howard County, Indiana* indicates a seasonal high groundwater level ranging from zero foot to two (2) feet below the existing ground surface. The exact location of the water table will fluctuate depending upon normal seasonal variations in precipitation and surface runoff.

Depending upon the time of the year and the weather conditions when the excavations are made, seepage from surface runoff may occur into shallow excavations or soften the subgrade soils. Since these foundation materials tend to loosen when exposed to free water, every effort should be made to keep the excavations dry should water be encountered. Sump pumps or other conventional dewatering procedures should be sufficient for this purpose. It is also recommended that all concrete for footings be poured the same day as the excavation is made in order to prevent the softening of foundation soils from groundwater infiltration.

STATEMENT OF LIMITATIONS

This report is solely for the use of 40th Parallel Surveying and any reliance of this report by third parties shall be at such party's sole risk and may not contain sufficient information for purposes of other parties for other uses. This report shall only be presented in full and may not be used to support any other objectives than those set out in the scope of work, except where written approval and consent are provided by 40th Parallel Surveying and Alt &Witzig Engineering.

An inherent limitation of any geotechnical engineering study is that conclusions must be drawn on the basis of data collected at a limited number of discrete locations. The geotechnical parameters provided in this report were developed from the information obtained from the test borings that depict subsurface conditions only at these specific locations and on the particular date indicated on the boring logs. Soil conditions at other locations may differ from conditions encountered at these boring locations and groundwater levels shall be expected to vary with time. The nature and extent of variations between the borings may not become evident until the course of construction.

The exploration and analysis reported herein is considered in sufficient detail and scope to form a reasonable basis for design. The recommendations submitted are based on the available soil information and assumed design details enumerated in this report. If actual design details differ from those specified in this report, this information should be brought to the attention of Alt & Witzig Engineering, Inc. so that it may be determined if changes in the recommendations herein are required. If deviations from the noted subsurface conditions are encountered during construction, they should also be brought to the attention of Alt & Witzig Engineering, Inc.

We appreciate the opportunity to work with you on this project. Often, because of design and construction details that occur, questions arise concerning the soils conditions. If we can give further service in these matters, please contact us at your convenience.

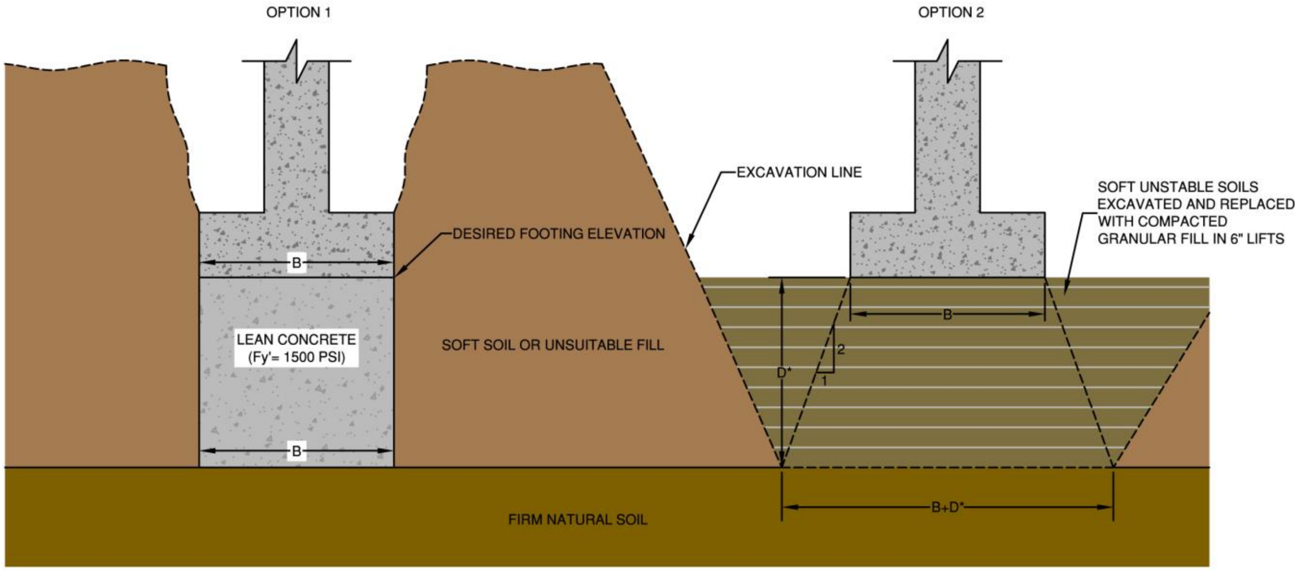
APPENDIX A

Recommended Specifications for Compacted Fills and Backfills
Excavation Details
Site Location Map
Boring Location Map
Boring Logs
General Notes

RECOMMENDED SPECIFICATIONS FOR COMPACTED FILLS AND BACKFILLS

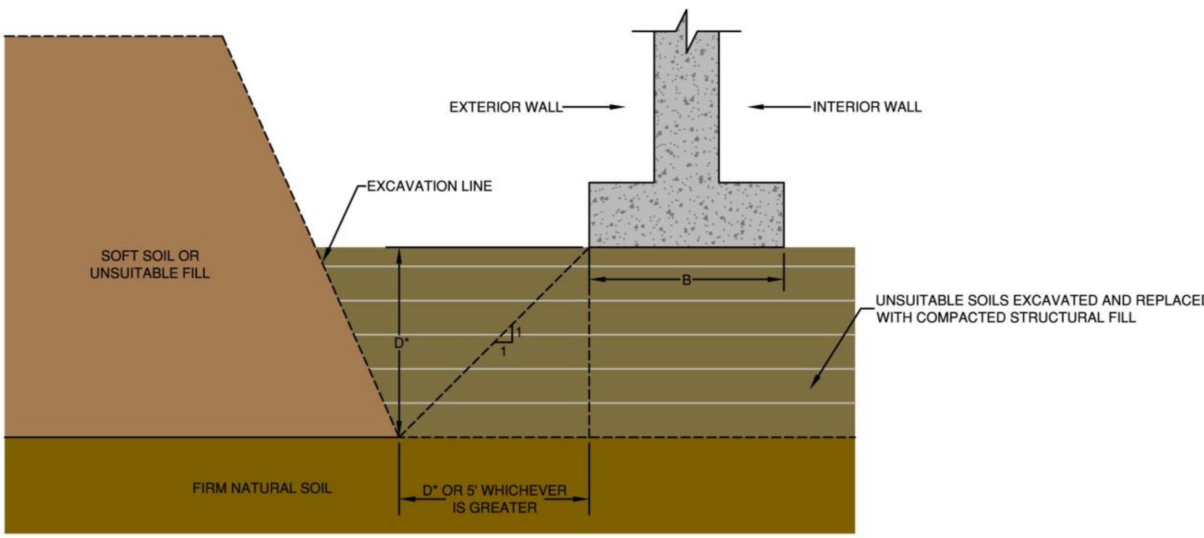
All fill shall be formed from material free of vegetable matter, rubbish, large rock, and other deleterious material. Prior to placement of fill, a sample of the proposed fill material should be submitted to Alt & Witzig Engineering, Inc. for his approval. The surface of each layer will be approximately horizontal but will be provided with sufficient longitudinal and transverse slope to provide for runoff of surface water from every point. The fill material should be placed in layers not to exceed eight (8) inches in loose thickness and should be sprinkled with water as required to secure specified compactions. Each layer should be uniformly compacted by means of suitable equipment of the type required by the materials composing the fill. Under no circumstances should a bulldozer or similar tracked vehicles be used as compacting equipment. Material containing an excess of water so the specified compaction limits cannot be attained should be spread and dried to a moisture content that will permit proper compaction. All fill should be compacted to the specified percent of the maximum density obtained in accordance with ASTM density test D-1557 (95 percent of maximum dry density beneath foundations, 93 percent of maximum dry density beneath floor slabs). Should the results of the in-place density tests indicate that the specified compaction limits are not obtained; the areas represented by such tests should be reworked and retested as required until the specified limits are reached.

UNDERCUT EXCAVATION FOR ISOLATED FOOTINGS IN UNSTABLE MATERIALS



D* IS DEPTH FOR SUITABLE SOILS

MASS EXCAVATION FOR FOOTINGS IN UNSTABLE MATERIALS



D* IS DEPTH FOR SUITABLE SOILS

Undercut Detail for Footing Excavation in Unstable Material

PROJECT: **Railroad Scale Sirmax**
LOCATION: W. 25th St. & Arrow Ave. Anderson, Indiana
CLIENT: **Trace Construction Unlimted, LLC**
A&W File No.: 15IN0781

Alt & Witzig Engineering Inc.
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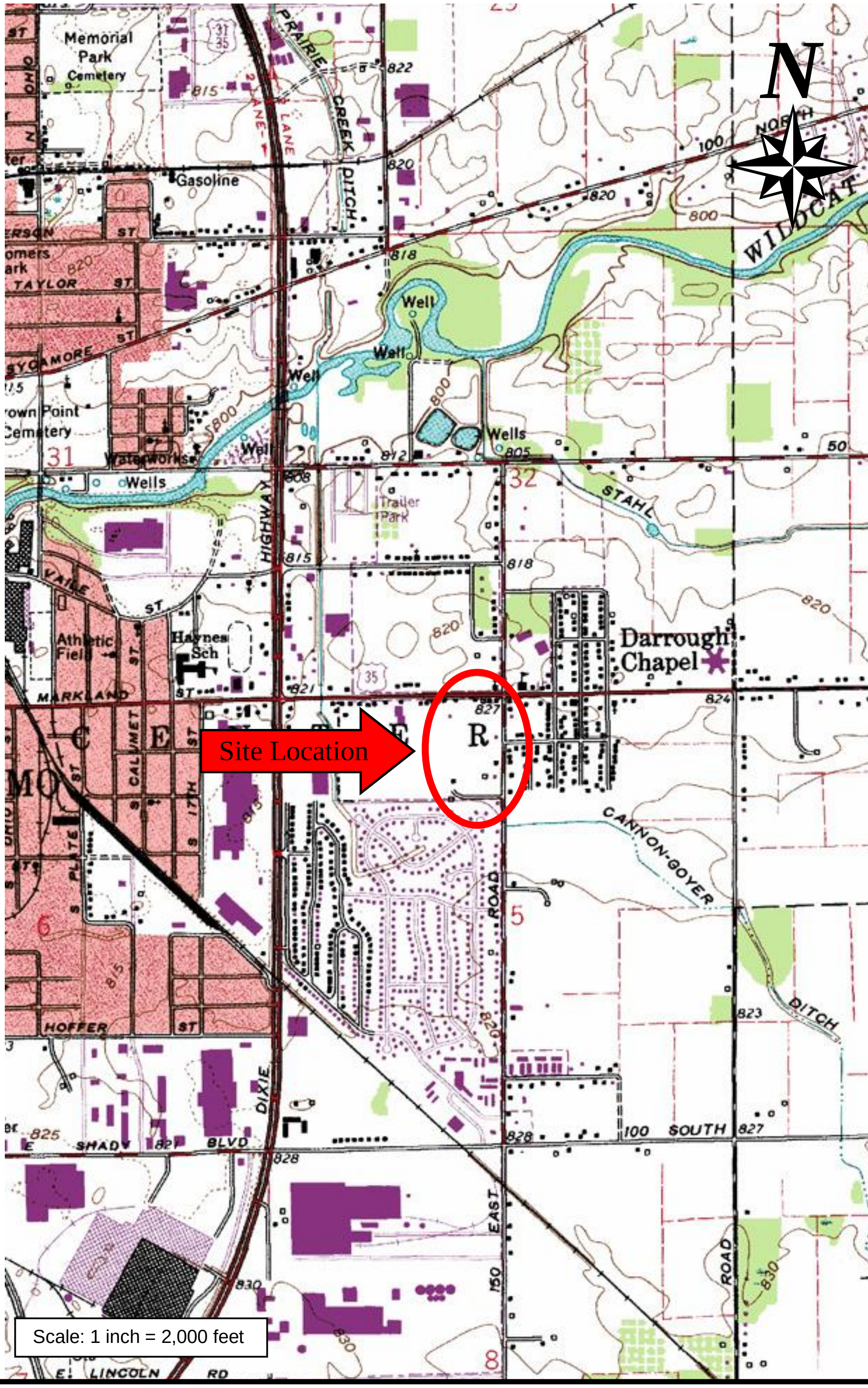
SITE LOCATION MAP



USGS Topographic Map:
Kokomo East Quadrangle

Township: T 23 N.
Range: R 4 E.
Section: 5

PROJECT: **Sonic Restaurant**
LOCATION: E. Marchland Ave., Kokomo, IN
CLIENT: **40th Parallel Surveying**
A&W File No.: 15IN0779

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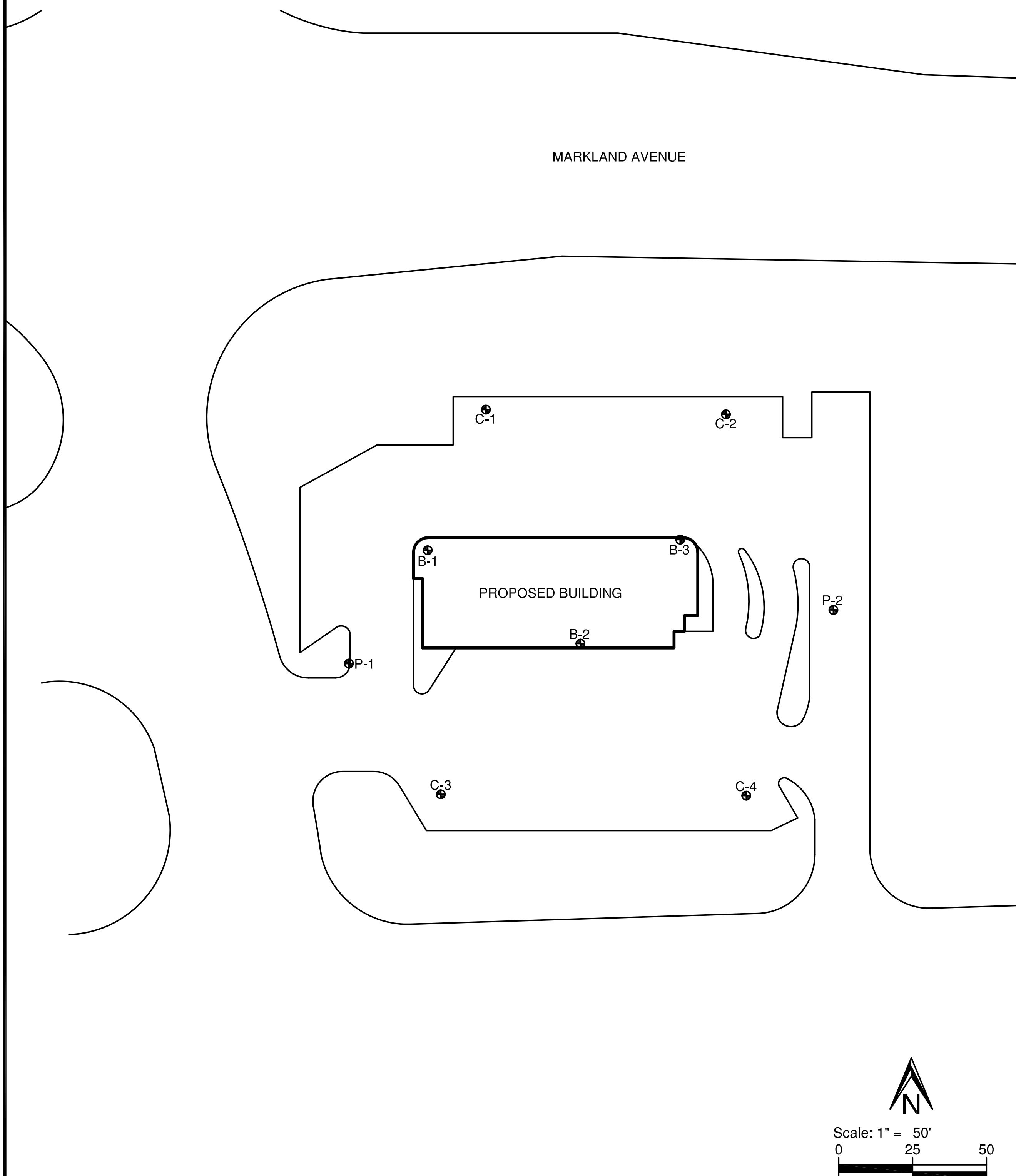
Last Modified: 11/5/2015 10:38 AM



BORING LOCATION PLAN

PROJECT NAME: Sonic Restaurant
LOCATION: E. Marchland Ave., Kokomo, IN
PREPARED FOR: 40th Parallel Surveying
PROJECT NO: 15IN0779

Project Manager: CK
Checked By: DH
Drawn By: JT
Date: 10/15

Alt & Witzig Engineering, Inc.
4105 West 99th Street • Carmel, IN 46032
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BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT **40th Parallel Surveying**
BORING # **B-1**
PROJECT NAME **Kokomo Sonic Restaurant**
ALT & WITZIG FILE # **15IN0779**
PROJECT LOCATION **Kokomo, Indiana**

DRILLING and SAMPLING INFORMATION

Date Started	**11/3/15**	Hammer Wt.	**140** lbs.
Date Completed	**11/3/15**	Hammer Drop	**30** in.
Boring Method	**HSA**	Spoon Sampler OD	**2** in.
Driller	**J. Livingston**	Rig Type	**BK51 Truck**

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % *Dry Unit Weight (pcf)*	Remarks
	TOPSOIL	0.3										
	Brown Sandy CLAY			1	SS			18		2.5	21.8	
		5.0	5	2	SS			9	2.4	2.5	30.9	
	Brown Mottled Gray Silty CLAY			3	SS			9		1.0	30.5	
		8.5										
	Brownish Gray Silty CLAY	10.0	10	4	SS			10				
	Brown, Slightly Moist Fine SAND	15.5	15	5	SS			12		1.5	12.7	
	Gray Sandy CLAY	16.0										
	End of Boring at 16 feet											

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater
○ During Drilling *Dry ft.*
▽ At Completion *Dry ft.*

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT **40th Parallel Surveying**
BORING # **B-2**
PROJECT NAME **Kokomo Sonic Restaurant**
ALT & WITZIG FILE # **15IN0779**
PROJECT LOCATION **Kokomo, Indiana**

DRILLING and SAMPLING INFORMATION

Date Started	**11/3/15**	Hammer Wt.	**140** lbs.
Date Completed	**11/3/15**	Hammer Drop	**30** in.
Boring Method	**HSA**	Spoon Sampler OD	**2** in.
Driller	**J. Livingston**	Rig Type	**BK51 Truck**

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % *Dry Unit Weight (pcf)*	Remarks
	TOPSOIL	0.3										
	Brown Sandy CLAY			1	SS			9			14.5	
			5	2	SS			12				Driving on a Rock
		6.5										
	Gray, Slightly Moist Fine SAND with Gravel			3	SS			30				
			10	4	SS			17				
							⊻					
							○					
		15.0	15	5	SS			50/1"				
	Brown Sandy CLAY with Gravel	16.0										
	End of Boring at 16 feet											

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater
○ During Drilling *14.0 ft.*
⊻ At Completion *11.0 ft.*

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT **40th Parallel Surveying**

BORING # **B-3**

PROJECT NAME **Kokomo Sonic Restaurant**

ALT & WITZIG FILE # **15IN0779**

PROJECT LOCATION **Kokomo, Indiana**

DRILLING and SAMPLING INFORMATION

Date Started	**11/2/15**	Hammer Wt.	**140** lbs.
Date Completed	**11/1/15**	Hammer Drop	**30** in.
Boring Method	**HSA**	Spoon Sampler OD	**2** in.
Driller	**J. Livingston**	Rig Type	**BK51 Truck**

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % *Dry Unit Weight (pcf)*	Remarks
	TOPSOIL	0.5										
	Brown Sandy Silty CLAY			1	SS			9		4.5	9.6	
			5	2	SS			6		1.5	18.1	
		7.0										
	Brown Clayey SAND			3	SS			9				
		9.5										
	Gray LEAN CLAY with Gravel *(Glacial Till)*		10	4	SS			13			7.1	
			15	5	SS			29		4.5	7.6	
		16.0										
	End of Boring at 16 feet											

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling *Dry ft.*
∇ At Completion *Dry ft.*

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT 40th Parallel Surveying
BORING # C-1
PROJECT NAME Kokomo Sonic Restaurant
ALT & WITZIG FILE # 15IN0779
PROJECT LOCATION Kokomo, Indiana

DRILLING and SAMPLING INFORMATION

Date Started 11/2/15
Hammer Wt. 140 lbs.
Date Completed 11/1/15
Hammer Drop 30 in.
Boring Method HSA
Spoon Sampler OD 2 in.
Driller J. Livingston
Rig Type BK51 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % *Dry Unit Weight (pcf)*	Remarks
	TOPSOIL	0.4										
	Brown Silty CLAY			1	SS			7		2.0	18.6	
			5	2	SS			10		2.0	20.4	
		8.5		3	SS			10		1.5	23.2	
	Brown Mottled Gray Silty CLAY	11.0	10	4	SS			16		1.0	23.0	
	Brown SAND	15.0										
	Gray, Wet SAND	16.0	15	5	SS			13				
	End of Boring at 16 feet											

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater
○ During Drilling *Dry ft.*
∇ At Completion *Dry ft.*

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT 40th Parallel Surveying

PROJECT NAME Kokomo Sonic Restaurant

PROJECT LOCATION Kokomo, Indiana

BORING # C-2

ALT & WITZIG FILE # 15IN0779

DRILLING and SAMPLING INFORMATION

Date Started	11/2/15	Hammer Wt.	140 lbs.
Date Completed	11/1/15	Hammer Drop	30 in.
Boring Method	HSA	Spoon Sampler OD	2 in.
Driller	J. Livingston	Rig Type	BK51 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % *Dry Unit Weight (pcf)*	Remarks
	TOPSOIL	0.4										
	Brown Silty CLAY			1	SS			13		4.5	12.4	
		6.0	5	2	SS			10				
	Light Brown SAND with Some Gravel	7.0										
	Gray and Brown Silty CLAY			3	SS			13		2.0	24.1	
			10	4	SS		⊗	5	0.8		26.7	
	Brown, Wet Gravel with Brown Silty Clay *(Glacial Till)*	15.5	15	5	SS			14				
		16.0										
	End of Boring at 16 feet											

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling *11.0 ft.*
⊻ At Completion *11.0 ft.*

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT **40th Parallel Surveying**
PROJECT NAME **Kokomo Sonic Restaurant**
PROJECT LOCATION **Kokomo, Indiana**

BORING # **C-3**
ALT & WITZIG FILE # **15IN0779**

DRILLING and SAMPLING INFORMATION

Date Started	**11/3/15**	Hammer Wt.	**140** lbs.
Date Completed	**11/3/15**	Hammer Drop	**30** in.
Boring Method	**HSA**	Spoon Sampler OD	**2** in.
Driller	**J. Livingston**	Rig Type	**BK51 Truck**

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % / *Dry Unit Weight (pcf)*	Remarks
	TOPSOIL	0.3										
	Brown and Gray Sandy CLAY			1	SS			9		2.5	11.6	
			5	2	SS			11		3.0	14.4	
		8.5		3	SS			8	1.3	1.5	12.3	
	Gray Sandy CLAY with Gravel		10	4	SS			22		2.5	11.5	
		16.0	15	5	SS			10	2.9	2.5	10.3	
	End of Boring at 16 feet											

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater
○ During Drilling *Dry ft.*
▽ At Completion *ft.*

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT **40th Parallel Surveying** | BORING # **C-4**

PROJECT NAME **Kokomo Sonic Restaurant** | ALT & WITZIG FILE # **15IN0779**

PROJECT LOCATION **Kokomo, Indiana**

DRILLING and SAMPLING INFORMATION

Date Started	**11/3/15**	Hammer Wt.	**140** lbs.
Date Completed	**11/3/15**	Hammer Drop	**30** in.
Boring Method	**HSA**	Spoon Sampler OD	**2** in.
Driller	**J. Livingston**	Rig Type	**BK51 Truck**

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics / Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % *Dry Unit Weight (pcf)*	Remarks
	TOPSOIL	0.3										
	Brown and Gray Sandy CLAY			1	SS			9		1.5	16.8	
		5.0	5	2	SS			27				
	Brown and Gray, Dry SAND and GRAVEL	7.5		3	SS			9		2.0	11.7	
	Gray Sandy LEAN CLAY with Gravel	9.5	10	4	SS			28		2.0	12.5	
	Gray LEAN CLAY *(Glacial Till)*						▽					
		16.0	15	5	SS			30	4.1	4.5	9.7	
	End of Boring at 16 feet											

Sample Type

SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater

○ During Drilling *Dry ft.*
▽ At Completion *14.0 ft.*

Boring Method

HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT 40th Parallel Surveying
PROJECT NAME Kokomo Sonic Restaurant
PROJECT LOCATION Kokomo, Indiana

BORING # P-1
ALT & WITZIG FILE # 15IN0779

DRILLING and SAMPLING INFORMATION

Date Started	11/3/15	Hammer Wt.	140 lbs.
Date Completed	11/3/15	Hammer Drop	30 in.
Boring Method	HSA	Spoon Sampler OD	2 in.
Driller	J. Livingston	Rig Type	BK51 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % *Dry Unit Weight (pcf)*	Remarks
	TOPSOIL	0.3										
	Dark Gray Sandy CLAY *(Possible Fill)*	4.5		1	SS			13		4.5	16.0	
	Brown Mottled Gray Silty CLAY	6.0	5	2	SS			9	2.6	3.0	28.0	
	End of Boring at 6 feet											

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater
○ During Drilling *Dry ft.*
▽ At Completion *Dry ft.*

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

BORING LOG

Alt & Witzig Engineering, Inc.

CLIENT 40th Parallel Surveying
PROJECT NAME Kokomo Sonic Restaurant
PROJECT LOCATION Kokomo, Indiana

BORING # P-2
ALT & WITZIG FILE # 15IN0779

DRILLING and SAMPLING INFORMATION

Date Started	11/3/15	Hammer Wt.	140 lbs.
Date Completed	11/3/15	Hammer Drop	30 in.
Boring Method	HSA	Spoon Sampler OD	2 in.
Driller	J. Livingston	Rig Type	BK51 Truck

TEST DATA

STRATA ELEV.	SOIL CLASSIFICATION / SURFACE ELEVATION	Strata Depth	Depth Scale	Sample No.	Sample Type	Sampler Graphics Recovery Graphics	Ground Water	Standard Penetration Test, N - blows/foot	Qu-tsf Unconfined Compressive Strength	PP-tsf Pocket Penetrometer	Moisture Content % *Dry Unit Weight (pcf)*	Remarks
	TOPSOIL	0.3										
	Brown and Gray Silty Sandy CLAY			1	SS			7	1.4	2.5	19.9	
			5	2	SS			9		2.5	12.9	
		6.0										
	End of Boring at 6 feet											

Sample Type
SS - Driven Split Spoon
ST - Pressed Shelby Tube
CA - Continuous Flight Auger
RC - Rock Core
CU - Cuttings
CT - Continuous Tube

Groundwater
○ During Drilling *Dry ft.*
∇ At Completion *Dry ft.*

Boring Method
HSA - Hollow Stem Augers
CFA - Continuous Flight Augers
DC - Driving Casing
MD - Mud Drilling

MATERIAL GRAPHICS LEGEND

CL: USCS Low Plasticity Clay	CL-ML: USCS Low Plasticity Silty Clay
CLS: USCS Low Plasticity Sandy Clay	IN GRAVEL: INDOT Gravel
SC: USCS Clayey Sand	SP: USCS Poorly-graded Sand
SPG: USCS Poorly-graded Gravelly Sand	TOPSOIL

SOIL PROPERTY SYMBOLS

N: *Standard "N" penetration value. Blows per foot of a 140-lb hammer falling 30" on a 2" O.D. split-spoon.*

Qu: *Unconfined Compressive Strength, tsf*

PP: *Pocket Penetrometer, tsf*

LL: *Liquid Limit, %*

PL: *Plastic Limit, %*

PI: *Plasticity Index, %*

DRILLING AND SAMPLING SYMBOLS

GROUNDWATER SYMBOLS

- ○ *Apparent water level noted while drilling.*
- ⊽ *Apparent water level noted upon completion.*
- ▼ *Apparent water level noted upon delayed time.*

SAMPLER SYMBOLS

SS: Split Spoon

RELATIVE DENSITY & CONSISTANCY CLASSIFICATION (NON-COHESIVE SOILS)

TERM	*BLOWS PER FOOT*
Very Loose	0 - 5
Loose	6 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	>51

RELATIVE DENSITY & CONSISTANCY CLASSIFICATION (COHESIVE SOILS)

TERM	*BLOWS PER FOOT*
Very Soft	0 - 3
Soft	4 - 5
Medium Stiff	6 - 10
Stiff	11 - 15
Very Stiff	16 - 30
Hard	>31

Alt & Witzig Engineering, Inc.
4105 West 99th St.
Carmel, IN 46032
Telephone: 317-875-7000
Fax:

GENERAL NOTES

Project: Kokomo Sonic Restaurant

Location: Kokomo, Indiana

Number: 15IN0779

APPENDIX B

Seismic Design Parameters
Custom Soil Resource of Howard County, Indiana

Design Maps Summary Report

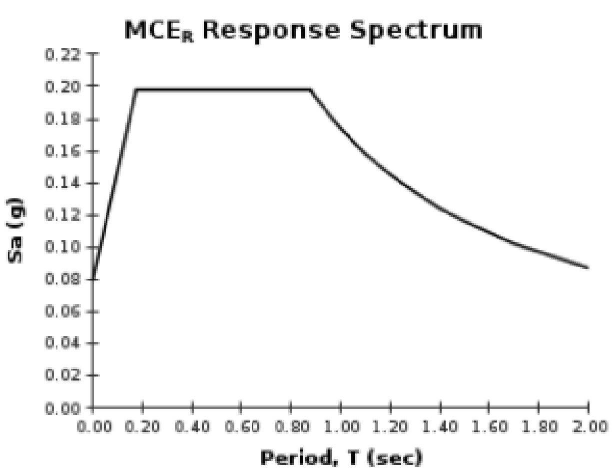
User–Specified Input

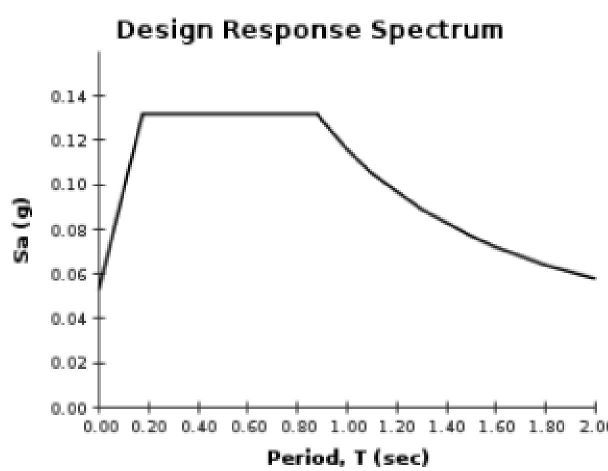
Report Title	**15in0779** Wed November 11, 2015 20:22:46 UTC
Building Code Reference Document	**2012 International Building Code** (which utilizes USGS hazard data available in 2008)
Site Coordinates	**40.47667°N, 86.10525°W**
Site Soil Classification	**Site Class D – “Stiff Soil”**
Risk Category	**I/II/III**

USGS–Provided Output

S_S =	**0.124 g**	S_{MS} =	**0.198 g**	S_{DS} =	**0.132 g**
S_1 =	**0.072 g**	S_{M1} =	**0.174 g**	S_{D1} =	**0.116 g**

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the “2009 NEHRP” building code reference document.





United States Department of Agriculture

NRCS

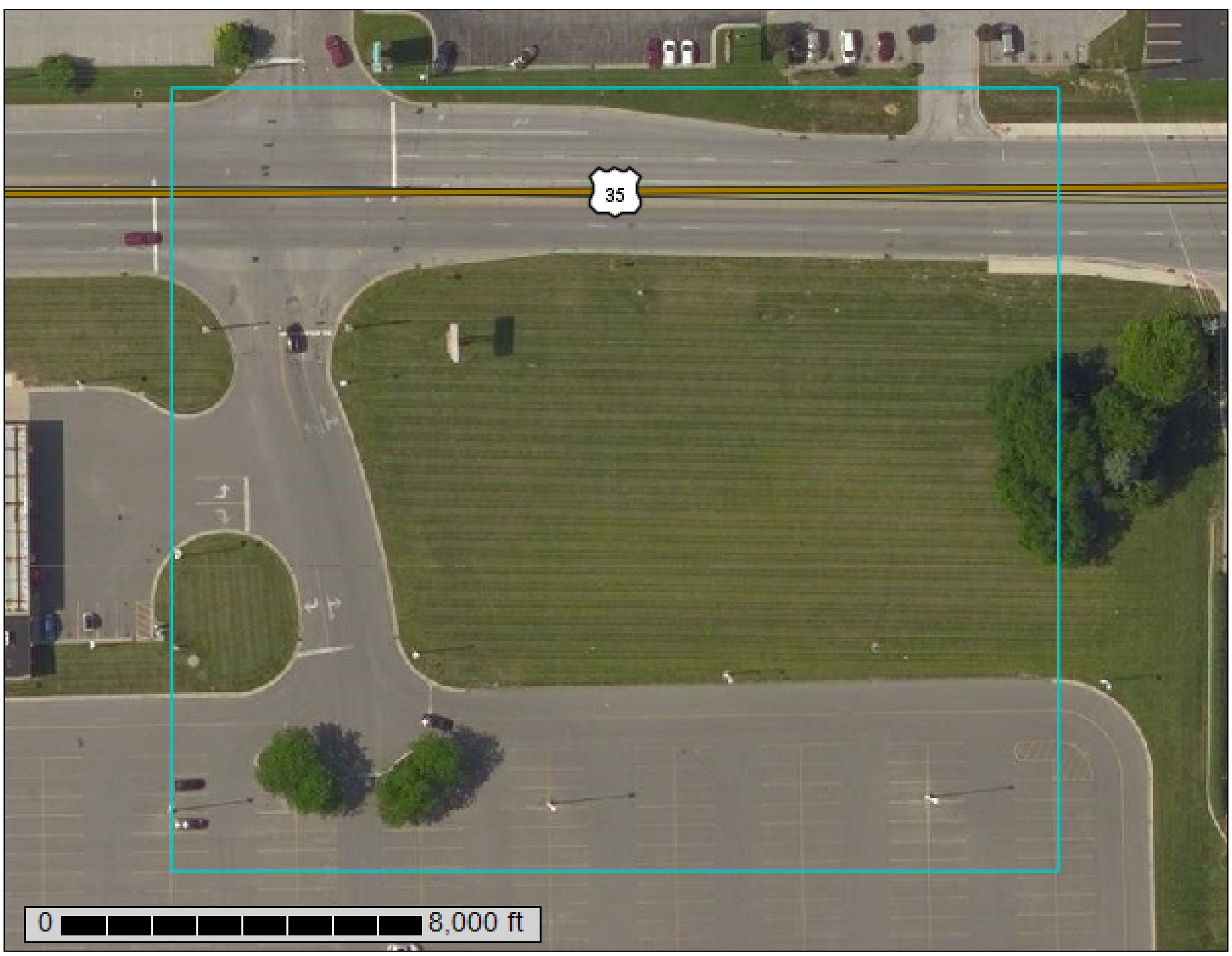
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Howard County, Indiana

15in0779



November 11, 2015

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,030 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 15, 30, 60, 90

Feet: 0, 50, 100, 200, 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Howard County, Indiana
Survey Area Data: Version 20, Sep 9, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 4, 2015—Jun 10, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Howard County, Indiana (IN067)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
Bs	Brookston silty clay loam, 0 to 2 percent slopes	2.7	65.4%
CsA	Crosby silt loam, fine-loamy subsoil, 0 to 2 percent slopes	1.5	34.6%
Totals for Area of Interest		**4.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Howard County, Indiana

Bs—Brookston silty clay loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2t98n
Elevation: 600 to 1,260 feet
Mean annual precipitation: 37 to 46 inches
Mean annual air temperature: 48 to 55 degrees F
Frost-free period: 145 to 180 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Brookston and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brookston

Setting

Landform: Depressions, till plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Parent material: Loess over loamy till

Typical profile

Ap - 0 to 16 inches: silty clay loam
Btg1 - 16 to 32 inches: silty clay loam
Btg2 - 32 to 44 inches: loam
C - 44 to 60 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum in profile: 40 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D

Minor Components

Crosby

Percent of map unit: 5 percent

Landform: Till plains
Landform position (two-dimensional): Footslope, summit
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Linear

CsA—Crosby silt loam, fine-loamy subsoil, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2thy4
Elevation: 600 to 1,000 feet
Mean annual precipitation: 36 to 44 inches
Mean annual air temperature: 49 to 54 degrees F
Frost-free period: 145 to 180 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Crosby and similar soils: 93 percent
Minor components: 7 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Crosby

Setting

Landform: Ground moraines, recessional moraines, water-lain moraines
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Interfluve, rise
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Parent material: Silty material or loess over loamy till

Typical profile

Ap - 0 to 10 inches: silt loam
Btg - 10 to 17 inches: silty clay loam
2Bt - 17 to 29 inches: clay loam
2BCt - 29 to 36 inches: loam
2Cd - 36 to 79 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 24 to 40 inches to densic material
Natural drainage class: Somewhat poorly drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 55 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water storage in profile: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D

Minor Components

Williamstown, eroded

Percent of map unit: 5 percent
Landform: Ground moraines, recessionial moraines, water-lain moraines
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Crest, head slope, nose slope, side slope, rise
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex

Treaty, drained

Percent of map unit: 2 percent
Landform: Depressions, swales, water-lain moraines
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Linear
Across-slope shape: Concave

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