

GEOTECHNICAL EXPLORATION TECHNICAL MEMO

PREPARED FOR:	Clinton Regional Development Corporation
PREPARED BY:	Edward Schnackenberg, P.E. – Olsson Associates Nathan Jensen, E.I. – Olsson Associates
PROJECT:	Lincolnway Industrial Rail and Air Park Clinton County, Iowa
DATE:	February 10, 2016
OA PROJECT #:	015-2757

GEOTECHNICAL SCOPE

This memo was requested and authorized by Ms. Janelle Kreiling of the Clinton Regional Development Corporation for the purpose of evaluating the existing subsurface conditions for the Lincolnway Industrial Rail and Air Park in Clinton County, Iowa. The geotechnical work for this project included:

- Site reconnaissance and review of soil and geologic subsurface information from the USDA Natural Resource and Conservation Service (NRCS).
- Drilling and sampling of 9 soil test borings extending to depths ranging from 25 to 51.5 feet each below existing grades.
- Laboratory testing (as noted in the attachments) of soil samples obtained during the field operations.
- Completion of a geotechnical engineering evaluation using information obtained from our field observations, soil test borings, and laboratory testing program.
- Preparation of this memo presenting the soil test borings, laboratory test results, and a summary of our engineering evaluations and recommendations.

SITE LOCATION AND PROJECT DESCRIPTION

As proposed, the Clinton Regional Development Corporation plans to develop approximately 450 acres in Clinton County, Iowa bounded by Hwy 30 (Lincoln Highway) on the north, 44th Avenue on the south, 380th Avenue on the west, and 400th Avenue on the east. Refer to the attached *Site Location Plan* for more detailed property boundaries. A review of aerial photographs dating back to the mid 1930's indicate the project site has been and is currently utilized for row crop farming.

Topographic information obtained from the Clinton County Beacon database indicated the site has approximately 60 feet of grade change ranging from a high elevation of approximately 618 feet along Lincoln Highway at the north edge of the property to a low elevation of approximately 618 feet near a draw at the southeast corner.

Geotechnical recommendations, such as foundation design or settlement estimates, are not included in the scope of services for this preliminary exploration. When final site design, grading plans, and specific structures have been determined, final geotechnical exploration(s) will be required to provide earthwork and foundation recommendations for design and construction. More complicated structure designs or heavily loaded foundations may require a more detailed evaluation and geotechnical exploration. Olsson can provide a separate scope and fee for these future services if requested by the architect or developer.

FIELD EXPLORATION

A truck-mounted CME 75 drill rig was used to complete 9 soil borings for this project to depths ranging from 25 to 51.5 feet below existing grades. The soil boring locations and depths referenced in our proposal may have been shifted slightly in the field if it was necessary to avoid existing underground or overhead utilities, existing structures, site features, or areas of limited access. Refer to the attached *Boring Location Map* for the final boring locations. Boreholes were backfilled with native auger cuttings after completing the drilling operations. Ground surface elevations at each boring location were interpolated from the topographic survey provided by the Clinton County Beacon database.

Undisturbed and split-barrel soil samples were obtained at 2.5 to 5-foot depth intervals during the drilling process and returned to the laboratory for additional testing. Soil samples designated as "U" samples on the boring logs were obtained using thin-walled, steel Shelby tubes hydraulically pushed into the ground. Soil samples designated as "SS" samples on the boring logs were obtained with a split-barrel sampler. Recovered samples were sealed, labeled, and protected for transportation to our laboratory for testing.

LABORATORY TESTING

Descriptions of the soils encountered in the soil test borings were prepared in general accordance with ASTM D-2488 (Visual-Manual Procedure for Description and Identification of Soils). The soil stratification shown on the boring logs represents soil conditions at the specific boring locations, but variations may occur between or beyond the borings. The stratification lines represent the approximate boundaries between soil types, but the actual transitions between soil layers may be

gradual. Per the laboratory scope determined by Olsson engineers and the soil conditions encountered, tests were completed to evaluate the engineering properties of recovered soil samples.

AREA GEOLOGY AND SOIL STRATIGRAPHY

The USDA Soil Survey for Clinton County, Iowa considers the project site to be within a variety of soil complexes. Those are described as follows:

TABLE 1 - USDA Soil Survey - Lincolnway Industrial Rail and Air Park, Clinton, IA			
Map Unit Symbol & Soil Name	USCS Classification	Bedrock indicated (Y/N/NA)	Bedrock depth (in.)
133 - Coly silt clay loam	CL, CH	N	
175B - Dickinson fine sandy loam	SC, SM, SP, and variations	N	
184 - Klinger silt loam	ML, CL, & variations	N	
214C - Rockton loam	ML, CL, and variations	Y	25 - 38
217B - Ripon silt loam	ML, CL, SC, and variations	Y	34 - 79
284B - Flagler sandy loam	SC, SM, SP, and variations	N	
284D - Buckhardt sandy loam	SM, SC, SP, ML, and variations	N	
350 & 350B - Waukegan silt loam	SM, SC, SP, ML, CL, and variations	N	
351 - Atterberry silt loam	SM, SC, ML, CL, and variations	N	
377B - Dunsdale silt loam	SM, SC, ML, CL, and variations	N	
404 - Thorp silt loam	SM, SC, ML, CL, and variations	N	
412D - Sogn loam	CL	Y	13 - 17
428B - Ely silt loam	CL, ML, CH, and variations	N	
760 - Ansgar silt loam	CL, ML, and variations	N	
918 - Garwin silty clay loam	ML, CL, CH, MH, and variations	N	
919 - Muscatine silt loam	ML, CL, CH, MH, SC, SM, and variations	N	
920 & 920B - Tama silt loam	ML, CL, CH, MH, SC, SM, SP, and variations	N	
1152 - Marshan clay loam	ML, CL, CH, MH, SC, SM, SW, SP, and variations	N	

Note: The soil survey complex designations and classifications are general in nature and represent existing soil conditions to depths of up to 80 inches only. The boundaries shown on the accompanying map are not definite and variations between unit designations and soil classifications should be anticipated.

The wide variation in soil complex descriptions can be generally summarized as silts and clays with variations in sand content, all overlying glacial drift. The original surface geology has been altered during seasonal row crop farming practices.

Of special note in Table 1 are the map unit designations for 214C, 217B, and 412D referencing the presence of limestone bedrock within 13 to 79 inches of the ground surface. For reference, these general areas are hatched on the attached *USDA Soil Survey Map*. Although final geotechnical explorations should confirm or deny the presence of bedrock in these areas, we have included the potential shallow bedrock locations in this report for consideration during future site development. In most instances, other than increased earthwork and demolition costs, shallow bedrock should not pose a significant concern for overall site development.

A review of the Iowa Department of Natural Resources (IDNR) Coal Mine database indicated the closest coal mine or prospect holes are located approximately 29.5 miles south/southwest of the project site. Refer to the attached *IDNR Coal Mine Map* for additional details.

SOIL PROPERTIES – BORING LOCATIONS SAMPLED

Loess – Soft to very stiff, light brown to dark grayish brown, slightly moist to very moist, fat and lean clay.						
USCS Classification	Dry Density (pcf)	Moisture Content (%)	Saturation (%)	LL/PI (%)	P-200 (%)	Unconfined Strength (tsf) (SPT (blows/ft))
CH, CL	88.8 – 105.5	14.5 – 33.1	65.5 – SAT.	67/19	N/A	1.1 (3 – 4)

N/A-Not Applicable

Glacial Drift (Cohesive) – Firm to hard, light brown to dark gray to bluish grayish, slightly moist to wet, lean clay with varying sand and gravel content.					
USCS Classification	Dry Density (pcf)	Moisture Content (%)	Saturation (%)	LL/PI (%)	Unconfined Strength (tsf) (SPT (blows/ft))
CL	88.6 – 127.4	8.3 – 39.7	60.3 – SAT.	29-41/12-16	1.0 (6 – 50/2")

N/A-Not Applicable

Glacial Drift (Cohesionless) – Very loose to dense, light brown to reddish brown to dark gray, slightly moist to wet, sands with varying fines and gravel contents.					
USCS Classification	Dry Density (pcf)	Moisture Content (%)	Saturation (%)	P-200 (%)	Unconfined Strength (tsf) (SPT (blows/ft))
SC, SP-SC, SP	113.8 – 127.5	6.9 – 21.5	93.0 – SAT.	3.5 – 49.9	0.6 – 1.1 (3 – 50/0.5")

GROUNDWATER SUMMARY

Free water was observed in all 9 of the soil borings completed during this exploration. Groundwater measurements obtained during this exploration are presented in the following table. Groundwater and drainage considerations for future development are presented in the *Drainage and Groundwater Considerations* section of this memo.

GROUNDWATER MEASUREMENTS

Boring No.	Groundwater Depth While Drilling (ft)	Groundwater Elevation While Drilling (ft)	Groundwater Depth Immediately After Drilling (ft)	Groundwater Elevation Immediately After Drilling (ft)
B-1	5.5	628.5	5.0	629.0
B-2	8.0	652.0	7.5	652.5
B-3	5.0	630.0	4.5*	630.5
B-4	5.0	645.0	3.5	646.5
B-5	6.0	666.0	4.0*	668.0
B-6	6.0	667.0	10.5	662.5
B-7	5.0	641.0	20.7	625.3
B-8	18.0	646.0	14.9	649.1
B-9	8.0	638.0	6.5	639.5

*-Groundwater measurement taken at least 10 hours but less than 24 hours after completion of soil boring

It should be noted that groundwater levels (perched or otherwise) typically fluctuate with seasonal variations in precipitation, drainage, runoff, snowmelt, irrigation demands, and other factors that may differ from those at the time of drilling operations.

SITE PREPARATION

At the time of drilling, the project site was covered with recently harvested crop stubble and shallow weeds and grasses. Prior to site grading, vegetation, trees (including the root balls), frozen soil, and other deleterious or unsuitable materials should be stripped and removed from areas of new construction. We anticipate stripping depths on the order of 6 to 10 inches will be required to remove old crop stubble and root crowns, but isolated areas may require stripping to slightly greater depths. If requested, an Olsson field representative can be contracted to help determine final stripping or removal depths in areas of concern. If encountered, known or unknown structures, including foundations, floor slabs, and basement walls or floors should be completely removed and the resulting excavations replaced with structural fill. Topsoil removed during the stripping operations should not be reused as structural fill below or around new

structures, pavements, or for utility backfill but may be reused in landscaped or other non-loaded areas around the project site.

Site clearing, grubbing, and stripping should be completed during periods of dry weather. Operating heavy equipment on the site during periods of wet weather could result in excessive pumping and rutting of the subgrade soils. The base of new construction excavations should be evaluated by an Olsson geotechnical engineer or their authorized representative prior to the placement of new fill soils. New structural fill should be placed and compacted in accordance with the recommendations presented in the *Structural Fill* section of this memo.

In areas requiring new structural fill, the contractor should lightly scarify the exposed subgrade, moisture condition as necessary, and compact the subgrade soils in accordance with the recommendations in the *Structural Fill* section of this memo. After preparation and compaction, areas to receive new structural fill should be proofrolled with a loaded tandem-axle dump truck, scraper, or similar rubber-tired equipment weighing at least 25 tons. Proofrolling operations should be observed and documented by an Olsson field representative. Unstable or unsuitable soils which are revealed by proofrolling and which cannot be reworked, moisture conditioned, and adequately compacted in-place should be documented, removed, and replaced with new compacted structural fill or be stabilized in accordance with the *Structural Fill* section of this memo. The geotechnical engineer should be contacted if additional subgrade stabilization is required to prepare the site for construction.

During this exploration, our soil borings identified 2.5 to 6.0 feet (includes the agriculture zone thickness) of expansive (fat) clay loess. These surface materials varied from moist to very moist and soft to very stiff at the locations sampled. During future development, areas requiring cut may remove these surface clays and expose the underlying sands and sands with clay. If or where this occurs, the native sands may be susceptible to increased erosion and rutting under earthwork equipment traffic. In some areas, it may be possible to improve erosion resistance and increase subgrade stability by incorporating the on-site clays into the exposed sands. A 30 to 50 percent blend ratio would be considered typical but should be determined in the field at the time of earthwork. The geotechnical engineer can be contracted to assist with this process if desired.

SUBGRADE STABILIZATION (IF REQUIRED)

If areas of the project site expose very moist or unstable soils, it may be feasible to scarify the subgrade soils, allow them to dry to near optimum moisture, and compact them following the recommendations of this memo. If unstable conditions persist and additional subgrade

stabilization is necessary, 3- to 4-inch thick lifts of crushed aggregates (2- to 3-inch diameter top-sized particles) could be driven into the exposed subgrade, using an appropriately sized sheepfoot roller (no vibration), until stable. Initially, this stabilization method should be attempted in an isolated “test pad” area to determine its effectiveness using the available materials and the contractor’s means and methods. The “test pad” approach will limit costs until the effectiveness of the applicable stabilization method can be documented in the field. In the case of extremely soft or unstable subgrades, the use of geosynthetic fabric and/or geogrid below the crushed aggregates may be more efficient and cost effective by reducing the overall aggregate thickness. Well graded, crushed limestone or crushed recycled concrete with maximum top sized particles of 1½ inches are recommended when stabilization methods include the use of geogrid. If desired, an Olsson geotechnical engineer can be contracted to evaluate subgrade conditions at the time of earthwork and provide more specific recommendations for stabilization using geosynthetics and crushed aggregate.

Subgrade stabilization may also be necessary at the base of utility trenches across low-lying areas of the project site. The methods of subgrade stabilization described previously also apply to the base of utility trenches; however, a backhoe-mounted, sheepfoot type, trench roller would be the preferred method of compaction for stabilization aggregates and cohesive backfill soils in this application.

It is the responsibility of the earthwork contractor to utilize equipment and procedures that prevent unnecessary deterioration or damage to exposed subgrade soils. It may be necessary to utilize low ground pressure (LGP) equipment in low lying areas or in natural exposed sands that will minimize disturbance of very moist subgrade soils during excavation. Heavy, rubber-tired construction equipment may not be suitable for use in low lying areas of this site, as this equipment is more likely to disturb potentially sensitive subgrade soils. The contractor should provide a uniform and stable soil subgrade as part of the final grading operations. Unstable soil subgrade or instability related to repetitive construction traffic is the responsibility of the contractor to repair or replace at no additional cost to the owner. If unstable soil conditions are encountered across the project site, the geotechnical engineer should evaluate and document these unsuitable conditions and will recommend appropriate corrective action for removal and replacement or in-place stabilization.

STRUCTURAL FILL

During earthwork and construction, we recommend that on-site and imported fill materials have a liquid limit less than 50 and a plasticity index less than 25. Soils which have a liquid limit greater than 50 and a plasticity index greater than 25 typically require blending with less plastic materials to reduce the expansive characteristics. In addition to maintaining the recommended plasticity criteria, the fill soils should be relatively free of organic materials (less than about 2 percent by weight) or other deleterious materials and should not contain particles larger than 2 inches. Based on laboratory test results, the surface soils sampled during this exploration are not within the previously mentioned soil parameters. In this instance, reuse of on-site soils as structural fill may be acceptable in areas of deeper fill. During the final geotechnical explorations prior to future development, the use of blended on-site soils (to reduce plasticity), imported low plastic cohesive fill, or soil amendments such as lime or fly ash may be recommended to provide a low plastic separation layer between future building slabs and pavement and the underlying moisture sensitive expansive soils. All new structural fill should be free of debris and excessive organic material and should be properly moisture conditioned prior to compaction.

Suitable fill materials should be placed in thin lifts. Lift thickness depends on the type of compaction equipment, but in general, lifts of 4 to 8-inch loose measurements are recommended. The soil should be compacted using appropriately sized equipment capable of achieving the compaction recommendations of this memo. A self-propelled sheepfoot roller, such as CAT 815, is generally recommended for compacting cohesive soils over large areas. The contractor should take care if working near existing structures or site features, and it may be necessary to restrict or eliminate the use of vibration to prevent damage. Within small excavations, such as in footing trenches, utility trenches, or around manholes, we recommend the use of "Wacker-Packers" or "Rammax" compactors for cohesive soils or vibrating plate compactors for granular soils to achieve the specified compaction. Lift thicknesses should be reduced to 4 inches in small fill areas requiring hand-operated equipment.

During grading operations, representative samples of general and structural fill materials should be initially and periodically checked by laboratory testing to document that the previously mentioned soil parameters are maintained. An Olsson representative should regularly observe and monitor excavation and grading operations and perform field density tests to document that the specified moisture and compaction requirements are being achieved. We recommend that general fill, structural fill, and utility backfill be compacted and moisture conditioned in accordance with the following table:

FILL PLACEMENT/COMPACTION GUIDELINES

Areas of Fill Placement	Compaction Recommendation (ASTM D-698 Standard Proctor)	Moisture Content (Percent of Optimum)
Structural Fill – Cohesive fill soils placed during mass grading operations.	95%	-2 to +3 percent
Structural Fill – Granular fill soils placed during mass grading operations.	95%	As necessary to achieve compaction
Non-Structural Fill – Beneath non-loaded landscape/grass areas	92%	As necessary to achieve compaction

The moisture content of imported or on-site soils at the time of compaction should generally be maintained between the ranges specified above. More stringent moisture limits may be necessary with certain soils, and some adjustments to moisture contents may be necessary to achieve compaction in accordance with project specifications.

DRAINAGE AND GROUNDWATER CONSIDERATIONS

During future site development, free or perched groundwater and saturated soil conditions could adversely impact site grading, earthwork, or building construction in low lying areas of the project site. If extensive cut is proposed in areas with shallow groundwater, temporary or permanent dewatering procedures may be necessary. Information pertaining to the need for dewatering should be provided during the final geotechnical exploration(s) after site grading requirements and structure designs have been determined.

Surface water or precipitation should not be allowed to collect at the ground surfaces either during or after construction. Provisions should be made to quickly remove accumulating seepage or storm water runoff from excavations. Undercut or excavated areas should be sloped toward one corner to allow rainwater or surface runoff to be quickly collected and gravity drained or pumped from construction areas. Subgrade soils that are exposed to precipitation or runoff should be evaluated by the geotechnical engineer prior to the placement of new fill to determine if corrective action is required.

With shallow groundwater indicated across most of this site, provisions for rapid and efficient drainage should be anticipated during future site development. This could include trench drains below or around parking lots or roadways, perimeter drains around shallow building foundations, and properly designed and constructed surface grading which promotes positive drainage away from new structures or site features.

CONSTRUCTION EQUIPMENT MOBILITY

On-site soils or imported structural fill may be susceptible to softening under construction equipment traffic during periods of wet weather. Reducing equipment mobility problems and managing soft surface soils will be dependent on the severity of the circumstances, the soil types, the season in which construction is performed, and prevailing weather conditions.

Some general guidelines for reducing equipment mobility problems and addressing potential soft and wet surface soils are as follows:

- Optimize surface water drainage at the site during construction.
- Whenever possible, wait for dry weather conditions to prevail, and do not operate construction equipment on the site during wet conditions. Rutting the surface soils will aggravate the condition and accelerate subgrade disturbance.
- Disk or scarify wet surface soils during favorable weather to accelerate drying. Temporarily compact loose subgrade soils if rain is forecast to promote site drainage and reduce moisture infiltration.
- Use construction equipment that is well-suited for the intended job under the existing site conditions. Heavy rubber-tired equipment typically requires better site conditions than light, track-mounted equipment.
- Implement a construction schedule that realistically allows for rain days. Pressure to perform earthwork under a tight schedule is frequently counterproductive.

If requested, Olsson engineers can help determine the best approach for stabilizing unsuitable soils at the time of construction.

TEMPORARY SLOPES AND EXCAVATIONS

Construction site safety is the responsibility of the general contractor. The contractor shall also be solely responsible for the means, methods, techniques, sequencing, and operations during construction. Olsson is providing the following information solely as a service to our client. Under no circumstances should Olsson's provision of the following information be construed to mean that we are assuming responsibility for construction site safety or the contractor's activities. Such responsibility is not implied and should not be inferred.

The contractor should be aware that slope height, slope inclination, and excavation depths (including utility trench excavations) should in no case exceed those specified in local, state, or federal safety regulation; e.g., *OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926*, or successor regulations. Such regulations are strictly enforced, and if not followed, the

owner, the contractor, or earthwork or utility subcontractors could be liable for substantial penalties.

SEISMIC CLASSIFICATION

According to the International Building Code (IBC), soils within the upper 100 feet determine the seismic classification criteria for the project site. Based on the soils encountered in our test borings and our experience with the local geology, Olsson estimated the soil properties below the deepest boring to a depth of 100 feet. The soil shear strengths and N values were estimated based on the results of the laboratory testing program and the assumed properties of the undocumented soils and rock below the lowest boring. For this project site, we recommend using Site Class C (Very Dense Soil and Soft Rock) according to Section 1613 of the 2012 IBC.

LIMITATIONS

The conclusions presented in this memo report are based on the information available regarding future development, the results obtained from our soil test borings and sampling procedures, the results of the laboratory testing program, and our experience with similar projects. The soil test borings represent a very small statistical sampling of subsurface soils, and it is possible that conditions may be encountered during construction that are substantially different from those indicated by the soil test borings. In these instances, adjustments to design and construction may be necessary. This geotechnical memo is based on the initial information provided to Olsson and our understanding of the project as noted in this memo.

This memo was prepared under the direction and supervision of a Professional Engineer registered in the State of Iowa with the firm of Olsson Associates. The information contained herein is based on generally accepted, professional geotechnical engineering practices at the time of this memo, within this geographic area. No warranty, express or implied, is intended or made. This memo has been prepared for the exclusive use of Clinton Regional Development Corporation for specific application to the proposed project. Olsson appreciates the opportunity to provide our services on this project and looks forward to working with you during the final geotechnical exploration. Should you have any questions, please do not hesitate to contact us.

Respectfully submitted,
Olsson Associates



Nathan Jensen, E.I.
Assistant Engineer

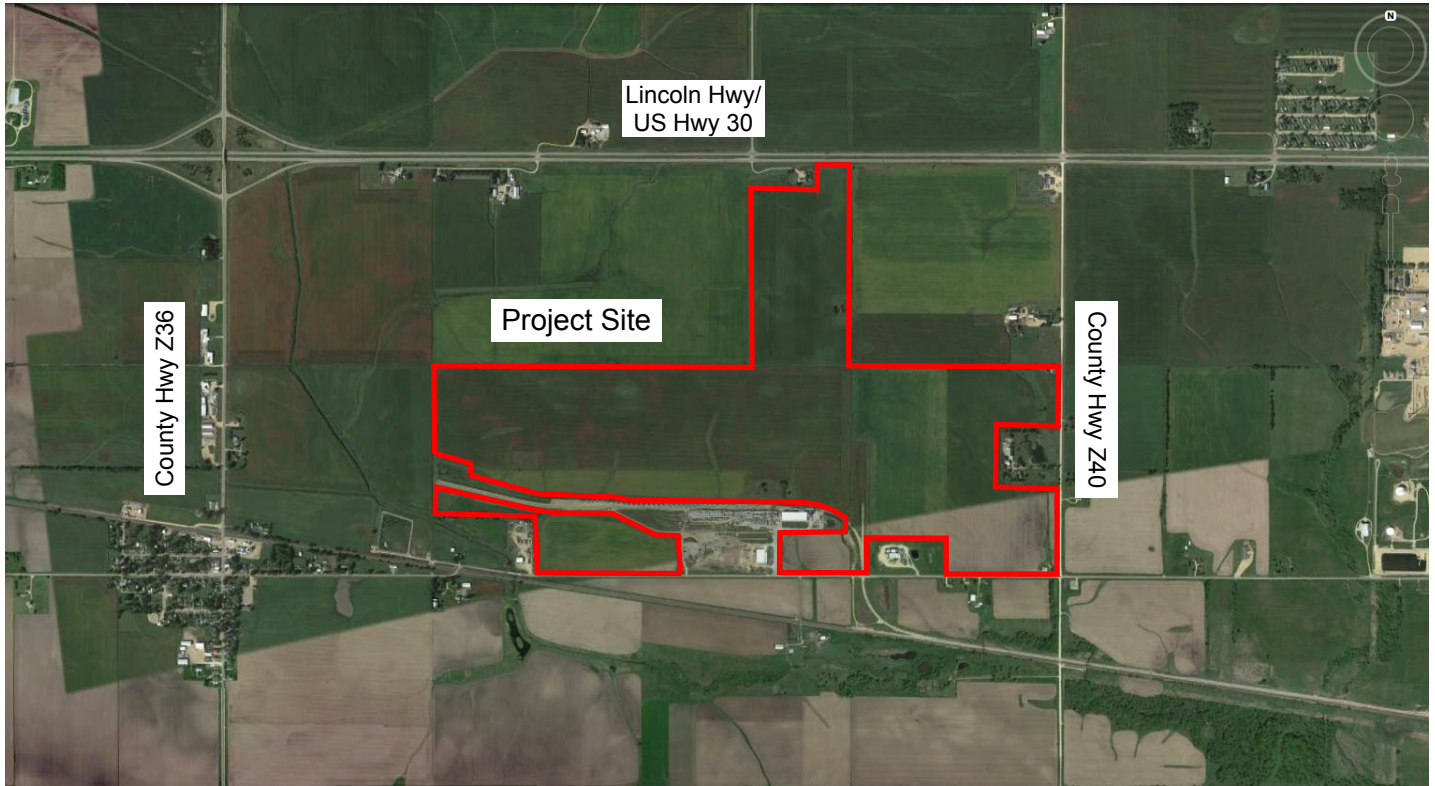


Edward Schnackenberg, P.E.
Geotechnical Engineer

Attachments:

Site Location Plan
Boring Location Map
Summary of Laboratory Results
USGS Soil Survey Map
USGS Soil Survey Test
IDNR Coal Mine Map



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SITE LOCATION PLAN
LINCOLNWAY INDUSTRIAL RAIL AND AIR PARK
NEAR LINCOLN HWY (US HWY 30) AND COUNTY HWY Z40
CLINTON COUNTY, IOWA
OLSSON PROJECT NO. 015-2757



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<div>LEGEND</div> <div> SOIL BORING LOCATION</div> <div>PROJECT: 015-2757</div>		<div><div>04008001600</div><div>SCALE IN FEET</div></div> <div>BORING LOCATION MAP LINCOLNWAY INDUSTRIAL RAIL CLINTON COUNTY, IOWA</div>
DRAWN BY: AFC		
DATE: 02/04/2016		





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PROJECT NAME Lincolnway Industrial Rail and Air Park				CLIENT Clinton Regional Development Corporation								
PROJECT NUMBER 015-2757				LOCATION Clinton County, Iowa								
ELEVATION (ft)	MATERIAL DESCRIPTION		GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	APPROX. SURFACE ELEV. (ft): 634			0								
	AGRICULTURAL ZONE											
	1.0'											
	LOESS											
	Fat clay (CH), stiff, moist, grayish brown with organics				U 1			1.1	22.9	99.8		
630	4.0'											
	GLACIAL DRIFT											
	▼			5	U 2				17.3			
	▽											
	Clayey sand (SC), medium dense, wet, yellowish brown with iron staining				SS 3		3-7-7 N=14		17.2			
625												
	Clayey sand (SC), medium dense, wet, yellowish brown with iron staining				SS 4		5-6-7 N=13		18.9			P-200 = 25.9%
				10								
620												
	Clayey sand (SC), medium dense, wet, yellowish brown				SS 5		4-6-7 N=13					
				15								
	17.0'											
615												
	Poorly graded sand with gravel (SP), medium dense, wet, light grayish brown mottled with yellow				SS 6		5-13-14 N=27		18.8			P-200 = 3.5%
	20.0'			20								
CONTINUED NEXT PAGE												

WATER LEVEL OBSERVATIONS			STARTED 1/24/16 FINISHED 1/24/16		
WD	▽	5.5 ft	DRILL CO.	OA	DRILL RIG CME 75
IAD	▼	5.0 ft	DRILLER	JY	LOGGED BY SS
AD	▽	Not Performed	METHOD CONTINUOUS FLIGHT AUGER		
OLSSON ASSOCIATES 8720 SOUTH 114TH STREET, SUITE 107 LA VISTA, NE 68128					


PROJECT NAME Lincolnway Industrial Rail and Air Park				CLIENT Clinton Regional Development Corporation							
PROJECT NUMBER 015-2757				LOCATION Clinton County, Iowa							
ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	 Shelby Tube  Split Spoon		20								
	GLACIAL DRIFT										
610	Clayey sand with gravel (SC), loose, wet, yellowish brown mottled with gray		25	SS 7		2-3-3 N=6					
			25.0'								

BASE OF BORING AT 25.0 FEET

WATER LEVEL OBSERVATIONS		OLSSON ASSOCIATES 8720 SOUTH 114TH STREET, SUITE 107 LA VISTA, NE 68128		STARTED	1/24/16	FINISHED	1/24/16
WD	▽ 5.5 ft			DRILL CO.	OA	DRILL RIG	CME 75
IAD	▼ 5.0 ft			DRILLER	JY	LOGGED BY	SS
AD	▽ Not Performed			METHOD CONTINUOUS FLIGHT AUGER			

PROJECT NAME Lincolnway Industrial Rail and Air Park				CLIENT Clinton Regional Development Corporation								
PROJECT NUMBER 015-2757				LOCATION Clinton County, Iowa								
ELEVATION (ft)	MATERIAL DESCRIPTION		GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
660	APPROX. SURFACE ELEV. (ft): 660			0								
	AGRICULTURAL ZONE		0.5'									
	LOESS											
	Fat clay (CH), stiff, very moist, grayish brown with organics		2.5'		U 1	CH			26.3	95.4	67/19	
	GLACIAL DRIFT											
	Clayey sand with gravel (SC), medium dense, slightly moist, reddish brown with iron staining				SS 2		8-10-11 N=21		14.8			
655				5								
	Clayey sand with gravel (SC), very loose, slightly moist, orangish brown with iron staining				SS 3		1-1-2 N=3		14.6			
	Clayey sand with gravel (SC), loose, wet, grayish brown with iron staining				SS 4		2-2-5 N=7		15.1			P-200 = 34.3%
650				10								
					NR 5							
645			15.0'	15								
	Sandy lean clay (CL), stiff, wet, brown with iron staining				SS 5		4-5-8 N=13		13.6			
	Sandy lean clay (CL), stiff, wet, dark gray with iron staining				SS 6		3-5-7 N=12		17.8			
640			20.0'	20								
CONTINUED NEXT PAGE												

WATER LEVEL OBSERVATIONS			STARTED 1/24/16		FINISHED 1/24/16	
WD	▽ 8.0 ft	OLSSON ASSOCIATES 8720 SOUTH 114TH STREET, SUITE 107 LA VISTA, NE 68128	DRILL CO.	OA	DRILL RIG	CME 75
IAD	▽ 7.5 ft		DRILLER	JY	LOGGED BY	SS
AD	▽ Not Performed		METHOD	CONTINUOUS FLIGHT AUGER		







PROJECT NAME Lincolnway Industrial Rail and Air Park				CLIENT Clinton Regional Development Corporation									
PROJECT NUMBER 015-2757				LOCATION Clinton County, Iowa									
ELEVATION (ft)	MATERIAL DESCRIPTION			GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
640	<div style="display: flex; justify-content: space-between; align-items: center;"> <div> <div style="width: 15px; height: 15px; background-color: black; border: 1px solid black; margin-bottom: 5px;"></div> Shelby Tube <div style="width: 15px; height: 15px; border: 1px solid black; border-radius: 50%; margin-top: 5px;"></div> No Recovery </div> <div> <div style="width: 20px; height: 20px; border: 1px solid black; position: relative; margin-bottom: 5px;"> <div style="position: absolute; top: 50%; left: 50%; transform: translate(-50%, -50%); border-left: 1px solid black; border-right: 1px solid black;"></div> </div> Split Spoon </div> </div>				20								
	GLACIAL DRIFT												
635	<i>Sandy lean clay (CL), stiff, wet, light brown mottled with gray and iron staining</i>				25	7 U				13.5	105.2		

BASE OF BORING AT 25.0 FEET

WATER LEVEL OBSERVATIONS		OLSSON ASSOCIATES 8720 SOUTH 114TH STREET, SUITE 107 LA VISTA, NE 68128	STARTED	1/24/16	FINISHED	1/24/16
WD	▽ 8.0 ft		DRILL CO.	OA	DRILL RIG	CME 75
IAD	▼ 7.5 ft		DRILLER	JY	LOGGED BY	SS
AD	▽ Not Performed		METHOD CONTINUOUS FLIGHT AUGER			




PROJECT NAME Lincolnway Industrial Rail and Air Park				CLIENT Clinton Regional Development Corporation								
PROJECT NUMBER 015-2757				LOCATION Clinton County, Iowa								
ELEVATION (ft)	MATERIAL DESCRIPTION		GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
635	APPROX. SURFACE ELEV. (ft): 635			0								
	AGRICULTURAL ZONE											
	LOESS		1.0'									
	Fat clay (CH), very stiff, moist, light grayish brown with organics				U 1				22.9	105.1		
			4.0'									
	GLACIAL DRIFT											
630				5	U 2				12.8			
	Poorly graded sand with clay (SP-SC), medium dense, wet, reddish brown with iron staining				SS 3		4-5-5 N=10		20.6			
	Poorly graded sand with clay (SP-SC), loose, wet, grayish brown			10	SS 4		1-2-2 N=4		19.3			P-200 = 9.6%
625												
			13.0'									
	Clayey sand (SC), loose, wet, light brown			15	SS 5		4-3-5 N=8					
620												
	Clayey sand (SC), medium dense, wet, light brown			20	SS 6		3-5-11 N=16					
615			20.0'									
CONTINUED NEXT PAGE												

WATER LEVEL OBSERVATIONS			<div>OLSSON ASSOCIATES</div> <div>8720 SOUTH 114TH STREET, SUITE 107</div> <div>LA VISTA, NE 68128</div>	STARTED	1/22/16	FINISHED	1/22/16
WD	▽	5.0 ft		DRILL CO.	OA	DRILL RIG	CME 75
IAD	▼	Not Performed		DRILLER	JY	LOGGED BY	SS
AD	▼	4.5 ft after 24 Hrs		METHOD HOLLOW STEM AUGER			

PROJECT NAME Lincolnway Industrial Rail and Air Park				CLIENT Clinton Regional Development Corporation								
PROJECT NUMBER 015-2757				LOCATION Clinton County, Iowa								
ELEVATION (ft)	MATERIAL DESCRIPTION		GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
615	GLACIAL DRIFT			20								
	Lean clay (CL), firm, wet, dark gray				 SS 7	CL	2-3-4 N=7		36.5		41/16	
610												
	Lean clay (CL), firm, wet, dark gray				 SS 8		2-3-4 N=7		39.7			
605					 U 9				38.2	88.6		
	Lean clay (CL), firm, wet, dark gray				 U 10				38.7			
600												
	Sandy lean clay (CL), stiff, wet, light brown mottled with gray			 U 11					21.6	98.0		
595	40.0'			40								
CONTINUED NEXT PAGE												

WATER LEVEL OBSERVATIONS		<div>OLSSON ASSOCIATES</div> <div>8720 SOUTH 114TH STREET, SUITE 107</div> <div>LA VISTA, NE 68128</div>	STARTED1/22/16		FINISHED1/22/16	
WD	<div><div></div>5.0 ft</div>		DRILL CO.OA		DRILL RIGCME 75	
IAD	<div><div></div>Not Performed</div>		DRILLERJY		LOGGED BYSS	
AD	<div><div></div>4.5 ft after 24 Hrs</div>		METHODHOLLOW STEM AUGER			

PROJECT NAME Lincolnway Industrial Rail and Air Park	CLIENT Clinton Regional Development Corporation
PROJECT NUMBER 015-2757	LOCATION Clinton County, Iowa

ELEVATION (ft)	<div><div></div> Shelby Tube</div> <div><div></div> Split Spoon</div> <div>MATERIAL DESCRIPTION</div>	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
595	GLACIAL DRIFT		40								
	Sandy lean clay with gravel (CL), very stiff, wet, bluish gray			<div><div></div> U 12</div>				17.8			
590											
	Sandy lean clay with gravel (CL), very stiff, wet, bluish gray			<div><div></div> U 13</div>				13.7	127.4		
585											
			<div><div></div> SS 13</div>		6-7-13 N=20		14.0				
		51.5'		<div><div></div></div>							




BASE OF BORING AT 51.5 FEET

51.5'

WATER LEVEL OBSERVATIONS	OLSSON ASSOCIATES 8720 SOUTH 114TH STREET, SUITE 107 LA VISTA, NE 68128	STARTED 1/22/16	FINISHED 1/22/16
WD  5.0 ft		DRILL CO. OA	DRILL RIG CME 75
IAD  Not Performed		DRILLER JY	LOGGED BY SS
AD  4.5 ft after 24 Hrs		METHOD HOLLOW STEM AUGER	

WATER LEVEL OBSERVATIONS		OLSSON ASSOCIATES 8720 SOUTH 114TH STREET, SUITE 107 LA VISTA, NE 68128	STARTED	1/24/16	FINISHED	1/24/16
WD	▽ 5.0 ft		DRILL CO.	OA	DRILL RIG	CME 75
IAD	▼ 3.5 ft		DRILLER	JY	LOGGED BY	SS
AD	▼ Not Performed		METHOD CONTINUOUS FLIGHT AUGER			

PROJECT NAME Lincolnway Industrial Rail and Air Park	CLIENT Clinton Regional Development Corporation
PROJECT NUMBER 015-2757	LOCATION Clinton County, Iowa

ELEVATION (ft)	 Shelby Tube  Split Spoon	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
630	MATERIAL DESCRIPTION		20								
	GLACIAL DRIFT										
	<i>Sandy lean clay (CL), stiff, wet, dark gray</i>										
625		25.0'	25	 SS 7		5-6-8 N=14		15.5			






BASE OF BORING AT 25.0 FEET




WATER LEVEL OBSERVATIONS	OLSSON ASSOCIATES 8720 SOUTH 114TH STREET, SUITE 107 LA VISTA, NE 68128	STARTED	1/24/16	FINISHED	1/24/16
WD  5.0 ft		DRILL CO.	OA	DRILL RIG	CME 75
IAD  3.5 ft		DRILLER	JY	LOGGED BY	SS
AD  Not Performed		METHOD	CONTINUOUS FLIGHT AUGER		

PROJECT NAME Lincolnway Industrial Rail and Air Park				CLIENT Clinton Regional Development Corporation								
PROJECT NUMBER 015-2757				LOCATION Clinton County, Iowa								
ELEVATION (ft)	MATERIAL DESCRIPTION		GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	APPROX. SURFACE ELEV. (ft): 672			0								
	AGRICULTURAL ZONE											
	1.0'											
670	LOESS											
	Fat clay (CH), stiff, very moist, dark grayish brown with organics				U 1				33.1	93.0		
	3.0'											
	GLACIAL DRIFT											
	▼ Clayey sand (SC), medium dense, wet, reddish brown with iron staining				U 2				15.5			
				5								
665	▼ Clayey sand with gravel (SC), medium dense, wet, light grayish brown				SS 3		11-10-12 N=22		11.3			P-200 = 22.9%
	Driller's Note: Auger chatter indicated Stone Line at 7.5 feet											
	9.0'											
					SS 4		7-2-1 N=3		11.6			
				10								
660												
	Sandy lean clay with gravel (CL), stiff, wet, light brown with iron staining				SS 5		4-6-8 N=14		14.4			
				15								
655												
	Sandy lean clay (CL), very stiff, wet, grayish brown with iron staining				U 6				16.4	119.5		
	20.0'			20								
CONTINUED NEXT PAGE												



WATER LEVEL OBSERVATIONS		<div>OLSSON ASSOCIATES</div> <div>8720 SOUTH 114TH STREET, SUITE 107</div> <div>LA VISTA, NE 68128</div>	STARTED	1/23/16	FINISHED	1/23/16
WD	<div><div></div>6.0 ft</div>		DRILL CO.	OA	DRILL RIG	CME 75
IAD	<div><div></div>Not Performed</div>		DRILLER	JY	LOGGED BY	SS
AD	<div><div></div>4.0 ft after 14 Hrs</div>		METHOD HOLLOW STEM AUGER			

OLSSON ASSOCIATES
8720 SOUTH 114TH STREET, SUITE 107
LA VISTA, NE 68128

PROJECT NAME Lincolnway Industrial Rail and Air Park					CLIENT Clinton Regional Development Corporation									
PROJECT NUMBER 015-2757					LOCATION Clinton County, Iowa									
ELEVATION (ft)	MATERIAL DESCRIPTION				GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	GLACIAL DRIFT					20								
650														
	Sandy lean clay (CL), stiff, wet, light grayish brown with iron staining						 U 7				10.7	125.9		
645														
	Sandy lean clay (CL), stiff, wet, light brown with iron staining						 SS 8		4-7-7 N=14		17.5			
640														
	Sandy lean clay (CL), stiff, wet, light brown mottled with gray and iron staining						 U 9				22.3	112.9		
635														
	Sandy lean clay with gravel (CL), stiff, wet, dark gray						 U 10				22.9	104.4		
	40.0'						40							
CONTINUED NEXT PAGE														

WATER LEVEL OBSERVATIONS			OLSSON ASSOCIATES 8720 SOUTH 114TH STREET, SUITE 107 LA VISTA, NE 68128			STARTED	1/23/16	FINISHED	1/23/16
WD		6.0 ft				DRILL CO.	OA	DRILL RIG	CME 75
IAD		Not Performed				DRILLER	JY	LOGGED BY	SS
AD		4.0 ft after 14 Hrs				METHOD	HOLLOW STEM AUGER		

PROJECT NAME Lincolnway Industrial Rail and Air Park	CLIENT Clinton Regional Development Corporation
PROJECT NUMBER 015-2757	LOCATION Clinton County, Iowa

ELEVATION (ft)	 Shelby Tube  Split Spoon MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
630	GLACIAL DRIFT		40								
	Sandy lean clay with gravel (CL), very stiff, wet, dark gray		45	U 11				27.2	99.3		
625											
	Driller's Note: Split Spoon tipped into limestone bedrock		50	SS 12		50 /2"		8.3			
		50.0'									

BASE OF BORING AT 50.0 FEET

WATER LEVEL OBSERVATIONS	OLSSON ASSOCIATES 8720 SOUTH 114TH STREET, SUITE 107 LA VISTA, NE 68128	STARTED	1/23/16	FINISHED	1/23/16
WD  6.0 ft		DRILL CO.	OA	DRILL RIG	CME 75
IAD  Not Performed		DRILLER	JY	LOGGED BY	SS
AD  4.0 ft after 14 Hrs		METHOD	HOLLOW STEM AUGER		




PROJECT NAME Lincolnway Industrial Rail and Air Park				CLIENT Clinton Regional Development Corporation								
PROJECT NUMBER 015-2757				LOCATION Clinton County, Iowa								
ELEVATION (ft)	MATERIAL DESCRIPTION		GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	APPROX. SURFACE ELEV. (ft): 673			0								
	AGRICULTURAL ZONE		0.5'									
	LOESS											
	Fat clay (CH), stiff, very moist, dark grayish brown				U 1				26.8	92.6		
670	3.0'											
	GLACIAL DRIFT											
	Clayey sand with gravel (SC), loose, slightly moist, reddish brown with iron staining			5	SS 2		4-4-2 N=6		13.3			
	Clayey sand with gravel (SC), medium dense, wet, light yellowish brown				U 3			0.6	13.0	123.1		
665												
	Clayey sand with gravel (SC), medium dense, wet, light brown			10	U 4				13.8	127.5		
660	Driller's Note Stone Line encountered at 13 feet											
	Clayey sand with gravel (SC), medium dense, light brown with iron staining			15	SS 5		4-5-8 N=13		13.2			
	15.0'											
655												
	Sandy lean clay with gravel (CL), very stiff, wet, light brown with iron staining			20	SS 6		7-11-14 N=25		11.2			
	20.0'											
CONTINUED NEXT PAGE												

WATER LEVEL OBSERVATIONS			<div>OLSSON ASSOCIATES</div> <div>8720 SOUTH 114TH STREET, SUITE 107</div> <div>LA VISTA, NE 68128</div>	STARTED1/24/16		FINISHED1/24/16	
WD	▽	6.0 ft		DRILL CO.OA		DRILL RIGCME 75	
IAD	▼	10.5 ft		DRILLERJY		LOGGED BYSS	
AD	▼	Not Performed		METHODCONTINUOUS FLIGHT AUGER			

PROJECT NAME Lincolnway Industrial Rail and Air Park					CLIENT Clinton Regional Development Corporation									
PROJECT NUMBER 015-2757					LOCATION Clinton County, Iowa									
ELEVATION (ft)	<div><div></div> Shelby Tube</div> <div><div></div> Split Spoon</div> MATERIAL DESCRIPTION				GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	GLACIAL DRIFT				<div></div>	20								
650														
	<i>Sandy lean clay with gravel (CL), hard, wet, light brown with iron staining</i>					25	<div></div> SS 7		16-25-50 N=75		11.2			
	25.0'													

BASE OF BORING AT 25.0 FEET

WATER LEVEL OBSERVATIONS





WD	 6.0 ft
IAD	 10.5 ft
AD	 Not Performed

OLSSON ASSOCIATES
8720 SOUTH 114TH STREET, SUITE 107
LA VISTA, NE 68128

STARTED	1/24/16	FINISHED	1/24/16
DRILL CO.	OA	DRILL RIG	CME 75
DRILLER	JY	LOGGED BY	SS
METHOD	CONTINUOUS FLIGHT AUGER		

PROJECT NAME				CLIENT								
Lincolnway Industrial Rail and Air Park				Clinton Regional Development Corporation								
PROJECT NUMBER				LOCATION								
015-2757				Clinton County, Iowa								
ELEVATION (ft)	<div><div></div> Shelby Tube<div></div> Split Spoon</div> MATERIAL DESCRIPTION APPROX. SURFACE ELEV. (ft): 646		GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
				0								
645	AGRICULTURAL ZONE 0.5'		<div></div>									
	LOESS											
	Fat clay (CH), stiff, very moist, dark grayish brown			<div></div> U 1				29.4	89.2			
	Lean clay (CL), soft, moist, light yellowish brown with iron staining			5	<div></div> SS 2		1-2-2 N=4		22.9			
640	GLACIAL DRIFT		<div></div>									
	Clayey sand (SC), medim dense, wet, light yellowish brown with iron staining			<div></div> U 3				1.1	16.7	118.5		
	Clayey sand (SC), medium dense, wet, light brown			<div></div> U 4				15.2	121.3			
635				10								
									</			

WATER LEVEL OBSERVATIONS			<div>OLSSON ASSOCIATES</div> <div>8720 SOUTH 114TH STREET, SUITE 107</div> <div>LA VISTA, NE 68128</div>	STARTED1/24/16		FINISHED1/24/16	
WD	▽	5.0 ft		DRILL CO.OA		DRILL RIGCME 75	
IAD	▼	20.7 ft		DRILLERJY		LOGGED BYSS	
AD	▼	Not Performed		METHODCONTINUOUS FLIGHT AUGER			

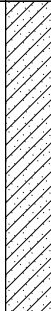
PROJECT NAME Lincolnway Industrial Rail and Air Park				CLIENT Clinton Regional Development Corporation							
PROJECT NUMBER 015-2757				LOCATION Clinton County, Iowa							
ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/REMARKS
625	 Shelby Tube  Split Spoon GLACIAL DRIFT		20								
	Sandy lean clay with gravel (CL), hard, wet, dark brown 25.0'		25	 SS 7		11-16-21 N=37		13.8			

BASE OF BORING AT 25.0 FEET

WATER LEVEL OBSERVATIONS		OLSSON ASSOCIATES 8720 SOUTH 114TH STREET, SUITE 107 LA VISTA, NE 68128	STARTED	1/24/16	FINISHED	1/24/16
WD	 5.0 ft		DRILL CO.	OA	DRILL RIG	CME 75
IAD	 20.7 ft		DRILLER	JY	LOGGED BY	SS
AD	 Not Performed		METHOD CONTINUOUS FLIGHT AUGER			

PROJECT NAME Lincolnway Industrial Rail and Air Park				CLIENT Clinton Regional Development Corporation								
PROJECT NUMBER 015-2757				LOCATION Clinton County, Iowa								
ELEVATION (ft)	MATERIAL DESCRIPTION		GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	APPROX. SURFACE ELEV. (ft): 664			0								
	AGRICULTURAL ZONE		0.5'									
	LOESS											
	Fat clay (CH), stiff, very moist, dark grayish brown				U 1				25.9	88.8		
			3.0'									
	GLACIAL DRIFT											
660	Clayey sand (SC), loose, slightly moist, light brown with iron staining				U 2				6.9			
				5								
	Clayey sand (SC), loose, slightly moist, light brown with iron staining				SS 3		4-4-3 N=7		11.9			
655	Clayey sand (SC), loose, slightly moist, light brown with iron staining				SS 4		3-3-4 N=7		21.5			P-200 = 49.9%
				10								
	Driller's Note: Auger chatter indicated Stone Line between 13 to 25 feet		13.5'									
650	Poorly graded sand (SP), dense, wet, orangish brown				SS 5		9-15-23 N=38		18.6			
				15								
645	Poorly graded sand (SP), dense, wet, orangish brown				SS 6		9-16-27 N=43		18.9			
			20.0'	20								
CONTINUED NEXT PAGE												

WATER LEVEL OBSERVATIONS			STARTED 1/24/16 FINISHED 1/24/16		
WD	▽ 18.0 ft	OLSSON ASSOCIATES 8720 SOUTH 114TH STREET, SUITE 107 LA VISTA, NE 68128	DRILL CO.	OA	DRILL RIG CME 75
IAD	▼ 14.9 ft		DRILLER	JY	LOGGED BY SS
AD	▽ Not Performed		METHOD CONTINUOUS FLIGHT AUGER		

PROJECT NAME Lincolnway Industrial Rail and Air Park				CLIENT Clinton Regional Development Corporation							
PROJECT NUMBER 015-2757				LOCATION Clinton County, Iowa							
ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
640	GLACIAL DRIFT <i>Driller's Note: Split Spoon tipped into limestone bedrock</i>		20								
			25	SS 7		50 /0.5"					

BASE OF BORING AT 25.0 FEET

WATER LEVEL OBSERVATIONS		OLSSON ASSOCIATES 8720 SOUTH 114TH STREET, SUITE 107 LA VISTA, NE 68128	STARTED	1/24/16	FINISHED	1/24/16
WD	▽ 18.0 ft		DRILL CO.	OA	DRILL RIG	CME 75
IAD	▼ 14.9 ft		DRILLER	JY	LOGGED BY	SS
AD	▽ Not Performed		METHOD CONTINUOUS FLIGHT AUGER			

PROJECT NAME Lincolnway Industrial Rail and Air Park					CLIENT Clinton Regional Development Corporation							
PROJECT NUMBER 015-2757					LOCATION Clinton County, Iowa							
ELEVATION (ft)	MATERIAL DESCRIPTION		GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	APPROX. SURFACE ELEV. (ft): 646			0								
645	AGRICULTURAL ZONE											
	LOESS											
	Fat clay (CH), stiff, slightly moist, dark grayish brown with organics				U 1				14.5	105.5		
	Lean clay (CL), soft, moist, light brown with iron staining			5	SS 2		0-1-2 N=3		18.8			
640	GLACIAL DRIFT											
	Clayey sand with gravel (SC), medium dense, wet, light brown with iron staining				U 3				16.6	113.8		
	Lean clay (CL), stiff, wet, light gray			10	U 4			1.0	21.8	106.7		
635	Lean clay (CL), stiff, wet, dark gray			15	U 5	CL			22.1	110.6	29/12	
630	Lean clay (CL), stiff, wet, dark gray				U 6				29.5	100.3		
	CONTINUED NEXT PAGE											

WATER LEVEL OBSERVATIONS			<div>OLSSON ASSOCIATES</div> <div>8720 SOUTH 114TH STREET, SUITE 107</div> <div>LA VISTA, NE 68128</div>	STARTED	1/23/16	FINISHED	1/23/16
WD	▽	8.0 ft		DRILL CO.	OA	DRILL RIG	CME 75
IAD	▼	6.5 ft		DRILLER	JY	LOGGED BY	SS
AD	▼	Not Performed		METHOD HOLLOW STEM AUGER			

PROJECT NAME Lincolnway Industrial Rail and Air Park				CLIENT Clinton Regional Development Corporation								
PROJECT NUMBER 015-2757				LOCATION Clinton County, Iowa								
ELEVATION (ft)	MATERIAL DESCRIPTION		GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	GLACIAL DRIFT			20								
625												
	Lean clay (CL), very stiff, wet, dark gray			25	U 7				22.8	109.3		
620												
	Lean clay (CL), stiff, wet, gray			30	U 8				20.2			
615												
			33.0'									
	Poorly graded sand with silt (SP-SM), medium dense, wet, light grayish brown			35	SS 9		2-4-6 N=10					
610												
	Poorly graded sand with silt (SP-SM), medium dense, wet, light grayish brown			40	SS 10		4-7-8 N=15		14.5			P-200 = 6.3%
			40.0'									
CONTINUED NEXT PAGE												

WATER LEVEL OBSERVATIONS			<div>OLSSON ASSOCIATES</div> <div>8720 SOUTH 114TH STREET, SUITE 107</div> <div>LA VISTA, NE 68128</div>	STARTED	1/23/16	FINISHED	1/23/16
WD	▽	8.0 ft		DRILL CO.	OA	DRILL RIG	CME 75
IAD	▼	6.5 ft		DRILLER	JY	LOGGED BY	SS
AD	▼	Not Performed		METHOD HOLLOW STEM AUGER			

PROJECT NAME Lincolnway Industrial Rail and Air Park				CLIENT Clinton Regional Development Corporation								
PROJECT NUMBER 015-2757				LOCATION Clinton County, Iowa								
ELEVATION (ft)	MATERIAL DESCRIPTION		GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE RQD	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
605	GLACIAL DRIFT Poorly graded sand with silt (SP-SM), medium dense, wet, light grayish brown			40								
	43.5'											
	Clayey sand with gravel (SC), medium dense, wet, yellowish brown with iron staining				SS 11		4-5-6 N=11					
600				45								
	Clayey sand with gravel (SC), medium dense, wet, yellowish brown with iron staining				SS 12		5-6-8 N=14		13.7			
	50.0'			50								

BASE OF BORING AT 50.0 FEET

WATER LEVEL OBSERVATIONS		<div>OLSSON ASSOCIATES</div> <div>8720 SOUTH 114TH STREET, SUITE 107</div> <div>LA VISTA, NE 68128</div>	STARTED	1/23/16	FINISHED	1/23/16
WD	<div><div></div>8.0 ft</div>		DRILL CO.	OA	DRILL RIG	CME 75
IAD	<div><div></div>6.5 ft</div>		DRILLER	JY	LOGGED BY	SS
AD	<div><div></div>Not Performed</div>		METHOD HOLLOW STEM AUGER			



SUMMARY OF LABORATORY RESULTS

PAGE 1 OF 3

PROJECT NAME Lincolnway Industrial Rail and Air Park

CLIENT Clinton Regional Development Corporation

PROJECT NUMBER 015-2757

PROJECT LOCATION Clinton County, Iowa

BORING NUMBER	SAMPLE I.D.	SAMPLE DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	VOID RATIO	SATURATION (%)	UNCONFINED STRENGTH (tsf)	ATTERBERG LIMITS			P-200	USCS CLASS.
								LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
B-1	U-1	1.0 - 2.5'	22.9	99.8	0.688	89.6	1.1					
B-1	U-2	3.5 - 5.0'	17.3									
B-1	SS-3	6.0 - 7.5'	17.2									
B-1	SS-4	8.5 - 10.0'	18.9								25.9	
B-1	SS-5	13.5 - 15.0'										
B-1	SS-6	18.5 - 20.0'	18.8								3.5	
B-1	SS-7	23.5 - 25.0'										
B-2	U-1	1.0 - 2.5'	26.3	95.4	0.767	92.5		67	48	19		CH
B-2	SS-2	3.5 - 5.0'	14.8									
B-2	SS-3	6.0 - 7.5'	14.6									
B-2	SS-4	8.5 - 10.0'	15.1								34.3	
B-2	NR-5	13.5 - 15.0'										
B-2	SS-5	15.0 - 16.5'	13.6									
B-2	SS-6	18.5 - 20.0'	17.8									
B-2	U-7	23.5 - 25.0'	13.5	105.2	0.603	60.3						
B-3	U-1	1.0 - 2.5'	22.9	105.1	0.604	100.0						
B-3	U-2	3.5 - 5.0'	12.8									
B-3	SS-3	6.0 - 7.5'	20.6									
B-3	SS-4	8.5 - 10.0'	19.3								9.6	
B-3	SS-5	13.5 - 15.0'										
B-3	SS-6	18.5 - 20.0'										
B-3	SS-7	23.5 - 25.0'	36.5					41	25	16		CL
B-3	SS-8	28.5 - 30.0'	39.7									
B-3	U-9	30.0 - 31.5'	38.2	88.6	0.902	100.0						
B-3	U-10	33.5 - 35.0'	38.7									
B-3	U-11	38.5 - 40.0'	21.6	98.0	0.719	81.1						
B-3	U-12	43.5 - 45.0'	17.8									
B-3	U-13	48.5 - 50.0'	13.7	127.4	0.323	100.0						
B-3	SS-13	50.0 - 51.5'	14.0									
B-4	U-1	1.0 - 2.5'	28.4	91.2	0.849	90.3						

USDA Soil Survey map of designated soil complexes within or near the Lincolnway Industrial Rail and Air Park project site near Clinton, IA. The hatched areas represent the general project locations where limestone bedrock may be encountered within 13 to 79 inches of the ground surface.

2/10/16 ES

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Report—Engineering Properties

Absence of an entry indicates that the data were not estimated. The asterisk "*" denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>).

Engineering Properties—Clinton County, Iowa														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>Pct</i>	<i>Pct</i>					<i>Pct</i>	
133—Colo silty clay loam, 0 to 2 percent slopes														
Colo, occasionally flooded	95	C/D	0-38	Silty clay loam	CL, CH	A-7	0-0-0	0-0-0	100-100-100	100-100-100	90-95-100	90-95-100	40-50-60	15-23-30
			38-60	Silty clay loam, silt loam, clay loam	CH, CL	A-7	0-0-0	0-0-0	100-100-100	100-100-100	95-98-100	80-90-100	40-48-55	15-23-30
175B—Dickinson fine sandy loam, 2 to 5 percent slopes														
Dickinson	95	A	0-8	Loam, sandy loam, fine sandy loam	SC-SM, SC	A-6, A-4	0-0-0	0-0-0	100-100-100	100-100-100	90-93-96	41-44-47	25-29-33	7-9-11
			8-18	Loam, sandy loam, fine sandy loam	SC, SC-SM	A-6, A-4	0-0-0	0-0-0	100-100-100	100-100-100	89-93-97	39-43-47	21-27-33	6-9-11
			18-30	Sandy loam, fine sandy loam	SC, SC-SM	A-6, A-4	0-0-0	0-0-0	100-100-100	100-100-100	89-93-97	39-43-47	20-24-28	6-9-12
			30-36	Loamy sand, sand, fine sand, loamy fine sand	SC-SM, SM	A-2-4	0-0-0	0-0-0	100-100-100	100-100-100	78-80-83	21-23-26	16-18-21	2-3-6
			36-60	Fine sand, sand, loamy fine sand, loamy sand	SM, SP-SM, SC-SM	A-2-4	0-0-0	0-0-0	100-100-100	100-100-100	78-80-83	12-14-17	16-18-21	2-3-6

Engineering Properties---Clinton County, Iowa													
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200	
			In				Pct	Pct					Pct
177B—Saude loam, 2 to 5 percent slopes													
Saude	90 B		0-7	Sandy loam, loam	SC, ML	A-6, A-4, A-7-6	0-0-0	0-0-0	100-100-100	83-98-100	67-83-90	45-58-64	32-37-43
			7-13	Loam, sandy loam	CL, SC, ML	A-6, A-4, A-7-6	0-0-0	0-0-0	100-100-100	83-98-100	67-83-90	45-58-64	30-36-43
			13-16	Loam, sandy loam	SC, CL	A-6, A-4	0-0-0	0-0-1	88-98-100	85-96-100	70-82-92	46-55-64	27-32-40
			16-24	Loam, sandy loam	SC, SC-SM, CL	A-4, A-6	0-0-0	0-1-3	95-96-100	86-89-100	69-74-86	43-48-56	24-27-30
			24-28	Sandy loam, loam	SC-SM, CL, SC	A-6, A-4	0-0-0	0-1-3	95-96-100	86-89-100	67-73-84	40-44-52	24-27-30
			28-36	Loamy sand, sand, loamy coarse sand, gravelly coarse sand, coarse sand	SW-SM, SC-SM, SC	A-1-a, A-2-4	0-0-0	0-1-6	74-91-97	41-82-92	24-55-69	7-20-29	0-19-26
			36-79	Loamy sand, gravelly coarse sand, sand, coarse sand, loamy coarse sand	SP-SC, SC, SW-SM	A-1-b, A-1-a, A-2-4	0-0-0	0-5-6	74-88-97	41-70-92	24-45-69	5-12-24	0-17-26
184—Klinger silt loam, 1 to 3 percent slopes													
Klinger	95 C/D		0-17	Silt loam	CL	A-6	0-0-0	0-0-0	100-100-100	100-100-100	100-100-100	95-98-100	30-35-40
			17-31	Silty clay loam	CL	A-7	0-0-0	0-0-0	100-100-100	100-100-100	100-100-100	95-98-100	40-45-50
			31-60	Loam, clay loam	CL	A-6	0-0-0	0-3-5	90-93-95	85-88-90	75-80-85	55-60-65	25-30-35

Engineering Properties—Clinton County, Iowa														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				Pct	Pct					Pct	
214B—Rockton loam, 20 to 30 inches to limestone, 2 to 5 percent slopes														
Rockton, 20 to 30 inches to bedrock	100	C	0-14	Loam	CL, ML, CL-ML	A-4	0-0-0	0-0-0	90-95-100	90-95-100	85-90-95	50-63-75	25-30-35	5-8 -10
			14-25	Sandy clay loam, loam, clay loam	SC, CL	A-6, A-7	0-0-0	0-0-0	90-95-100	90-95-100	75-83-90	45-58-70	30-38-45	10-15-20
			25-38	Bedrock	—	—	0-0-0	0-0-0	—	—	—	—	—	—
214C—Rockton loam, 20 to 30 inches to limestone, 5 to 9 percent slopes														
Rockton, 20 to 30 inches to bedrock	100	C	0-14	Loam	CL-ML, CL, ML	A-4	0-0-0	0-0-0	90-95-100	90-95-100	85-90-95	50-63-75	25-30-35	5-8 -10
			14-25	Loam, clay loam, sandy clay loam	CL, SC	A-7, A-6	0-0-0	0-0-0	90-95-100	90-95-100	75-83-90	45-58-70	30-38-45	10-15-20
			25-38	Bedrock	—	—	0-0-0	0-0-0	—	—	—	—	—	—

Engineering Properties—Clinton County, Iowa														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>Pct</i>	<i>Pct</i>					<i>Pct</i>	
217B—Ripon silt loam, 30 to 40 inches to limestone, 2 to 5 percent slopes														
Ripon, 30 to 40 inches to bedrock	100	C	0-9	Silt loam	ML, CL- ML, CL	A-6	0-0-0	0-0-0	100-100 -100	100-100 -100	89-99-1 00	83-93- 98	29-40 -45	7-15-18
			9-11	Silt loam	ML, CL- ML, CL	A-6	0-0-0	0-0-0	100-100 -100	100-100 -100	88-100- 100	81-93- 96	27-39 -43	7-16-19
			11-23	Silt loam	ML, CL- ML, CL	A-6	0-0-0	0-0-0	100-100 -100	100-100 -100	92-100- 100	86-94-1 00	30-39 -49	12-18-2 5
			23-32	Silt loam, silty clay loam	CL	A-6, A-7-6	0-0-0	0-0-0	100-100 -100	100-100 -100	87-99-1 00	83-95-1 00	29-41 -47	12-21-2 5
			32-34	Sandy clay loam, clay loam, loam	SC, CL	A-6	0-0-0	0-1-4	91-95- 98	81-91- 97	73-90- 97	58-73- 83	30-40 -45	13-21-2 5
			34-79	Bedrock	—	—	—	—	—	—	—	—	—	—
284B—Flagler sandy loam, 1 to 5 percent slopes														
Flagler	100	A	0-19	Sandy loam	SC-SM, SC	A-4, A-2	0-0-0	0-0-0	95-98-1 00	90-93- 95	60-65- 70	25-33- 40	15-20 -25	5-8 -10
			19-35	Sandy loam	SC-SM, SC	A-4, A-2	0-0-0	0-0-0	95-98-1 00	90-93- 95	50-60- 70	25-33- 40	15-20 -25	5-8 -10
			35-60	Gravelly sand, loamy sand, sand	SP, SW- SM, SW, SP-SM	A-1	0-0-0	0-3-5	70-73- 90	70-72- 85	20-30- 40	3-8-12	0-7 -14	NP

Engineering Properties—Clinton County, Iowa														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				Pct	Pct					Pct	
285D—Burkhardt sandy loam, 5 to 14 percent slopes														
Burkhardt	100	A	0-17	Sandy loam	SM, SC-SM	A-2, A-4	0-0-0	0-0-0	95-98-100	90-95-100	55-63-70	25-33-40	15-21-26	2-5-7
			17-22	Sandy loam, loamy sand	ML, SM, SC, CL	A-2, A-4	0-0-0	0-0-0	95-98-100	85-93-100	50-73-95	25-50-75	15-23-30	2-6-10
			22-60	Very gravelly loamy sand, coarse sand, gravelly coarse sand	SP, SP-SM	A-1	0-0-0	0-0-0	50-68-85	45-65-85	20-28-35	1-3-5	0-7-14	NP
350—Waukegan silt loam, 0 to 2 percent slopes														
Waukegan	95	B	0-15	Silt loam	ML	A-4	0-0-0	0-0-0	95-98-100	95-98-100	95-98-100	85-90-95	25-33-40	3-7-10
			15-35	Silt loam, loam	CL-ML, CL	A-4, A-6	0-0-0	0-0-0	95-98-100	95-98-100	95-98-100	85-90-95	25-33-40	5-10-15
			35-60	Very gravelly loamy sand, gravelly coarse sand, gravelly sand	SW, SP, SP-SM	A-1	0-0-0	0-1-2	80-88-95	65-75-85	30-40-50	3-7-10	0-7-14	NP

Engineering Properties—Clinton County, Iowa														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>Pct</i>	<i>Pct</i>					<i>Pct</i>	
350B—Waukegan silt loam, 2 to 5 percent slopes														
Waukegan	95	B	0-15	Silt loam	ML	A-4	0-0-0	0-0-0	95-98-100	95-98-100	95-98-100	85-90-95	25-33-40	3-7 -10
			15-35	Loam, silt loam	CL, CL-ML	A-6, A-4	0-0-0	0-0-0	95-98-100	95-98-100	95-98-100	85-90-95	25-33-40	5-10-15
			35-60	Very gravelly loamy sand, gravelly sand, gravelly coarse sand	SW, SP, SP-SM	A-1	0-0-0	0-1-2	80-88-95	65-75-85	30-40-50	3-7-10	0-7-14	NP
351—Atterberry silt loam, sandy substratum, 0 to 2 percent slopes														
Atterberry, sandy substratum	95	C/D	0-16	Silt loam	CL, CL-ML	A-6, A-4	0-0-0	0-0-0	100-100-100	100-100-100	100-100-100	95-98-100	25-33-40	5-10-15
			16-46	Silty clay loam	CL	A-7	0-0-0	0-0-0	100-100-100	100-100-100	100-100-100	95-98-100	40-45-50	20-25-30
			46-50	Sandy loam	SC, SC-SM	A-4	0-0-0	0-0-0	100-100-100	95-98-100	80-85-90	35-43-50	20-25-30	5-8 -10
			50-60	Sand, loamy sand	SM	A-3, A-2	0-0-0	0-0-0	100-100-100	95-98-100	80-85-90	5-13-20	15-18-20	NP-3 -5

Engineering Properties—Clinton County, Iowa														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				Pct	Pct					Pct	
377B—Dinsdale silt loam, 2 to 5 percent slopes														
Dinsdale	90 C		0-7	Silty clay loam, silt loam	CL	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	96-99-100	91-94-99	40-43-50	16-17-22
			7-12	Silt loam, silty clay loam	CL	A-6, A-7-6	0-0-0	0-0-0	100-100-100	100-100-100	92-99-100	87-94-95	38-46-48	16-22-22
			12-19	Silty clay loam	CL	A-7-6	0-0-0	0-0-0	100-100-100	100-100-100	92-99-100	87-94-95	36-44-46	16-22-22
			19-28	Silty clay loam	CL	A-7-6	0-0-0	0-0-0	100-100-100	100-100-100	94-98-100	89-93-97	38-43-49	19-22-22
			28-34	Silty clay loam	CL	A-7-6	0-0-0	0-1-3	92-96-100	85-92-98	80-91-98	75-86-95	38-43-49	19-22-22
			34-46	Clay loam, loam	CL	A-6	0-0-0	0-0-4	91-98-98	82-95-97	71-85-93	47-57-65	30-33-41	13-16-21
			46-58	Clay loam, loam	CL	A-6	0-0-0	0-0-2	92-98-98	85-95-97	70-85-88	45-57-60	33-35-38	16-17-19
			58-80	Clay loam, loam	CL	A-6	0-0-0	0-0-2	92-97-98	85-94-97	70-84-88	45-56-60	33-35-38	16-17-19

Engineering Properties—Clinton County, Iowa														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				Pct	Pct					Pct	
404—Thorp silt loam, 0 to 2 percent slopes														
Thorp	100	B/D	0-14	Silt loam	CL	A-6, A-4	0-0-0	0-0-0	95-98-100	95-98-100	90-95-100	75-85-95	20-30-40	8-14-19
			14-19	Silt loam	CL	A-6, A-4	0-0-0	0-0-0	95-98-100	95-98-100	90-95-100	75-85-95	25-30-35	7-11-15
			19-43	Silty clay loam, silt loam	CL	A-6, A-7	0-0-0	0-0-0	95-98-100	95-98-100	90-95-100	75-85-95	35-43-50	13-20-27
			43-50	Silt loam, sandy clay loam, clay loam	CL	A-6, A-7, A-4	0-0-0	0-0-0	90-95-100	90-95-100	90-95-100	70-80-90	20-35-50	8-17-26
			50-65	Sand, sandy loam	SM, SC-SM, CL-ML, ML	A-4, A-2	0-0-0	0-0-0	85-93-100	75-85-95	65-75-85	20-40-60	15-18-20	NP-3-6
412D—Sogn loam, 5 to 14 percent slopes														
Sogn	100	D	0-11	Clay loam, loam	CL	A-6, A-7-6	0-0-0	0-5-10	85-93-100	85-93-100	80-90-100	65-73-80	35-40-45	15-18-20
			11-13	Loam	CL	A-6	0-0-0	0-5-10	85-93-100	85-93-100	85-93-100	70-85-100	25-33-40	11-17-23
			13-17	Bedrock	—	—	0-0-0	0-0-0	—	—	—	—	—	—
428B—Ely silt loam, 2 to 5 percent slopes														
Ely	95	C/D	0-26	Silt loam	CL	A-6, A-7	0-0-0	0-0-0	100-100-100	100-100-100	95-98-100	95-98-100	30-38-45	10-18-25
			26-60	Silty clay loam	CL, ML	A-6, A-7	0-0-0	0-0-0	100-100-100	100-100-100	95-98-100	95-98-100	35-43-50	10-18-25
			60-64	Silt loam, loam, silty clay loam	CL	A-6	0-0-0	0-0-0	100-100-100	100-100-100	90-95-100	85-93-100	25-33-40	10-15-20

Engineering Properties—Clinton County, Iowa														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				Pct	Pct					Pct	
499F—Nordness silt loam, 14 to 25 percent slopes														
Nordness	100 D		0-12	Silt loam	CL-ML, CL	A-4	0-0-0	0-0-0	100-100-100	100-100-100	90-95-100	70-80-90	20-25-30	5-8-10
			12-15	Silt loam, loam, silty clay loam	CL	A-7, A-6	0-0-0	0-0-0	100-100-100	100-100-100	90-95-100	70-80-90	30-38-45	15-20-25
			15-19	Clay loam, silty clay loam, loam	CL	A-6, A-7	0-0-0	2-6-10	85-90-95	80-85-90	70-78-85	65-75-85	30-38-45	15-20-25
			19-60	Weathered bedrock, bedrock	—	—	0-0-0	0-0-0	—	—	—	—	—	—
760—Ansgar silt loam, 0 to 3 percent slopes														
Ansgar	95 C/D		0-8	Silt loam	CL, CL-ML	A-4, A-6	0-0-0	0-0-0	100-100-100	100-100-100	95-99-100	89-93-96	34-39-43	11-15-17
			8-12	Silt loam	CL-ML, CL	A-4, A-6	0-0-0	0-0-0	100-100-100	100-100-100	95-99-100	89-93-96	28-33-37	12-15-17
			12-18	Silty clay loam	CL	A-7-6	0-0-0	0-0-0	100-100-100	100-100-100	97-99-100	93-95-97	40-42-45	21-23-24
			18-28	Silty clay loam	CL	A-7-6	0-0-0	0-0-0	100-100-100	100-100-100	97-99-100	93-95-97	40-42-45	21-23-24
			28-36	Clay loam, loam	CL	A-6	0-0-0	2-3-15	91-92-98	82-88-98	78-87-98	63-71-83	29-34-39	13-16-19
			36-68	Clay loam, loam	CL	A-6	0-0-0	2-3-15	91-92-98	82-88-98	78-87-98	63-71-83	29-34-39	13-16-19
			68-80	Clay loam, loam	CL	A-6	0-0-0	2-3-15	91-92-98	82-88-98	77-87-98	56-65-76	29-35-39	12-17-19

Engineering Properties—Clinton County, Iowa														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>Pct</i>	<i>Pct</i>					<i>Pct</i>	
918—Garwin silty clay loam, sandy substratum, 0 to 2 percent slopes														
Garwin, sandy substratum	95	C/D	0-8	Silty clay loam	ML, MH	A-7-5	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	95-99-100	49-54-58	18-21-24
			8-12	Silty clay loam	CL, MH	A-7-5, A-7-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	95-99-100	44-52-56	19-22-24
			12-18	Silty clay loam	CH, CL	A-7-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	95-99-100	41-49-53	19-23-25
			18-22	Silty clay loam	CH, CL	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	95-99-100	40-48-50	19-24-25
			22-27	Silty clay loam	CL	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	95-99-100	39-46-49	19-23-25
			27-36	Silty clay loam	CL	A-6, A-7-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	95-99-100	39-45-49	19-23-25
			36-42	Silty clay loam	CL	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	95-99-100	38-43-48	19-22-25
			42-47	Silty clay loam, silt loam	CL	A-6, A-7-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	94-98-100	34-37-43	16-18-23
			47-50	Silt loam, silty clay loam	CL	A-6, A-7-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	94-98-100	34-35-43	16-17-23
			50-79	Loamy fine sand	SC-SM, SM	A-2-4	0-0-0	0-0-0	100-100-100	100-100-100	89-95-100	18-23-30	16-19-22	2-4-6

Engineering Properties—Clinton County, Iowa														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				Pct	Pct					Pct	
919—Muscatine silt loam, sandy substratum, 0 to 2 percent slopes														
Muscatine, sandy substratum	95	C/D	0-7	Silty clay loam, silt loam	MH, ML	A-7-6, A-7-5	0-0-0	0-0-0	100-100-100	100-100-100	96-99-100	92-98-100	43-47-57	16-18-24
			7-16	Silty clay loam, silt loam	MH, ML	A-7-6, A-7-5	0-0-0	0-0-0	100-100-100	100-100-100	96-99-100	92-98-100	43-48-57	16-19-24
			16-20	Silty clay loam	CL, CH	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	96-99-100	92-97-100	40-48-53	19-23-25
			20-42	Silty clay loam	CL	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	96-100-100	92-97-100	38-45-49	19-23-25
			42-50	Silty clay loam, silt loam	CL	A-6, A-7-6	0-0-0	0-0-0	100-100-100	100-100-100	95-100-100	89-97-100	31-36-46	13-17-25
			50-79	Loamy fine sand	SC-SM, SM	A-2-4	0-0-0	0-0-0	100-100-100	100-100-100	89-95-100	18-23-30	16-19-22	2-4-6

Engineering Properties—Clinton County, Iowa														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				Pct	Pct					Pct	
920—Tama silt loam, sandy substratum, 0 to 2 percent slopes														
Tama, sandy substratum	85	C	0-6	Silt loam, silty clay loam	CL, ML	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	93-98-100	39-42-49	15-17-21
			6-10	Silt loam, silty clay loam	CL	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	93-98-100	37-43-48	15-19-21
			10-14	Silt loam, silty clay loam	CL	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	93-98-100	37-44-48	15-19-21
			14-18	Silty clay loam, silt loam	CL	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	98-100-100	94-98-100	36-44-47	16-22-22
			18-32	Silty clay loam, silt loam	CL	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	93-98-100	35-45-49	16-23-25
			32-45	Silty clay loam, silt loam	CL	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	93-98-100	35-43-49	16-22-25
			45-60	Silty clay loam, silt loam	CL	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	94-98-100	30-38-41	13-19-21
			60-79	Loamy sand, fine sand, loamy fine sand	SC-SM, SM	A-2-4	0-0-0	0-0-0	100-100-100	100-100-100	89-95-100	18-23-30	16-19-22	2-4-6

Engineering Properties—Clinton County, Iowa														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				Pct	Pct					Pct	
920B—Tama silt loam, sandy substratum, 2 to 5 percent slopes														
Tama, sandy substratum	85	C	0-6	Silt loam, silty clay loam	CL, ML	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	93-98-100	39-42-49	15-17-21
			6-10	Silt loam, silty clay loam	CL	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	93-98-100	37-43-48	15-19-21
			10-14	Silt loam, silty clay loam	CL	A-6, A-7-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	93-98-100	37-44-48	15-19-21
			14-18	Silty clay loam, silt loam	CL	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	98-100-100	94-98-100	36-44-47	16-22-22
			18-32	Silty clay loam, silt loam	CL	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	93-98-100	35-45-49	16-23-25
			32-45	Silty clay loam, silt loam	CL	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	93-98-100	35-43-49	16-22-25
			45-60	Silty clay loam, silt loam	CL	A-7-6, A-6	0-0-0	0-0-0	100-100-100	100-100-100	97-100-100	94-98-100	30-38-41	13-19-21
			60-79	Loamy sand, fine sand, loamy fine sand	SM, SC-SM	A-2-4	0-0-0	0-0-0	100-100-100	100-100-100	89-95-100	18-23-30	16-19-22	2-4-6

Engineering Properties—Clinton County, Iowa														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				Pct	Pct					Pct	
1152—Marshan clay loam, 0 to 2 percent slopes, rarely flooded														
Marshan, rarely flooded	75	C/D	0-8	Clay loam, silty clay loam, loam, silt loam	ML, MH	A-7-5, A-6	0-0-0	0-0-0	100-100-100	82-96-100	71-91-100	57-79-91	39-49-56	11-19-24
			8-14	Loam, clay loam, silty clay loam, silt loam	MH, CL	A-6, A-7-6, A-7-5	0-0-0	0-0-0	100-100-100	82-96-100	72-93-100	59-82-93	32-45-55	12-19-24
			14-18	Loam, clay loam, silty clay loam, silt loam	CH, CL	A-6, A-7-6	0-0-0	0-0-0	100-100-100	83-96-100	73-93-100	60-82-93	30-42-51	12-19-25
			18-23	Clay loam, silty clay loam, loam, silt loam	CL	A-6, A-7-6	0-0-0	0-0-0	100-100-100	83-96-100	73-93-100	60-82-93	29-39-47	12-19-25
			23-30	Sandy loam, clay loam, loam, silt loam	CL, SC	A-6, A-7-6	0-0-0	0-0-0	92-97-100	84-91-100	68-81-97	45-59-73	29-35-42	12-16-21
			30-40	Coarse sand, loamy sand, gravelly sand, sand	SW, SP-SC, SP-SM	A-2-4, A-1-b, A-1-a	0-0-0	0-1-3	78-90-97	39-72-92	25-49-65	3-8-14	0-17-22	NP-5-6
			40-79	Gravelly sand, coarse sand, loamy sand, sand	SW, SP-SC, SP-SM	A-1-b, A-1-a, A-2-4	0-0-0	0-1-3	78-90-97	39-72-92	25-49-65	3-8-14	0-17-22	NP-5-6

Data Source Information

Soil Survey Area: Clinton County, Iowa
Survey Area Data: Version 21, Sep 28, 2015



Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

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Iowa Department of Natural Resources - Coal Mine Map

Clinton, Iowa, United States

Lincolnway Industrial Rail and Air Park

Approximately 29.5 miles

Coal Mines or Prospect Hole Locations

