SUBSURFACE EXPLORATION AND STRUCTURE GEOTECHNICAL REPORT

FOR THE

Proposed Bridge at Station 119+44
FAP 343, IL Route 68 (Dundee Road)
Over Wheeling Drainage Ditch
Structure Number 016-2302
Wheeling, Cook County, Illinois

Section 105-1415.1 MFT

Prepared for

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Prepared by

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May 3, 2011

GROUND
ENGINEERING
CONSULTANTS, INC.

May 3, 2011

Ms. Joyce J. DeLong, P.E.
Applied Technology, Inc.
468 Park Avenue
Lake Villa, Illinois 60046

Reference: *Structure Geotechnical Engineering Report for Illinois Route 68 (Dundee Road) Bridge Over Wheeling Drainage Ditch, Structure Number 016-2302, Section 105-1415.1 MFT*

Dear Ms. DeLong:

As per your authorization we have completed the subsurface exploration for the above noted project. Enclosed is our Structure and Roadway Geotechnical Engineering Report for the project, including revisions based on comments from the Illinois Department of Transportation Memorandum received on May 27, 2010.

If there are any questions on the subject please do not hesitate to contact us. We appreciate this opportunity to be of service.

Very Truly Yours,

GROUND ENGINEERING CONSULTANTS, INC.

Safdar A. Gill

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INTRODUCTION

This report prepared by Ground Engineering Consultants, Inc. (GEC) presents the results of our subsurface exploration and recommendations for the design of foundations for the proposed bridge at IL Route 68 (Dundee Road) over Wheeling Drainage Ditch in Cook County at Station 119 + 44, Structure Number 016-2302, Section 105-1415.1 MFT. The proposed improvements include the removal of the existing bridge and reconstruction with a wider roadway.

The existing structure is Number 016 -0525. It was built in 1965 as part of County Highway 105, Section 105-1415.1 MFT as a single span pre-stressed concrete box beam multi-girder bridge. Five of the box beams were removed and replaced in 2006. Substructure is two full heights reinforced concrete abutments on spread footings 39 feet 6 inches back to back abutments and 65 feet 0 inches out to out in width. The new bridge will be a single span precast concrete arch supported on spread footing type foundations. Out to out dimension of this arch is indicated as 38 feet 4 inches. Clear span will be 36 feet 0 inches. The width of the roadway will be 86 feet out to out of head walls. Traffic is to be staged during construction utilizing two stages with two lanes of traffic to remain open during each stage.

The section of the roadway included in this report is located in Section 2 of Township 42 North, Range 11 East of the Third Principal Meridian in the Village of Wheeling, Cook County, Illinois. The roadway section extends from approximately Station 113+57 to Station 119+44 as shown on the Project Location Diagram in Appendix A.

Results of field and laboratory testing and final recommendations based upon this data are included in this report. The soil borings performed at the site, a project location diagram, a soil profile diagram, and the results of the exploration are included with this report. The boring locations were selected, located, and surveyed by GEC's Client, Applied Technology, Inc.

The purpose of this report is to describe the subsurface conditions encountered in the borings, to summarize the test data and to provide recommendations regarding design and construction of the proposed structures and roadway improvements.

PUBLISHED GEOLOGICAL SOURCES

The Chicago area geologic stratigraphy is comprised of glacial Till of the Pleistocene age overlying sedimentary bedrock of Silurian age and older rocks. The entire Chicago area was buried under several thousand feet of ice that spread from northeast during the Wisconsinan age of glaciations, the last major advancement of the ice. The glaciers retreated from Chicago area about 13,500 years ago. The surficial deposits which overlie the Silurian age bedrock are the remnants of various processes of glacial outwash, meltwater, windblown sand, vegetation cover, lake basin deposits, erosional streams and channels. Along the project area, elevations to the top of the bedrock are approximately 600 feet, or 40 to 50 feet below ground surface.

Glacial and postglacial deposits overlie the bedrock surface. The glacial deposits are of Wisconsinan age, 75,000 to 10,000 Y.B.P. The project area is situated at the west limit Wadsworth member of Wedron Formation.

The surficial geology in the area consists of the Quaternary Deposits. The majority of the shallow soils beneath the site have been classified into a distinct geologic unit known as Tinley Moraine. This unit consists mostly of well sorted and evenly bedded sand and gravel deposits in valleys. These deposits include glacial outwash in terraces and remnants of valley trains, including similar deposits in glacial Sluiceways. An excerpt from Chicago Area Geologic Maps, surveyed 1930 – 1932, “Surficial Geology of the Wheeling Quadrangle” by J. Harlen Bretz is enclosed. It indicates the surficial deposits as “Valley-train”.

According to the United States Department of Agriculture Natural Resources Conservation Service *Web Soil Survey,* dated 2009, soils within the project area consist primarily of the soil units described below. Additional minor soil units present in the project area are identified on the soil map and report provided in Appendix B.

Drummer Silty Clay Loam: These soils consist of nearly level, poorly drained soil on uplands on smooth flats and in shallow depressions and drainageways. They are occasionally flooded for brief periods in spring. These soils formed in silty material and the underlying loamy glacial till or stratified loamy outwash. Slopes range from 0 to 2 percent. Drummer soils are moderately permeable.

Mundelein Silt Loam: These soils consist of deep, somewhat poorly drained, moderately high to highly permeable soils on outwash plains, stream terraces, or along footslopes on uplands. These soils formed in loess or other silty material and in the underlying outwash. Slopes range from 0 to 2 percent. The typical shallow profile for Mundelein soils consists of silt loam to a depth of 17 inches, underlain by silty clay loam to a depth of 31 inches and silty loam extending to 42 inches.

Orthents, Loamy: These deep, well drained soils are commonly found in outwash plains and ground moraines. These soils formed from deposits of earthy fill. Soils exhibit a moderately high permeability and slopes range from 1 to 6 percent. The typical shallow soil profile for Orthent soils consists of loam extending to a depth of 6 inches followed by clay loam to a depth of 60 inches.

A detailed depiction of this area of the soil map is provided in Appendix B.

TOPOGRAPHY

Surface elevations at the boring locations obtained by Applied Technology, Inc. are shown on the boring logs. The site generally exhibits a fairly level topography.

SURROUNDING LAND USE AND DEVELOPMENT

The project is located in a moderately-developed suburban area. The areas along both sides of the proposed roadway improvements are primarily occupied by municipal buildings and undeveloped land.

SUBSURFACE EXPLORATION PROCEDURES

Soil Borings

Roadway drawings with boring locations were provided by Applied Technology, Inc. The subsurface exploration consisted of four structure borings for the bridge extending to depths of 50 to 60 feet below grade and four roadway borings extending to depths of 5.5 to 10 feet. Borings are shown on the project location diagram included in Appendix A.

The soil borings were performed by Wang Drilling, Inc. under the supervision of GEC's soil engineer between February 25 and March 1, 2010. A truck mounted drill rig capable of power auger or rotary drilling was used for the drilling and sampling. For the roadway borings, soil samples were obtained at 2.5 foot intervals to a depth of 30 feet and at 5 feet intervals thereafter. For the roadway borings, soil samples were obtained continuously to 10 feet depth.

Soil samples were obtained using a split barrel sampling procedure, which involves driving a heavy walled split barrel sampler 2 foot long, 2 inch OD and 1.375 inch ID by a 140 pound hammer falling freely a distance of 30 inches. The number of blows required to drive the sampler for each 6 inch of penetration is recorded. The sum of the resistance values for the second and third penetration intervals is called the standard penetration resistance (SPT or N) value. This value gives an indication of the relative density of granular soils and to some extent the consistency of cohesive soils. The soil samples so obtained were classified by a soil engineer and then placed in sealed plastic bags for further examination and testing in the laboratory.

Rotary drilling was utilized for the structure borings to maintain stability of the boreholes. The roadway borings were performed by using a power auger type drilling and sampling.

Upon completion of the drilling and sampling the boreholes were grouted and the surface was restored. Some of the boring locations had to be offset due to the presence of overhead electric lines and underground obstructions.

SOIL CONDITIONS

The soil conditions encountered at each of the borings are shown on the enclosed boring logs. A brief description of the soil conditions at the roadway borings and the structure borings is given below. Soil profiles have been prepared for the roadway borings and for the structure borings which give a generalized soil description and test data.

Roadway Borings

Borings RB-1 and RB-3 performed outside the paved areas encountered topsoil in a thickness of 2 feet underlain by fill extending to depths of 9 to 10 feet below grade. The fill was quite variable and consisted of silty clay with sand and stone or clayey sand. The cohesive soils were generally stiff and the granular soils were medium dense.

Borings RB-2 and RB-4 performed in the paved areas encountered 6 inches of asphalt over 6 to 7 inches of concrete overlying crushed stone. These pavement materials were underlain by fill soils to the end of boring RB-2 which encountered refusal at 5.5 feet depth. At boring RB-4 the fill soils extended to a depth of 6 feet and were underlain by silt and clayey fine sand and fine to coarse sand extending to the boring termination depth of 10 feet.

Structure Borings

Two of the structure borings, SB-1 and SB-2, were performed in the roadway areas and encountered 6 inches of asphalt over 5 to 7 inches of concrete. The other two borings SB-3 and SB-4 were performed outside the roadway. Soils near the surface in boring SB-4 consisted of 2.5 feet of topsoil and silty clay with miscellaneous materials in a very stiff condition. At boring SB-3 sand and gravel was encountered to 5.5 feet depth. Below the pavement or the sand and gravel at SB-3 or the topsoil at SB-4, fill soils were encountered extending to depths of 6.5 feet to 11 feet below grade. The fill soils were quite variable and consisted of silty clay and sand with gravel or fine to medium sand or sand and stone. Their strength or relative density was also quite variable from loose to medium dense for the granular soils and soft to very stiff for the cohesive soils.

Below the fill the borings encountered granular soils consisting of fine to coarse sand or gravel to depths of 16 feet to 21 feet below grade. The granular soils were medium dense in relative density with some samples showing dense relative density.

Below the above described granular soils, stiff to very stiff silty clay or clayey silt was encountered to depths of 26 to 37 feet below grade.

Below the above described soils the borings encountered dense to very dense silt or silt and stone or gravel and coarse sand to the end of borings. Some of the samples showed relative density in the medium dense range as indicated on the boring logs.

Based on an examination of the soils and a review of the test data, the soils were grouped into various strata as noted on the boring logs. However, the demarcation lines should be considered approximate because in situ the transition between the soil types is more gradual.

A plan and soil profile is included in Appendix C, and detailed descriptions of the soil conditions are shown in the boring logs included in Appendix D.

Subgrade Support Ratings (SSR) and Illinois Bearing Ratio (IBR)

Due to weak subsoil conditions, we recommend Subgrade Support Rating (SSR) of “Poor”. The pavement should be designed for an Illinois Bearing Ratio (IBR) of 2.0 based on materials encountered in the soil borings.

Topsoil Thickness

The following table summarizes the thickness of topsoil present in the roadway borings performed for this project. GEC recommends that an average topsoil thickness of 12 inches be used for the calculation of the quantity of “removal and disposal of unsuitable materials” required for this project.

TABLE 1: TOPSOIL THICKNESS SUMMARY		
Boring No.	**Station and Offset (feet)**	**Topsoil Thickness (feet)**
RB-1	113+95.67, 34.48 RT	1.5
RB-3	117+50.25, 37.18 RT	1.5
Note: Roadway borings not listed in the table did not exhibit measurable topsoil. Topsoil thickness was estimated from auger cuttings of the first 12 to 24 inches of each boring. Actual topsoil thickness should be verified by a soils engineer during construction.		

Unsuitable Soils

Some of the subgrade soils along the proposed roadway improvements could be identified as potentially unsuitable. The criteria for making this evaluation were as follows:

- Soils identified as frost susceptible
- Soil identified as peat or other organic soil

The soil conditions for each of the roadway borings were compared to the above criteria based on visual classification and moisture content test results. The results are discussed in the following sections.

Frost Susceptible Soils

Frost susceptible soils are defined as having at least two of the following:

- Silt and fine sand contents are greater than 65 percent
- Plastic index is less than 12 percent
- Zone of capillary rise lies within the depth of frost penetration, generally assumed to be 42 inches below ground surface

Based on the results of moisture content testing and visual classification, none of the roadway borings exhibited soils which met the definition of frost susceptible soils.

Peat or Highly Organic Soils

No deposits of peat or highly organic soils were encountered in the borings, with the exception of topsoil with trace organics encountered at a depth of 5 to 6 feet in boring RB-4. Only surface topsoil materials with trace organics were encountered in some of the borings.

Soft or Loose Soils

The criterion for classifying a soil as having a soft consistency requires that the unconfined compressive strength obtained from either the calibrated penetration test or RIMAC compression to be less than 0.5 tsf. Loose soils are those which exhibit a blow count (N-value) of less than 7 blows per foot. Based on these criteria, no soils encountered in the borings are considered soft or loose soils.

LABORATORY TESTING PROGRAM

Each of the soil samples was tested in GEC's laboratory to determine its natural moisture content according to ASTM D-2216. The unconfined compressive strength of the cohesive soils was verified by testing with a calibrated hand penetrometer and/or RIMAC machine. Each of the soil samples was examined by an experienced soil engineer and classified according to the AASHTO soil classification system. The results of all testing performed, along with a visual classification of the material based upon both a textural analysis and the AASHTO soil classification system, are indicated on the boring logs in Appendix D.

GROUNDWATER CONDITIONS

Since the borings were performed with a rotary drilling method it was not possible to determine the prevailing water table or the long term water table. No ground water was encountered in the roadway borings which extended to 10 feet depth. At boring Number SB-2, which was performed by power auger type drilling, ground water was encountered at 21.5 feet below grade. Based on the wet condition of the soil samples it can be inferred that the present water table is at a depth of about 11 feet to 12 feet below grade.

The borings were backfilled immediately after drilling for safety reasons. Fluctuations in the groundwater level and the possible development of perched water table should be anticipated throughout the year depending on variations in water level in the drainage ditch and other factors not apparent at the time the borings were performed. The possibility of groundwater level fluctuation should be considered when developing the design and construction plans for the project. For design purposes the highest water level should be considered the same as the design flood level for the drainage ditch.

ANALYSIS AND RECOMMENDATIONS

Summary of Subgrade Soil Conditions

Our recommendations are based upon the proposed grades provided in the drawing identified as *Soil Borings, IL Route 68 at Wheeling Drainage Ditch, FAP Route 343, Section 105-1415.1-MFT, Cook County, Sheet 1*, and provided by Applied Technologies, Inc., dated March 17, 2010.

The boring logs and laboratory test results depict subsurface conditions only at the specified locations on the site. With these limitations, the following general geotechnical guideline recommendations are provided for the proposed structural and roadway improvements.

Foundation Recommendations

It is inferred from the TS&L drawing that the proposed bridge will be a precast concrete arch supported on existing footings and extended spread footing foundations for the widened roadway. Soil borings show variable conditions at and below 15 feet depth. Medium dense gravel or sand was encountered in three of the boring locations. At borings Number SB-4 soft silty clay was encountered to a depth of 16 feet, underlain by medium stiff silty clay extending to 18 feet and medium dense sand below a depth of 18 feet. The sandy soils are considered suitable for support of the proposed footings.

For foundations bearing on granular soils, the allowable bearing pressure depends on the width of the footing and the embedment depth. Considering a minimum embedment depth of 4 feet and a 7 foot wide footing as shown on the TS&L drawings it is our opinion that a net allowable bearing pressure of 4,000 psf can be used for the design of footings. Where unsuitable soils are encountered at the design footing elevation it is recommended that the existing unsuitable soils or loose soils be removed and backfilled with crushed stone such as IDOT gradation CA-7 or CA-1 placed in 9 inch loose lifts and each lift compacted to 95% of AASHTO specification T-180 (modified Proctor). Foundations placed on the compacted granular soils can also be designed for a bearing pressure of 4,000 psf. For foundations so designed and constructed we estimate settlement of less than 1 inch and differential settlement of less than ½ inch. New foundations should be designed to accommodate differential settlement of ¼ inch between the existing and new foundations.

The above recommendations also apply to wing wall foundations.

Scour Protection

Scour elevations for the existed structure were computed by the IDOT Hydraulic Unit and provided to GEC. We adjusted the 50 year scour depths as per guidelines in IDOT Bridge Manual based on the soil boring data. The adjusted scour levels are as follows:

TABLE 2: Adjusted Scour Elevations		
Boring	**Station and Offset (feet)**	**Scour Elevation (USGS)**
East Abutment		
SB-2	119+86.37, 19.41 LT	628
SB-3	119+92.15, 40.79 RT	626
West Abutment		
SB-1	118+97.54, 8.57 LT	622
SB-4	119+03.05, 45.43 RT	621

The scour levels are deeper than the base of the existing footings, which are at an elevation of 629 feet. Scour protection measures will be required in order to utilize the existing footings. It is our understanding that rip rap alone cannot be relied upon to provide adequate scour protection; therefore we proposed the following two alternatives.

<u>Option 1:</u> Install steel sheet piles around footings extending deeper than the maximum scour depth, with sufficient toe embedment and 2 feet of rip rap to provide additional protection. Sheet piles can be secured by anchoring the top of the sheeting to the footings.

<u>Option 2:</u> Provide a reinforced concrete slab below the stream bed extending from footing to footing. The slab should have extended cutoffs at the upstream and downstream edges along with the rip rap protection. This scheme is similar to the concept of a precast concrete culvert of box type. Scour analysis for a box culvert is different from that of a bridge type structure. The FHWA Manual does not include recommendations for box culverts in the HEC-18 publication used for scour evaluation.

Lateral Pressure for Arch Abutment and Wing Walls

Lateral pressure on the abutment of the arch will depend on the nature of the soil and its compaction characteristics. We recommend that the backfill consist of a granular material such as IDOT gradation CA-6 or CA-7 placed in 9 inch loose lifts and each lift compacted to 90% of AASHTO T-180 maximum density. The backfill should be placed evenly on both sides. For backfill placed and compacted using this procedure, at rest lateral pressure can be computed by using an at rest earth pressure coefficient of 0.5. For CA-6 or CA-7 backfill a moist unit weight of 130 pounds per cubic foot and a buoyant unit weight of 68 pounds per cubic foot can be considered for determining the lateral pressure.

The same lateral pressure values can be used for the design of wing walls. However, the design for cantilever wing walls can be based on an active earth pressure for which a coefficient of 0.4 can be utilized.

Resistance to lateral load can be computed by using an allowable friction factor of 0.35 at the base of the footing. Passive resistance should not be relied upon due to the potential for erosion.

Seismic Considerations

The following seismic data, based on AASHTO 17^{th} edition, is recommended for the design of the proposed structure:

Seismic Performance Category (SPC) = A

Bedrock Acceleration Coefficient (A) = 0.04g

Site Coefficient (S) = 1.0

Temporary Earth Retention for Stage Line

It is anticipated that the precast culvert bridge will be constructed in two stages with the southern half of the roadway closed during Stage 1. An earth retention system will be required at the stage line to maintain the pavement and traffic in the roadway which will remain in use during that stage of construction. Soil retention systems will also be required for new footings adjacent to existing footings which must be protected against undermining and damage. The soil conditions are such that cantilever sheet pile system for earth retention does not appear practical. Some kind of earth retention system with bracing will be required. The design of the retention system should be at the choice of the contractor.

Roadway Recommendations

It is our understanding that the proposed pavement structure will consist of Polymerized HMA Surface Course 2" and Polymerized HMA Binder Course 10 ¼". All typical sections are adequate to carry the estimated traffic loads, provided that the subgrade soils at the project site are prepared as discussed below.

The existing topsoil and fill soils are not considered suitable for support of the roadway pavement. For weak soils IDOT District One, Aggregate Subgrade Improvement 12" is required in the zone of reconstruction and widening from Station 113+57 to 116+00 and 121+00 to 123+00. We recommend that the subgrade materials be undercut an additional 6" below the Aggregate Subgrade 12" and replaced with Porous Granular Embankment, Subgrade (PGES) following the procedure described below in Stabilization of Subgrade Soils.

The actual need for removal and replacement of the above-listed areas with PGES should be determined in the field at the time of construction by the Engineer or Soil Inspector. These areas should be determined by testing with a static cone penetrometer and treated in accordance with Article 301.04 of the standard specifications and the undercut guidelines in the IDOT Subgrade

Stability Manual (SSM). After excavation to rough subgrade elevation, the Engineer or Soils Inspector should observe the behavior of the exposed subgrade by proofrolling in accordance with the recommendations below. Any PGES not needed at the time of construction should be deleted from the contract.

Stabilization of Subgrade Soils

Based on the information obtained in the borings, it is recommended that any topsoil, vegetation, existing pavement, and loose, soft, or otherwise unsuitable materials be removed from the entire project construction area. If the organic content of the topsoil is less than 10% and the thickness of the topsoil is less than 12 inches, the topsoil can remain in place. Otherwise, all topsoil should be removed to a depth of approximately 12 inches as described above. If the topsoil meets IDOT requirements for use in landscaped areas, the stripped topsoil may be removed and stockpiled for that purpose. If possible, the existing pavement materials should be removed or recycled. However, the necessary stripping depths will vary and should be closely monitored during construction to verify that all unsuitable materials have been removed.

Prior to fill placement in areas presently below design grade, and after rough grading is completed in other areas, the exposed subgrade should be proofrolled. Proofrolling can be accomplished using fully loaded tandem axle dump truck with a minimum gross weight of 20 tons, in dry weather conditions, under the observation of an experienced soil engineer. The purpose of proof rolling is to compact the subgrade and also to detect the presence of any overly soft soils that will require removal. Loose soils may be evident by the sponginess of the subgrade and sinking of the wheels of the proof rolling vehicle. Loose or disturbed soils showing such undesirable effects may only require scarification and recompaction in-place. If they cannot be compacted in place, areas exhibiting deflection should be dug out and backfilled with PGES, placed in 9 inch loose lifts with each lift compacted to AASHTO T-180 maximum density. These areas should be determined by testing with a static cone penetrometer and treated in accordance with Article 301.04 of the standard specifications and the undercut guidelines in the IDOT Subgrade Stability Manual (SSM).

Soft, wet and unstable subgrade soils may occur where shallow groundwater is present along the roadway. For stabilizing wet and soft subgrade areas, undercutting should be performed in a manner which will minimize disturbance of the undercut subgrade. Heavy equipment traffic directly on these materials should be minimized and in many cases undercutting with a backhoe would be preferable. The undercut areas should be replaced with a layer of granular materials. Geotextile fabrics or geogrids should be placed in undercut areas below the granular materials. As an alternative and depending upon weather conditions during construction, it may be possible to disc, aerate and recompact any higher moisture content clay soils.

Special attention should be given to achieving a good bond between roadway embankment fill and existing slopes, if present at the site. Care should be taken to avoid a potential shear plane at this interface. Loose or soft material on steeper slopes should be removed as part of the topsoil stripping operations. Particular attention should be given to any wet or seeping areas encountered on existing slopes. Any such areas could cause instability of a roadway embankment constructed over them by blocking natural drainage. The contractor should refer to IDOT Special Provision "Embankment I," included as Appendix E to this report. GEC recommends that the IDOT *District Benching Detail for Embankment Widenings* be included in the construction plans.

Any new fill placed in the upper 12 inches below the pavement section should consist of approved granular material that is free of organic matter and debris. The fill should be placed and compacted in lifts not exceeding 9 inches in loose thickness. Each fill lift should be compacted to a minimum of 90% of the maximum dry density of the material as determined by ASTM Specification D-1557. All fill should be compacted at a moisture content within 2% of the optimum moisture content as determined by the modified Proctor test.

Subgrade Drainage Recommendations

The Aggregate Subgrade 12" and PGES should be provided with proper drainage. The following under drains are recommended:

TABLE 3: Subgrade Drainage

From Station and Offset (feet)	To Station and Offset (feet)	Recommended Drainage Configuration
Reconstruction		
116+25	120+75	Transverse 4 inch underdrains
Widening		
114+30 RT	114+60 RT	30 foot longitudinal sections of 4 inch underdrains
114+26 LT	114+56 LT	
122+36 LT, RT	122+66 LT, RT	

These drains should be placed in a manner to allow for positive drainage. The depth of drains should be adjusted to insure they are at the low points of undercut or as determined in the field. The drains should be constructed as per check sheet 19 of the Department's Supplementary Specifications, adopted January 1, 2010.

No potential problems from groundwater and seepage are anticipated during the construction of the majority of the proposed roadway improvement. As a general precaution, the exposed subgrade soils should be kept free of standing water or excessive runoff. Nominally sloped grades, collector ditches with properly diverted flow, and sumps with conventional pumps should be sufficient to maintain dry working conditions. We recommend that the site be graded so that surface water flows away from the pavement areas and is not allowed to accumulate near or under the pavements. All ditch crossings should be cleaned of any debris and soft sediments before junction chambers are placed.

Longitudinal drains are recommended at the outside edge of pavement at low areas, and should be placed in 30 foot sections. Longitudinal drains are not required at the median locations.

Transverse 4-inch pipe underdrains are recommended at 300 foot intervals and in all low points in the profile grade and undercuts to provide drainage for the Aggregate Subgrade 12-inch and PGES.

These underdrains furnish an outlet for any surface and/or groundwater that would otherwise build up in the granular material and should be installed at the lowest point of the granular subgrade replacement. All underdrains and slope drains should be tied into storm sewers or ditches. Underdrains should be placed at a depth of 36 inches from the top of pavement or as deep as possible and in accordance with check sheet 19 of IDOT's Supplemental Specifications adopted 1/1/09. FA-1 or FA-2 backfill should be used.

Storm Sewer Recommendations

Sewers will be located in moist to wet granular soils. No special support measures are considered necessary. Support of sewer in trenches and backfilling should be as per Standard Specifications Construction Methods, and trench shoring and dewatering should be at the discretion of the contractor.

The installation of the sewer should be performed in accordance with the Illinois Department of

Transportation (IDOT) Standard Specification for Road and Bridge Construction. Based on soil boring information, storm sewers will generally be placed in moist to wet granular soils. GEC does not anticipate the need for any unique construction techniques for support of the proposed storm sewer. A qualified soil engineer should confirm the soil strength at the location of each proposed structure prior to the placement of any structure.

CONSTRUCTION CONSIDERATIONS

No unique soil-related construction problems other than those discussed in previous sections are foreseen for the roadway subgrade preparation.

For the construction of the bridge foundations it will be necessary to excavate to depths of 16 to 18 feet below grade. Stage line sheeting and a coffer dam for the construction of the new footings and reinforced concrete slab below the stream bed will likely be required. The design of the sheeting and shoring should be left to the prospective contractor subject to review by IDOT. Cantilever sheet pile for an excavation depth of 16 to 18 feet does not appear feasible and hence a braced coffer dam and sheeting scheme will be required. Excavation for the foundations will be in a wet ground and so a dewatering system will be required. The design of the dewatering system should also be left to the discretion of the contractor subject to approval by IDOT.

An experienced soil engineer should be retained to oversee all soil-related operations. All federal, state, and local regulations regarding work in excavation and trenches should be reviewed and followed.

GENERAL QUALIFICATIONS

The analysis and recommendations presented in this report are based upon the data obtained from the soil borings performed at the indicated locations and from any other information discussed in this report. This report does not reflect any variations which may occur between borings or across the site. The nature and extent of such variations may not become evident until construction. If variations become evident, it will be necessary to reevaluate the recommendations of this report.

Boring locations were spaced as closely as economically feasible for this project. Unanticipated subsurface conditions are sometimes encountered between borings.

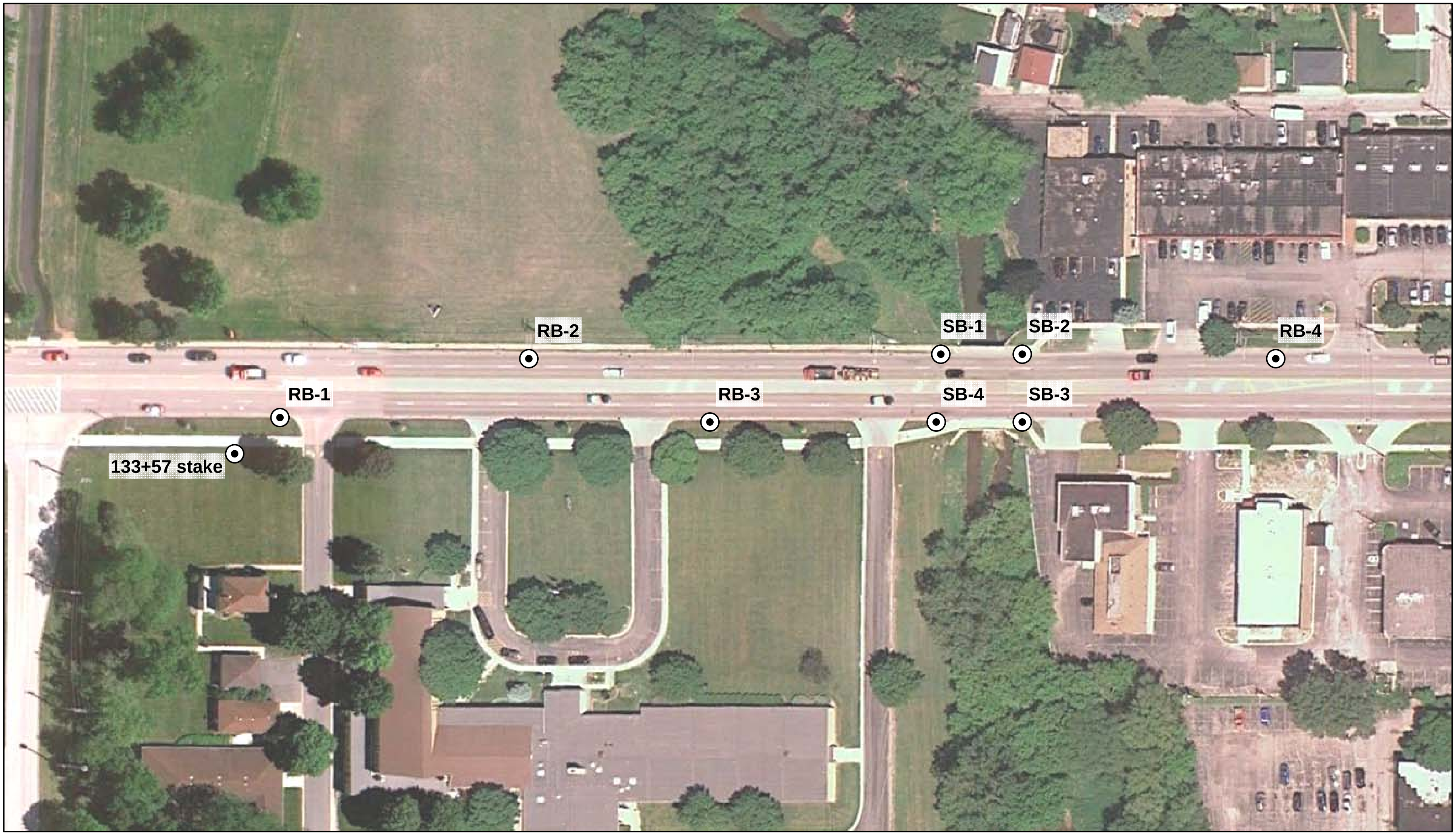
Additional recommendations or technical clarifications may be provided to the Client upon GEC's receipt of final design requirements. It is recommended that Ground Engineering Consultants, Inc. or their representative be retained for testing and observation during earthwork construction phases to help ensure that design requirements are met.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No other warranties, either expressed or implied, are intended or made. In the event that any changes in the nature, design or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing by the geotechnical engineer.

We appreciate this opportunity to be of service. Please do not hesitate to contact us with any questions regarding the contents of this report.

APPENDIX A

PROJECT LOCATION DIAGRAM



Date: 4/25/11	APPENDIX A **Project Location Diagram**	N	**Ground Engineering Consultants, Inc.** 350 Pfingsten Road, Suite 106 Northbrook, Illinois 60062 Tel: (847) 559-0085
Structure No: 016-2302	**IL 68, Dundee Road Over Wheeling Drainage Ditch** **Cook County, Illinois**		
Scale: Not to scale			

APPENDIX B

GENERAL SOIL MAP AND USDA REPORT

United States Department of Agriculture

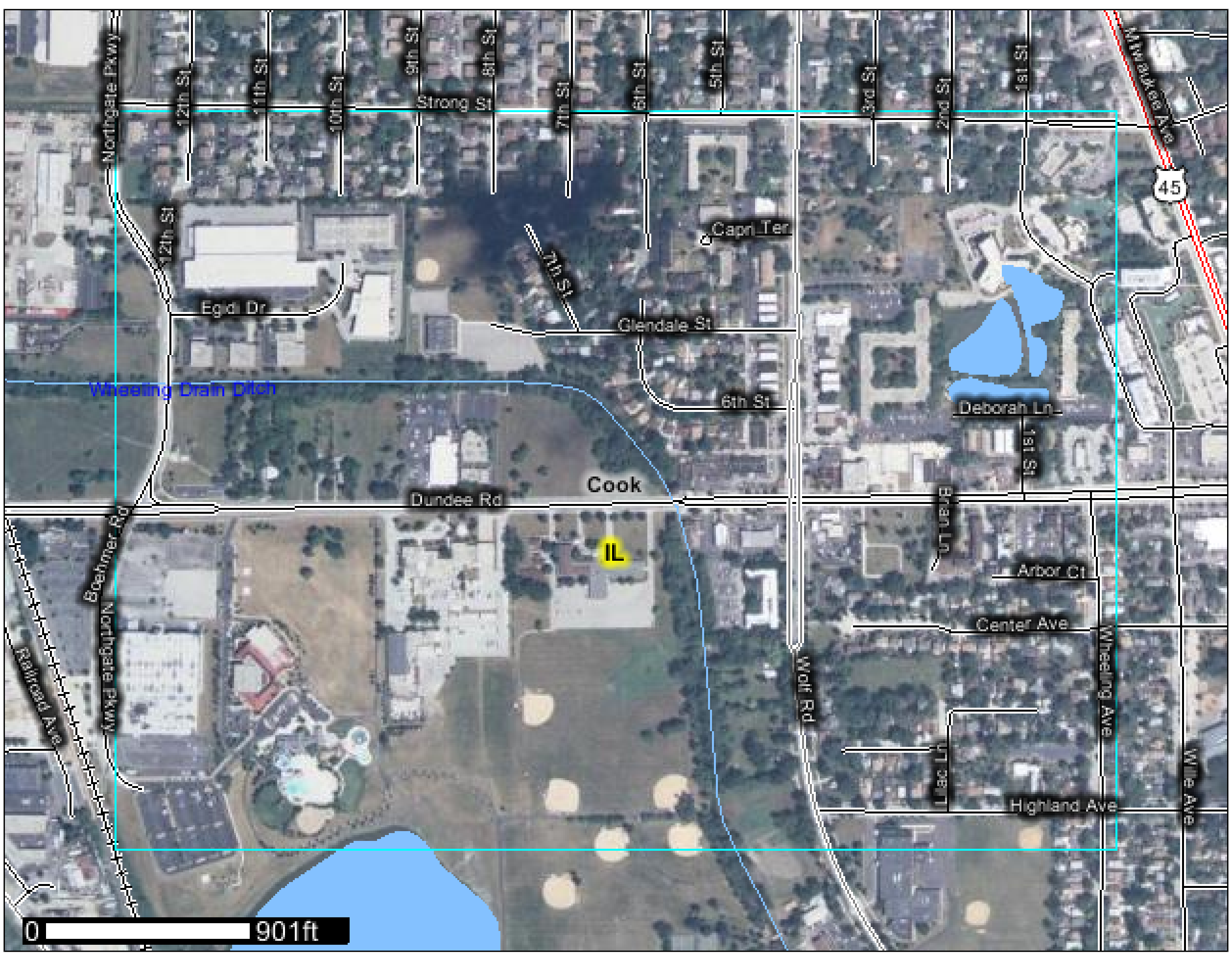
NRCS

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

Cook County, Illinois



May 3, 2011

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://soils.usda.gov/sqi/) 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://soils.usda.gov/contact/state_offices/).

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 Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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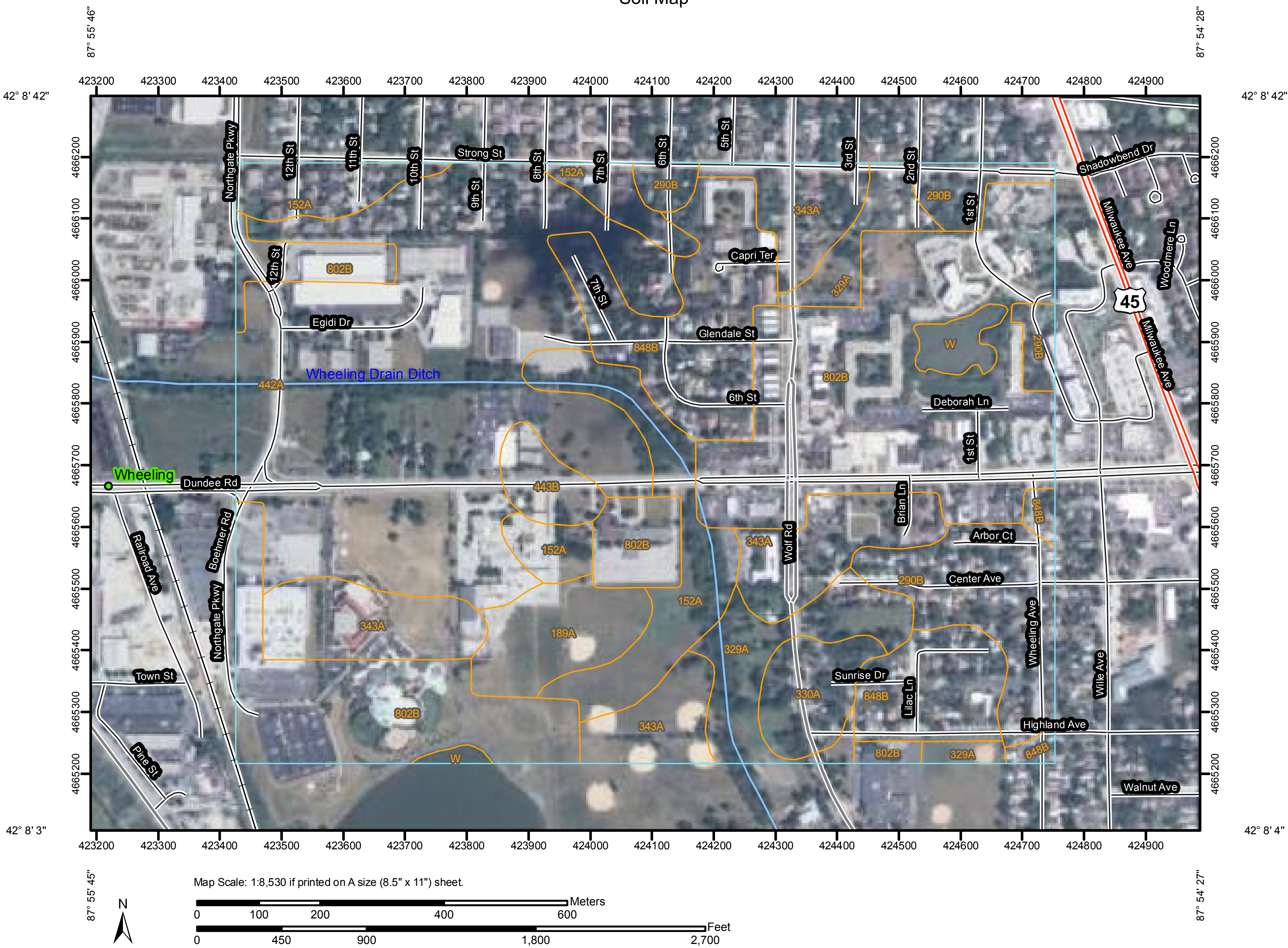
Contents

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.

Soil Map


87° 55' 46"
87° 54' 28"
42° 8' 42"
42° 8' 3"
42° 8' 4"
87° 55' 45"
87° 54' 27"
423200 423300 423400 423500 423600 423700 423800 423900 424000 424100 424200 424300 424400 424500 424600 424700 424800 424900
4666200 4666100 4666000 4665900 4665800 4665700 4665600 4665500 4665400 4665300 4665200
Wheeling Drain Ditch
Wheeling
Dundee Rd
Strong St
Northgate Pkwy
12th St
11th St
10th St
9th St
8th St
7th St
6th St
5th St
3rd St
2nd St
1st St
Shadowbend Dr
Milwaukee Ave
Woodmere Ln
45
Capri Ter
Egidi Dr
Glendale St
Deborah Ln
Boehmer Rd
Railroad Ave
Wolf Rd
Brian Ln
Arbor Ct
Center Ave
Wheeling Ave
Wille Ave
Sunrise Dr
Lilac Ln
Highland Ave
Walnut Ave
Town St
Pine St
152A
290B
343A
802B
329A
848B
W
442A
443B
189A
330A
Map Scale: 1:8,530 if printed on A size (8.5" x 11") sheet.
N
Meters
0 100 200 400 600
Feet
0 450 900 1,800 2,700

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Units

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

Gully

Short Steep Slope

Other

Political Features

Cities

Water Features

Oceans

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

MAP INFORMATION

Map Scale: 1:8,530 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:12,000.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 16N NAD83

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

Soil Survey Area: Cook County, Illinois
Survey Area Data: Version 5, Feb 12, 2010

Date(s) aerial images were photographed: 7/7/2007

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

Cook County, Illinois (IL031)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
152A	Drummer silty clay loam, 0 to 2 percent slopes	26.9	8.4%
189A	Martinton silt loam, 0 to 2 percent slopes	9.6	3.0%
290B	Warsaw silt loam, 2 to 4 percent slopes	21.8	6.8%
329A	Will silty clay loam, 0 to 2 percent slopes	17.1	5.3%
330A	Peotone silty clay loam, 0 to 2 percent slopes	6.8	2.1%
343A	Kane silt loam, 0 to 2 percent slopes	33.0	10.3%
442A	Mundelein silt loam, 0 to 2 percent slopes	82.4	25.8%
443B	Barrington silt loam, 2 to 4 percent slopes	4.3	1.4%
802B	Orthents, loamy, undulating	83.0	25.9%
848B	Drummer-Barrington-Mundelein complex, 1 to 6 percent slopes	31.5	9.9%
W	Water	3.3	1.0%
Totals for Area of Interest		**319.7**	**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.

Cook County, Illinois

152A—Drummer silty clay loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 510 to 930 feet
Mean annual precipitation: 28 to 40 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 180 days

Map Unit Composition

Drummer and similar soils: 90 percent

Description of Drummer

Setting

Landform: Outwash plains, ground moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess or other silty material and in the underlying outwash

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 40 percent
Available water capacity: Very high (about 12.5 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 14 inches: Silty clay loam
14 to 42 inches: Silty clay loam
42 to 50 inches: Loam
50 to 60 inches: Stratified loamy sand to silty clay loam

189A—Martinton silt loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 540 to 930 feet
Mean annual precipitation: 28 to 40 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 180 days

Map Unit Composition

Martinton and similar soils: 92 percent

Description of Martinton

Setting

Landform: Lake plains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water capacity: High (about 10.6 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 12 inches: Silt loam
12 to 39 inches: Silty clay loam
39 to 60 inches: Stratified sandy loam to silty clay

290B—Warsaw silt loam, 2 to 4 percent slopes

Map Unit Setting

Elevation: 510 to 930 feet
Mean annual precipitation: 28 to 40 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 180 days

Map Unit Composition

Warsaw and similar soils: 92 percent

Description of Warsaw

Setting

Landform: Stream terraces, outwash plains
Landform position (two-dimensional): Backslope, summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex

Parent material: Thin mantle of loess or other silty material and in the underlying loamy glaciofluvial deposits over sandy and gravelly glaciofluvial deposits

Properties and qualities

Slope: 2 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water capacity: Moderate (about 6.8 inches)

Interpretive groups

Land capability (nonirrigated): 2e

Typical profile

0 to 10 inches: Silt loam
10 to 24 inches: Clay loam
24 to 34 inches: Gravelly sandy clay loam
34 to 60 inches: Stratified gravelly loamy sand to extremely gravelly coarse sand

329A—Will silty clay loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 510 to 930 feet
Mean annual precipitation: 28 to 40 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 180 days

Map Unit Composition

Will and similar soils: 90 percent

Description of Will

Setting

Landform: Outwash plains, stream terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Thin mantle of loess or other silty material and in the underlying loamy glaciofluvial deposits over sandy and gravelly glaciofluvial deposits

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 12 inches

Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 35 percent
Available water capacity: Low (about 5.7 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 16 inches: Silty clay loam
16 to 24 inches: Loam
24 to 60 inches: Stratified gravelly loamy sand to extremely gravelly coarse sand

330A—Peotone silty clay loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 510 to 930 feet
Mean annual precipitation: 28 to 40 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 180 days

Map Unit Composition

Peotone and similar soils: 90 percent

Description of Peotone

Setting

Landform: Ground moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Colluvium

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
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 content: 15 percent
Available water capacity: High (about 10.3 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 13 inches: Silty clay loam
13 to 50 inches: Silty clay
50 to 60 inches: Silty clay loam

343A—Kane silt loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 680 to 1,020 feet
Mean annual precipitation: 30 to 40 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 180 days

Map Unit Composition

Kane and similar soils: 90 percent

Description of Kane

Setting

Landform: Outwash plains, stream terraces, kames
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Thin mantle of loess or other silty material and in the underlying loamy glaciofluvial deposits over sandy and gravelly glaciofluvial deposits

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 20 to 40 inches to strongly contrasting textural stratification
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Available water capacity: Low (about 5.4 inches)

Interpretive groups

Land capability (nonirrigated): 2s

Typical profile

0 to 5 inches: Silt loam
5 to 12 inches: Silty clay loam
12 to 22 inches: Silty clay loam
22 to 29 inches: Sandy clay loam
29 to 60 inches: Stratified gravelly loamy sand to extremely gravelly coarse sand

442A—Mundelein silt loam, 0 to 2 percent slopes

Map Unit Setting

Elevation: 600 to 970 feet
Mean annual precipitation: 28 to 40 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 180 days

Map Unit Composition

Mundelein and similar soils: 90 percent

Description of Mundelein

Setting

Landform: Outwash plains, stream terraces
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess or other silty material and in the underlying outwash

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water capacity: High (about 10.0 inches)

Interpretive groups

Land capability (nonirrigated): 1

Typical profile

0 to 17 inches: Silt loam
17 to 31 inches: Silty clay loam
31 to 42 inches: Silt loam
42 to 60 inches: Stratified sandy loam to silt loam

443B—Barrington silt loam, 2 to 4 percent slopes

Map Unit Setting

Elevation: 600 to 970 feet
Mean annual precipitation: 28 to 40 inches

Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 180 days

Map Unit Composition
Barrington and similar soils: 90 percent

Description of Barrington

Setting
Landform: Outwash plains, stream terraces
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess or other silty material and in the underlying outwash

Properties and qualities
Slope: 2 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water capacity: High (about 9.9 inches)

Interpretive groups
Land capability (nonirrigated): 2e

Typical profile
0 to 11 inches: Silt loam
11 to 32 inches: Silty clay loam
32 to 42 inches: Silt loam
42 to 60 inches: Stratified fine sand to silt loam

802B—Orthents, loamy, undulating

Map Unit Setting
Elevation: 510 to 930 feet
Mean annual precipitation: 28 to 40 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 180 days

Map Unit Composition
Orthents, loamy and similar soils: 92 percent

Description of Orthents, Loamy

Setting
Landform: Outwash plains, ground moraines
Landform position (two-dimensional): Summit, backslope

Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Earthy fill

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 42 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Available water capacity: High (about 9.8 inches)

Interpretive groups

Land capability (nonirrigated): 2e

Typical profile

0 to 6 inches: Loam
6 to 60 inches: Clay loam

848B—Drummer-Barrington-Mundelein complex, 1 to 6 percent slopes

Map Unit Setting

Elevation: 510 to 970 feet
Mean annual precipitation: 28 to 40 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 180 days

Map Unit Composition

Drummer and similar soils: 35 percent
Mundelein and similar soils: 30 percent
Barrington and similar soils: 30 percent

Description of Drummer

Setting

Landform: Outwash plains, ground moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess or other silty material and in the underlying outwash

Properties and qualities

Slope: 1 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)

Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 40 percent
Available water capacity: Very high (about 12.5 inches)

Interpretive groups

Land capability (nonirrigated): 2w

Typical profile

0 to 14 inches: Silty clay loam
14 to 42 inches: Silty clay loam
42 to 50 inches: Loam
50 to 60 inches: Stratified loamy sand to silty clay loam

Description of Barrington

Setting

Landform: Outwash plains, stream terraces
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loess or other silty material and in the underlying outwash

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water capacity: High (about 9.9 inches)

Interpretive groups

Land capability (nonirrigated): 2e

Typical profile

0 to 11 inches: Silt loam
11 to 32 inches: Silty clay loam
32 to 42 inches: Silt loam
42 to 60 inches: Stratified fine sand to silt loam

Description of Mundelein

Setting

Landform: Outwash plains, stream terraces
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess or other silty material and in the underlying outwash

Properties and qualities

Slope: 1 to 2 percent

Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water capacity: High (about 10.0 inches)

Interpretive groups

Land capability (nonirrigated): 1

Typical profile

0 to 17 inches: Silt loam
17 to 31 inches: Silty clay loam
31 to 42 inches: Silt loam
42 to 60 inches: Stratified sandy loam to silt loam

W—Water

Map Unit Composition

Water: 100 percent

Description of Water

Setting

Landform: Channels, drainageways, lakes, oxbows, perenial streams, rivers
Parent material: Water

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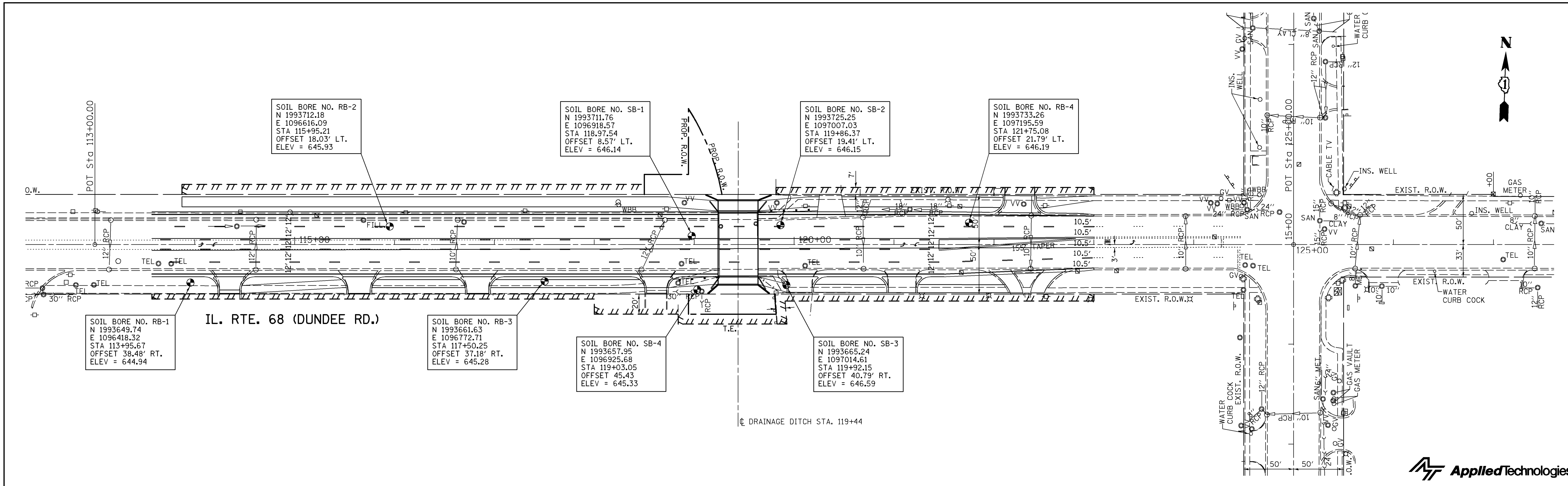
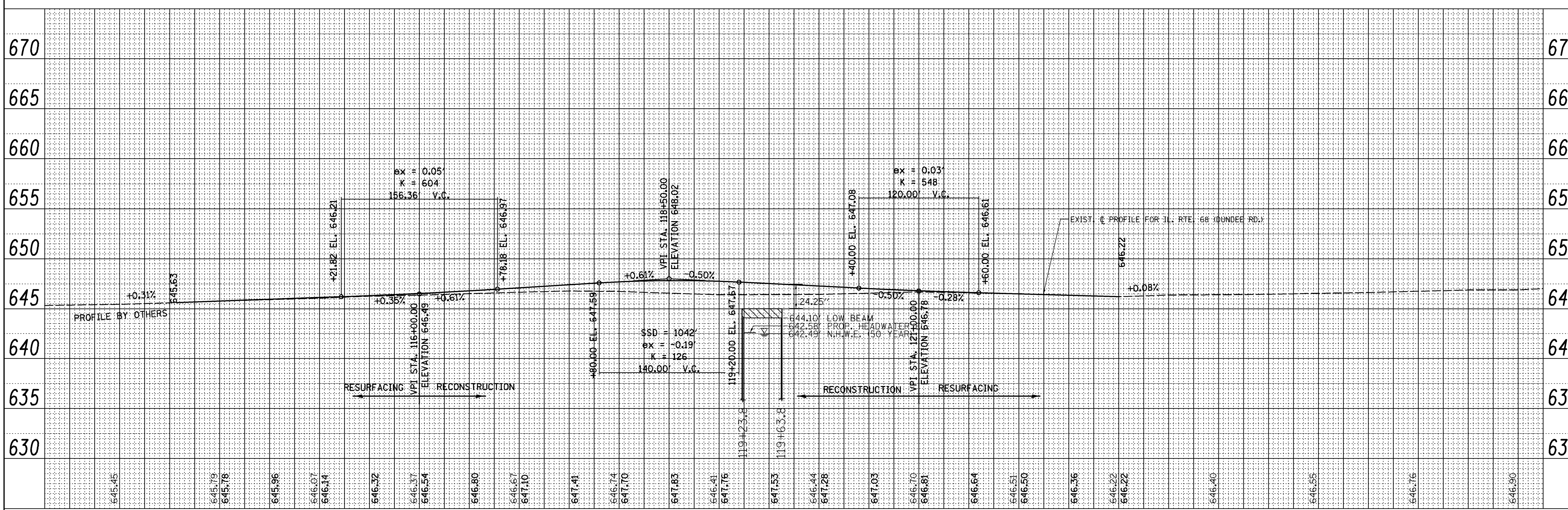
APPENDIX C

SOIL PROFILE SHEETS





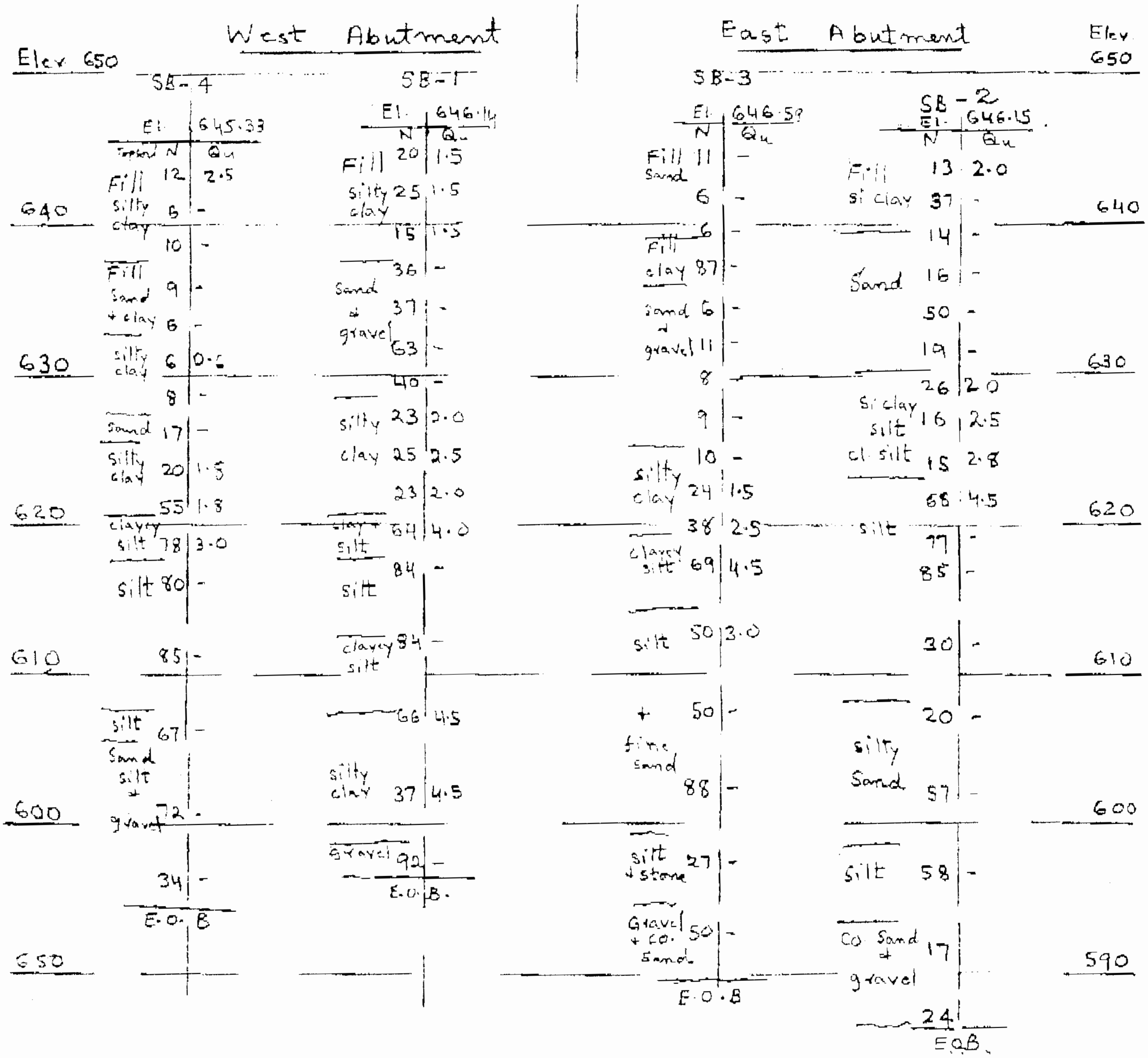
FILE NAME = SOIL BORES	USER NAME = $USER$	DESIGNED - JJD	REVISED -	**STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION**	**SOIL BORES IL. ROUTE 68 AT WHEELING DRAINAGE DITCH**
	PLOT SCALE = 1"=50'	DRAWN - RDS	REVISED -		SCALE: 1"=50' SHEET NO. OF SHEETS STA. TO STA.
	PLOT DATE = 3-17-10	CHECKED -	REVISED -		
		DATE - 03-17-10	REVISED -		

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
343	105-1415.1-MFT	COOK	1	1
		CONTRACT NO. 11574		

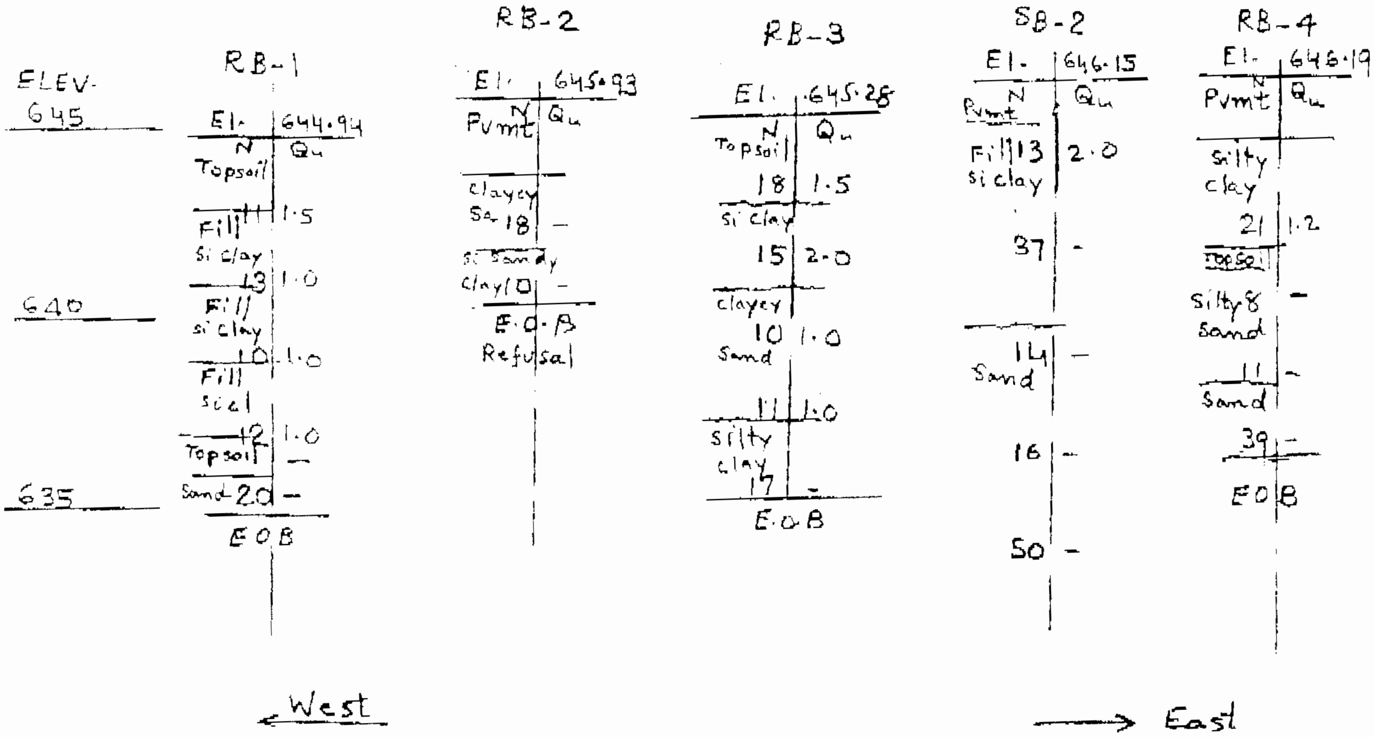
FED. ROAD DIST. NO. | ILLINOIS | FED. AID PROJECT

PLAN: SURVEYED / PLOTTED / ALIGNMENT CHECKED / R.T. OF WAY CHECKED / CADD FILE NAME / NOTE BOOK / NO. / BY / DATE

PROFILE: SURVEYED / PLOTTED / GRADES CHECKED / B.M. NOTED / STRUCTURE NOTAT'NS CHK'D / NOTE BOOK / NO. / BY / DATE



SOIL PROFILE at PROPOSED BRIDGE



SOIL PROFILE ROADWAY BORINGS

APPENDIX D

BORING LOGS

Ground Engineering Consultants, Inc.

SOIL BORING LOG

DRILLER:

Date 2/26/10

ROUTE IL Route 68 **DESCRIPTION** Dundee Road over Wheeling Drainage Ditch **LOGGED BY** MG

SECTION 105-1415-1-MFT **LOCATION** FAP Route 343, **SEC.** , **TWP.** , **RNG.**

COUNTY Cook **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Manual

STRUCT. NO. 016-2302
Station 119+44

BORING NO. RB-1
Station 113+95.67
Offset 38.48ft RT
Ground Surface Elev. 644.94 ft

Surface Water Elev. ____ ft
Stream Bed Elev. ____ ft

Groundwater Elev.:
First Encounter ____ ft
Upon Completion ____ ft
After ____ **Hrs.** ____ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Topsoil, black (frozen)			2		
			2	1.5	23.0
			9		
	642.94		9		
Silty clay, trace sand, stone, topsoil & roots, black (FILL)			8		
			8	1.0	13.0
			7		
	640.94		8		
Silty clay, some sand & stone, trace organics, black & dark gray, medium dense, moist (FILL)			5		
		-5	5	1.0	15.0
			5		
	638.94		7		
Silty clay, some stone & topsoil, brown & dark gray, stiff (FILL)			6		
			6	1.0	17.0
			6		
	636.94		7		
Topsoil, black			9		
	635.94		10		24.0
Coarse sand & small gravel, brown, gray, wet, medium dense			10		
	634.94	-10	10		
End of Boring					
		-15			
		-20			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Ground Engineering Consultants, Inc.

SOIL BORING LOG

DRILLER:

Date 2/25/10

ROUTE IL Route 68 **DESCRIPTION** Dundee Road over Wheeling Drainage Ditch **LOGGED BY** MG

SECTION 105-1415-1-MFT **LOCATION** FAP Route 343, **SEC.** , **TWP.** , **RNG.**

COUNTY Cook **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Manual

STRUCT. NO. 016-2302
Station 119+44

BORING NO. RB-2
Station 115+95.21
Offset 18.03ft LT
Ground Surface Elev. 645.93 ft

Surface Water Elev. ____ ft
Stream Bed Elev. ____ ft

Groundwater Elev.:
First Encounter ____ ft
Upon Completion ____ ft
After ____ **Hrs.** ____ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
6" Asphalt over 7" concrete over crushed stone	643.93				
Clayey sand, trace stone, dark brown, moist, medium dense (FILL)			8		
			9		17.0
			9		
	641.93		9		
Silty sandy clay, trace stone & wood, dark brown, moist, medium dense (FILL)			6		
		-5	5		18.0
	640.43		5		
Refusal to drilling End of Boring					
		-10			
		-15			
		-20			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Ground Engineering Consultants, Inc.

SOIL BORING LOG

DRILLER:

Date 2/26/10

ROUTE IL Route 68 **DESCRIPTION** Dundee Road over Wheeling Drainage Ditch **LOGGED BY** MG

SECTION 105-1415-1-MFT **LOCATION** FAP Route 343, **SEC.** , **TWP.** , **RNG.**

COUNTY Cook **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Manual

STRUCT. NO. 016-2302
Station 119+44

BORING NO. RB-3
Station 117+50.25
Offset 37.18ft RT
Ground Surface Elev. 645.28 ft

Surface Water Elev. ____ ft
Stream Bed Elev. ____ ft

Groundwater Elev.:
First Encounter ____ ft
Upon Completion ____ ft
After ____ **Hrs.** ____ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Topsoil & clay, trace roots & gravel, black, (FILL)			7		
			9	1.5	20.0
			9		
	643.28		10		
Silty clay, trace sand & stone, topsoil & roots, dark brown & gray, stiff (FILL)			6		
			6	2.0	17.0
			9		
	641.28		7		
Clayey sand & silt, trace organics, gravel & brick, brown to dark gray, medium dense (FILL) Layer of brown silt at 5' & 7'			2		
		-5	4	1.0	24.0
			6		
			6		
			4		
			5	1.0	19.0
			6		
	637.28		7		
Silty clay, trace stone & sand & organics, dark gray & brown, medium dense (FILL)			8		
			8		23.0
			9		
	635.28	-10	7		
End of Boring					
		-15			
		-20			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, from 137 (Rev. 8-99)

Ground Engineering Consultants, Inc.

SOIL BORING LOG

DRILLER:

Date 2/25/10

ROUTE IL Route 68 **DESCRIPTION** Dundee Road over Wheeling Drainage Ditch **LOGGED BY** MG

SECTION 105-1415-1-MFT **LOCATION** FAP Route 343, **SEC.** , **TWP.** , **RNG.**

COUNTY Cook **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Manual

STRUCT. NO. 016-2302
Station 119+44

BORING NO. RB-4
Station 121+75.08
Offset 21.79ft LT
Ground Surface Elev. 646.19 ft

Surface Water Elev. ____ ft
Stream Bed Elev. ____ ft

Groundwater Elev.:
First Encounter ____ ft
Upon Completion ____ ft
After ____ **Hrs.** ____ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
6" Asphalt over 5" concrete & 6" crushed stone	644.69				
Silty clay, some sand, trace brick & fine gravel, brown, stiff (FILL)			5		
			8	1.2	15.0
			13		
			12		
	641.69		1		
Topsoil, black	641.19	-5	4		24.0
Fine silty sand & clay, some organics, brown & black, loose (FILL)			4		
	640.19		4		
Silt & clayey fine to medium sand, moist, medium dense			4		
			5		21.0
			6		
	638.19		9		
Fine to coarse sand & fine gravel, brown, wet, dense			14		
			17		12.0
			22		
	636.19	-10	23		
End of Boring					
		-15			
		-20			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Ground Engineering Consultants, Inc.

SOIL BORING LOG

DRILLER:

Date 2/26/10

ROUTE IL Route 68 **DESCRIPTION** Dundee Road over Wheeling Drainage Ditch **LOGGED BY** MG

SECTION 105-1415-1-MFT **LOCATION** FAP Route 343, **SEC.** , **TWP.** , **RNG.**

COUNTY Cook **DRILLING METHOD** Mud Rotary **HAMMER TYPE** Manual

STRUCT. NO. 016-2302
Station 119+44

BORING NO. SB-1
Station 118+97.54
Offset 8.57ft LT
Ground Surface Elev. 646.14 ft

Surface Water Elev. ______ ft
Stream Bed Elev. ______ ft

Groundwater Elev.:
First Encounter ______ ft
Upon Completion ______ ft
After ______ **Hrs.** ______ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
6" Asphalt over 7" concrete					
	645.14				
Silty clay & sand, some small			13		
gravel, dark gray, stiff (FILL)			10	1.5	14.0
Encountered refusal at 6'. Moved			10		
boring 8' South & 4' West					
			15		
			10	1.5	15.0
		-5	15		
	640.14				
Silty clay & sand, some small			8		
gravel, trace brick, dark gray &			9	1.5	26.0
brown, medium dense (FILL)			6		
	637.14		7		
Fine to coarse sand, some fine			19		14.0
gravel, trace silt, brown, dense		-10	17		
	635.14				
Gravel & sand, some silt, gray,			10		
dense			15		14.0
			22		
	632.14		15		
Gravel, gray, wet, dense			23		6.0
		-15	40		
			8		
	629.14		24		10.0
Coarse sand, gray, medium dense			16		
	627.64				
Silty clay, gray, very stiff			11		
			9	2.0	23.0
		-20	14		

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Silty clay, gray, very stiff					
(continued)					
			10		
			11	2.5	14.0
			16		
			8		
			9	2.0	14.0
		-25	14		
	620.14				
Clay & silt, gray, hard			12		
			14	4.0	12.0
			50		
	617.64				
Silt & sand, trace clay, gray, wet,			25		
dense			34		20.0
	616.14	-30	50		
Silt, gray, dense					
	612.14		34		
Clayey silt, gray, hard			50		19.0
		-35			
	607.14		14		
Silty sand, gray, dense			16	4.5	20.0
	606.14	-40	50		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Ground Engineering Consultants, Inc.

SOIL BORING LOG

DRILLER:

Date 2/26/10

ROUTE IL Route 68 **DESCRIPTION** Dundee Road over Wheeling Drainage Ditch **LOGGED BY** MG

SECTION 105-1415-1-MFT **LOCATION** FAP Route 343, **SEC.** , **TWP.** , **RNG.**

COUNTY Cook **DRILLING METHOD** Mud Rotary **HAMMER TYPE** Manual

STRUCT. NO. 016-2302
Station 119+44

BORING NO. SB-1
Station 118+97.54
Offset 8.57ft LT
Ground Surface Elev. 646.14 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion ft
After Hrs. ft

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Silty clay, trace gravel, gray, hard		9		
		18	4.5	14.0
	-45	19		
598.14				
Gravel with limestonepieces, some silt & clay, gray, very dense		37		
		42		15.0
596.14	-50	50		
End of Boring				
	-55			
	-60			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Ground Engineering Consultants, Inc.

SOIL BORING LOG

DRILLER:

Date 2/25/10

ROUTE IL Route 68 **DESCRIPTION** Dundee Road over Wheeling Drainage Ditch **LOGGED BY** MG

SECTION 105-1415-1-MFT **LOCATION** FAP Route 343, **SEC.** , **TWP.** , **RNG.**

COUNTY Cook **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Manual

STRUCT. NO. 016-2302
Station 119+44

BORING NO. SB-2
Station 119+86.37
Offset 19.41ft LT
Ground Surface Elev. 646.15 ft

Surface Water Elev. ______ ft
Stream Bed Elev. ______ ft

Groundwater Elev.:
First Encounter ______ ft
Upon Completion 624.7 ft ▽
After ____ **Hrs.** ______ ft

Description	Elev. (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
6" Asphalt over 5" concrete	645.15				
Silty clay, some small gravel & sand, gray, medium stiff			8		
			5	2.0	18.0
	643.15		8		
Silty clay & sand, trace wood, gray, wet			9		
			17		18.0
		-5	20		
	639.65		6		
Fine to medium sand & gravel, gray, moist, medium dense			8		13.0
			6		
	637.15		8		
Fine to coarse sand, trace stone & clay, gray, moist to wet, medium dense to dense			8		13.0
		-10	8		
			13		
			25		5.0
	632.65		25		
Silty fine to coarse sand, trace fine gravel, gray, wet, medium dense			8		
			10		16.0
		-15	9		
	629.65		23		
Silty clay, gray, very stiff			19	2.0	24.0
			7		
	627.15		7		
Silt, gray, dry, medium dense			8	2.5	20.0
	626.15	-20	8		

Description	Elev. (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Clayey silt, gray, medium dense		▽	5		
			7	2.8	25.0
	623.15		8		
Silt, trace clay, gray, dry, dense			19		
			31	4.5	18.0
		-25	37		
			27		
			50		16.0
			28		
			43		15.0
	613.15	-30	42		
Silt, trace clay, gray, wet, dense			10		
			15		21.0
	608.15	-35	15		
Silty sand, gray, wet, medium dense			11		
			10		22.0
		-40	10		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Ground Engineering Consultants, Inc.

SOIL BORING LOG

DRILLER:

Date 2/25/10

ROUTE IL Route 68 **DESCRIPTION** Dundee Road over Wheeling Drainage Ditch **LOGGED BY** MG

SECTION 105-1415-1-MFT **LOCATION** FAP Route 343, **SEC.** , **TWP.** , **RNG.**

COUNTY Cook **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** Manual

STRUCT. NO. 016-2302
Station 119+44

BORING NO. SB-2
Station 119+86.37
Offset 19.41ft LT
Ground Surface Elev. 646.15 ft

Surface Water Elev. ____ ft
Stream Bed Elev. ____ ft

Groundwater Elev.:
First Encounter ____ ft
Upon Completion 624.7 ft ▽
After ____ **Hrs.** ____ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Silty sand, gray, wet, medium dense *(continued)*			19		
			29		20.0
		-45	28		
	598.15				
Silt, one large stone, gray, wet, dense			32		
			25		23.0
		-50	33		
	593.15				
Coarse sand, some stone, gray, wet, medium dense			10		
			9		14.0
		-55	8		
	588.15				
Fine gravel & coarse sand, gray, wet, dense			12		
			16		14.0
	586.15	-60	8		

End of Boring

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Ground Engineering Consultants, Inc.

SOIL BORING LOG

DRILLER:

Date 3/1/10

ROUTE IL Route 68 **DESCRIPTION** Dundee Road over Wheeling Drainage Ditch **LOGGED BY** MG

SECTION 105-1415-1-MFT **LOCATION** FAP Route 343, **SEC.** , **TWP.** , **RNG.**

COUNTY Cook **DRILLING METHOD** Mud Rotary **HAMMER TYPE** Manual

STRUCT. NO. 016-2302
Station 119+44

BORING NO. SB-3
Station 119+92.15
Offset 40.79ft RT
Ground Surface Elev. 646.59 ft

Surface Water Elev. ____ ft
Stream Bed Elev. ____ ft

Groundwater Elev.:
First Encounter ____ ft
Upon Completion ____ ft
After ____ **Hrs.** ____ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Fine to medium sand, some gravel, dark brown, moist, medium dense to loose (FILL)			10		
			6		6.0
			5		
			4		
			3		8.0
		-5	3		
	640.59				
Fine to medium sand,trace stone, dark brown, moist, loose (FILL)			4		
			3		6.0
			3		
	638.59				
Silty clay, some organic at 9', some wood & large gravel, moist, dense (FILL)			37		
			50		14.0
		-10			
	635.59				
Fine to coarse sand & fine gravel, brown, wet, loose to medium dense			3		
			3		19.0
			3		
			6		
			6		17.0
	631.59	-15	5		
Gravel & sand, brown, wet loose			6		
			4		12.0
			4		
			8		
			4		13.0
		-20	5		

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gravel & sand, brown, wet loose *(continued)*	625.59				
Small to large stone, wet, gray, medium dense			7		
			5		17.0
	624.09		5		
Silty clay, gray, stiff			12		
			11	1.5	15.0
	621.59	-25	13		
Silty clay, trace stone, gray, very stiff			9		
	619.59		19	2.5	19.0
Sand & gravel, wet, dense			19		
	617.59		19		
Clayey silt, some stone, gray, dense			50	4.5	18.0
		-30			
	613.59				
Silt, some clay, gray, wet, very dense			50		
				3.0	14.0
		-35			
	609.59				
Silt & fine sand, gray, wet, very dense			50		
					20.0
		-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Ground Engineering Consultants, Inc.

SOIL BORING LOG

DRILLER:

Date 3/1/10

ROUTE IL Route 68 **DESCRIPTION** Dundee Road over Wheeling Drainage Ditch **LOGGED BY** MG

SECTION 105-1415-1-MFT **LOCATION** FAP Route 343, **SEC.** , **TWP.** , **RNG.**

COUNTY Cook **DRILLING METHOD** Mud Rotary **HAMMER TYPE** Manual

STRUCT. NO. 016-2302
Station 119+44

BORING NO. SB-3
Station 119+92.15
Offset 40.79ft RT
Ground Surface Elev. 646.59 ft

Surface Water Elev. ____ ft
Stream Bed Elev. ____ ft

Groundwater Elev.:
First Encounter ____ ft
Upon Completion ____ ft
After ____ **Hrs.** ____ ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Silt & fine sand, gray, wet, very dense *(continued)*			38		
			50		21.0
		-45			
	598.59				
Silt & stone, trace clay, gray, wet, very dense			7		
			12		17.0
		-50	15		
	594.59				
Gravel & coarse sand, gray, wet, medium dense			50		
					16.0
		-55			
	589.59				
Auger Refusal End of Boring					
		-60			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Ground Engineering Consultants, Inc.

SOIL BORING LOG

DRILLER:

Date 3/1/10

ROUTE IL Route 68 **DESCRIPTION** Dundee Road over Wheeling Drainage Ditch **LOGGED BY** MG

SECTION 105-1415-1-MFT **LOCATION** FAP Route 343, **SEC.** , **TWP.** , **RNG.**

COUNTY Cook **DRILLING METHOD** Mud Rotary **HAMMER TYPE** Manual

STRUCT. NO. 016-2302
Station 119+44

BORING NO. SB-4
Station 119+03.05
Offset 45.43ft
Ground Surface Elev. 645.33 ft

Surface Water Elev. ______ ft
Stream Bed Elev. ______ ft

Groundwater Elev.:
First Encounter ______ ft
Upon Completion ______ ft
After ____ **Hrs.** ______ ft

Description	Bottom Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Topsoil, silty clay, trace roots, gravel & brick, dark gray, very stiff (FILL)	642.83		4		
			6	2.5	18.0
			6		
Silty clay, some stone, trace roots, dark gray, wet, soft (FILL)			2		
			3		33.0
		-5	3		
			3		
			5		29.0
	637.33		5		
Sand & stone, some clay, trace organic, dark gray, wet, loose (FILL)			3		
			5		15.0
	634.33	-10	4		
Sandy clay & stone, trace organic, wet, dark gray, loose (FILL)			2		
			3		23.0
	632.33		3		
Silty clay, some organic, trace sand, dark gray, soft			2		
			2	0.6	21.0
	629.33	-15	4		
Silty clay, some stone, trace organic & sand, dark gray, wet, medium stiff			2		
			4		25.0
	627.33		4		
Sand, some stone & silt, dark gray, medium dense			3		
			7		24.0
	625.33	-20	10		

Description	Bottom Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Silty clay, trace stone, gray, stiff			6		
			9	1.8	15.0
	622.33		11		
Silty clay, some stone with silt & sand layers, gray, stiff			10		
			25	1.8	17.0
	620.33	-25	30		
Clayey silt, some stone, gray, very stiff			28		
	617.33		50	3.0	16.0
Silt, some gravel, trace clay, gray, very dense			30		
		-30	50	3.5	16.0
			35		
	607.33	-35	50		20.0
Silt & fine sand, gray, wet, dense			16		
			31		16.0
	605.33	-40	36		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, from 137 (Rev. 8-99)

Ground Engineering Consultants, Inc.

SOIL BORING LOG

DRILLER:

Date 3/1/10

ROUTE IL Route 68 **DESCRIPTION** Dundee Road over Wheeling Drainage Ditch **LOGGED BY** MG

SECTION 105-1415-1-MFT **LOCATION** FAP Route 343, **SEC.** , **TWP.** , **RNG.**

COUNTY Cook **DRILLING METHOD** Mud Rotary **HAMMER TYPE** Manual

STRUCT. NO. 016-2302
Station 119+44

BORING NO. SB-4
Station 119+03.05
Offset 45.43ft
Ground Surface Elev. 645.33 ft

Surface Water Elev. ____ ft
Stream Bed Elev. ____ ft

Groundwater Elev.:
First Encounter ____ ft
Upon Completion ____ ft
After ____ **Hrs.** ____ ft

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Sand, silt & gravel, gray, wet, dense				
		22		
		50		14.0
	-45			
		21		
		19		16.0
	-50	15		
594.33				
Refusal to auger drilling End of Boring				
	-55			
	-60			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, from 137 (Rev. 8-99)

APPENDIX E

IDOT SPECIAL PROVISION "EMBANKMENT I"

EMBANKMENT I

Effective: January 1, 2007

Description. This work shall be according to Section 205 of the Standard Specifications except for the following.

Material. All material shall be approved by the District Geotechnical Engineer. The proposed material must meet the following requirements.

a) The laboratory Standard Dry Density shall be a minimum of 1450 kg/cu m (90 lb/cu ft) when determined in accordance with AASHTO T 99.

b) The organic content shall be less than ten percent determined in accordance with AASHTO designation T 194 (Wet Combustion).

c) Soils which demonstrate the following properties should be restricted to the interior of the embankment and shall be covered on both the sides and top of the embankment by a minimum of 900 mm (3 ft) of soil not considered detrimental in terms of erosion potential or excess volume change.

    1) A grain size distribution with less than 35 percent passing the number 75 um (#200) sieve.

    2) A plasticity index (PI) of less than 11.

    3) A liquid limit (LL) in excess of 45.

d) Reclaimed asphalt shall not be used within the ground water table or as a fill if ground water is present.

CONSTRUCTION REQUIREMENTS

Samples. Embankment material shall be sampled, tested, and approved before use. The contractor shall identify embankment sources, and provide equipment as the Engineer requires, for the collection of samples from those sources. Samples will be furnished to the Geotechnical Engineer a minimum of three weeks prior to use in order that laboratory tests for approval and compaction can be performed. Embankment material placement cannot begin until tests are completed and approval given.

Placing Material. In addition to Article 202.03, broken concrete, reclaimed asphalt with no expansive aggregate, or uncontaminated dirt and sand generated from construction or demolition activities shall be placed in 150 mm (6 in.) lifts and disked with the underlying lift until a uniform homogenous material is formed. This process also applies to the overlaying lifts. The disk must have a minimum of 600 mm (24 in.) diameter blade.

Compaction. Soils classification for moisture content control will be determined by the Soils Inspector using visual field examination techniques and the IDH Textural Classification Chart.

When tested for density in place each lift shall have a maximum moisture content as follows.

a) A maximum of 110 percent of the optimum moisture for all forms of clay soils.

b) A maximum of 105 percent of the optimum moisture for all forms of clay loam soils.