

GEOTECHNICAL ENGINEERING REPORT

for

UNION GROVE CEMETERY LAND SITE

TOWN OF CASSIAN

ONEIDA COUNTY, WISCONSIN

December 2014


GEOTECHNICAL ENGINEERING REPORT

Prepared for

NEWMARK GRUBB KNIGHT FRANK
3424 PEACHTREE ROAD, NE
SUITE 800
ATLANTA, GA 30326

CWE Project #44441400

I, David W. Buckner, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the requirements of ch. A-E 4, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Adm. Code; and that, to the best of my knowledge, all information contained in this document is correct.



David W. Buckner, P.E.
Project Engineer



December 2014

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1.0 INTRODUCTION

1.1 Purpose and Scope

The U. S. Department of Veterans Affairs ("VA") intends to acquire up to 6 acres of land in Rhinelander, Wisconsin, for use as National Veterans Burial Grounds. The V.A. will use the site for new pre-placed crypts, columbarium structures, and access roadways.

This geotechnical report was prepared to aid in the evaluation of the site described herein and to assist the client in the design phase of the project. The report includes geotechnical exploration data, laboratory soil classification, engineering analysis, and recommendations for design and construction. The primary purpose of this geotechnical exploration is to determine the stratigraphy and physical properties of the soils underlying the site, particularly the strength and deformation characteristics, so that the feasibility of constructing the proposed structure(s) can be evaluated. Information that could affect construction and earthwork operations, such as groundwater levels, was also obtained.

The analysis and recommendations presented in this report are based in part upon our interpretation of the subsurface information revealed by the borings. The report may not reflect variations in subsurface conditions that may exist between or beyond these borings. Variations in soil conditions should be expected between the borings, the nature and extent of which may not become evident until construction is undertaken. This report is intended for geotechnical purposes only, and not to document or detect the presence or absence of any environmental conditions at the site. Other information regarding this geotechnical report is represented in the appendices.

1.2 Site Description

1.2.1 Site Location

The area evaluated for the project is located across from Union Grove Cemetery, off Lakewood Road, approximately ½ mile north of the intersection of Lakewood Road and Rocky Run Road in the town of Cassian, Oneida County, WI. The location of the parcel is: the "Northeast Quarter of Section Twenty-four (24), Township Thirty-seven (37) North, Range Six (6) East, town of Cassian, Oneida County, WI.

1.2.2 Site Topography and Drainage

The topographic relief of the project site is relatively flat, sloping gently to the southeast at an elevation of approximately 1530 feet above mean sea level (MSL). The nearest surface water is Bearskin Creek, located approximately 1-mile to the east of the project site.

1.2.3 Existing Structures and Improvements

The project site is currently a wooded land parcel, with no structures and/or improvements.

1.2.4 Adjacent Properties

The parcel is bounded on the North by Lakewood Road, followed by undeveloped wooded land, with Union Grove Cemetery located to the northwest. To the East, the project site is bound by

undeveloped wooded lots, with Golf Lane beyond. Developed residential/commercial property bounds the parcel to the South, with undeveloped wooded land beyond. Lakewood Road bounds the project site to the West, followed by undeveloped wooded land.

1.3 Proposed Development

The site is intended for use as National Veterans Burial Grounds. Pre-placed crypts and columbarium structures, as well as access roadways, are proposed for construction on the site.

1.4 Previous Geotechnical Data

It is our understanding that no geotechnical investigations have previously been completed at the subject parcel.

1.5 Interested Parties

1.5.1 Client

Newmark Grubb Knight Frank
3424 Peachtree Road, NE
Suite 800
Atlanta, GA 30326

Attn: Mr. Ernest Kiser, Jr
Phone: 404-926-1136
E-mail: ekiser@ngkf.com

1.5.2 Geotechnical Contractor

Geotechnical Drilling Contractors, LLC
P.O. Box 5033
Wausau, WI 54402

Attn: Mr. Bob Levra
Phone: 715-571-4163
Fax: 715-355-9032

1.5.3 Geotechnical Consultant

CWE, Inc.
P.O. Box 107
5707 Schofield Avenue
Weston, WI 54476

Phone: 715-359-9400
Fax: 715-355-4199

2.0 METHODS

Six (6) boring locations were identified by CWE, Inc. (refer to attached Boring Location Map, Appendix A). Geotechnical Drilling Contractors, LLC (GDC) of Wausau, Wisconsin, conducted the geotechnical drilling activities for the project. On November 13, 2014, six (6) penetration test borings were drilled at the previously identified locations. The borings were drilled with a Track-Mounted All-Terrain Vehicle Drilling Rig (ATV Rig), using 3-1/4" hollow-stem auger rotary drilling methods. The borings (B1 thru B6) were drilled to depths of 20 feet. Continuous soil samples were recovered from each of the borings to the terminal depth of the bore holes. Sampling procedures were completed in accordance with Standard Penetration Test Method ASTM D1586. All of the recovered samples were classified visually by GDC in accordance with the Unified Classification System (USCS).

After allowing the open boreholes to recharge, water level measurements were obtained. Water was encountered at 15 feet below ground surface in B-4 and B-6, and at 20 feet below ground surface in B-1, B-2 and B-5. Water was not encountered in B-3. The boreholes were subsequently abandoned with chipped bentonite (holeplug) in accordance with ch. NR 141 Wis. Adm. Code. Copies of the soil boring logs and borehole abandonment forms are included in Appendix B. The key to report and test boring general notes and terms is included in Appendix C.

3.0 SITE SUBSURFACE CONDITIONS

3.1 Soil Observations

The generalized subsurface profile consists of:

- Brown silty sand
- Brown sandy silt
- Brown silty sand and gravel
- Gravel, sand and silt mix to the terminal depth of the borings.

Soil sampling was performed in accordance with ASTM D1586-84. A 2.0 inch O.D. split barrel sampler was driven into the soil by a 140 lb. weight falling 30 inches. After an initial set of 6.0 inches, the number of blows required to drive the sample an additional 12 inches was recorded. The number of blows or penetration resistance is an index of the relative density of cohesionless soils and the consistency of cohesive soils.

As the samples were obtained in the field, they were visually and manually classified by the crew chief in accordance with ASTM D2487. Continuous soil samples from each boring were then returned to the CWE soils laboratory for further examination and for verification of the field classification. Logs of the borings indicating the depth and identification of the various strata, the "N" value, water level information, and pertinent information regarding the method of maintaining and advancing the drill holes are included as Appendix B. The laboratory descriptions of the soils are also included in Appendix B. Charts illustrating the soil classification procedure, the descriptive terminology, and the symbols used on the boring logs are included in Appendix C.

3.2 Ground Water Observations

Upon completion of drilling activities, free water was observed at 15 feet below ground surface in B-4 and B-6, and at 20 feet below ground surface in B-1, B-2 and B-5. Water was not encountered in B-3. Considering the granular nature of the soils, it is unlikely that saturated conditions extend above 15 feet depth, however water may at times become perched over less porous soils such as the fine sandy silt soil identified at 2'-4' bgs at borings 2, 3, and 4. Note that groundwater levels should be expected to fluctuate seasonally and yearly from the levels noted on the boring logs.

3.3 Seismic Site Class

On-site soils within the top 2 to 4 feet are generally classified as loose silty sand or loose sandy silt. Therefore, the top 2 to 4 feet of soil on the project site is considered to be Seismic Site Class F in accordance with Table 1615.1.1 of the International Building Code- 2003. On-site soils below 4 feet down to 20 feet below ground surface are generally classified as medium-dense silty sand. Therefore, soils on the project site below approximately 4 feet are considered to be Seismic Site Class F in accordance with Table 1615.1.1 of the International Building Code- 2003.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 Site Preparation

Prior to cut and/or fill operations, all organic soils, trees and vegetation, including root systems, should be stripped and/or removed from within the columbarium footprints and planned paved locations.

After site stripping is completed, the exposed sub-grade at proposed paved areas should be proof rolled with a filled tandem axle dump truck or a large vibratory compactor with a minimum drum weight of ten tons. Areas that exhibit rutting/pumping of one inch or greater will require stabilization and/or removal and replacement with engineered fill. Proof rolling and site undercutting should be performed under the direction of a qualified engineer to ensure that all soft/loose native and fill soils have been removed.

We recommend that an engineered fill be placed and compacted in lifts to attain foundation, and pavement sub-grade elevations. For fill directly beneath footings, a pit run sand/gravel mixture or crushed stone can be used. These select materials should have less than 5% passing the #200 sieve.

It is anticipated that the excavation side-slopes will likely be unstable at typical slopes of 2H:1V and should be excavated to slope 1H:1V. Excavations remaining open for extended periods may require flatter side slopes. Regardless, all excavations should be performed in accordance with pertinent state, local, and federal (OSHA) regulations.

4.2 Groundwater Control

Groundwater at the site was observed in B-4 and B-6 at 15 feet below surface, and it is reasonable to assume that saturated conditions are unlikely to occur at shallower depth (refer to Section 3.2).

4.3 Bearing Capacity and Footing Recommendations

Based on the blow counts recorded during the geotechnical investigation, it is our opinion that a building can be supported on reinforced concrete spread or continuous wall footing foundations bearing on acceptable re-compacted native soils and imported fill. The following parameters should be used for foundation and footing design:

- Maximum allowable bearing pressure: 2000 pounds per square foot
- Minimum foundation widths:
 - Continuous wall footings: 24 inches
 - Column pad footings: 30 inches
- Minimum footing depths:
 - Exterior/perimeter footings: 4 feet
 - Interior footings: resting on 4 feet compacted fill

We recommend using a smooth-edged backhoe "bucket" for footing excavations. We recommend that footing subgrade soils be rigorously re-compacted with a back-hoe mounted plate compactor or hand operated plate compactor, after excavation, and prior to formwork/concrete placement. Provided the foundation design/construction recommendations discussed above are followed, we estimate that total and differential settlements should not exceed 1.0 and 0.5 inches, respectively.

4.4 Columbarium Design

We recommend that the upper 4.0 feet be stripped and removed from beneath the footing elevations and then backfilled with structural fill, placed in 12 inch maximum compacted lifts. The excavation should be observed and tested by a geotechnical engineer or other qualified representative.

4.5 Exterior Concrete Slab Design

The soils encountered onsite have a potential for frost heave (NRCS web soil survey located at <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>). Soils found in Borings 2, 3 & 4, at the 2 ½ to 4 foot zone contained a fine sandy silt. This type material is very moisture sensitive and can become unstable under dynamic loads. This material can also increase the likeliness for water to perch over it. In areas where concrete slab is proposed, and the silt layer is identified, the following method could be used to reduce the potential for frost heave:

- Remove frost-susceptible soils and replace this material with well-graded clean sand containing less than 5% by weight passing the #200 sieve. The material should be placed in thin lifts not exceeding twelve inches in loose thickness and be compacted to a minimum of 95% of the maximum dry density (ASTM D1557).

4.6 Use of On-Site Materials

It is our opinion that the soils encountered in the borings are suitable for use as general fill. However, verification in the field during earthwork operations is recommended to check that any organic or unsuitable material is removed from the construction area. The soil between the borings could vary from what is indicated on the boring logs.

Soils found in Borings 2, 3 & 4, at the 2 ½ to 4 foot zone contained a fine sandy silt. This type material is very moisture sensitive and can become unstable under dynamic loads. This material could be used as a general fill and should not be used under pavements or areas to receive dynamic loads.

Backfill in landscaped areas should be placed in a maximum of 12.0 inch lifts and compacted to at least 85% of the maximum dry density as determined by the Modified Proctor ASTM D1557 test. No topsoil was identified in any of the boring logs. While topsoil may exist at locations between borings, topsoil for landscape purposes will likely need to be imported to this site.

A small amount of organic material from Boring 2 was tested for pH and organic content. Test results were: 11.6% organic matter and 5.7 pH. Material such as this is of suitable organic content and pH for use as landscaping soil (refer to Appendix B for pH and organic content test results).

4.7 Pavement Design

All areas receiving asphalt and/or concrete pavement should be prepared as outlined in Section 4.1. A pavement section is a layered system designed to distribute concentrated traffic loads to the sub-grade. Performance of the pavement structure is directly related to the physical properties of the sub-grade soils and traffic loadings. For pavement design purposes, soils are represented by means of a soil support value for flexible pavements and a modulus of sub-grade reaction for rigid pavements. Both values are empirically related to strength.

Pavement design procedures are based on strength properties of the sub-grade and pavement materials assuming stable, uniform conditions. Certain soils, such as those encountered at this site, are frost susceptible and require additional precautions to be taken to provide for adequate pavement performance.

Proper surface drainage is essential for adequate performance of pavement. Final pavement grades should be designed to promote good surface water runoff from the pavement structure.

4.7.1 Light Duty Pavement Design (Automobile Parking Lot)

A flexible pavement design is recommended for areas of light duty such as an automobile parking lot. Pavement design was derived from WisPave, a WisDOT Pavement Design Software program. The design is based on 3 equivalent 18 kip single axle loads per day and a design life of 20 years. Based on this analysis, the recommended pavement components are as follows:

Material	Section Thickness (Inches)	Structural Layer Coefficient
Bituminous Wearing Course	1.75	0.44
Bituminous Binder Course	1.75	0.44
Aggregate Base Course	6.0	0.10

This design assumes a stable, unyielding, well-compacted sub-grade. The aggregate base course should conform to the grading requirements as outlined in *State of Wisconsin Standard Specifications for Road and Bridge Construction*, 2014 Edition, Section 305, ¾-inch gradation, except that it should contain less than 5% finer than the #200 sieve. The asphalt concrete aggregate should conform to Wisconsin Department of Transportation section 450, 455, 460 for the binder course and surface course.

Maintenance will be required over the life of the pavement. Normal shrinkage cracks may develop within one to three years after construction. We recommend timely repair and maintenance to maximize the overall design life of the pavement. Seal coating should also be periodically applied as part of the maintenance program.

4.7.2 Heavy Duty Pavement Design

A rigid pavement design is recommended for areas of high impact loading and concentrated truck traffic, such as near loading docks and dumpsters. Pavement design was derived from WisPave, a WisDOT Pavement Design Software program. Recommended pavement components are as follows:

Material	Thickness (Inches)
Type I Portland Cement Concrete	6.0
Base Course	6.0

The concrete mix design should consist of a 6 bag, normal weight concrete with design strength of at least 4,000 psi and contain an air admixture to reduce the effects of freezing and thawing. It is also recommended that the pavement edges be thickened to 12.0 inches to minimize cracking. The pavement should contain a wire mesh reinforcement in the bottom third of the pavement section and should contain dowels at construction joints to permit the proper transfer of loads. Expansion joints should be provided where pavement abuts fixed objects such as building, columns, and light poles.

5.0 GENERAL COMMENTS

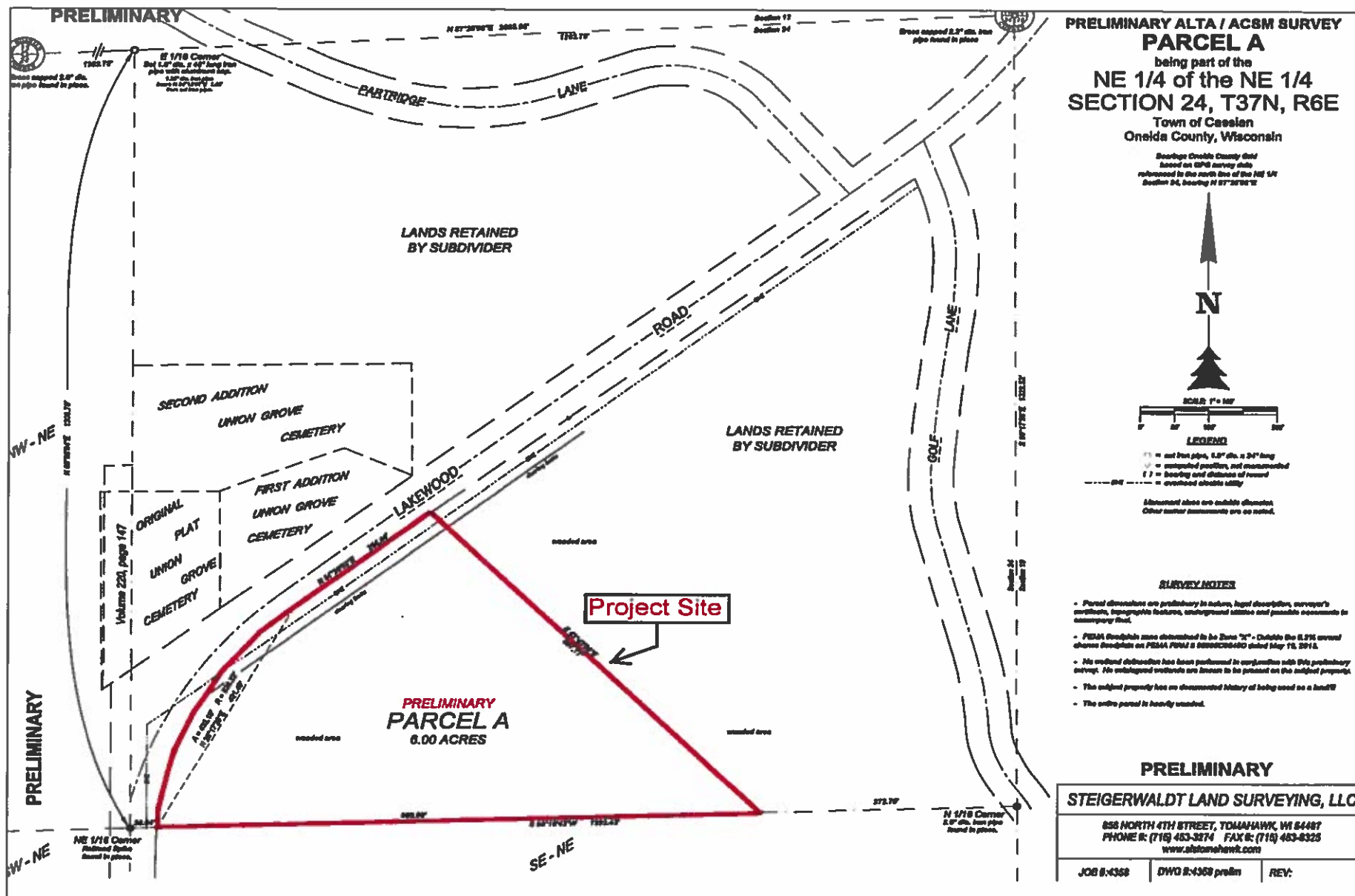
The recommendations made in this report have been made based on the subsurface conditions found in the six test boring locations. It is possible that there are soil and groundwater conditions on site that were not represented by those borings. On-site observation during construction is considered integral to the successful implementation of the recommendations described herein. It is recommended that the earthwork and foundation operations be monitored by a soils engineer to test and evaluate the bearing capacities and the selection, placement, and compaction of controlled fills.

This geotechnical exploration and foundation analysis has been prepared to aid in the evaluation of the foundation soil conditions on this site. The recommendations presented herein are based on the available soils information. When the specific proposed building location and foundation design is known, it should be brought to the attention of the soils engineer to determine if modifications in the recommendations are required. The final design plans and specifications should also be reviewed by the soils engineer to determine that the recommendations presented herein have been interpreted and implemented as intended.

This geotechnical investigation has been conducted in a manner consistent with the level of care ordinarily exercised by members of the profession currently practicing in the same locality under similar conditions. The findings, recommendations, and opinions contained herein have been promulgated in accordance with generally accepted practice in the fields of foundation engineering, soils mechanics, and engineering geology. No other representations, expressed or implied, and no warranty or guarantee is included or intended in this report.

APPENDIX A

**Site Location Map
Boring Location Map**



CWE

5707 Schofield Avenue, Weston WI. 54476

Phone: 715-359-9400 Fax: 715-355-4199

general@cweengineers.com www.cweengineers.com

Parcel Location Map
Geotechnical Engineering Report
Union Grove Cemetery Land Site
Town of Cassian, Oneida County, WI

DRAWN BY: S. W. B.

DATE: 11/21/2014

CHECKED BY: S.M. F.

CWE PROJECT #:
44441400

APPROVED BY: D. B.

FIGURE 4



CWE

5707 Schofield Avenue, Weston WI, 54476

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general@cweengineers.com www.cweengineers.com

Boring Location Map
Geotechnical Engineering Report
Union Grove Cemetery Land Site
Town of Cassia, Oneida County, WI

DRAWN BY: S. W. B.

DATE: 11/21/2014

CHECKED BY: S.M. F.

CWE PROJECT #:
44441400

APPROVED BY: D. B.

FIGURE 3


APPENDIX B

**Soil Boring Logs
Borehole Abandonment Forms
Laboratory Gradation Test Results
pH Test Results
Organic Matter Determination**

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☒

Page 1 of 1

Facility/Project Name Union Grove Cemetery Project			License/Permit/Monitoring Number		Boring Number B1
Boring Drilled By: Name of crew chief (first, last) and Firm First Name: Last Name: Ken Schram GDC, LLC			Date Drilling Started 11/13/2014 m m d d y y y y	Date Drilling Completed 11/13/2014 m m d d y y y y	Drilling Method HSA
WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level 20 Feet MSL	Surface Elevation Feet MSL	Borehole Diameter 3.25 inches
Local Grid Origin <input type="checkbox"/> (estimated: <input type="checkbox"/>) or Boring Location <input checked="" type="checkbox"/> State Plane N E NE 1/4 of NE 1/4 of Section 24, T 37 N, R 6			Local Grid Location Lat 0 ' " Long 0 ' " Feet <input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> S <input type="checkbox"/> W		
Facility ID		County Onieda	County Code	Civil Town/City/ or Village Town of Cassian	

Sample		TOWN OF GASTON												
Number and Type	Length Au. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties					RQD/ Comments
									Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	
1		AS	2	Silty Sand, Fine Grain, Brown, Moist, Loose	ML									
2		9	4	Silty Sand, Fine Grain, Brown, Moist, Loose	ML									
3		24	6.5	Silty Sand, Fine Grain, Some Gravel, Brown Moist, Med-Dense	ML									
4		30	9	Silty Sand, Fine Grain, Some Gravel, Brown Moist, Med-Dense	ML									
5		36	1.5	Silty Sand, Fine Grain, Some Gravel, Brown Moist, Med-Dense, Some Cobble	ML									
6		20	16.5	Silty Sand, Fine Grain, Some Gravel, Brown Moist, Med-Dense, Some Cobble	ML									
7		27	21.5	Silty Gravel, Gravel-Sand-Silt mix, Very Moist, Dense, Some Cobble	GM									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature

Firm

CWE, Inc

This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between \$10 and \$25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☒

Page 1 of 1

Facility/Project Name Union Grove Cemetery Project			License/Permit/Monitoring Number		Boring Number B2
Boring Drilled By: Name of crew chief (first, last) and Firm First Name: Last Name: Ken Schram GDC, LLC			Date Drilling Started 11/13/2014 m m d d y y y y	Date Drilling Completed 11/13/2014 m m d d y y y y	Drilling Method HSA
WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level 20 Feet MSL	Surface Elevation Feet MSL	Borehole Diameter 3.25 inches
Local Grid Origin <input type="checkbox"/> (estimated: <input type="checkbox"/>) or Boring Location <input checked="" type="checkbox"/> State Plane N , E NE 1/4 of NE 1/4 of Section 24 , T 37 N, R 6			Local Grid Location Lat 0 ' " Long 0 ' " Feet <input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> S <input type="checkbox"/> W		
Facility ID		County Onieda	County Code	Civil Town/City/ or Village Town of Cassian	

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties					P 200	RQD/ Comments
									Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index			
1		AS	2	Silty Sand, Fine Grain, Dark Brown, Moist, Loose	OL										
2		7	4	Silty Sand, Fine Grain, Brown, Moist, Loose	ML										
3		21	6.5	Silty Sand, Fine Grain, Brown, Moist, Med-Dense	ML										
4		32	9	Silty Sand, Fine Grain, Brown, Moist, Dense	ML										
5		13	11.5	Silty Sand, Fine to Med-Grain, Trace Gravel, Brown, Moist, Med- Dense	ML										
6		21	16.5	Silty Sand, Fine Grain, Brown, Moist, Med-Dense	ML										
7		20	21.5	Silty Gravels, Gravel-Sand-Silt mix, Brown, Moist, Med-Dense	GM										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature _____ Firm **CWE, Inc.**

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Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☒

Page 1 of 1

Facility/Project Name Union Grove Cemetery Project			License/Permit/Monitoring Number		Boring Number B3	
Boring Drilled By: Name of crew chief (first, last) and Firm First Name: Ken Last Name: Schram Firm: GDC, LLC			Date Drilling Started 11 / 13 / 2014 m m d d y y y y		Date Drilling Completed 11 / 13 / 2014 m m d d y y y y	
Drilling Method HSA			Final Static Water Level N/A Feet MSL		Surface Elevation Feet MSL	
WI Unique Well No.		DNR Well ID No.		Well Name		Borehole Diameter 3.25 inches
Local Grid Origin <input type="checkbox"/> (estimated: <input type="checkbox"/>) or Boring Location <input checked="" type="checkbox"/> State Plane N , E NE 1/4 of NE 1/4 of Section 24, T 37 N, R 6			Lat 0 ' " Long 0 ' "		Local Grid Location <input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> S <input type="checkbox"/> W Feet Feet	
Facility ID		County Oneida		County Code		Civil Town/City/ or Village Town of Cassian

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties					P 200	RQD/ Comments
									Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index			
1		AS	2	Sandy Silty, Fine Grain, Brown, Moist, Loose	OL										
2	12		4	Fine Sandy Silt, Trace Clay, Brown, Moist-Wet Med-Dense	ML										
3	22		6.5	Silty Sand, Trace Gravel, Fine Grain, Brown, Moist, Med-Dense	ML										
4	22		9	Silty Sand, Trace Clay, Fine Grain, Brown, Moist, Med-Dense	ML										
5	10		11.5	Silty Sand, Fine Grain, Brown, Moist, Med-Dense	ML										
6	28		16.5	Silty Sand, Fine Grain, Brown, Moist, Med-Dense	ML										
7	45		21.5	Silty Gravels, Gravel-Sand-Silt mix, Brown, Moist, Dense	GM										

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature _____ Firm **CWE, Inc.**

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Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☒

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Facility/Project Name Union Grove Cemetery Project			License/Permit/Monitoring Number		Boring Number B4
Boring Drilled By: Name of crew chief (first, last) and Firm First Name: Ken Last Name: Schram Firm: GDC, LLC			Date Drilling Started 11/13/2014 m m d d y y y y	Date Drilling Completed 11/13/2014 m m d d y y y y	Drilling Method HSA
WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level 15 Feet MSL	Surface Elevation Feet MSL	Borehole Diameter 3.25 inches
Local Grid Origin <input type="checkbox"/> (estimated: <input type="checkbox"/>) or Boring Location <input checked="" type="checkbox"/> State Plane N , E Lat 0 ' " Long 0 ' "			Local Grid Location <input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> S <input type="checkbox"/> W Feet Feet		
NE 1/4 of NE 1/4 of Section 24 , T 37 N, R 6					
Facility ID		County Odeida	County Code	Civil Town/City/ or Village Town of Cassian	

Sample Number and Type	Length An. & Recovered (in)	Blow Counts	Depth in Feet (below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties					RQD/ Comments
									Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	
1		AS	2	Silty fine grained Sand, Brown, moist, loose	OL									
2		11	4	Sandy Silt, Trace Clay, Fine Grain, Brown, Moist, Med-Dense	ML									
3		17	6.5	Silty Sand, Fine Grain, Brown, Moist, Med-Dense	ML									
4		17	9	Silty Sand, Fine Grain, Brown, Moist, Med-Dense	ML									
5		16	11.5	Silty Sand, Fine Grain, Brown, Moist, Med-Dense	ML									
6		18	16.5	Silty Sand, Fine Grain, Brown, Moist, Med-Dense	ML									
7		18	21.5	Silty Sand, Fine Grain, Brown, Moist, Med-Dense	ML									

I hereby certify that the information on this form is true and correct to the best of my knowledge.


Signature	Firm CWE, Inc.
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This form is authorized by Chapters 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats. Completion of this form is mandatory. Failure to file this form may result in forfeiture of between \$10 and \$25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See instructions for more information, including where the completed form should be sent.

Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revelopment ☐ Other ☒

Page 1 of 1

Facility/Project Name Union Grove Cemetery Project			License/Permit/Monitoring Number		Boring Number B5
Boring Drilled By: Name of crew chief (first, last) and Firm First Name: Ken Last Name: Schram Firm: GDC, LLC			Date Drilling Started 11 / 13 / 2014 m m d d / y y y y	Date Drilling Completed 11 / 13 / 2014 m m d d / y y y y	Drilling Method HSA
WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level 20 Feet MSL	Surface Elevation Feet MSL	Borehole Diameter 3.25 inches
Local Grid Origin <input type="checkbox"/> (estimated: <input type="checkbox"/>) or Boring Location <input checked="" type="checkbox"/> State Plane N E			Lat 0 ' "	Local Grid Location <input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> S <input type="checkbox"/> W	
NE 1/4 of NE 1/4 of Section 24 , T 37 N, R 6			Long 0 ' "	Feet 0 Feet 0	
Facility ID		County Oneida	County Code	Civil Town/City/ or Village Town of Cassian	

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties					RQD/ Comments
									Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	
1		AS	2	Silty Sand, Fine Grain, Brown, Moist, Loose	ML									
2		7	4	Silty Sand, Fine Grain, Brown, Moist, Loose	ML									
3		18	6.5	Silty Sand, Fine Grain, Brown, Moist, Med-Dense	ML									
4		20	9	Silty Sand, Fine Grain Brown, Moist, Med-Dense, Some Cobble	ML									
5		22	11.5	Silty Sand, Fine Grain, Some Cobble, Brown, Moist, Med-Dense	ML									
6		16	16.5	Silty Sand, Fine Grain, Some Gravel and Cobble, Brown, Moist, Med- Dense	ML									
7		27	21.5	Groundwater at 20-feet bgs Silty Sand, Fine Grain, Some Gravel and Cobble, Brown, Moist, Med- Dense	ML									

I hereby certify that the information on this form is true and correct to the best of my knowledge.


Signature	Firm CWE, Inc
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Route To: Watershed/Wastewater ☐ Waste Management ☐
Remediation/Revlopment ☐ Other ☒ _____

Page 1 of 1

Facility/Project Name Union Grove Cemetery Project			License/Permit/Monitoring Number		Boring Number B6
Boring Drilled By: Name of crew chief (first, last) and Firm First Name: _____ Last Name: _____ Firm: Ken Schram GDC, LLC			Date Drilling Started 11 / 13 / 2014 m m d d y y y y	Date Drilling Completed 11 / 13 / 2014 m m d d y y y y	Drilling Method HSA
WI Unique Well No.	DNR Well ID No.	Well Name	Final Static Water Level 15 Feet MSL	Surface Elevation _____ Feet MSL	Borehole Diameter 3.25 inches
Local Grid Origin <input type="checkbox"/> (estimated: <input type="checkbox"/>) or Boring Location <input checked="" type="checkbox"/> State Plane _____ N, _____ E NE 1/4 of NE 1/4 of Section 24, T 37 N, R 6			Lat _____ Long _____	Local Grid Location <input type="checkbox"/> N <input type="checkbox"/> E <input type="checkbox"/> S <input type="checkbox"/> W	
Facility ID		County Oneida	County Code _____	Civil Town/City/ or Village Town of Cassian	

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth in Feet (Below ground surface)	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID/FID	Soil Properties					RQD/ Comments
									Compressive Strength	Moisture Content	Liquid Limit	Plasticity Index	P 200	
1		AS	2	Silty Sand, Some Gravel, Fine Grain, Brown, Loose	ML									
2		12	4	Silty Sand, Fine Grain, Brown, Moist, Med-Dense	ML									
3		24	6.5	Silty Sand, Fine Grain, Brown, Moist, Med-Dense	ML									
4		24	9	Silty Sand, Fine Grain, Some Gravel and Cobble, Brown, Moist, Med-Dense	ML									
5		24	11.5	Silty Sand, Fine Grain, Some Gravel and Cobble, Brown, Moist, Med-Dense	ML									
6		37	16.5	Groundwater at 15-feet bgs Silty Sand, Fine Grain, Some Gravel and Cobble, Brown, Moist, Dense	ML									
7		20	21.5	Silty Sand, Fine Grain, Some Gravel and Cobble, Brown, Moist, Med-Dense	ML									

I hereby certify that the information on this form is true and correct to the best of my knowledge.

Signature	Firm CWE, Inc.
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☒ Verification Only of Fill and Seal

Route to:

☐ Drinking Water

☐ Watershed/Wastewater

☐ Remediation/Redevelopment

☐ Waste Management

☒ Other: _____

1. Well Location Information

County Oneida WI Unique Well # of Removed Well B-1

Latitude / Longitude (Degrees and Minutes) _____ 'N
_____ 'W

Section 24 Township 37 N Range 6 E
or Gov't Lot # _____ W

Well Street Address Near intersection of Lakewood Rd & Rocky

Well City, Village or Town Town of Cassian Well ZIP Code RUN

Subdivision Name _____ Lot # _____

Reason For Removal From Service Geotech Boring WI Unique Well # of Replacement Well _____

3. Well / Drillhole / Borehole Information

☐ Monitoring Well

☐ Water Well

☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy)

11-13-2014

If a Well Construction Report is available, please attach N/A

Construction Type:

☒ Drilled

☐ Driven (Sandpoint)

☐ Dug

☐ Other (specify): _____

Formation Type:

☒ Unconsolidated Formation

☐ Bedrock

Total ~~Well~~ Depth From Ground Surface (ft.)

Casing Diameter (in.)

NA

Lower Drillhole Diameter (in.)

Casing Depth (ft.)

NA

Was well annular space grouted?

☐ Yes

☒ No

☐ Unknown

If yes, to what depth (feet)?

Depth to Water (feet)

5. Material Used To Fill Well / Drillhole

Chipped bentonite 3/8"

From (ft.)

To (ft.)

No. Yards, Sacks Sealant or Volume (circle one)

Mix Ratio or Mud Weight

Surface

20'

30 #

6. Comments

3 1/4" Hollow Stem Augers used to conduct Geotechnical Investigation

7. Supervision of Work + Drilling

Name of Person or Firm Doing Filling & Sealing

License #

Date of Filling & Sealing (mm/dd/yyyy)

Date Received

Noted By

Street or Route

Telephone Number

Comments

City

State

ZIP Code

Signature of Person Doing Work

Date Signed

Waupun

WI

54402

Chris Zelenka for GOC, LLC 12-17-14

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between \$10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

<input checked="" type="checkbox"/> Verification Only of Fill and Seal	Route to:		
	<input type="checkbox"/> Drinking Water	<input type="checkbox"/> Watershed/Wastewater	<input type="checkbox"/> Remediation/Redevelopment
	<input type="checkbox"/> Waste Management	<input checked="" type="checkbox"/> Other: _____	

1. Well Location Information			2. Facility / Owner Information		
County <u>Oneida</u>	WI Unique Well # of Removed Well _____	Field # <u>B-2</u>	Facility Name <u>Union Grove Cemetery Land Site</u>		

Latitude / Longitude (Degrees and Minutes)		Method Code (see instructions)	
____' ____' ____" N ____' ____' ____" W		_____	

1/4 1/4 or Gov't Lot #	Section <u>24</u>	Township <u>37 N</u>	Range <u>6</u>	<input type="checkbox"/> E <input type="checkbox"/> W	Original Well Owner <u>Town of Cassian</u>
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Well Street Address <u>Near intersection of Lakewood Rd & Ricky</u>		Present Well Owner <u>Town of Cassian</u>	
--	--	--	--

Well City, Village or Town <u>Town of Cassian</u>	Well ZIP Code <u>Run</u>	Mailing Address of Present Owner <u>Town Hall, 9110 Church Rd Harshaw, WI</u>
--	-----------------------------	--

Subdivision Name	Lot #	City of Present Owner <u>Same</u>	State	ZIP Code <u>54529</u>
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Reason For Removal From Service <u>Geotech Boring</u>	WI Unique Well # of Replacement Well _____	4. Pump, Liner, Screen, Casing & Sealing Material
--	---	---

3. Well / Drillhole / Borehole Information		<input type="checkbox"/> Pump and piping removed? <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A <input type="checkbox"/> Liner(s) removed? <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A <input type="checkbox"/> Screen removed? <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A <input type="checkbox"/> Casing left in place? <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A <input type="checkbox"/> Was casing cut off below surface? <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A <input checked="" type="checkbox"/> Did sealing material rise to surface? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> Did material settle after 24 hours? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A If yes, was hole retopped? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> If bentonite chips were used, were they hydrated with water from a known safe source? <input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A	
<input type="checkbox"/> Monitoring Well <input type="checkbox"/> Water Well <input checked="" type="checkbox"/> Borehole / Drillhole	Original Construction Date (mm/dd/yyyy) <u>11-13-2014</u> If a Well Construction Report is available, please attach <u>N/A</u>		
Construction Type:			
<input checked="" type="checkbox"/> Drilled <input type="checkbox"/> Driven (Sandpoint) <input type="checkbox"/> Dug <input type="checkbox"/> Other (specify): _____			

Formation Type:		Required Method of Placing Sealing Material	
<input checked="" type="checkbox"/> Unconsolidated Formation <input type="checkbox"/> Bedrock		<input type="checkbox"/> Conductor Pipe-Gravity <input type="checkbox"/> Conductor Pipe-Pumped <input checked="" type="checkbox"/> Screened & Poured (Bentonite Chips) <input type="checkbox"/> Other (Explain): _____	
Total Well Depth From Ground Surface (ft.)	Casing Diameter (in.)	Sealing Materials	
<u>NA</u>	<u>NA</u>	<input type="checkbox"/> Neat Cement Grout <input type="checkbox"/> Clay-Sand Slurry (11 lb./gal. wt.) <input type="checkbox"/> Sand-Cement (Concrete) Grout <input type="checkbox"/> Bentonite-Sand Slurry " " <input type="checkbox"/> Concrete <input checked="" type="checkbox"/> Bentonite Chips	
Lower Drillhole Diameter (in.)	Casing Depth (ft.)	For Monitoring Wells and Monitoring Well Boreholes Only:	
<u>NA</u>	<u>NA</u>	<input type="checkbox"/> Bentonite Chips <input type="checkbox"/> Bentonite - Cement Grout <input type="checkbox"/> Granular Bentonite <input type="checkbox"/> Bentonite - Sand Slurry	
Was well annular space grouted? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown			
If yes, to what depth (feet)?	Depth to Water (feet)		

5. Material Used To Fill Well / Drillhole		From (ft.)	To (ft.)	No. Yards, Sacks Sealant or Volume (circle one)	Mix Ratio or Mud Weight
<u>chipped bentonite 3/8"</u>		Surface	<u>20'</u>	<u>30 #</u>	

6. Comments	
<u>3 1/4" Hollow Stem Augers used to conduct Geotechnical Investigation</u>	

7. Supervision of Work + Drilling			DNR Use Only	
Name of Person or Firm Doing Filling & Sealing <u>GDC, LLC</u>	License #	Date of Filling & Sealing (mm/dd/yyyy) <u>11-13-2014</u>	Date Received	Noted By
Street or Route <u>PO Box 5033</u>		Telephone Number <u>(715) 241-8490</u>	Comments	
City <u>Waupun</u>	State <u>WI</u>	ZIP Code <u>54982</u>	Signature of Person Doing Work <u>Cindy Zelenka for GDC, LLC</u>	
			Date Signed <u>12-17-14</u>	

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between \$10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

☒ Verification Only of Fill and Seal

Route to:

☐ Drinking Water ☐ Watershed/Wastewater ☐ Remediation/Redevelopment

☐ Waste Management ☒ Other: _____

1. Well Location Information

County Oneida WI Unique Well # of Removed Well B-3

Latitude / Longitude (Degrees and Minutes) _____ 'N
_____ 'W

Method Code (see instructions) _____

1/4 1/4 NE Section 24 Township 37 N Range 6 ☐ E ☐ W

or Gov't Lot # _____

Well Street Address Near intersection of Lakewood Rd & Rocky

Well City, Village or Town Town of Cassian Well ZIP Code Run

Subdivision Name _____ Lot # _____

City of Present Owner Same State _____ ZIP Code 54559

Reason For Removal From Service Geotech Boring WI Unique Well # of Replacement Well _____

3. Well / Drillhole / Borehole Information

☐ Monitoring Well ☐ Water Well ☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy) 11-13-2014

If a Well Construction Report is available, please attach N/A

Construction Type:

☒ Drilled ☐ Driven (Sandpoint) ☐ Dug

☐ Other (specify): _____

Formation Type:

☒ Unconsolidated Formation ☐ Bedrock

Total ~~Well~~ Depth From Ground Surface (ft.) _____ Casing Diameter (in.) NA

Lower Drillhole Diameter (in.) _____ Casing Depth (ft.) NA

Was well annular space grouted? ☐ Yes ☒ No ☐ Unknown

If yes, to what depth (feet)? _____ Depth to Water (feet) _____

5. Material Used To Fill Well / Drillhole

Chipped bentonite 3/8"

From (ft.)	To (ft.)	No. Yards, Sacks Sealant or Volume (circle one)	Mix Ratio or Mud Weight
Surface	<u>20'</u>	<u>30 #</u>	

6. Comments

3 1/4" hollow stem Augers used to conduct Geotechnical Investigation

7. Supervision of Work + Drilling

Name of Person or Firm Doing Filling & Sealing GOC, LLC License # _____ Date of Filling & Sealing (mm/dd/yyyy) 11-13-2014

Street or Route PO Box 5033 Telephone Number (715) 241-8490

City Waupun State WI ZIP Code 54982 Signature of Person Doing Work Chris Zelenka for GOC, LLC Date Signed 12-17-14

2. Facility / Owner Information

Facility Name Union Grove Cemetery Land Site

Facility ID (FID or PWS) _____

License/Permit/Monitoring # _____

Original ~~Well~~ Owner Town of Cassian

Present ~~Well~~ Owner Town of Cassian

Mailing Address of Present Owner Town Hall 9110 Church Rd Marshaw, WI

City of Present Owner Same State _____ ZIP Code 54559

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed? ☐ Yes ☐ No ☒ N/A

Liner(s) removed? ☐ Yes ☐ No ☒ N/A

Screen removed? ☐ Yes ☐ No ☒ N/A

Casing left in place? ☐ Yes ☐ No ☒ N/A

Was casing cut off below surface? ☐ Yes ☐ No ☒ N/A

Did sealing material rise to surface? ☒ Yes ☐ No ☐ N/A

Did material settle after 24 hours? ☐ Yes ☒ No ☐ N/A

If yes, was hole relogged? ☐ Yes ☐ No ☐ N/A

If bentonite chips were used, were they hydrated with water from a known safe source? ☐ Yes ☐ No ☒ N/A

Required Method of Placing Sealing Material

☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped

☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain): _____

Sealing Materials

☐ Neat Cement Grout ☐ Clay-Sand Slurry (11 lb./gal. wt.)

☐ Sand-Cement (Concrete) Grout ☐ Bentonite-Sand Slurry " "

☐ Concrete ☒ Bentonite Chips

For Monitoring Wells and Monitoring Well Boreholes Only:

☐ Bentonite Chips ☐ Bentonite - Cement Grout

☐ Granular Bentonite ☐ Bentonite - Sand Slurry

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<input checked="" type="checkbox"/> Verification Only of Fill and Seal	Route to:		
	<input type="checkbox"/> Drinking Water <input type="checkbox"/> Waste Management	<input type="checkbox"/> Watershed/Wastewater <input checked="" type="checkbox"/> Other:	<input type="checkbox"/> Remediation/Redevelopment

1. Well Location Information

County <u>Oneida</u>	WI Unique Well # of Removed Well _____	Well # <u>B-4</u>
Latitude / Longitude (Degrees and Minutes) ____° ____' ____" N ____° ____' ____" W		Method Code (see instructions) _____
1/4 or Gov't Lot # <u>1/4 NE</u>	Section <u>24</u>	Township <u>37 N</u>
Well Street Address <u>Near intersection of Lakewood Rd & Ricky</u>		Range <u>6 E</u>
Well City, Village or Town <u>Town of Cassian</u>		Well ZIP Code <u>Run</u>
Subdivision Name _____		Lot # _____

2. Facility / Owner Information

Facility Name <u>Union Grove Cemetery Land Site</u>
Facility ID (FID or PWS) _____
License/Permit/Monitoring # _____
Original Well Owner <u>Town of Cassian</u>
Present Well Owner <u>Town of Cassian</u>
Mailing Address of Present Owner <u>Town Hall, 9110 Church Rd, Marshfield, WI</u>
City of Present Owner <u>Same</u>
State <u>WI</u>
ZIP Code <u>54459</u>

Reason For Removal From Service

<u>Geotech Boring</u>	WI Unique Well # of Replacement Well _____
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3. Well / Drillhole / Borehole Information

<input type="checkbox"/> Monitoring Well <input type="checkbox"/> Water Well <input checked="" type="checkbox"/> Borehole / Drillhole	Original Construction Date (mm/dd/yyyy) <u>11-13-2014</u>
If a Well Construction Report is available, please attach. <u>N/A</u>	
Construction Type: <input checked="" type="checkbox"/> Drilled <input type="checkbox"/> Driven (Sandpoint) <input type="checkbox"/> Dug <input type="checkbox"/> Other (specify): _____	
Formation Type: <input checked="" type="checkbox"/> Unconsolidated Formation <input type="checkbox"/> Bedrock	
Total Well Depth From Ground Surface (ft.) <u>NA</u>	Casing Diameter (in.) <u>NA</u>
Lower Drillhole Diameter (in.) <u>NA</u>	Casing Depth (ft.) <u>NA</u>
Was well annular space grouted? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown	
If yes, to what depth (feet)? _____	Depth to Water (feet) _____

4. Pump, Liner, Screen, Casing & Sealing Material

Pump and piping removed?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Liner(s) removed?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Screen removed?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Casing left in place?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Was casing cut off below surface?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A
Did sealing material rise to surface?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Did material settle after 24 hours?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> N/A
If yes, was hole retopped?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
If bentonite chips were used, were they hydrated with water from a known safe source?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> N/A

Required Method of Placing Sealing Material

<input type="checkbox"/> Conductor Pipe-Gravity <input checked="" type="checkbox"/> Screened & Poured (Bentonite Chips)	<input type="checkbox"/> Conductor Pipe-Pumped <input type="checkbox"/> Other (Explain): _____
--	---

Sealing Materials

<input type="checkbox"/> Neat Cement Grout <input type="checkbox"/> Sand-Cement (Concrete) Grout <input type="checkbox"/> Concrete	<input type="checkbox"/> Clay-Sand Slurry (11 lb./gal. wt.) <input type="checkbox"/> Bentonite-Sand Slurry " " <input checked="" type="checkbox"/> Bentonite Chips
--	--

For Monitoring Wells and Monitoring Well Boreholes Only:

<input type="checkbox"/> Bentonite Chips <input type="checkbox"/> Granular Bentonite	<input type="checkbox"/> Bentonite - Cement Grout <input type="checkbox"/> Bentonite - Sand Slurry
---	---

5. Material Used To Fill Well / Drillhole

From (ft.)	To (ft.)	No. Yards, Sacks Sealant or Volume (circle one)	Mix Ratio or Mud Weight
Surface	<u>20'</u>	<u>30#</u>	

6. Comments

3 1/4" Hollow Stem Augers used to conduct Geotechnical Investigation

7. Supervision of Work + Drilling

Name of Person or Firm Doing Filling & Sealing <u>GDC, LLC</u>	License # _____	Date of Filling & Sealing (mm/dd/yyyy) <u>11-13-2014</u>	DNR Use Only	
Street or Route <u>PO Box 5033</u>	City <u>Waupun</u>	State <u>WI</u>	ZIP Code <u>54982</u>	Date Received _____
Telephone Number <u>(715) 241-8490</u>		Noted By _____		
Signature of Person Doing Work <u>Chris Zelenka for GDC, LLC</u>		Comments _____		
Date Signed <u>12-17-14</u>				

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<input checked="" type="checkbox"/> Verification Only of Fill and Seal	Route to:		
	<input type="checkbox"/> Drinking Water <input type="checkbox"/> Waste Management	<input type="checkbox"/> Watershed/Wastewater <input checked="" type="checkbox"/> Other:	<input type="checkbox"/> Remediation/Redevelopment

1. Well Location Information			2. Facility / Owner Information		
County <u>Oneida</u>	WI Unique Well # of Removed Well	Well # <u>B-5</u>	Facility Name <u>Union Grove Cemetery Land Site</u>		

Latitude / Longitude (Degrees and Minutes)		Method Code (see instructions)	
_____ 'N _____ 'W		_____	

1/4 1/4 or Gov't Lot #	Section <u>24</u>	Township <u>37 N</u>	Range <u>6 E</u>	Original Well Owner <u>Town of Cassian</u>
---------------------------	----------------------	-------------------------	---------------------	---

Well Street Address <u>Near intersection of Lakewood Rd & Ricky</u>		Present Well Owner <u>Town of Cassian</u>	
--	--	--	--

Well City, Village or Town <u>Town of Cassian</u>		Well ZIP Code <u>Run</u>		Mailing Address of Present Owner <u>Town Hall 9110 Church Rd Harshaw WI</u>	
--	--	-----------------------------	--	--	--

Subdivision Name		Lot #		City of Present Owner <u>Same</u>	
------------------	--	-------	--	--------------------------------------	--

Reason For Removal From Service <u>Geotech Boring</u>		WI Unique Well # of Replacement Well		4. Pump, Liner, Screen, Casing & Sealing Material	
--	--	--------------------------------------	--	---	--

3. Well / Drillhole / Borehole Information		<input type="checkbox"/> Monitoring Well <input type="checkbox"/> Water Well <input checked="" type="checkbox"/> Borehole / Drillhole		Original Construction Date (mm/dd/yyyy) <u>11-13-2014</u>	
--	--	---	--	--	--

Construction Type:		<input checked="" type="checkbox"/> Drilled <input type="checkbox"/> Driven (Sandpoint) <input type="checkbox"/> Dug <input type="checkbox"/> Other (specify):		If a Well Construction Report is available, please attach. <u>N/A</u>	
--------------------	--	---	--	--	--

Formation Type:		<input checked="" type="checkbox"/> Unconsolidated Formation <input type="checkbox"/> Bedrock		Required Method of Placing Sealing Material <input type="checkbox"/> Conductor Pipe-Gravity <input checked="" type="checkbox"/> Screened & Poured (Bentonite Chips) <input type="checkbox"/> Conductor Pipe-Pumped <input type="checkbox"/> Other (Explain):	
-----------------	--	--	--	--	--

Total Depth From Ground Surface (ft.)		Casing Diameter (in.) <u>NA</u>		Sealing Materials <input type="checkbox"/> Neat Cement Grout <input type="checkbox"/> Sand-Cement (Concrete) Grout <input type="checkbox"/> Concrete <input type="checkbox"/> Clay-Sand Slurry (11 lb./gal. wt.) <input type="checkbox"/> Bentonite-Sand Slurry " " <input checked="" type="checkbox"/> Bentonite Chips	
---------------------------------------	--	------------------------------------	--	---	--

Lower Drillhole Diameter (in.)		Casing Depth (ft.) <u>NA</u>		Was well annular space grouted? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Unknown	
--------------------------------	--	---------------------------------	--	---	--

If yes, to what depth (feet)?		Depth to Water (feet)		For Monitoring Wells and Monitoring Well Boreholes Only: <input type="checkbox"/> Bentonite Chips <input type="checkbox"/> Granular Bentonite <input type="checkbox"/> Bentonite - Cement Grout <input type="checkbox"/> Bentonite - Sand Slurry	
-------------------------------	--	-----------------------	--	--	--

5. Material Used To Fill Well / Drillhole		From (ft.)		To (ft.)		No. Yards, Sacks Sealant or Volume (circle one)		Mix Ratio or Mud Weight	
<u>Chipped Bentonite 3/8"</u>		Surface		<u>20'</u>		<u>30 #</u>			

6. Comments <u>3 1/4" Hollow Stem Augers used to conduct Geotechnical Investigation</u>									
--	--	--	--	--	--	--	--	--	--

7. Supervision of Work + Drilling				DNR Use Only					
Name of Person or Firm Doing Filling & Sealing <u>GDC, LLC</u>		License #		Date of Filling & Sealing (mm/dd/yyyy) <u>11-13-2014</u>		Date Received		Noted By	

Street or Route <u>PO Box 5033</u>		Telephone Number <u>(715) 241-8490</u>		Comments	
---------------------------------------	--	---	--	----------	--

City <u>Waupun</u>		State <u>WI</u>		ZIP Code <u>54982</u>		Signature of Person Doing Work <u>Chris Zelenka for GDC, LLC</u>		Date Signed <u>12-17-14</u>	
-----------------------	--	--------------------	--	--------------------------	--	---	--	--------------------------------	--

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between \$10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions on reverse for more information.

☒ Verification Only of Fill and Seal

Route to:

☐ Drinking Water

☐ Watershed/Wastewater

☐ Remediation/Redevelopment

☐ Waste Management

☒ Other:

1. Well Location Information

County Oneida WI Unique Well # of Removed Well B-6

Latitude / Longitude (Degrees and Minutes) ' N ' W

1/4 1/4 NE Section 24 Township 37 N Range 6 ☐ E ☐ W

Well Street Address Near intersection of Lakewood Rd & Rocky

Well City, Village or Town Town of Cassian Well ZIP Code Rm

Subdivision Name Lot #

Reason For Removal From Service Geotech Boring WI Unique Well # of Replacement Well

3. Well / Drillhole / Borehole Information

☐ Monitoring Well

☐ Water Well

☒ Borehole / Drillhole

Original Construction Date (mm/dd/yyyy)

11-13-2014

If a Well Construction Report is available, please attach N/A

Construction Type:

☒ Drilled

☐ Driven (Sandpoint)

☐ Dug

☐ Other (specify):

Formation Type:

☒ Unconsolidated Formation

☐ Bedrock

Total ~~Well~~ Depth From Ground Surface (ft.)

Casing Diameter (in.)

NA

Lower Drillhole Diameter (in.)

Casing Depth (ft.)

NA

Was well annular space grouted?

☐ Yes

☒ No

☐ Unknown

If yes, to what depth (feet)?

Depth to Water (feet)

5. Material Used To Fill Well / Drillhole

Chipped bentonite 3/8"

From (ft.)

To (ft.)

No. Yards, Sacks Sealant or Volume (circle one)

Mix Ratio or Mud Weight

Surface

20'

30 #

6. Comments

3 1/4" Hollow Stem Augers used to Conduct Geotechnical Investigation

7. Supervision of Work + Drilling

Name of Person or Firm Doing Filling & Sealing

License #

Date of Filling & Sealing (mm/dd/yyyy)

Date Received

Noted By

Street or Route

Telephone Number

Comments

City

State

ZIP Code

Signature of Person Doing Work

Date Signed

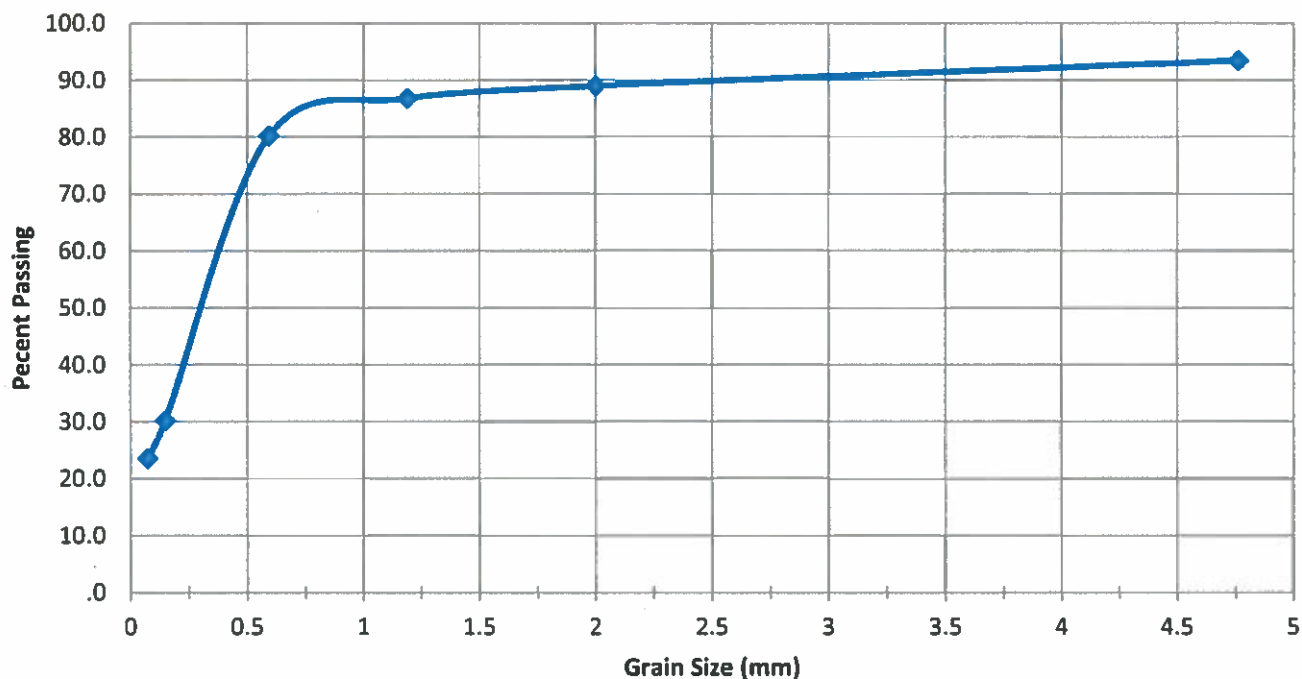
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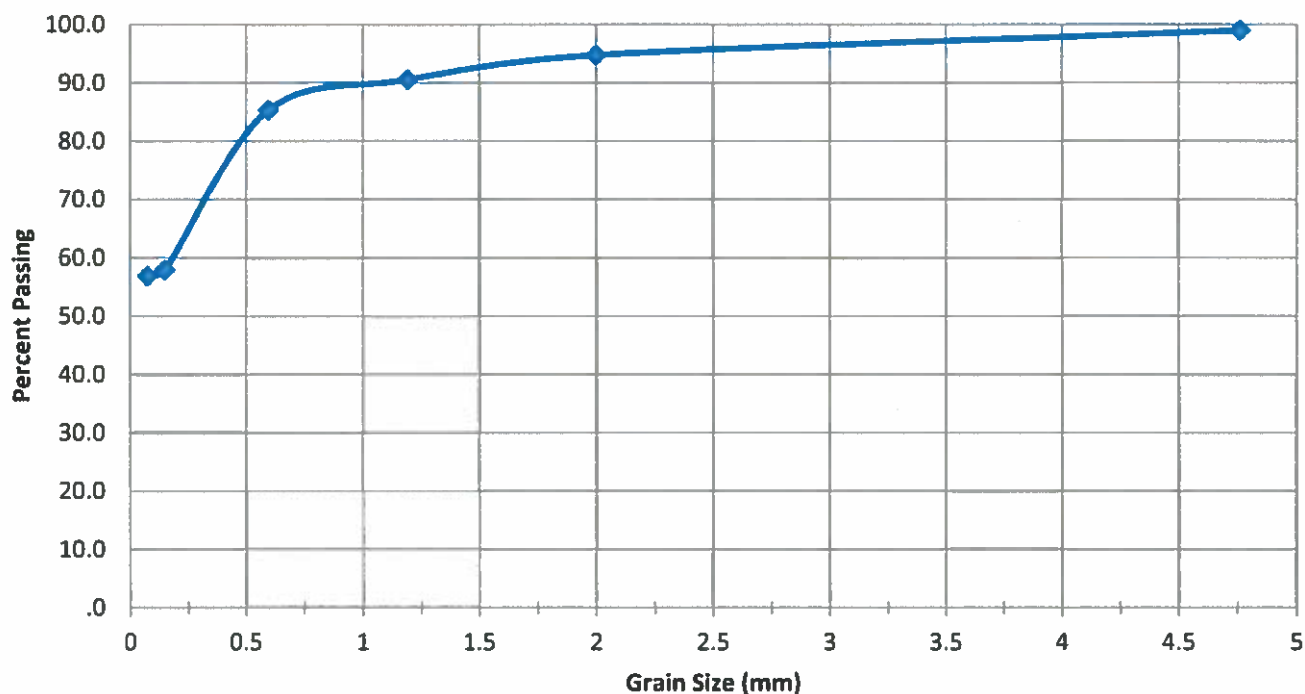
Chris Zelenka for GDC, LLC 12-17-14

Grain Size



Date: 12/12/2014					
Project No.: 44441400					
Project Name: Union Grove Cemetery					
Location of Sample: Boring Number 5, Depth: 5 ft to 6 1/2 ft					
Sample Description: Light Brown Fine Sand, Some Fines					
	Initial Sample (g)		After Wash (g)		
Dry Sample + tare =	292		448		
tare =	156		342		
Dry Sample Weight =	136		106		
Calculated % Pass 200 =	22.1				
Sieve Number	Weight Retained (g)	Tare (g)	Cum. Weight Retained (g)	% Pass	Grain Size (mm)
4	477	468	9	93.4	4.76
10	465	459	15	89.0	2
16	400	397	18	86.8	1.19
30	411	402	27	80.1	0.595
100	430	362	95	30.1	0.149
200	351	342	104	23.5	0.074

Grain Size



Date: 12/12/2014					
Project No.: 44441400					
Project Name: Union Grove Cemetery					
Location of Sample: Boring Number 4, Depth: 2 1/2 ft to 4 ft					
Sample Description: Light Grey Sandy Silt, Trace Clay					
	Initial Sample (g)		After Wash (g)		
Dry Sample + tare =	251		333		
tare =	156		292		
Dry Sample Weight =	95		41		
Calculated % Pass 200 =	56.8				
Sieve Number	Weight Retained (g)	Tare (g)	Cum. Weight Retained (g)	% Pass	Grain Size (mm)
4	468	467	1	98.9	4.76
10	464	460	5	94.7	2
16	401	397	9	90.5	1.19
30	407	402	14	85.3	0.595
100	389	363	40	57.9	0.149
200	343	342	41	56.8	0.074

CWE. Inc.

ASTM D4972-01 Standard Test Method for pH of Soils

Union Grove Cemetery Boring No. 2 , 0 to 2ft

Tested by Lucas Specketer on 12-15-14

Test #	pH
1	5.8
2	5.7
3	5.7
Average	5.7

<http://extension.usu.edu/files/publications/publication/AG-SO-02.pdf>

According to Utah State University, the ideal landscaping topsoil has a pH between 5.5 and 7.5. With a pH of 5.7 at Boring No. 2 that particular area would be suitable for growing plant materials and turf.

Organic Matter Determination ASTM D 2974	
Date:	12/17/2014
Project No.:	44441400
Project Name:	Union Grove Cemetery
Location of Sample:	Boring Number 2, Depth: 0ft to 2ft
Sample Description:	Dark Brown Organic Silty/Clay
Oven Dried	
Mass of Porcelain Dish (g):	123
Mass of Dish + Soil (g):	166
Mass of Soil (g):	43
Muffle Furnace	
Mass of Porcelain Dish (g):	123
Mass of Dish + Soil (g):	161
Mass of Soil (g):	38
Organic Content	
Organic Matter (g):	5
Organic Matter Content %:	11.6



APPENDIX C

Reference Material



5707 Schofield Avenue, Weston WI, 54476

Phone: 715-359-9400 Fax: 715-355-4199
general@cwengineers.com www.cwengineers.com

USDA/NRCS Web Soil Survey Map
 Geotechnical Engineering Report
 Union Grove Cemetery Land Site
 Town of Cassian, Oneida County, WI

DRAWN BY: S. W. B.

DATE: 11/21/2014

CHECKED BY: S.M. F.

CWE PROJECT #:
44441400

APPROVED BY: D. B.

FIGURE 2

Soil Map—Oneida County, Wisconsin
(Union Grove Cemetery)

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

 Blowout

 Borrow Pit

 Clay Spot

 Closed Depression

 Gravel Pit

 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot

 Sinkhole

 Slide or Slip

 Sodic Spot

 Spoil Area

 Stony Spot

 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals

Transportation

 Rails

 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Oneida County, Wisconsin
Survey Area Data: Version 12, Sep 16, 2014

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

Date(s) aerial images were photographed: Aug 25, 2011—Aug 28, 2011

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

Oneida County, Wisconsin (WI085)			
Map Unit Symbol	Map Unit Name	Acres In AOI	Percent of AOI
PaC	Padus loam, 6 to 15 percent slopes	2.7	3.0%
PeC	Padus-Pence sandy loams, 6 to 15 percent slopes	68.5	77.4%
PeD	Padus-Pence sandy loams, 15 to 45 percent slopes	17.3	19.6%
Totals for Area of Interest		88.6	100.0%

CWE, Inc. - Report and Test Boring General Notes and Terms

Descriptive Soil Classification			
GRAIN SIZE TERMINOLOGY			
Soil Fraction		Particle Size	US Standard Sieve Size
Boulders		Larger than 12"	Larger than 12"
Cobbles		3" to 12"	3" to 12"
Gravel	Coarse	3/4" to 3"	3/4" to 3"
	Fine	4.76 mm to 3/4"	#4 to 3/4"
Sand	Fine	2.00 mm to 4.76 mm	#10 to #4
	Medium	0.42 mm to 2.00 mm	#40 to #10
	Coarse	0.074 mm to 0.42 mm	#200 to #40
Silt		0.005 mm to 0.074 mm	smaller than #200
Clay		smaller than 0.005 mm	smaller than #200

GENERAL TERMINOLOGY	
Physical Characteristics Color, moisture, grain shape, fineness, etc.	
Major Constituents Clay, silt, sand, gravel	
Structure Laminated, varved, fibrous, stratified cemented, fissured, etc.	
Geologic Origins Glacial, alluvial, residual, etc.	

RELATIVE DENSITY	
Term	"N" Value
Very Soft	0-4
Loose	10-Apr
Medium Dense	30-Oct
Dense	30-50
Very Dense	Over 50

Physical & Plasticity Characteristics Differ Greatly between Silt and Clay.

RELATIVE PROPORTIONS OF COHESIONLESS SOILS	
Proportional Term	Defining Range By Percentage Weight
Trace	0% to 5%
Little	5% to 12%
Some or With	12% to 35%
And	35% to 50%

CONSISTENCY	
Term	q _u tons/ft ²
Very Soft	0.0 to 0.25
Soft	0.25 to 0.50
Medium	0.50 to 1.0
Stiff	1.0 to 2.0
Very Stiff	2.0 to 4.0
Hard	Over 4.0

ORGANIC CONTENT BY COMBUSTION METHOD	
Soil Description	Loss On Ignition
Non Organic	0% to 5%
Organic Silt/Clay	5% to 12%
Sedimentary Peat	12% to 35%
Fibrous and Woody Peat	35% to 50%

PLASTICITY	
Term	Plastic Index
None to Slight	0-4
Slight	10-Apr
Medium	30-Oct
High to Very High	30-50

The penetration resistance, "N", is the summation of the number of blows required to effect two successive 6 inch penetrations of a 2 inch split barrel sampler. The sampler is driven with a 140 pound weight falling 30 inches and is seated to a depth of 6 inches before commencing the standard penetration test (count).

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not represent static levels, especially in cohesive soils.

TERMINOLOGY & SYMBOLS

DRILLING AND SAMPLING

CS - Continuous Sampling
 RC - Rock Coring: Size AW, BW, NW, 2"W
 RQD - Rock Quality Designator
 RB - Rock Bit
 FT - Fish Tail
 DC - Drove Casing
 C - Casing: Size 2 1/2", NW, 4", HW
 CW - Clear Water
 DM - Drilling Mud
 HSA - Hollow Stem Auger
 FA - Flight Auger
 HA - Hand Auger
 COA - Clean Out Auger
 SS-2" Diameter Split-Barrel Sample
 2ST-2" Diameter Thin-Walled Tube Sample
 3ST-3" Diameter Thin-Walled Tube Sample
 PT-3" Diameter Piston Tube Sample
 AS - Auger Sample
 WS - Wash Sample
 PTS - Peat Sample
 PS - Pitcher Sample
 NR - No Recovery
 S - Sounding
 PMT - Borehole Pressuremeter Test
 VS - Vane Shear Test
 WPT - Water Pressure Test

LABORATORY TESTS

q - Penetrometer Reading, tons/ft²
 q_u - Unconfined strength, tons/ft²
 W - Moisture Content, %
 LL - Liquid Limit, %
 PL - Plastic Limit, %
 SL - Shrinkage Limit, %
 LI - Loss On Ignition, %
 D - Dry Unit Weight, lbs/ft³
 pH - Measure of Soil Alkalinity or Acidity
 FS - Free Swell, %

WATER LEVEL MEASUREMENT

∇ - Water Level at Time Indicated
 NW - No Water Encountered
 WO - While Drilling
 BC R - Before Casing Removal
 ACR - After Casing Removal
 CW - Caved and Wet
 CM - Caved and Moist



**TABLE 1615.1.1
SITE CLASS DEFINITIONS**

SITE CLASS	SOIL PROFILE NAME	AVERAGE PROPERTIES IN TOP 100 feet, AS PER SECTION 1615.1.5		
		Soil shear wave velocity, \bar{v}_s , (ft/s)	Standard penetration resistance, \bar{N}	Soil undrained shear strength, \bar{s}_u , (psf)
A	Hard rock	$\bar{v}_s > 5,000$	N/A	N/A
B	Rock	$2,500 < \bar{v}_s \leq 5,000$	N/A	N/A
C	Very dense soil and soft rock	$1,200 < \bar{v}_s \leq 2,500$	$\bar{N} > 50$	$\bar{s}_u \geq 2,000$
D	Stiff soil profile	$600 \leq \bar{v}_s \leq 1,200$	$15 \leq \bar{N} \leq 50$	$1,000 \leq \bar{s}_u \leq 2,000$
E	Soft soil profile	$\bar{v}_s < 600$	$\bar{N} < 15$	$\bar{s}_u < 1,000$
E	—	Any profile with more than 10 feet of soil having the following characteristics: 1. Plasticity index $PI > 20$, 2. Moisture content $w \geq 40\%$, and 3. Undrained shear strength $\bar{s}_u < 500$ psf		
F	—	Any profile containing soils having one or more of the following characteristics: 1. Soils vulnerable to potential failure or collapse under seismic loading such as liquefiable soils, quick and highly sensitive clays, collapsible weakly cemented soils. 2. Peats and/or highly organic clays ($H > 10$ feet of peat and/or highly organic clay where H = thickness of soil) 3. Very high plasticity clays ($H > 25$ feet with plasticity index $PI > 75$) 4. Very thick soft/medium stiff clays ($H > 120$ feet)		

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 pound per square foot = 0.0479 kPa. N/A = Not applicable

Table 1. Soil Parameters for Pavement Design

Material	AASHTO	Soil Support Value	Wisconsin Design Group Index	Subgrade K	Resilient Modulus M_R
I – well sorted	A-1-a	5.5-5.4	0-2	300	7000
	A-1-b	5.3-5.2	3-4	275	6000
	A-3	5.1-5.0	5-6	250	5000
	A-2-4	4.9-4.7	7-8	225	4300
	A-2-4/A-4	4.6-4.5	9-10	200	3600
	A-4/A-6	4.4-4.2	11-12	175	3300
II – poorly sorted	A-4	4.2	12	150	3000
	A-4/A-6	4.1-3.8	13-15	125	2800
	A-7-6	3.7-3.5	16-17	100	2600
	A-7-5	3.3-3.0	18-20	75	2500

Design Group Index as it Relates to Frost Index

0-1	F-0 to F-1
1-6	F-2
6-15	F-3
15-20	F-4

UNIFIED SOIL CLASSIFICATION SYSTEM

COARSE-GRAINED SOILS

(More than half of material is larger than No. 200 sieve size.)

GRAVELS More than half of coarse fraction larger than No. 4 sieve size	Clean Gravels (Little or no fines)	
	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
	Gravels with Fines (Appreciable amount of fines)	
	GM^d_u	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
SANDS More than half of coarse fraction smaller than No. 4 sieve size	Clean Sands (Little or no fines)	
	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with Fines (Appreciable amount of fines)	
	SM^d_u	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures

FINE-GRAINED SOILS

(More than half of material is smaller than No. 200 sieve.)

SILTS AND CLAYS Liquid limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit greater than 50%	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils

LABORATORY CLASSIFICATION CRITERIA

GW $C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^3}{D_{10} \times D_{60}}$ between 1 and 3

GP Not meeting all gradation requirements for GW

GM Atterberg limits below "A" line or P.I. less than 4

GC Atterberg limits above "A" line with P.I. greater than 7

Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols

SW $C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^3}{D_{10} \times D_{60}}$ between 1 and 3

SP Not meeting all gradation requirements for SW

SM Atterberg limits below "A" line or P.I. less than 4

SC Atterberg limits above "A" line with P.I. greater than 7

Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.

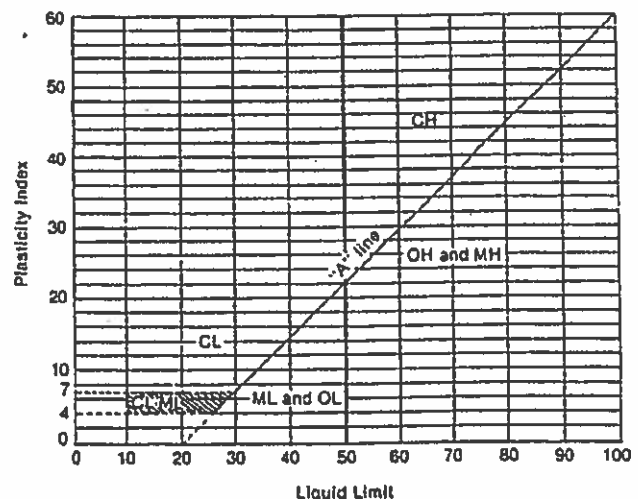
Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 per cent GW, GP, SW, SP

More than 12 per cent GM, GC, SM, SC

5 to 12 per cent Borderline cases requiring dual symbols

PLASTICITY CHART











For classification of fine-grained soils and fine fraction of coarse-grained soils.

Atterberg Limits plotting in hatched area are borderline classifications requiring use of dual symbols.

Equation of A-line: $PI = 0.73 (LL - 20)$

MAJOR DIVISIONS				TYPICAL NAMES
COARSE GRAINED SOILS More than Half > #200 sieve	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES
		GRAVELS WITH OVER 15% FINES	GM	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS
			SP	POORLY GRADED SANDS, GRAVELLY SANDS
		SANDS WITH OVER 15% FINES	SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES
			SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE GRAINED SOILS More than Half < #200 sieve	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
	HIGHLY ORGANIC SOILS		Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

-  Modified California
-  Split Spoon
-  Pushed Shelby Tube
-  Auger Cuttings
-  Grab Sample
-  Sample Attempt with No Recovery
- CA Chemical Analysis
- CN Consolidation
- CP Compaction
- DS Direct Shear
- PM Permeability
- PP Pocket Penetrometer

- RV R-Value
- SA Sieve Analysis
- SW Swell Test
- TC Cyclic Triaxial
- TX Unconsolidated Undrained Triaxial
- TV Torvane Shear
- UC Unconfined Compression
- (1.2) (Shear Strength, ksf)
- WA Wash Analysis
- (20) (with % Passing No. 200 Sieve)
-  Water Level at Time of Drilling
-  Water Level after Drilling (with date measured)

SOIL CLASSIFICATION CHART AND KEY TO TEST DATA

gINT Example
Somewhere, USA

LOGO