PREPARED FOR:

GEOTECHNICAL REPORT

JEFFERSON MAIN TOWER
JEFFERSON COUNTY, WISCONSIN

EDGE PROJECT NUMBER: 27648

November 23, 2020

Edge
Consulting Engineers, Inc.

624 Water Street
Prairie du Sac, Wisconsin 53578
608.644.1449 Phone
608.644.1549 Fax
www.edgeconsult.com

Reliable
Comprehensive
Exceeding Expectations

GEOTECHNICAL REPORT

Project Name & Address:	Jefferson Main Tower 345 E Ogden Street Jefferson, Wisconsin 53549
Property Information:	NE ¼ of the SE ¼, Section 2, T6N, R14W City of Jefferson Jefferson County, Wisconsin
Client:	Jefferson County Sheriff's Office 411 S. Center Avenue Jefferson, WI 53549 Contact: Todd Lindert Phone: 920.674.7346
Consultant:	Edge Consulting Engineers, Inc. 624 Water Street Prairie du Sac, Wisconsin 53578 Contact: Arlen Ostreng, P.E. Phone: 608.644.1449
Edge Project Number:	27648
Date:	November 23, 2020

Kaitlin Rinabarger
Geotechnical Specialist

11/23/2020
Date

Arlen Ostreng, P.E.
Geotechnical Manager

11-23-2020
Date

WISCONSIN
ARLEN J. OSTRENG
32437
PRAIRIE DU SAC, WISCONSIN
PROFESSIONAL ENGINEER

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SECTION 1
INTRODUCTION

1.1 PROJECT INFORMATION

This report summarizes the results of a geotechnical exploration conducted by Edge Consulting Engineers, Inc. (Edge Consulting) for Jefferson County for an existing 150-foot self-support telecommunications tower. The tower is located at 345 E. Ogden Street in the City of Jefferson, Jefferson County, Wisconsin. Existing equipment is located within an existing equipment shelter near the base of the tower within a fenced compound. A street map showing the location of the tower site is available in Figure 1. The location of the proposed project site on the Jefferson, Wisconsin United States Geological Survey (USGS) 7.5 Minute Quadrangle is shown in Figure 2. Based on an inspection of the quadrangle map and detailed site survey, the site is located at an approximate elevation of 896 feet above mean sea level. A site plan depicting the tower site has been included as Figure 3. Site photos have also been included in Figure 4.

1.2 PURPOSE OF REPORT

The investigative activities of this report were conducted for the purposes of providing geotechnical engineering design parameters and soil characteristics for use in evaluating the structural adequacy of the existing tower foundation system to support a structural loading change. This assessment was completed in conformance with client directed protocols, and utilizing the judgment of the geotechnical engineer.

1.3 SCOPE OF SERVICES

The scope of services for this project included research of reference materials and field exploration. Section 5 contains a list of references consulted in the preparation of this report. The scope of services for this report was determined predominantly by client supplied standards.

Field exploration consisted of advancing one boring in the vicinity of the existing tower base to a depth of 40 feet, or until auger refusal. Edge Consulting reviewed the boring logs, the recovered soil samples, and laboratory testing results (if any) to determine the engineering characteristics of the soils at or near the existing tower location. This report summarizes the field exploration results and provides recommendations related to suitable foundation types and depths, allowable bearing pressure, and estimates of foundation settlement.

SECTION 2
EXPLORATION RESULTS

2.1 REFERENCE RESEARCH & BACKGROUND

Review of United States Department of Agriculture NRCS (Natural Resource Conservation Service) Web Soil Survey for Jefferson County indicates natural site soils are classified as “RtD2” (Rotamer loam). These soil types are typically well drained soils that are gradually to steeply sloping and consist of calcareous sandy loamy till. The soils are typically classified as SC-SM and CG-GM on the Unified Soil Classification System. The risk of corrosion to uncoated steel and concrete is low. Edge Consulting reviewed the “Thickness of Unconsolidated Material in Wisconsin” map prepared by the Geologic and Natural History Survey. This map indicates that the anticipated depth to bedrock is between 100-200 feet, with underlying bedrock consisting of orthoquartzitic sandstone with minor limestone, shale, and conglomerate of the Ordovician System from the Paleozoic Age.

2.2 TOPOGRAPHY

The existing topography of the subject site is gradually to steeply sloping, with surface water generally flowing to the west and east. Existing slopes are approximately 3-20%. Site drainage is adequate, and no standing water was observed during drilling operations.

2.3 FIELD EXPLORATION

Soil Essentials, Ltd performed the field drilling services for the project. One standard penetration test (SPT) soil boring was advanced to a depth of 16 feet below grade surface (bgs) due to auger refusal. Drilling was completed on November 17, 2020. The boring was advanced using a rotary drill rig. Representative soil samples were obtained using a standard 2-inch diameter split spoon sampler in general accordance with ASTM D1586 / D1586M-18, “Standard Test Method for Penetration Tests and Split-Barrel Sampling of Soils”. A description of this procedure is available in Appendix C of this report. Split spoon sampling was performed by collecting 18 inch samples at 2.5-foot intervals to a depth of 15 feet and 5 foot intervals thereafter.

The drill crew chief visually and manually classified samples in the field in accordance with ASTM D2487-17. The field personnel then collected representative soil samples from each split spoon and placed these samples in glass jars for further examination and verification of the field classification by a geotechnical engineer. The soil boring logs located in Appendix A contain pocket penetrometer readings, standard penetration measurements, soil classification information and other pertinent information.

Upon completion of drilling, the soil borings were abandoned in accordance with Chapter NR 141, Wisconsin Administrative Code.

2.4 SUBSURFACE CONDITIONS

One soil boring was completed at the site. Boring B-1 was drilled as close to the existing tower center location as was possible. Subsurface soils were noted to consist of 2 inches of topsoil followed by silty sand and gravel to 1-foot bgs. Soft silty clay was then encountered to 3 feet bgs followed by medium dense silty fine sand with gravel and cobbles (till) to 8 feet bgs. Very dense silty fine sand with gravel and cobbles (till) was then observed to the end of boring and maximum depth explored at 16 feet bgs. The approximate location of the boring is depicted in Figure 3. The boring log is available in Appendix A.

2.5 BEDROCK

Auger refusal was encountered at 16 feet bgs near the tower center. A confirmation boring was advanced approximately 10 feet south of the tower center boring (B-1). Auger refusal was also encountered at 16 feet bgs. It is believed that the auger refusal was the result of encountering large cobbles or a boulder and not competent bedrock.

2.6 FROST DEPTH AND COVER

According to the ANSI/TIA -222-G standards, frost depth for the area is expected to be 60 inches. It is recommended that all tower foundation elements, not bearing directly on solid rock or otherwise protected from frost, be founded at or below this depth to adequately protect against frost heave. Similarly, foundations for equipment buildings larger than 400 sq.ft. shall also extend below the frost line of the locality, be constructed on solid rock or be otherwise protected from frost in accordance with Section 1809.5 of the International Building Code (IBC).

2.7 WATER LEVEL OBSERVATIONS

Groundwater **was not** encountered during this investigation.

2.8 LABORATORY TESTING

Edge Consulting utilized a Bluelab® soil pH pen to obtain a pH reading of 8.0 from a collective soil sample obtained at the tower center from 3.5 to 5.0 feet bgs. The pH level was obtained in accordance with ASTM G51-95(2005) “Standard Test Method for Measuring pH of Soil for Use in Corrosion Testing”.

A soil resistivity test was also completed on the same collective soil sample using a MC Miller soil box in conjunction with a Nilsson Model 400 Soil Resistance Meter to obtain a resistance reading of 73,000 OHM-cm. The soil resistance test was collected in accordance with ASTM G57-95a (Reapproved 2001) “Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method”.

SECTION 3
ANALYSIS & RECOMMENDATIONS

3.1 FOUNDATIONS

3.1.1 Existing Tower

The existing tower foundation design was not available. Edge Consulting completed a foundation investigation to determine the existing foundation type and size. It was determined that the tower foundation consists of individual pad and pier footings at each of the tower legs installed to 11 feet bgs. The footings are bearing on very dense silty sand with gravel and cobbles (till). A complete listing of soil properties for use in foundation design is contained in Appendix B.

3.2 SOIL BEARING CAPACITY

The recommended maximum presumptive net bearing capacity of very dense silty sand with gravel and cobbles (till) at depths between 8 and 16 feet bgs is 7,000 psf. Foundation systems designed for these capacities should experience a total settlement of less than 1 inch, with a differential settlement of less than half this amount. All bearing values should be considered allowable. A factor of safety of 2.0 has been assumed.

3.3 LATERAL EARTH PRESSURE

Edge Consulting utilized Rankine methodology to determine the foundation earth pressure parameters. Recommended values for passive lateral earth pressure based on soil depth are available in Appendix B. All calculated values are considered ultimate. It is assumed that a minimum factor of safety of 2.0 will be incorporated at the time of foundation design.

3.4 FRICTIONAL SKIN RESISTANCE

Included in Appendix B are recommended values for compressive frictional skin resistance for this site. These resistances are assumed to occur between concrete foundation elements and existing site soils. All calculated values are considered ultimate. It is assumed that a minimum factor of safety of 2.0 will be incorporated at the time of foundation design. For uplift and pull-out type calculations, it is further recommended that the uplift frictional skin resistance be considered as 2/3 of the listed compressive values.

3.5 SPECIAL DESIGN CONSIDERATIONS

The existing tower is located within soils with relatively high resistivity readings. It is recommended that an enhanced grounding system be implemented at this site, if one is not already present, which may include the use of chemical ground rods, tight ground rod spacing pattern and/or low-resistivity grounding backfill.

3.9 SPECIAL CONSTRUCTION CONSIDERATIONS

Special precautions should be taken for earthwork during winter months. Footings or fills should not be placed on frozen soils. Exposed subgrade soil should be adequately protected with insulating blankets.

SECTION 4
LIMITATIONS AND RESTRICTIONS

This report has been prepared to aid in the evaluation of this property for the intended use described herein, and to assist in the design or planning of this project. In the event any changes in the design as outlined herein, or changes in the vertical position or horizontal location of the facility are planned, the conclusions and recommendations contained in this report shall not be considered valid unless such changes are reviewed by Edge Consulting Engineers, Inc.

The analysis and recommendations submitted in this report are our opinions based on the data obtained and subsurface conditions noted from the field investigation described at the locations indicated on the accompanying site plan. This report does not reflect any variations that may occur between, beyond, or below the depths of these test pits or borings. If variations then appear evident, it will be necessary for a re-evaluation of the recommendations of this report to be made after performing on-site observations during the construction period and noting the characteristics of any variations.

The soil report is only for the purposes stated in the contract and may not be sufficient to prepare an accurate bid.

Certain assumptions have been made regarding the foundation design for this site. Edge Consulting Engineers, Inc. should be given the opportunity to review the final foundation design to determine whether the final design necessitates any changes of the recommendations contained in this document. If Edge Consulting is not provided the opportunity for this review, we can assume no responsibility for the misinterpretation or misapplication of these recommendations or for their validity in the event changes have been made to the initial understanding of the project or design content.

There is the possibility that variations in soil conditions will be encountered during construction. In order to permit correlation between soil data in this report and the actual soil conditions encountered during construction, it is required that the soil engineer be retained to perform a review of the excavation prior to foundation placement. Edge Consulting assumes no responsibility for construction compliance with design concepts, specifications, or recommendations unless we have been retained to perform on-site review during the course of construction. Edge Consulting should be contacted immediately if conditions encountered are not consistent with those described.

This report was prepared in accordance with generally accepted soil and foundation engineering practices and makes no other warranties, either expressed or implied, as to the professional advice provided under the terms of the agreement between the Engineer and his client. This report has not been prepared for uses or parties other than those specifically named, or for uses or applications other than those enumerated herein. The report may contain insufficient or inaccurate information for other purposes, applications, building sites, or other uses.

SECTION 5
REFERENCES

1. Das, Braja M., *Principles of Foundation Engineering*, 2nd. Edition, 1990.

2. Das, Braja M., *Principles of Geotechnical Engineering*, 2nd. Edition, 1990.

3. Das, Braja M., *Soil Mechanics Laboratory Manual*, 3rd. Edition, 1989.

4. Hadley, David W. and Pelham, James H., *Glacial Deposits of Wisconsin*, 1976.

5. Hole, F.D., etal., *Overlay Soil Map of Wisconsin*, 1:250,000, University of Wisconsin, Geological and Natural History Survey, 1968.

6. Mudrey, M.G., Brown, B.A., & Greenburg, J.K. Bedrock Geologic Map of Wisconsin [map]. 1982. 1:1,000,000. University of Wisconsin, Geological and Natural History Survey. Retrieved from http://www.uwex.edu/wgnhs/gis.htm.

7. Ostrom, Meredith E. Thickness of Unconsolidated Material in Wisconsin [map]. 1983. No scale. University of Wisconsin – Extension, Wisconsin Geologic and Natural History Survey. Retrieved from http://www.uwex.edu/wgnhs/gis.htm

8. Reese, Lymon C., Ph.D., P.E. and Michael W. O'Neill Ph.D., P.E., Drilled Shafts: Construction Procedures and Design Methods, Publication Nos. FHWA-HI-88-042, ADSC-TL-4, August 1988.

9. Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.gov/.

Figure 1

Street Maps

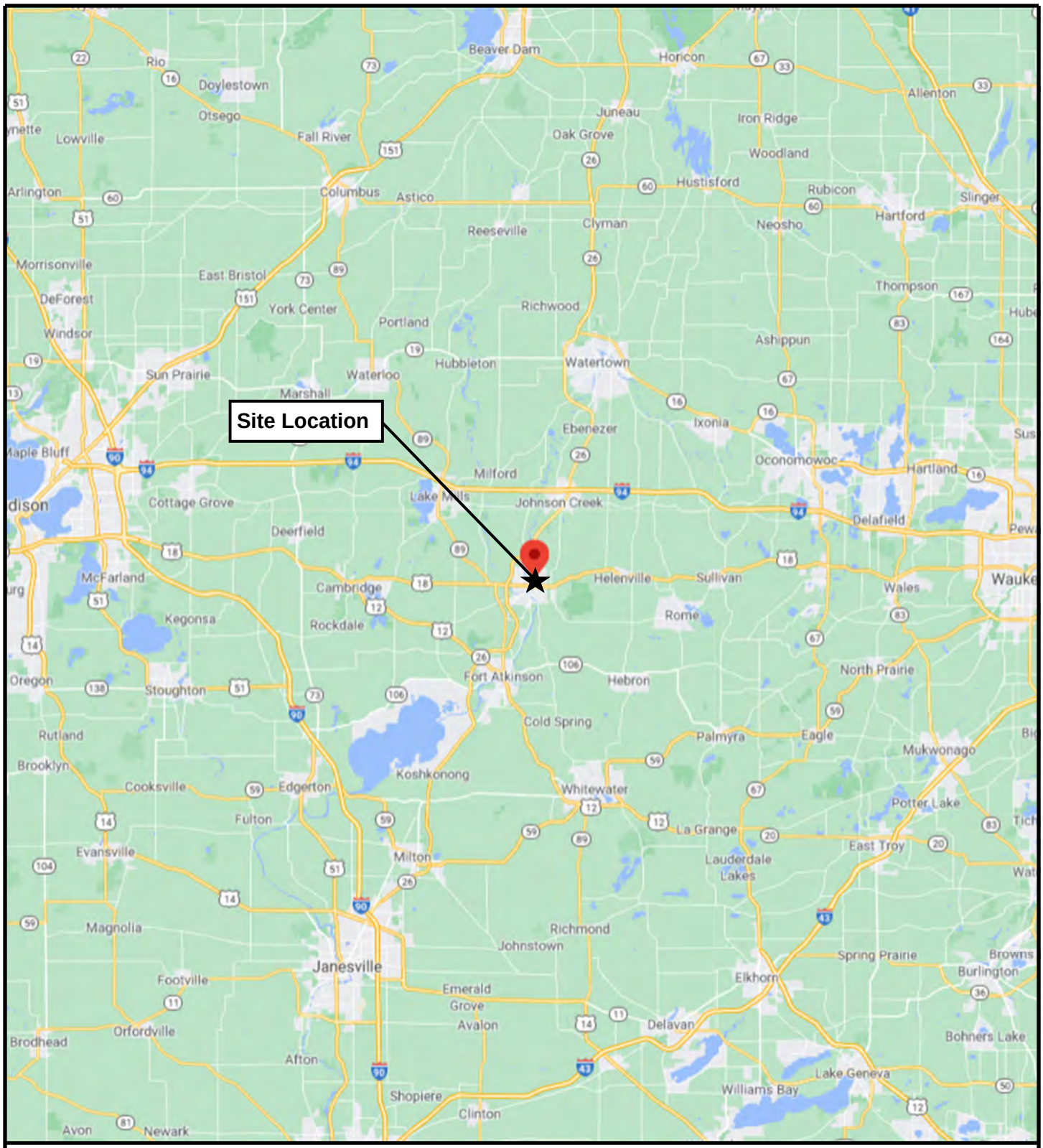


FIGURE #1
Regional Map

Edge
Consulting Engineers, Inc.

Project Number: #27648

Project Info: Jefferson County / Jefferson Main Tower

Project Location: 345 E Ogden Street, Jefferson, WI 53549

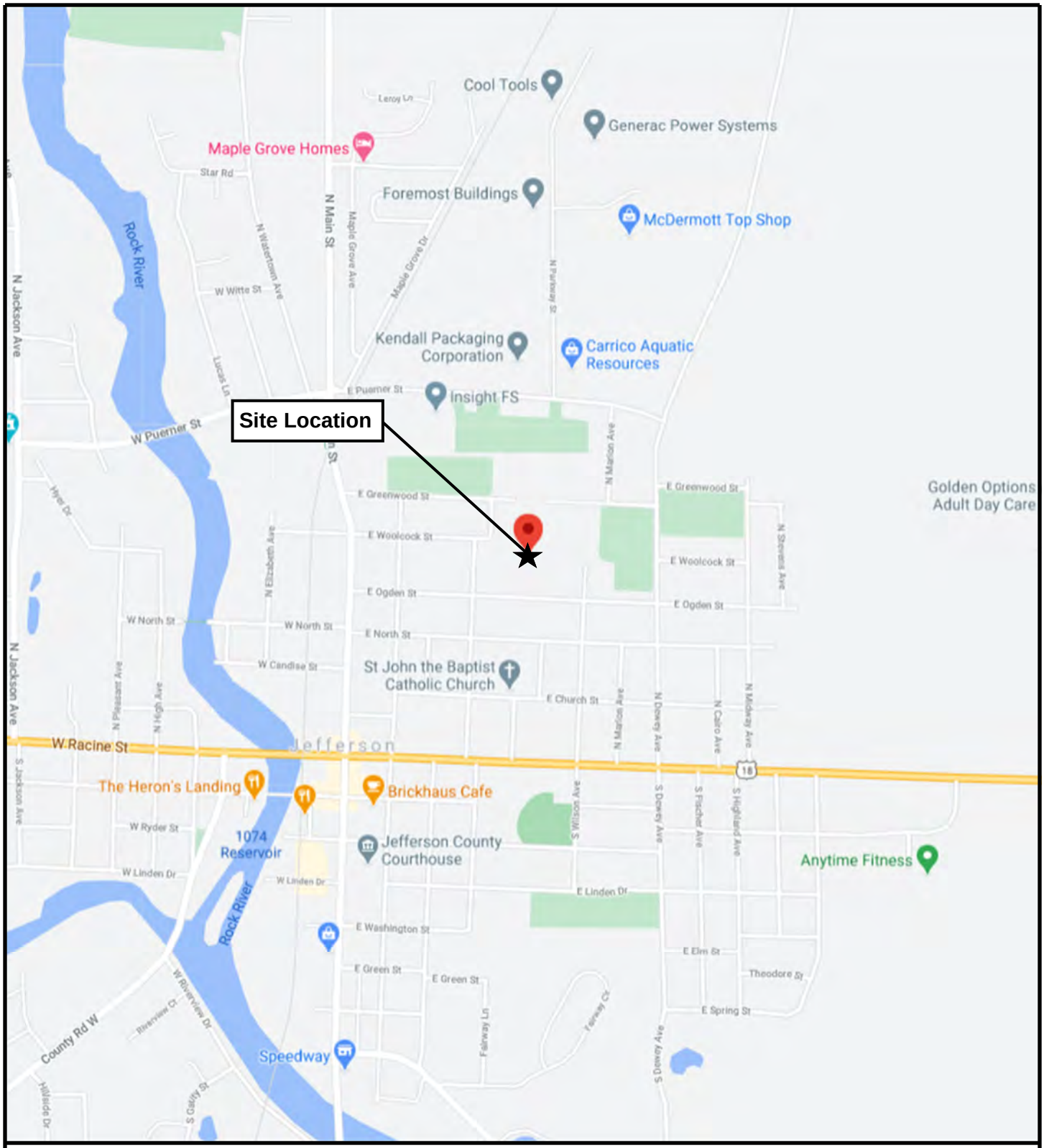


FIGURE #2
Street Map

Edge
Consulting Engineers, Inc.

Project Number: #27648

Project Info: Jefferson County / Jefferson Main Tower

Project Location: 345 E Ogden Street, Jefferson, WI 53549

Figure 2

USGS Topographic Quadrangle Map

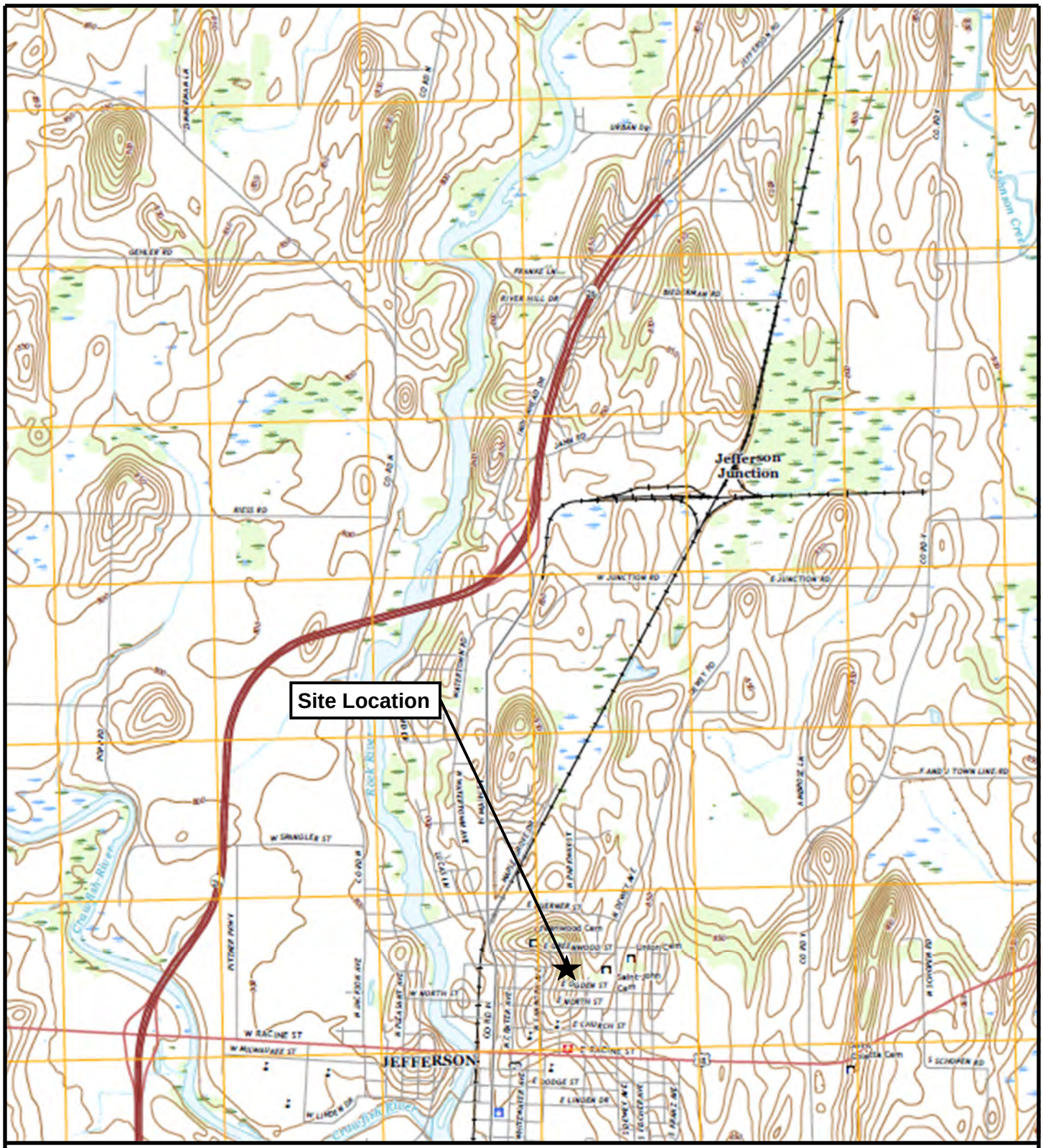


FIGURE #3
7.5 Minute USGS Quadrangle Map

Edge
Consulting Engineers, Inc.

Project Number: #27648

Project Info: Jefferson County / Jefferson Main Tower

Project Location: 345 E Ogden Street, Jefferson, WI 53549

Figure 3

Site Plan

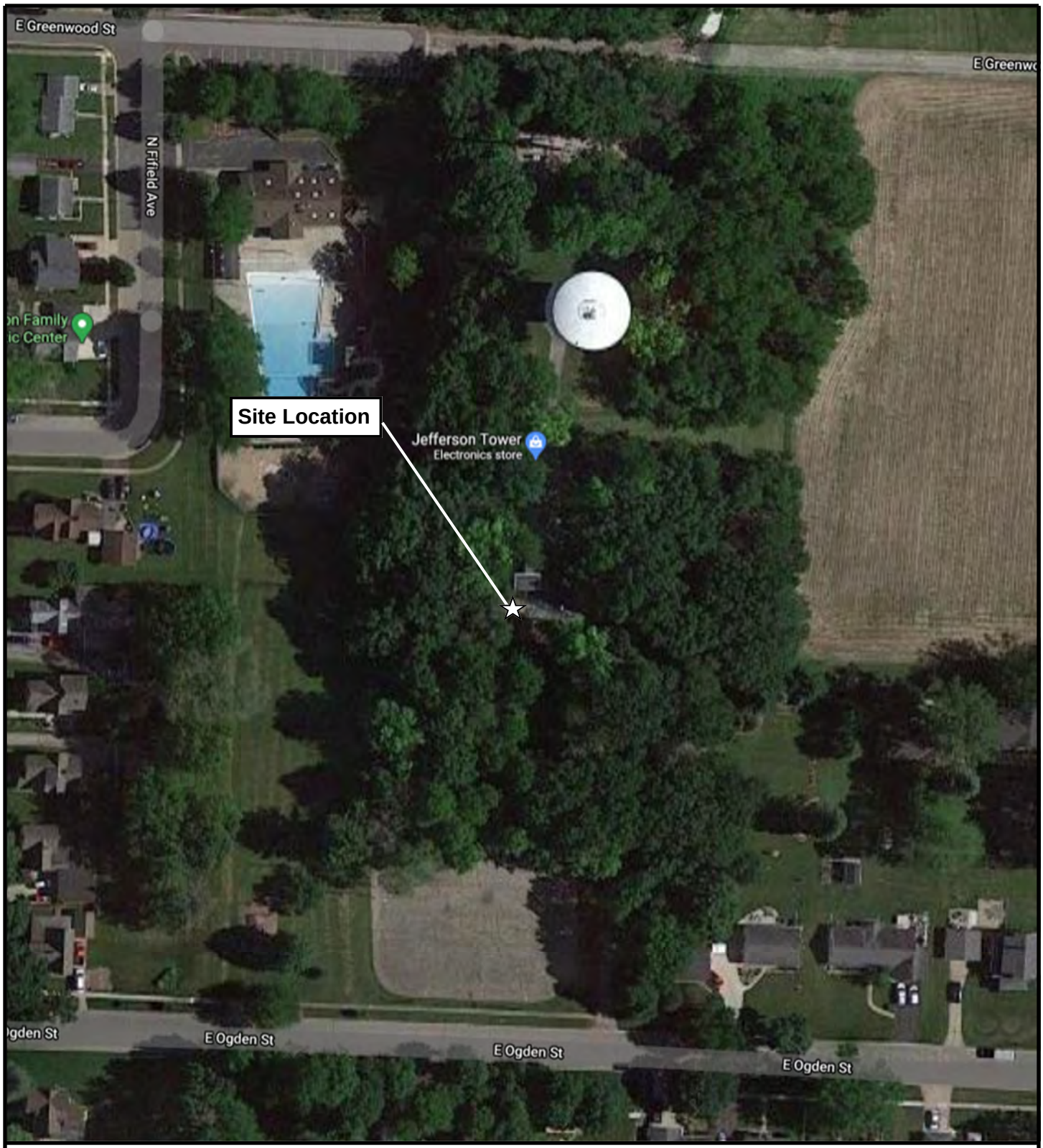


FIGURE #4
Aerial Site Plan

Edge
Consulting Engineers, Inc.

Project Number: #27648

Project Info: Jefferson County / Jefferson Main Tower

Project Location: 345 E Ogden Street, Jefferson, WI 53549

KEYNOTES: (THIS SHEET)

A. JEFFERSON COUNTY EQUIPMENT SHELTER

NORTH

EXISTING POWER POLE
N/E 8F63R

ASPHALT DRIVE TO
WATER TOWER

GRAVEL

WOODS

WOODS

APPROX. PROPERTY LINE

EXISTING ASPHALT
ACCESS ROAD

EXISTING 150' SELF-SUPPORT TOWER

EXISTING FENCED COMPOUND

GRASS

Boring B-1

GENERAL NOTES: (THIS SHEET)

1. NORTH ARROW SHOWN AS APPROXIMATE.
2. AERIAL IMAGERY PER UAS-DRONE FLIGHT:
   EDGE CONSULTING ENGINEERS, INC. ON 08/18/2020
3. NO PROPERTY SURVEY WAS PERFORMED AS PART OF THIS PROJECT. ALL PROPERTY LINES SHOWN ARE APPROXIMATE.
4. TOPOGRAPHIC FEATURES PER TOPOGRAPHIC SURVEY BY:
   EDGE CONSULTING ENGINEERS, INC. ON 08/18/2020
5. UNDERGROUND UTILITIES SHOWN PER:
   DIGGERS HOTLINE TICKET #: 20203315230
   UTILITIES NOTIFIED INCLUDE:
   JEFFERSON COUNTY JC001
   CITY OF JEFFERSON JEF01
   AT&T DISTRIBUTION SBC01
   WE ENERGIES-WE GAS-WOWEG

10' 0 10' 20'
SCALE: 11" x 17" - 1" = 20'
22" x 34" - 1" = 10'

CONSULTANT:
Edge
Consulting Engineers, Inc.
624 WATER STREET
PRAIRIE DU SAC, WI 53578
608.644.1449 VOICE
608.644.1549 FAX
www.edgeconsult.com

CLIENT:
JEFFERSON COUNTY WI. ESTABLISHED 1836

ENLARGED SITE PLAN
JEFFERSON MAIN TOWER (27648)
JEFFERSON, WISCONSIN

SUBMITTAL:		
INT.	DATE:	DESCRIPTION:
TJT	10/29/20	PR2

CHECKED BY	AJO
PLOT DATE	10/29/2020
PROJECT NUMBER	27648
SET TYPE	PR2
SHEET NUMBER	C-102

k:\27600\27648\Design\CAD\PR2\Plot\C-102.dgn

Figure 4

Site Photographs

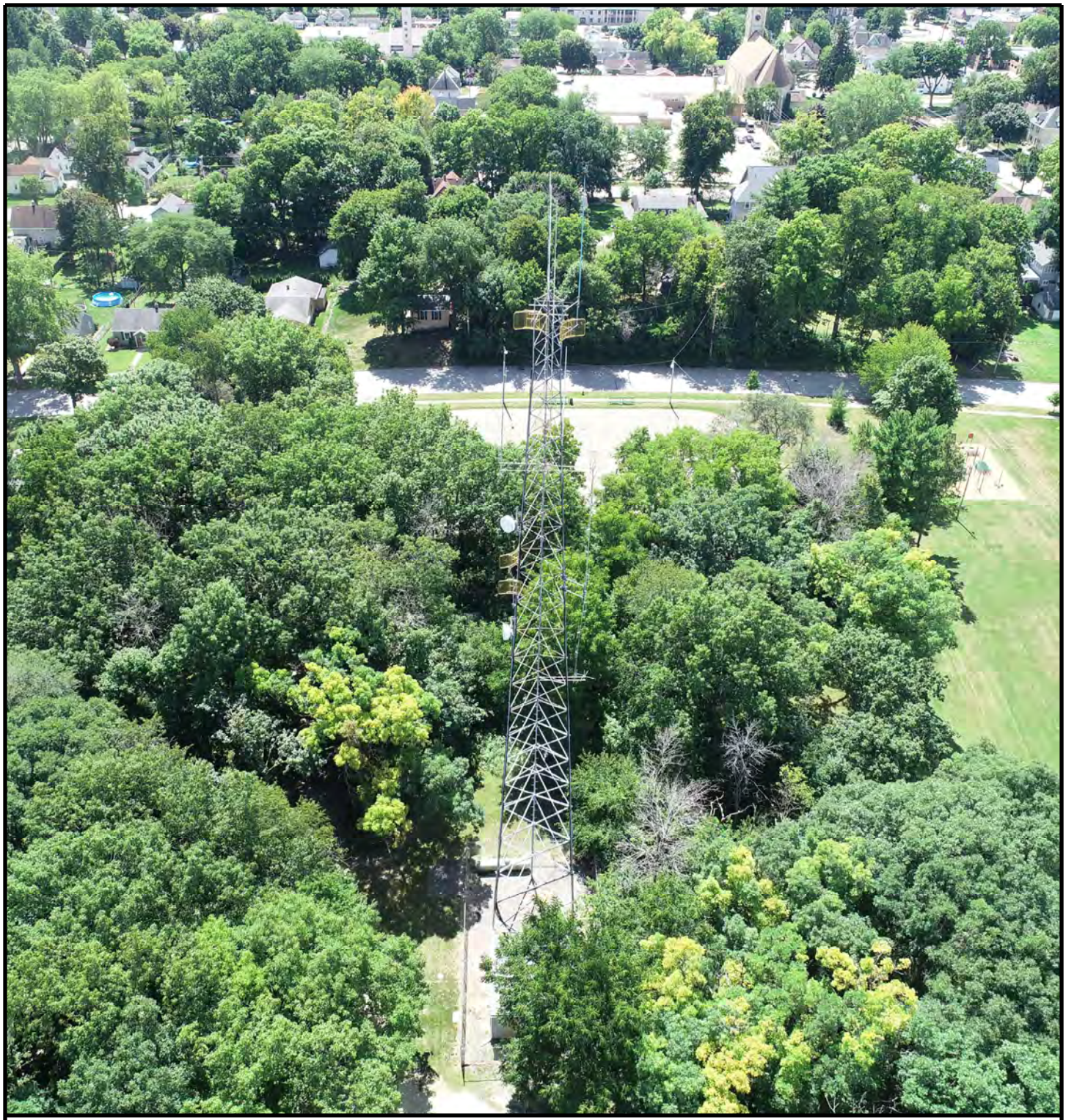


Photo 1 - EXISTING TOWER OVERVIEW

FIGURE #5
Site Photographs

Edge
Consulting Engineers, Inc.

Project Number:	#27648
Project Info:	Jefferson County / Jefferson Main Tower
Project Location:	345 E Ogden Street, Jefferson, WI 53549
Photograph Date:	July 1, 2020

Photo 2 - COMPOUND OVERVIEW—LOOKING SOUTH

Photo 3 - EXISTING TOWER BASE

FIGURE #5
Site Photographs

Edge
Consulting Engineers, Inc.

Project Number:	#27648
Project Info:	Jefferson County / Jefferson Main Tower
Project Location:	345 E Ogden Street, Jefferson, WI 53549
Photograph Date:	July 1, 2020

Appendix A

Soil Boring Logs

Edge
Consulting Engineers, Inc.

Project: Jefferson County (Jefferson Main Tower)
Project Location: Jefferson, Wisconsin
Project Number: 27648

Log of Boring B-1

Sheet 1 of 1

Date(s) Drilled **November 17, 2020**	Logged By **T**	Checked By **L**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **2 inch Split Spoon**	Total Depth of Borehole **16 feet bgs**
Drill Rig Type **Geoprobe 7822DT**	Drilling Contractor **Soil Essentials**	Approximate Surface Elevation **896 feet MSL**
Groundwater Level and Date Measured **Not Encountered ATD**	Sampling Method(s) **SPT, Grab**	Hammer Data **140 lb, 30 in drop, rope & cathead**
Borehole Backfill **Bentonite/Cuttings**	Location **Tower Center (South of Fenced Compound)**	

Elevation, feet	Depth, feet	Sample Type	Sample Number	Sampling Resistance, blows/foot	Relative Consistency	USCS Symbol	MATERIAL DESCRIPTION	Moisture	Qu (tsf)	Recovery (in)	REMARKS AND OTHER TESTS
896	0					OL-OH	2" Topsoil				
			0			GM	Brown Silty Sand and Gravel	D	-	-	
						CL	Brown Silty Clay				
			1	3,1,2	Soft			D	1.0	12	
						SM	Brown Silty Fine Sand w/Gravel and Cobbles (Till)				
			2	8,9,10	Medium Dense			D	-	14	
891	5										
			3	10,11,14	Medium Dense			D	-	12	
			4	23,31,36	Very Dense			D	-	11	
886	10										
			5	22,42,100/2"	Very Dense			D	-	12	
			6	19,25,31	Very Dense			D	-	16	
881	15										
							Bottom of Boring and Auger Refusal at 16 feet bgs Confirmation boring advanced approximately 10 feet south of B-1. Auger refusal encountered at 16 feet bgs.				
876	20										

Figure 1

I:\27600\27648\Geotech\27648 BorinGS.bgs [basic log new.tpl]

Edge
Consulting Engineers, Inc.

Project: Jefferson County (Jefferson Main Tower)
Project Location: Jefferson, Wisconsin
Project Number: 27648

Key to Log of Boring

Sheet 1 of 1

Elevation, feet	Depth, feet	Sample Type	Sample Number	Sampling Resistance, blows/foot	Relative Consistency	USCS Symbol	Graphic Log	MATERIAL DESCRIPTION	Moisture	Qu (tsf)	Recovery (in)	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8	9	10	11	12	13

COLUMN DESCRIPTIONS

1 **Elevation, feet:** Elevation (MSL, feet)

2 **Depth, feet:** Depth in feet below the ground surface.

3 **Sample Type:** Type of soil sample collected at the depth interval shown.

4 **Sample Number:** Sample identification number.

5 **Sampling Resistance, blows/foot:** Number of blows to advance driven sampler foot (or distance shown) beyond seating interval using the hammer identified on the boring log.

6 **Relative Consistency:** Relative consistency of the subsurface material.

7 **USCS Symbol:** USCS symbol of the subsurface material.

8 **Graphic Log:** Graphic depiction of the subsurface material encountered.

9 **MATERIAL DESCRIPTION:** Description of material encountered. May include consistency, moisture, color, and other descriptive text.

10 **Moisture:** Water content of the soil sample, expressed as percentage of dry weight of sample.

11 **Qu (tsf):** Dry weight per unit volume of soil sample measured in laboratory, in pounds per cubic foot.

12 **Recovery (in):** The percent fines (soil passing the No. 200 Sieve) in the sample. WA indicates a Wash Sieve, SA indicates a Sieve Analysis.

13 **REMARKS AND OTHER TESTS:** Comments and observations regarding drilling or sampling made by driller or field personnel.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

TYPICAL MATERIAL GRAPHIC SYMBOLS

- Well graded GRAVEL (GW)
- Poorly graded GRAVEL (GP)
- Well graded GRAVEL with Silt (GW-GM)
- Well graded GRAVEL with Clay (GW-GC)
- Poorly graded GRAVEL with Silt (GP-GM)
- Poorly graded GRAVEL with Clay (GP-GC)
- Silty GRAVEL (GM)
- Clayey GRAVEL (GC)
- Well graded SAND (SW)
- Poorly graded SAND (SP)
- Well graded SAND with Silt (SW-SM)
- Well graded SAND with Clay (SW-SC)
- Poorly graded SAND with Silt (SP-SM)
- Poorly graded SAND with Clay (SP-SC)
- Silty SAND (SM)
- Clayey SAND (SC)
- SILT, SILT w/SAND, SANDY SILT (ML)
- Lean CLAY, CLAY w/SAND, SANDY CLAY (CL)
- SILT, SILT w/SAND, SANDY SILT (MH)
- Fat CLAY, CLAY w/SAND, SANDY CLAY (CH)
- SILT, SILT with SAND, SANDY SILT (ML-MH)
- Lean-Fat CLAY, CLAY w/SAND, SANDY CLAY (CL-CH)
- SILTY CLAY (CL-ML)
- Lean CLAY/PEAT (CL-OL)
- Fat CLAY/SILT (CH-MH)
- Fat CLAY/PEAT (CH-OH)
- Silty SAND to Sandy SILT (SM-ML)
- Silty SAND to Sandy SILT (SM-MH)
- Clayey SAND to Sandy CLAY (SC-CL)
- Clayey SAND to Sandy CLAY (SC-CH)
- SILT to CLAY (CL/ML)
- Silty to Clayey SAND (SC/SM)

TYPICAL SAMPLER GRAPHIC SYMBOLS

- 2-inch-OD unlined split spoon (SPT)
- 2.5-inch-OD Modified California w/ brass liners
- 3-inch-OD California w/ brass rings
- Shelby Tube (Thin-walled, fixed head)
- Grab Sample
- Bulk Sample
- Pitcher Sample
- Other sampler

OTHER GRAPHIC SYMBOLS

- Water level (at time of drilling, ATD)
- Water level (after waiting a given time)
- Minor change in material properties within a stratum
- Inferred or gradational contact between strata
- Queried contact between strata

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

I:\27600\27648\Geotech\27648 BorinGS.bgs [basic log new.tpl]

Appendix B

Soil Properties, Calculations

Edge
Consulting Engineers, Inc.
624 Water Street
Prairie du Sac, WI 53578
608.644.1449 phone

Project Name: Jefferon Main Tower
Project Number: 27648
Client: Jefferson County
Location: Jefferson , Wisconsin

SOIL PROFILE

Notes:

Groundwater not encountered

Frost depth is at 5' BGS

k, E50 values are for Lpile use only

Soft Silty Clay (CL) (0 to 3 feet BGS)		
γ =	110	pcf
Φ =	0	°
Cu =	1,000	psf
E50 =	0.01	
k =	100	pci
Bc =	2,000	psf

Medium Dense Silty Sand & Gravel (Till) (SM) (3 to 8 feet BGS)		
γ =	115	pcf
Φ =	33	°
Cu =	0	psf
E50 =	N/A	
k =	90	pci
Bc =	5,000	psf

Very Dense Silty Sand & Gravel (Till) (SM) (8 to 16 feet BGS)		
γ =	130	pcf
Φ =	38	°
Cu =	0	psf
E50 =	N/A	
k =	225	pci
Bc =	7,000	psf

SOIL PROPERTIES

Depth (feet)	Unit Weight (pcf)	Friction Angle (°)	Cohesion (psf)	Effective Stress (psf)	Passive Pressure (psf)	Skin Friction Resistance (psf)
0	110	0°	1,000	0	0	400
1	110	0°	1,000	110	2,110	400
2	110	0°	1,000	220	2,220	400
3	110	0°	1,000	330	2,330	400
3	115	33°	0	335	1,136	424
4	115	33°	0	445	1,509	547
5	115	33°	0	560	1,900	671
6	115	33°	0	675	2,290	789
7	115	33°	0	790	2,680	903
8	115	33°	0	905	3,070	1,012
8	130	38°	0	905	3,804	1,012
9	130	38°	0	1,035	4,351	1,133
10	130	38°	0	1,165	4,897	1,250
11	130	38°	0	1,295	5,444	1,363
12	130	38°	0	1,425	5,990	1,471
13	130	38°	0	1,555	6,537	1,576
14	130	38°	0	1,685	7,083	1,676
15	130	38°	0	1,815	7,630	1,774
16	130	38°	0	1,945	8,176	1,867

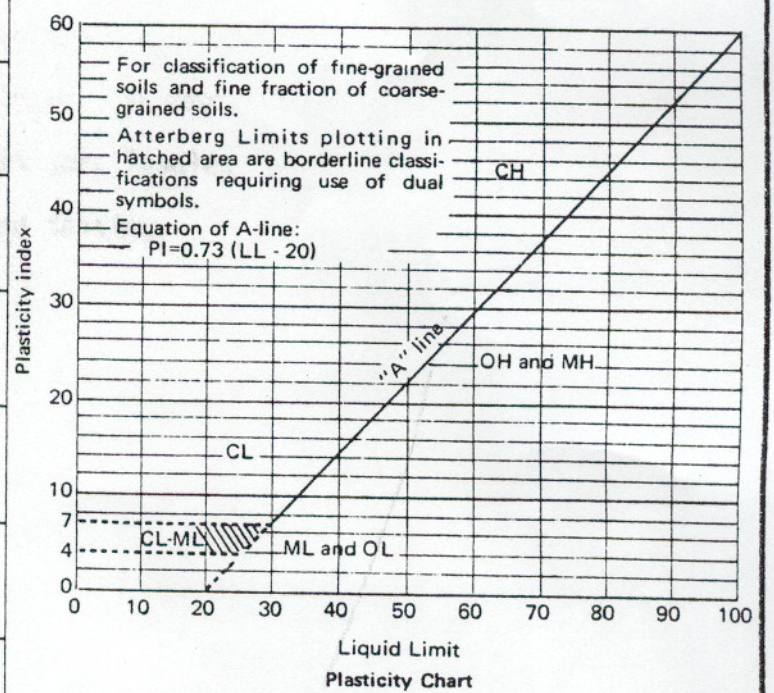
Appendix C

Classification of Soils for Engineering Purposes

UNIFIED SOIL CLASSIFICATION SYSTEM

Major divisions			Group symbols	Typical names	Laboratory classification criteria
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	$C_u=\frac{D_{60}}{D_{10}}$ greater than 4; $C_c=\frac{(D_{30})^2}{D_{10}XD_{60}}$ between 1 and 3
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW
		Gravels with fines (Appreciable amount of fines)	GM d / u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 / 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
			GC	Clayey gravels, gravel-sand-clay mixtures	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u=\frac{D_{60}}{D_{10}}$ greater than 6; $C_c=\frac{(D_{30})^2}{D_{10}XD_{60}}$ between 1 and 3
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM d / u	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 / 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.
			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	

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

Penetration Testing Procedure - "N" Values

The penetration testing procedure used for this project followed the requirements of ASTM Specification D 1586-67, "Standard Method for Penetration Tests and Split-Barrel Sampling of Soils". This procedure involves driving a 2-inch OD standard split spoon sampler 18 inches with a 140-pound hammer free falling a distance of 30 inches. The number of blows required to drive the sampler the final foot was recorded as the Standard "N" Penetration. This N-value is used by Soils Engineers to estimate the strength and compressibility of the soil. After driving, the sampler was returned to the surface and opened. The length of sample (recovery) was measured and the soil was preliminarily classified according to type by a Soils Technician. A representative portion of each sample was then sealed in a glass jar, labeled, and returned to our office for further examination and testing.