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GEOTECHNICAL REPORT

PREPARED FOR:

WEST BRANCH DT
(IA-00-5315)

EDGE PROJECT NUMBER:
8593

JANUARY 6, 2014

GEOTECHNICAL REPORT

Project Information:	West Branch DT 207 Northridge Drive West Branch, IA 52358
Client Project Number:	IA-00-5315
Client:	Central States Tower II, LLC 323 S. Hale Street, STE 100 Wheaton, IL 60187 Contact: Yuri Dobrowolsky Phone: (630) 221-8500 Ext. 104
Consultant:	Edge Consulting Engineers 624 Water Street Prairie du Sac, Wisconsin 53578 Contact: Paul Molitor Phone: (608) 644-1449
Edge Project Number:	8593
Date:	January 6, 2014

Kaitlin Rinabarger
Geotechnical Specialist

1/6/14
Date

Arlen Ostreng, P.E.
Geotechnical Manager

1-6-2014
Date

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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 (Edge) for Central States Tower (CST), who is considering leasing a parcel of land located at 207 Northridge Drive in the City of West Branch in Cedar County, Iowa. CST intends to construct a new 190-foot monopole telecommunications tower. Proposed equipment will be located near the base of the proposed tower within a fenced compound. A street map showing the location of the proposed tower site is available in Figure 1. The location of the proposed lease site on the West Branch, Iowa 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 proposed lease site is located at an approximate elevation of 726 feet above mean sea level. A site plan depicting the proposed project has been included as Figure 3. Site photos have also been included in Figure 4.

1.2 PURPOSE OF REPORT

The purpose of this report is to provide soils information for the design of tower and equipment building foundations at the proposed project site. 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 proposed tower base to a depth of 40 feet and one boring at the equipment shelter center to a depth of 15 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 proposed 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 Cedar County indicates natural site soils are classified as "65D2" (Lindley loam). These soil types are typically well drained soils that are gradually to steeply sloping and consist of subglacial till. The soils are typically classified as CL on the Unified Soil Classification System. The risk of corrosion to uncoated steel is moderate to high and for concrete is moderate. Edge Consulting reviewed the "Bedrock Geologic Map of Iowa" map prepared by the Iowa Geological and Water Survey. This map indicates that the underlying bedrock consists of dolomite, limestone, and anhydrite of the Wapsipinicon Group from the Devonian Age.

2.2 TOPOGRAPHY

The existing topography of the subject site is slightly sloping near the tower center and steeply sloping near the western and eastern borders of the lease area, with surface water generally flowing to the west. Existing slopes are approximately 1 to 22%. 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. Two standard penetration test (SPT) soil borings were completed at the site to a depth of 40 feet below ground surface (bgs) at the tower center and 15 feet bgs at the equipment shelter center. Drilling was completed on December 30, 2013. The borings were advanced using an all-terrain vehicle mounted rotary, drill rig. Representative soil samples were obtained using a standard 2-inch diameter split spoon sampler in general accordance with ASTM D 1586-08, "Standard 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 D 2487-06. 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 Iowa Administrative Code.

2.4 SUBSURFACE CONDITIONS

Two soil borings were completed at the site. The borings were completed as close to the field staked tower base and equipment shelter center as possible. Subsurface soils were noted to consist of 1.3 feet of topsoil followed by medium dense silt with trace clay to 6 feet bgs. Medium to stiff silty clay with some gravel was then encountered to 36 feet bgs followed by weathered dolomite to the end of boring and maximum depth explored at 40 feet bgs. The approximate locations of the borings are depicted in Figure 3.

2.5 BEDROCK

Weathered dolomite was encountered at 36 feet bgs at the tower center. This material was drillable to the maximum depth explored at 40 feet bgs.

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 and foundation systems for other unheated structures, not bearing directly on solid rock or otherwise protected from frost, be provided with a minimum cover depth of 60 inches 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 the International Building Code (IBC).

2.7 WATER LEVEL OBSERVATIONS

Groundwater was encountered during drilling operations at 33 feet bgs. Upon boring completion, a stable groundwater measurement of 28 feet bgs was made. Seasonal fluctuations in groundwater elevation should be expected. For design purposes, it is recommended that the groundwater table be assumed to be at 26 feet bgs.

2.8 LABORATORY TESTING

Edge Consulting utilized a Field Scout SoilStik Pro pH meter to obtain a pH reading of 6.8 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 15,000 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 Proposed Tower

Based upon the information obtained during this investigation, Edge Consulting recommends the use of a standard spread footing (mat) or drilled pier (caisson) foundation to support the proposed tower. It is recommended that the spread footing tower foundation should bear on existing medium dense sandy silt soils at a minimum depth of 5 feet below existing grade surface. A complete listing of soil properties for use in foundation design is contained in Appendix B.

3.1.2 Equipment Building and/or Platform

Edge Consulting recommends the use of conventional strip footings or an engineered floating slab for the proposed equipment building foundation. Strip footings should have a minimum width of 12 inches. Strip footings for heated structures should extend to below the frost line of the locality or 48 inches below finished grade, whichever is greater. Footings bearing directly on solid rock above this depth or insulated by other means are also acceptable forms of frost protection.

If a floating slab foundation system is utilized, the slab should be designed in accordance with ACI 302.1R80 practice. Concrete floor slabs may be constructed on exposed subgrade or new compacted fill. In all cases, the exposed subgrade beneath new fill or the proposed floor slab should be compacted to 90% - 95% of the Modified Proctor maximum dry density (ASTM D1557). A minimum of 8 inches of compacted granular fill, or free draining gravel (ASTM C33, Size 57 concrete aggregate), should be located immediately beneath any floor slabs.

If an elevated equipment platform or building is to be utilized, Edge Consulting recommends supporting these structures with the use of individual drilled piers. Drilled piers for elevated equipment platforms and buildings (unheated structures) should extend to 60 inches below grade surface similar to the tower foundation or otherwise be protected from frost.

3.2 SITE AND FOUNDATION DRAINAGE

Positive site drainage should be provided to reduce infiltration of surface water into the backfills around the perimeters of the building, tower base and beneath the floor slabs. All grades should slope away from the building and all roof and surface drainage should be collected and diverted through non-perforated pipe to be discharged away from the building backfill. Edge Consulting recommends that the top of tower foundation elements extend a minimum of 12 inches above the final site surface.

3.3 SITE PREPARATION & FILL RECOMMENDATIONS

The following general site preparation and fill recommendations are provided for the development of this site.

- All vegetation, root-mat, topsoil, and any other soft or unsuitable material should be stripped from the proposed tower, building, compound and drive areas. Site strippings should be placed outside of the future construction areas. These materials should not be utilized for backfill purposes.
- Removal of unsuitable fill material should be conducted within the footprint of the proposed tower compound. Any construction debris should be removed from the site. The remaining material may used as fill in other "non load bearing" areas of the site outside of the building, tower compound and road bed footprints.
- All areas requiring engineered fill should be brought up to grade. Engineered fill material should consist of clean well graded granular material containing less than 15% by weight passing the No. 200 sieve. This material should be placed in thin lifts not exceeding 8 inches in a loose thickness and compacted to 90% to 95% of the maximum dry density, as determined by ASTM D 1557, Modified Proctor test. Fill areas under footings should be extended from each side of the outermost location of the footing at a rate of 1 foot width for every 1 foot of fill depth. Fill placement activities should be performed in the presence of a qualified geotechnical engineer.
- Once final grade for footing placement has been established, density tests and/or examination by a geotechnical engineer should be performed in the footing trenches prior to footing placement to confirm that the material has achieved an adequate degree of compaction.
- Foundation and wall construction should follow in accordance with the structural engineers requirements.
- Once the prescribed curing time has been achieved, installation of any required perimeter drainage system and backfill may be initiated. Backfill of foundation walls may consist of onsite or imported granular material. Backfill should be installed in a maximum of 12 inch lifts and compacted to a 92% of the maximum dry density (D1557).

3.4 EXCAVATION SLOPE RECOMMENDATIONS

It is expected that short term slopes of 1:1 can be maintained in the soils encountered at this site. However, construction practices should follow all federal, state and local regulations regarding safety standards for all excavation activities.

Construction site safety is the sole responsibility of the Contractor. Edge Consulting assumes no liability for Contractor's construction activities, construction site safety, or interpretation of information provided within this report. Such responsibility shall neither be implied nor inferred.

3.5 SOIL BEARING CAPACITY

The recommended maximum presumptive net bearing capacity of medium dense sandy silt soils at depths between 1 and 6 feet bgs is 2,000 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.

3.6 LATERAL EARTH PRESSURE

Edge Consulting utilized Rankine methodology to determine the foundation earth pressure parameters. A passive earth pressure coefficient of 3.1 was calculated for the medium dense sandy silt located at 5 feet bgs. A passive earth pressure of 1,718 psf was calculated for this depth (see 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. A passive soil pressure diagram has been included in Appendix B.

3.7 FRICTIONAL SKIN RESISTANCE

Included in Appendix B is a recommended frictional skin resistance table and diagram for this site. These resistances are assumed to occur between concrete foundation elements and existing site soils. A frictional skin resistance of 659 psf was calculated at a depth of 5 feet. All calculated values are considered ultimate. It is assumed that a minimum factor of safety of 2.0 for downward loading and 3.0 for uplift calculations will be incorporated at the time of foundation design. Edge Consulting does not recommend the use of frictional resistance for depths of less than 5 feet bgs.

3.8 SPECIAL DESIGN CONSIDERATIONS

Based upon the proposed site grading plans for this site, the dimension from top of concrete at the tower anchor bolt setting to the spread footing foundation base should be a minimum of 6 feet to account for existing site contour, proposed filling, drainage and frost protection.

Weathered dolomite was observed below 36 feet bgs. If a drilled pier foundation is utilized, the design of a foundation base which terminates above this depth should be considered.

A groundwater depth of 26 feet bgs is recommended for design purposes. Buoyant unit weights of soil and concrete should be utilized for all uplift resistance calculations below this depth.

3.9 SPECIAL CONSTRUCTION CONSIDERATIONS

The contractor should review the proposed tower foundation design with the site construction plans prior to ordering foundation reinforcing steel. The tower foundation should be designed such that the top of concrete extends 12-inches above the proposed compound finished grade. In addition, the spread footing foundation base should extend to a minimum of 5 feet below existing grade. If the plans do not reflect this condition, please contact the project manager and foundation designer.

If a caisson foundation system is utilized at this site, the groundwater table will likely be encountered during foundation excavation below 26 feet bgs. The quantity and rate of groundwater entry in is unknown. The foundation contractor should take all necessary precautions to limit groundwater entry and borehole caving. This may include the use of a casing during drilling operations. The use of drilling slurries and/or drilling mud may be required and should be pre-approved by the tower foundation designer.

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 and building 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. Bedrock Geologic Map of Iowa (map). 1998. No scale. Iowa Department of Natural Resources – Geological Survey Bureau. Retrieved from http://publications.iowa.gov/4859/1/EM-19.pdf

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

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

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

5. 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.

6. Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.gov/. Accessed (12/17/2013).

7. United States Geological Survey. *West Branch, Iowa* (map). 1:24,000. 7.5 Minute Series. Reston, VA: United States Department of the Interior, USGS, 1965.

FIGURE 1

STREET MAPS

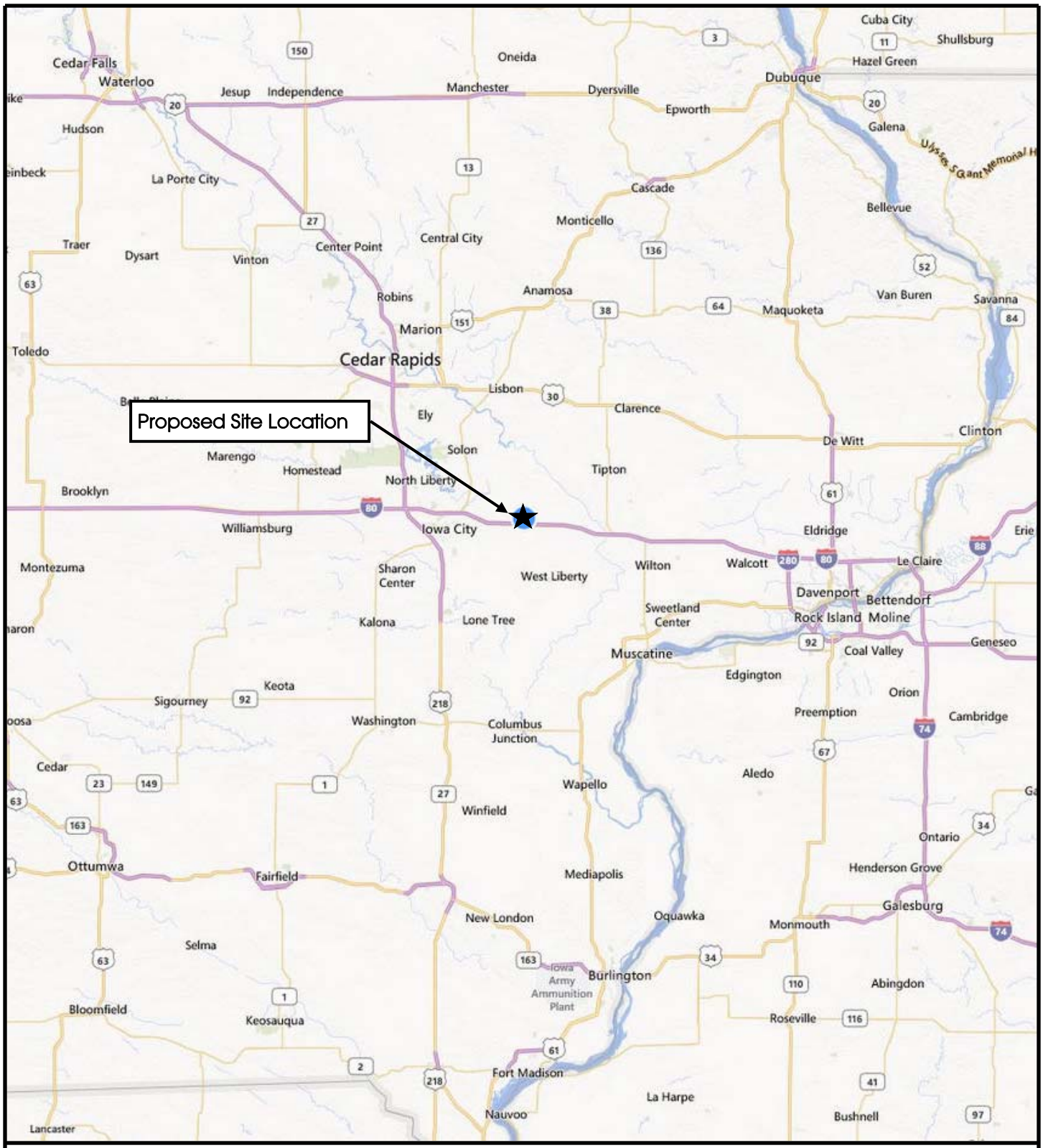

FIGURE # 1
Regional Map

Edge
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Project Number:	#8593
Project Info:	CST (Verizon) / West Branch DT
Project Location:	207 Northridge Drive, West Branch, IA 52358

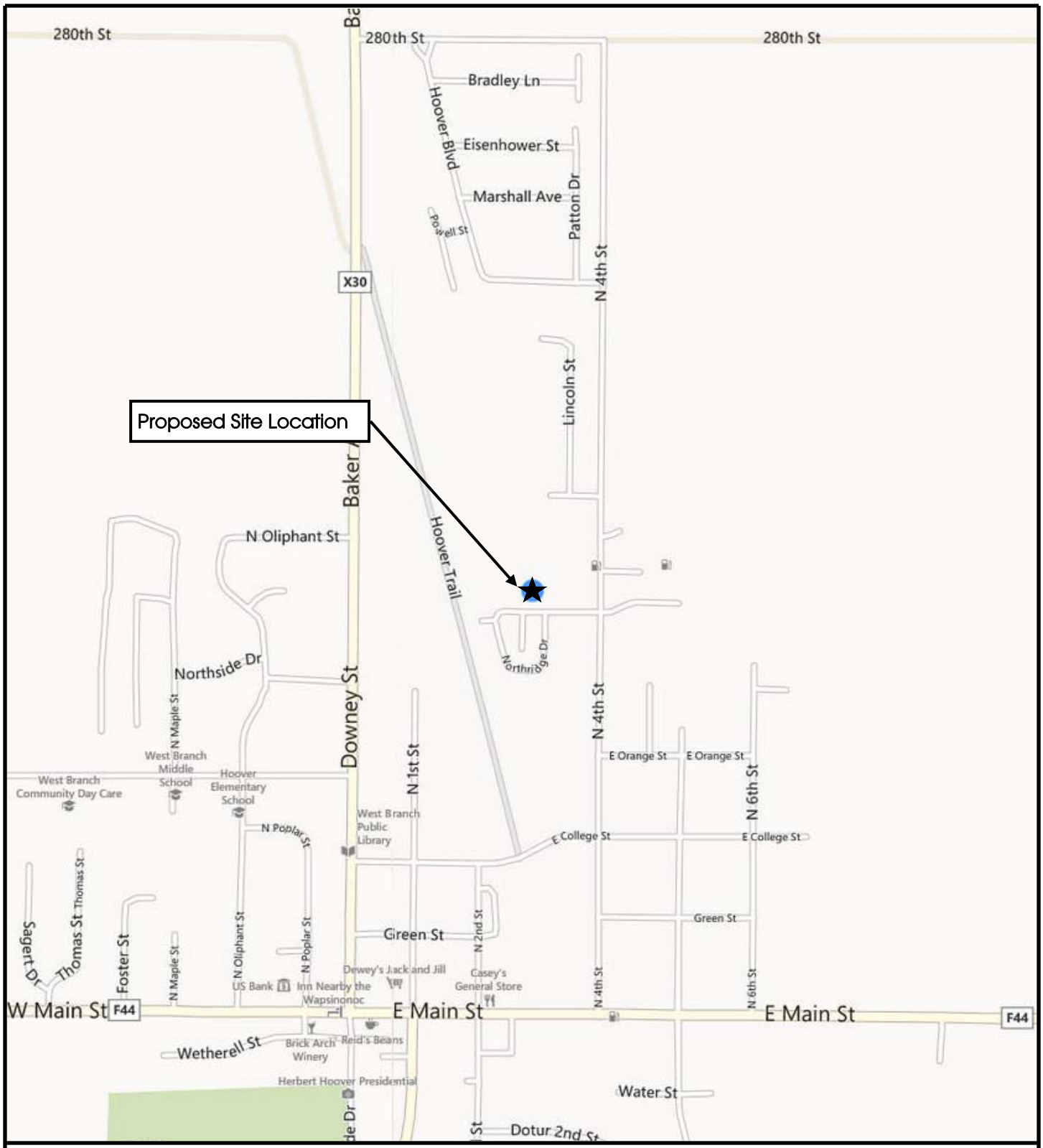

FIGURE # 1
Street Map

Edge
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Project Info:	CST (Verizon) / West Branch DT
Project Location:	207 Northridge Drive, West Branch, IA 52358

FIGURE 2

USGS QUADRANGLE MAP

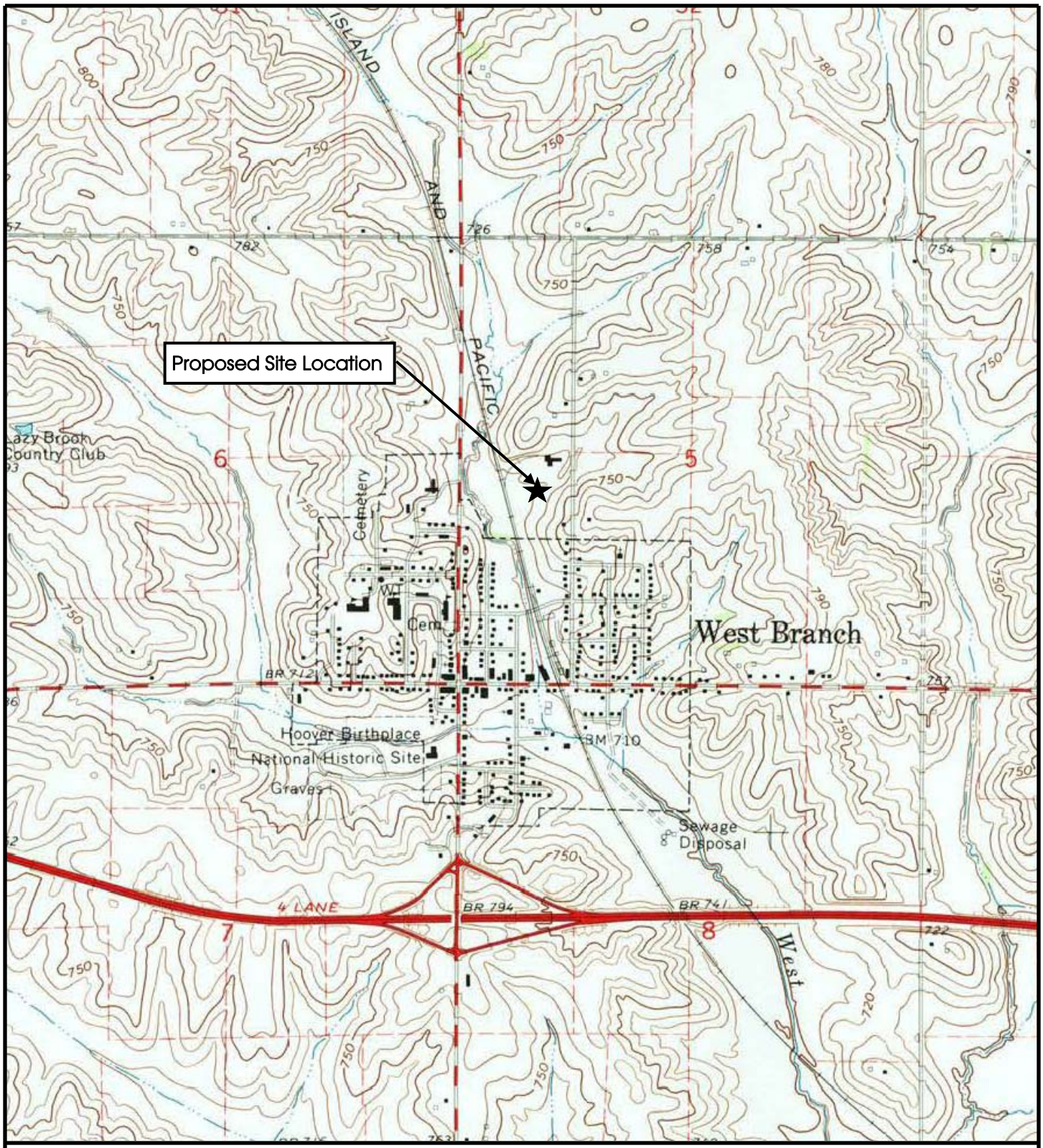

FIGURE # 2

7.5 Minute USGS Quadrangle Map

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Project Location:	207 Northridge Drive, West Branch, IA 52358

FIGURE 3

SITE PLAN

FIGURE # 3
Aerial Site Plan

Edge
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Project Number:	#8593
Project Info:	CST (Verizon) / West Branch DT
Project Location:	207 Northridge Drive, West Branch, IA 52358

NORTH

PROPERTY LINE

WOODS

TOP OF DITCH BANK

35'-0" TO NORTH PROPERTY LINE

EXISTING 35'-0" WIDE WATER & SEWER EASEMENT

WOODS

PROPOSED 62' x 77' LEASE AREA

PROPOSED 60' x 75' FENCED COMPOUND W/ TAN VINYL PRIVACY SLATS

66'-0" TO NORTH PROPERTY LINE

726'

730'

GRAVEL COMPOUND (SEE DETAIL B/C-4)

EXISTING BUILDING

PROPOSED 190' MONOPOLE TOWER

B-1

43'-5" TO WEST PROPERTY LINE

38'-6" TO EAST PROPERTY LINE

EXISTING BUILDING

PROPERTY LINE

B-2

PROPOSED 20' x 36' LESSEE LEASE AREA

PROPERTY LINE

PROPOSED ARBOR VITAE (TYP.)

CENTERLINE OF PROPOSED 12' WIDE ACCESS EASEMENT

79'-8" TO SOUTH PROPERTY LINE

CENTERLINE OF PROPOSED 15' WIDE UTILITY EASEMENT

PROPOSED BURIED UTILITY ROUTING, VERIFY EXACT SOURCE & ROUTING W/ LOCAL UTILITY PROVIDER

PROPOSED 12' WIDE CONCRETE ACCESS DRIVE (SEE DETAIL A/C-4)

PROPOSED PIN OAK TREE (TYP.)

726'

EXISTING ELECTRICAL TRANSFORMER

RIGHT - OF - WAY

PROPERTY LINE / RIGHT - OF - WAY

RIGHT - OF - WAY

10'-0"

5'-0"

2'-0"

5'-0"

722'

EXISTING 10'-0" WIDE UTILITY EASEMENT

EXISTING FIRE HYDRANT

10'-0"

9'-5"

8'-5"

EXISTING FIBER OPTIC VAULT

PROPOSED 5' WIDE CONCRETE SIDEWALK (SEE DETAIL D/C-4)

PROPOSED CONCRTE DRIVEWAY ENTRANCE TO NORTHRIDGE ROAD: (SEE DETAIL A/C-4)

NORTHRIDGE ROAD

A
C-1

PROPOSED SITE AERIAL PHOTO

10' 0 10' 20'

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

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SITE PLAN

WEST BRANCH DT

WEST BRANCH, IOWA

SHEET TITLE:

PRELIMINARY CDS:
PRELIMINARY CDS - 04/03/13
CITY REQUIREMENTS - 01/02/13
STAMPED FINALS:
DRAWN BY:
CJL, TAS
CHECKED BY:
PCM
PLOT DATE:
1/6/2014
PROJECT #:
8593
FILE NAME:
C-1.dgn

SHEET NUMBER:

C-1

L:\8500\8593\CADD\Plan\CDs\C-1.dgn

NORTH

A
C-2

PROPOSED SITE LOOKING NORTH

TOP OF CREEK BANK

5'-0"

PROPOSED 77'-0" CST LEASE AREA

PROPOSED 75'-0" FENCED COMPOUND

1'-0"

75'-0"

37'-11"

37'-1"

1'-0"

E: 724.50
P: 726.00

PROPOSED CHAIN LINK FENCED COMPOUND
W/ TAN VINYL PRIVACY SLATS

E: 727.50
P: 727.50

GRAVEL
COMPOUND
(SEE DETAIL
B/C-4)

31'-0" TO TOWER CENTER

PROPOSED 62' x 77' CST LEASE AREA

38'-6" TO TOWER CENTER

38'-6" TO TOWER CENTER

21'-10"

PROPOSED 60'-0" FENCED COMPOUND

PROPOSED 62'-0" CST LEASE AREA

PROPERTY LINE

2% SLOPE

E: 725.50
P: 727.50
TOC: 728.00

B-1

PROPOSED TOWER FOUNDATION, EXACT SIZE
TO BE VERIFIED WITH TOWER PLANS

PROPOSED 190' MONOPOLE TOWER

PROPOSED 12' LONG LESSEE ICE BRIDGE

38'-4"

PROPERTY LINE

EXISTING BUILDING

2% SLOPE

31'-0" TO TOWER CENTER

4'-3"

PROPOSED LESSEE GENERATOR
ON CONCRETE SLAB; SOUND
ATTENUATOR TO BE INSTALLED
TO REDUCE DECIBEL LEVEL

11'-6"

B-2

PROPOSED 11'-6" x 16'-10"
LESSEE EQUIPMENT SHELTER

PROPOSED MULTI-METER UTILITY RACK

4'-3"

20'-0" LESSEE LEASE AREA

E: 724.25
P: 727.20

E: 728.25
P: 728.70

6'-1 1/2"

23'-4-1/2"

6'-6"

5'-0"

1'-0"

1'-6"

PROPOSED 12' WIDE
DOUBLE SWING ACCESS GATE

1'-0"

12'-0"

9'-11-1/2"

36'-0" LESSEE LEASE AREA

50'-0"

8'-0"

5'-0"

1'-0"

(4) PROPOSED ARBOR VITAE FOR SCREENING (TYP.)

CENTERLINE OF PROPOSED 12' WIDE ACCESS EASEMENT

PROPOSED TRANSFORMER & FIBER OPTIC VAULT,
VERIFY EXACT LOCATION W/ LOCAL PROVIDER

PROPOSED 12' WIDE
CONCRETE ACCESS
DRIVE (SEE DETAIL A/C-4)

PROPOSED BURIED UTILITIES: VERIFY EXACT SOURCE
& LOCATION W/ LOCAL UTILITY PROVIDERS

A
C-2

GRADING LEGEND

963' = EXISTING CONTOUR GRADES

963' = PROPOSED CONTOUR GRADES

= PROPOSED SPOT ELEVATIONS

= PROPOSED DRAINAGE PATH

= SILT FENCE

= EROSION MAT

GRADING NOTES

1. CONTOUR INTERVAL IS 1 FOOT.
2. CONTRACTOR SHALL GRADUALLY MATCH INTO EXISTING GRADE.
3. NO PROPOSED EARTHWORK SHALL HAVE A GREATER SLOPE THAN 3:1.
4. DRIVEWAY GRADE WITHIN 25 FEET OF PUBLIC ROAD ACCESS POINT SHALL BE LESS THAN 10% (10:1).
5. ALL DISTURBED GRASS/TURF AREAS SHALL BE RESTORED WITH TOPSOIL, SEED AND MULCH. TOPSOIL TO BE 6-INCHES MINIMUM. SEED TO CONSIST OF NATIVE PURE LIVE SEED (PLS) AT 98% PURITY AND 95% GERMINATION. MULCH TO BE WEED-FREE GRAIN STRAW.

L:\8600\8593\CAD\Plot\CD's\C-2.dgn

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COMPOUND PLAN
WEST BRANCH DT
WEST BRANCH, IOWA

SHEET TITLE:

PRELIMINARY CDS:
PRELIMINARY CDS - 04/03/13
CITY REQUIREMENTS - 01/02/13
STAMPED FINALS:
DRAWN BY:
CJL TAS
CHECKED BY:
PCM
PLOT DATE:
1/6/2014
PROJECT #:
8593
FILE NAME:
C-2.dgn

5' 0 5' 10'

SCALE: 11" x 17" - 1" = 10'
22" x 34" - 1" = 5'

SHEET NUMBER:
C-2

FIGURE 4

SITE PHOTOS

Photo 1 - VIEW NORTH TOWARD PROPOSED LEASE SITE

Photo 2 - VIEW SOUTH FROM PROPOSED LEASE SITE

FIGURE # 4
Site Photographs

Edge
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Project Number:	#8593
Project Info:	CST (Verizon) / West Branch DT
Project Location:	207 Northridge Drive, West Branch, IA 52358
Photograph Date:	March 4, 2013

Photo 3 - VIEW EAST FROM PROPOSED LEASE SITE

Photo 4 - VIEW WEST FROM PROPOSED LEASE SITE

FIGURE # 4
Site Photographs

Edge
Consulting Engineers, Inc.

Project Number:	#8593
Project Info:	CST (Verizon) / West Branch DT
Project Location:	207 Northridge Drive, West Branch, IA 52358
Photograph Date:	March 4, 2013

APPENDIX A

SOIL BORING LOGS

Edge
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Project: CST (West Branch DT)
Project Location: West Branch, Iowa
Project Number: 4815

Log of Boring B-1

Sheet 1 of 1

Date(s) Drilled **December 30, 2013**	Logged By **CRJ**	Checked By **N/A**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **2 inch Split Spoon**	Total Depth of Borehole **40 feet bgs**
Drill Rig Type **Geoprobe 7822DT**	Drilling Contractor **Soil Essentials**	Approximate Surface Elevation **726 feet MSL**
Groundwater Level and Date Measured **33 feet ATD, 28 feet after 30 Minutes**	Sampling Method(s) **SPT, Grab**	Hammer Data **140 lb, 30 in drop, rope & cathead**
Borehole Backfill **Bentonite/Cuttings**	Location **Tower Center**	

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
726	0		0			OL-OH		1.3' Topsoil	D	-	-	
			1	2,5,7	Medium Dense	SM-ML		Brown Sandy Silt w/Trace Clay	D	-	8	
			2	7,8,8	Medium Dense				M	-	4	
721	5		3	3,4,5	Stiff	CL-CH		Dark Brown and Gray Silty Clay w/Some Gravel	M	1.4	15	
			4	2,2,2	Medium				M	0.0	17	
716	10		5	2,2,3	Medium				M	0.5	16	
			6	3,5,5	Stiff				M	1.2	15	
711	15											
			7	2,5,6	Stiff				M	1.6	16	
706	20											
			8	3,5,5	Stiff				M	1.4	15	
701	25							(after 30 Minutes) ▼				
			9	2,2,3	Medium				M	1.3	17	
696	30							(ATD) ▽				
			10	4,7,8	Medium Dense	SM-ML		Gray Fine Sandy Silt w/Trace Clay & Gravel	W	-	16	
691	35					DOLOMITE		Weathered Dolomite / Hard Drilling (Petroleum Odor)				
			11	100/4",-,-	Very Dense				W	-	4	
686	40							Bottom of Boring at 40 feet bgs				
681	45											

Figure 1

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Edge
Consulting Engineers, Inc.

Project: CST (West Branch DT)
Project Location: West Branch, Iowa
Project Number: 4815

Log of Boring B-2

Sheet 1 of 1

Date(s) Drilled **December 30, 2013**	Logged By **CRJ**	Checked By **N/A**
Drilling Method **Hollow Stem Auger**	Drill Bit Size/Type **2 inch Split Spoon**	Total Depth of Borehole **15 feet bgs**
Drill Rig Type **Geoprobe 7822DT**	Drilling Contractor **Soil Essentials**	Approximate Surface Elevation **726 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 **Equipment Shelter Center**	

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
726	0		0			OL-OH		1.1' Topsoil	D	-	-	
			1	3,5,5	Medium Dense	SM-ML		Brown Sandy Silt	D	-	9	
						SM-ML		↓ Black Sandy Silt				
			2	7,5,5	Medium Dense				M	-	13	
721	5											
			3	2,2,2	Medium	CL-CH		Black Silty Clay	M	1.5	15	
			4	2,3,5	Medium	CL-CH		↓ Brown Silty Clay w/Some Gravel	M	1.2	16	
716	10											
			5	2,4,4	Medium				M	2.1	16	
			6	2,4,5	Stiff				M	1.9	17	
711	15							Bottom of Boring at 15 feet bgs				
706	20											

Figure 2

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Edge
Consulting Engineers, Inc.

Project: CST (West Branch DT)
Project Location: West Branch, Iowa
Project Number: 4815

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.

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APPENDIX B

SOIL PROPERTIES, CALCULATIONS

TOWER SOIL PROFILE

Medium Dense Silt w/Trace Clay [SM-ML] [1 to 6 feet BGS]	
γ =	110 pcf
γ'=	58 pcf
Φ =	31 °
Cu =	0 psf
Bc =	2,000 psf

Medium to Stiff Silty Clay w/Some Gravel [CL-CH] [6 to 36 feet BGS]	
γ =	110 pcf
γ'=	56 pcf
Φ =	0 °
Cu =	1,000 psf
Bc =	2,000 psf

Weathered Dolomite [>36 feet BGS]	
γ =	145 pcf
γ'=	72 pcf
Φ =	42 °
Cu =	0 psf
Bc =	8,000 psf

TOWER SOIL PROPERTIES

Depth [feet]	Unit Weight [pcf]	Friction Angle [degrees]	Cohesion [psf]	Effective Stress [psf]	Passive Soil Pressure [psf]	Frictional Skin Resistance [psf]
0	110	31	0	0	0	0
1	110	31	0	110	0	0
2	110	31	0	220	0	0
2	110	31	0	220	0	0
3	110	31	0	330	0	0
3	110	31	0	330	0	0
4	110	31	0	440	1,375	0
4	110	31	0	440	1,375	0
5	110	31	0	550	1,718	659
6	110	31	0	660	2,062	772
6	110	0	1,000	660	2,660	400
7	110	0	1,000	770	2,770	400
8	110	0	1,000	880	2,880	400
9	110	0	1,000	990	2,990	400
10	110	0	1,000	1,100	3,100	400
11	110	0	1,000	1,210	3,210	400
12	110	0	1,000	1,320	3,320	400
13	110	0	1,000	1,430	3,430	400
14	110	0	1,000	1,540	3,540	400
15	110	0	1,000	1,650	3,650	400
16	110	0	1,000	1,760	3,760	400
17	110	0	1,000	1,870	3,870	400
18	110	0	1,000	1,980	3,980	400
19	110	0	1,000	2,090	4,090	400
20	110	0	1,000	2,200	4,200	400
21	110	0	1,000	2,310	4,310	400
22	110	0	1,000	2,420	4,420	400
23	110	0	1,000	2,530	4,530	400
24	110	0	1,000	2,640	4,640	400
25	110	0	1,000	2,750	4,750	400
26	110	0	1,000	2,860	4,860	400
26	56	0	1,000	2,860	4,860	400
27	56	0	1,000	2,916	4,916	400
28	56	0	1,000	2,972	4,972	400
29	56	0	1,000	3,028	5,028	400
30	56	0	1,000	3,084	5,084	400
31	56	0	1,000	3,140	5,140	400
32	56	0	1,000	3,196	5,196	400
33	56	0	1,000	3,252	5,252	400
34	56	0	1,000	3,308	5,308	400
35	56	0	1,000	3,364	5,364	400
36	56	0	1,000	3,420	5,420	400
36	72	42	0	3,420	17,253	2,360
37	72	42	0	3,492	17,616	2,370
38	72	42	0	3,564	17,979	2,380
39	72	42	0	3,636	18,342	2,389
40	72	42	0	3,708	18,706	2,396

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

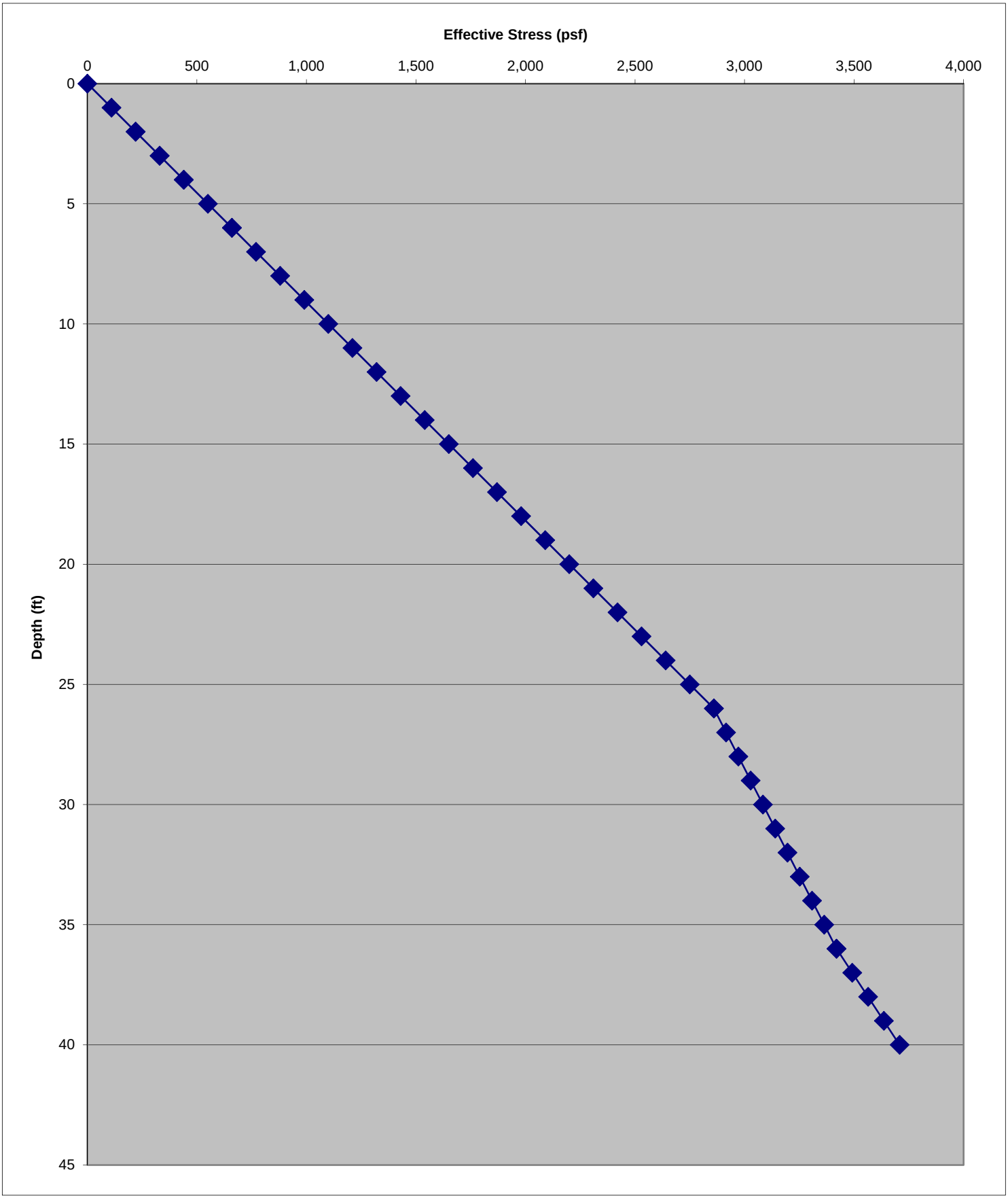
Project Name: West Branch DT
Project Number: 8593
Client: CST
Location: West Branch, Iowa

SOIL PROPERTIES

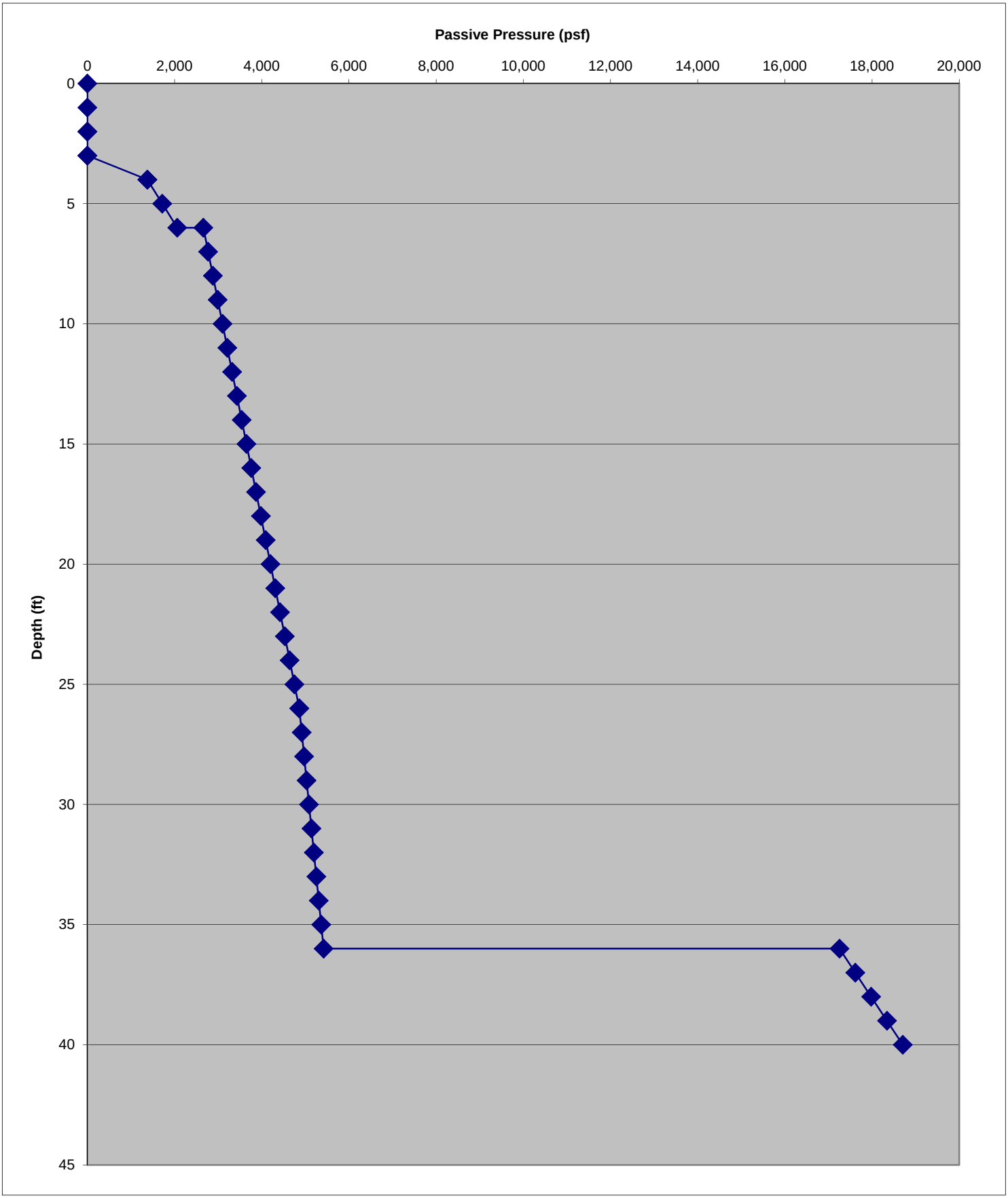
Depth Range, Below Grade	Soil Type	Soil Shear Strength	Ultimate Side Friction	Lateral Modulus, K	Strain Factor, E50	Allowable Bearing Capacity
0 to 4 feet	Neglect any soil resistance due to frost effects.					
4 to 6 feet	Medium Dense Silt w/Trace Clay	31°	715 psf	60 pci	N/A	2000 psf
6 to 36 feet	Medium to Stiff Silty Clay w/Some Gravel	1000 psf	400 psf	500 pci	0.007	2000 psf
>36 feet	Weathered Dolomite	42°	2380 psf	200 pci	N/A	8000 psf

Notes:
Groundwater at 26 feet bgs
Weathered dolomite >36 feet bgs

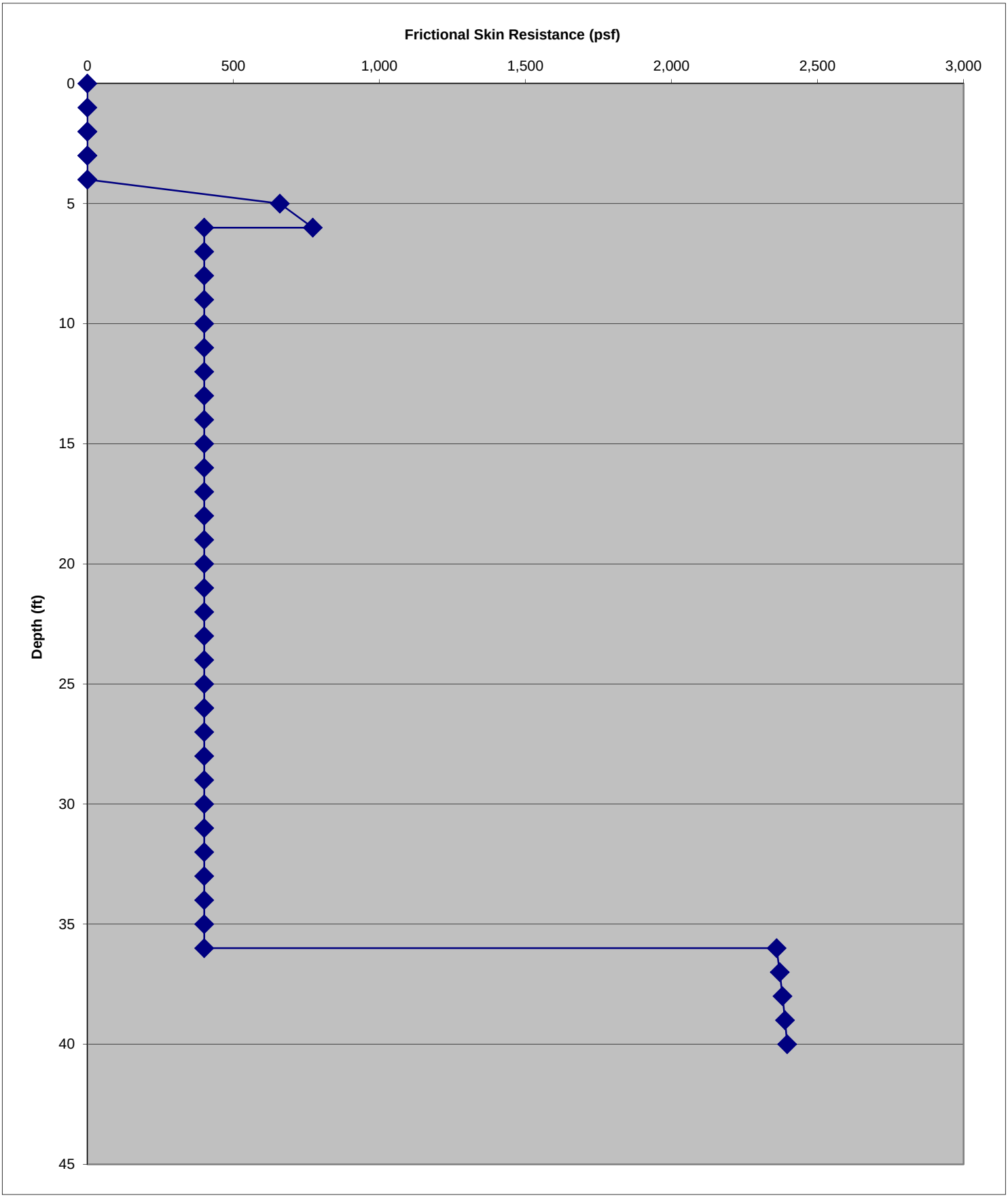
EFFECTIVE STRESS DIAGRAM
B-1



Passive Soil Pressure Diagram
B-1



Frictional Skin Resistance
B-1



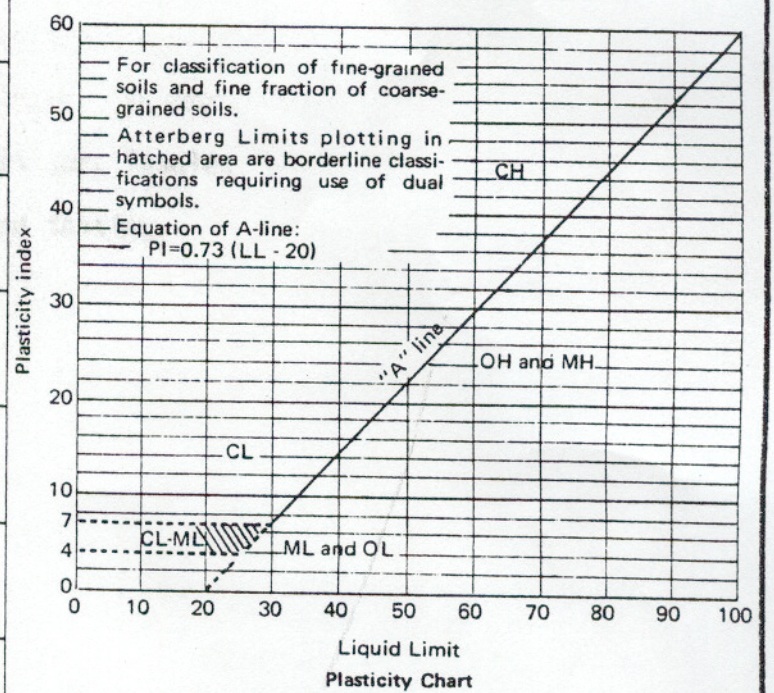
APPENDIX C

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.