THE DIRT ON SOILS

WAUKESHA COUNTY STORM WATER WORKSHOP

STORM WATER BMP DESIGN CASE STUDY

PRESENTED BY

RUEKERT & MIELKE, INC.

&

PROFESSIONAL SERVICE INDUSTRIES INC. (PSI)

Ruekert · Mielke

Storm Water BMP Case Study

WE-Energies Headwaters Service Center
Land O' Lakes WI

Ruekert · Mielke

WE-Energies Headwaters Service Center

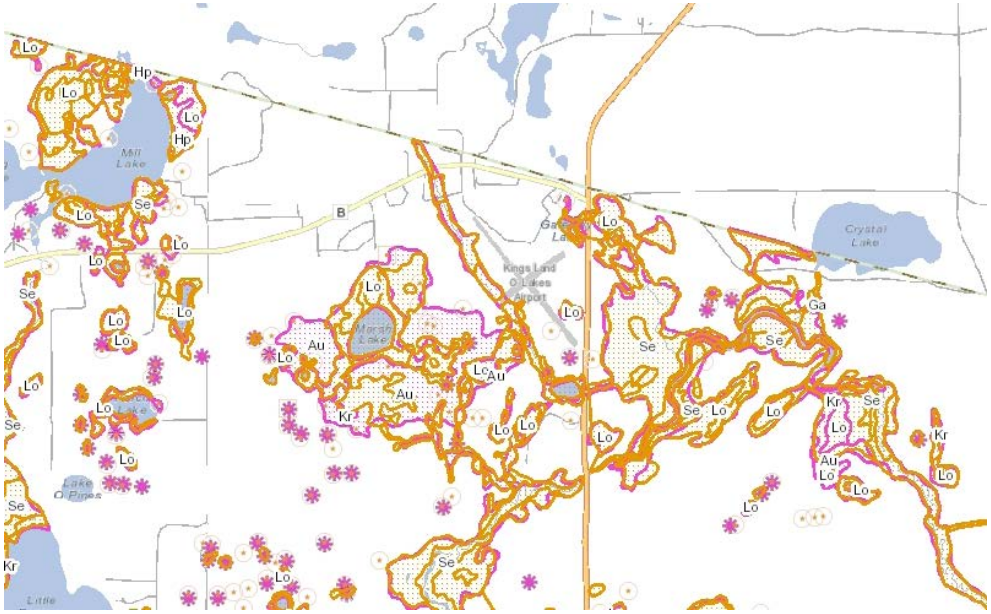
- Need for the project/project background
  - Old/Undersized Service Center
  - Dilapitated Communication Antennae
    - Need taller antennae
    - Height restrictions on current property.

WE-Energies Headwaters Service Center

- The Search for property is on.
  - Need to be near CTH B and 45 for good east west/north south access
  - Prefer municipal sanitary/water
  - Big enough property to provide for taller antennae
  - Beware FAA height restrictions for Kings Land O Lakes Airport

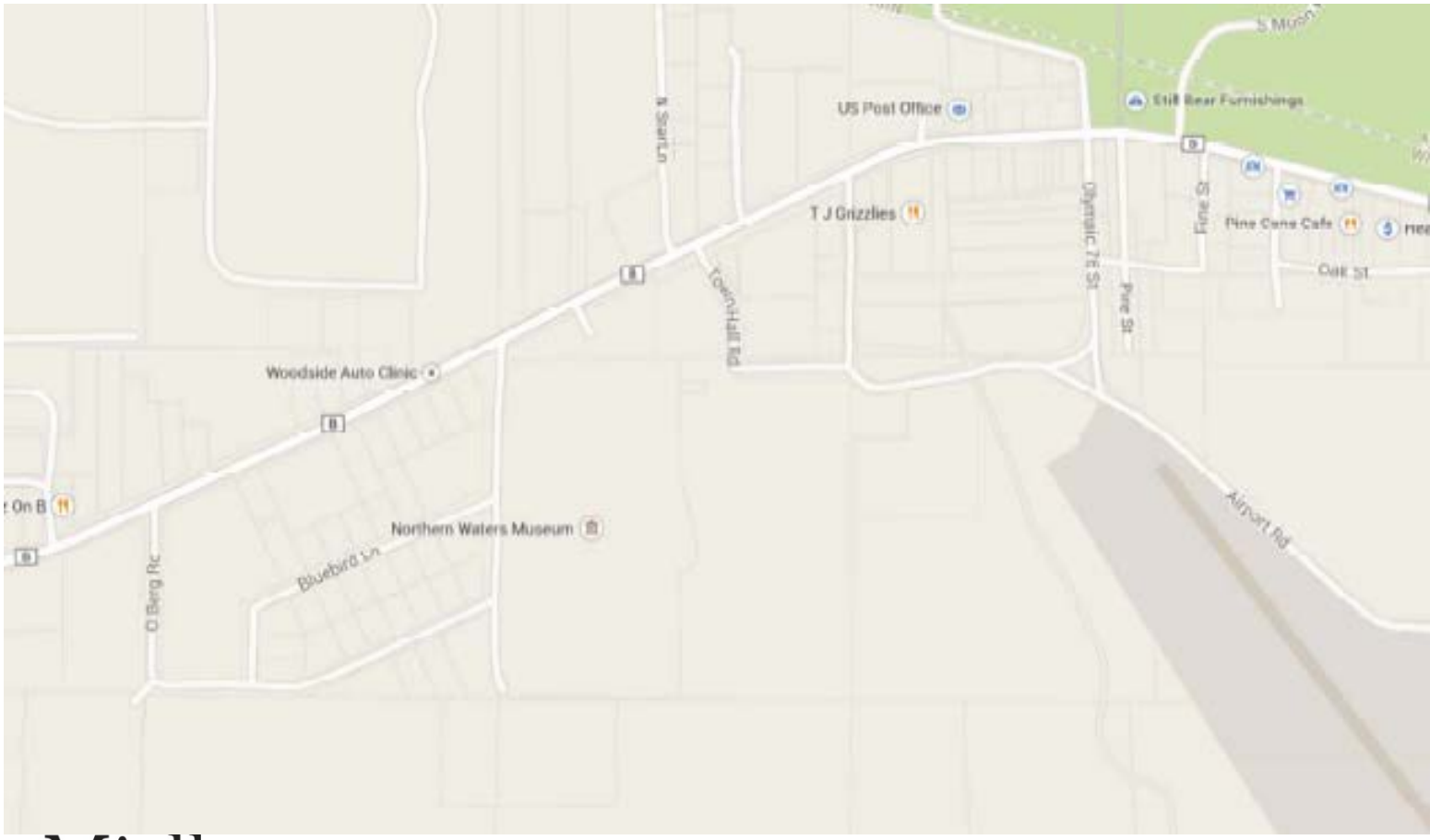
WE-Energies Headwaters Service Center

- Potential site investigation
  - Evaluation of Soils- Sand is good!
  - Mapped wetlands/wetland indicators
  - Sewer and water services areas.
  - Aerial photos-
  - Its God's Country,
    what can go wrong?



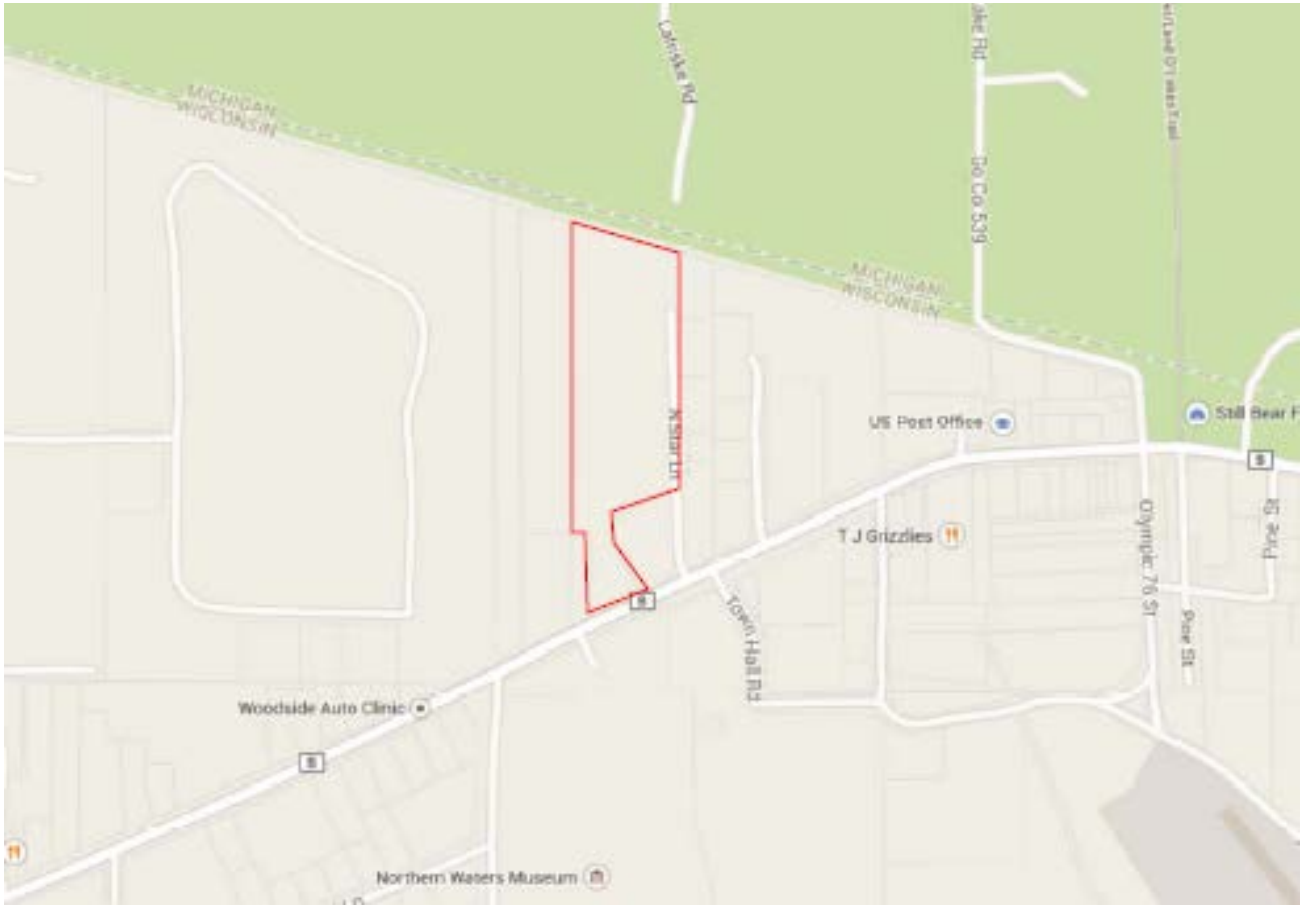
WE-Energies Headwaters Service Center

- Blue Bird Lane Site- no go!



WE-Energies Headwaters Service Center

CTH B Site- is the one.

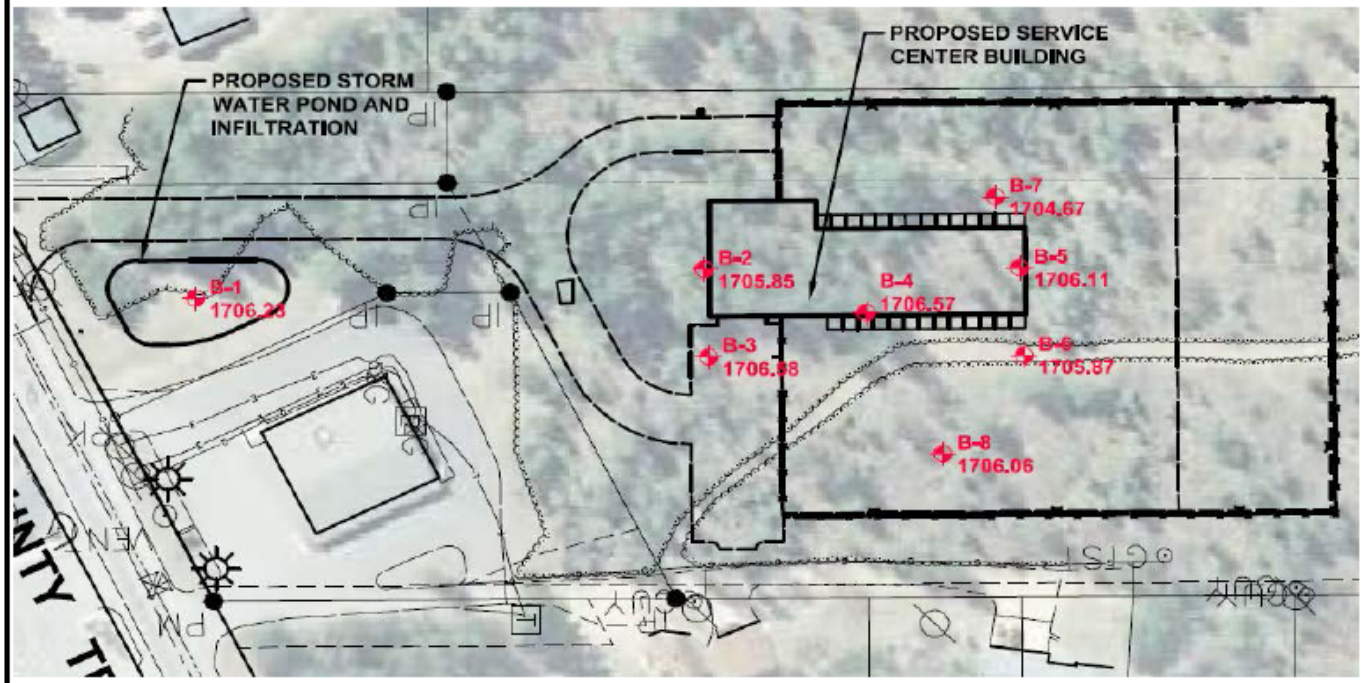


Ruekert · Mielke

WE-Energies Headwaters Service Center

- Time to Survey- Do ALTA
- Prepare soil borings
- Preliminary Layouts and Design

Boring Locations



N

psi *Information To Build On*

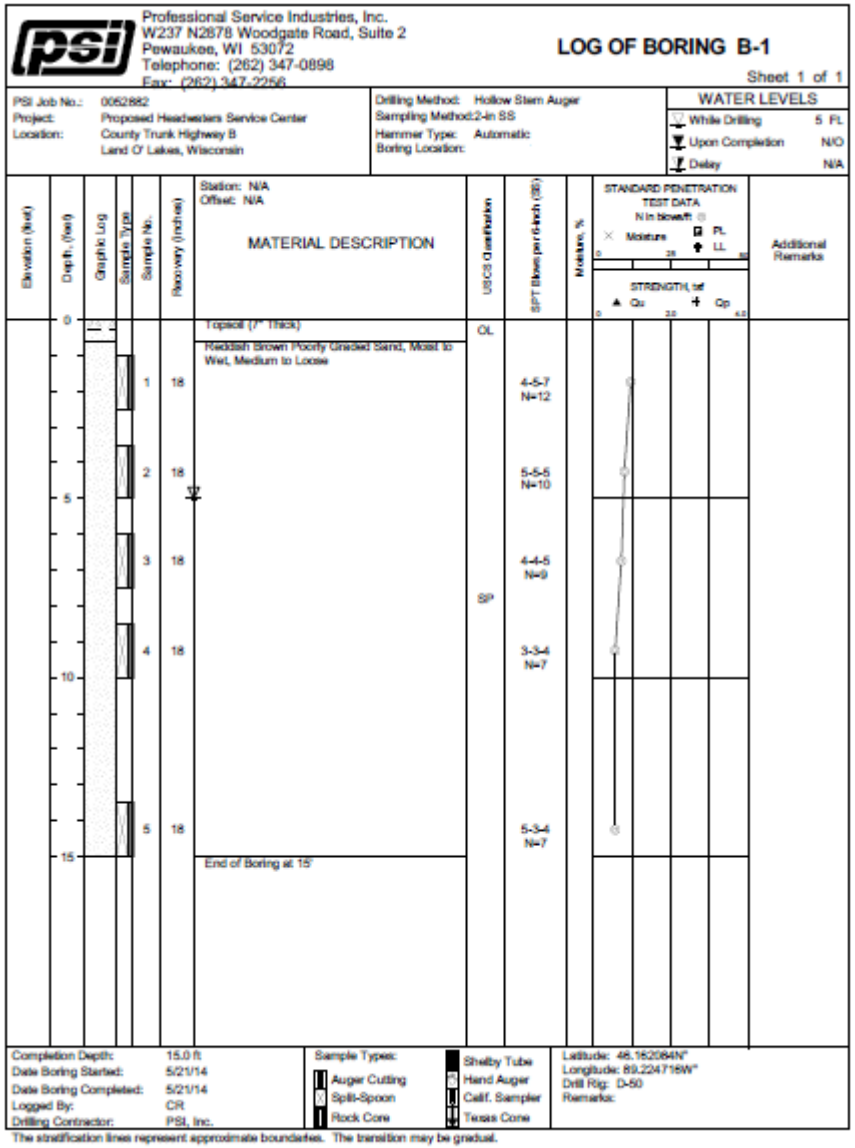
Engineering • Consulting • Testing

W237 N2878 Woodgate Road, Suite 2
Pewaukee, Wisconsin 53072

Project Name:	Proposed Headwaters Service Center
Project Location:	County Trunk Highway B Land O' Lakes, Wisconsin
PSI Project # :	0052882

Boring Location Plan

Soil Boring Data



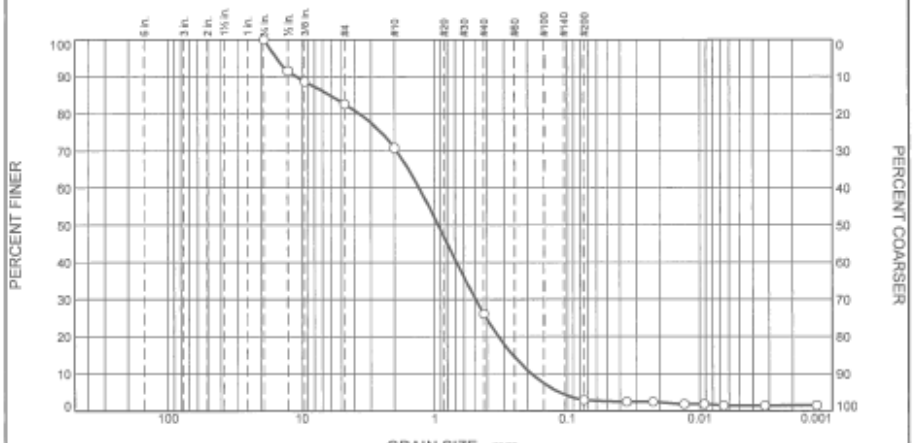
- Typical Soil Profile Consisted of 5 to 6 inches of Topsoil over Reddish Brown Poorly Graded Sand in a Medium Dense Condition

Groundwater Elevations

Boring Number	General Location	Surface Elevation	Depth to Free Groundwater (ft)	Groundwater Elevation (ft)
B-1	Storm Water	1706	5	1701
B-2	Building Pad	1706	5	1701
B-3	Building Pad	1707	6.5	1700.5
B-4	Building Pad	1707	6	1701
B-5	Building Pad	1706	5	1701
B-6	Building Pad	1706	6	1700
B-7	Pavement	1705	5	1700
B-8	Pavement	1706	5	1701

Grainsize Distribution

Particle Size Distribution Report



% Stones	% +3"	% Gravel			% Sand					% Silt		% Clay
		Coarse	Medium	Fine	V. Crs.	Crs.	Med.	Fine	V. Fine	Crs.	Fine	
0.0	0.0	0.0	17.4	11.8	18.8	21.4	16.0	10.5	1.5	0.3	0.9	1.4

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3/4"	100.0		
1/2"	91.5		
3/8"	88.7		
#4	82.6		
#10	70.8		
#40	26.1		
#200	2.9		
0.0357 mm.	2.4		
0.0226 mm.	2.4		
0.0131 mm.	1.8		
0.0093 mm.	1.8		
0.0066 mm.	1.4		
0.0032 mm.	1.4		
0.0013 mm.	1.4		

* (no specification provided)

Material Description

Brown Gravelly SAND

Atterberg Limits (ASTM D 4318)

PL= LL= PI=

Classification

USCS (D 2487)= SP AASHTO (M 145)=

Coefficients

D_{90}= 11.1374 D_{85}= 6.1368 D_{60}= 1.3036
D_{50}= 0.9377 D_{30}= 0.4901 D_{15}= 0.2562
D_{10}= 0.1861 C_u= 7.01 C_c= 0.99

Remarks

Date Received: 7/16/14 Date Tested: 7/21/14
Tested By: CK
Checked By: PP
Title: PM

Location: B-1
Depth: 1 to 2.5 ft.

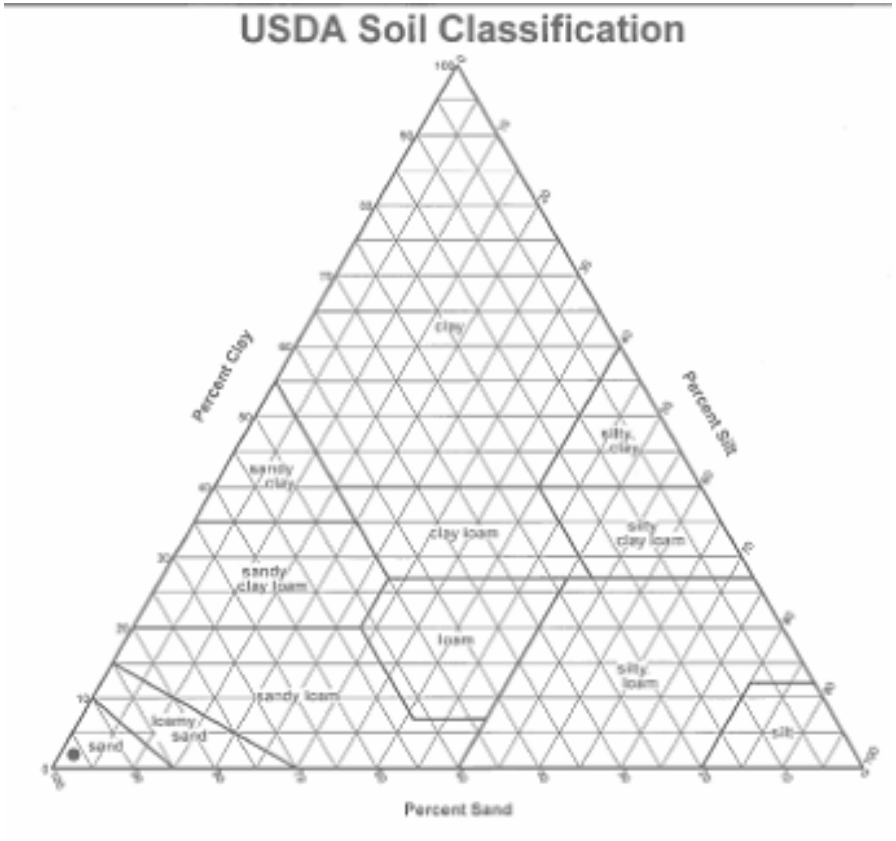
Date Sampled: 5/21/14

Midwest Engineering Services

Waukesha, Wisconsin

Client: WE Energies
Project: Headwater Service Center
Land O Lakes, WI
Project No: 0052882 Figure

USDA Classification



Storm Form

B-1 Obs. #

☒ Boring
☐ Pit

Ground surface elev. ___ ft.

Depth to limiting factor _60_ in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistency	Boundary	% Rock Frag.	NRCS Infiltration Rate Inches/Hr
A	7	7.5YR3/2	NONE	C	0,ma	VFR	A	---	0.06-0.20
C	180	7.5YR4/4	NONE	S	0,sg	L	A	---	>20

Infiltration Rates

Table 2: Design Infiltration Rates for Soil Textures Receiving Stormwater

Soil Texture[1]	Design Infiltration Rate Without Measurement inches/hour[2]
Coarse sand or coarser	3.60
Loamy coarse sand	3.60
Sand	3.60
Loamy sand	1.63
Sandy loam	0.50
Loam	0.24
Silt loam	0.13
Sandy clay loam	0.11
Clay loam	0.03
Silty Clay loam	0.04[3]
Sandy clay	0.04
Silty clay	0.07
Clay	0.07

Double Ring Infiltrometer Results

Test Location	Test Depth	Soil Description	Infiltration Rate (in./hour)
Test #1	1'	Sand	43

Recommendations for Infiltration

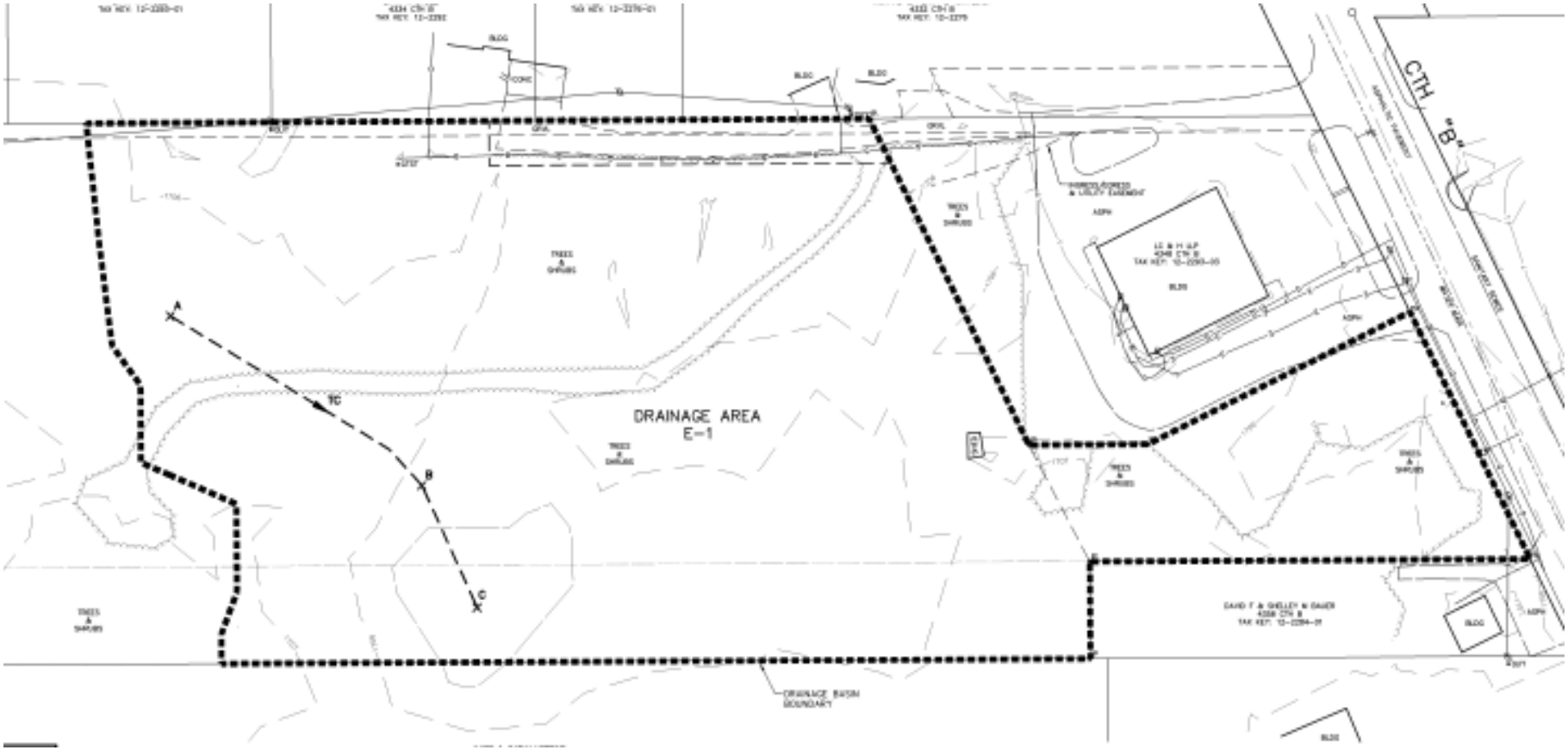
Results of Double Ring Testing were 43 inches per hour but for design should be limited to 14 inches per hour according to code.

Recommendations for Infiltration

- NR151 Requires at least 3 feet of soil containing 20% fines above the seasonal high groundwater level or 5 feet of soil containing 10% fines above the seasonal high groundwater level.

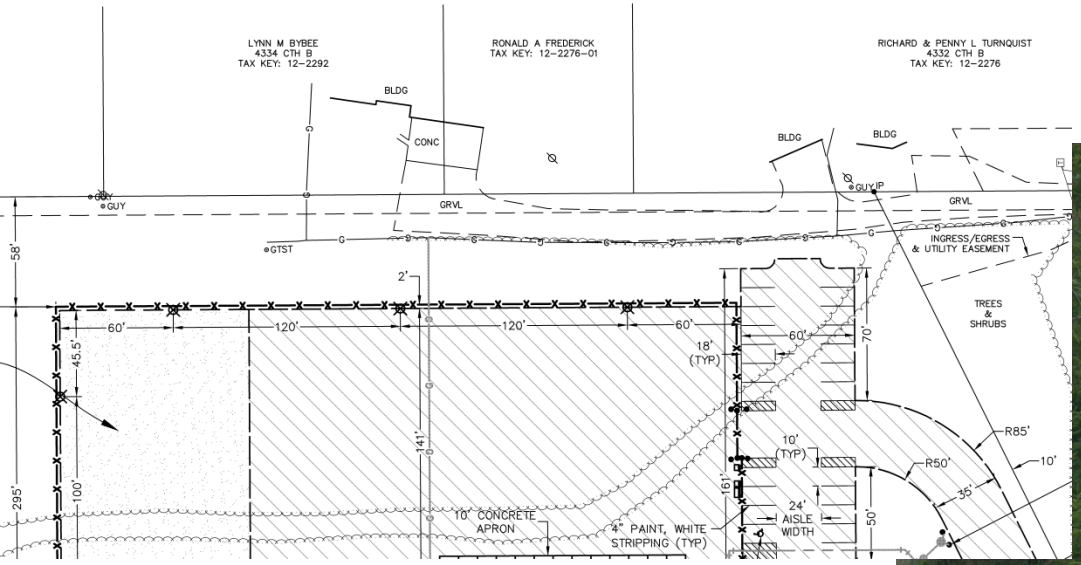
- Both were challenges since the soil had less than 10% fines and the groundwater level was approximately 5 to 6 feet down

WE-Energies Headwaters Service Center



Ruekert · Mielke

WE-Energies Headwaters Service Center



Ruekert · Mielke

WE-Energies Headwaters Service Center

- Existing driveway with no easement on property.
  - Village Clerk lives next door.
  - Village President owns land next door too!
  - Driveway can't be relocated--Forces shift of everything west. Plus need space for landscape buffer.
  - Nothing is ever easy! But hey- Its God's Country.

WE-Energies Headwaters Service Center

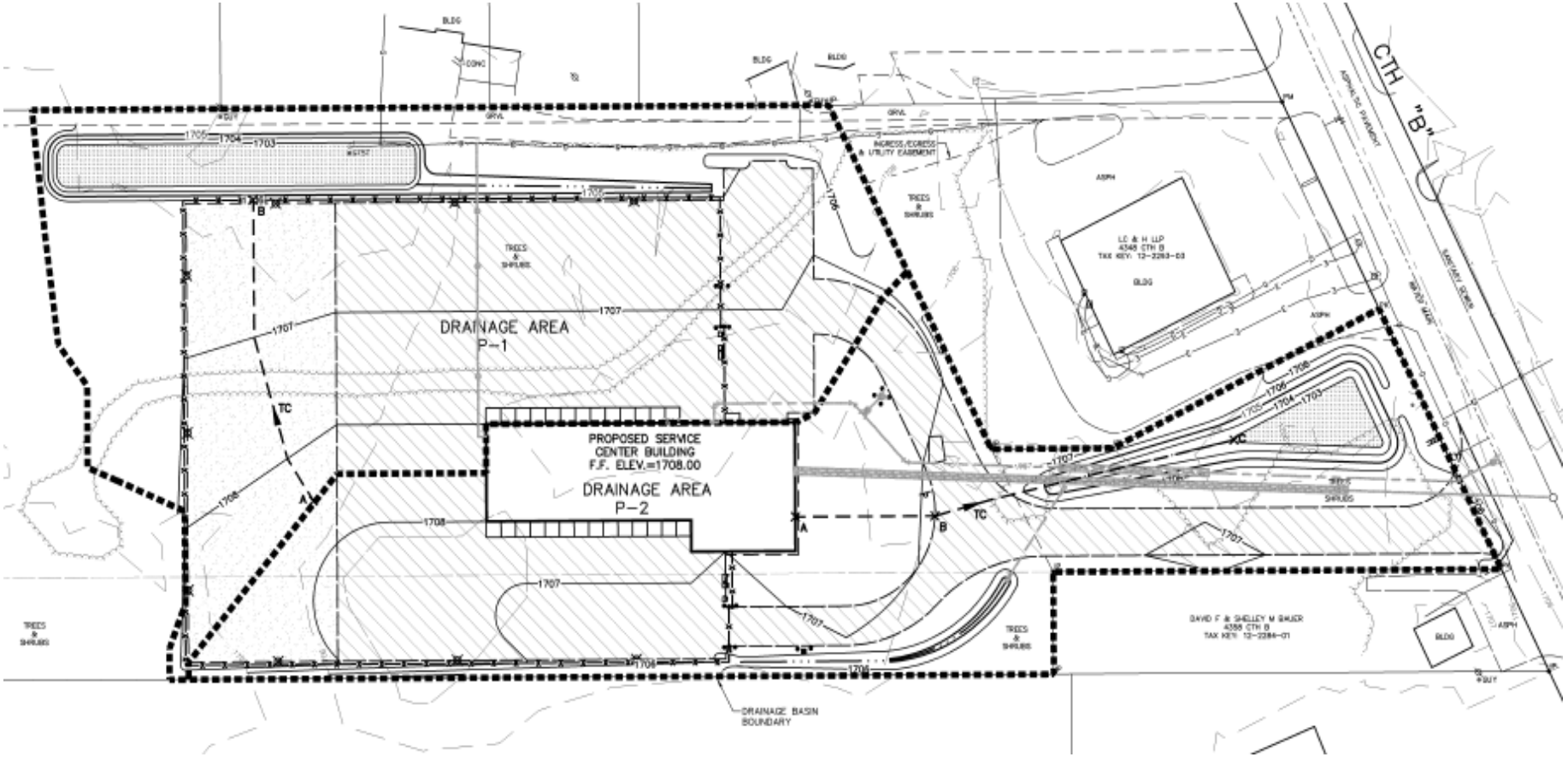
Ruekert · Mielke

WE-Energies Headwaters Service Center

- South drainage pattern decided rather easily
- East pond and drainage pattern developed out of lack of elevation and space
- West drainage swale developed as a result of isolated low spot on lot line.

Ruekert · Mielke

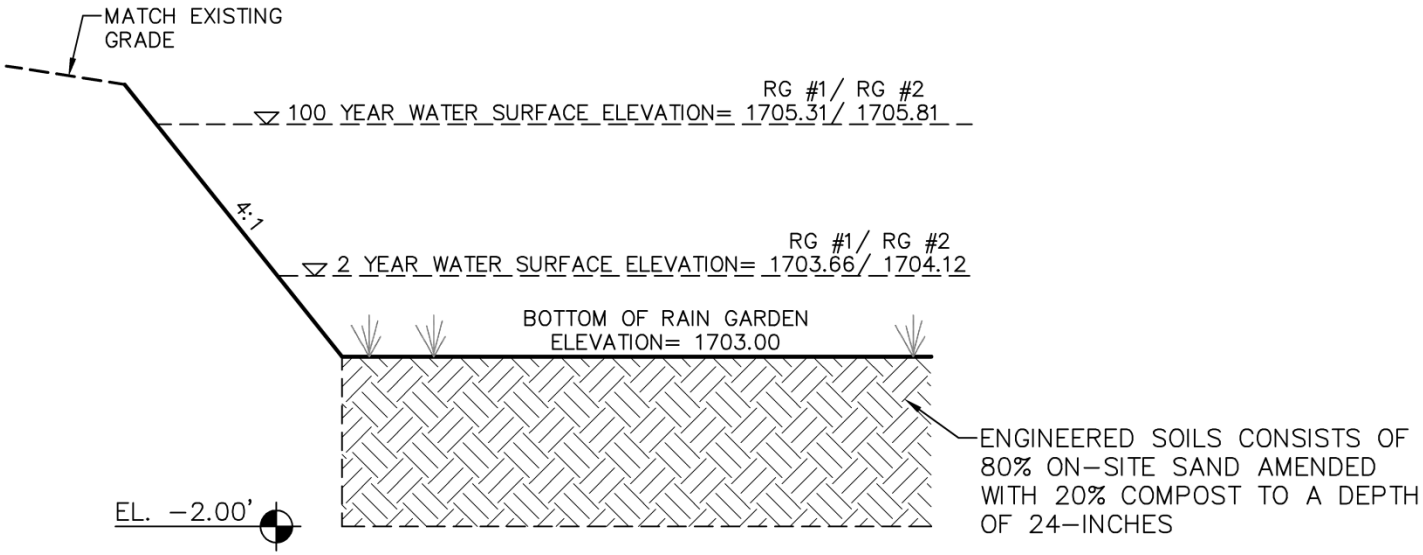
WE-Energies Headwaters Service Center



Ruekert · Mielke

WE-Energies Headwaters Service Center

Bio-infiltration



STORM WATER FACILITY TYPICAL SECTION NO SCALE

Cgdtpond Section 30

WE-Energies Headwaters Service Center

- Infiltration design rate vs actual
- Concerns from DNR staff
  - No borings in east BMP
  - DEPTH TO GROUNDWATER!!!!! Raise site?

WE-Energies Headwaters Service Center

Ruekert · Mielke

WE-Energies Headwaters Service Center

Ruekert · Mielke

WE-Energies Headwaters Service Center

Ruekert · Mielke

WE-Energies Headwaters Service Center

Ruekert · Mielke

WE-Energies Headwaters Service Center

Ruekert · Mielke

WE-Energies Headwaters Service Center

Ruekert · Mielke

WE-Energies Headwaters Service Center

LESSONS LEARNED:

- Good Soils & Ground Water Data is critical to BMP Design.
- Sand isn’t necessarily perfect despite being in God’s Country.