STATE OF WISCONSIN

CORRESPONDENCE/MEMORANDUM

Date: January 31, 2017

To: File

From: Patrick J. Gavinski, P.E.
SW Region Soils Engineer

Subject: Soils Report
Project I.D. 5845-01-06
Stoughton - Madison
STH 138 Intersection
USH 51, Dane County

General

This project is located on USH 51 in Dane County, at the STH 138 and Hoel Ave/Silverado Dr. Intersections in the City of Stoughton. The proposed improvement will reconfigure the intersections as roundabouts to handle the increased traffic.

Geology

This project is located in southern Dane County an area that was affected by the Green Bay lobe of the Late Wisconsin Stage glaciation. This particular project area is in an area of ground moraine.

Soils

The soils on project 5845-01-06 were mapped using NRCS's Web Soil Survey. The following table lists the soil series with general information. Note that in general the suitability of the material for use in highway construction decreases as the DGI number increases. For example, DGI 6 soils are typically better for highway construction than DGI 12 soils, though it is possible to use DGI 12 material.

Series Name	Description	Design Group Index (DGI)	Frost Index	Modulus of Subgrade Reaction (K)	AASHTO Classification	Approximate % of Project
Batavia	Silty clay on calcareous sandy loam	12,10	F-3	150,200	A-6	41
Dresden	Loam on calcareous sand and gravel	12	F-3	150	A-2, A-6	11
Gravel Pit	Gravel pit	-	-	-		5
Kidder	Loamy soil over calcareous sandy till	10,2	F-3, F-2	-	A-1, A-2, A-4, A-6	15
Kegonsa	Silt over calcareous sand and gravel	12	F-3	150	A-4, A-6	5
McHenry	Clay over sand with fines	10,2	F-3, F-2	200,300	A-4, A-6, A-7	5

Plano	Silty clay on calcareous sandy loam	12, 10	F-3	150, 200	A-4, A-6, A-7	10
Radford	Silty alluvium over paleosols	20,16	F-4	75,100	A-4, A-7	8

As part of this investigation, 13 roadway borings were taken over various times and locations. Copies of the soil borings may be found in Attachment A. The proposed plan and profile at the time of borings can be found in Attachment B. Copies of the NRCS soil maps and Soil Properties may be found in Attachment C.

Pavement Design Parameters

Based on NRCS information and our subsurface investigation, the following design values are recommended **WITHOUT Subgrade Improvement**.

Soil Support Value	4.2
Design Group Index	12
K Modulus	150 PCI
Frost Index	F-3
AASHTO Classification	A-7-6
Depth to Water	>5’
Depth to Rock	>8’

Using select material will help bridge the marginal subgrade soils and allow local traffic and construction loads to operate on the roadway even in periods of wet weather. Select material can increase pavement life by decreasing the amount of frost susceptible soil in the frost zone. In Addition, pipe under drain and french drains reduce frost heave by keeping moisture away from frost susceptible soils.

The following parameters should be used during the pavement design **WITH Subgrade Improvement:**

Soil Support Value	4.7
Design Group Index	12
K Modulus	375 PCI
Frost Index	F-3
AASHTO Classification	A-7-6(Deer Creek)
Depth to Water	>5’
Depth to Rock	>8’

Materials Availability

All common roadbuilding materials should be readily available in the area.

Compaction

Standard compaction is recommended for this project.

Erosion Control

Slopes and channels should be protected as per Chapter 10 of the FDM (See Procedure 10-5-35, Attachments 35.1 & 35.2). As always, embankment side slopes and cut slopes should be topsoiled, seeded, and mulched as early as possible to reduce the potential for erosion.

Fertilizer Type
For areas requiring topsoil, seeding, and mulch, Type B fertilizer is recommended.

Subgrade Improvement
Soils in this area are generally silts and silt loam. 16 inches of Select Crush Material is recommended for this project.

Discussion and Recommendations

Soil borings encountered existing 6" concrete pavement 2'–6' below existing grade in the areas of station 22+00NB and 25+00SB 30'RT(existing southbound Lanes). Refer to the elevations on the borings for depth to existing pavement. This existing pavement should be called out in the plan and removed if it will be encountered during construction. Boring 8 showed wet soil at the depth of the existing pavement, if the existing pavement will be encountered in this area ensure that adequate drainage of the select material is provided either by French drain or underdrain.

Typical topsoil thickness was 6".

An expansion factor of 1.33 should be used in earthwork calculations.

EBS should be estimated at 5% of the surface area of the project to a depth 1' below subgrade.

Clays and silts can be difficult to work with, especially when wet. The subgrade should be bladed and rolled daily to promote drainage.

Proper construction practices such as removing unsuitable materials underlying proposed embankments and benching into existing steep slopes as described in Section 205.3 of the 2017 State of Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction should be followed at all times. Cut and fill slopes should be held to a maximum of 2-1/2:1 whenever possible.

If sidewalks are replaced or new sidewalk added a 4-inch layer of base course under the new sidewalk is recommended.

If you have any question, please contact Pat Gavinski at (608) 516 – 6469.

Attachment A

Soil borings

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FIELD BORING LOG

Wisconsin Department of Transportation

Boring No.	Structure	County	Sheet	Of
B-1	Road Boring	Dane	1	1

Project	Road
5845-01-06	USH 51

Station	Offset	Surface Elevation
11+50 NB	20' Rt	

GROUND WATER OBSERVATIONS

Streambed Elevation:	Time After Drilling:					
Water Elevation:	Depth to Water:					
Top of Well Elevation:						

MOISTURE

D = Damp
M = Moist
W = Wet

DRILLING METHOD

HS = Hollowstem
WA = Wash Ahead
RB = Rockbit
ST = Shelby Tube
SS = Splitspoon
DM = Drilling Mud
A = Auger
C = Coring
W = Wash
E = Easy
M = Medium
H = Hard

Unit	Chief
1	SKO/05

Start	Finish
12/8/16	12/8/16

Sample No.	Moisture	Blows on Sampler 0/6	Blows on Sampler 6/12	Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method
						PCC 8"			A
						Base 20"			↓
	M								E
	↓					Silt Br F-Sandy little F-m Gravel some clay			M
1		2	1/5		7	5' Clay Br. some silt 5'	2.5		
						Silt Br some F sand			
2	D/M	14	8/20		34	10' Sand Br. some silt little F-m Gravel dense 10'			
	↓								
3		14	8/18		32	15' 15'			
						EOB - B-1 16'			
						20' 20'			
						25' 25'			
						30' 30'			
						35' 35'			

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FIELD BORING LOG

Wisconsin Department of Transportation

Boring No.	Structure	County	Sheet	Of
B-2	Road Boring	DANE	1	1

Project	Road
5845-01-06	USH 51

Station	Offset	Surface Elevation
15+00 NB	0' on R/C	

GROUND WATER OBSERVATIONS

Streambed Elevation:	Time After Drilling:					
Water Elevation:	Depth to Water:					
Top of Well Elevation:						

MOISTURE

D = Damp
M = Moist
W = Wet

DRILLING METHOD

HS = Hollowstem
WA = Wash Ahead
RB = Rockbit
ST = Shelby Tube
SS = Splitspoon
DM = Drilling Mud
A = Auger
C = Coring
W = Wash
E = Easy
M = Medium
H = Hard

Unit	Chief
1	S Kolos

Start	Finish
12/8/16	12/8/16

Sample No.	Moisture	Blows on Sampler	Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method
								A
	M				F-C SAND & F-C gravel Br. 1'			
					2' F-M SAND little silt little gravel			F/M
					3'			
					4' Silt Br F SANDy little F-M gravel			
					5'			
					6'			
					7' Silt black			
					8' Silt & Brown Some clay			
					9'			
					10' EOB - B-2 10'			
					11'			
					12'			
					13'			

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FIELD BORING LOG

Wisconsin Department of Transportation

Boring No.	Structure	County	Sheet	Of
B-3	ROAD Boring	Dane	1	1

Project	Road
5845-01-06	USH 51

Station	Offset	Surface Elevation
19+00 NB	0 m R/L	

GROUND WATER OBSERVATIONS

Streambed Elevation:	Time After Drilling:					
Water Elevation:	Depth to Water:					
Top of Well Elevation:						

MOISTURE

D = Damp
M = Moist
W = Wet

DRILLING METHOD

HS = Hollowstem
WA = Wash Ahead
RB = Rockbit
ST = Shelby Tube
SS = Splitspoon
DM = Drilling Mud
A = Auger
C = Coring
W = Wash
E = Easy
M = Medium
H = Hard

Unit	Chief
1	SKolos
Start	**Finish**
12/8/16	12/8/16

Sample No.	Moisture	Blows on Sampler	Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method
					Bit. 3"			A
					Base 11"			
					1' 1'			
	m				2' 2'			E/m
					3' silt Br F-sandy tr. F-m gravel 3'			
					4' 4'			
					5' 5'			
					silt dk Br. sandy			
					6' 6'			
					clay Br. little silt			
					7' 7'			
					8' 8'			
					F-m sand Br little silt			
					9' 9'			
					10' 10'			
					EOB B-3 10'			
					11' 11'			
					12' 12'			
					13' 13'			

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FIELD BORING LOG

Wisconsin Department of Transportation

Boring No.	Structure	County	Sheet	Of
B-4	Road Boring	Dane	1	1
Project	**Road**			
5845-01-06	USH 51			
Station	**Offset**	**Surface Elevation**		
22+00 NB	0			

GROUND WATER OBSERVATIONS

Streambed Elevation:	Time After Drilling:					
Water Elevation:	Depth to Water:					
Top of Well Elevation:						

MOISTURE	DRILLING METHOD				Unit	Chief
D = Damp M = Moist W = Wet	HS = Hollowstem WA = Wash Ahead RB = Rockbit	ST = Shelby Tube SS = Splitspoon DM = Drilling Mud	A = Auger C = Coring W = Wash	E = Easy M = Medium H = Hard	1	Skalos
					Start: 12/8/16	Finish: 12/8/16

Sample No.	Moisture	Blows on Sampler	Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method
					Bit. 6"			A
					Base 12"			↓
	M				1' 1'			E
					silt Br F-sandy tr. gravel			M
					2' 2'			
					3' 3'			
					4' 4'			
					5' 5'			↓
					PCC.			H
					6' 6'			↓
					silt Br F-sandy tr. F-gravel			E
					7' 7'			M
					8' 8'			
					9' 9'			
					10' 10'			
					EOB B-4 10'			
					11' 11'			
					12' 12'			
					13' 13'			

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FIELD BORING LOG

Wisconsin Department of Transportation

Boring No.	Structure	County	Sheet	Of
B-5	Road Boring	DANE	1	1
Project	**Road**			
5845-01-06	US 51			
Station	**Offset**	**Surface Elevation**		
14+00 SB	20' LT			

GROUND WATER OBSERVATIONS

Streambed Elevation:	Time After Drilling:					
Water Elevation:	Depth to Water:					
Top of Well Elevation:						

MOISTURE	DRILLING METHOD				Unit	Chief
D = Damp M = Moist W = Wet	HS = Hollowstem WA = Wash Ahead RB = Rockbit	ST = Shelby Tube SS = Splitspoon DM = Drilling Mud	A = Auger C = Coring W = Wash	E = Easy M = Medium H = Hard	1	SKolos
					Start	Finish
					12/8/16	12/8/16

Sample No.	Moisture	Blows on Sampler	Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method
					TOPSOIL			A
	M				1' SILT Br F-SAndy little F-m Gravel 1'			
					2' 2'			E/CM
					3' 3'			
					4' 4'			
					5' 5'			
					F-SAND SILTS Br little F-m Gravel			
					6' 6'			
					7' 7'			
					8' 8'			
					SILT Br F-Sandy tr. F-m Gravel			
					9' 9'			
					10' 10'			
					EOB-BL 5/0'			
					11' 11'			
					12' 12'			
					13' 13'			

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FIELD BORING LOG

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Boring No. B-6	Structure Road Boring	County Dane	Sheet 1 Of 1
Project 5845-01-06	Road USH 51		
Station 18+00 58	Offset 30' LT	Surface Elevation	

GROUND WATER OBSERVATIONS

Streambed Elevation:	Time After Drilling:					
Water Elevation:	Depth to Water:					
Top of Well Elevation:						

MOISTURE	DRILLING METHOD				Unit 1	Chief Sholar
D = Damp M = Moist W = Wet	HS = Hollowstem WA = Wash Ahead RB = Rockbit	ST = Shelby Tube SS = Splitspoon DM = Drilling Mud	A = Auger C = Coring W = Wash	E = Easy M = Medium H = Hard	Start 12/8/16	Finish 12/8/16

Sample No.	Moisture	Blows on Sampler 0/6	Blows on Sampler 6/12	Sample and Recovery	Total Blows	Depth	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method
							617 3'			A
							PCC 8"			
							Base 7"			
	M						Silt Br F Sand tr F-m gravel			E/M
1	↓	4	5 / 4	X	8	5'	Silt dk B. Tr clay	1.5		
2	↓	4	2 / 5		9	10'	Silt Br. tr clay tr F-Sand	3.5		
							clay brown silts mottled			
3	↓	2	2 / 4		6	15'		1.0 / 1.0		
							EOB B-6 16'			
						20'				
						25'				
						30'				
						35'				

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FIELD BORING LOG

Wisconsin Department of Transportation

Boring No.	Structure	County	Sheet	Of
B-7	Road Boring	DANE	1	1

Project	Road
5845-01-06	USH 51

Station	Offset	Surface Elevation
23+25 SB	35' LT	

GROUND WATER OBSERVATIONS

Streambed Elevation:	Time After Drilling:					
Water Elevation:	Depth to Water:					
Top of Well Elevation:						

MOISTURE

D = Damp
M = Moist
W = Wet

DRILLING METHOD

HS = Hollowstem
WA = Wash Ahead
RB = Rockbit
ST = Shelby Tube
SS = Splitspoon
DM = Drilling Mud
A = Auger
C = Coring
W = Wash
E = Easy
M = Medium
H = Hard

Unit	Chief
1	SKyles
Start	**Finish**
12/9/16	12/9/16

Sample No.	Moisture	Blows on Sampler	Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method
	M				Top Soil 6"			A
					Silt Br. Fr. cls			
					1' 1'			
					2' 2'			E
					3' 3'			M
					4' 4'			
					5' 5'			
					F-m Sand Br.			
	M/W				6' 6'			
					7' 7'			
					8' 8'			
					9' 9'			
					10' 10'			
					EOB-B-7 10'			
					11' 11'			
					12' 12'			
					13' 13'			

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FIELD BORING LOG

Wisconsin Department of Transportation

Boring No.	Structure	County	Sheet	Of
B-8	Road Boring	Dane	1	1

Project	Road
5845-01-06	USH 51

Station	Offset	Surface Elevation
25+00 SB	30 Rt	

GROUND WATER OBSERVATIONS

Streambed Elevation:	Time After Drilling:					
Water Elevation:	Depth to Water:					
Top of Well Elevation:						

MOISTURE

D = Damp
M = Moist
W = Wet

DRILLING METHOD

HS = Hollowstem
WA = Wash Ahead
RB = Rockbit
ST = Shelby Tube
SS = Splitspoon
DM = Drilling Mud
A = Auger
C = Coring
W = Wash
E = Easy
M = Medium
H = Hard

Unit	Chief
1	SKalas
Start	**Finish**
12/8/16	12/8/16

Sample No.	Moisture	Blows on Sampler	Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method
					Bit 4"			A
	M				1' gravel lift "22" 1'			
	M				2' 2'			E
	M				concrete 6"?			
	M				3' F-sand Br- tr F-m gravel tr silt 3'			
	M				4' 4'			
	M				5' 5'			
	M				6' silt dk Br- tr sand 6'			
	M				7' 7'			
	M				8' silt Br/gray mottled 8'			
	M				9' 9'			
	M				10' 10'			
					EOB- B-8 10'			
					11' 11'			
					12' 12'			
					13' 13'			

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FIELD BORING LOG

Wisconsin Department of Transportation

Boring No.	Structure	County	Sheet	Of
B-9	Road Boring	Dane	1	1

Project	Road	Surface Elevation
5845-01-06	USH 51	

Station	Offset
28+00	24' LT

GROUND WATER OBSERVATIONS

Streambed Elevation:	Time After Drilling:					
Water Elevation:	Depth to Water:					
Top of Well Elevation:						

MOISTURE: D = Damp, M = Moist, W = Wet

DRILLING METHOD: HS = Hollowstem, WA = Wash Ahead, RB = Rockbit, ST = Shelby Tube, SS = Splitspoon, DM = Drilling Mud, A = Auger, C = Coring, W = Wash, E = Easy, M = Medium, H = Hard

Unit	Chief
1	Skoks

Start	Finish
12/8/16	12/8/16

Sample No.	Moisture	Blows on Sampler 0/6	Blows on Sampler 6/12	Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method
						Bit 2" PCC 8"			
						Base 9"			
	M								E
						silt Br F sandy tr F-m gravel			
1	M		5						
		12	16		28	5' firm	2.5		
1									
2	W		3			10' F-C sand little gravel, silt Br some gravel tr F-C gravel			
	M	6	6				3.25		
						silt Br/gry mottled			
3	M		2						
		5	9		14	15' firm	1.75		
						EOB. B-9 16'			
						20'			
						25'			
						30'			
						35'			

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FIELD BORING LOG

Wisconsin Department of Transportation

Boring No.	Structure	County	Sheet	Of
B-10	Road Boring	DANE	1	1
Project 5845-01-06	**Road** USH 51			
Station 12+00 EB	**Offset** 0 on R/C	**Surface Elevation**		

GROUND WATER OBSERVATIONS

Streambed Elevation:	Time After Drilling:					
Water Elevation:	Depth to Water:					
Top of Well Elevation:						

MOISTURE: D = Damp; M = Moist; W = Wet

DRILLING METHOD: HS = Hollowstem; WA = Wash Ahead; RB = Rockbit; ST = Shelby Tube; SS = Splitspoon; DM = Drilling Mud; A = Auger; C = Coring; W = Wash; E = Easy; M = Medium; H = Hard

Unit 1 | Chief SKdcs

Start 12/9/16 | Finish 12/9/16

Sample No.	Moisture	Blows on Sampler 0/6	Blows on Sampler 6/12	Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method
	V					BIT. 6" Base 2" recycled 5.5"			A
	M								I
	M					SILT dk Br tr F. SAND			F
	M		3						M
1						5' F-m SAND & F-C gravel tr silt 5'			
	D	2	1	X					
	D					F-m SAND Br. tr F-m gravel			
			4						
2		6	6		12	10' 10'			
	M		7						A
3		8	10		18	15' F-m SAND Br & F-m gravel tr silt 15'			
						EOB. B-10 @ 16'			
						20' 20'			
						25' 25'			
						30' 30'			
						35' 35'			

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FIELD BORING LOG

Wisconsin Department of Transportation

Boring No.	Structure	County	Sheet	Of
B-11	Road Boring	DANE	1	

Project	Road
5845-01-06	USH 51

Station	Offset	Surface Elevation
13+00 WB	0 on R/L	

GROUND WATER OBSERVATIONS

Streambed Elevation:	Time After Drilling:					
Water Elevation:	Depth to Water:					
Top of Well Elevation:						

MOISTURE

D = Damp
M = Moist
W = Wet

DRILLING METHOD

HS = Hollowstem
WA = Wash Ahead
RB = Rockbit
ST = Shelby Tube
SS = Splitspoon
DM = Drilling Mud
A = Auger
C = Coring
W = Wash
E = Easy
M = Medium
H = Hard

Unit	Chief
1	SKOLOS

Start	Finish
12/9/16	12/9/16

Sample No.	Moisture	Blows on Sampler	Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method
					topsoil 6"			A
	M				1' Silt Br some F sand little F-m Gravel 1'			
					2' 2'			E/A
					3' 3'			
					4' 4'			
					5' 5'			
					6' F-m sand & F-m Gravel Br. little silt 6'			
	D/M				7' 7'			
					8' 8'			
					9' 9'			
					10' EOB-B-10' 10'			
					11' 11'			
					12' 12'			
					13' 13'			

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FIELD BORING LOG

Wisconsin Department of Transportation

Boring No.	Structure	County	Sheet	Of
B-12	Rock Boring	Dane	1	1

Project	Road
5845-01-06	USH 51

Station	Offset	Surface Elevation
11-66 Hoel Ave	0	

GROUND WATER OBSERVATIONS

Streambed Elevation:	Time After Drilling:					
Water Elevation:	Depth to Water:					
Top of Well Elevation:						

MOISTURE

D = Damp
M = Moist
W = Wet

DRILLING METHOD

HS = Hollowstem
WA = Wash Ahead
RB = Rockbit
ST = Shelby Tube
SS = Splitspoon
DM = Drilling Mud
A = Auger
C = Coring
W = Wash
E = Easy
M = Medium
H = Hard

Unit	Chief
1	Skalos

Start	Finish
12/8/16	12/8/16

Sample No.	Moisture	Blows on Sampler	Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method
					Bit 3"			A
					Base 11"			
					1' 1'			
					2' 2'			
	M							E
					Silt Br F. Sand 3' 3'			M
					4' 4'			
					5' 5'			
					EOB - B-12 5'			
					6' 6'			
					7' 7'			
					8' 8'			
					9' 9'			
					10' 10'			
					11' 11'			
					12' 12'			
					13' 13'			

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Final

Boring No. B-12

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FIELD BORING LOG

Wisconsin Department of Transportation

Boring No.	Structure	County	Sheet	Of
B-13	Road Boring	Dane	1	1

Project	Road
5845-01-06	USH 51

Station	Offset	Surface Elevation
12+00 S. Woodside Dr	0	

GROUND WATER OBSERVATIONS

Streambed Elevation:	Time After Drilling:					
Water Elevation:	Depth to Water:					
Top of Well Elevation:						

MOISTURE	DRILLING METHOD				Unit	Chief
D = Damp M = Moist W = Wet	HS = Hollowstem WA = Wash Ahead RB = Rockbit	ST = Shelby Tube SS = Splitspoon DM = Drilling Mud	A = Auger C = Coring W = Wash	E = Easy M = Medium H = Hard	1 Start 12/8/16	SKolar Finish 12/8/16

Sample No.	Moisture	Blows on Sampler	Sample and Recovery	Total Blows	VISUAL FIELD CLASSIFICATION AND REMARKS	Unconfined Strength	Boulders	Drilling Method
					Bit 3" Base 9"			A
	M				1' Silt Br. little sand tr gravel. 1'			A
					2' 2'			E/M
					3' 3'			
					4' 4'			
					5' 5' EOB - B-13 5'			
					6' 6'			
					7' 7'			
					8' 8'			
					9' 9'			
					10' 10'			
					11' 11'			
					12' 12'			
					13' 13'			

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Attachment B

Plan and Profile

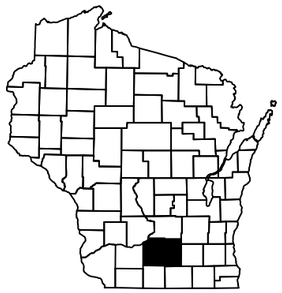
PROJECT ID: 5845-01-06/07

WITH:

COUNTY: DANE

ORDER OF SHEETS

TOTAL SHEETS =



N

DESIGN DESIGNATION

A.A.D.T.	(2012)	= 10,900
A.A.D.T.	(2045)	= 15,100
D.H.V.		= 1,058
D.D.		= 60/40
T. (DHV)		= 7.1
DESIGN SPEED		= 40 MPH
ESALS		=

CONVENTIONAL SYMBOLS

PLAN

- CORPORATE LIMITS
- PROPERTY LINE
- LOT LINE
- LIMITED HIGHWAY EASEMENT
- EXISTING RIGHT OF WAY
- PROPOSED OR NEW R/W LINE
- SLOPE INTERCEPT
- REFERENCE LINE (300'EB')
- EXISTING CULVERT
- PROPOSED CULVERT (Box or Pipe)
- COMBUSTIBLE FLUIDS (CAUTION)
- MARSH AREA
- WOODED OR SHRUB AREA

PROFILE

- GRADE LINE
- ORIGINAL GROUND
- MARSH OR ROCK PROFILE (To be noted as such) (ROCK)
- SPECIAL DITCH (LABEL)
- GRADE ELEVATION (95.36)
- CULVERT (Profile View)

UTILITIES

- ELECTRIC (E)
- OVERHEAD UTILITY (OH)
- FIBER OPTIC (FO)
- GAS (G)
- SANITARY SEWER (SAN)
- STORM SEWER (SS)
- TELEPHONE (T)
- WATER (W)
- UTILITY PEDESTAL
- POWER POLE
- TELEPHONE POLE

STATE OF WISCONSIN

DEPARTMENT OF TRANSPORTATION

PLAN OF PROPOSED IMPROVEMENT

STATE PROJECT	FEDERAL PROJECT	
	PROJECT	CONTRACT
5845-01-06		
5845-01-07		

CITY OF STOUGHTON

STOUGHTON TO MADISON

STH 138 INTERSECTION

USH 51

DANE, COUNTY

STATE PROJECT NUMBER
5845-01-06

CITY OF STOUGHTON

STOUGHTON TO MADISON

HOEL/SILVERADO INTERSECTION

USH 51

DANE, COUNTY

STATE PROJECT NUMBER
5845-01-07

END PROJECT
30+30.62
X: 857057.20
Y: 426478.33

END PROJECT
STA. 10+00.00
X=858720.94
Y=425822.09

LAYOUT
SCALE 0 1 MILE

TOTAL NET LENGTH OF CENTERLINE = 0.385 MI

HORIZONTAL POSITIONS SHOWN ON THIS PLAN ARE WISCONSIN COUNTY COORDINATES, DANE COUNTY, NAD88 (2007), IN U.S. SURVEY FEET. VALUES ARE GRID COORDINATES, GRID BEARINGS, AND GRID DISTANCES. GRID DISTANCES MAY BE USED AS GROUND DISTANCES.

ORIGINAL PLANS PREPARED BY:

STRAND ASSOCIATES

STATE OF WISCONSIN
DEPARTMENT OF TRANSPORTATION

PREPARED BY

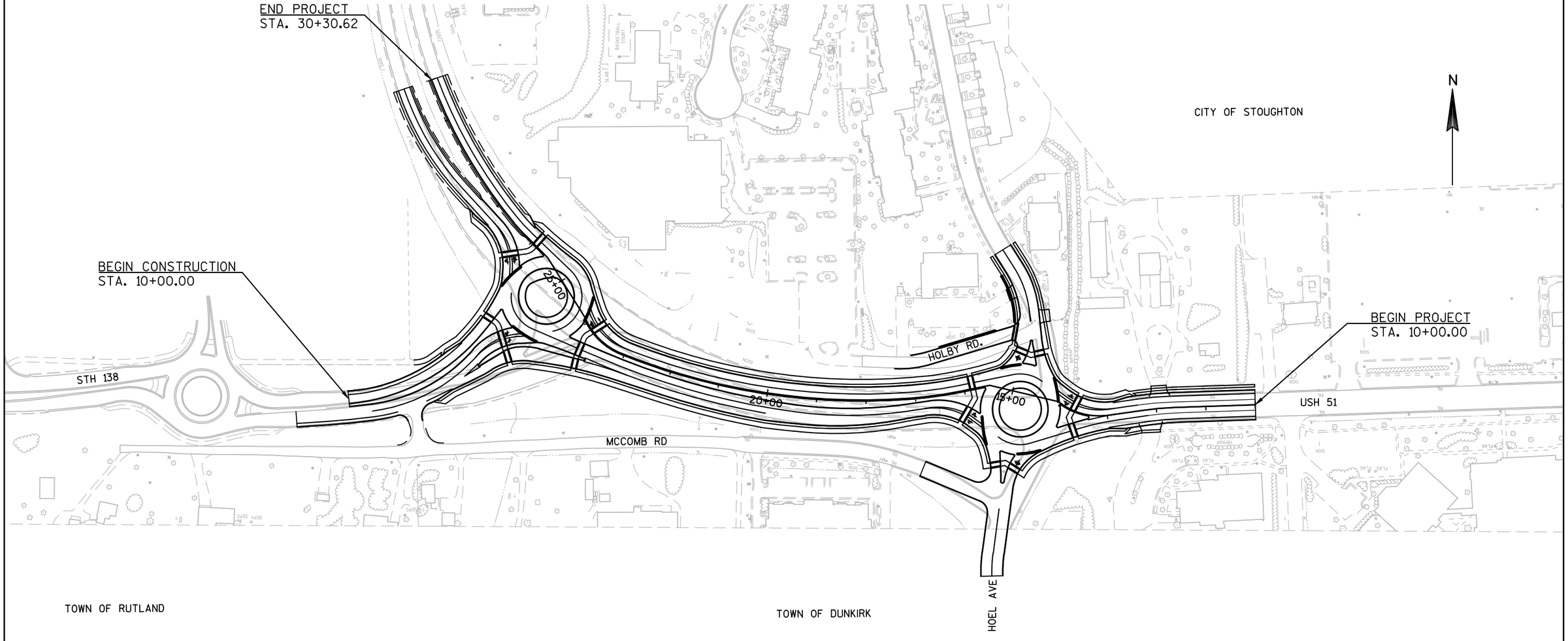
Surveyor	STRAND ASSOCIATES, INC.
Designer	STRAND ASSOCIATES, INC.
Project Manager	PROJECT MANAGER
Regional Examiner	REGIONAL EXAMINER
Regional Supervisor	REGIONAL SUPERVISOR

APPROVED FOR THE DEPARTMENT

DATE: _____ _____ (Signature)

E

2



PROJECT NO:5845-01-06/07	HWY: USH 51	COUNTY: DANE	PROJECT OVERVIEW	SHEET _____	E

FILE NAME : S:\MAD\1000--1099\1089\804\ACAD\CIVIL3D\SHEETSPLAN\021801_LD.DWG
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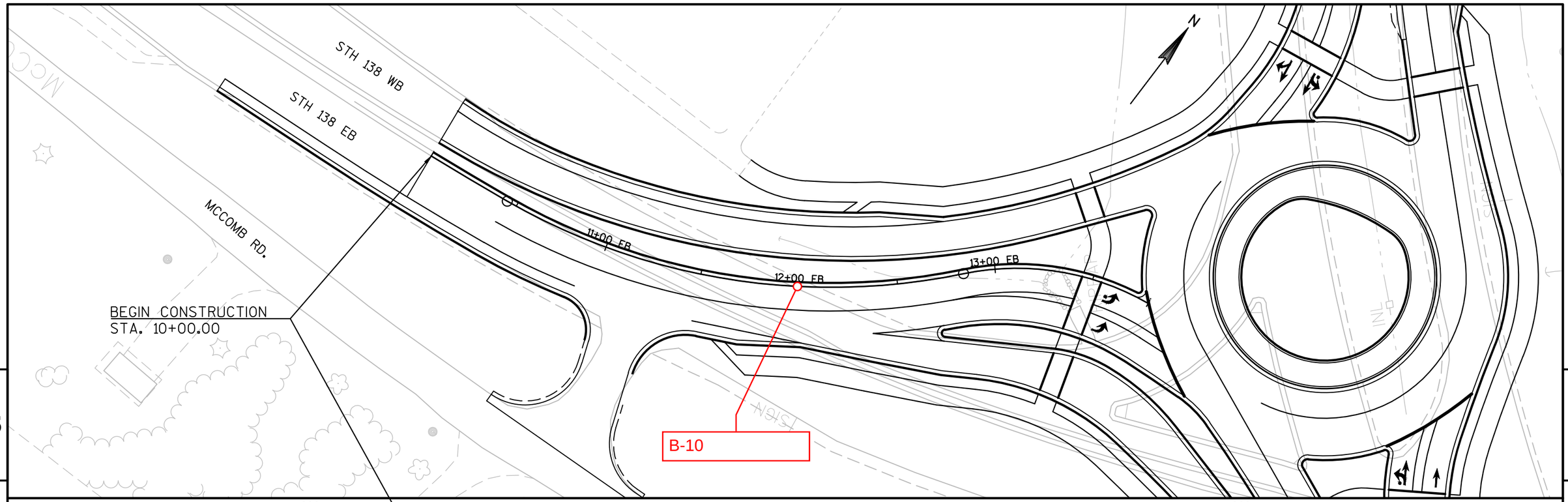
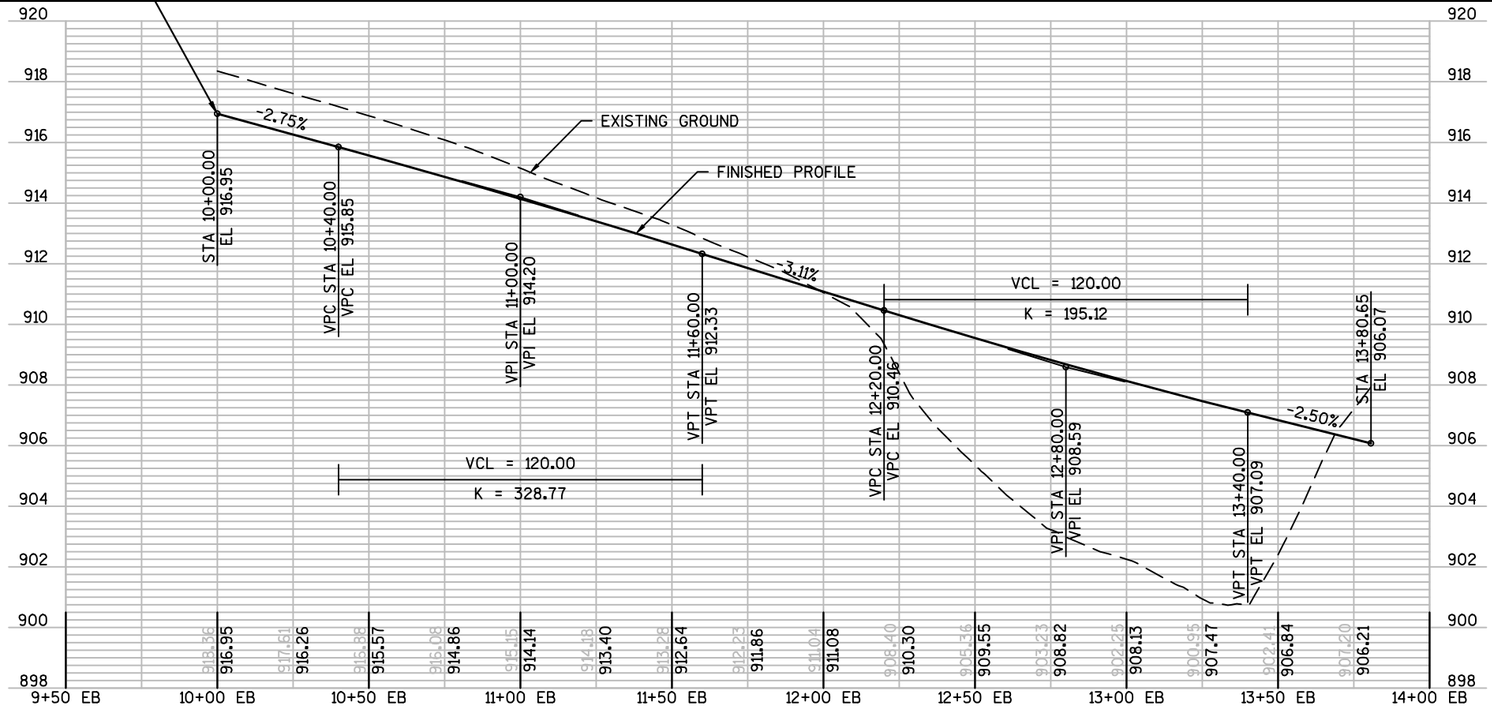
PLOT DATE : 7/28/2016 1:23 PM PLOT BY : MEYER, TERA PLOT NAME : ----------PLOT SCALE : 1" = 200'_XREF





PROJECT NO: 5848-01-06/07	HWY: USH 51	COUNTY: DANE	PLAN AND PROFILE: WIS 138 EB	SHEET	E

FILE NAME : S:\MAD\1000--1099\1089\804\ACAD\CIVIL3D\SHEETSPLAN\050101_PP.DWG
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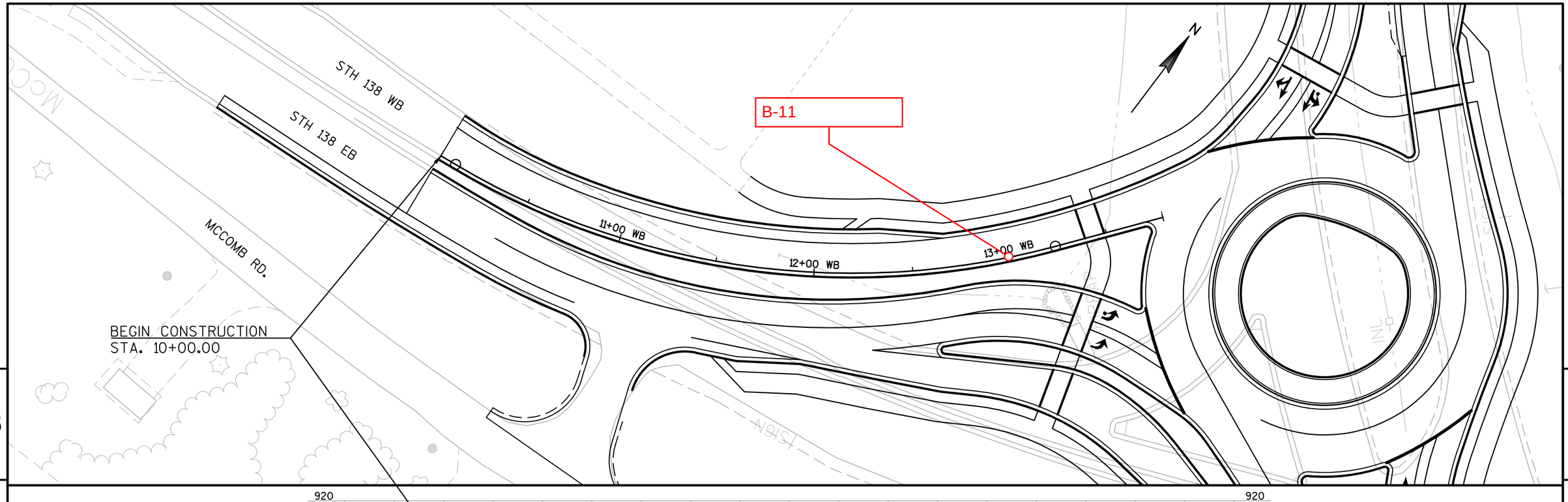
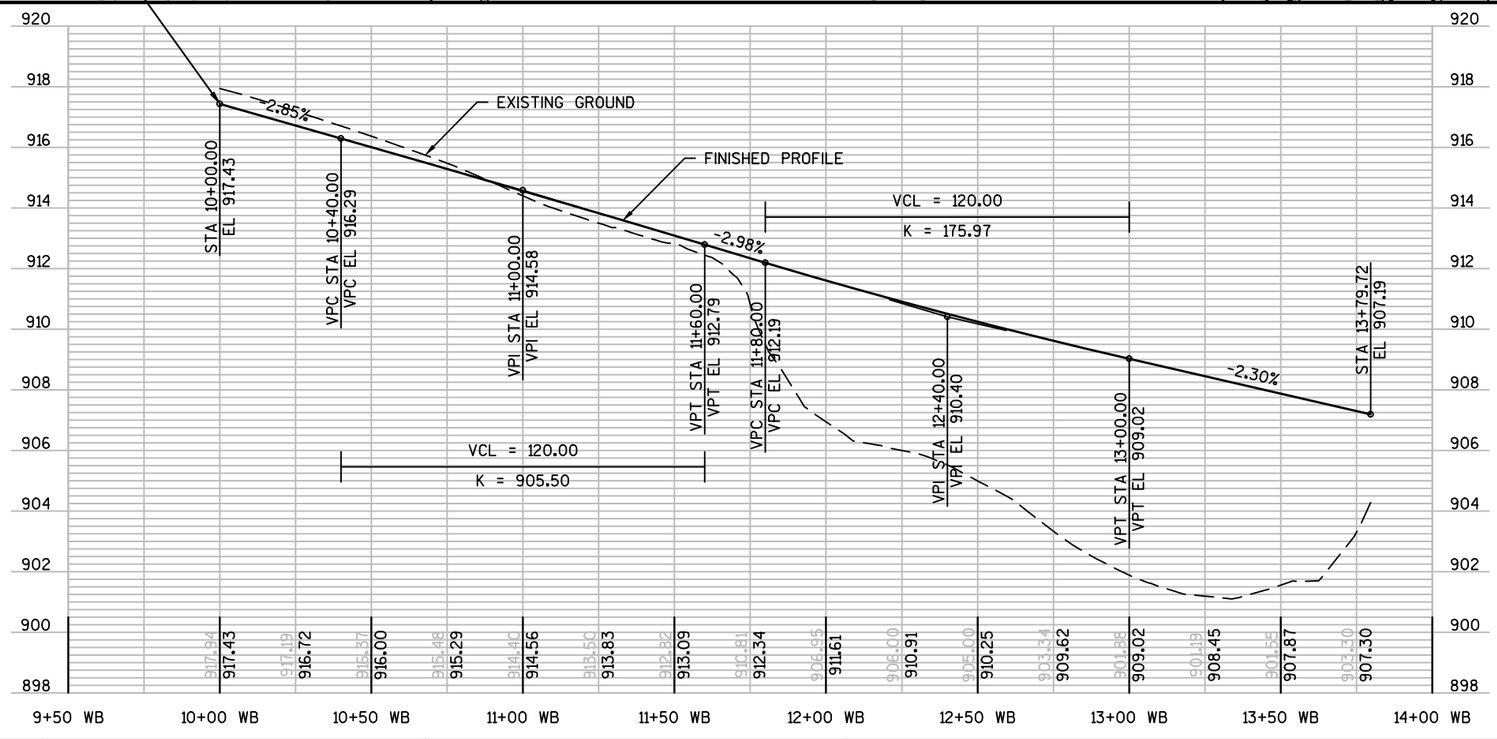
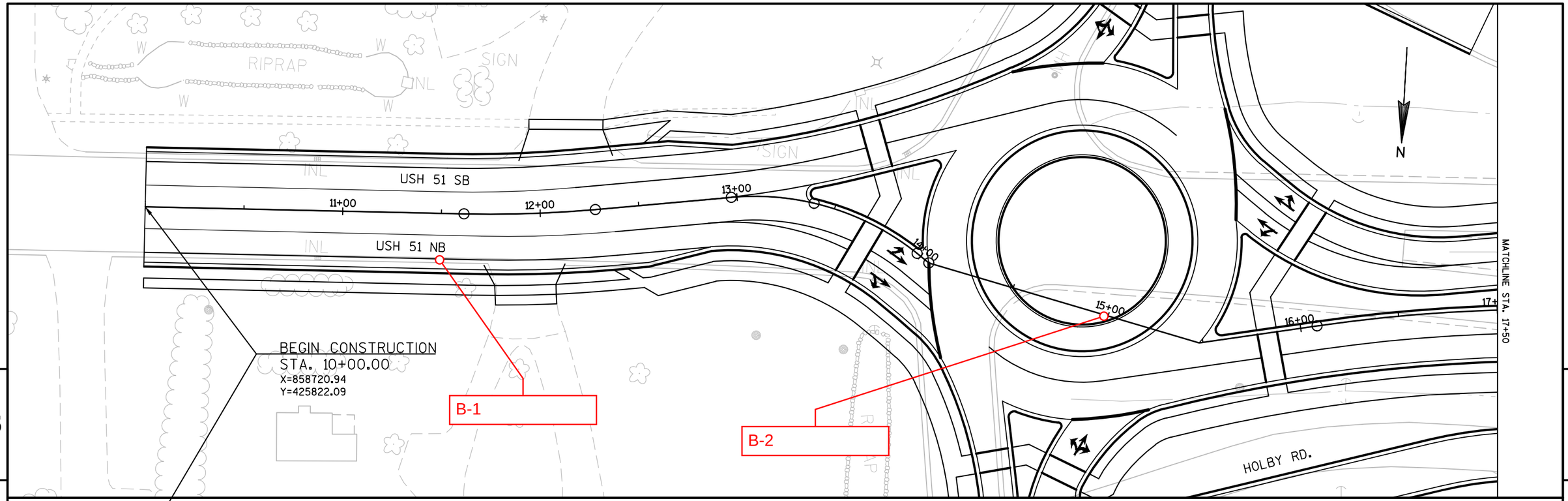
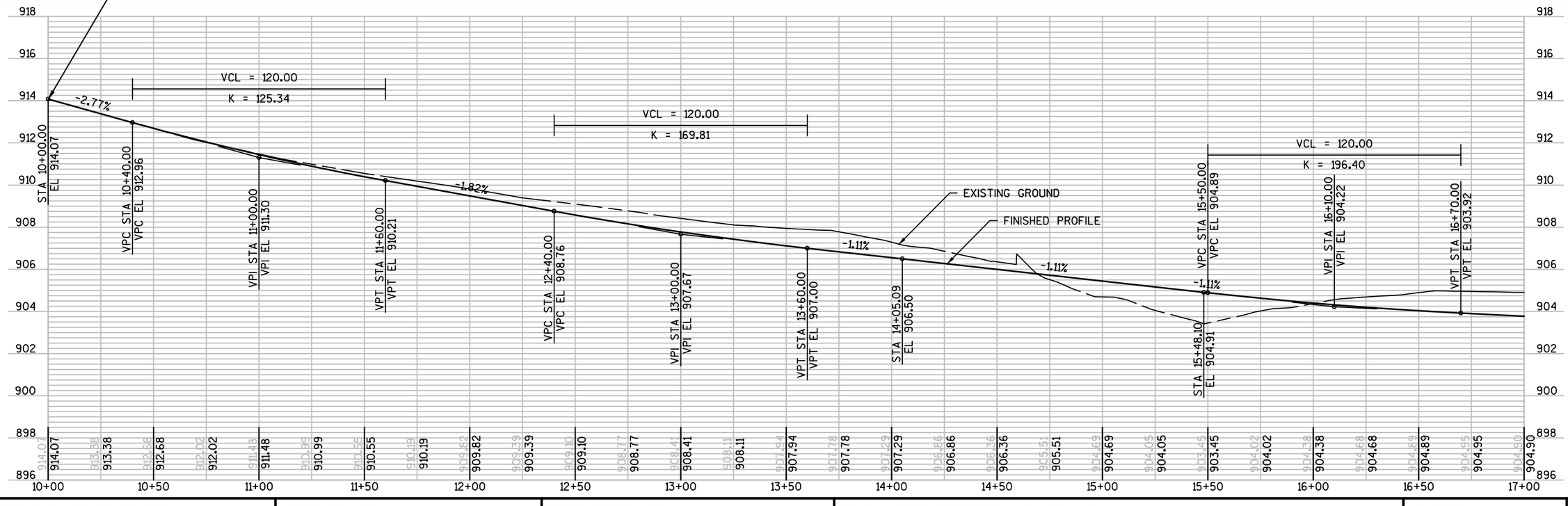
PLOT DATE : 7/28/2016 1:24 PM PLOT BY : MEYER, TERA PLOT NAME : PLOT SCALE : 1 IN:50 FT



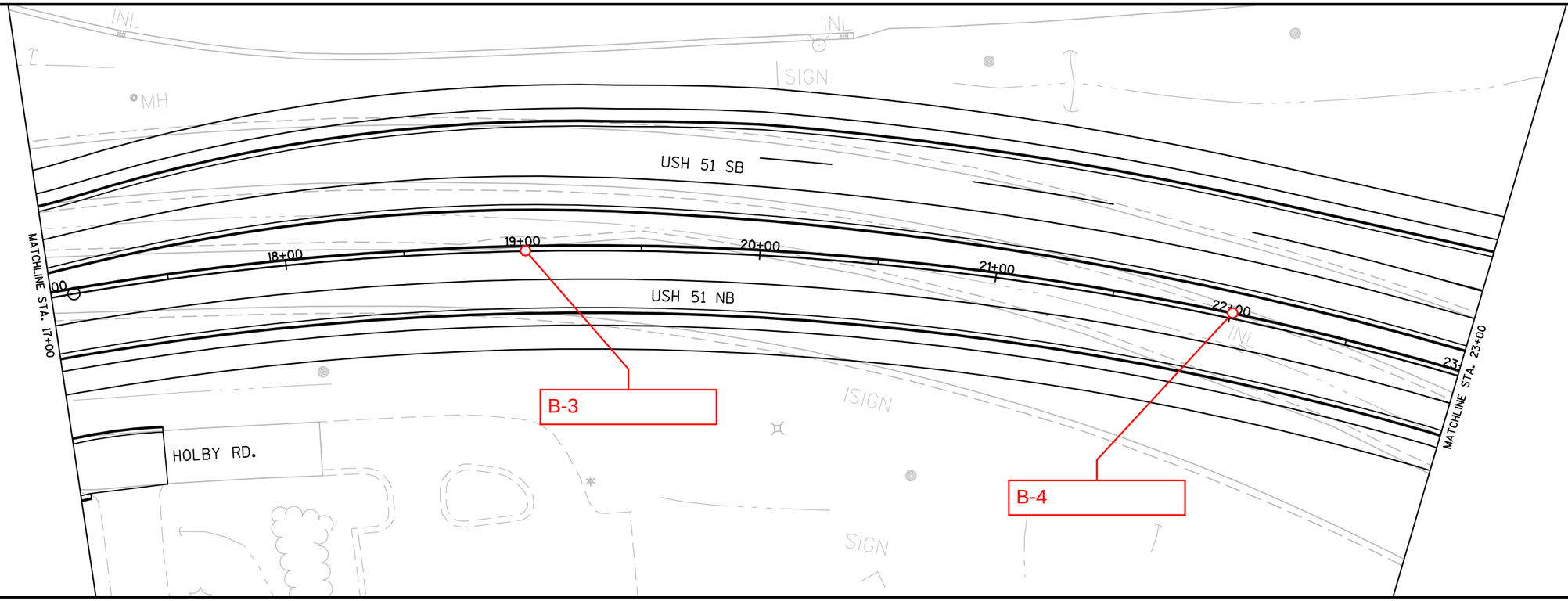


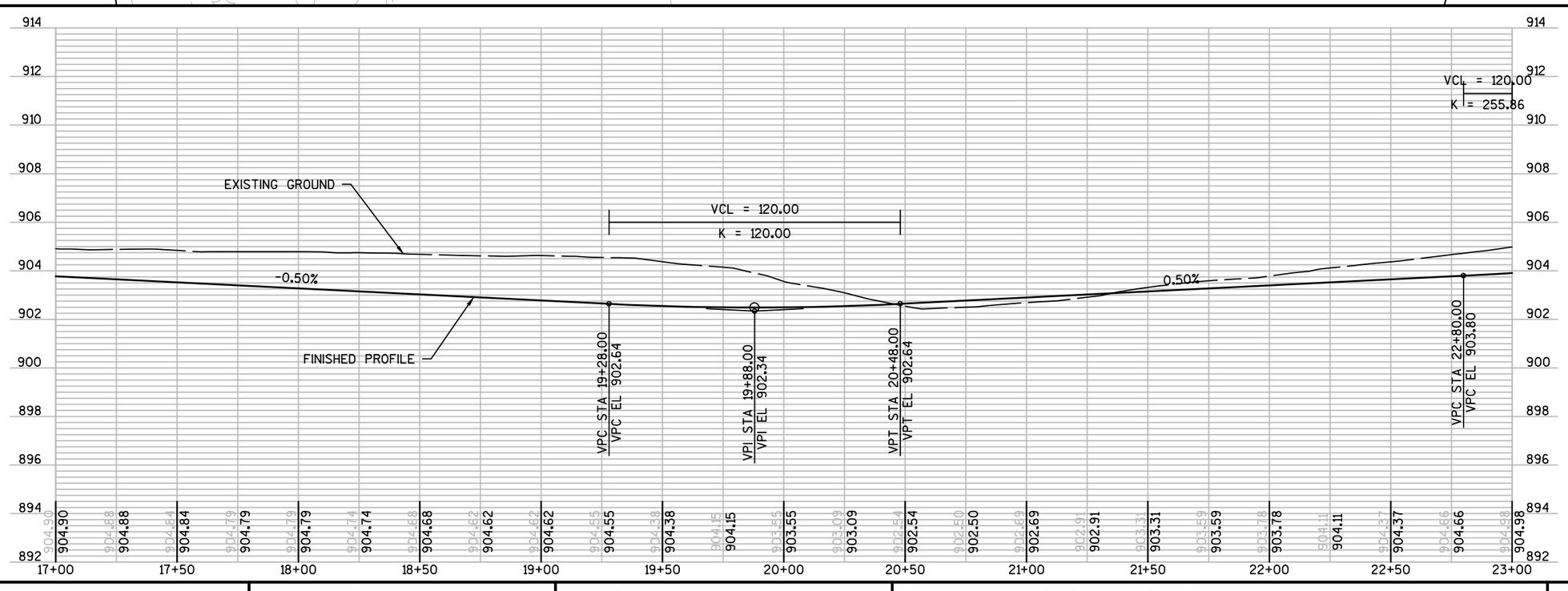
PROJECT NO: 5845-01-06/07	HWY: USH 51	COUNTY: DANE	PLAN AND PROFILE: WIS 138 WB	SHEET	E





PROJECT NO: 5848-01-06/07	HWY: USH 51	COUNTY: DANE	PLAN AND PROFILE: USH 51 NB	SHEET	E





PROJECT NO: 5848-01-06/07	HWY: USH 51	COUNTY: DANE	PLAN AND PROFILE: USH 51 NB	SHEET	E

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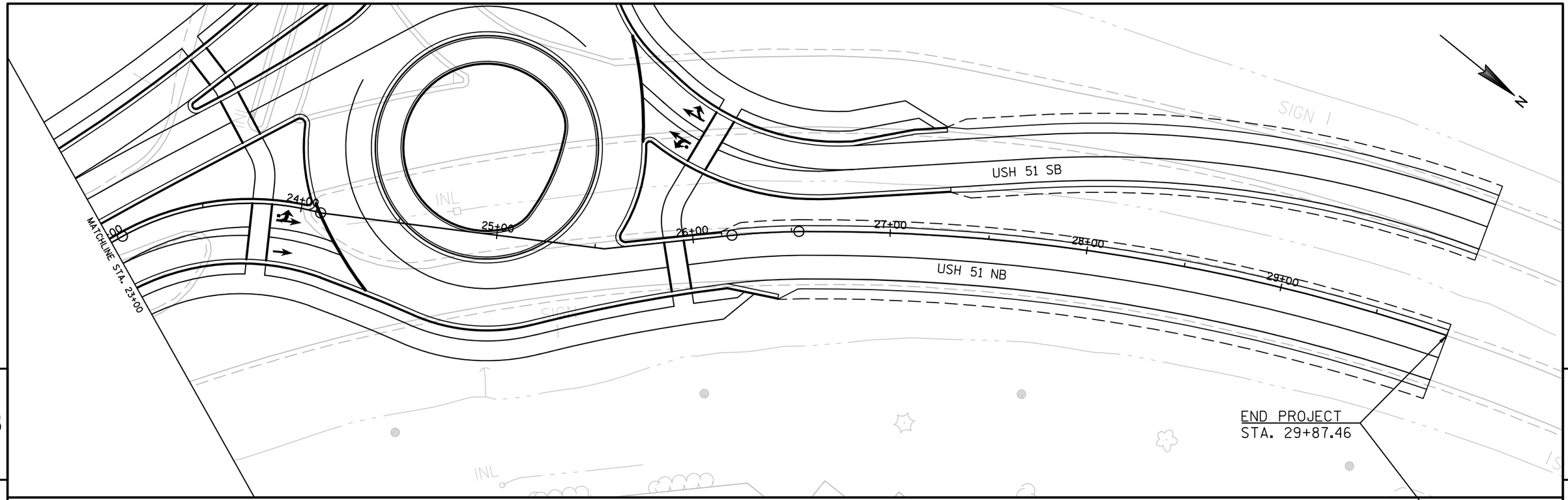
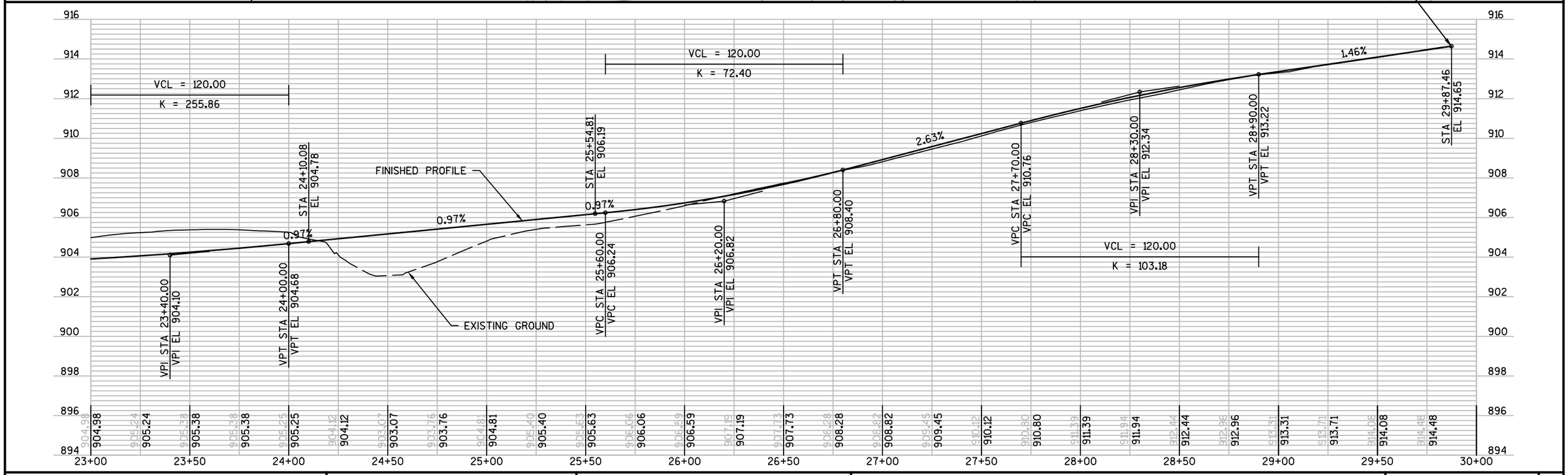
PLOT DATE : 7/28/2016 1:25 PM PLOT BY : MEYER, TERA PLOT NAME : PLOT SCALE : 1 IN:50 FT





PROJECT NO: 5848-01-06/07	HWY: USH 51	COUNTY: DANE	PLAN AND PROFILE: USH 51 NB	SHEET	E

FILE NAME : S:\MAD\1000--1099\1089\804\ACAD\CIVIL3D\SHEETSPLAN\050301_PP.DWG
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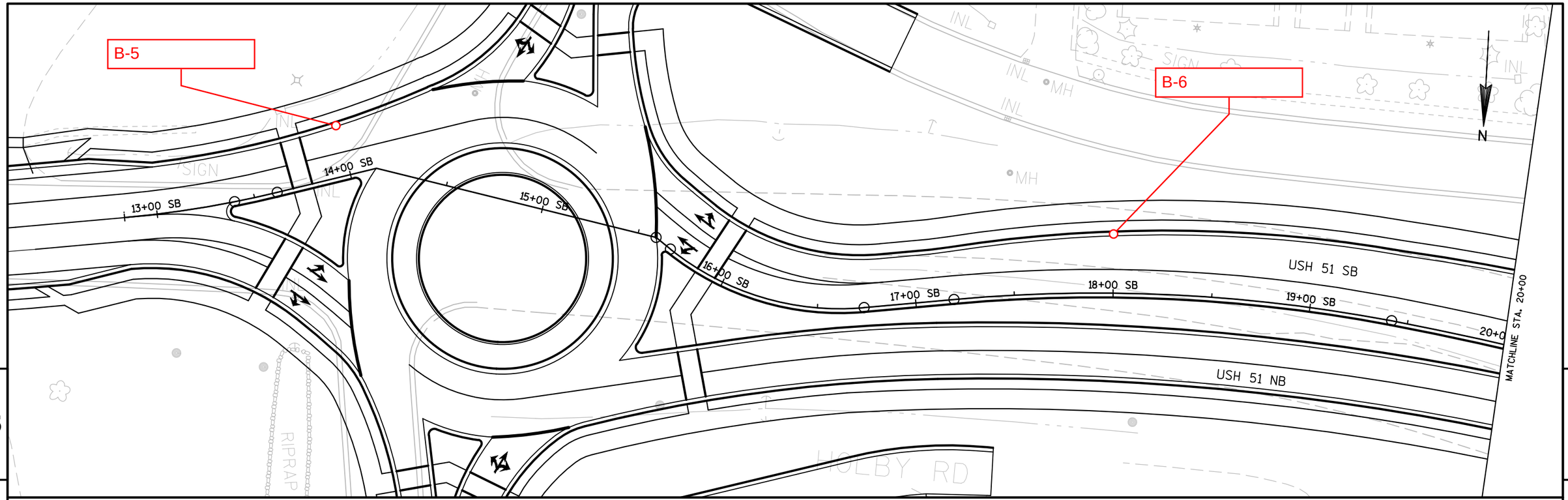
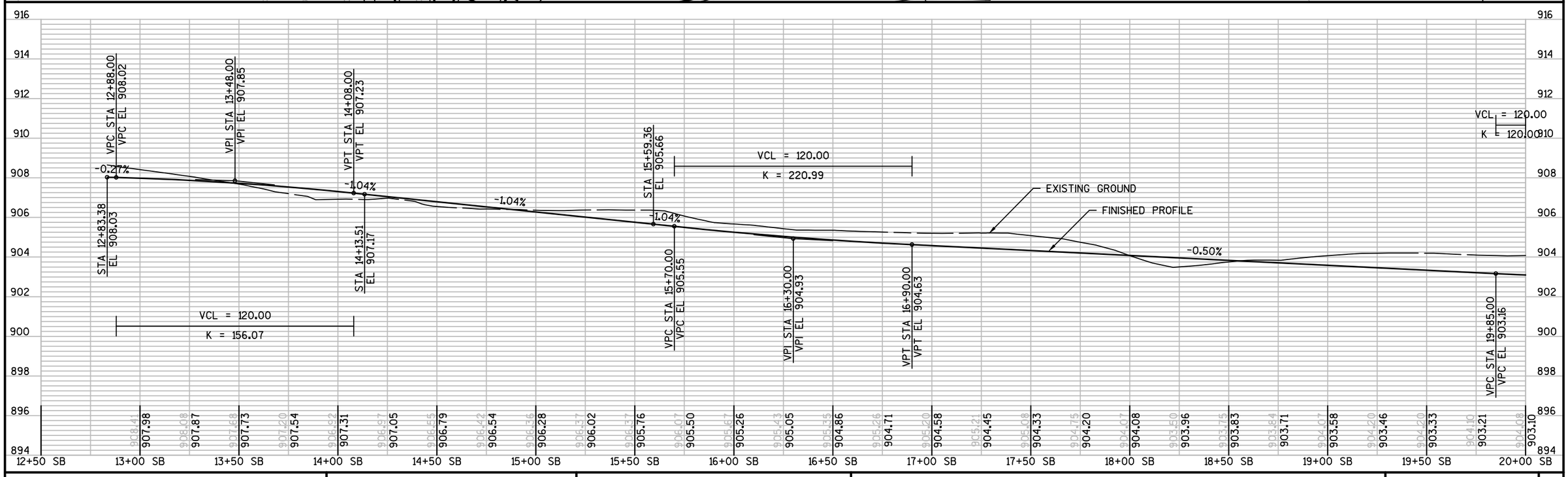
PLOT DATE : 7/28/2016 1:25 PM PLOT BY : MEYER, TERA PLOT NAME : PLOT SCALE : 1 IN:50 FT

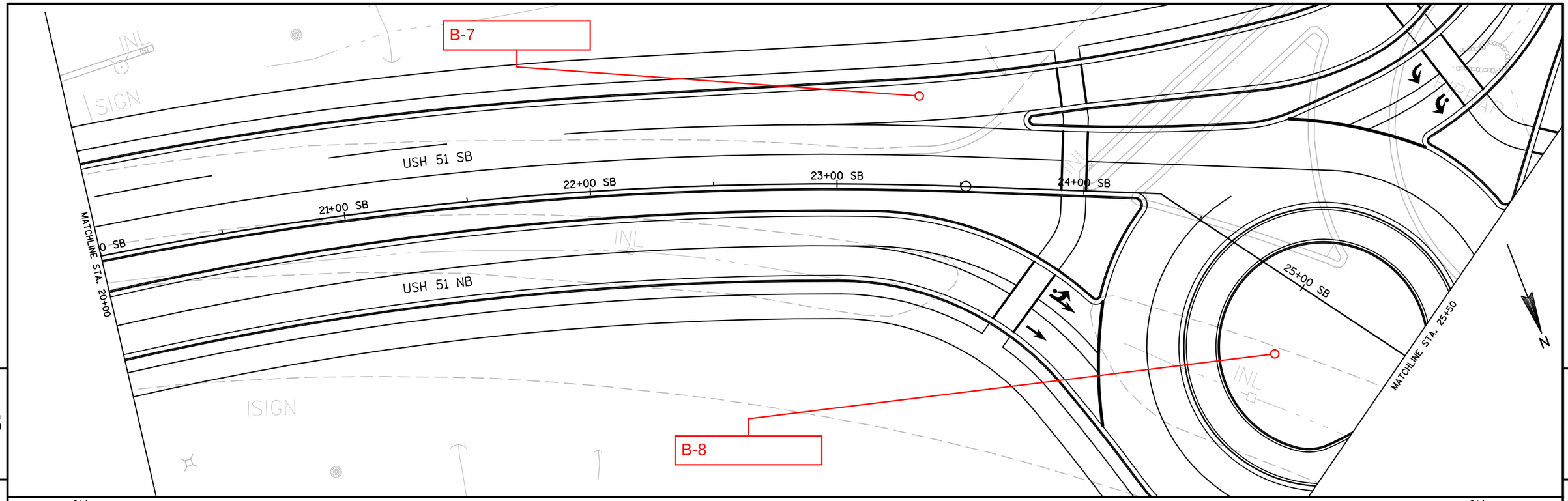


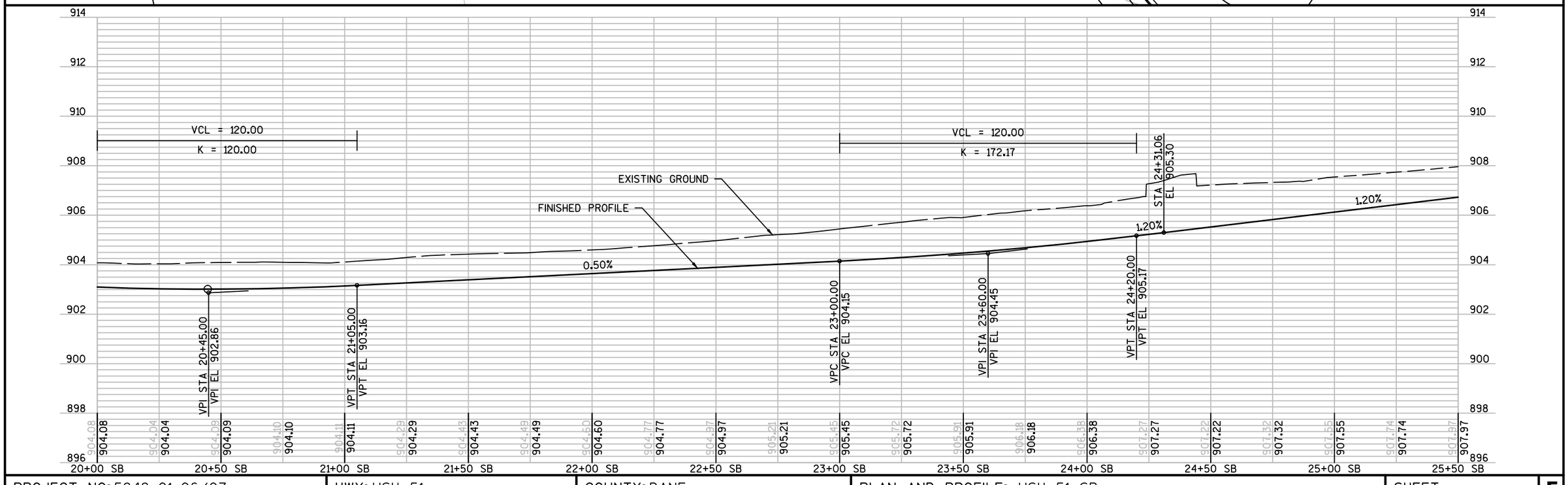


PROJECT NO: 5848-01-06/07	HWY: USH 51	COUNTY: DANE	PLAN AND PROFILE: USH 51 SB	SHEET	E

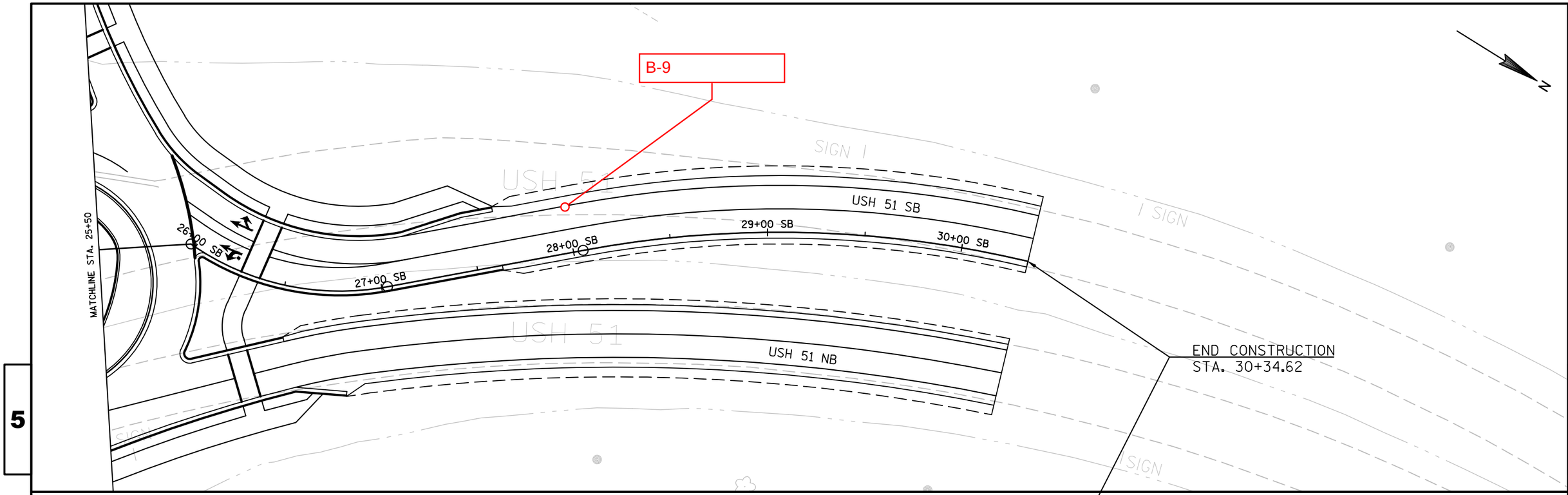
FILE NAME : S:\MAD\1000--1099\1089\804\ACAD\CIVIL3D\SHEETSPLAN\050401_PP.DWG
LAYOUT NAME - 050401_PP - 050401_PP

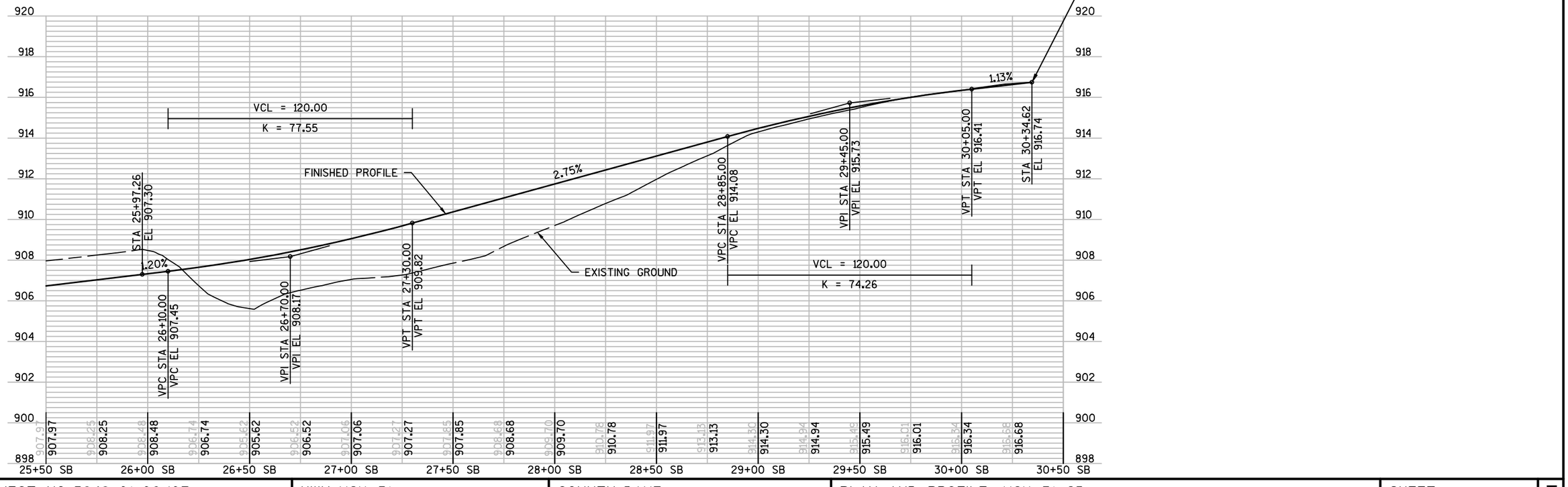
PLOT DATE : 7/28/2016 1:28 PM PLOT BY : MEYER, TERA PLOT NAME : PLOT SCALE : 1 IN:50 FT





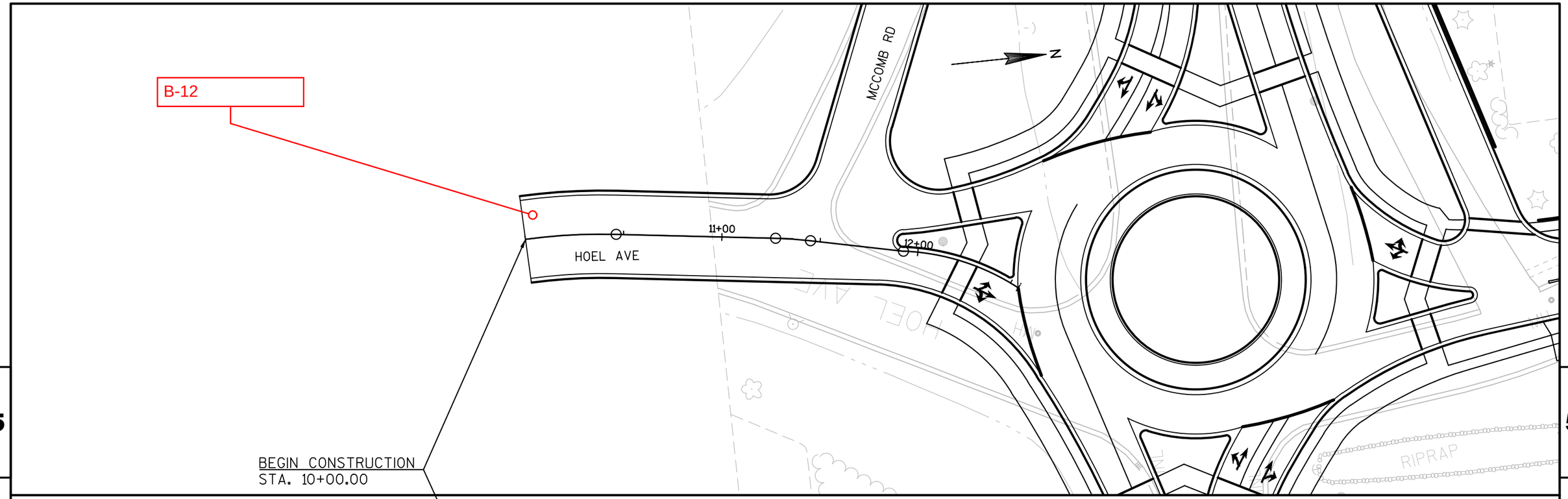
PROJECT NO: 5848-01-06/07	HWY: USH 51	COUNTY: DANE	PLAN AND PROFILE: USH 51 SB	SHEET	E

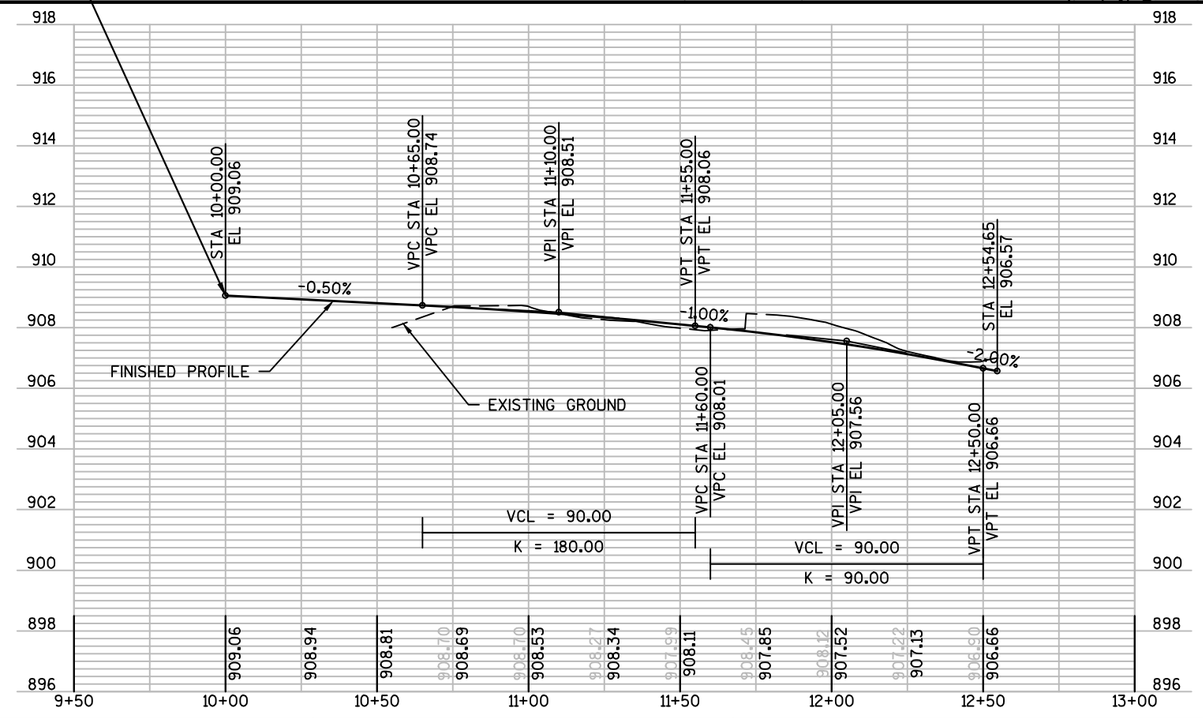




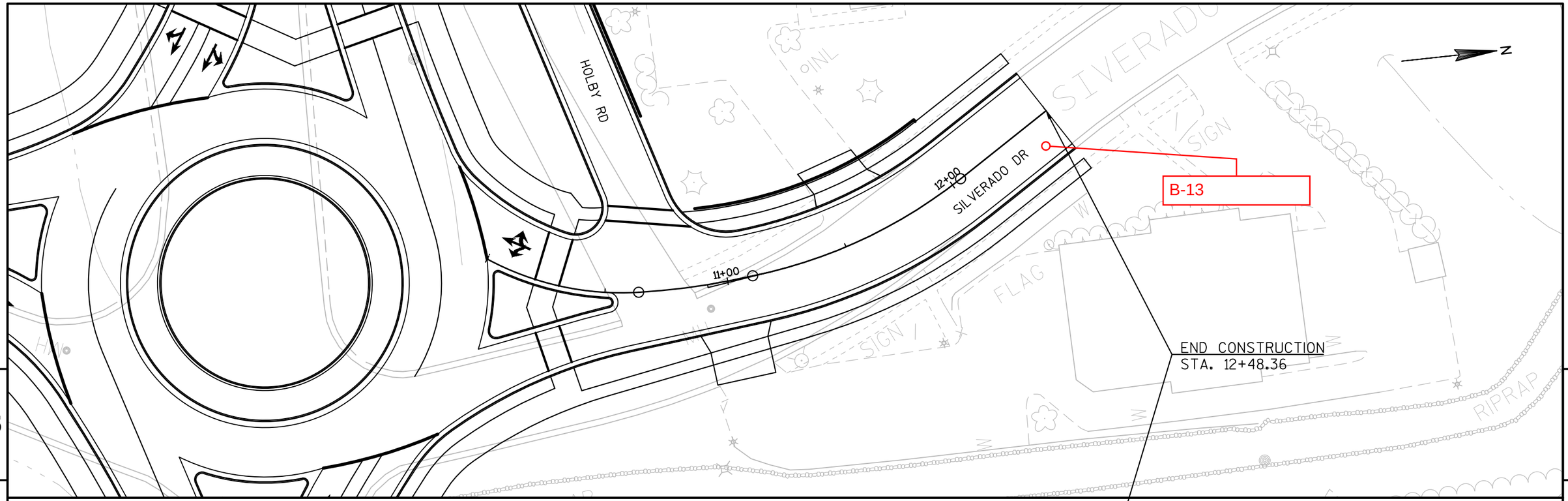
PROJECT NO: 5848-01-06/07	HWY: USH 51	COUNTY: DANE	PLAN AND PROFILE: USH 51 SB	SHEET	E

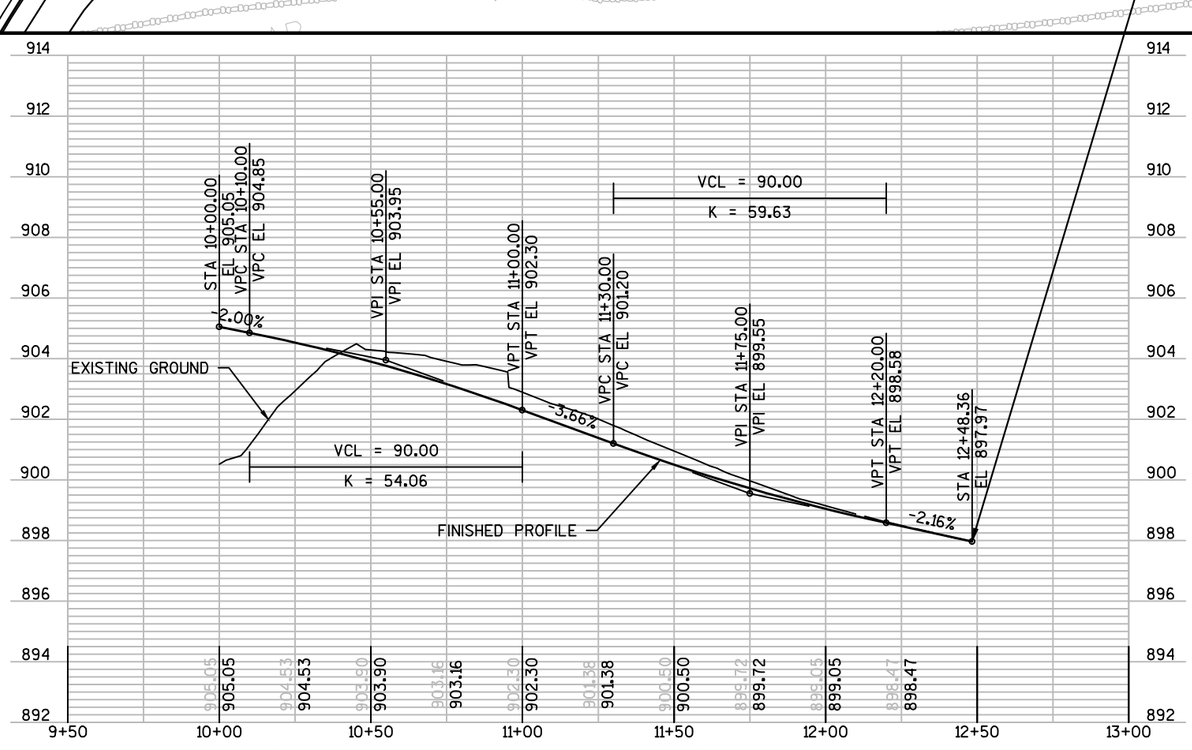
FILE NAME : S:\MAD\1000--1099\1089\804\ACAD\CIVIL3D\SHEETSPLAN\050401_PP.DWG
LAYOUT NAME - 050401_PP - 050403_PP
PLOT DATE : 7/28/2016 1:28 PM PLOT BY : MEYER, TERA PLOT NAME : PLOT SCALE : 1 IN:50 FT





PROJECT NO: 5848-01-06/07	HWY: USH 51	COUNTY: DANE	PLAN AND PROFILE: HOEL AVE	SHEET	E





PROJECT NO: 5848-01-06/07	HWY: USH 51	COUNTY: DANE	PLAN AND PROFILE: SILVERADO DR	SHEET	E

Attachment C

NRCS Soil Map and Soil Properties

Soil Map—Dane County, Wisconsin
(5845-01-06)

Map Scale: 1:4,400 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

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 1:15,800.

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: Dane County, Wisconsin
Survey Area Data: Version 15, Sep 27, 2016

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

Date(s) aerial images were photographed: Data not available.

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

Dane County, Wisconsin (WI025)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
BbB	Batavia silt loam, gravelly substratum, 2 to 6 percent slopes	10.2	41.2%
DsC2	Dresden silt loam, 6 to 12 percent slopes, eroded	2.8	11.4%
GP	Gravel pit	1.3	5.3%
KdC2	Kidder loam, 6 to 12 percent slopes, eroded	2.4	9.9%
KdD2	Kidder loam, 12 to 20 percent slopes, eroded	1.3	5.4%
KeB	Kegonsa silt loam, 2 to 6 percent slopes	1.1	4.6%
MdC2	McHenry silt loam, 6 to 12 percent slopes, eroded	1.1	4.5%
PnB	Plano silt loam, till substratum, 2 to 6 percent slopes	1.7	6.8%
PnC2	Plano silt loam, till substratum, 6 to 12 percent slopes, eroded	0.7	3.0%
RaA	Radford silt loam, 0 to 3 percent slopes	1.9	7.8%
Totals for Area of Interest		**24.7**	**100.0%**

Chemical Soil Properties

This table shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Effective cation-exchange capacity refers to the sum of extractable cations plus aluminum expressed in terms of milliequivalents per 100 grams of soil. It is determined for soils that have pH of less than 5.5.

Soil reaction is a measure of acidity or alkalinity. It is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil.

Gypsum is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 millimeters in size. Gypsum is partially soluble in water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced saturated hydraulic conductivity and aeration, and a general degradation of soil structure.

Report—Chemical Soil Properties

Chemical Soil Properties–Dane County, Wisconsin								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
BbB—Batavia silt loam, gravelly substratum, 2 to 6 percent slopes								
Batavia, gravelly substratum	0-10	12-19	—	6.1-7.3	0	0	—	—
	10-44	14-19	—	5.1-6.5	0	0	—	—
	44-50	2.0-21	—	6.6-7.8	0	0	—	—
	50-60	0.0-3.2	—	7.4-8.4	0	0	—	—
DsC2—Dresden silt loam, 6 to 12 percent slopes, eroded								
Dresden, eroded	0-8	9.8-14	—	5.6-7.3	0	0	0.0-2.0	0
	8-25	14-19	—	5.6-7.3	0	0	0.0-2.0	0
	25-30	10-16	—	5.6-7.8	0	0	0.0-2.0	0
	30-79	0.5-0.5	—	7.4-8.4	0-20	0	0.0-2.0	0
GP—Gravel pit								
Pits, gravel	0-10	—	—	—	0	0	0	0
KdC2—Kidder loam, 6 to 12 percent slopes, eroded								
Kidder, eroded	0-8	5.4-9.3	—	6.1-7.8	0	0	0.0-2.0	0
	8-31	10-16	—	5.6-7.8	0	0	0.0-2.0	0
	31-79	3.1-8.0	—	7.4-8.4	0-35	0	0.0-2.0	0

Chemical Soil Properties–Dane County, Wisconsin								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
KdD2—Kidder loam, 12 to 20 percent slopes, eroded								
Kidder, eroded	0-8	5.4-9.3	—	6.1-7.8	0	0	0.0-2.0	0
	8-31	10-16	—	5.6-7.8	0	0	0.0-2.0	0
	31-79	3.1-8.0	—	7.4-8.4	0-35	0	0.0-2.0	0
KeB—Kegonsa silt loam, 2 to 6 percent slopes								
Kegonsa	0-12	9.4-15	—	5.1-7.3	0	0	—	—
	12-29	13-17	—	5.1-6.5	0	0	—	—
	29-33	13-17	—	6.1-7.8	0	0	—	—
	33-60	0.0-1.4	—	7.4-8.4	0	0	—	—
MdC2—McHenry silt loam, 6 to 12 percent slopes, eroded								
Mchenry, eroded	0-6	8.9-19	—	5.6-7.3	0	0	0.0-2.0	0
	6-22	18-28	—	5.6-7.3	0	0	0.0-2.0	0
	22-31	15-24	—	5.6-7.8	0-10	0	0.0-2.0	0
	31-36	6.8-15	—	6.6-8.4	0-20	0	0.0-2.0	0
	36-79	4.1-13	—	7.4-8.4	10-30	0	0.0-2.0	0
PnB—Plano silt loam, till substratum, 2 to 6 percent slopes								
Plano, till substratum	0-11	16-23	—	6.1-7.3	0	0	0.0-2.0	0
	11-41	19-28	—	5.1-7.3	0	0	0.0-2.0	0
	41-46	12-25	—	6.1-7.8	3-15	0	0.0-2.0	0
	46-79	8.1-13	—	6.6-8.4	15-35	0	0.0-2.0	0

Chemical Soil Properties–Dane County, Wisconsin								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
PnC2—Plano silt loam, till substratum, 6 to 12 percent slopes, eroded								
Plano, till substratum	0-9	16-23	—	6.1-7.3	0	0	0.0-2.0	0
	9-41	19-28	—	5.1-7.3	0	0	0.0-2.0	0
	41-46	12-25	—	6.1-7.8	3-15	0	0.0-2.0	0
	46-79	8.1-13	—	6.6-8.4	15-35	0	0.0-2.0	0
RaA—Radford silt loam, 0 to 3 percent slopes								
Radford	0-23	16-24	—	5.6-7.8	0	0	—	—
	23-29	17-25	—	6.1-7.8	0	0	—	—
	29-60	16-23	—	6.6-7.8	0	0	—	—

Data Source Information

Soil Survey Area: Dane County, Wisconsin
Survey Area Data: Version 15, Sep 27, 2016

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Report—Engineering Properties

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties–Dane County, Wisconsin														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
BbB—Batavia silt loam, gravelly substratum, 2 to 6 percent slopes														
Batavia, gravelly substratum	100	B	0-10	Silt loam	CL	A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-98-100	95-98-100	25-33-40	9-13-16
			10-44	Silt loam, silty clay loam	CL	A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-98-100	90-95-100	30-38-45	11-17-22
			44-50	Gravelly clay loam, sandy loam	SC	A-6	—	0- 3- 5	80-88-95	70-80-90	40-65-90	20-48-75	15-31-46	NP-14-28
			50-60	Gravelly coarse sand, sand, coarse sand	SP-SM	A-3	—	0- 5- 10	30-65-100	30-65-100	10-53-95	2- 7- 12	0-0 -19	NP-0 -2

Engineering Properties–Dane County, Wisconsin														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
DsC2—Dresden silt loam, 6 to 12 percent slopes, eroded														
Dresden, eroded	90	B	0-8	Silt loam	CL	A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	88-95-100	73-83-88	32-39-45	12-15-18
			8-25	Clay loam	CL	A-6, A-7-6	0- 0- 0	0- 0- 0	90-95-100	89-95-100	85-94-100	73-81-90	36-41-46	19-22-25
			25-30	Gravelly sandy clay loam, very gravelly loam, loam	GC	A-2-6, A-6	0- 0- 0	0- 2- 3	47-64-100	44-63-100	36-54-92	20-31-55	29-35-40	13-17-21
			30-79	Very gravelly sand, gravelly sand, stratified gravel to coarse sand	SP-SM	A-1-b	0- 0- 0	4-12- 23	35-55-79	32-53-78	18-30-46	4- 7- 11	0-0 -0	NP
GP—Gravel pit														
Pits, gravel	99		0-10	Stratified extremely gravelly coarse sand to very gravelly sand	—	—	0- 0- 0	0- 0- 0	0- 0- 0	0- 0- 0	0- 0- 0	0- 0- 0	—	—
KdC2—Kidder loam, 6 to 12 percent slopes, eroded														
Kidder, eroded	95	B	0-8	Loam	CL	A-4	0- 0- 0	0- 0- 0	78-88-100	77-88-100	64-79-95	42-54-68	23-28-33	6-8 -11
			8-31	Sandy clay loam, loam	SC	A-2, A-6	0- 0- 0	0- 3- 3	82-82-100	81-81-100	63-71-93	34-40-56	30-35-40	13-17-21
			31-79	Gravelly sandy loam, sandy loam, fine sandy loam	GC-GM	A-1, A-4, A-1-b	0- 0- 0	2- 2- 2	57-61-95	55-60-95	38-46-80	18-24-45	17-21-26	3-6 -9

Engineering Properties–Dane County, Wisconsin														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
KdD2—Kidder loam, 12 to 20 percent slopes, eroded														
Kidder, eroded	95	B	0-8	Loam	CL	A-4	0- 0- 0	0- 0- 0	78-88-100	77-88-100	64-79-95	42-54-68	23-28-33	6-8 -11
			8-31	Sandy clay loam, loam	SC	A-2, A-6	0- 0- 0	0- 3- 3	82-82-100	81-81-100	63-71-93	34-40-56	30-35-40	13-17-21
			31-79	Gravelly sandy loam, sandy loam, fine sandy loam	GC-GM	A-1, A-4, A-1-b	0- 0- 0	2- 2- 2	57-61-95	55-60-95	38-46-80	18-24-45	17-21-26	3-6 -9
KeB—Kegonsa silt loam, 2 to 6 percent slopes														
Kegonsa	100	B	0-12	Silt loam	CL	A-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	90-95-100	70-80-90	20-25-30	5-8 -10
			12-29	Silt loam, silty clay loam	CL	A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	90-95-100	85-90-95	30-38-45	10-15-20
			29-33	Sandy clay loam, clay loam, loam	CL	A-6	0- 0- 0	0- 0- 0	90-95-100	80-90-100	65-83-100	30-55-80	30-38-45	10-15-20
			33-60	Gravelly coarse sand	SW	A-1-b	—	0- 3- 5	40-63-85	35-60-85	15-25-35	0- 3- 5	0-0 -14	NP

Engineering Properties–Dane County, Wisconsin														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
MdC2—McHenry silt loam, 6 to 12 percent slopes, eroded														
Mchenry, eroded	90	B	0-6	Silt loam	CL, ML, CL-ML	A-4, A-6	0- 0- 0	0- 0- 0	95-97-100	95-96-100	85-92-100	72-79-88	23-31-39	6-10-15
			6-22	Silty clay loam, silt loam	CL	A-6, A-7-6	0- 0- 0	0- 0- 0	95-97-100	95-96-100	84-93-100	75-84-92	33-41-47	15-21-25
			22-31	Sandy clay loam, clay loam, loam	CL	A-6, A-7-6	0- 0- 0	0- 1- 1	86-92-95	85-92-95	71-83-91	47-57-64	29-36-42	12-17-21
			31-36	Sandy loam, loam, fine sandy loam	SC, SC-SM	A-4, A-6	0- 0- 0	0- 3- 4	83-89-95	83-89-95	71-78-91	42-47-58	19-21-29	4-6 -12
			36-79	Sandy loam, gravelly sandy loam, fine sandy loam	SC, SC-SM, SM	A-4	0- 0- 0	0- 6- 9	59-78-88	59-78-88	42-59-71	24-36-45	16-21-26	2-6 -9
PnB—Plano silt loam, till substratum, 2 to 6 percent slopes														
Plano, till substratum	85	B	0-11	Silt loam	CL, ML	A-6, A-7-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	96-99-100	88-93-100	35-41-48	12-15-18
			11-41	Silty clay loam, silt loam	CL	A-6, A-7-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	96-99-100	90-95-100	35-41-47	17-21-25
			41-46	Clay loam, loam, sandy loam, sandy clay loam	CL, SC	A-4, A-6, A-7-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	78-91-100	46-60-75	25-33-43	9-16-23
			46-79	Sandy loam, gravelly loam	CL, SC-SM, CL-ML	A-4	0- 0- 0	0- 0- 0	70-85-91	68-85-91	46-64-80	26-36-53	19-22-31	3-6 -13

Engineering Properties–Dane County, Wisconsin														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
PnC2—Plano silt loam, till substratum, 6 to 12 percent slopes, eroded														
Plano, till substratum	90	B	0-9	Silt loam	CL, ML	A-6, A-7-6	0- 0- 0	0- 0- 0	100-100 -100	100-100 -100	96-99-1 00	88-93-1 00	35-41 -48	12-15-1 8
			9-41	Silty clay loam, silt loam	CL	A-6, A-7-6	0- 0- 0	0- 0- 0	100-100 -100	100-100 -100	96-99-1 00	90-95-1 00	35-41 -47	17-21-2 5
			41-46	Clay loam, loam, sandy loam, sandy clay loam	CL, SC	A-4, A-6, A-7-6	0- 0- 0	0- 0- 0	100-100 -100	100-100 -100	78-91-1 00	46-60- 75	25-33 -43	9-16-23
			46-79	Gravelly loam, sandy loam	CL, SC-SM, CL-ML	A-4	0- 0- 0	0- 0- 0	70-85- 91	68-85- 91	46-64- 80	26-36- 53	19-22 -31	3-6 -13
RaA—Radford silt loam, 0 to 3 percent slopes														
Radford	100	C	0-23	Silt loam	ML	A-4	0- 0- 0	0- 0- 0	100-100 -100	100-100 -100	95-98-1 00	80-90-1 00	30-35 -40	5-10-15
			23-29	Silt loam	CL	A-4	0- 0- 0	0- 0- 0	100-100 -100	100-100 -100	95-98-1 00	80-90-1 00	25-30 -35	5-10-15
			29-60	Silt loam, silty clay loam, clay loam	CL	A-7-6	0- 0- 0	0- 0- 0	100-100 -100	100-100 -100	95-98-1 00	80-88- 95	35-43 -50	15-20-2 5

Data Source Information

Soil Survey Area: Dane County, Wisconsin
Survey Area Data: Version 15, Sep 27, 2016

Water Features (WI)

This table gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

Surface runoff refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. The concept indicates relative runoff for very specific conditions. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high.

The *months* in the table indicate the portion of the year in which a water table, ponding, and/or flooding is most likely to be a concern.

Water table refers to a saturated zone in the soil. The water features table indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table. (*Kind*) The kind of water table if a seasonal high water table exists in the soil. Entries are either apparent or perched. A perched water table is where free water is restricted from moving downward in the soil by a restrictive feature, in most cases a hard pan. Therefore, there is a dry layer of soil underneath a wet layer. An apparent water table is one where there is free water present in all horizons from its upper boundary to below 2 meters or to the depth of observation. The water table kind listed is for the first major component in the map unit.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. The table indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Report—Water Features (WI)

Map unit symbol and soil name	Hydrologic group	Surface runoff	Month	Water table			Ponding			Flooding	
				Upper limit	Lower limit	Kind	Surface depth	Duration	Frequency	Duration	Frequency
				Ft	*Ft*		*Ft*				
BbB—Batavia silt loam, gravelly substratum, 2 to 6 percent slopes											
Batavia, gravelly substratum	B		Jan-Dec	—	—	—	—	—	None	—	None
DsC2—Dresden silt loam, 6 to 12 percent slopes, eroded											
Dresden, eroded	B		Jan-Dec	—	—	—	—	—	None	—	None
GP—Gravel pit											
Pits, gravel			Jan-Dec	—	—	—	—	—	—	—	None
KdC2—Kidder loam, 6 to 12 percent slopes, eroded											
Kidder, eroded	B		Jan-Dec	—	—	—	—	—	None	—	None
KdD2—Kidder loam, 12 to 20 percent slopes, eroded											
Kidder, eroded	B		Jan-Dec	—	—	—	—	—	None	—	None
KeB—Kegonsa silt loam, 2 to 6 percent slopes											
Kegonsa	B		Jan-Dec	—	—	—	—	—	None	—	None
MdC2—McHenry silt loam, 6 to 12 percent slopes, eroded											
Mchenry, eroded	B		Jan-Dec	—	—	—	—	—	None	—	None
PnB—Plano silt loam, till substratum, 2 to 6 percent slopes											
Plano, till substratum	B		Jan-Feb	3.7-5.0	6.0	Apparent	—	—	None	—	None
			Mar-May	3.3-3.7	6.0	Apparent	—	—	None	—	None
			Jun	3.7-5.0	6.0	Apparent	—	—	None	—	None
			Juy-Oct	—	—	—	—	—	None	—	None
			Nov	3.3-3.7	6.0	Apparent	—	—	None	—	None
			Dec	3.7-5.0	6.0	Apparent	—	—	None	—	None

Map unit symbol and soil name	Hydrologic group	Surface runoff	Month	Water table			Ponding			Flooding	
				Upper limit	Lower limit	Kind	Surface depth	Duration	Frequency	Duration	Frequency
				Ft	*Ft*		*Ft*				
PnC2—Plano silt loam, till substratum, 6 to 12 percent slopes, eroded											
Plano, till substratum	B	Medium	Jan-Feb	3.7-5.0	6.0	Apparent	—	—	None	—	None
			Mar-May	3.3-3.7	6.0	Apparent	—	—	None	—	None
			Jun	3.7-5.0	6.0	Apparent	—	—	None	—	None
			Juy-Oct	—	—	—	—	—	None	—	None
			Nov	3.3-3.7	6.0	Apparent	—	—	None	—	None
			Dec	3.7-5.0	6.0	Apparent	—	—	None	—	None
RaA—Radford silt loam, 0 to 3 percent slopes											
Radford	C		Jan-Feb	—	—	—	—	—	None	—	Rare
			Mar-Jun	1.0-3.0	6.0	Apparent	—	—	None	Brief (2 to 7 days)	Frequent
			Juy-Dec	—	—	—	—	—	None	—	Rare

Data Source Information

Soil Survey Area: Dane County, Wisconsin
Survey Area Data: Version 15, Sep 27, 2016