CORRESPONDENCE/MEMORANDUM _____ **State of Wisconsin**

Date: August 26, 2015

To: Beth Cannestra, P.E.
Director, Bureau of Project Development
Attn: Don Gruel, P.E.

From: Olubunmi Olapo, P.E.
WisDOT Southeast Region

Subject: DESIGN STUDY REPORT
Project I.D. 2788-00-01
USH 18
Waukesha Bypass
Genesee Road to Madison Street
Waukesha County

Having considered the economic and social effects of this project, its impact on the environment, and its consistency with the goals of community planning, we request your approval of the attached design study report.

Olubunmi Olapo 8/26/15

Region Project Development Chief Date

Concur:

Richard Hunich 8/27/15

Bureau of Project Development, Date
Project Services Chief

DESIGN STUDY REPORT

Project I.D. 2788-00-01

USH 18
Waukesha Bypass
Genesee Road to Madison Street

Waukesha County

DESIGN STUDY REPORT

1.0 PROJECT DESCRIPTION AND NEED

The proposed Waukesha Bypass project consists of construction on new alignment and reconstruction/expansion on existing alignment as a multi-jurisdictional project under a signed Memorandum of Understanding between WisDOT, City of Waukesha, Town of Waukesha and Waukesha County. The Environmental Impact Statement was completed for the entire Waukesha Bypass project and the Record of Decision was signed by FHWA on January 20, 2015.

This DSR covers project ID 2788-00-01, which encompasses the proposed construction on new alignment from Genesee Road/Les Paul Parkway to 500 feet north of Madison Street, with construction scheduled for late 2016 & 2017. The proposed roadway will be designated USH 18.

1.1. Federal Oversight Project (Yes or No): Yes

1.2. Project Length & Termini

Project Length: 3.04 miles

Termini/Limits:

The proposed project is located in the City and Town of Waukesha in Waukesha County. The project extends from the current intersection of Genesee Road (STH 59/CTH X) & Les Paul Parkway (STH 59) to 500 feet north of Merrill Hills Road (CTH TT) & Madison Street.

See Attachment 1 – Project Location/Overview Map

1.3. Functional Classification/Access Control

Roadway Name	Functional Class (Arterial, Collector or Local)	Rural, Urban or Transitional	Corridors 2020 or Backbone (No or State which)	NHS Route (Yes or No)	Long Truck Route(No or state Federal or State)	Access Control Tier	On Ped. Trans. Plan (Yes or No)	On Bike Trans. Plan (Yes or No)
USH 18	Arterial	Transitional	No	Yes	No	2A	Yes	Yes

1.4. Need for the Project

The need for the project is demonstrated through a combination of factors that include regional/local transportation and land-use planning, traffic demand, safety concerns, existing roadway deficiencies, and system linkage.

Regional and local transportation system plans document the importance of CTH TT/Meadowbrook Road as a north-south arterial and the need for capacity expansion. Based on predicted growth in population and employment, residential and commercial development, and vehicle miles traveled in Waukesha County, regional and local transportation system plans recommend that CTH TT/Meadowbrook Road be reconstructed as a 4-lane roadway.

Traffic on CTH TT/Meadowbrook Road in the project area is expected to increase 24 to 128 percent above the 2009 traffic volumes, based on projected growth trends.

From 2009 through 2013, 116 crashes occurred along the corridor. The crash rate on CTH TT from Sunset Drive to Madison Street exceeded the statewide average crash rate for similar roadways during that period.

The project corridor consists of roadways of varying characteristics with posted speed limits from 25 to 45 miles per hour. Substandard horizontal and vertical curves, high number of access points, narrow shoulders, and substandard stopping sight distance and intersection sight distance adversely affect traffic operations and safety.

The gap in the circumferential route around the city of Waukesha creates increased demand on local roads and impedes the flow of people and goods into and out of the area. A more reliable north-south arterial on the west side of Waukesha is necessary to connect the area south of Waukesha with I-94.

2.0 PRESENT FACILITY

2.1. Posted Speed

Roadway or Roadway Segment	Posted Speed	Advisory Speed
Merrill Hills Road (CTH TT), Sunset Drive to Madison Street	45 mph	30 mph (railroad crossing)

2.2. Geometrics

2.2.1. * Horizontal Alignment Features Outside of Desirable or Minimum Design Standards.

* Horizontal Feature (Curve, P.I. Deflection, etc.)	Location (Stationing)	* Size (Radius, P.I. Deflection, etc.)*	* Super-Elevation (s.e.)	Speed Rating
Curve	136+21	R=800'	2.0%	<25 mph
Curve	170+70	R=800'	2.0%	<25 mph

*Controlling Criteria

Comments:

See Attachment 2 – Existing Geometry.

2.2.2. * Vertical Alignment Features/SSD Outside Desirable or Minimum Design Standards.

* Vertical Feature (Curve, Vertical Grade Deflection, etc.)	Location (Stationing)	Sag or Crest	* % Grades	K Value/ Grade Deflection	Speed Rating	* SSD** Met (Yes or No/ Length)	DSD Met (Yes or No/ Length)
Curve	97+21	Sag	-3.83%/-2.00%	K=109	50mph	Yes/425'	No/425'
Curve	130+30	Crest	4.81%/-0.39%	K=53	40mph	No/305'	No/305'
Curve	136+09	Crest	-0.39%/-5.08%	K=43	35mph	No/250'	No/250'
Curve	137+99	Sag	-5.08%/-2.01%	K=49	35mph	No/250'	No/250'
Curve	139+87	Crest	-2.01%/-3.79%	K-56	40mph	No/305'	No/305'
Curve	153+71	Crest	3.47%/0.62%	K=53	40mph	No/305'	No/305'
Curve	155+70	Sag	0.62%/2.68%	K=24	<25mph	No/<155'	No/<155'
Curve	156+66	Crest	2.68%/0.67%	K=25	30mph	No/200'	No/200'
Curve	158+35	Crest	0.67%/-5.19%	K=21	30 mph	No/200'	No/200'
Curve	160+74	Sag	-5.19%/-3.53%	K=30	25 mph	No/155'	No/155'
Curve	162+43	Crest	-3.53%/-5.91%	K=21	30 mph	No/200'	No/200'
Curve	164+98	Sag	-5.91%/5.21%	K=31	25 mph	No/155'	No/155'
Curve	169+69	Crest	5.21%/-3.52%	K=40	35 mph	No/250'	No/250'
Curve	172+29	Sag	-3.52%/-0.70%	K=35	25 mph	No/155'	No/155'
Curve	175+14	Sag	-0.70%/10.31%	K=16	<25 mph	No/<155'	No/<155'
Curve	176+28	Crest	10.31%/7.34%	K=17	25 mph	No/155'	No/155'
Curve	178+50	Crest	7.34%/-2.65%	K=23	30 mph	No/200'	No/200'

*Controlling Criteria **SSD = Stopping Sight Distance

Comments:

Desirable and Minimum Stopping Sight Distances are listed below per FDM

$SSD_{des/min}$: 25 mph = 155', 30 mph = 200', 35 mph = 250', 40 mph = 305', 45 mph = 360', 50 mph = 425'

See Attachment 2 – Existing Geometry.

2.2.3 * Grades and Vertical Clearance Outside Desirable or Minimum Design Standards.

Location (Stationing, Overpass Structures, etc.)	* % Grade	* Vertical Clearance
118+44 to 119+69	5.61%	-
128+00 to 128+06	7.77%	-
137+09 to 137+24	-5.08%	-
158+98 to 160+49	-5.19%	-
162+68 to 163+23	-5.91%	-
166+73 to 167+94	5.21%	-
176+01 to 176+02	10.31%	-
176+53 to 177+38	7.34%	-

*Controlling Criteria

Comments:

See Attachment 2 – Existing Geometry.

Desirable 5% maximum grade for urban arterials with level terrain.

2.3 Side-Roads/Intersections/Interchanges

2.3.1 Side-roads

Roadway Name	Functional Class	Posted Speed (MPH)	Existing Traffic*** (AADT)	Approach Grades	Pedestrian Facilities (Yes or No)	Bicycle Facilities (Yes or No)
Saylesville Road (CTH X)	Minor Arterial	35 mph	13,100	3.2%	No	No
Genesee Road (STH 59)	Principal Arterial	45 mph	12,600	2.7%	No	No
Genesee Road (CTH X)	Principal Arterial	45 mph	19,900	3.1%	No	Yes
Sunset Drive (CTH D)	Principal Arterial	45 mph	12,600	6.6%	No	No
Green Lane	Local Rd	35 mph	1,400	1.7%	No	No
MacArthur Road	Collector	35 mph	1,300	2.7%	No	No
Kame Terrace	Local Rd	25 mph	>100	5.7%	No	No
Madison Street	Collector/ Minor Arterial	35 mph	700 West/ 3,300 East	1.9%/5.8%	Yes	No

***If Existing Traffic volumes are not available, then state at a minimum whether AADT is assumed to be <100 or >100.

Comments:

2.3.2 Intersections

Intersecting Roadway Names	Intersect Type	Intersect Angle	Traffic Control	* SSD** Met [(Y/N) / Length]	ISD** Met [(Y/N) / Length]	DSD** Met [(Y/N) / Length]	Vision Triangle (Y/N)	Corner Clearance To Driveways Present (Y/N)
Les Paul Parkway/ Genesee Road/ Saylesville Road	4 Legs/ Urban	85	Signals	No/250’	No/435’	No/250’	No	No
Merrill Hills Road/ Green Lane	3 Legs/ Rural	76	1 Way Stop	Yes/305’	No/445’	No/305’	No	No
Merrill Hills Road/ MacArthur Road	3 Legs/ Rural	89	1 Way Stop	Yes/250’	No/100’	No/450’	No	No
Merrill Hills Road/ Kame Terrace	3 Legs/ Rural	90	1 Way Stop	Yes/200’	No/690’	Yes/450’	No	No
Merrill Hills Road/ Merrill Hills Court	3 Legs/ Rural	90	1 Way Stop	Yes/200’	No/555’	No/200’	No	No
Merrill Hills Road/ Madison Street	4 Legs/ Urban	80	4 Way Stop	No/155’	Yes/100’	No/155’	No	Yes

*Controlling Criteria

**SSD=Stopping Sight Distance, ISD=Intersection Sight Distance, and DSD=Decision Sight Distance (See FDM 11-25-1).

Comments:

ISD shown is for passenger car.

Has intersection control evaluation (ICE) worksheet been coordinated (Yes or No)? Yes, see Attachment 12 – Intersection Control Evaluation

2.3.3 Interchanges

Intersecting Roadway Names	Interchange Type	Ramp Types	Ramp Design Speed	Horizontal Curve on Ramp	Vertical Curve on Ramp	Ramp Grades	* SSD** [(Met (Y/N) / Length]	DSD** [Met (Y/N) / Length]
None								

*Controlling Criteria

**SSD = Stopping Sight Distance & DSD = Decision Sight Distance (See FDM 11-25-1).

Comments:

No interchanges exist within the project limits.

2.4 Cross Section

See Attachment 3 – Existing Typical Cross Sections

Number of roadways: 1

Number of lanes: 2

Median width: None

* Lane width: 12’

* Shoulder width (Total and Paved or Curb & Gutter): varies 3’ to 10’ / 0’ to 3’ paved

Bicycle Facility Type: None

Sidewalk and curb ramps: None

* Cross slope: 2%

* Super-elevation: 6% maximum

* Horizontal clearance: 2’ minimum

Clear Zone: varies – 5’ to 30’

* Vertical clearance: No vertical obstruction

Side-slopes and Ditch sections: varies 3:1 to 6:1 / v-ditch typical

*Controlling Criteria

2.5 Pavement Structure/Condition

Roadway	Pavement Types & Thicknesses	Physical Description
Merrill Hills Road (CTH TT), Sunset Drive to Madison Street	Approx. 5” HMA	Fair to good condition. Some areas of distressed pavement, including longitudinal, transverse, and alligator cracking and rutting.

2.6 Right Of Way

2.6.1 Encroachments

See Attachment 4 – List of Encroachments

2.6.2 Unique Right of Way Issues:

None

2.7 Structures

Existing Structure I.D. #	Feature Crossed	Structure Type	Sufficiency Rating	* Clear Roadway Width	Railing Type	* Structurally Deficient or Functionally Obsolete	* Inventory Load Rating
B67-0038	Genesee Road over Pebble Creek	Deck Girder	54.4	40.0’	Concrete	Structurally Deficient	HS17
B67-0270	Merrill Hills Road over Pebble Creek	Flat Slab	94.7	40.0’	Steel	No	HS23

*Controlling Criteria

Comments: See Attachment 1 – Project Location/Overview Map

2.8 Utilities

Utility Name	Type of Utility	General Location	Underground/ Overhead/Both
We Energies	Gas	West side of Merrill Hills Road East side of Genesee Road North side of MacArthur Road South side of Madison Street	Underground
We Energies	Electric	Both sides of Merrill Hills Road North side of Les Paul Parkway East side of Saylesville Road Both sides of Genesee Road South side of Sunset Drive South side of MacArthur Road Along Wisconsin & Southern Railroad North side of Madison Street	Both
Time Warner Cable	Communication	Both sides of Merrill Hills Road East side of Saylesville Road Both sides of Genesee Road South side of Sunset Drive South side of MacArthur Road North side of Madison Street	Both
AT&T	Communication	Both sides of Merrill Hills Road East side of Saylesville Road Both sides of Genesee Road South side of Sunset Drive South side of MacArthur Road Both sides of Madison Street	Both
Waukesha Water Utility	Water	Les Paul Parkway Saylesville Road Genesee Road Sunset Drive Madison Street	Underground
City of Waukesha	Sanitary Sewer	East side of Merrill Hills Road South side of Madison Street	Underground
City of Waukesha & Waukesha School District	Fiber/ Communications	East side of Merrill Hills Road Both sides of Genesee Road East side of Saylesville Road North side of Madison Street	Both

Comments:

2.9 Railroad Crossings

Location (Sta.)	Railroad Name	No. of Tracks	Function	Crossing Type
99+25	Wisconsin & Southern Railroad	2	Freight – Mainline	At-grade with warning lights & gates

Comments:
Two trains per day

See Attachment 2 – Existing Geometry.

2.10 Special Soils Conditions

A Phase 1 Subsurface Investigation was completed and indicated potential contaminated soil/groundwater locations. Four (4) Phase 2.5 Investigations have been conducted. Special provisions will be included in the contract to instruct the contractor as to the appropriate removal, dewatering and disposal methods required for any contaminated soils or groundwater discovered during construction.

An area of shallow groundwater flow was identified in the vicinity of Pebble Creek north and south of Sunset Drive. Along the hillside south of Sunset Drive, shallow groundwater flows west to east toward Pebble Creek. Excavation below subgrade may be required in areas where poor soil conditions are identified.

2.11 Unique Project Features

Waukesha County is responsible for preliminary design of this project. Final design and construction will be led by WisDOT.

3.0 TRAFFIC

3.1 Traffic Volumes/Conditions

3.1.1 See Attachment 5 – Traffic Forecast Report

3.1.2 Highway Capacity Analysis

Location (Roadway Segment or Intersection)	Existing Level of Service		Design Year Level of Service Under Existing Roadway		Design Year Level of Service Under Proposed Roadway	
	AM	PM	AM	PM	AM	PM
Les Paul Parkway & Genesee Road & Saylesville Road	C	C	E	C	N/A	N/A
Genesee Road & Saylesville Road	N/A	N/A	N/A	N/A	C	B
Les Paul Parkway & Genesee Road	N/A	N/A	N/A	N/A	Mid D	Mid D
Sunset Drive & Bypass	N/A	N/A	N/A	N/A	B	B
Merrill Hills Road & Sunset Drive	B	C	D	D	N/A*	N/A*
Merrill Hills Road & Madison Street	F	F	F	F	B	B

Comments:

Signalized intersections control LOS for the roadway. All movements are expected to operate at LOS D or better conditions during the peak hours.

*The existing intersection of Merrill Hills Road & Sunset Drive will no longer meet signal warrants in the proposed condition. LOS is not comparable for the proposed two-way stop configuration.

3.2 Crash Analysis

3.2.1 Project Crash Information – Preliminary Crash Data 2009 to 2013

Roadway	Crash Rate [1] (Year.)	Statewide Crash Rate [1] (Year)	Number & Severity of Crashes			
			Fatal	Injury	Property Damage	Total No. Crashes
Merrill Hills Road (South of Sunset Drive to north of Madison Street)	319 (2009-2013)	108 (2009-2013)	0	31	85	116

[1] Crash rate based on 100 million vehicles miles traveled (100 MVMT)

Comments:
Segment crashes include all crashes at intersections within segment.

Statewide Crash Rate comparison for this segment is the Rural County Highway average from 2009-2013.

3.2.2 Significant Crash Locations or Patterns – Preliminary Crash Data 2009 to 2013

Location or Pattern	Year	Number & Severity of Crashes				Crash Rate[2]	Possible Factors Contributing to Crashes
		Fatal	Injury	Property Damage	Total		
Les Paul Parkway & Genesee Road & Saylesville Road	2009-2013	0	11	44	55	0.92	No specific pattern identified
Merrill Hills Road & Madison Street	2009-2013	0	5	27	32	1.24	Vertical curve located north of the all-way stop control intersection 23 of the 32 crashes were rear end

[2] Crashes per million entering vehicles (MEV)

Comments:
The crash rates for all other intersections are not significant, below 0.75 crashes per MEV. Typically 1.5 crashes per MEV is the threshold used as a flag for safety improvements.

4.0 PROPOSED DESIGN CRITERIA

4.1 Design Class

Roadway or Roadway Segment	Design Class
USH 18, Genesee Road to Madison Street	UA3

4.2 * Design Speed

Roadway or Roadway Segment	Design Speed	Posted Speed
USH 18, Genesee Road to Madison Street	50 mph	45 mph

* Controlling Criteria

The selected posted/design speed matches the existing speed along STH 59 to the east and along the existing Merrill Hills Road (CTH TT).

4.3 Design Criteria Outside Of Desirable Standards

Saylesville Road

In order to construct the new intersection of USH 18 with Genesee Road and Les Paul Parkway, Saylesville Road is proposed to be relocated to the west along Genesee Road. The proposed intersection location was selected to maximize the distance between intersections in order to provide sufficient storage length along Genesee Road. At the southwest corner of the Genesee Road/Saylesville Road intersection lies a historic property known as the Sebina Barney house. Through extensive coordination with the State Historic Preservation Office during preparation of the Environmental Impact Statement, a horizontal alignment for Saylesville road with a 250-foot radius was selected in order to minimize impacts on the historic property. The 250-foot radius meets a design speed of 30 mph at 4.0% superelevation, per FDM 11-10, Exhibit 5.1. Saylesville Road meets Genesee Road at a signalized T-intersection, therefore a reduced design speed at the intersection is appropriate. This curve was designed based on FDM 11-10-5.2.2, which calls for a design speed on the curved approach to an intersection 20 mph less than the side road design speed, but not less than 30 mph. The posted speed limit on Saylesville Road is 35 mph. There is no potential for a fourth leg to be added to this intersection in the future.

Southbound Saylesville Road has two lanes at the departure from the Genesee Road intersection in order to accommodate a dual left turn lane from Genesee Road. This merges to one southbound lane prior to matching into the existing roadway. The tangent prior to merge of 525 feet meets the desirable length of 525 feet per FDM 11-25, Attachment 2.3, Table A2.2 for a posted speed of 25 mph. The merging taper length of 309 feet meets the minimum 300 feet per FDM 11-25, Attachment 2.3, Table A2.1 for a posted speed of 25 mph. The use of design standards for a posted speed of 25 mph corresponds to the 30 mph design speed used for the horizontal curve at the departure of the intersection.

The proposed geometry of Saylesville Road is required in order to minimize impacts on the Sebina Barney house as well as wetlands on the east side of Saylesville Road, while maintaining sufficient distance between the Genesee Road intersections with Saylesville Road and USH 18. Stopping sight distance of 305 feet is met for the design speed of 40 mph. Decision sight distance is required for the northbound approach to the dual right turn lanes and for the southbound approach to the merging taper. Decision sight distance of 600 feet is met for the design speed of 40 mph on the northbound approach to the horizontal curve. Decision sight distance of 450 feet is met for the design speed of 30 mph along the horizontal curve in both directions.

Design Speed

A design speed equal to the posted speed limit was used for MacArthur Road at the approach to USH 18. The use of a minimum design speed equal to the posted speed is acceptable according to FDM 11-20, Attachment 1.1 (footnote 3). The minimum design speed was used in this location because desirable and minimum /vertical curve requirements could not be met for the higher design speed. This is an approach to a stop-controlled intersection, therefore the operating speed is lower. There is no notable crash history at this location.

Curb Offset

The median curb offset along Genesee Road, from STA 52+00 to STA 62+00 is 3.83 feet, which is less than the desirable 6 feet, but greater than the minimum 1.8 feet. This dimension matches the recently reconstructed roadway to the northeast. This is a county road (CTH X) and Waukesha County approves this design.

The median curb offset along USH 18 is 5.83 feet, which is less than the desirable 6 feet, but greater than the minimum 1.8 feet. This dimension was selected based on a 4-foot offset to the curb flange.

The outside shoulder with curb & gutter is 9.83 feet, which is less than the desirable 10 feet, but greater than the minimum 1.8 feet. This dimension was selected based on an 8-foot offset to the curb flange.

Vertical Curves

The crest vertical curve on northbound USH 18 at STA 107+94 (K=137.70) does not meet the desirable K-value of 261(sight distance category 2 due to dual left turn lanes); however, the minimum criteria (K=84) is met. The category 1 desirable criteria (K=136) is also met. The desirable K-value could be met by either lengthening the curve or reducing the approach/departure grades. Both of these options would result in extending the project limits to the east and greater wetland fill on the south side of the roadway. Additionally, the departure grade cannot be flattened because it is required as superelevation for the cross road (Genesee Road).

The crest vertical curve on westbound Genesee Road (CTH X) at STA 53+40 (K=141.16) does not meet the desirable K-value of 261(sight distance category 2 due to dual left turn lanes); however, the minimum criteria (K=84) is met. The category 1 desirable criteria (K=136) is also met. The desirable K-value could be met by either lengthening the curve or adjusting the approach/departure grades. The approach grade is fixed by the

location of the proposed bridge over Pebble Creek. Increasing the departure grade would negatively impact the USH 18 profile and would result in greater wetland impacts on the west side of Genesee Road.

A single run of median barrier is proposed from approximately STA 120+00 to STA 147+00. The desirable two runs of barrier are not feasible because it would require a wider section through this environmentally sensitive corridor. No lighting is proposed in the median and no signs will be placed on top of the median barrier, therefore there will be no risk of collisions with fixed objects on top of the barrier.

Free-flow Right Turn Lane

Due to the limited distance between intersections, a free-flow right turn lane was designed from eastbound Genesee Road to southbound USH 18. The 215-foot radius curve is rated at 25 mph per FDM 11-10, Attachment 5.12. The downstream acceleration lane and taper were designed similar to an on-ramp configuration. The tangent prior to merge is based on Figure 2-24 from GDHS 2011, which shows the distance for a passenger car to accelerate from 25 mph to 50 mph to be 625 feet. The merging taper is based on a parallel entrance ramp merge distance of 360 feet, per FDM 11-30, Attachment 1.1.

Turn Lane Length

The westbound dual left turn lane on Genesee Road at Saylesville Road is shorter than the desirable length. The inside left turn lane meets the desirable length of 425 feet, but the outside left turn lane has a length of 200 feet, which accommodates the queue in the design year. This shorter length is required due to the close proximity between Saylesville Road and USH 18.

The eastbound left turn lane on Genesee Road at USH 18 has a length of 287 feet, which is shorter than the desirable length of 355 feet, but meets the minimum length of 280 feet. This shorter length is required due to the close proximity between Saylesville Road and USH 18.

The westbound dual left turn lane on Genesee Road at USH 18 is shorter than the desirable length. The left lane meets the minimum length of 290 feet. The right lane has a length of 146 feet, which accommodates the queue in the design year. This shorter length is required because of the location of the proposed bridge over Pebble Creek. The proposed bridge geometry will not allow the turn lanes to extend onto the bridge.

The westbound right turn lane on Genesee Road at USH 18 has a length of 280 feet, which is shorter than the desirable length of 350 feet, but meets the minimum length of 225 feet. This shorter length is required because of the location of the proposed bridge over Pebble Creek. The proposed bridge geometry does not allow the turn lane to extend onto the bridge.

Intersection Design/Check Vehicles

The required design vehicle (WB-65) for the intersection of USH 18 and Genesee Road does not meet the required degree of encroachment (A1) for vehicles turning from SB USH 18 to EB Genesee Road and from EB Genesee Road to NB USH 18. A degree of encroachment A2 is met, without conflicting with the opposing right turn movement. Accommodating the required degree of encroachment would require a larger intersection footprint, which is undesirable due to wetland impacts.

The required design vehicle (WB-65) for the intersection of USH 18 and Sunset Drive does not meet the required degree of encroachment (A1) for vehicles turning left from Sunset Drive to USH 18. A degree of encroachment A2 is met. Accommodating the required degree of encroachment would require a larger intersection footprint, which is undesirable due to wetland impacts.

The required check vehicle (WB-65) for the intersection of USH 18 and Green Lane does not meet the required degree of encroachment (A2) for vehicles turning right from SB USH 18 to WB Green Lane. A degree of encroachment B2 is met. Accommodating the required degree of encroachment would require a larger intersection footprint, resulting in greater impacts on the surrounding area. The WB-40 can make this movement with a degree of encroachment A2. This side road is a local road serving a residential area, a church, and two businesses. Alternate access is available to the south on Sunset Drive.

The required check vehicle (WB-65) for the intersection of USH 18 and MacArthur Road does not meet the required degree of encroachment (A2) for vehicles turning right from NB USH 18 to EB MacArthur Road. A degree of encroachment B2 is met. Accommodating the required degree of encroachment would require a larger intersection footprint, resulting in greater impacts on the surrounding area. This side road is a local road serving a residential area, and is posted no trucks over 5 tons.

The required check vehicle (WB-65) for the intersection of USH 18 and Kame Terrace does not meet the required degree of encroachment (A2) for vehicles turning right from SB USH 18 to WB Kame Terrace. A degree of encroachment B2 is met. Accommodating the required degree of encroachment would require a

larger intersection footprint, resulting in greater impacts on the surrounding area. The WB-40 can make this movement with a degree of encroachment A2. This side road is a local road with no other access points serving a residential area.

The required check vehicle (WB-65) for the intersection of USH 18 and Merrill Hills Court does not meet the required degree of encroachment (A2) for vehicles turning right from SB USH 18 to WB Merrill Hills Court. A degree of encroachment A3 is met. Accommodating the required degree of encroachment would require a larger intersection footprint, resulting in greater impacts on the surrounding area. The WB-40 can make this movement with a degree of encroachment A2. This side road is a local road with no other access points serving a residential area.

4.4 Exceptions To Standards

None required

4.4.1 Safety Screening Analysis (SSA) and Programmatic Exception to Standards per FDM 11-1-4 (3R projects and Preventive Maintenance (PM) Group I and Group II pavement strategy projects (FDM 3-1 Exhibit 5.1))

See attached Safety Screening worksheets for locations and details of Crash Flags, Improvement Flags, and Programmatic Exceptions to Standards within the project limits.

National Highway System (NHS) Roadway- Substandard Geometric Features Covered by a Programmatic Exception to Standards (3R & PM projects)

NHS roadway name:

Location					
Sta.	to Sta.	RP	to RP	Feature Type	Magnitude of Variance

* This documentation is required only for 3R projects on the National Highway System.
Comments: This is not a 3R project and thus is not required for this project.

Substandard Geometric Features NOT Covered by a Programmatic Exception to Standards and NOT corrected as part of PM project (PM Group I and Group II pavement strategy projects)

Roadway Name:

Location						
Sta.	to Sta.	RP	to RP	Feature Type	Magnitude of Variance	Operational Improvements

Comments: This is not a PM project and thus is not required for this project.

4.5 Typical Cross Section Elements Considered

The proposed USH 18 roadway will be a divided section with two 12-foot lanes in each direction. Outside shoulders will provide bicycle accommodations. Left and right turn lanes will be 12 feet in width. Either a 10-foot rural shoulder (8-foot paved), or 9.83-foot paved urban shoulder including curb and gutter will be constructed. Inside shoulders are 5.83 feet with curb and gutter or 6 feet with median barrier.

From the southern project limit to Genesee Road, the raised median width varies from 22 to 62 feet. In order to minimize roadway footprint through the environmentally sensitive southern segment from Genesee Road to Sunset Drive, a 14-foot median with concrete median barrier separates northbound and southbound traffic. North of Sunset Drive the typical raised median width is 30 feet (widens to 38 feet at Sunset Drive and Madison Street intersections).

Pedestrian Accommodations

A 10-foot wide multi-use path will be constructed on the east side of the roadway from Sunset Drive to the north project limit. Grading provisions will be made for a potential future sidewalk on both sides of the roadway from the southern project limit to Genesee Road and on the west side of the roadway from Sunset Drive to Kame Terrace. A 5-foot wide sidewalk will be constructed on the west side of the roadway from Kame Terrace to the north project limit.

No sidewalk or multi-use path will be constructed along the environmentally sensitive southern section (between Genesee Road and Sunset Drive) in order to minimize the proposed roadway footprint on the existing habitat and natural resources.

The “Wisconsin Guide to Pedestrian Best Practices” states that the minimum face to face median pedestrian refuge for new construction is 6 feet and 8 feet or more can better accommodate multiple pedestrians, bikes, strollers and wheelchairs. All median pedestrian refuges will measure at least 6 feet face to face. Pedestrian refuges at signalized intersections will measure at least 8 feet face to face.

5.0 PROPOSED DESIGN IMPROVEMENT

5.1 Improvement Type

Reconstruction / Expansion

Program Number: 303SE

5.2 Geometrics

5.2.1 * Horizontal alignment

Horizontal alignments including superelevation rates meeting current standards were used for both directions of travel along USH 18 and for all side roads.

See Attachment 6 – Preliminary Plan Sheets

5.2.2 * Vertical alignment/Stopping sight distance

Vertical alignments meet stopping sight distance requirements and decision sight distance where applicable, with the exception of locations noted in section 4.3.

See Attachment 6 – Preliminary Plan Sheets

5.2.3 * Grades

Finished grades on USH 18 will range from 0.50% to 4.82%. The proposed roadway is classified as an urban arterial, with level terrain. Per 2011 GDHS, Table 7-4, maximum grade is 6% for 50 mph.

Finished grades on side roads within the project limits will range from 0.50% to 5.75%. All side roads are classified as urban, with level terrain. All roadways meet maximum grades per 2011 GDHS, Section 5.3, Table 6-8, and Table 7-4.

See Attachment 6 – Preliminary Plan Sheets

* Controlling Criteria

5.3 Side-roads/Intersections/Interchanges

5.3.1 Side-roads

Roadway Name	Functional Class	Design Speed (MPH)	Design Year Traffic (AADT)	Design Class	Approach Grades	Ped. Facilities (Y / N)	Bike Facilities (Y / N)
Saylesville Road (CTH X)	Minor Arterial	40 mph^	15,300	UA2	2.00%	Yes	Yes
Genesee Road (STH 59)	Principal Arterial	50 mph	15,100	UA2	1.67% EB/ 1.63% WB	Yes	Yes
Genesee Road (CTH X)	Principal Arterial	50 mph	23,200	UA3	1.67% EB/ 1.63% WB	Yes	Yes
Sunset Drive (CTH D)	Principal Arterial	50 mph	17,200	UA2	1.54%	No	Yes
Green Lane	Local Road	30 mph	+/-2,000*	Urban 1b	1.00%	No	Yes
MacArthur Road	Collector	40 mph	+/-2,000*	Urban 2b	1.80%	No	Yes
Kame Terrace	Local Road	30 mph	>100	Urban 1b	1.80%	No	Yes
Merrill Hills Court	Local Road	30 mph	<100	Urban 1b	1.20%	No	Yes
Madison Street	Collector/ Minor Arterial	40 mph	880 west/ 5,700 east	Urban 2b	1.72%	Yes	Yes

Comments:

*Estimation; roadway not forecasted.

^See section 4.3 regarding Saylesville Road.

5.3.2 Intersections

Intersecting Roadway Names	Intersect. Type	Intersect. Angle	Traffic Control	* SSD** Met [(Y/N) / Length]	ISD** Met [(Y/N) / Length]	DSD** Met [(Y/N)/ Length]	Vision Triangles Proposed (Y / N)	Corner Clearance To Driveways Met (Y / N)
Saylesville Road & Genesee Road	3 Legs urban	90	Signals	Y/>305’	Y/955’	Y/>600’	N	N
USH 18 & Genesee Road	4 legs urban	79	Signals	Y/>425’	N/800’	N/450’	N	N
USH 18 & Sunset Drive	4 legs urban	75	Signals	Y/>425’	Y/825’	N/450’	N	N
USH 18 & Green Lane	3 Legs rural	90	1- Way Stop (minor road)	Y/>200’	Y/950’	N/<375’	N	Y
USH 18 & Wisconsin & Southern Railroad	At-grade railroad crossing	50	Gates & signals	Y/425’	N/A	Y/750’	N	N/A
USH 18 & MacArthur Road	3 Legs urban	90	1- Way Stop (minor road)	Y/>250’	Y/1135’	N/<375’	N	Y
USH 18 & Kame Terrace	3 Legs rural	90	1- Way Stop (minor road)	Y/>200’	Y/1135’	N/<375’	N	N
USH 18 & Merrill Hills Court	3 Legs urban	90	1- Way Stop (minor road)	Y/>200’	Y/1135’	Y/450’	N	Y
USH 18 & Madison Street	4 legs urban	85	Signals	Y/>250’	Y/920’	N/<375’	N	Y

* Controlling Criteria

**SSD = Stopping Sight Distance, ISD = Intersection Sight Distance & DSD = Decision Sight Distance (See FDM 11-25-1).

Comments:

Intersection control evaluation (ICE) worksheet has been coordinated. Draft Scoping ICE Memo dated December 19, 2014; BTO scoping ICE comments January 13, 2015.

Intersection Sight Distance

ISD is shown for the design vehicle (SU or WB truck).

USH 18 & Genesee Road: Minimum ISD for the WB truck is not met for the right turn on red from WB Genesee Road to NB USH 18; 800 feet is available, rather than the minimum 825 feet.

All other locations meet desirable or minimum ISD values.

5.3.3 Interchanges

Name of Intersecting Roadways	Interchange Type	Ramp Type	Ramp Design Speed	Ramp Grades	* SSD** Met [(Y/N) / Length]	DSD** Met [(Y/N) / Length]	Vision Triangle (Yes or No)
None							

* Controlling Criteria

**SSD = Stopping Sight Distance & DSD = Decision Sight Distance (See FDM 11—25-1).

Comments:

No interchanges exist within the project limits.

5.4 Roundabouts

Roundabout construction is not part of the recommended design. Traffic signals are recommended because, in several cases, it was determined that dual lane roundabouts would not provide an acceptable level of service. Triple lane roundabouts were not considered for this project.

See Attachment 12 – Intersection Control Evaluation

5.5 Cross Section/Pavement Structure

See Attachment 7 – Finished/Proposed Typical Cross Sections

Number of roadways: 2

Number of lanes: 2

Median width/Type: varies 14-62’ / raised grassed median or median barrier

* Lane width/Type (Driving, Parking, Bike Lane, etc.):

12’ driving lanes, 12’ turn lanes, 9.83/10’ shoulder (for bike accommodations, no parking)

* Shoulder width (Total & Paved or Curb & Gutter):

Urban – 5.83’ left with curb and gutter, 9.83’ right with curb and gutter

Rural – 5.83’ left with curb and gutter, 10’ right (8’ paved)

Bike facilities proposed: Paved shoulder/multi-use path

Pedestrian facilities / sidewalk proposed: 5’ sidewalk and 10’ multi-use path

* Cross slope: 2% typical

* Super-elevation: 4% maximum

See comments below regarding non-standard cross slope locations.

* Horizontal clearance: 2’ minimum (from face of curb)

* Vertical clearance: No vertical obstructions

Pavement Structure: 8-inch non-reinforced PCC over 6-inch Base Aggregate Dense 1-¼” over 16” select crushed material

Clear Zone: 22’

Side-slope / Ditch Sections: 6:1 foreslope and 4:1 backslope typical; 3:1 foreslope outside clear zone; 2.5:1foreslope outside ditch or behind guard rail

* Controlling Criteria

Comments:

Non-standard cross slope is used at the locations noted below:

USH 18:

At the Genesee Road intersection (STA 113+00) northbound and southbound lanes slope 2.0% to the right to create a smooth profile along Genesee Road.

At the Sunset Drive intersection (STA 152+50) northbound and southbound lanes slope 2.0% to the right to create a smooth profile along Sunset Drive.

At the Wisconsin & Southern Railroad (STA 174+00) northbound and southbound lanes are warped to match the railroad crossing.

At the bridge over the Pebble Creek (STA 179+00) northbound and southbound lanes slope 2.0% to the right to simplify bridge construction and transition into the horizontal curve north of the bridge.

At the Kame Terrace intersection (STA 221+50) northbound and southbound lanes slope 2.0% to the left to better match the intersection and reduce the cut on the east side of the roadway.

At the Merrill Hills Court intersection (STA 234+50) southbound lanes slope 2.0% to the right to better match the intersection.

At the Madison Street intersection (STA 255+00) northbound and southbound lanes slope 2.0% to the left to create a smooth profile along Madison Street.

Genesee Road:

At the USH 18 intersection eastbound and westbound lanes slope 2.8% to the left to match the intersection.

Sunset Drive:

At the USH 18 intersection eastbound and westbound lanes slope 2.0% to the left to match the intersection.

Madison Street:

At the USH 18 intersection eastbound and westbound lanes slope 3.0% to the right to match the intersection.

5.6 Street Lighting

Location	Type	Break-away Requirements

None currently proposed. Traffic signals will include intersection lighting.

5.7 Structures

5.7.1 Bridge Structures

Structure I.D. #	Location	Structure Type	Length	* Clear Width	No. of Spans	* Vertical Clearance	* Horizontal Clearance
B-67-314 B-67-315	CTH X over Pebble Creek	36W" Prestressed Girder	75'	38'	1	N/A	N/A
	Proposed Improvement:		New Bridges				
B-67-352 B-67-353	Bypass Land Bridge	36W" Prestressed Girder	250'	38'	3	N/A	N/A
	Proposed Improvement:		New Bridges				
B-67-354 B-67-355	Bypass over Pebble Creek	Reinforced Concrete Slab	200'	40'	4	N/A	N/A
	Proposed Improvement:		New Bridges				

* Controlling Criteria

Comments:

5.7.2 Box Culverts and Multiple Pipe Structures

Structure I.D. #	Location	Type	Length	No. Pipes
C-67-88	Glacial Drumlin Trail under Bypass	Box Culvert	~180'	1 cell
	Proposed Improvement:	New box culvert		
C-67-91	STA 245+00	Box culvert	~200'	2 cell
	Proposed Improvement:	New box culvert		

Comments:

5.7.3 Retaining Walls and Noise Barrier Structures

Structure I.D. #	Location	Type	Length	Height
R-67-129	STA 256+10 through STA 260+50; Right			
	Proposed Improvement:	Retaining Wall	440’	Varies – 4’ to 20’
Unknown	~STA 256+50 through ~STA 262+00; Right			
	Proposed Improvement:	Potential Noise Wall	550’	Varies 9’ to 17’
Unknown	~STA 258+00 through ~STA 259+04; Left			
	Proposed Improvement:	Potential Noise Wall	104’	13’

Comments:
There is a potential for two noise wall locations along the corridor. Public meetings, comment and voting proceedings need to be completed in final design.

5.7.4 Sign Bridge Structures

Structure I.D. #	Location	Type	Length	Clear Roadway Width	* Vertical Clearance	* Horizontal Clearance	Clear Zone Under
	Proposed Improvement:						
	Proposed Improvement:						

* Controlling Criteria

Comments:
None currently proposed within the project. Further analysis is required to determine location and need.

5.7.5 Tunnel Structures

Structure I.D. #	Location	Type (Veh.,Ped., Bicycle, etc.)	Length	Lighting Type	* Vertical Clearance	* Horizontal Clearance
None						
	Safety Features			Coordination with Local Emergency Responders		
	Proposed Improvement:					

* Controlling Criteria

Comments:
None proposed within the project.

5.8 Permanent Traffic Control

Will permanent signs be installed (Yes or No)? Yes

Are non-standard sign layout details needed (Yes or no)? Yes

Comments:

There is a potential need for non-standard sign layout details at the following locations:

Saylesville Road & Genesee Road (NB to EB dual right turn)

Genesee Road & Saylesville Road (WB to SB dual left turn)

Genesee Road & Bypass (WB to SB dual left turn)

Bypass & Genesee Road (NB to WB dual left turn)

Freeway size signs will be used where median barrier is present. No signs will be placed in the median due to lateral clearance restrictions.

5.9 Transportation Management Plan

See Attachment 9 – Transportation Management Plan Documentation

5.10 Safety Enhancements/Mitigation Measures

- Improved stopping sight distance.
- Improved Level of Service.
- Improved (coordinated) traffic signals with pedestrian accommodations.
- Additional through lanes will reduce congestion.
- New pavement will provide for a smoother ride and higher friction factor to reduce skidding.
- New curb and gutter and positively graded ditches will improve drainage.
- New pavement markings and permanent signing will meet current standards and increase driver awareness.
- New curb ramps with detectable warning fields will increase pedestrian safety.
- Pedestrian refuge will be provided in medians.
- Sidewalk and multi-use path will improve pedestrian safety.
- Paved shoulders will accommodate on-street bicycles.

5.11 Real Estate

5.11.1 Real Estate Acquisition

Plat I.D.:2788-00-22

Relocations		Land	Permanent	Temporary	Construction
Type	Number	(Acres)	Easements	Easements	Permits
Residential Relocations	4	71.22	0.09	6.11	None

Comments:
Right of way plat is in progress.
This plat covers project ID's 2788-00-01, 2788-00-02, and 2788-02-00.
Numbers shown above are estimated for project 2788-00-01 only.

5.11.2 Encroachment Actions

See Attachment 4 – List of Encroachments

Comments:

5.12 Utilities

Is Project Trans 220 Utility Project (Yes or No)? No

Describe any special design features to accommodate utilities:

None

Major Utility Agreements:

None

Comments:

5.13 Railroads

Describe improvements to Railroad Facilities:

A new at-grade crossing with warning signals & gates will be constructed at the Wisconsin & Southern Railroad.

The existing Merrill Hills Road railroad crossing warning signals & gates will be removed; however, a connection between existing Merrill Hills Road to the south and the Glacial Drumlin Trail is to be provided adjacent to the new roadway/railroad crossing.

Railroad Agreements:

Railroad coordination is ongoing.

Comments:

5.14 Financing And Scheduling

Construction I.D.	Construction Cost Estimate	Type of Funding			Proposed Timeframe For Construction	Ties to Other Work or Projects	Incentive/ Disincentive Clauses (Yes or No)
		% Fed.	% State	% Local			
2788-00-71	$28.3M	80	20	-	2016-2017	None	No

Describe Incentive/Disincentive Clauses:

None

Non-participating Work:

Sanitary sewer and water main facility adjustments are anticipated in the project corridor.

Deferred Construction Work (Preventative Maintenance projects)

None

5.15 Unique Or Non-standard Features

5.15.1 Hazardous Waste

Phase 2.5 Subsurface Investigations were completed at four (4) hazardous material sites in the project area.

Special provisions will instruct the contractor as to the appropriate removal, dewatering, and disposal methods required for any contaminated soils or groundwater discovered.

5.15.2 Environmental Commitments

No storage of materials or equipment will be permitted in wetland areas. Appropriate erosion control measures and best management practices will be included in the plan and implemented during construction. Silt fence and inlet protection will be installed prior to ground disturbing activities and maintained as needed. Special provisions for dust abatement will be used.

An eco-passage will be included at the proposed Genesee Road bridges over Pebble Creek.

See Attachment 8 – Impact Mitigation Measures

5.15.3 Community Sensitive Design/Public Involvement

A series of 5 Community Sensitive Solutions Advisory Group workshops were held between March 24, 2010 and January 31, 2011. A final meeting was held October 29, 2012.

Public Involvement meetings were held May 18, 2010, July 14, 2010, August 4, 2010, and February 10, 2011.

A Public Hearing was held on November 13, 2012.

Future Public Involvement meetings are ongoing.

5.15.4 Value Engineering

Value Engineering was conducted March 2 through 5, 2015.

See Attachment 13 – Value Engineering Study Report

6.0 SYNOPSIS

	Completion/Approval Dates	Status of Coordination or Other Information as Needed
Concept Definition Report	Not required for Project	Not required for Project
Scoping Document	Not required for Project	Not required for Project
Public Involvement Plan	March, 2010	Ongoing
Final Aesthetic & Visual Level of Impact Worksheet	FEIS	
Speed Limit Change Declaration	Not required for Project	Not required for Project
Environmental Document (Type: EIS)	September 11, 2014	ROD January 20, 2015
Public Hearing/Public Information Meetings	May 8, 2010 July 14, 2010 August 4, 2010 February 10, 2011 November 13, 2012	Ongoing
SHPO Involvement	Memorandum of Agreement April 2, 2014	Ongoing
DNR Involvement	Initial Concurrence December 3, 2013	Ongoing
Agricultural Impact Statement	November 30, 2012	Complete
Pavement Design Report	January 20, 2015	Complete
Roundabout Review (ICE Report)	January 13, 2015	Complete
Transportation Management Plan (Type: 2)	August 24, 2015	Approved
Permits Required (Types: IP)	Expected May 1, 2016	Ongoing
Local Project Agreements: MOU	April 6, 2009	Ongoing Coordination
Value Engineering Study	March 2-5, 2015	Complete
Status of Statutory Actions	Jurisdictional Transfer After Construction	Pending
Trans 75 Documentation	September 10, 2013 April 17, 2015 Amendment	Complete

7.0 ATTACHMENTS

1 – Project Location/Overview Map
2 – Existing Geometry
3 – Existing Typical Cross Sections
4 – List of Encroachments
5 – Traffic Forecast Report
6 – Preliminary Plan Sheets
7 – Finished/Proposed Typical Cross Sections
8 – Impact Mitigation Measures
9 – Transportation Management Plan Documentation
10 – Roadside Hazard Analysis
11 – Trans 75 Documentation
12 – Intersection Control Evaluation
13 – Value Engineering Study Report

Attachment 1 – Project Location/Overview Map

PROJECT LOCATION MAP

WAUKESHA BYPASS

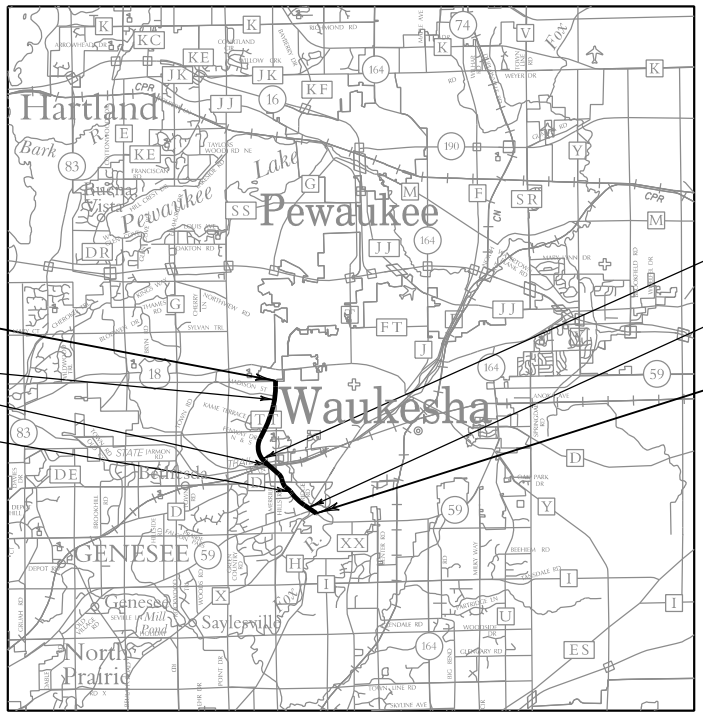
USH 18

GENESEE ROAD TO MADISON STREET

WAUKESHA COUNTY

STATE PROJECT NUMBER
2788-00-71

R-18-E R-19-E R-20-E



N

T-7-N

T-6-N

END PROJECT ID 2788-00-71
STA 261+00.00

C-67-91
C-67-88
B-67-352
B-67-353

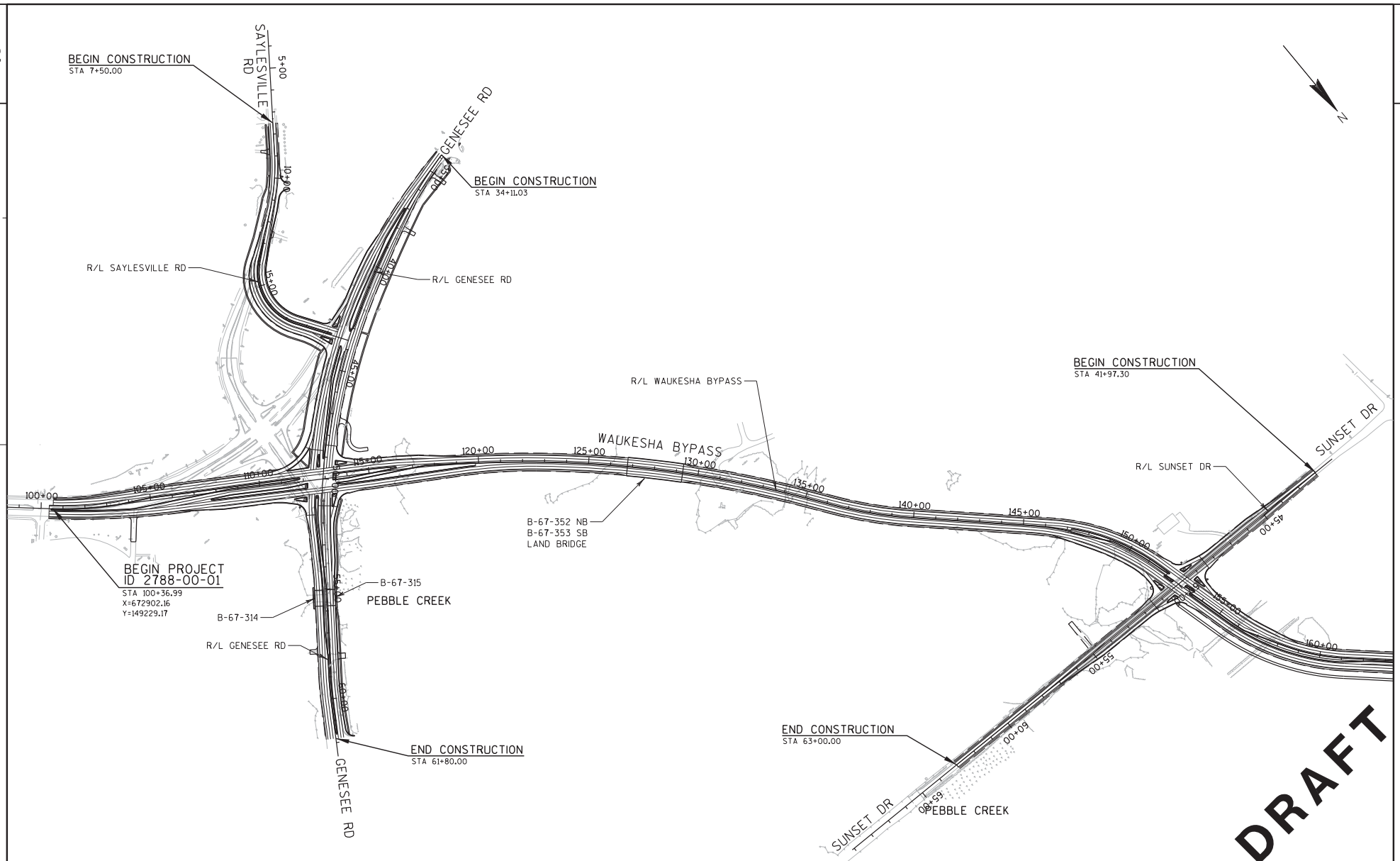
B-67-354
B-67-355
B-67-314
B-67-315

BEGIN PROJECT ID 2788-00-71
STA 100+36.99
X=672902.16
Y=149229.17

LAYOUT
SCALE 0 0.75 MI.

TOTAL NET LENGTH OF CENTERLINE = 3.042 MI.

ATTACHMENT 1



PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROJECT OVERVIEW	SHEET	E

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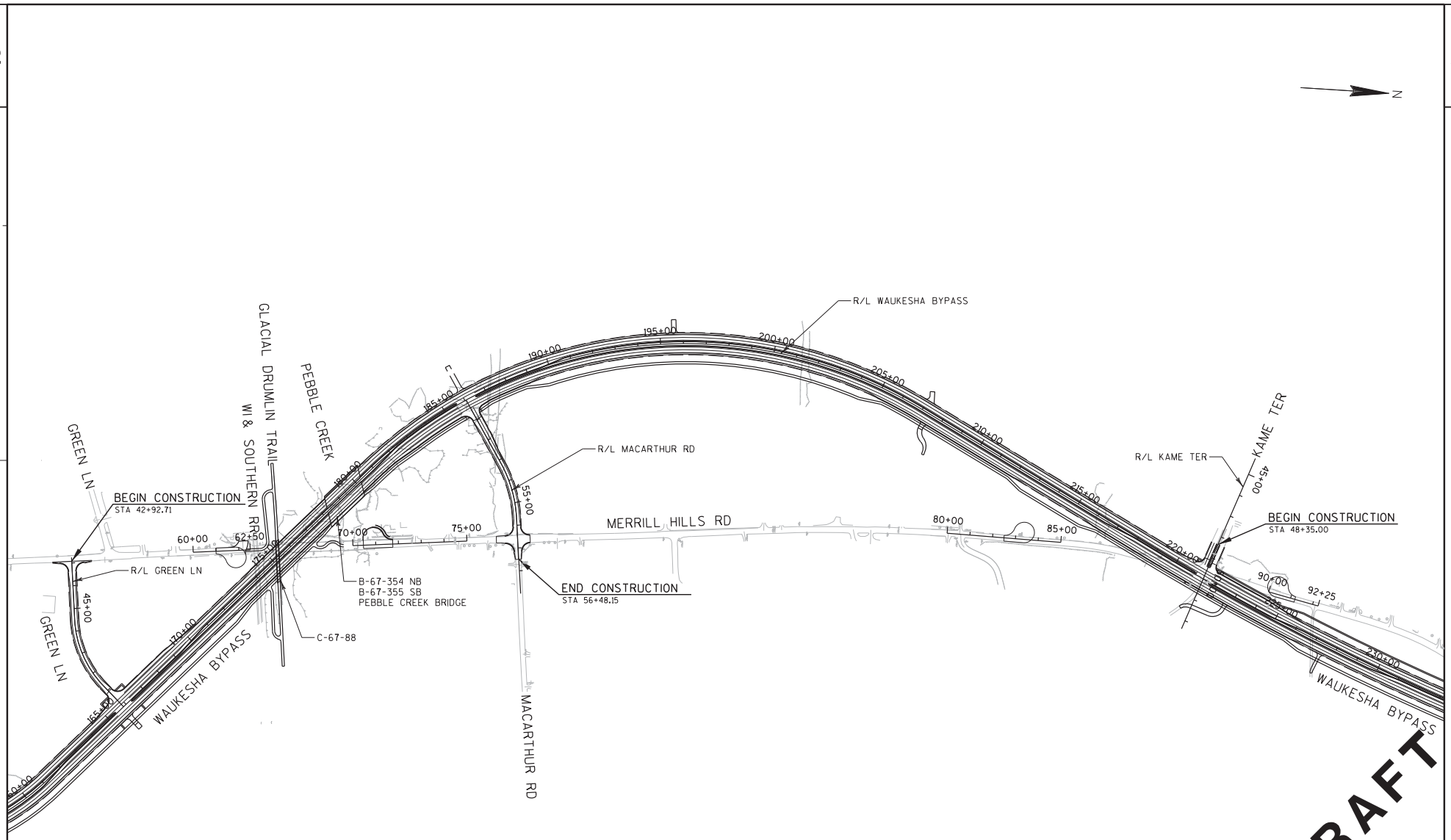
WISDOT/CADDS SHEET 42

ATTACHMENT 1



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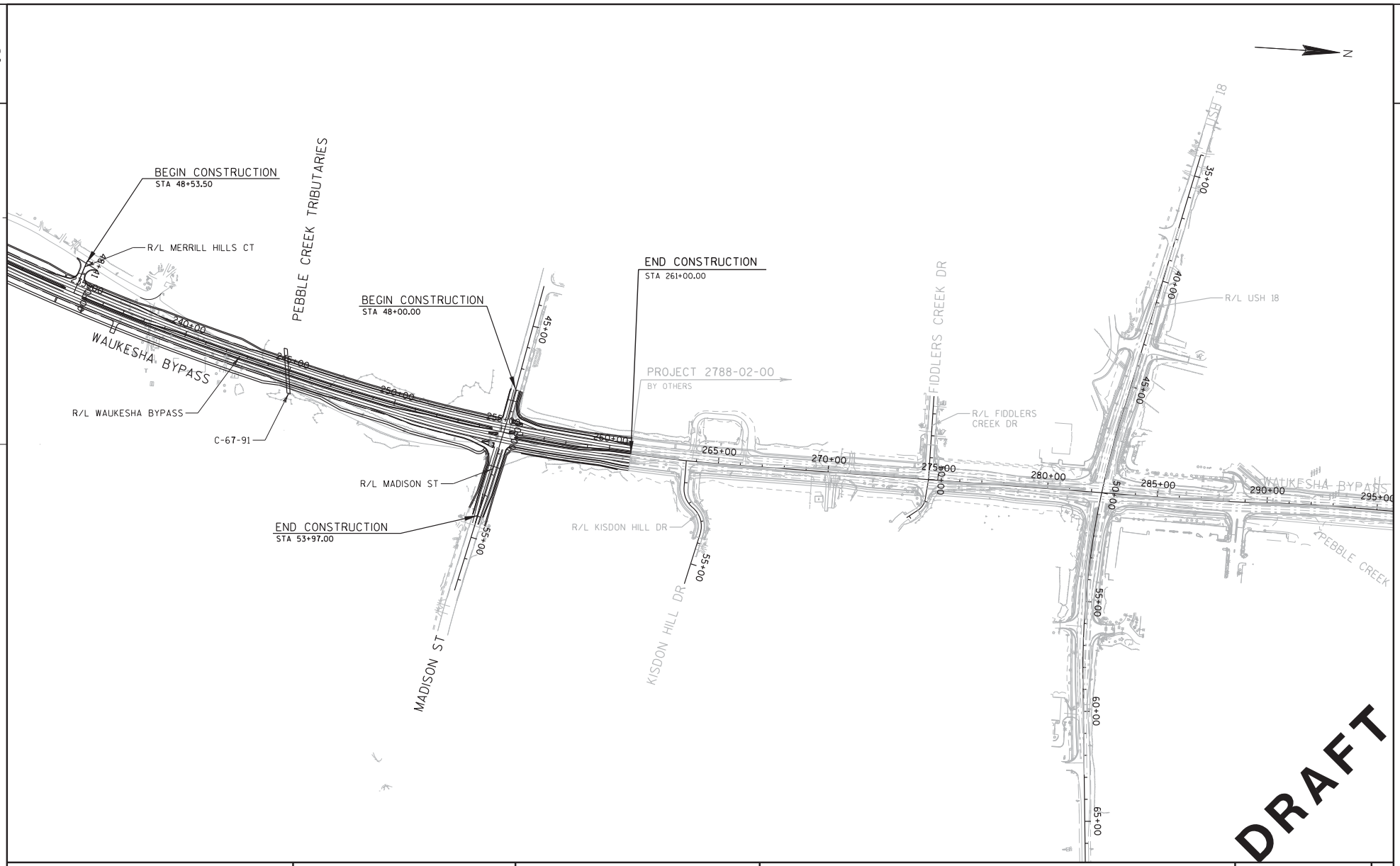
ATTACHMENT 1



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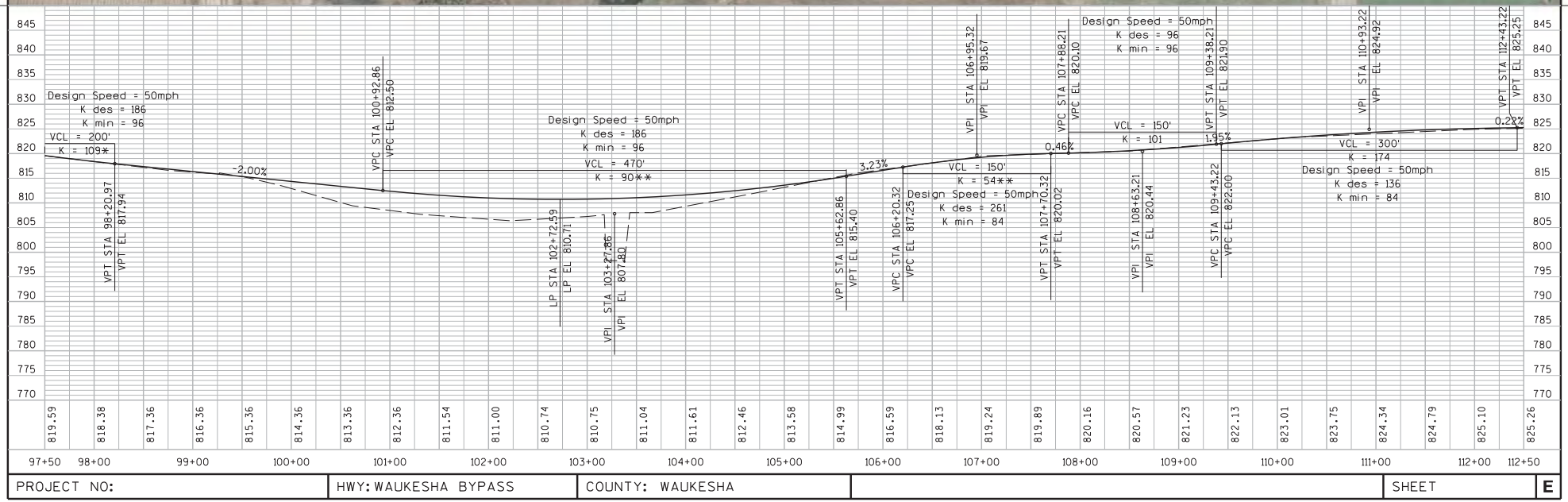
WISDOT/CADDS SHEET 42

ATTACHMENT 1

Attachment 2 – Existing Geometry



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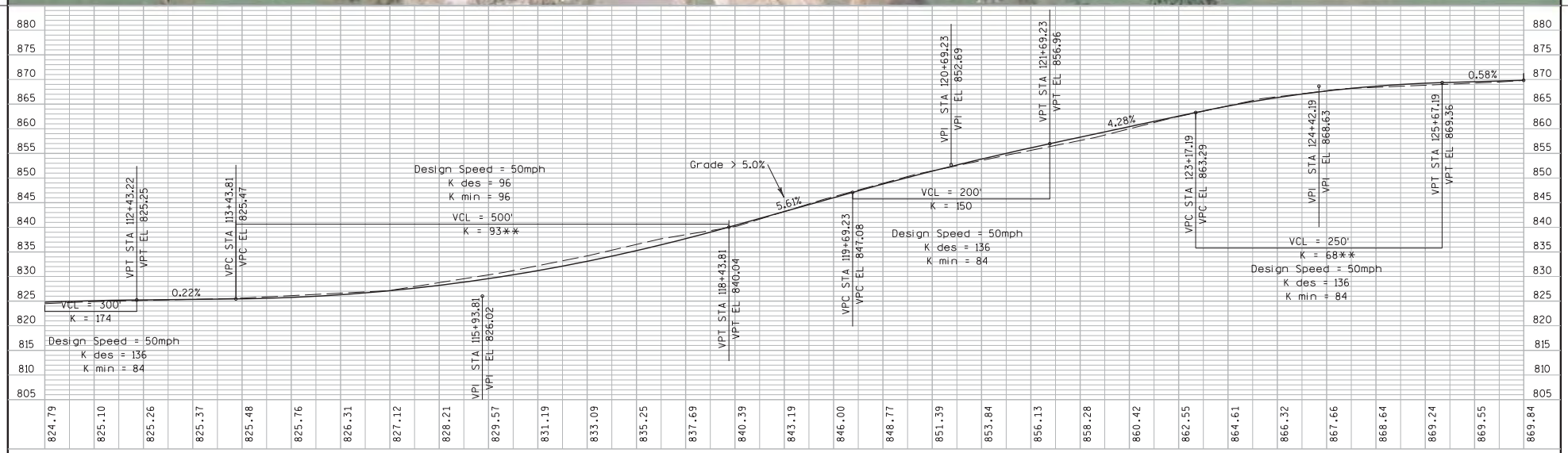
WISDOT/CADDS SHEET 40

ATTACHMENT 2



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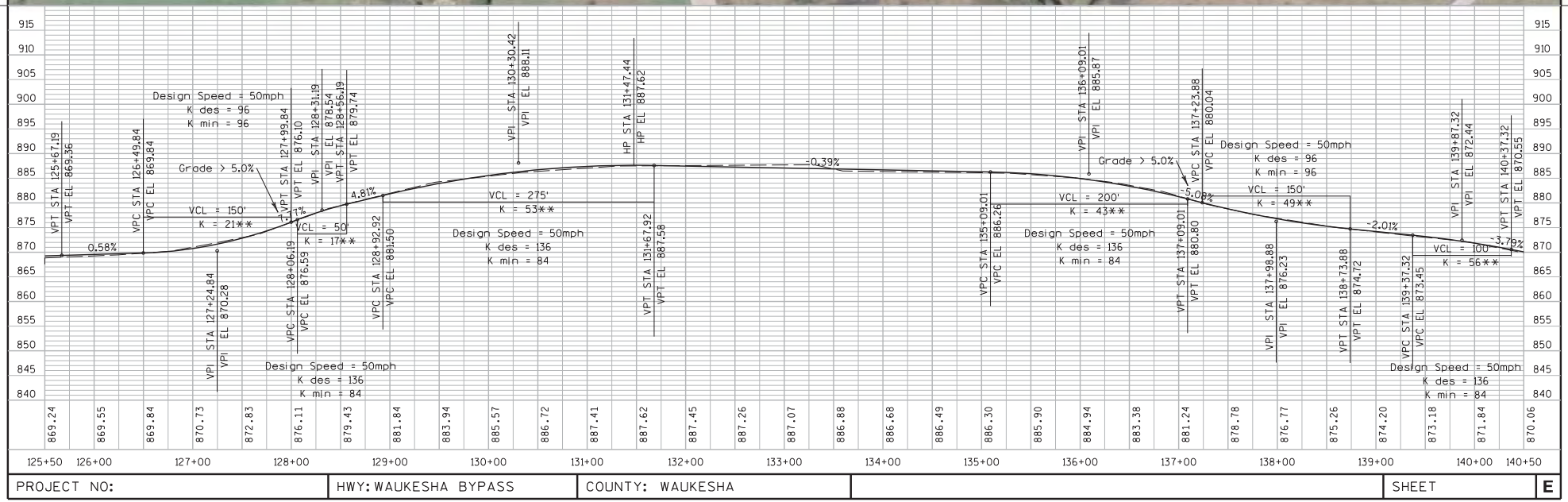

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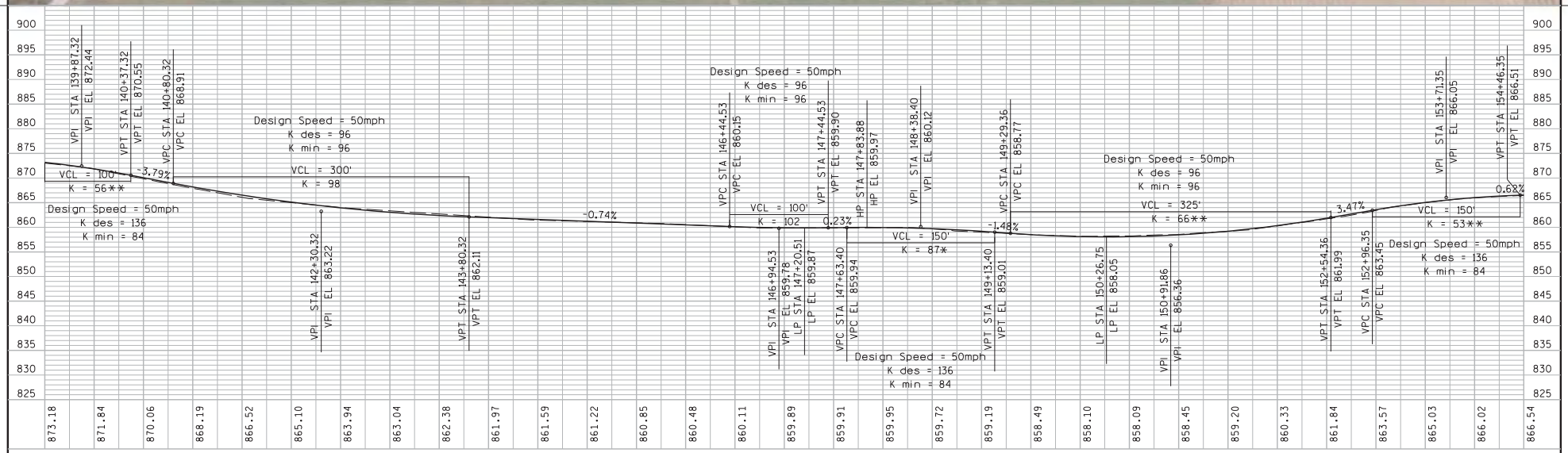

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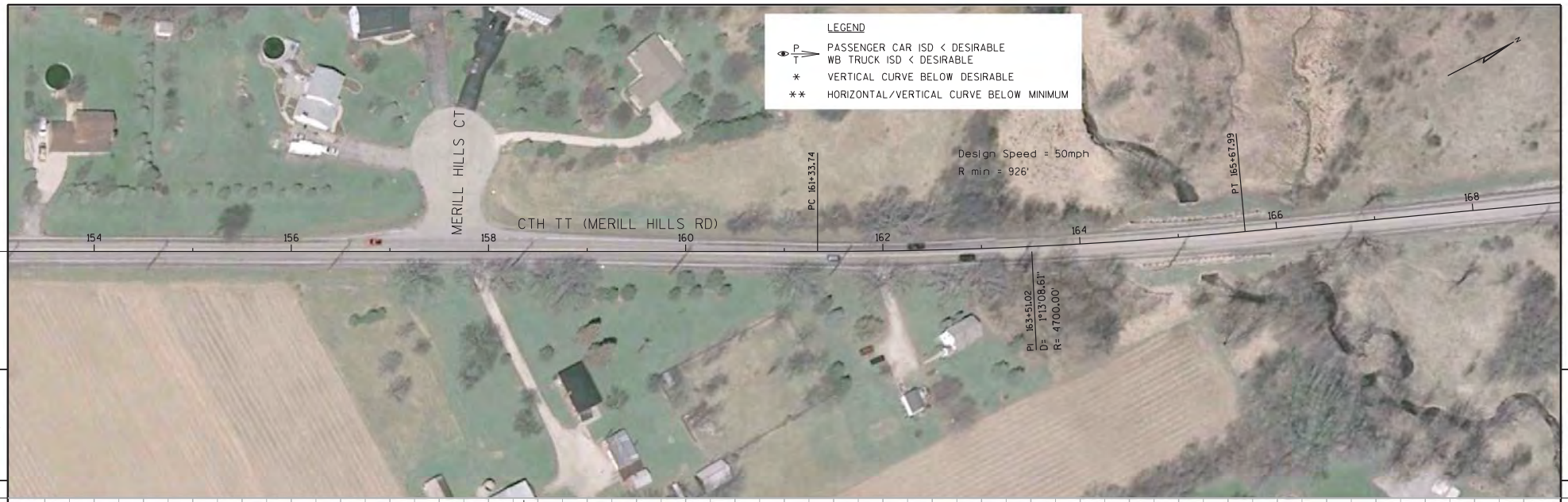
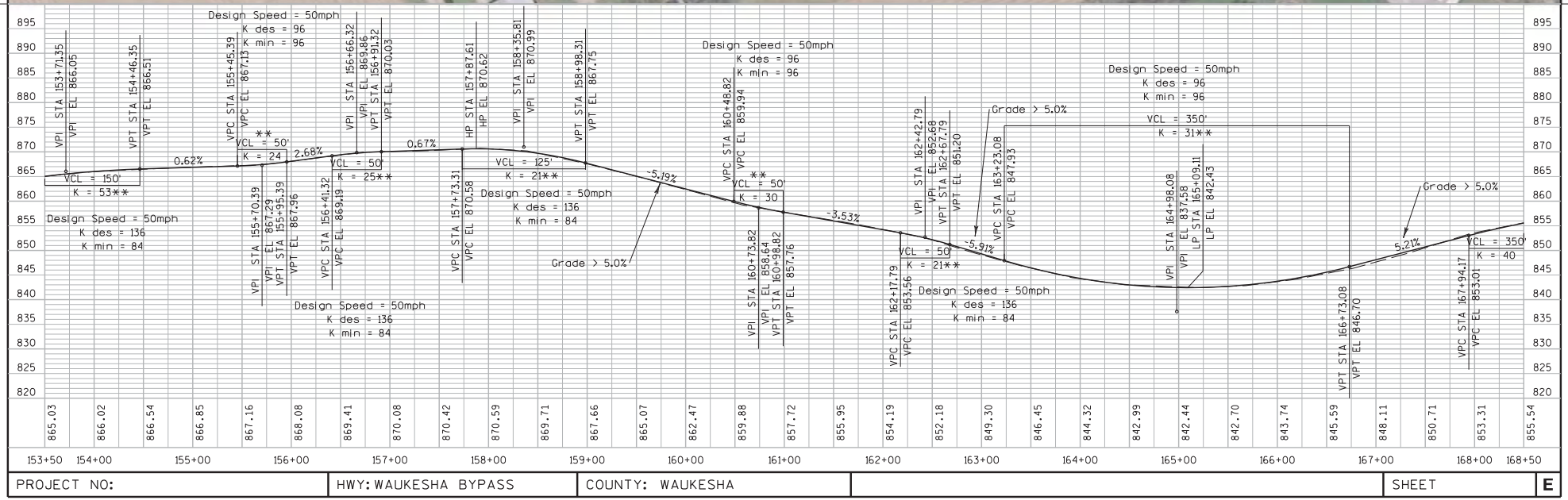
ATTACHMENT 2





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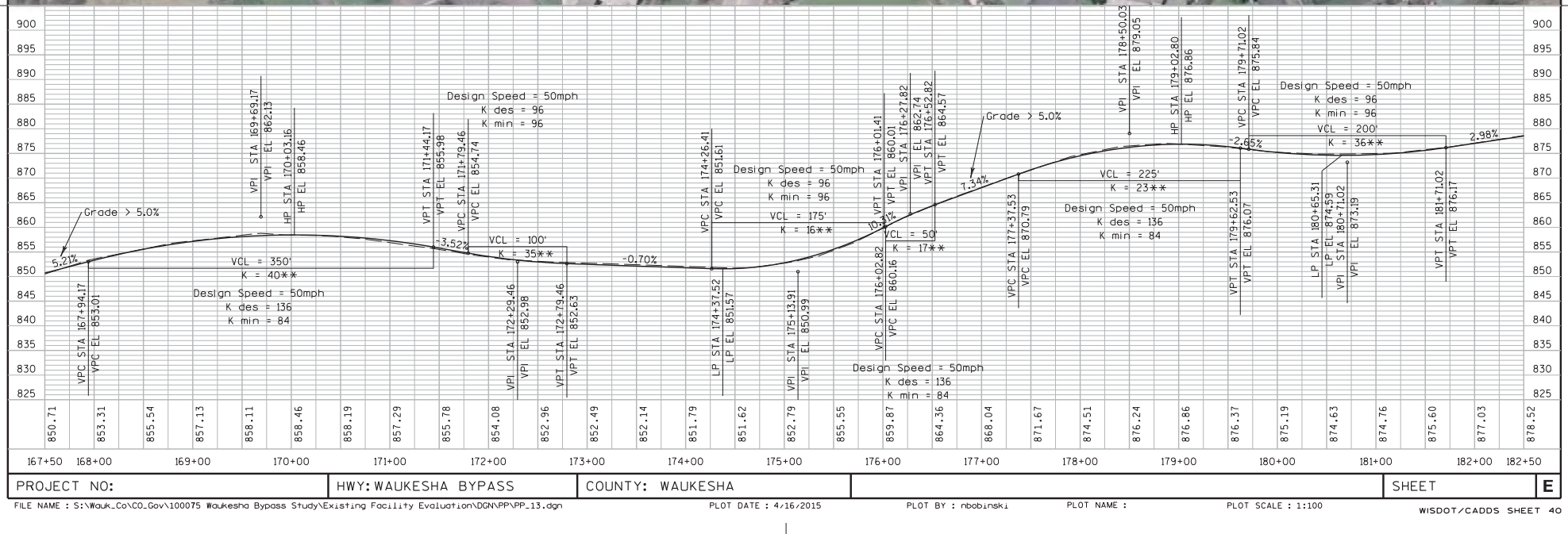

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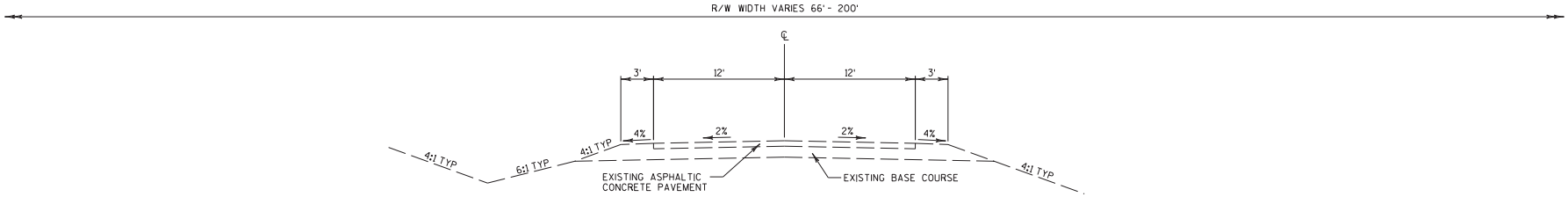
WISDOT/CADDS SHEET 40

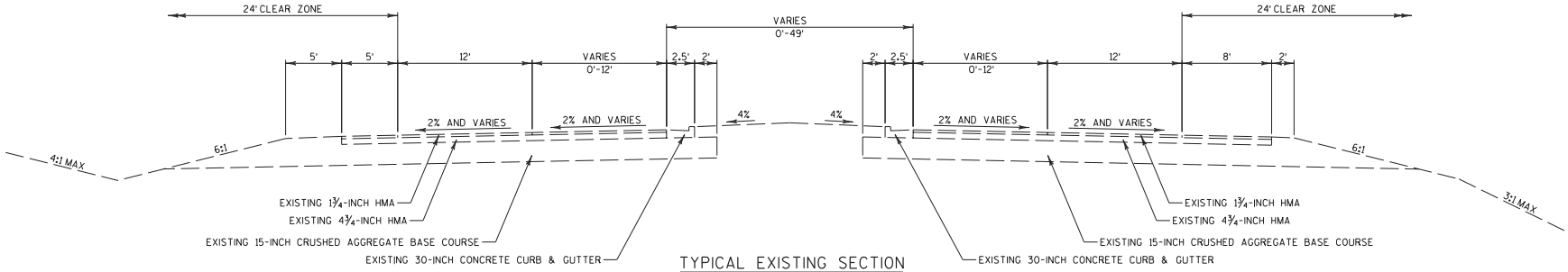
ATTACHMENT 2

Attachment 3 – Existing Typical Cross Sections



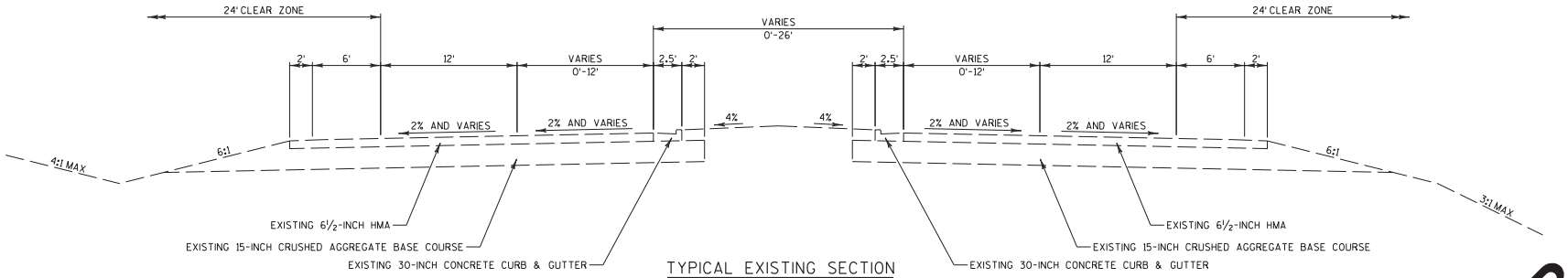
TYPICAL EXISTING SECTION

CTH TT/MERRIL HILLS RD
STA 173+00 TO STA 261+00



TYPICAL EXISTING SECTION

STH 59/LES PAUL PKWY (WAUKESHA BYPASS)
STA 100+37 TO STA 111+00
STH 59/GENESEE RD
STA 34+11 TO STA 50+00



TYPICAL EXISTING SECTION

CTH X/SAYLESVILLE RD
STA 7+50 TO STA 20+00
CTH X/GENESEE RD
STA 50+00 TO STA 61+80

DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TYPICAL EXISTING SECTIONS	SHEET	E

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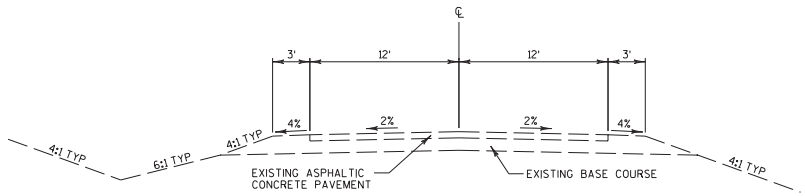
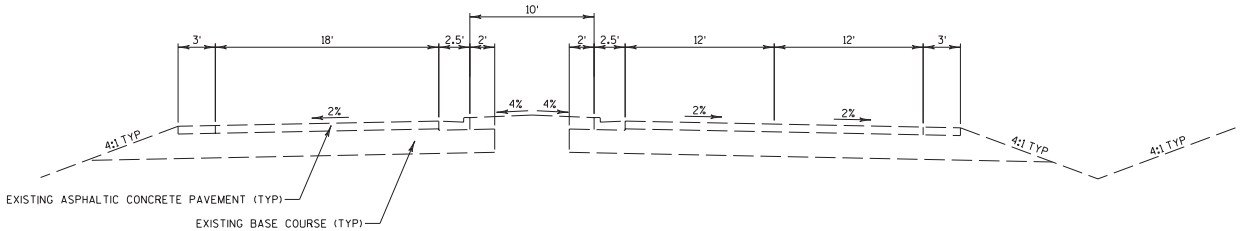
WISDOT/CADDS SHEET 42

ATTACHMENT 3



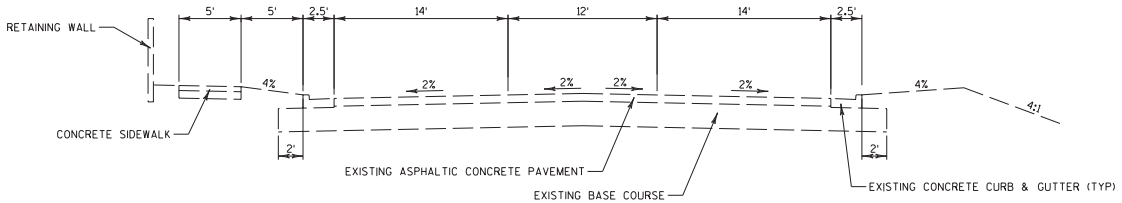
TYPICAL EXISTING SECTION

CTH D/SUNSET DR
STA 41+97 TO STA 63+00



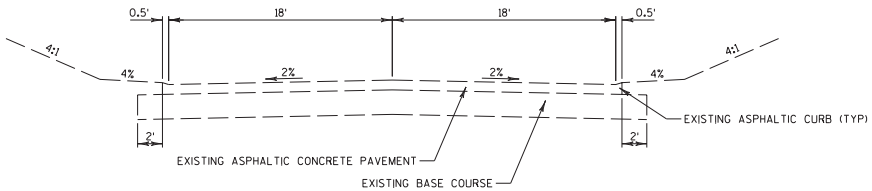
TYPICAL EXISTING SECTION

KAME TER
STA 48+35 TO STA 49+45



TYPICAL EXISTING SECTION

MADISON ST
STA 48+00 TO STA 50+50



TYPICAL EXISTING SECTION

MADISON ST
STA 50+50 TO STA 53+97

DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TYPICAL EXISTING SECTIONS	SHEET	E

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WISDOT/CADDS SHEET 42

ATTACHMENT 3

Attachment 4 – List of Encroachments

Encroachment Report
Project ID 2788-00-01
Project Name Waukesha Bypass

Encroachment No.	Roadway/Station	East/West North/South	Encroachment Type	Property Address	Owner and Mailing Address	Tax Key Number	Existing R/W from R/L	Encroachment Distance to R/L	Within Grading/ Construction Limits	Anticipate R/W Purchase from Owner	Encroachment Size	Proposed Action
39	Bypass 221+35	West	Rocks/Kame Terraces Subdivision Rock Sign	Kame Terrace	Kame Terrace	N/A, in sideroad median	N/A, in sideroad median	118.2' (to sign)	Yes	No	Sign-6.25' wide 5.67' tall Rocks - Vary	Remove
43	STH 59 104+00	South	Lightpole	2400 STH 59	? St. John Neumann Congregation 2400 STH 59 Waukesha, WI 53189	WAKC1364999001	TBD	93'	No	No	0.833' diameter	TBD Revocable Permit?
45	Madison Street 49+00 to 49+25	North	Retaining Wall	123 Jersey Cir	? Jon Sodemann & Karen Klein-Sodemann 123 Jersey Cir Waukesha, WI 53188	WAKC1317063	TBD	37'	Yes	Yes	TBD wide 19' long TBD tall	Remove

ATTACHMENT 4

Attachment 5 – Traffic Forecast Report

No Build Forecast

WisDOT TRAFFIC FORECAST REPORT

PROJECT ID(S):	2788-01-00
ROUTE(S):	CTH TT
Region/COUNTY(IES):	SE / Waukesha
LOCATION:	West Waukesha Bypass
COMPLETED:	24 November, 2014

Developed by: Brent DesRoches
Phone: (262) 548-5611
FAX #: (262) 548-4425
E-Mail: brent.desroches@dot.wi.gov

Design Values (%)

Site(s)	672707		
Routes(s)	CTH TT		
Volume(s)	18300		
Site Growth %	0.56%		
K250	10.1		
K100	10.8		
K30	11.3		
P	12.6		
D(Dsgn. Hr.)	59/41		
T(DHV)	6.7		
T(PHV)	5.9		

Site IDs are Colored, **Bolded**, and Underlined

-000-	2013 Count	(000)	2017 AADT
000	2012 Count	[000]	2027 AADT
+000+	2009 Count	000	2037 AADT
		/000/	XXXX AADT

Trucks	672707		
AADTT	1260		
2D	2.2		
3AX	0.6		
2S1+2S2	4.5		
3-S2	0.5		
DBL-BTM	0.0		
Total %	7.8%		

NOTES ON THE FORECAST:

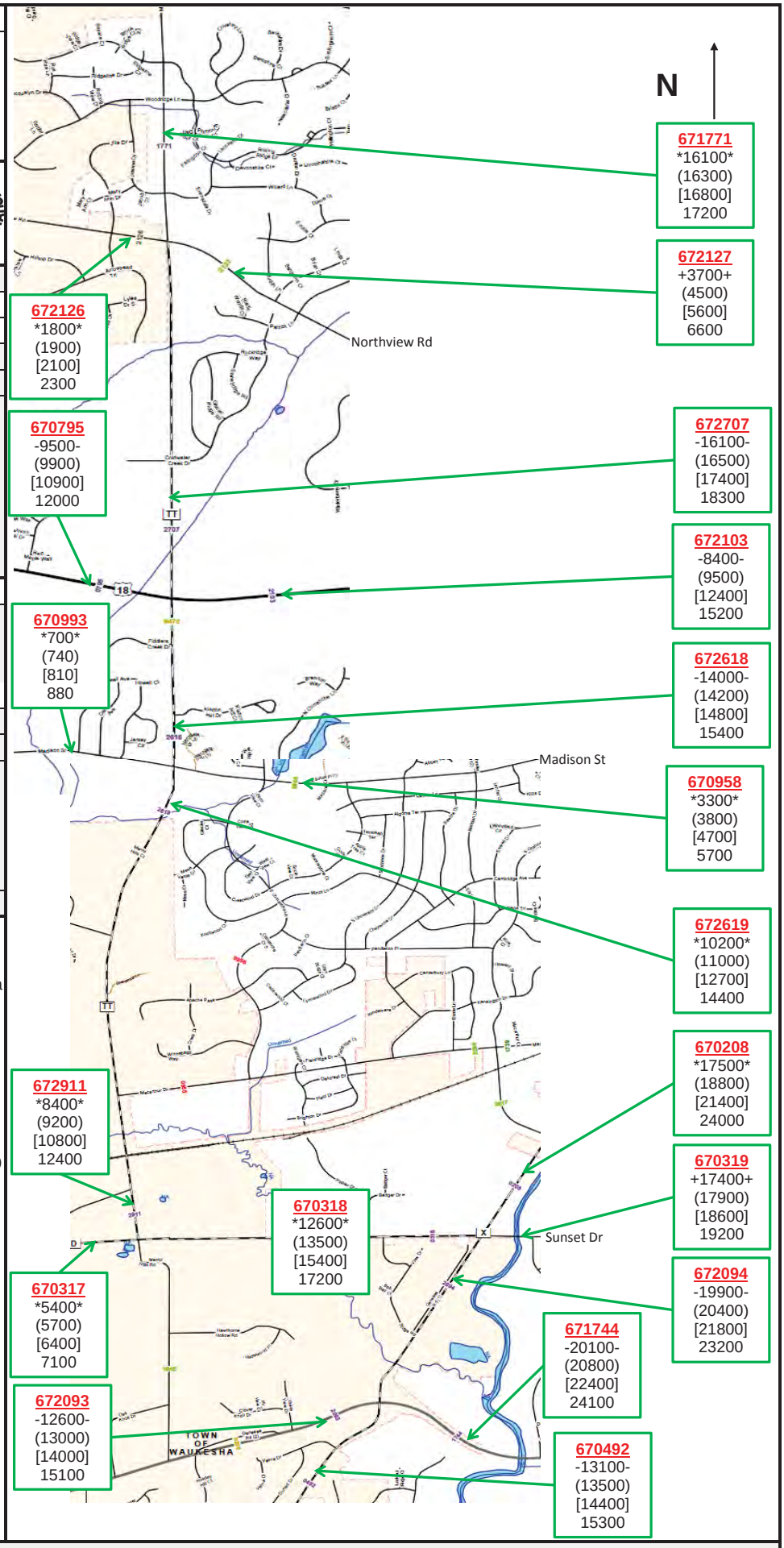
1. This projection assumes no major new traffic generators will be added to the roadway network and the West Waukesha Bypass will not be built. This is the no-build forecast and is based on SEWRPC.

2. Truck classification percentages were taken from a 2010 consultant classification tube counts as referenced in the 2010 WisDOT forecast.

3. CTH TT is a Factor Group II (Urban-Other) highway (indicating low to moderate fluctuation in traffic from a seasonal perspective). It is functionally classified as a Urban Principal Arterial (14) for count purposes.

4. The SEWRPC forecast is the basis of the volumes with the Traffic Analysis Forecasting Information System output and history regression used as comparison tools. Adjustments were made as needed.

5. 2013 volumes represent the 24 hr expanded volumes from turn movement counts.



Build Forecast

WisDOT TRAFFIC FORECAST REPORT

PROJECT ID(S):	2788-01-00
ROUTE(S):	CTH TT
Region/COUNTY(IES):	SE / Waukesha
LOCATION:	West Waukesha Bypass
COMPLETED:	24 November, 2014

Developed by: Brent DesRoches
Phone: (262) 548-5611
FAX #: (262) 548-4425
E-Mail: brent.desroches@dot.wi.gov

Design Values (%)

Site(s)	671771		
Routes(s)	CTH TT		
Volume(s)	26800		
Site Growth %	2.65%		
K250	10.0		
K100	10.7		
K30	11.2		
P	12.4		
D(Dsgn. Hr.)	59/41		
T(DHV)	7.1		
T(PHV)	6.2		

Site IDs are Colored, **Bolded**, and Underlined

-000-	2013 Count	(000)	2017 AADT
000	2012 Count	[000]	2027 AADT
+000+	2009 Count	000	2037 AADT
		/000/	XXXX AADT

Trucks	671771		
AADTT	2220		
2D	2.2		
3AX	0.7		
2S1+2S2	4.6		
3-S2	0.8		
DBL-BTM	0.0		
Total %	8.3%		

NOTES ON THE FORECAST:

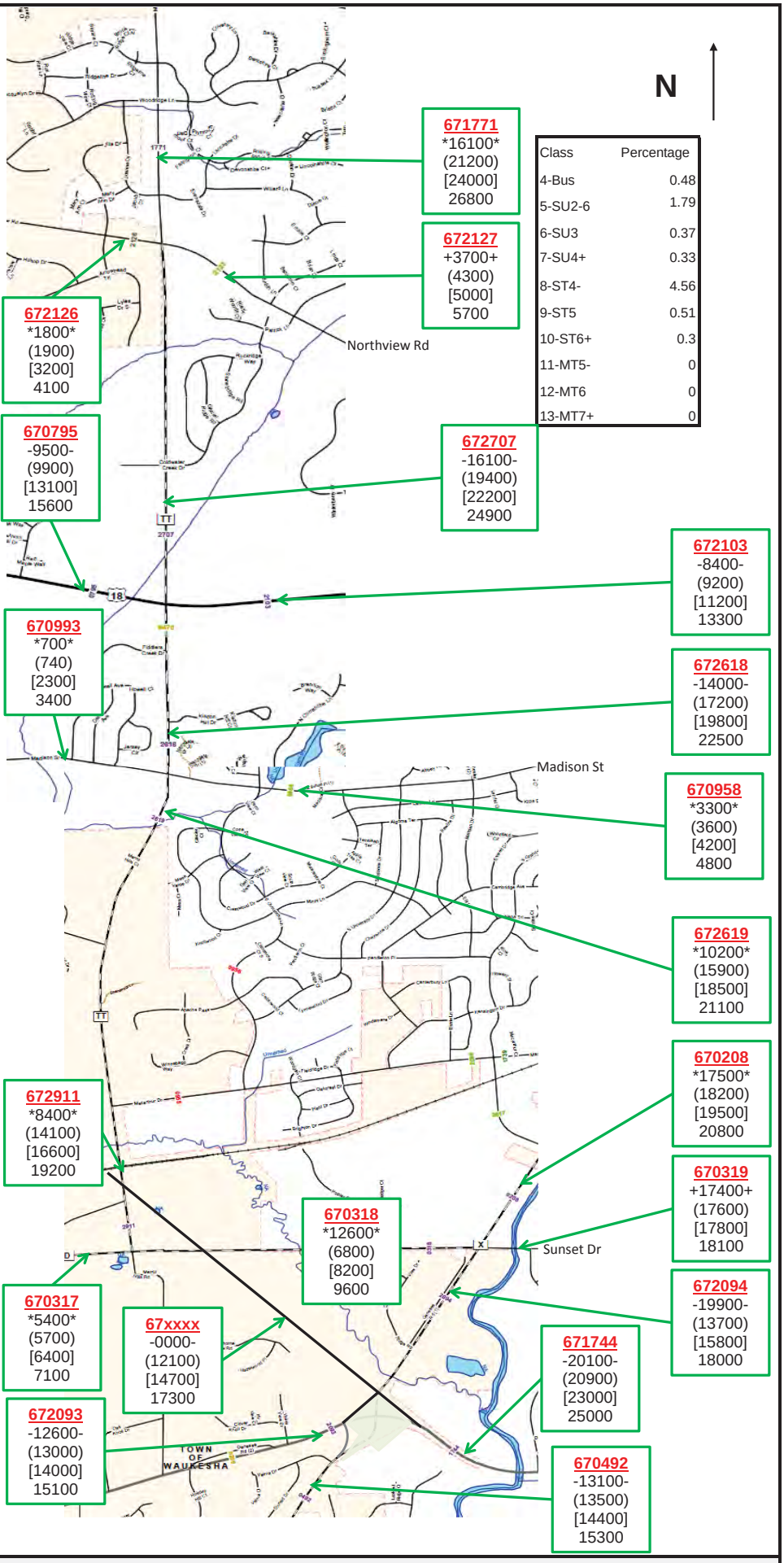
1. This projection assumes the residential development West of CTH TT will be added to the roadway network and the West Waukesha Bypass will be built. This is the build forecast.

2. Truck classification percentages were taken from a 2010 consultant classification tube counts on CTH TT North of Joanne Dr.

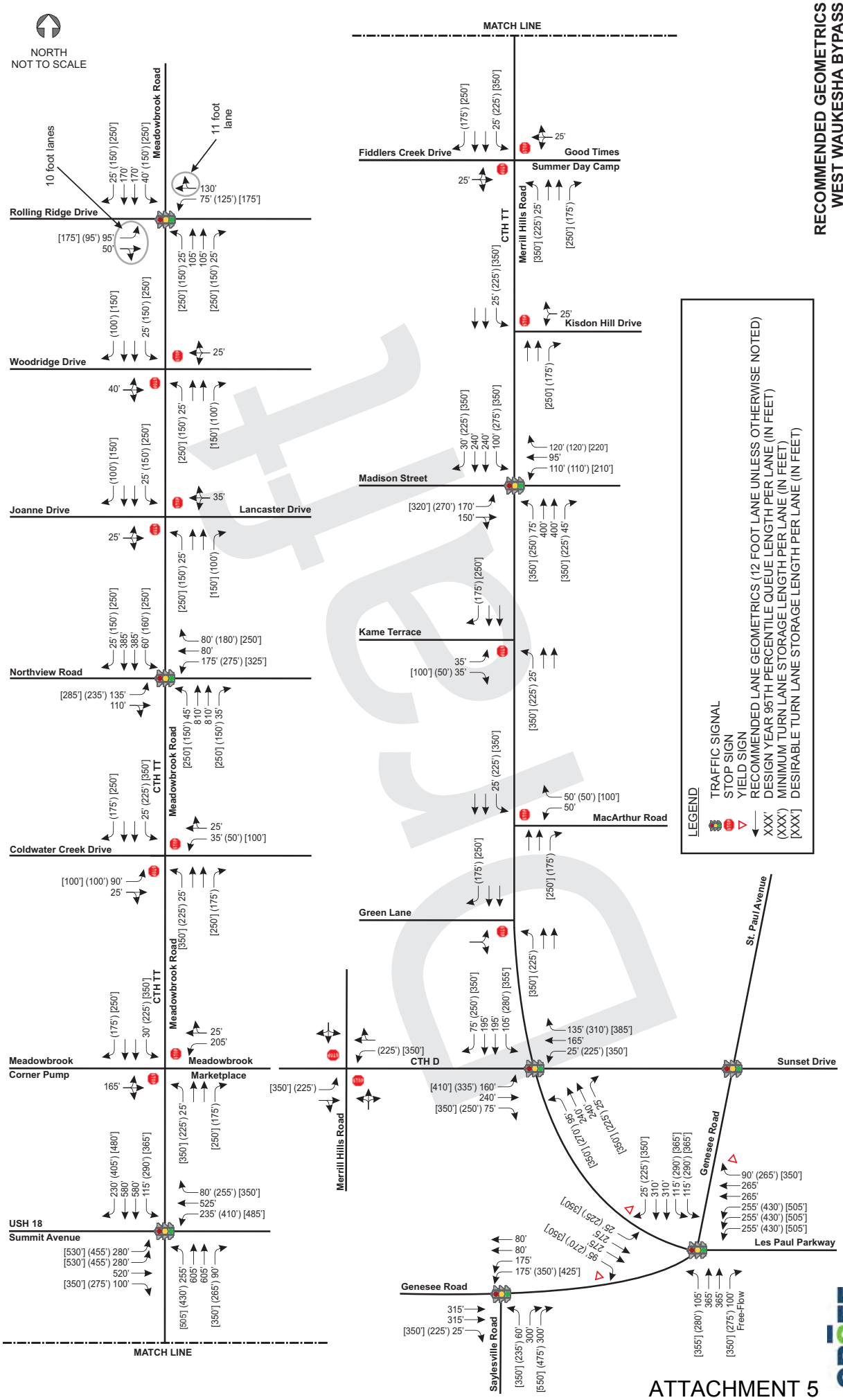
3. CTH TT is a Factor Group II (Urban-Other) highway (indicating low to moderate fluctuation in traffic from a seasonal perspective). It is functionally classified as a Urban Principal Arterial (14) for count purposes.

4. The Traffic Analysis Forecasting Information System output and history regression were used as a comparison tool to check against the SEWRPC forecast. Adjustments were made as needed.

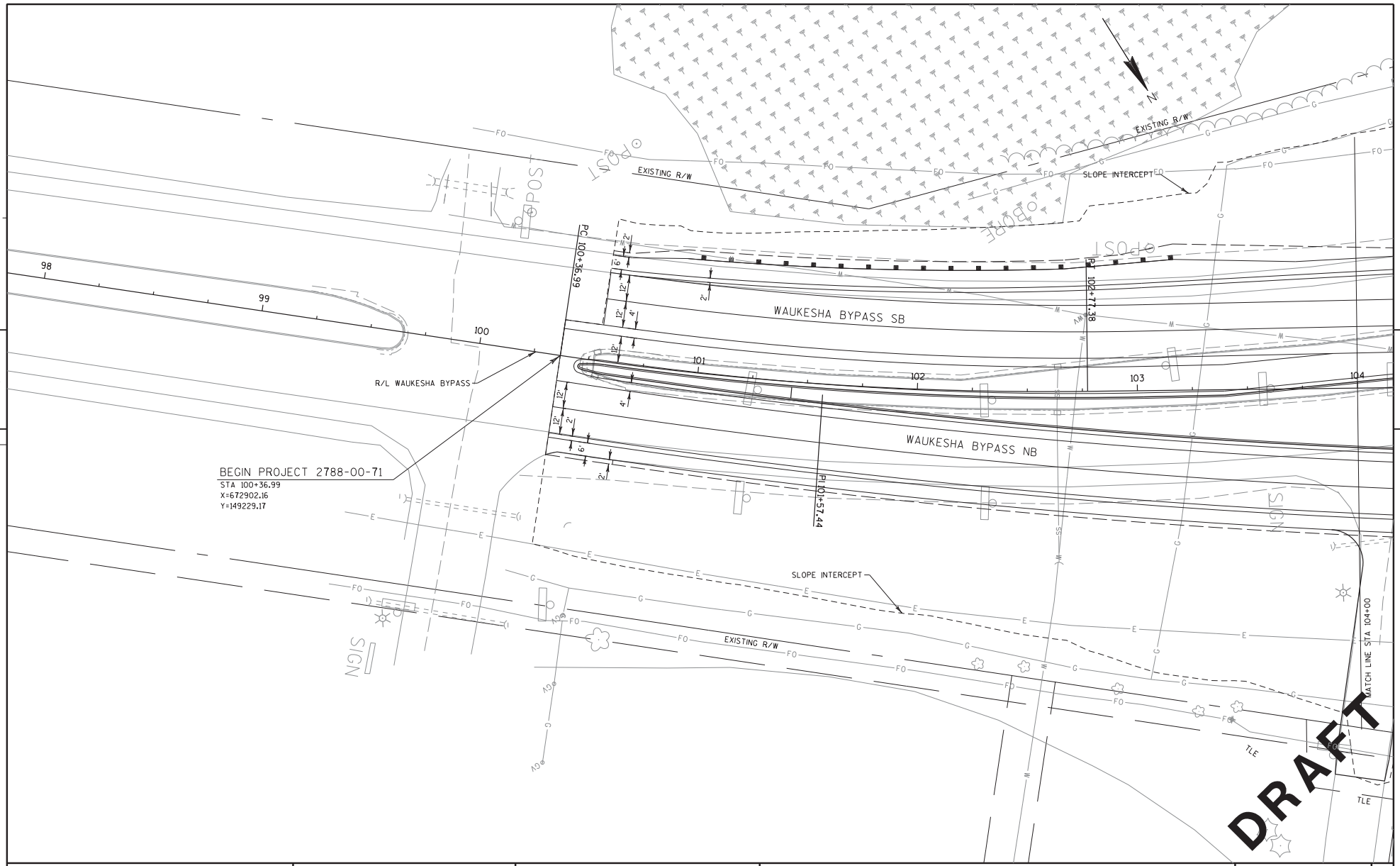
5. 2013 volumes represent the 24 hr expanded volumes from turn movement counts.



Class	Percentage
4-Bus	0.48
5-SU2-6	1.79
6-SU3	0.37
7-SU4+	0.33
8-ST4-	4.56
9-ST5	0.51
10-ST6+	0.3
11-MT5-	0
12-MT6	0
13-MT7+	0


NORTH
NOT TO SCALE
MATCH LINE
RECOMMENDED GEOMETRICS
WEST WAUKESHA BYPASS
PROJECT I.D. 2788-00-01/02 & 2788-02-00
WAUKESHA COUNTY, WISCONSIN
LEGEND
TRAFFIC SIGNAL
STOP SIGN
YIELD SIGN
RECOMMENDED LANE GEOMETRICS (12 FOOT LANE UNLESS OTHERWISE NOTED)
XXX' DESIGN YEAR 95TH PERCENTILE QUEUE LENGTH PER LANE (IN FEET)
(XXX') MINIMUM TURN LANE STORAGE LENGTH PER LANE (IN FEET)
[XXX'] DESIRABLE TURN LANE STORAGE LENGTH PER LANE (IN FEET)
Rolling Ridge Drive
Meadowbrook Road
Woodridge Drive
Joanne Drive
Lancaster Drive
Northview Road
Coldwater Creek Drive
Meadowbrook Corner Pump
Marketplace
USH 18
Summit Avenue
Fiddlers Creek Drive
Good Times Summer Day Camp
Merrill Hills Road
CTH TT
Kisdon Hill Drive
Madison Street
Kame Terrace
MacArthur Road
Green Lane
CTH D
Merrill Hills Road
St. Paul Avenue
Sunset Drive
Genesee Road
Les Paul Parkway
Saylesville Road
ATTACHMENT 5
L:\Jobs2010\20100001\Project Information\Traffic\Analysis\150518 Analysis - DSR\150518 Draft Exhibit.cdr

Attachment 6 – Preliminary Plan Sheets



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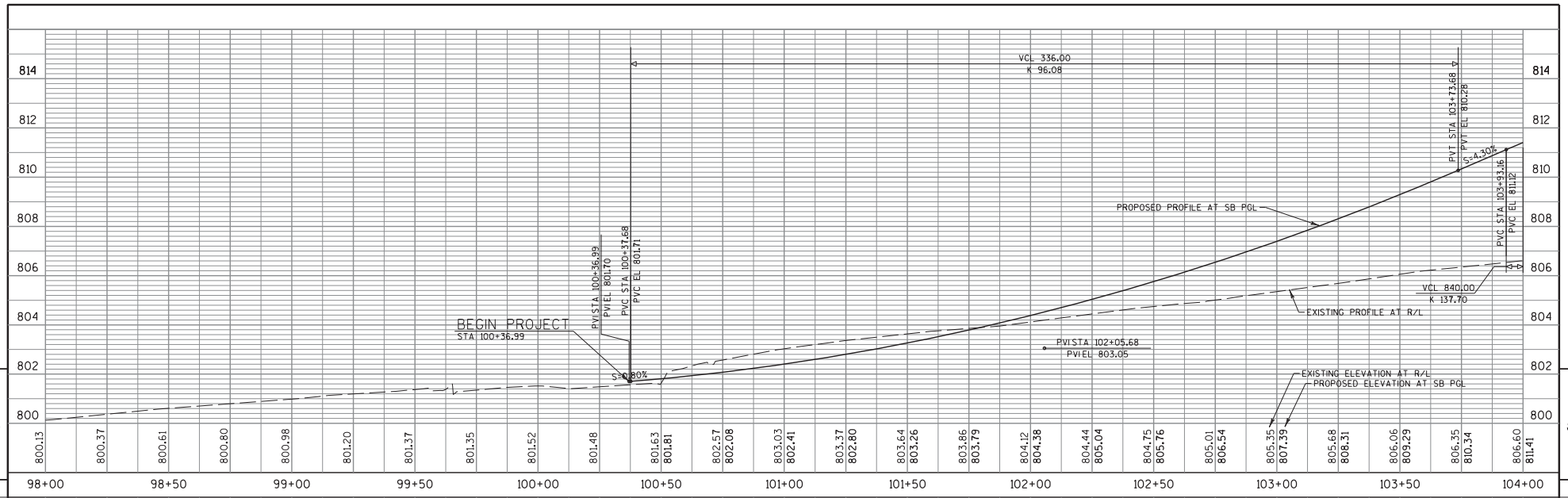
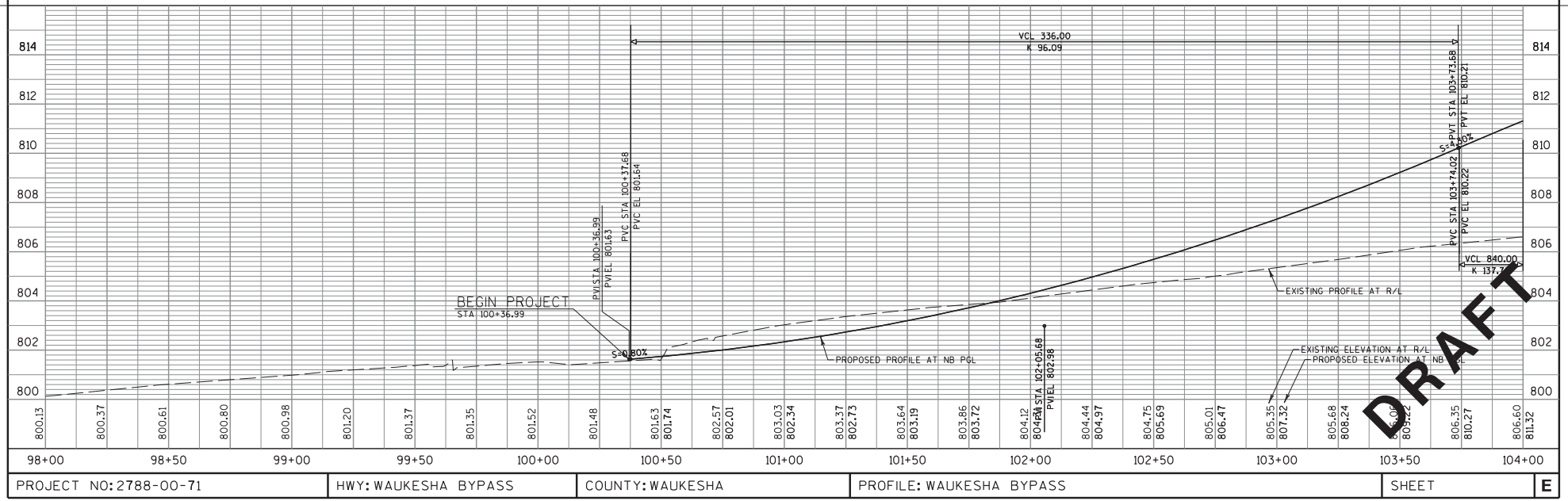
ATTACHMENT 6





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WISDOT/CADDS SHEET 30

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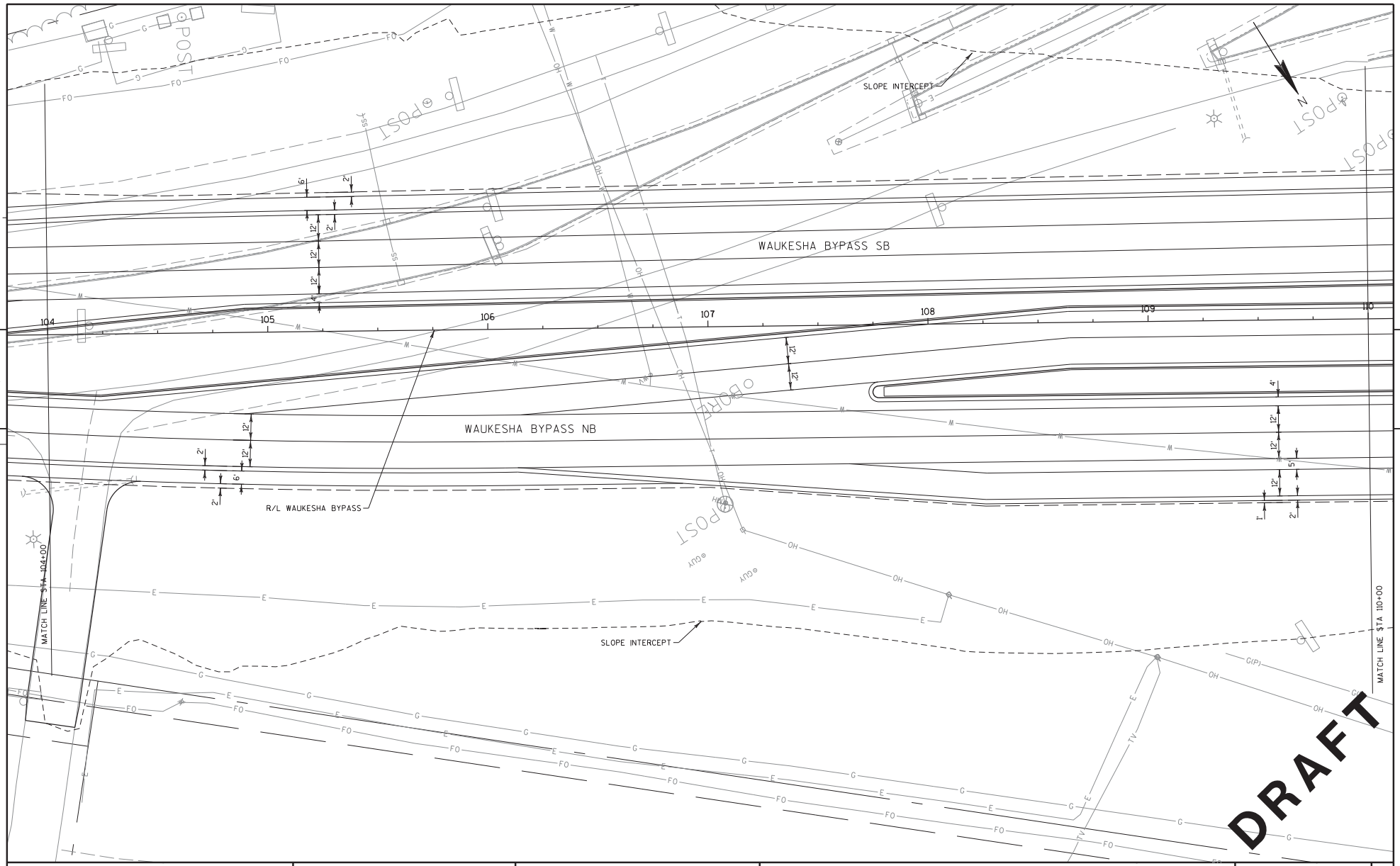

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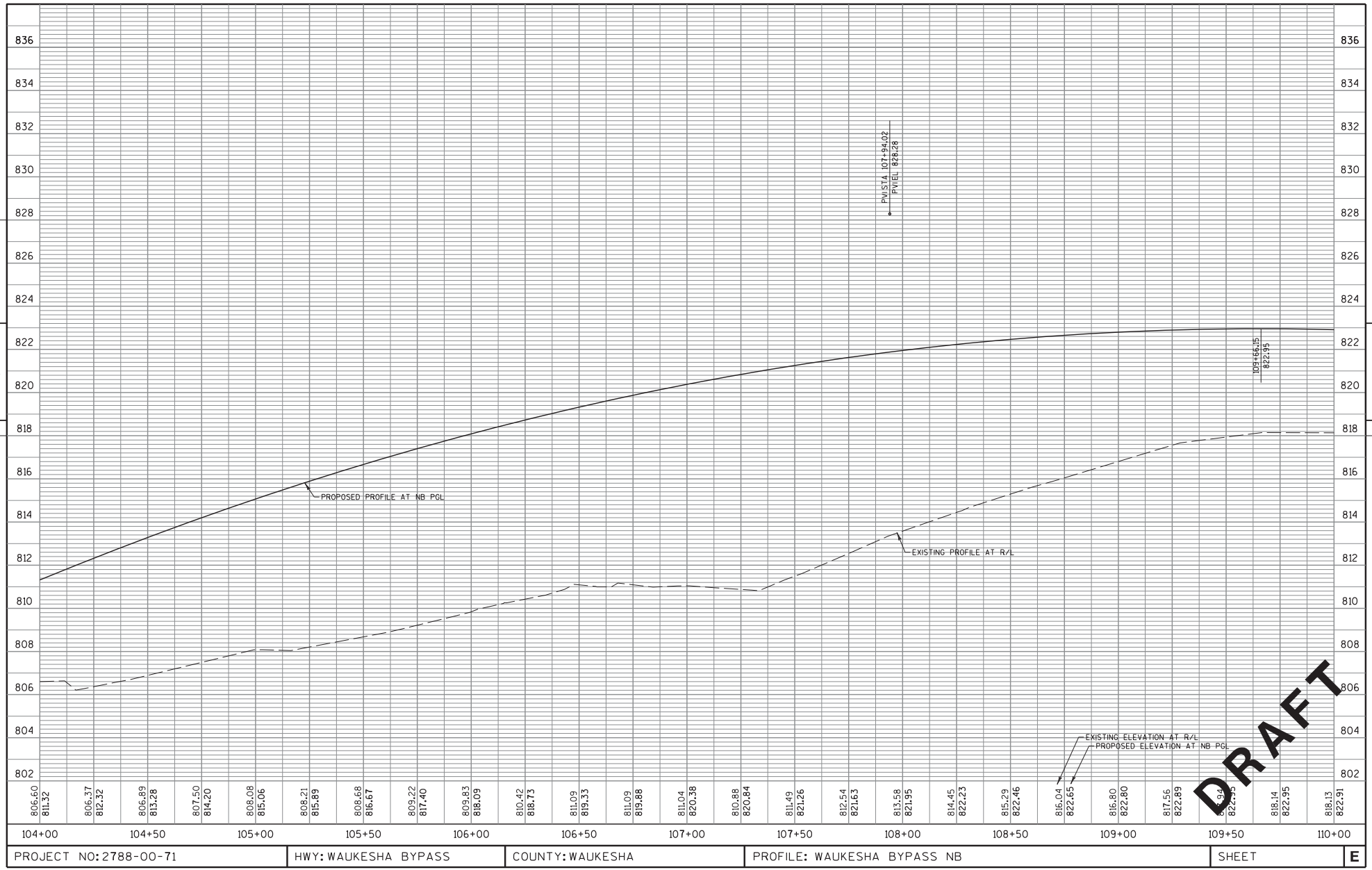

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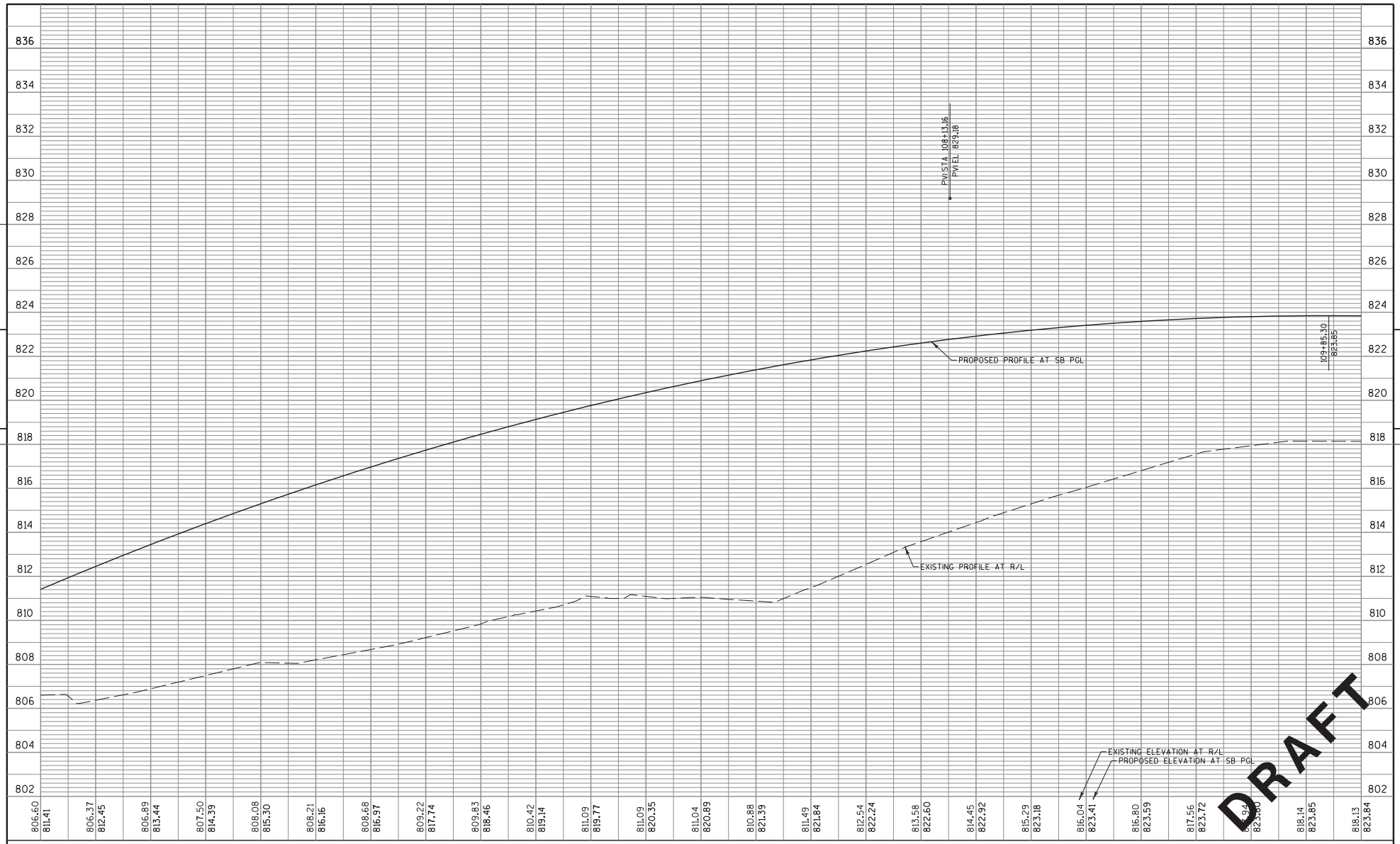

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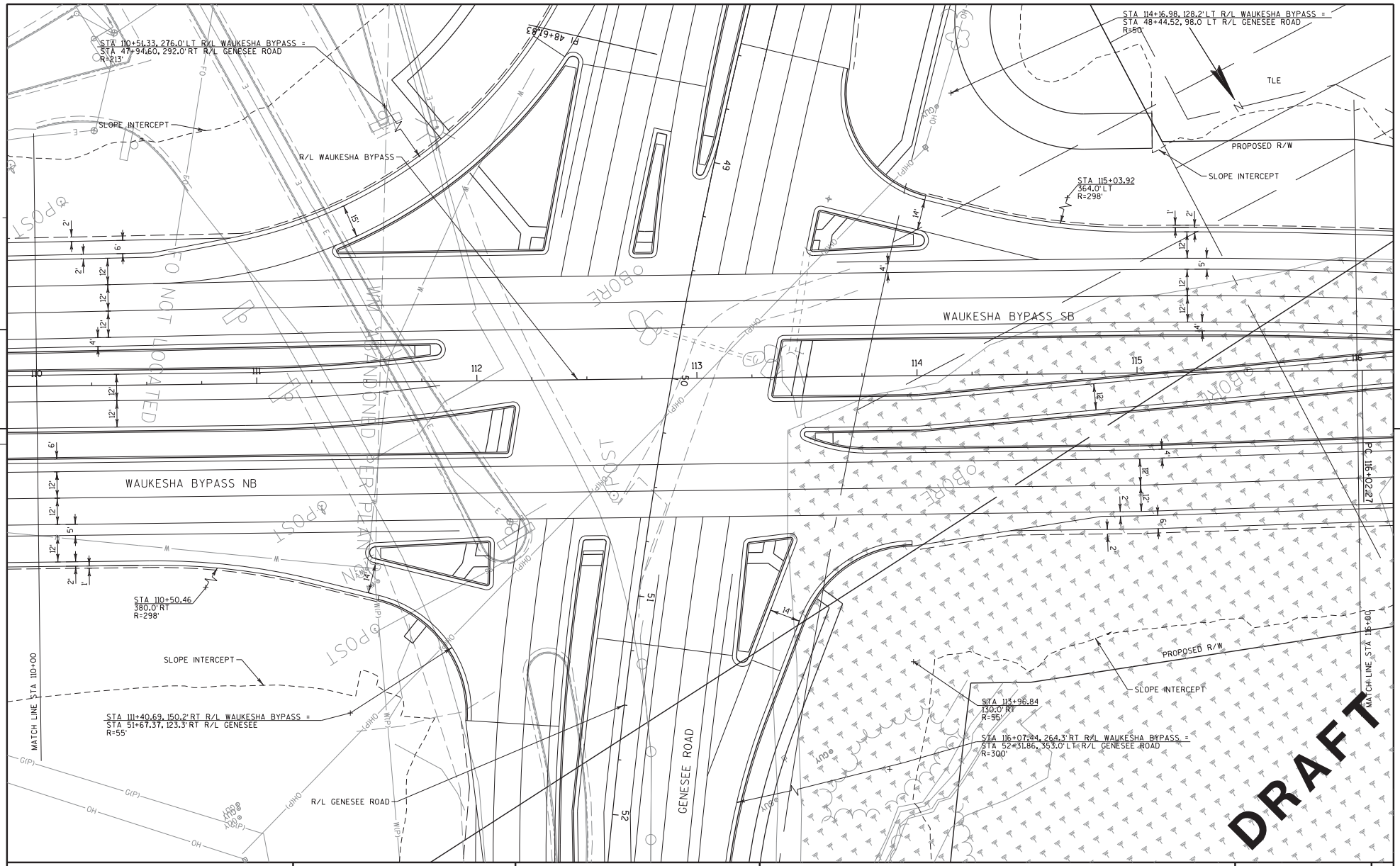

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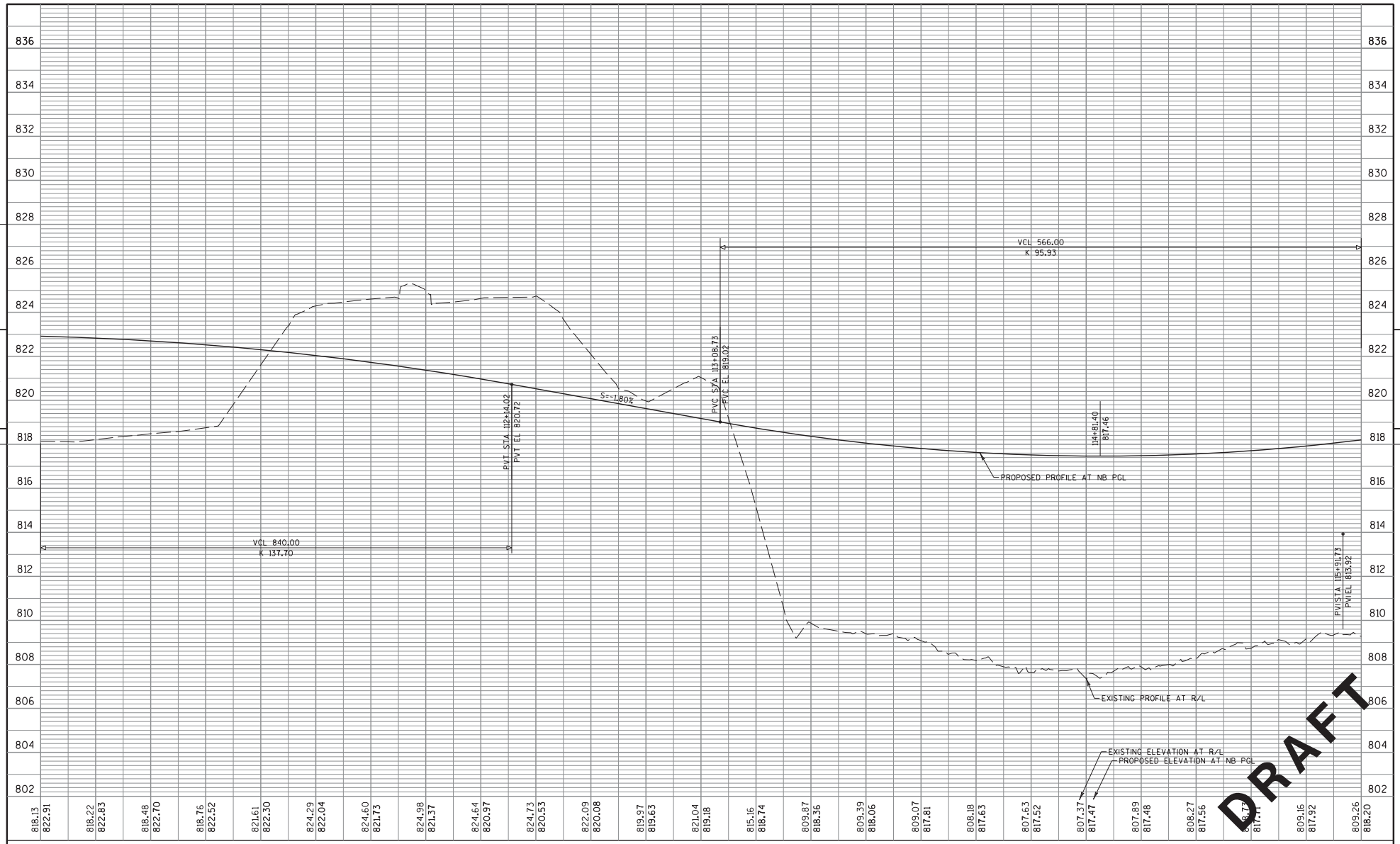

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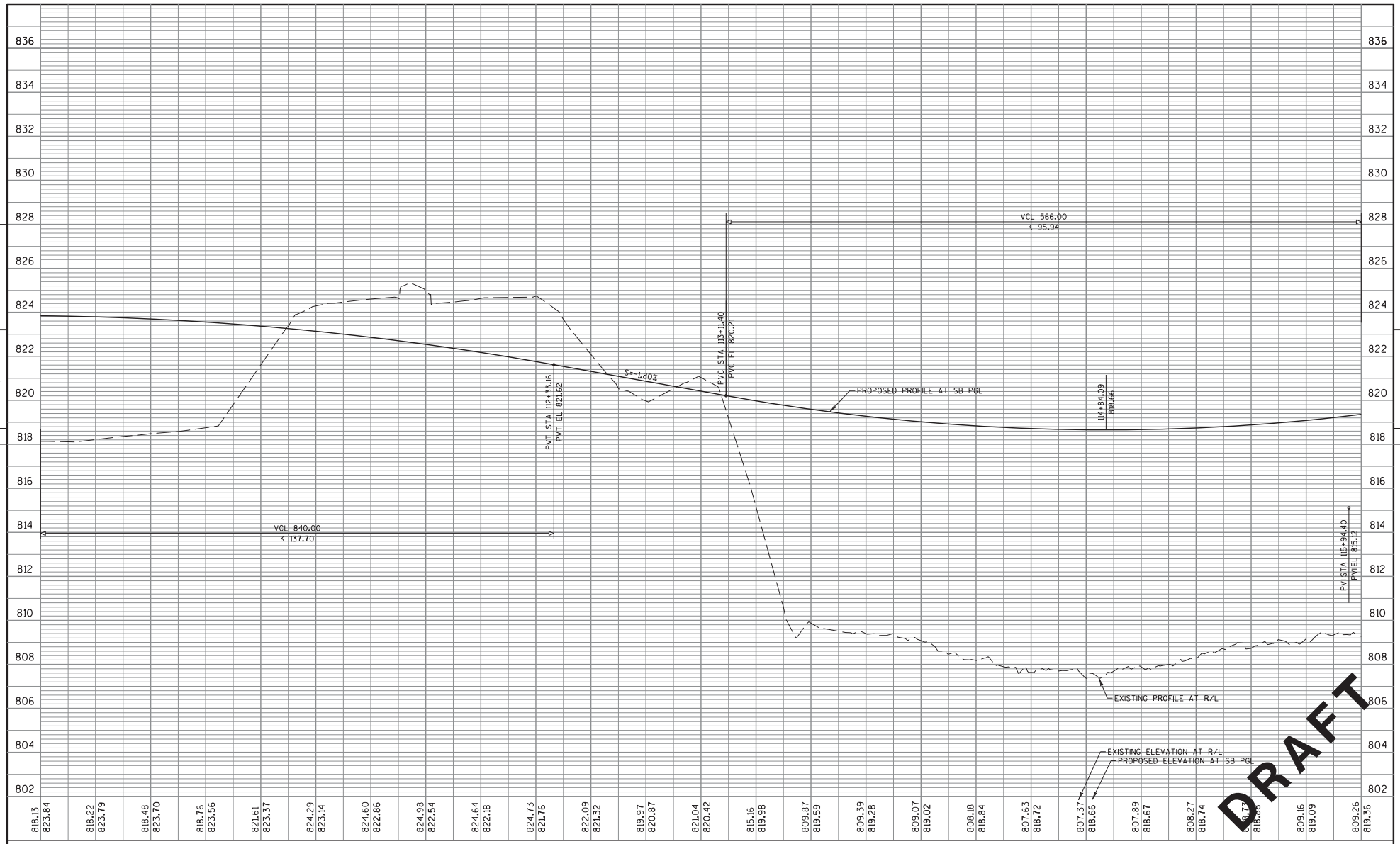

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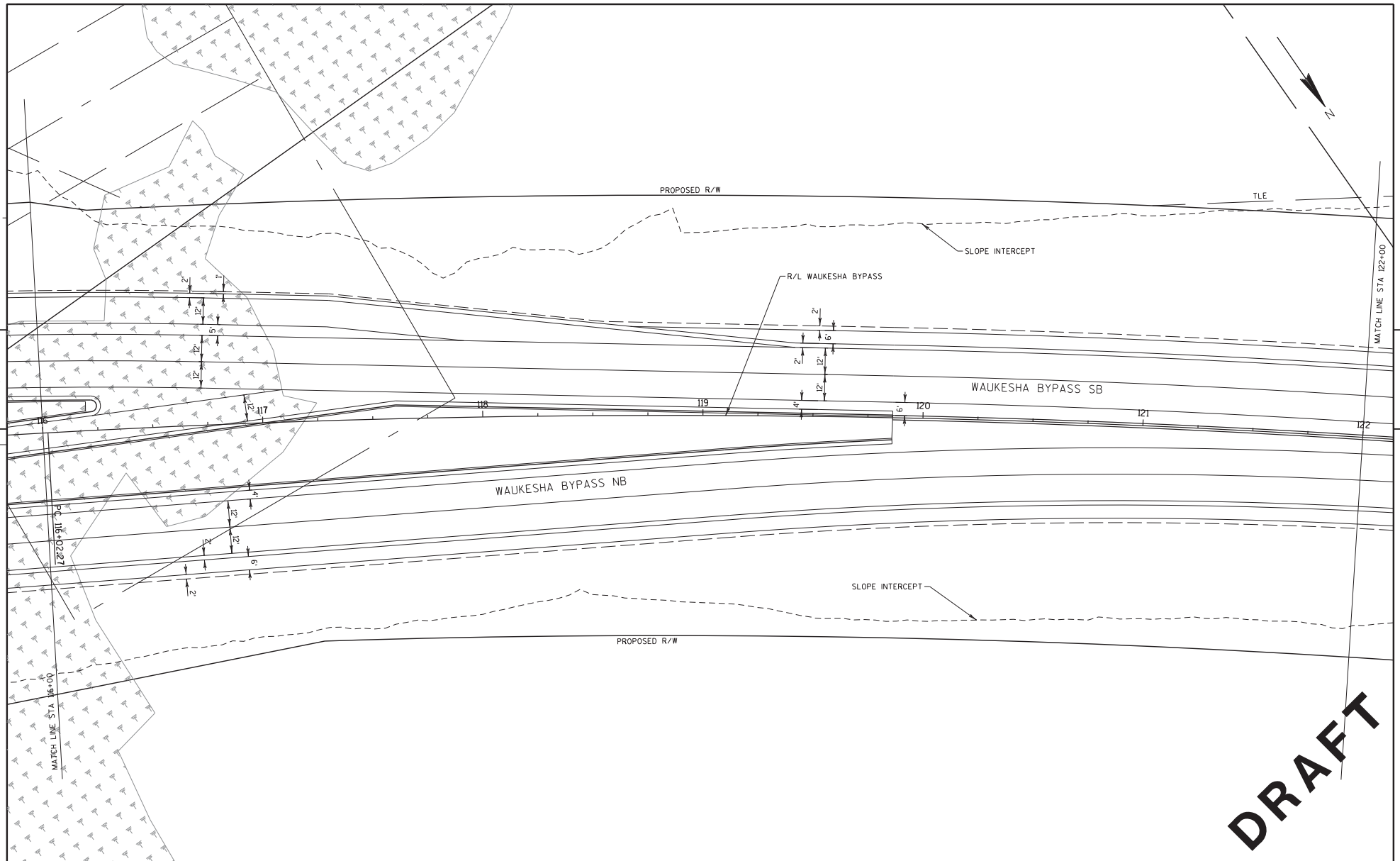

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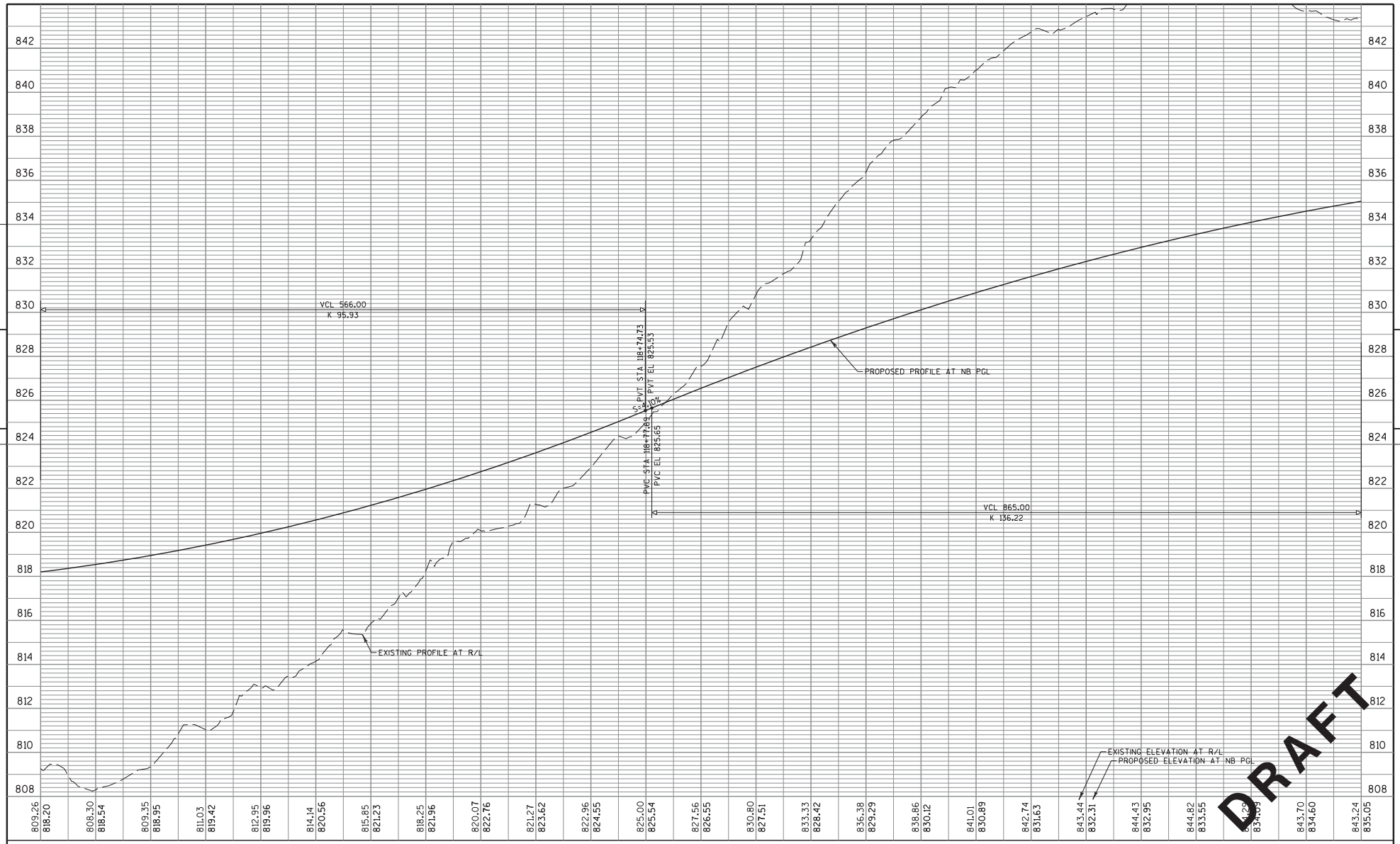

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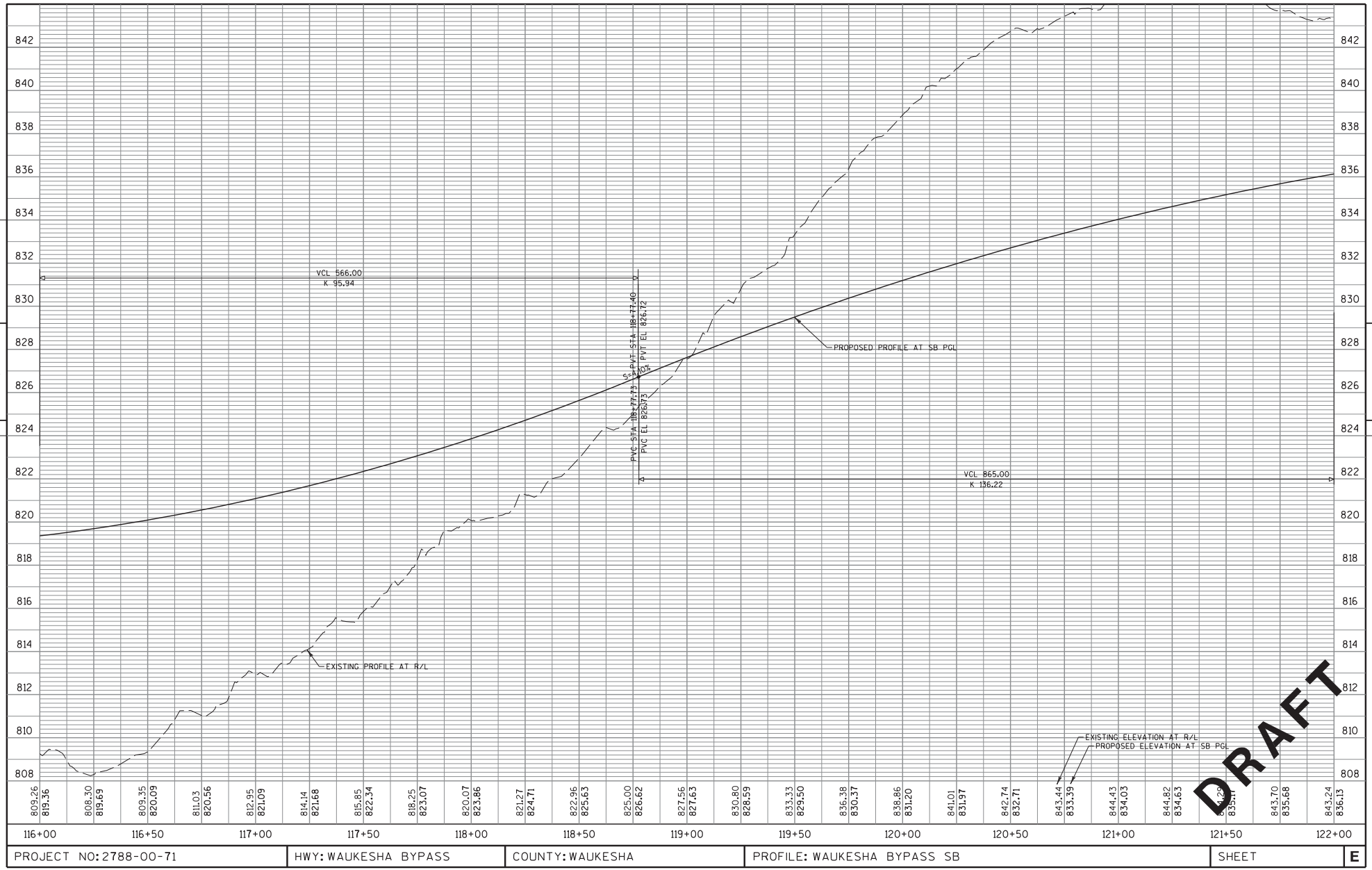

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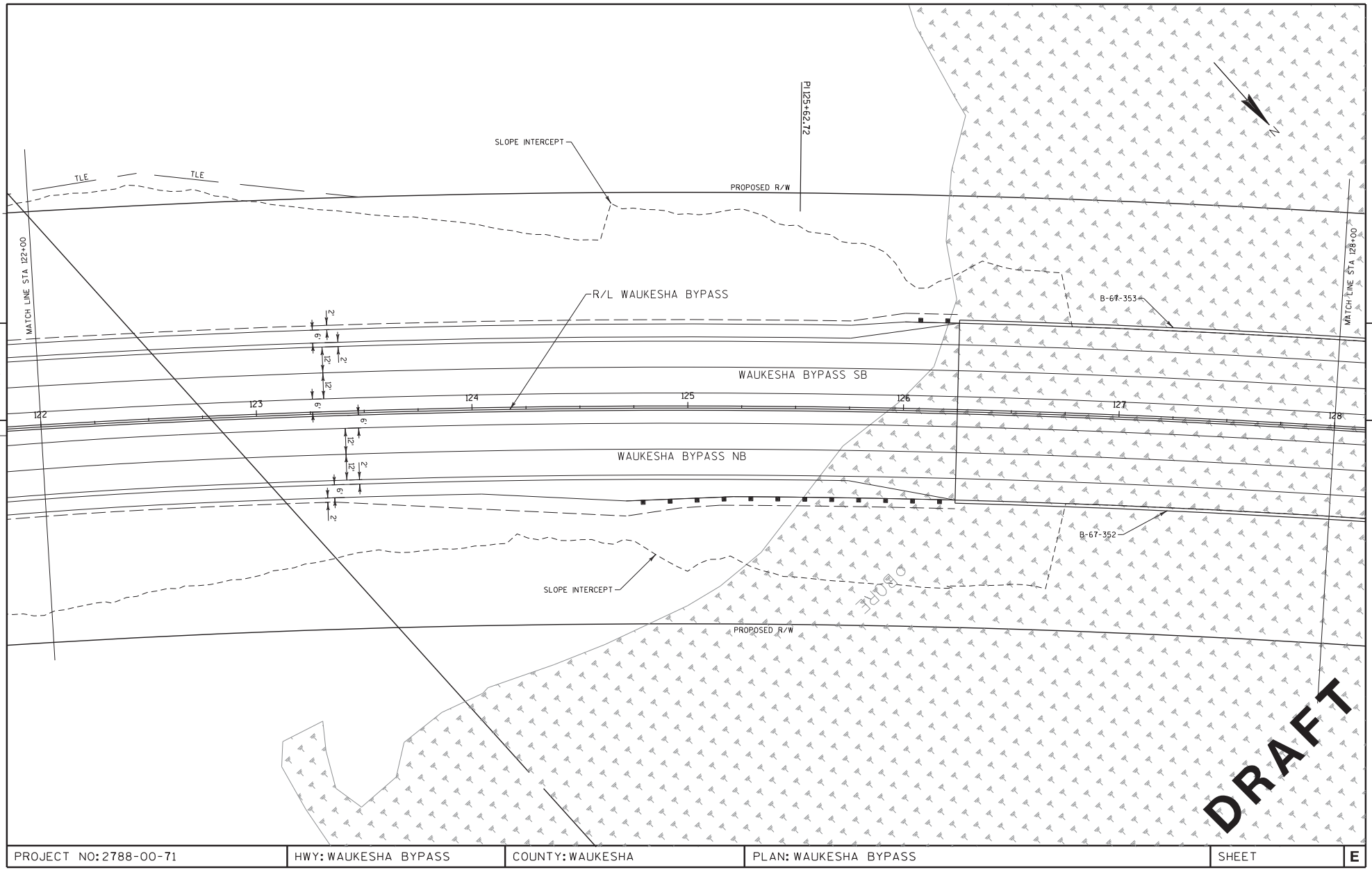

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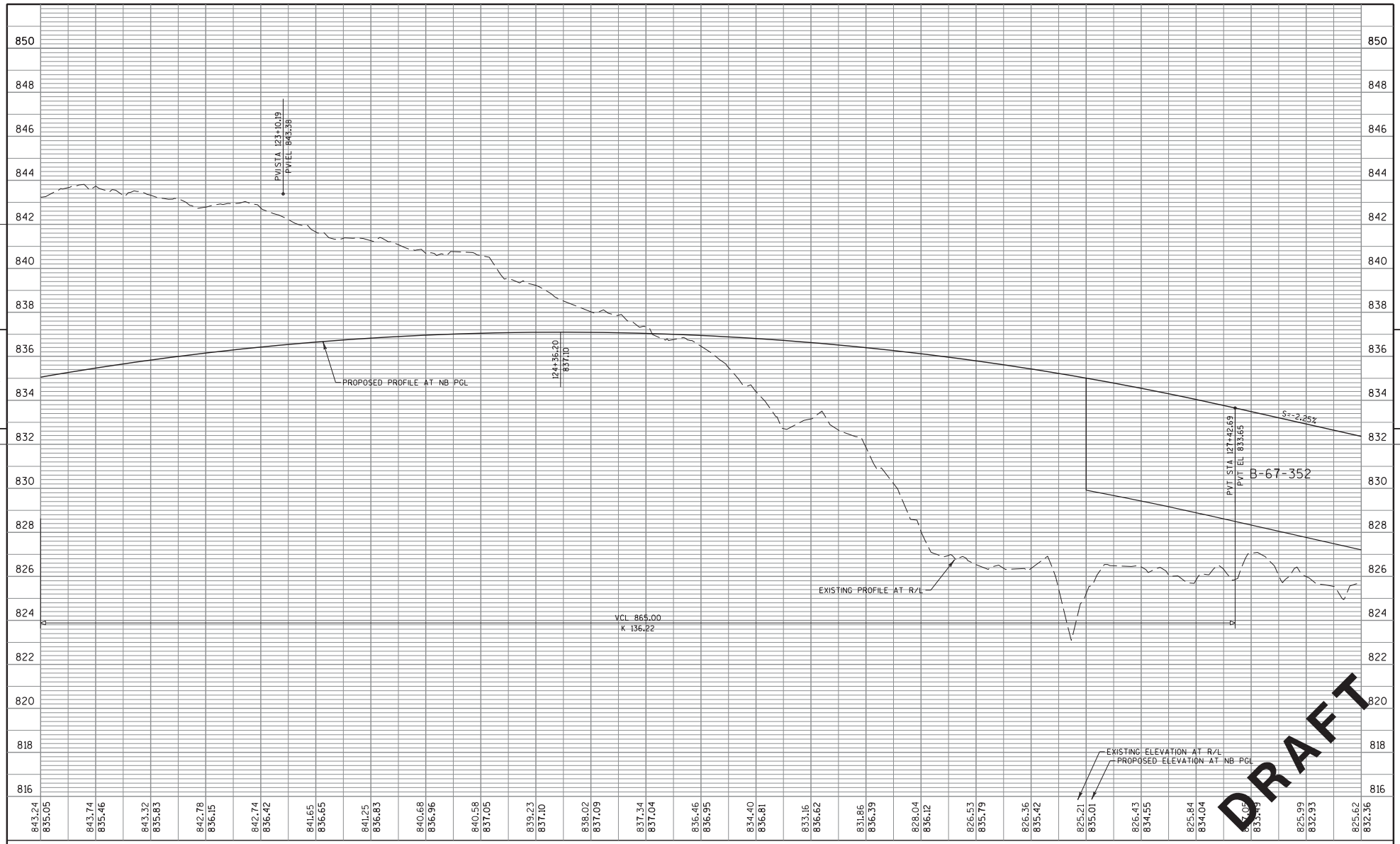

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WISDOT/CADDS SHEET 40

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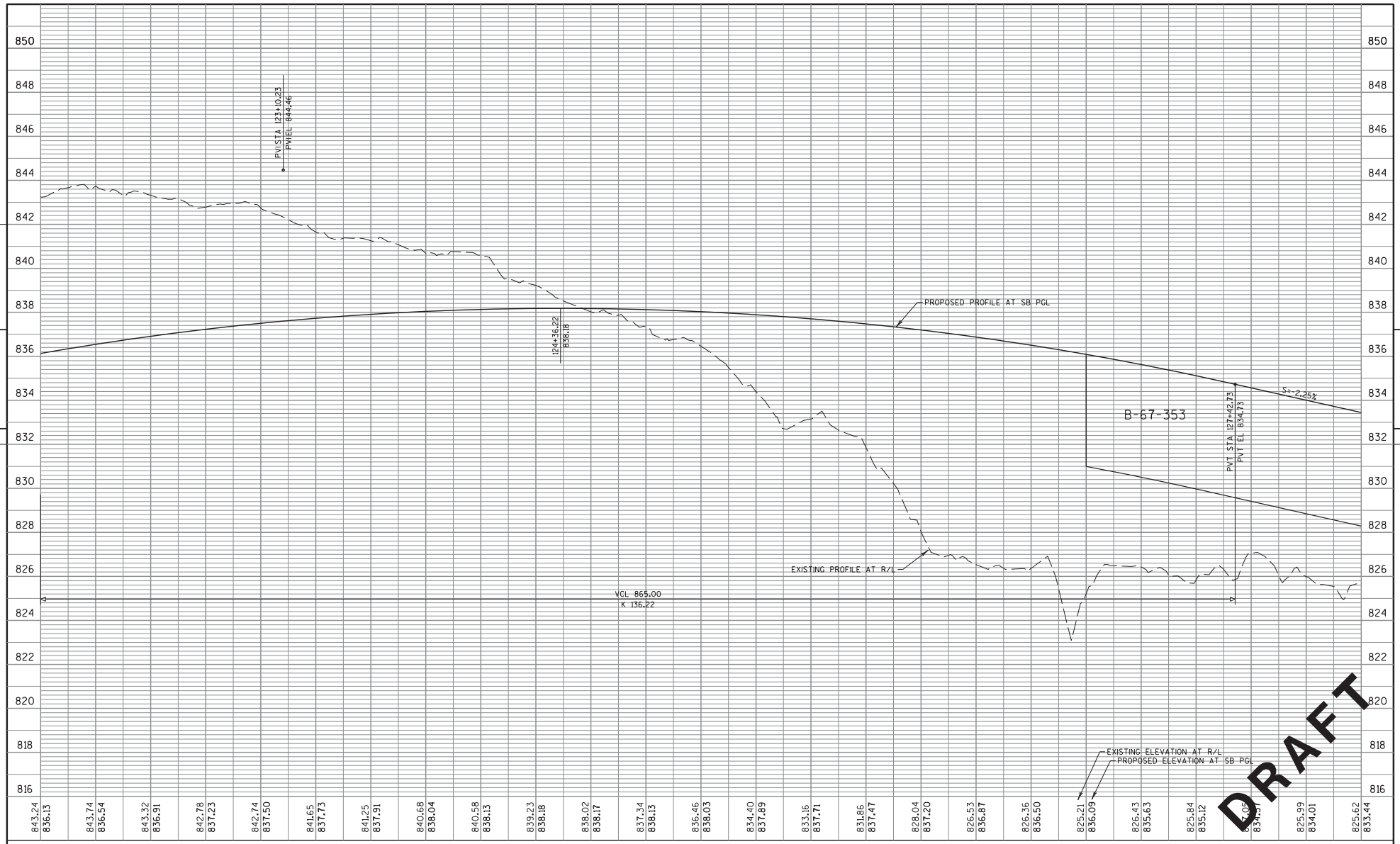

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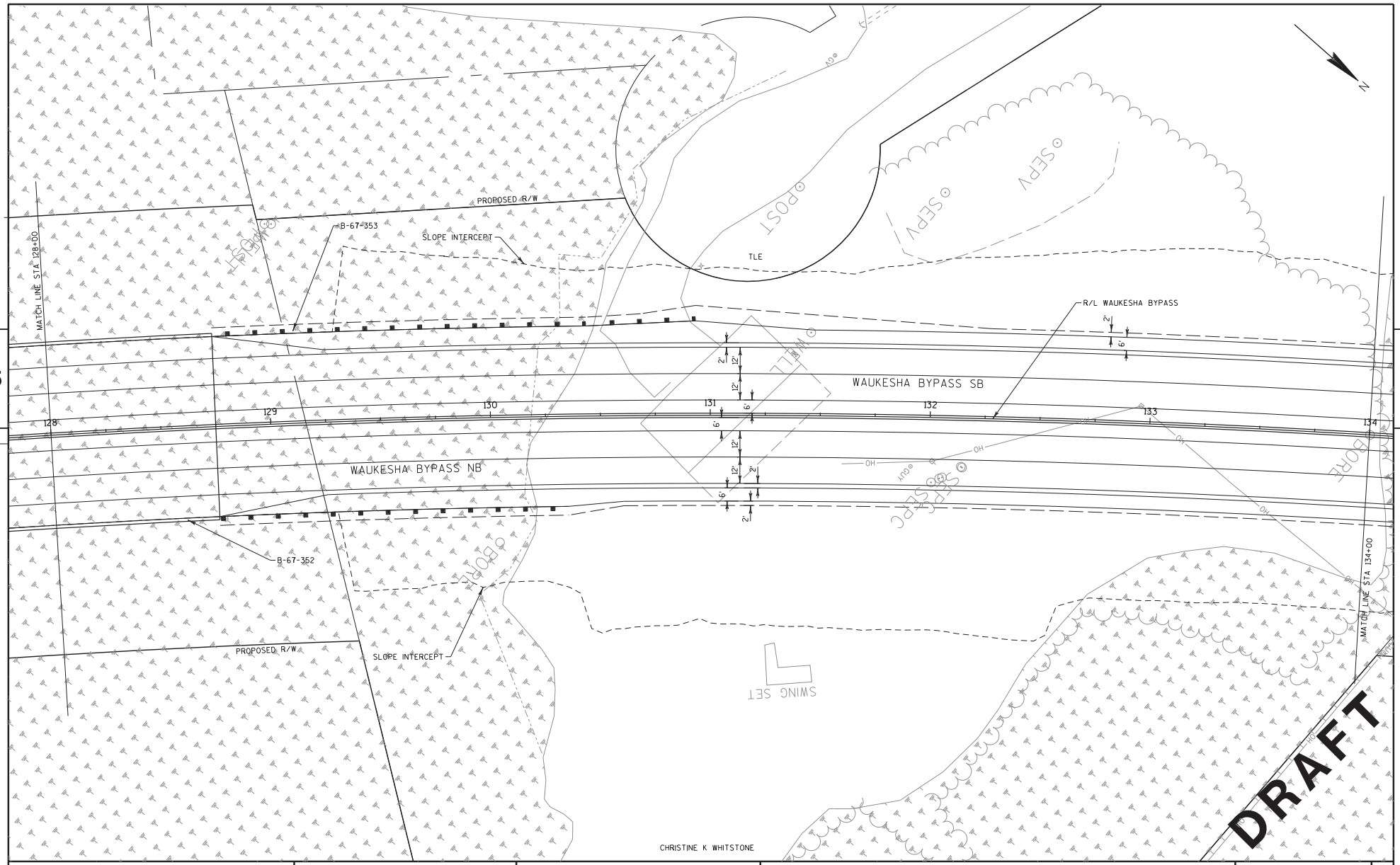

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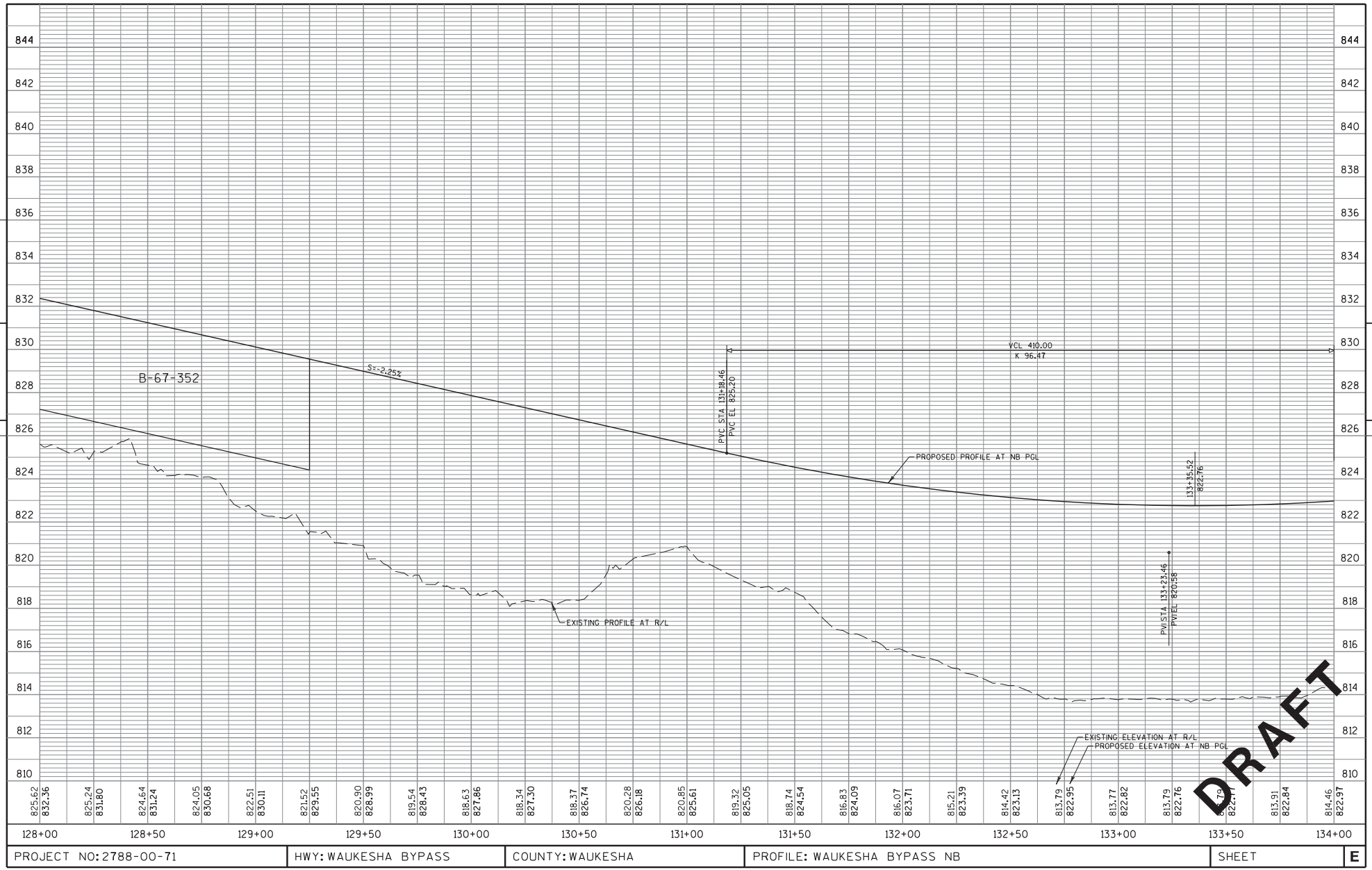
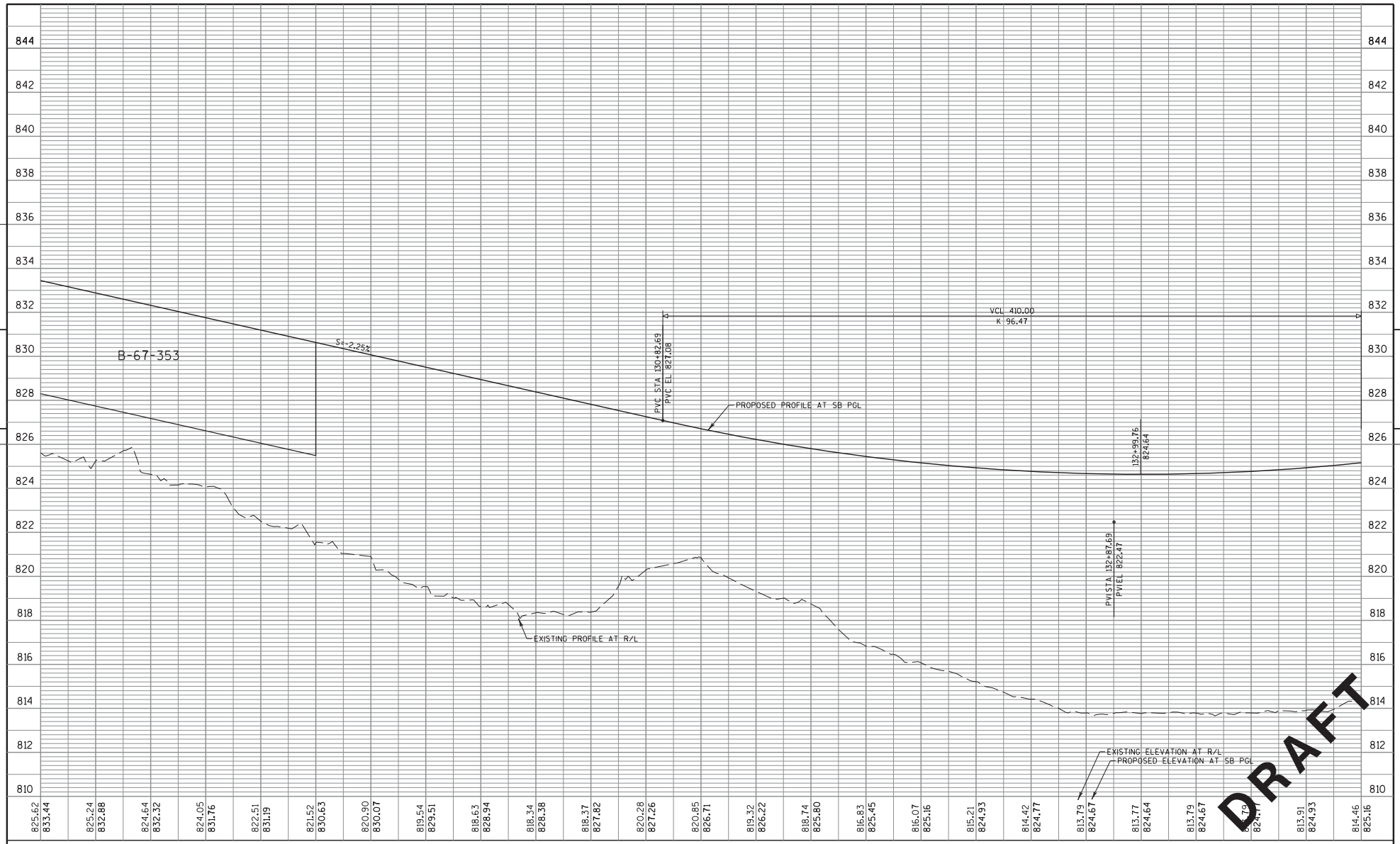


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS NB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050112a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

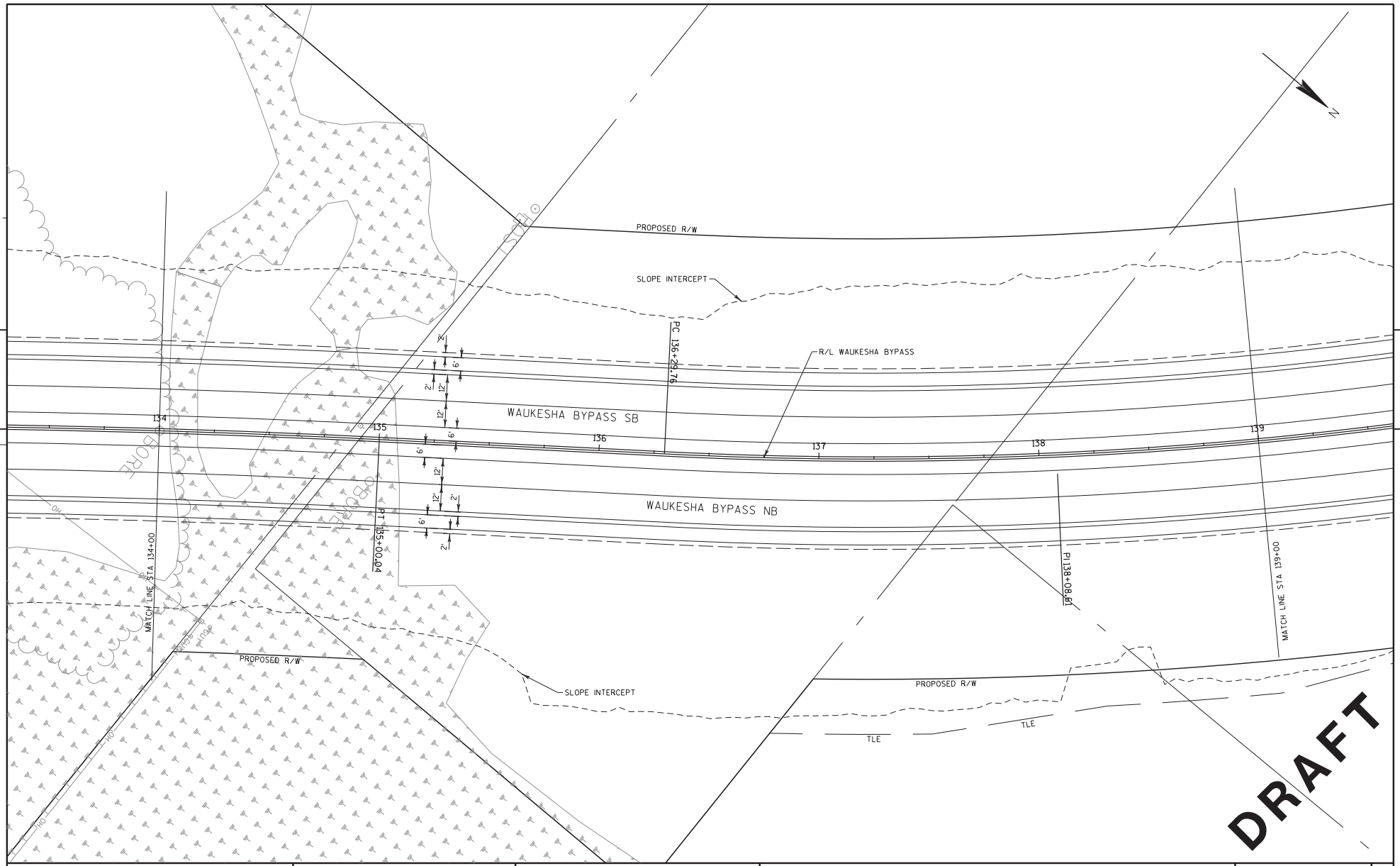
ATTACHMENT 6



PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS SB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050112b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40 WISDOT/CADDS SHEET 40

ATTACHMENT 6

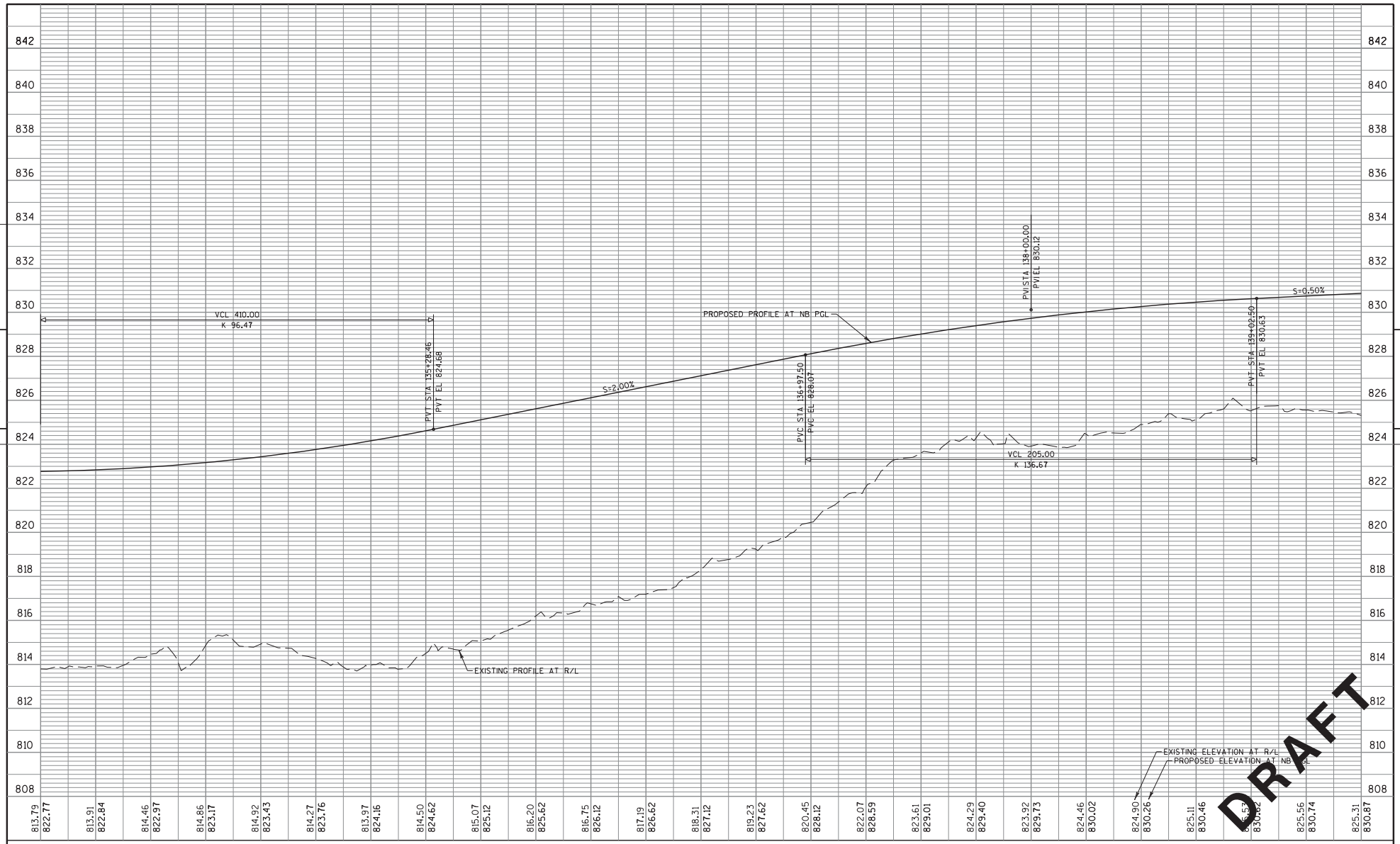


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050113-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6

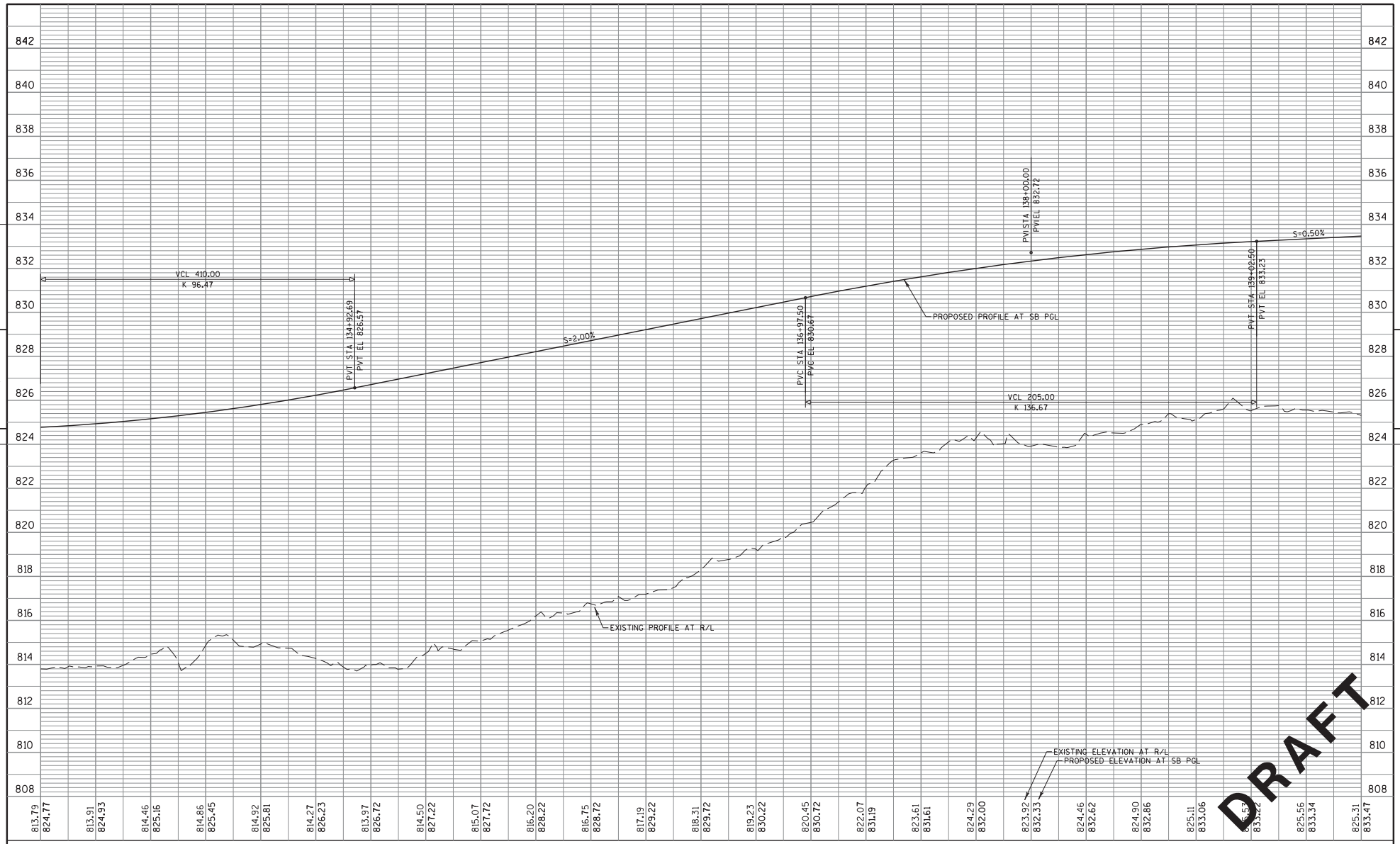


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS NB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050114a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

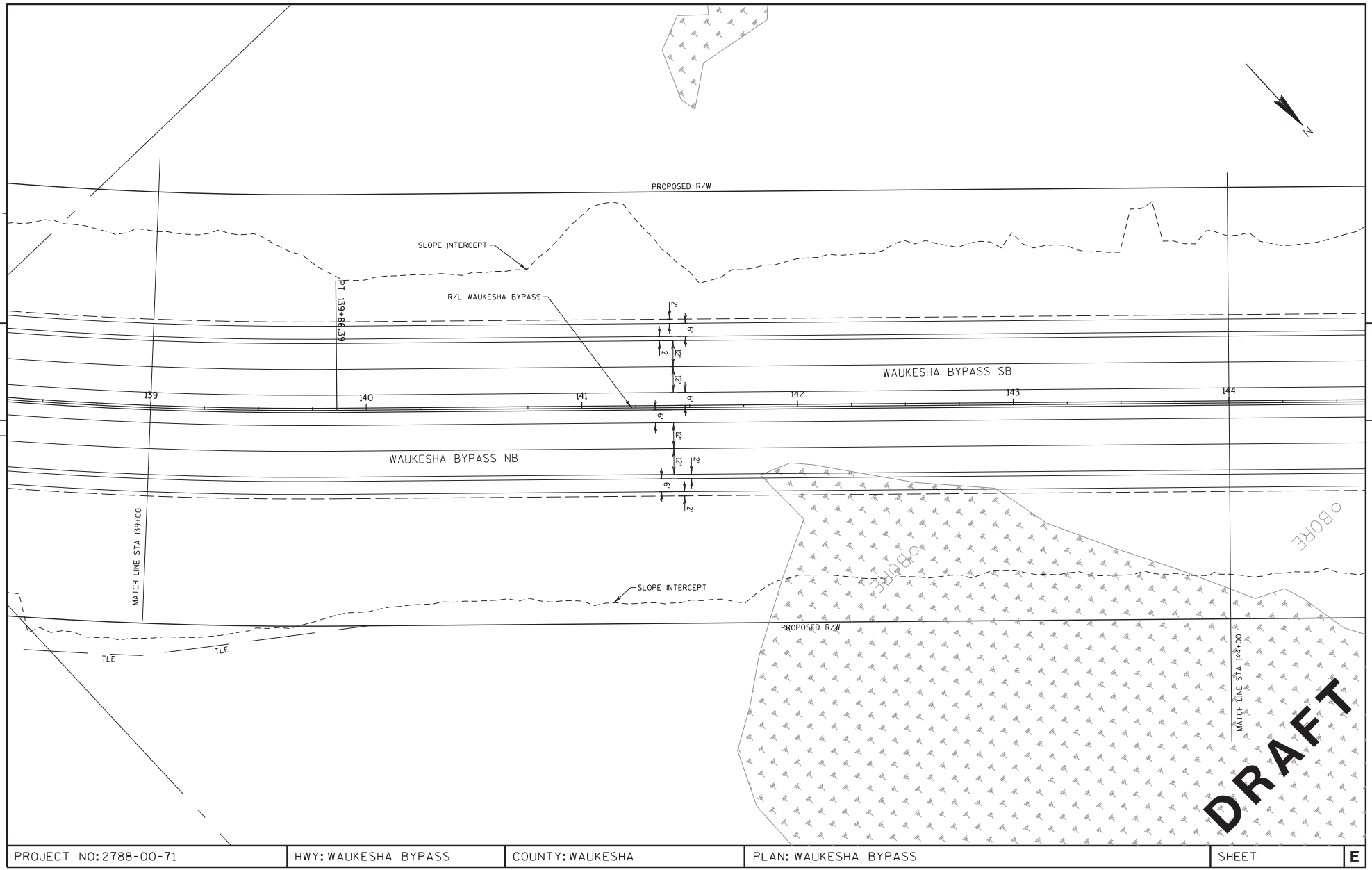


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS SB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050114b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

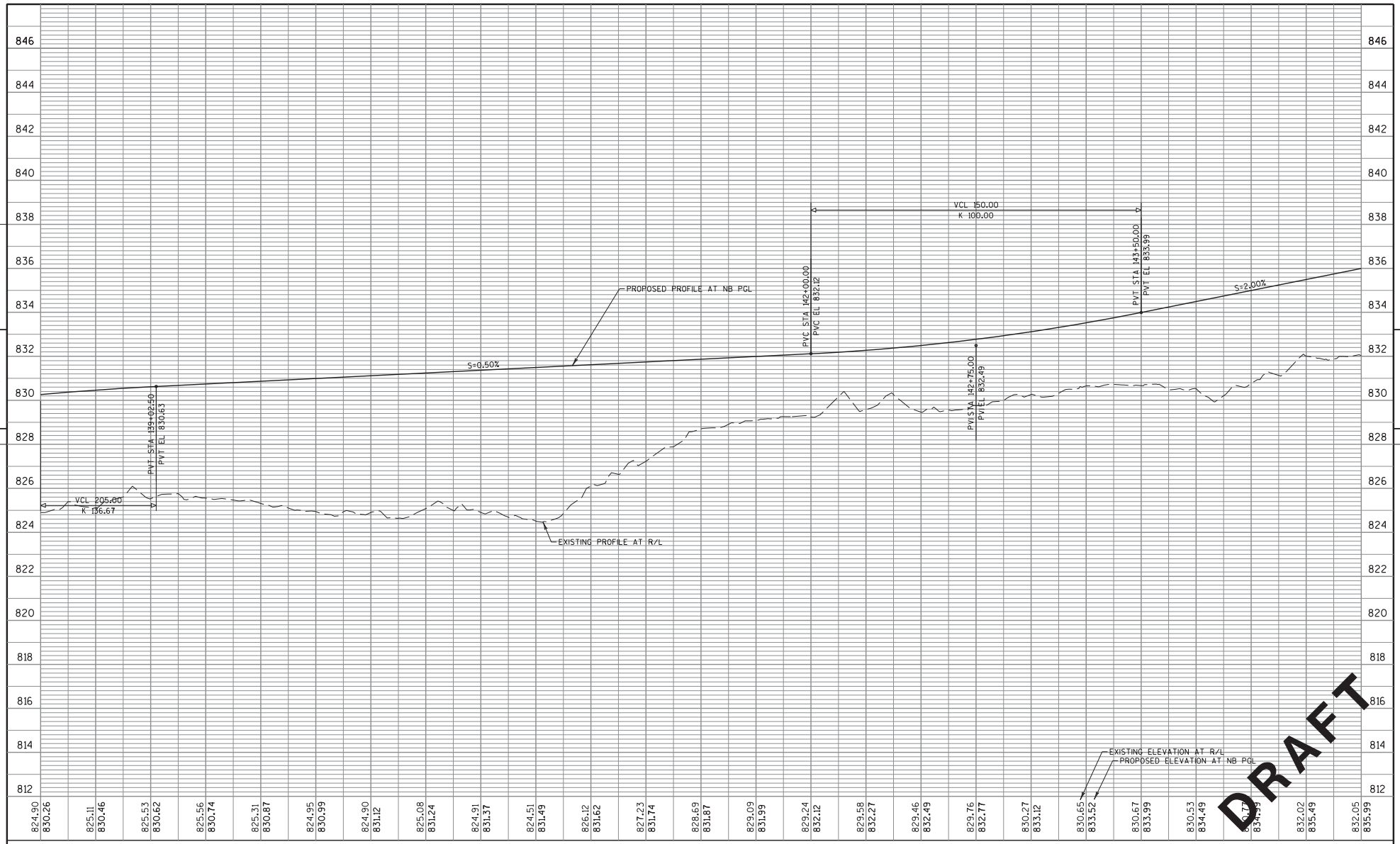


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050115-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6

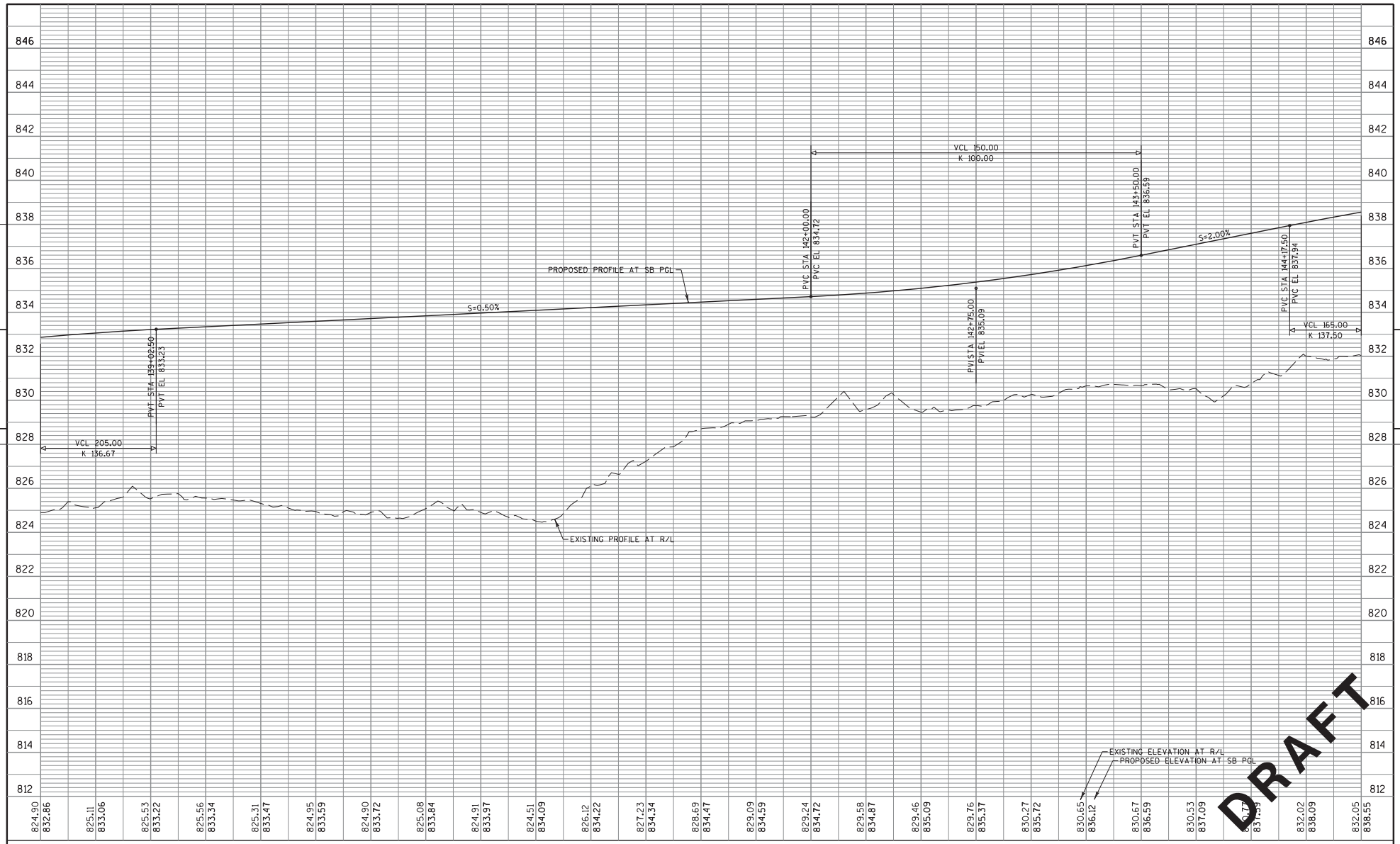


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS NB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050116a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

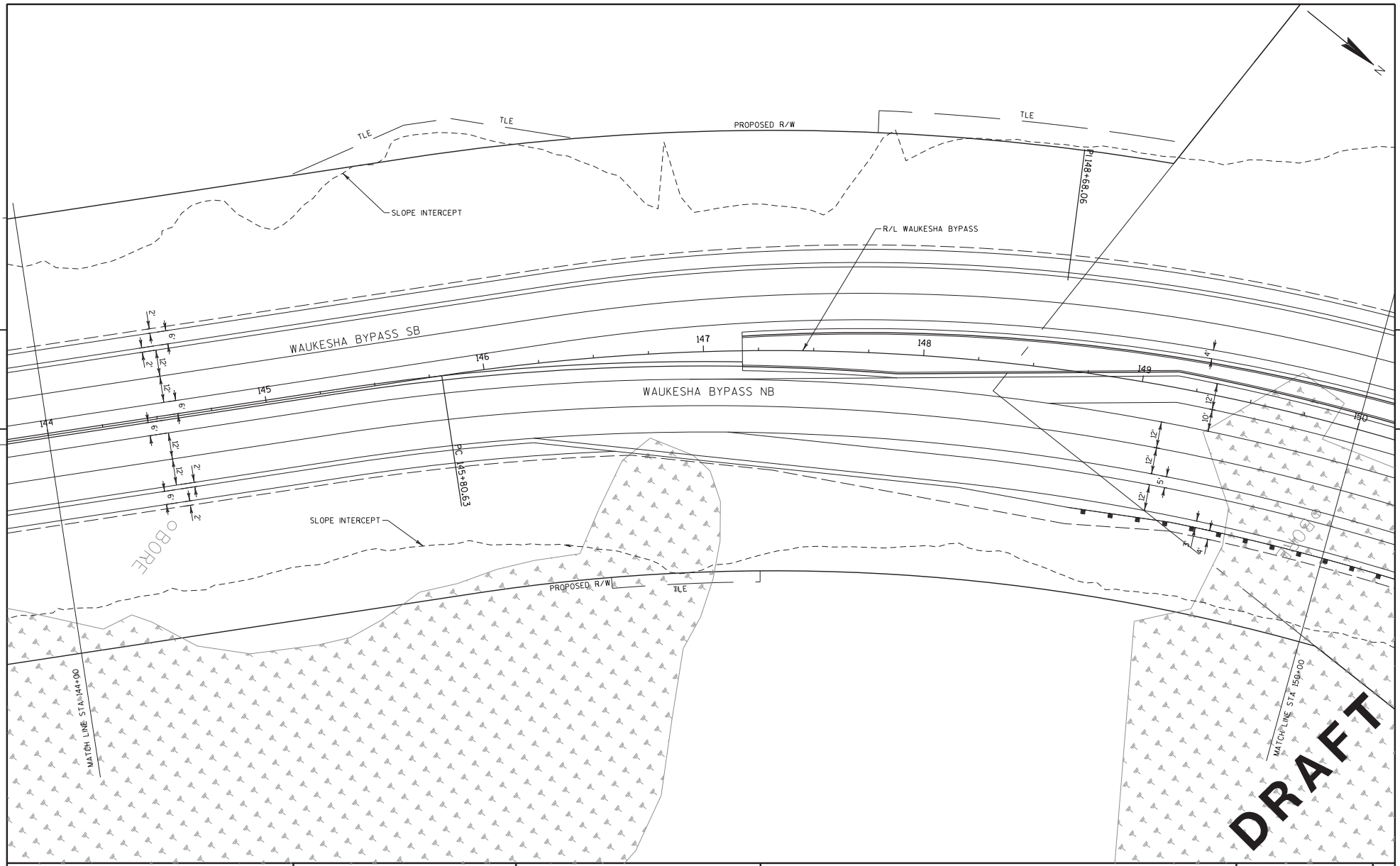


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS SB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050116b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

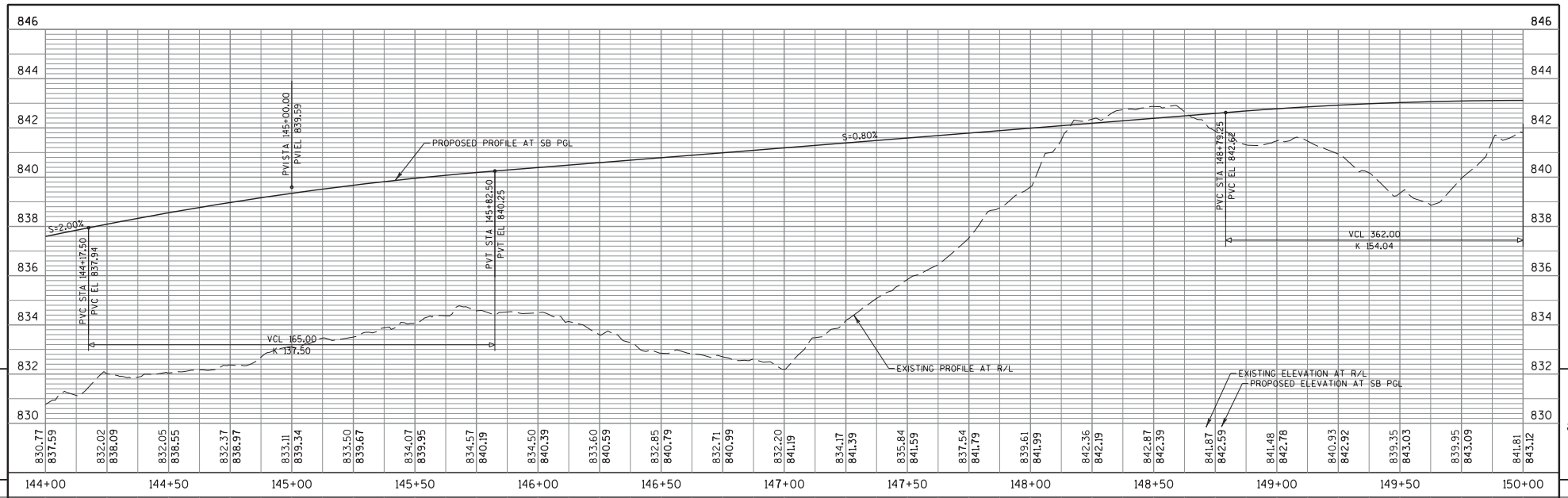


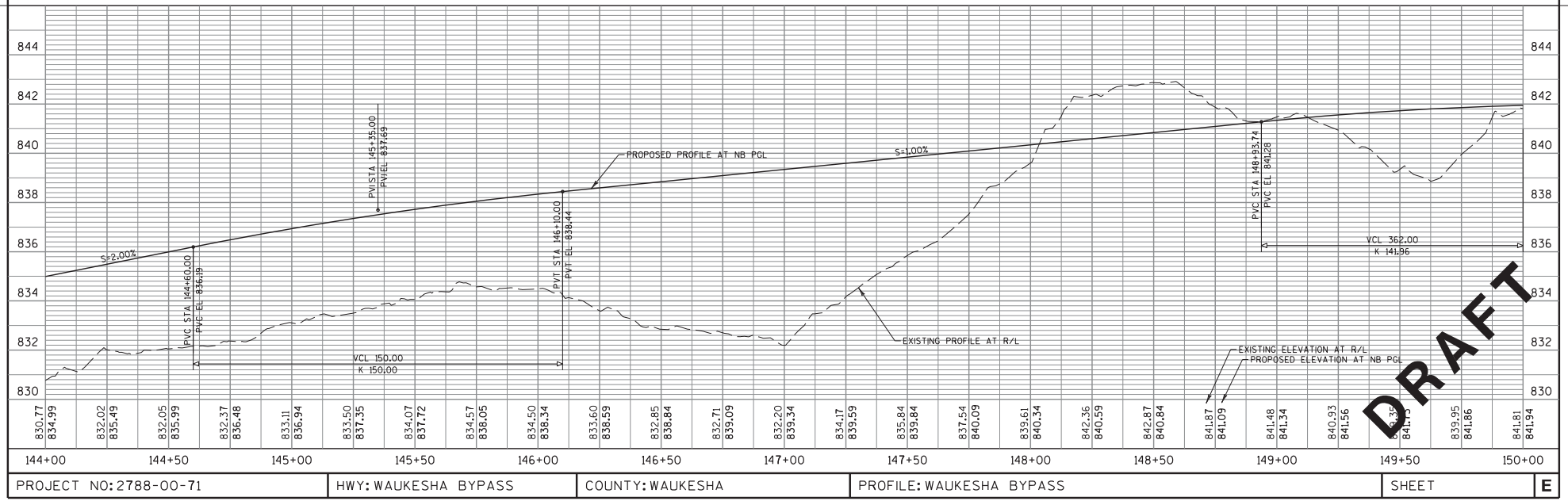
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050117-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6





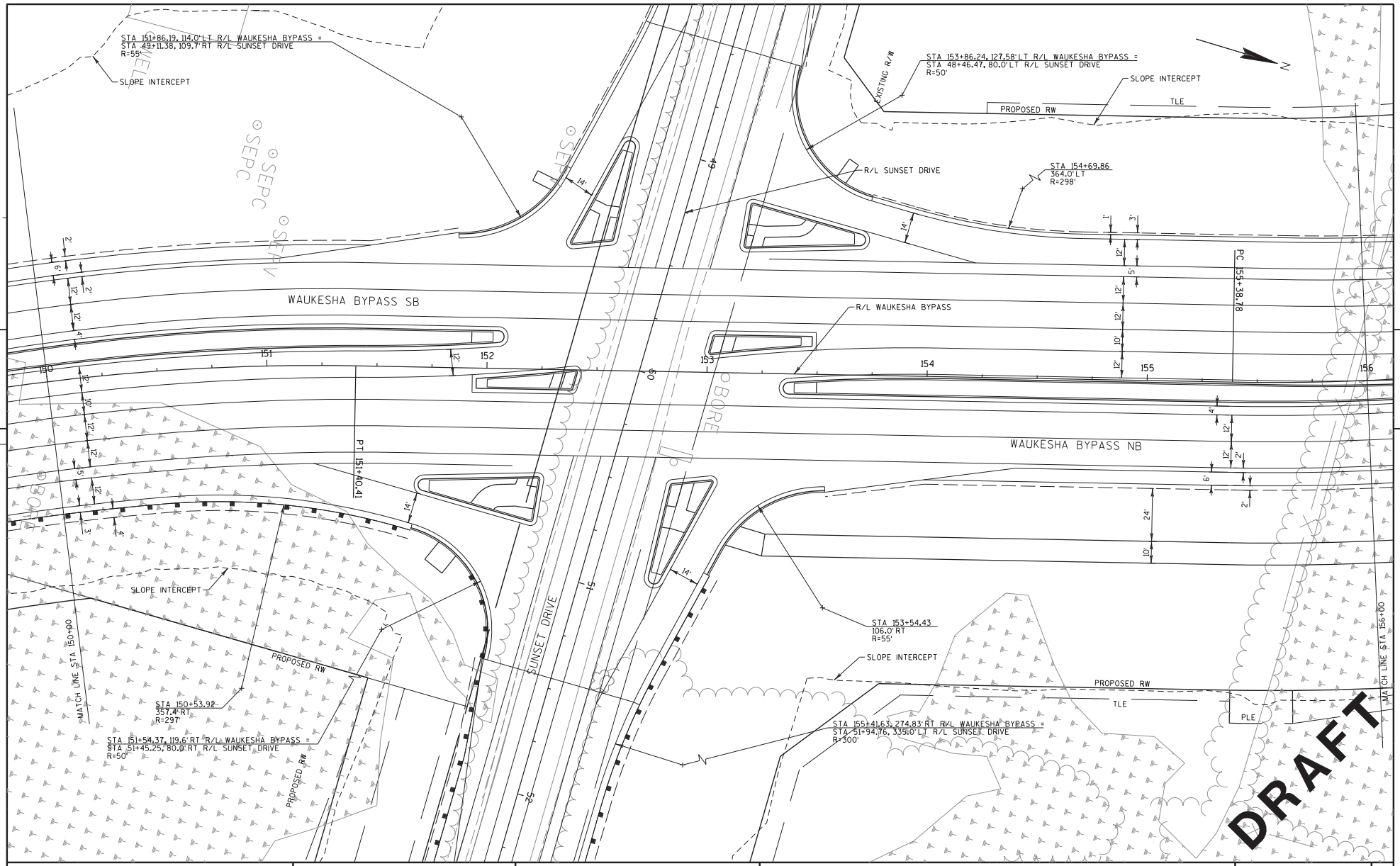
DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050118a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 30

ATTACHMENT 6

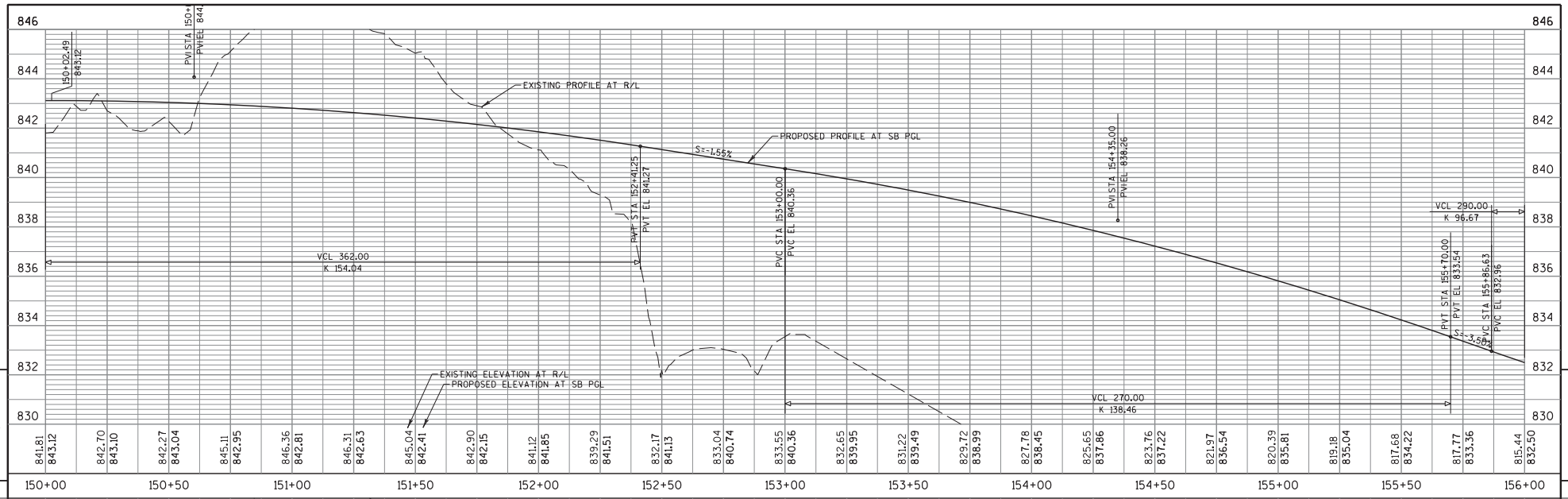


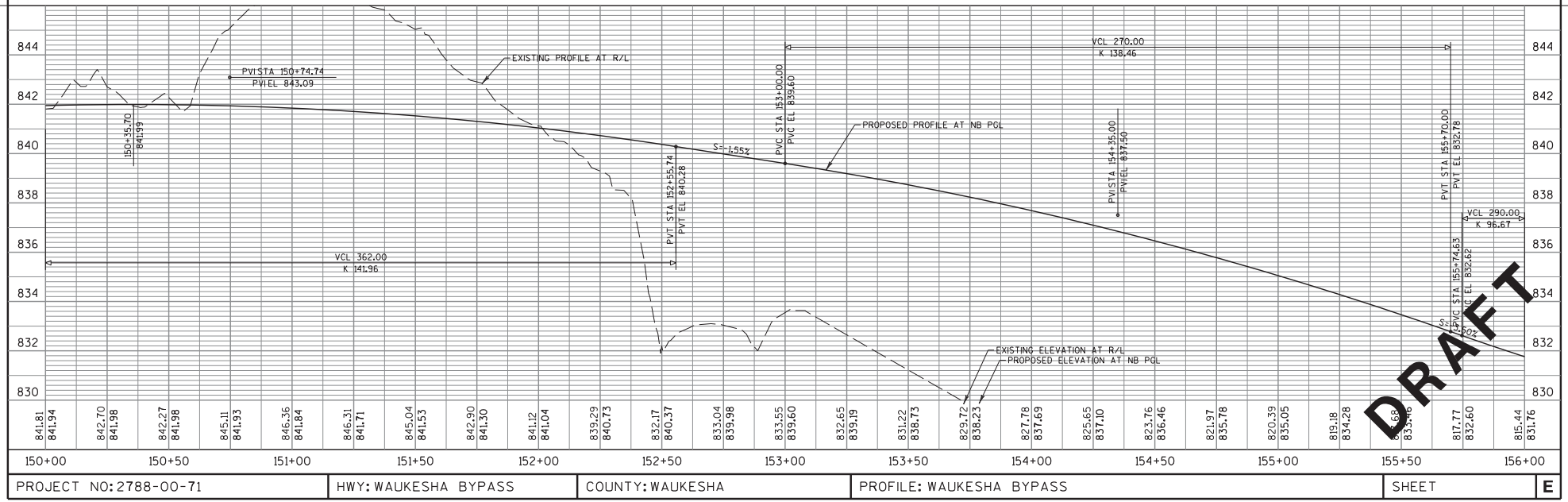
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050119-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6



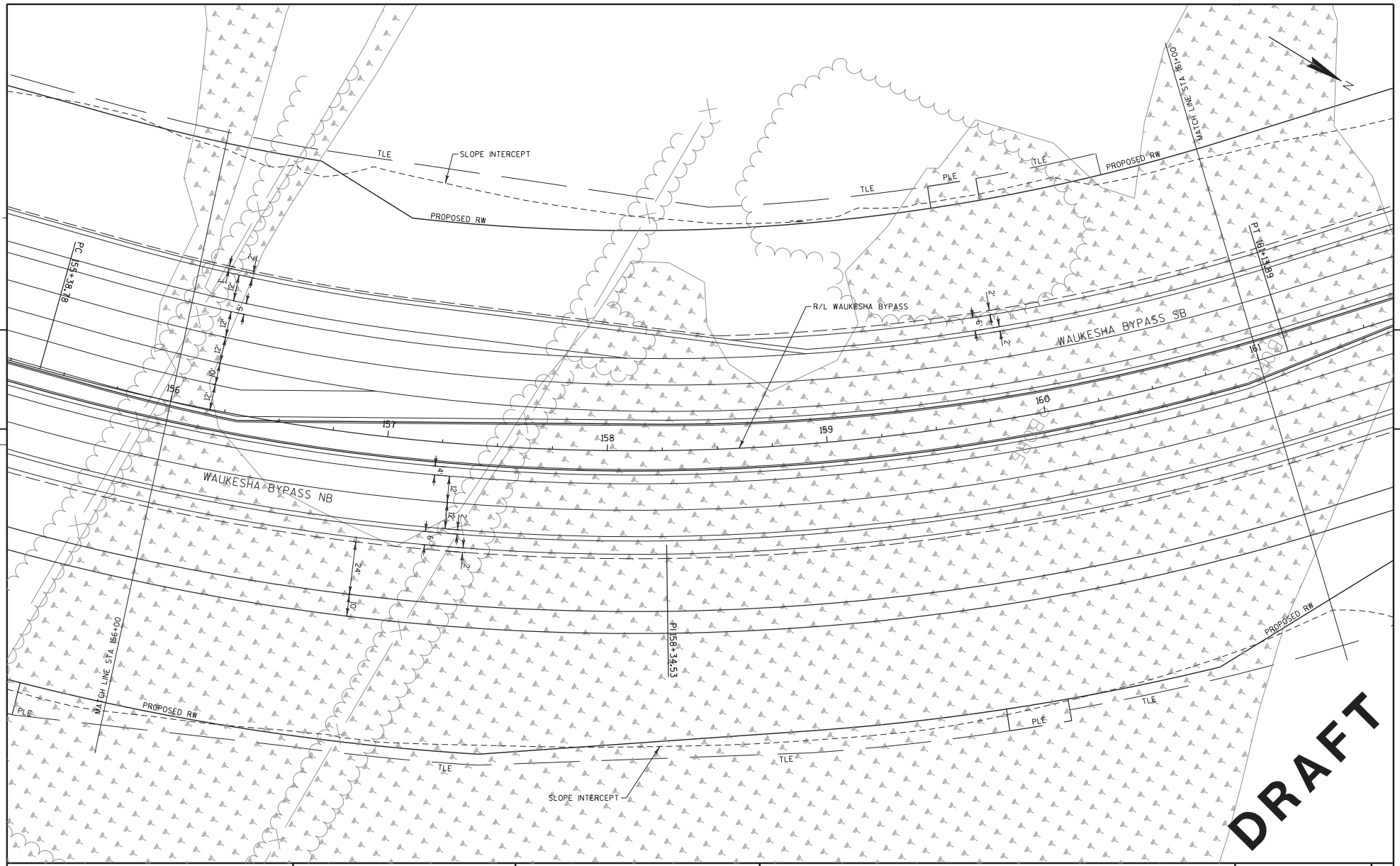


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050120a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 30

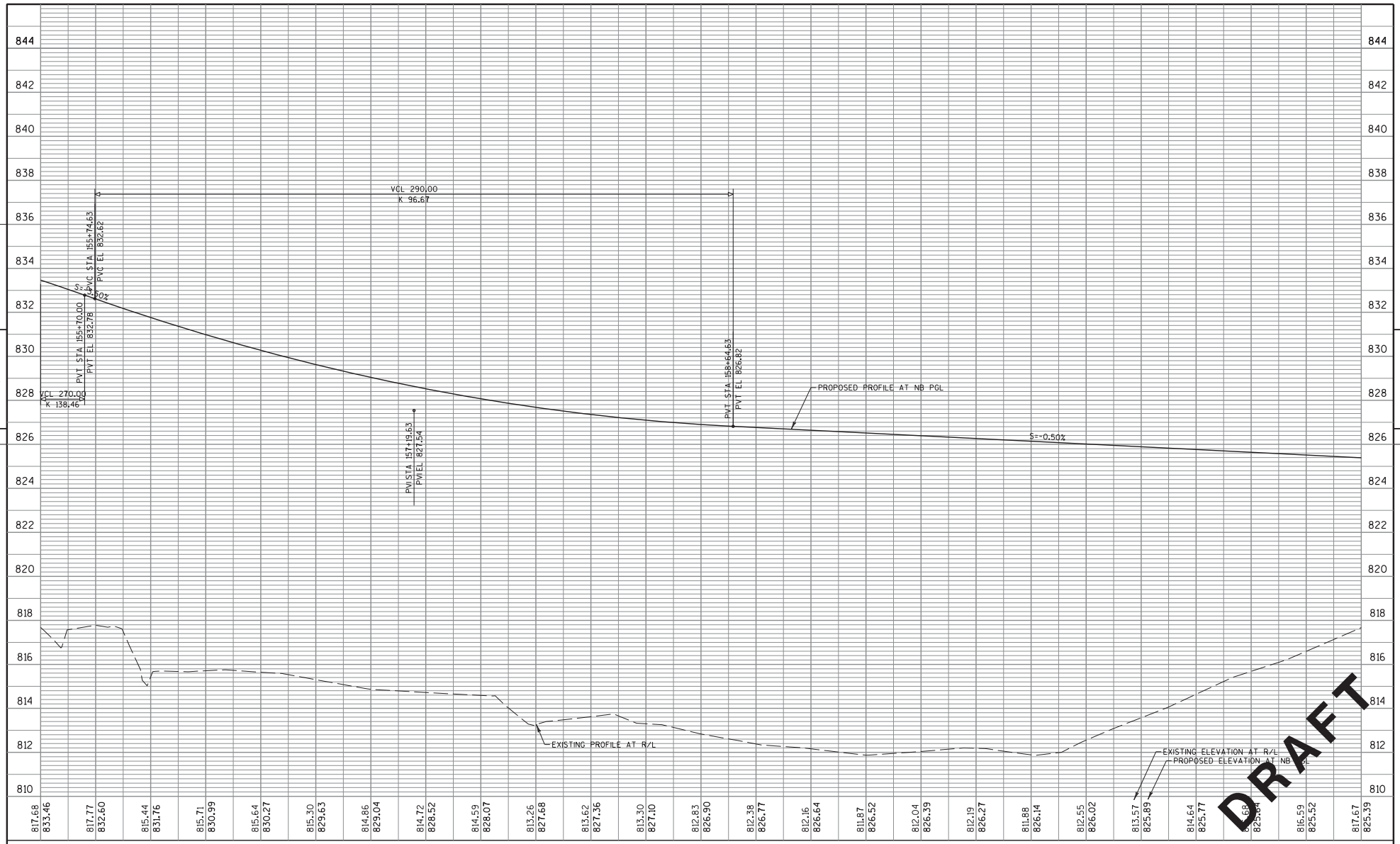
ATTACHMENT 6



PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050121-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40 WISDOT/CADDS SHEET 44

ATTACHMENT 6

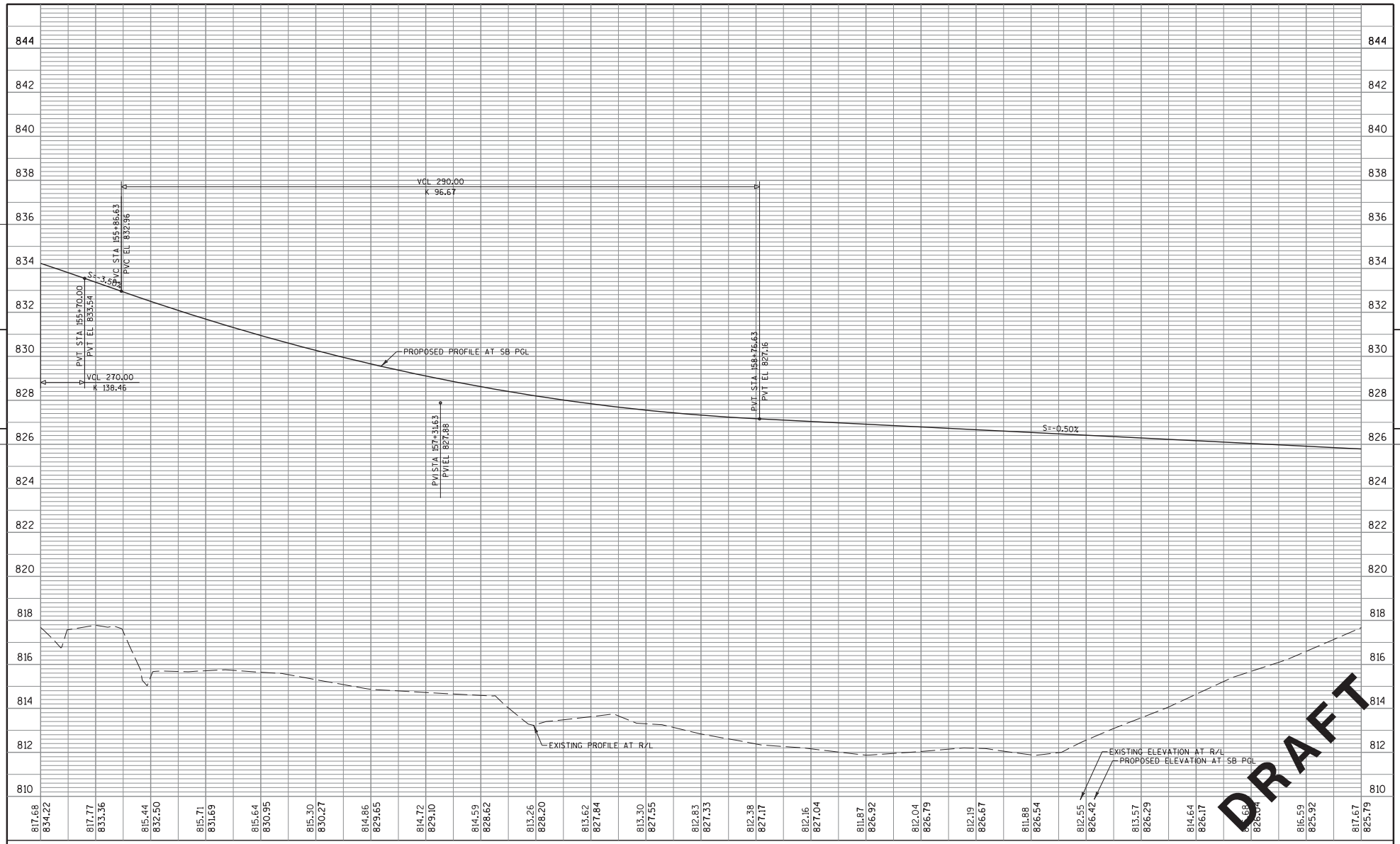


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS NB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050122a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

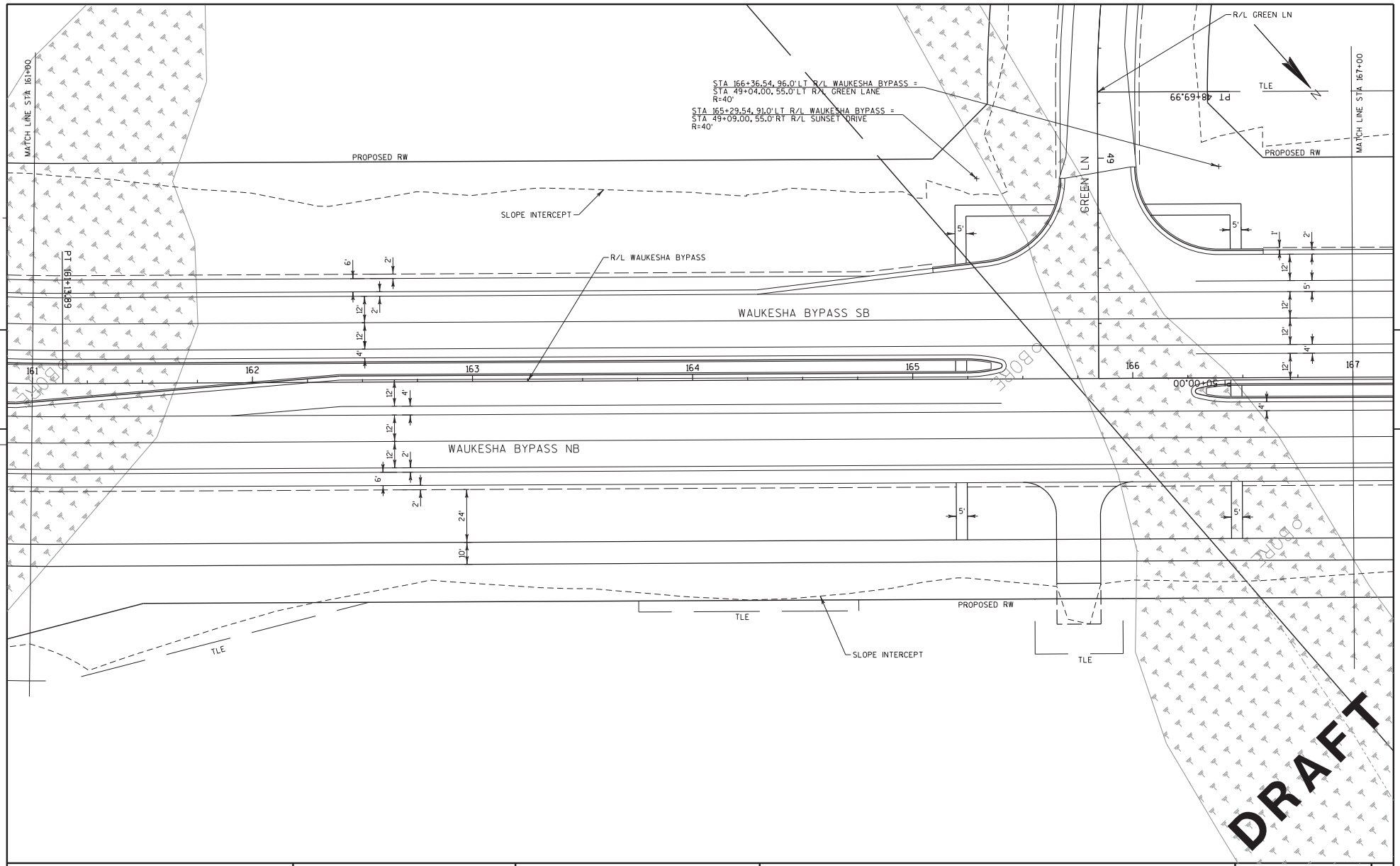


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS SB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050122b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

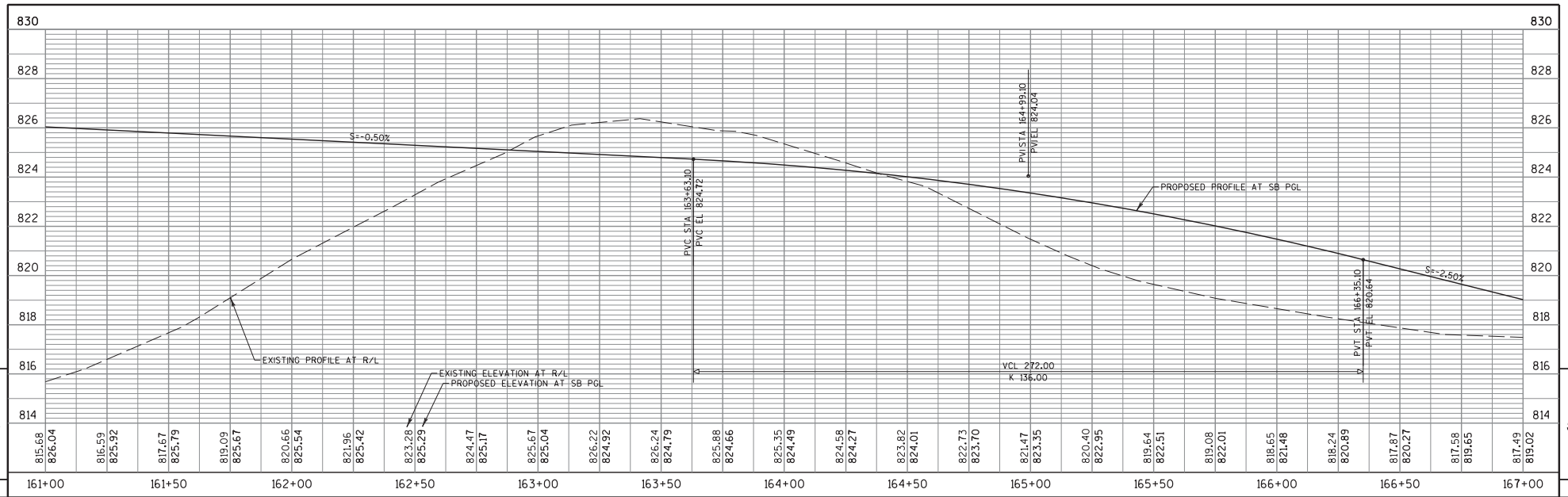


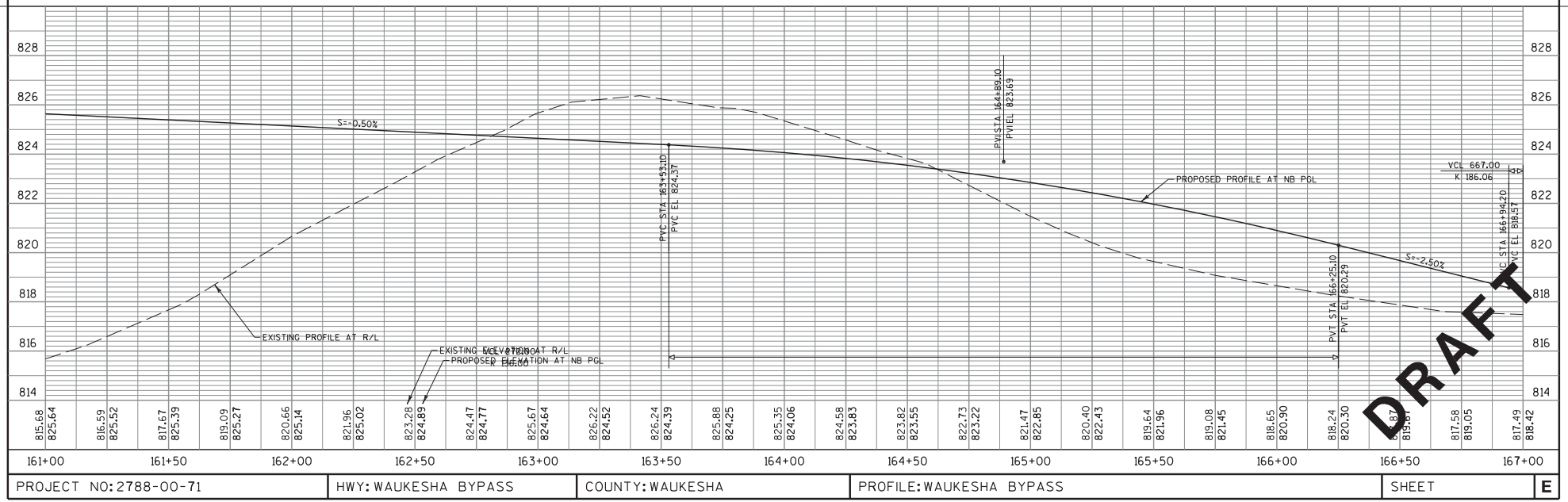
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050123-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6





DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS	SHEET	E

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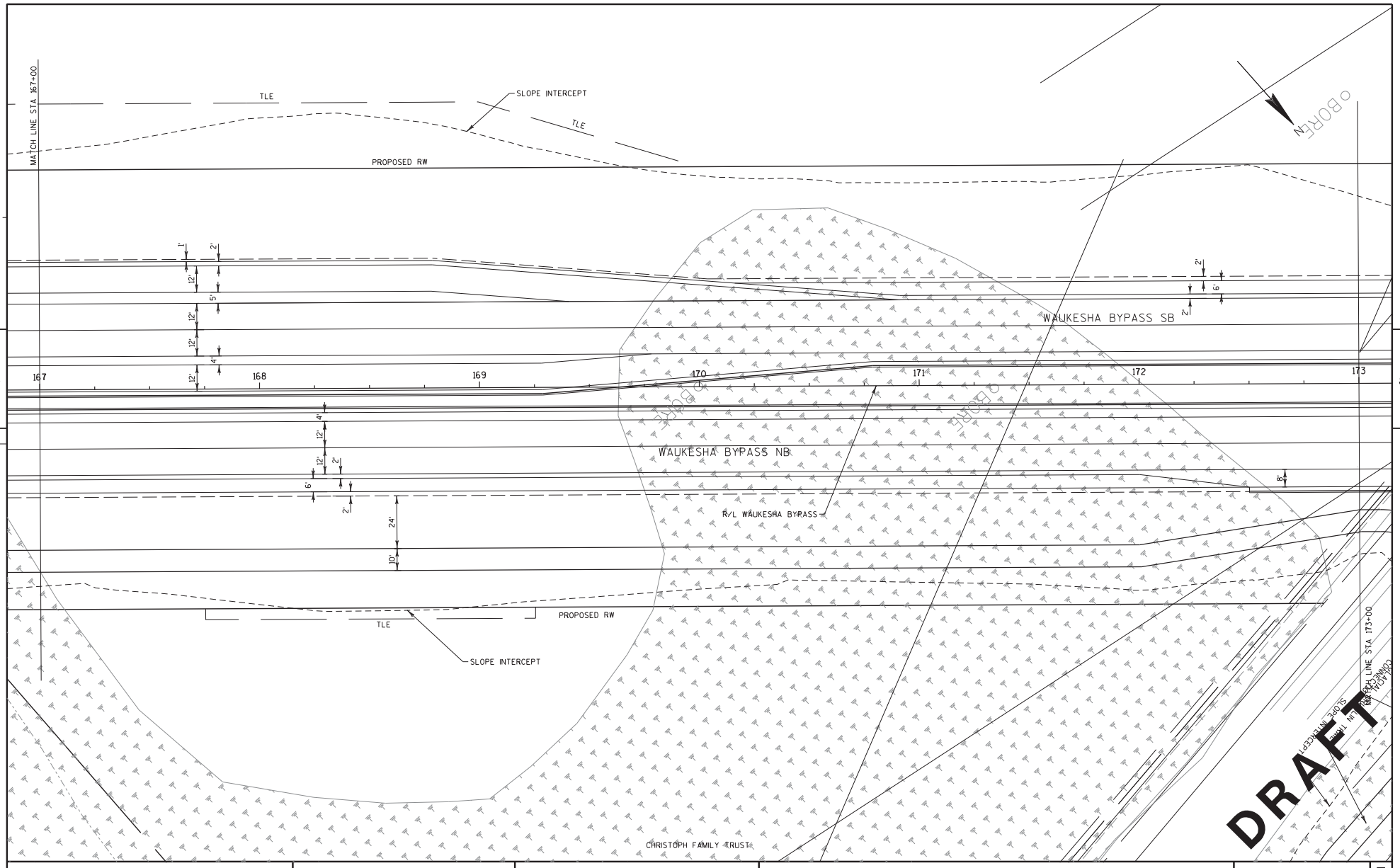
WISDOT/CADDS SHEET 30

ATTACHMENT 6



PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

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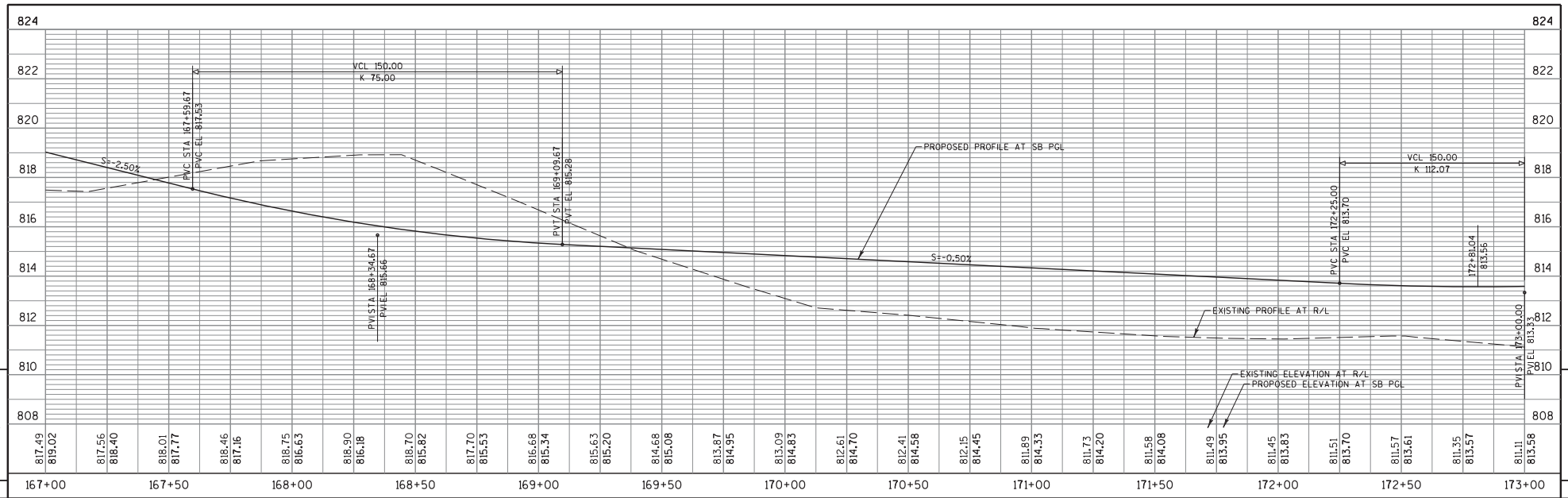
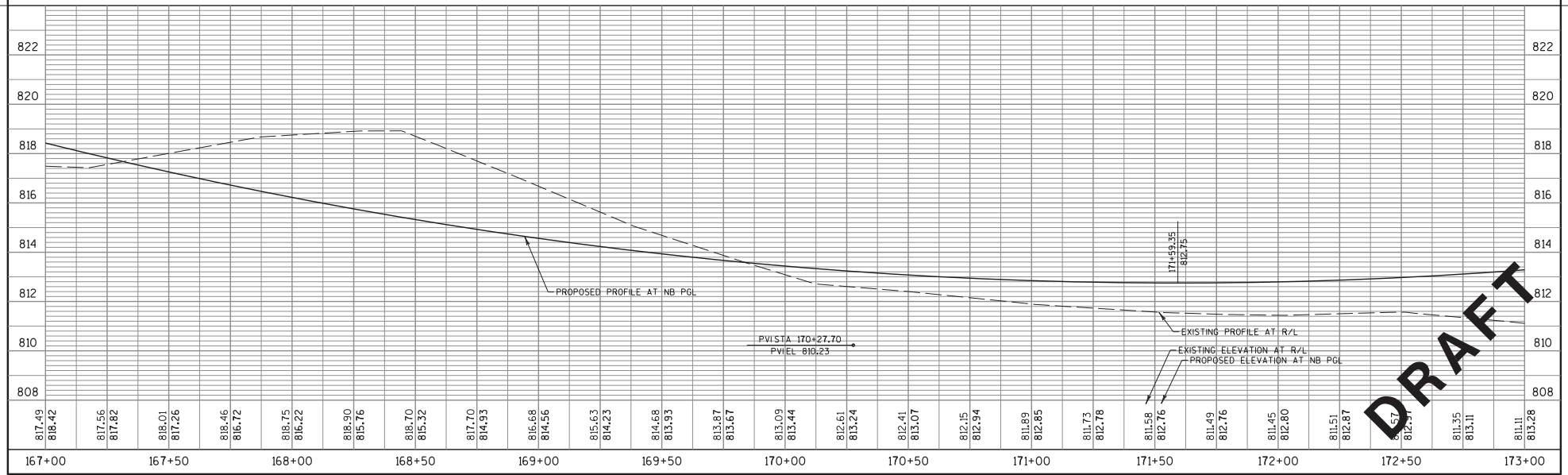
WISDOT/CADDS SHEET 44

ATTACHMENT 6





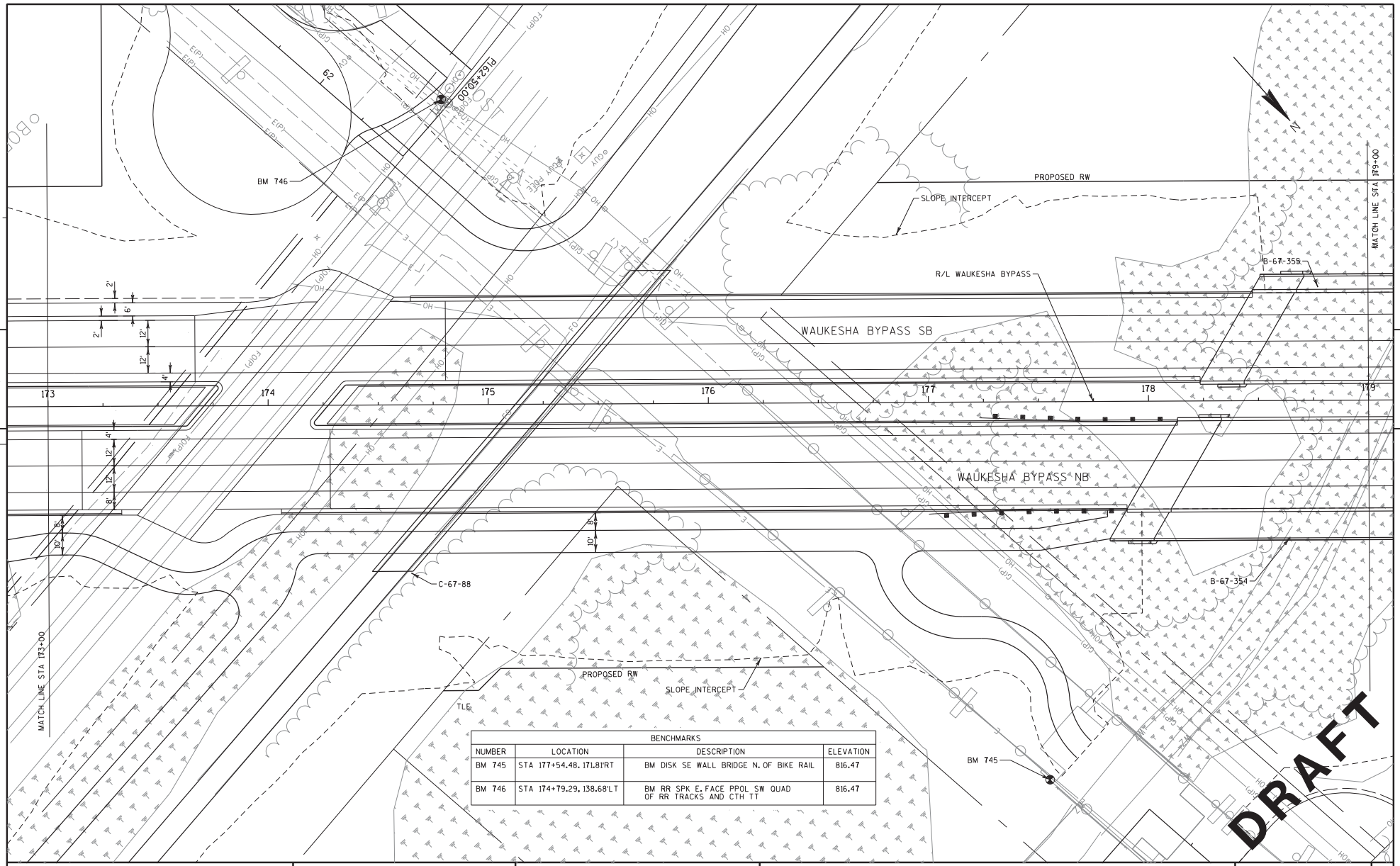
DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050126-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 30

ATTACHMENT 6



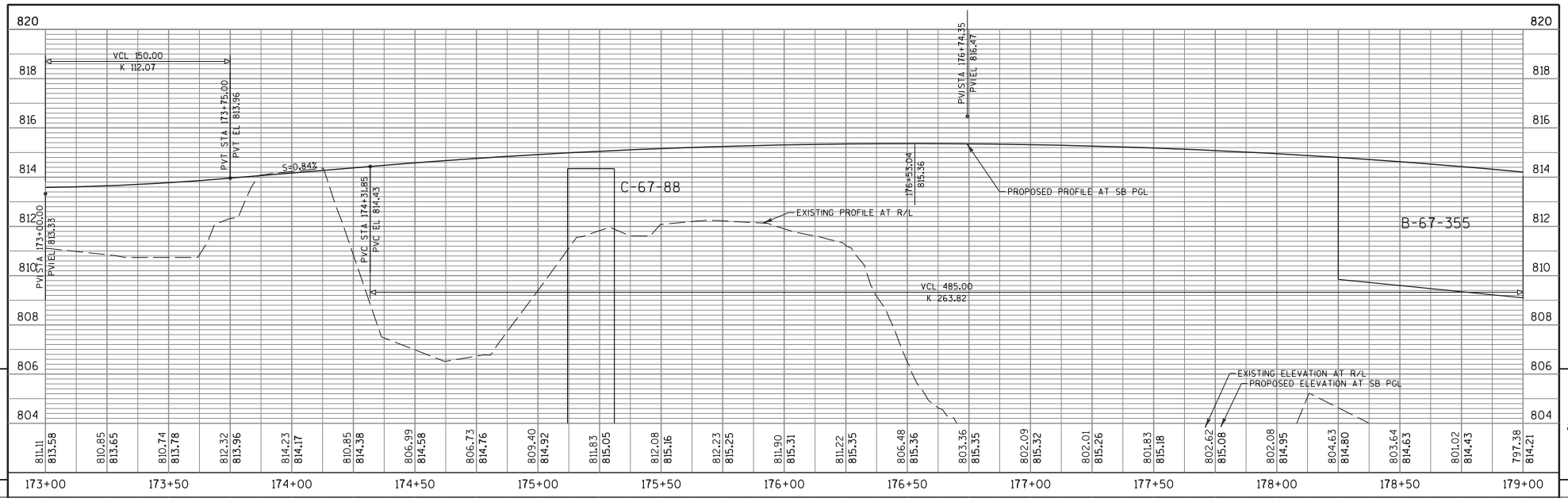
BENCHMARKS			
NUMBER	LOCATION	DESCRIPTION	ELEVATION
BM 745	STA 177+54.48, 171.81'RT	BM DISK SE WALL BRIDGE N. OF BIKE RAIL	816.47
BM 746	STA 174+79.29, 138.68'LT	BM RR SPK E. FACE PPOL SW QUAD OF RR TRACKS AND CTH TT	816.47

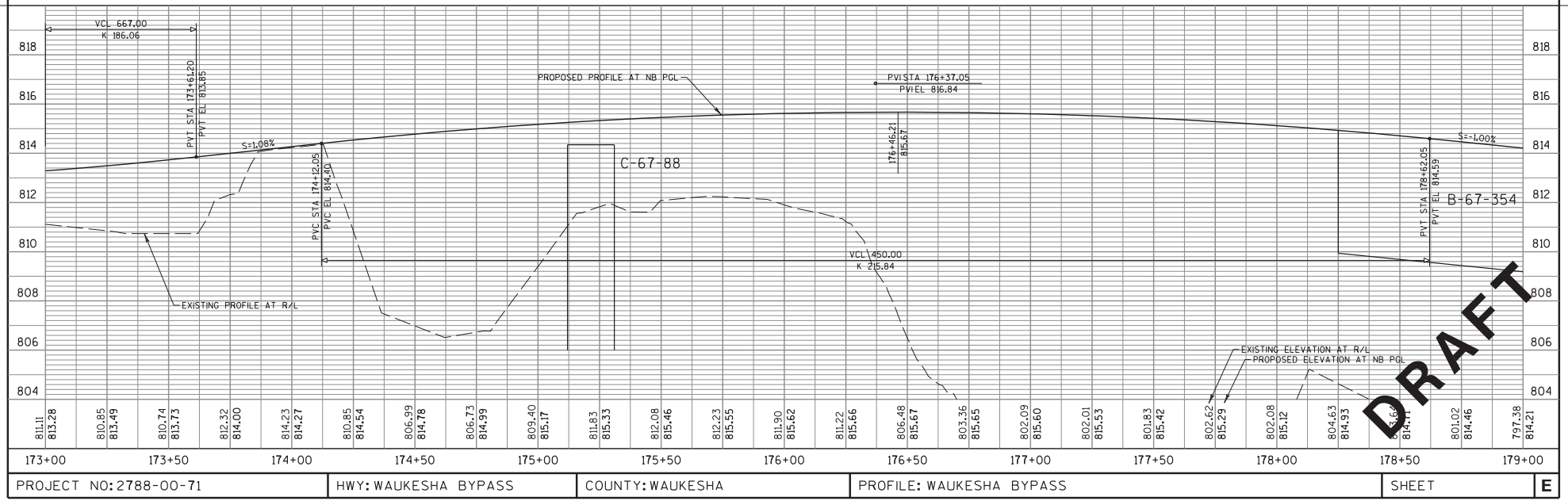
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050127-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6





DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS	SHEET	E

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WISDOT/CADDS SHEET 30

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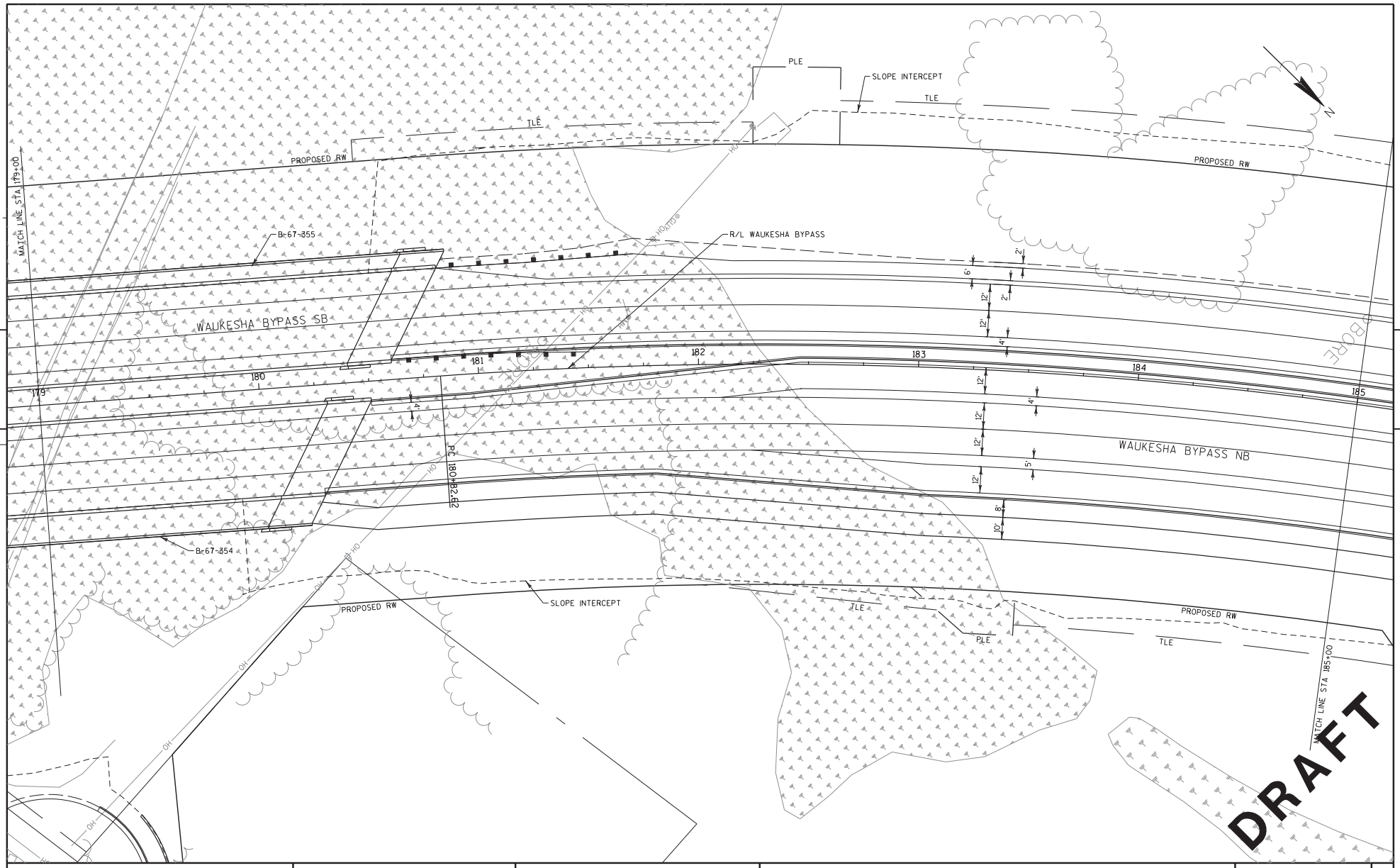
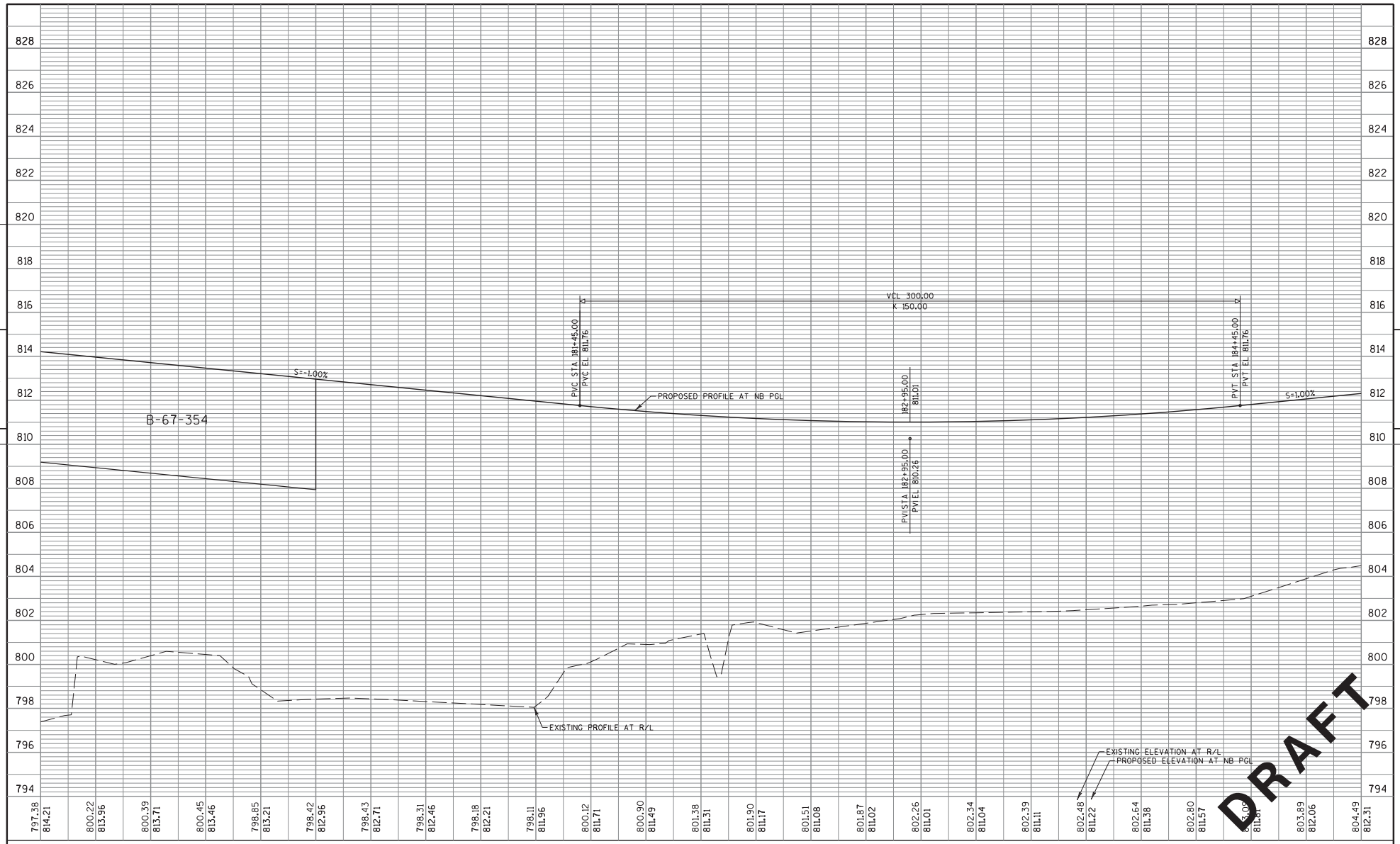


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050129-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6



PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS NB	SHEET	E

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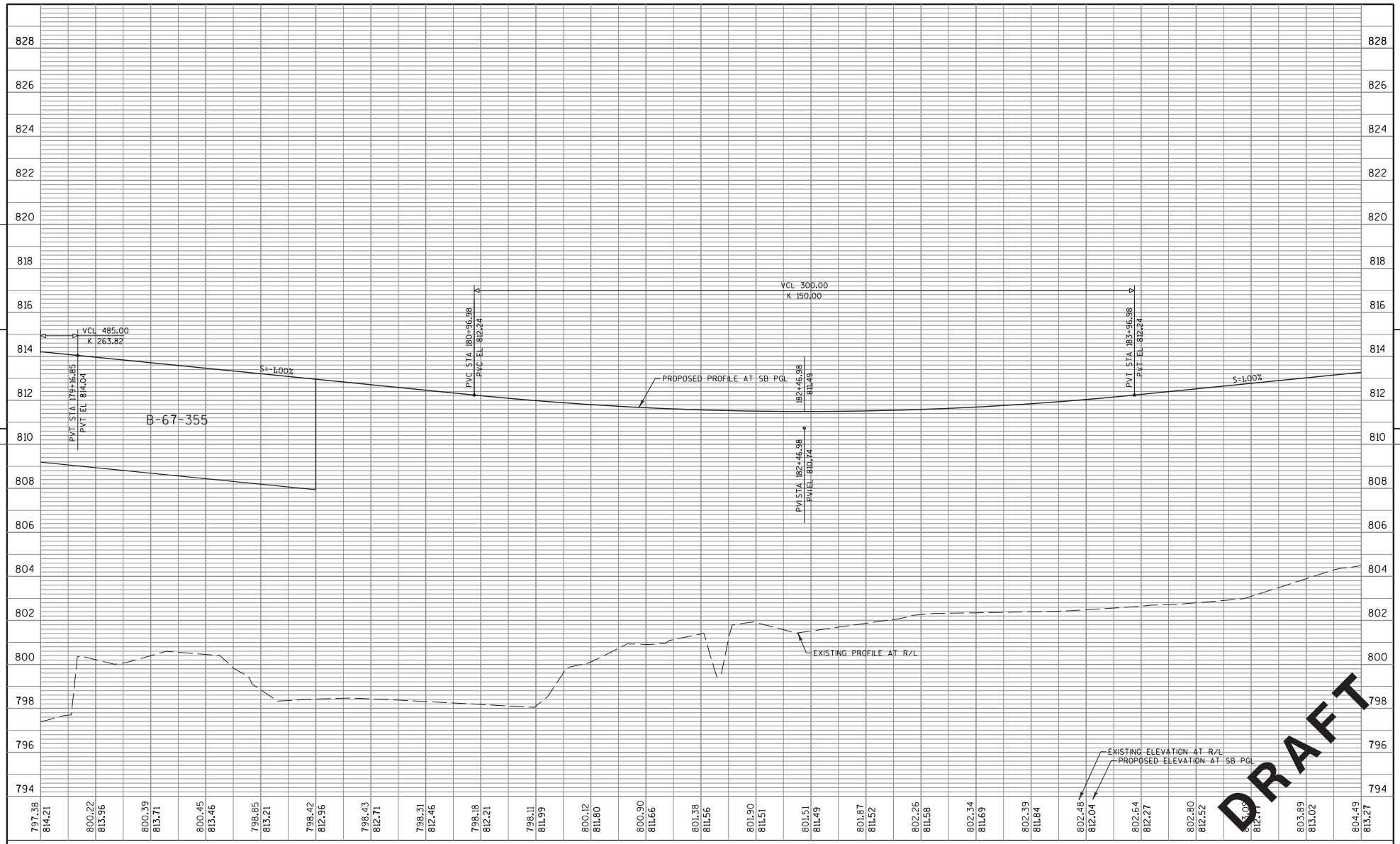
WISDOT/CADDS SHEET 40

ATTACHMENT 6

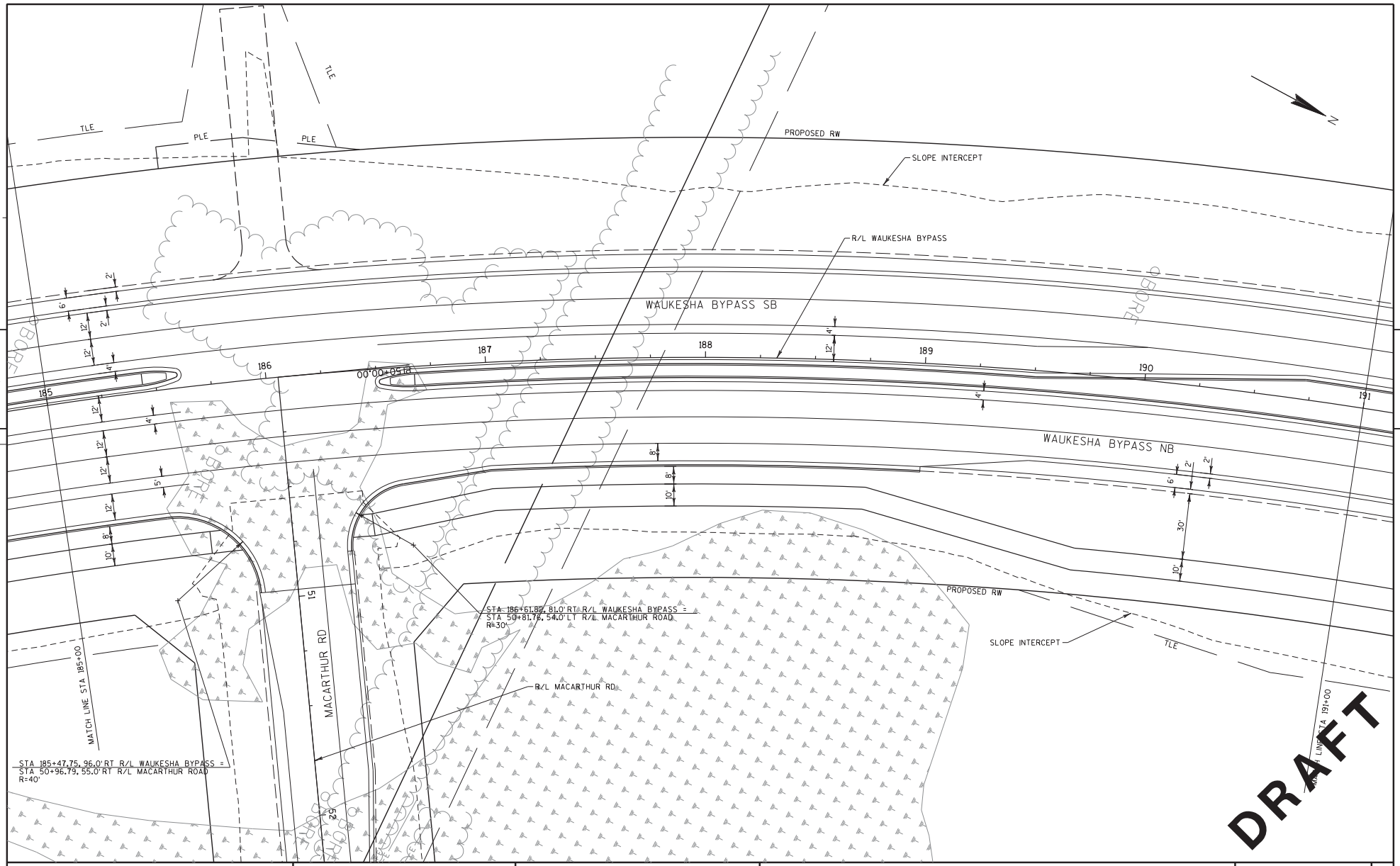


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS SB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050130b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

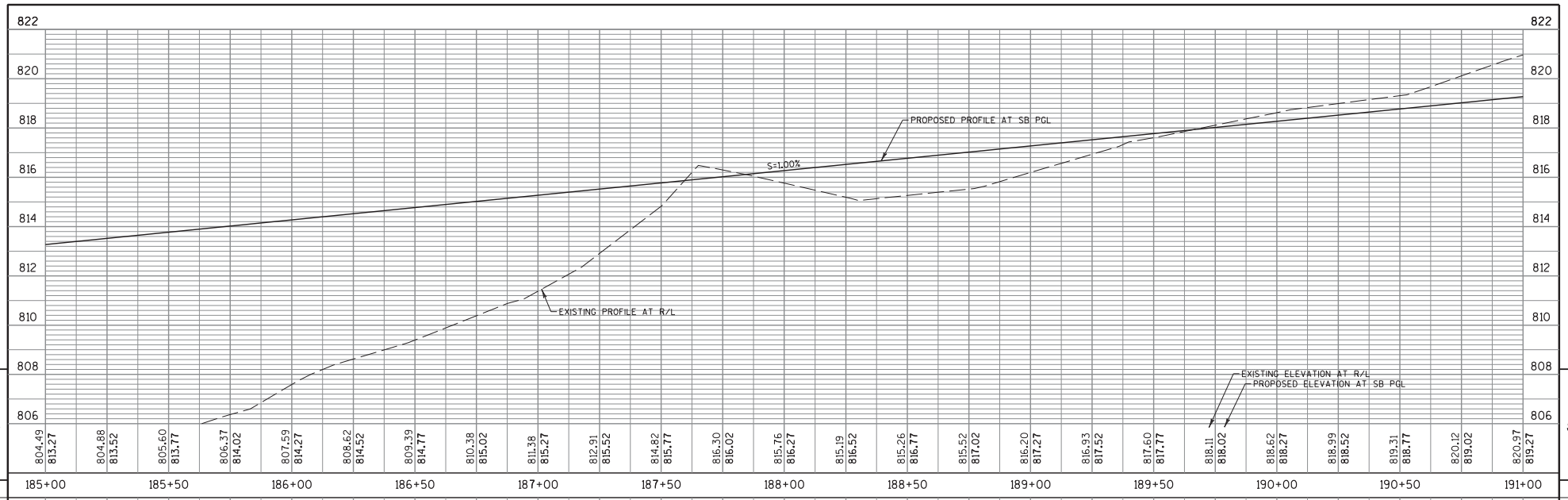


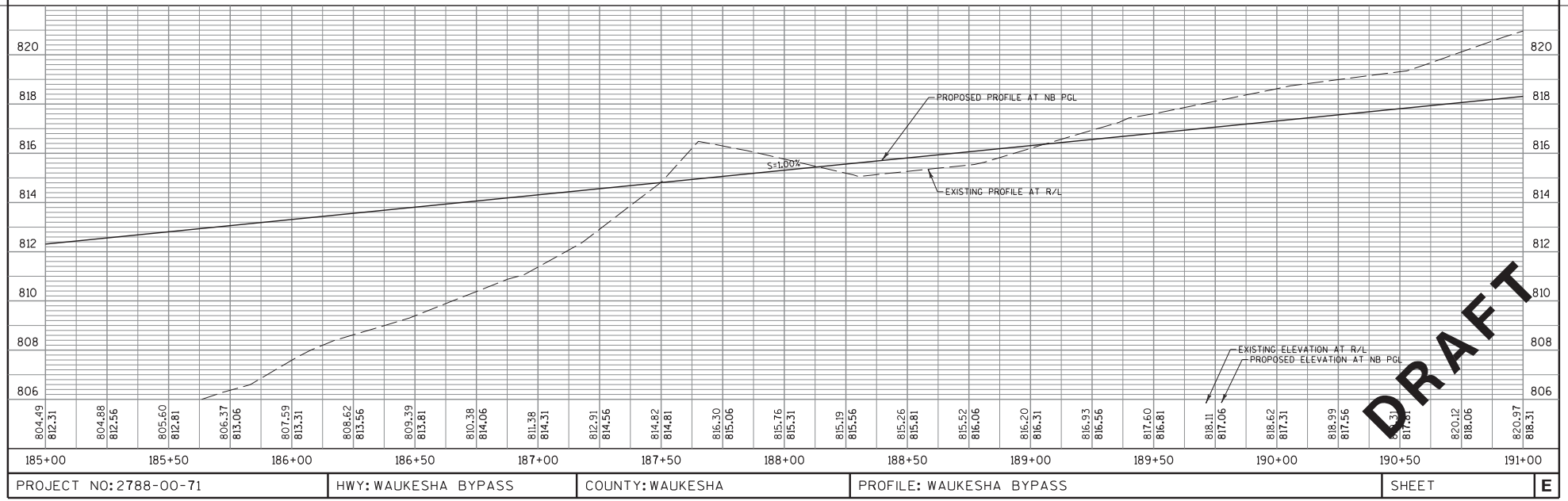
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050131-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6





DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS	SHEET	E

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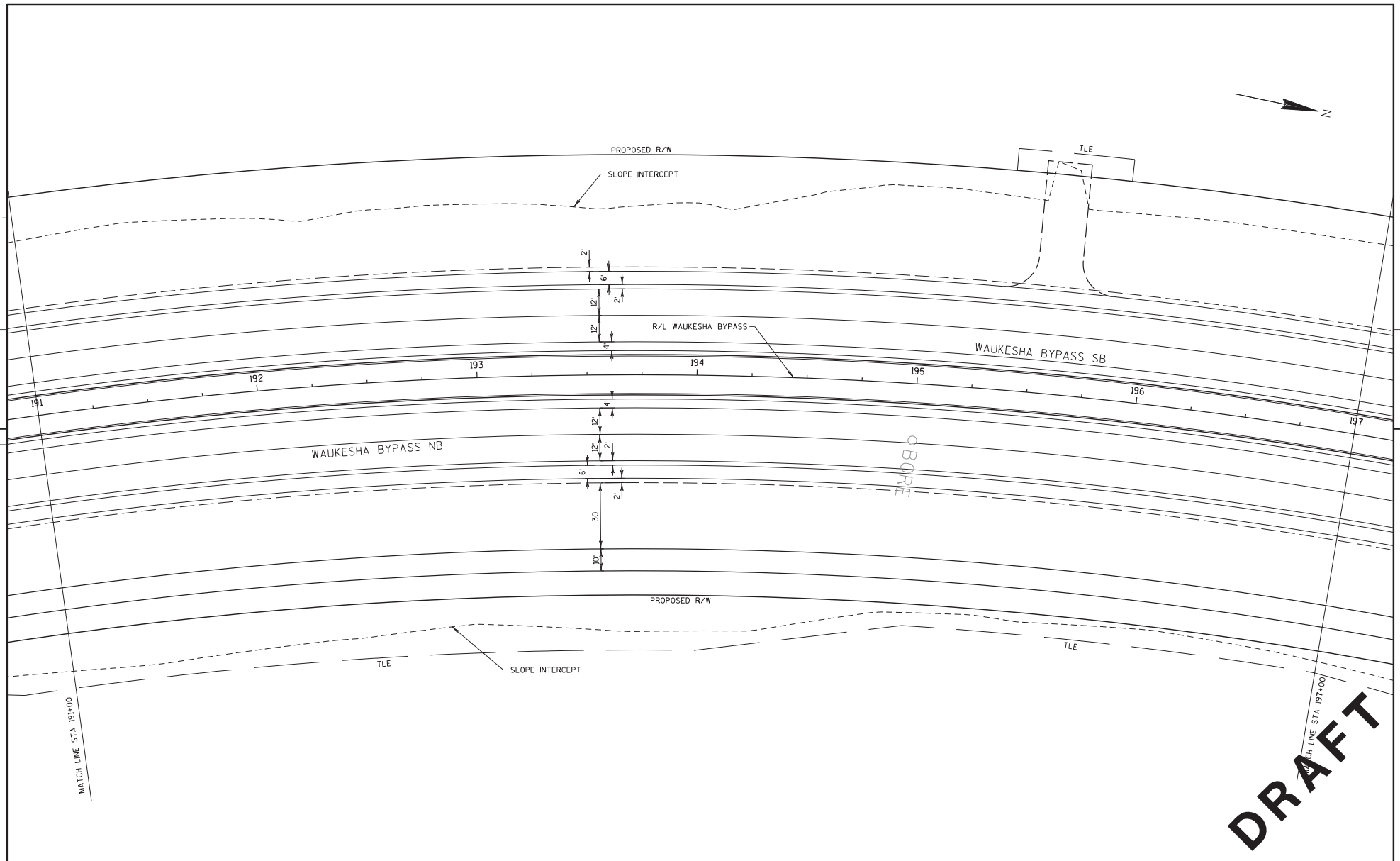
WISDOT/CADDS SHEET 30

ATTACHMENT 6

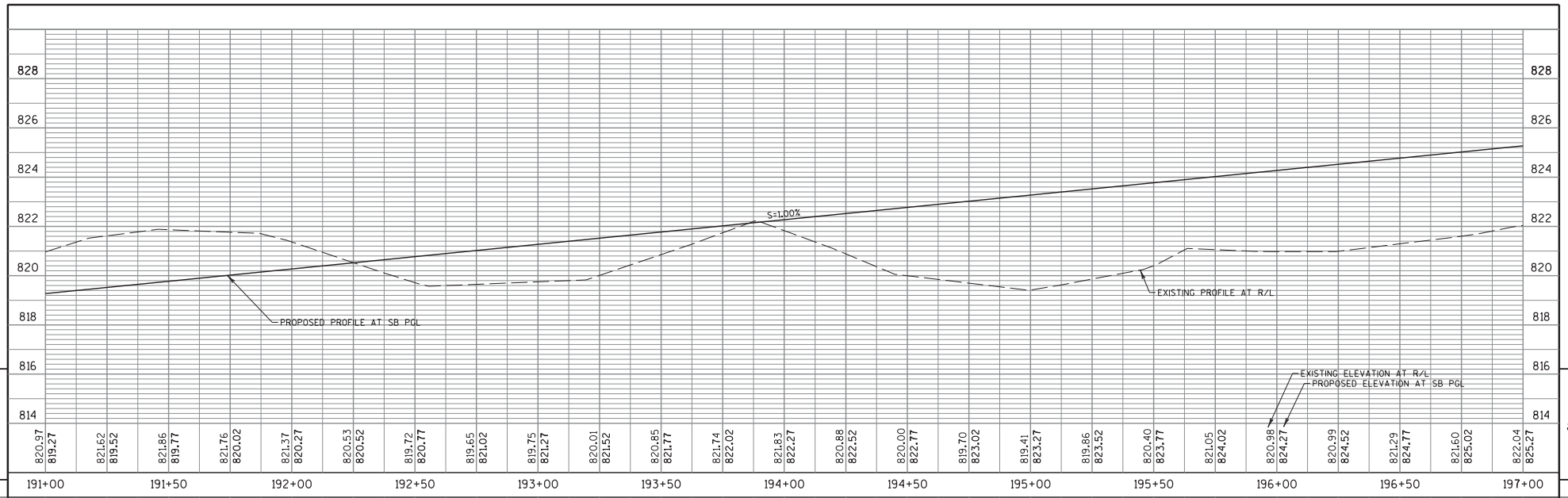


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050133-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6



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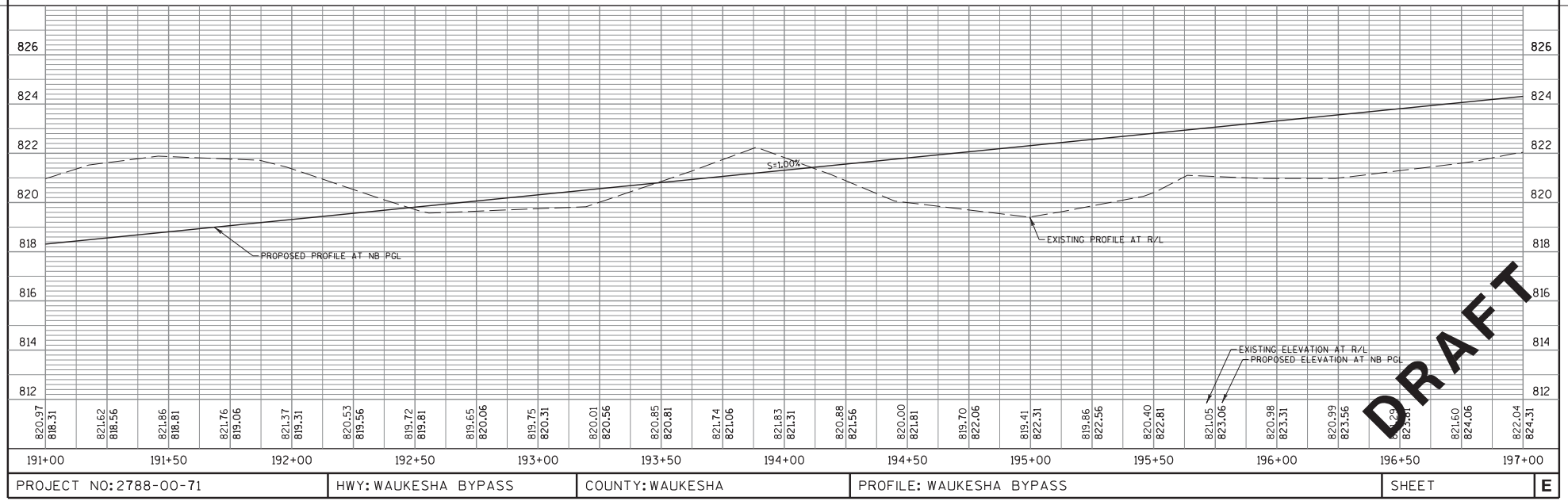
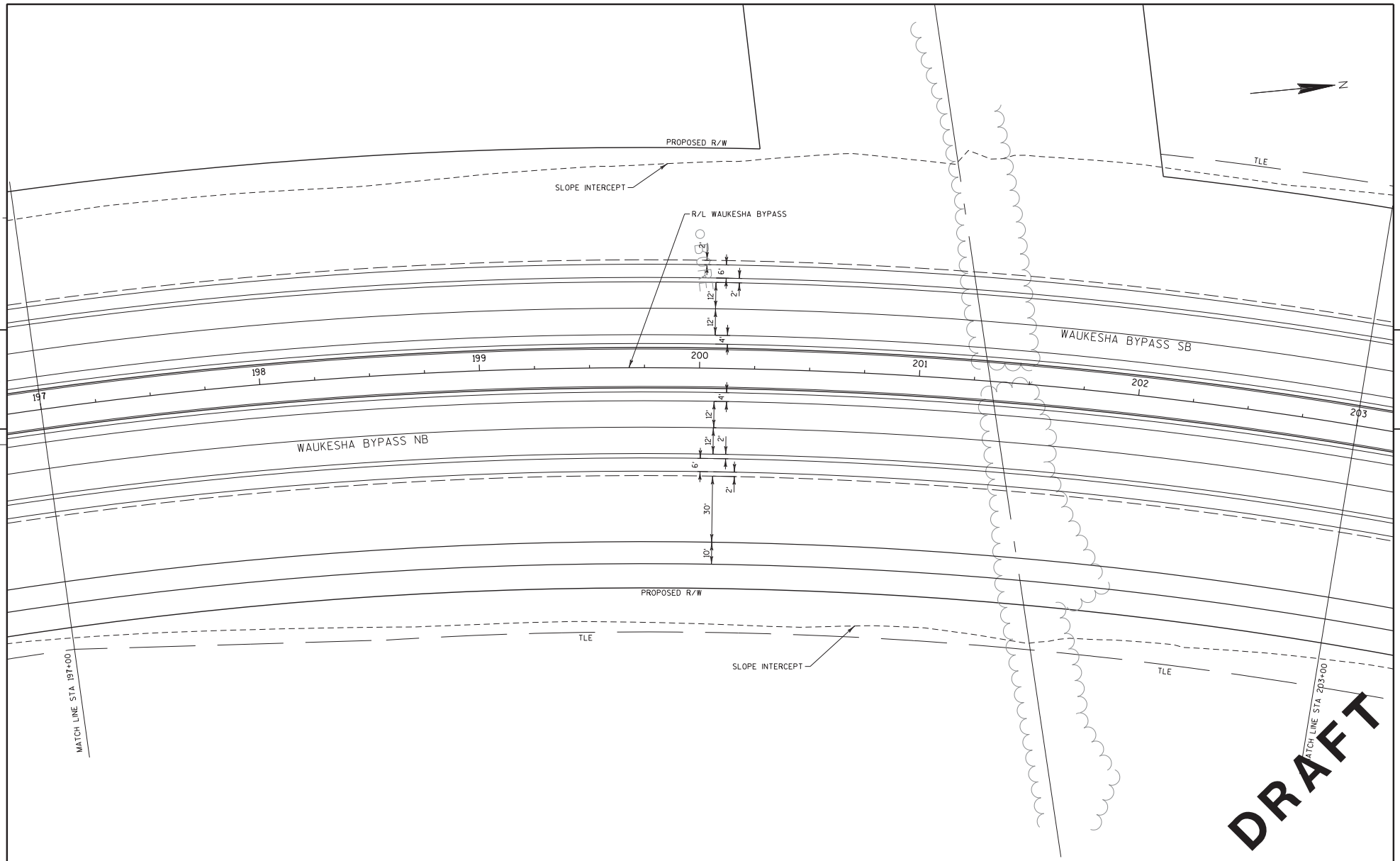


DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050134-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40 WISDOT/CADDS SHEET 30

ATTACHMENT 6

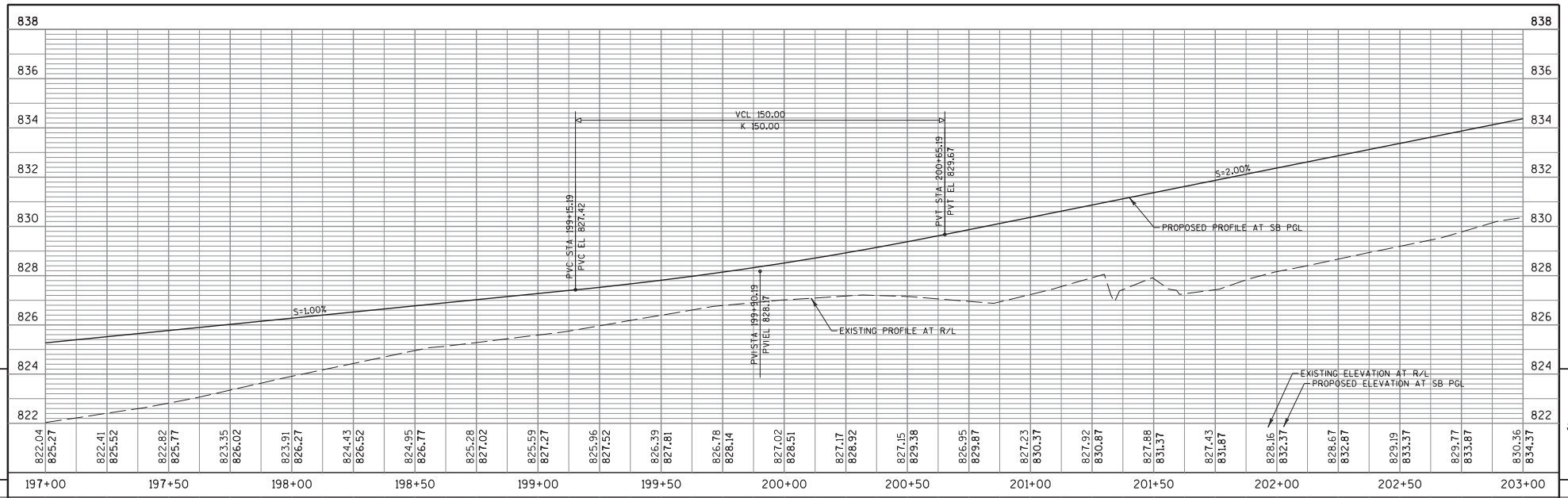


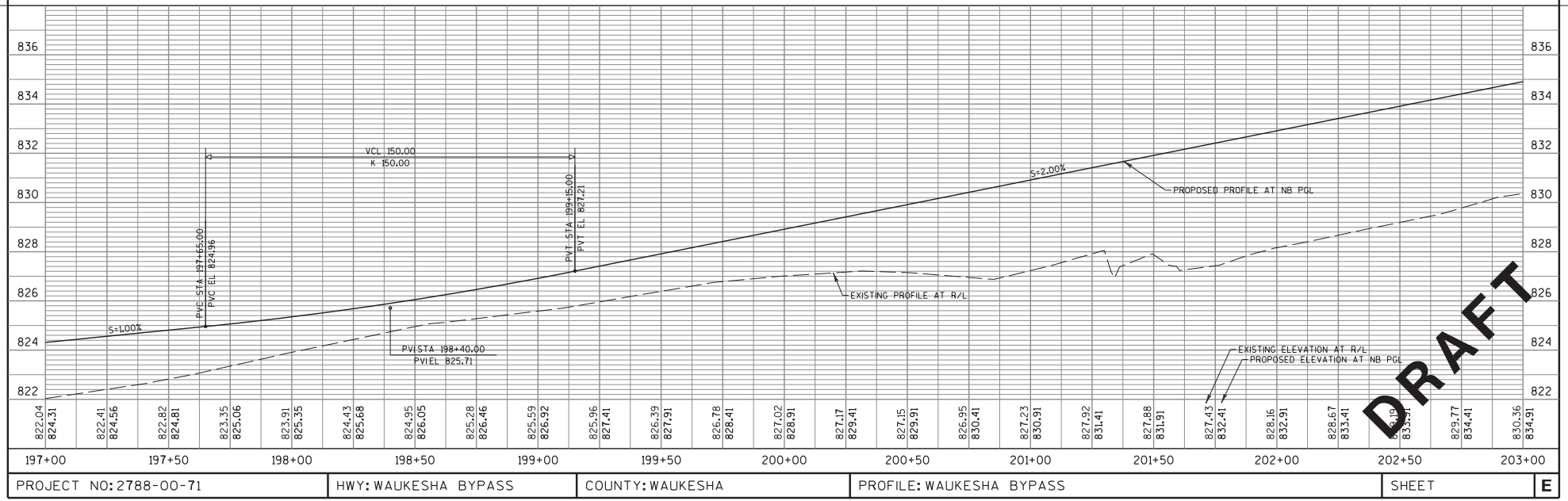
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050135-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6





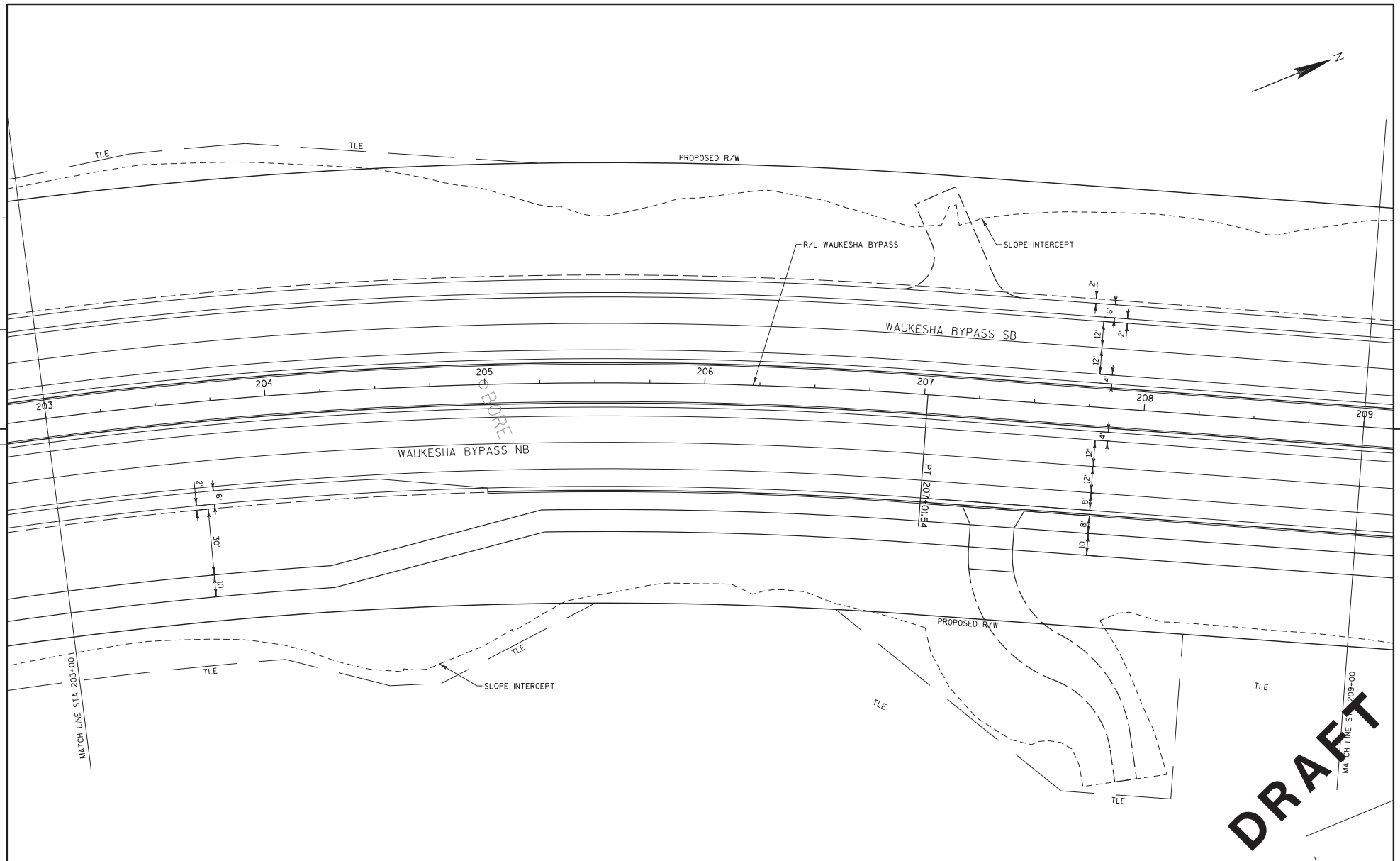
DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050136-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 30

ATTACHMENT 6

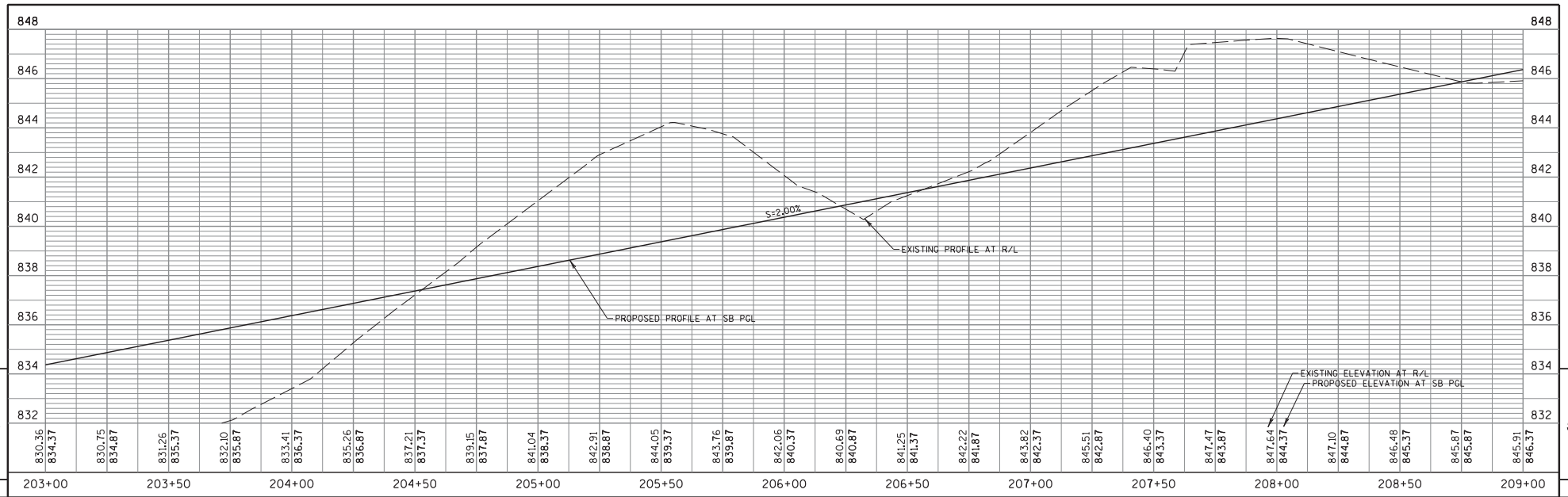


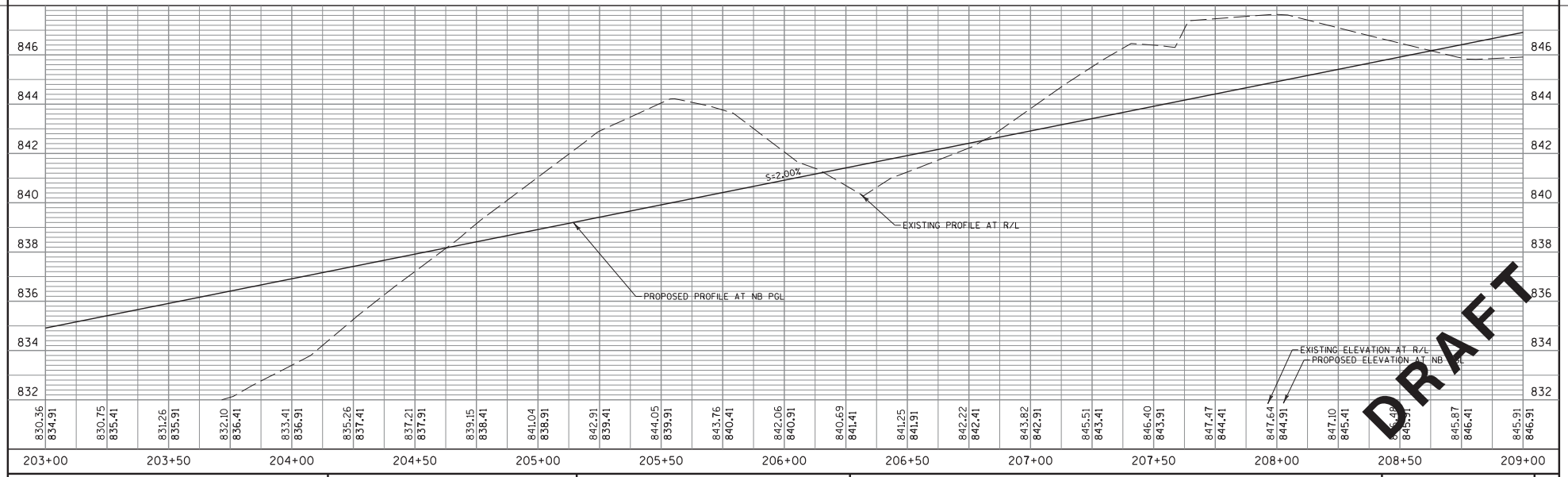
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050137-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6





PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050138-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 30

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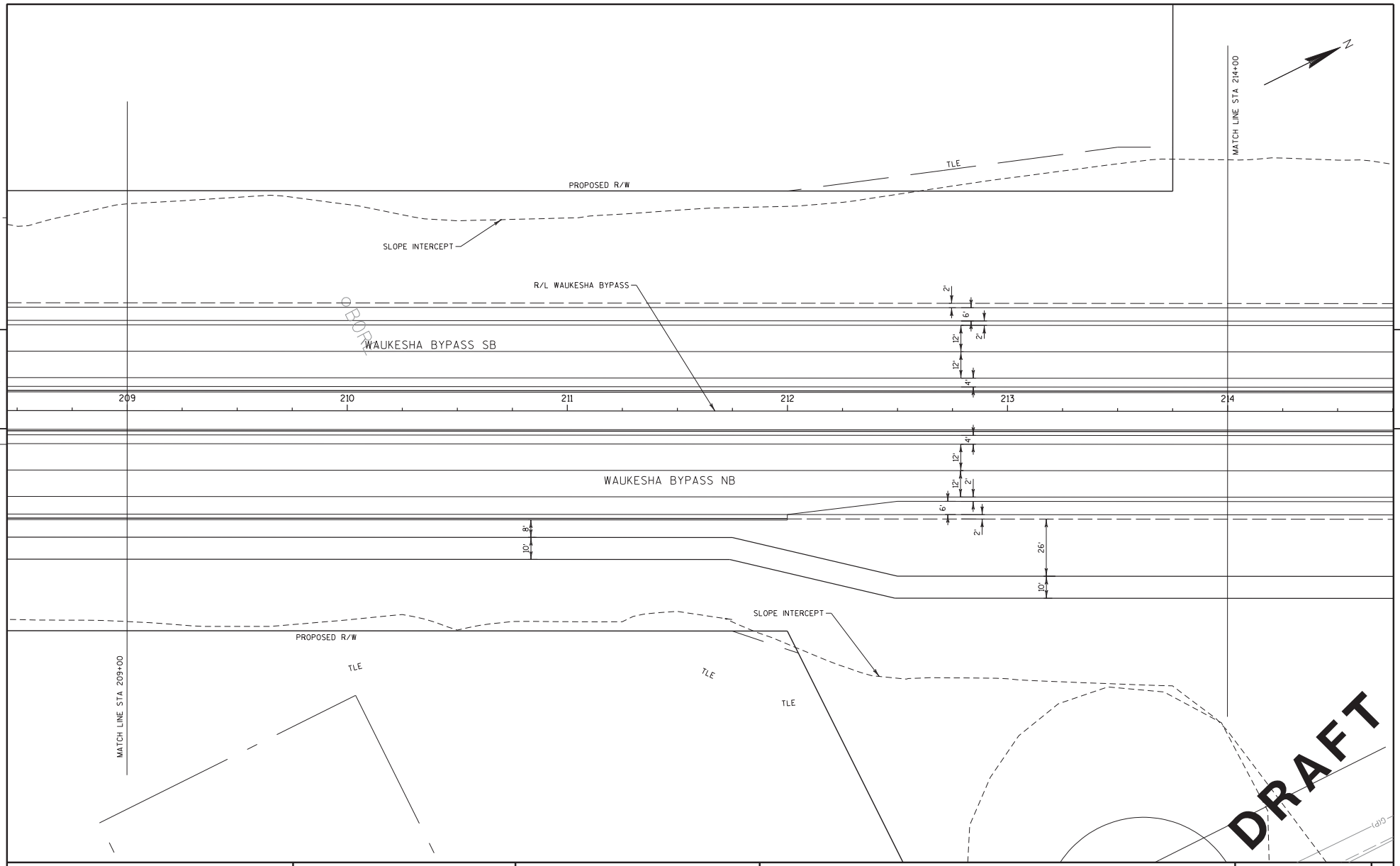

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050139-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

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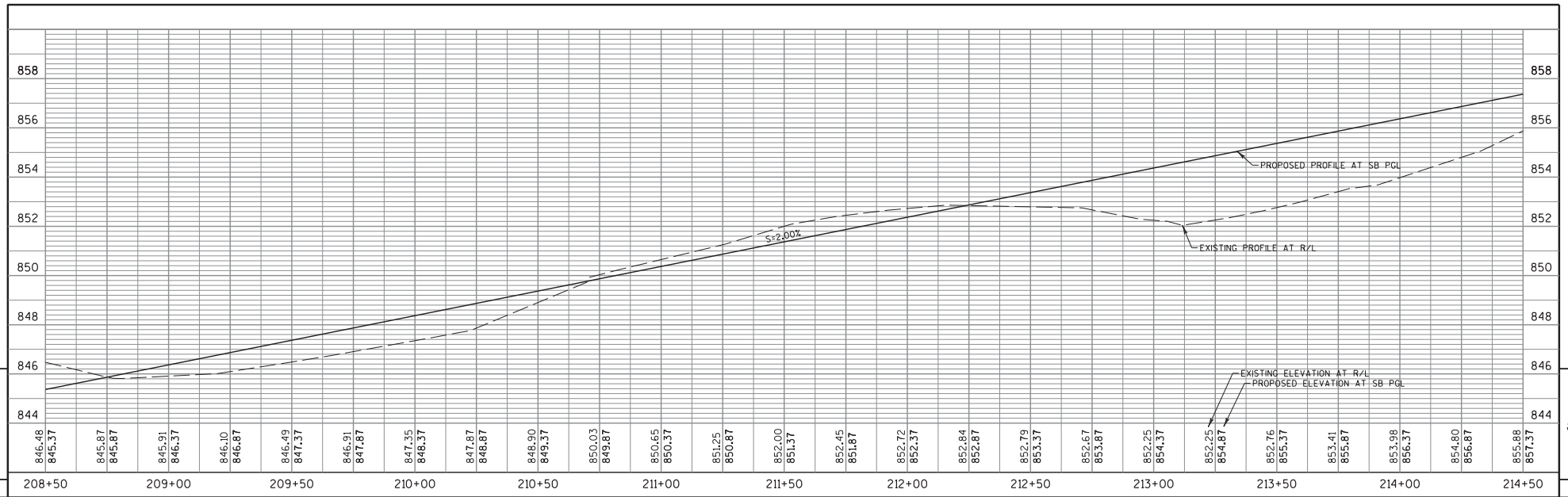
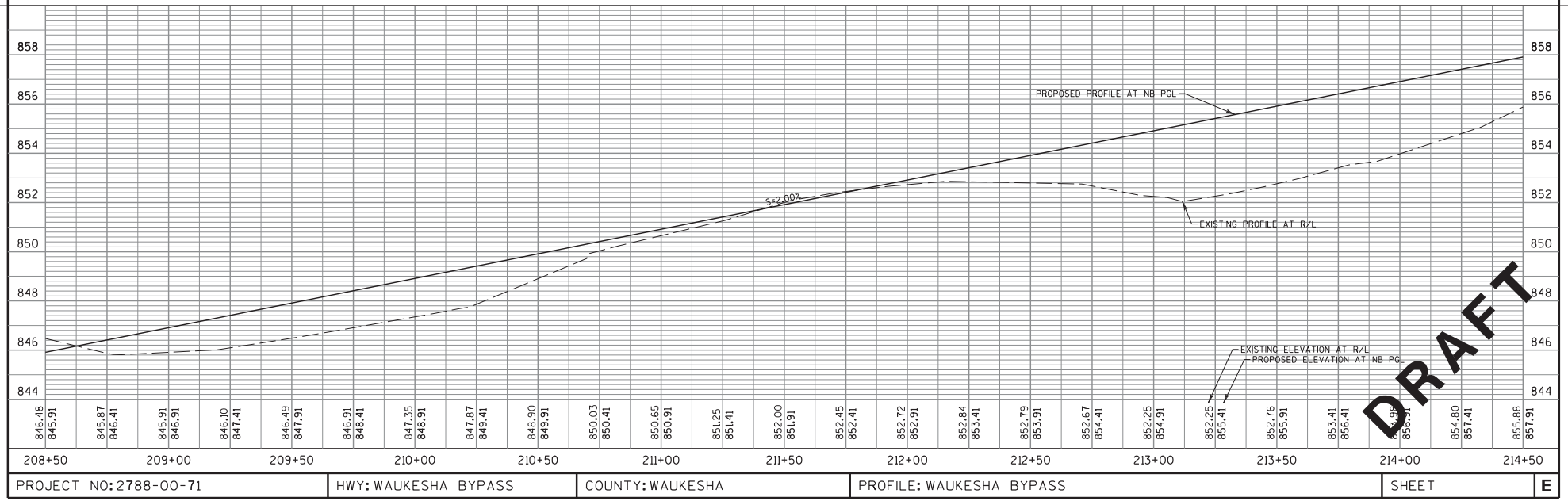




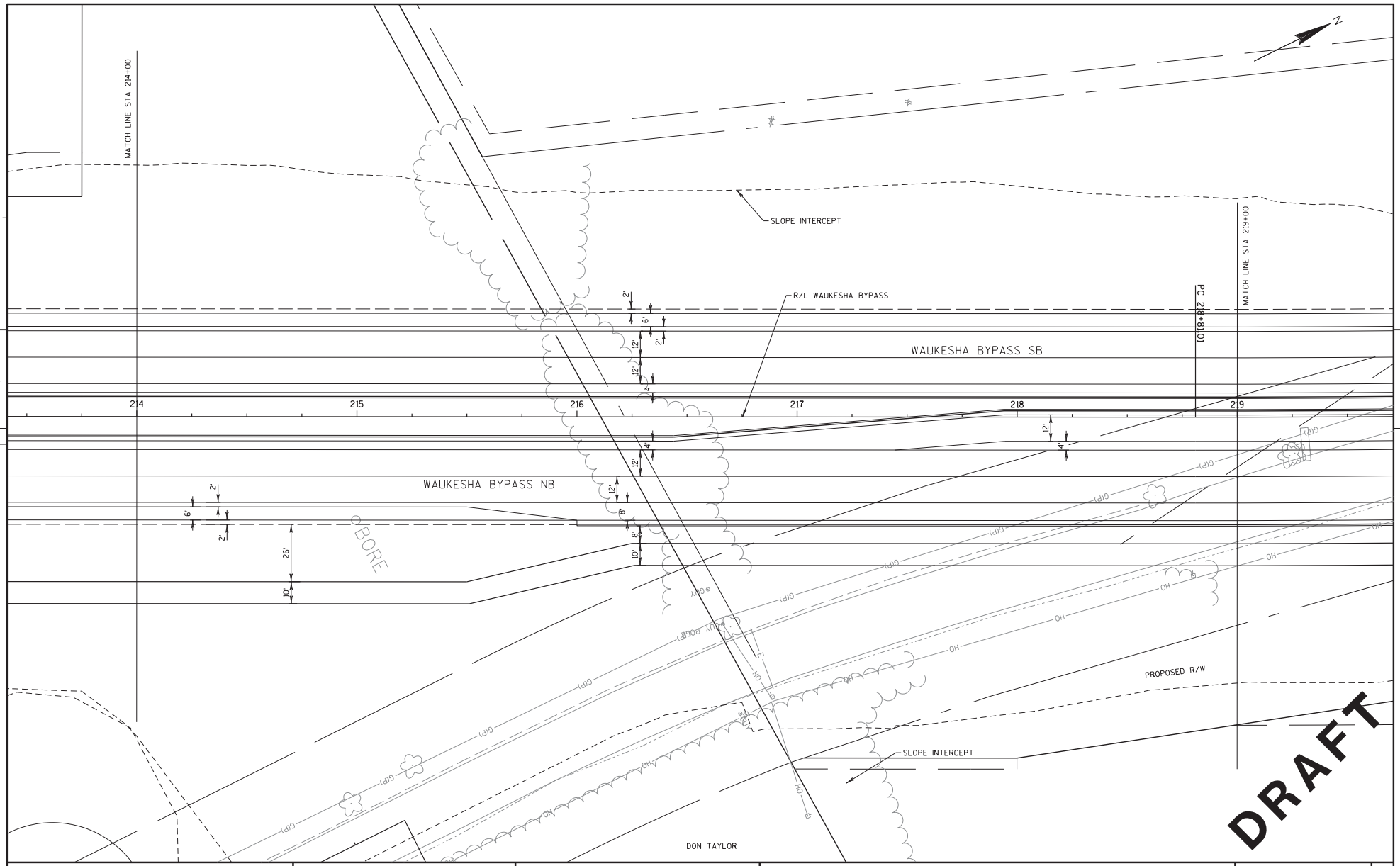
DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050140-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 30

ATTACHMENT 6

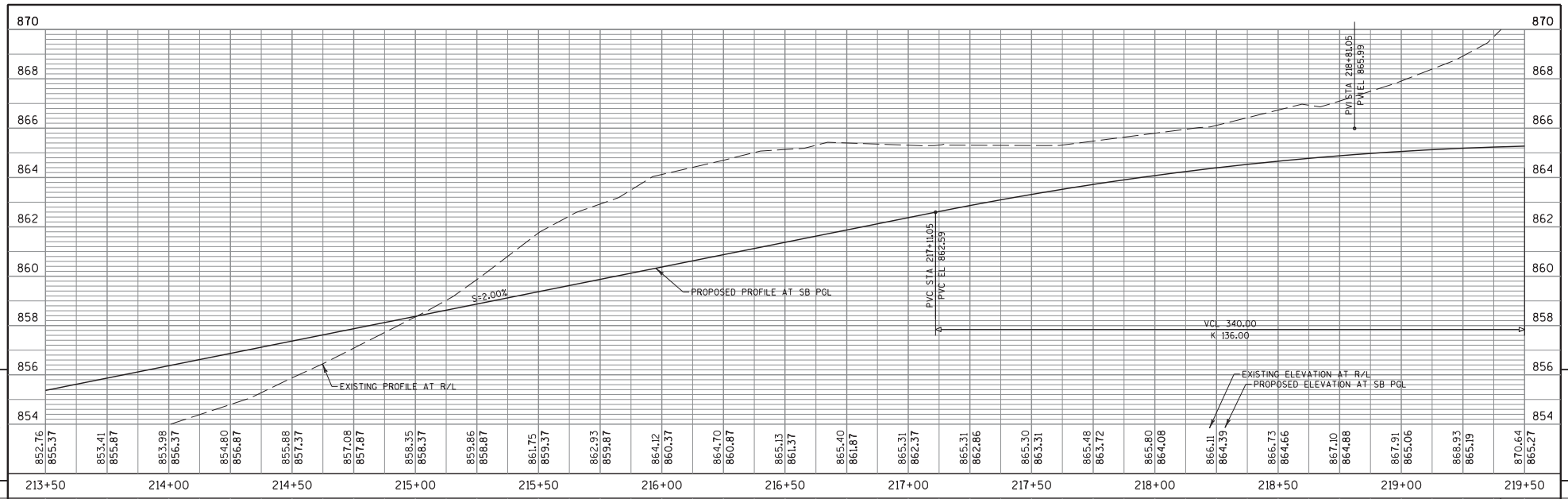


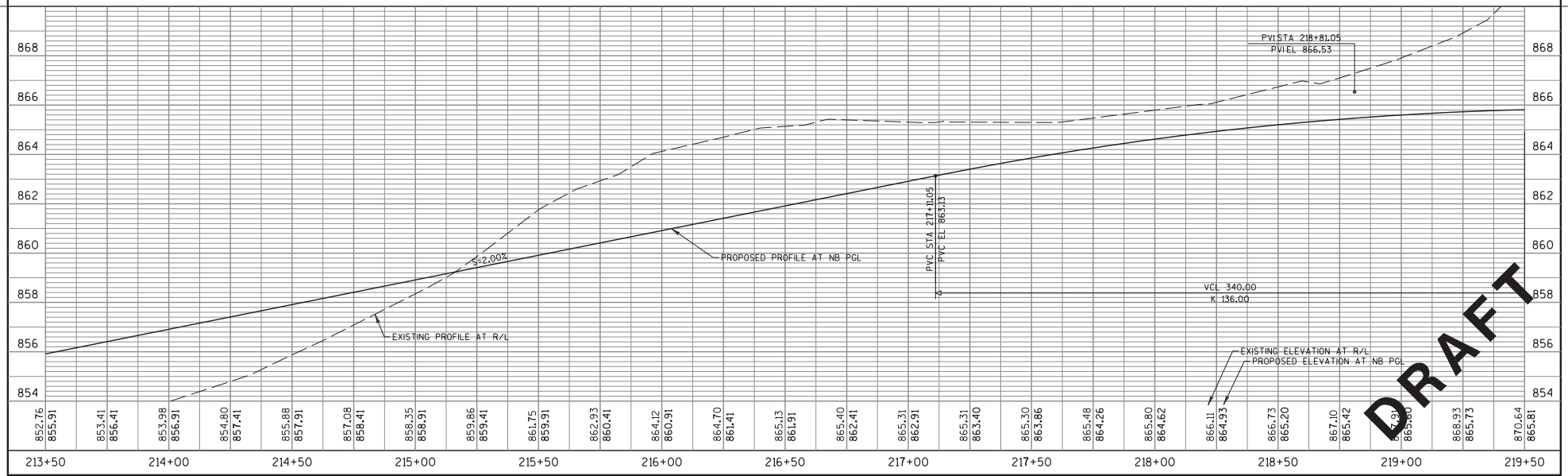
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050141-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6





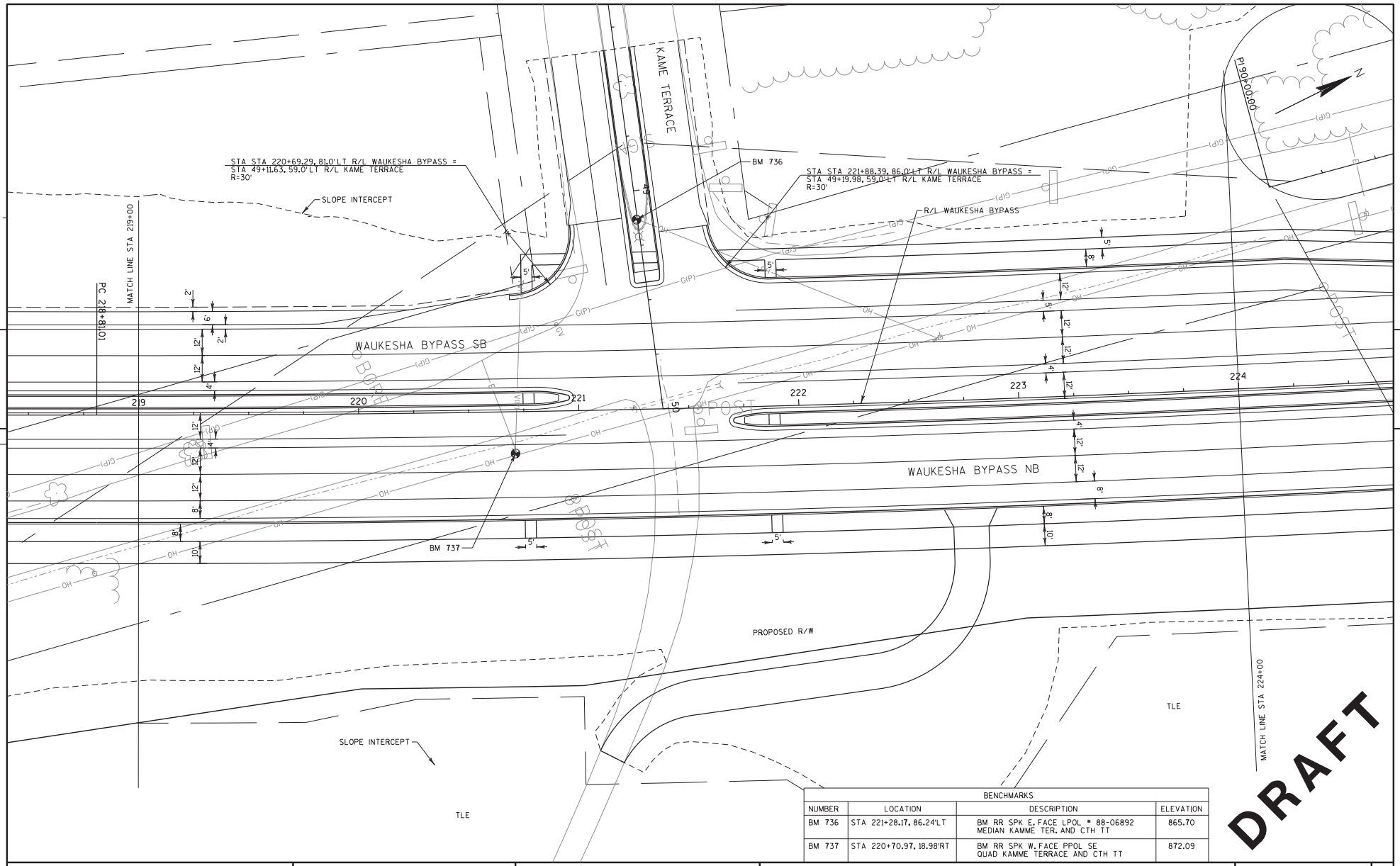
DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050142-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 30

ATTACHMENT 6



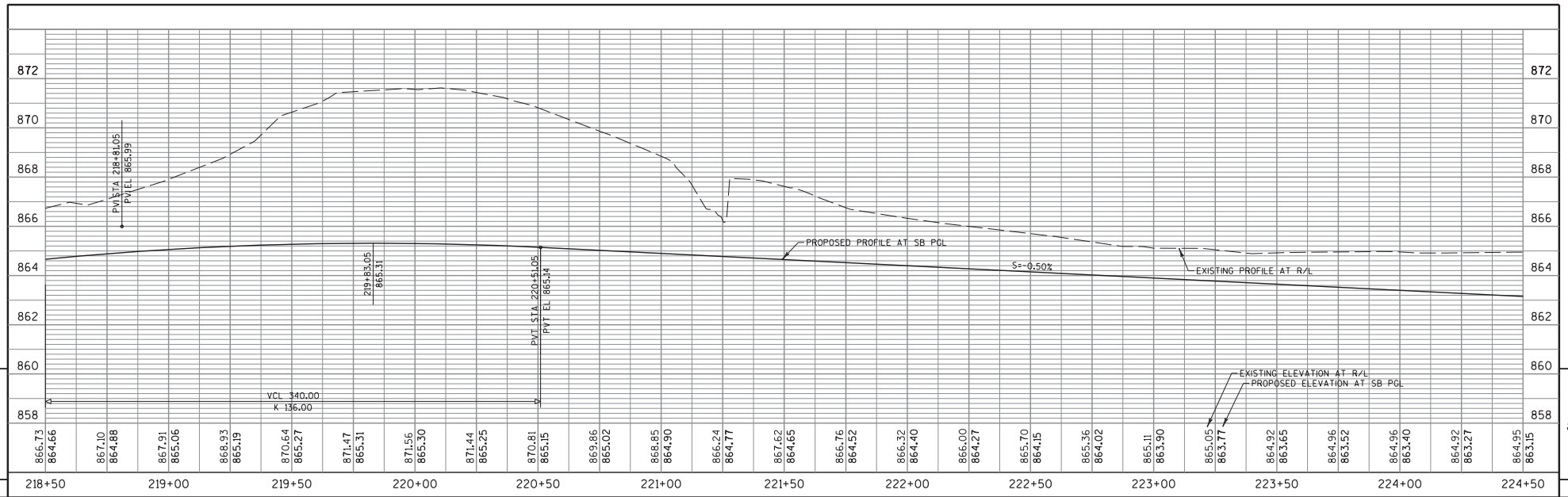
BENCHMARKS			
NUMBER	LOCATION	DESCRIPTION	ELEVATION
BM 736	STA 221+28.17, 86.24'LT	BM RR SPK E. FACE LPOL * 88-06892 MEDIAN KAMME TER. AND CTH TT	865.70
BM 737	STA 220+70.97, 18.98'RT	BM RR SPK W. FACE PPOL SE QUAD KAMME TERRACE AND CTH TT	872.09

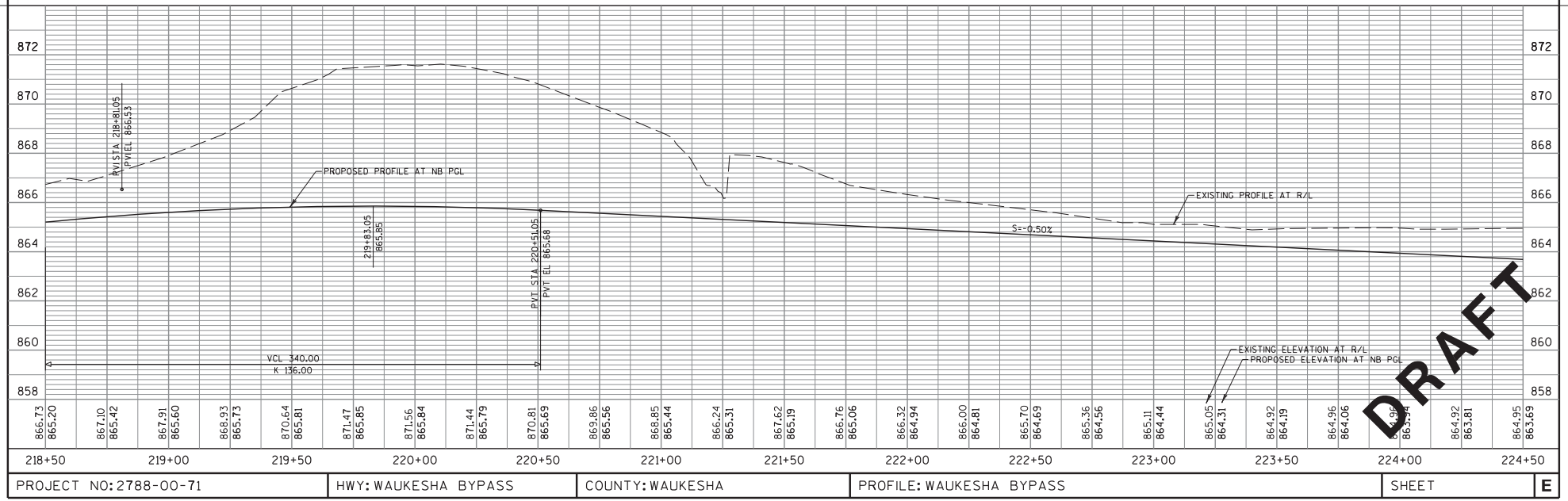
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050143-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6





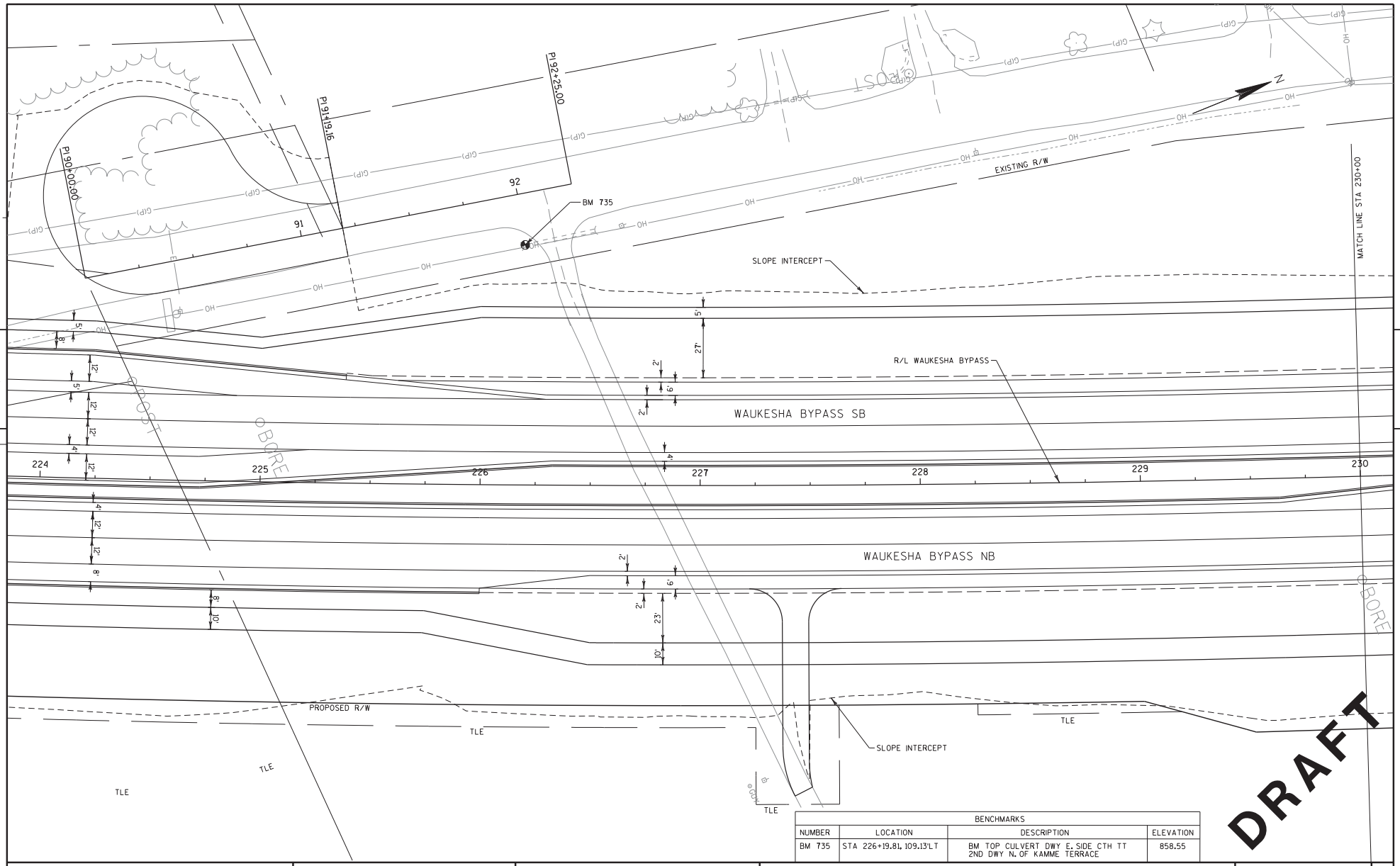
DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050144-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 30

ATTACHMENT 6



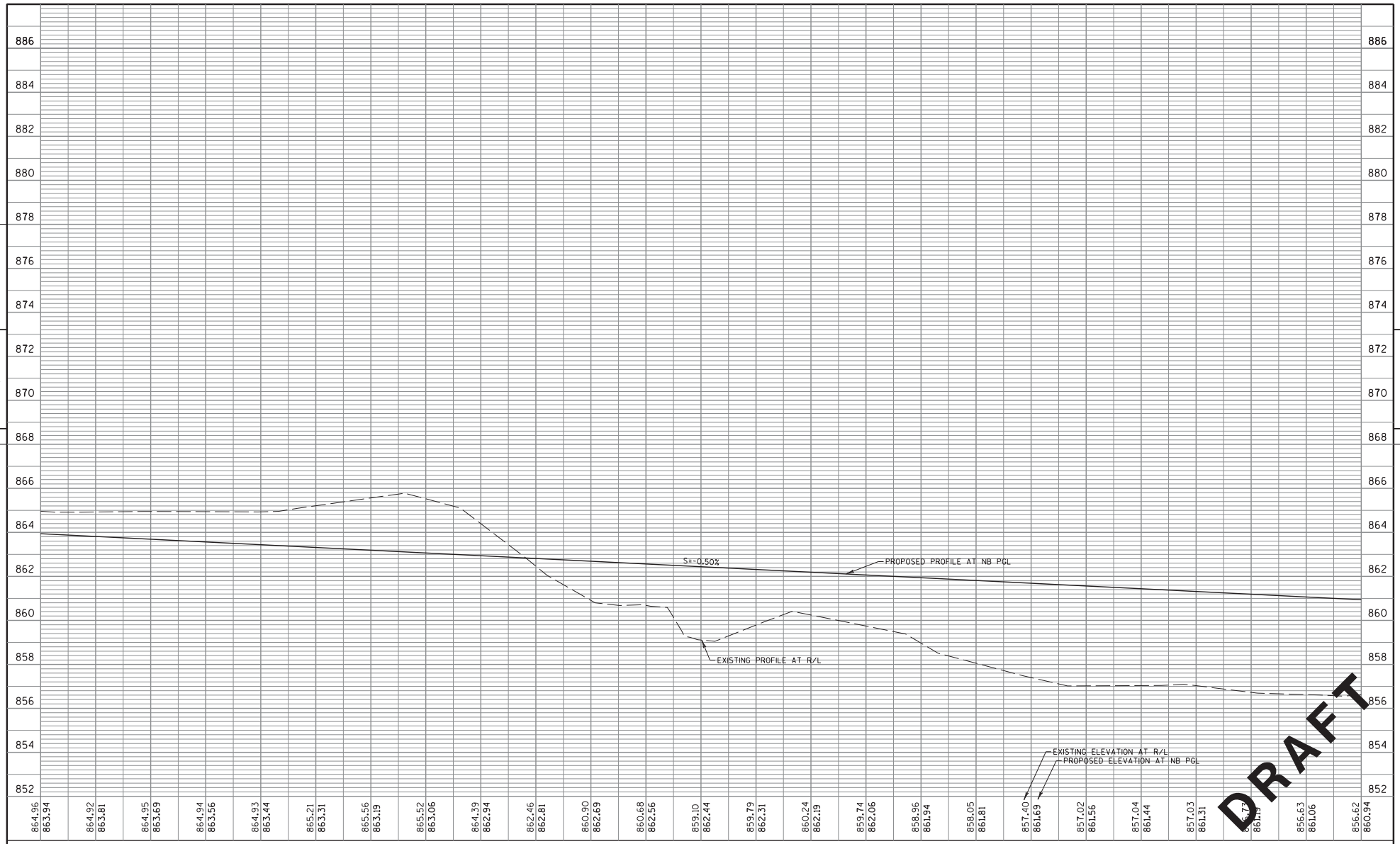
BENCHMARKS			
NUMBER	LOCATION	DESCRIPTION	ELEVATION
BM 735	STA 226+19.81, 109.13'LT	BM TOP CULVERT DWY E. SIDE CTH TT 2ND DWY N. OF KAMME TERRACE	858.55

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050145-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6



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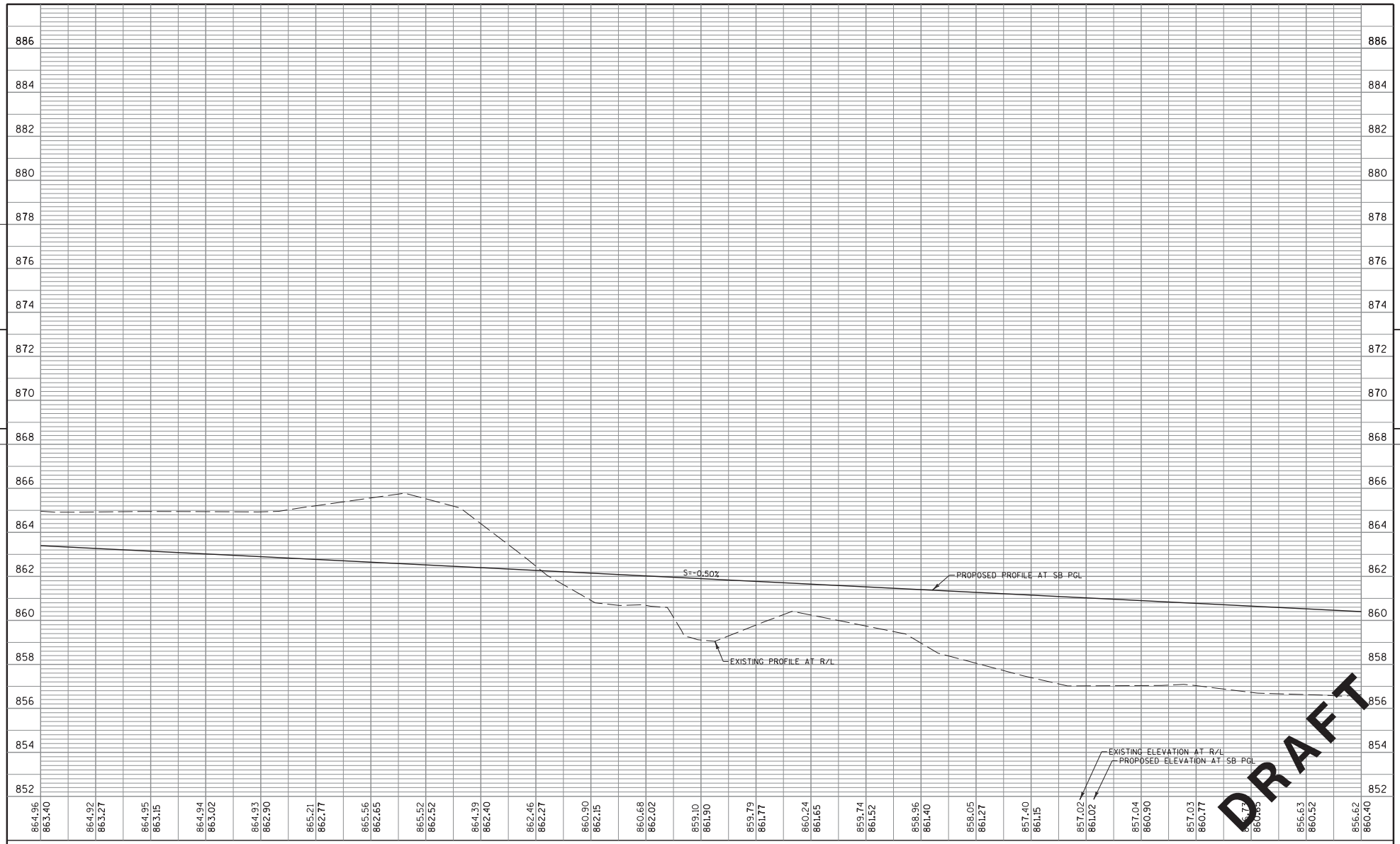
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS NB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050146a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

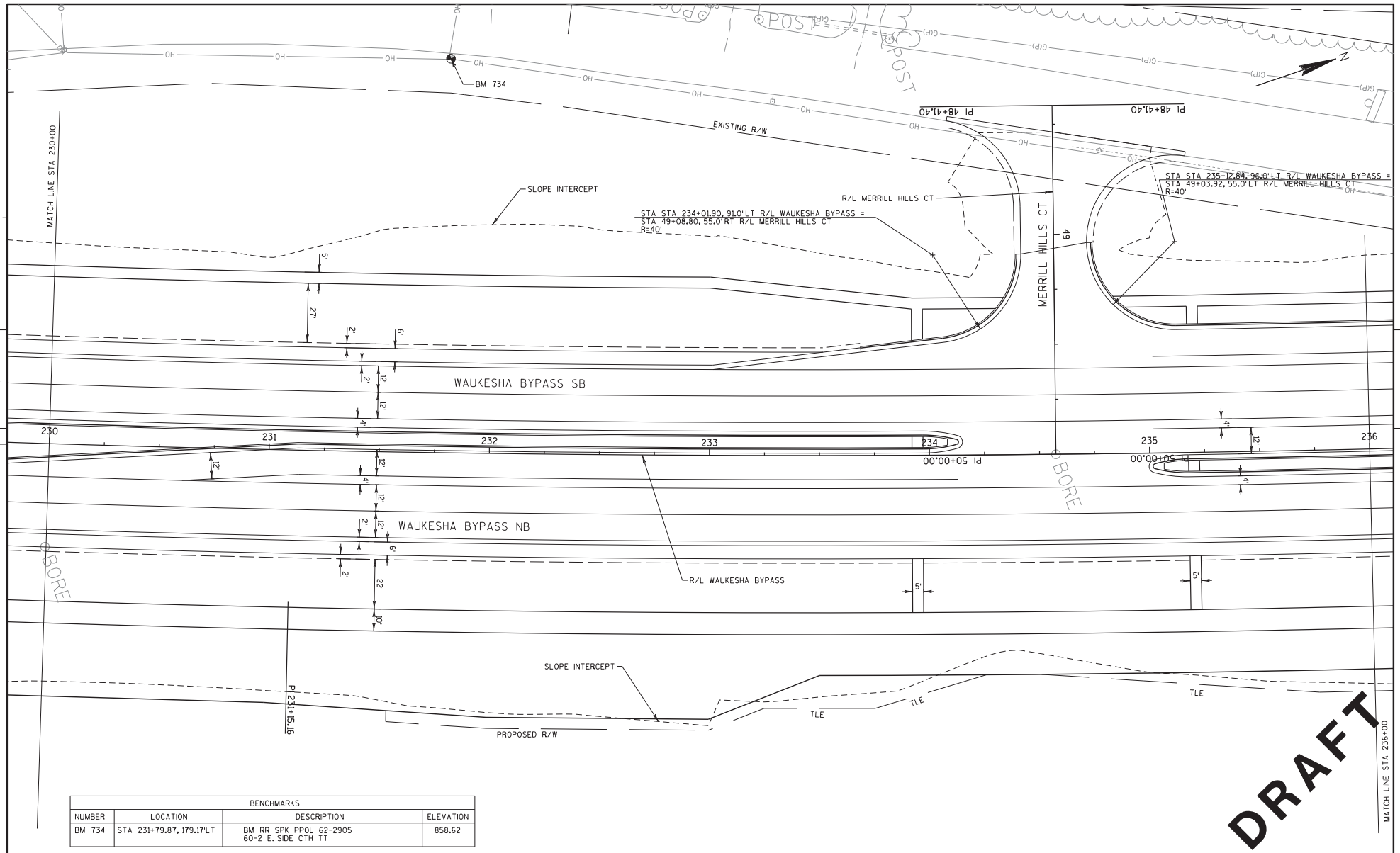


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS SB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050146b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6



BENCHMARKS			
NUMBER	LOCATION	DESCRIPTION	ELEVATION
BM 734	STA 231+79.87, 179.17'LT	BM RR SPK PPOL 62-2905 60-2 E. SIDE CTH TT	858.62

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050147-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

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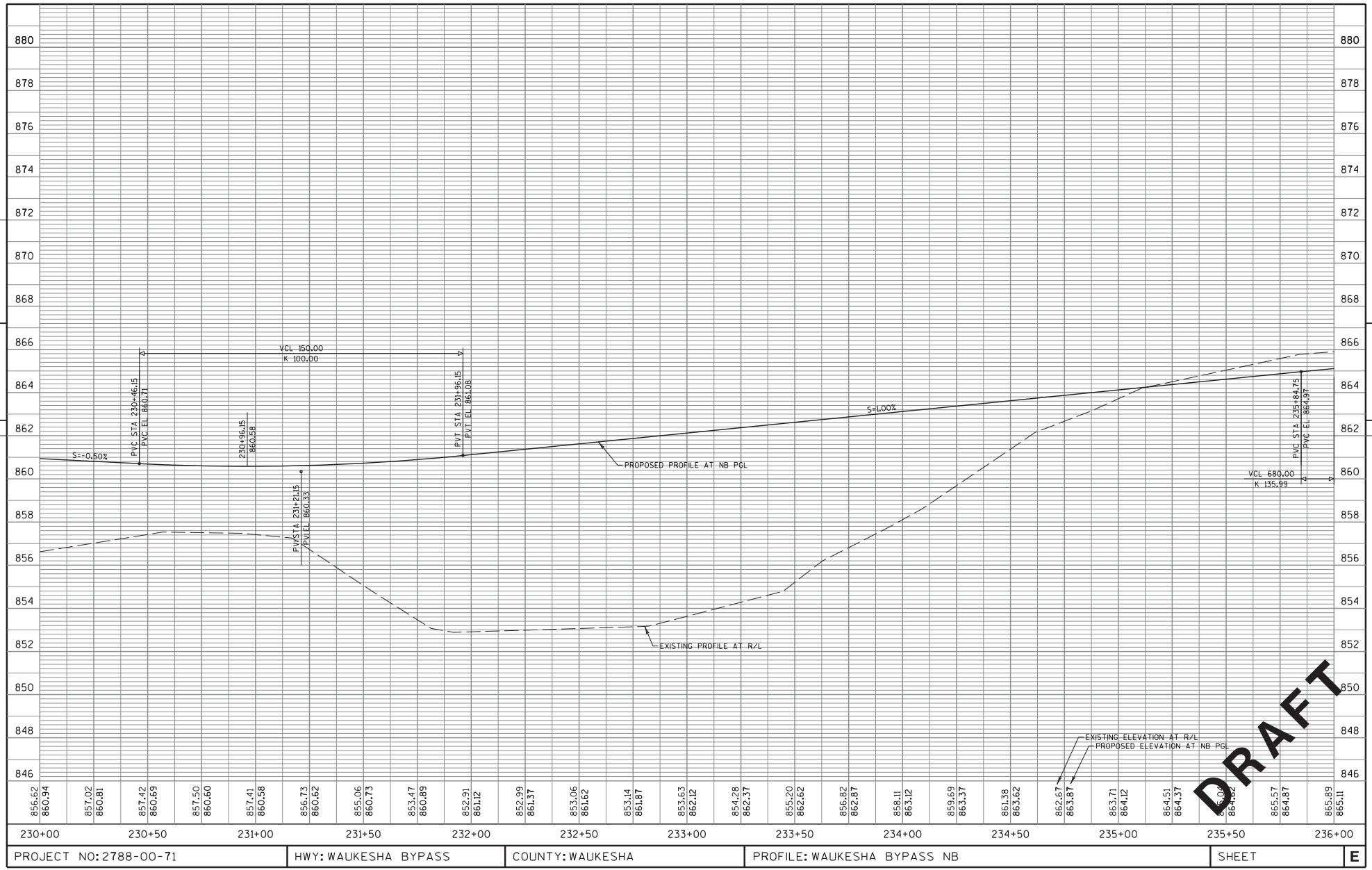

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS NB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050148a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

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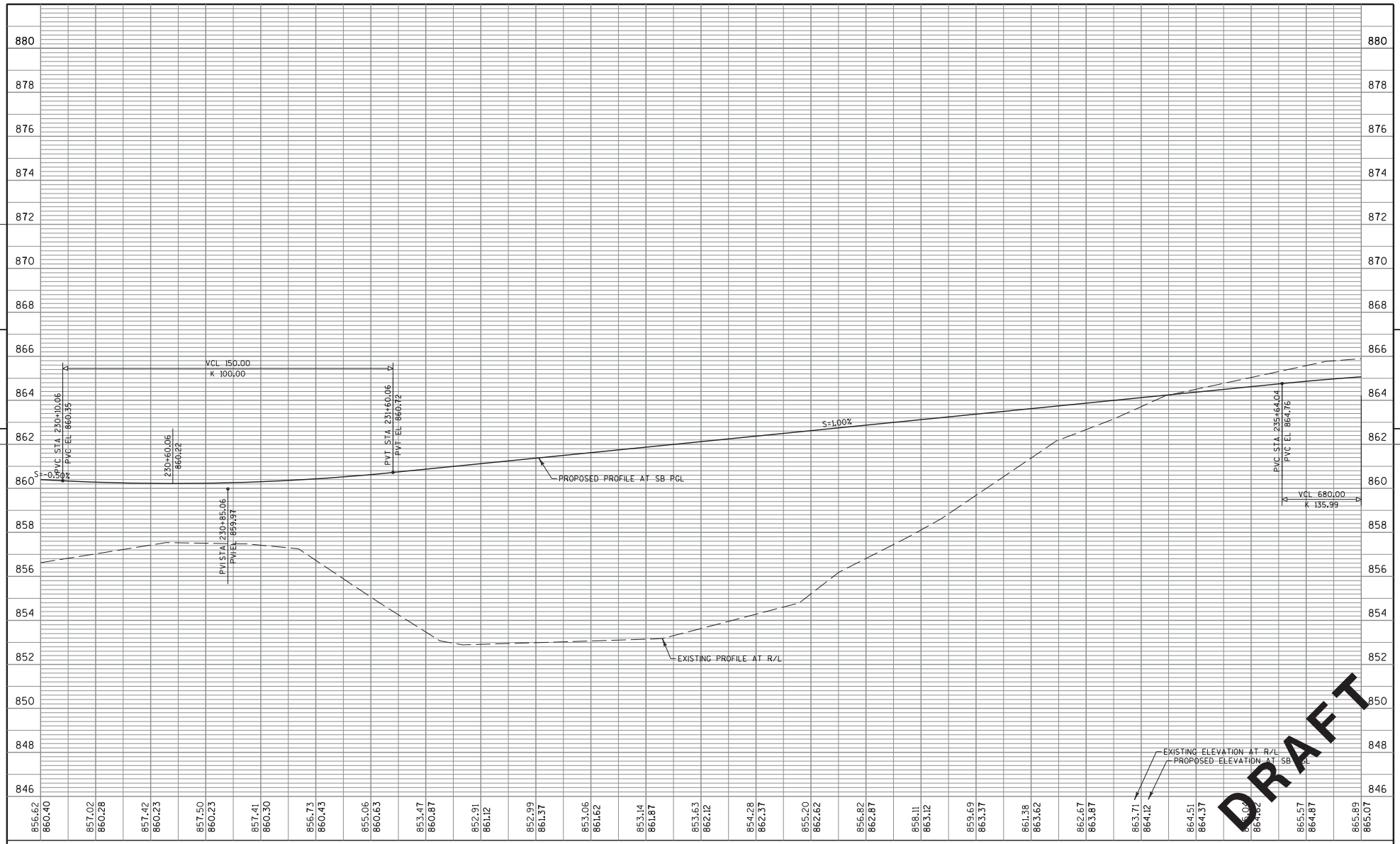

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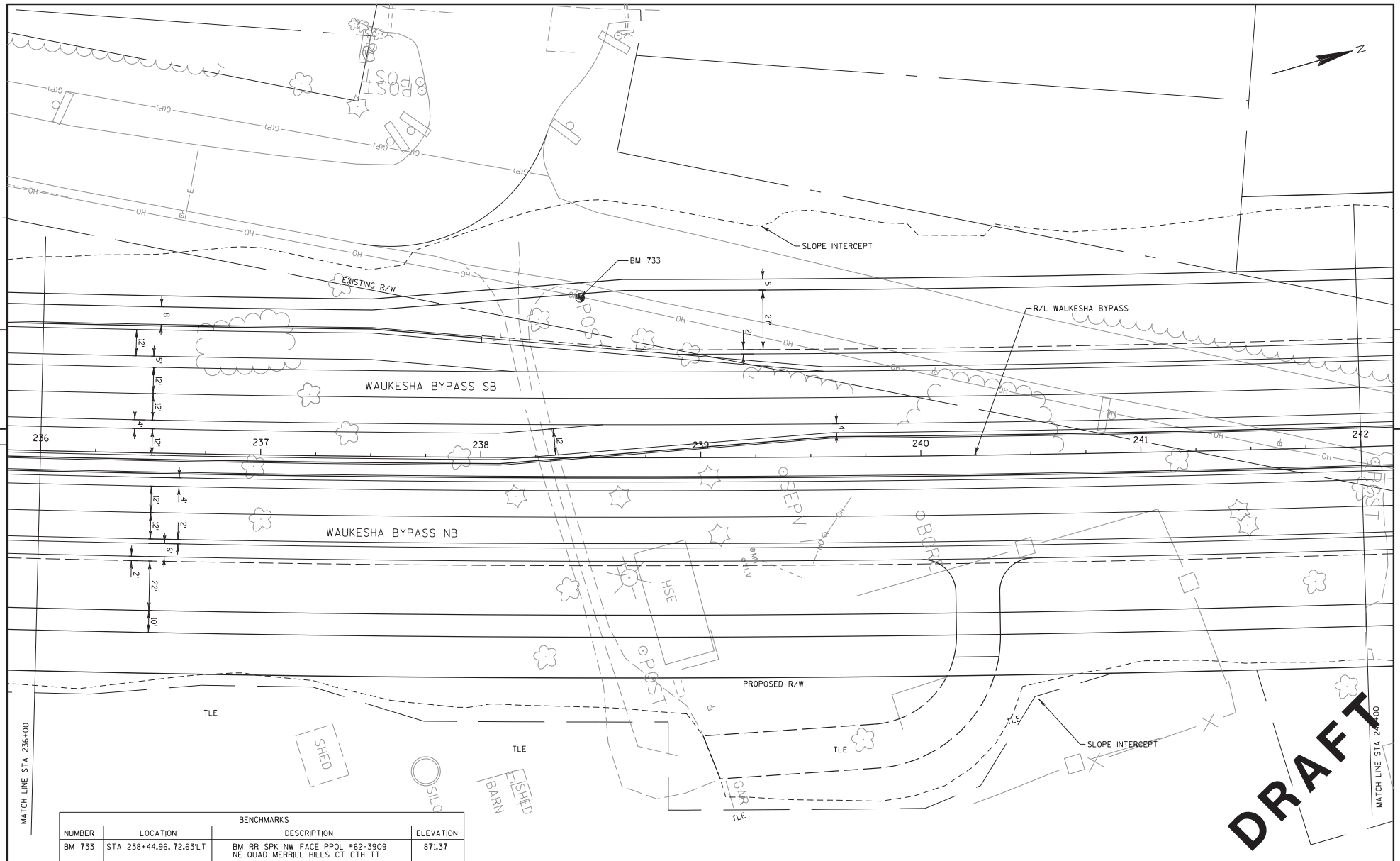
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS SB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050148b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6



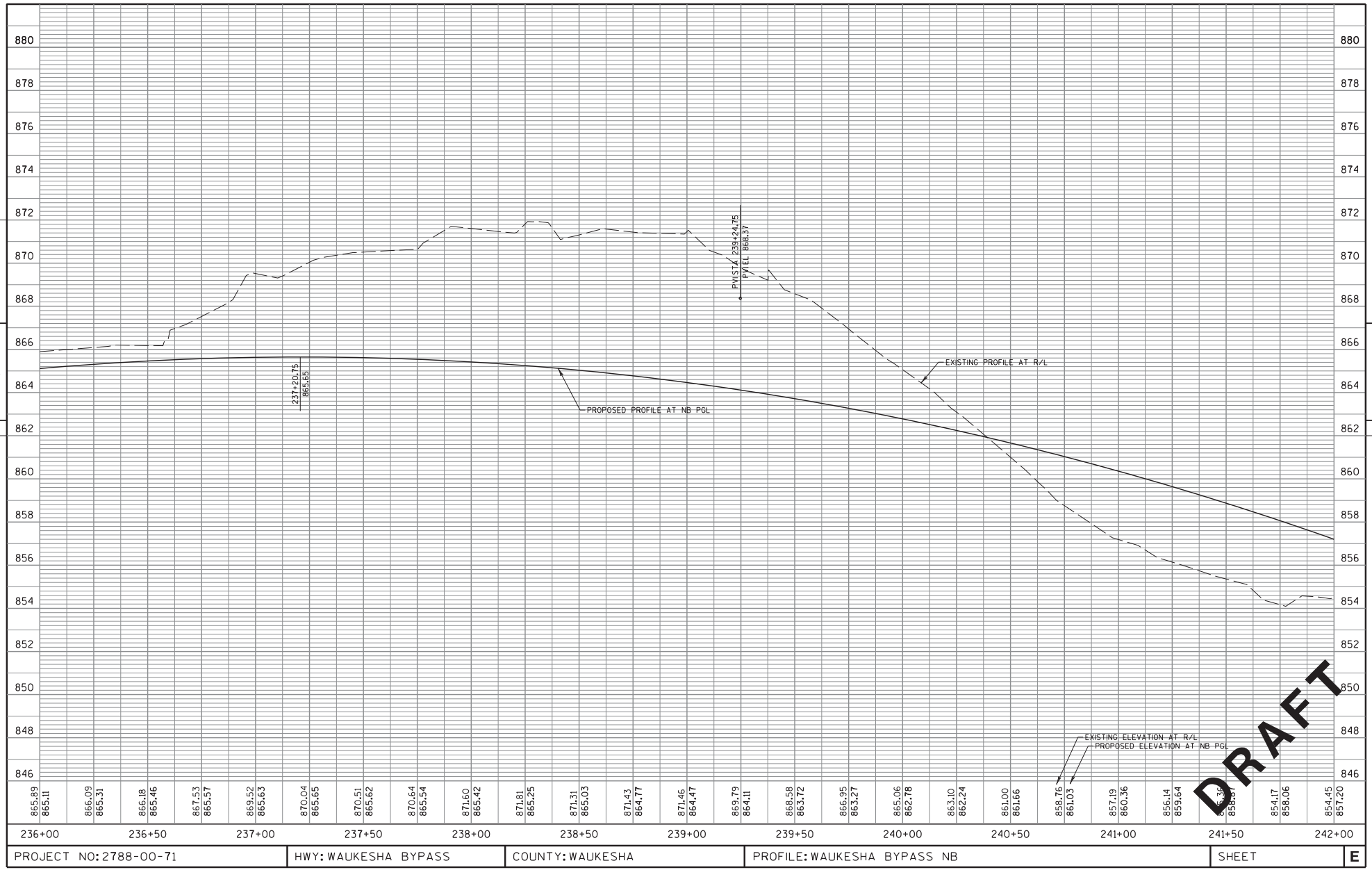
BENCHMARKS			
NUMBER	LOCATION	DESCRIPTION	ELEVATION
BM 733	STA 238+44.96, 72.63'LT	BM RR SPK NW FACE PPOL #62-3909 NE QUAD MERRILL HILLS CT CTH TT	871.37

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050149-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6

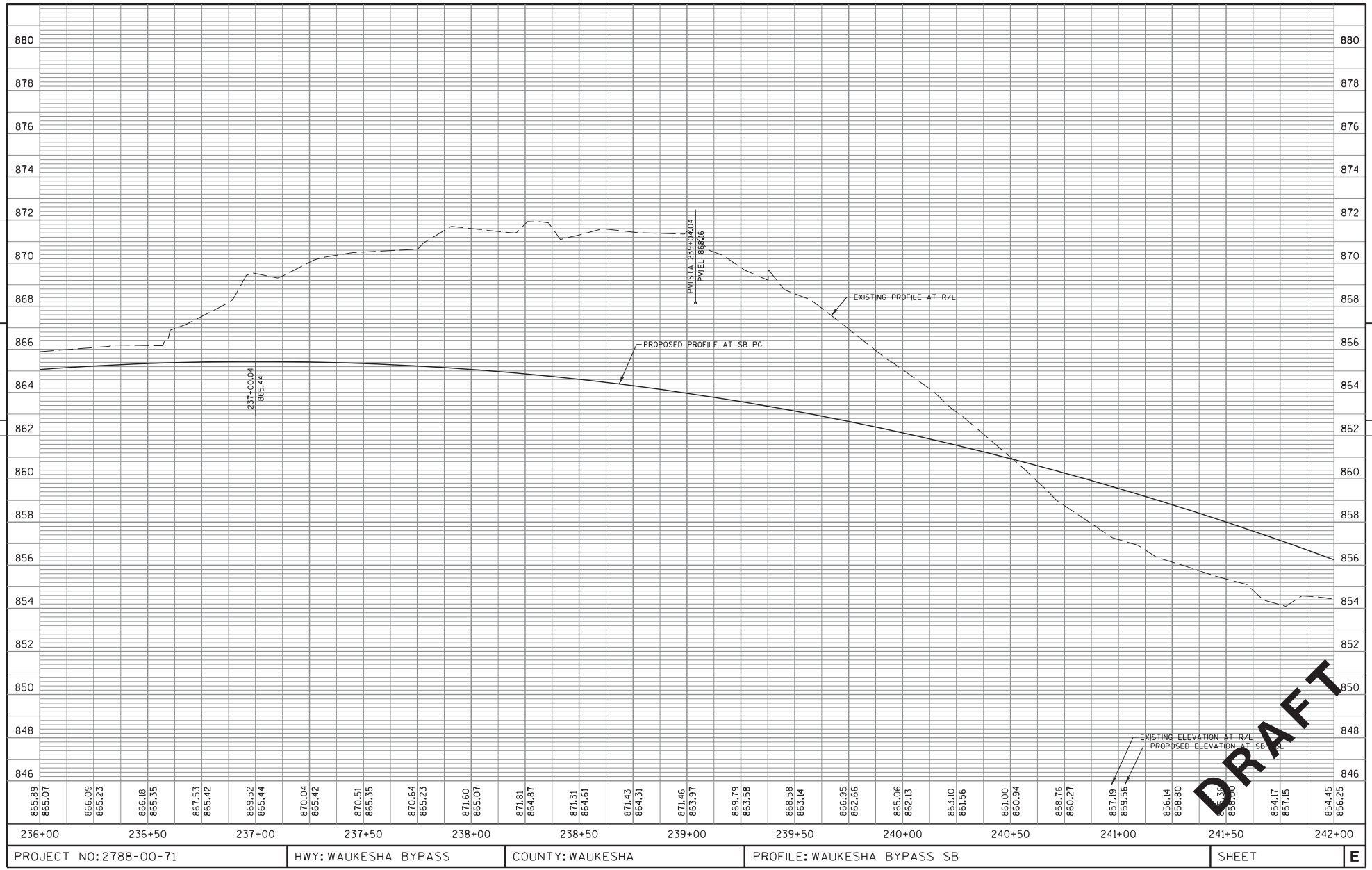


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS NB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050150a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

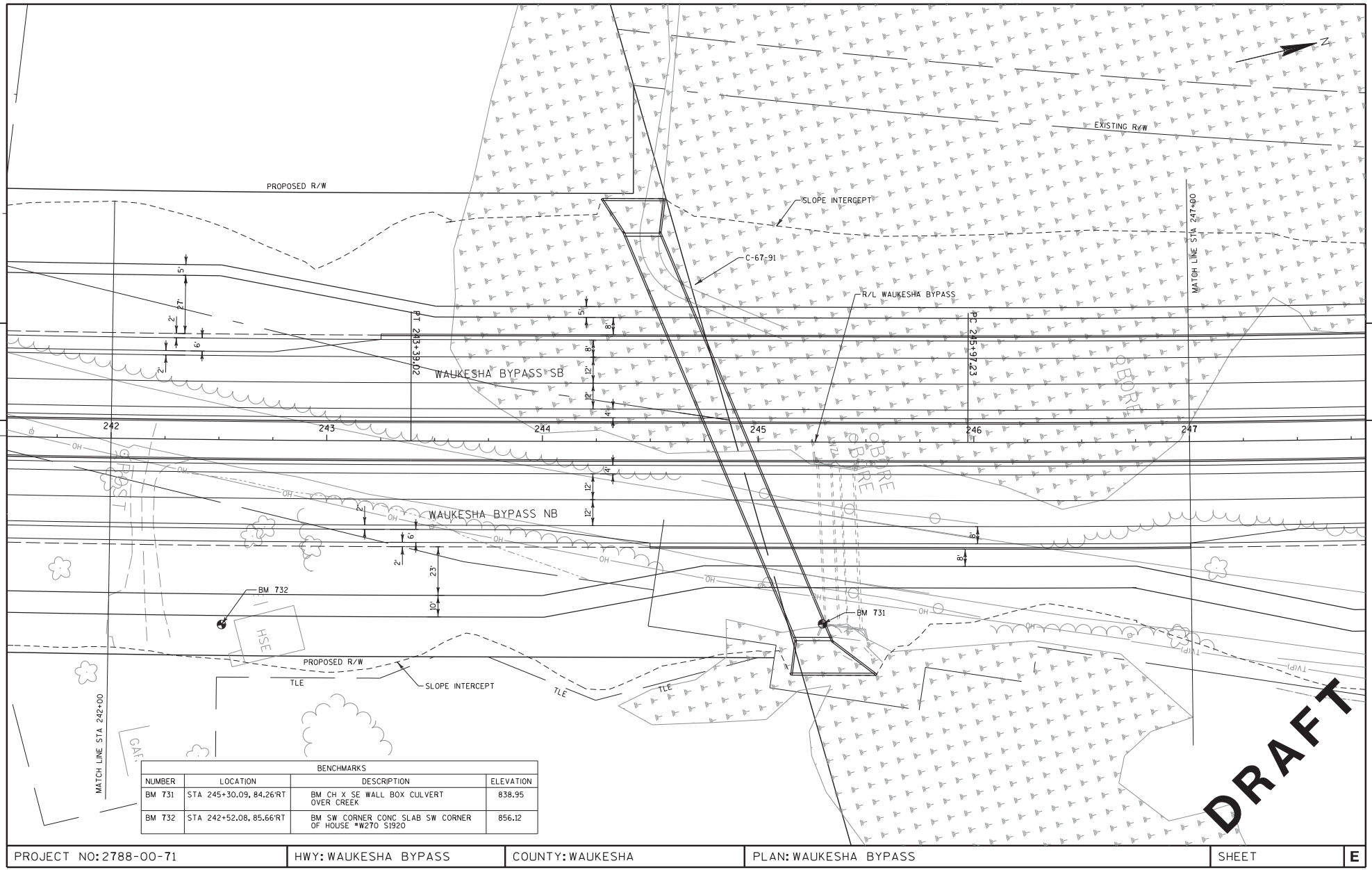


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS SB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050150b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

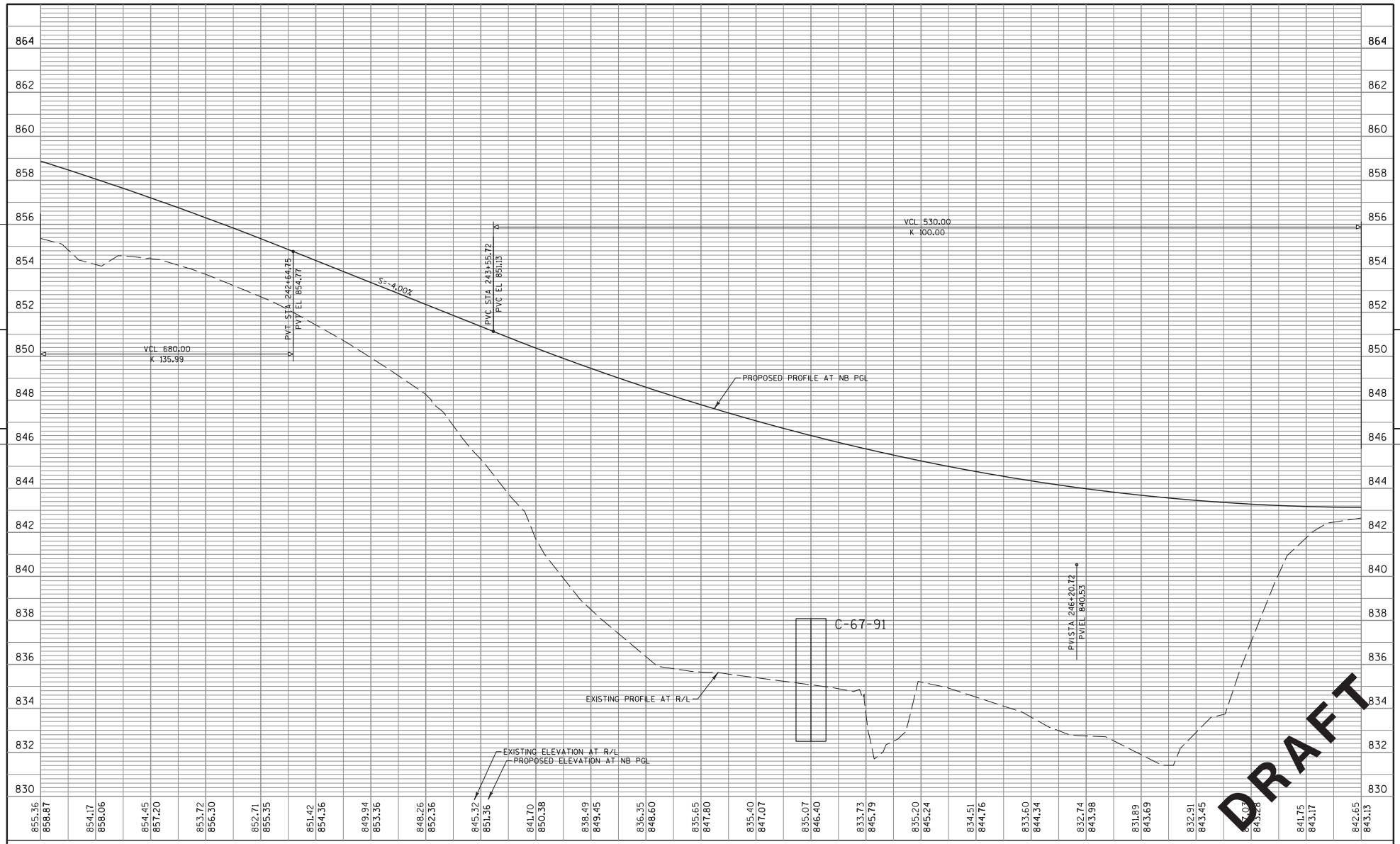


BENCHMARKS			
NUMBER	LOCATION	DESCRIPTION	ELEVATION
BM 731	STA 245+30.09, 84.26'RT	BM CH X SE WALL BOX CULVERT OVER CREEK	838.95
BM 732	STA 242+52.08, 85.66'RT	BM SW CORNER CONC SLAB SW CORNER OF HOUSE #W270 S1920	856.12

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050151-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40 WISDOT/CADDS SHEET 44

ATTACHMENT 6

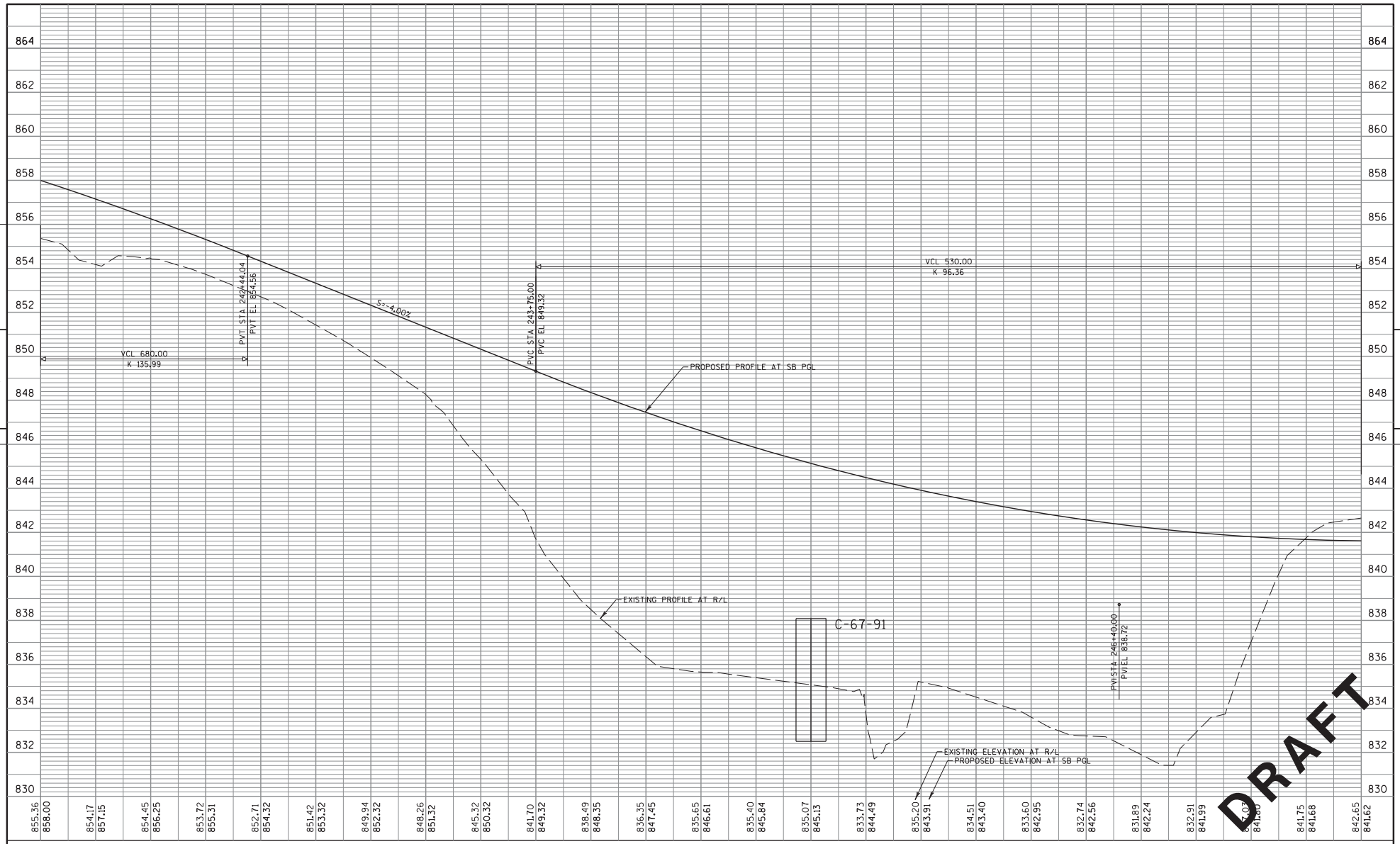


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS NB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050152a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

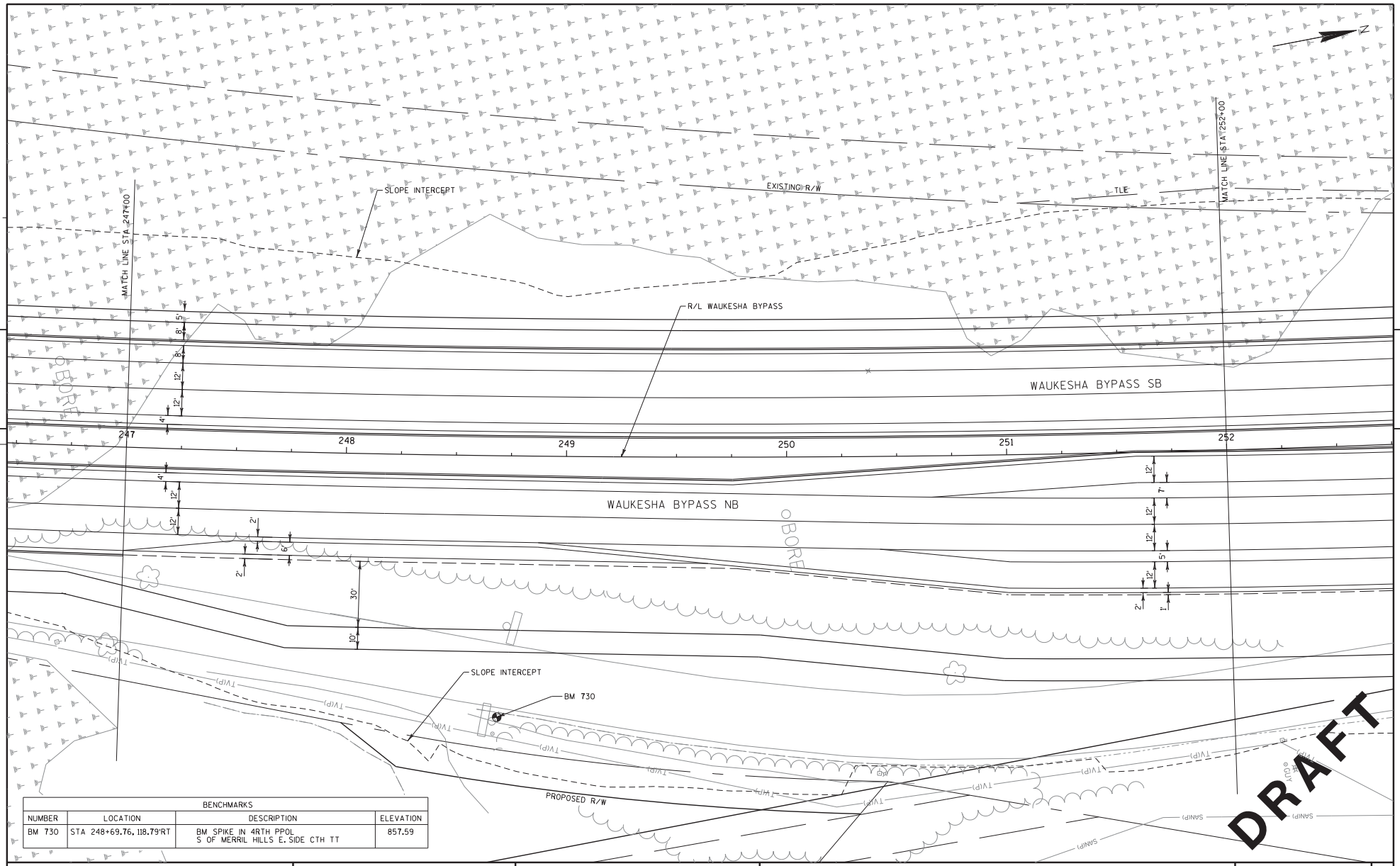


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS SB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050152b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

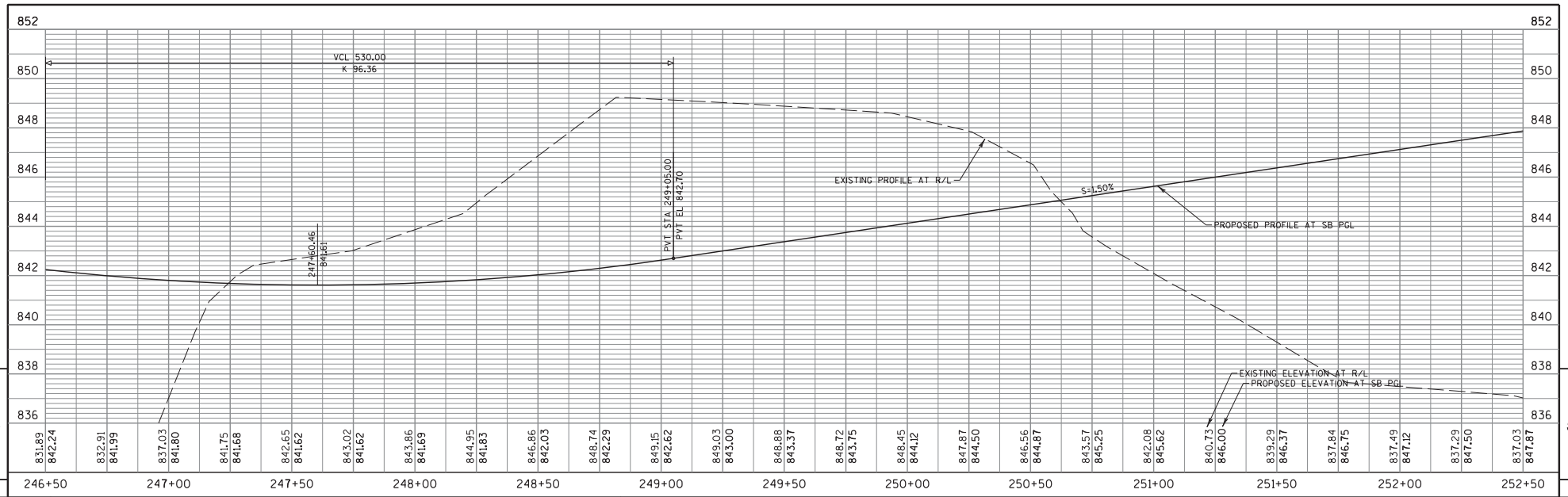


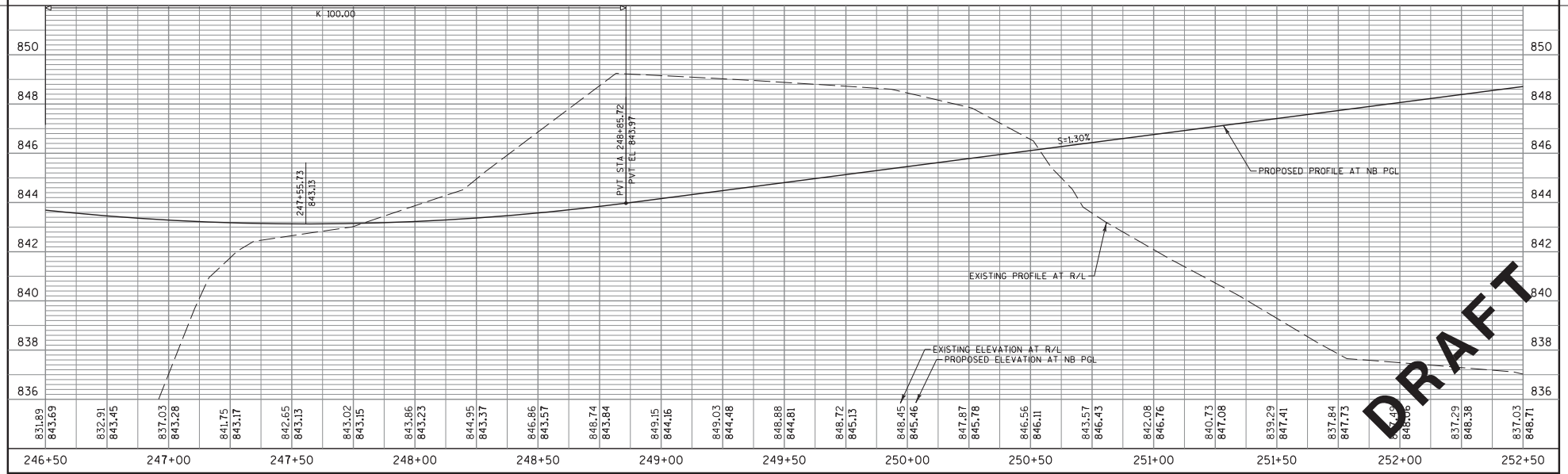
BENCHMARKS			
NUMBER	LOCATION	DESCRIPTION	ELEVATION
BM 730	STA 248+69.76, 118.79'RT	BM SPIKE IN 4RTH PPOL S OF MERRIL HILLS E. SIDE CTH TT	857.59

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050153-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40 WISDOT/CADDS SHEET 44

ATTACHMENT 6



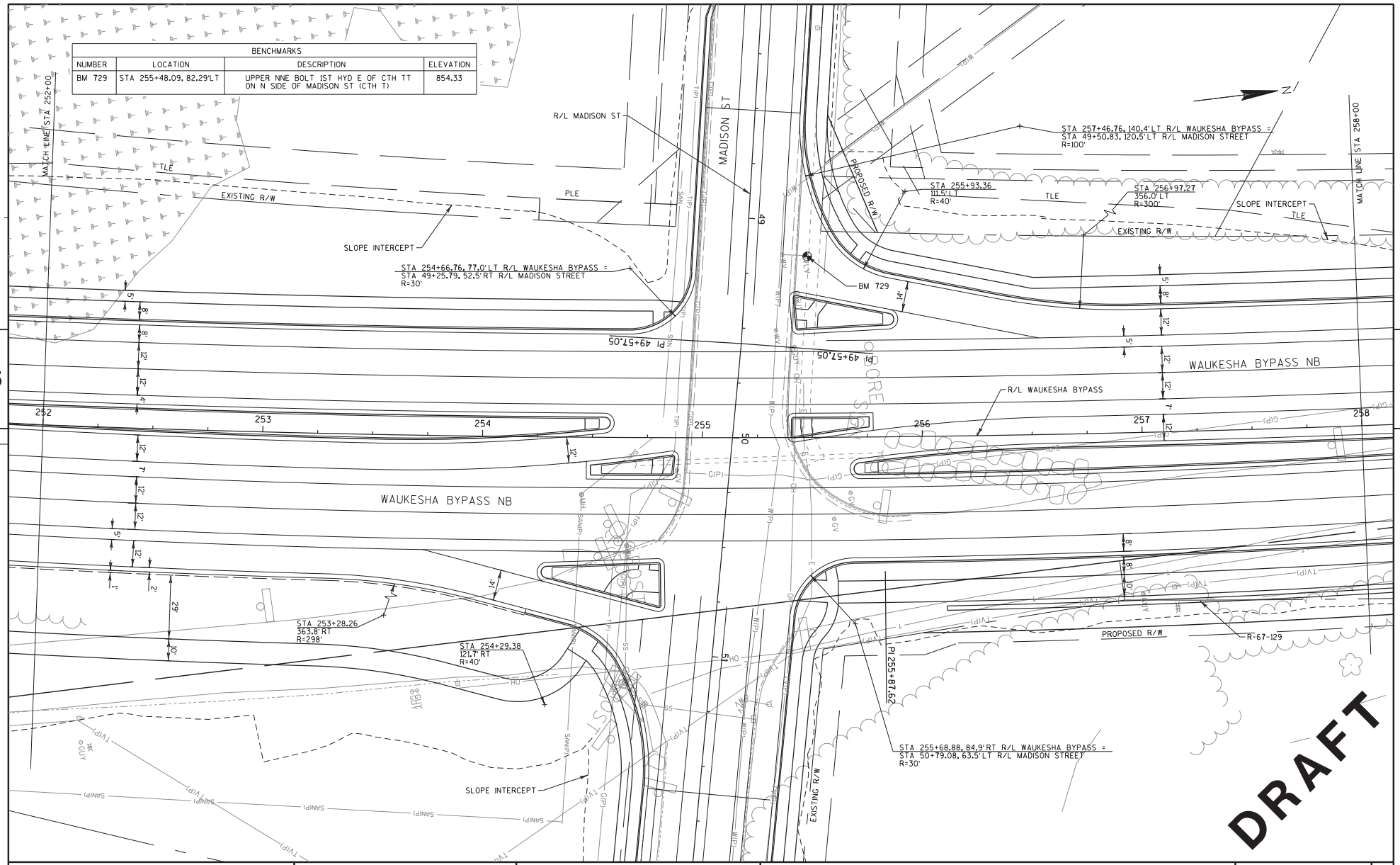


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050154a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 30

ATTACHMENT 6

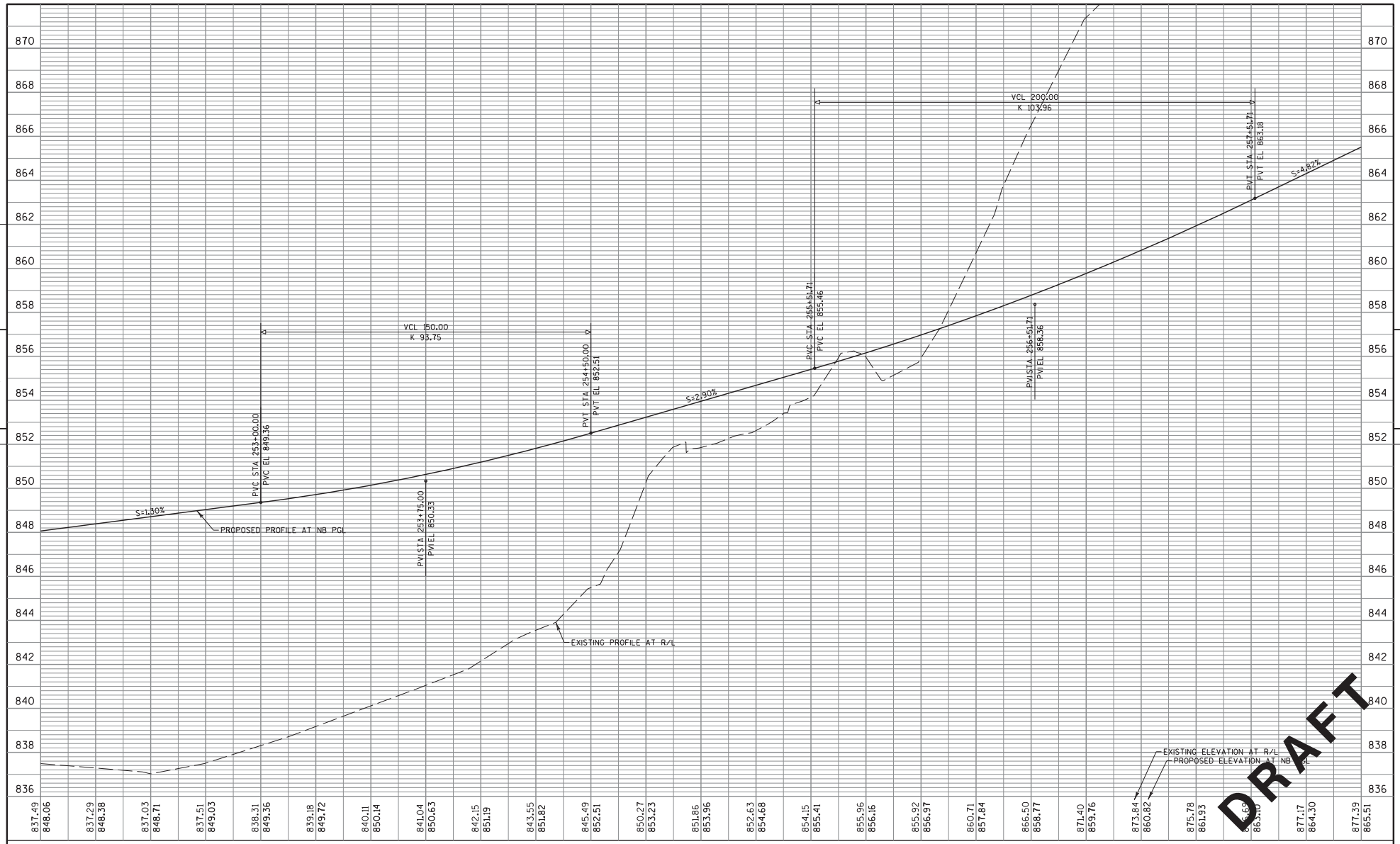


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050155-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6

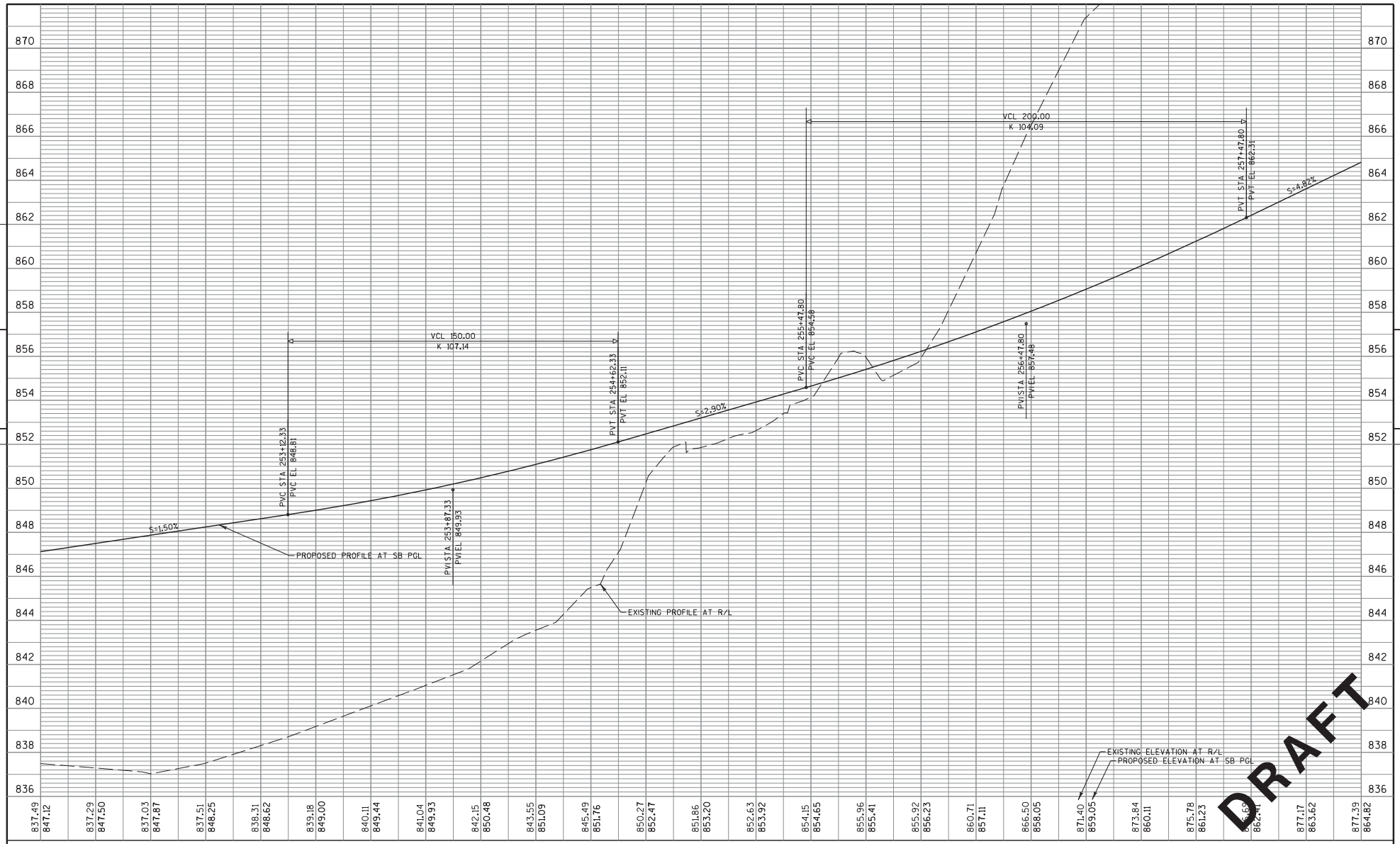


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS NB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050156a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

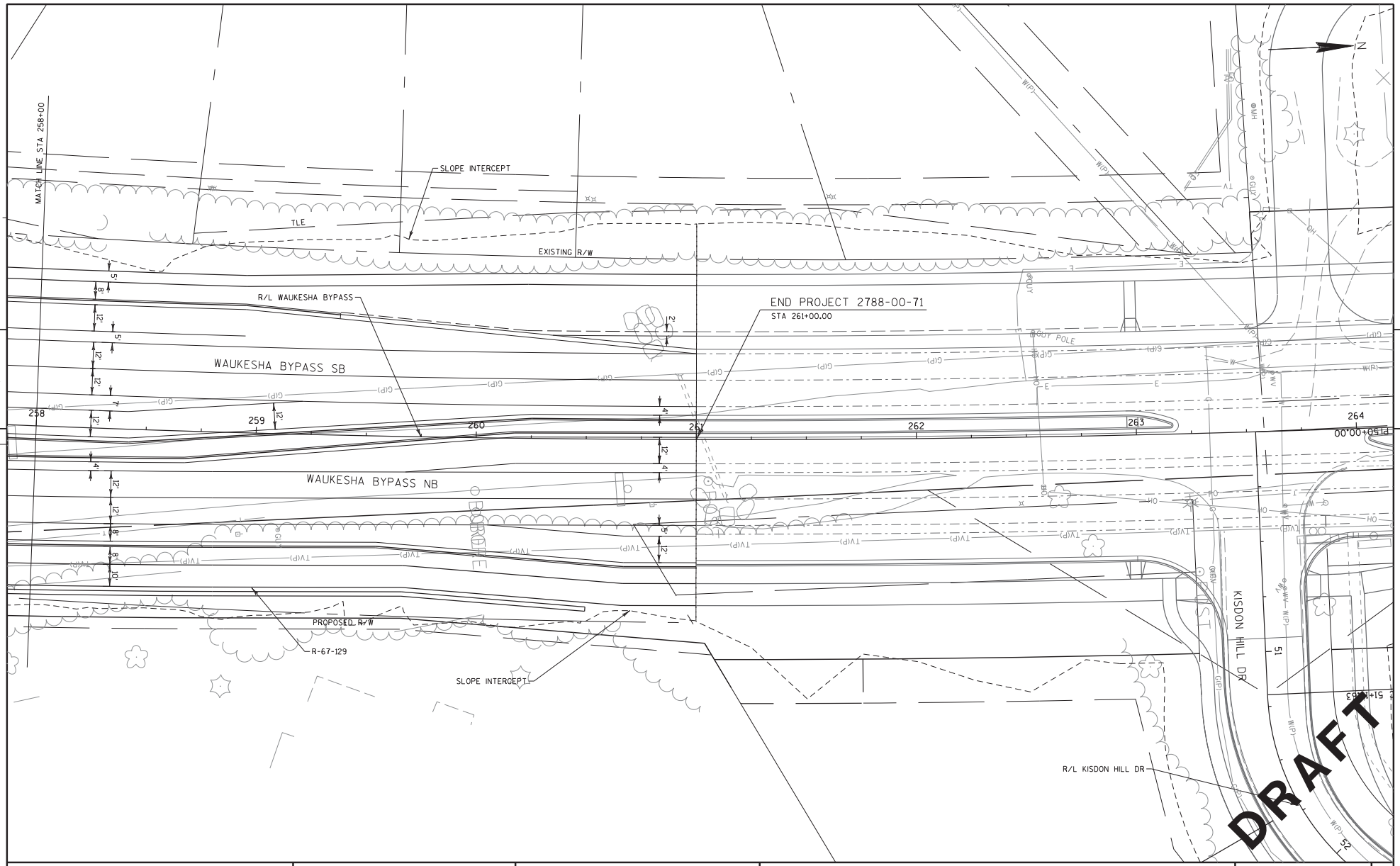


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS SB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050156b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

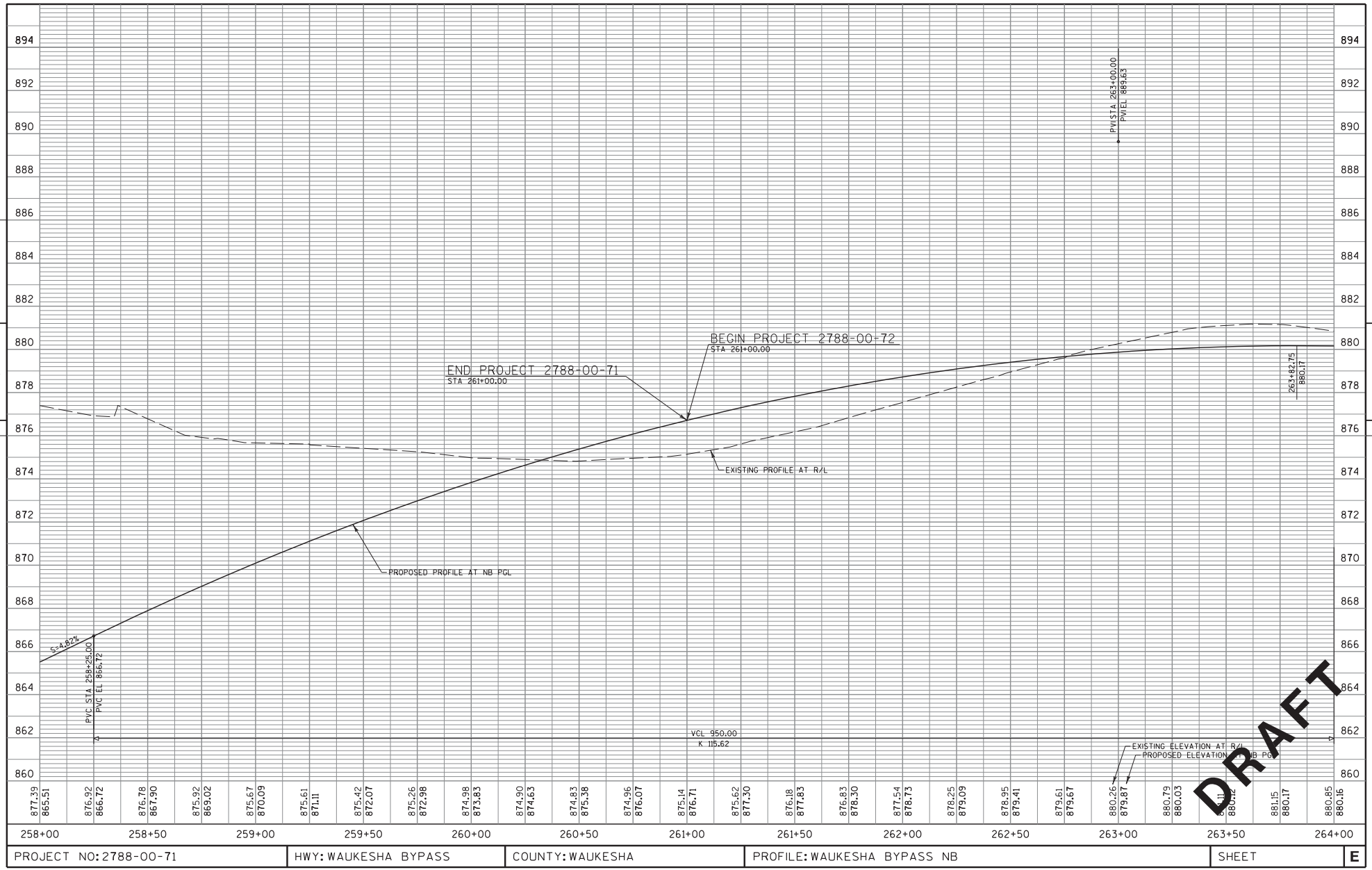


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: WAUKESHA BYPASS	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050157-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6

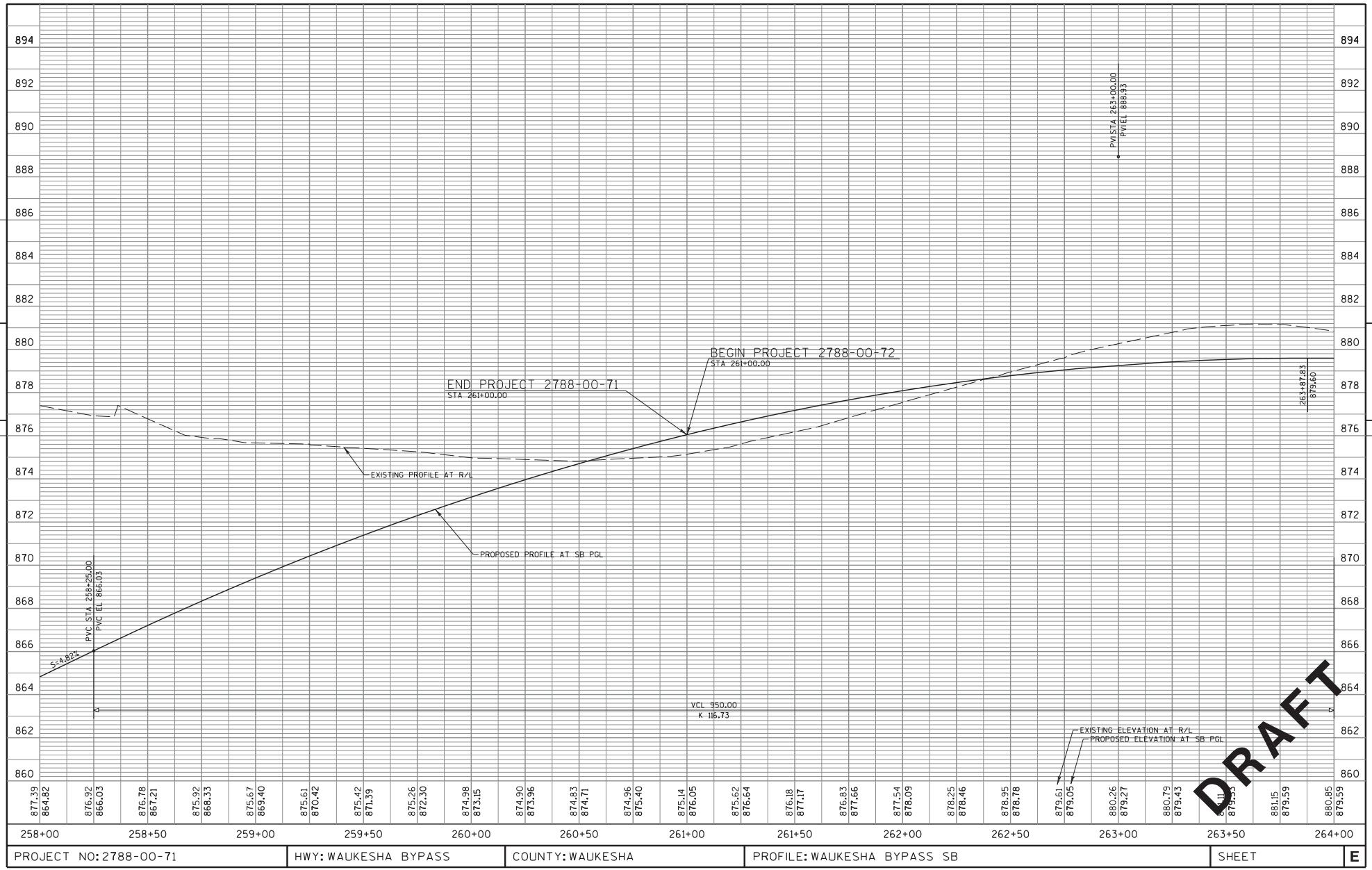


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS NB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050158a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

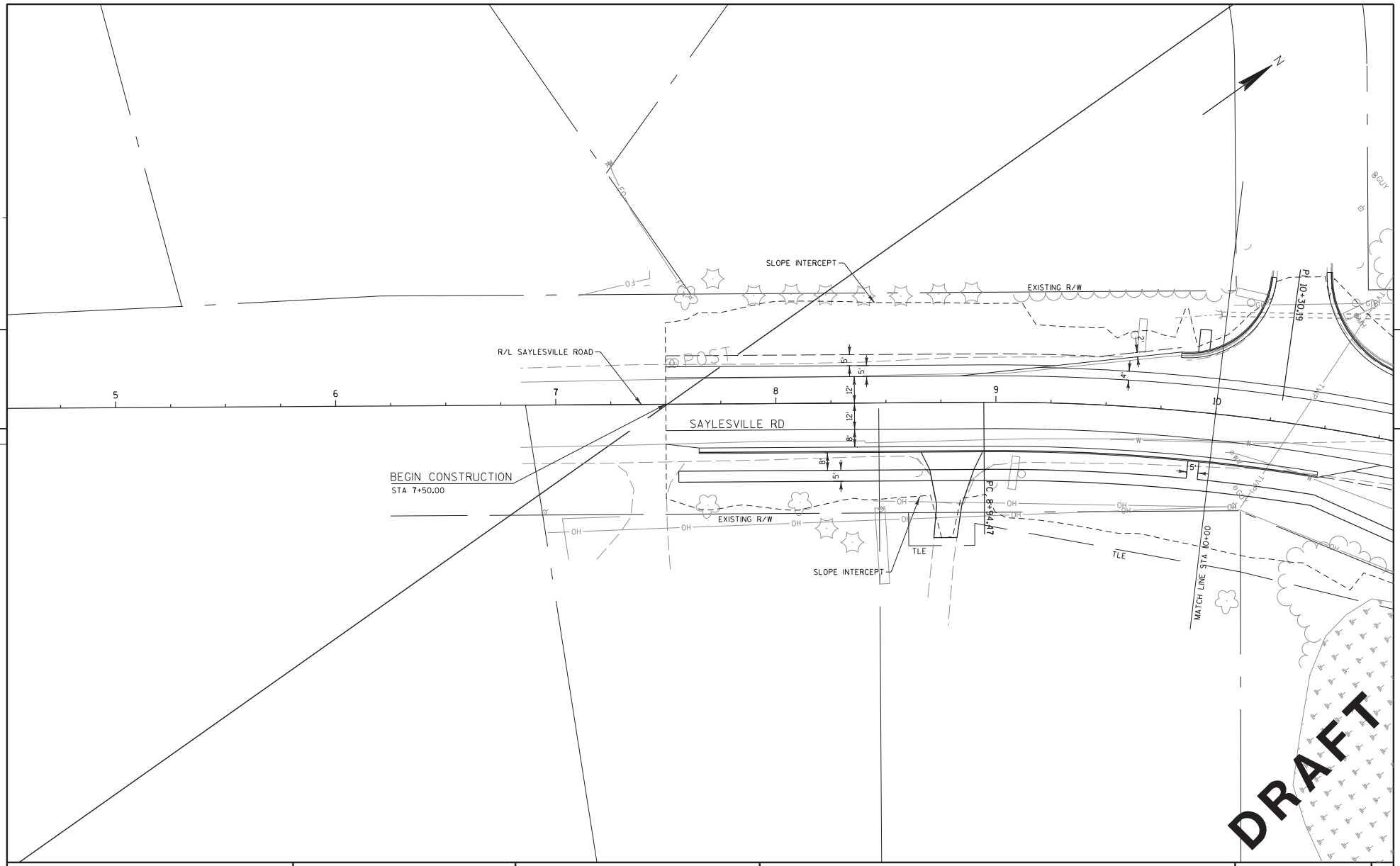


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: WAUKESHA BYPASS SB	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050158b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

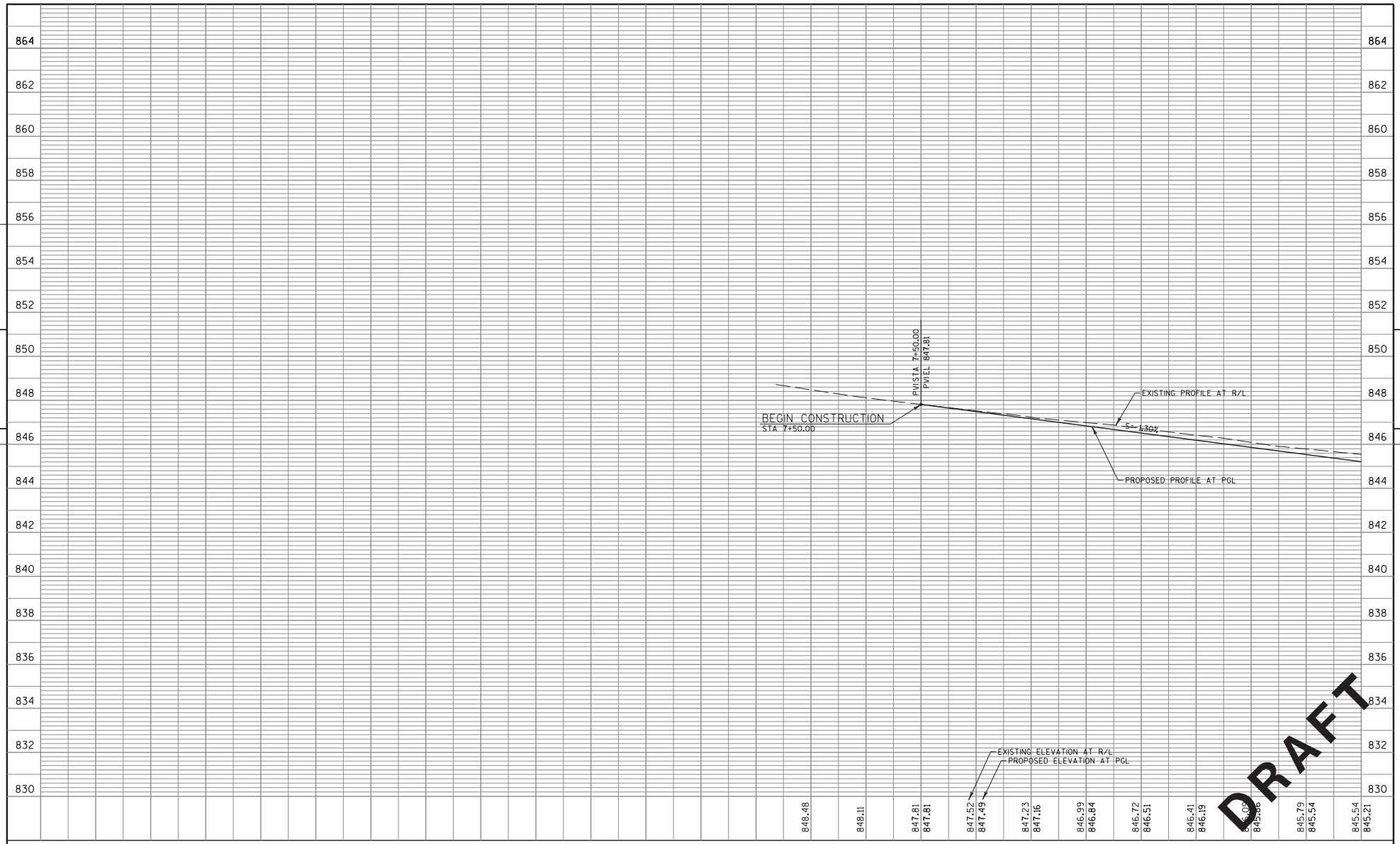


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: SAYLESVILLE ROAD	SHEET	E

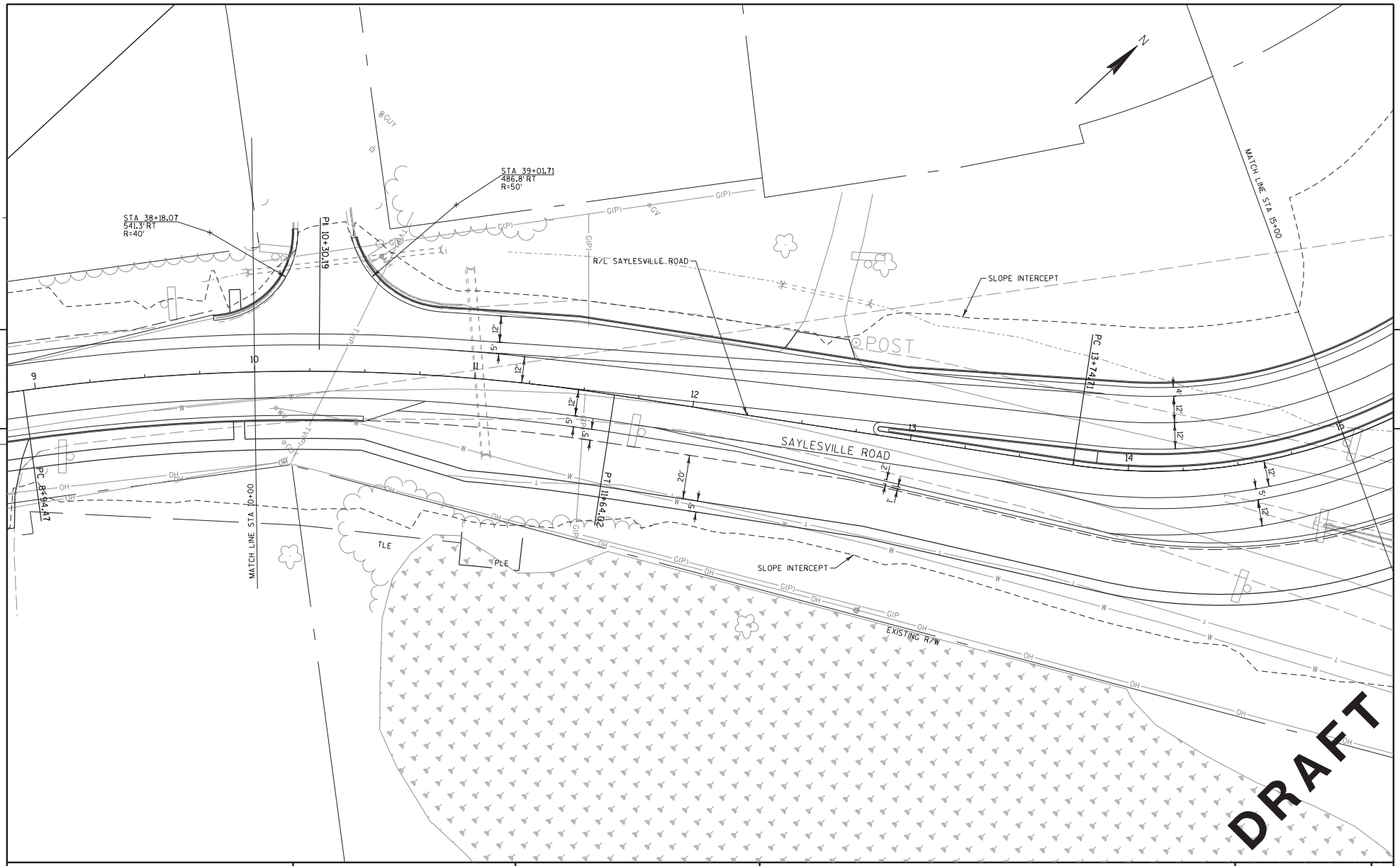
FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050165-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6



ATTACHMENT 6

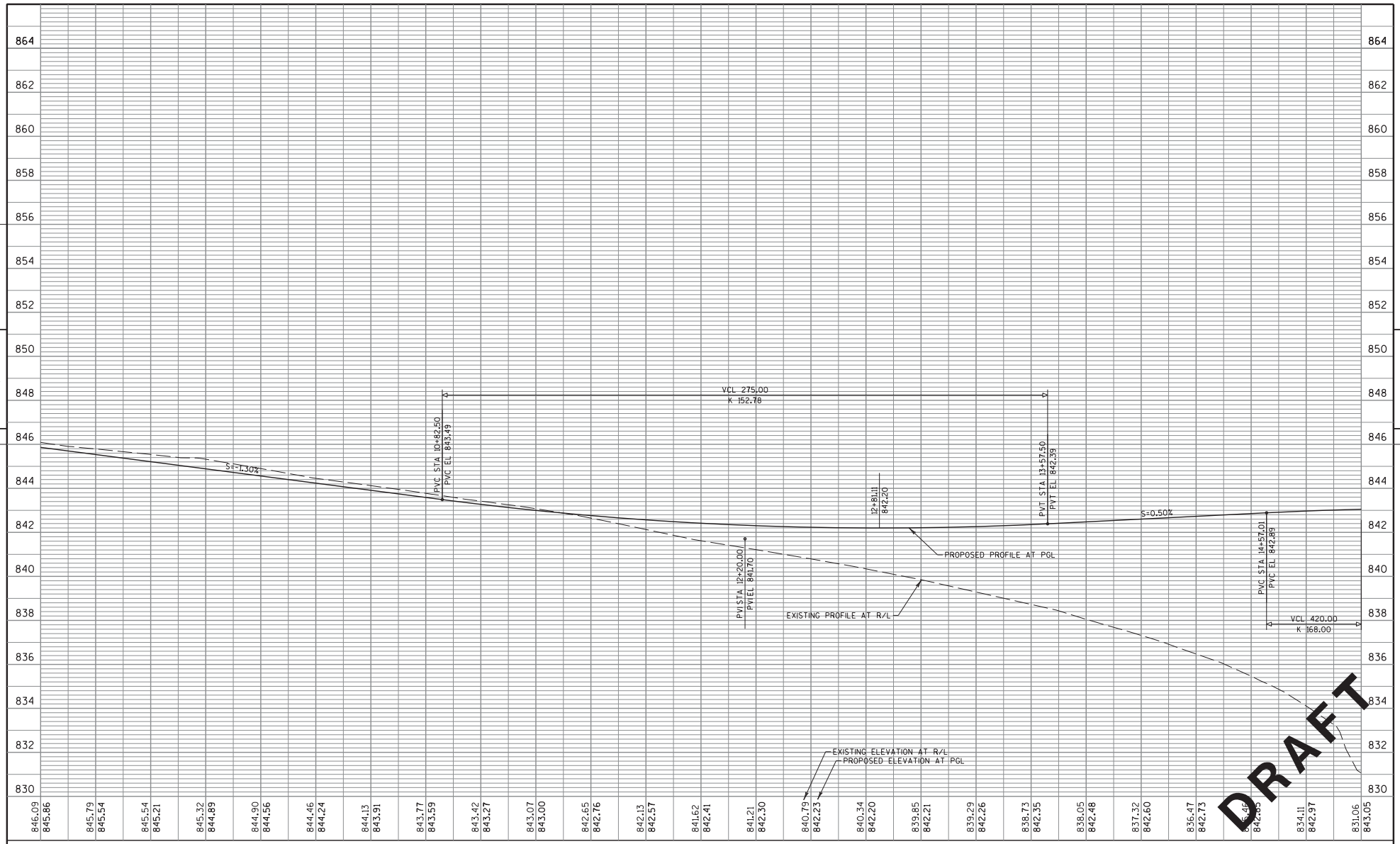


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: SAYLESVILLE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050167-pp.dgn PLOT DATE : 8/21/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6

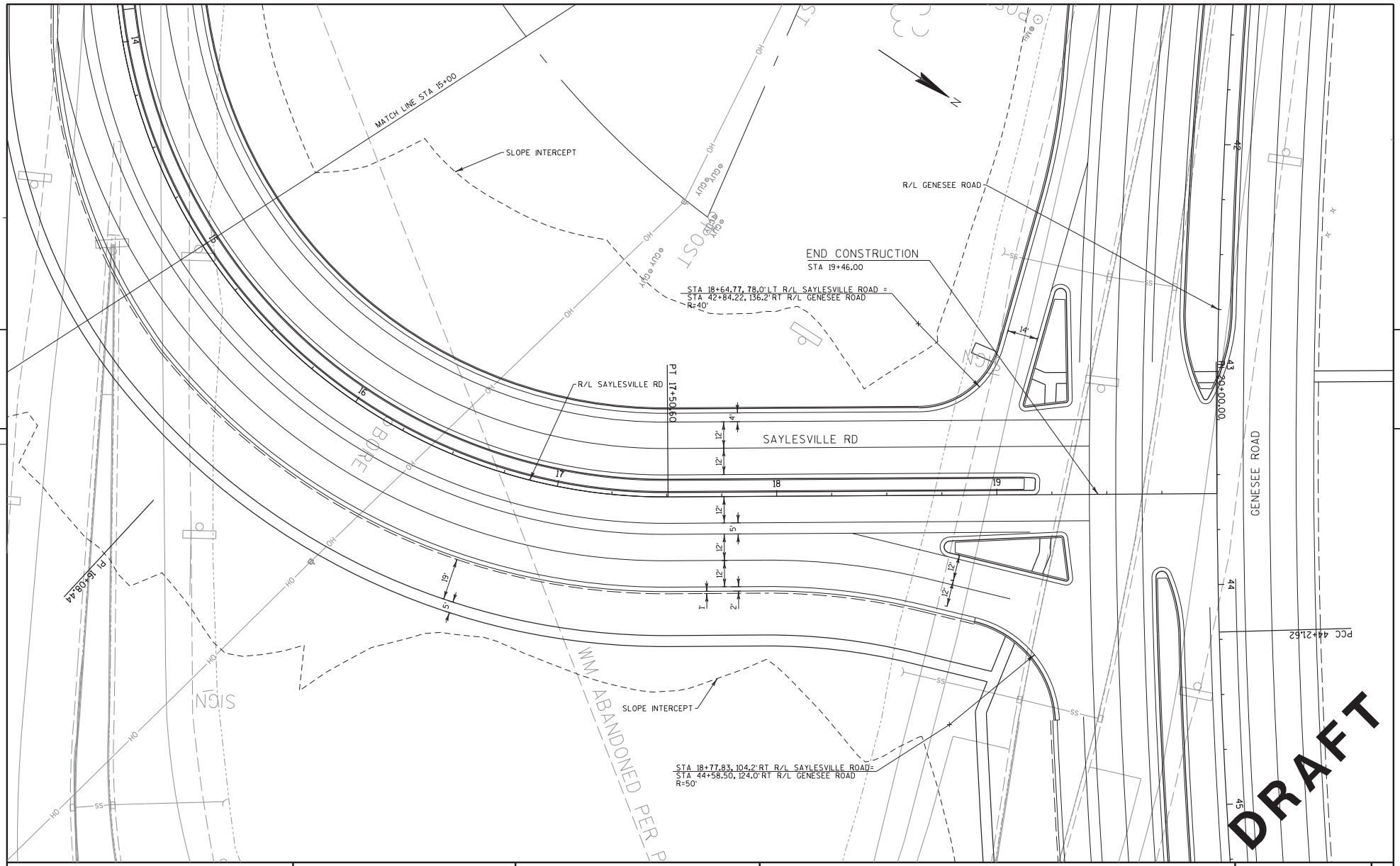


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: SAYLESVILLE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050168a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

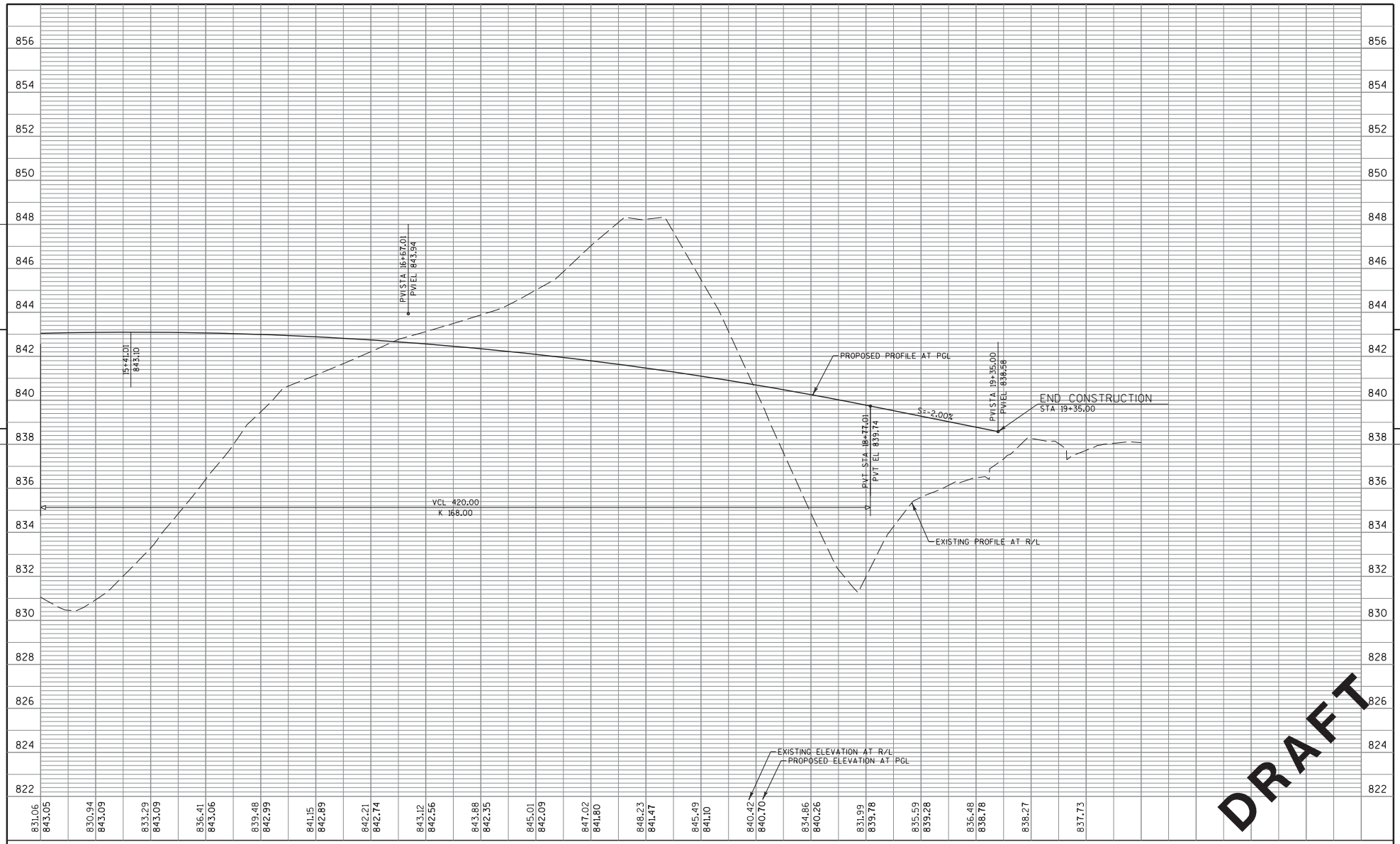


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: SAYLESVILLE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050169-pp.dgn PLOT DATE : 8/21/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6

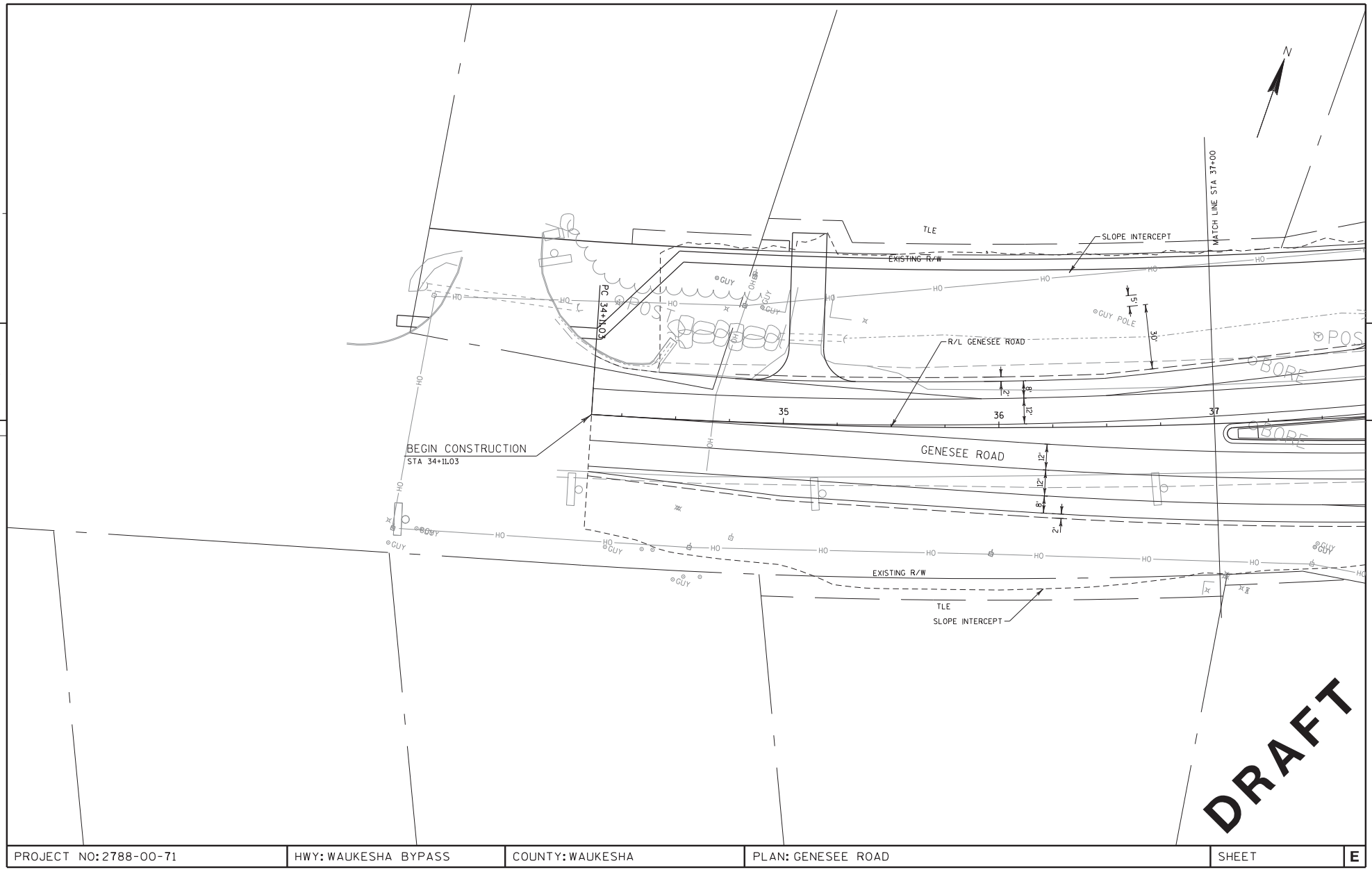


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: SAYLESVILLE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050170a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

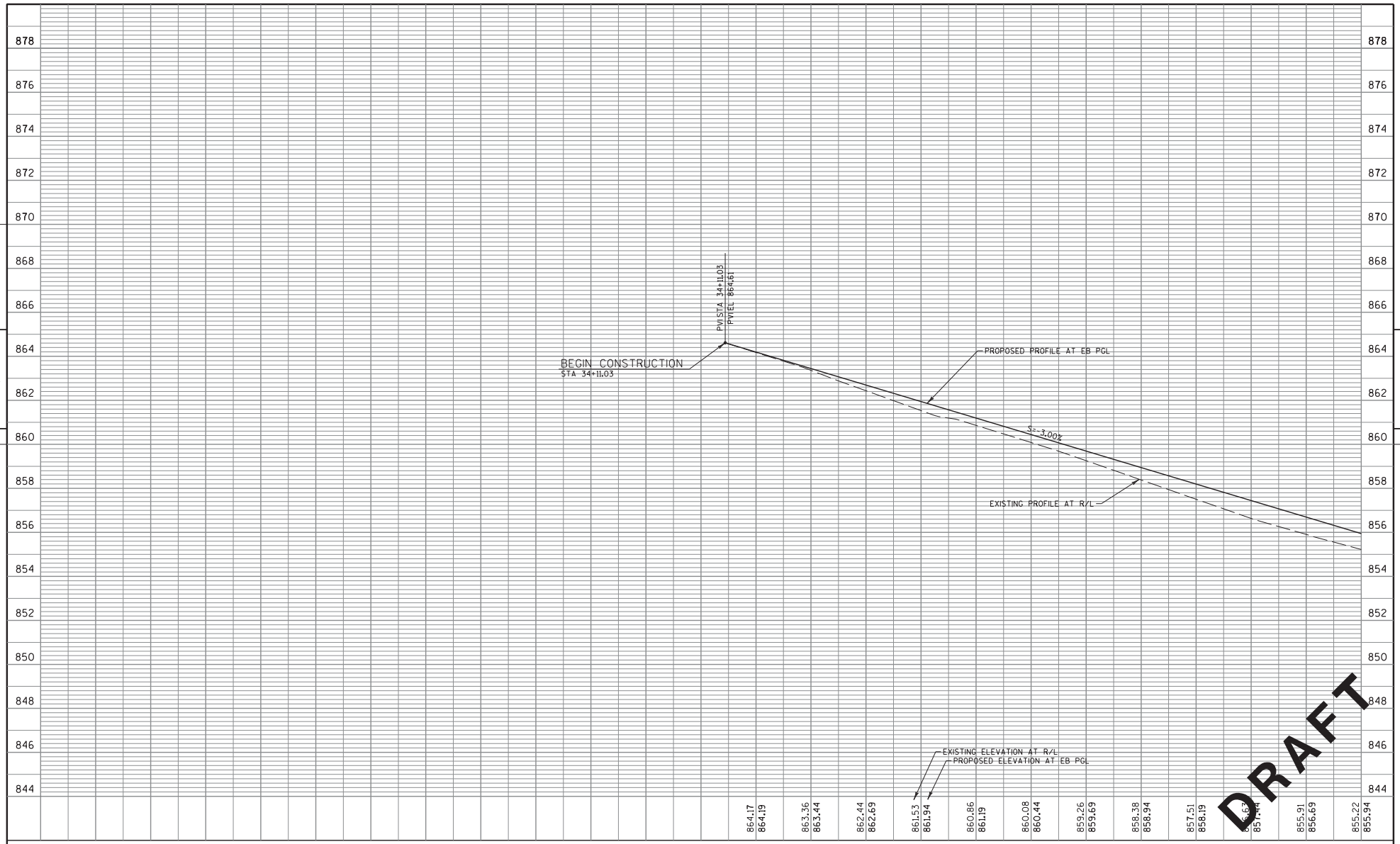


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050171-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6

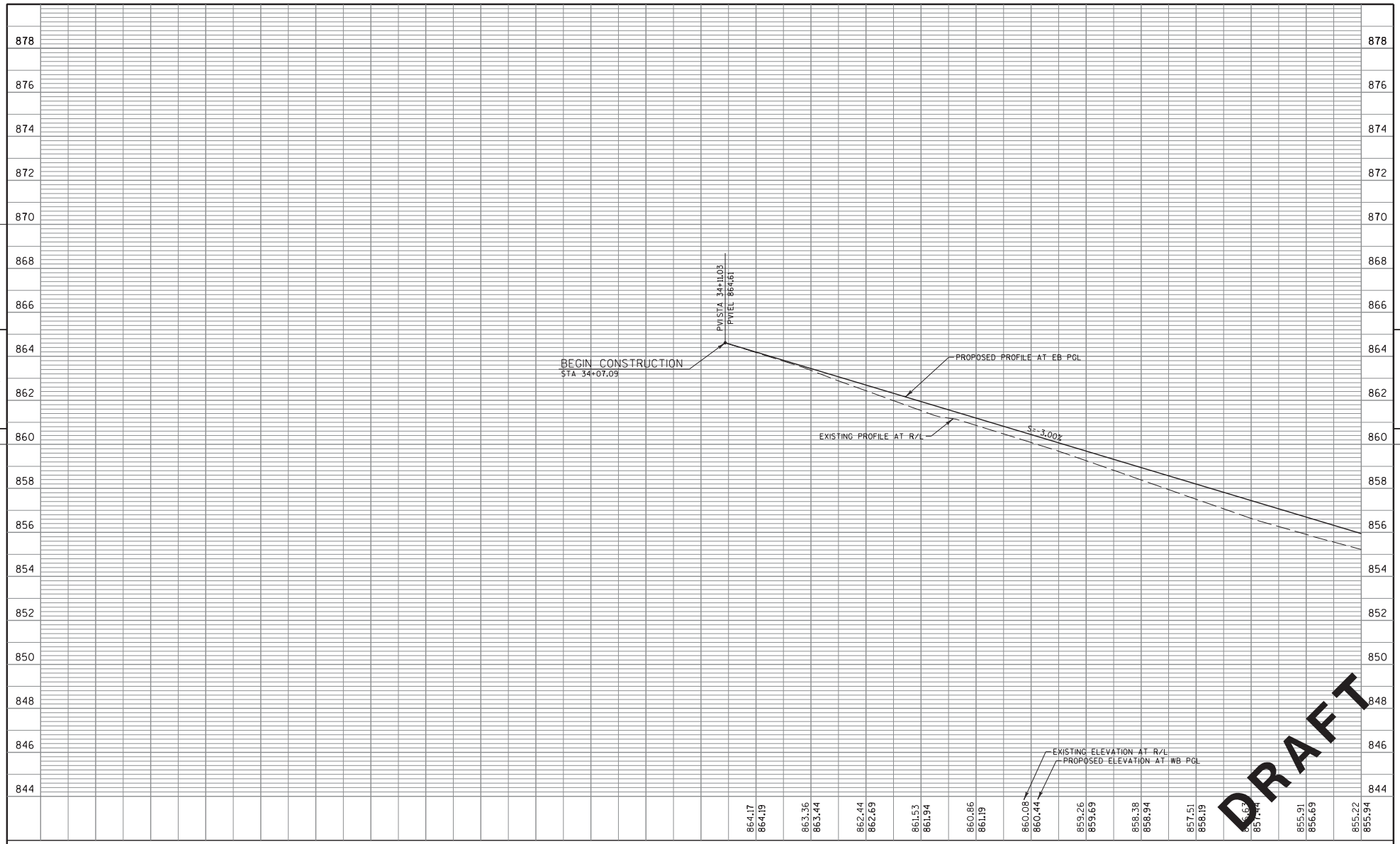


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050172a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6



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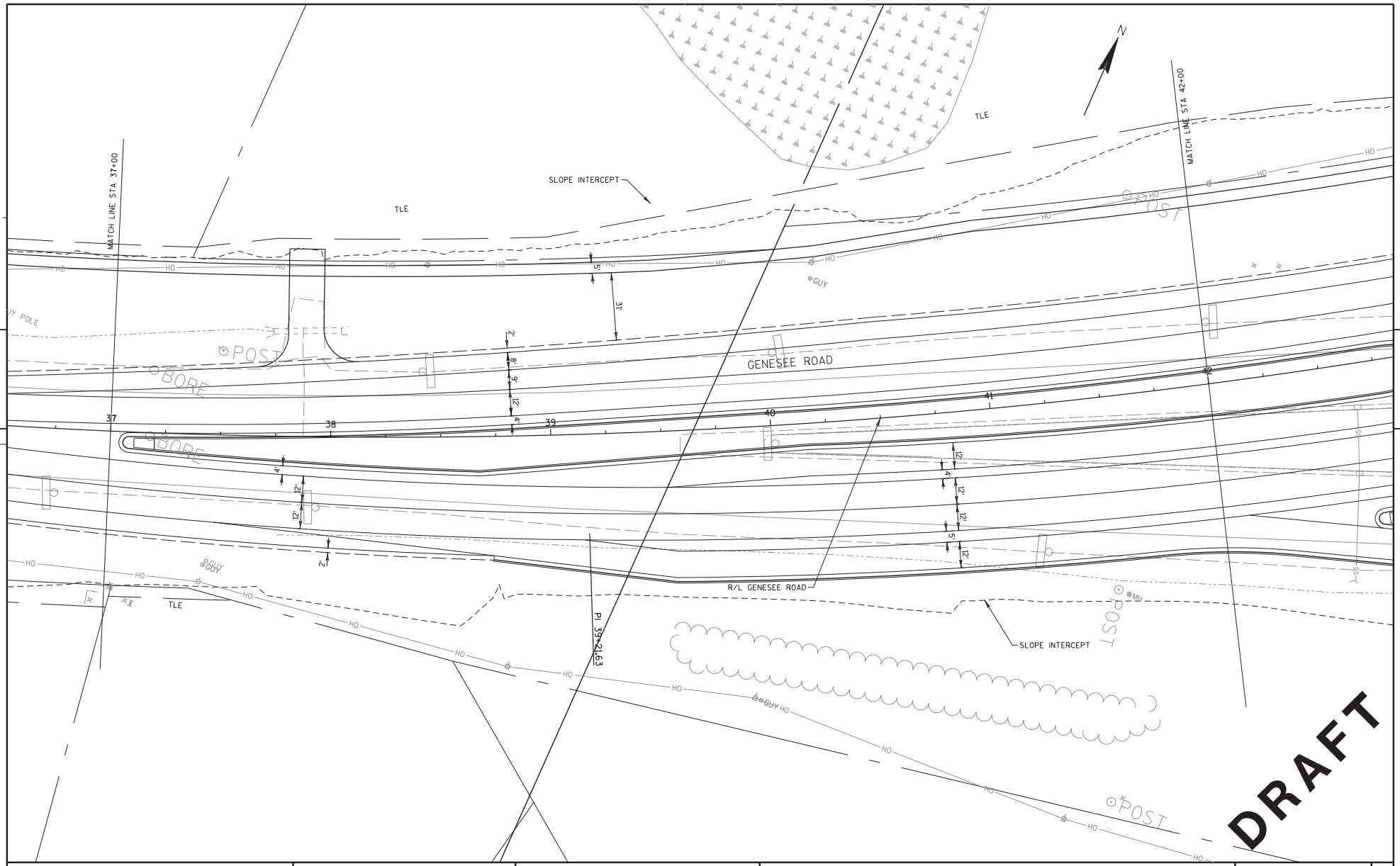
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050172b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

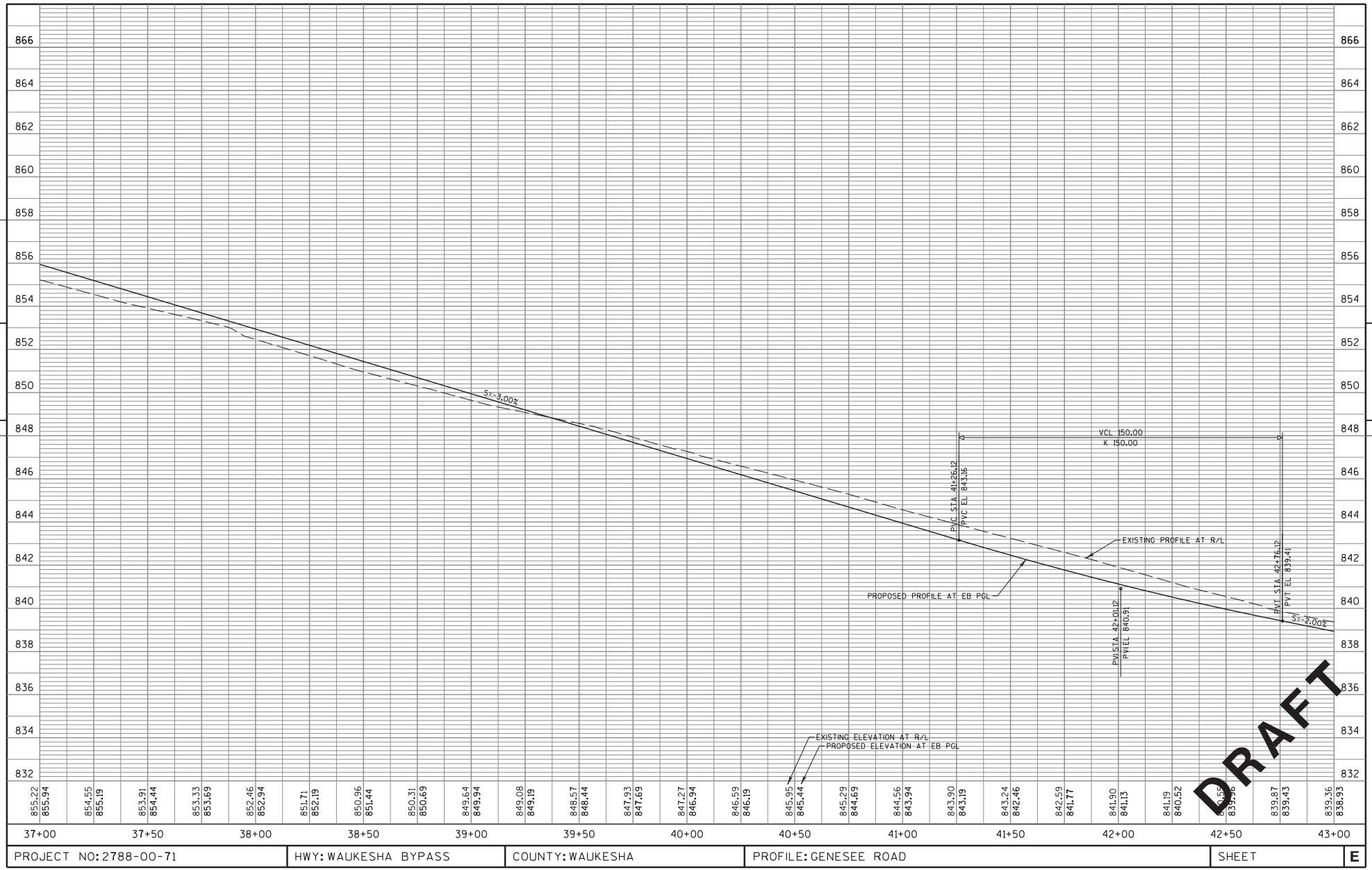


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050173-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6

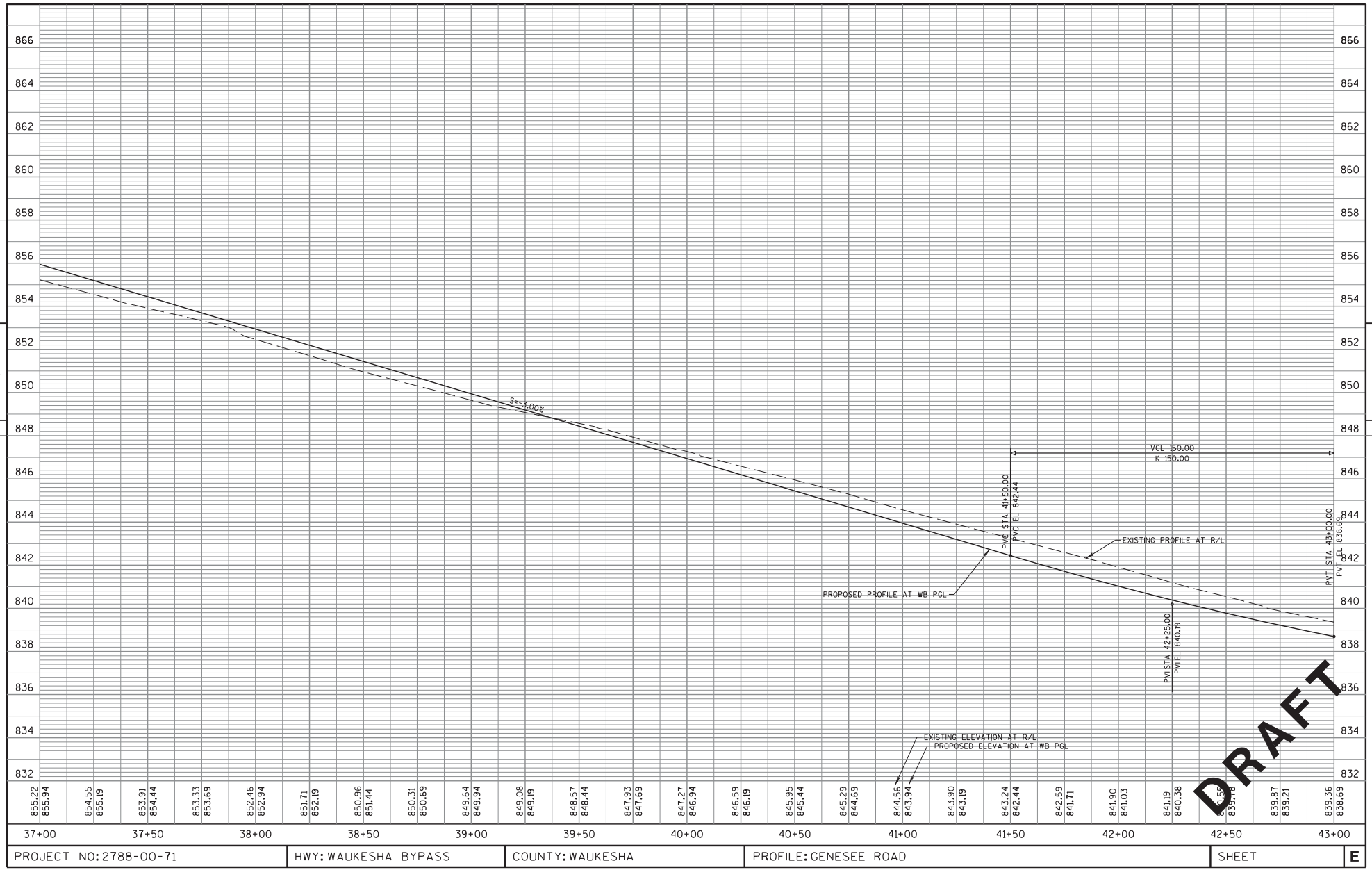


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050174a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

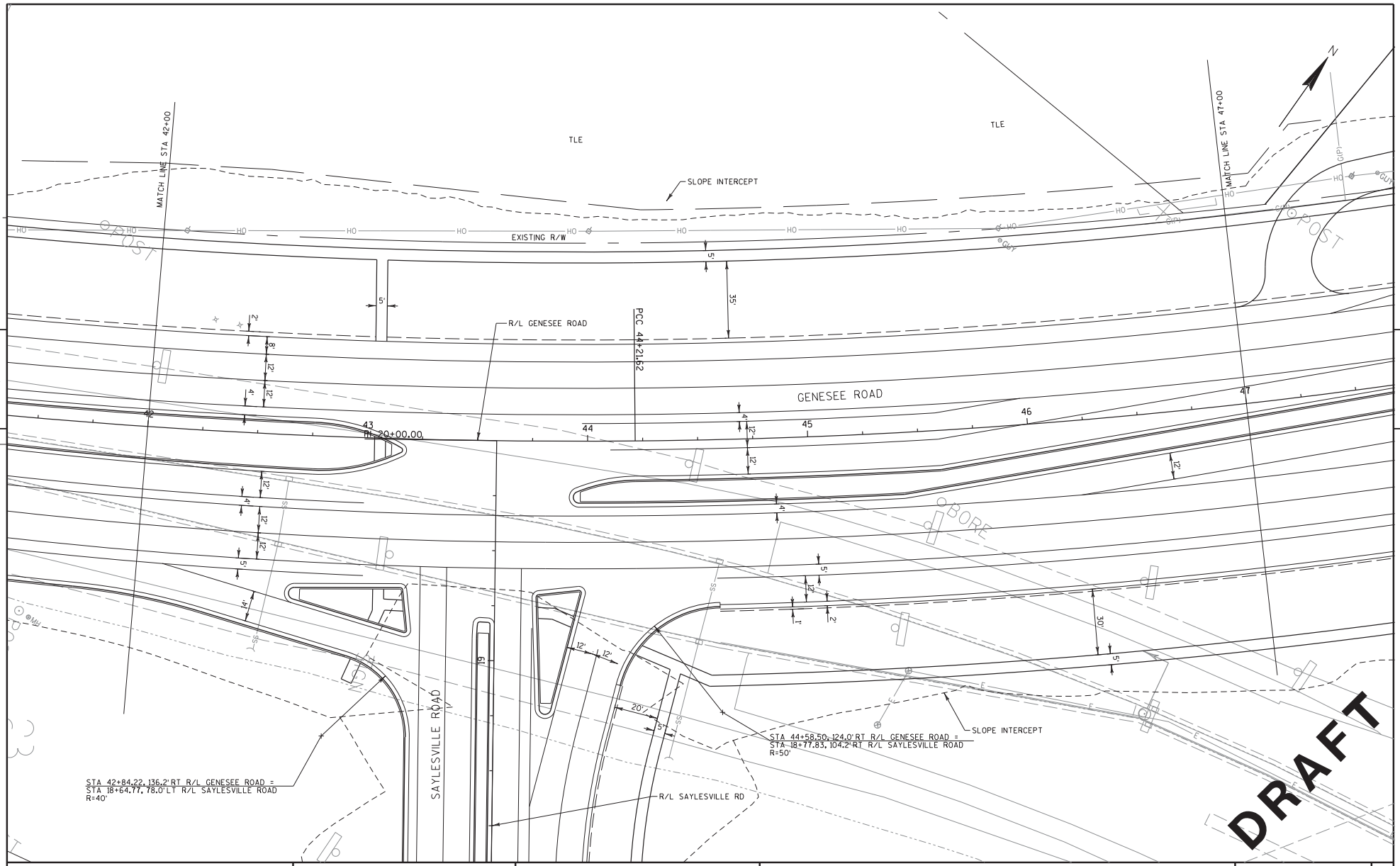
ATTACHMENT 6



PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050174b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40 WISDOT/CADDS SHEET 40

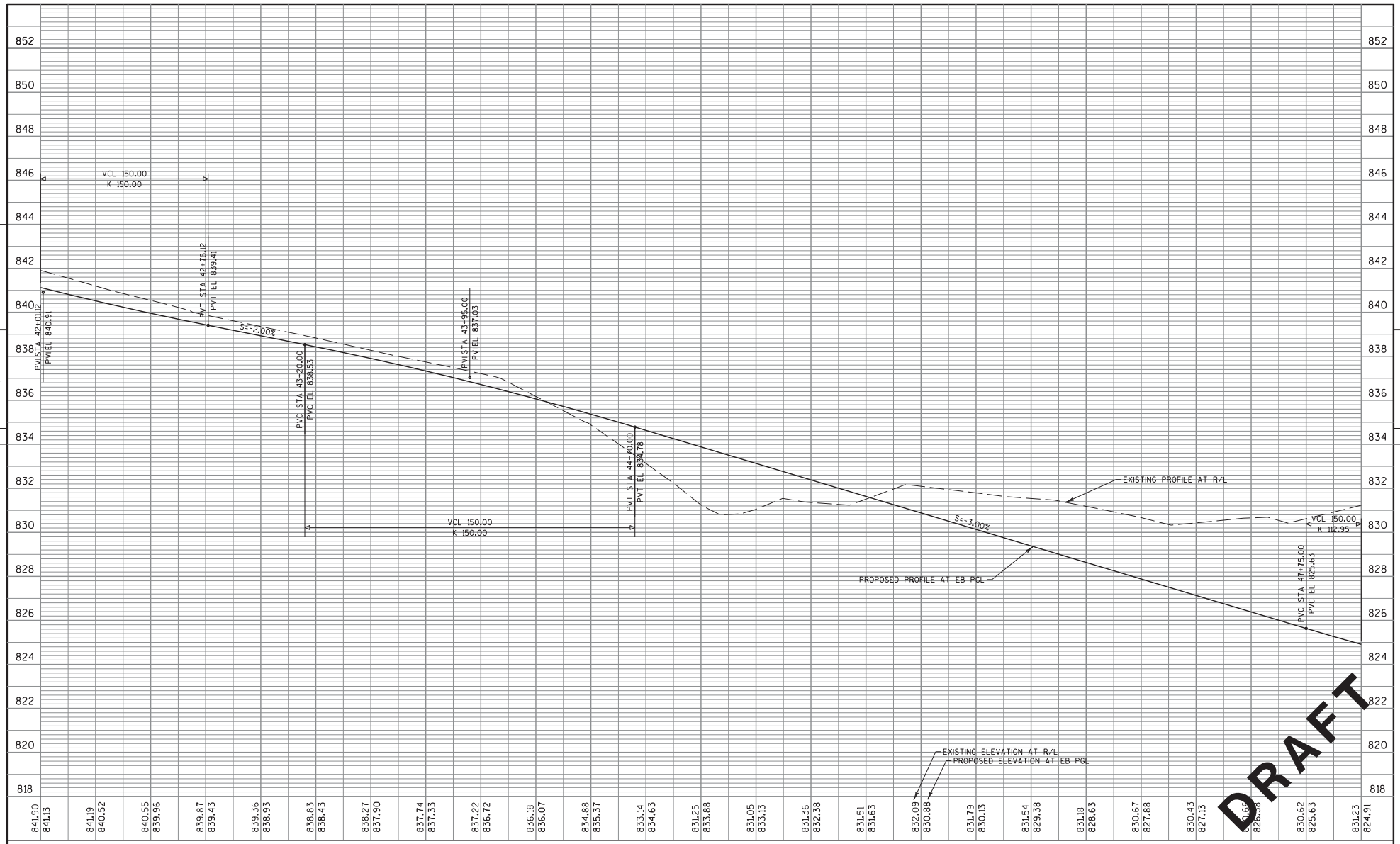
ATTACHMENT 6



PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050175-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40 WISDOT/CADDS SHEET 44

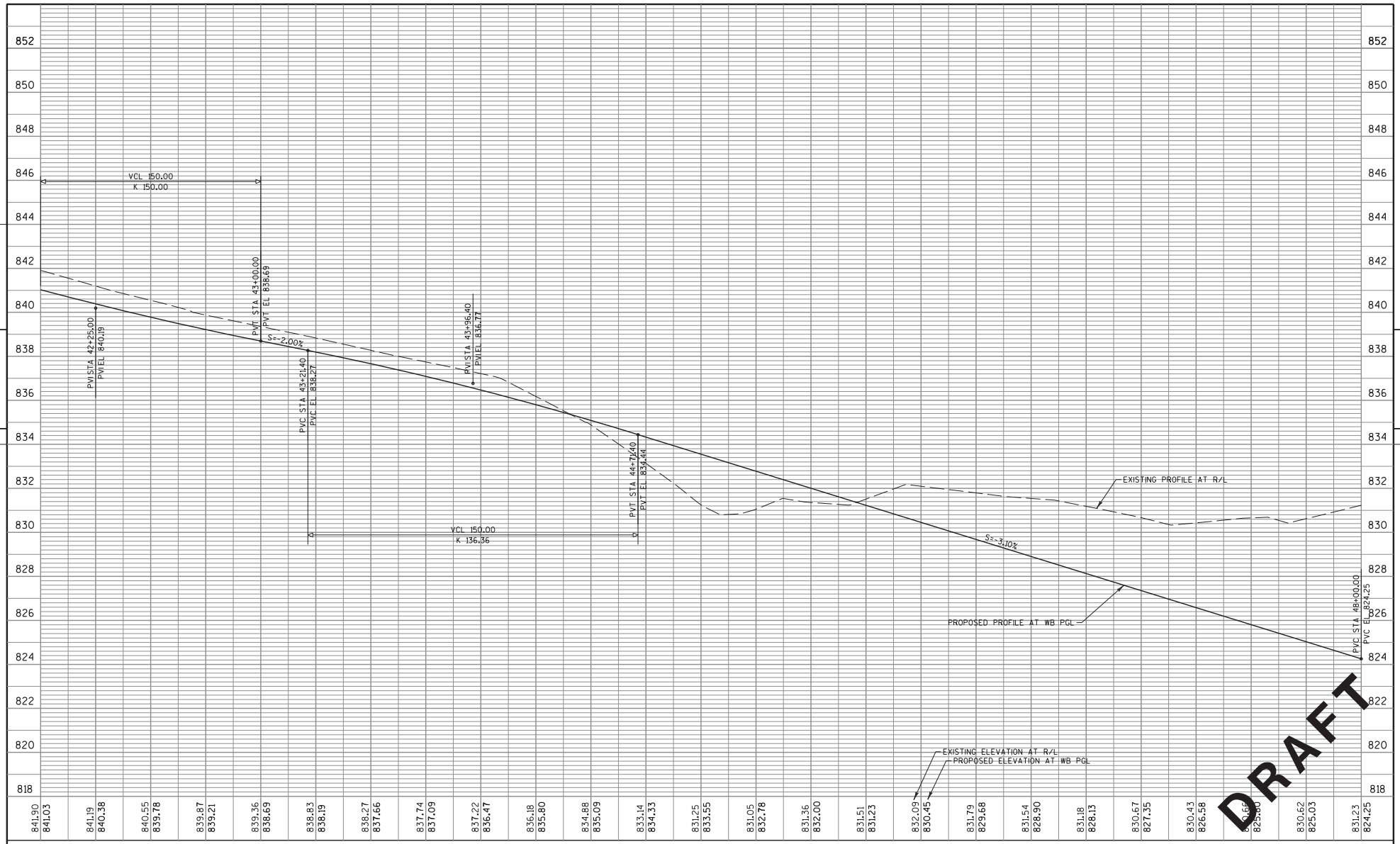
ATTACHMENT 6



PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050176a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40 WISDOT/CADDS SHEET 40

ATTACHMENT 6



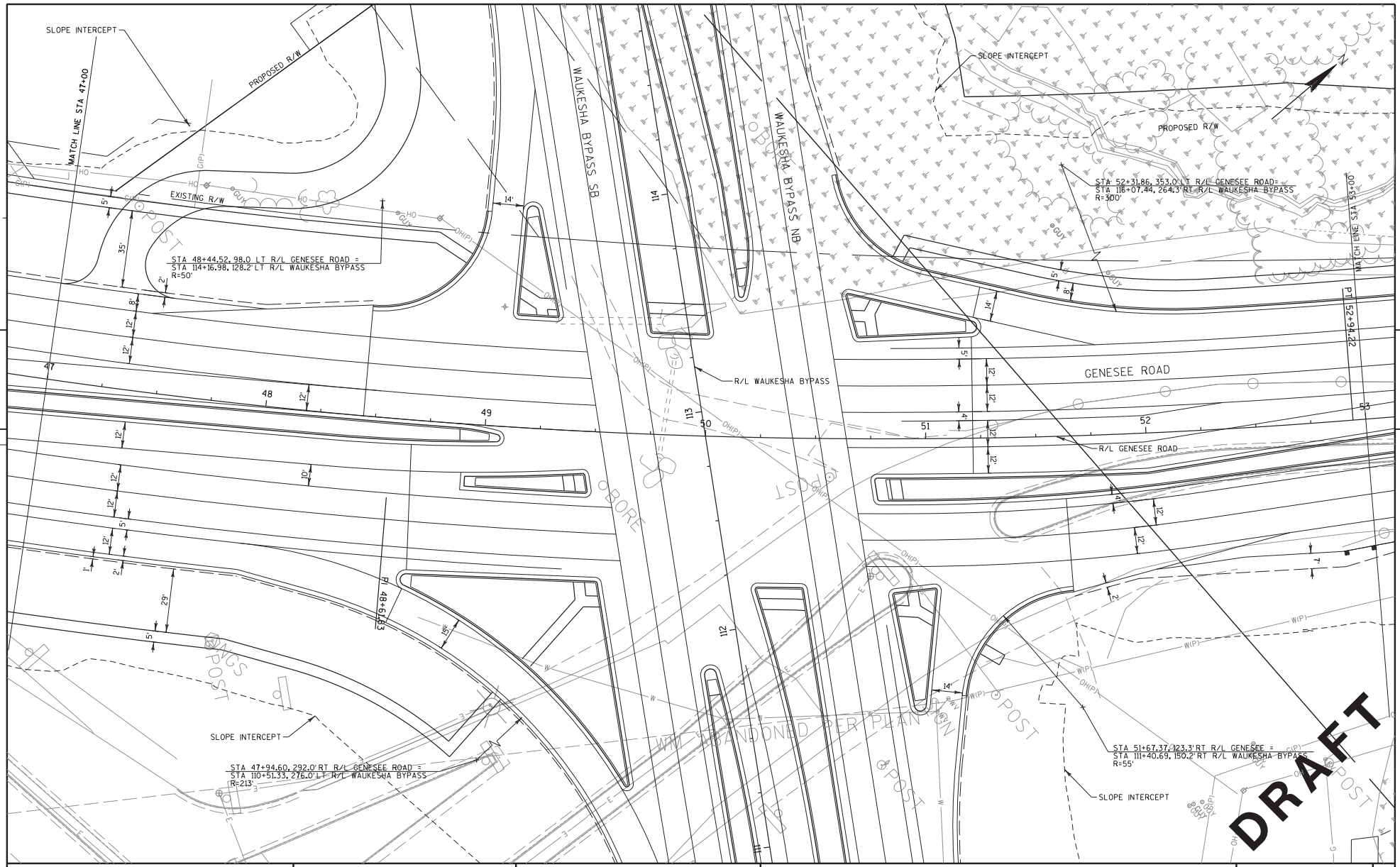
DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050176b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

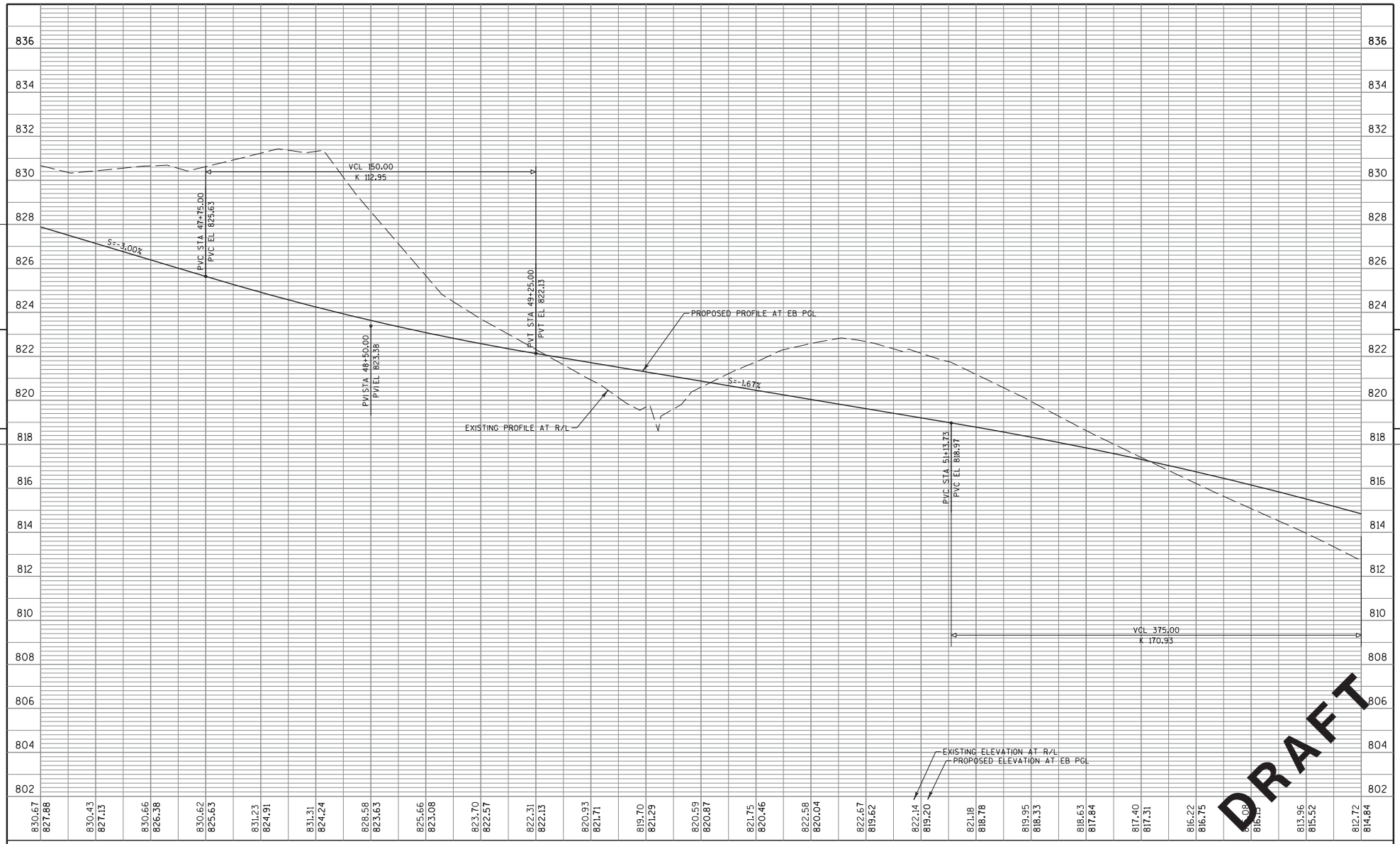


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050177-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6

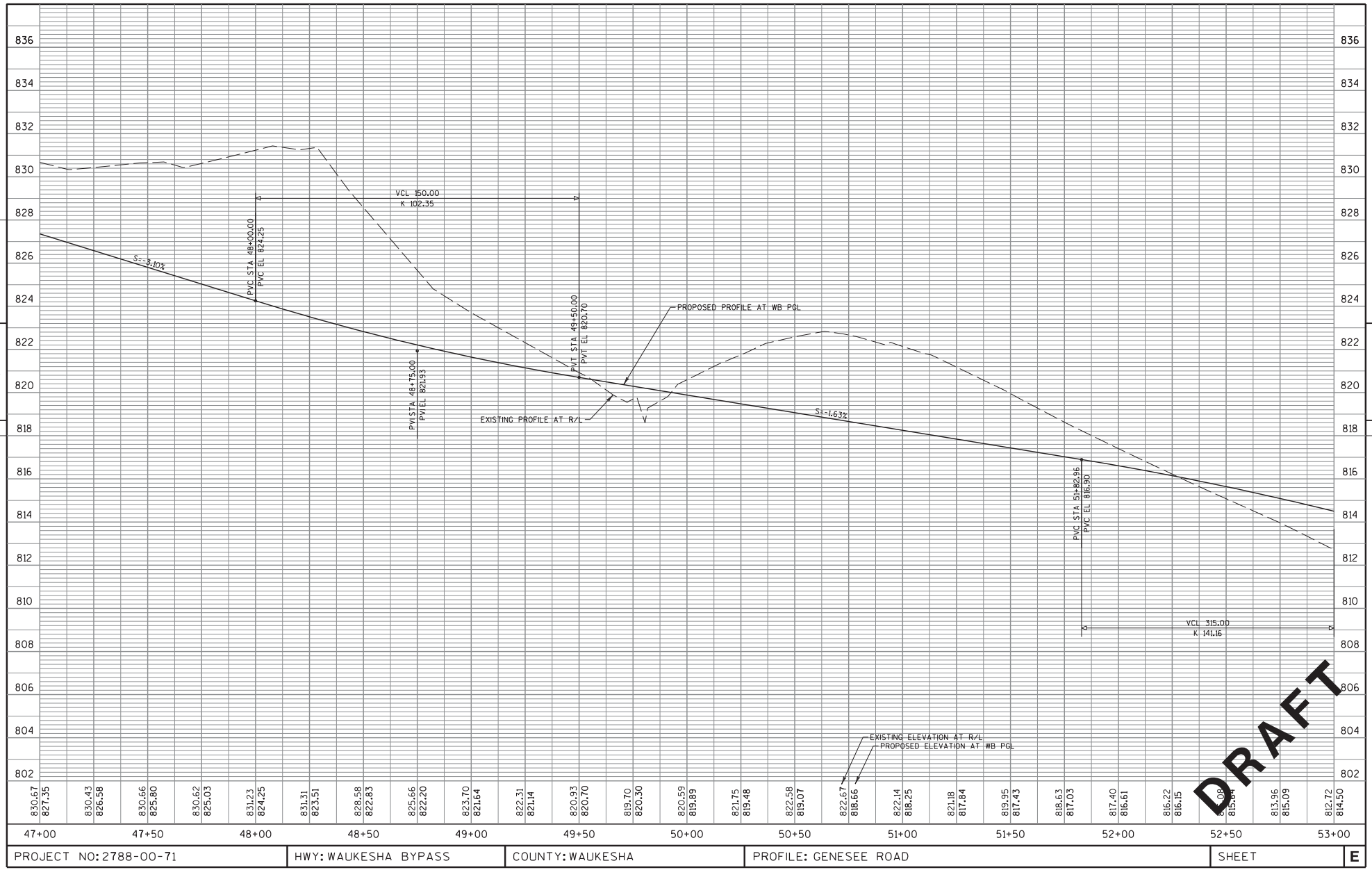


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050178a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

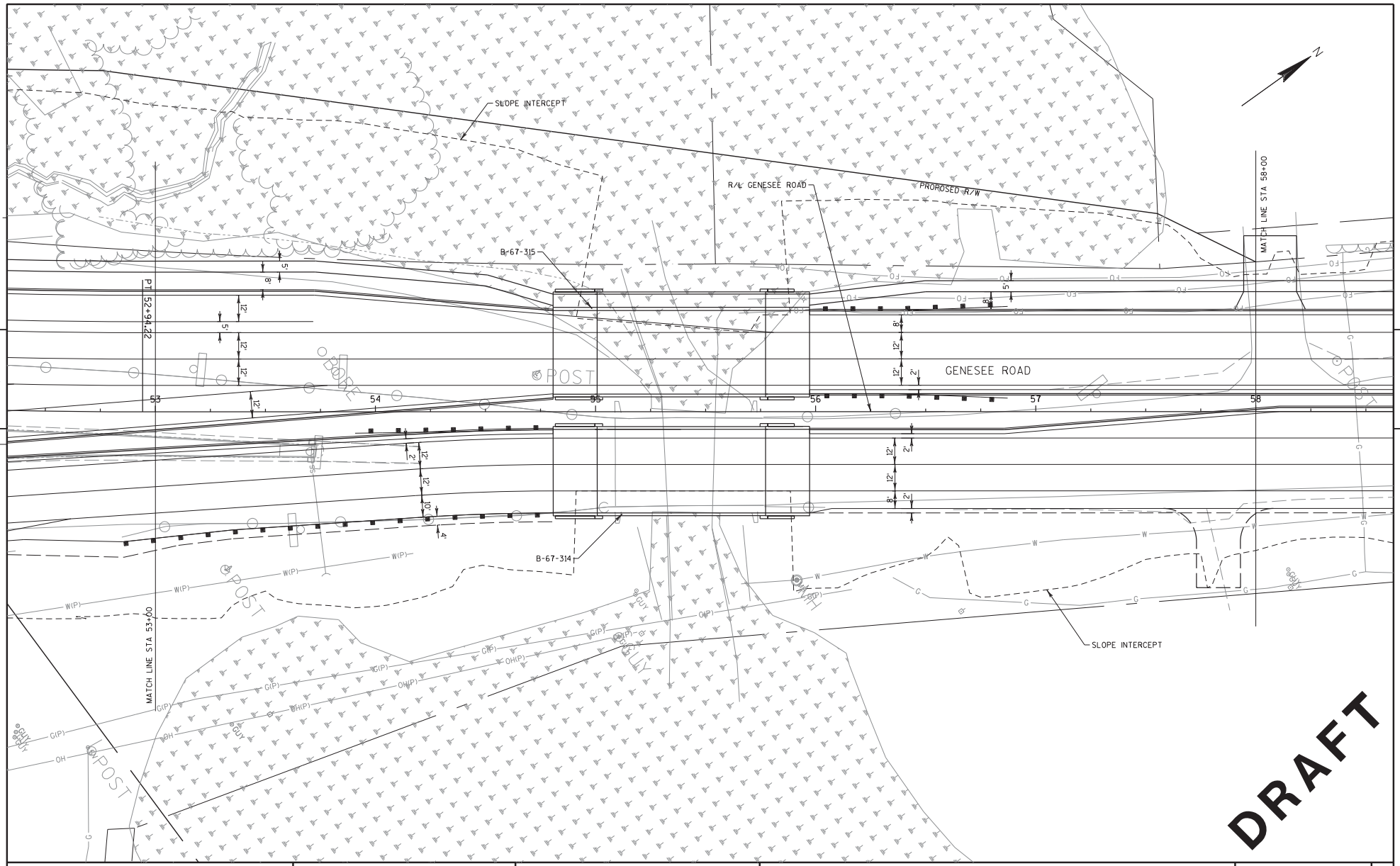


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050178b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

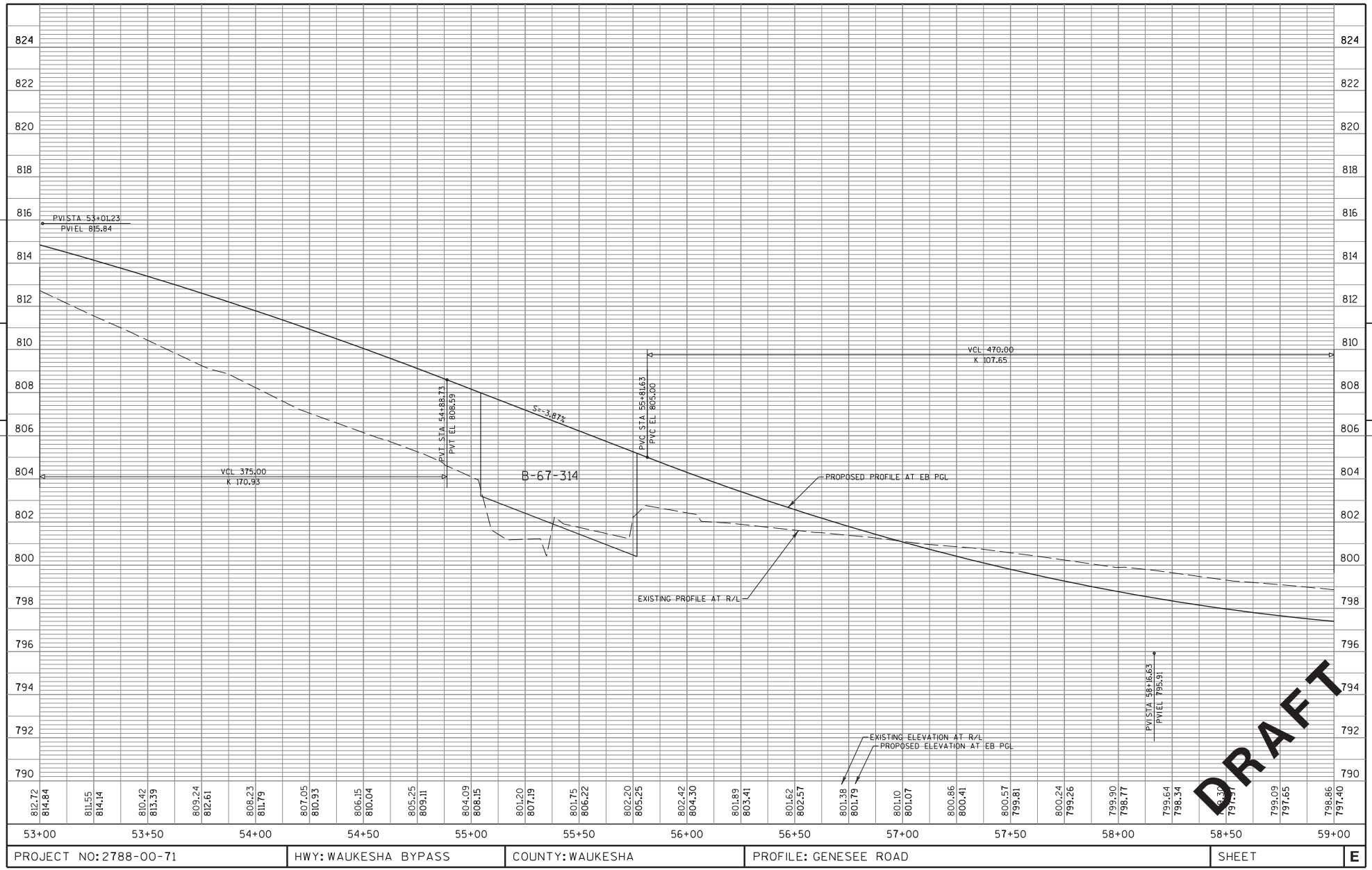


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050179-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6

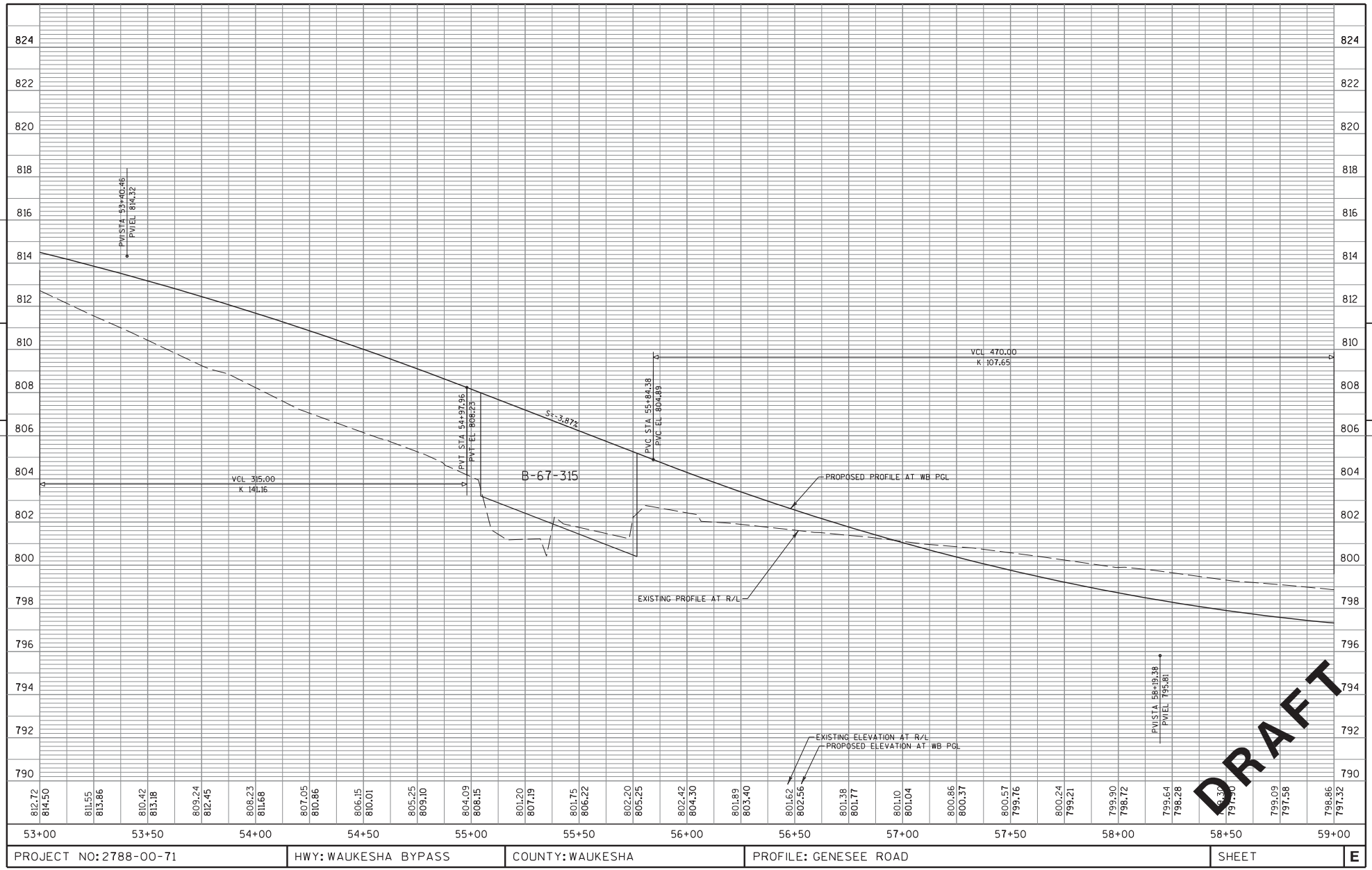


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050180a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

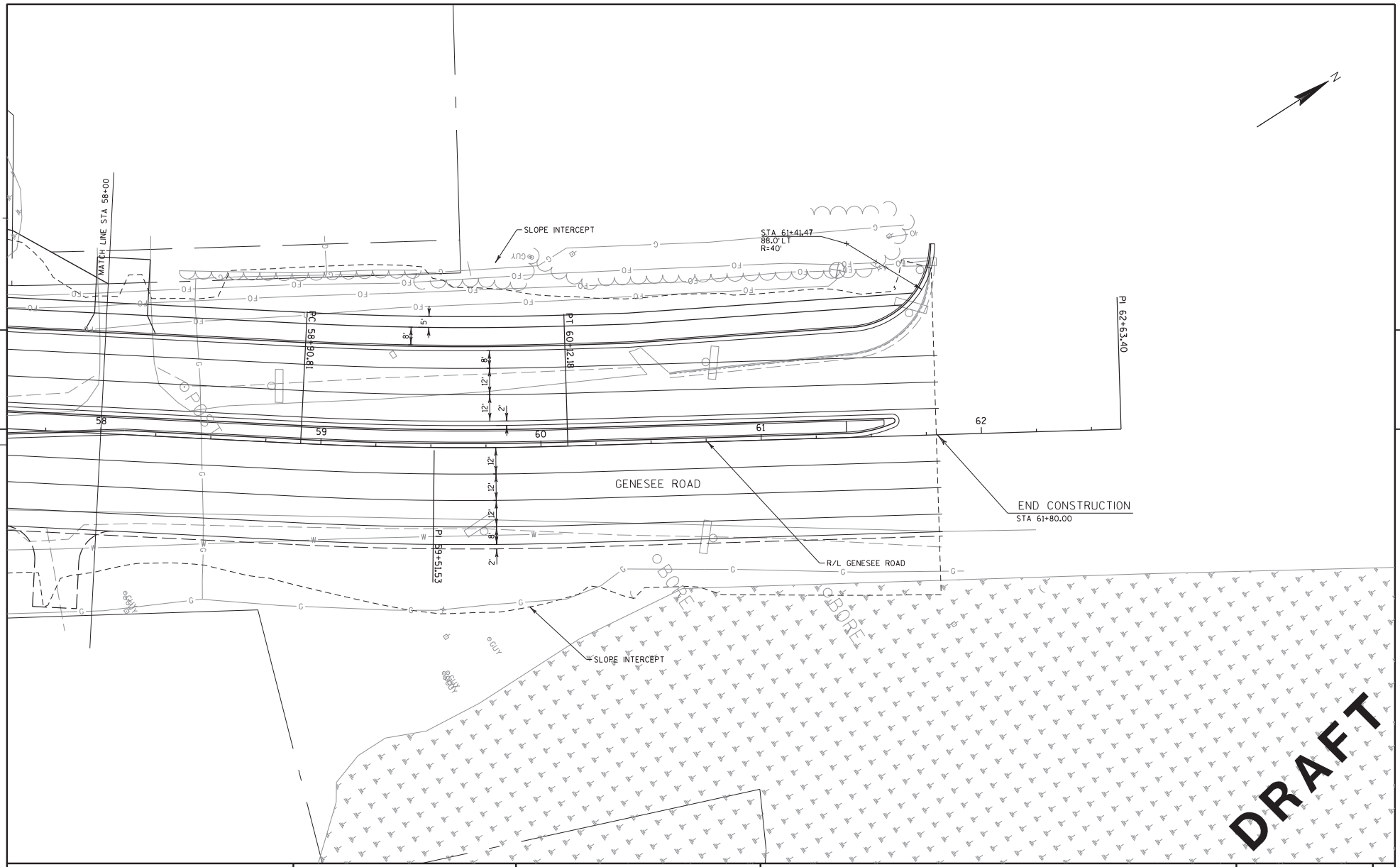


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050180b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

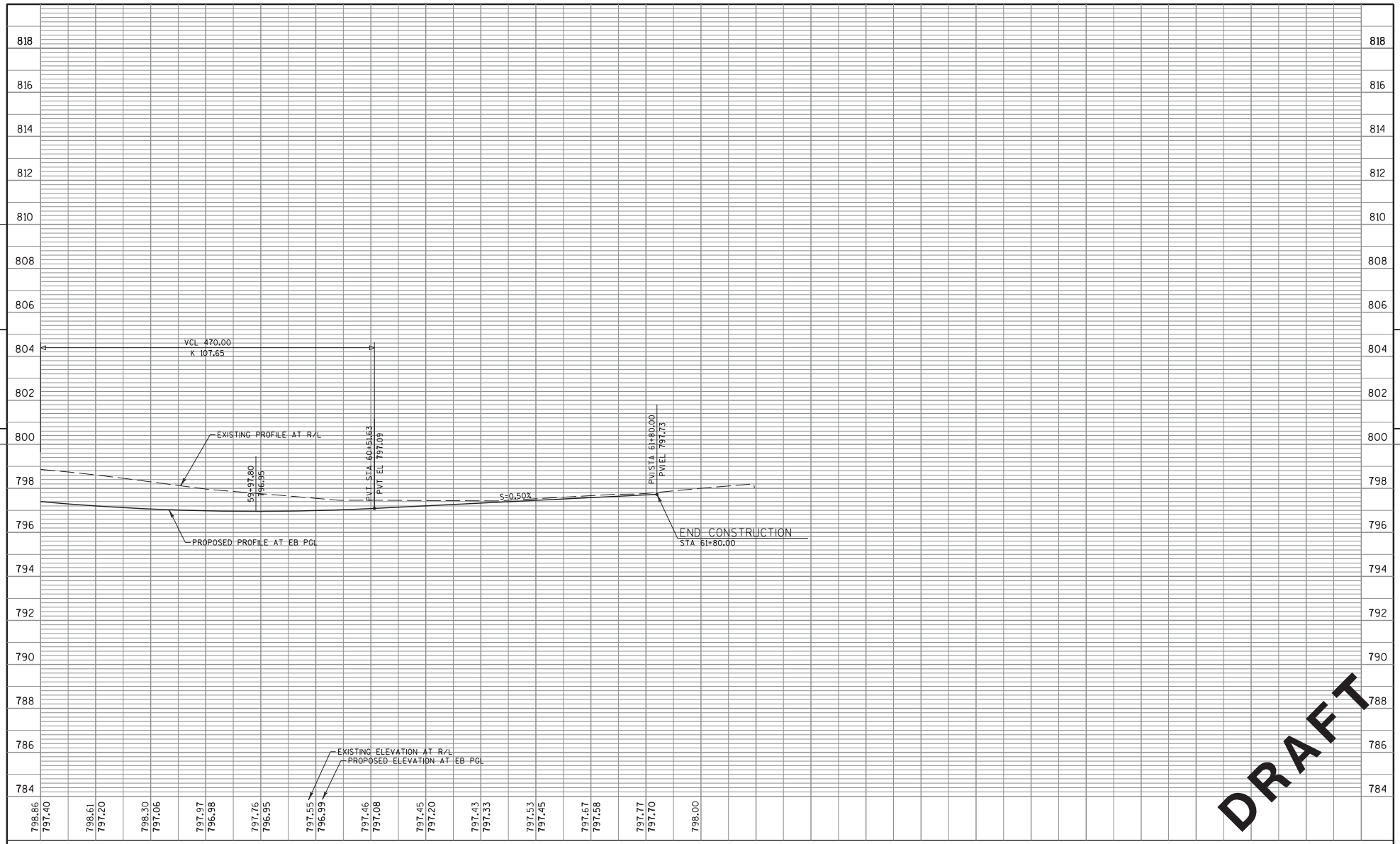
ATTACHMENT 6



PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050181-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40 WISDOT/CADDS SHEET 44

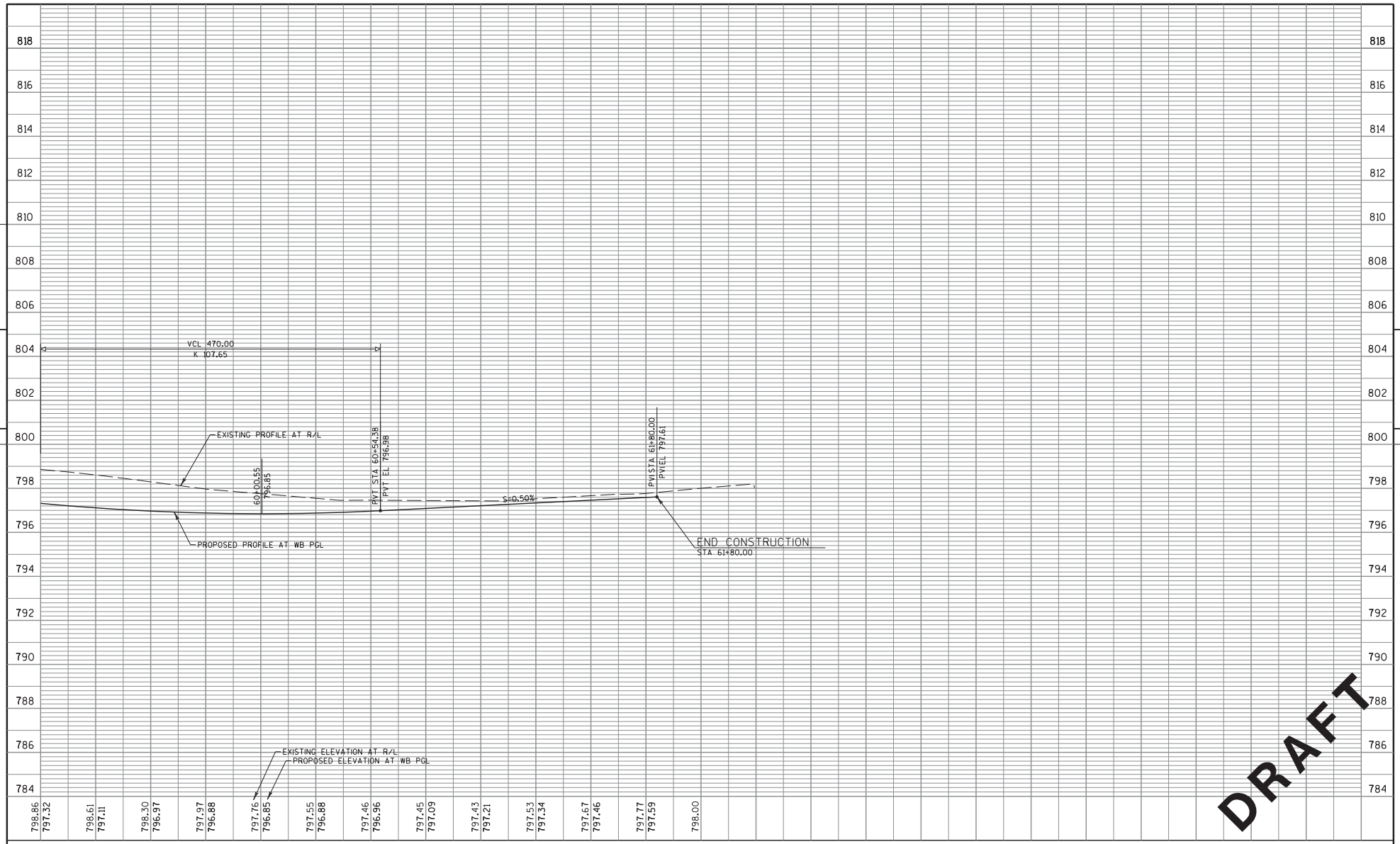
ATTACHMENT 6



PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050182a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40 WISDOT/CADDS SHEET 40

ATTACHMENT 6

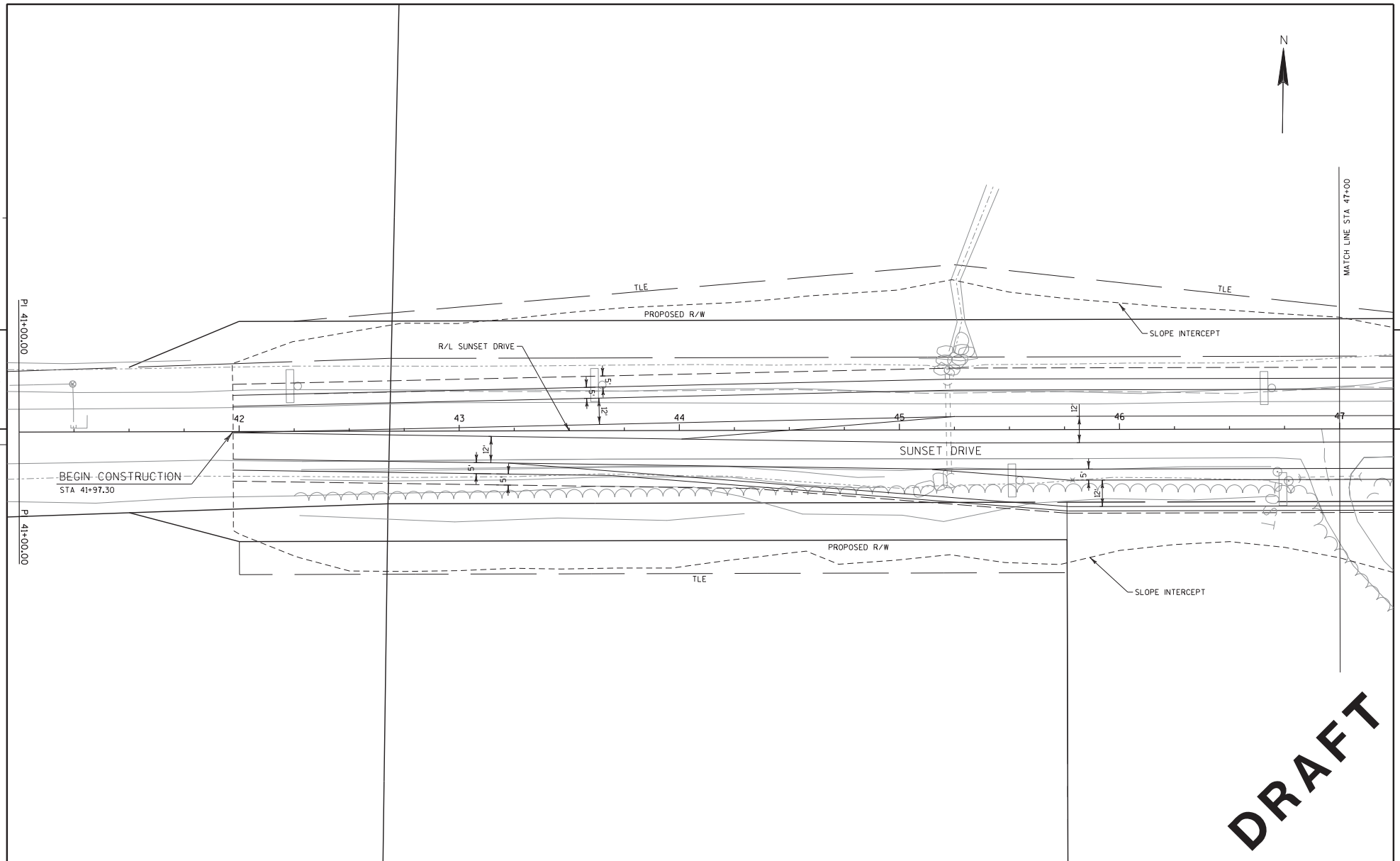


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: GENESEE ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050182b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

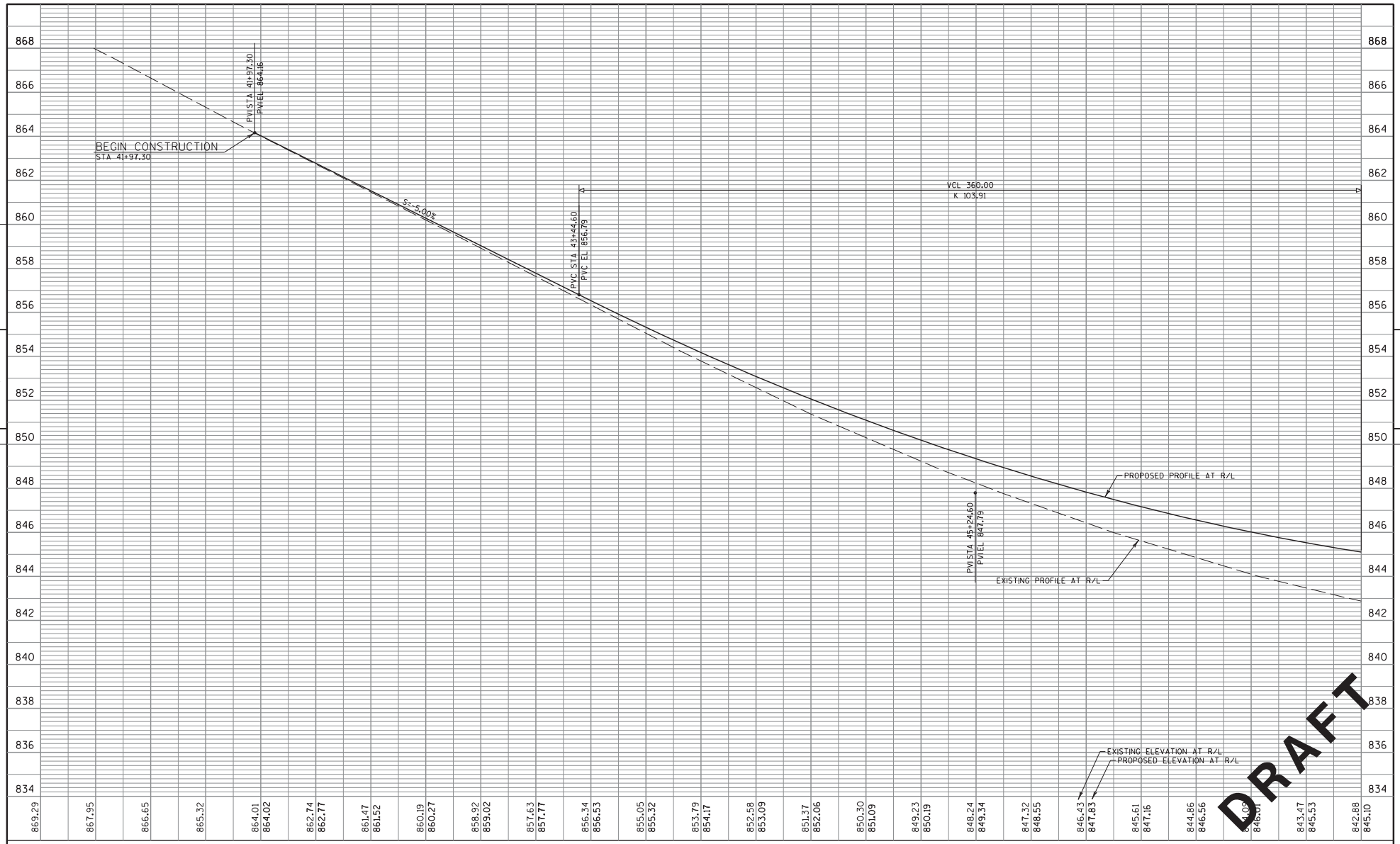


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: SUNSET DRIVE	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050183-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6



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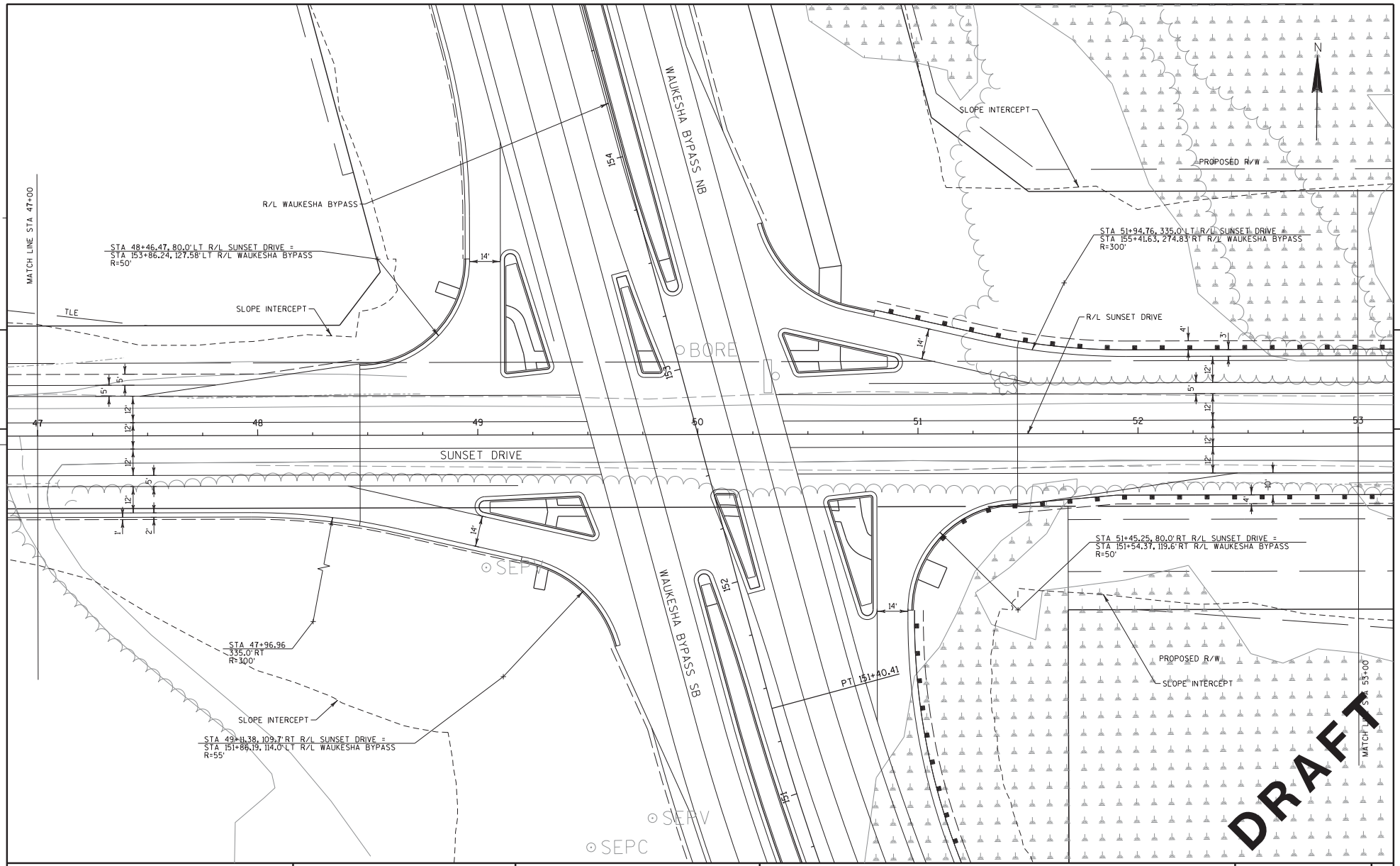
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: SUNSET DRIVE	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050184-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

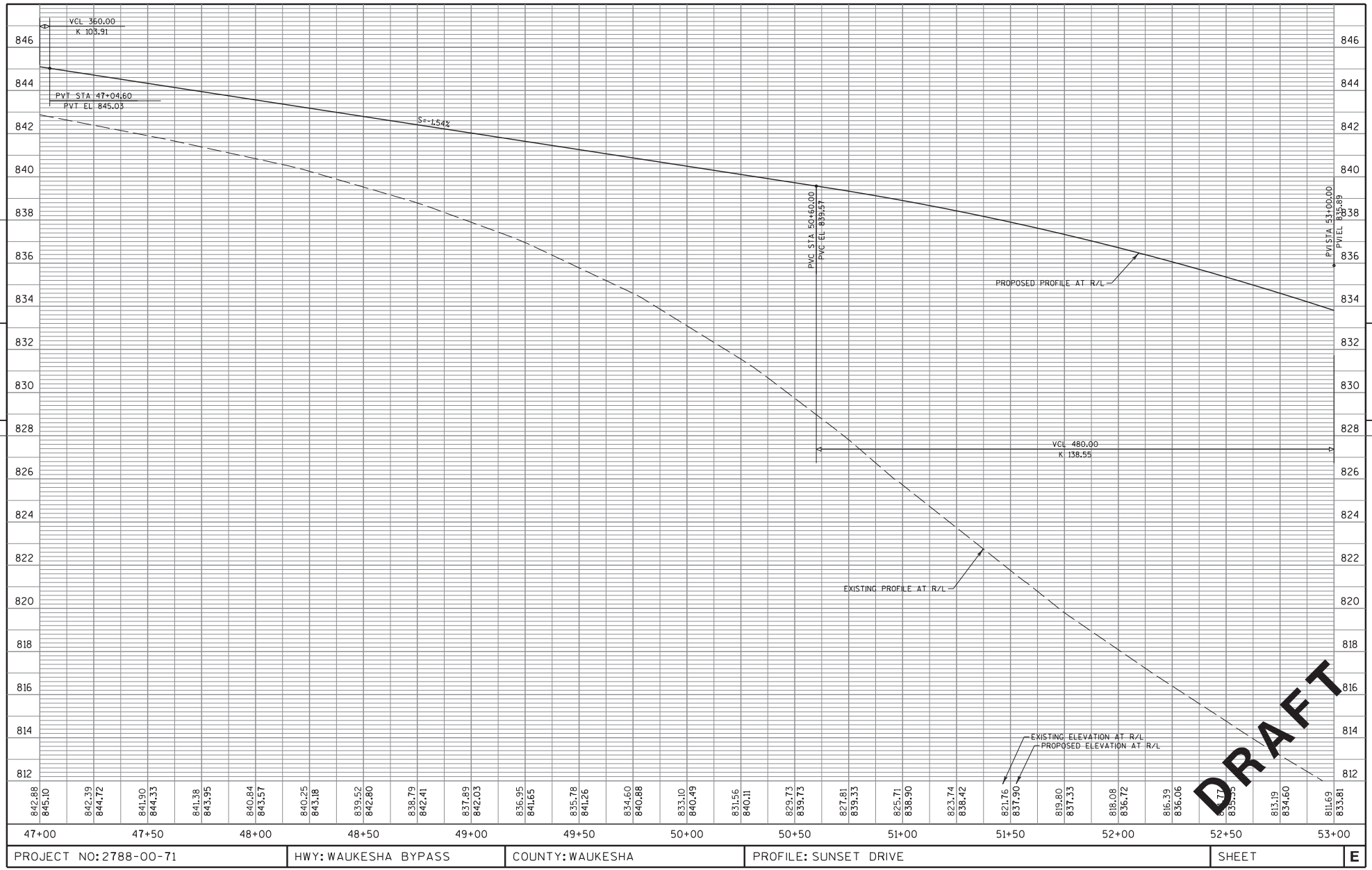


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: SUNSET DRIVE	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050185-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6



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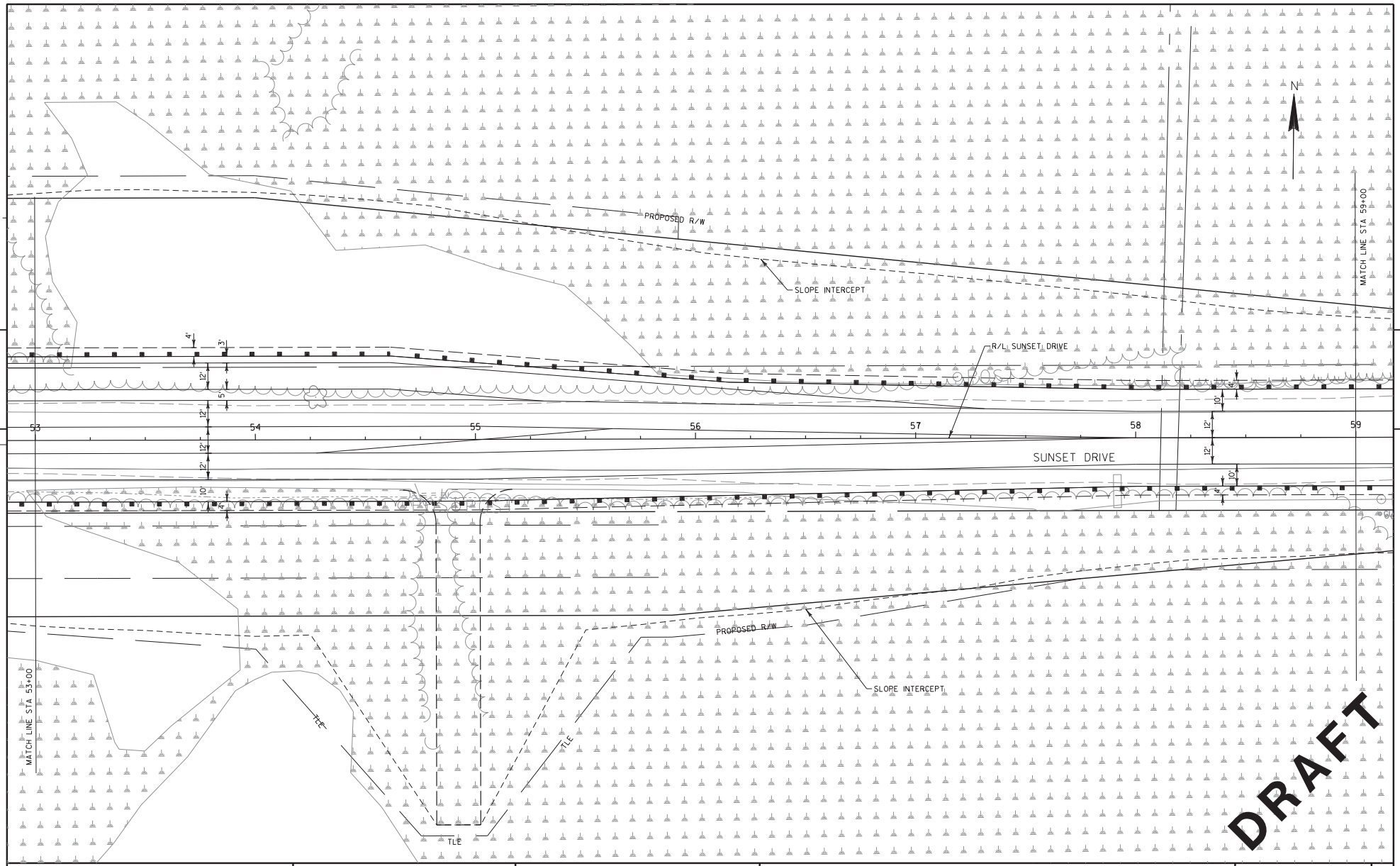
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: SUNSET DRIVE	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050186-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6



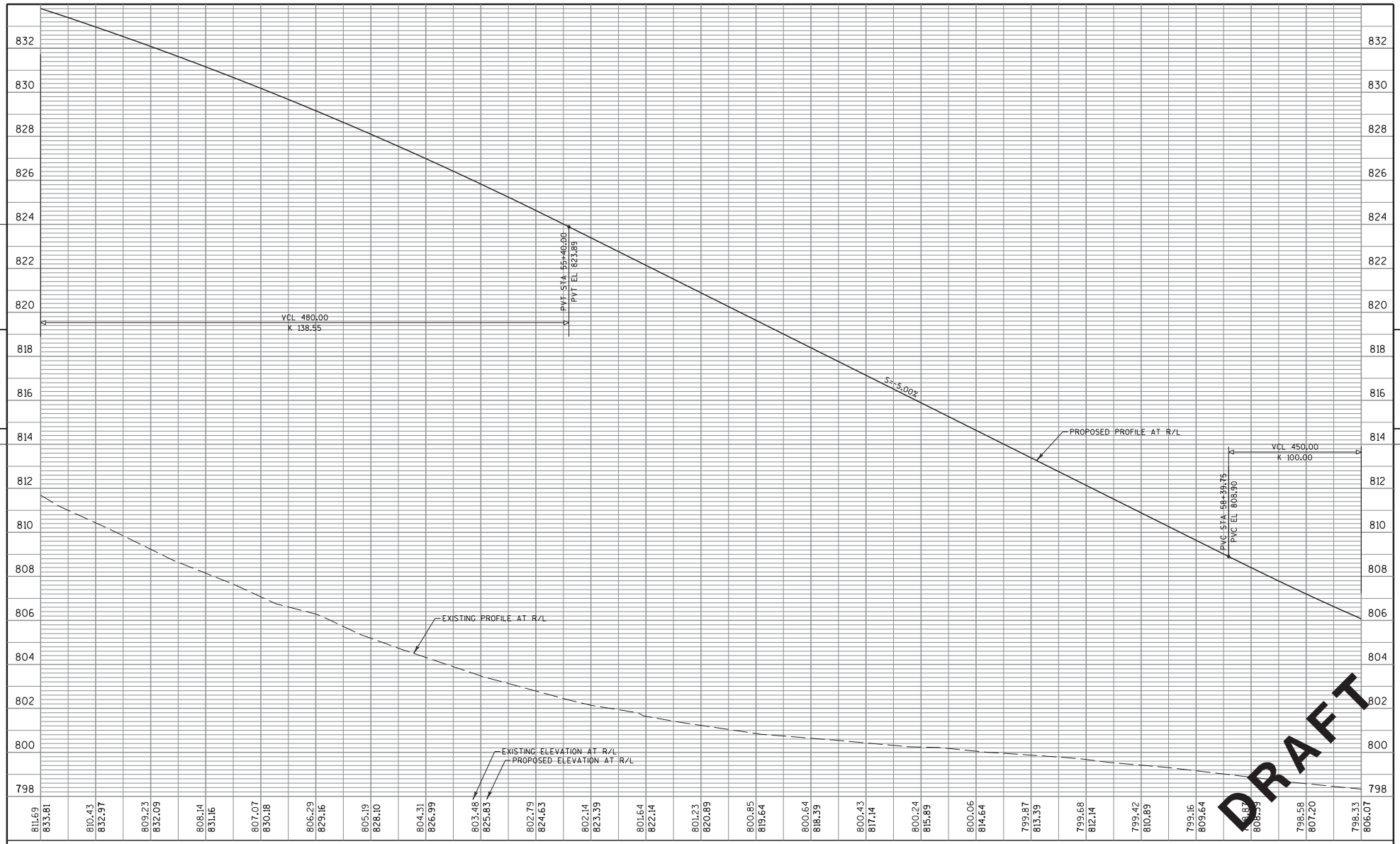
DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: SUNSET DRIVE	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050187-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6



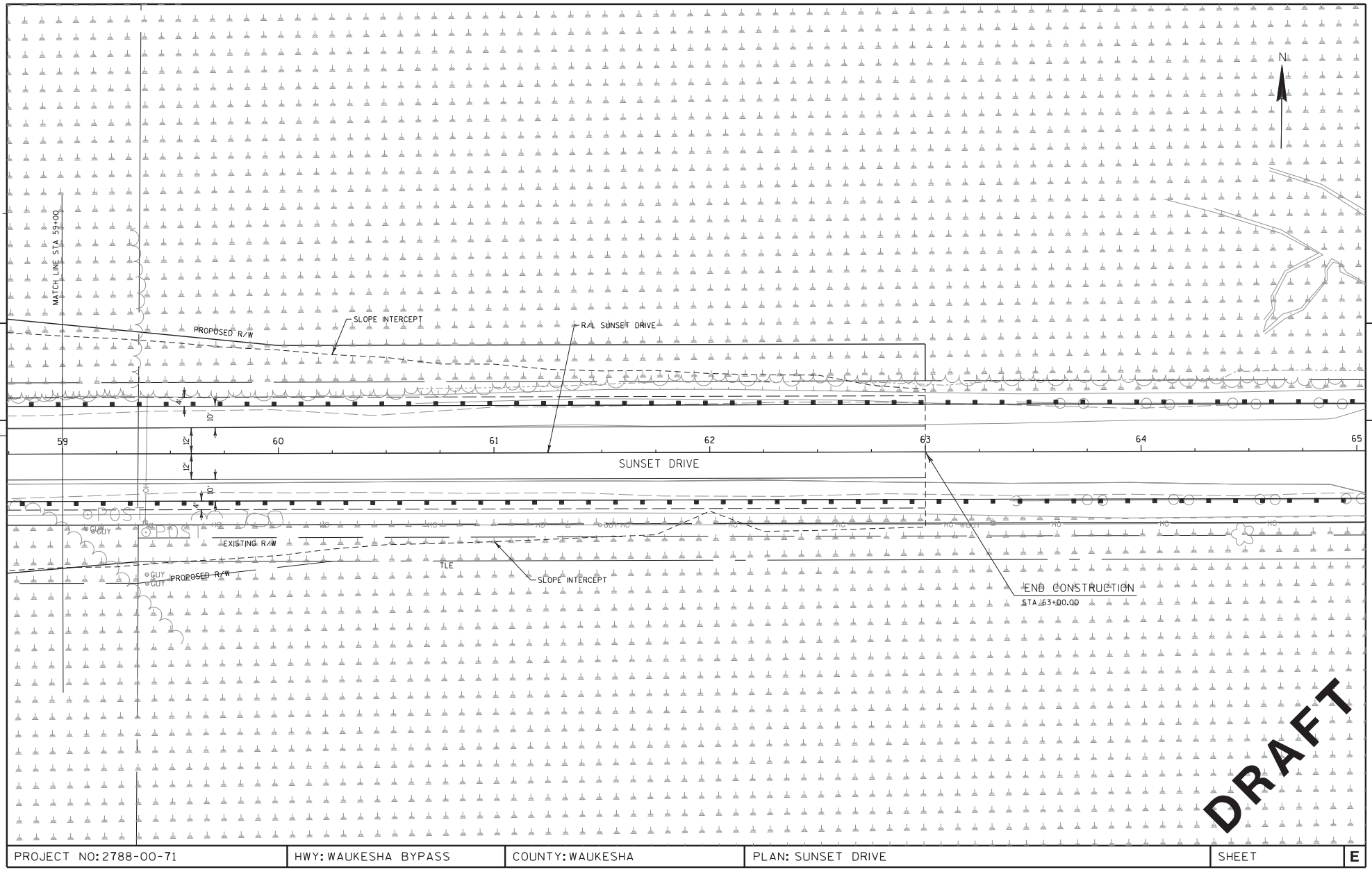
DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: SUNSET DRIVE	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050188-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

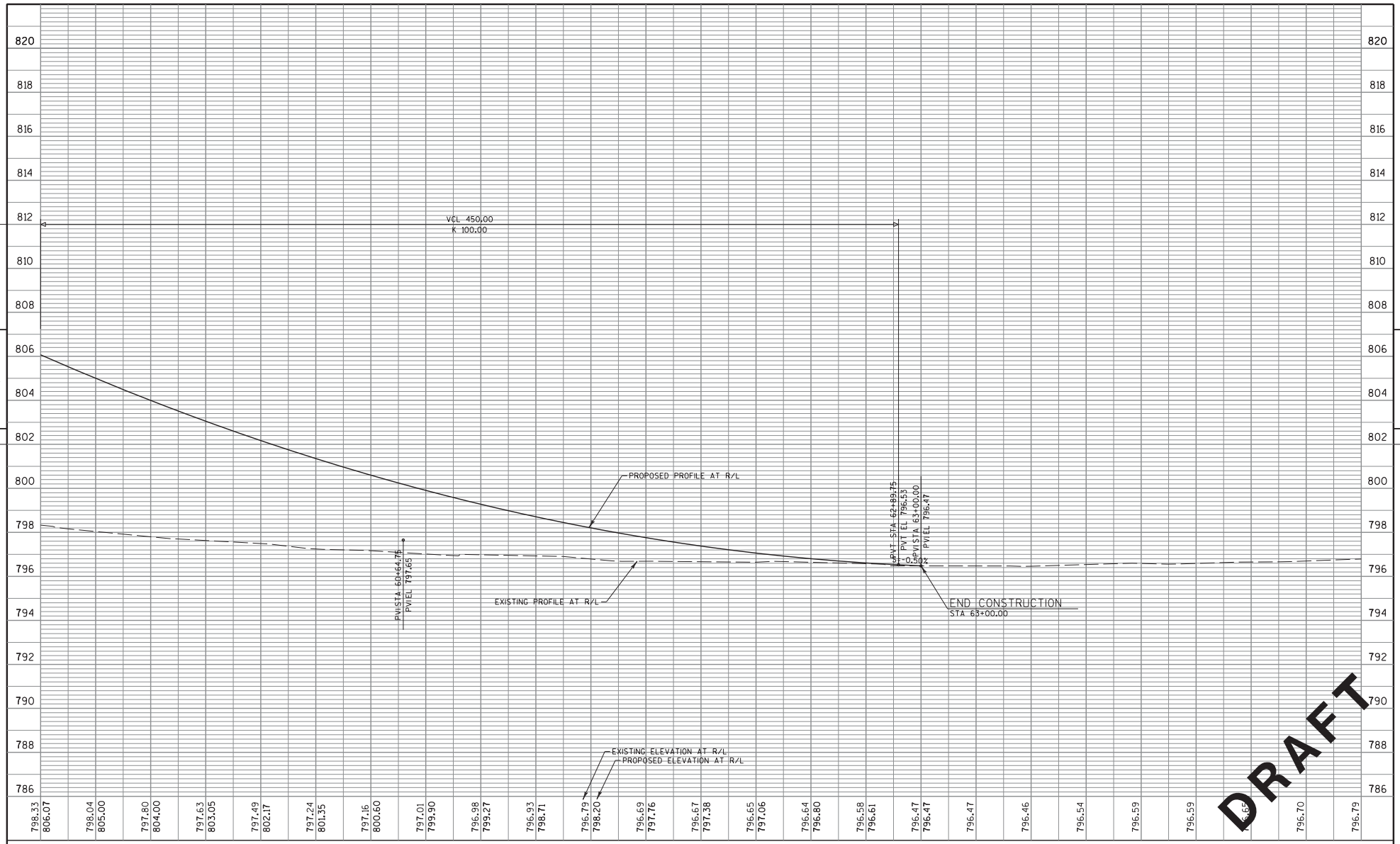


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: SUNSET DRIVE	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050189-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6

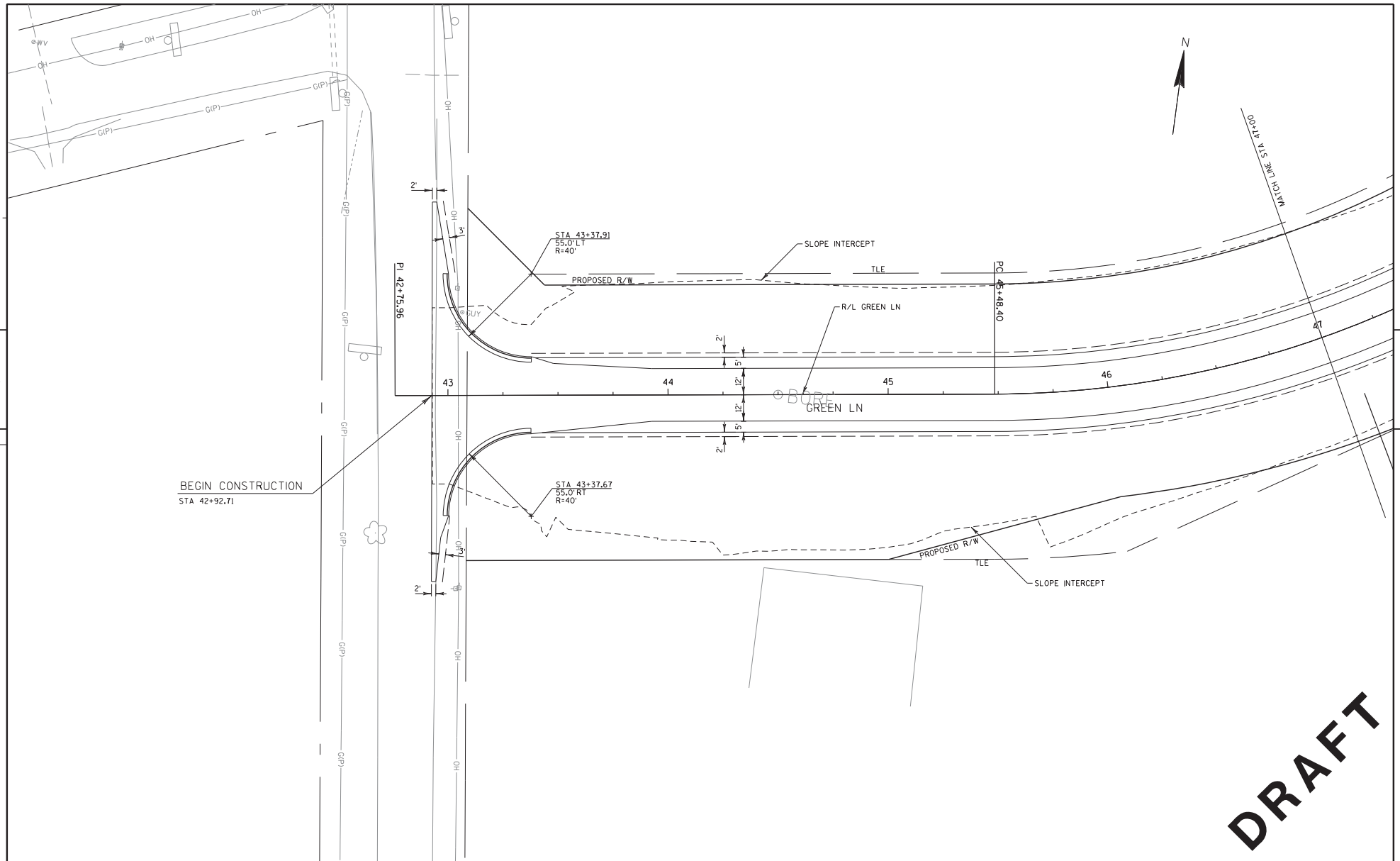


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: SUNSET DRIVE	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050190-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

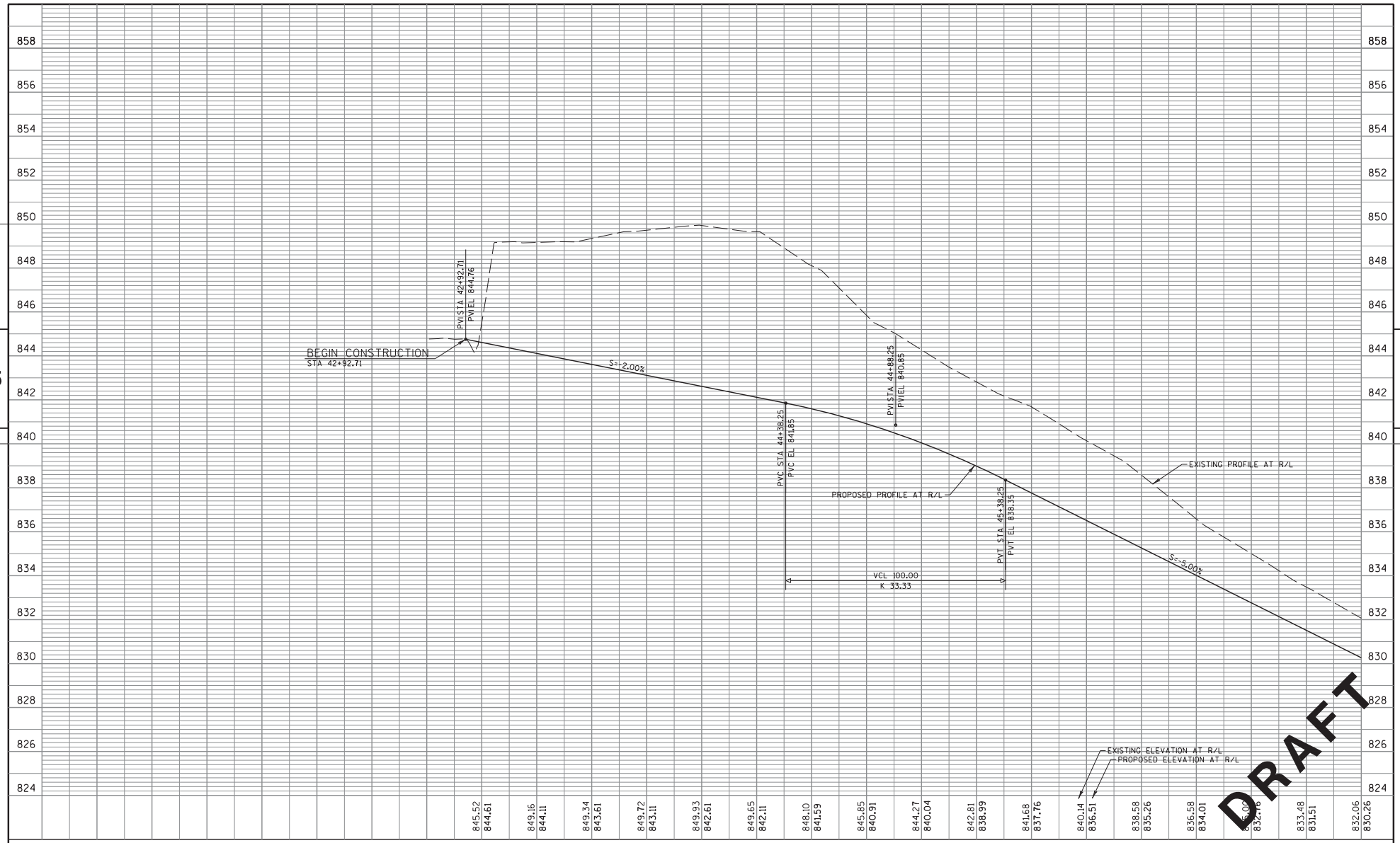


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: GREEN LANE	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050191-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6

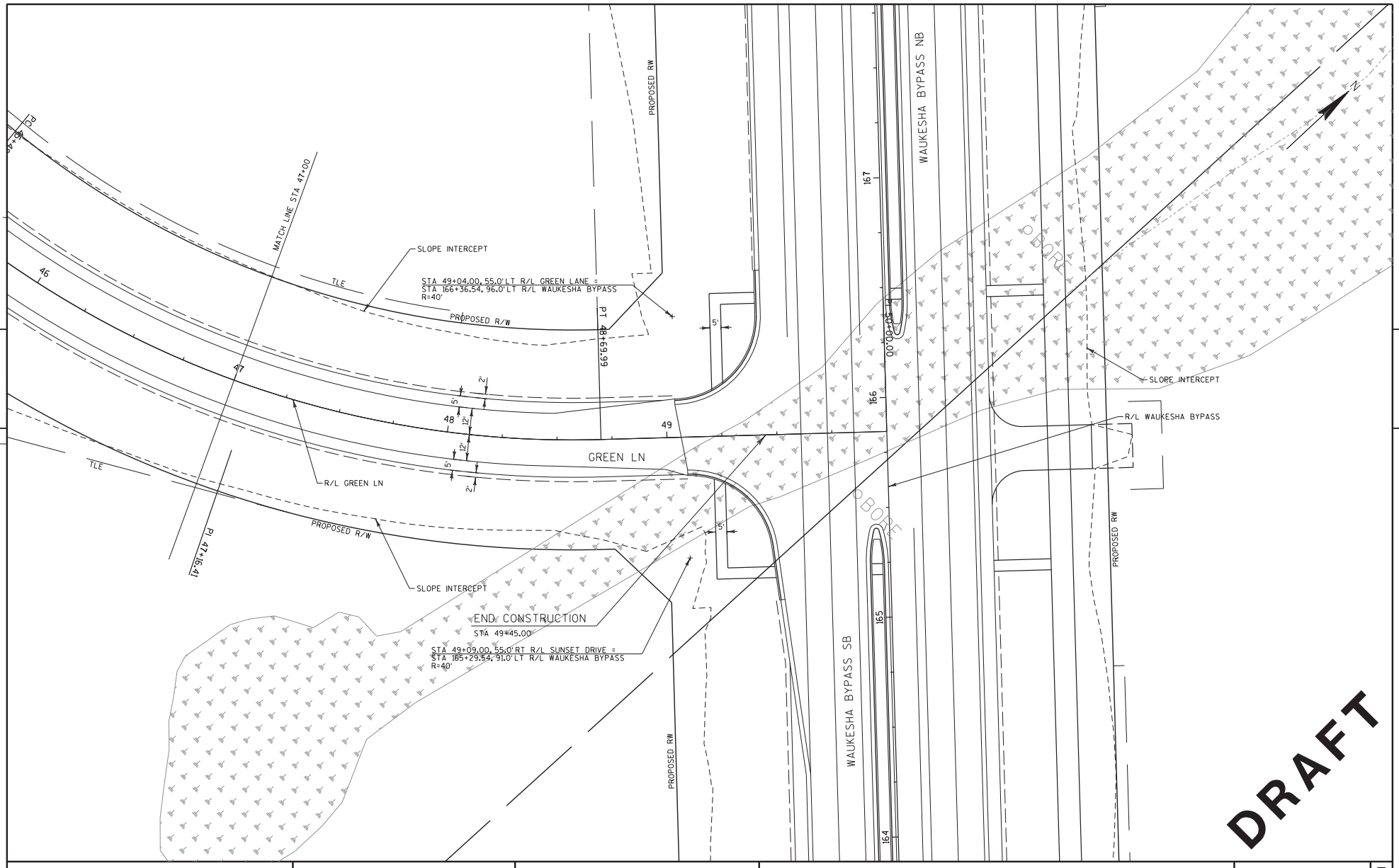


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: GREEN LANE	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050192-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

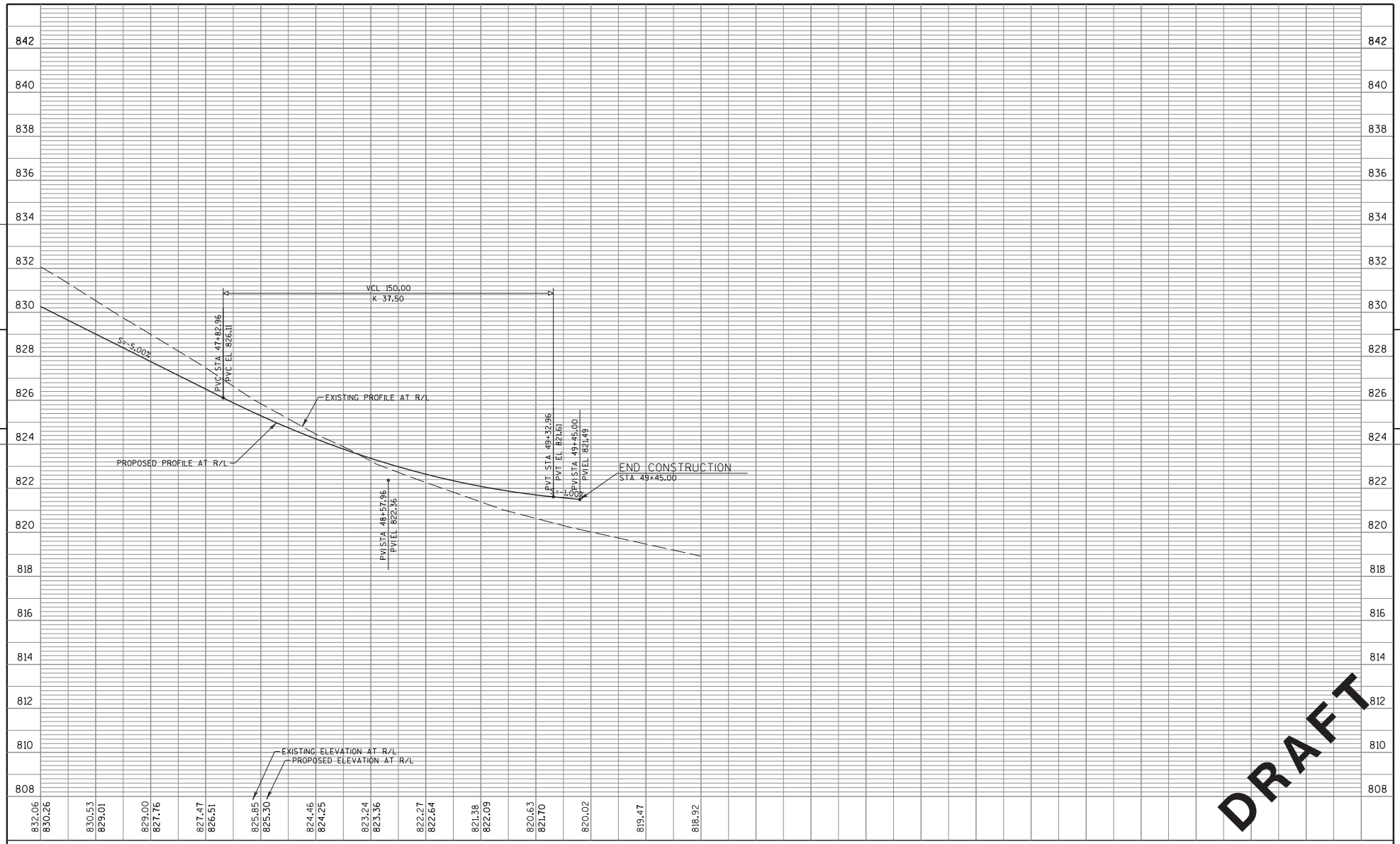


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: GREEN LANE	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050193-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6



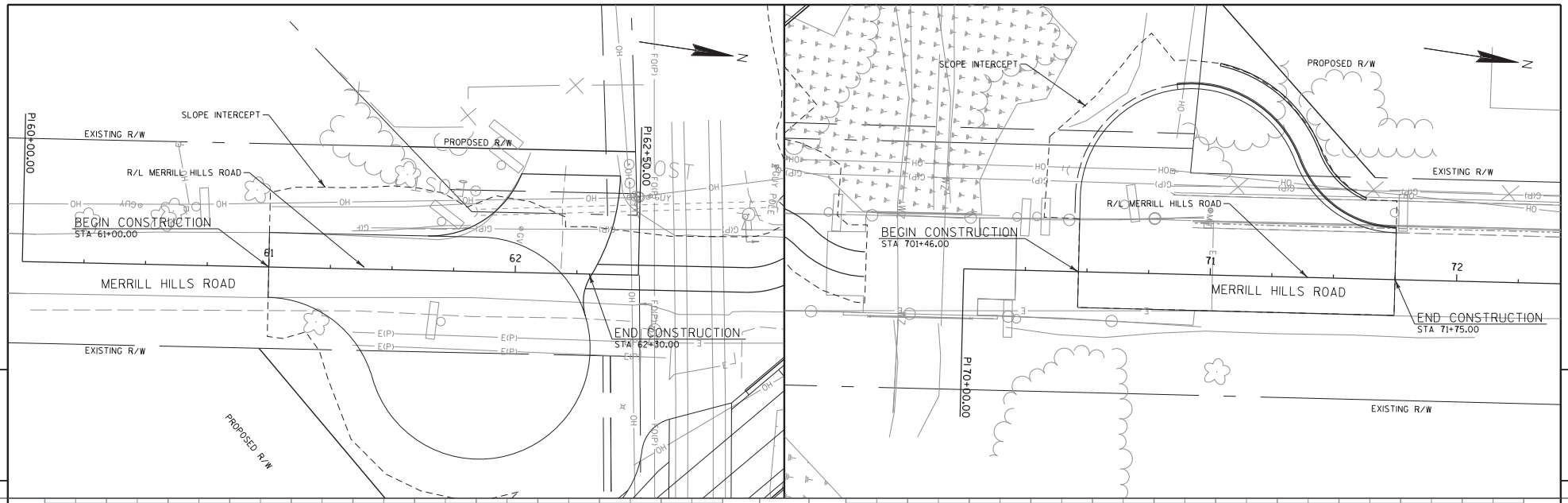
DRAFT

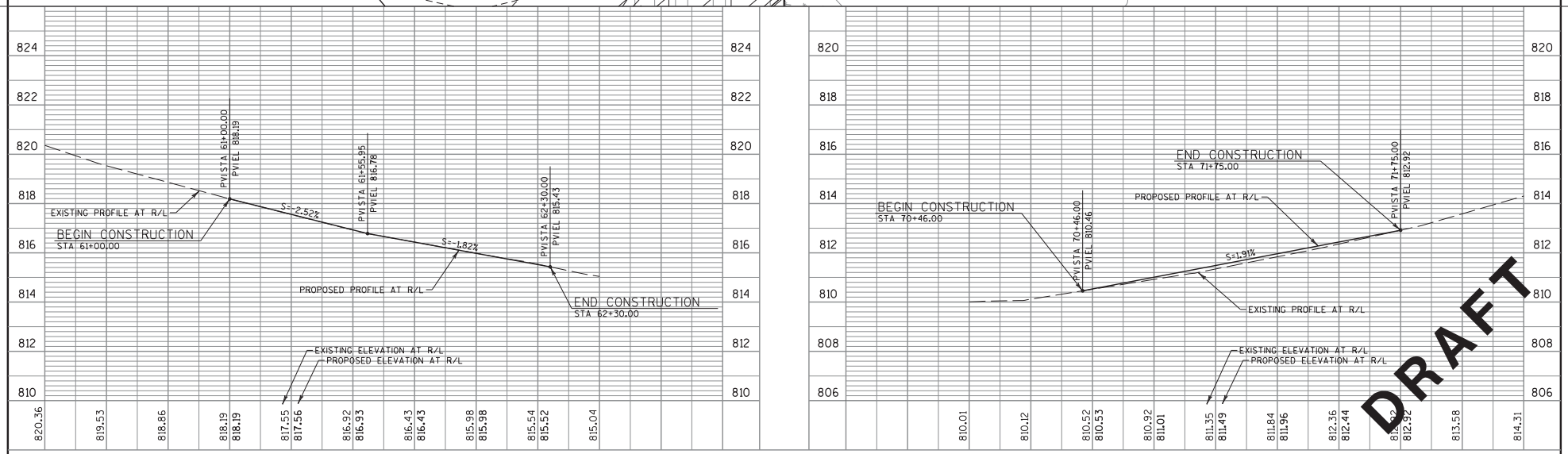
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: GREEN LANE	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050194-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6





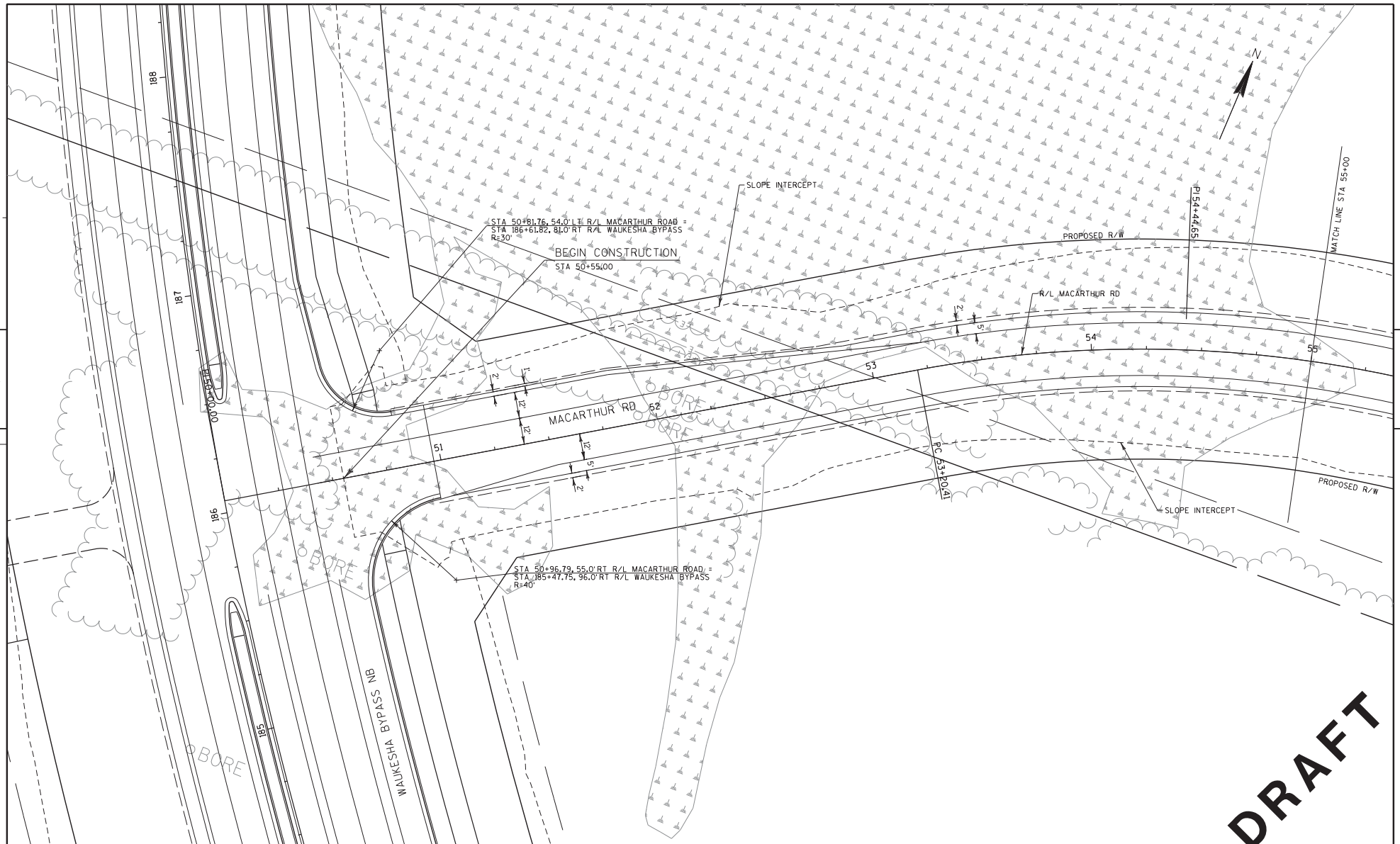
DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN AND PROFILE: MERRILL HILLS ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050195-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 30

ATTACHMENT 6

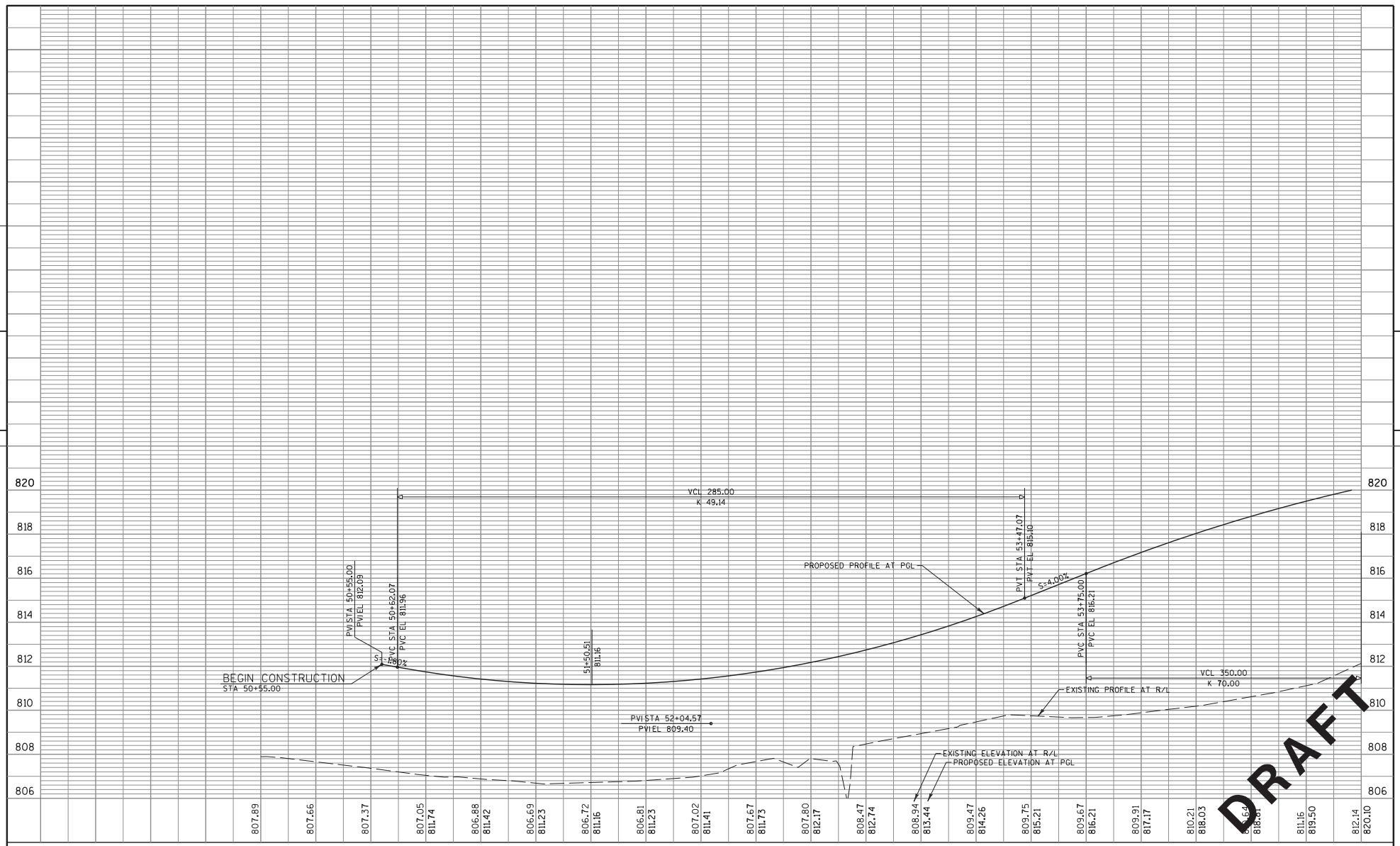


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: MACARTHUR ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050197a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

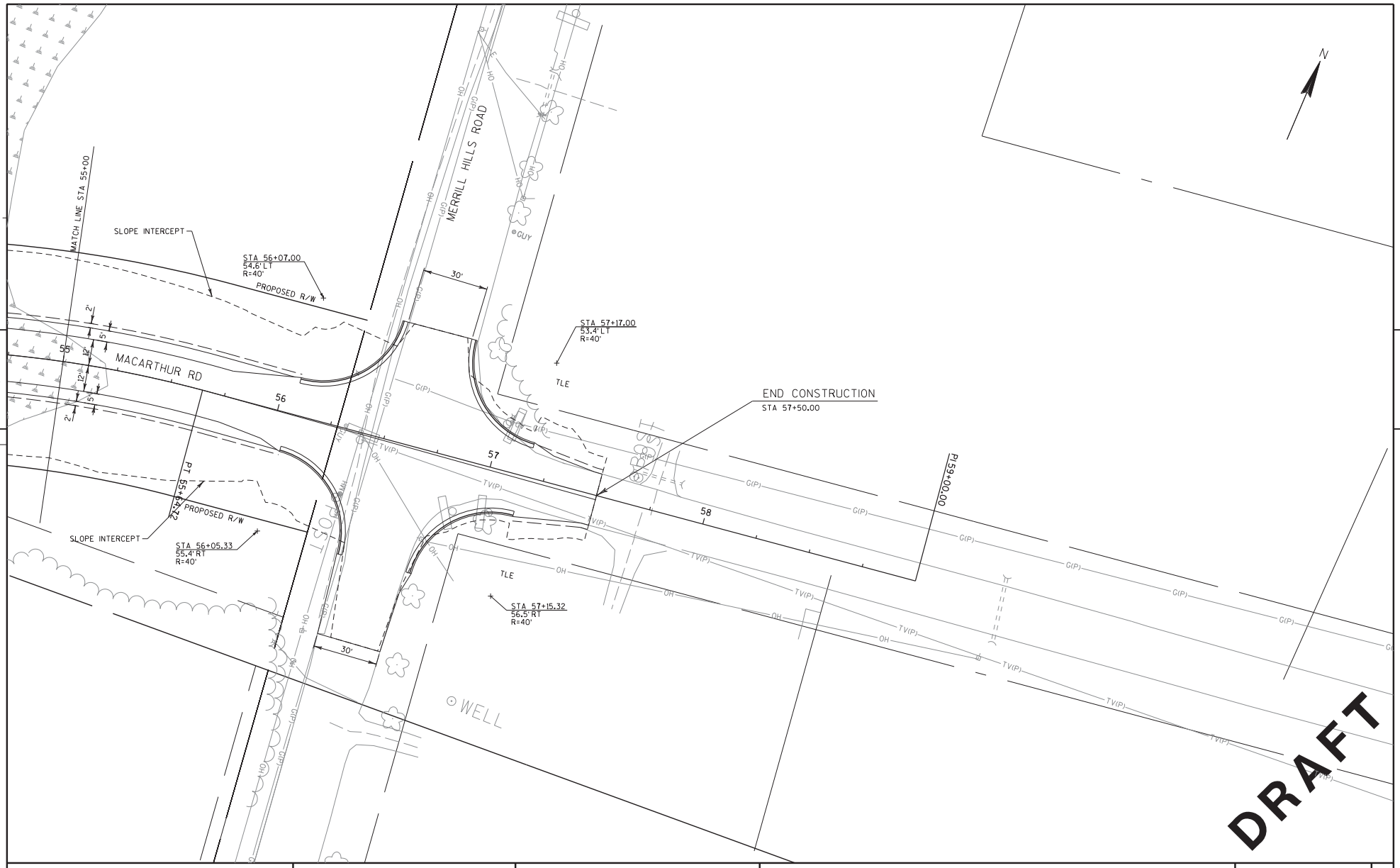
ATTACHMENT 6



PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: MACARTHUR ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050197b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40 WISDOT/CADDS SHEET 40

ATTACHMENT 6

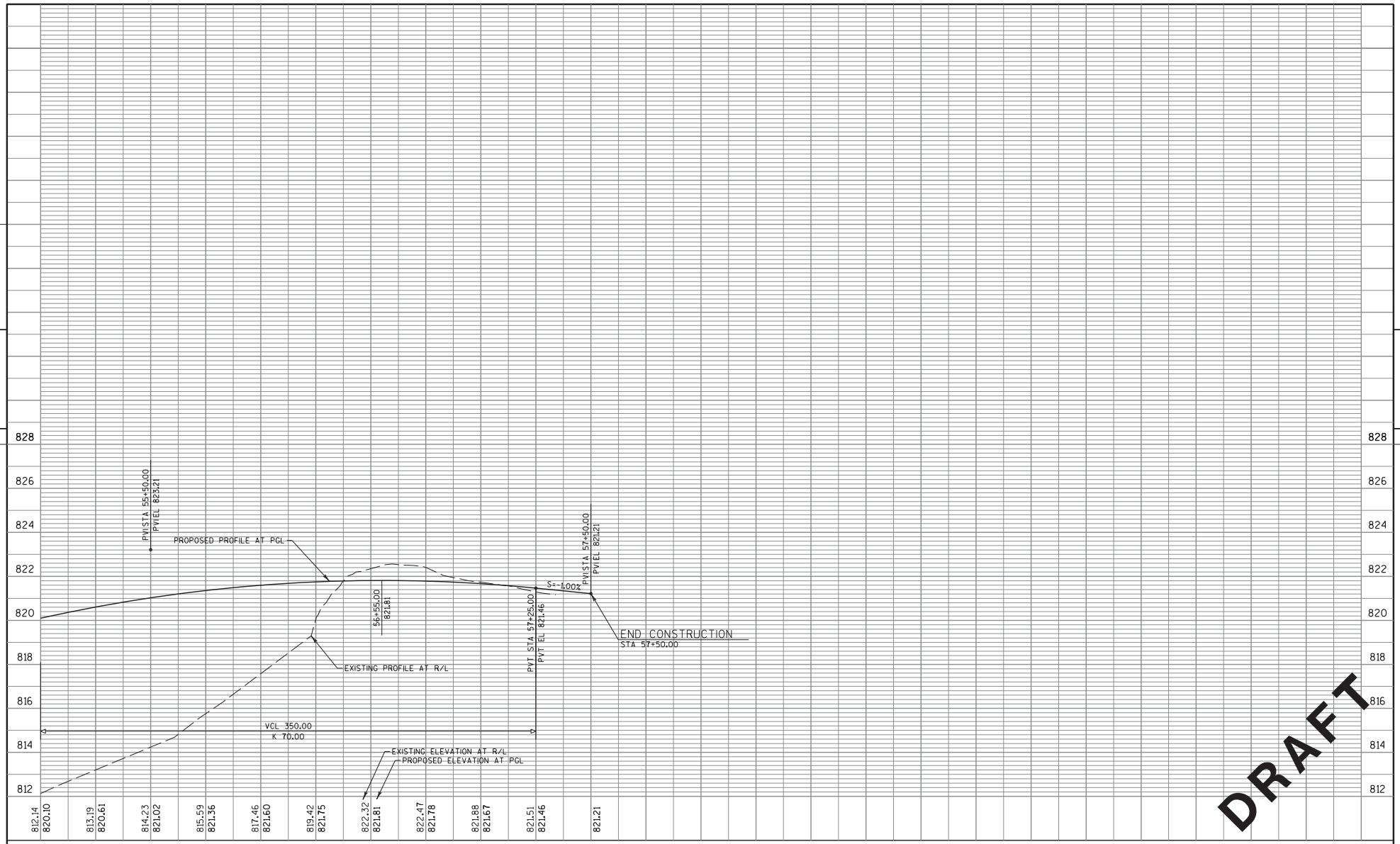


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: MACARTHUR ROAD	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050198a-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6

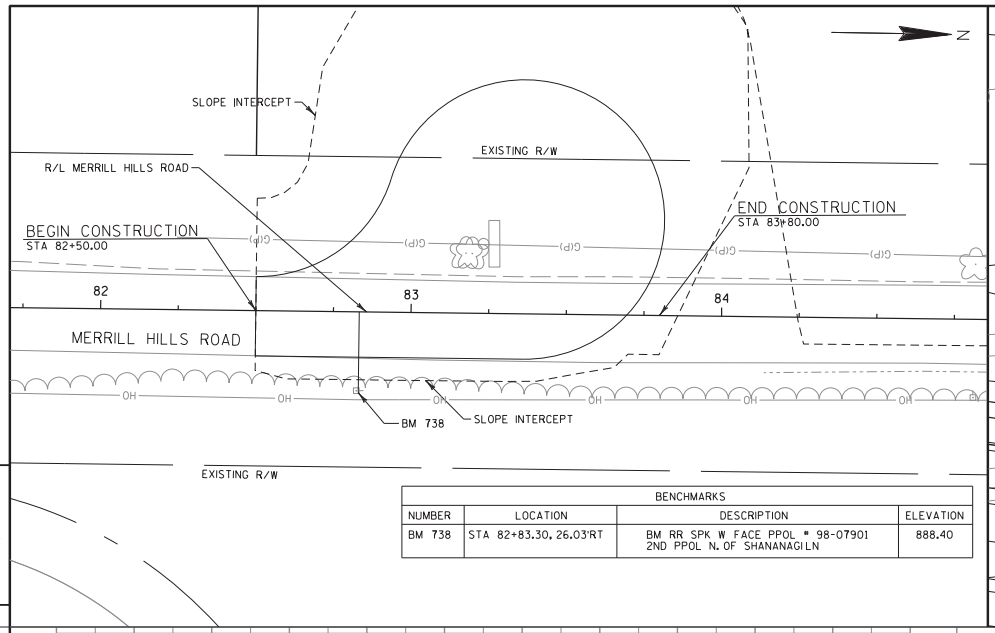


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: MACARTHUR ROAD	SHEET	E

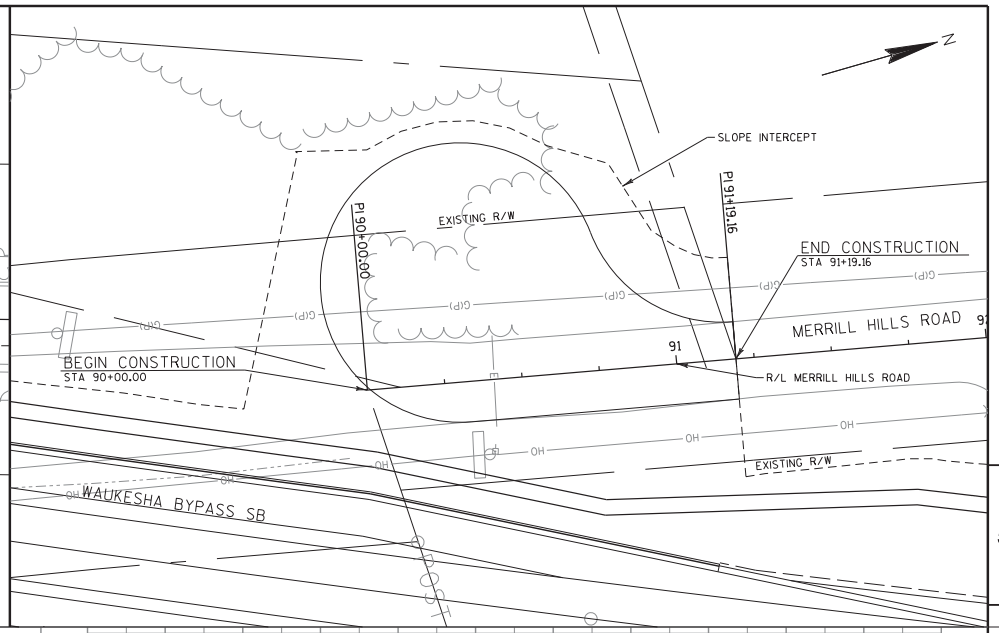
FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050198b-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

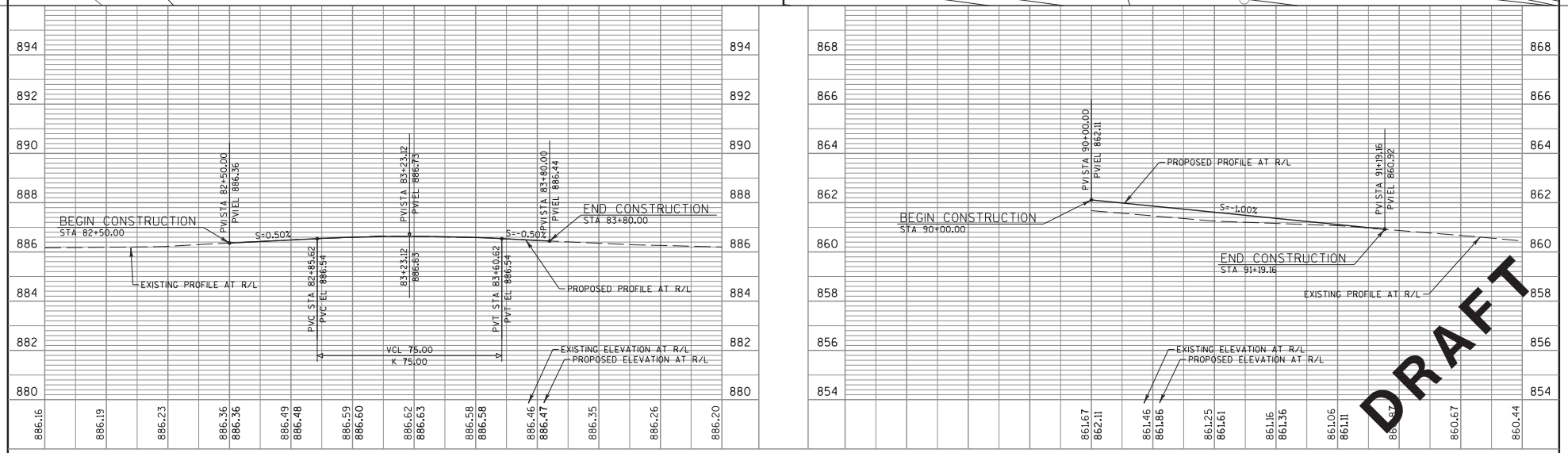
WISDOT/CADDS SHEET 40

ATTACHMENT 6



BENCHMARKS			
NUMBER	LOCATION	DESCRIPTION	ELEVATION
BM 738	STA 82+83.30, 26.03'RT	BM RR SPK W FACE PPOL * 98-07901 2ND PPOL N. OF SHANANAGILN	888.40





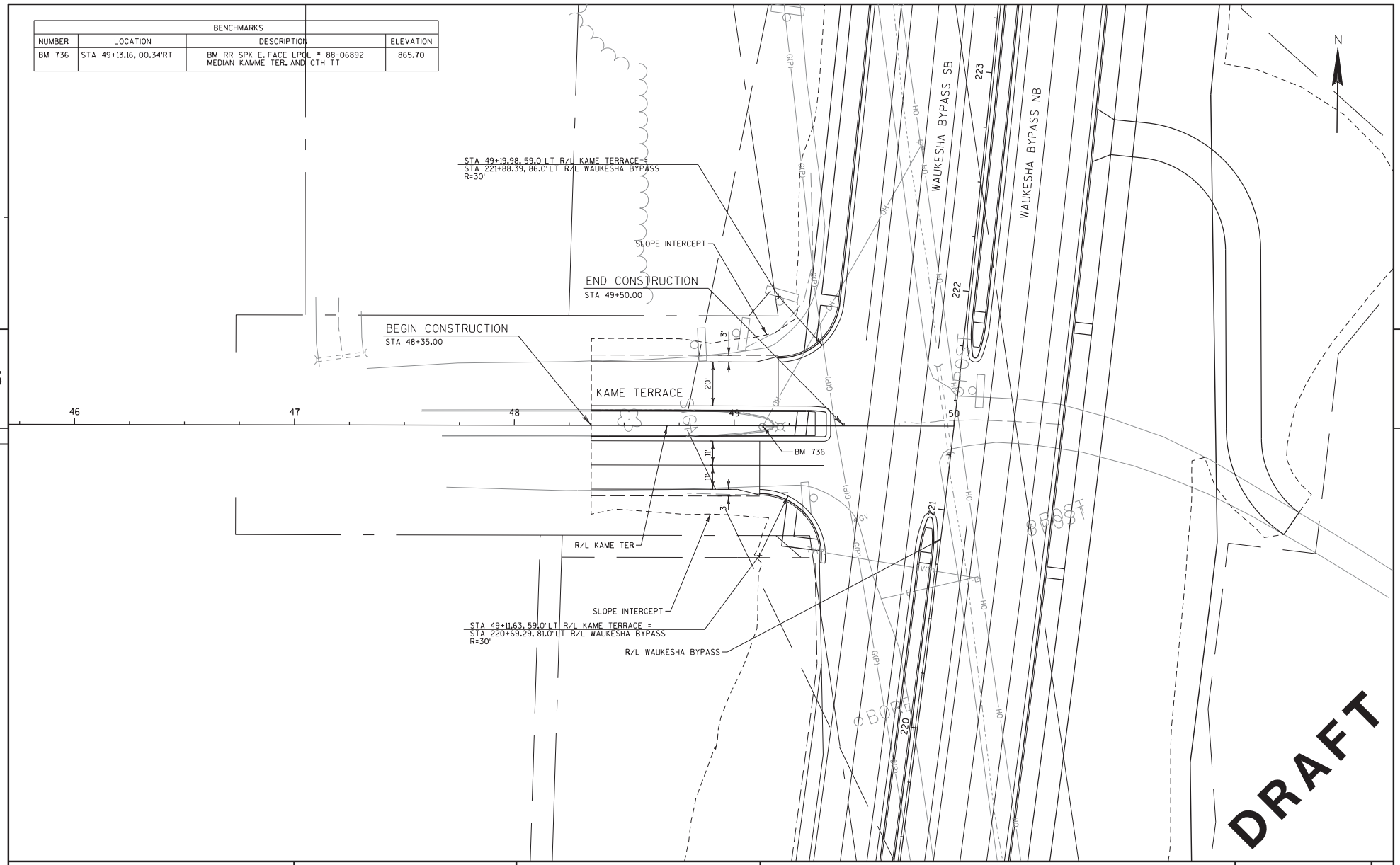
DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN AND PROFILE: MERRILL HILLS ROAD	SHEET	E

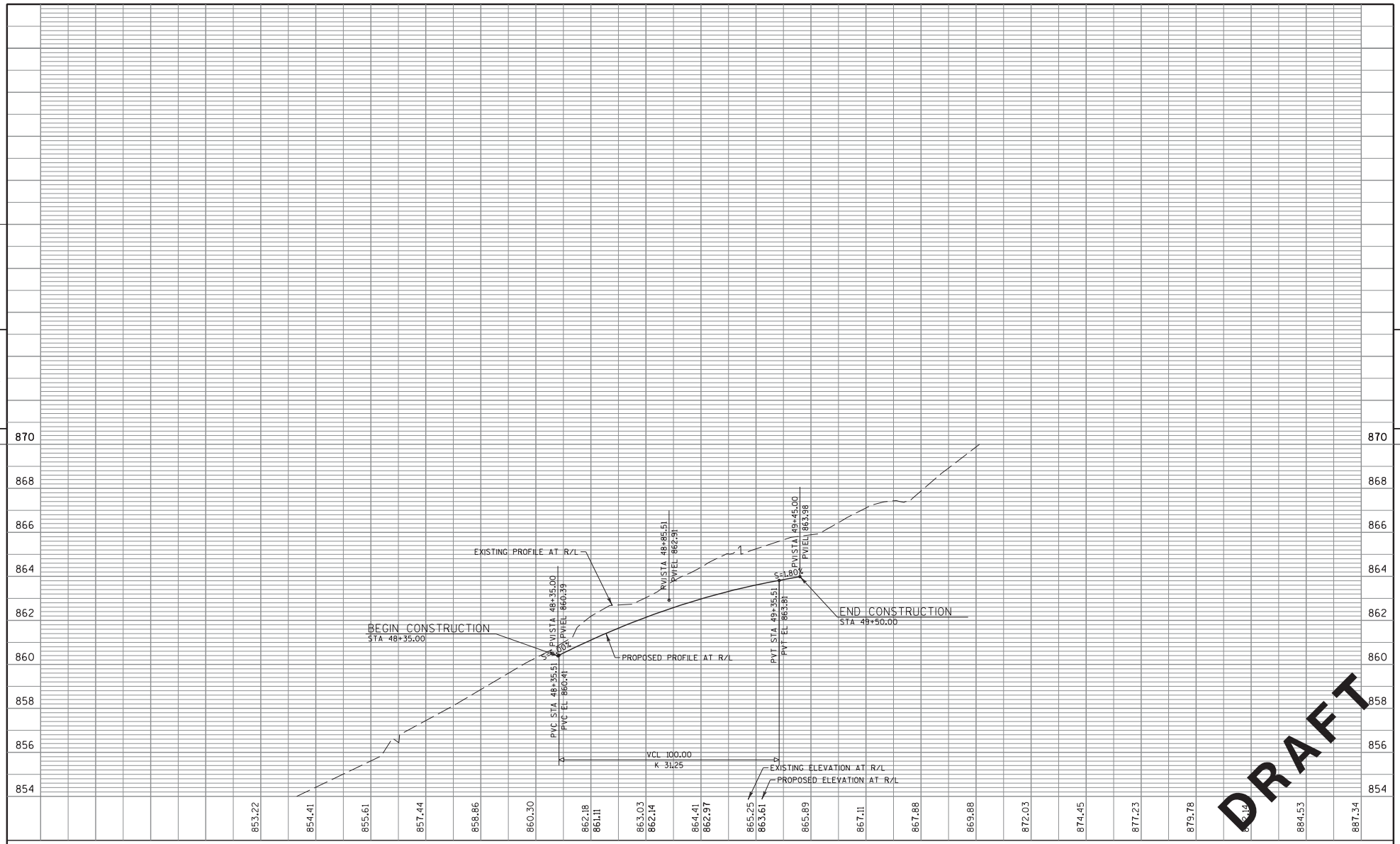
FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050199-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 30

ATTACHMENT 6



ATTACHMENT 6

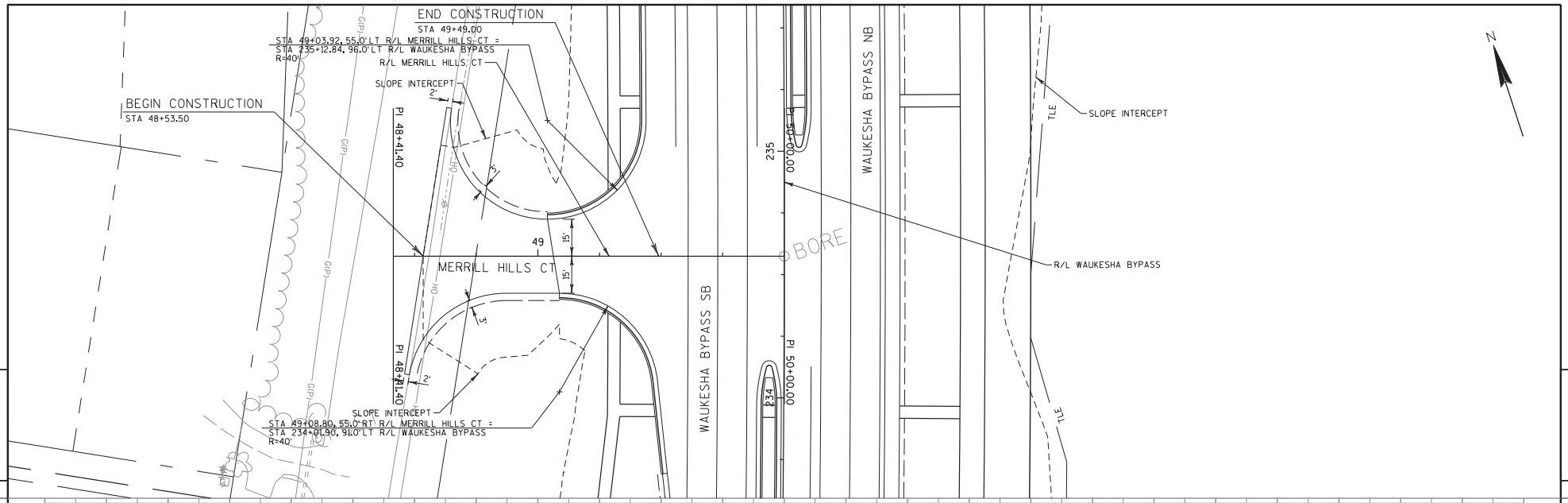


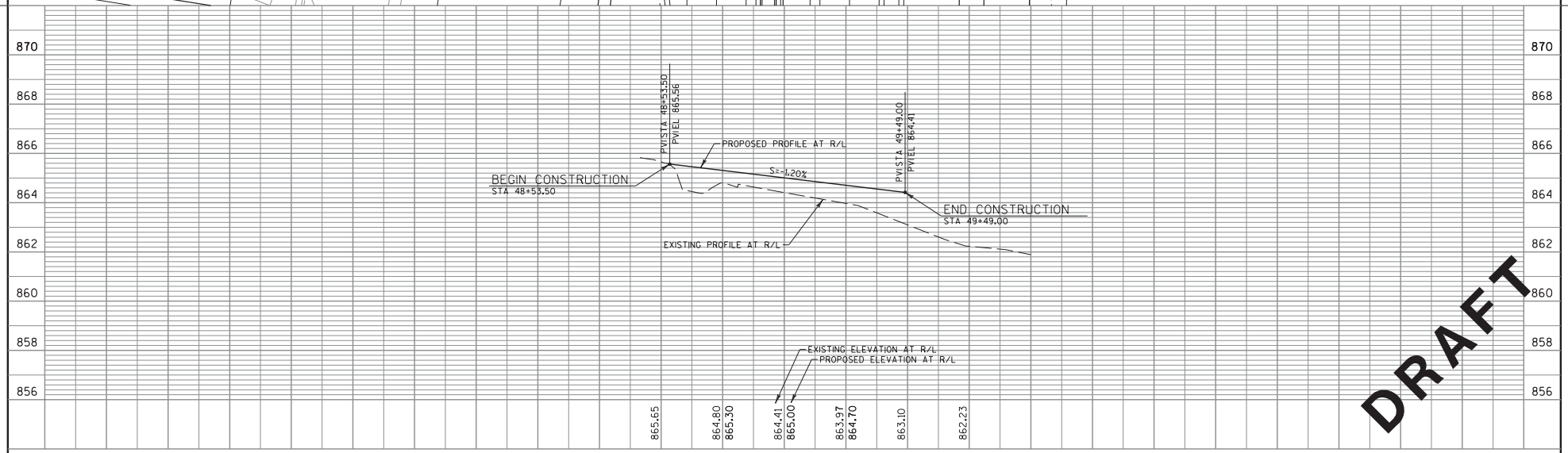
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: KAME TERRACE	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050202-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6





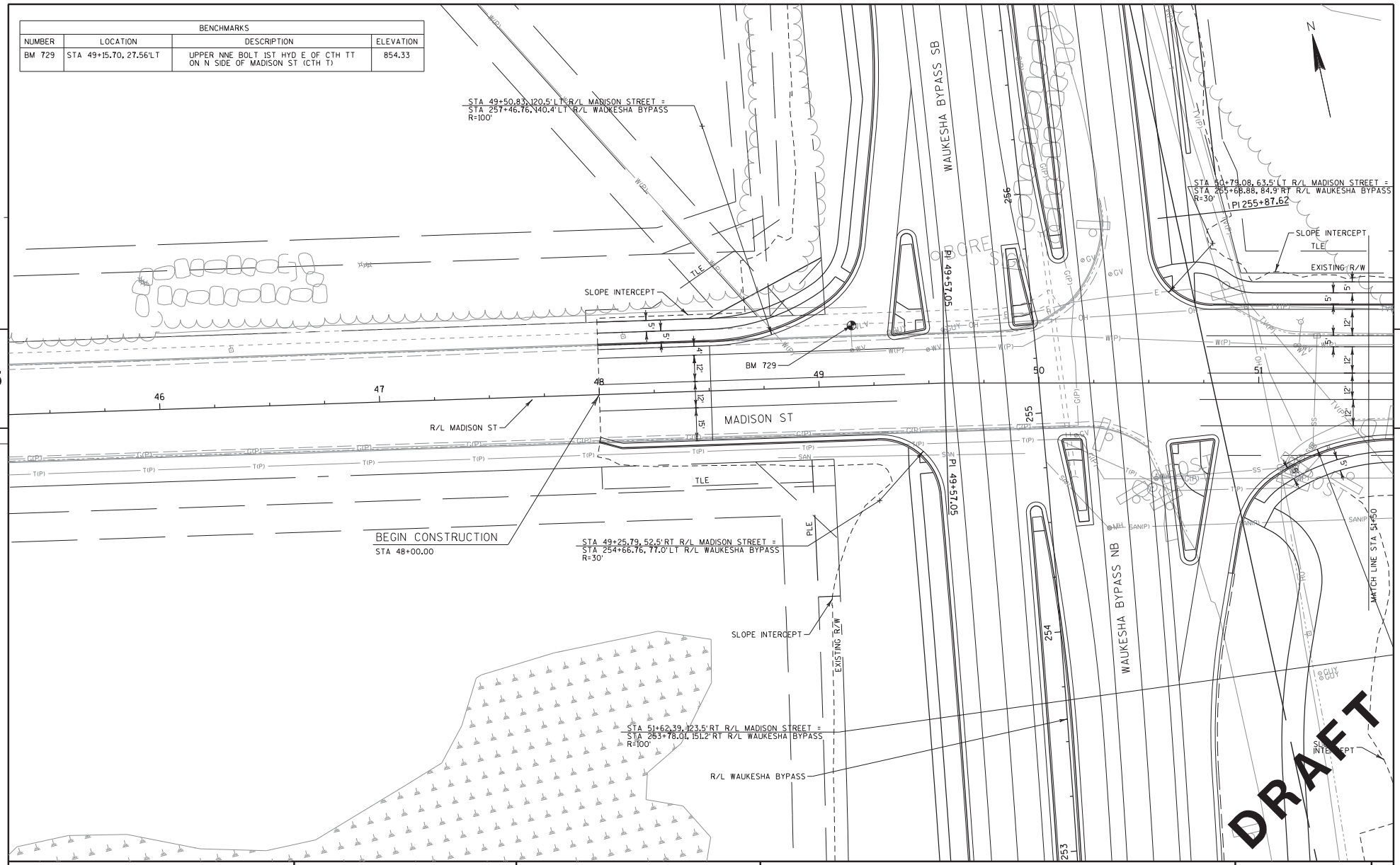
DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN AND PROFILE: MERRILL HILLS COURT	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050203-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 30

ATTACHMENT 6



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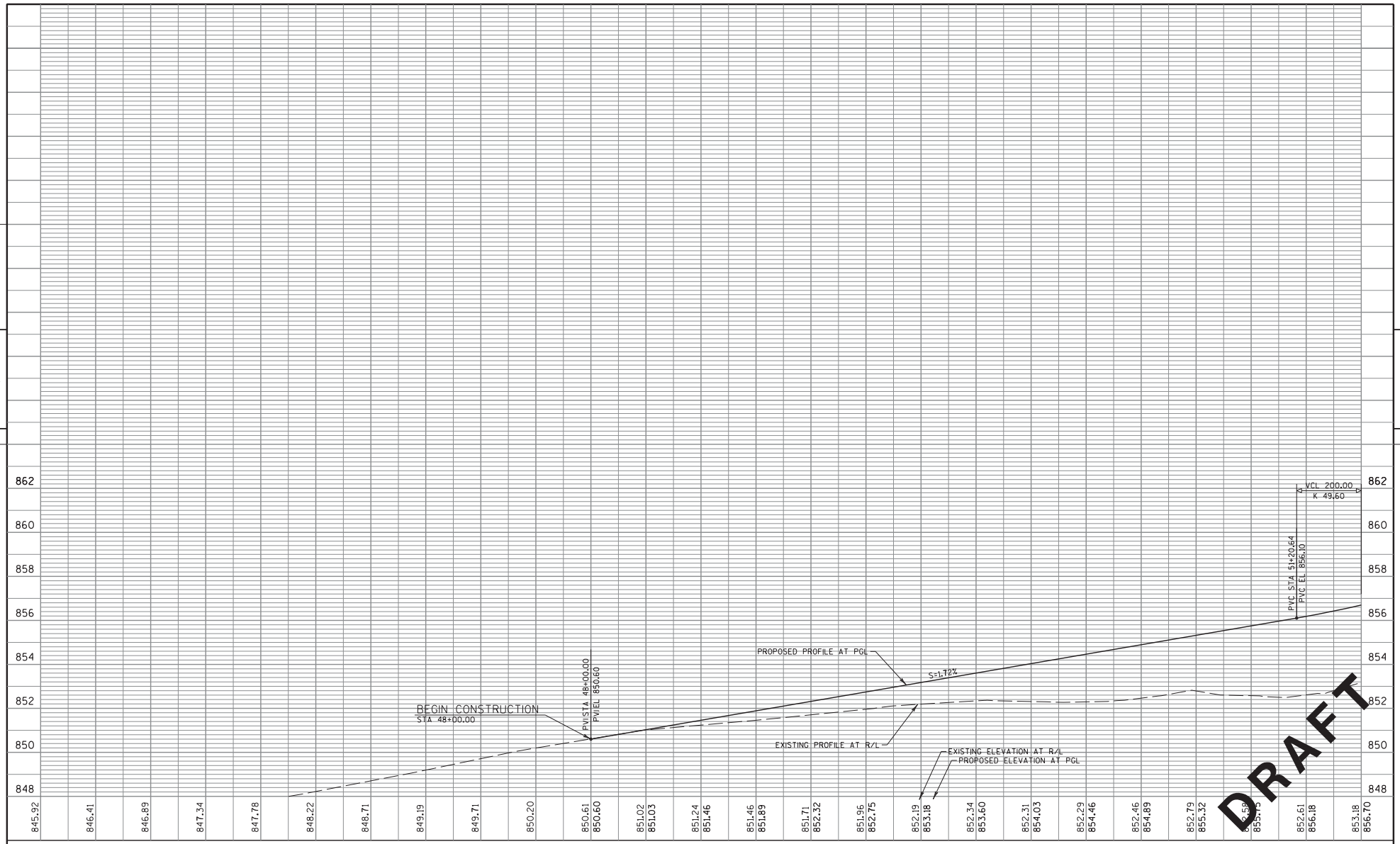

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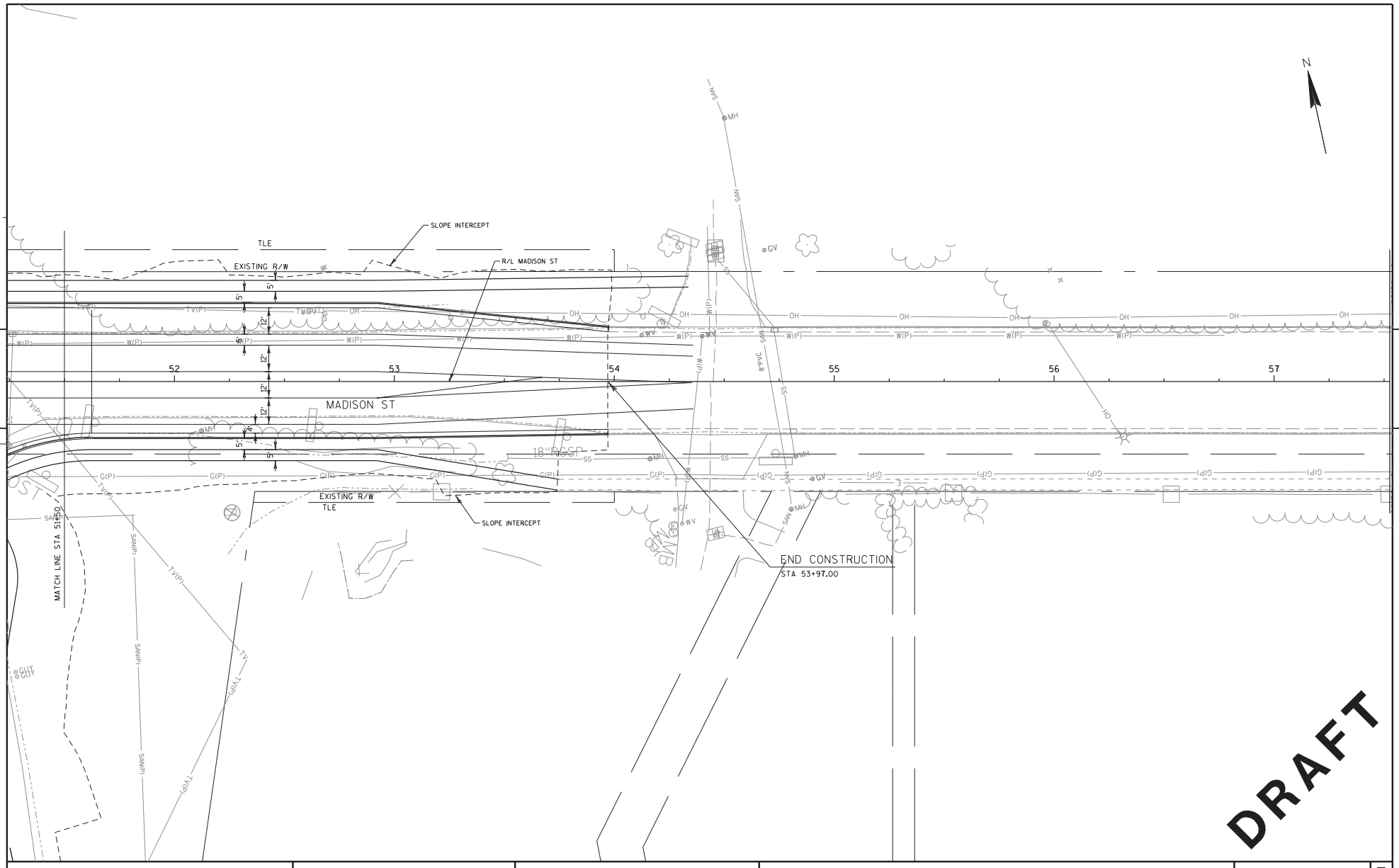
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: MADISON STREET	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050206-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6

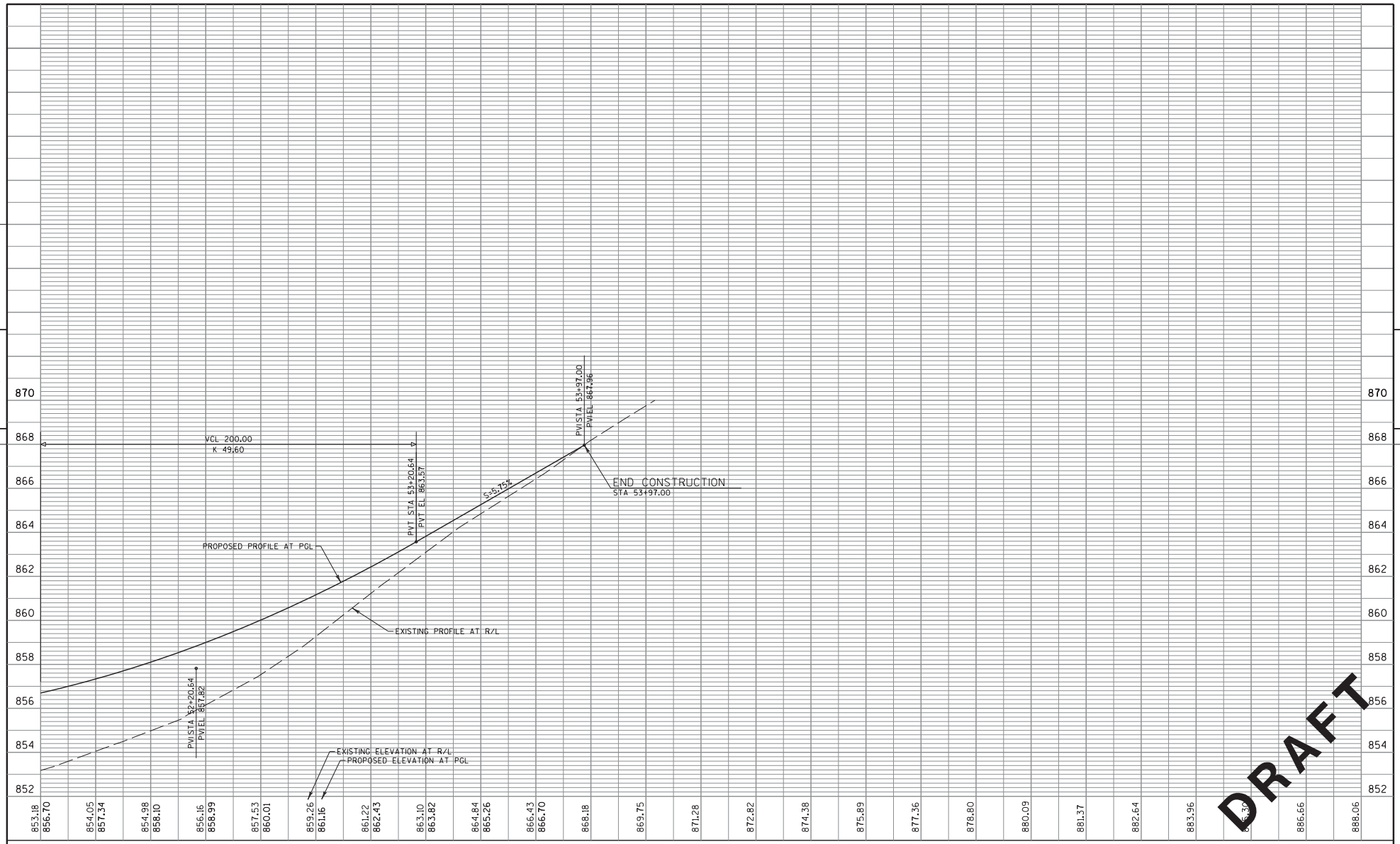


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN: MADISON STREET	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050207-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 44

ATTACHMENT 6

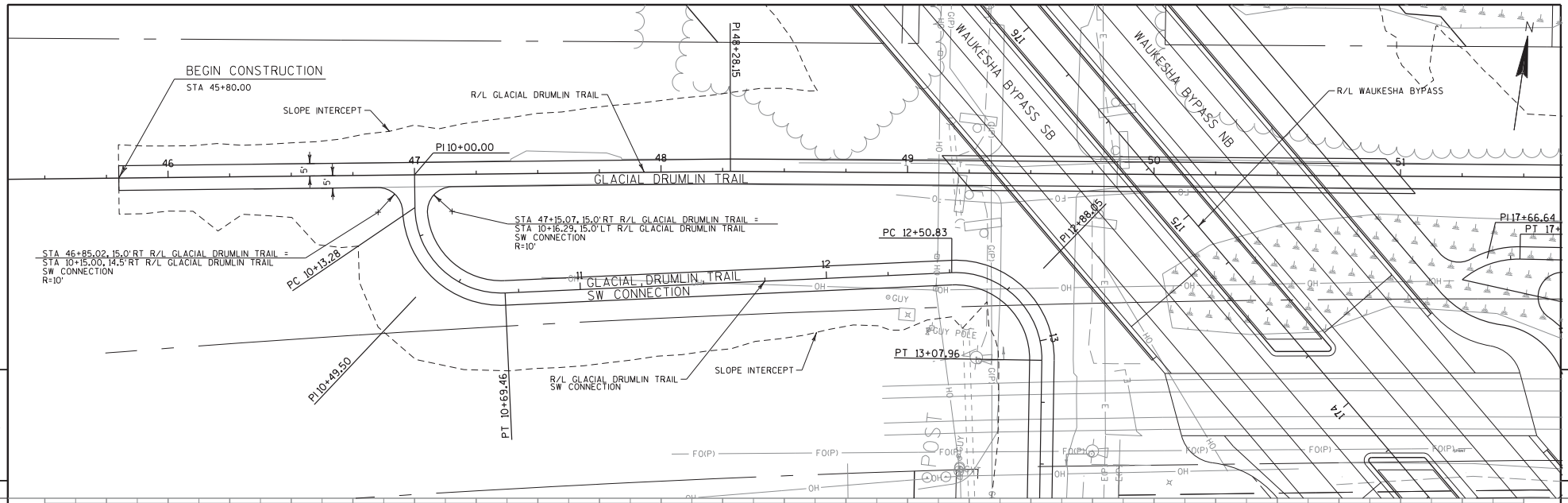


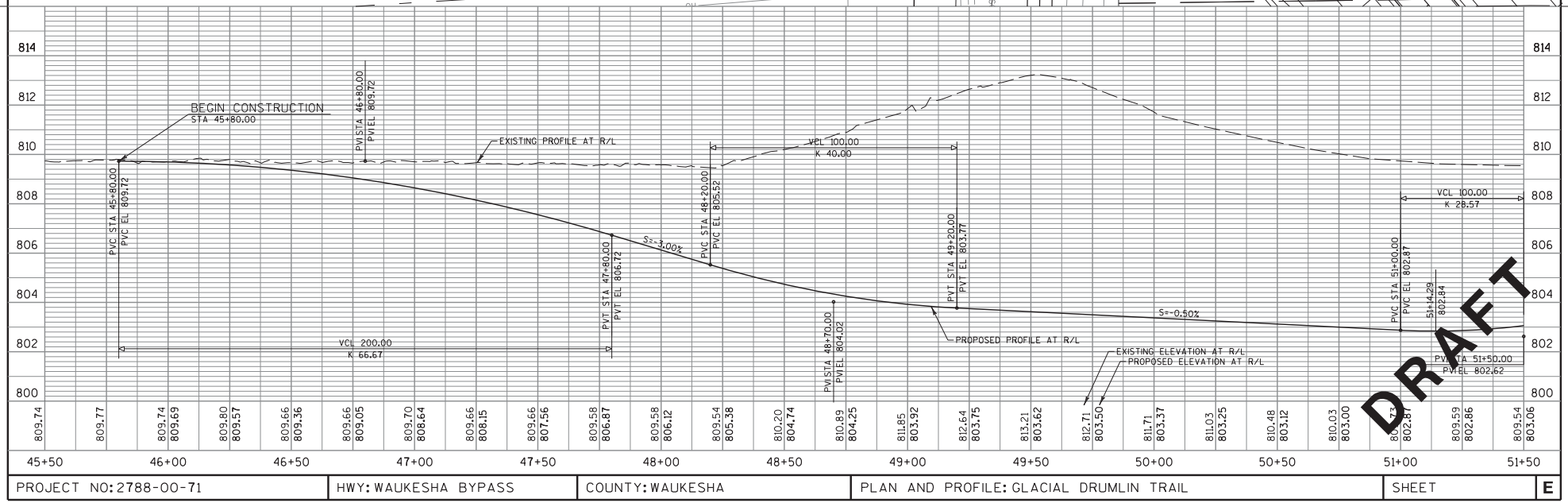
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PROFILE: MADISON STREET	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050208-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT SCALE : 1:40

WISDOT/CADDS SHEET 40

ATTACHMENT 6



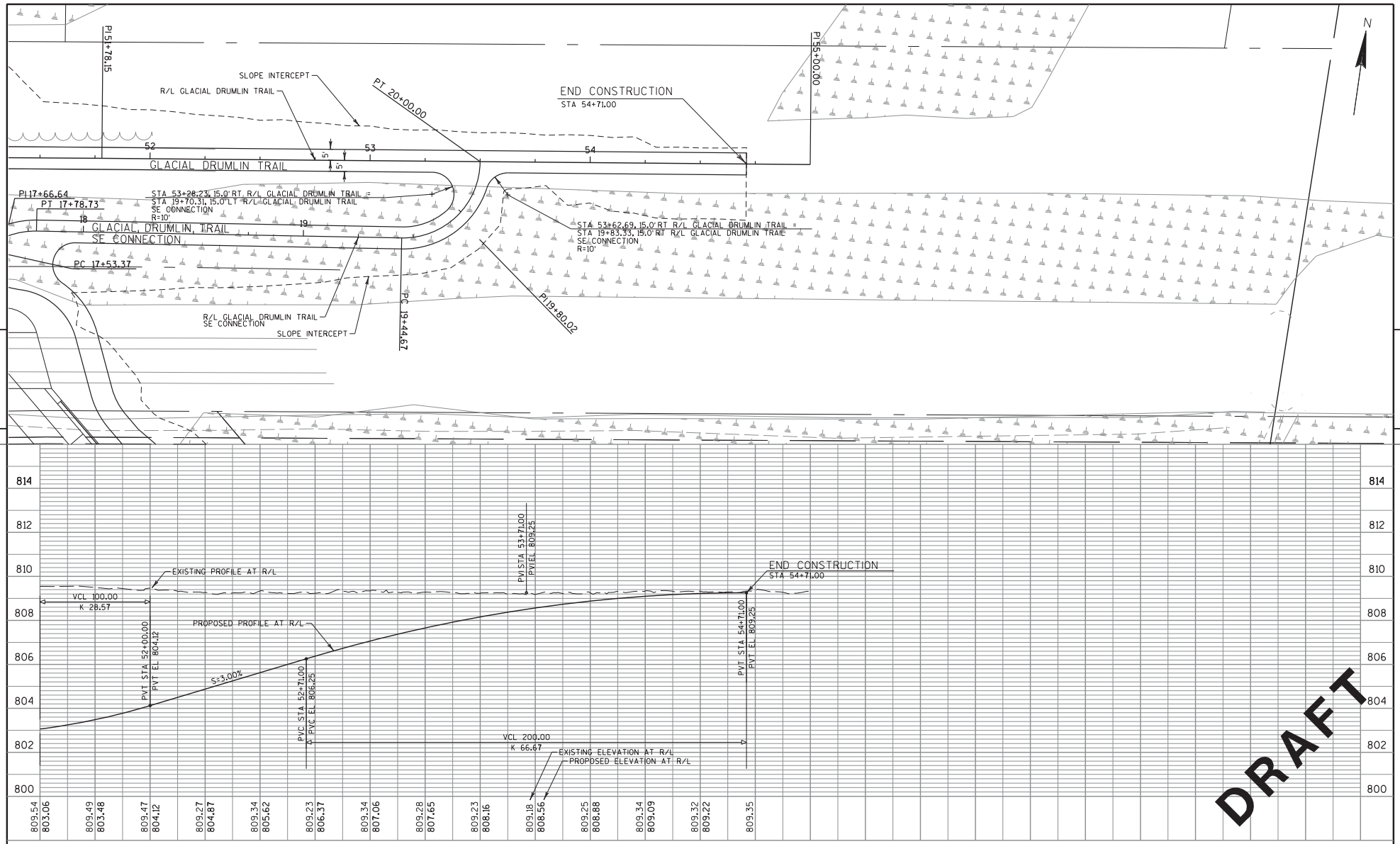


PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN AND PROFILE: GLACIAL DRUMLIN TRAIL	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050209-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 30

ATTACHMENT 6



PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN AND PROFILE: GLACIAL DRUMLIN TRAIL	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050211-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 30

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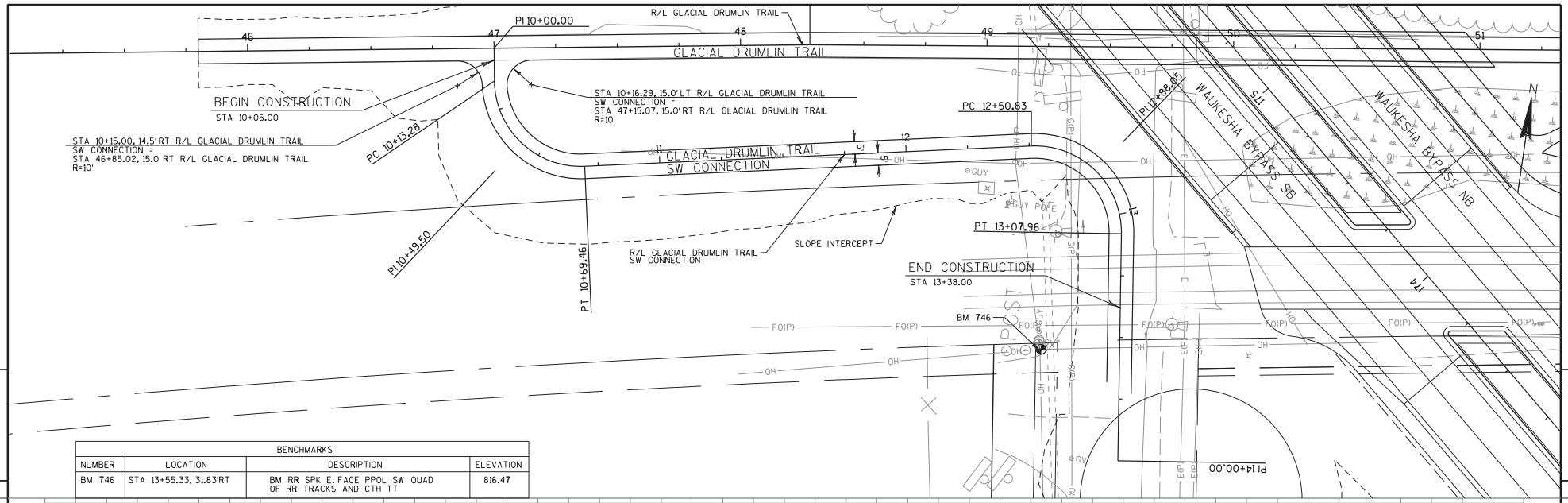
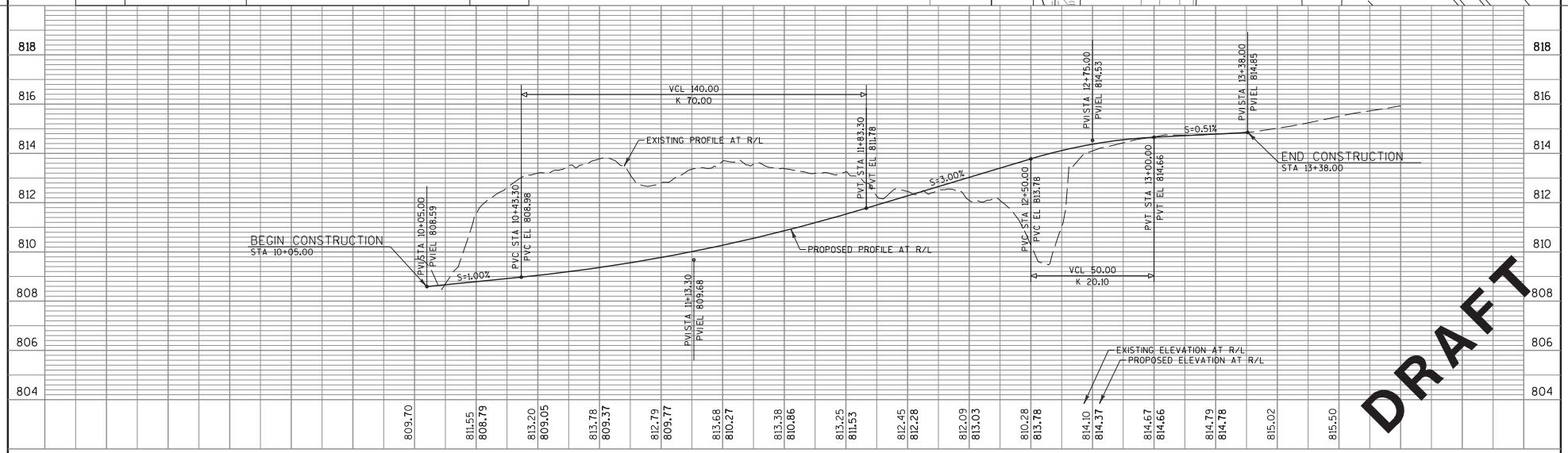


BENCHMARKS			
NUMBER	LOCATION	DESCRIPTION	ELEVATION
BM 746	STA 13+55.33, 31.83'RT	BM RR SPK E. FACE PPOL SW QUAD OF RR TRACKS AND CTH TT	816.47

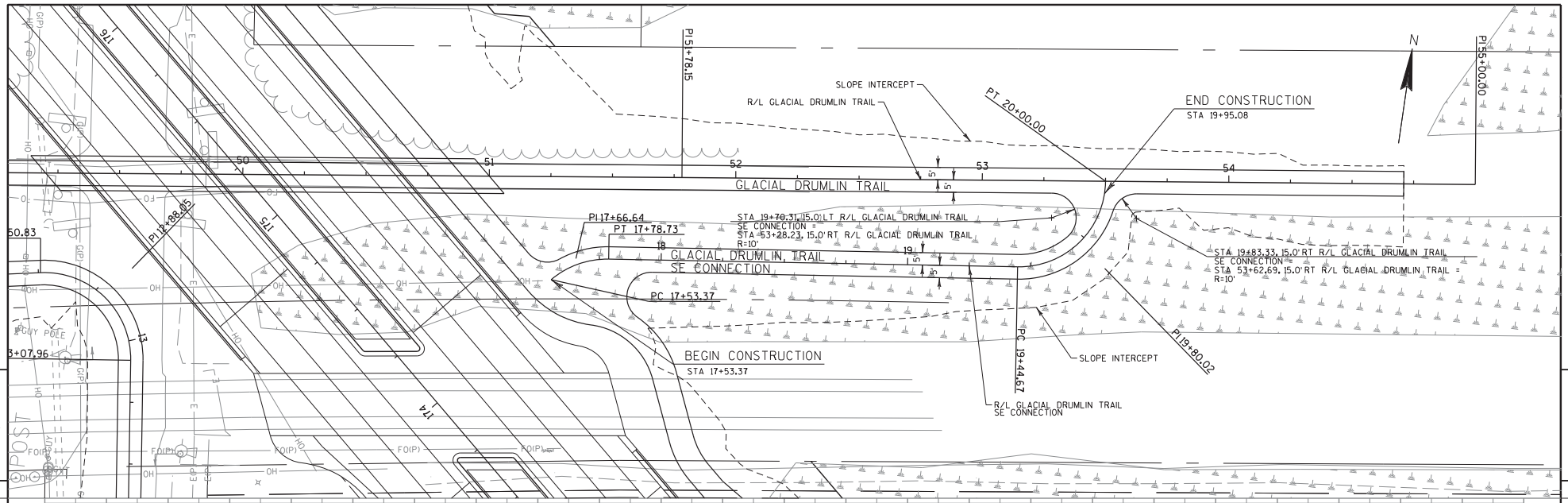


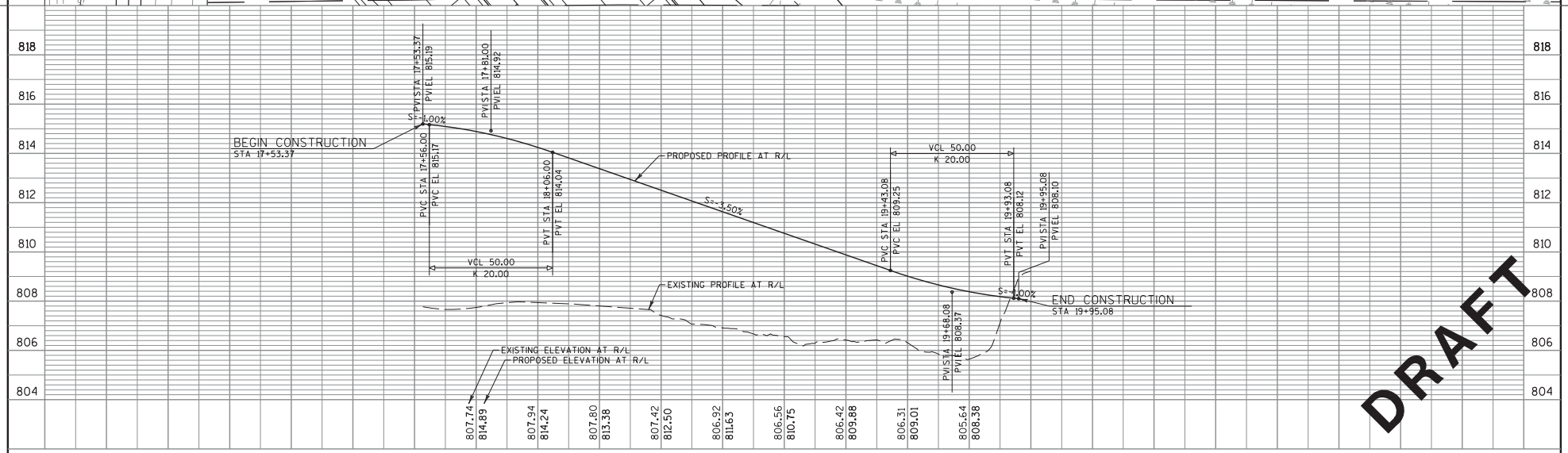
PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN AND PROFILE: GLACIAL DRUMLIN TRAIL SW CONNECTION	SHEET	E

FILE NAME : c:\pw_workdir\den001\nb018510\dms17104\KA_050213-pp.dgn PLOT DATE : 8/20/2015 PLOT BY : nbobinski PLOT NAME : PLOT SCALE : 1:40

WISDOT/CADDS SHEET 30

ATTACHMENT 6





DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	PLAN AND PROFILE: GLACIAL DRUMLIN TRAIL SE CONNECTION	SHEET	E

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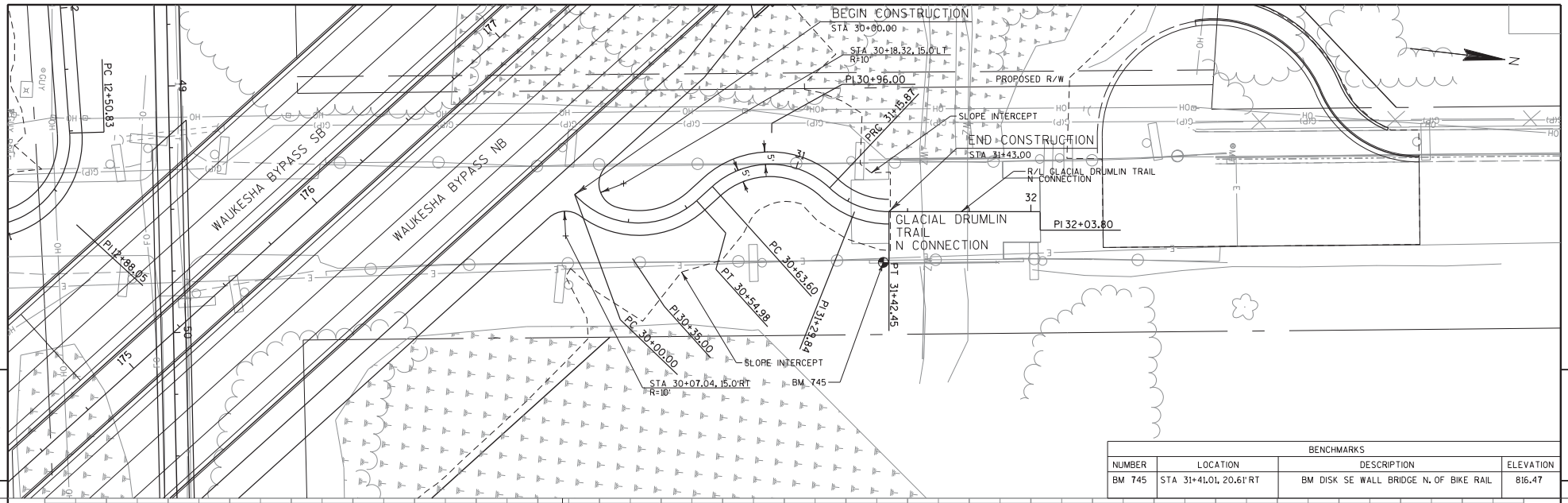
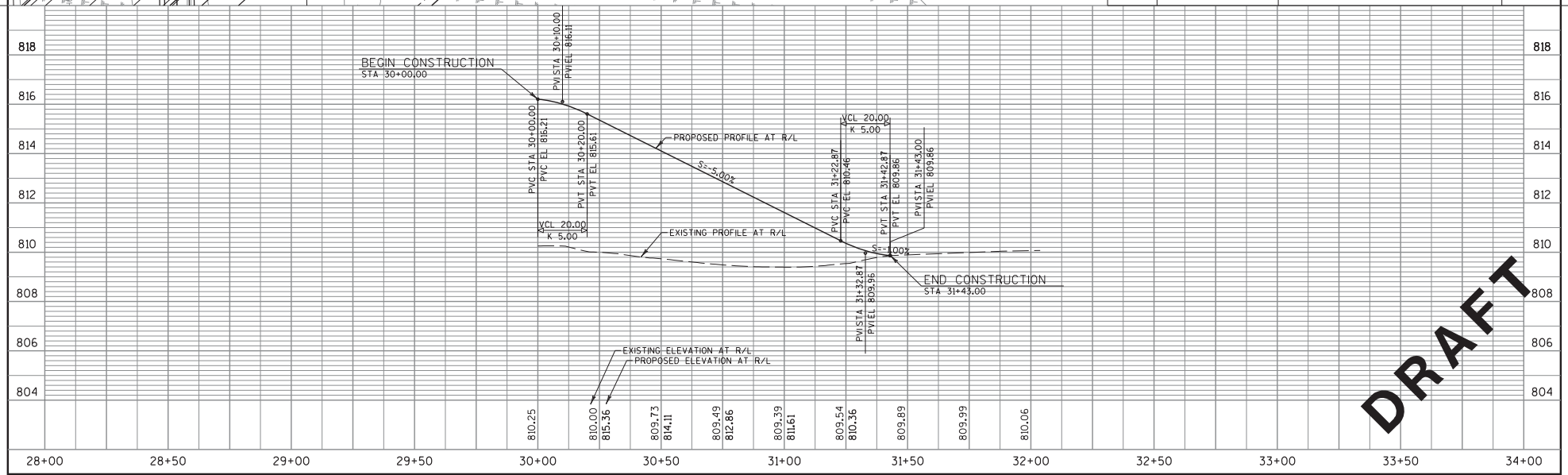
WISDOT/CADDS SHEET 30

ATTACHMENT 6



BENCHMARKS			
NUMBER	LOCATION	DESCRIPTION	ELEVATION
BM 745	STA 31+41.01, 20.61'RT	BM DISK SE WALL BRIDGE N. OF BIKE RAIL	816.47



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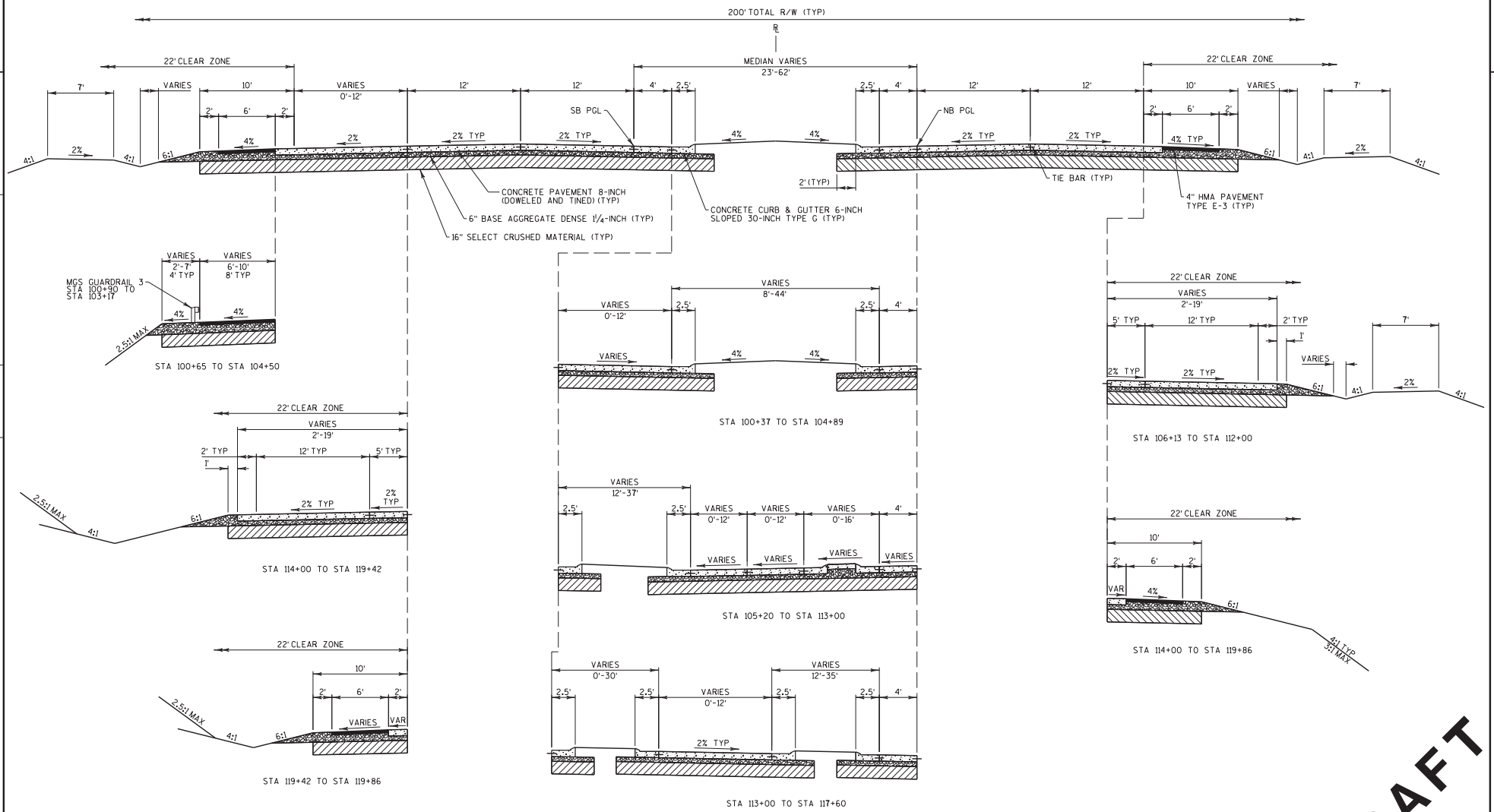
WISDOT/CADDS SHEET 30

ATTACHMENT 6

Attachment 7 – Finished/Proposed Typical Cross Sections



TYPICAL FINISHED SECTION

WAUKESHA BYPASS
STA 100+37 TO STA 119+86

DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TYPICAL FINISHED SECTIONS	SHEET	E

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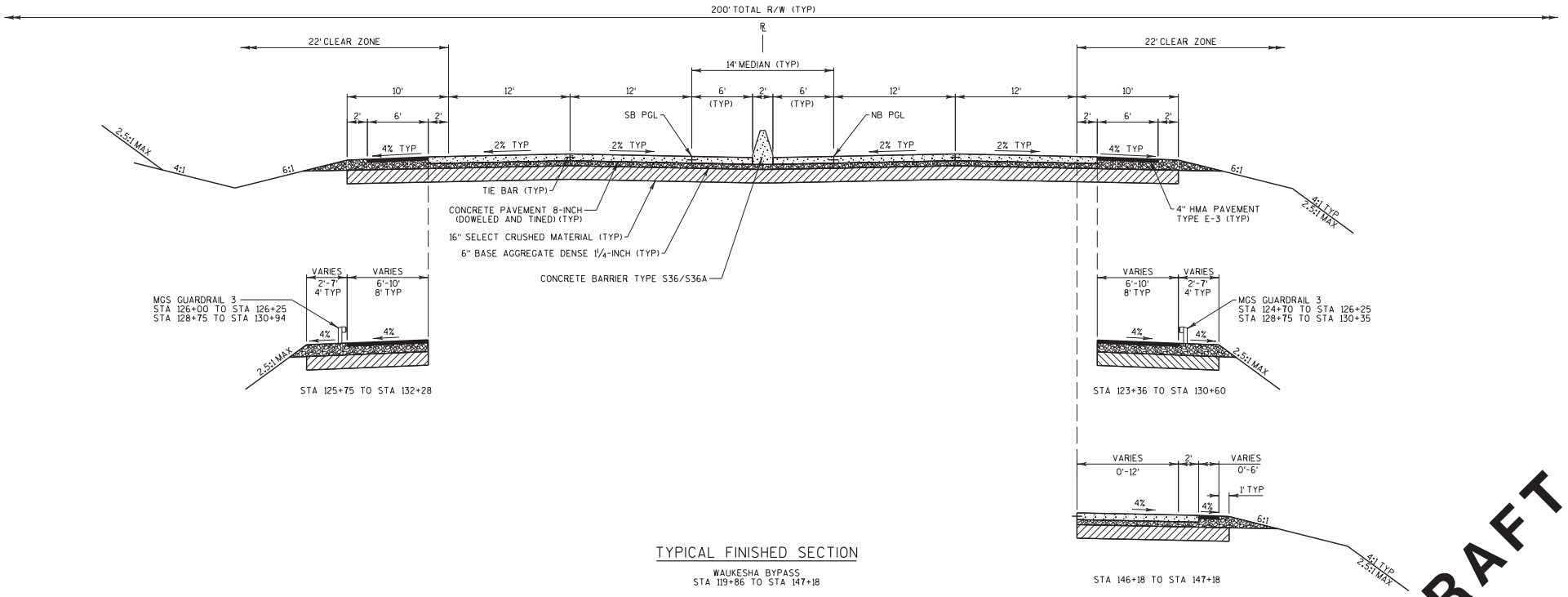
WISDOT/CADDS SHEET 42

ATTACHMENT 7



TYPICAL FINISHED SECTION

WAUKESHA BYPASS
STA 119+86 TO STA 147+18

DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TYPICAL FINISHED SECTIONS	SHEET	E

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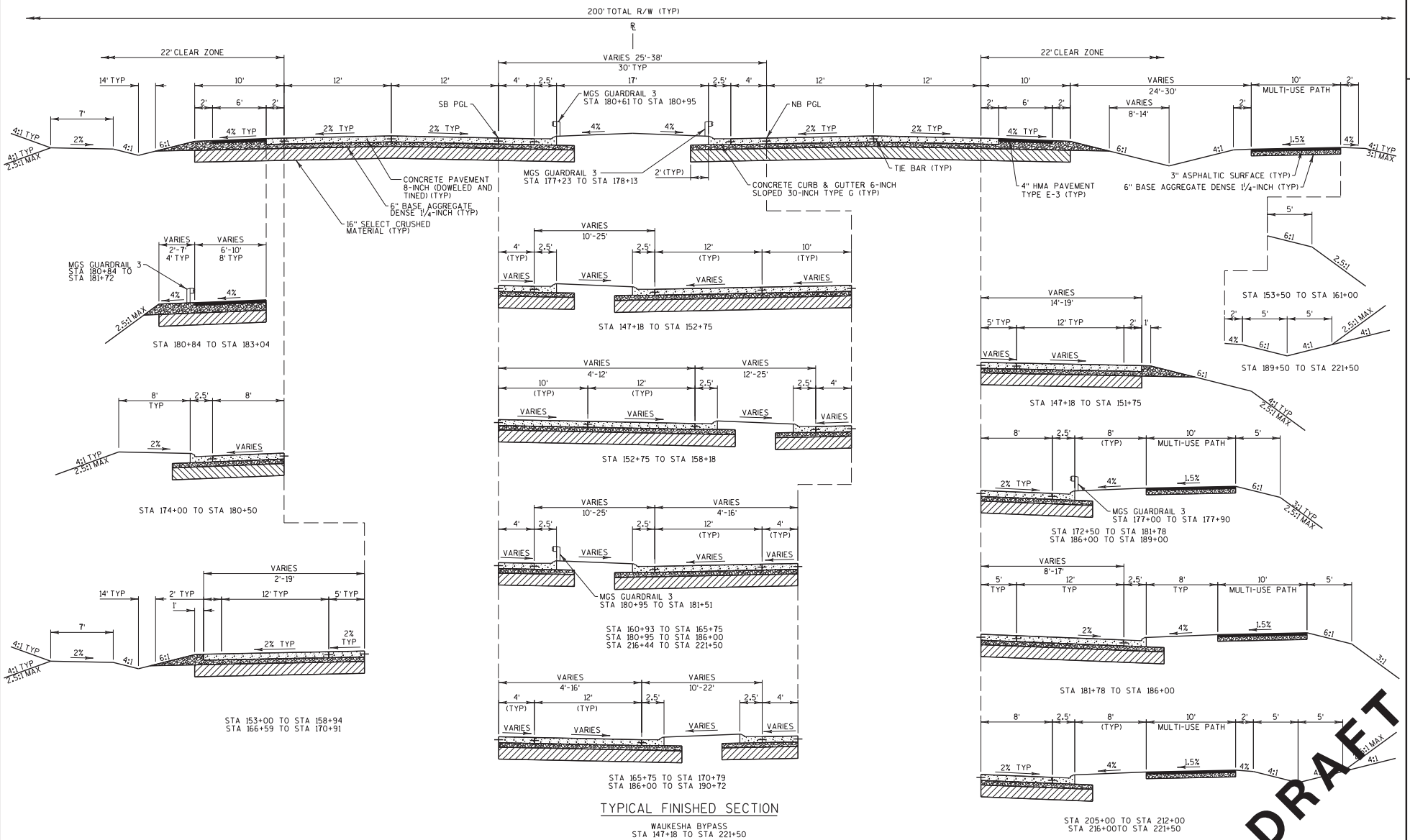

TYPICAL FINISHED SECTION

WAUKESHA BYPASS
STA 147+18 TO STA 221+50

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TYPICAL FINISHED SECTIONS	SHEET	E

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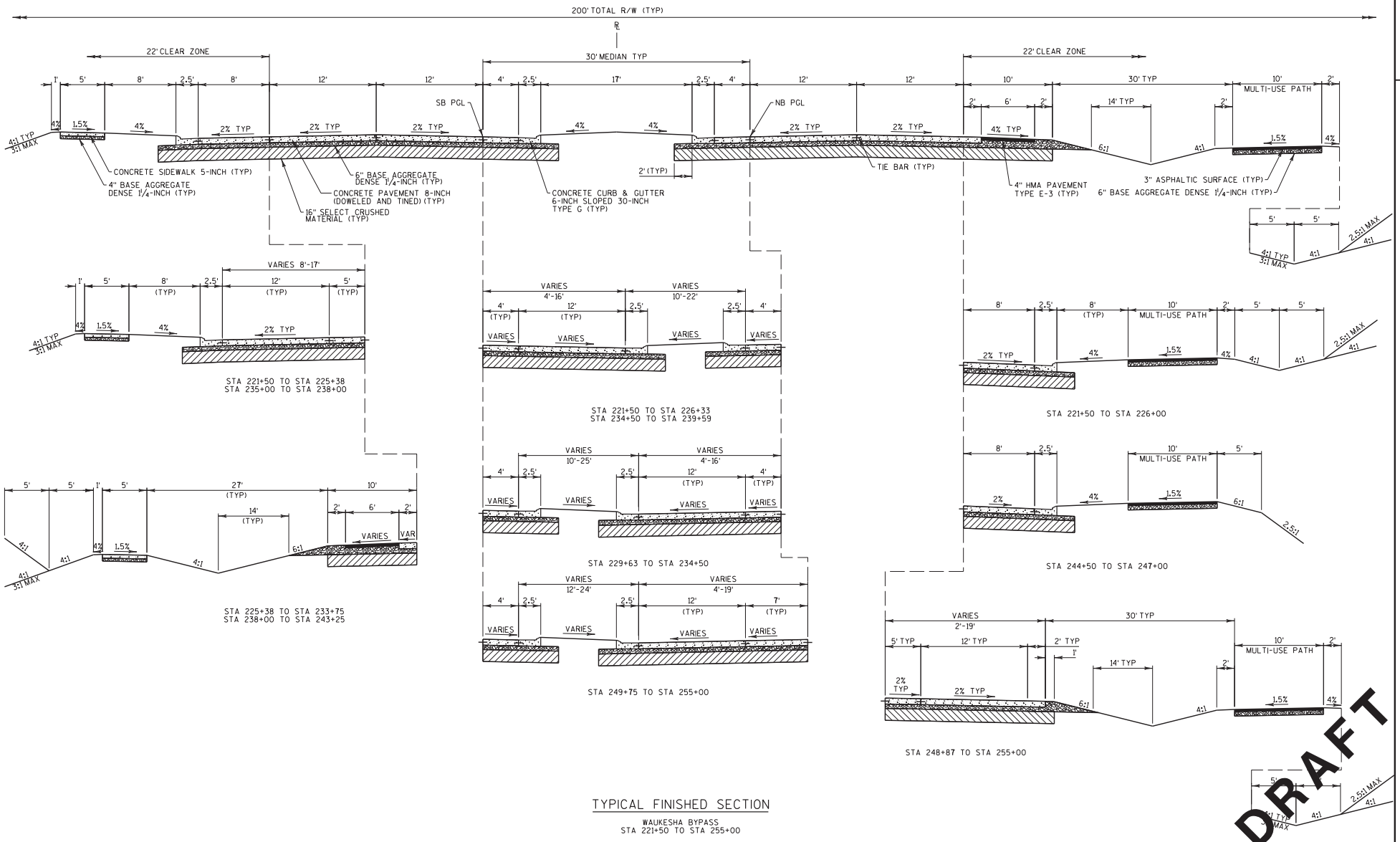

TYPICAL FINISHED SECTION

WAUKESHA BYPASS
STA 221+50 TO STA 255+00

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WISDOT/CADDS SHEET 42

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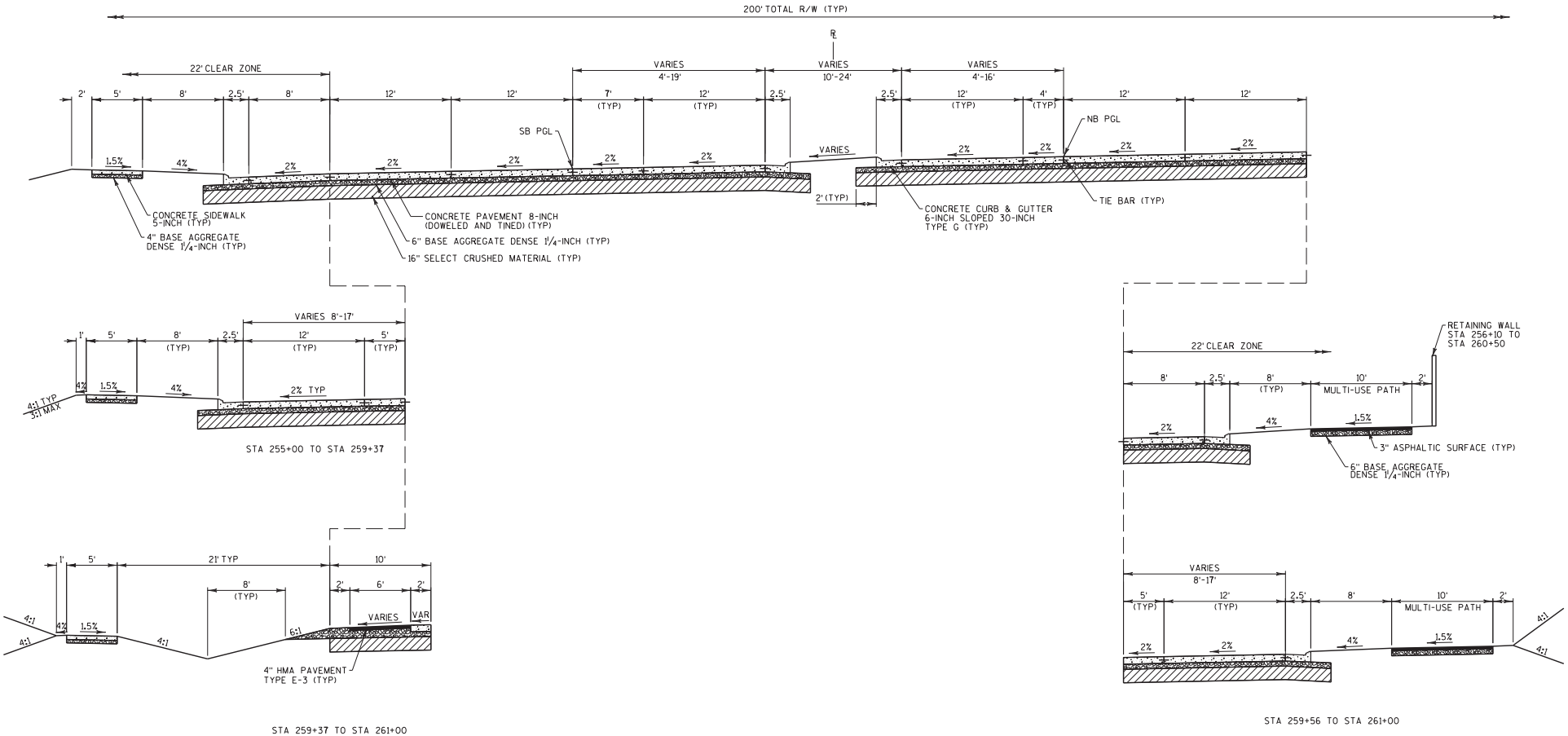

TYPICAL FINISHED SECTION

WAUKESHA BYPASS
STA 255+00 TO STA 261+00

DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TYPICAL FINISHED SECTIONS	SHEET	E

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WISDOT/CADDS SHEET 42

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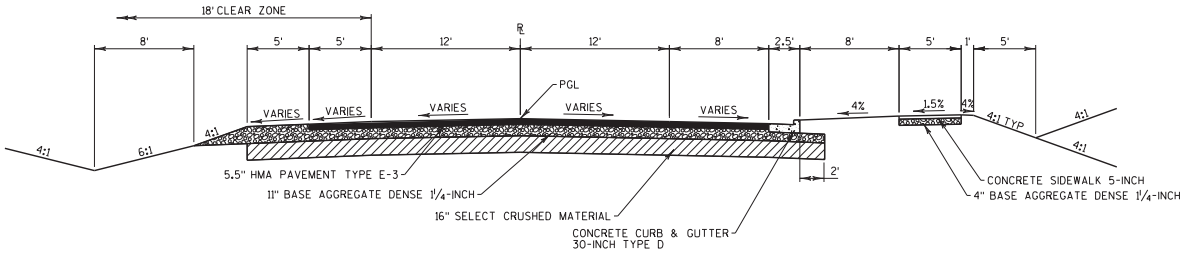
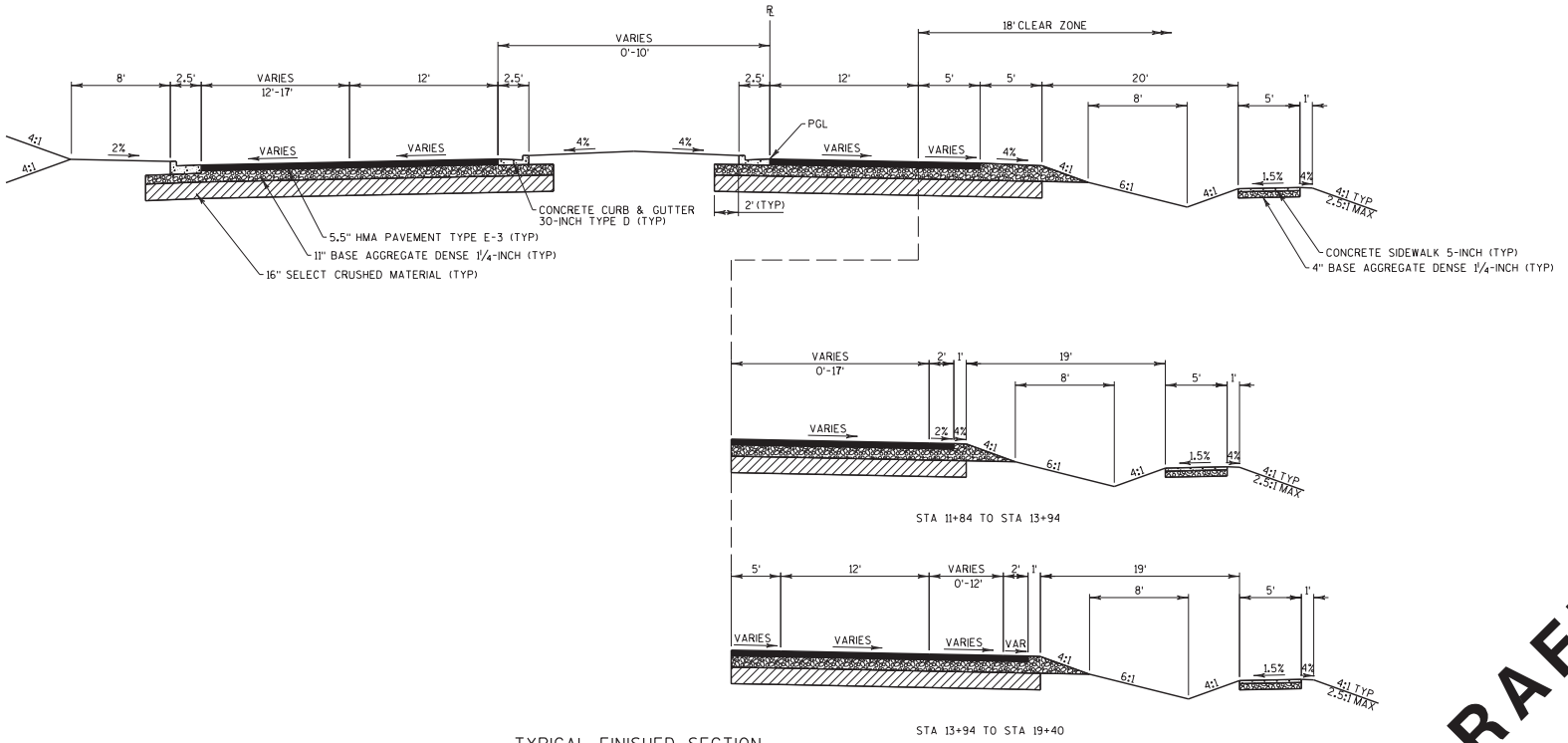


TYPICAL FINISHED SECTION

SAYLESVILLE RD
STA 7+50 TO STA 10+50



TYPICAL FINISHED SECTION

SAYLESVILLE RD
STA 10+50 TO STA 19+40

DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TYPICAL FINISHED SECTIONS	SHEET	E

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WISDOT/CADDS SHEET 42

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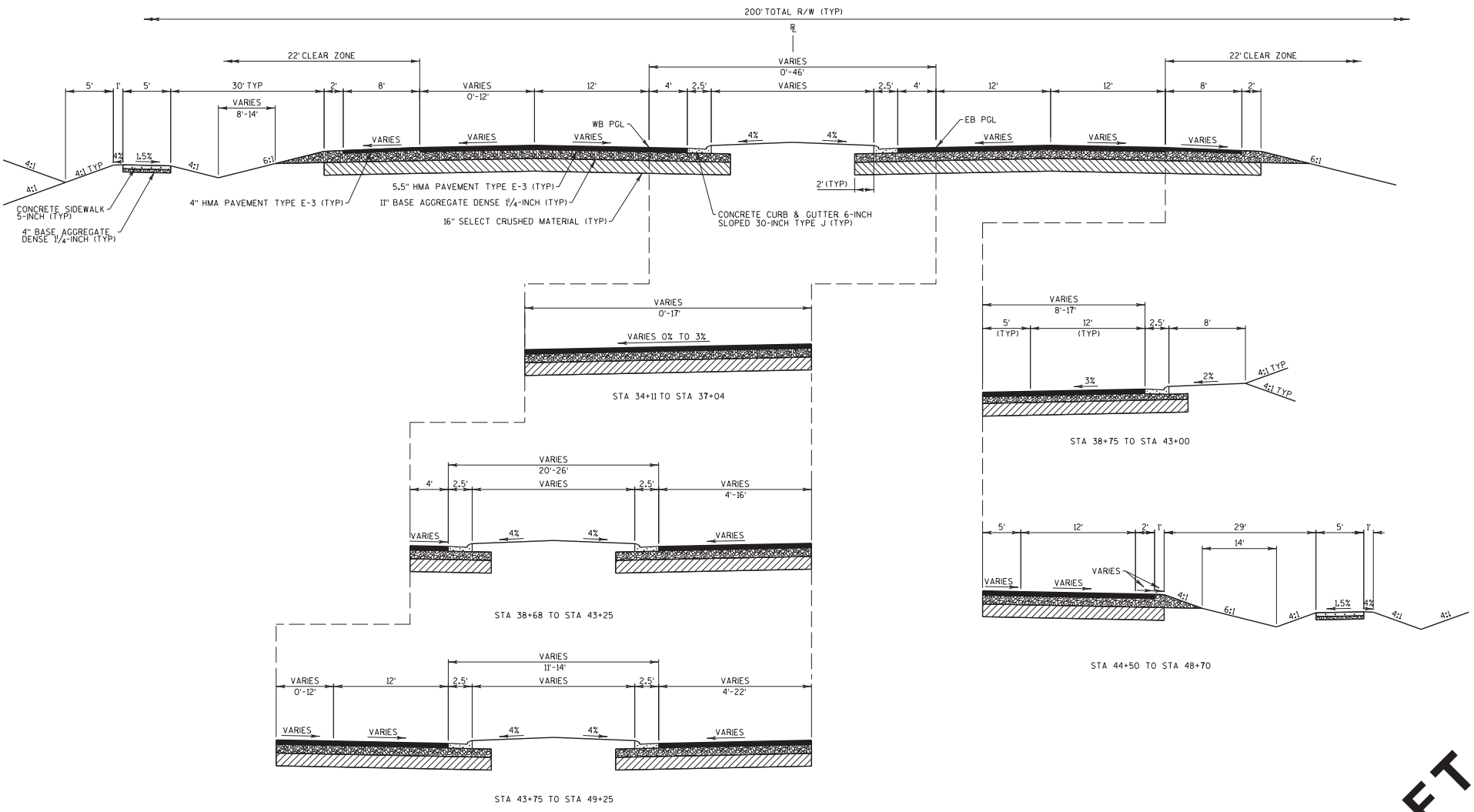


TYPICAL FINISHED SECTION

GENESEE RD
STA 34+11 TO STA 50+00

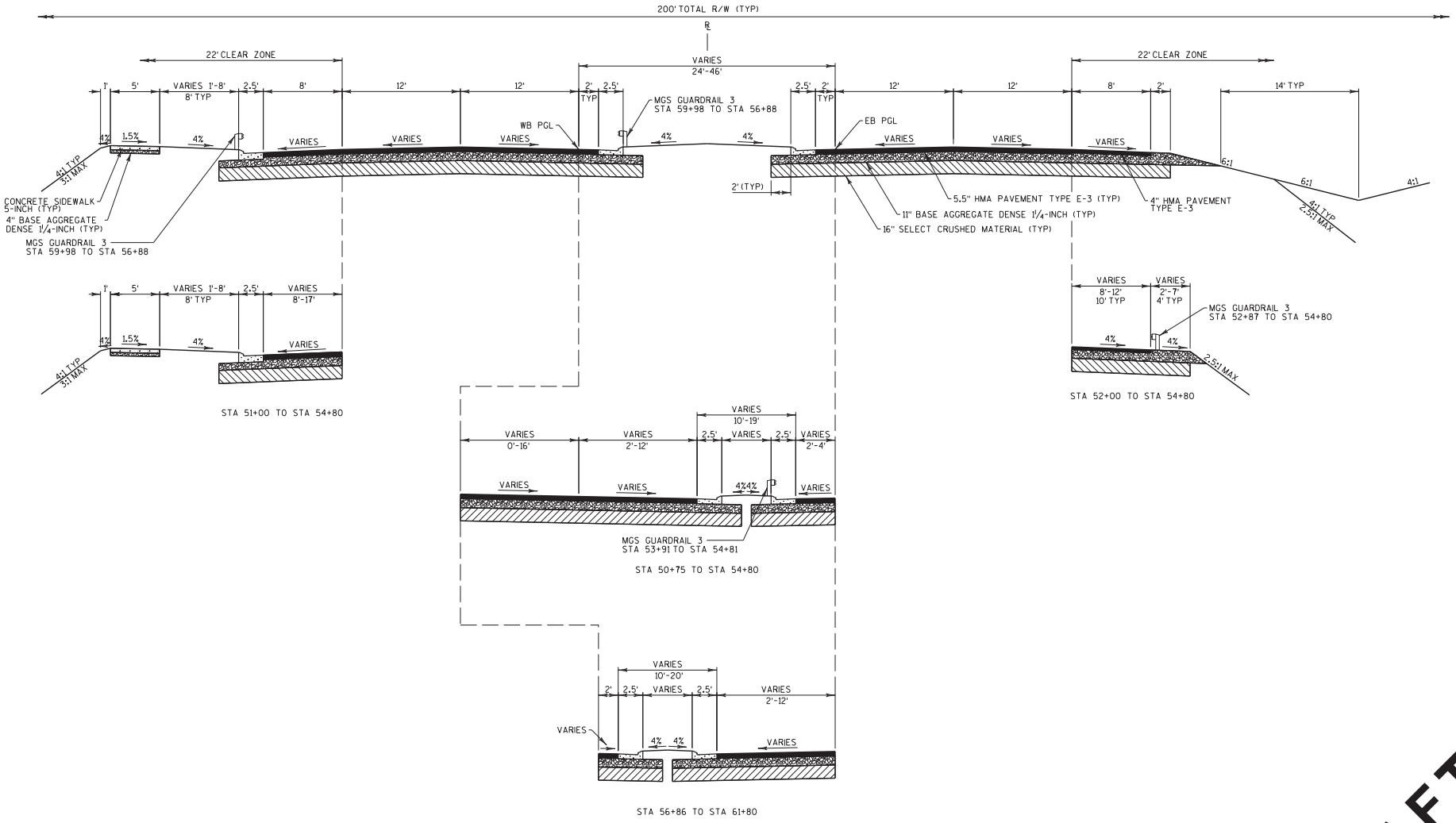
DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TYPICAL FINISHED SECTIONS	SHEET	E

FILE NAME : c:\pw_workdir\den001\wwoldk\dms17104\ka_020310_ts.dgn PLOT DATE : 8/20/2015 PLOT BY : wwoldk PLOT NAME : PLOT SCALE : 1:10

WISDOT/CADDS SHEET 42

ATTACHMENT 7



TYPICAL FINISHED SECTION

GENESEE RD
STA 50+00 TO STA STA 61+80

DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TYPICAL FINISHED SECTIONS	SHEET	E

FILE NAME : c:\pw_workdir\den001\wwoldk\dms17104\ka_020310_ts.dgn PLOT DATE : 8/20/2015 PLOT BY : wwoldk PLOT NAME : PLOT SCALE : 1:10

WISDOT/CADDS SHEET 42

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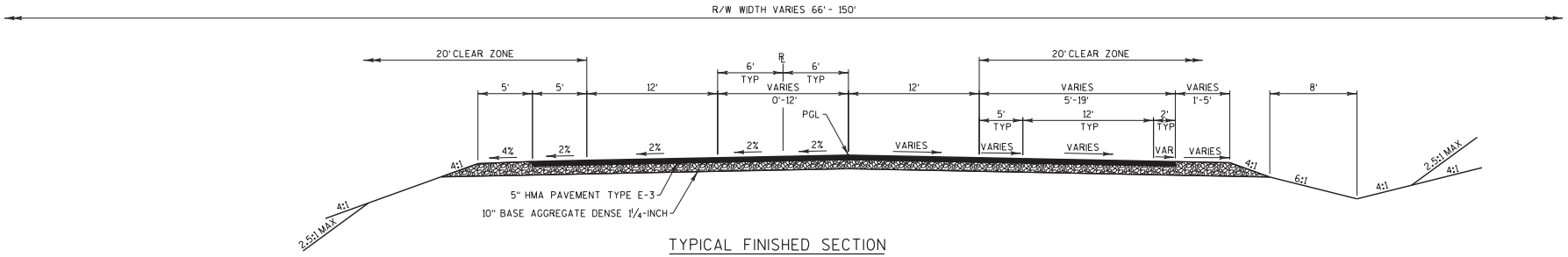
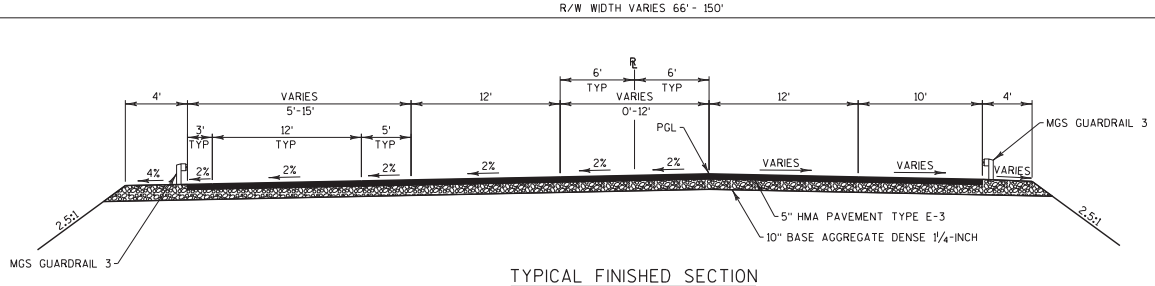


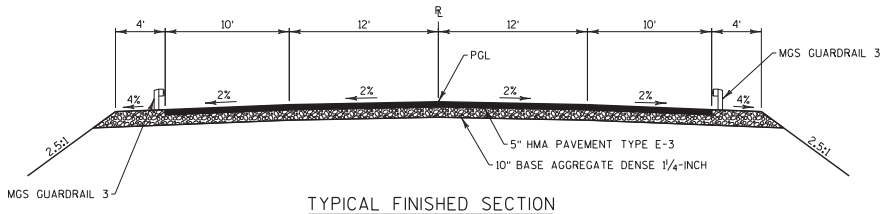
TYPICAL FINISHED SECTION

CTH D/SUNSET DR
STA 41+97 TO STA 49+50



TYPICAL FINISHED SECTION

CTH D/SUNSET DR
STA 50+50 TO STA 58+00



TYPICAL FINISHED SECTION

CTH D/SUNSET DR
STA 58+00 TO STA 63+00

DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TYPICAL FINISHED SECTIONS	SHEET	E

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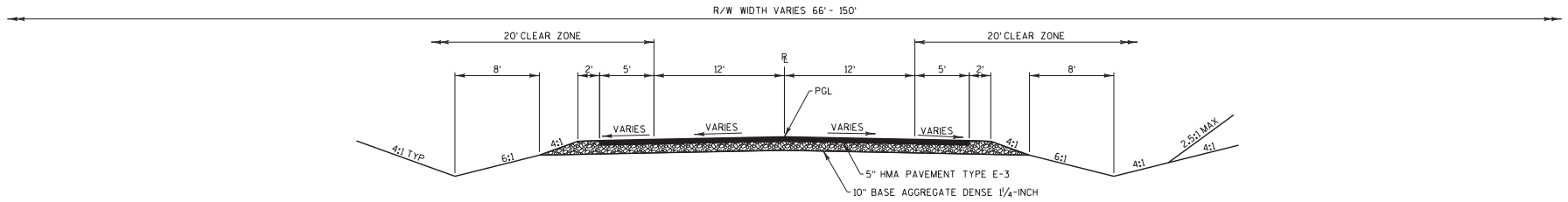
WISDOT/CADDS SHEET 42

ATTACHMENT 7



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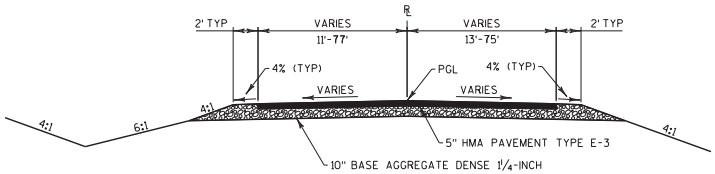
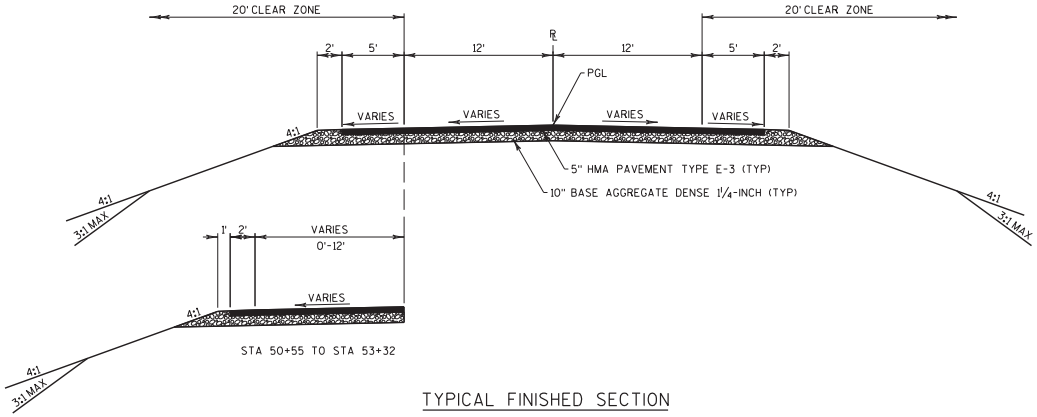
GREEN LN
STA 42+93 TO STA 49+45



TYPICAL FINISHED SECTION

MERRILL HILLS RD (CUL DE SACS)
STA 61+00 TO STA 62+30
STA 71+22 TO STA 72+50
STA 82+50 TO STA 83+80
STA 90+00 TO STA 91+19



STA 50+55 TO STA 53+32

TYPICAL FINISHED SECTION

MACARTHUR RD
STA 50+55 TO STA 57+50

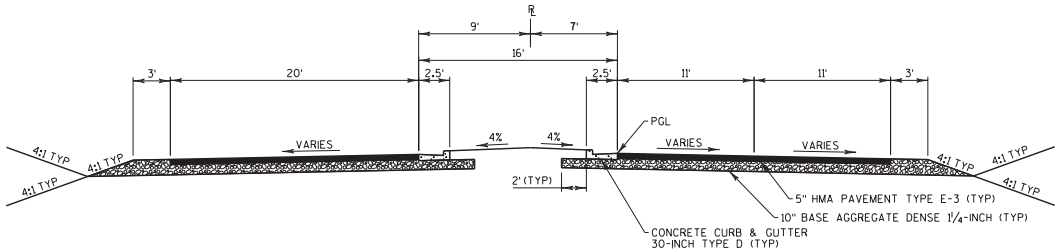
DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TYPICAL FINISHED SECTIONS	SHEET	E

FILE NAME : c:\pw_workdir\den001\wwoldk\dms17104\ka_020310_ts.dgn PLOT DATE : 8/20/2015 PLOT BY : wwoldk PLOT NAME : PLOT SCALE : 1:10

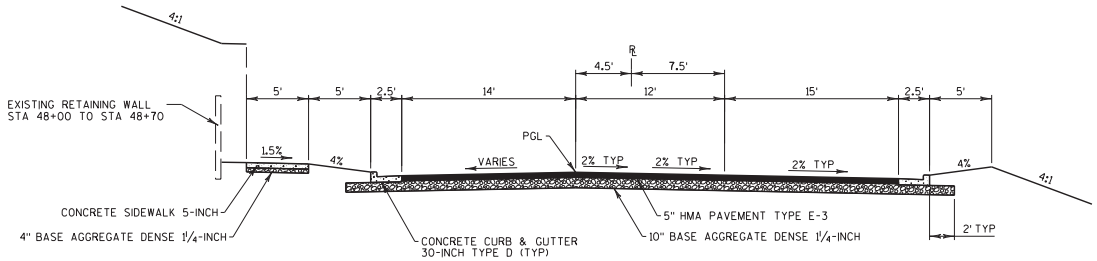
WISDOT/CADDS SHEET 42

ATTACHMENT 7



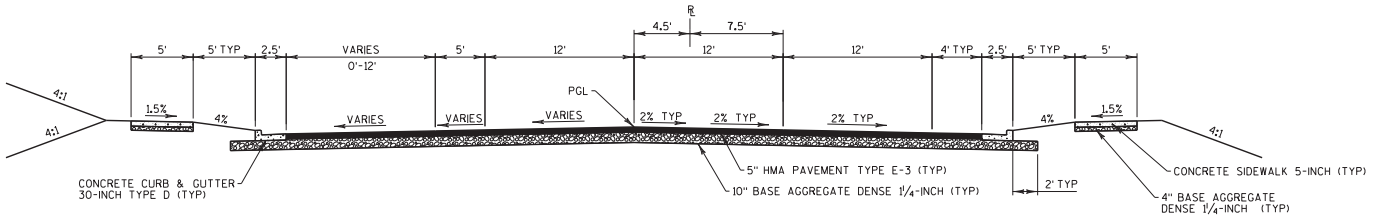
TYPICAL FINISHED SECTION

KAME TER
STA 48+35 TO STA 49+45



TYPICAL FINISHED SECTION

MADISON ST
STA 48+00 TO STA 50+50



TYPICAL FINISHED SECTION

MADISON ST
STA 50+50 TO STA 53+97

DRAFT

PROJECT NO: 2788-00-71	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TYPICAL FINISHED SECTIONS	SHEET	E

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WISDOT/CADDS SHEET 42

ATTACHMENT 7

Attachment 8 – Impact Mitigation Measures

TABLE 2
Summary of Measures to Mitigate Adverse Impacts

Resource	Summary of Measures to Mitigate Adverse Impacts
Transportation Service	Extending the Meadowbrook Road multi-use trail between Summit Avenue and Sunset Drive, which will improve safety for bicyclists and pedestrians. Section 3.27, Construction, describes measures to manage traffic during construction. Additional information on measures to mitigate adverse impacts to transportation services can be found in Section 3.5.3.
Utilities	Waukesha County and WisDOT will compensate utilities that are outside the highway right-of-way and must relocate facilities as a result of the proposed action. Additional information on measures to mitigate adverse impacts to utilities can be found in Section 3.6.3.
Residential and Commercial Development	Federal property acquisition law provides for payment of just compensation for residences and businesses displaced for a federally funded transportation project under the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. Additional information on measures to mitigate adverse impacts to residential and commercial development can be found in Sections 3.7.3 and 3.8.3 respectively.
Agriculture	Management and design practices will be implemented to help minimize agricultural impacts by limiting severances, maintaining accessibility to fields, maintaining existing drainage patterns, and limiting erosion. Additional information on measures to mitigate adverse impacts to agriculture and DATCP recommendations can be found in Section 3.9.3.
Socioeconomic Characteristics	The following mitigation measures could reduce the preferred alternative's impacts to community character, public services, and pedestrian facilities: – The contractor and WisDOT would coordinate with the City of Waukesha, Waukesha County, and local emergency service providers in developing detour plans. – Emergency service providers would be given advance notice of road and sidewalk closures and detour routes. – The contractor would maintain local access and circulation to neighborhoods and businesses during construction for pedestrians, bicyclists, and motorists.
Surface Water and Groundwater Resources	Mitigation measures to help mitigate the adverse effects to water quality include minimizing the size of disturbed area exposed at any one time and the duration of exposure, using control methods such as ditch checks to prevent erosion and sedimentation in sensitive areas, and implementing best management practices (BMPs) such as dry detention basins to minimize suspended solids and pollutants in stormwater. Although the preferred alternative has been elevated above the groundwater level drainage systems would be installed if roadway excavations encounter groundwater to convey groundwater from the west side of the proposed improvements to the east side (toward Pebble Creek). In addition, a land bridge will be constructed just south of Hawthorne Hollow Drive cul-de-sac to avoid a wetland supported by root-level groundwater. See Section 3.12.8. To minimize impacts to fish and aquatic life, in-water construction would be avoided during the spring fish spawning season (March 15 to June 1), box culverts will be constructed with either an open bottom or a partially buried bottom that will maintain substrate continuity consistent with FHWA Aquatic Organism Passage guidelines.
Floodplains	Narrowing the roadway median will reduce the roadway cross section where floodplain impacts occur. During the design phase, WisDOT will evaluate whether it is practicable to extend the length of bridges where floodplain impacts occur, to avoid floodplain impacts. Additional information on measures to mitigate adverse impacts floodplains can be found in Section 3.14.3.
Wetlands	Measures to minimize harm to wetlands, which include a land bridge over W-4 south of Sunset Drive and the use of a 14-foot median rather than a 30-foot median south of Sunset Drive. The conceptual wetland mitigation plan is to create a project-specific mitigation site on the Retzer Nature Center property, which is located on the west side of County TT, preserve an unprotected offsite fen in the Upper Fox River Watershed and possibly preserve the unaffected portion of W-8 (fen). The wetland mitigation plan is described in Section 3.16.3.

TABLE 2
Summary of Measures to Mitigate Adverse Impacts

Resource	Summary of Measures to Mitigate Adverse Impacts
Upland Habitat	Waukesha County and WisDOT are investigating tree mitigation for impacts to the upland forest/interior forest bird habitat in the primary environmental corridor south of Sunset Drive. WisDOT and Waukesha County are considering planting one acre of trees for each acre affected by the preferred alternative. Waukesha County is also coordinating with the owner of the upland forest south of Sunset Drive to donate the unaffected portion of property to a land conservancy or to Waukesha County. During design, WisDOT and Waukesha County will also evaluate the feasibility of planting native grasses, shrubs and trees within the right-of-way, including areas where segments of existing roadway would be removed.
Wildlife	The inadvertent loss of nesting birds in the construction area and bat roosting/nurseries in cavity trees, particularly south of Sunset Drive, will be avoided by imposing a tree clearing restriction. Tree removal would not be allowed between April 15 and August 15 of any given year. Potential mitigation measures for marsh and grassland nesting birds and bats roosting under the County X bridge will be assessed during design. Waukesha County and WisDOT also will consider the feasibility of acquiring and preserving remnant parcels between rights-of-way and natural areas to increase the wildlife habitat within the corridor.More detailed information on measures to mitigate adverse impacts to wildlife can be found in Section 3.18.3.
Threatened and Endangered Species	WisDOT will survey the County X bridge over Pebble Creek for little brown bats. If the bats are present on the County X bridge, which is planned for demolition, WisDOT will follow the guidelines established by the DNR in its *Broad Incidental Take Permit and Broad Incidental Take Authorization for Wisconsin Cave Bats Conservation Plan.* To protect migratory birds, nests may not be disturbed between May 1 and August 30 of the construction year. If construction would conflict with the nesting period, measures for avoiding impacts or preventing swallows from nesting on the structures would be implemented. Additional information about measures to mitigate adverse impacts can be found in Section 3.19.3.
Noise	Based on the noise analysis, WisDOT intends to incorporate feasible and reasonable noise barriers into the project. During design, as locations of retaining walls are more accurately defined relative to the surrounding areas, the location of feasible and reasonable noise mitigation will be reassessed. More detailed information about traffic noise abatement can be found in Section 3.20.3.
Hazardous Materials	WisDOT will develop remediation measures for contaminated sites that cannot be avoided. Disposition of any petroleum contamination will be resolved to the satisfaction of the DNR, WisDOT, and FHWA. During the real estate acquisition phase buildings needing to be demolished will be surveyed for asbestos. Additional information about the handling and disposal of hazardous materials can be found in Section 3.22.3.
Historic Sites	The design changes adjacent to the Sebina Barney House are mitigation measures. Additional measures to mitigate adverse impacts on the Sebina Barney House include vegetative screening and archival quality photographs, which are described in Section 4.
Parks and Recreation	Waukesha County and WisDOT will provide a connection between the Glacial Drumlin State Trail and the planned 10-foot multi-use path to be constructed next to the Bypass. Details of the trailhead and connection between the two trails will be finalized during design. See Section 4.4.5 and **Exhibit 4-4**.

Attachment 9 – Transportation Management Plan Documentation

WisDOT TMP Documentation and Request for Approval

TMP ID: 2321
Version: Current

This is a request for approval of the Transportation Management Plan (TMP) for the project detailed below. Impacts resulting from project activities meet the current work zone policies of the Wisconsin Department of Transportation.

1A. Project Information:

TMP Type:	Type 2
Region:	SE
Local Program:	No
Created Comment:	Created from Scratch. User comment: WisDOT section of the Waukesha Bypass
Design ID:	2788-00-01
Project Title:	West Waukesha BypassGenesee Road (STH 59) to Summit Ave (USH 18)
County:	WAUKESHA
Highway:	US 18
Construction ID:	2788-00-71
Project Type:	Reconstruct/New alignment
Project Limits:	Genesee Road (STH 59) to Summit Ave (USH 18)
Project Length:	3.0 Mile(s)
Project Duration:	400 Day(s)
Engineer's Estimate:	more than $10M
PS&E Date:	05/01/2016
LET Date:	08/09/2016
NHS Route:	Yes
AADT:	10200
AADT Year:	2012
Federal Oversight:	Yes

1B. Project Impacts:

Anticipated Begin:	11/2016
Anticipated End:	11/2017
Delay:	Minor
OSOW Route:	No

1C. Location:

Local Road

Begin County:	WAUKESHA
End County:	WAUKESHA

ATTACHMENT 9

Roadway Name: CTH TT/Merrill Hills Road
Begin Landmark (LR): WIS 59
End Landmark (LR): 600-ft North of Madison Street

2. Brief description of work activities.

The proposed improvements consist of the expansion and construction of approximately 5.2 miles of roadway from STH 59/CTH X to IH 94 in the City of Waukesha, the Town of Waukesha and the Town of Pewaukee in Waukesha County. The Waukesha Bypass project will widen CTH TT/Merrill Hills Road/Meadbrook Road from Kame Terrace to Rolling Ridge Drive and be located along new alignment from WIS 59 to Kame Terrace. See Attachments A1 for a Project Location Map and A2 for Project Overview. The West Waukesha Bypass project will be separated into three segments and this TMP includes the one southern section of the project. The North projects are included under TMP ID 2320 for projects I.D. 2788-02-00/2788-00-02 which received 60% approval on May 4, 2015.

* South Project; ID 2788-00-01 WisDOT (STH 59/CTH X - 600ft north of Madison Street) - Included in this TMP and construction scheduled to begin in Fall 2016 and last through 2017

* North Project, Section 1; ID 2788-02-00/2788-00-02 WisDOT and Waukesha County (600ft north of Madison Street - north of Northview Road) Included in TMP 2320 and construction scheduled for 2016.

* North Project, Section 2; City of Waukesha Project (north of Northview Rd to Rolling Ridge Dr) Included in TMP 2320 and construction scheduled for 2016.

The South Section will construct a 4-lane divided roadway on new alignment from STH 59 to approximately 600-ft north of Madison Street. The STH 59 and CTH X intersections with the proposed West Waukesha Bypass will also be reconstructed as part of this project. Structure work included in this project consists of the replacement of two parrallel CTH X structures crossing Pebble Creek (B-67-315/316), two parallel landbridges located between Sta. 126+00 and 129+00 (B-67-352/353) and the addition of two West Waukesha Bypass structures (B-67-354/355) crossing Pebble Creek along the proposed alignment which are located west of the existing CTH TT structure crossing Pebble Creek. An existing culvert crossing will also be replaced 242+50 (C-67-91) with a new box culvert and a retaining wall (R-67-129) will be constructed from Sta. 256+10 to Sta. 260+50 RT.

3. Briefly describe the staging planned for maintaining traffic.

South Section:

Project I.D. - 2788-00-01 South Project (WIS 59/CTH X - 600ft north of Madison Street); 2016 - 2017 Construction

Construction will begin in the Fall of 2016 and continue through the end of 2017. The North project and City of Waukesha project will be completed prior to Stage 2 work commencing. Saylesville Road is to remain open while school is in session. Construction will be completed in four stages with Stage 2 being split into three sub-stages as described below. (See Attachment A3 - South Project Staging

ATTACHMENT 9

Overviews)

Stage 1 (+/- 5 months) November 2016 - March 2017

Maintenance of Traffic:

o No change to existing traffic patterns.

Construction Activities:

o Begin constructing the land bridge structures south of CTH D and the structures over Pebble Creek.

o Construct temporary roadway utilizing proposed NB lane location of Waukesha Bypass from Sta 215+00 to Sta 245+00.

o Temporary pavement where widening is needed at project limits along STH 59 and CTH X, to be determined in final design.

Stage 2 (broken into three sub-stages)

Stage 2A (+/- 4.5 months) March - August 2017

Maintenance of Traffic:

o CTH TT/Merrill Hills Road traffic remains on existing roadway from STH 59 to south of Kame Terrace and uses temporary bypass constructed in Stage 1.

o CTH X has 2-way traffic on existing NB lanes.

o STH 59 has 2-way traffic on existing EB lanes.

o CTH D to remain open.

o Saylesville Road to remain open.

o All side roads shall remain open.

o Maintain connection to Merrill Hills Court.

o Coordinate work with railroad.

Construction Activities:

o Replace median islands with temporary pavement in areas of temporary traffic at the STH 59/CTH X intersection.

o Construct off-alignment Waukesha Bypass segments from beginning of project to approximately Sta 215+00.

o Construct SB Waukesha Bypass lanes from Sta 215+00 to end of project.

o Construct STH 59/CTH X intersection, gaps to remain.

o Construct WB lanes of STH 59.

o Construct SB lanes of CTH X.

o Construct Saylesville Road from Sta 15+15 to STH 59, gaps to remain.

o Construct Green Lane, MacArthur Road, Kame Terrace and Merrill Hills Court.

o Construct west leg of Madison Street.

o At-grade railroad crossing will be constructed.

o Construction of bridges in Stage 1 continues.

o Begin construction of culvert at Sta 242+50.

Stage 2B (+/- 1 months) June - July 2017 (restricted to when school is out)

Maintenance of Traffic:

o Stage 2A MOT continues with the exception of Saylesville Road.

o Flagging operations or short-term detour of Saylesville Road, to be determined in final design.

Construction Activities:

o Construct remaining Saylesville Road.

Stage 2C (+/- 2 months) July - August 2017

Maintenance of Traffic:

o Stage 2A MOT continues from beginning of project to Sta 215+00.

o CTH TT/Merrill Hills Road traffic remains on existing roadway from STH 59 to south of Kame Terrace and uses SB Waukesha Bypass lanes from Sta 215+00 to end of project constructed in Stage 2A.

o CTH D detoured.

o Glacial Drumlin State Trail on temporary connection due to bypass box culvert construction. Construction staging in final design to determine if temporary trail connection is detoured using existing roadway or temporary connection between trail and railroad. Proper slopes must be maintained.

Construction Activities:

o Construct NB Waukesha Bypass lanes from Sta 215+00 to end of project.

o Construction of Waukesha Bypass in Stage 2A from beginning of project to Sta 215+00 continues.

o Complete bridges and culvert structures started in previous stages.

o Construct retaining wall north of Madison Street.

o Construct east leg of Madison Street.

o Construct CTH D.

o Construct portion of Glacial Drumlin State Trail box culvert outside of existing Merrill Hills Road.

Stage 3 (+/- 2 months) August - October 2017

Maintenance of Traffic:

o Traffic on proposed Waukesha Bypass lanes. Single lane, short term lane closures may be necessary to complete miscellaneous work. Specific traffic routing of southbound lane at location of Glacial Drumlin State Trail Box Culvert construction to be determined in final design.

o Glacial Drumlin State Trail on temporary connection due to bypass box culvert construction. Construction staging in final design to determine if temporary trail connection is detoured using existing roadway or temporary connection between trail and railroad. Proper slopes must be maintained.

o STH 59 has 2-way traffic on proposed WB lanes.

o CTH X has 2-way traffic on proposed SB lanes.

Construction Activities:

o Construct EB lanes of STH 59.

o Construct NB lanes of CTH X.

o Complete construction of Glacial Drumlin State Trail box culvert.

o Construct Merrill Hills Road cul-de-sacs.

o Complete side road connections.

o Complete median work in North project area that remains from Stage 2A and 2B cross-overs.

o Construct finishing items in median.

Stage 4 (+/- 6 weeks) October - November 2017

Maintenance of Traffic:

o Traffic on proposed Waukesha Bypass lanes. Single lane, short term lane closures to complete gaps on Waukesha Bypass.

o Flagging operations or short-term detour of STH 59, to be determined in final design.

Construction Activities:

o Construct Waukesha Bypass gaps.

o Construct STH 59 at south project limit.

4. Will there be restrictions on pedestrian/bicycle access?

☑ Yes ☐ No

If Yes:

ATTACHMENT 9

a) Will sidewalk/multiuse path be closed?

☑ Yes ☐ No

b) Describe how pedestrian and bicyclists will be accommodated

To accommodate bicyclists and pedestrians utilizing the Glacial Drumlin Trail, a temporary on-road detour may be utilized and temporary path connection to the Glacial Drumlin Trail may be constructed. The Glacial Drumlin trail cannot be closed for any length of time and must be maintained.

South of Fiddlers Creek Drive there are currently no existing bicycle or pedestrian accomodations.

c) Will crosswalks be provided? What is the spacing of crosswalks?

Accomodations will be made for any temporary trail crossings needed as part of this project.

d) Are the strategies in compliance with ADA?

Temporary trail crossings and temporary surface material will be installed to meet ADA requirements.

5. Briefly describe how access to traffic generators, businesses, school buses, garbage trucks, postal services, and transit impacts will be mitigated (alternate routes, etc.).

a) Are the strategies in compliance with ADA?

Access to traffic generators will be mitigated through the standard detours, temporary connections and lane shifts throughout the project. The contractor will be required to provide 48 hour notice to businesses when access points will be reconstructed. Access points will be constructed in stages to allow access to businesses throughout construction. Several access points will temporarily become right-in/right-out access points. All access shall take ADA into consideration.

b) Is access to bus stops affected?

☐ Yes ☑ No

6. Will the project have lane closures?

☑ Yes ☐ No

If Yes:

a) Are there restrictions on when lane closures are allowed?

☑ Yes ☐ No

b) What hours/days are lane closures permitted?

The existing roadway of CTH TT/Merrill Hills Road functions as a 2 lane roadway and lane closures are not permitted. During Stage 3 and 4 when traffic is on the proposed Waukesha Bypass (4 lane roadway), single lane, short term lane closures may be used. Lane closures will be permitted on Saylesville Road (with flagging operation) and STH 59 during off-peak timeframes and during periods when school and other events are not scheduled.

c) How were traffic counts used in determining permitted lane closure times?(For multi-lane road, indicate typical peak hour volume per direction of travel.For two-lane, two-way road indicate AADT)?

The anticipated work zone capacity of the roadway during construction was estimated to be 1,380 vph per direction using FDM 11-50-30 (See Attachment A4).

Single lane closures are proposed along STH 59 east of the intersection with CTH X within the south project limits. The 2012 existing counts on STH 59 at this location (WisDOT Site #671744, see Attachment A5) were used to compare to the work zone capacity. A summary of the peak periods are found below:

STH 59 East of CTH X

WisDOT Count Site # 671744

Hour | Pos Dir | Neg Dir | Total

06:00-06:59 | 613 | 417 | 1,030

07:00-07:59 | 826 | 639 | 1,465

08:00-08:59 | 719 | 519 | 1,238

09:00-09:59 | 628 | 686 | 1,313

10:00-10:59 | 713 | 891 | 1,604

11:00-11:59 | 850 | 964 | 1,814

From the existing counts no direction exceeds the 1,380 vphpl single lane capacity, therefore minimal queuing and delay is expected as a result of the lane drop.

7. Please provide the following.

a) Minimum lane width to be maintained.
11-ft lanes

b) Minimum lane width plus shoulder width to accommodate OSOW.
11-ft lanes plus shoulder width of not less than 3-ft. OSOW vehicles are currently not allowed on this route and will be restricted during coonstruction.

c) Minimum height (if less than typically available)
Not less than what is typically available.

8. Will the project be detoured?

☑ Yes ☐ No

a) Explain length of detour, travel times, improvements required for signaltiming, surface and shoulder conditions, capacity, etc

ATTACHMENT 9

Two roadway detours of CTH D/DE and CTH X and one trail detour of the Glacial Drumlin Trail are expected during the construction of the Waukesha Bypass South project.

CTH D/DE is expected to require a detour for the realignment of the Waukesha Bypass during Stage 2C of the South project. This detour is required because of tight right-of-way and profile changes at the proposed CTH D intersection with the Waukesha Bypass. The detour is expected to be long term (> 1month). The final duration of the detour shall be analyzed during final design. The anticipated detour route is to the south on STH 83 to STH 59 to CTH X as shown in Attachment A6 - Detour Routes. The detour is an additional 2.2 miles with a delay of approximately 5 minutes. The existing CTH DE/ CTH D roadway has a volume of 5,400 vpd. It is anticipated that the majority of this traffic is local traffic, expecting high diversion on other parallel roadways. The detour roadways of STH 83, STH 59 and CTH X should be able to accommodate the detour traffic. The only mitigation measure anticipated is signal timing changes at the intersection of CTH DE (Sunset Drive) & CTH X (Genesee Road), which should be monitored during construction. The other intersections along the detour route are either unsignalized or roundabout controlled. The specifications shall require that the detour is not permitted while there are lane restrictions at the STH 59 & CTH X intersection.

CTH X (south of STH 59) is expected to require a detour for the reconstruction during Stages 2A & 2B of the South project. This detour is required because of tight right-of-way at the match limits. The detour is expected to be short term (< 1 week). The final duration of the detour shall be analyzed with final design. The anticipated detour route is east onto CTH H to CTH I to CTH XX (Oakdale Road) to STH 59 as shown in Attachment A6. The detour is an additional 1.9 miles with a delay of approximately 3 minutes. The existing CTH X roadway has a volume of 13,100 vpd. The CTH X detour should be limited to non-peak periods (weekends). If the detour is required during peak periods temporary signals would be required at CTH XX (Oakdale Dr.) & CTH I (Lawnsdale Rd) and CTH I (Lawnsdale Rd) & CTH H (River Rd) along with signal timing changes to the intersection of STH 59 & CTH XX (Oakdale Drive). Waukesha West High School is located on CTH X south of the project limits, but within the detour route. The roadway work on CTH X should take place in summer when school is not in session.

The Glacial Drumlin Trail will be detoured during construction of the box culvert that will route the trail under the roadway in proposed conditions. The anticipated trail detour route will utilize the local roads and the existing connection at Poplar Dr. North on Poplar Dr, west on MacArthur Rd and south on Merrill Hills Road with a temporary connection to access the Glacial Drumlin Trail as shown in Attachment A6 - Detour Routes. The detour is an additional 2,150 feet. Coordination with WDNR to occur during final design.

b) Are there width and height restrictions on the detour?

☐ Yes ☑ No

9. List major special events and holidays, and how traffic disruptions will be minimized.

The Holiday work restrictions shown in the FDM will be implemented around holidays:

Memorial Day, Labor Day, and Thanksgiving.

Work will be restricted during the following holidays in order to avoid disruptions:

* From noon Wednesday, November 23, 2016 to 6:00 AM Monday, November 28,

2016

* From noon Friday, May 26, 2017 to 6:00 AM Tuesday, May 30, 2017

* From noon Friday, September 1, 2017 to 6:00 AM Tuesday, September 5, 2017

* From noon Wednesday, November 22, 2017 to 6:00 AM Monday, November 26,

2017

CTH X detour is restricted during the following time periods (school session):

October 2016 - June 2017

September 2017 - November 2017

10. Describe the method(s) (LCAT, Quadro, FDM 11-50-30, etc.) used to estimate motorist delays or queue length? (Applicable only for freeways, expressways, and signalized corridors).

The anticipated work zone capacity of the roadway during construction was estimated to be 1,380 vphpl per direction using FDM 11-50-30. Existing traffic volumes were reviewed from available data and no delays are anticipated due to volumes not exceeding the 1,380 vphpl threshhold, therefore, no delay modeling is required at this time. See Attachments A4 and A5.

11. What is the anticipated travel delay during peak travel periods (also indicate frequency, e.g. daily and duration). Please compare the peak hour volumes per lane with the work zone capacity criteria in 11-50-30. If it exceeds the estimated capacity, a delay calculation is required. If the delay is more than 15 minutes, the TMP will be a type 3 and if less than 15 minutes, it generally will be a type 2. The Regional Work Zone Engineer can assist you in determining your delay.

The anticipated work zone capacity of the roadway during construction was estimated to be 1,380 vphpl per direction using FDM 11-50-30. The existing roadway of CTH TT/Merrill Hills Road functions as a 2 lane roadway. Since one lane in each direction with left turn lanes will be provided at all major intersections during construction it is expected that there will be no additional delay due to construction activities along CTH TT/Merrill Hills Road. Existing 2012 counts at WisDOT Sites #671744 and #672618 (see Attachment A5) show that no direction exceeds the 1,380 vphpl single lane capacity. The signalized intersection of CTH X and WIS 59 will have additional delay as a result of single lane closures. This intersection should be analyzed using Synchro during final design once the staging of the intersections has been completed; however it is expect that delays will be less than 15 minutes.

12. Identify alternate routes anticipated, and any alternate route improvements or signing planned.

There are several alternate routes that the locals will use to maneuver around construction. It is

also anticipated that local truck drivers within the city of Waukesha will utilize alternate routes such as CTH X, Grandview Blvd, and Moreland Blvd. These routes are local and town roads therefore they will not be marked as alternative routes.

13. Are any intersection traffic control changes proposed such as temporary signals, temporary changes to an all way stop, etc?

The anticipated intersection control of each intersection per stage is identified in the tables below using the following designations:

TS - Temporary Signal, PS - Install Permanent Signal after Construction, AW - All Way Stop, TW - Two-Way Stop, OW - One-Way Stop, P - Signal Phasing Change, T - Update Signal Timing, N/A - No Action

South Project: Stages:

Intersection | Existing | 1 | 2A | 2B | 2C | 3 | 4 | FINAL

STH 59 & CTH X/Saylesville Road | Signalized | TS | TS | TS | TS | - | - |

STH 59 & Saylesville Road | - | - | - | - | - | T | T | PS

STH 59/CTH X & Waukesha Bypass | - | - | - | - | - | TW(1) | TW(1) | TW(1)

CTH D/Sunset Drive & CTH TT | Signalized | T | T | T | T | T | TW (1) | TW (1) | TW (1)

CTH D/Sunset Drive & Waukesha Bypass | - | - | - | - | - | PS | PS | PS

CTH TT & Green Lane | One-way Stop | OW | OW | OW | OW | OW | OW | OW | OW

Green Lane & Waukesha Bypass | - | - | - | - | - | OW | OW | OW

CTH TT & Railroad | RR Signal | N/A | N/A | N/A | N/A | - | - |

Waukesha Bypass & Railroad | - | - | - | - | - | RR Sig(2) | RR Sig(2) | RR Sign(2)

CTH TT & McArthur Drive | One-way Stop | OW | OW | OW | OW | TW (3) | TW | TW (3)

McArthur Drive & Waukesha Bypass | - | - | - | - | - | OW | OW | OW

CTH TT & Kame Terrace | One-way Stop | OW | OW | OW | OW | - | - | --

Kame Terrace & Waukesha Bypass | - | - | - | - | - | OW | OW | OW

Merrill Hills Court & Waukesha Bypass | - | - | - | - | OW | OW | OW | OW

CTH TT & Madison Street | All-Way Stop | AW | AW | AW | AW | PS | PS | PS

Notes:

1 Intersection of CTH D/Sunset Drive & CTH TT to become stop control with opening of Waukesha Bypass in Stage 3

2 Waukesha Bypass & Railroad signal to be coordinated during final design

ATTACHMENT 9

3 TW stop changes from MacArthur Dr. to Merrill Hills (Old CTH TT) with Cul-de-sac of CTH TT in Stage 3

14. Are there anticipated traffic impacts from the proposed project on other roads/routes in the region/corridor? Identify other projects in the corridor (only if delay anticipated on this project).

The following roads will have traffic impacts due to being used as detour routes for sideroad closures:

STH 83, STH 59, CTH X, CTH H, CTH I, CTH XX (Oakdale Road)

No delays are anticipated on mainline.

Not aware of any other construction projects in the area.

15. Does the project affect other regions/states?

☐ Yes ☑ No

16. Check mitigation strategies planned

STRATEGY	COMMENTS
☑ Public information campaigns	There is currently a website to obtain project information at www.waukeshabbypass.org
☑ Off-peak lane closures	Lane closures will be restricted while school is in session.
☐ Temporary widening to maintain traffic lanes	
☑ Changeable message signs (PCMS)	PCMS will be placed at the begin and end of the project.
☐ Ramp closures	
☑ Temporary signals/timing revisions	At numerous intersections, see Seciton 13.
☑ Coordination with adjacent projects	Coordinate with adjacent Project ID 2788-00-72, Waukesha Bypass, CTH TT, USH 18 to Northview Rd, Waukesha County and Project ID 2788-02-70, Waukesha Bypass, USH 18, Summit Ave, Waukesha County.
☐ Innovative contracting, (lane rental, A+B, etc)	
☐ Temporary Emergency Pullouts	
☐ Motorist service patrols	

ATTACHMENT 9

- ☐ Nighttime Work
- ☑ Enhanced Traffic control devices (Wet reflective pavement marking, temp concrete barrier, etc) — These will be explored during the final design phase.
- ☐ Reduced regulatory speed limit (requires declaration approved by Regional Traffic Engineer, & by BTO if 65-mph hwy.)

17. Describe public information strategies planned (coordinate this activity with your Regional Communications Manager).

Public information meetings will be held to solicit input from the public. A press release will be prepared and distributed prior to construction. Utilize local media, WisDOT website (511) and project website (www.waukeshabypass.org). Portable changeable message boards will be used to warn traffic of any lane closures and delay. Construction updates will be provided to local and emergency officials.

18. Describe incident management strategies planned.

The Regional Incident Management Plan will be utilized. Coordination with the State Traffic Operations Center, State Patrol, local patrol and other emergency services will be used to provide real time direction and guidance. Local units of government and first responders will be invited to the pre-construction conference. Coordination with emergency officials will continue throughout construction, with the contractor required to provide 24 hour notice prior to making any traffic control changes.

19. Describe how transit impacts will be mitigated.

There are currently no bus or transit stops located along the project.

Attachments:

Attachments for TMP ID 2321 are listed below.

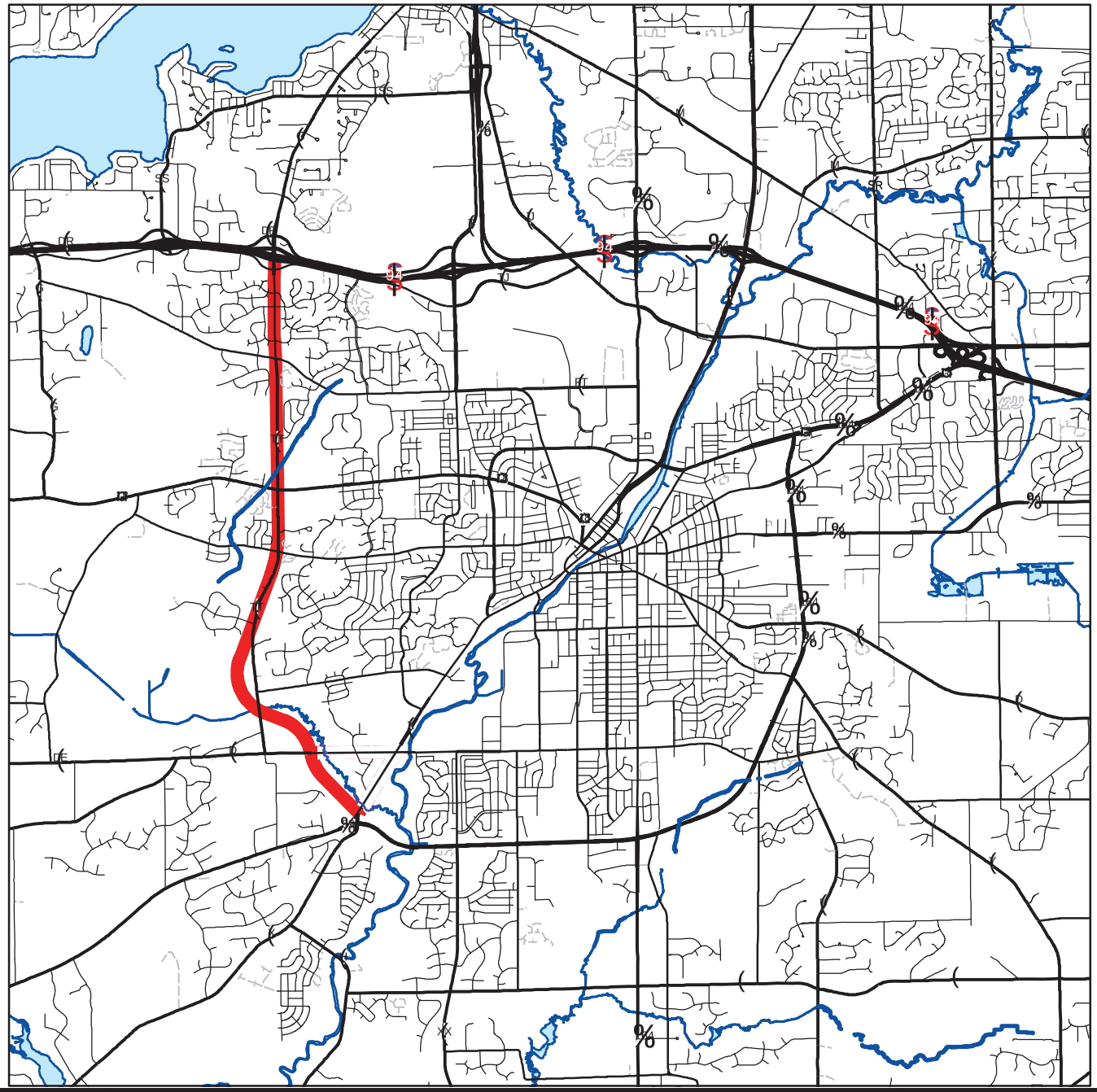
[f] Attachment A6 - Detour Routes.pdf
[f] Attachment A7 - Forecast Report.pdf
[f] Attachment A4 - Lane Capacity Calculation_Bypass.pdf
[f] Attachment A2 - Project Overview.pdf
[f] West Waukesha Bypass_South_Public Outreach Plan.pdf
[f] West Waukesha Bypass_South_Transportation Operations Plan.pdf
[f] Attachment A1 - Project Location Map.pdf
[f] Attachment A5 - West Waukesha Bypass Hourly Traffic Volume.pdf
[f] Attachment A3 - South Project Staging Overviews.pdf

*** [F] represents folder and [f] represents file.**

Approvals:

ATTACHMENT 9

ATTACHMENT 9

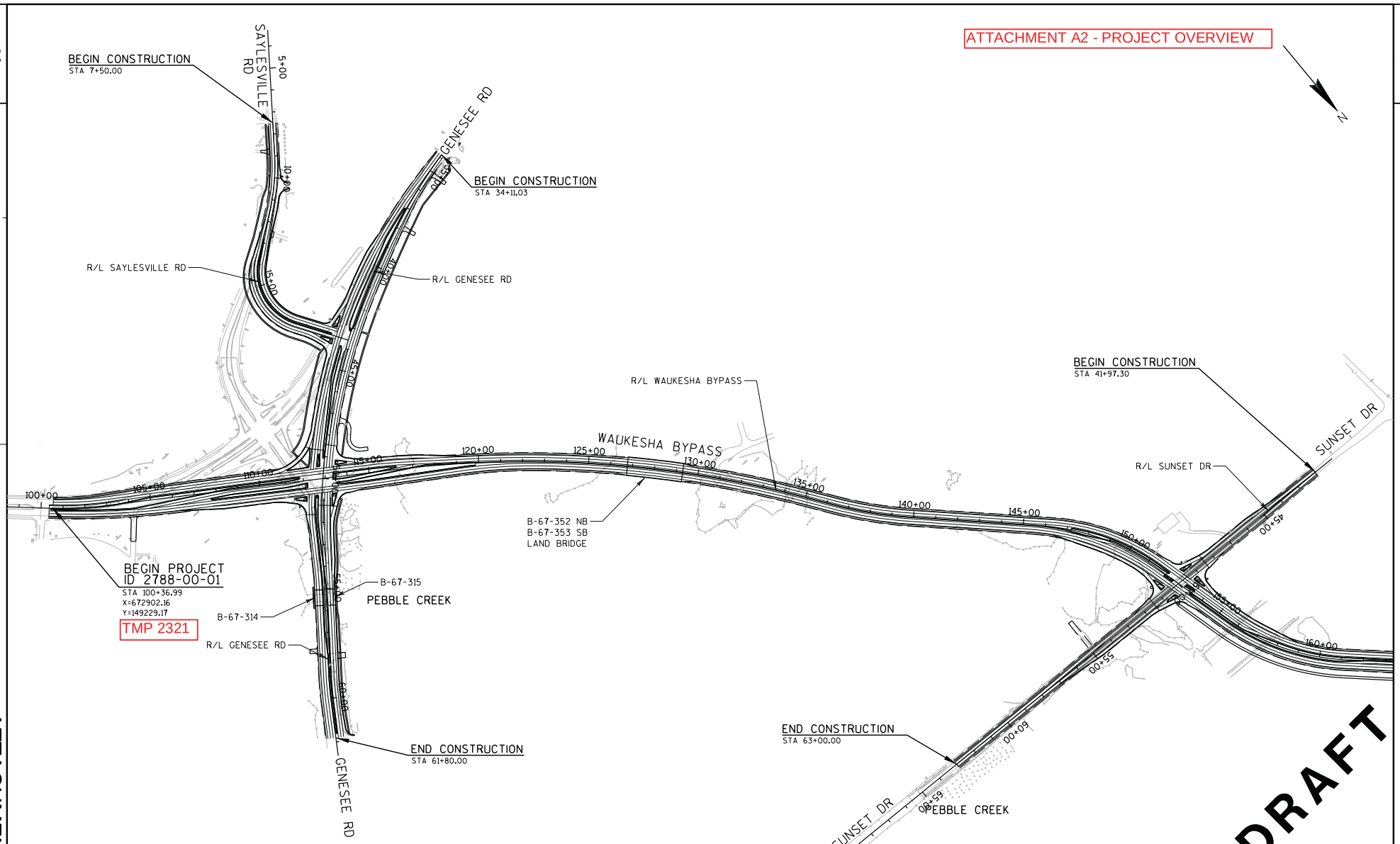


8

WAUKESHA COUNTY
WAUKESHA WEST BYPASS

The information and depictions herein are for informational purposes and Waukesha County specifically disclaims accuracy in this reproduction and specifically admonishes and advises that if specific and precise accuracy is required, the same should be determined by procurement of certified maps, surveys, plats, Flood Insurance Studies, or other official means. Waukesha County will not be responsible for any damages which result from third party use of the information and depictions herein or for use which ignores this warning.

ATTACHMENT A2 - PROJECT OVERVIEW



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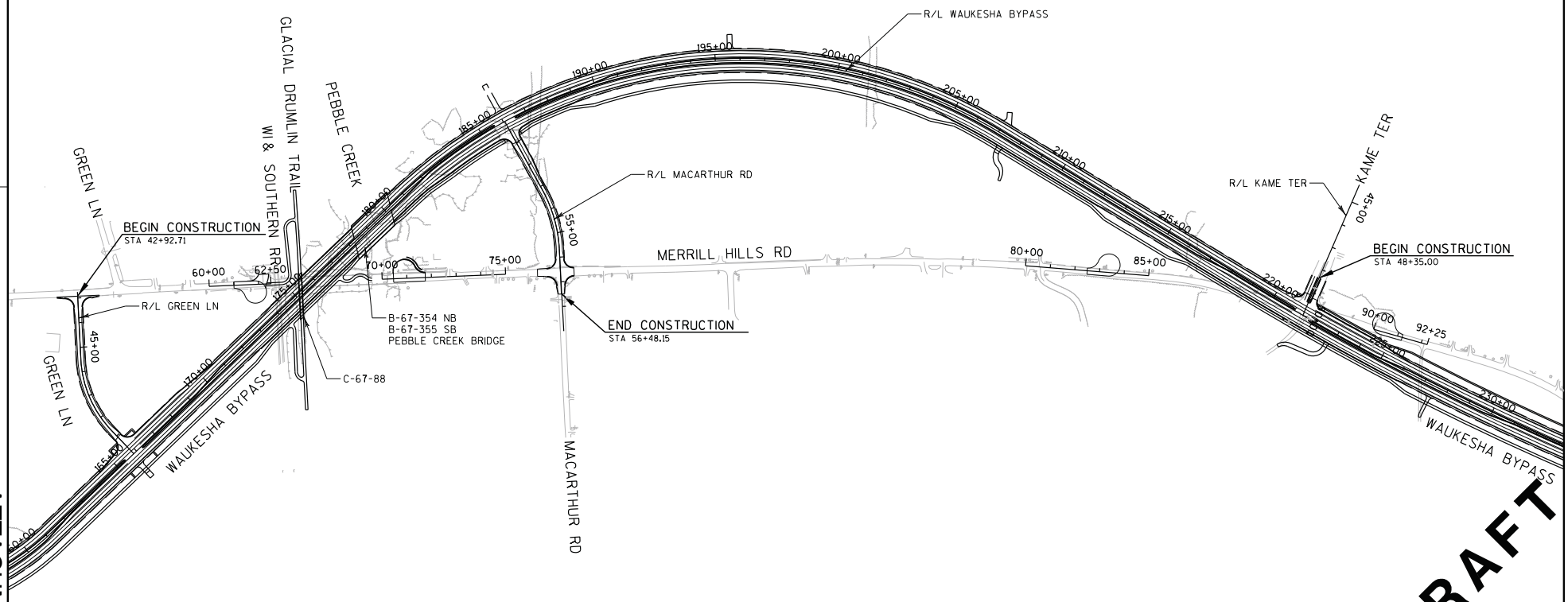
ATTACHMENT 9

ATTACHMENT A2 - PROJECT OVERVIEW



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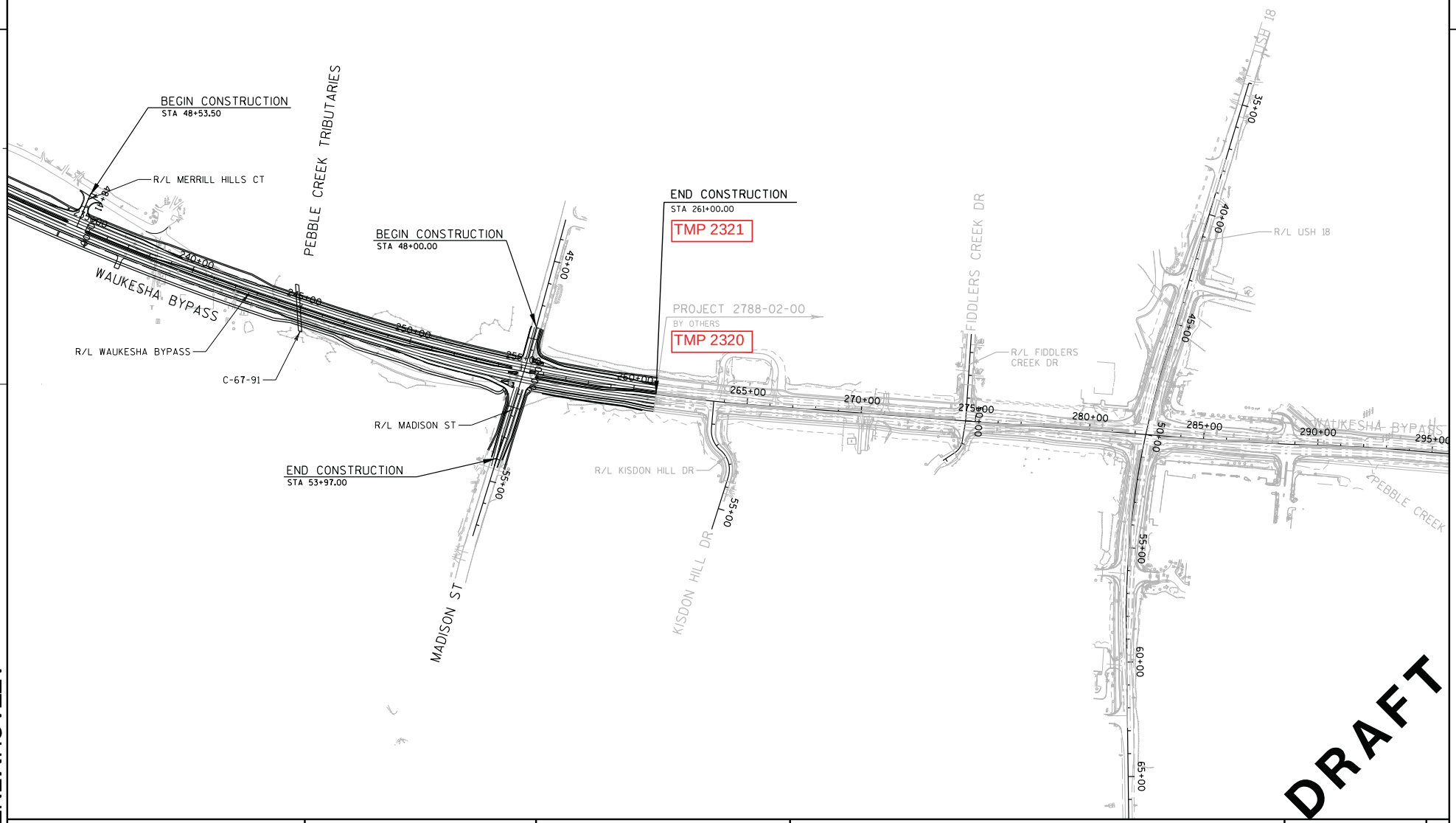
ATTACHMENT 9

ATTACHMENT A2 - PROJECT OVERVIEW



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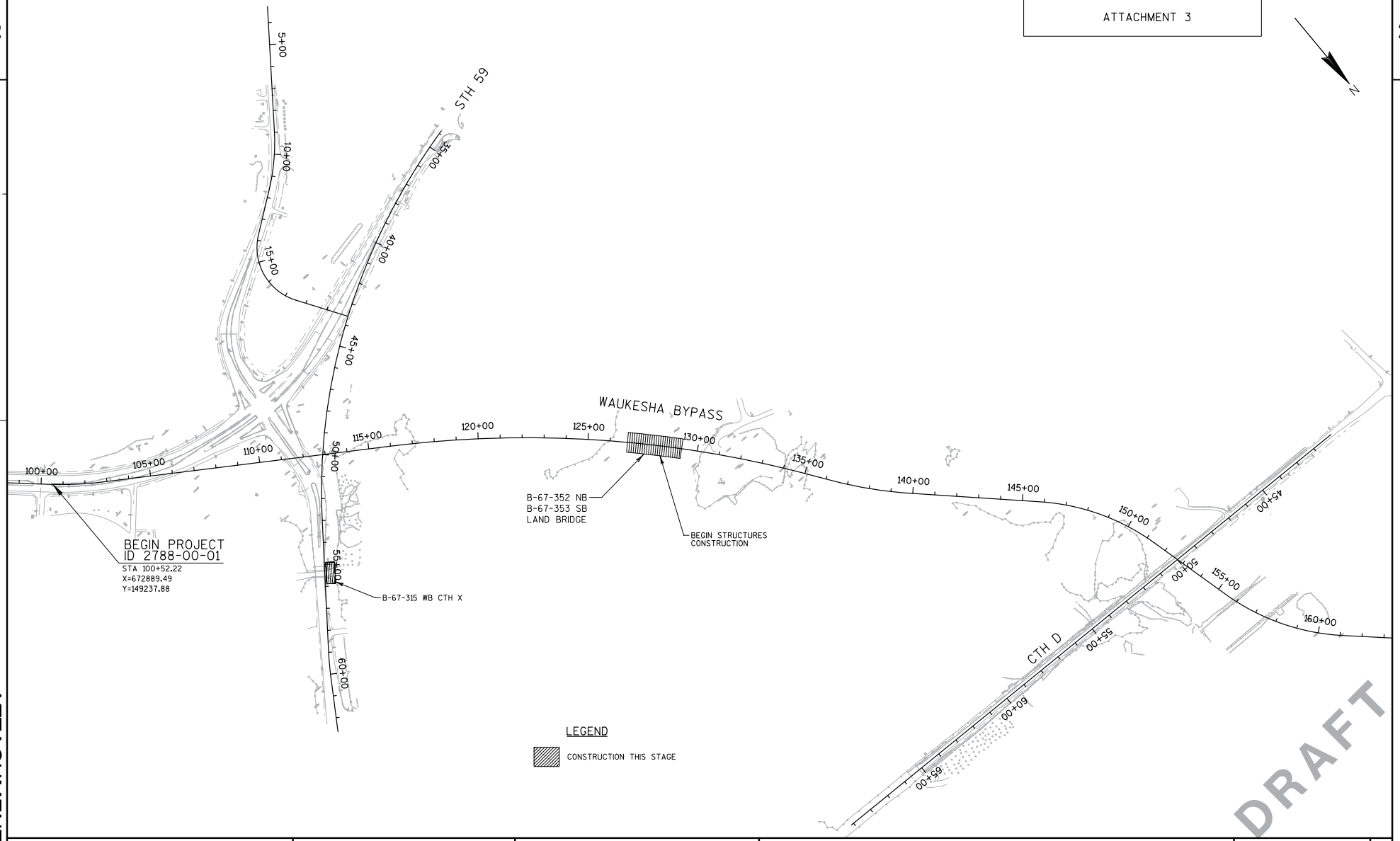
ATTACHMENT 9

ATTACHMENT 3



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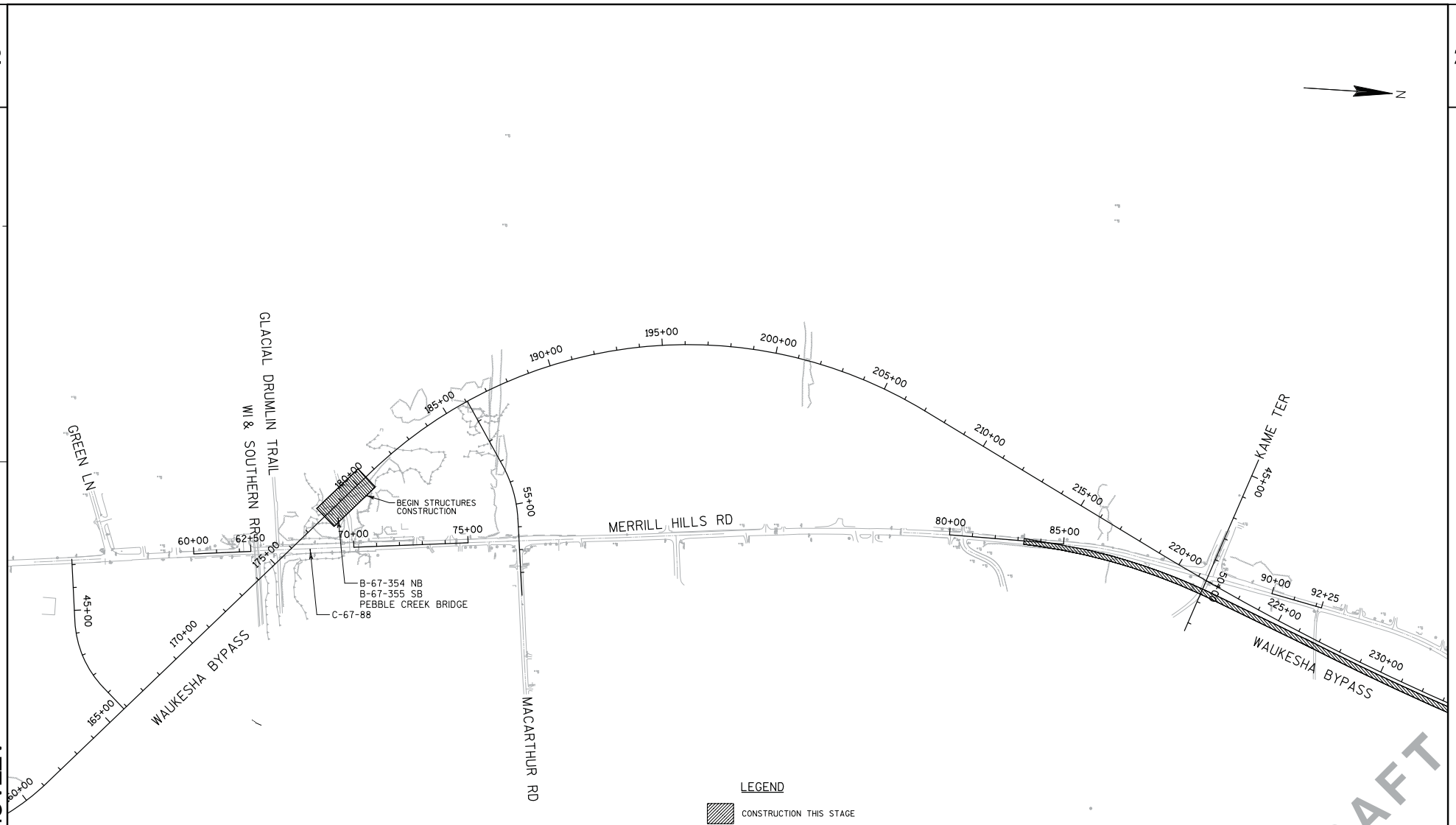
ATTACHMENT 9

ATTACHMENT 9



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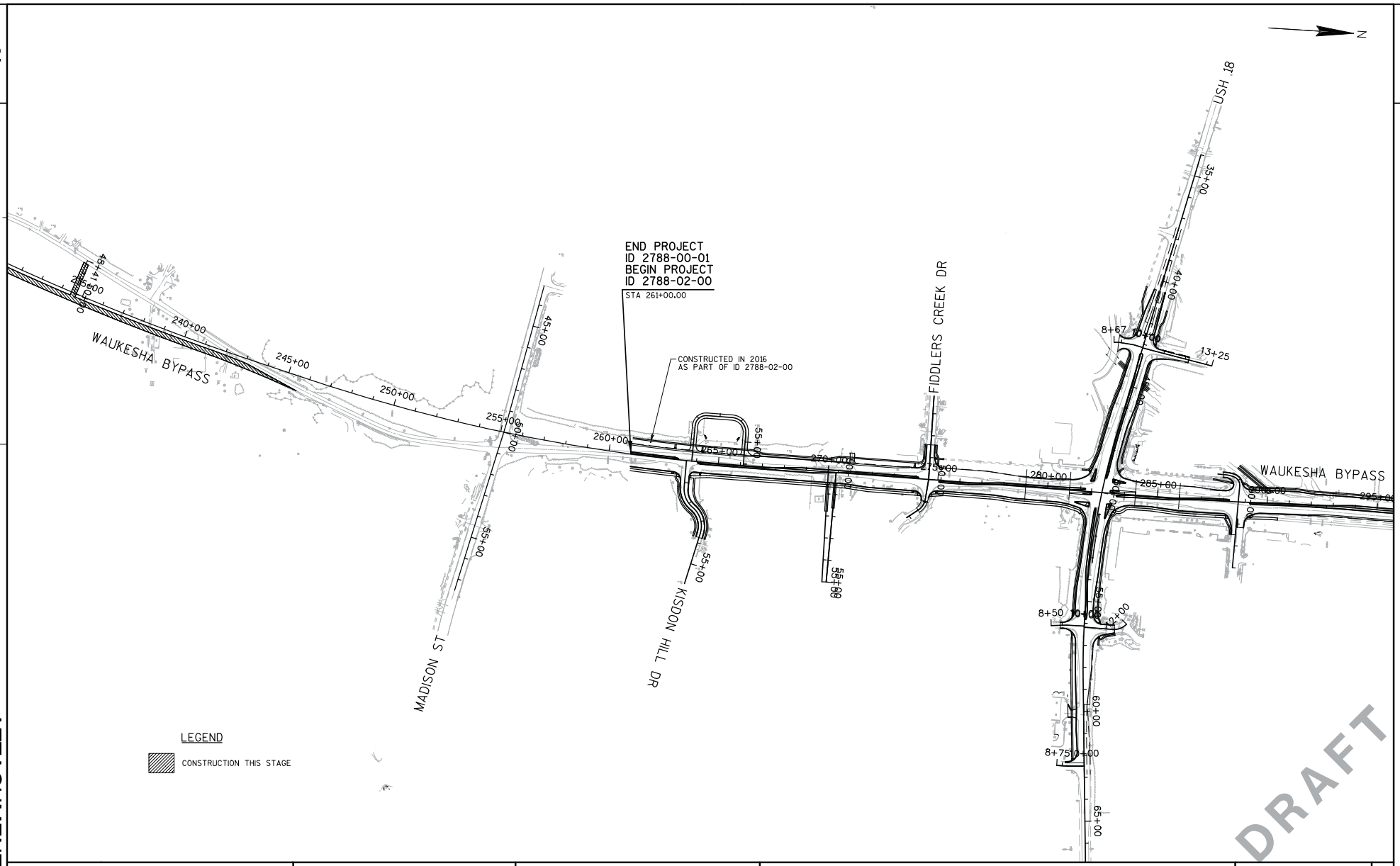

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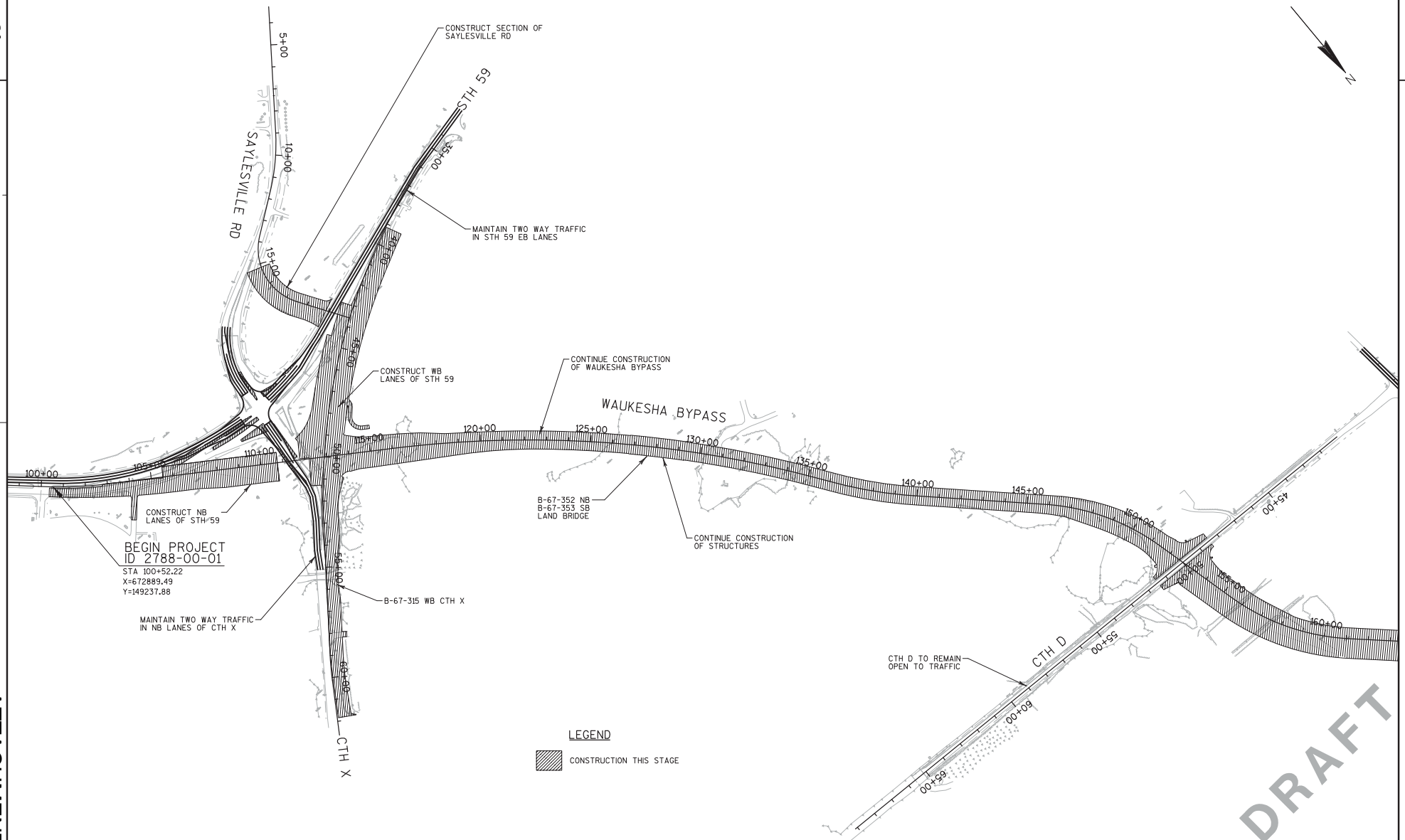
ATTACHMENT 9



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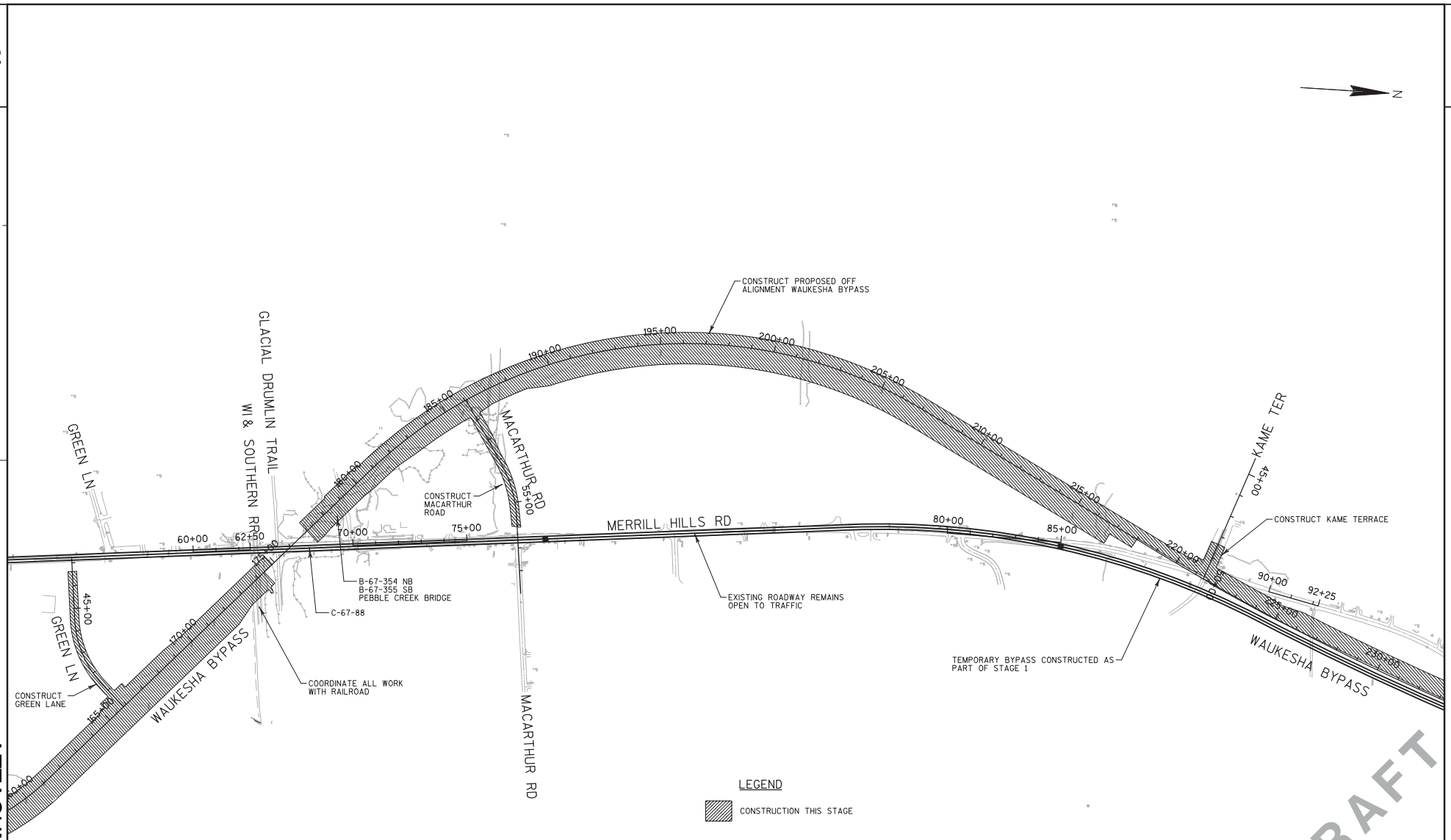
ATTACHMENT 9

ATTACHMENT 9



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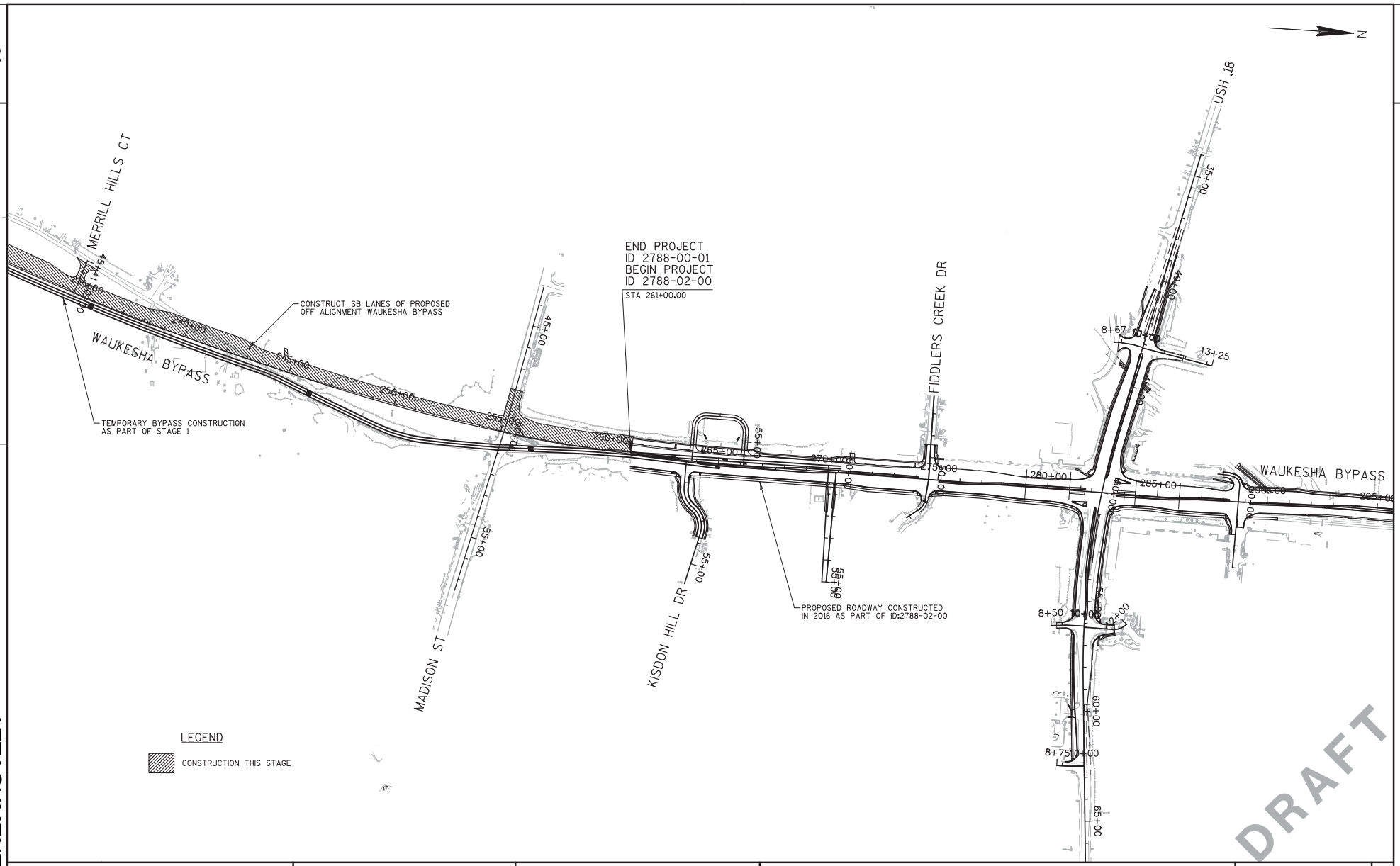

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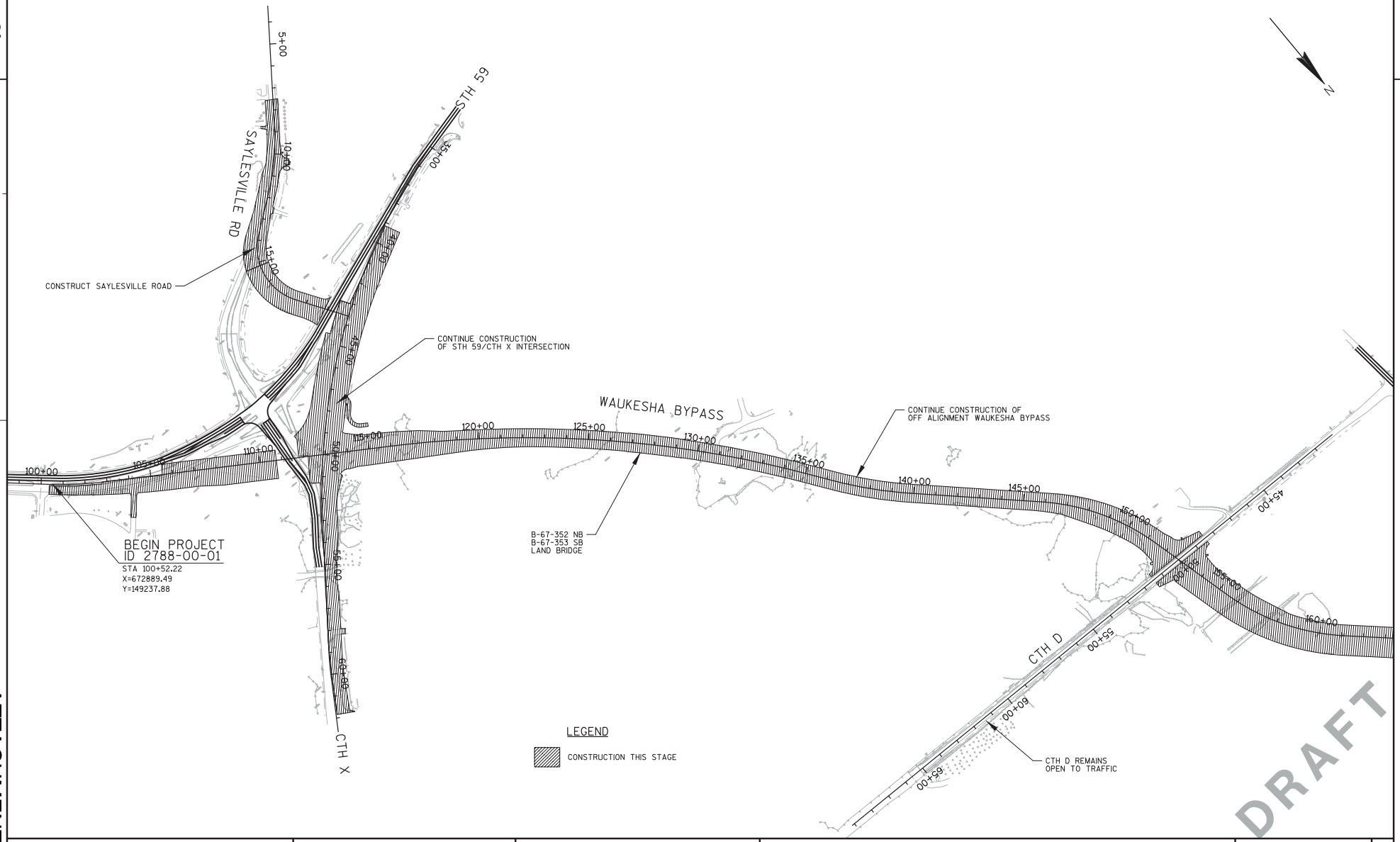

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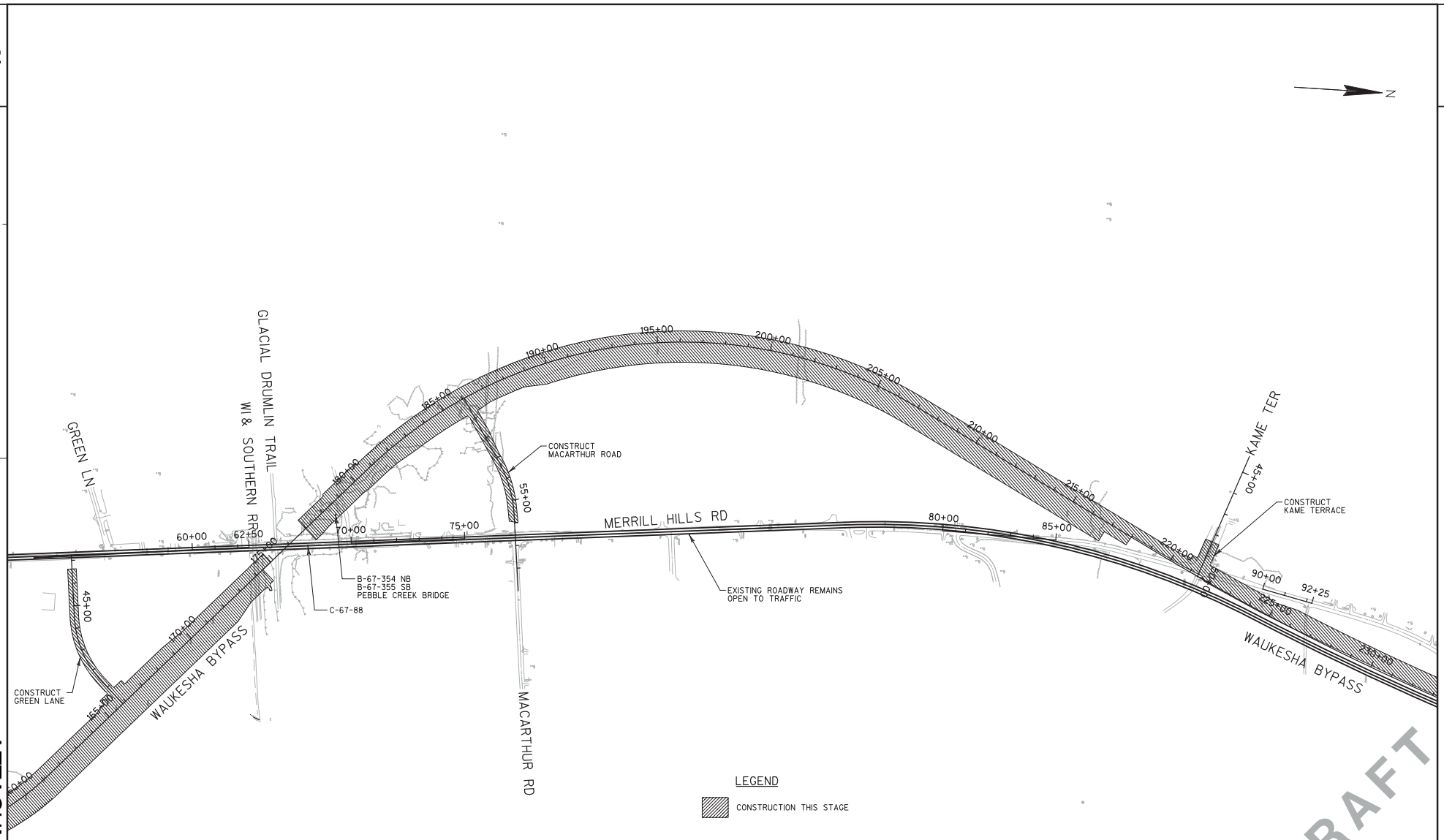
ATTACHMENT 9

ATTACHMENT 9

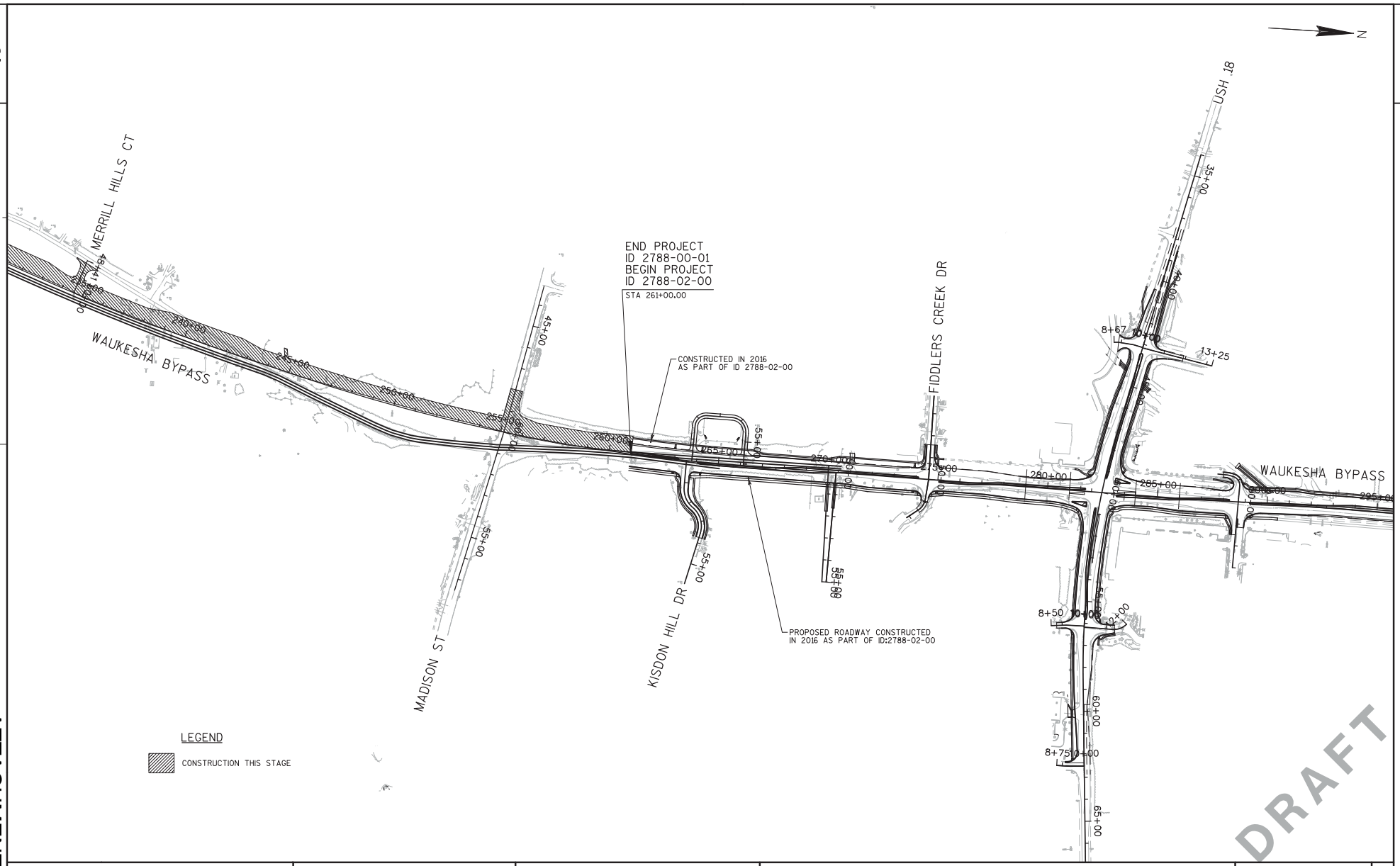


DRAFT

PROJECT NO: 2788-00-01	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TRAFFIC CONTROL - STAGE 2B OVERVIEW	SHEET	E

FILE NAME : 026128_S2B.dgn PLOT DATE : 29-JUL-2015 PLOT BY : szongolo PLOT NAME : PLOT SCALE : 400:1

WISDOT/CADDS SHEET 42



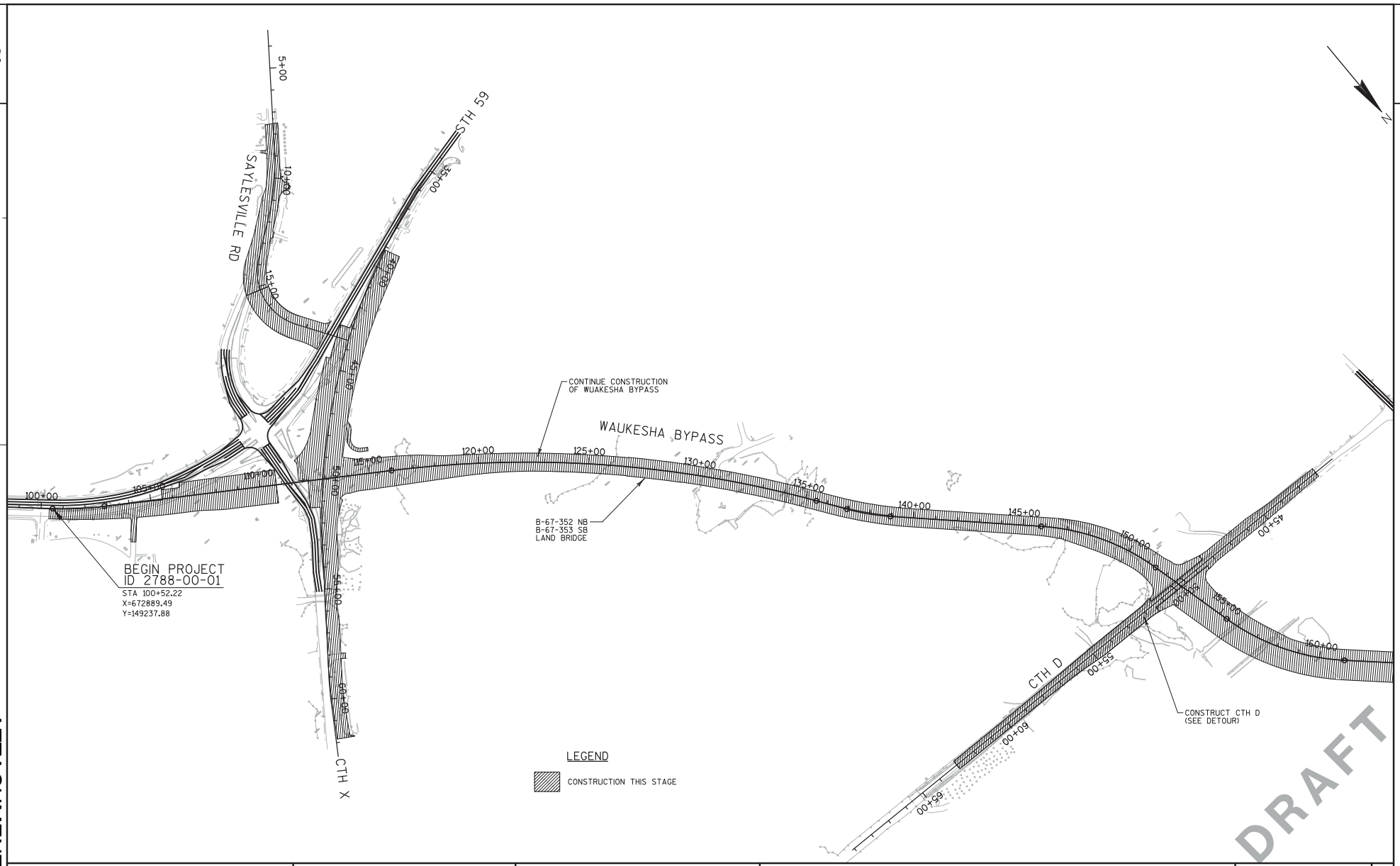
PROJECT NO: 2788-00-01	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TRAFFIC CONTROL - STAGE 2B OVERVIEW	SHEET	E

FILE NAME : 026129_S2B.dgn PLOT DATE : 29-JUL-2015 PLOT BY : szongolo PLOT NAME : PLOT SCALE : 400:1

WISDOT/CADDS SHEET 42

ATTACHMENT 9

ATTACHMENT 9

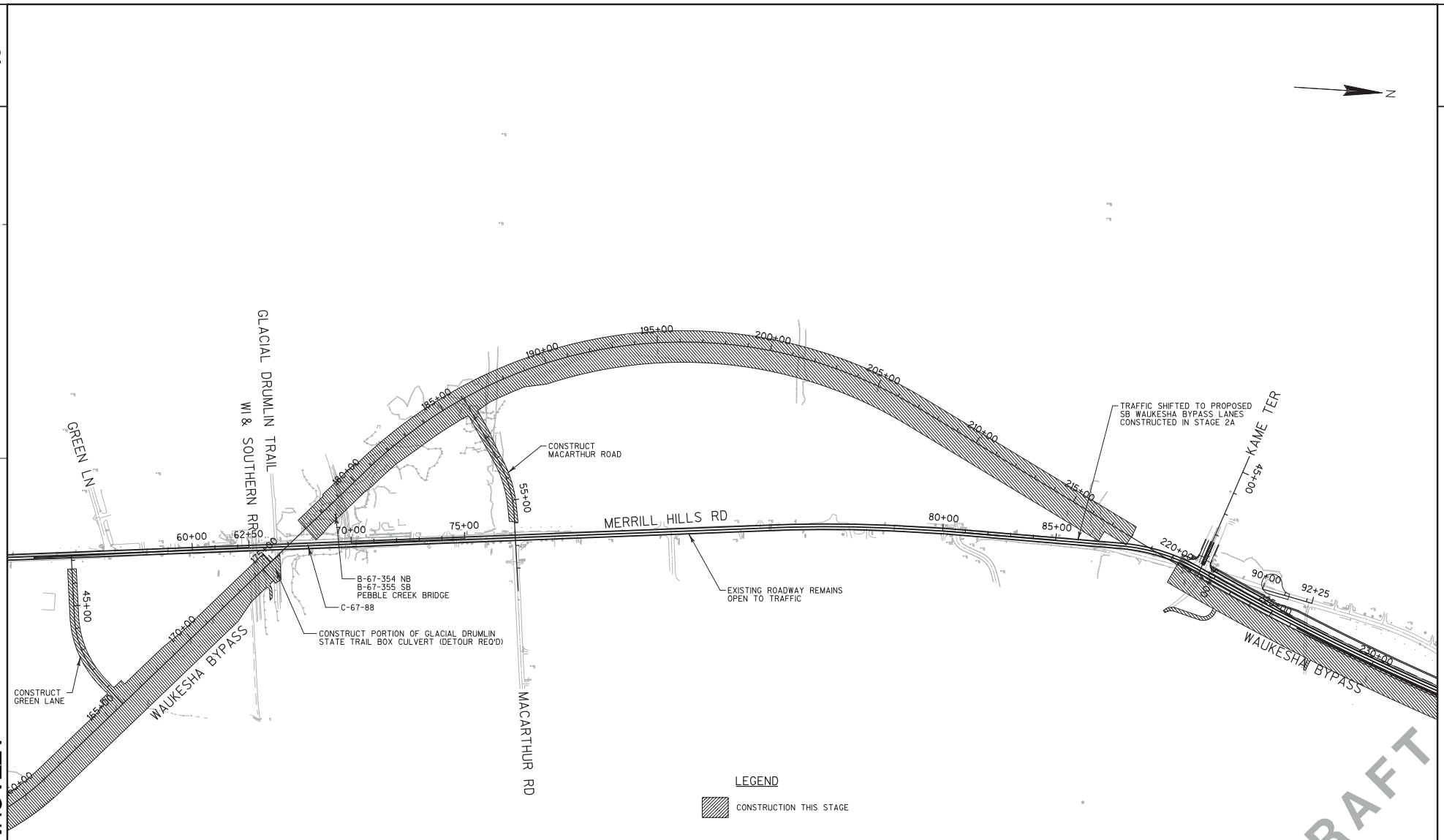


PROJECT NO: 2788-00-01	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TRAFFIC CONTROL - STAGE 2C OVERVIEW	SHEET	E

FILE NAME : 026130_S2C.dgn PLOT DATE : 29-JUL-2015 PLOT BY : szongolo PLOT NAME : PLOT SCALE : 400:1

WISDOT/CADDS SHEET 42

ATTACHMENT 9

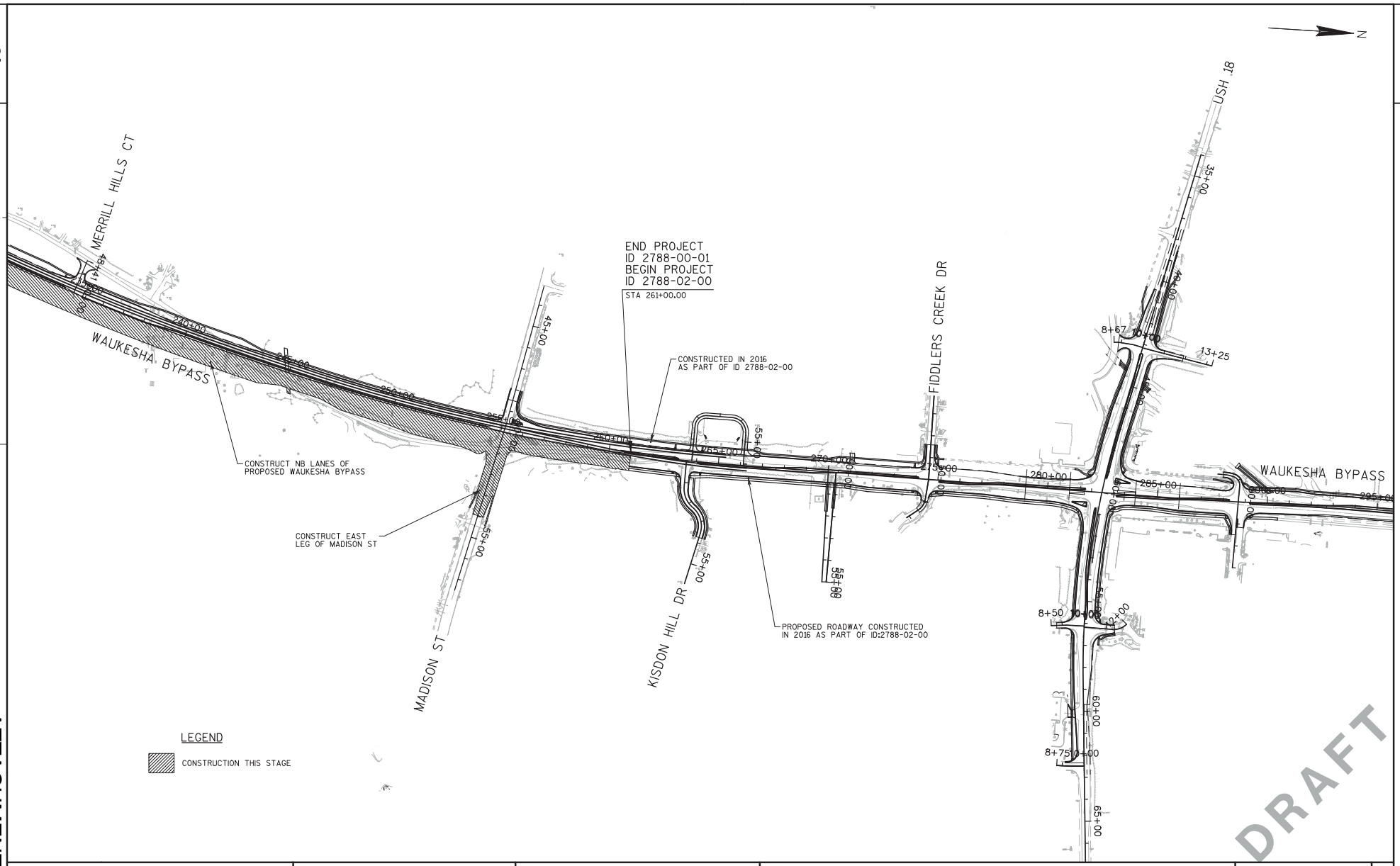


DRAFT

PROJECT NO: 2788-00-01	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TRAFFIC CONTROL - STAGE 2C OVERVIEW	SHEET	E

FILE NAME : 026131_S2C.dgn PLOT DATE : 29-JUL-2015 PLOT BY : szongolo PLOT NAME : PLOT SCALE : 400:1

WISDOT/CADDS SHEET 42

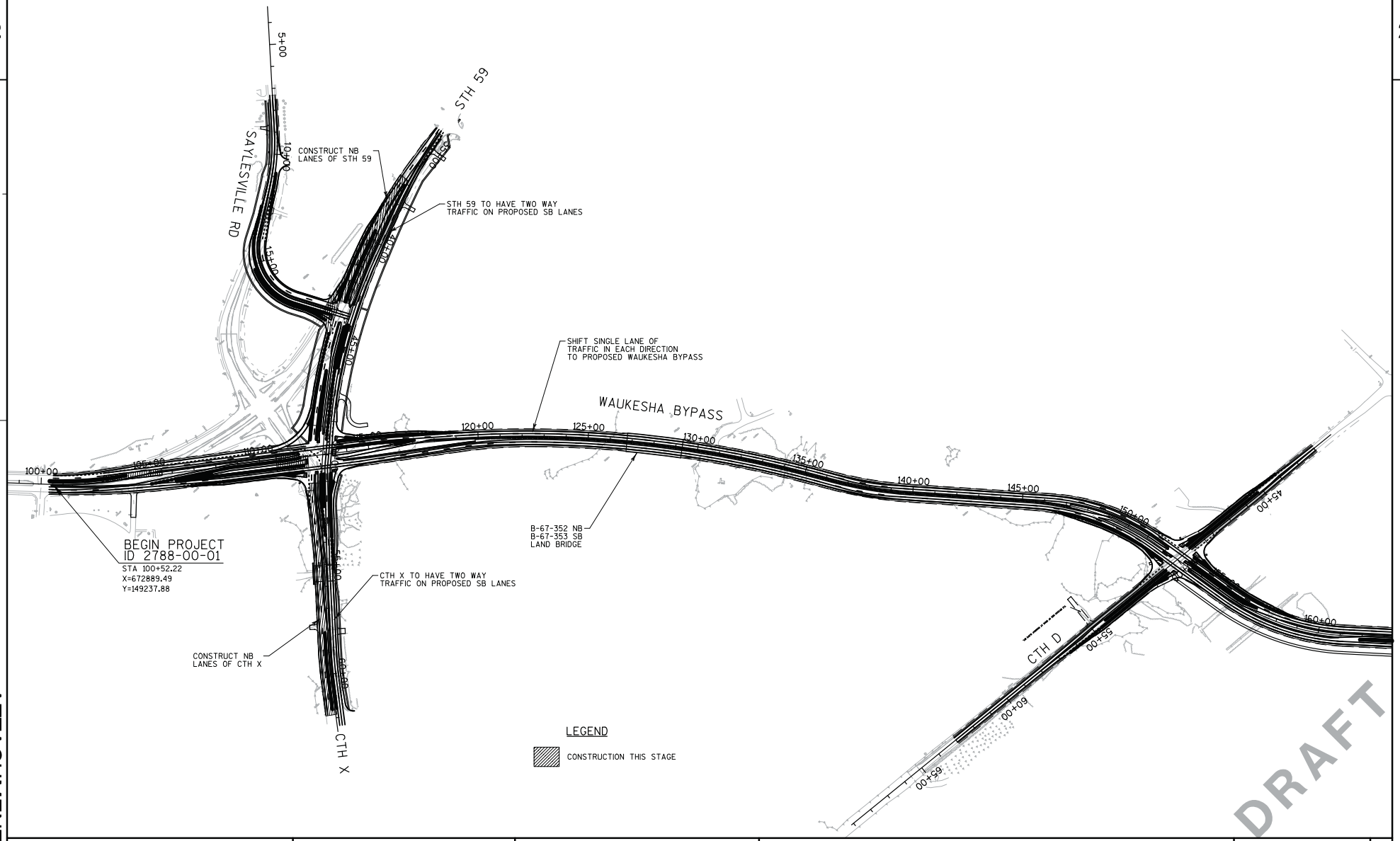


PROJECT NO: 2788-00-01	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TRAFFIC CONTROL - STAGE 2C OVERVIEW	SHEET	E

FILE NAME : 026132_S2C.dgn PLOT DATE : 29-JUL-2015 PLOT BY : szongolo PLOT NAME : PLOT SCALE : 400:1

WISDOT/CADDS SHEET 42

ATTACHMENT 9



PROJECT NO: 2788-00-01	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TRAFFIC CONTROL - STAGE 3 OVERVIEW	SHEET	E

FILE NAME : 026133_S3.dgn PLOT DATE : 26-JUN-2015 PLOT BY : szongolo PLOT NAME : PLOT SCALE : 400:1

WISDOT/CADDS SHEET 42

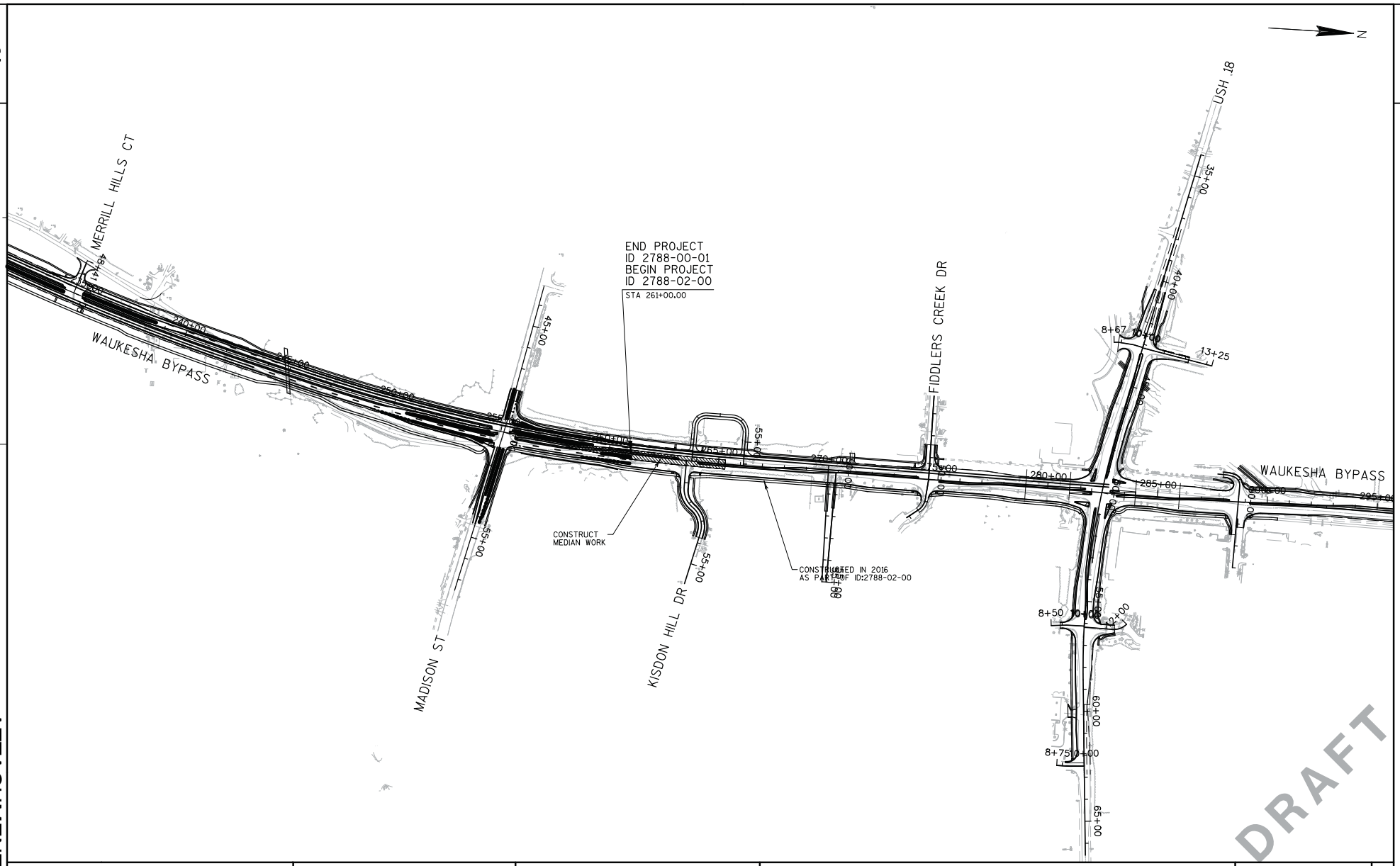
ATTACHMENT 9

PROJECT NO: 2788-00-01	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TRAFFIC CONTROL - STAGE 3 OVERVIEW	SHEET	E

FILE NAME : 026134_S3.dgn PLOT DATE : 26-JUN-2015 PLOT BY : szongolo PLOT NAME : PLOT SCALE : 400:1

WISDOT/CADDS SHEET 42

ATTACHMENT 9

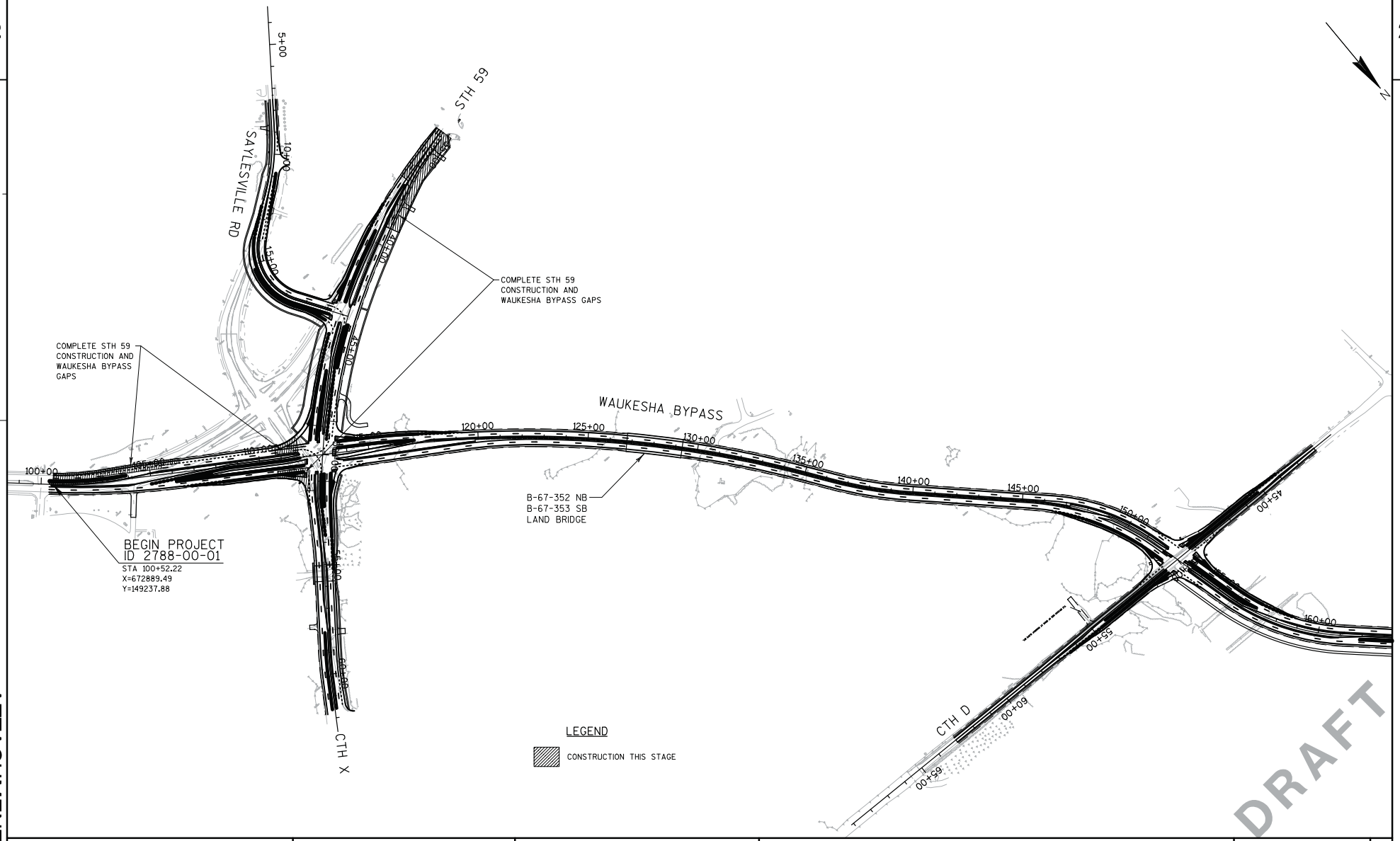


PROJECT NO: 2788-00-01	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TRAFFIC CONTROL - STAGE 3 OVERVIEW	SHEET	E

FILE NAME : 026135_S3.dgn PLOT DATE : 26-JUN-2015 PLOT BY : szongolo PLOT NAME : PLOT SCALE : 400:1

WISDOT/CADDS SHEET 42

ATTACHMENT 9



PROJECT NO: 2788-00-01	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TRAFFIC CONTROL - STAGE 4 OVERVIEW	SHEET	E

ATTACHMENT 9

FILE NAME : 026141_S4.dgn PLOT DATE : 26-JUN-2015 PLOT BY : szongolo PLOT NAME : PLOT SCALE : 400:1

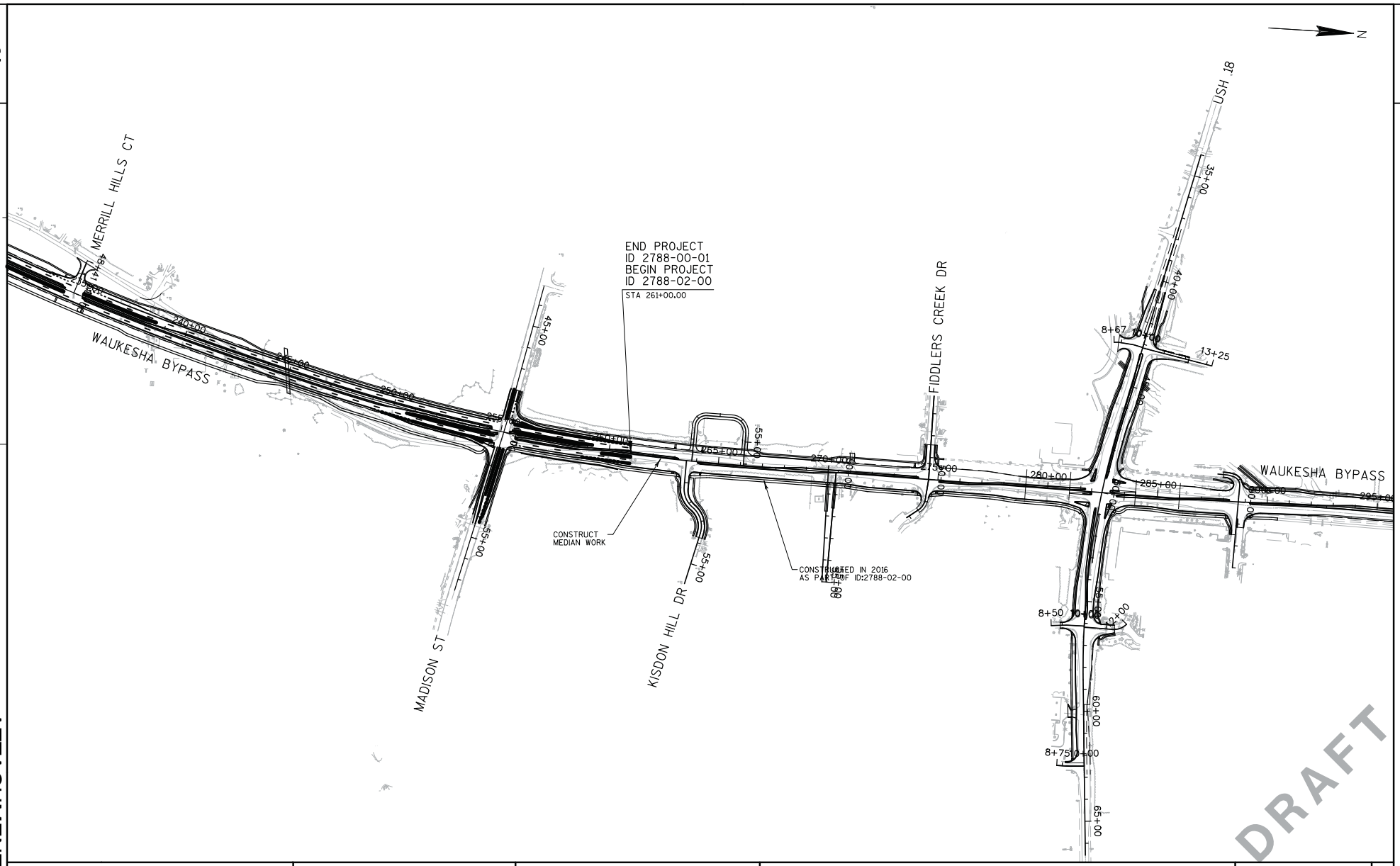
WISDOT/CADDS SHEET 42

PROJECT NO: 2788-00-01	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TRAFFIC CONTROL - STAGE 4 OVERVIEW	SHEET	E

FILE NAME : 026142_S4.dgn PLOT DATE : 26-JUN-2015 PLOT BY : szongolo PLOT NAME : PLOT SCALE : 400:1

WISDOT/CADDS SHEET 42

ATTACHMENT 9



PROJECT NO: 2788-00-01	HWY: WAUKESHA BYPASS	COUNTY: WAUKESHA	TRAFFIC CONTROL - STAGE 4 OVERVIEW	SHEET	E

FILE NAME : 026143_S4.dgn PLOT DATE : 26-JUN-2015 PLOT BY : szongolo PLOT NAME : PLOT SCALE : 400:1

WISDOT/CADDS SHEET 42

ATTACHMENT 9

PROJECT I.D. 2788-00-01

West Waukesha Bypass Genesee Road (STH 59) to Summit Ave (USH 18)

West Waukesha Bypass

LANE CAPACITY

Ca = (1,550 =+ I – R) x fHV x fLS x N

a. Percent trucks (P_T)= 7.8% (Based on FDM estimates for Wisconsin freeways from Forecast)

b. E_T = 2.5 (Highway Capacity Manual rolling terrain factor)

c. Work zone lane capacity = 1550 passenger cars per hour (Rural w/ crossover - FDM 11-50-30.5)

d. fHV = Heavy vehicle adjustment factor = $f_{HV} = (1 / (1+P_T(E_T-1)))$

$f_{HV} = (1 / (1+.078(2.5-1))) = 0.89$

e. fLS = 1

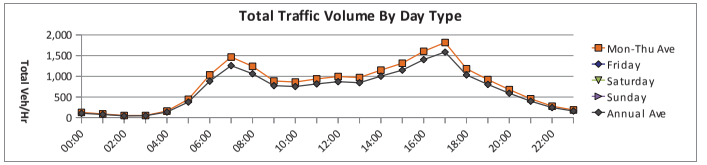
f. Adjusted lane capacity with heavy vehicles = (1550 cars per hour) x (0.89) x1 = 1380 vehicles per hour

Wisconsin Department of Transportation

Hourly Traffic Volume Report — **2012-Aug-13 to 2012-Aug-15**

Coverage Count

48 Hour Count - Averages and Graphs Do Not Include All Days



Location	STH 59 EAST OF CTH X WAUKESHA	Segment ID	7114
Site #	671744	Seasonal Factor Group	2
Region	SE	Daily Factor Group	2
County	WAUKESHA	Axle Factor Group	5
Funct. Class	U Principal Arterial - Other	Growth Factor Group	1

Hour	Sun			Mon 2012-08-13			Tues 2012-08-14			Wed 2012-08-15			Thur			Fri			Sat		
	Pos Dir	Neg Dir	Total	Pos Dir	Neg Dir	Total	Pos Dir	Neg Dir	Total	Pos Dir	Neg Dir	Total	Pos Dir	Neg Dir	Total	Pos Dir	Neg Dir	Total	Pos Dir	Neg Dir	Total
00:00-00:59			-			-	72	55	127	61	62	123			-			-			-
01:00-01:59			-			-	61	36	97	52	29	81			-			-			-
02:00-02:59			-			-	23	20	43	34	22	56			-			-			-
03:00-03:59			-			-	33	22	55	29	23	52			-			-			-
04:00-04:59			-			-	84	73	157	88	72	160			-			-			-
05:00-05:59			-			-	267	176	443	259	182	441			-			-			-
06:00-06:59			-			-	615	426	1,041	611	407	1,018			-			-			-
07:00-07:59			-			-	825	643	1,468	826	635	1,461			-			-			-
08:00-08:59			-			-	735	503	1,238	703	534	1,237			-			-			-
09:00-09:59			-	445	381	826	499	447	946			-			-			-			-
10:00-10:59			-	454	404	858	474	391	865			-			-			-			-
11:00-11:59			-	463	403	866	513	490	1,003			-			-			-			-
12:00-12:59			-	481	478	959	506	523	1,029			-			-			-			-
13:00-13:59			-	459	463	922	497	517	1,014			-			-			-			-
14:00-14:59			-	527	594	1,121	554	616	1,170			-			-			-			-
15:00-15:59			-	587	647	1,234	668	724	1,392			-			-			-			-
16:00-16:59			-	687	865	1,552	739	917	1,656			-			-			-			-
17:00-17:59			-	810	935	1,745	890	992	1,882			-			-			-			-
18:00-18:59			-	509	585	1,094	582	689	1,271			-			-			-			-
19:00-19:59			-	393	455	848	448	538	986			-			-			-			-
20:00-20:59			-	279	334	613	354	384	738			-			-			-			-
21:00-21:59			-	184	249	433	187	289	476			-			-			-			-
22:00-22:59			-	114	162	276	110	169	279			-			-			-			-
23:00-23:59			-	81	85	166	101	100	201			-			-			-			-
Daily Total	-	-	-	-	-	-	9,837	9,740	19,577	-	-	-	-	-	-	-	-	-	-	-	-
AM Peak	-	-	-	-	-	-	825	643	1,468	-	-	-	-	-	-	-	-	-	-	-	-
Hour	-	-	-	-	-	-	07:00	07:00	07:00	-	-	-	-	-	-	-	-	-	-	-	-
MD Peak	-	-	-	527	594	1,121	554	616	1,170	-	-	-	-	-	-	-	-	-	-	-	-
Hour	-	-	-	14:00	14:00	14:00	14:00	14:00	14:00	-	-	-	-	-	-	-	-	-	-	-	-
PM Peak	-	-	-	810	935	1,745	890	992	1,882	-	-	-	-	-	-	-	-	-	-	-	-
Hour	-	-	-	17:00	17:00	17:00	17:00	17:00	17:00	-	-	-	-	-	-	-	-	-	-	-	-
Daily Peak	-	-	-	-	-	-	890	992	1,882	-	-	-	-	-	-	-	-	-	-	-	-
Hour	-	-	-	-	-	-	17:00	17:00	17:00	-	-	-	-	-	-	-	-	-	-	-	-
% of Total	-	-	-	-	-	-	9.0%	10.2%	9.6%	-	-	-	-	-	-	-	-	-	-	-	-
Daily Ave	-	-	-	-	-	-	410	406	816	-	-	-	-	-	-	-	-	-	-	-	-
Seasonal Fctr				0.943	0.943		0.943	0.943		0.943	0.943										
Daily Fctr				0.966	0.966		0.955	0.955		0.929	0.929										
Axle Factor				0.482	0.482		0.482	0.482		0.482	0.482										
Pulse Fctr				2.000	2.000		2.000	2.000		2.000	2.000										
Overall Fctr	0.000	0.000		0.878	0.878		0.868	0.868		0.845	0.845		0.000	0.000		0.000	0.000		0.000	0.000	

Hour	Mon-Thurs Average			Mon-Fri Average			7 Day Average			Estimated Annual Ave		
	Pos Dir	Neg Dir	Total	Pos Dir	Neg Dir	Total	Pos Dir	Neg Dir	Total	Pos Dir	Neg Dir	Total
00:00-00:59	67	59	125	-	-	-	-	-	-	57	50	107
01:00-01:59	57	33	89	-	-	-	-	-	-	48	28	76
02:00-02:59	29	21	50	-	-	-	-	-	-	24	18	42
03:00-03:59	31	23	54	-	-	-	-	-	-	27	19	46
04:00-04:59	86	73	159	-	-	-	-	-	-	74	62	136
05:00-05:59	263	179	442	-	-	-	-	-	-	225	153	379
06:00-06:59	613	417	1,030	-	-	-	-	-	-	525	357	882
07:00-07:59	826	639	1,465	-	-	-	-	-	-	707	547	1,254
08:00-08:59	719	519	1,238	-	-	-	-	-	-	616	444	1,060
09:00-09:59	472	414	886	-	-	-	-	-	-	412	361	773
10:00-10:59	464	398	862	-	-	-	-	-	-	405	347	752
11:00-11:59	488	447	935	-	-	-	-	-	-	426	390	816
12:00-12:59	494	501	994	-	-	-	-	-	-	431	437	868
13:00-13:59	478	490	968	-	-	-	-	-	-	417	428	845
14:00-14:59	541	605	1,146	-	-	-	-	-	-	472	528	1,000
15:00-15:59	628	686	1,313	-	-	-	-	-	-	548	598	1,146
16:00-16:59	713	891	1,604	-	-	-	-	-	-	622	778	1,400
17:00-17:59	850	964	1,814	-	-	-	-	-	-	742	841	1,583
18:00-18:59	546	637	1,183	-	-	-	-	-	-	476	556	1,032
19:00-19:59	421	497	917	-	-	-	-	-	-	367	433	800
20:00-20:59	317	359	676	-	-	-	-	-	-	276	313	589
21:00-21:59	186	269	455	-	-	-	-	-	-	162	235	397
22:00-22:59	112	166	278	-	-	-	-	-	-	98	144	242
23:00-23:59	91	93	184	-	-	-	-	-	-	79	81	160
Daily Total	9,487	9,373	18,860	-	-	-	-	-	-	8,237	8,149	16,386
AM Peak	826	639	1,465	-	-	-	-	-	-	707	547	1,254
Hour	07:00	07:00	07:00	-	-	-	-	-	-	07:00	07:00	07:00
MD Peak	541	605	1,146	-	-	-	-	-	-	472	528	1,000
Hour	14:00	14:00	14:00	-	-	-	-	-	-	14:00	14:00	14:00
PM Peak	850	964	1,814	-	-	-	-	-	-	742	841	1,583
Hour	17:00	17:00	17:00	-	-	-	-	-	-	17:00	17:00	17:00
Daily Peak	850	964	1,814	-	-	-	-	-	-	742	841	1,583
Hour	17:00	17:00	17:00	-	-	-	-	-	-	17:00	17:00	17:00
% of Total	9.0%	10.3%	9.6%	-	-	-	-	-	-	9.0%	10.3%	9.7%
Daily Ave	395	391	786	-	-	-	-	-	-	343	340	683

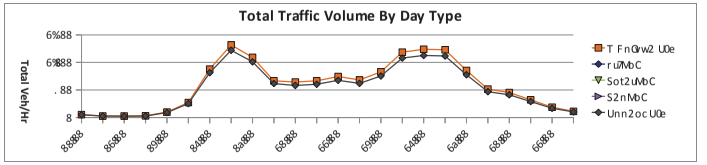
ATTACHMENT 9

Wisconsin Department of Transportation

Hourly Traffic Volume Report — 2012-Nov-12 to 2012-Nov-15

Coverage Count

48 Hour Count - Averages and Graphs Do Not Include All Days



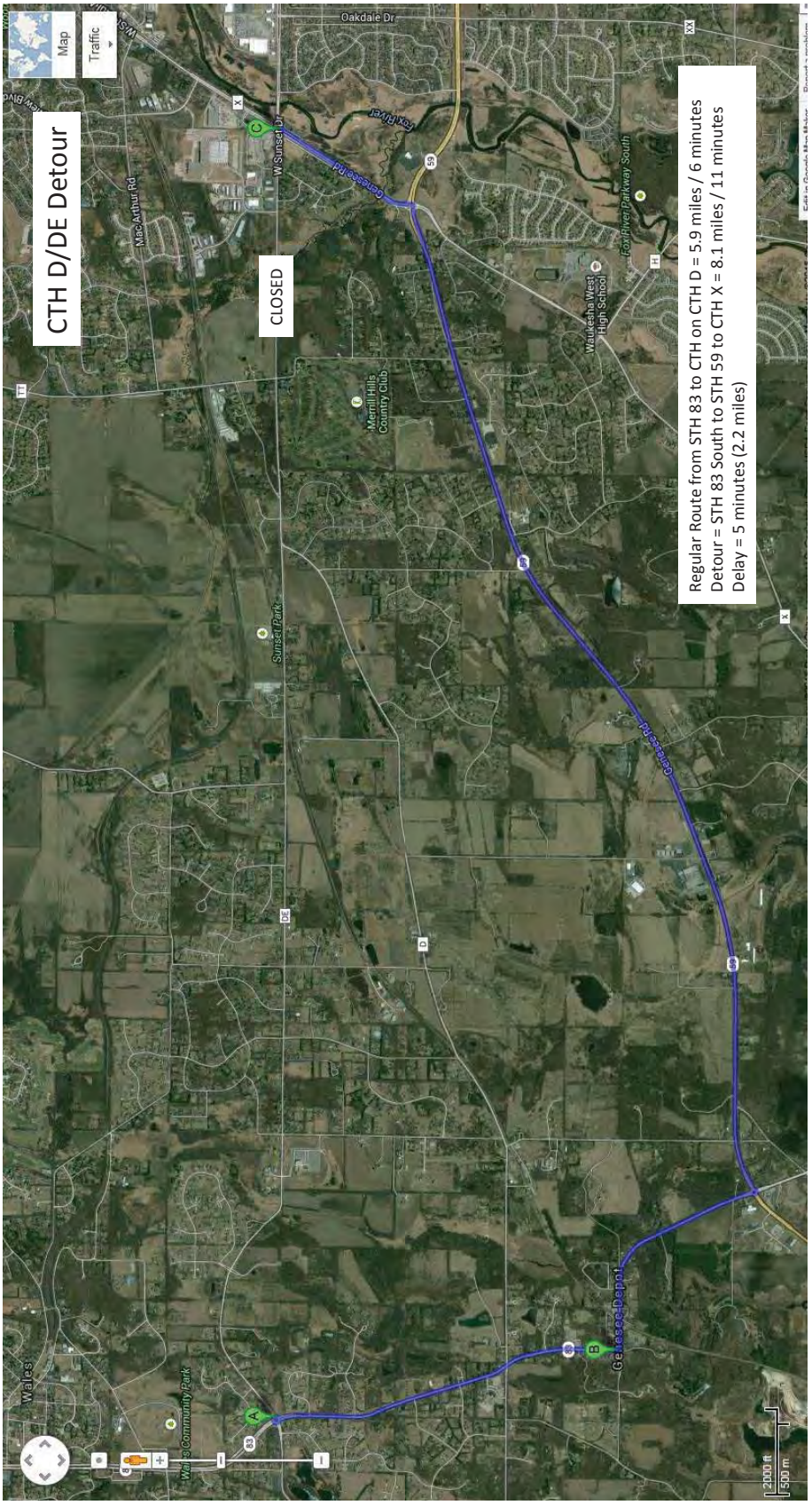
Location	CTH TT MERRIL HILL RD NORTH OF MADISON WAUKESHA	Segment ID	
S7te 1	4#646a	Seol FnocroGtFupuF2R	6
Eeg7Fn	Sy	DoZCroGtFupuF2R	6
WF2ntC	A UK HySx U	U5ceroGtFupuF2R	.
r2nGtPWoll	K - u7hGRocUuteuZbcOhtweu	puFd twroGtFupuF2R	6

Hour	Sun			Mon 2012-11-12			Tues 2012-11-13			Wed 2012-11-14			Thur 2012-11-15			Fri			Sat		
	Undivided	Hwy	*Total*	Undivided	Hwy	*Total*	Undivided	Hwy	*Total*	Undivided	Hwy	*Total*	Undivided	Hwy	*Total*	Undivided	Hwy	*Total*	Undivided	Hwy	*Total*
00:00	388	3	-			-		4:	*12*		. 6	*78*		93	*35*			-			-
01:00	368	3	-			-		: 6	*28*		6a	*96*		: 6	*28*			-			-
02:00	368	3	-			-		: 8	*20*		63	*95*		69	*93*			-			-
03:00	8:	8 3	-			-		: 6	*29*		6a	*96*		: a	*26*			-			-
04:00	898	3	-			-		688	*800*		688	*800*		686	*809*			-			-
05:00	8.	8 3	-			-		6#6	*948*		6#a	*946*		6#9	*943*			-			-
06:00	848	3	-			-		366	*588*		a. :	*672*		a#9	*643*			-			-
07:00	8#8	3	-			-		6%6a	*8,296*		6%3#	*8,954*		6%66	*8,299*			-			-
08:00	8a8	3	-			-		6%8a4	*8,061*		6%64	*8,891*		6%4#	*8,014*			-			-
09:00	838	3	-			-		4. a	*176*		4aa	*166*		4. a	*176*			-			-
10:00	688	3	-			-		469	*183*		4#.	*147*			-			-			-
11:00	668	3	-		496	*138*		4#8	*140*		4a.	*167*			-			-			-
12:00	668	3	-		#4a	*416*		#: 4	*421*		#6#	*494*			-			-			-
13:00	6:	8 3	-		4a6	*169*		4#6	*148*		436	*158*			-			-			-
14:00	698	3	-		a9:	*632*		a6a	*686*		a63	*695*			-			-			-
15:00	6.	8 3	-		6%. 6	*8,879*		6%86	*8,908*		6%84	*8,901*			-			-			-
16:00	648	3	-		6%6:	*8,982*		6%#6	*8,949*		6%: .	*8,927*			-			-			-
17:00	6#8	3	-		6%#8	*8,840*		6%6#	*8,984*		6%33	*8,955*			-			-			-
18:00	6a8	3	-		#a#	*464*		a43	*615*		389	*503*			-			-			-
19:00	638	3	-		94:	*312*		9a4	*361*		486	*108*			-			-			-
20:00	688	3	-		96#	*384*		9: 3	*325*		. 84	*701*			-			-			-
21:00	668	3	-		6##	*944*		: : .	*227*		: . .	*277*			-			-			-
22:00	668	3	-		6. 6	*878*		683	*905*		68:	*902*			-			-			-
23:00	6:	8 3	-		683	*805*		66:	*882*		666	*898*			-			-			-
Daily Total	-	-	-	-	-	-	-	14,160	*14,160*	-	14,515	*14,515*	-	-	-	-	-	-	-	-	-
AM Peak	-	-	-	-	-	-	-	1,328	*1,328*	-	1,297	*1,297*	-	1,322	*1,322*	-	-	-	-	-	-
x F2u	0	0	-	0	0	-	0	8##88	*04:00*	0	8##88	*04:00*	0	8##88	*04:00*	0	0	-	0	0	-
MD Peak	-	-	-	-	-	-	-	818	*818*	-	829	*829*	-	-	-	-	-	-	-	-	-
x F2u	0	0	-	0	0	-	0	69888	*83:00*	0	69888	*83:00*	0	0	-	0	0	-	0	0	-
PM Peak	-	-	-	-	1,213	*1,213*	-	1,272	*1,272*	-	1,299	*1,299*	-	-	-	-	-	-	-	-	-
x F2u	0	0	-	0	64888	*81:00*	0	64888	*81:00*	0	6#888	*84:00*	0	0	-	0	0	-	0	0	-
Daily Peak	-	-	-	-	-	-	-	1,328	*1,328*	-	1,299	*1,299*	-	-	-	-	-	-	-	-	-
x F2u	0	0	-	0	0	-	0	8##88	*04:00*	0	6#888	*84:00*	0	0	-	0	0	-	0	0	-
₀ F, vFtoc	0	0	-	0	0	-	0	3P₀	*5.3%*	0	aP₀	*6.5%*	0	0	-	0	0	-	0	0	-
Daily Ave	-	-	-	-	-	-	-	590	*590*	-	605	*605*	-	-	-	-	-	-	-	-	-
Seol FnocrGtu				6R869	6R869		6R869	6R869		6R869	6R869		6R869	6R869							
DoZCrGtu				8P3: 6	8P3: 6		8P368	8P368		8P364	8P364		8P3a:	8P3a:							
U5ceroGtFu				8P9a:	8P9a:		8P9a:	8P9a:		8P9a:	8P9a:		8P9a:	8P9a:							
-2derGtu				6R888	6R888		6R888	6R888		6R888	6R888		6R888	6R888							
hOeuocrGtu	8R888	8R888		8P366	8P366		8P388	8P388		8P384	8P384		8P3#6	8P3#6		8R888	8R888		8R888	8R888	

Hour	Mon-Thurs Average			Mon-Fri Average			7 Day Average			Estimated Annual Ave		
	Undivided	Hwy	*Total*	Undivided	Hwy	*Total*	Undivided	Hwy	*Total*	Undivided	Hwy	*Total*
00:00	388	3	*73*			-			-		. 8	*70*
01:00	368	3	*20*			-			-		6a	*96*
02:00	368	3	*96*			-			-		64	*91*
03:00	8:	8 3	*22*			-			-		: 8	*20*
04:00	898	3	*808*			-			-		3:	*52*
05:00	8.	8 3	*943*			-			-		6. 9	*973*
06:00	848	3	*645*			-			-		a69	*683*
07:00	8#8	3	*8,281*			-			-		6%63	*8,985*
08:00	8a8	3	*8,052*			-			-		6%66	*8,089*
09:00	838	3	*116*			-			-		463	*185*
10:00	688	3	*137*			-			-		. a6	*769*
11:00	668	3	*117*			-			-		48.	*107*
12:00	668	3	*433*			-			-		4#4	*141*
13:00	6:	8 3	*168*			-			-		463	*185*
14:00	698	3	*620*			-			-		#. .	*477*
15:00	6.	8 3	*8,861*			-			-		6%#a	*8,046*
16:00	648	3	*8,930*			-			-		6%6#	*8,894*
17:00	6#8	3	*8,995*			-			-		6%6#	*8,884*
18:00	6a8	3	*672*			-			-		##.	*447*
19:00	638	3	*784*			-			-		943	*315*
20:00	688	3	*373*			-			-		96:	*382*
21:00	668	3	*299*			-			-		63:	*952*
22:00	668	3	*866*			-			-		6#8	*840*
23:00	6:	8 3	*883*			-			-		689	*803*
Daily Total	-	14,144	*14,144*	-	-	-	-	-	-	-	12,928	12,928
AM Peak	-	1,316	*1,316*	-	-	-	-	-	-	-	1,219	*1,219*
x F2u	0	8##88	*04:00*	0	0	-	0	0	-	0	8##88	*04:00*
MD Peak	-	830	*830*	-	-	-	-	-	-	-	755	*755*
x F2u	0	69888	*83:00*	0	0	-	0	0	-	0	69888	*83:00*
PM Peak	-	1,240	*1,240*	-	-	-	-	-	-	-	1,127	*1,127*
x F2u	0	64888	*81:00*	0	0	-	0	0	-	0	64888	*81:00*
Daily Peak	-	1,316	*1,316*	-	-	-	-	-	-	-	1,219	*1,219*
x F2u	0	8##88	*04:00*	0	0	-	0	0	-	0	8##88	*04:00*
₀ F, vFtoc	0	3P₀	*5.2%*	0	0	-	0	0	-	0	3P₀	*5.3%*
Daily Ave	-	589	*589*	-	-	-	-	-	-	-	539	*539*

ATTACHMENT 9

ATTACHMENT 6



ATTACHMENT 9

ATTACHMENT 9

Glacial Drumlin Trail Detour

ATTACHMENT 9

WisDOT TRAFFIC FORECAST REPORT

PROJECT ID(S):	2788-01-00
ROUTE(S):	CTH TT
Region/COUNTY(IES):	SE / Waukesha
LOCATION:	West Waukesha Bypass
COMPLETED:	24 November, 2014

Developed by: Brent DesRoches
Phone: (262) 548-5611
FAX #: (262) 548-4425
E-Mail: brent.desroches@dot.wi.gov

WISCONSIN DEPARTMENT OF TRANSPORTATION

Design Values (%)

Site(s)	672707		
Routes(s)	CTH TT		
Volume(s)	18300		
Site Growth %	0.56%		
K250	10.1		
K100	10.8		
K30	11.3		
P	12.6		
D(Dsgn. Hr.)	59/41		
T(DHV)	6.7		
T(PHV)	5.9		

Site IDs are Colored, **Bolded**, and Underlined

-000-	2013 Count	(000)	2017 AADT
000	2012 Count	[000]	2027 AADT
+000+	2009 Count	000	2037 AADT
		/000/	XXXX AADT

Trucks	672707		
AADTT	1260		
2D	2.2		
3AX	0.6		
2S1+2S2	4.5		
3-S2	0.5		
DBL-BTM	0.0		
Total %	7.8%		

NOTES ON THE FORECAST:

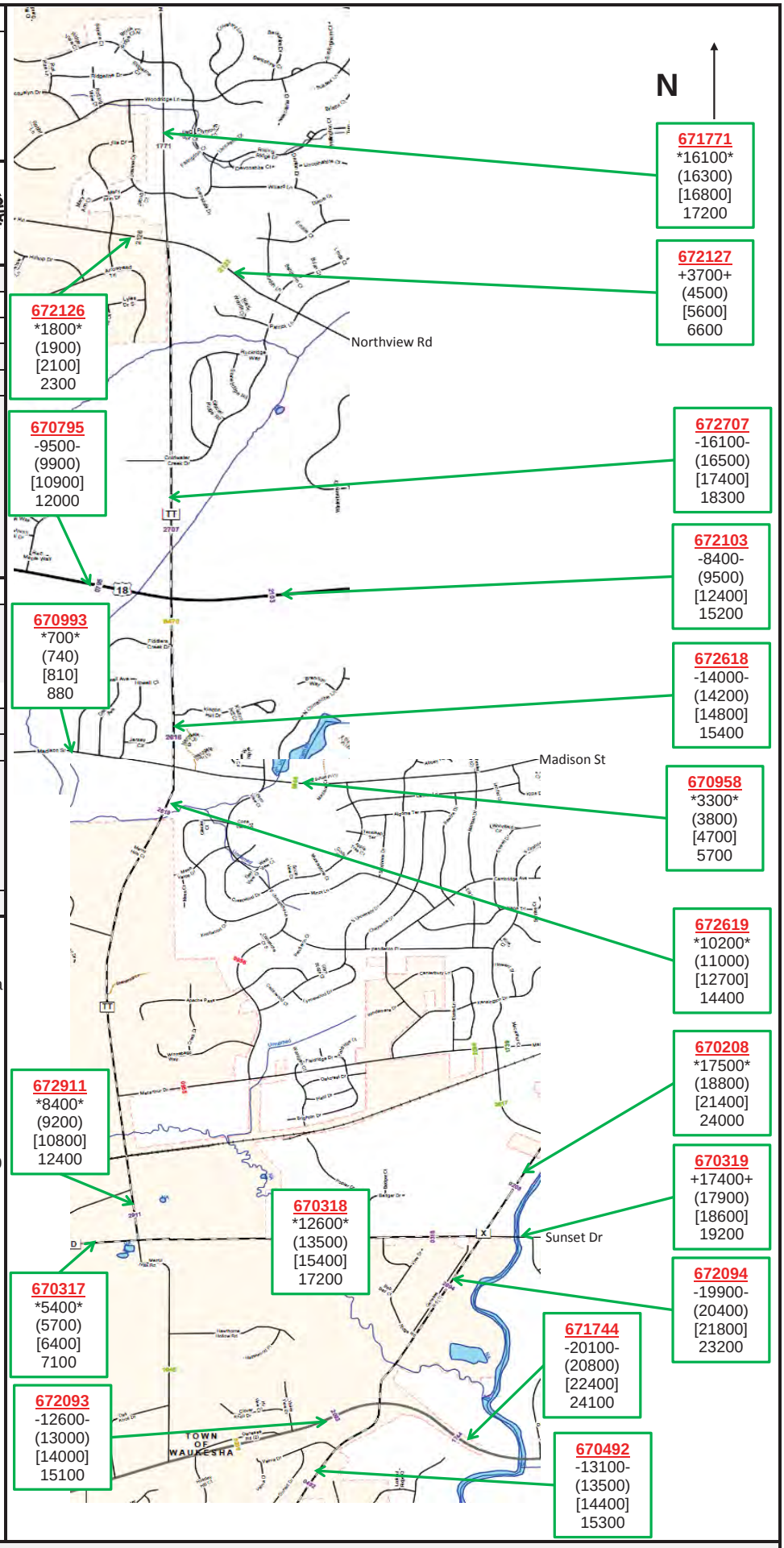
1. This projection assumes no major new traffic generators will be added to the roadway network and the West Waukesha Bypass will not be built. This is the no-build forecast and is based on SEWRPC.

2. Truck classification percentages were taken from a 2010 consultant classification tube counts as referenced in the 2010 WisDOT forecast.

3. CTH TT is a Factor Group II (Urban-Other) highway (indicating low to moderate fluctuation in traffic from a seasonal perspective). It is functionally classified as a Urban Principal Arterial (14) for count purposes.

4. The SEWRPC forecast is the basis of the volumes with the Traffic Analysis Forecasting Information System output and history regression used as comparison tools. Adjustments were made as needed.

5. 2013 volumes represent the 24 hr expanded volumes from turn movement counts.



WisDOT TRAFFIC FORECAST REPORT

PROJECT ID(S):	2788-01-00
ROUTE(S):	CTH TT
Region/COUNTY(IES):	SE / Waukesha
LOCATION:	West Waukesha Bypass
COMPLETED:	24 November, 2014

Developed by: Brent DesRoches
Phone: (262) 548-5611
FAX #: (262) 548-4425
E-Mail: brent.desroches@dot.wi.gov

Design Values (%)			
Site(s)	671771		
Routes(s)	CTH TT		
Volume(s)	26800		
Site Growth %	2.65%		
K250	10.0		
K100	10.7		
K30	11.2		
P	12.4		
D(Dsgn. Hr.)	59/41		
T(DHV)	7.1		
T(PHV)	6.2		

Site IDs are Colored, **Bolded**, and Underlined

-000-	2013 Count	(000)	2017 AADT
000	2012 Count	[000]	2027 AADT
+000+	2009 Count	000	2037 AADT
		/000/	XXXX AADT

Trucks	671771		
AADTT	2220		
2D	2.2		
3AX	0.7		
2S1+2S2	4.6		
3-S2	0.8		
DBL-BTM	0.0		
Total %	8.3%		

NOTES ON THE FORECAST:

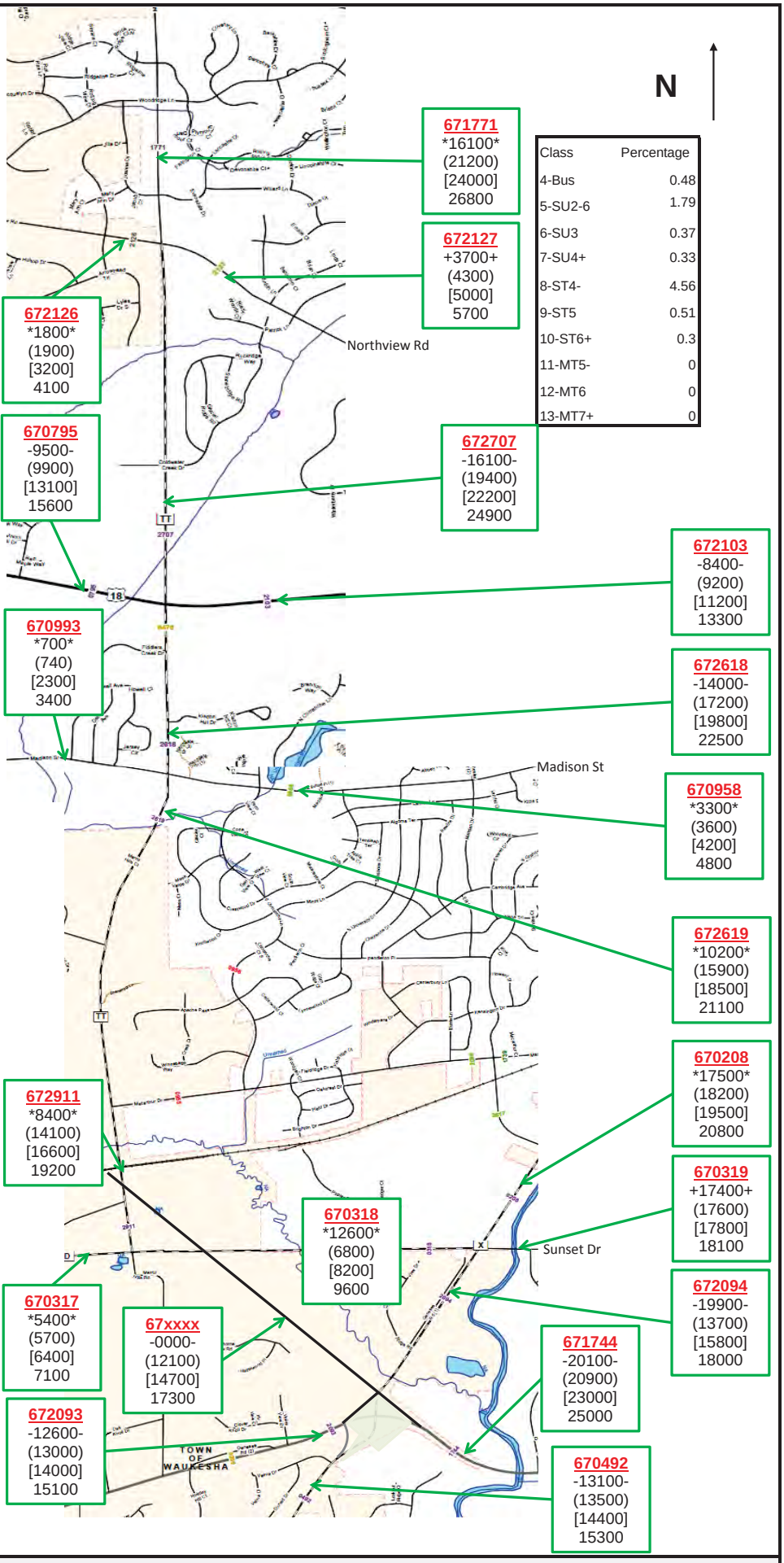
1. This projection assumes the residential development West of CTH TT will be added to the roadway network and the West Waukesha Bypass will be built. This is the build forecast.

2. Truck classification percentages were taken from a 2010 consultant classification tube counts on CTH TT North of Joanne Dr.

3. CTH TT is a Factor Group II (Urban-Other) highway (indicating low to moderate fluctuation in traffic from a seasonal perspective). It is functionally classified as a Urban Principal Arterial (14) for count purposes.

4. The Traffic Analysis Forecasting Information System output and history regression were used as a comparison tool to check against the SEWRPC forecast. Adjustments were made as needed.

5. 2013 volumes represent the 24 hr expanded volumes from turn movement counts.



PUBLIC INFORMATION & OUTREACH PLAN CHECKLIST

PIOP Checklist (Use for TMP type 2, 3 & 4 - save with project files)

1. Project Information

Project ID: 2788-00-01 | Date: 7/29/2015

2. Stakeholder Groups

Stakeholders have been Identified in the plan:	X Yes	☐ No	

Groups Identified:

Motorists	X	Pedestrians	X	Bicyclists	X	Transport Companies	☐
Businesses	X	Residents	X	City/County Officials	X	Emergency Responder	X
Bus Lines	N/A	Ferries	N/A	Mass Transit	N/A	Law Enforcement	X

Other: _____

3. Communication Issues

Communication needs have been identified:	X Yes	☐ No		
Coordination with media/schools/businesses/emergency service/adjacent regions/state:	X Yes	☐ No		

4. Communication Processes

Scheduled delays and project duration:	X Yes	☐ No		
Process meets schedule requirements:	X Yes	☐ No		
Unscheduled delays and incident clearing:	X Yes	☐ No		
Process meets response requirements:	X Yes	☐ No		
Lane Closure and Roadway closures / detours: ☐ NA	X Yes	☐ No		
Process meets response requirements:	X Yes	☐ No		
Notification of alternate route to public:	☐ Yes	X No		
Process meets response requirements	X Yes	☐ No		

5. Communication Methods

Brochures, Flyers	X	Media Release	X	Newspaper	☐	Radio	☐
Television	☐	Paid advertising	☐	Telephone Hotline	X	Internet Website	X
Public Meetings	X	Traveler Info Sign	☐			Other	X

Explain: Project website at waukeshabypass.org

6. Comments: _____

PIOP Developed by: Jennifer Sonnenberg Date: 7 / 29 / 2015

ATTACHMENT 9

TRANSPORTATION OPERATIONS PLAN CHECKLIST

TOP Checklist (Use for TMP type 2, 3 & 4 - save with project files)

1. Project Information

Project ID: 2788-00-01 Date: 7/29/2015

Transit service improvement needs identified:	X	NA		Yes		No
Transit, ridesharing, train, shuttle and bus incentives discussed:	X	NA		Yes		No
Ramps require metering:	X	NA		Yes		No
Park & Ride lots identified and improved:	X	NA		Yes		No
Signal timing/Coordination improvements identified:		NA	X	Yes		No
Need for temporary traffic signals identified:		NA	X	Yes		No
Street/intersections improvement identified:		NA	X	Yes		No
Turn/parking restrictions identified:		NA	X	Yes		No
Truck/heavy vehicle restrictions identified:		NA	X	Yes		No
Bus turnouts identified on plans:	X	NA		Yes		No
Ramp closures identified and shown on plan:	X	NA		Yes		No
Railroad crossing controls identified:		NA	X	Yes		No
Project scheduling coordinated with adjacent projects, regions/state:		NA	X	Yes		No
Speed limit reduction considered:		NA	X	Yes		No
Need for Temporary Concrete Barrier discussed and identified on plan:	X	NA		Yes		No
Movable traffic barrier system identified:	X	NA		Yes		No
Crash cushions discussed and identified on plans:	X	NA		Yes		No
Project team/task force identified:		NA		Yes	X	No
Construction leader & traffic control specialist identified:		NA		Yes	X	No
TMP monitoring/inspection personnel identified:		NA		Yes	X	No
Team meetings planned and scheduled:		NA	X	Yes		No
Use of ITS systems discussed and identified on plan:	X	NA		Yes		No
Fixed Message Sign:	X	NA		Yes		No
Portable Changeable Message Signs (PCMS):		NA	X	Yes		No

2. Comments: _____

TOP Developed by: Jennifer Sonnenberg Date 7/29/2015

ATTACHMENT 9

Attachment 10 – Roadside Hazard Analysis

Roadside Hazard Analysis

Project ID: 2788-00-01
Speed: 50 mph (design)
AADT: 8400 to 14000
Alignment: WB (Waukesha Bypass)

Entered By: NTD
Check By: NAB

Hazard ID	Station	L/R*	Total Hazard Length (ft)	Description	Action	Discussion
1	55+10 (CTH X)	R	-	Beam guard end treatment	Bridge to be replaced	Proper treatments will be included with new bridge
2	42+00 - 47+00 (CTH D)	R	500	Backslope steeper than 4:1	Reconstruct area	Slopes will be traversable when reconstructed.
3	46+90 (CTH D)	R	-	Driveway culvert lacks apron endwall	Reconstruct area	Driveway will be removed when reconstructed.
4	48+30 - 54+30 (CTH D)	R	600	Backslope steeper than 4:1	Reconstruct area	Slopes will be traversable when reconstructed.
5	54+28 (CTH D)	L	-	Mature tree	Clear and grub	Tree is within the proposed roadway and will be removed
6	47+00 - 52+00 (CTH D)	L	500	Backslope steeper than 4:1	Reconstruct area	Slopes will be traversable when reconstructed.
7	163+39 - 165+14 (Begins approx. 50' north of CTH D)	L	175	Mature trees (4)	Consider clearing and grubbing	Trees are located within clear zone, but proposed roadway is off of existing alignment in this location
8	164+25 - 166+19 (Begins approx. 135' north of CTH D)	R	194	Mature trees (4-5)	Consider clearing and grubbing	Trees are located within clear zone, but proposed roadway is off of existing alignment in this location
9	166+38 - 169+00 (Begins approx. 450' north of CTH D)	L	262	Backslope steeper than 4:1	Consider regrading	Existing ditch backslope within the clear zone is too steep, regrade ditch to correct
10	166+59 - 169+15 (Begins approx. 470' north of CTH D)	R	256	Backslope steeper than 4:1	Consider regrading	Existing ditch backslope within the clear zone is too steep, regrade ditch to correct
11	170+30 (70' north of Green Ln)	R	-	Mature tree	Consider clearing and grubbing	Trees are located within clear zone, but proposed roadway is off of existing alignment in this location
12	172+10 (300' north of Green Ln)	R	-	Mature tree	Consider clearing and grubbing	Trees are located within clear zone, but proposed roadway is off of existing alignment in this location
13	173+49 (500' north of Green Ln)	R	-	Mature tree	Consider clearing and grubbing	Tree is located within clear zone, but proposed roadway is off of existing alignment in this location
14	171+45 - 174+00 (Begins approx. 175' north of CTH D)	L	255	Mature trees (7-8)	Consider clearing and grubbing	Trees are located within clear zone, but proposed roadway is off of existing alignment in this location
15	171+45 - 174+00 (Begins approx. 175' north of CTH D)	L	255	Backslope and foreslope steeper than 4:1	Consider regrading	Existing ditch backslope within the clear zone is too steep, regrade ditch to correct
16	180+10 - 182+75 (Begins approx. 400' south of MacArthur Rd)	R	265	Mature trees (6-7)	Consider clearing and grubbing	Trees are located within clear zone, but proposed roadway is off of existing alignment in this location
17	184+80 - 189+10 (Begins just north of MacArthur Rd)	R	430	Foreslope steeper than 4:1	Consider regrading	Existing ditch foreslope within the clear zone is too steep, regrade ditch to correct
18	184+80 - 194+65 (Begins just north of MacArthur Rd)	R	985	Mature trees (10+)	Consider clearing and grubbing	Trees are located within clear zone, but proposed roadway is off of existing alignment in this location
19	195+40 - 199+65 (Just north of Rocky Hills Ct)	L	425	Foreslope steeper than 4:1	Consider regrading	Existing ditch foreslope within the clear zone is too steep, regrade ditch to correct
20	195+91 - 199+66 (Begins approx. 250' north of Rocky Hills Ct)	R	375	Backslope steeper than 4:1	Consider regrading	Existing ditch backslope within the clear zone is too steep, regrade ditch to correct
21	208+88 (Approx 350' south of Shananagi Ln)	R	-	Mature tree	Consider clearing and grubbing	Tree is located within clear zone, but proposed roadway is off of existing alignment in this location
22	209+00 - 209+50 (Begins approx. 250' south of Shananagi Ln)	R	50	Foreslope steeper than 4:1	Consider regrading	Existing ditch backslope within the clear zone is too steep, regrade ditch to correct
23	209+50 - 211+12 (Begins approx. 200' south of Shananagi Ln)	R	162	Backslope steeper than 4:1	Consider regrading	Existing ditch backslope within the clear zone is too steep, regrade ditch to correct
24	209+24 - 209+67 (Begins approx. 225' south of Shananagi Ln)	L	43	Backslope steeper than 4:1	Consider regrading	Existing ditch backslope within the clear zone is too steep, regrade ditch to correct
25	210+31 (Approx 130' south of Shananagi Ln)	L	-	Mature tree	Consider clearing and grubbing	Tree is located within clear zone, but proposed roadway is off of existing alignment in this location
26	210+00 - 211+00 (Begins approx. 100' south of Shananagi Ln)	L	100	Split rail wooden fence	Consider removal	Fence should be removed and installed out of the clear zone
27	212+38 - 217+34 (Begins approx. 150' north of Shananagi Ln)	R	496	Brush and mature trees	Consider clearing and grubbing	Trees are located within clear zone, but proposed roadway is off of existing alignment in this location
28	212+38 - 221+00 (Begins approx. 150' north of Shananagi Ln)	R	862	Backslope steeper than 4:1	Consider regrading	Existing ditch backslope within the clear zone is too steep, regrade ditch to correct
29	212+82 - 217+00 (Begins approx 250' north of Shananagi Ln)	L	418	Foreslope steeper than 4:1	Consider regrading	Existing ditch foreslope within the clear zone is too steep, regrade ditch to correct
30	215+00	L	-	Mature trees (4)	Trees to remain	Verify trees are beyond the realigned roadway's clear zone
31	218+63	L	-	Mature tree	Clear and grub	Tree is within the proposed roadway and will be removed
32	219+34	L	-	Mature tree	Clear and grub	Tree is within the proposed roadway and will be removed
33	224+46 - 224+70	L	24	Mature trees	Clear and grub	Trees are within the proposed roadway (cul-de-sac) and will be removed

Hazard ID	Station	L/R*	Total Hazard Length (ft)	Description	Action	Discussion
34	224+70 - 226+71	L	201	Mature trees	Consider clearing and grubbing	Trees are located within clear zone, but proposed roadway is off of existing alignment in this location
35	227+24	L	-	Mature tree	Consider clearing and grubbing	Tree is located within clear zone, but proposed roadway is off of existing alignment in this location
36	228+74	L	-	Mature tree	Consider clearing and grubbing	Tree is located within clear zone, but proposed roadway is off of existing alignment in this location
37	229+81	L	-	Driveway culvert lacks apron endwall	Consider replacing culvert	Replace existing driveway culvert and use appropriate apron endwall
38	241+50 - 244+00	L	250	Backslope steeper than 4:1	Reconstruct area	Slopes will be traversable when reconstructed.
39	241+50 - 244+00	L	250	Mature trees	Clear and grub	Trees are within the proposed roadway clear zone and will should be removed
40	243+00 - 244+30	R	130	Mature trees (10+)	Clear and grub	Trees are within the proposed roadway and will be removed
41	246+10	L	-	Mature tree	Clear and grub	Tree is within the proposed roadway and will be removed
42	246+20	R	-	Mature tree	Clear and grub	Tree is within the proposed roadway and will be removed
43	247+39 - 248+56	R	117	Foreslope steeper than 4:1	Reconstruct area	Slopes will be traversable when reconstructed.
44	248+56 - 252+73	R	417	Backslope steeper than 4:1	Reconstruct area	Slopes will be traversable when reconstructed.
45	250+80	L	-	Mature tree	Clear and grub	Tree is within the proposed roadway and will be removed
46	253+00 - 254+40	L	140	Backslope steeper than 4:1	Reconstruct area	Slopes will be traversable when reconstructed.
47	255+80 - 256+70	L	90	Riprap lined ditch	Reconstruct area	Slopes will be traversable when reconstructed.
48	256+00 - 260+00	R	400	Backslope steeper than 4:1	Reconstruct area	Slopes will be traversable when reconstructed.
49	257+00 - 259+50	L	250	Backslope steeper than 4:1	Reconstruct area	Slopes will be traversable when reconstructed.

* L/R designation dependent on the existing road alignment in locations where proposed roadway is off alignment. Stationing based on proposed alignment.

Attachment 11 – Trans 75 Documentation

MEMORANDUM

CH2MHILL®

West Waukesha Bypass

TRANS 75 Exception

PREPARED FOR: Doug Cain/WisDOT SE Region
Chris Squires/WisDOT SE Region

COPY TO: Gary Evans/Waukesha County

PREPARED BY: Charlie Webb/CH2M HILL
Zach Bentzler/CH2M HILL

DATE: July 8, 2013

Location and Type of Project

The project area is on the west side of the City of Waukesha in central Waukesha County (**Exhibit 1**) in the Town of Waukesha, City of Waukesha, and City of Pewaukee (**Exhibit 2**). The project termini are I-94 on the north and the intersection of WIS 59 and County X on the south.

Waukesha County, in consultation with the Wisconsin Department of Transportation (WisDOT) and the Federal Highway Administration (FHWA), is proposing to improve the safety and efficiency of the arterial connection between the WIS 59/County X intersection and I-94 on Waukesha's west side.

Currently, County TT (also signed as Meadowbrook Road north of Madison Street and Merrill Hills Road south of Madison Street) has a two-lane typical section from WIS 59 to Rolling Ridge Drive and a four-lane typical section from Rolling Ridge Drive to I-94. The corridor lacks paved shoulders from WIS 59 to US 18 (Summit Avenue). From Summit Avenue to just south of Rolling Ridge Drive the roadway has 7-foot to 8-foot paved shoulders (**Exhibit 3**). A paved shared-use path currently parallels the roadway on its east side from Summit Avenue to I-94 and a sidewalk parallels the roadway on its west side from just north of Northview Road to Rolling Ridge Drive. There are no on-road or off-road bicycle or pedestrian accommodations from WIS 59 to Summit Avenue.

The preferred alternative (Pebble Creek West Alternative) would reconstruct County Highway TT on alignment from I-94 to Madison Street. From Madison Street to the Glacial Drumlin State Trail the highway would be constructed off its existing alignment west of where it is currently located. From the Glacial Drumlin State Trail to WIS 59/County X the highway would be built off alignment east of where it is currently located (**Exhibit 4**). The roadway would have varying four-lane typical sections through the entire project corridor (**Exhibit 5**).

Existing traffic along County TT ranges from 8,320 to 14,830 vehicles per day (vpd) and is expected to reach 13,000 to 20,000 vpd in 2035. The highest existing volumes along County TT are between Northview Road and Summit Avenue. Traffic volumes forecast for 2035 would be 23 to 56 percent higher than 2009 volumes.

Bicycle and Pedestrian Aspects of the Pebble Creek West Alternative

Exhibit 6 summarizes proposed bicycle and pedestrian accommodations through the entire corridor.

Rolling Ridge Drive to Sunset Drive

Rolling Ridge Drive to Northview Road

Between Rolling Ridge Drive and Northview Road, County TT, which is a 2-lane roadway, would be widened to the west to continue the 4-lane divided urban section in place today north of Rolling Ridge Drive. The roadway would have a 24-foot-wide raised grass median, including curb and gutter, two 12-foot lanes in each direction, and a 4-foot outside offset and curb and gutter on the outside. The existing sidewalk would remain on the west side. An existing shared-use path would remain on the east side of the road (**Exhibit 5**).

The sidewalk on the west side of County TT would be extended south through the Northview Road intersection from its current terminus just north of Northview Road (**Exhibit 6**). The posted speed north of Northview Road would be 25 to 35 mph.

Northview Road to Summit Avenue

Between Northview Road and Summit Avenue, the widening would consist of 4 lanes and a 30-foot-wide median (a 22-foot-wide raised median with curb and gutter and a 4-foot-wide inside shoulder on each side). There would be an 8-foot-wide paved shoulder outside the travel lanes and curb and gutter. The shared-use path east of County TT would not be affected, and a new sidewalk, constructed on the west side of the roadway, would tie into the sidewalk north of Northview Road. The posted speed north of Summit Avenue would remain at 45 mph.

Summit Avenue to Sunset Drive

South of Summit Avenue, the 4-lane widening of County TT would have the same typical section as north of Summit Avenue. The posted speed limit would remain at 45 mph.

South of Madison Street, County TT would mostly be located on a new alignment. The shared-use path would continue along the east side of the roadway to Sunset Drive. The sidewalk would continue on the west side of the new roadway to the southern boundary of the Kame Terrace subdivision. The expanded County TT would cross where the existing road is today and go through the farm fields west of the existing road, behind the residences along existing County TT. MacArthur Road would be extended to intersect the new alignment. Between to the southern boundary of the Kame Terrace subdivision and Sunset Drive, grading for sidewalks on the west side of the roadway would be performed during construction of the roadway but no sidewalk would be constructed. Sidewalk could be constructed in the future if new development occurs along this segment. Existing County TT would be left in place to act as a frontage road for residences along existing County TT. An exception to TRANS 75 based on "Absence of Need" is requested for not constructing sidewalk for the 1.3-mile segment between the southern boundary of the Kame Terrace subdivision and Sunset Drive. The posted speed between Madison Street and the railroad would remain at 45 mph.

Existing County TT would be closed north of the Glacial Drumlin State Trail, and that part of the road could be used for trail parking as access to the trail would be provided here.

South of the new MacArthur Road intersection, the new roadway would cross Pebble Creek, existing County TT, the Glacial Drumlin State Trail, and the Wisconsin & Southern Railroad on a bridge. Bike accommodations would be provided on the bridge by a 10-foot-wide outside shoulder on the west side of the bridge and a 12-foot shared use path on the east side of the bridge. The 12-foot shared use path would be separated from the two northbound travel lanes by a 10-foot shoulder and a concrete parapet. Sidewalk would be provided on the west side of the bridge (**Exhibit 7**). After the bridge touches down south of the railroad, the roadway would be east of existing County TT. The posted speed limit would remain at 45 mph.

Absence of Need. There is currently no development along the preferred alternative route between the southern boundary of the Kame Terrace subdivision and Sunset Drive that would have direct access to the new roadway. The Town of Waukesha Land Use Plan calls for low-density residential development in this corridor between Kame Terrace and Sunset Drive by 2035. Low-density development is defined as 20,000 square feet (sq ft) to 43,560 sq ft (1 acre) lot sizes (**Exhibit 8**).

Trans 75 permits the exclusion of pedestrian facilities based on Exception 4 "Absence of Need" if the area in question averages or is planned to average more than 200 feet between buildings. On the low end of the allowed lot size (20,000 sq ft) homes could be on average 200 feet apart depending on the configuration of the parcels. For example if homes were placed in the center of a (200-foot wide by 100-foot deep parcel); however, if the homes were placed in the center of a square lot the distance between homes would be less than 200 feet. Properties on the high end of the allowed lot size (1 acre), if square, would result in residences more than 200 feet apart on average. Because this area is not located within a city or village and the planned development density could result in less dense development than the *semi-urban district* criteria allow for, WisDOT determined that the segment of roadway between the southern boundary of the Kame Terrace subdivision and Sunset Drive meets

the definition of an *outlying district*. Therefore, it qualifies for an "Absence of Need" exception (FDM 11-46, 1.3.1.4)

Sunset Drive to WIS 59

Between Sunset Drive and the southern terminus at WIS 59 several alternatives were considered and the Pebble Creek West Alternative has been selected as the preferred alternative. The Pebble Creek West alternative has the following features:

- A four-lane divided typical section with 10-foot outside shoulders (8-foot paved) for on-road bicycle accommodations (**Exhibit 5**).
- It would affect the Pebble Creek corridor which contains high quality wetlands including a fen, threatened and endangered species habitat, floodplain and primary environmental corridor. As a result the project team is seeking an exception to TRANS 75 to not provide sidewalk between Sunset Drive and WIS 59 based on Exception 3 "Constrained Environment".
- The roadway cross section would be narrowed south of Sunset Drive to further minimize wetland impacts by narrowing the median to 14 feet. A two-foot inside median was considered but rejected by FHWA for safety reasons.

Two-lane cross sections were evaluated but would not provide enough capacity for forecast traffic volumes.

Constrained Environment. South of Sunset Drive, the new roadway would be on the west edge of the Pebble Creek wetland complex.

There are several connected wetlands in the project area, ranging from a 1-acre fen to 15- to 20-acre wetlands. There is approximately 95 acres of total wetland between Sunset Drive and WIS 59/County X. Most of the wetland and some of the upland adjacent to the wetland are in primary environmental corridor. Constructing the roadway without sidewalks would result in approximately 3.3 acres of wetland impacts, while providing sidewalk on both sides would impact 3.9 acres of wetland and providing sidewalk on one side would impact 3.6 acres of wetland. WisDOT has committed to US EPA, DNR and Corps of Engineers to minimize wetland impacts to the extent practicable to demonstrate compliance with Clean Water Act. Adding sidewalk would also increase impacts to a high-quality upland forest in the primary environmental corridor.

A boardwalk was evaluated but rejected because of the wetland impacts that would be incurred during and after its construction and its cost. A search of board walk costs found $60-$200 per square foot (the $60 per sf cost assumed some volunteer labor). For the 3/4-mile segment between Sunset Drive and WIS 59 that would cost $1.2 to $3.9 million. Association of State Wetland Managers 2006 (aswm,org/pdf_lib/2_boardwalk_6_26_06.pdf) and North Carolina DOT (connect.ncdot.gov/municipalities/planning grants).

Because the inclusion of off-road pedestrian facilities through the wetland corridor would increase wetland and upland impacts and because WisDOT has committed to resource agencies to minimize wetland impacts to the extent practicable WisDOT determined the segment of roadway between Sunset Drive and WIS 59/County X, including County X from the southern project terminus to Ridge Road, qualifies for a "Constrained Environment" exception.

City of Waukesha Bikeway Facilities Plan. The City of Waukesha Bikeway Facilities Plan calls for a shared-use path between the Glacial Drumlin State Trail and WIS 59 (**Exhibit 9**). The plan was prepared during the early stages of the West Waukesha Bypass study. At the time the West Waukesha Bypass study team assumed a shared-use path adjacent to the West Waukesha Bypass and relayed this information to the City of Waukesha's bike plan consultant. After the alternatives were narrowed to a reasonable range and impacts were calculated the US EPA and Corps of Engineers pressed WisDOT and Waukesha County to minimize the typical section by eliminating the shared-use path and sidewalk. So the City's plan reflects a shared-use path in this segment because the West Waukesha Bypass study, in its early stages, suggested that a shared-use path would be built in this location. The City of Waukesha has been contacted for comment on the proposed omission of the shared-use path. No

response has been received. This segment of the project is not in the City of Waukesha. On-road bike accommodations will be provided by paved shoulders.

Type of Resource Being Avoided/Minimized

Based on 2010 wetland boundary determinations, wetlands in the project area range in size from less than 0.01 acre to over 55 acres. The 2011/2012 wetland delineations found fresh (wet) meadow, riparian forested wetland, shallow marsh and southern wet to wet-mesic hardwoods, shrub-carr and southern sedge meadow. The large wetland complex along Pebble Creek in the southern part of the project area (between Sunset Drive and WIS 59) is a mosaic of wetland types.

A fen is located in the Pebble Creek corridor south of Sunset Drive. Fens are wetlands supported by groundwater and tend to be of higher quality than other wetland types. The fen in the project area is a sedge fen, not the rarer calcarious fen. Invasive species have a harder time establishing in the fens because the groundwater carries the seeds away from the wetland. However, fens can be affected by runoff, allowing invasive species such as buckthorn to take hold. This creates management problems and degrades the floristic quality of the wetland. The narrower the footprint of the roadway, less fen will be affected and less stormwater run-off will be generated.

Don Reed, SEWRPC chief biologist, stated at the July 2011 inter-agency meeting that the Pebble Creek wetlands make up the best remaining wetland complex in and around the City of Waukesha. At the same meeting Maureen Millmann/DNR said there is a difference in wetland quality on either side of Sunset Drive. The wetlands south of Sunset Drive are generally of higher quality but some of that high quality wetland is present immediately north of Sunset Drive as well. There are several wetlands south of Sunset Drive, ranging from a 1-acre fen to 15- to 20-acre wetlands. Most of the wetland, and some of the upland adjacent to the wetland, are in primary environmental corridor. There is approximately 95 acres of total wetland between Sunset Drive and WIS 59/County X.

The US EPA and Corps of Engineers have also noted the high quality of the Pebble Creek wetland and have requested on several occasions that Waukesha County and WisDOT pursue a TRANS 75 exception for "Constrained Environment" south of Sunset Drive.

Alternative Accommodations for Bicyclists and Pedestrians south of Sunset Drive

If bicyclist choose to not to use the on-road bike accommodations on the new roadway south of Sunset Drive the DNR's Glacial Drumlin State Trail provides an off-road bike/pedestrian connection to the east and west about one-quarter to one-half mile north of, and roughly parallel to, Sunset Drive. The off-road shared-use path built as part of the project will have a connection to the Glacial Drumlin State Trail. The Glacial Drumlin State Trail provides a connection to Grandview Boulevard (about 1.25 miles east of the project) which in turn connects to County X. It is about 1.25 miles between where the Glacial Drumlin State Trail meets Grandview Boulevard and where County X intersects with the new roadway. The Glacial Drumlin Trail directly connects MacArthur Road, Grandview Boulevard and the north-south Fox River Trail about 2 miles east of the proposed project. The off-road Fox River trail crosses under WIS 59 about one-half mile east of the project's south terminus.

Summary of Bicycle and Pedestrian Measures Being Incorporated

The project would include on-road bicycle accommodation throughout, off-road bicycle accommodation from Sunset Drive to Rolling Ridge Drive, and off-road pedestrian accommodation from Kame Terrace to Rolling Ridge Drive. No sidewalk would be provided on the west side of the new roadway from Sunset Drive to the southern boundary of the Kame Terrace subdivision but grading for sidewalks would occur during construction. WisDOT, Waukesha County, and the Town of Waukesha believes an "Absence of Need" exception outlined in Wisconsin Administrative Code, Trans 75.06 is warranted in this segment (see attached resolutions). The on-road bicycle accommodation would be in the form of a paved shoulder.

A 10-foot-wide shared-use path would be built parallel to the east side of new or reconstructed roadway to accommodate pedestrians and bicyclists between Rolling Ridge Drive (north terminus) and Sunset Drive. The shared-use path would provide a safe connection between the Glacial Drumlin State Trail and the Lake Country

Trail north of I-94. Many public comments noted it is unsafe to walk or ride bikes along County TT and asked for a connection between the Glacial Drumlin State Trail and the existing shared-use path.

Between WIS 59 and Sunset Drive the new roadway would include on-road bicycle accommodation but not off-road bicycle or pedestrian accommodations, and no provision would be made for future accommodations, because of the compressed typical section asked for by the Corps of Engineers and US EPA. WisDOT, Waukesha County, and the Town of Waukesha believes a "Constrained Environment" exception outlined in Wisconsin Administrative Code, Trans 75.06 is warranted in this segment, including County X from southern project terminus to Ridge Road (see attached resolutions). The on-road bicycle accommodation would be in the form of a paved shoulder.

TRANS 75 COMPLETE STREETS COMPLIANCE CHECK SHEET

Project ID	Highway/Roadway	Limits/Termini	
2788-01-00	West Waukesha Bypass (existing CTH TT)	Sunset Drive to Kame Terrace (Overall project limits STH 59 to Rolling Ridge Drive) Exception limits are on the west side of the roadway from Sunset Drive to Kame Terrace	
County: Waukesha	Unit of Government: Town of Waukesha, City of Waukesha, and City of Pewaukee	Existing AADT (year): 8,300 to 14,600 vpd in 2009	Design Year AADT (year): 18,000 vpd in 2035
List of local land use plans reviewed /considered. Town of Waukesha Smart Growth Plan, City of Waukesha Land Use Plan	List of regional land use plans reviewed /considered. SEWRPC 2035 Regional Land Use Plan	List of local transportation and/or bicycle/pedestrian plans reviewed /considered. City of Waukesha Bike/Ped Plan, Waukesha County Comprehensive Plan	List of regional transportation and/or bicycle/pedestrian plans reviewed /considered. An Amendment to the Regional Bicycle and Pedestrian Facilities System Plan for Southeastern Wisconsin: 2020 (SEWRPC December 2001)

Existing Facility
Number of Lanes: 2
~~Lane Width: 11 to 12 feet~~
Cross Section Shoulder Type:
☒ Rural Shoulder width (paved): 0 feet
☐ Urban
Sidewalk: ☒ Yes ☒ No ☐ Other: Sidewalk on west side of CTH TT from Rolling Ridge Drive to Northview Road
Bike/Ped Accommodation: : ☐ Yes ☐ No ☒ Other: Off-road shared-use path on east side of CTH TT from Rolling Ridge Drive to Summit Avenue (US 18)

Proposed Improvement
Number of Lanes: 4
~~Lane Width: 12 feet~~
Cross Section Shoulder Type:
☐ Rural Shoulder width (paved): 8
☒ Urban
Sidewalk: ☐ Yes ☐ No ☒ Other: Sidewalk on west side of roadway from Rolling Ridge Drive to Kame Terrace Court. Grade for sidewalk but don't construct sidewalk between the southern boundary of the Kame Terrace subdivision and Sunset Drive.
Bike/Ped Accommodation: : ☐ Yes ☐ No ☒ Other: Off-road shared-use path on east side from Rolling Ridge Drive to Sunset Drive (CTH D). On-road bike accommodations in the form of 8-foot paved shoulder from Rolling Ridge Drive to STH 59.

Section 1 Project Type (check all that apply) (*Trans 75 and FDM 11-46-1*)

This project is:
☐ New Construction – Trans 75 applies.
☒ Reconstruction – Trans 75 applies.
☐ Pavement Replacement – Trans 75 applies.
☒ New Bridge – Trans 75 applies.
☐ Bridge Replacement – Trans 75 applies.
☐ Bridge Redecking – Trans 75 applies.
☐ Bridge Elimination – Depending on project scope, Trans 75 may apply.
☐ Other – Explain:
Go to Section 2

☐ None of the above – Improve bike/ped accommodations as appropriate, Trans 75 does not apply, go to Section 4.

Section 2 Pedestrian Accommodations (check all that apply) (FDM 11-46-5)

☒ Pedestrian accommodations **are** being provided by:
☐ Bridge overpass/underpass, accommodations addressed.
☐ Sidewalk on both sides of the highway.
* ☒ Sidewalk:
☒ On one side of the highway
☐ Sidewalk along a portion of the highway
☒ A shared use path is provided
*An exception is required. Explain mitigation efforts as part of the appropriate completed exception documentation.

☒ Pedestrian accommodations **are NOT** being fully provided because the following exceptions apply:
☐ Prohibition of Bicycles and Pedestrians - Attach Exception 1 Worksheet.
☐ Excessively disproportionate cost - Attach Exception 2 Worksheet.
☐ Constrained environment – Attach Exception 3 Worksheet.
☒ Absence of need – Attach Exception 4 Worksheet.
☐ Refusal to maintain – Attach Exception 5 Worksheet.

Section 3 Bicycle Accommodations (check all that apply) (*FDM 11-46-15*)

☒ Bicycle accommodations **are** being provided by:
☐ Bike Lanes.
☐ Bike lane/parking lane combination.
☐ Bike lane full time.
☐ Short term parking restriction. Explain
☐ Wide curb lane or wide parking lane where parking is allowed.
☒ Paved shoulders. Paved shoulder width is 8 feet.
☒ Other – Explain: off-road shared use path on east side of road
☐ Bike accommodations:
☐ On a portion of the highway
☐ A shared use path instead of on-street accommodations.** **
Requires approval from the Project Services Section Chief- attach shared use path worksheet. Exception is required. Explain mitigation efforts as part of the appropriate completed exception documentation.

☐ Bicycle accommodations **are NOT** being fully provided because the following exceptions apply:
☐ Prohibition of Bicycles and Pedestrians - Attach Exception 1 Worksheet.
☐ Excessive cost - Attach Exception 2 Worksheet.
☐ Constrained environment – Attach Exception 3 Worksheet.
☐ Parking restrictions create only partial absence
Explain:
☐ Absence of need – Attach Exception 4 Worksheet.

Section 4 Concurrence – Attach any supporting documents or reports

We concur that pedestrian and bicycle accommodations are being provided in compliance with Trans 75 or that the project satisfies one of the exceptions stipulated in Trans 75. If the project scope changes after the bike/ped coordinator signature date the project manager will re-evaluate the accommodations and engage the bike/ped coordinator in further discussions.

ATTACHMENT 11

Signature (WisDOT Regional Project Manager)

Douglas A. Cain

Printed Name (WisDOT Regional Project Manager)

Date: 9-10-13

Signature (WisDOT Regional Bicycle/Pedestrian Coordinator)

Christopher Squires

Printed Name (WisDOT Regional Bicycle/Pedestrian Coordinator)

Date: 9/10/13

EXCEPTION 1 – PROHIBITION OF BICYCLES and PEDESTRIANS WORKSHEET – FDM 11-46-1.3.1.1

Project ID	Highway/Roadway	Limits/Termini	
0000-00-00			
County	Unit of Government	Proposed posted speed	Design Year AADT (year)
Waukesha	City of		

Section 1 Highway Characteristics

Does the existing highway prohibit bicycles and pedestrians from the highway? Yes ☐ No ☐

Will the proposed highway be designated as a freeway or expressway and signed or marked to prohibit bicycles and pedestrians? Yes ☐ No ☐
(If no, Exception 1 does not apply and pedestrian/bicycle accommodations must be provided.)

Section 2 Alternative Accommodations

☐ Parallel accommodations **are** being provided through:
- ☐ Shared-use path.
- ☐ Parallel and adjacent local roadways (provide separation distance _____ feet).

Section 3 Highway Crossings

☐ The project **includes** road grade separations and/or interchanges.
List existing & proposed crossings;
1)
2)
3)
4)

☐ The project **does not include** road grade separations and/or interchanges.

☐ Pedestrian accommodations **are** being provided on the crossing roadway through:
- ☐ Sidewalks.
- ☐ Shared-use Paths.

☐ Pedestrian accommodations **are not** being provided on the crossing roadway because of:
- ☐ Excessive cost – Attach Exception 2 Worksheet.
- ☐ Constrained environment – Attach Exception 3 Worksheet.
- ☐ Absence of need – Attach Exception 4 Worksheet.
- ☐ Refusal to maintain – Attach Exception 5 Worksheet.

☐ Dedicated ped/bike crossings (eg shared use path overpass or underpasses) **are** being incorporated into the project.
Identify each and explain: (add worksheets if necessary)

☐ Dedicated ped/bike crossings (eg shared use path overpass or underpasses) have been reviewed and **are not** being incorporated into the project.
Explain:

☐ Bicycle accommodations **are** being provided on the crossing roadway through:
- ☐ Bike Lanes.
- ☐ Bike lane/parking lane combination.
  - ☐ Bike lane full time.
  - ☐ Short term parking restriction.
- ☐ Wide curb lane.
- ☐ Paved shoulders. Paved shoulder width is feet.
- ☐ Other – Explain:

☐ Bicycle accommodations **are not** being provided on the crossing roadway because of:
- ☐ Shared use path (attach appropriate exception).
- ☐ Excessive cost – Attach Exception 2 Worksheet
- ☐ Constrained environment – Attach Exception 3 Worksheet
- ☐ Absence of need – Attach Exception 4 Worksheet.

☐ Roadway work for these crossing(s) is not included within the scope of this project.
Explain:

ATTACHMENT 11

EXCEPTION 4 – ABSENCE OF NEED WORKSHEET – FDM 11-46-1.3.1.4

Resolution required for this exception. Community resolution states that conditions are met for this exception after initial consultation with WisDOT. Attach a report justifying the exception in accordance with FDM 11-46-1.3.1.4.

Project ID	Highway/Roadway	Limits/Termini	
2788-01-00	West Waukesha Bypass (existing CTH TT)	West side of County TT from Sunset Drive to Kame Terrace (Overall project limits STH 59 to Rolling Ridge Drive)	
County: Waukesha	Unit of Government: Town of Waukesha	Proposed posted speed: 45 mph	Design Year AADT (year): 18,000 vpd in 2035

Section 1 Bicycle Accommodations

If bicycle accommodation projects were proposed and funded under the Transportation Enhancement (TE), Congestion Mitigation & Air Quality (CMAQ) or Safe Routes to School (SRTS) this exception does not apply. See FDM 11-46-15.4.1, Table 15.1.

Urban/Semi Urban Roadways and Bridges

☐ The design year AADT is less than 1500 vpd.

Rural/Outlying District Roadways and Bridges (Both boxes must be checked to qualify for the exception for absence of need.)

☐ The construction year ADT is less than 750 vpd and any of the following conditions apply:

- Roadway is not in the Wisconsin Bicycle Transportation Plan or other government-endorsed WisDOT supported bicycle plan.
- Two-way bicycle volume is projected to be less than 25 cyclists per day on the 10 most traveled days of the year.
- Bicycle accommodations are not needed to complete gaps in an otherwise continuous bicycle route.
- Bicycle accommodations are not needed to connect communities or urban areas within 3 miles of each other.

☐ There will be no significant development within the next 10 years based on an official land use plan or the design year ADT is less than 750*.

* If the design year ADT is less than 750, consider establishing a bikeway that (1) will complete a gap of one mile or less in an otherwise continuous bike route (2) Make a connection of not more than 3 miles from communities or urban areas to a town or county roadway network, excluding any dead end roadway.

Section 2 Pedestrian Accommodations

Urban/Semi Urban Roadway and Bridges

☐ The roadway travels through an urban area however a portion of this roadway has an outlying district and there is no significant development, based on an official land use plan, within the next 10 years.

☐ This is a semi urban area where on each side of the roadway within any 1,000 feet along the roadway the buildings fronting thereon average not more than 200 feet apart or where both sides of the roadway considered collectively average not more than 200 feet apart (does not meet omission).

☐ Local (City, Village or Town) land use, bike and pedestrian, and transportation plans cited

☐ County land use, bike and pedestrian, and transportation plans cited

☐ MPO and/or RPC plans cited

Cite the source used to describe the planned development.

Outlying District/Rural Roadways or Bridges

☒ The roadway travels through an outlying district or rural area where on each side of the roadway within any 1,000 feet along the roadway the buildings fronting thereon average more than 200 feet apart and there is no significant development, based on an official land use plan, within the next 10 years.

☒ Local (City, Village or Town) land use, bike and pedestrian, and transportation plans cited

☐ County land use, bike and pedestrian, and transportation plans cited

☒ MPO and/or RPC plans cited

Cite the source used to describe the planned development. Town of Waukesha Smart Growth Plan calls for low density residential between Kame Terrace and Sunset Drive (20,000 sq. ft - 1 acre).

Section 3 Bicycle and Pedestrian Accommodations within Project Design Life

Roadway/Bridge Design Life

Defined as 20 years for a roadway, 75 years for a bridge (refer to FDM 1.3.1.4.1 Sidewalks, FDM 1.3.1.4.2 Bikeways).

☒ Project evaluated changing patterns of use during the design life of the highway

☒ Use is expected to increase (does not meet omission).

☐ Use is not expected to increase.

☐ Local (City, Village or Town) land use, bike and pedestrian, and transportation plans cited

☐ County land use, bike and pedestrian, and transportation plans cited

☐ MPO and/or RPC plans cited

Cite the source used to describe the planned development. Town of Waukesha Land Use Plan

TRANS 75 COMPLETE STREETS COMPLIANCE CHECK SHEET

Project ID	Highway/Roadway	Limits/Termini	
2788-01-00	West Waukesha Bypass (existing CTH TT)	STH 59 to Sunset Drive (Overall project limits STH 59 to Rolling Ridge Drive)	
County: Waukesha	Unit of Government: Town of of Waukesha, City of Waukesha, and City of Pewaukee	Existing AADT (year): no existing roadway	Design Year AADT (year): 18,000 vpd in 2035
List of local land use plans reviewed /considered. Town of Waukesha Smart Growth Plan, City of Waukesha Land Use Plan	List of regional land use plans reviewed /considered. SEWRPC 2035 Regional Land Use Plan	List of local transportation and/or bicycle/pedestrian plans reviewed /considered. City of Waukesha Bike/Ped Plan, Waukesha County Comprehensive Plan	List of regional transportation and/or bicycle/pedestrian plans reviewed /considered. An Amendment to the Regional Bicycle and Pedestrian Facilities System Plan for Southeastern Wisconsin: 2020 (SEWRPC December 2001)

Existing Facility	Proposed Improvement
Number of Lanes: N/A Lane Width: N/A Cross Section Shoulder Type: ☐ Rural Shoulder width (paved): ☐ Urban Sidewalk: ☐ Yes ☐ No ☐ Other: Bike/Ped Accommodation: : ☐ Yes ☐ No ☐ Other:	Number of Lanes: 4 Lane Width: 12 feet Cross Section Shoulder Type: ☒ Rural Shoulder width (paved): 8 ☐ Urban Sidewalk: ☐ Yes ☒ No ☐ Other: Bike/Ped Accommodation: : ☒ Yes ☐ No ☐ Other: On-road bike accommodations in the form of 8-foot paved shoulder from Sunset Drive Drive to STH 59.

Section 1 Project Type (check all that apply) (*Trans 75 and FDM 11-46-1*)

This project is:

- ☒ New Construction – Trans 75 applies.
- ☐ Reconstruction – Trans 75 applies.
- ☐ Pavement Replacement – Trans 75 applies.
- ☐ New Bridge – Trans 75 applies.
- ☐ Bridge Replacement – Trans 75 applies.
- ☐ Bridge Redecking – Trans 75 applies.
- ☐ Bridge Elimination – Depending on project scope, Trans 75 may apply.
- ☐ Other – Explain:

Go to Section 2

- ☐ None of the above – Improve bike/ped accommodations as appropriate, Trans 75 does not apply, go to Section 4.

Section 2 Pedestrian Accommodations (check all that apply) (FDM 11-46-5)

☐ Pedestrian accommodations **are** being provided by:

- ☐ Bridge overpass/underpass, accommodations addressed.
- ☐ Sidewalk on both sides of the highway.
- * ☐ Sidewalk:
  - ☐ On one side of the highway
  - ☐ Sidewalk along a portion of the highway
  - ☐ A shared use path is provided

*An exception is required. Explain mitigation efforts as part of the appropriate completed exception documentation.

☒ Pedestrian accommodations **are NOT** being fully provided because the following exceptions apply:

- ☐ Prohibition of Bicycles and Pedestrians - Attach Exception 1 Worksheet.
- ☐ Excessively disproportionate cost - Attach Exception 2 Worksheet.
- ☒ Constrained environment – Attach Exception 3 Worksheet.
- ☐ Absence of need – Attach Exception 4 Worksheet.
- ☐ Refusal to maintain – Attach Exception 5 Worksheet.

Section 3 Bicycle Accommodations (check all that apply) (*FDM 11-46-15*)

☒ Bicycle accommodations **are** being provided by:

- ☐ Bike Lanes.
- ☐ Bike lane/parking lane combination.
  - ☐ Bike lane full time.
  - ☐ Short term parking restriction. Explain
- ☐ Wide curb lane or wide parking lane where parking is allowed.
- ☒ Paved shoulders. Paved shoulder width is 8 feet.
- ☐ Other – Explain:
- ☐ Bike accommodations:
  - ☐ On a portion of the highway
  - ☐ A shared use path instead of on-street accommodations.** **

Requires approval from the Project Services Section Chief- attach shared use path worksheet. Exception is required. Explain mitigation efforts as part of the appropriate completed exception documentation.

☐ Bicycle accommodations **are NOT** being fully provided because the following exceptions apply:

- ☐ Prohibition of Bicycles and Pedestrians - Attach Exception 1 Worksheet.
- ☐ Excessive cost - Attach Exception 2 Worksheet.
- ☐ Constrained environment – Attach Exception 3 Worksheet.
  - ☐ Parking restrictions create only partial absence
    Explain:
- ☐ Absence of need – Attach Exception 4 Worksheet.

Section 4 Concurrence – Attach any supporting documents or reports

We concur that pedestrian and bicycle accommodations are being provided in compliance with Trans 75 or that the project satisfies one of the exceptions stipulated in Trans 75. If the project scope changes after the bike/ped coordinator signature date the project manager will re-evaluate the accommodations and engage the bike/ped coordinator in further discussions.

Douglas A Cain
Signature (WisDOT Regional Project Manager)

Douglas A Cain
Printed Name (WisDOT Regional Project Manager)

Date: 9-10-13

Signature (WisDOT Regional Bicycle/Pedestrian Coordinator)

Christ[illegible]
Printed Name (WisDOT Regional Bicycle/Pedestrian Coordinator)

Date: 9/10/13

EXCEPTION 1 – PROHIBITION OF BICYCLES and PEDESTRIANS WORKSHEET – FDM 11-46-1.3.1.1

Project ID	Highway/Roadway	Limits/Termini	
0000-00-00			
County: Waukesha	Unit of Government: City of	Proposed posted speed	Design Year AADT (year)

Section 1 Highway Characteristics

Does the existing highway prohibit bicycles and pedestrians from the highway? Yes ☐ No ☐

Will the proposed highway be designated as a freeway or expressway and signed or marked to prohibit bicycles and pedestrians? Yes ☐ No ☐
(If no, Exception 1 does not apply and pedestrian/bicycle accommodations must be provided.)

Section 2 Alternative Accommodations

☐ Parallel accommodations **are** being provided through:
- ☐ Shared-use path.
- ☐ Parallel and adjacent local roadways (provide separation distance _____ feet).

Section 3 Highway Crossings

☐ The project **includes** road grade separations and/or interchanges.
List existing & proposed crossings;
1)
2)
3)
4)

☐ The project **does not include** road grade separations and/or interchanges.

☐ Pedestrian accommodations **are** being provided on the crossing roadway through:
- ☐ Sidewalks.
- ☐ Shared-use Paths.

☐ Pedestrian accommodations **are not** being provided on the crossing roadway because of:
- ☐ Excessive cost – Attach Exception 2 Worksheet.
- ☐ Constrained environment – Attach Exception 3 Worksheet.
- ☐ Absence of need – Attach Exception 4 Worksheet.
- ☐ Refusal to maintain – Attach Exception 5 Worksheet.

☐ Dedicated ped/bike crossings (eg shared use path overpass or underpasses) **are** being incorporated into the project.
Identify each and explain: (add worksheets if necessary)

☐ Dedicated ped/bike crossings (eg shared use path overpass or underpasses) have been reviewed and **are not** being incorporated into the project.
Explain:

☐ Bicycle accommodations **are** being provided on the crossing roadway through:
- ☐ Bike Lanes.
- ☐ Bike lane/parking lane combination.
  - ☐ Bike lane full time.
  - ☐ Short term parking restriction.
- ☐ Wide curb lane.
- ☐ Paved shoulders. Paved shoulder width is feet.
- ☐ Other – Explain:

☐ Bicycle accommodations **are not** being provided on the crossing roadway because of:
- ☐ Shared use path (attach appropriate exception).
- ☐ Excessive cost – Attach Exception 2 Worksheet
- ☐ Constrained environment – Attach Exception 3 Worksheet
- ☐ Absence of need – Attach Exception 4 Worksheet.

☐ Roadway work for these crossing(s) is not included within the scope of this project.
Explain:

ATTACHMENT 11

EXCEPTION 3 – CONSTRAINED ENVIRONMENT WORKSHEET – FDM 11-46-1.3.1.3

Resolution required for this exception. Community resolution states that conditions are met for this exception after initial consultation with WisDOT. Attach a report justifying the exception in accordance with FDM 11-46-1.3.1.3.

Project ID	Highway/Roadway	Limits/Termini	
2788-01-00	West Waukesha Bypass (existing CTH TT)	STH 59 to Sunset Drive (Overall project limits STH 59 to Rolling Ridge Drive)	
County	Unit of Government	Proposed posted speed	Design Year AADT (year)
Waukesha	Town of Waukesha	45	18,000 vpd in 2035

Section 1 Urban Roadway Constrained Environment

☐ The minimum provision of pedestrian and bicycle accommodations (see FDM 11-46-15, Figure 15.1 for sequential preference) would have excessively negative impacts. **At least one of the following must be checked.**

- ☐ The provision of bikeway and sidewalk, or just a sidewalk, would require the reduction of the terrace width to less than 3 feet for more than 50 percent of the total project length.
- ☐ The provision of bicycle and pedestrian facilities would result in the relocation of a residence or business or improvement adjacent to the highway that would dramatically reduce the aesthetic value or functionality of the remaining area.
- ☐ The environmental documentation process shows that providing bike or pedestrian facilities would result in excessively negative impacts or would result in loss or degradation of natural resources, historical or archaeological sites potentially eligible for the National Registry of Historic Places (NRHP).

Section 2 Rural Roadway Constrained Environment

☐ The minimum provision of bicycle accommodations would have excessively negative impacts. **One of the following must be checked.**

- ☐ The provision of bicycle and pedestrian facilities would result in the relocation of a residence or business or improvement adjacent to the highway that would dramatically reduce the aesthetic value or functionality of the remaining area.
- ☐ The environmental documentation process shows that providing bicycle facilities would result in an unacceptable loss or degradation of natural resources or has an adverse impact on historical or archaeological sites potentially eligible for the National Registry of Historic Places (NRHP).

Section 3 Partial Accommodations

Urban Roadways and Bridges

Pedestrian Accommodations

If sidewalks and bikeways cannot both be accommodated, consideration shall be given to sidewalks before adding bikeways; however the project must include bike/ped facilities to the greatest extent practicable.

- ☐ Pedestrian accommodations are being provided on both sides of roadway.
- ☐ Pedestrian accommodations are being **partially** provided.

Explain:

- ☒ Pedestrian accommodations **are not** being provided.

Explain: No sidewalk provided between Sunset Drive and STH 59 due to wetland, primary environmental corridor and groundwater impacts

Bicycle Accommodations

- ☒ Bicycle accommodations are being provided.
- ☐ Bicycle accommodations are being **partially** provided.

Explain:

- ☐ Bicycle accommodations will be available for portions of the day through parking restrictions.
- ☐ Bicycle accommodations will be available on a parallel route.

Explain:

- ☐ Bicycle accommodations **are not** being provided.

Explain:

Rural Roadways and Bridges

Bicycle Accommodations

- ☒ Bicycle accommodations are being provided.
- ☐ Bicycle accommodations are being **partially** provided.

Explain:

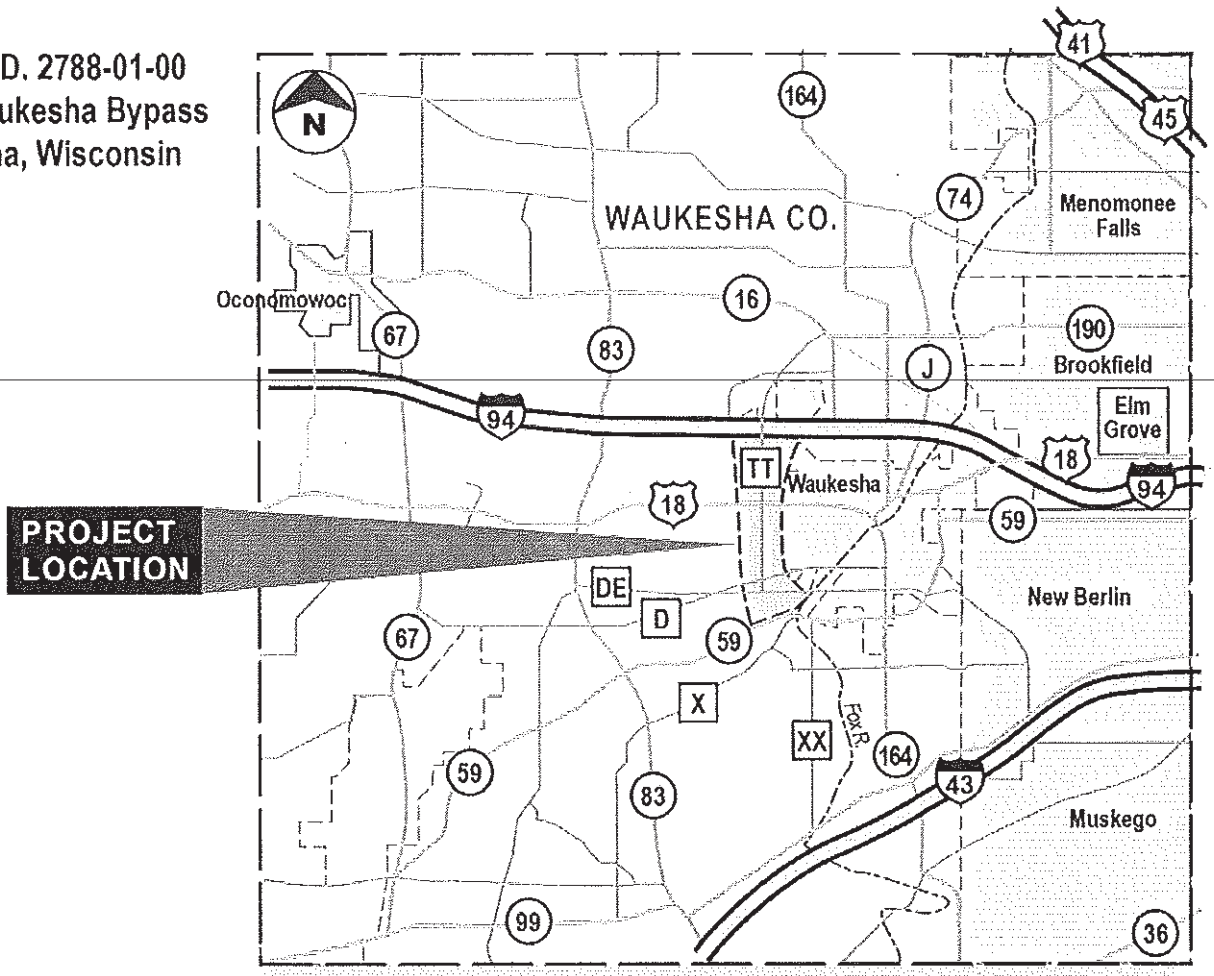
- ☐ Bicycle accommodations will be available on a parallel route.

Explain:

- ☐ Bicycle accommodations **are not** being provided.

Explain:

Project I.D. 2788-01-00
West Waukesha Bypass
Waukesha, Wisconsin



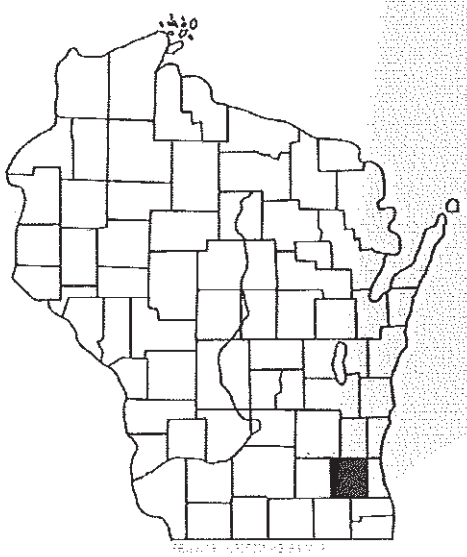


Exhibit 1
Project Location

T:\GIS\13\13163258\MXD\Trans75_Memo_WB_Exh1_Project_Location_v1.mxd 6/23/13 mj

ATTACHMENT 11

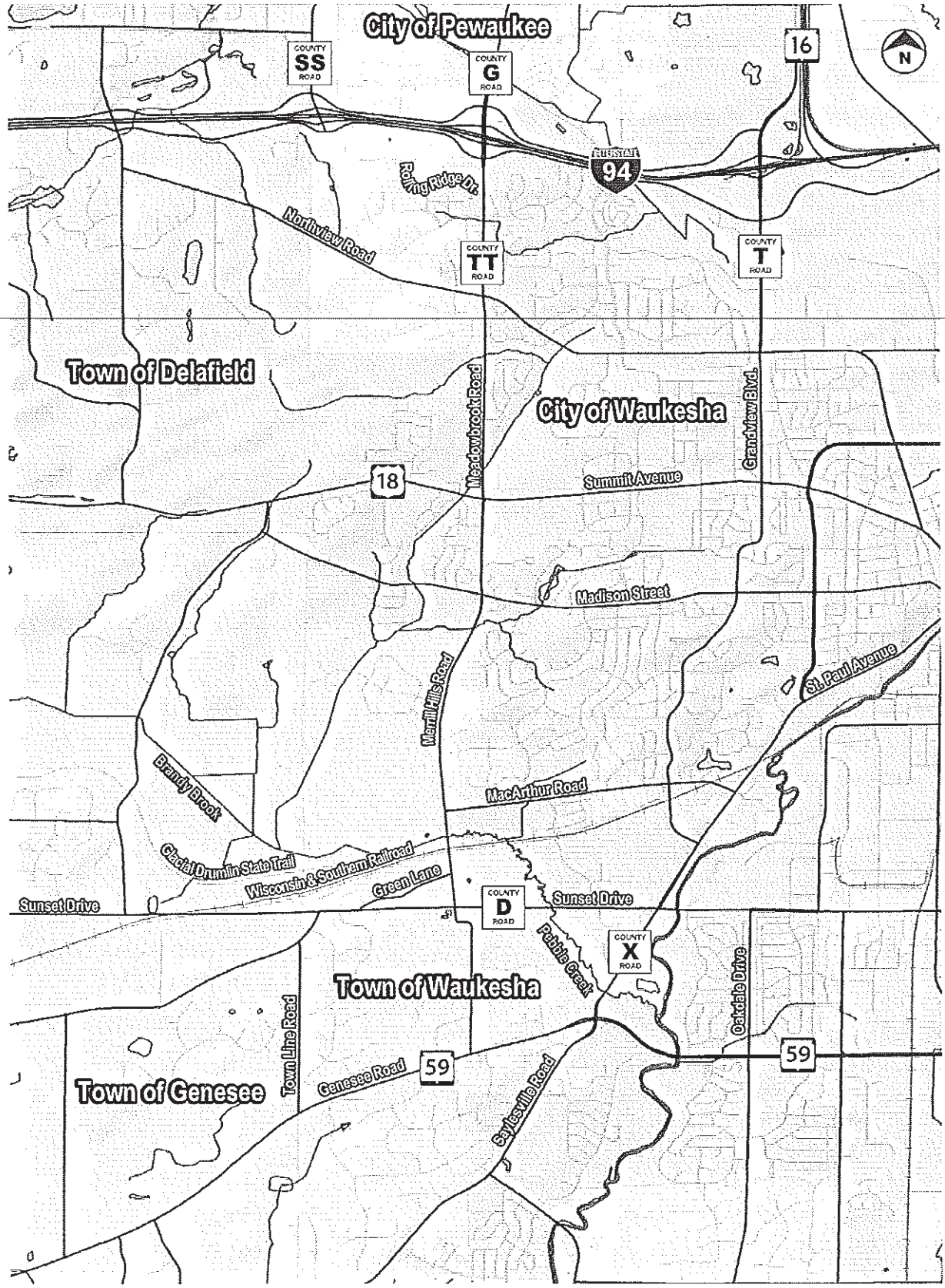


Exhibit 2

Municipal Boundaries

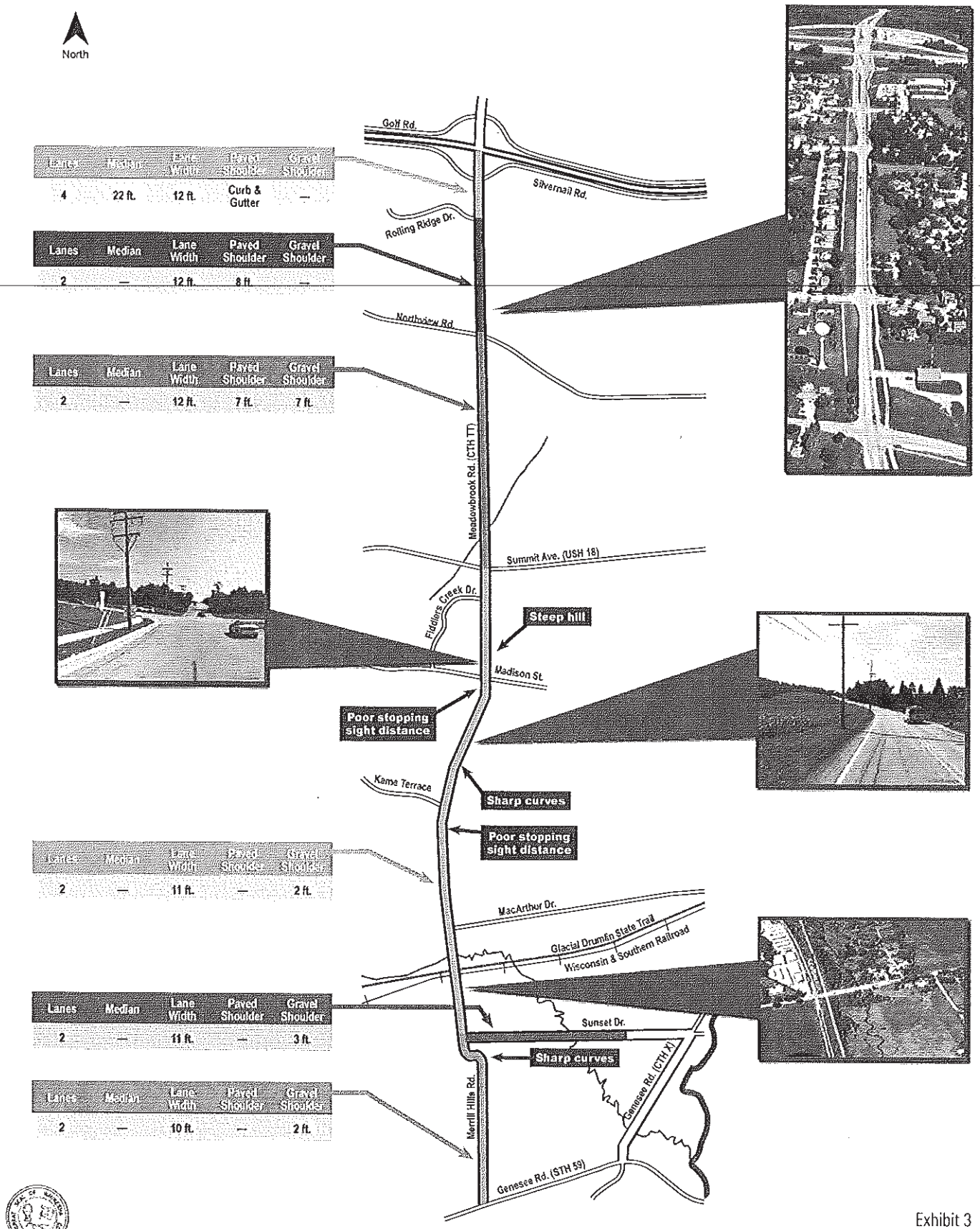
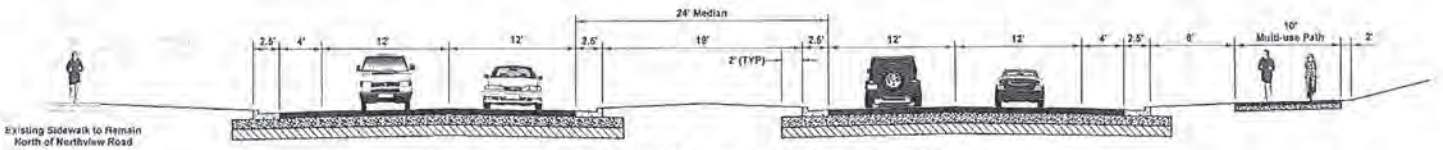


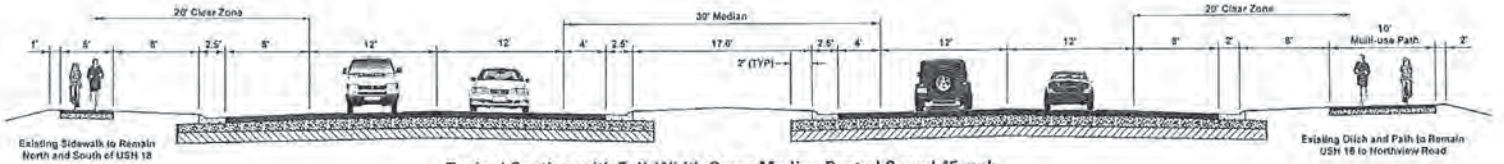
Exhibit 3

Roadway Characteristics

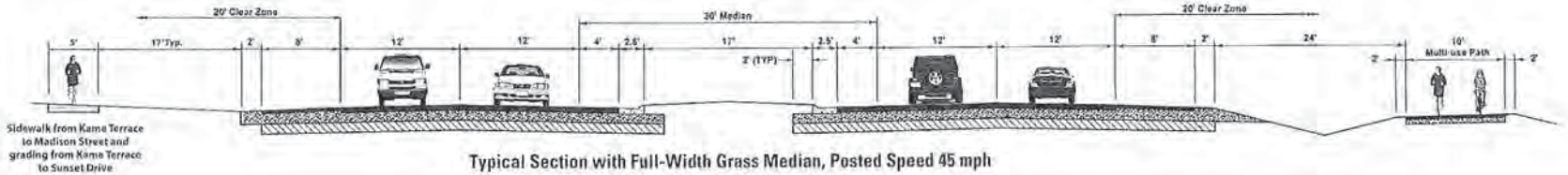
Legend
River/Stream
Railroad
Wetlands
Municipal Boundary
FEMA Floodplain
Parcel
Isolated Natural Resource Area
Primary Environmental Corridor
Secondary Environmental Corridor
Preferred Alternative Route
Note: 2008 Aerial Photography from the National Agriculture Imagery Program (NAIP)
Final Environmental Impact Statement
Waukesha Bypass - Waukesha County
Exhibit 4
Preferred Alternative
Meadow Brook School
Cities Field
Meadowview Park
Grandview Boulevard
Grandview Park
Summit Avenue
Good Times
Kiddon Hill Park
Madison Street
Morgeland Boulevard
Waukesha
Substation
Factor Nature Center
Kamo Terrace
Waukesha Christian Academy
Waukesha School District Property
Wisconsin & Southern Railroad
St. Paul Avenue
MacArthur Road
Pebble Creek Park
Shoppes at Fox River
Sunset Drive
Parkland
Glacial Drumlin State Trail
Apostolic Life Tabernacle
Green Lane
Sunset Park
Merrill Hills Country Club
St. John Neumann Congregation
Genesee Road
Town Line Rd.
Sawyerville Road
Cemetery
Northview Road
Dakefield
Pewaukee
Meadowbrook Road
Fiddlers Creek
Faith Baptist Church
Bonny Brook
Bonny Brook
Merrimac Road
Merrimac Road
Bonny Brook
Bonny Brook
Bonny Brook



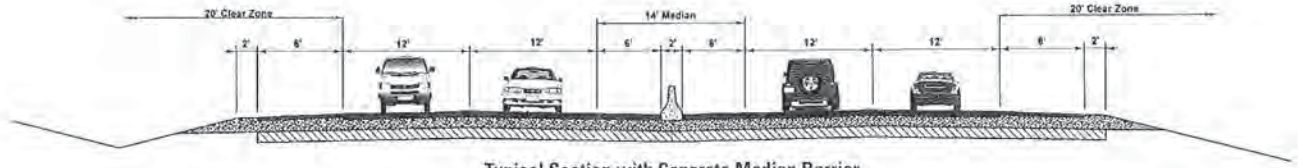
Typical Section with Full-Width Grass Median, Posted Speed 35 mph
North of Northview Road



Typical Section with Full-Width Grass Median Posted Speed 45 mph
Madison Street to Northview Road



Typical Section with Full-Width Grass Median, Posted Speed 45 mph
Sunset Drive to Madison Street

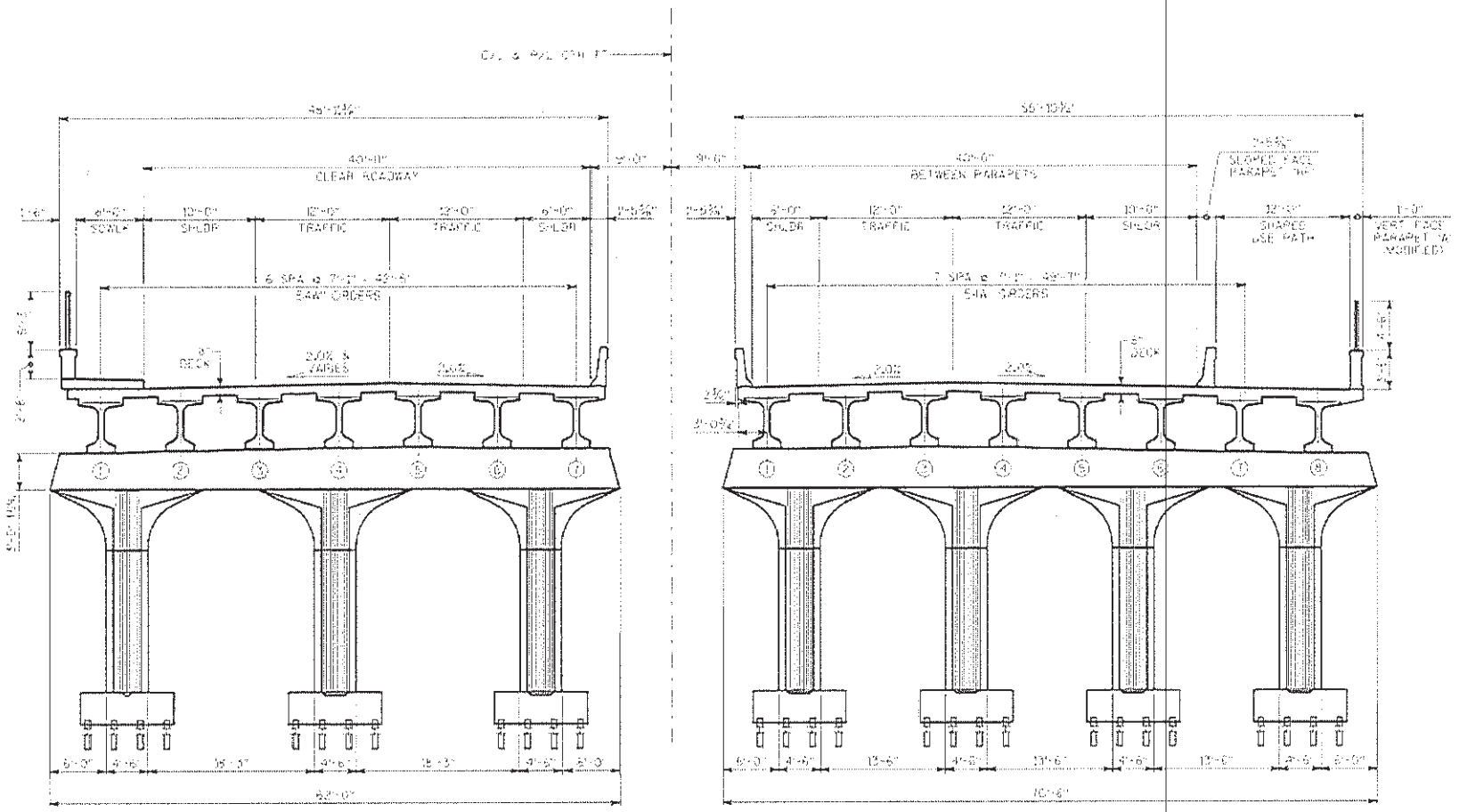


Typical Section with Concrete Median Barrier
(through Pebble Creek area), Posted Speed 45 mph

Exhibit 5
Four-Lane Alternative Typical Sections

ATTACHMENT 11

Legend
River/Stream
Railroad
Wetlands
Municipal Boundary
FEMA Floodplain
Parcel
Isolated Natural Resource Area
Primary Environmental Corridor
Secondary Environmental Corridor
Preferred Alternative Route
Off-road multi-use trail
Sidewalk
Note: 2005 Aerial Photography from the National Agricultural Imagery Program (NAIP)
Proposed Bicycle/Pedestrian Accomodations
Exhibit 8
Final Environmental Impact Statement
Waukesha Bypass - Waukesha County
Meadowbrook Road
Meadowview Park
Grandview Boulevard
Cities Field
Meadow Brook School
Pebble Creek
Faith Baptist Church
Fiddlers Creek
Good Times
Summit Avenue
Wauwatosa
Moreland Boulevard
Grandview Park
Madison Street
Kiddon Hill Park
Substation
Rotary Nature Center
Merrill Hills Road
Kame Terrace
Waukesha Christian Academy
St. Paul Avenue
Waukesha School District Property
Wisconsin & Southern Railroad
MacArthur Road
Pebble Creek Park
Shoppes at Fox River
Sunset Drive
Fox River
Bypass
Glacial Drumlin State Trail
Apostolic Life Tabernacle
Green Lawn
Sunset Park
Sunset Drive
Merrill Hills Country Club
Pebble Creek
Wauwatosa
St. John Neumann Congregation
Genesee Road
Genesee Road
Sylvesville Road
Town Line Rd
Maple Ave
Northview Road
Pewaukee
Delafield
Spring Brook
16
G
SS
94
TT
T
18
59
59
D
X



PROPOSED SOUTH BOUND STRUCTURE

LOOKING NORTH (SHEET XXX)

PROPOSED NORTH BOUND STRUCTURE

LOOKING NORTH (SHEET XXX)

TYPICAL SECTION

LOOKING NORTH

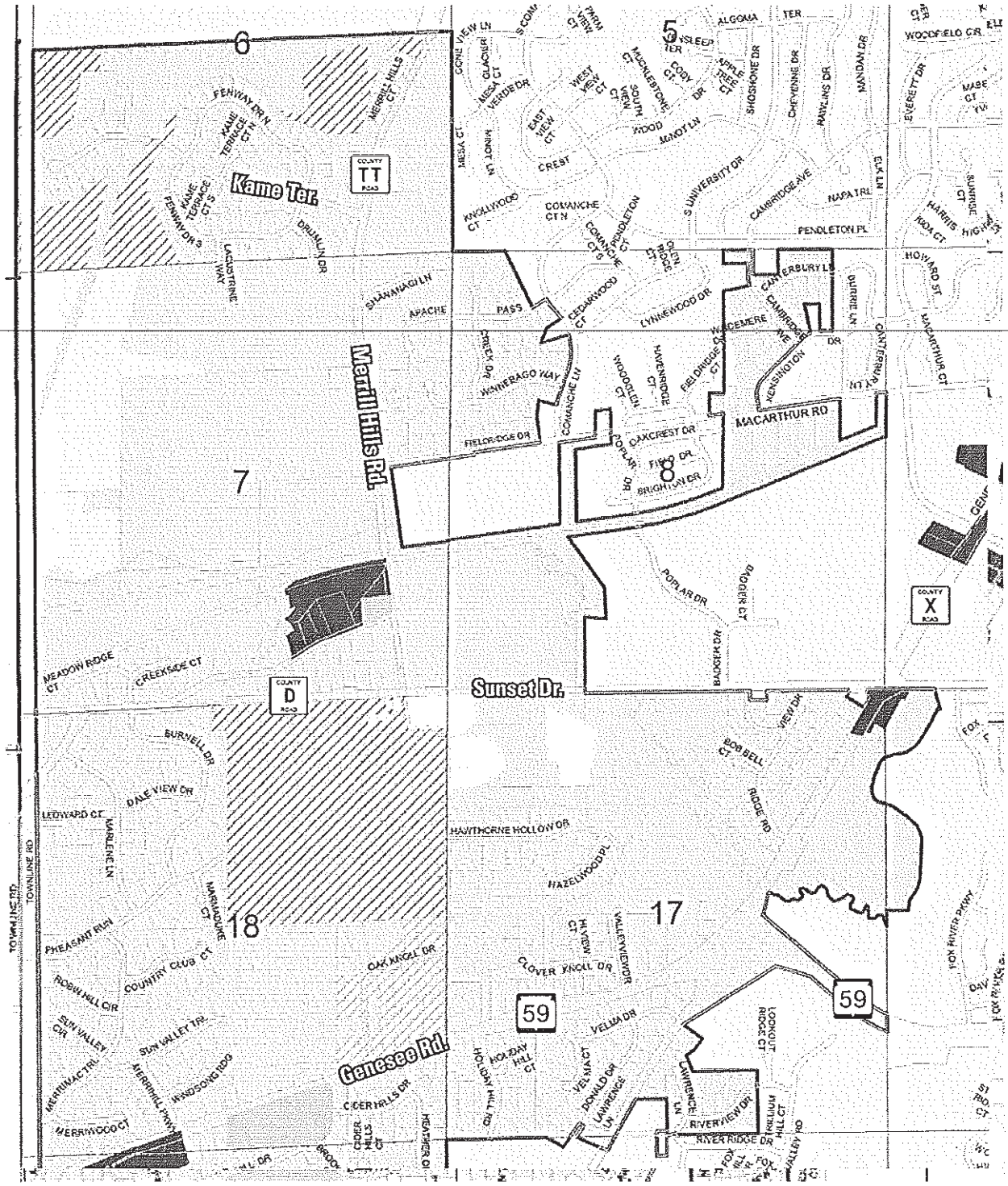
-PIER DIMENSIONS ARE SHOWN ON A 30° SKEW
-ROADWAY & GIRDER DIMENSIONS ARE SHOWN PERPENDICULAR TO THE ℄

ATTACHMENT 11

Exhibit 7

Proposed West Waukesha Bypass Bridge Typical Section

TB\30131313932\6MXE\Trans\5 Mono WB Ex-7 Proposed Bridge Typical Section.v1 at 6:28:13 mj



LEGEND

- Low Density Residential (20,000 sq. ft. - 1 AC)
- Suburban Density I Residential (1.1 - 2.9 AC)
- Suburban Density II Residential (3 - 4.9 AC)
- Agricultural (5 AC+)
- Mixed Use
- Commercial
- Commercial Office
- Industrial
- Governmental/Institutional
- Recreational
- Open Lands to be Preserved
- Environmental Corridors
- Surface Water
- Adopted WI Dept Of Natural Resources Project Boundary

Exhibit 8

Town of Waukesha Land Use - Kame Terrace to Sunset Drive

TEG031313193\05\MxD\Final\75_Memo_AB_Ex-8_Town_Waukesha_Land_Use_v2.mxd 7.2.13 mj

ATTACHMENT 11

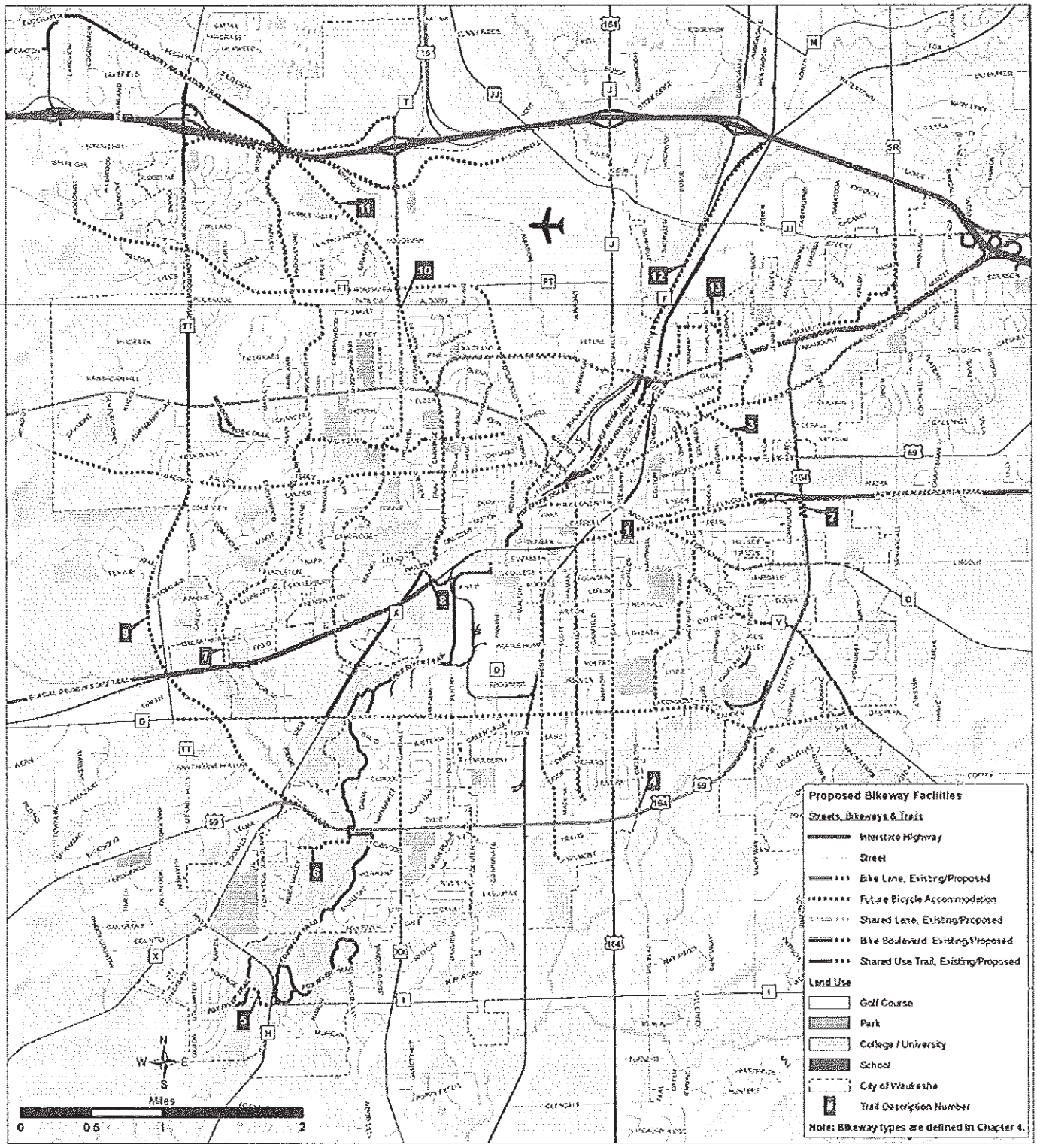


Exhibit 9

City of Waukesha Proposed Bikeway Facilities Plan

TBG031313183256\MKE\Tasks\75 Memo WB_Ex9_City_Of_Waukesha_Proposed_Bikeway_v2.ai 7.31.13 mj

ATTACHMENT 11

CERTIFICATE

STATE OF WISCONSIN)
:ss
WAUKESHA COUNTY)

I, Kelly Yaeger, Deputy County Clerk in and for the County of Waukesha, State of Wisconsin, DO HEREBY CERTIFY that the attached Enrolled Resolution 167-7, was adopted by the Waukesha County Board of Supervisors in regular session on the 27th day of November, 2012.

CERTIFIED this 11th day of December, A.D., 2012.

Kelly Yaeger
Deputy County Clerk, CERA

ATTACHMENT 11

ENROLLED RESOLUTION 167-7

RESOLUTION SUPPORTING THE INSTALLATION OF SIDEWALKS AND BICYCLE PATHS ALONG WEST WAUKESHA BYPASS
WAUKESHA COUNTY PROJECT
PROJECT I.D. 2788-01-00
CTH TT
STH 59 TO I-94
TOWN OF WAUKESHA AND CITY OF WAUKESHA
WAUKESHA COUNTY

WHEREAS, Waukesha County has entered into an Agreement with the Wisconsin Department of Transportation (State Project No. 2788-01-00) to construct The West Waukesha Bypass, between STH 59 and I-94 in the Town of Waukesha and City of Waukesha, and

WHEREAS, the Waukesha County Bicycle Plan calls for the construction of an off road Bicycle facility along CTH TT between Glacial Drumlin Trail and the Lake Country Trail, and

WHEREAS, the Waukesha County Department of Public Works has determined that pedestrian and off-street bicycle accommodations shall be installed as part of the West Bypass project, and

WHEREAS, it has been determined that between STH 59 and Kame Terrace there are a limited number of homes along this section of roadway and that many have access from internal subdivision streets, and

WHEREAS, between STH 59 and Sunset Drive there are environmental constraints along the project corridor that limit the location where pedestrian and bicycle facilities can be installed, and

WHEREAS, this will provide for sparse use and difficult maintenance of the pedestrian and bicycle amenities by the adjoining property owners, and

WHEREAS, the Town of Waukesha does not possess equipment for maintaining and clearing sidewalks in winter conditions.

NOW BE IT HEREBY RESOLVED that the Waukesha County Board of Supervisors supports the installation of concrete sidewalks located on the west side of CTH TT between Kame Terrace and I-94 and an off street, asphalt bicycle path located along the east side of CTH TT between Sunset Drive and I-94.

STATE OF WISCONSIN WAUKESHA COUNTY TOWN OF WAUKESHA

RESOLUTION NO. 05-09-2013A

A RESOLUTION ADDRESSING THE TRANS 75 ABSENCE OF NEED EXCEPTION
FOR
~~PROPOSED WEST WAUKESHA BYPASS~~
STH 59 TO I-94
WISDOT PROJECT I.D. 2788-01-00
WAUKESHA COUNTY

WHEREAS, Waukesha County has entered into an Agreement with the Wisconsin Department of Transportation (WisDOT) to construct the roadway known as the West Waukesha Bypass (WisDOT Project No. 2788-01-00),

WHEREAS, it has determined that on the southern portion of the project between STH 59 and Sunset Drive the proposed West Waukesha Bypass meet the conditions outlined in Wisconsin Administrative Code Trans 75.05 "Constrained Environment" (WisDOT Exception 3) for pedestrian accommodations (installation of sidewalks).

WHEREAS, it has determined that on the central portion of the project between Sunset Drive and Kame Terrace the proposed West Waukesha Bypass project meets the conditions outlined in Wisconsin Administrative Code, Trans 75.06 "Absence of Need" Exception (WisDOT Exception 4) for pedestrian accommodations (installation of sidewalks).

NOW THEREFORE BE IT RESOLVED by The Waukesha Town Board:

The Waukesha Town Board has determined that the portion between STH 59 and Kame Terrace within the proposed West Waukesha Bypass (WisDOT Project No. 2788-01-00) meets the conditions outlined in Wisconsin Administrative Code, Trans 75.06 "Absence of Need" Exception (WisDOT Exception 4) and Trans 75.05 "Constrained Environment" (WisDOT Exception 3) for pedestrian accommodations (installation of sidewalks).

ATTACHMENT 11

Adopted this 9th day of May, 2013.

TOWN OF WAUKESHA

By: _____
John Marek, Town Chairman

By: _____
Joe Banske, Supervisor 1

By: _____
Larry Wolf, Supervisor 2

By: _____
Mike Laska, Supervisor 3

By: _____ 05/09/13
Brian Tom Fischer, Supervisor 4

ATTEST:

_____
Jamie Salentine, Town of Waukesha Clerk/Treasurer

Z:\Documents\Clerk-Treasurer\Ordinances - Resolutions\Resolutions & Proclamations\Resolutions\2013\05-03-2013A - A Resolution Addressing the Trans 75 Absence of Need.docx

ATTACHMENT 11

MEMORANDUM

West Waukesha Bypass

TRANS 75 Addendum No. 1

TO: Doug Cain/WisDOT SE Region
Chris Squires/ WisDOT SE Region
Gary Evans/Waukesha County
Charlie Webb/CH2M Hill Inc.

FROM: Kurt Farrenkopf/Kapur & Associates, Inc.

DATE: April 14, 2015

Purpose

The purpose of this addendum is to clarify the bicycle and pedestrian accommodations being provided at the south project limits at the intersections of STH 59, West Waukesha Bypass, and CTH X, and the intersection of STH 59 and Saylesville Rd.

The following information supplements the Summary of the original TRANS 75 Exceptions Memo dated September 3, 2013:

Bicycle Accommodations

On-road bike accommodations consisting of a minimum 5' paved shoulder will be provided on all reconstructed portions of STH 59, CTH X, and Saylesville Road. No off-road bike accommodations will be provided at these locations.

Pedestrian Accommodations

New sidewalk will be placed along the north side of STH 59 from Valley View Dr. to the new West Waukesha Bypass, and on the west side of CTH X from the new West Waukesha Bypass to Ridge Rd.
New sidewalk will be placed along the east side of Saylesville Rd. and along the south side of STH 59 between Saylesville Rd. and the West Waukesha Bypass.

Grading of an 8' terrace behind the new curb and gutter for future sidewalk will be completed along the west side of the reconstructed Saylesville Rd. between Velma Dr. and STH 59 and along the south side of STH 59 west of Saylesville Rd. No sidewalk will be constructed as part of the project at these locations due to potential adverse impacts to the historic property located in the southwest quadrant of the intersection of Saylesville Rd. and STH 59.

Grading for a future sidewalk on both sides of the reconstructed portion of STH 59 east of CTH X will be completed outside the roadway ditch. No sidewalk will be constructed at this location as part of the project.

The new bridge structures on CTH X over the Pebble Creek will be constructed with sidewalk on both sides of the roadway.

No new sidewalk or grading for future sidewalk will be completed on the east side of CTH X north of the intersection with STH 59 due to absence of need and the constrained wetland environment.

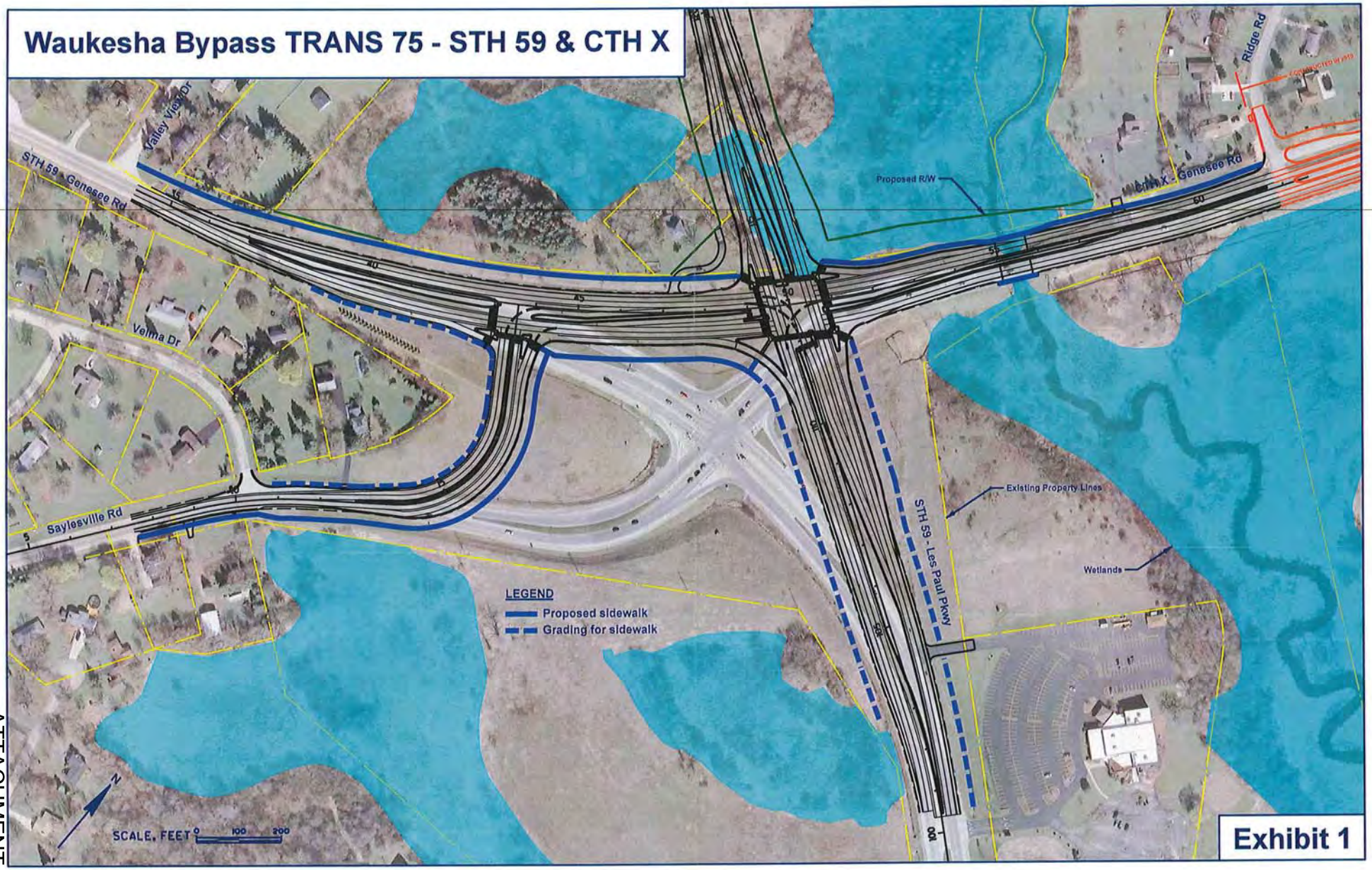
(See attached Exhibit 1)

Approved: 4-17-15

Douglas A Cain Project Manager WisDOT

Bike/Ped Coordinator WisDOT

ATTACHMENT 11



ATTACHMENT 11

Attachment 12 – Intersection Control Evaluation

Intersection Control Evaluation Comments

BUREAU OF TRAFFIC OPERATIONS

Intersection: Waukesha West Bypass
Project ID: 2788-01-00
Topic: Scoping ICE
Reviewed by: Vicki Haskell, Kevin M. Scopoline
Date: 1/13/2015

ICE Report Comments	
Operational Analysis	▪ Some movements at the CTH TT/Meadowbrook Rd & USH 18 will operate at LOS E under signal control. Signal timing should be periodically evaluated to ensure optimal operating conditions.
Right of Way Impacts	▪ What impacts will the new roadway and intersection have?
ICE Report Summary	
Safety	▪ The roundabout alternatives may improve safety.
Operational Analysis	▪ Many of the intersections in the project will have a LOS of E or worse during the peak hour for a dual lane roundabout. ▪ It is recommended that the corridor stay signalized and that the signals are coordinated.
Right of Way Impacts	▪ Not included in report.
Construction & R/W Costs	▪ Not included in report.
Practical Feasibility	▪ Triple lane roundabouts are not feasible for this project.
Operations and Maintenance Cost	▪ Not included in report.
Pedestrians and Bicycles	▪ Not included in report.
OSOW Freight Network	▪ Not included in report.
Environmental Impacts	▪ Not included in report.

Conclusions & Recommendation

- BTO concurs with moving forward with a coordinated signalized corridor.
- Signal timing should be periodically evaluated to ensure optimal operating conditions.

ATTACHMENT 12

One Honey Creek Corporate Center
125 South 84th Street, Suite 401
Milwaukee, WI 53214-1470
414 / 259 1500
414 / 259 0037 fax
www.graef-usa.com

GRAEF

collaborate / formulate / innovate

MEMORANDUM

TO: Allison Blackwood, P.E.

FROM: Shana Brummond, P.E., PTOE

DATE: December 19, 2014

SUBJECT: West Waukesha Bypass (Rolling Ridge Drive to STH 59)
Scoping Level Intersection Control Evaluations
Waukesha County, Wisconsin
Project ID 2788-01-00

Draft

Introduction

The West Waukesha Bypass project includes a four-lane divided roadway connecting I-94 to STH 59 on the west side of the City of Waukesha. The bypass route generally runs along CTH TT with a new connection from CTH D (Sunset Drive) to STH 59 through the Pebble Creek area. As requested by WisDOT, GRAEF has prepared this scoping level intersection control evaluation for the existing signalized intersections to compare the safety and traffic operations for dual lane roundabouts and traffic signals along the corridor.

Scoping Level Intersection Control Evaluation

The study area intersections are shown on Exhibit 1. The four signalized intersections north of Rolling Ridge Drive including Meadowbrook Road /Silvernail Road, CTH G/I-94 EB ramps, CTH G/I-94 WB ramps and CTH G/CTH DR are outside of the project limits. They were included in the traffic study for the purpose of future traffic signal coordination. These four signalized intersections are recommended to operate as a coordinated signal system to accommodate the future bypass traffic. The Southeast Region has indicated that a roundabout with more than two circulating lanes will not be considered for this project. Scoping level intersection control evaluations are attached for the following existing and planned signalized intersections along the corridor:

- Meadowbrook Road & Rolling Ridge Drive Intersection – existing traffic signal
- CTH TT (Meadowbrook Road) & Northview Road Intersection – existing traffic signal
- CTH TT (Meadowbrook Road) & USH 18 (Summit Avenue) Intersection – existing traffic signal
- CTH TT (Merrill Hills Road) & Madison Street Intersection – existing all-way stop control / traffic signal is warranted based on Year 2010 signal warrant analysis (Warrants 1, 2 & 3 are met)
- CTH TT (Merrill Hills Road) & CTH D (Sunset Drive) Intersection – existing traffic signal
- Bypass/STH 59 /CTH X North Intersection – STH 59 & CTH X is an existing traffic signal

ATTACHMENT 12

Recommendation

The safety and traffic operations for traffic signal and roundabout control were compared in the intersection control evaluations. The recommended intersection control for the study area intersections is summarized below.

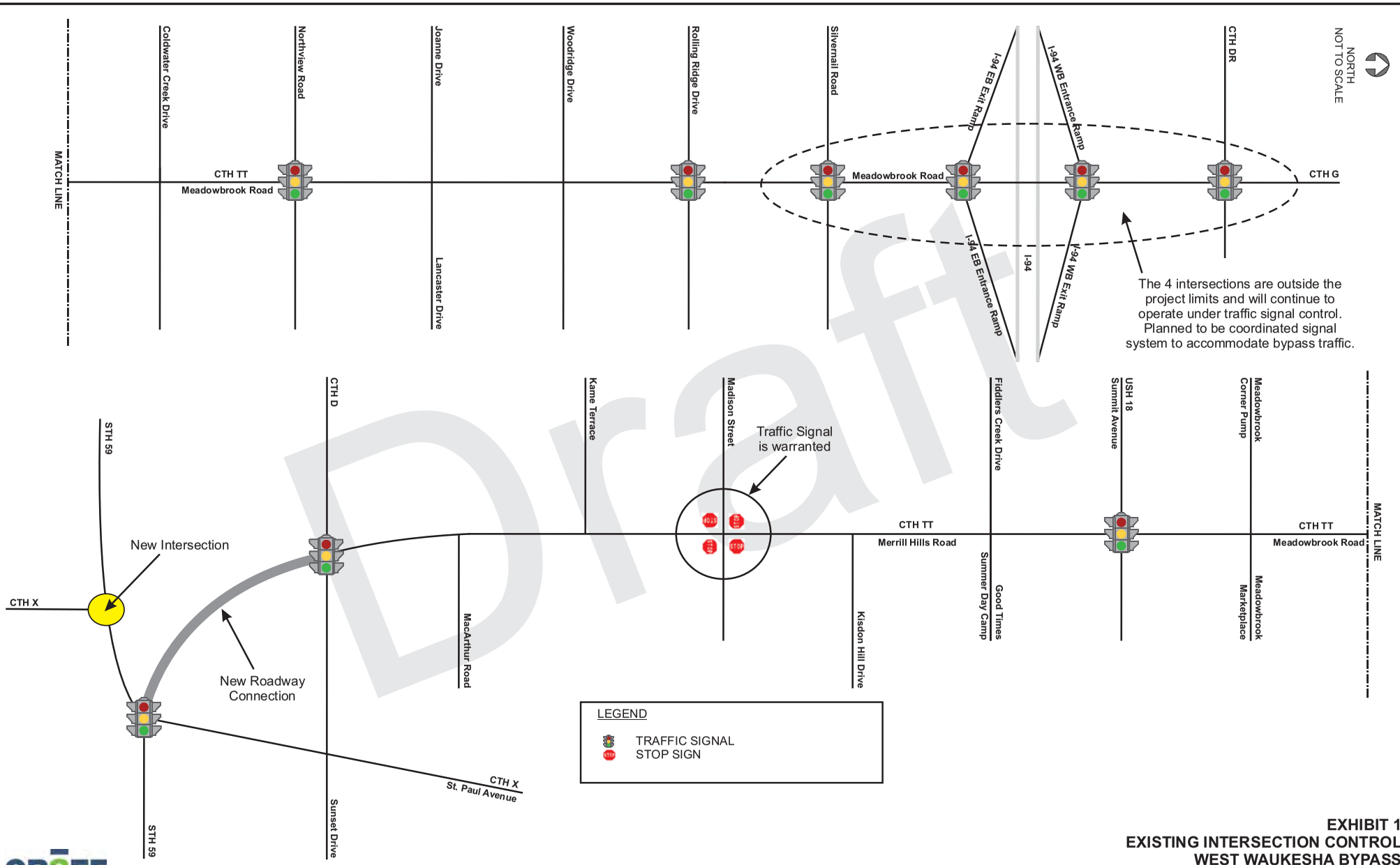
- Meadowbrook Road & Rolling Ridge Drive Intersection:
  - A dual lane roundabout is not desired at this intersection due to the nearby elementary school and the challenge for the school crossing guard and students to cross the exit lanes.
  - A traffic signal is recommended to be maintained due to unacceptable traffic operations with a dual lane roundabout.
  - It is recommended to coordinate this intersection with the signal system to the north.
- CTH TT (Meadowbrook Road) & Northview Road Intersection:
  - A traffic signal is recommended to be maintained due to unacceptable traffic operations with a dual lane roundabout. A triple lane roundabout will not be considered for this project.
  - It is recommended to coordinate this intersection with the signal system to the north.
- CTH TT (Meadowbrook Road) & USH 18 (Summit Avenue) Intersection:
  - A traffic signal is recommended to be maintained due to unacceptable traffic operations with a dual lane roundabout. A triple lane roundabout will not be considered for this project.
- CTH TT (Merrill Hills Road) & Madison Street Intersection:
  - The intersection currently experiences unacceptable traffic operations under all-way stop control. Traffic signal is warranted based on the Year 2010 traffic volumes.
  - Based on the traffic analysis, the intersection is expected to operate acceptably under traffic signal or roundabout control.
  - A traffic signal is recommended to be installed at this intersection to be coordinated with the adjacent traffic signal at USH 18 (Summit Avenue).
- CTH TT (Merrill Hills Road) & CTH D (Sunset Drive) Intersection:
  - Based on the traffic analysis, the intersection is expected to operate acceptably under traffic signal or roundabout control.
  - A traffic signal is recommended for this intersection to provide consistent intersection traffic control along the corridor.
- Bypass/STH 59 /CTH X North Intersection:
  - A traffic signal is recommended to be maintained due to unacceptable traffic operations with a dual lane roundabout. A triple lane roundabout will not be considered for this project.
- STH 59 & CTH X South Intersection (New T-intersection):
  - The intersection control for this new T-intersection is recommended to be consistent with the Bypass/STH 59/CTH X North intersection due to the closely spaced intersections (approximately 700 feet of spacing). A separate intersection control evaluation was not completed for this new intersection.

Draft

Appendix: Intersection Control Evaluation Matrix & Traffic Analysis

Appendix 1	Meadowbrook Road & Rolling Ridge Drive Intersection
Appendix 2	CTH TT (Meadowbrook Road) & Northview Road Intersection
Appendix 3	CTH TT & USH 18 (Summit Avenue) Intersection
Appendix 4	CTH TT (Merrill Hills Road) & Madison Street Intersection
Appendix 5	CTH TT (Merrill Hills Road) & CTH D (Sunset Drive) Intersection
Appendix 6	Bypass & STH 59 & CTH X North Intersection

ATTACHMENT 12



Draft

GRAEF

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EXHIBIT 1
EXISTING INTERSECTION CONTROL
WEST WAUKESHA BYPASS
PROJECT I.D. 2788-01-00
WAUKESHA COUNTY, WISCONSIN

ATTACHMENT 12

Appendix 1

Meadowbrook Road & Rolling Ridge Drive

ATTACHMENT 12

Intersection Control Evaluation Worksheet

BUREAU OF TRAFFIC OPERATIONS

Revised: March 31, 2014

NOTE: Attach Items in BLUE as appendices

SPELL CHECK

Prepared By Shana Brummond **Date** 19-Dec-14

Intersection: Meadowbrook Road & Rolling Ridge Drive **Design Project ID:** 2788-01-00 **Project Description:** West Waukesha Bypass

Factor	**Existing Traffic Control** Traffic Signal	**Alternative 1** Dual Lane Roundabout
Safety		
Crash diagram trends	13 crashes (2009-2013) - 10 rear end, 1 right angle, 1 left turn & 1 single vehicle crash	
Percent and type of crashes expected to be reduced by alternative		Right angle & left-turn crashes would be reduced with roundabout. These crashes account for 2 of the 13 intersection crashes (approximately 15% reduction).
Access near the intersection and side road traffic impacts		
Additional considerations	Meadowbrook Elementary School is located in the northeast quadrant of the intesrection. The east leg of Rolling Ridge Drive provides access to the school. The school currently has a crossing guard at this signalized intersection. A dual lane roundabout will be more difficult for the crossing guard and elementary students to cross.	
Operational Analysis		
Discuss the Warrant Analysis (Attach AWSC/Signal warrants)		

LOS, delay, v/c ratio and 95th percentile queues for each movement. (Attach traffic count, forecast and analysis inputs/outputs)

Existing Traffic Control

AM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
LOS	C	C	C	C	C	C	A	B	A	C	A	A
Delay (s)	31.5	24.6	24.6	24.9	27.4	27.4	5.7	17.9	4.3	27.1	2.3	1.6
v/c Ratio	0.36	0.06	0.06	0.02	0.44	0.44	0.0	0.92	0.01	0.21	0.40	0.0
Queue (ft)	95	30	30	25	130	130	25	125	25	35	100	25
Int. LOS	B											

PM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
LOS	D	D	D	D	D	D	A	A	A	A	A	A
Delay (s)	43.6	41.8	41.8	42.6	42.3	42.3	0.5	0.5	0.0	0.2	0.5	0.0
v/c Ratio	0.14	0.14	0.14	0.08	0.21	0.21	0.06	0.42	0.0	0.15	0.76	0.03
Queue (ft)	40	40	40	30	50	50	25	70	25	25	45	25
Int. LOS	A											

Notes: With the design year (Year 2037) traffic, all movements are expected to operate acceptably at LOS D or better condiitons during the peak hours.

Alternative 1

AM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	0	0	1	1	0	2	0	0	2	0
LOS	A	A	A	C	C	D	E	E	E	A	A	A
Delay (s)	7.6	6.2	6.2	16.4	16.4	32.5	37.0	37.0	37.0	6.9	6.9	6.9
v/c Ratio	0.15	0.03	0.03	0.07	0.07	0.51	0.96	0.96	0.96	0.39	0.39	0.39
Queue (ft)	25	25	25	25	25	75	450	450	450	50	50	50
Int. LOS	D											

PM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	0	0	1	1	0	2	0	0	2	0
LOS	C	C	C	A	A	A	A	A	A	D	D	D
Delay (s)	16.8	17.0	17.0	7.6	7.6	7.7	9.1	9.1	9.1	33.5	33.5	33.5
v/c Ratio	0.07	0.08	0.08	0.05	0.05	0.06	0.52	0.52	0.52	0.95	0.95	0.95
Queue (ft)	25	25	25	25	25	25	100	100	100	425	425	425
Int. LOS	C											

Notes: With the design year (Year 2037) traffic, the northbound movements are expected to operate at LOS E during AM peak hour.

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Factor	Existing Traffic Control Traffic Signal	Alternative 1 Dual Lane Roundabout
Queue impact on adjacent driveways		None
Capacity to accommodate diverted freeway traffic for routes parallel to freeway		N/A
Impacts of railroad crossings within 1000 feet	N/A	N/A
Preliminary Layout of existing and proposed traffic control	See Appendix	See Appendix
Additional considerations (Indicate if roundabout is expected to be a spiral design)		
Right-of-Way Impacts		
Amount of acreage impacted (# of relocations, access restrictions)		
Anticipated right-of-way and real estate costs (Attach cost estimate tables)		
Additional considerations		
Costs		
Discuss estimated costs (Attach itemized cost estimate tables)		
Operations and Maintenance Costs		
Additional considerations		
Practical Feasibility		
Concerns alternative may present		
Major impacts on businesses, parking availability, real estate and utilities		
Frequency of use as an alternate route		
Additional considerations		
Pedestrians and Bicycles		
Describe the need for pedestrian and bicycle facilities		

Factor	Existing Traffic Control Traffic Signal	Alternative 1 Dual Lane Roundabout
Identify nearby pedestrian generators, bike routes, transit stops and if the intersection is on a Safe Route to School (part of existing conditions exhibit)		
State if and what facilities are proposed, within, the project limits (part of preliminary layout of proposed alternatives)		
Additional considerations		
OSOW Freight Network		
Identify nearby OSOW generators		
If either intersecting road is on the freight network, is a significant diversion route or near a freight origin or destination discuss the following: • The geometric features and other design considerations to account for the OSOW vehicle path (e.g. grading, medians, islands). • Vertical and horizontal clearance to account for the OSOW vehicle path (e.g. monotubes, signing)		
Additional considerations		
Environmental Impacts		
Type (i.e. historical, archeological, wetlands or hazardous material) and amount of environmental acreage impacts		
Additional considerations		

Factor	Alternative 2	Alternative 3
Safety		
Crash diagram trends		

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Factor	Alternative 2	Alternative 3
Percent and type of crashes expected to be reduced by alternative		
Access near the intersection and side road traffic impacts		
Additional considerations		
Operational Analysis		
Discuss the Warrant Analysis (Attach AWSC/Signal warrants)		
LOS, delay, v/c ratio and 95th percentile queues for each movement. (include traffic count, forecast and analysis inputs/outputs)		
Queue impact on adjacent driveways		
Capacity to accommodate 5-20% of diverted freeway traffic for routes parallel to freeway		
Document railroad crossings within 1000 feet of the intersection.		
Preliminary Layout of existing and proposed traffic control	See Appendix	See Appendix
Additional considerations (Indicate if roundabout is expected to be a spiral design)		
Right-of-Way Impacts		
Amount of acreage impacted (# of relocations, access restrictions)		

Alternative 2

AM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

PM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

Notes:

Alternative 3

AM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

PM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

Notes:

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Factor	Alternative 2	Alternative 3
Anticipated right-of-way and real estate costs (Attach cost estimate tables)		
Additional Considerations		
Costs		
Discuss estimated costs (Attach itemized cost estimate tables)		
Operations and Maintenance Costs		
Additional considerations		
Practical Feasibility		
Concerns alternative may present		
Major impacts on businesses, parking availability, real estate and utilities		
Frequency of use as an alternate route		
Additional considerations		
Pedestrians and Bicycles		
Describe the need for pedestrian and bicycle facilities		
Identify nearby pedestrian generators, bike routes, transit stops and if the intersection is on a Safe Route to School (part of existing conditions exhibit)		
State if and what facilities are proposed, within, the project limits (part of preliminary layout of proposed alternatives)		
Additional considerations		
OSOW Vehicle Routes		
Identify nearby OSOW generators		

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Factor	Alternative 2	Alternative 3
If either intersecting road is on the freight network, is a significant diversion route or near a freight origin or destination discuss the following: • The geometric features and other design considerations to account for the OSOW vehicle path (e.g. grading, medians, islands). • Vertical and horizontal clearance to account for the OSOW vehicle path (e.g. monotubes, signing)		
Additional considerations		
Environmental Impacts		
Type (i.e. historical, archeological, wetlands or hazardous material) and amount of environmental acreage impacts		
Additional considerations		

Recommendation

A dual lane roundabout is not desired at this intersection due to the nearby elementary school and the challenge for the school crossing guard and students to cross the exit lanes.
Traffic signal control is recommended to be maintained due to the unacceptable traffic operations with a dual lane roundabout.
It is recommended to coordinate this intersection with the signal system to the north.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	81	3	13	8	2	117	2	2041	18	25	861	5
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1881	1881	1900	1881	1881	1881	1827	1827	1827
Adj Flow Rate, veh/h	85	3	14	8	2	123	2	2148	9	26	906	3
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	1	1	1	1	1	1	4	4	4
Cap, veh/h	237	51	238	338	5	280	473	2341	1047	125	2274	1017
Arrive On Green	0.18	0.18	0.18	0.18	0.18	0.18	0.66	0.66	0.66	0.87	0.87	0.87
Sat Flow, veh/h	1261	287	1339	1404	26	1577	617	3574	1599	180	3471	1553
Grp Volume(v), veh/h	85	0	17	8	0	125	2	2148	9	26	906	3
Grp Sat Flow(s),veh/h/ln	1261	0	1626	1404	0	1603	617	1787	1599	180	1736	1553
Q Serve(g_s), s	4.6	0.0	0.6	0.3	0.0	5.0	0.1	37.3	0.1	9.7	3.7	0.0
Cycle Q Clear(g_c), s	9.6	0.0	0.6	1.0	0.0	5.0	3.8	37.3	0.1	47.0	3.7	0.0
Prop In Lane	1.00		0.82	1.00		0.98	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	237	0	289	338	0	285	473	2341	1047	125	2274	1017
V/C Ratio(X)	0.36	0.00	0.06	0.02	0.00	0.44	0.00	0.92	0.01	0.21	0.40	0.00
Avail Cap(c_a), veh/h	733	0	929	890	0	916	473	2341	1047	125	2274	1017
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.33
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.94	0.94	0.94
Uniform Delay (d), s/veh	30.6	0.0	24.5	24.9	0.0	26.3	5.7	10.7	4.3	23.5	1.8	1.6
Incr Delay (d2), s/veh	0.9	0.0	0.1	0.0	0.0	1.1	0.0	7.2	0.0	3.5	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	0.0	0.3	0.1	0.0	2.3	0.0	20.2	0.1	0.6	1.7	0.0
LnGrp Delay(d),s/veh	31.5	0.0	24.6	24.9	0.0	27.4	5.7	17.9	4.3	27.1	2.3	1.6
LnGrp LOS	C		C	C		C	A	B	A	C	A	A
Approach Vol, veh/h		102			133			2159			935	
Approach Delay, s/veh		30.4			27.2			17.8			3.0	
Approach LOS		C			C			B			A	

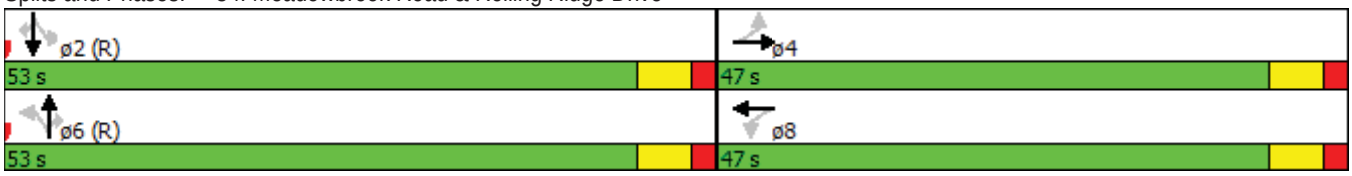
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		81.3		18.7		81.3		18.7
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		47.0		41.0		47.0		41.0
Max Q Clear Time (g_c+I1), s		49.0		11.6		39.3		7.0
Green Ext Time (p_c), s		0.0		1.2		7.5		1.3

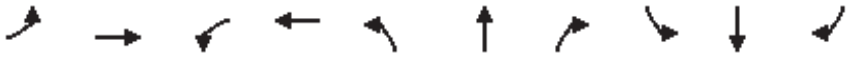
Intersection Summary	
HCM 2010 Ctrl Delay	14.4
HCM 2010 LOS	B

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	81	3	8	2	2	2041	18	25	861	5
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4		8		6			2	
Permitted Phases	4		8		6		6	2		2
Detector Phase	4	4	8	8	6	6	6	2	2	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	12.0	12.0	12.0	12.0	12.0	12.0
Minimum Split (s)	47.0	47.0	47.0	47.0	31.0	31.0	31.0	31.0	31.0	31.0
Total Split (s)	47.0	47.0	47.0	47.0	53.0	53.0	53.0	53.0	53.0	53.0
Total Split (%)	47.0%	47.0%	47.0%	47.0%	53.0%	53.0%	53.0%	53.0%	53.0%	53.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Act Effct Green (s)	13.7	13.7	13.7	13.7	74.3	74.3	74.3	74.3	74.3	74.3
Actuated g/C Ratio	0.14	0.14	0.14	0.14	0.74	0.74	0.74	0.74	0.74	0.74
v/c Ratio	0.51	0.08	0.04	0.57	0.00	0.81	0.01	0.36	0.35	0.00
Control Delay	50.1	36.3	35.5	50.2	2.5	5.6	2.3	24.2	3.5	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.1	36.3	35.5	50.2	2.5	5.6	2.3	24.2	3.5	3.7
LOS	D	D	D	D	A	A	A	C	A	A
Approach Delay		47.8		49.3		5.5			4.1	
Approach LOS		D		D		A			A	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 4 (4%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green	
Natural Cycle: 130	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.81	
Intersection Signal Delay: 8.2	Intersection LOS: A
Intersection Capacity Utilization 77.6%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 34: Meadowbrook Road & Rolling Ridge Drive





Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	85	17	8	125	2	2148	9	26	906	3
v/c Ratio	0.51	0.08	0.04	0.57	0.00	0.81	0.01	0.36	0.35	0.00
Control Delay	50.1	36.3	35.5	50.2	2.5	5.6	2.3	24.2	3.5	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.1	36.3	35.5	50.2	2.5	5.6	2.3	24.2	3.5	3.7
Queue Length 50th (ft)	51	10	5	76	0	108	1	2	37	0
Queue Length 95th (ft)	95	28	17	128	m0	122	m1	34	100	m1
Internal Link Dist (ft)		184		148		534			900	
Turn Bay Length (ft)					200		200	200		200
Base Capacity (vph)	500	669	575	657	420	2656	1188	73	2579	1154
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.03	0.01	0.19	0.00	0.81	0.01	0.36	0.35	0.00

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	22	6	14	14	4	26	11	1088	3	64	1976	68
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1792	1792	1900	1881	1881	1900	1881	1881	1881	1881	1881	1881
Adj Flow Rate, veh/h	24	6	15	15	4	28	12	1170	2	69	2125	37
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	6	6	6	1	1	1	1	1	1	1	1	1
Cap, veh/h	171	42	106	185	19	132	218	2810	1257	451	2810	1257
Arrive On Green	0.09	0.09	0.09	0.09	0.09	0.09	1.00	1.00	1.00	1.00	1.00	1.00
Sat Flow, veh/h	1320	455	1137	1399	204	1426	185	3574	1599	482	3574	1599
Grp Volume(v), veh/h	24	0	21	15	0	32	12	1170	2	69	2125	37
Grp Sat Flow(s),veh/h/ln	1320	0	1592	1399	0	1630	185	1787	1599	482	1787	1599
Q Serve(g_s), s	1.7	0.0	1.2	1.0	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	3.5	0.0	1.2	2.2	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0
Prop In Lane	1.00		0.71	1.00		0.88	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	171	0	148	185	0	151	218	2810	1257	451	2810	1257
V/C Ratio(X)	0.14	0.00	0.14	0.08	0.00	0.21	0.06	0.42	0.00	0.15	0.76	0.03
Avail Cap(c_a), veh/h	182	0	160	197	0	164	218	2810	1257	451	2810	1257
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.24	0.24	0.24
Uniform Delay (d), s/veh	43.3	0.0	41.4	42.4	0.0	41.6	0.0	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.4	0.0	0.4	0.2	0.0	0.7	0.5	0.5	0.0	0.2	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.5	0.4	0.0	0.8	0.0	0.2	0.0	0.0	0.2	0.0
LnGrp Delay(d),s/veh	43.6	0.0	41.8	42.6	0.0	42.3	0.5	0.5	0.0	0.2	0.5	0.0
LnGrp LOS	D		D	D		D	A	A	A	A	A	A
Approach Vol, veh/h		45			47			1184			2231	
Approach Delay, s/veh		42.8			42.4			0.5			0.5	
Approach LOS		D			D			A			A	

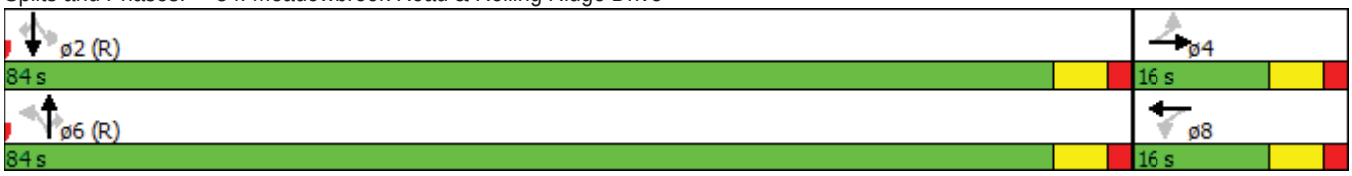
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		84.8		15.2		84.8		15.2
Change Period (Y+Rc), s		6.0		6.0		6.0		6.0
Max Green Setting (Gmax), s		78.0		10.0		78.0		10.0
Max Q Clear Time (g_c+I1), s		2.0		5.5		2.0		4.2
Green Ext Time (p_c), s		65.1		0.1		65.1		0.1

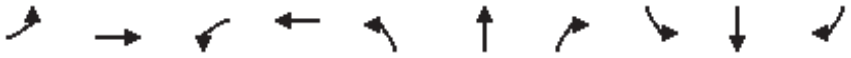
Intersection Summary	
HCM 2010 Ctrl Delay	1.6
HCM 2010 LOS	A

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	22	6	14	4	11	1088	3	64	1976	68
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4		8		6			2	
Permitted Phases	4		8		6		6	2		2
Detector Phase	4	4	8	8	6	6	6	2	2	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	12.0	12.0	12.0	12.0	12.0	12.0
Minimum Split (s)	16.0	16.0	16.0	16.0	18.0	18.0	18.0	18.0	18.0	18.0
Total Split (s)	16.0	16.0	16.0	16.0	84.0	84.0	84.0	84.0	84.0	84.0
Total Split (%)	16.0%	16.0%	16.0%	16.0%	84.0%	84.0%	84.0%	84.0%	84.0%	84.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Act Effct Green (s)	10.0	10.0	10.0	10.0	86.8	86.8	86.8	86.8	86.8	86.8
Actuated g/C Ratio	0.10	0.10	0.10	0.10	0.87	0.87	0.87	0.87	0.87	0.87
v/c Ratio	0.18	0.13	0.11	0.20	0.11	0.38	0.00	0.18	0.69	0.03
Control Delay	45.0	43.2	43.0	44.6	4.3	2.1	2.0	1.1	1.9	0.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	45.0	43.2	43.0	44.6	4.3	2.1	2.0	1.1	1.9	0.7
LOS	D	D	D	D	A	A	A	A	A	A
Approach Delay		44.2		44.1		2.1			1.8	
Approach LOS		D		D		A			A	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 4 (4%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.69	
Intersection Signal Delay: 3.0	Intersection LOS: A
Intersection Capacity Utilization 73.0%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 34: Meadowbrook Road & Rolling Ridge Drive





Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	24	21	15	32	12	1170	2	69	2125	37
v/c Ratio	0.18	0.13	0.11	0.20	0.11	0.38	0.00	0.18	0.69	0.03
Control Delay	45.0	43.2	43.0	44.6	4.3	2.1	2.0	1.1	1.9	0.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	45.0	43.2	43.0	44.6	4.3	2.1	2.0	1.1	1.9	0.7
Queue Length 50th (ft)	14	12	9	19	1	64	0	1	24	1
Queue Length 95th (ft)	40	36	29	48	m2	70	m0	m3	m41	m1
Internal Link Dist (ft)		184		148		534			900	
Turn Bay Length (ft)					200		200	200		200
Base Capacity (vph)	131	160	140	163	106	3102	1388	378	3102	1388
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.18	0.13	0.11	0.20	0.11	0.38	0.00	0.18	0.69	0.03

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

ATTACHMENT 12

Phone: Fax:
E-Mail:

ROUNDABOUT ANALYSIS

Analyst: SKB
Agency/Co.: GRAEF
Date Performed: 12/16/2014
Analysis Time Period: AM Peak Hour
Intersection: Meadowbrook & Rolling Ridge
Jurisdiction: Waukesha County
Units: U. S. Customary
Analysis Year: Year 2037
Project ID: 2788-01-00 West Waukesha Bypass
East/West Street: Rolling Ridge Drive
North/South Street: Meadowbrook Rd

Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	81	3	13	8	2	117	2	2041	18	25	861	5
U-Turn Vol	5			5			5			5		
% Thrus Left Lane									50			50

	Eastbound			Westbound			Northbound			Southbound		
	Left		Right	BP	Left	Right	BP	Left	Right	BP	Left	Right	BP
Lane Assn.	L	TR			LT	R		LT	TR		LT	TR	
RT Bypass	None				None			None			None		
PHF	0.95	0.95	0.95		0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
%HV	2	2	2		2	2	2	2	2	2	4	4	4
NumPeds	10				10			10			10		
U-Turn PHF	0.95				0.95			0.95			0.95		
U-Turn %HV	2				2			2			4		
Flow Rate	87	3	14		9	2	126	2	2191	19	27	943	5
No. Lanes	1	1	0		0	1	1	0	2	0	0	2	0
Cnfl. Lanes	2				2			2			1		

Duration, T 0.25 hrs.

Critical and Follow-Up Headway Adjustment

	Eastbound			Westbound		
Crit. Hdwy	4.0000*	4.0000*	5.1929	4.0000*	4.0000*	5.1929
	Northbound			Southbound		
Crit. Hdwy	4.0000*	4.0000*	5.1929	4.2000*	4.2000*	5.1929
	Eastbound			Westbound		
Flup. Hdwy	2.8000*	2.8000*	3.1858	2.8000*	2.8000*	3.1858
	Northbound			Southbound		
Flup. Hdwy	2.8000*	2.8000*	3.1858	2.8000*	2.8000*	3.1858

Flow Computations

	Eastbound	Westbound	Northbound	Southbound
Circ. Flow	994	2295	132	28
Exit. Flow	55	15	2409	970

Capacity and Level of Service

	Eastbound	Westbound	Northbound	Southbound

ATTACHMENT 12

	Left	Right	BP	Left	Right	BP	Left	Right	BP	Left	Right	BP
Entry Flow	92	17		16	126		1109	1109		490	490	
Entry Cap.	627	627		245	245		1167	1167		1257	1257	
Volume (vph)	90	17		16	124		1087	1087		471	471	
Cap. (vph)	615	615		240	240		1133	1133		1195	1195	
v/c Ratio	0.15	0.03		0.07	0.51		0.96	0.96		0.39	0.39	
Critical Lane					*			*			*	
Lane Delay	7.6	6.2		16.4	32.5		37.0	37.0		6.9	6.9	
Lane LOS	A	A		C	D		E	E		A	A	
95 % Queue	0.5	0.1		0.2	2.7		17.5	17.5		1.9	1.9	
Approach:												
Delay		7.36			30.63			37.03			6.93	
LOS		A			D			E			A	

Intersection Delay 27.39 Intersection LOS D

ATTACHMENT 12

Phone: Fax:
E-Mail:

ROUNDABOUT ANALYSIS

Analyst: SKB
Agency/Co.: GRAEF
Date Performed: 12/16/2014
Analysis Time Period: PM Peak Hour
Intersection: Meadowbrook & Rolling Ridge
Jurisdiction: Waukesha County
Units: U. S. Customary
Analysis Year: Year 2037
Project ID: 2788-01-00 West Waukesha Bypass
East/West Street: Rolling Ridge Drive
North/South Street: Meadowbrook Rd

Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	22	6		14	4	26	11	1088	3	64	1976	68
U-Turn Vol	5			5			5			5		
% Thrus Left Lane								50			50	

	Eastbound			Westbound			Northbound			Southbound		
	Left		Right	BP	Left	Right	BP	Left	Right	BP	Left	Right	BP
Lane Assn.	L		LT		LT	R		LT	TR		LT	TR	
RT Bypass	None				None			None			None		
PHF	0.93	0.93	0.93		0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
%HV	6	6	6		2	2	2	2	2	2	2	2	2
NumPeds	10				10			10			10		
U-Turn PHF	0.93				0.93			0.93			0.93		
U-Turn %HV	6				2			2			5		
Flow Rate	25	7	0		15	4	29	12	1193	3	70	2167	75
No. Lanes	1	1	0		0	1	1	0	2	0	0	2	0
Cnfl. Lanes	2				2			2			1		

Duration, T 0.25 hrs.

Critical and Follow-Up Headway Adjustment

	Eastbound			Westbound		
Crit. Hdwy	4.0000*	4.0000*	5.1929	4.0000*	4.0000*	5.1929
	Northbound			Southbound		
Crit. Hdwy	4.0000*	4.0000*	5.1929	4.2000*	4.2000*	5.1929
	Eastbound			Westbound		
Flup. Hdwy	2.8000*	2.8000*	3.1858	2.8000*	2.8000*	3.1858
	Northbound			Southbound		
Flup. Hdwy	2.8000*	2.8000*	3.1858	2.8000*	2.8000*	3.1858

Flow Computations

	Eastbound	Westbound	Northbound	Southbound
Circ. Flow	2268	1247	119	47
Exit. Flow	86	97	1253	2188

Capacity and Level of Service

	Eastbound	Westbound	Northbound	Southbound

ATTACHMENT 12

	Left	Right	BP	Left	Right	BP	Left	Right	BP	Left	Right	BP
Entry Flow	18	20		25	29		607	607		1159	1159	
Entry Cap.	250	250		522	522		1180	1180		1238	1238	
Volume (vph)	17	19		25	28		595	595		1136	1136	
Cap. (vph)	236	236		512	512		1145	1145		1200	1200	
v/c Ratio	0.07	0.08		0.05	0.06		0.52	0.52		0.95	0.95	
Critical Lane		*			*			*			*	
Lane Delay	16.8	17.0		7.6	7.7		9.1	9.1		33.5	33.5	
Lane LOS	C	C		A	A		A	A		D	D	
95 % Queue	0.2	0.3		0.2	0.2		3.1	3.1		17.0	17.0	
Approach:												
Delay		16.89			7.68			9.09			33.47	
LOS		C			A			A			D	
Intersection Delay		24.75					Intersection LOS			C		

ATTACHMENT 12

Appendix 2

CTH TT (Meadowbrook Road) & Northview Road

ATTACHMENT 12

Intersection Control Evaluation Worksheet

BUREAU OF TRAFFIC OPERATIONS

Revised: March 31, 2014

NOTE: Attach Items in BLUE as appendices

SPELL CHECK

Prepared By Shana Brummond **Date** 19-Dec-14

Intersection: CTH TT (Meadowbrook Road) & Northview Road **Design Project ID:** 2788-01-00 **Project Description:** West Waukesha Bypass

Factor	**Existing Traffic Control** Traffic Signal	**Alternative 1** Dual Lane Roundabout
Safety		
Crash diagram trends	18 crashes (2009-2013) - 13 rear end, 2 right angle, 2 left turn & 1 single vehicle crash	
Percent and type of crashes expected to be reduced by alternative		Right angle & left-turn crashes would be reduced with roundabout. These crashes account for 4 of the 18 intersection crashes (approximately 22% reduction).
Access near the intersection and side road traffic impacts		
Additional considerations		
Operational Analysis		
Discuss the Warrant Analysis (Attach AWSC/Signal warrants)		

ATTACHMENT 12

Factor	Existing Traffic Control Traffic Signal	Alternative 1 Dual Lane Roundabout
LOS, delay, v/c ratio and 95th percentile queues for each movement. (Attach traffic count, forecast and analysis inputs/outputs)		

AM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
LOS	D	D	D	D	D	D	A	C	A	C	A	A
Delay (s)	50.9	35.2	35.2	39.4	37.4	37.4	9.5	24.5	9.2	20.6	0.4	0.0
v/c Ratio	0.64	0.29	0.29	0.27	0.49	0.49	0.06	0.89	0.05	0.34	0.35	0.02
Queue (ft)	155	100	100	80	150	150	25	650	30	55	130	25
Int. LOS	C											

PM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
LOS	D	D	D	D	D	D	B	B	A	A	A	A
Delay (s)	45.8	37.2	37.2	51.4	38.9	38.9	15.4	12.4	8.7	7.5	1.5	0.1
v/c Ratio	0.46	0.34	0.34	0.67	0.49	0.49	0.33	0.48	0.05	0.29	0.68	0.06
Queue (ft)	100	105	105	185	150	150	110	235	30	25	40	25
Int. LOS	B											

Notes: With the design year (Year 2037) traffic, all movements are expected to operate acceptably at LOS D or better conditions during the peak hours.

AM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
LOS	B	A	A	D	F	F	F	F	F	A	A	A
Delay (s)	11.5	9.9	9.9	28.7	63.3	63.3	100.9	100.9	100.9	3.0	3.0	3.0
v/c Ratio	0.30	0.21	0.21	0.40	0.79	0.79	1.16	1.16	1.16	0.51	0.51	0.51
Queue (ft)	50	25	25	50	150	150	825	825	825	75	75	75
Int. LOS	F											

PM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	0	1	1	0	0	2	0	0	2	0
LOS	C	C	C	B	B	B	B	B	B	F	F	F
Delay (s)	21.9	22.7	2.7	12.1	11.6	11.6	11.9	11.9	11.9	60.5	60.5	60.5
v/c Ratio	0.35	0.37	0.37	0.32	0.30	0.30	0.61	0.61	0.61	1.04	1.04	1.04
Queue (ft)	50	50	50	50	50	50	125	125	125	575	575	575
Int. LOS	C											

Notes: With the design year (Year 2037) traffic, select movements are expected to operate at LOS F conditions during the peak hours. The overall intesrection is expected to operate at LOS F conditions during the AM peak hour. V/C ratio exceeds 1.0 for the northbound movements during the AM peak hour and the southbound movements during the PM peak hour.

Queue impact on adjacent driveways	None	None
Capacity to accommodate diverted freeway traffic for routes parallel to freeway	N/A	N/A
Impacts of railroad crossings within 1000 feet	N/A	N/A
Preliminary Layout of existing and proposed traffic control	See Appendix	See Appendix
Additional considerations (Indicate if roundabout is expected to be a spiral design)		
Right-of-Way Impacts		
Amount of acreage impacted (# of relocations, access restrictions)		
Anticipated right-of-way and real estate costs (Attach cost estimate tables)		
Additional considerations		
Costs		

ATTACHMENT 12

Factor	Existing Traffic Control Traffic Signal	Alternative 1 Dual Lane Roundabout
Discuss estimated costs (Attach itemized cost estimate tables)		
Operations and Maintenance Costs		
Additional considerations		
Practical Feasibility		
Concerns alternative may present		
Major impacts on businesses, parking availability, real estate and utilities		
Frequency of use as an alternate route		
Additional considerations		
Pedestrians and Bicycles		
Describe the need for pedestrian and bicycle facilities		
Identify nearby pedestrian generators, bike routes, transit stops and if the intersection is on a Safe Route to School (part of existing conditions exhibit)		
State if and what facilities are proposed, within, the project limits (part of preliminary layout of proposed alternatives)		
Additional considerations		
OSOW Freight Network		
Identify nearby OSOW generators		

ATTACHMENT 12

Factor	Existing Traffic Control Traffic Signal	Alternative 1 Dual Lane Roundabout
If either intersecting road is on the freight network, is a significant diversion route or near a freight origin or destination discuss the following: • The geometric features and other design considerations to account for the OSOW vehicle path (e.g. grading, medians, islands). • Vertical and horizontal clearance to account for the OSOW vehicle path (e.g. monotubes, signing)		
Additional considerations		
Environmental Impacts		
Type (i.e. historical, archeological, wetlands or hazardous material) and amount of environmental acreage impacts		
Additional considerations		

Factor	Alternative 2	Alternative 3
Safety		
Crash diagram trends		
Percent and type of crashes expected to be reduced by alternative		
Access near the intersection and side road traffic impacts		
Additional considerations		
Operational Analysis		
Discuss the Warrant Analysis (Attach AWSC/Signal warrants)		

Factor	Alternative 2	Alternative 3
LOS, delay, v/c ratio and 95th percentile queues for each movement. (include traffic count, forecast and analysis inputs/outputs)		

Alternative 2

AM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

PM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

Notes:

Alternative 3

AM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

PM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

Notes:

Queue impact on adjacent driveways		
Capacity to accommodate 5-20% of diverted freeway traffic for routes parallel to freeway		
Document railroad crossings within 1000 feet of the intersection.		
Preliminary Layout of existing and proposed traffic control	See Appendix	See Appendix
Additional considerations (Indicate if roundabout is expected to be a spiral design)		
Right-of-Way Impacts		
Amount of acreage impacted (# of relocations, access restrictions)		
Anticipated right-of-way and real estate costs (Attach cost estimate tables)		
Additional Considerations		
Costs		
Discuss estimated costs (Attach itemized cost estimate tables)		
Operations and Maintenance Costs		
Additional considerations		

ATTACHMENT 12

Factor	Alternative 2	Alternative 3
Practical Feasibility		
Concerns alternative may present		
Major impacts on businesses, parking availability, real estate and utilities		
Frequency of use as an alternate route		
Additional considerations		
Pedestrians and Bicycles		
Describe the need for pedestrian and bicycle facilities		
Identify nearby pedestrian generators, bike routes, transit stops and if the intersection is on a Safe Route to School (part of existing conditions exhibit)		
State if and what facilities are proposed, within, the project limits (part of preliminary layout of proposed alternatives)		
Additional considerations		
OSOW Vehicle Routes		
Identify nearby OSOW generators		
If either intersecting road is on the freight network, is a significant diversion route or near a freight origin or destination discuss the following: • The geometric features and other design considerations to account for the OSOW vehicle path (e.g. grading, medians, islands). • Vertical and horizontal clearance to account for the OSOW vehicle path (e.g. monotubes, signing)		
Additional considerations		
Environmental Impacts		

ATTACHMENT 12

Factor	Alternative 2	Alternative 3
Type (i.e. historical, archeological, wetlands or hazardous material) and amount of environmental acreage impacts		
Additional considerations		

Recommendation
A traffic signal is recommended to be maintained due to unacceptable traffic operations with a dual lane roundabout. A triple lane roundabout will not be considered for this project. It is recommended to coordinate this intersection with the signal system to the north.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	123	43	47	66	14	127	26	1754	85	67	799	38
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1900	1863	1863	1900	1881	1881	1881	1827	1827	1827
Adj Flow Rate, veh/h	129	45	49	69	15	134	27	1846	45	71	841	20
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	2	2	2	1	1	1	4	4	4
Cap, veh/h	203	154	167	256	31	275	446	2072	927	207	2395	1071
Arrive On Green	0.19	0.19	0.19	0.19	0.19	0.19	0.58	0.58	0.58	0.12	1.00	1.00
Sat Flow, veh/h	1222	809	881	1297	162	1446	646	3574	1599	1740	3471	1553
Grp Volume(v), veh/h	129	0	94	69	0	149	27	1846	45	71	841	20
Grp Sat Flow(s),veh/h/ln	1222	0	1689	1297	0	1608	646	1787	1599	1740	1736	1553
Q Serve(g_s), s	10.5	0.0	4.8	4.8	0.0	8.3	1.8	44.9	1.2	1.4	0.0	0.0
Cycle Q Clear(g_c), s	18.8	0.0	4.8	9.6	0.0	8.3	1.8	44.9	1.2	1.4	0.0	0.0
Prop In Lane	1.00		0.52	1.00		0.90	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	203	0	321	256	0	305	446	2072	927	207	2395	1071
V/C Ratio(X)	0.64	0.00	0.29	0.27	0.00	0.49	0.06	0.89	0.05	0.34	0.35	0.02
Avail Cap(c_a), veh/h	203	0	321	256	0	305	446	2072	927	224	2395	1071
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	44.6	0.0	34.7	38.9	0.0	36.2	9.2	18.3	9.1	19.6	0.0	0.0
Incr Delay (d2), s/veh	6.4	0.0	0.5	0.6	0.0	1.2	0.3	6.3	0.1	1.0	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.9	0.0	2.3	1.8	0.0	3.8	0.4	23.6	0.6	1.2	0.1	0.0
LnGrp Delay(d),s/veh	50.9	0.0	35.2	39.4	0.0	37.4	9.5	24.5	9.2	20.6	0.4	0.0
LnGrp LOS	D		D	D		D	A	C	A	C	A	A
Approach Vol, veh/h		223			218			1918			932	
Approach Delay, s/veh		44.3			38.0			24.0			1.9	
Approach LOS		D			D			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		75.0		25.0	11.0	64.0		25.0
Change Period (Y+Rc), s		6.0		6.0	5.0	6.0		6.0
Max Green Setting (Gmax), s		69.0		19.0	7.0	57.0		19.0
Max Q Clear Time (g_c+I1), s		2.0		20.8	3.4	46.9		11.6
Green Ext Time (p_c), s		44.0		0.0	0.0	9.3		1.3

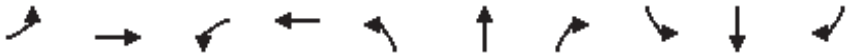
Intersection Summary	
HCM 2010 Ctrl Delay	20.0
HCM 2010 LOS	C

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	123	43	66	14	26	1754	85	67	799	38
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		8		6		5	2	
Permitted Phases	4		8		6		6	2		2
Detector Phase	4	4	8	8	6	6	6	5	2	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	12.0	12.0	12.0	7.0	12.0	12.0
Minimum Split (s)	16.0	16.0	16.0	16.0	18.0	18.0	18.0	12.0	18.0	18.0
Total Split (s)	25.0	25.0	25.0	25.0	63.0	63.0	63.0	12.0	75.0	75.0
Total Split (%)	25.0%	25.0%	25.0%	25.0%	63.0%	63.0%	63.0%	12.0%	75.0%	75.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag					Lag	Lag	Lag	Lead		
Lead-Lag Optimize?					Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	15.6	15.6	15.6	15.6	62.8	62.8	62.8	73.4	72.4	72.4
Actuated g/C Ratio	0.16	0.16	0.16	0.16	0.63	0.63	0.63	0.73	0.72	0.72
v/c Ratio	0.76	0.35	0.34	0.59	0.07	0.82	0.04	0.37	0.33	0.02
Control Delay	66.8	40.4	41.2	48.7	10.0	20.2	9.3	21.2	9.5	8.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.8	40.4	41.2	48.7	10.0	20.2	9.3	21.2	9.5	8.9
LOS	E	D	D	D	A	C	A	C	A	A
Approach Delay		55.7		46.3		19.8			10.4	
Approach LOS		E		D		B			B	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 36 (36%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green	
Natural Cycle: 80	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.82	
Intersection Signal Delay: 21.3	Intersection LOS: C
Intersection Capacity Utilization 87.6%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 25: CTH TT (Meadowbrook Road) & Northview Road

ATTACHMENT 12



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	129	94	69	149	27	1846	45	71	841	20
v/c Ratio	0.76	0.35	0.34	0.59	0.07	0.82	0.04	0.37	0.33	0.02
Control Delay	66.8	40.4	41.2	48.7	10.0	20.2	9.3	21.2	9.5	8.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.8	40.4	41.2	48.7	10.0	20.2	9.3	21.2	9.5	8.9
Queue Length 50th (ft)	79	54	39	88	7	482	11	23	116	5
Queue Length 95th (ft)	#151	99	79	148	20	#650	27	52	130	m14
Internal Link Dist (ft)		959		1758		3378			706	
Turn Bay Length (ft)	200		200		325		325	200		200
Base Capacity (vph)	208	323	246	306	397	2245	1004	194	2513	1124
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.62	0.29	0.28	0.49	0.07	0.82	0.04	0.37	0.33	0.02

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	84	40	55	148	65	75	73	996	97	116	1679	133
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1881	1900	1881	1881	1900	1881	1881	1881	1881	1881	1881
Adj Flow Rate, veh/h	87	41	57	153	67	77	75	1027	50	120	1731	69
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	190	121	169	228	136	156	228	2118	947	419	2538	1135
Arrive On Green	0.17	0.17	0.17	0.17	0.17	0.17	0.59	0.59	0.59	0.14	1.00	1.00
Sat Flow, veh/h	1251	714	992	1305	800	919	263	3574	1599	1792	3574	1599
Grp Volume(v), veh/h	87	0	98	153	0	144	75	1027	50	120	1731	69
Grp Sat Flow(s),veh/h/ln	1251	0	1706	1305	0	1719	263	1787	1599	1792	1787	1599
Q Serve(g_s), s	6.8	0.0	5.1	11.7	0.0	7.6	16.2	16.4	1.3	2.3	0.0	0.0
Cycle Q Clear(g_c), s	14.4	0.0	5.1	16.8	0.0	7.6	16.2	16.4	1.3	2.3	0.0	0.0
Prop In Lane	1.00		0.58	1.00		0.53	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	190	0	290	228	0	292	228	2118	947	419	2538	1135
V/C Ratio(X)	0.46	0.00	0.34	0.67	0.00	0.49	0.33	0.48	0.05	0.29	0.68	0.06
Avail Cap(c_a), veh/h	190	0	290	228	0	292	228	2118	947	423	2538	1135
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	44.1	0.0	36.5	43.9	0.0	37.6	11.6	11.7	8.6	7.1	0.0	0.0
Incr Delay (d2), s/veh	1.7	0.0	0.7	7.5	0.0	1.3	3.8	0.8	0.1	0.4	1.5	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.4	0.0	2.4	4.7	0.0	3.7	1.4	8.2	0.6	1.1	0.5	0.0
LnGrp Delay(d),s/veh	45.8	0.0	37.2	51.4	0.0	38.9	15.4	12.4	8.7	7.5	1.5	0.1
LnGrp LOS	D		D	D		D	B	B	A	A	A	A
Approach Vol, veh/h		185			297			1152			1920	
Approach Delay, s/veh		41.3			45.3			12.5			1.8	
Approach LOS		D			D			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		77.0		23.0	11.8	65.2		23.0
Change Period (Y+Rc), s		6.0		6.0	5.0	6.0		6.0
Max Green Setting (Gmax), s		71.0		17.0	7.0	59.0		17.0
Max Q Clear Time (g_c+I1), s		2.0		16.4	4.3	18.4		18.8
Green Ext Time (p_c), s		51.1		0.2	0.1	33.7		0.0

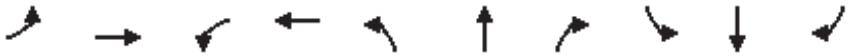
Intersection Summary	
HCM 2010 Ctrl Delay	11.0
HCM 2010 LOS	B

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	84	40	148	65	73	996	97	116	1679	133
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		8		6		5	2	
Permitted Phases	4		8		6		6	2		2
Detector Phase	4	4	8	8	6	6	6	5	2	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	12.0	12.0	12.0	7.0	12.0	12.0
Minimum Split (s)	16.0	16.0	16.0	16.0	18.0	18.0	18.0	12.0	18.0	18.0
Total Split (s)	23.0	23.0	23.0	23.0	65.0	65.0	65.0	12.0	77.0	77.0
Total Split (%)	23.0%	23.0%	23.0%	23.0%	65.0%	65.0%	65.0%	12.0%	77.0%	77.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag					Lag	Lag	Lag	Lead		
Lead-Lag Optimize?					Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	15.1	15.1	15.1	15.1	60.9	60.9	60.9	73.9	72.9	72.9
Actuated g/C Ratio	0.15	0.15	0.15	0.15	0.61	0.61	0.61	0.74	0.73	0.73
v/c Ratio	0.51	0.38	0.77	0.55	0.57	0.47	0.05	0.31	0.67	0.06
Control Delay	49.1	41.9	66.2	47.1	34.5	12.0	8.8	2.0	2.2	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.1	41.9	66.2	47.1	34.5	12.0	8.8	2.0	2.2	0.5
LOS	D	D	E	D	C	B	A	A	A	A
Approach Delay		45.3		57.0		13.3			2.2	
Approach LOS		D		E		B			A	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 80 (80%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.77	
Intersection Signal Delay: 12.6	Intersection LOS: B
Intersection Capacity Utilization 93.1%	ICU Level of Service F
Analysis Period (min) 15	

Splits and Phases: 25: CTH TT (Meadowbrook Road) & Northview Road

ATTACHMENT 12



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	87	98	153	144	75	1027	50	120	1731	69
v/c Ratio	0.51	0.38	0.77	0.55	0.57	0.47	0.05	0.31	0.67	0.06
Control Delay	49.1	41.9	66.2	47.1	34.5	12.0	8.8	2.0	2.2	0.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.1	41.9	66.2	47.1	34.5	12.0	8.8	2.0	2.2	0.5
Queue Length 50th (ft)	50	56	93	84	28	184	13	3	25	2
Queue Length 95th (ft)	100	105	#183	146	#107	234	28	m5	40	m3
Internal Link Dist (ft)		959		1758		3378			706	
Turn Bay Length (ft)	200		200		325		325	200		200
Base Capacity (vph)	193	292	222	294	131	2175	973	391	2603	1165
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.34	0.69	0.49	0.57	0.47	0.05	0.31	0.67	0.06

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

ATTACHMENT 12

Phone: Fax:
E-Mail:

ROUNDABOUT ANALYSIS

Analyst: SKB
Agency/Co.: GRAEF
Date Performed: 12/16/2014
Analysis Time Period: AM Peak Hour
Intersection: CTH TT & Northview Road
Jurisdiction: Waukesha County
Units: U. S. Customary
Analysis Year: Year 2037
Project ID: 2788-01-00 West Waukesha Bypass
East/West Street: Northview Road
North/South Street: CTH TT

Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	123	43	47	66	14	127	26	1754	85	67	799	38
U-Turn Vol	5			5			5			5		
% Thrus Left Lane								50			50	

	Eastbound			Westbound			Northbound			Southbound		
	Left		Right	BP	Left		Right	BP	Left		Right	BP
Lane Assn.	L		TR		L		TR		LT		TR	
RT Bypass	None				None				None			
PHF	0.81	0.81	0.81		0.81	0.81	0.81		0.81	0.81	0.81	
%HV	3	3	3		2	2	2		2	2	2	
NumPeds	10				10				10			
U-Turn PHF	0.81				0.81				0.81			
U-Turn %HV	3				2				2			
Flow Rate	156	55	60		83	18	160		33	2209	107	
No. Lanes	1	1	0		1	1	0		0	2	0	
Cnfl. Lanes	2				2				2			

Duration, T 0.25 hrs.

Critical and Follow-Up Headway Adjustment

	Eastbound			Westbound		
Crit. Hdwy	4.0000*	4.0000*	5.1929	4.0000*	4.0000*	5.1929
	Northbound			Southbound		
Crit. Hdwy	4.0000*	4.0000*	5.1929	4.0000*	4.0000*	5.1929
	Eastbound			Westbound		
Flup. Hdwy	2.8000*	2.8000*	3.1858	2.8000*	2.8000*	3.1858
	Northbound			Southbound		
Flup. Hdwy	2.8000*	2.8000*	3.1858	2.8000*	2.8000*	3.1858

Flow Computations

	Eastbound	Westbound	Northbound	Southbound
Circ. Flow	1213	2416	315	152
Exit. Flow	254	106	2531	1175

Capacity and Level of Service

	Eastbound	Westbound	Northbound	Southbound

ATTACHMENT 12

	Left	Right	BP	Left	Right	BP	Left	Right	BP	Left	Right	BP
Entry Flow	163	114		89	178		1177	1177		584	584	
Entry Cap.	535	535		224	224		1023	1023		1152	1152	
Volume (vph)	158	111		87	175		1154	1154		562	562	
Cap. (vph)	519	519		220	220		995	995		1096	1096	
v/c Ratio	0.30	0.21		0.40	0.79		1.16	1.16		0.51	0.51	
Critical Lane					*			*			*	
Lane Delay	11.5	9.9		28.7	63.3		100.9		100.9			9.2
Lane LOS	B	A		D	F		F	F		A	A	
95 % Queue	1.3	0.8		1.8	5.7		33.0	33.0		3.0	3.0	
Approach:												
Delay		10.81			51.80			100.94			9.24	
LOS		B			F			F			A	
Intersection Delay		65.57					Intersection LOS			F		

ATTACHMENT 12

Phone: Fax:
E-Mail:

ROUNDABOUT ANALYSIS

Analyst: SKB
Agency/Co.: GRAEF
Date Performed: 12/16/2014
Analysis Time Period: PM Peak Hour
Intersection: CTH TT & Northview Road
Jurisdiction: Waukesha County
Units: U. S. Customary
Analysis Year: Year 2037
Project ID: 2788-01-00 West Waukesha Bypass
East/West Street: Northview Road
North/South Street:

Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	84	40	55	148	65	75	73	996	97	116	1679	133
U-Turn Vol	5			5			5			5		
% Thrus Left Lane								50			50	

	Eastbound			Westbound			Northbound			Southbound		
	Left		Right	BP	Left		Right	BP	Left		Right	BP
Lane Assn.	L		TR		L		TR		LT		TR	
RT Bypass	None				None				None			
PHF	0.94	0.94	0.94		0.94	0.94	0.94		0.94	0.94	0.94	
%HV	2	2	2		2	2	2		2	2	2	
NumPeds	10				10				10			
U-Turn PHF	0.94				0.94				0.94			
U-Turn %HV	2				2				2			
Flow Rate	91	43	60		161	71	81		79	1081	105	
126	1822	144										
No. Lanes	1	1	0		1	1	0		0	2	0	
0	2	0										
Cnfl. Lanes	2				2				2			
2												

Duration, T 0.25 hrs.

Critical and Follow-Up Headway Adjustment

	Eastbound			Westbound		
Crit. Hdwy	4.0000*	4.0000*	5.1929	4.0000*	4.0000*	5.1929
	Northbound			Southbound		
Crit. Hdwy	4.0000*	4.0000*	5.1929	4.0000*	4.0000*	5.1929
	Eastbound			Westbound		
Flup. Hdwy	2.8000*	2.8000*	3.1858	2.8000*	2.8000*	3.1858
	Northbound			Southbound		
Flup. Hdwy	2.8000*	2.8000*	3.1858	2.8000*	2.8000*	3.1858

Flow Computations

	Eastbound	Westbound	Northbound	Southbound
Circ. Flow	2124	1266	275	326
Exit. Flow	280	299	1259	2048

Capacity and Level of Service

	Eastbound	Westbound	Northbound	Southbound

ATTACHMENT 12

	Left	Right	BP	Left	Right	BP	Left	Right	BP	Left	Right	BP
Entry Flow	97	103		166	152		635	635		1049	1049	
Entry Cap.	277	277		515	515		1053	1053		1016	1016	
Volume (vph)	95	101		163	149		623	623		1028	1028	
Cap. (vph)	272	272		505	505		1023	1023		987	987	
v/c Ratio	0.35	0.37		0.32	0.30		0.61	0.61		1.04	1.04	
Critical Lane		*			*			*			*	
Lane Delay	21.9	22.7		12.1	11.6		11.9	11.9		60.5	60.5	
Lane LOS	C	C		B	B		B	B		F	F	
95 % Queue	1.5	1.6		1.4	1.2		4.3	4.3		22.4	22.4	
Approach:												
Delay		22.33			11.84			11.87			60.51	
LOS		C			B			B			F	

Intersection Delay 38.66 Intersection LOS E

ATTACHMENT 12

Appendix 3

CTH TT & USH 18 (Summit Avenue)

ATTACHMENT 12

Intersection Control Evaluation Worksheet

BUREAU OF TRAFFIC OPERATIONS

Revised: March 31, 2014

SPELL CHECK

Prepared By Shana Brummond **Date** 19-Dec-14

Intersection: CTH TT (Meadowbrook Road) & USH 18 **Design Project ID:** 2788-01-00 **Project Description:** West Waukesha Bypass

Factor	**Existing Traffic Control** Traffic Signal	**Alternative 1** Dual Lane Roundabout with RT Bypass lanes for all approaches
Safety		
Crash diagram trends	26 crashes (2009-2013) - 10 rear end, 4 right angle, 10 left turn & 2 single vehicle crash	
Percent and type of crashes expected to be reduced by alternative		Right angle & left-turn crashes would be reduced with roundabout. These crashes account for 14 of the 26 intersection crashes (approximately 54% reduction).
Access near the intersection and side road traffic impacts		
Additional considerations		
Operational Analysis		
Discuss the Warrant Analysis (Attach AWSC/Signal warrants)		

ATTACHMENT 12

<table>
<tr><th>Factor</th><th>Existing Traffic Control Traffic Signal</th><th>Alternative 1 Dual Lane Roundabout with RT Bypass lanes for all approaches</th></tr>
<tr><td>LOS, delay, v/c ratio and 95th percentile queues for each movement. (Attach traffic count, forecast and analysis inputs/outputs)</td><td>
<table>
<tr><th>AM PEAK</th><th colspan="3">EB</th><th colspan="3">WB</th><th colspan="3">NB</th><th colspan="3">SB</th></tr>
<tr><th></th><th>LT</th><th>TH</th><th>RT</th><th>LT</th><th>TH</th><th>RT</th><th>LT</th><th>TH</th><th>RT</th><th>LT</th><th>TH</th><th>RT</th></tr>
<tr><td># of Lanes</td><td>2</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>2</td><td>1</td><td>1</td><td>2</td><td>1</td></tr>
<tr><td>LOS</td><td>D</td><td>E</td><td>C</td><td>D</td><td>D</td><td>D</td><td>C</td><td>D</td><td>C</td><td>C</td><td>C</td><td>B</td></tr>
<tr><td>Delay (s)</td><td>54.3</td><td>55.2</td><td>29.5</td><td>39.2</td><td>47.2</td><td>41.7</td><td>21.9</td><td>54.0</td><td>27.7</td><td>33.5</td><td>28.8</td><td>18.7</td></tr>
<tr><td>v/c Ratio</td><td>0.89</td><td>0.91</td><td>0.17</td><td>0.50</td><td>0.59</td><td>0.20</td><td>0.44</td><td>0.94</td><td>0.15</td><td>0.64</td><td>0.55</td><td>0.13</td></tr>
<tr><td>Queue (ft)</td><td>290</td><td>520</td><td>85</td><td>80</td><td>185</td><td>70</td><td>55</td><td>630</td><td>35</td><td>125</td><td>295</td><td>45</td></tr>
<tr><td>Int. LOS</td><td colspan="12">D</td></tr>
</table>
<table>
<tr><th>PM PEAK</th><th colspan="3">EB</th><th colspan="3">WB</th><th colspan="3">NB</th><th colspan="3">SB</th></tr>
<tr><th></th><th>LT</th><th>TH</th><th>RT</th><th>LT</th><th>TH</th><th>RT</th><th>LT</th><th>TH</th><th>RT</th><th>LT</th><th>TH</th><th>RT</th></tr>
<tr><td># of Lanes</td><td>2</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>2</td><td>1</td><td>1</td><td>2</td><td>1</td></tr>
<tr><td>LOS</td><td>E</td><td>D</td><td>C</td><td>C</td><td>D</td><td>C</td><td>D</td><td>D</td><td>C</td><td>C</td><td>D</td><td>C</td></tr>
<tr><td>Delay (s)</td><td>75.6</td><td>38.9</td><td>33.0</td><td>29.4</td><td>53.9</td><td>29.7</td><td>54.3</td><td>43.8</td><td>33.4</td><td>25.4</td><td>53.5</td><td>21.5</td></tr>
<tr><td>v/c Ratio</td><td>0.90</td><td>0.63</td><td>0.22</td><td>0.65</td><td>0.90</td><td>0.16</td><td>0.87</td><td>0.66</td><td>0.16</td><td>0.52</td><td>0.96</td><td>0.43</td></tr>
<tr><td>Queue (ft)</td><td>190</td><td>265</td><td>95</td><td>185</td><td>480</td><td>75</td><td>235</td><td>360</td><td>60</td><td>95</td><td>560</td><td>215</td></tr>
<tr><td>Int. LOS</td><td colspan="12">D</td></tr>
</table>
Notes: With the design year (Year 2037) traffic, the eastbound through movement is expected to experience LOS E conditions (0.2 secs from LOS D) during the AM peak hour based on preliminary traffic analysis. The eastbound left-turn movement is expected to experience LOS E condiitons during the PM peak hour due to low volume operating under protected only phasing. All other movements are expected to operate acceptably at LOS D or better condiitons during the peak hours.
</td><td>
<table>
<tr><th>AM PEAK</th><th colspan="3">EB</th><th colspan="3">WB</th><th colspan="3">NB</th><th colspan="3">SB</th></tr>
<tr><th></th><th>LT</th><th>TH</th><th>RT</th><th>LT</th><th>TH</th><th>RT</th><th>LT</th><th>TH</th><th>RT</th><th>LT</th><th>TH</th><th>RT</th></tr>
<tr><td># of Lanes</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>2</td><td>1</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>LOS</td><td>F</td><td>D</td><td>A</td><td>D</td><td>E</td><td>C</td><td>F</td><td>F</td><td>A</td><td>B</td><td>B</td><td>A</td></tr>
<tr><td>Delay (s)</td><td>70.0</td><td>31.0</td><td>8.3</td><td>25.2</td><td>36.5</td><td>19.9</td><td>229.5</td><td>229.5</td><td>?</td><td>7.4</td><td>7.4</td><td>10.2</td></tr>
<tr><td>v/c Ratio</td><td>1.03</td><td>0.81</td><td>0.24</td><td>0.40</td><td>0.61</td><td>0.32</td><td>1.43</td><td>1.43</td><td>0.24</td><td>0.48</td><td>0.48</td><td>0.18</td></tr>
<tr><td>Queue (ft)</td><td>425</td><td>225</td><td>25</td><td>50</td><td>100</td><td>50</td><td>875</td><td>875</td><td>25</td><td>75</td><td>75</td><td>25</td></tr>
<tr><td>Int. LOS</td><td colspan="12">F</td></tr>
</table>
<table>
<tr><th>PM PEAK</th><th colspan="3">EB</th><th colspan="3">WB</th><th colspan="3">NB</th><th colspan="3">SB</th></tr>
<tr><th></th><th>LT</th><th>TH</th><th>RT</th><th>LT</th><th>TH</th><th>RT</th><th>LT</th><th>TH</th><th>RT</th><th>LT</th><th>TH</th><th>RT</th></tr>
<tr><td># of Lanes</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>2</td><td>1</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>LOS</td><td>D</td><td>D</td><td>B</td><td>C</td><td>F</td><td>B</td><td>C</td><td>C</td><td>A</td><td>F</td><td>F</td><td>D</td></tr>
<tr><td>Delay (s)</td><td>33.0</td><td>29.8</td><td>14.4</td><td>20.9</td><td>70.2</td><td>10.2</td><td>20.3</td><td>20.3</td><td>6.1</td><td>65.5</td><td>65.5</td><td>29.5</td></tr>
<tr><td>v/c Ratio</td><td>0.73</td><td>0.69</td><td>0.37</td><td>0.58</td><td>0.99</td><td>0.26</td><td>0.72</td><td>0.72</td><td>0.20</td><td>1.01</td><td>1.01</td><td>0.84</td></tr>
<tr><td>Queue (ft)</td><td>150</td><td>125</td><td>50</td><td>100</td><td>325</td><td>25</td><td>175</td><td>175</td><td>25</td><td>400</td><td>400</td><td>250</td></tr>
<tr><td>Int. LOS</td><td colspan="12">E</td></tr>
</table>
Notes: With the design year (Year 2037) traffic, select movements are expected to operate at LOS E or F conditions during the peak hours. The overall intesrection is expected to operate at LOS F during the AM peak hour and LOS E during the PM peak hour. V/C ratio exceeds 1.0 for select movements during the peak hours.
</td></tr>
<tr><td>Queue impact on adjacent driveways</td><td>None</td><td>None</td></tr>
<tr><td>Capacity to accommodate diverted freeway traffic for routes parallel to freeway</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Impacts of railroad crossings within 1000 feet</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Preliminary Layout of existing and proposed traffic control</td><td>See Appendix</td><td>See Appendix</td></tr>
<tr><td>Additional considerations (Indicate if roundabout is expected to be a spiral design)</td><td colspan="2"></td></tr>
<tr><td>Right-of-Way Impacts</td><td></td><td></td></tr>
<tr><td>Amount of acreage impacted (# of relocations, access restrictions)</td><td></td><td></td></tr>
<tr><td>Anticipated right-of-way and real estate costs (Attach cost estimate tables)</td><td></td><td></td></tr>
<tr><td>Additional considerations</td><td colspan="2"></td></tr>
<tr><td>Costs</td><td></td><td></td></tr>
</table>

ATTACHMENT 12

Factor	Existing Traffic Control Traffic Signal	Alternative 1 Dual Lane Roundabout with RT Bypass lanes for all approaches
Discuss estimated costs (Attach itemized cost estimate tables)		
Operations and Maintenance Costs		
Additional considerations		
Practical Feasibility		
Concerns alternative may present		
Major impacts on businesses, parking availability, real estate and utilities		
Frequency of use as an alternate route		
Additional considerations		
Pedestrians and Bicycles		
Describe the need for pedestrian and bicycle facilities		
Identify nearby pedestrian generators, bike routes, transit stops and if the intersection is on a Safe Route to School (part of existing conditions exhibit)		
State if and what facilities are proposed, within, the project limits (part of preliminary layout of proposed alternatives)		
Additional considerations		
OSOW Freight Network		
Identify nearby OSOW generators		

Factor	Existing Traffic Control Traffic Signal	Alternative 1 Dual Lane Roundabout with RT Bypass lanes for all approaches
If either intersecting road is on the freight network, is a significant diversion route or near a freight origin or destination discuss the following: • The geometric features and other design considerations to account for the OSOW vehicle path (e.g. grading, medians, islands). • Vertical and horizontal clearance to account for the OSOW vehicle path (e.g. monotubes, signing)		
Additional considerations		
Environmental Impacts		
Type (i.e. historical, archeological, wetlands or hazardous material) and amount of environmental acreage impacts		
Additional considerations		

Factor	Alternative 2	Alternative 3
Safety		
Crash diagram trends		
Percent and type of crashes expected to be reduced by alternative		
Access near the intersection and side road traffic impacts		
Additional considerations		
Operational Analysis		
Discuss the Warrant Analysis (Attach AWSC/Signal warrants)		

Factor	Alternative 2	Alternative 3
LOS, delay, v/c ratio and 95th percentile queues for each movement. (include traffic count, forecast and analysis inputs/outputs)		

Alternative 2

AM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

PM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

Notes:

Alternative 3

AM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

PM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

Notes:

Queue impact on adjacent driveways		
Capacity to accommodate 5-20% of diverted freeway traffic for routes parallel to freeway		
Document railroad crossings within 1000 feet of the intersection.		
Preliminary Layout of existing and proposed traffic control	See Appendix	See Appendix
Additional considerations (Indicate if roundabout is expected to be a spiral design)		
Right-of-Way Impacts		
Amount of acreage impacted (# of relocations, access restrictions)		
Anticipated right-of-way and real estate costs (Attach cost estimate tables)		
Additional Considerations		
Costs		
Discuss estimated costs (Attach itemized cost estimate tables)		
Operations and Maintenance Costs		
Additional considerations		

ATTACHMENT 12

Factor	Alternative 2	Alternative 3
Practical Feasibility		
Concerns alternative may present		
Major impacts on businesses, parking availability, real estate and utilities		
Frequency of use as an alternate route		
Additional considerations		
Pedestrians and Bicycles		
Describe the need for pedestrian and bicycle facilities		
Identify nearby pedestrian generators, bike routes, transit stops and if the intersection is on a Safe Route to School (part of existing conditions exhibit)		
State if and what facilities are proposed, within, the project limits (part of preliminary layout of proposed alternatives)		
Additional considerations		
OSOW Vehicle Routes		
Identify nearby OSOW generators		
If either intersecting road is on the freight network, is a significant diversion route or near a freight origin or destination discuss the following: • The geometric features and other design considerations to account for the OSOW vehicle path (e.g. grading, medians, islands). • Vertical and horizontal clearance to account for the OSOW vehicle path (e.g. monotubes, signing)		
Additional considerations		
Environmental Impacts		

ATTACHMENT 12

Factor	Alternative 2	Alternative 3
Type (i.e. historical, archeological, wetlands or hazardous material) and amount of environmental acreage impacts		
Additional considerations		

Recommendation
A traffic signal is recommended to be maintained at this intersection due to the unacceptable traffic operations with a dual lane roundabout. A triple lane roundabout will not be considered for this project. It is recommended to coordinate this intersection with Madison Street if a traffic signal is installed at that intersection.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	559	447	144	89	142	84	131	1159	168	105	653	156
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1743	1743	1743	1845	1845	1845	1792	1792	1792
Adj Flow Rate, veh/h	614	491	79	98	156	46	144	1274	92	115	718	86
Adj No. of Lanes	2	1	1	1	1	1	1	2	1	1	2	1
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	3	3	3	9	9	9	3	3	3	6	6	6
Cap, veh/h	690	539	458	197	266	226	326	1354	606	180	1295	675
Arrive On Green	0.20	0.29	0.29	0.06	0.15	0.15	0.04	0.26	0.26	0.06	0.38	0.38
Sat Flow, veh/h	3408	1845	1568	1660	1743	1482	1757	3505	1568	1707	3406	1524
Grp Volume(v), veh/h	614	491	79	98	156	46	144	1274	92	115	718	86
Grp Sat Flow(s),veh/h/ln	1704	1845	1568	1660	1743	1482	1757	1752	1568	1707	1703	1524
Q Serve(g_s), s	19.5	28.6	4.2	5.5	9.3	3.0	5.5	39.7	5.0	4.5	18.4	3.7
Cycle Q Clear(g_c), s	19.5	28.6	4.2	5.5	9.3	3.0	5.5	39.7	5.0	4.5	18.4	3.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	690	539	458	197	266	226	326	1354	606	180	1295	675
V/C Ratio(X)	0.89	0.91	0.17	0.50	0.59	0.20	0.44	0.94	0.15	0.64	0.55	0.13
Avail Cap(c_a), veh/h	796	596	507	197	266	226	366	1354	606	183	1295	675
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.67	0.67	0.67	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	43.2	38.0	29.4	37.3	43.9	41.2	21.0	40.0	27.2	26.5	27.1	18.3
Incr Delay (d2), s/veh	11.1	17.2	0.2	1.9	3.3	0.4	0.9	13.9	0.5	7.0	1.7	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	10.3	17.2	1.8	2.6	4.7	1.3	2.7	21.8	2.3	2.5	9.0	1.6
LnGrp Delay(d),s/veh	54.3	55.2	29.5	39.2	47.2	41.7	21.9	54.0	27.7	33.5	28.8	18.7
LnGrp LOS	D	E	C	D	D	D	C	D	C	C	C	B
Approach Vol, veh/h		1184			300			1510			919	
Approach Delay, s/veh		53.0			43.7			49.3			28.4	
Approach LOS		D			D			D			C	

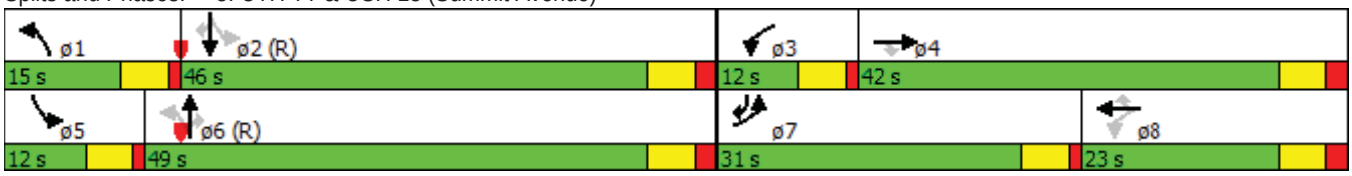
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.5	52.0	12.0	38.5	11.8	52.7	27.5	23.0
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0
Max Green Setting (Gmax), s	10.0	40.0	7.0	36.0	7.0	43.0	26.0	17.0
Max Q Clear Time (g_c+I1), s	7.5	20.4	7.5	30.6	6.5	41.7	21.5	11.3
Green Ext Time (p_c), s	0.1	13.5	0.0	2.0	0.0	1.2	1.0	2.0

Intersection Summary	
HCM 2010 Ctrl Delay	45.1
HCM 2010 LOS	D

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	559	447	144	89	142	84	131	1159	168	105	653	156
Turn Type	Prot	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	pm+ov
Protected Phases	7	4		3	8		1	6		5	2	7
Permitted Phases			4	8		8	6		6	2		2
Detector Phase	7	4	4	3	8	8	1	6	6	5	2	7
Switch Phase												
Minimum Initial (s)	7.0	12.0	12.0	7.0	12.0	12.0	7.0	12.0	12.0	7.0	12.0	7.0
Minimum Split (s)	12.0	18.0	18.0	12.0	18.0	18.0	12.0	18.0	18.0	12.0	18.0	12.0
Total Split (s)	31.0	42.0	42.0	12.0	23.0	23.0	15.0	49.0	49.0	12.0	46.0	31.0
Total Split (%)	27.0%	36.5%	36.5%	10.4%	20.0%	20.0%	13.0%	42.6%	42.6%	10.4%	40.0%	27.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max	None
Act Effct Green (s)	24.3	33.6	33.6	24.3	16.3	16.3	55.3	45.0	45.0	51.5	43.1	73.5
Actuated g/C Ratio	0.21	0.29	0.29	0.21	0.14	0.14	0.48	0.39	0.39	0.45	0.37	0.64
v/c Ratio	0.85	0.91	0.17	0.57	0.63	0.22	0.44	0.93	0.15	0.66	0.56	0.09
Control Delay	56.0	61.5	30.4	38.1	58.8	46.3	15.0	38.6	16.9	39.5	31.4	8.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.0	61.5	30.4	38.1	58.8	46.3	15.0	38.6	16.9	39.5	31.4	8.7
LOS	E	E	C	D	E	D	B	D	B	D	C	A
Approach Delay		56.6			50.1			35.0			30.3	
Approach LOS		E			D			D			C	

Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 115	
Offset: 45 (39%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.93	
Intersection Signal Delay: 41.6	Intersection LOS: D
Intersection Capacity Utilization 85.6%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 3: CTH TT & USH 18 (Summit Avenue)



3: CTH TT & USH 18 (Summit Avenue)

Queues

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	614	491	79	98	156	46	144	1274	92	115	718	86
v/c Ratio	0.85	0.91	0.17	0.57	0.63	0.22	0.44	0.93	0.15	0.66	0.56	0.09
Control Delay	56.0	61.5	30.4	38.1	58.8	46.3	15.0	38.6	16.9	39.5	31.4	8.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.0	61.5	30.4	38.1	58.8	46.3	15.0	38.6	16.9	39.5	31.4	8.7
Queue Length 50th (ft)	223	339	42	43	109	30	33	500	34	45	229	24
Queue Length 95th (ft)	290	#520	81	79	181	66	m51	#626	m35	#125	294	44
Internal Link Dist (ft)		1117			2796			681			546	
Turn Bay Length (ft)	325		325	325		325	325		325	325		325
Base Capacity (vph)	768	577	490	171	257	219	338	1372	614	173	1277	995
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.80	0.85	0.16	0.57	0.61	0.21	0.43	0.93	0.15	0.66	0.56	0.09

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

ATTACHMENT 12

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	271	260	157	247	431	134	206	786	171	132	1043	578
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1845	1845	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	288	277	84	263	459	71	219	836	91	140	1110	307
Adj No. of Lanes	2	1	1	1	1	1	1	2	1	1	2	1
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	3	3	3	2	2	2	2	2	2	2	2	2
Cap, veh/h	319	442	375	402	511	434	251	1263	565	270	1158	721
Arrive On Green	0.09	0.24	0.24	0.13	0.27	0.27	0.03	0.12	0.12	0.07	0.33	0.33
Sat Flow, veh/h	3408	1845	1568	1774	1863	1583	1774	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	288	277	84	263	459	71	219	836	91	140	1110	307
Grp Sat Flow(s),veh/h/ln	1704	1845	1568	1774	1863	1583	1774	1770	1583	1774	1770	1583
Q Serve(g_s), s	9.0	14.4	4.6	11.6	25.4	3.6	8.6	24.2	5.5	5.5	32.9	14.0
Cycle Q Clear(g_c), s	9.0	14.4	4.6	11.6	25.4	3.6	8.6	24.2	5.5	5.5	32.9	14.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	319	442	375	402	511	434	251	1263	565	270	1158	721
V/C Ratio(X)	0.90	0.63	0.22	0.65	0.90	0.16	0.87	0.66	0.16	0.52	0.96	0.43
Avail Cap(c_a), veh/h	319	466	396	423	557	474	257	1263	565	295	1158	721
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	48.0	36.4	32.7	26.0	37.4	29.5	28.4	41.0	32.8	23.8	35.3	19.7
Incr Delay (d2), s/veh	27.6	2.5	0.3	3.4	16.5	0.2	26.0	2.7	0.6	1.5	18.2	1.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.4	7.6	2.0	6.0	15.3	1.6	8.3	12.4	2.5	2.8	19.0	6.4
LnGrp Delay(d),s/veh	75.6	38.9	33.0	29.4	53.9	29.7	54.3	43.8	33.4	25.4	53.5	21.5
LnGrp LOS	E	D	C	C	D	C	D	D	C	C	D	C
Approach Vol, veh/h		649			793			1146			1557	
Approach Delay, s/veh		54.4			43.6			45.0			44.6	
Approach LOS		D			D			D			D	

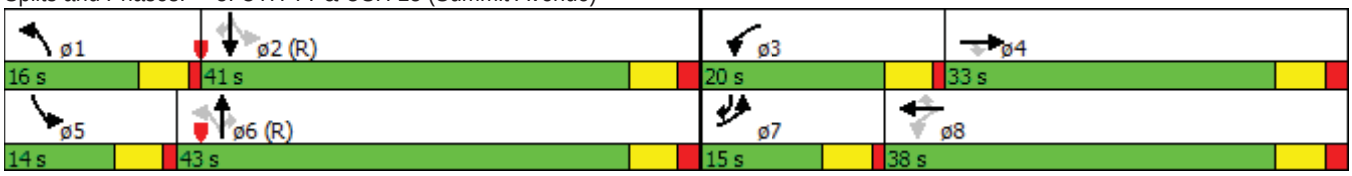
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.6	44.0	18.7	31.6	12.5	47.2	15.0	35.3
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0
Max Green Setting (Gmax), s	11.0	35.0	15.0	27.0	9.0	37.0	10.0	32.0
Max Q Clear Time (g_c+I1), s	10.6	34.9	13.6	16.4	7.5	26.2	11.0	27.4
Green Ext Time (p_c), s	0.0	0.1	0.1	3.5	0.0	8.6	0.0	2.0

Intersection Summary	
HCM 2010 Ctrl Delay	46.1
HCM 2010 LOS	D

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	271	260	157	247	431	134	206	786	171	132	1043	578
Turn Type	Prot	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	pm+ov
Protected Phases	7	4		3	8		1	6		5	2	7
Permitted Phases			4	8		8	6		6	2		2
Detector Phase	7	4	4	3	8	8	1	6	6	5	2	7
Switch Phase												
Minimum Initial (s)	7.0	12.0	12.0	7.0	12.0	12.0	7.0	12.0	12.0	7.0	12.0	7.0
Minimum Split (s)	12.0	18.0	18.0	12.0	18.0	18.0	12.0	18.0	18.0	12.0	18.0	12.0
Total Split (s)	15.0	33.0	33.0	20.0	38.0	38.0	16.0	43.0	43.0	14.0	41.0	15.0
Total Split (%)	13.6%	30.0%	30.0%	18.2%	34.5%	34.5%	14.5%	39.1%	39.1%	12.7%	37.3%	13.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Max	C-Max	None	C-Max	None
Act Effct Green (s)	10.0	25.7	25.7	45.2	29.9	29.9	52.0	39.5	39.5	46.1	36.5	52.5
Actuated g/C Ratio	0.09	0.23	0.23	0.41	0.27	0.27	0.47	0.36	0.36	0.42	0.33	0.48
v/c Ratio	0.93	0.64	0.23	0.66	0.91	0.17	0.86	0.66	0.16	0.52	0.94	0.41
Control Delay	86.8	45.5	35.5	30.2	61.4	30.7	54.9	28.9	20.3	23.8	52.8	21.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	86.8	45.5	35.5	30.2	61.4	30.7	54.9	28.9	20.3	23.8	52.8	21.2
LOS	F	D	D	C	E	C	D	C	C	C	D	C
Approach Delay		62.5			48.3			33.2			43.9	
Approach LOS		E			D			C			D	

Intersection Summary	
Cycle Length: 110	
Actuated Cycle Length: 110	
Offset: 51 (46%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green	
Natural Cycle: 90	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.94	
Intersection Signal Delay: 44.7	Intersection LOS: D
Intersection Capacity Utilization 89.0%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 3: CTH TT & USH 18 (Summit Avenue)



ATTACHMENT 12

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	288	277	84	263	459	71	219	836	91	140	1110	307
v/c Ratio	0.93	0.64	0.23	0.66	0.91	0.17	0.86	0.66	0.16	0.52	0.94	0.41
Control Delay	86.8	45.5	35.5	30.2	61.4	30.7	54.9	28.9	20.3	23.8	52.8	21.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	86.8	45.5	35.5	30.2	61.4	30.7	54.9	28.9	20.3	23.8	52.8	21.2
Queue Length 50th (ft)	106	174	47	120	305	37	72	285	50	55	407	140
Queue Length 95th (ft)	#188	265	91	185	#477	74	#235	356	56	94	#557	214
Internal Link Dist (ft)		1117			2796			681			546	
Turn Bay Length (ft)	325		325	325		325	325		325	325		325
Base Capacity (vph)	309	452	384	410	541	460	255	1270	568	276	1175	755
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.93	0.61	0.22	0.64	0.85	0.15	0.86	0.66	0.16	0.51	0.94	0.41

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

ATTACHMENT 12

Phone: Fax:
E-Mail:

ROUNDABOUT ANALYSIS

Analyst: SKB
Agency/Co.: GRAEF
Date Performed: 12/16/2014
Analysis Time Period: AM Peak Hour
Intersection: CTH TT & USH 18
Jurisdiction: Waukesha County
Units: U. S. Customary
Analysis Year: Year 2037
Project ID: 2788-01-00 West Waukesha Bypass
East/West Street: USH 18
North/South Street: CTH TT

Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	559	447	144	89	142	84	131	1159	168	105	653	156
U-Turn Vol	5			5			5			5		
% Thrus Left Lane								50			50	

	Eastbound			Westbound			Northbound			Southbound		
	Left		Right	BP	Left		Right	BP	Left		Right	BP
Lane Assn.	L		TR		L		TR		LT		TR	
RT Bypass	Yielding				Yielding				Yielding			
PHF	0.91	0.91	0.91		0.91	0.91	0.91		0.91	0.91	0.91	
%HV	3	3	3		9	9	9		3	3	3	
NumPeds	10				10				10			
U-Turn PHF	0.91				0.91				0.91			
U-Turn %HV	3				9				3			
Flow Rate	633	506	163		107	170	101		148	1312	190	
No. Lanes	1	1	0		1	1	0		0	2	0	
Cnfl. Lanes	2		2		2		2		2		1	
Duration, T	0.25	hrs.										

Critical and Follow-Up Headway Adjustment

	Eastbound			Westbound		
Crit. Hdwy	4.0000*	4.0000*	4.0000*	4.0000*	4.0000*	4.0000*
	Northbound			Southbound		
Crit. Hdwy	4.0000*	4.0000*	4.2000*	4.0000*	4.0000*	4.2000*
	Eastbound			Westbound		
Flup. Hdwy	2.8000*	2.8000*	2.8000*	2.8000*	2.8000*	2.8000*
	Northbound			Southbound		
Flup. Hdwy	2.8000*	2.8000*	2.8000*	2.8000*	2.8000*	2.8000*

Flow Computations

	Eastbound	Westbound	Northbound	Southbound
Circ. Flow	1008	2111	1279	443
Exit. Flow	634	324	1950	873

Capacity and Level of Service

	Eastbound	Westbound	Northbound	Southbound

ATTACHMENT 12

	Left	Right	BP	Left	Right	BP	Left	Right	BP	Left	Right	BP
Entry Flow	638	506	163	113	170	101	733	733	190	444	444	182
Entry Cap.	621	621	684	280	280	314	511	511	785	934	934	999
Volume (vph)	619	491	158	104	156	93	712	712	184	419	419	170
Cap. (vph)	603	603	665	257	257	288	496	496	762	875	875	936
v/c Ratio	1.03	0.81	0.24	0.40	0.61	0.32	1.43	1.43	0.24	0.48	0.48	0.18
Critical Lane					*			*			*	
Lane Delay	70.0	31.0	8.3	25.2	36.5	19.9	229.5		229.5		7.4	10.2
Lane LOS	F	D	A	D	E	C	F	F	A	B	B	A
95 % Queue	16.3	8.3	0.9	1.8	3.6	1.3	34.7	34.7	0.9	2.6	2.6	0.7
Approach:												
Delay		47.21			28.81			204.07			9.45	
LOS		E			D			F			A	
Intersection Delay		96.23				Intersection LOS		F				

ATTACHMENT 12

Phone: Fax:
E-Mail:

ROUNDABOUT ANALYSIS

Analyst: SKB
Agency/Co.: GRAEF
Date Performed: 12/16/2014
Analysis Time Period: PM Peak Hour
Intersection: CTH TT & USH 18
Jurisdiction: Waukesha County
Units: U. S. Customary
Analysis Year: Year 2037
Project ID: 2788-01-00 West Waukesha Bypass
East/West Street: USH 18
North/South Street:

Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	271	260	157	247	431	134	206	786	171	132	1043	578
U-Turn Vol	5			5			5			5		
% Thrus Left Lane								50			50	

	Eastbound			Westbound			Northbound			Southbound		
	Left		Right	BP	Left		Right	BP	Left		Right	BP
Lane Assn.	L	TR			L	TR			LT	TR		
RT Bypass	Yielding				Yielding				Yielding			
PHF	0.94	0.94	0.94		0.94	0.94	0.94		0.94	0.94	0.94	
%HV	3	3	3		2	2	2		2	2	2	
NumPeds	10				10				10			
U-Turn PHF	0.94				0.94				0.94			
U-Turn %HV	3				2				2			
Flow Rate	297	285	172		268	468	145		224	853	186	
No. Lanes	1	1	0		1	1	0		0	2	0	
Cnfl. Lanes	2		2		2		2		2		1	
Duration, T	0.25	hrs.										

Critical and Follow-Up Headway Adjustment

	Eastbound			Westbound		
Crit. Hdwy	4.0000*	4.0000*	4.0000*	4.0000*	4.0000*	4.0000*
	Northbound			Southbound		
Crit. Hdwy	4.0000*	4.0000*	4.2000*	4.0000*	4.0000*	4.2000*
	Eastbound			Westbound		
Flup. Hdwy	2.8000*	2.8000*	2.8000*	2.8000*	2.8000*	2.8000*
	Northbound			Southbound		
Flup. Hdwy	2.8000*	2.8000*	2.8000*	2.8000*	2.8000*	2.8000*

Flow Computations

	Eastbound	Westbound	Northbound	Southbound
Circ. Flow	1564	1389	746	975
Exit. Flow	439	697	1155	1405

Capacity and Level of Service

	Eastbound	Westbound	Northbound	Southbound

ATTACHMENT 12

	Left	Right	BP	Left	Right	BP	Left	Right	BP	Left	Right	BP
Entry Flow	302	285	172	273	468	145	541	541	186	643	643	627
Entry Cap.	415	415	466	471	471	558	750	750	914	636	636	748
Volume (vph)	293	277	167	268	459	142	530	530	182	629	629	613
Cap. (vph)	403	403	452	462	462	547	733	733	893	620	620	730
v/c Ratio	0.73	0.69	0.37	0.58	0.99	0.26	0.72	0.72	0.20	1.01	1.01	0.84
Critical Lane					*			*			*	
Lane Delay	33.0	29.8	14.4	20.9	70.2	10.2	20.3	20.3	6.1	65.5	65.5	29.2
Lane LOS	D	D	B	C	F	B	C	C	A	F	F	D
95 % Queue	5.7	5.0	1.7	3.6	12.9	1.0	6.3	6.3	0.8	15.9	15.9	9.5
Approach:												
Delay		27.58			45.20			18.20			53.57	
LOS		D			E			C			F	

Intersection Delay 38.66 Intersection LOS E

ATTACHMENT 12

Appendix 4

CTH TT (Merrill Hills Road) & Madison Street

ATTACHMENT 12

Intersection Control Evaluation Worksheet

BUREAU OF TRAFFIC OPERATIONS

Revised: March 31, 2014

NOTE: Attach Items in BLUE as appendices

SPELL CHECK

Prepared By Shana Brummond **Date** 19-Dec-14

Intersection: CTH TT & Madison Street **Design Project ID:** 2788-01-00 **Project Description:** West Waukesha Bypass

Factor	**Existing Traffic Control** All-Way Stop	**Alternative 1** Traffic Signal
Safety		
Crash diagram trends	33 crashes (2009-2013) - 23 rear end, 3 right angle, 1 left turn, 1 sideswipe & 5 single vehicle crashes	
Percent and type of crashes expected to be reduced by alternative		The number of rear end crashes will be reduced with the traffic signal due to the grade change on the north approach.
Access near the intersection and side road traffic impacts		
Additional considerations	A high number of the rear end crashes are related to the steep grade on the north approach. The project include adjusting the grade to reduce these type of crashes.	
Operational Analysis		
Discuss the Warrant Analysis (Attach AWSC/Signal warrants)		The Year 2010 traffic volumes meet Warrants 1, 2 & 3.

LOS, delay, v/c ratio and 95th percentile queues for each movement. (Attach traffic count, forecast and analysis inputs/outputs)

Existing Traffic Control

AM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	0	0	1	1	0	2	0	0	2	0
LOS	C	C	C	C	C	C	F	F	F	F	F	E
Delay (s)	20.8	17.2	17.2	15.6	15.6	22.2	73.7	73.7	72.9	74.7	74.7	47.3
v/c Ratio	0.44	0.36	0.36	0.22	0.22	0.55	1.52	1.52	1.47	1.35	1.35	0.87
Queue (ft)	75	50	50	25	25	100	325	325	325	325	325	225
Int. LOS	F											

PM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	0	0	1	1	0	2	0	0	2	0
LOS	C	C	C	C	C	C	F	F	F	F	F	F
Delay (s)	17.4	16.7	16.7	19.6	19.6	17.8	73.0	73.0	72.2	73.3	73.3	72.0
v/c Ratio	0.29	0.33	0.33	0.42	0.42	0.41	1.28	1.28	1.15	1.73	1.73	1.35
Queue (ft)	50	50	50	50	50	50	325	325	325	325	325	325
Int. LOS	F											

Notes: With the design year (Year 2037) traffic, select movements are expected to operate at LOS E or F conditions during the peak hours.

Alternative 1

AM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
LOS	D	C	C	D	D	D	B	C	B	C	A	A
Delay (s)	53.1	32.5	32.5	36.9	35.6	35.6	17.5	25.2	15.9	21.8	0.4	0.0
v/c Ratio	0.65	0.30	0.30	0.16	0.53	0.53	0.16	0.69	0.08	0.71	0.33	0.02
Queue (ft)	210	135	135	65	235	235	65	470	55	85	190	25
Int. LOS	C											

PM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
LOS	D	C	C	D	D	D	B	B	B	B	A	A
Delay (s)	48.6	34.1	34.1	39.2	38.3	38.3	16.8	17.1	12.4	11.6	0.7	0.1
v/c Ratio	0.52	0.30	0.30	0.27	0.59	0.59	0.28	0.49	0.05	0.51	0.46	0.07
Queue (ft)	125	125	125	90	230	230	90	310	35	25	35	25
Int. LOS	B											

Notes: With the design year (Year 2037) traffic, all movements are expected to operate acceptably at LOS D or better condiitons during the peak hours.

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Factor	Existing Traffic Control All-Way Stop	Alternative 1 Traffic Signal
Queue impact on adjacent driveways	None	None
Capacity to accommodate diverted freeway traffic for routes parallel to freeway	N/A	N/A
Impacts of railroad crossings within 1000 feet	N/A	N/A
Preliminary Layout of existing and proposed traffic control	See Appendix	See Appendix
Additional considerations (Indicate if roundabout is expected to be a spiral design)		
Right-of-Way Impacts		
Amount of acreage impacted (# of relocations, access restrictions)		
Anticipated right-of-way and real estate costs (Attach cost estimate tables)		
Additional considerations		
Costs		
Discuss estimated costs (Attach itemized cost estimate tables)		
Operations and Maintenance Costs		
Additional considerations		
Practical Feasibility		
Concerns alternative may present		
Major impacts on businesses, parking availability, real estate and utilities		
Frequency of use as an alternate route		
Additional considerations		
Pedestrians and Bicycles		
Describe the need for pedestrian and bicycle facilities		

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Factor	Existing Traffic Control All-Way Stop	Alternative 1 Traffic Signal
Identify nearby pedestrian generators, bike routes, transit stops and if the intersection is on a Safe Route to School (part of existing conditions exhibit)		
State if and what facilities are proposed, within, the project limits (part of preliminary layout of proposed alternatives)		
Additional considerations		
OSOW Freight Network		
Identify nearby OSOW generators		
If either intersecting road is on the freight network, is a significant diversion route or near a freight origin or destination discuss the following: • The geometric features and other design considerations to account for the OSOW vehicle path (e.g. grading, medians, islands). • Vertical and horizontal clearance to account for the OSOW vehicle path (e.g. monotubes, signing)		
Additional considerations		
Environmental Impacts		
Type (i.e. historical, archeological, wetlands or hazardous material) and amount of environmental acreage impacts		
Additional considerations		

Factor	Alternative 2 Dual Lane Roundabout	Alternative 3
Safety		
Crash diagram trends		

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Factor	Alternative 2 Dual Lane Roundabout	Alternative 3
Percent and type of crashes expected to be reduced by alternative	The number of rear end crashes will be reduced with the roundabout due to the grade change on the north approach. Additionallyl, the right angle & left-turn crashes would be reduced with the roundabout.	
Access near the intersection and side road traffic impacts		
Additional considerations		
Operational Analysis		
Discuss the Warrant Analysis (Attach AWSC/Signal warrants)		
LOS, delay, v/c ratio and 95th percentile queues for each movement. (include traffic count, forecast and analysis inputs/outputs)		

AM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	0	0	1	1	0	2	0	0	2	0
LOS	A	A	A	B	B	C	C	C	C	A	A	A
Delay (s)	9.9	9.3	9.3	11.1	11.1	18.6	20.3	20.3	20.3	8.4	8.4	8.4
v/c Ratio	0.27	0.24	0.24	0.19	0.19	0.50	0.77	0.77	0.77	0.45	0.45	0.45
Queue (ft)	50	25	25	25	25	75	200	200	200	75	75	75
Int. LOS	B											

PM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	0	0	1	1	0	2	0	0	2	0
LOS	B	B	B	B	B	B	B	B	B	B	B	B
Delay (s)	11.4	12.1	12.1	10.7	10.7	10.9	11.9	11.9	11.9	14.8	14.8	14.8
v/c Ratio	0.23	0.27	0.27	0.29	0.29	0.30	0.58	0.58	0.58	0.70	0.70	0.70
Queue (ft)	25	50	50	50	50	50	100	100	100	150	150	150
Int. LOS	B											

Notes: With the design year (Year 2037) traffic, all movements are expected to operate acceptably at LOS C or better conditions during the peak hours.

AM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

PM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

Notes:

Queue impact on adjacent driveways	None	
Capacity to accommodate 5-20% of diverted freeway traffic for routes parallel to freeway	N/A	
Document railroad crossings within 1000 feet of the intersection.	N/A	
Preliminary Layout of existing and proposed traffic control	See Appendix	See Appendix
Additional considerations (Indicate if roundabout is expected to be a spiral design)		
Right-of-Way Impacts		
Amount of acreage impacted (# of relocations, access restrictions)		

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Factor	Alternative 2 Dual Lane Roundabout	Alternative 3
Anticipated right-of-way and real estate costs (Attach cost estimate tables)		
Additional Considerations		
Costs		
Discuss estimated costs (Attach itemized cost estimate tables)		
Operations and Maintenance Costs		
Additional considerations		
Practical Feasibility		
Concerns alternative may present		
Major impacts on businesses, parking availability, real estate and utilities		
Frequency of use as an alternate route		
Additional considerations		
Pedestrians and Bicycles		
Describe the need for pedestrian and bicycle facilities		
Identify nearby pedestrian generators, bike routes, transit stops and if the intersection is on a Safe Route to School (part of existing conditions exhibit)		
State if and what facilities are proposed, within, the project limits (part of preliminary layout of proposed alternatives)		
Additional considerations		
OSOW Vehicle Routes		
Identify nearby OSOW generators		

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Factor	Alternative 2 Dual Lane Roundabout	Alternative 3
If either intersecting road is on the freight network, is a significant diversion route or near a freight origin or destination discuss the following: • The geometric features and other design considerations to account for the OSOW vehicle path (e.g. grading, medians, islands). • Vertical and horizontal clearance to account for the OSOW vehicle path (e.g. monotubes, signing)		
Additional considerations		
Environmental Impacts		
Type (i.e. historical, archeological, wetlands or hazardous material) and amount of environmental acreage impacts		
Additional considerations		
Recommendation		
Based on the traffic analysis, the intesrection is expected to operate acceptably under traffic signal or roundabout control. Traffic signal control is recommended for the CTH TT & Madison Street intersection due to traffic signal recommended at the CTH TT & USH 18 intersection to the north. It is recommended to coordinate these two traffic signals.		

Intersection	
Intersection Delay, s/veh	58.9
Intersection LOS	F

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	142	49	78	0	50	22	201	0	60	1074	108
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	5	5	5	2	1	1	1	2	4	4	4
Mvmt Flow	0	154	53	85	0	54	24	218	0	65	1167	59
Number of Lanes	0	1	1	0	0	0	1	1	0	0	2	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	2	2
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	2	2	2
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	2	2	2
HCM Control Delay	19.1	20.5	73.3
HCM LOS	C	C	F

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	10%	0%	100%	0%	69%	0%	38%	0%
Vol Thru, %	90%	83%	0%	39%	31%	0%	62%	88%
Vol Right, %	0%	17%	0%	61%	0%	100%	0%	12%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	597	645	142	127	72	201	518	361
LT Vol	537	537	0	49	22	0	319	319
Through Vol	0	108	0	78	0	201	0	42
RT Vol	60	0	142	0	50	0	199	0
Lane Flow Rate	649	642	154	138	78	218	562	369
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	1	1	0.439	0.357	0.219	0.547	1	0.872
Departure Headway (Hd)	8.548	8.38	10.237	9.309	10.058	9.012	8.782	8.508
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	428	437	352	387	357	400	416	424
Service Time	6.336	6.169	7.999	7.071	7.821	6.775	6.552	6.278
HCM Lane V/C Ratio	1.516	1.469	0.438	0.357	0.218	0.545	1.351	0.87
HCM Control Delay	73.7	72.9	20.8	17.2	15.6	22.2	74.7	47.3
HCM Lane LOS	F	F	C	C	C	C	F	E
HCM 95th-tile Q	12.5	12.6	2.2	1.6	0.8	3.2	12.3	8.8

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Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	199	637	42
Peak Hour Factor	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	5	5	5
Mvmt Flow	0	216	692	23
Number of Lanes	0	0	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	2
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	2
HCM Control Delay	63.8
HCM LOS	F

Lane

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Intersection	
Intersection Delay, s/veh	62.6
Intersection LOS	F

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	98	47	72	0	76	69	157	0	88	895	74
Peak Hour Factor	0.92	0.96	0.96	0.96	0.92	0.96	0.96	0.96	0.92	0.96	0.96	0.96
Heavy Vehicles, %	2	1	1	1	2	2	2	2	2	1	1	1
Mvmt Flow	0	102	49	75	0	79	72	164	0	92	932	39
Number of Lanes	0	1	1	0	0	0	1	1	0	0	2	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	2	2	2
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	2	2	2
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	2	2	2
HCM Control Delay	17	18.7	72.6
HCM LOS	C	C	F

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	16%	0%	100%	0%	52%	0%	28%	0%
Vol Thru, %	84%	86%	0%	39%	48%	0%	72%	80%
Vol Right, %	0%	14%	0%	61%	0%	100%	0%	20%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	536	522	98	119	145	157	717	645
LT Vol	448	448	0	47	69	0	514	514
Through Vol	0	74	0	72	0	157	0	131
RT Vol	88	0	98	0	76	0	203	0
Lane Flow Rate	558	505	102	124	151	164	747	604
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	1	1	0.295	0.326	0.417	0.408	1	1
Departure Headway (Hd)	8.439	8.257	10.395	9.472	9.939	8.978	8.498	8.214
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	435	439	347	381	364	402	433	447
Service Time	6.191	6.009	8.12	7.197	7.659	6.697	6.25	5.966
HCM Lane V/C Ratio	1.283	1.15	0.294	0.325	0.415	0.408	1.725	1.351
HCM Control Delay	73	72.2	17.4	16.7	19.6	17.8	73.3	72
HCM Lane LOS	F	F	C	C	C	C	F	F
HCM 95th-tile Q	12.6	12.7	1.2	1.4	2	1.9	12.6	12.8

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Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	203	1028	131
Peak Hour Factor	0.92	0.96	0.96	0.96
Heavy Vehicles, %	2	1	1	1
Mvmt Flow	0	211	1071	68
Number of Lanes	0	0	2	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	2
Conflicting Approach Left	WB
Conflicting Lanes Left	2
Conflicting Approach Right	EB
Conflicting Lanes Right	2
HCM Control Delay	72.7
HCM LOS	F

Lane

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	142	49	78	50	22	201	60	1074	108	199	637	42
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1810	1810	1900	1881	1881	1900	1827	1827	1827	1810	1810	1810
Adj Flow Rate, veh/h	154	53	85	54	24	218	65	1167	59	216	692	23
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	5	5	5	1	1	1	4	4	4	5	5	5
Cap, veh/h	236	177	285	336	46	414	412	1685	754	305	2104	941
Arrive On Green	0.28	0.28	0.28	0.28	0.28	0.28	0.49	0.49	0.49	0.17	1.00	1.00
Sat Flow, veh/h	1101	627	1005	1258	161	1462	719	3471	1553	1723	3438	1538
Grp Volume(v), veh/h	154	0	138	54	0	242	65	1167	59	216	692	23
Grp Sat Flow(s),veh/h/ln	1101	0	1632	1258	0	1623	719	1736	1553	1723	1719	1538
Q Serve(g_s), s	15.7	0.0	7.6	4.0	0.0	14.4	5.9	29.8	2.3	7.2	0.0	0.0
Cycle Q Clear(g_c), s	30.0	0.0	7.6	11.6	0.0	14.4	5.9	29.8	2.3	7.2	0.0	0.0
Prop In Lane	1.00		0.62	1.00		0.90	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	236	0	462	336	0	460	412	1685	754	305	2104	941
V/C Ratio(X)	0.65	0.00	0.30	0.16	0.00	0.53	0.16	0.69	0.08	0.71	0.33	0.02
Avail Cap(c_a), veh/h	242	0	471	343	0	468	412	1685	754	388	2104	941
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	47.2	0.0	32.1	36.6	0.0	34.5	16.7	22.8	15.7	17.6	0.0	0.0
Incr Delay (d2), s/veh	5.9	0.0	0.4	0.2	0.0	1.1	0.8	2.4	0.2	4.3	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.1	0.0	3.5	1.4	0.0	6.6	1.2	14.8	1.0	3.6	0.1	0.0
LnGrp Delay(d),s/veh	53.1	0.0	32.5	36.9	0.0	35.6	17.5	25.2	15.9	21.8	0.4	0.0
LnGrp LOS	D		C	D		D	B	C	B	C	A	A
Approach Vol, veh/h		292			296			1291			931	
Approach Delay, s/veh		43.3			35.8			24.4			5.4	
Approach LOS		D			D			C			A	

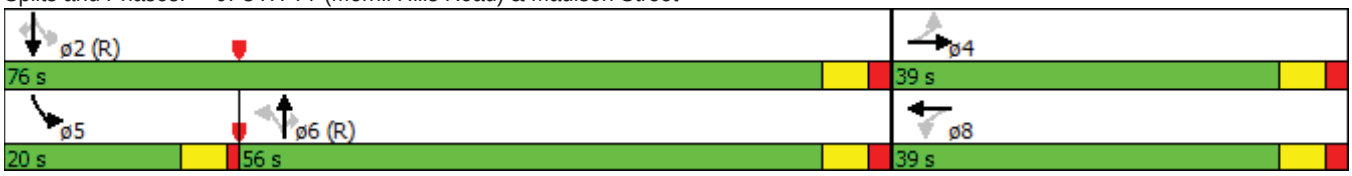
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		76.6		38.4	14.5	62.1		38.4
Change Period (Y+Rc), s		6.0		6.0	5.0	6.0		6.0
Max Green Setting (Gmax), s		70.0		33.0	15.0	50.0		33.0
Max Q Clear Time (g_c+I1), s		2.0		32.0	9.2	31.8		16.4
Green Ext Time (p_c), s		23.1		0.3	0.3	12.1		3.0

Intersection Summary	
HCM 2010 Ctrl Delay	21.3
HCM 2010 LOS	C

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	142	49	50	22	60	1074	108	199	637	42
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		8		6		5	2	
Permitted Phases	4		8		6		6	2		2
Detector Phase	4	4	8	8	6	6	6	5	2	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	12.0	12.0	12.0	7.0	12.0	12.0
Minimum Split (s)	16.0	16.0	16.0	16.0	18.0	18.0	18.0	12.0	18.0	18.0
Total Split (s)	39.0	39.0	39.0	39.0	56.0	56.0	56.0	20.0	76.0	76.0
Total Split (%)	33.9%	33.9%	33.9%	33.9%	48.7%	48.7%	48.7%	17.4%	66.1%	66.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag					Lag	Lag	Lag	Lead		
Lead-Lag Optimize?					Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	24.8	24.8	24.8	24.8	61.2	61.2	61.2	79.2	78.2	78.2
Actuated g/C Ratio	0.22	0.22	0.22	0.22	0.53	0.53	0.53	0.69	0.68	0.68
v/c Ratio	0.96	0.39	0.21	0.69	0.17	0.63	0.07	0.65	0.30	0.02
Control Delay	105.4	40.2	36.2	51.1	19.1	23.0	16.9	12.7	4.5	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	105.4	40.2	36.2	51.1	19.1	23.0	16.9	12.7	4.5	3.1
LOS	F	D	D	D	B	C	B	B	A	A
Approach Delay		74.6		48.4		22.5			6.4	
Approach LOS		E		D		C			A	

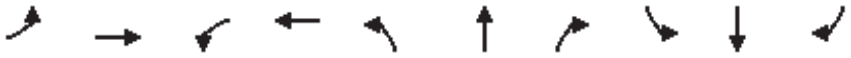
Intersection Summary	
Cycle Length: 115	
Actuated Cycle Length: 115	
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.96	
Intersection Signal Delay: 25.3	Intersection LOS: C
Intersection Capacity Utilization 81.8%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 9: CTH TT (Merrill Hills Road) & Madison Street



9: CTH TT (Merrill Hills Road) & Madison Street

Queues



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	154	138	54	242	65	1167	59	216	692	23
v/c Ratio	0.96	0.39	0.21	0.69	0.17	0.63	0.07	0.65	0.30	0.02
Control Delay	105.4	40.2	36.2	51.1	19.1	23.0	16.9	12.7	4.5	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	105.4	40.2	36.2	51.1	19.1	23.0	16.9	12.7	4.5	3.1
Queue Length 50th (ft)	113	87	33	165	24	315	21	11	19	1
Queue Length 95th (ft)	#207	135	64	233	62	466	52	85	186	m7
Internal Link Dist (ft)		1319		1435		3203			773	
Turn Bay Length (ft)	200		200		325		325	325		325
Base Capacity (vph)	214	471	339	466	378	1845	825	373	2338	1046
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.72	0.29	0.16	0.52	0.17	0.63	0.07	0.58	0.30	0.02

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	98	47	72	76	69	157	88	895	74	203	1028	131
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1881	1900	1863	1863	1900	1881	1881	1881	1881	1881	1881
Adj Flow Rate, veh/h	102	49	75	79	72	164	92	932	39	211	1071	68
Adj No. of Lanes	1	1	0	1	1	0	1	2	1	1	2	1
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Percent Heavy Veh, %	1	1	1	2	2	2	1	1	1	1	1	1
Cap, veh/h	197	161	246	293	121	276	329	1889	845	411	2321	1038
Arrive On Green	0.24	0.24	0.24	0.24	0.24	0.24	0.53	0.53	0.53	0.15	1.00	1.00
Sat Flow, veh/h	1151	672	1028	1262	506	1153	497	3574	1599	1792	3574	1599
Grp Volume(v), veh/h	102	0	124	79	0	236	92	932	39	211	1071	68
Grp Sat Flow(s),veh/h/ln	1151	0	1700	1262	0	1659	497	1787	1599	1792	1787	1599
Q Serve(g_s), s	9.3	0.0	6.5	5.9	0.0	13.6	11.6	17.9	1.3	5.8	0.0	0.0
Cycle Q Clear(g_c), s	22.9	0.0	6.5	12.4	0.0	13.6	11.6	17.9	1.3	5.8	0.0	0.0
Prop In Lane	1.00		0.60	1.00		0.69	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	197	0	407	293	0	397	329	1889	845	411	2321	1038
V/C Ratio(X)	0.52	0.00	0.30	0.27	0.00	0.59	0.28	0.49	0.05	0.51	0.46	0.07
Avail Cap(c_a), veh/h	221	0	442	319	0	431	329	1889	845	510	2321	1038
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	46.5	0.0	33.6	38.7	0.0	36.4	14.7	16.2	12.3	10.6	0.0	0.0
Incr Delay (d2), s/veh	2.1	0.0	0.4	0.5	0.0	1.9	2.1	0.9	0.1	1.0	0.7	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.1	0.0	3.1	2.1	0.0	6.4	1.8	9.0	0.6	2.9	0.2	0.0
LnGrp Delay(d),s/veh	48.6	0.0	34.1	39.2	0.0	38.3	16.8	17.1	12.4	11.6	0.7	0.1
LnGrp LOS	D		C	D		D	B	B	B	B	A	A
Approach Vol, veh/h		226			315			1063			1350	
Approach Delay, s/veh		40.6			38.5			16.9			2.3	
Approach LOS		D			D			B			A	

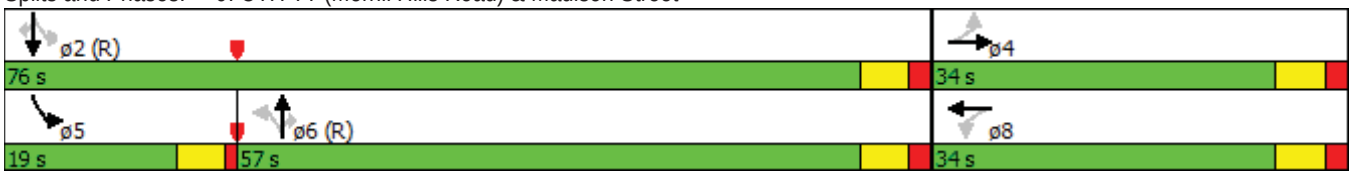
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		8
Phs Duration (G+Y+Rc), s		78.2		31.8	13.0	65.2		31.8
Change Period (Y+Rc), s		6.0		6.0	5.0	6.0		6.0
Max Green Setting (Gmax), s		70.0		28.0	14.0	51.0		28.0
Max Q Clear Time (g_c+I1), s		2.0		24.9	7.8	19.9		15.6
Green Ext Time (p_c), s		28.1		0.9	0.3	19.3		2.3

Intersection Summary	
HCM 2010 Ctrl Delay	14.4
HCM 2010 LOS	B

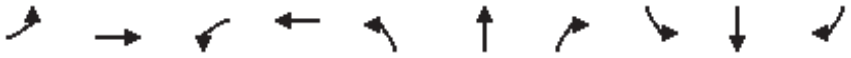
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	98	47	76	69	88	895	74	203	1028	131
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		8		6		5	2	
Permitted Phases	4		8		6		6	2		2
Detector Phase	4	4	8	8	6	6	6	5	2	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	12.0	12.0	12.0	7.0	12.0	12.0
Minimum Split (s)	16.0	16.0	16.0	16.0	18.0	18.0	18.0	12.0	18.0	18.0
Total Split (s)	34.0	34.0	34.0	34.0	57.0	57.0	57.0	19.0	76.0	76.0
Total Split (%)	30.9%	30.9%	30.9%	30.9%	51.8%	51.8%	51.8%	17.3%	69.1%	69.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag					Lag	Lag	Lag	Lead		
Lead-Lag Optimize?					Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	C-Max	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	20.7	20.7	20.7	20.7	62.2	62.2	62.2	78.3	77.3	77.3
Actuated g/C Ratio	0.19	0.19	0.19	0.19	0.57	0.57	0.57	0.71	0.70	0.70
v/c Ratio	0.74	0.39	0.34	0.75	0.32	0.46	0.04	0.49	0.43	0.06
Control Delay	70.6	41.2	41.1	56.6	19.6	16.3	13.6	6.0	1.9	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.6	41.2	41.1	56.6	19.6	16.3	13.6	6.0	1.9	1.7
LOS	E	D	D	E	B	B	B	A	A	A
Approach Delay		54.4		52.7		16.5			2.5	
Approach LOS		D		D		B			A	

Intersection Summary	
Cycle Length: 110	
Actuated Cycle Length: 110	
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.75	
Intersection Signal Delay: 16.9	Intersection LOS: B
Intersection Capacity Utilization 80.0%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 9: CTH TT (Merrill Hills Road) & Madison Street



ATTACHMENT 12



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	102	124	79	236	92	932	39	211	1071	68
v/c Ratio	0.74	0.39	0.34	0.75	0.32	0.46	0.04	0.49	0.43	0.06
Control Delay	70.6	41.2	41.1	56.6	19.6	16.3	13.6	6.0	1.9	1.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.6	41.2	41.1	56.6	19.6	16.3	13.6	6.0	1.9	1.7
Queue Length 50th (ft)	69	77	49	159	33	191	12	10	27	3
Queue Length 95th (ft)	123	124	88	228	89	306	34	m16	m33	m5
Internal Link Dist (ft)		1319		1435		3203			763	
Turn Bay Length (ft)	200		200		325		325	325		325
Base Capacity (vph)	187	435	312	424	284	2021	904	480	2510	1123
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.29	0.25	0.56	0.32	0.46	0.04	0.44	0.43	0.06

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

ATTACHMENT 12

Phone: Fax:
E-Mail:

ROUNDABOUT ANALYSIS

Analyst: SKB
Agency/Co.: GRAEF
Date Performed: 12/16/2014
Analysis Time Period: AM Peak Hour
Intersection: CTH TT & Madison Street
Jurisdiction: Waukesha County
Units: U. S. Customary
Analysis Year: Year 2037
Project ID: 2788-01-00 West Waukesha Bypass
East/West Street: Madison Street
North/South Street:

Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	142	49	78	50	22	201	60	1074	108	199	637	42
U-Turn Vol	5			5			5			5		
% Thrus Left Lane								50			50	

	Eastbound			Westbound			Northbound			Southbound		
	Left		Right	BP	Left		Right	BP	Left		Right	BP
Lane Assn.	L		TR		LT		R		LT		TR	
RT Bypass	None				None				None			
PHF	0.92	0.92	0.92		0.92	0.92	0.92		0.92	0.92	0.92	
%HV	5	5	5		2	2	2		4	4	4	
NumPeds	10				10				10			
U-Turn PHF	0.92				0.92				0.92			
U-Turn %HV	5				2				4			
Flow Rate	162	56	89		55	24	223		68	1214	122	
No. Lanes	1	1	0		0	1	1		0	2	0	
Cnfl. Lanes	2				2				2			
Duration, T	0.25	hrs.										

Critical and Follow-Up Headway Adjustment

	Eastbound			Westbound		
Crit. Hdwy	4.0000*	4.0000*	5.1929	4.0000*	4.0000*	5.1929
	Northbound			Southbound		
Crit. Hdwy	4.0000*	4.0000*	5.1929	4.2000*	4.2000*	5.1929
	Eastbound			Westbound		
Flup. Hdwy	2.8000*	2.8000*	3.1858	2.8000*	2.8000*	3.1858
	Northbound			Southbound		
Flup. Hdwy	2.8000*	2.8000*	3.1858	2.8000*	2.8000*	3.1858

Flow Computations

	Eastbound	Westbound	Northbound	Southbound
Circ. Flow	1027	1462	463	165
Exit. Flow	411	146	1605	877

Capacity and Level of Service

	Eastbound	Westbound	Northbound	Southbound

ATTACHMENT 12

	Left	Right	BP	Left	Right	BP	Left	Right	BP	Left	Right	BP
Entry Flow	168	145		85	223		705	705		504	504	
Entry Cap.	613	613		448	448		921	921		1131	1131	
Volume (vph)	160	138		83	219		678	678		480	480	
Cap. (vph)	583	583		439	439		879	879		1067	1067	
v/c Ratio	0.27	0.24		0.19	0.50		0.77	0.77		0.45	0.45	
Critical Lane					*			*			*	
Lane Delay	9.9	9.3		11.1	18.6		20.3	20.3		8.4	8.4	
Lane LOS	A	A		B	C		C	C		A	A	
95 % Queue	1.1	0.9		0.7	2.7		7.7	7.7		2.4	2.4	
Approach:												
Delay		9.59			16.49			20.28			8.35	
LOS		A			C			C			A	

Intersection Delay 14.87 Intersection LOS B

ATTACHMENT 12

Phone: Fax:
E-Mail:

ROUNDABOUT ANALYSIS

Analyst: SKB
Agency/Co.: GRAEF
Date Performed: 12/16/2014
Analysis Time Period: PM Peak Hour
Intersection: CTH TT & Madison Street
Jurisdiction: Waukesha County
Units: U. S. Customary
Analysis Year: Year 2037
Project ID: 2788-01-00 West Waukesha Bypass
East/West Street: Madison Street
North/South Street:

Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	98	47	72	76	69	157	88	895	74	203	1028	131
U-Turn Vol	5			5			5			5		
% Thrus Left Lane									50			50

	Eastbound			Westbound			Northbound			Southbound		
	Left		Right	BP	Left	Right	BP	Left	Right	BP	Left	Right	BP
Lane Assn.	L		TR		LT	R		LT	TR		LT	TR	
RT Bypass	None				None			None			None		
PHF	0.96	0.96	0.96		0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
%HV	2	2	2		2	2	2	2	2	2	2	2	2
NumPeds	10				10			10			10		
U-Turn PHF	0.96				0.96			0.96			0.96		
U-Turn %HV	2				2			2			2		
Flow Rate	104	50	76		81	73	167	94	951	79	216	1092	139
No. Lanes	1	1	0		0	1	1	0	2	0	0	2	0
Cnfl. Lanes	2				2			2			1		

Duration, T 0.25 hrs.

Critical and Follow-Up Headway Adjustment

	Eastbound			Westbound		
Crit. Hdwy	4.0000*	4.0000*	5.1929	4.0000*	4.0000*	5.1929
	Northbound			Southbound		
Crit. Hdwy	4.0000*	4.0000*	5.1929	4.2000*	4.2000*	5.1929
	Eastbound			Westbound		
Flup. Hdwy	2.8000*	2.8000*	3.1858	2.8000*	2.8000*	3.1858
	Northbound			Southbound		
Flup. Hdwy	2.8000*	2.8000*	3.1858	2.8000*	2.8000*	3.1858

Flow Computations

	Eastbound	Westbound	Northbound	Southbound
Circ. Flow	1404	1164	385	263
Exit. Flow	350	311	1227	1255

Capacity and Level of Service

	Eastbound	Westbound	Northbound	Southbound

ATTACHMENT 12

	Left	Right	BP	Left	Right	BP	Left	Right	BP	Left	Right	BP
Entry Flow	109	126		159	167		564	564		726	726	
Entry Cap.	466	466		554	554		973	973		1047	1047	
Volume (vph)	107	124		156	164		553	553		712	712	
Cap. (vph)	457	457		544	544		947	947		1018	1018	
v/c Ratio	0.23	0.27		0.29	0.30		0.58	0.58		0.70	0.70	
Critical Lane		*			*			*			*	
Lane Delay	11.4	12.1		10.7	10.9		11.9	11.9		14.8	14.8	
Lane LOS	B	B		B	B		B	B		B	B	
95 % Queue	0.9	1.1		1.2	1.3		3.9	3.9		6.0	6.0	
Approach:												
Delay		11.80			10.82			11.91			14.81	
LOS		B			B			B			B	
Intersection Delay		13.13					Intersection LOS			B		

ATTACHMENT 12

Appendix 5

CTH TT (Merrill Hills Road) & CTH D (Sunset Drive)

ATTACHMENT 12

Intersection Control Evaluation Worksheet

BUREAU OF TRAFFIC OPERATIONS

Revised: March 31, 2014

NOTE: Attach Items in BLUE as appendices

SPELL CHECK

Prepared By Shana Brummond **Date** 19-Dec-14

Intersection: CTH TT (Merrill Hills Road) & CTH D (Sunset Drive) **Design Project ID:** 2788-01-00 **Project Description:** West Waukesha Bypass

Factor	**Existing Traffic Control** Traffic Signal	**Alternative 1** Dual Lane Roundabout
Safety		
Crash diagram trends	23 crashes (2009-2013) - 11 rear end, 2 right angle, 6 left turn, 2 sideswipe & 2 single vehicle crashes	
Percent and type of crashes expected to be reduced by alternative		Right angle & left-turn crashes would be reduced with roundabout. These crashes account for 8 of the 23 intersection crashes (approximately 35% reduction).
Access near the intersection and side road traffic impacts		
Additional considerations		
Operational Analysis		
Discuss the Warrant Analysis (Attach AWSC/Signal warrants)		

LOS, delay, v/c ratio and 95th percentile queues for each movement. (Attach traffic count, forecast and analysis inputs/outputs)

AM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	1	1	1	1	1	2	1	1	2	1
LOS	C	C	B	C	B	B	B	B	B	B	B	B
Delay (s)	21.7	21.5	16.9	24.5	16.8	18.0	10.5	17.2	13.0	12.4	14.6	13.2
v/c Ratio	0.50	0.69	0.12	0.06	0.12	0.31	0.24	0.65	0.01	0.49	0.38	0.13
Queue (ft)	150	230	45	25	50	90	55	225	25	85	120	50
Int. LOS	B											

PM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	1	1	1	1	1	2	1	1	2	1
LOS	C	B	B	B	B	B	B	C	B	B	C	B
Delay (s)	25.5	16.5	15.8	18.3	17.3	17.1	16.5	21.5	17.7	15.8	21.8	18.4
v/c Ratio	0.54	0.29	0.19	0.03	0.39	0.36	0.55	0.59	0.03	0.55	0.66	0.22
Queue (ft)	140	125	75	25	165	135	95	180	25	105	210	75
Int. LOS	B											

Notes: With the design year (Year 2037) traffic, all movements are expected to operate acceptably at LOS C or better conditions during the peak hours.

AM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	0	0	1	1	0	2	0	0	2	0
LOS	A	C	C	A	A	C	C	C	C	A	A	A
Delay (s)	8.6	16.1	16.1	8.9	8.9	16.2	19.7	19.7	19.7	8.0	8.0	8.0
v/c Ratio	0.30	0.63	0.63	0.15	0.15	0.50	0.69	0.69	0.69	0.41	0.41	0.41
Queue (ft)	50	125	125	25	25	75	150	150	150	75	75	75
Int. LOS	B											

PM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	1	0	0	1	1	0	2	0	0	2	0
LOS	A	C	C	B	B	C	B	B	B	C	C	C
Delay (s)	9.5	17.4	17.4	12.5	12.5	18.5	11.8	11.8	11.8	15.4	15.4	15.4
v/c Ratio	0.29	0.61	0.61	0.43	0.43	0.63	0.52	0.52	0.52	0.66	0.66	0.66
Queue (ft)	50	125	125	75	75	125	75	75	75	150	150	150
Int. LOS	B											

Notes: With the design year (Year 2037) traffic, all movements are expected to operate acceptably at LOS C or better conditions during the peak hours.

ATTACHMENT 12

Factor	Existing Traffic Control Traffic Signal	Alternative 1 Dual Lane Roundabout
Queue impact on adjacent driveways	None	None
Capacity to accommodate diverted freeway traffic for routes parallel to freeway	N/A	N/A
Impacts of railroad crossings within 1000 feet	N/A	N/A
Preliminary Layout of existing and proposed traffic control	See Appendix	See Appendix
Additional considerations (Indicate if roundabout is expected to be a spiral design)		
Right-of-Way Impacts		
Amount of acreage impacted (# of relocations, access restrictions)		
Anticipated right-of-way and real estate costs (Attach cost estimate tables)		
Additional considerations		
Costs		
Discuss estimated costs (Attach itemized cost estimate tables)		
Operations and Maintenance Costs		
Additional considerations		
Practical Feasibility		
Concerns alternative may present		
Major impacts on businesses, parking availability, real estate and utilities		
Frequency of use as an alternate route		
Additional considerations		
Pedestrians and Bicycles		
Describe the need for pedestrian and bicycle facilities		

ATTACHMENT 12

Factor	Existing Traffic Control Traffic Signal	Alternative 1 Dual Lane Roundabout
Identify nearby pedestrian generators, bike routes, transit stops and if the intersection is on a Safe Route to School (part of existing conditions exhibit)		
State if and what facilities are proposed, within, the project limits (part of preliminary layout of proposed alternatives)		
Additional considerations		
OSOW Freight Network		
Identify nearby OSOW generators		
If either intersecting road is on the freight network, is a significant diversion route or near a freight origin or destination discuss the following: • The geometric features and other design considerations to account for the OSOW vehicle path (e.g. grading, medians, islands). • Vertical and horizontal clearance to account for the OSOW vehicle path (e.g. monotubes, signing)		
Additional considerations		
Environmental Impacts		
Type (i.e. historical, archeological, wetlands or hazardous material) and amount of environmental acreage impacts		
Additional considerations		

Factor	Alternative 2	Alternative 3
Safety		
Crash diagram trends		

ATTACHMENT 12

Factor	Alternative 2	Alternative 3
Percent and type of crashes expected to be reduced by alternative		
Access near the intersection and side road traffic impacts		
Additional considerations		
Operational Analysis		
Discuss the Warrant Analysis (Attach AWSC/Signal warrants)		
LOS, delay, v/c ratio and 95th percentile queues for each movement. (include traffic count, forecast and analysis inputs/outputs)		
Queue impact on adjacent driveways		
Capacity to accommodate 5-20% of diverted freeway traffic for routes parallel to freeway		
Document railroad crossings within 1000 feet of the intersection.		
Preliminary Layout of existing and proposed traffic control	See Appendix	See Appendix
Additional considerations (Indicate if roundabout is expected to be a spiral design)		
Right-of-Way Impacts		
Amount of acreage impacted (# of relocations, access restrictions)		

Alternative 2

AM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

PM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

Notes:

Alternative 3

AM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

PM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

Notes:

ATTACHMENT 12

Factor	Alternative 2	Alternative 3
Anticipated right-of-way and real estate costs (Attach cost estimate tables)		
Additional Considerations		
Costs		
Discuss estimated costs (Attach itemized cost estimate tables)		
Operations and Maintenance Costs		
Additional considerations		
Practical Feasibility		
Concerns alternative may present		
Major impacts on businesses, parking availability, real estate and utilities		
Frequency of use as an alternate route		
Additional considerations		
Pedestrians and Bicycles		
Describe the need for pedestrian and bicycle facilities		
Identify nearby pedestrian generators, bike routes, transit stops and if the intersection is on a Safe Route to School (part of existing conditions exhibit)		
State if and what facilities are proposed, within, the project limits (part of preliminary layout of proposed alternatives)		
Additional considerations		
OSOW Vehicle Routes		
Identify nearby OSOW generators		

ATTACHMENT 12

Factor	Alternative 2	Alternative 3
If either intersecting road is on the freight network, is a significant diversion route or near a freight origin or destination discuss the following: • The geometric features and other design considerations to account for the OSOW vehicle path (e.g. grading, medians, islands). • Vertical and horizontal clearance to account for the OSOW vehicle path (e.g. monotubes, signing)		
Additional considerations		
Environmental Impacts		
Type (i.e. historical, archeological, wetlands or hazardous material) and amount of environmental acreage impacts		
Additional considerations		
Recommendation		
Based on the traffic analysis, the intersection is expected to operate acceptably under traffic signal or roundabout control. A traffic signal is recommended for this intersection to provide consistent intersection control along the corridor.		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	193	319	97	12	53	238	119	727	12	198	438	133
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1827	1827	1827	1827	1827	1827	1827	1827	1827
Adj Flow Rate, veh/h	203	336	51	13	56	125	125	765	6	208	461	70
Adj No. of Lanes	1	1	1	1	1	1	1	2	1	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	4	4	4	4	4	4	4	4	4
Cap, veh/h	405	484	411	216	475	404	514	1173	525	424	1212	542
Arrive On Green	0.26	0.26	0.26	0.26	0.26	0.26	0.10	0.34	0.34	0.11	0.35	0.35
Sat Flow, veh/h	1198	1863	1583	973	1827	1553	1740	3471	1553	1740	3471	1553
Grp Volume(v), veh/h	203	336	51	13	56	125	125	765	6	208	461	70
Grp Sat Flow(s),veh/h/ln	1198	1863	1583	973	1827	1553	1740	1736	1553	1740	1736	1553
Q Serve(g_s), s	9.2	9.6	1.5	0.7	1.4	3.8	2.6	11.1	0.2	4.4	5.9	1.8
Cycle Q Clear(g_c), s	10.6	9.6	1.5	10.3	1.4	3.8	2.6	11.1	0.2	4.4	5.9	1.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	405	484	411	216	475	404	514	1173	525	424	1212	542
V/C Ratio(X)	0.50	0.69	0.12	0.06	0.12	0.31	0.24	0.65	0.01	0.49	0.38	0.13
Avail Cap(c_a), veh/h	580	757	643	359	742	631	541	1645	736	549	1880	841
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	20.7	19.7	16.7	24.4	16.7	17.6	10.2	16.6	13.0	11.6	14.4	13.1
Incr Delay (d2), s/veh	1.0	1.8	0.1	0.1	0.1	0.4	0.2	0.6	0.0	0.9	0.2	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.2	5.2	0.6	0.2	0.7	1.7	1.2	5.3	0.1	2.1	2.9	0.8
LnGrp Delay(d),s/veh	21.7	21.5	16.9	24.5	16.8	18.0	10.5	17.2	13.0	12.4	14.6	13.2
LnGrp LOS	C	C	B	C	B	B	B	B	B	B	B	B
Approach Vol, veh/h		590			194			896			739	
Approach Delay, s/veh		21.2			18.1			16.3			13.9	
Approach LOS		C			B			B			B	

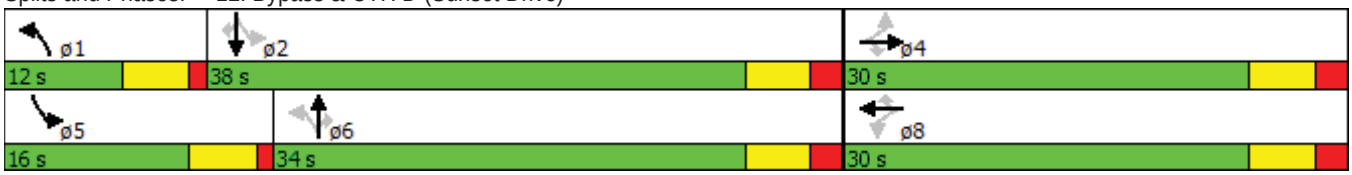
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.1	26.6		21.4	11.8	26.0		21.4
Change Period (Y+Rc), s	5.0	6.0		6.0	5.0	6.0		6.0
Max Green Setting (Gmax), s	7.0	32.0		24.0	11.0	28.0		24.0
Max Q Clear Time (g_c+I1), s	4.6	7.9		12.6	6.4	13.1		12.3
Green Ext Time (p_c), s	0.1	8.7		2.8	0.2	6.9		2.8

Intersection Summary	
HCM 2010 Ctrl Delay	16.9
HCM 2010 LOS	B

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	193	319	97	12	53	238	119	727	12	198	438	133
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		1	6		5	2	
Permitted Phases	4		4	8		8	6		6	2		2
Detector Phase	4	4	4	8	8	8	1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	7.0	12.0	12.0	7.0	12.0	12.0
Minimum Split (s)	16.0	16.0	16.0	16.0	16.0	16.0	12.0	18.0	18.0	12.0	18.0	18.0
Total Split (s)	30.0	30.0	30.0	30.0	30.0	30.0	12.0	34.0	34.0	16.0	38.0	38.0
Total Split (%)	37.5%	37.5%	37.5%	37.5%	37.5%	37.5%	15.0%	42.5%	42.5%	20.0%	47.5%	47.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Min	Min	None	Min	Min
Act Effct Green (s)	17.1	17.1	17.1	17.1	17.1	17.1	28.7	20.4	20.4	35.3	26.4	26.4
Actuated g/C Ratio	0.26	0.26	0.26	0.26	0.26	0.26	0.44	0.31	0.31	0.54	0.41	0.41
v/c Ratio	0.58	0.69	0.12	0.07	0.12	0.31	0.26	0.71	0.01	0.50	0.33	0.11
Control Delay	29.3	30.6	20.4	20.8	20.2	22.8	9.6	24.2	17.0	12.4	15.7	15.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.3	30.6	20.4	20.8	20.2	22.8	9.6	24.2	17.0	12.4	15.7	15.2
LOS	C	C	C	C	C	C	A	C	B	B	B	B
Approach Delay		29.3			21.9			22.1			14.7	
Approach LOS		C			C			C			B	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 65.1	
Natural Cycle: 55	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.71	
Intersection Signal Delay: 21.6	Intersection LOS: C
Intersection Capacity Utilization 62.6%	ICU Level of Service B
Analysis Period (min) 15	

Splits and Phases: 12: Bypass & CTH D (Sunset Drive)



12: Bypass & CTH D (Sunset Drive)

Queues

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	203	336	51	13	56	125	125	765	6	208	461	70
v/c Ratio	0.58	0.69	0.12	0.07	0.12	0.31	0.26	0.71	0.01	0.50	0.33	0.11
Control Delay	29.3	30.6	20.4	20.8	20.2	22.8	9.6	24.2	17.0	12.4	15.7	15.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.3	30.6	20.4	20.8	20.2	22.8	9.6	24.2	17.0	12.4	15.7	15.2
Queue Length 50th (ft)	72	123	16	4	17	41	22	143	2	38	70	18
Queue Length 95th (ft)	148	227	44	18	47	90	52	224	10	82	117	47
Internal Link Dist (ft)		1063			3557			3737			3474	
Turn Bay Length (ft)	325		325	325		325	325		325	325		325
Base Capacity (vph)	514	713	606	272	700	595	486	1552	694	445	1773	793
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.39	0.47	0.08	0.05	0.08	0.21	0.26	0.49	0.01	0.47	0.26	0.09

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	166	173	189	12	233	362	202	539	27	227	634	189
Number	7	4	14	3	8	18	1	6	16	5	2	12
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1881	1881	1881	1881	1881	1881	1881	1881	1881	1881	1881	1881
Adj Flow Rate, veh/h	180	188	103	13	253	197	220	586	15	247	689	103
Adj No. of Lanes	1	1	1	1	1	1	1	2	1	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	1	1	1	1	1	1	1	1	1	1	1	1
Cap, veh/h	333	642	545	400	642	545	398	998	446	449	1040	465
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.12	0.28	0.28	0.13	0.29	0.29
Sat Flow, veh/h	946	1881	1599	1094	1881	1599	1792	3574	1599	1792	3574	1599
Grp Volume(v), veh/h	180	188	103	13	253	197	220	586	15	247	689	103
Grp Sat Flow(s),veh/h/ln	946	1881	1599	1094	1881	1599	1792	1787	1599	1792	1787	1599
Q Serve(g_s), s	12.1	4.9	3.1	0.6	6.9	6.2	5.7	9.5	0.5	6.4	11.4	3.3
Cycle Q Clear(g_c), s	19.0	4.9	3.1	5.5	6.9	6.2	5.7	9.5	0.5	6.4	11.4	3.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	333	642	545	400	642	545	398	998	446	449	1040	465
V/C Ratio(X)	0.54	0.29	0.19	0.03	0.39	0.36	0.55	0.59	0.03	0.55	0.66	0.22
Avail Cap(c_a), veh/h	375	726	617	449	726	617	509	1273	569	566	1326	593
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	24.1	16.3	15.6	18.3	16.9	16.7	15.3	20.9	17.7	14.7	21.0	18.1
Incr Delay (d2), s/veh	1.4	0.3	0.2	0.0	0.4	0.4	1.2	0.6	0.0	1.1	0.8	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.3	2.6	1.4	0.2	3.7	2.8	2.9	4.7	0.2	3.3	5.8	1.5
LnGrp Delay(d),s/veh	25.5	16.5	15.8	18.3	17.3	17.1	16.5	21.5	17.7	15.8	21.8	18.4
LnGrp LOS	C	B	B	B	B	B	B	C	B	B	C	B
Approach Vol, veh/h		471			463			821			1039	
Approach Delay, s/veh		19.8			17.2			20.1			20.1	
Approach LOS		B			B			C			C	

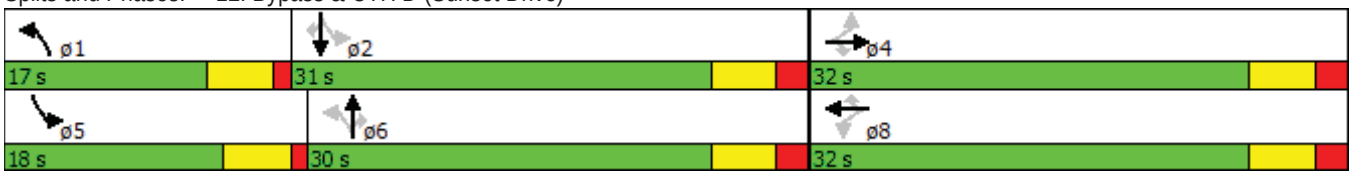
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	12.8	25.6		29.0	13.6	24.8		29.0
Change Period (Y+Rc), s	5.0	6.0		6.0	5.0	6.0		6.0
Max Green Setting (Gmax), s	12.0	25.0		26.0	13.0	24.0		26.0
Max Q Clear Time (g_c+I1), s	7.7	13.4		21.0	8.4	11.5		8.9
Green Ext Time (p_c), s	0.2	6.2		2.0	0.3	6.5		4.1

Intersection Summary	
HCM 2010 Ctrl Delay	19.6
HCM 2010 LOS	B

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	166	173	189	12	233	362	202	539	27	227	634	189
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4			8		1	6		5	2	
Permitted Phases	4		4	8		8	6		6	2		2
Detector Phase	4	4	4	8	8	8	1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	7.0	12.0	12.0	7.0	12.0	12.0
Minimum Split (s)	16.0	16.0	16.0	16.0	16.0	16.0	12.0	18.0	18.0	12.0	18.0	18.0
Total Split (s)	32.0	32.0	32.0	32.0	32.0	32.0	17.0	30.0	30.0	18.0	31.0	31.0
Total Split (%)	40.0%	40.0%	40.0%	40.0%	40.0%	40.0%	21.3%	37.5%	37.5%	22.5%	38.8%	38.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0	6.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	Min	Min	None	Min	Min
Act Effct Green (s)	17.0	17.0	17.0	17.0	17.0	17.0	28.3	17.7	17.7	29.9	18.5	18.5
Actuated g/C Ratio	0.27	0.27	0.27	0.27	0.27	0.27	0.45	0.28	0.28	0.48	0.29	0.29
v/c Ratio	0.64	0.37	0.24	0.04	0.50	0.46	0.50	0.58	0.03	0.50	0.66	0.22
Control Delay	32.7	21.7	20.4	18.6	23.8	23.7	13.0	23.0	19.1	12.4	23.6	19.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.7	21.7	20.4	18.6	23.8	23.7	13.0	23.0	19.1	12.4	23.6	19.9
LOS	C	C	C	B	C	C	B	C	B	B	C	B
Approach Delay		25.6			23.6			20.2			20.5	
Approach LOS		C			C			C			C	

Intersection Summary	
Cycle Length: 80	
Actuated Cycle Length: 62.8	
Natural Cycle: 60	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.66	
Intersection Signal Delay: 21.8	Intersection LOS: C
Intersection Capacity Utilization 69.3%	ICU Level of Service C
Analysis Period (min) 15	

Splits and Phases: 12: Bypass & CTH D (Sunset Drive)



12: Bypass & CTH D (Sunset Drive)

Queues

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	180	188	103	13	253	197	220	586	15	247	689	103
v/c Ratio	0.64	0.37	0.24	0.04	0.50	0.46	0.50	0.58	0.03	0.50	0.66	0.22
Control Delay	32.7	21.7	20.4	18.6	23.8	23.7	13.0	23.0	19.1	12.4	23.6	19.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.7	21.7	20.4	18.6	23.8	23.7	13.0	23.0	19.1	12.4	23.6	19.9
Queue Length 50th (ft)	60	57	30	4	80	62	38	97	4	43	115	28
Queue Length 95th (ft)	137	121	74	17	162	132	92	178	19	103	208	75
Internal Link Dist (ft)		1095			3585			3737			3474	
Turn Bay Length (ft)	325		325	325		325	325		325	325		325
Base Capacity (vph)	449	812	690	519	812	690	522	1424	637	580	1483	663
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.23	0.15	0.03	0.31	0.29	0.42	0.41	0.02	0.43	0.46	0.16

Intersection Summary

Phone: Fax:
E-Mail:

ROUNDABOUT ANALYSIS

Analyst: SKB
Agency/Co.: GRAEF
Date Performed: 12/16/2014
Analysis Time Period: AM Peak Hour
Intersection: CTH TT & CTH D
Jurisdiction: Waukesha County
Units: U. S. Customary
Analysis Year: Year 2037
Project ID: 2788-01-00 West Waukesha Bypass
East/West Street: CTH D
North/South Street: CTH TT

Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	193	319	97	12	53	238	119	727	12	198	438	133
U-Turn Vol	5			5			5			5		
% Thrus Left Lane								50			50	

	Eastbound			Westbound			Northbound			Southbound		
	Left		Right	BP	Left		Right	BP	Left		Right	BP
Lane Assn.	L		TR		LT		R		LT		TR	
RT Bypass	None				None				None			
PHF	0.91	0.91	0.91		0.91	0.91	0.91		0.91	0.91	0.91	
%HV	2	2	2		4	4	4		4	4	4	
NumPeds	10				10				10			
U-Turn PHF	0.91				0.91				0.91			
U-Turn %HV	2				4				4			
Flow Rate	216	358	109		14	61	272		136	831	14	
No. Lanes	1	1	0		0	1	1		0	2	0	
Cnfl. Lanes	2				2				2			
Duration, T	0.25	hrs.										

Critical and Follow-Up Headway Adjustment

	Eastbound			Westbound		
Crit. Hdwy	4.0000*	4.0000*	5.1929	4.0000*	4.0000*	5.1929
	Northbound			Southbound		
Crit. Hdwy	4.0000*	4.0000*	5.1929	4.2000*	4.2000*	5.1929
	Eastbound			Westbound		
Flup. Hdwy	2.8000*	2.8000*	3.1858	2.8000*	2.8000*	3.1858
	Northbound			Southbound		
Flup. Hdwy	2.8000*	2.8000*	3.1858	2.8000*	2.8000*	3.1858

Flow Computations

	Eastbound	Westbound	Northbound	Southbound
Circ. Flow	759	1201	818	229
Exit. Flow	603	354	1325	629

Capacity and Level of Service

	Eastbound	Westbound	Northbound	Southbound

ATTACHMENT 12

	Left	Right	BP	Left	Right	BP	Left	Right	BP	Left	Right	BP
Entry Flow	222	466		80	272		493	493		442	442	
Entry Cap.	744	744		540	540		713	713		1077	1077	
Volume (vph)	218	457		77	262		474	474		425	425	
Cap. (vph)	727	727		520	520		684	684		1026	1026	
v/c Ratio	0.30	0.63		0.15	0.50		0.69	0.69		0.41	0.41	
Critical Lane		*			*			*			*	
Lane Delay	8.6	16.1		8.9	16.2		19.7	19.7		8.0	8.0	
Lane LOS	A	C		A	C		C	C		A	A	
95 % Queue	1.3	4.5		0.5	2.8		5.6	5.6		2.1	2.1	
Approach:												
Delay		13.65			14.56			19.73			8.04	
LOS		B			B			C			A	
Intersection Delay		14.12					Intersection LOS			B		

ATTACHMENT 12

Phone: Fax:
E-Mail:

ROUNDABOUT ANALYSIS

Analyst: SKB
Agency/Co.: GRAEF
Date Performed: 12/16/2014
Analysis Time Period: PM Peak Hour
Intersection: CTH TT & CTH D
Jurisdiction: Waukesha County
Units: U. S. Customary
Analysis Year: Year 2037
Project ID: 2788-01-00 West Waukesha Bypass
East/West Street: CTH D
North/South Street:

Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	166	173	189	12	233	362	202	539	27	227	634	189
U-Turn Vol	5			5			5			5		
% Thrus Left Lane									50			50

	Eastbound			Westbound			Northbound			Southbound		
	Left		Right	BP	Left	Right	BP	Left	Right	BP	Left	Right	BP
Lane Assn.	L	TR			LT	R		LT	TR		LT	TR	
RT Bypass	None				None			None			None		
PHF	0.94	0.94	0.94		0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
%HV	2	2	2		2	2	2	2	2	2	2	2	2
NumPeds	10				10			10			10		
U-Turn PHF	0.94				0.94			0.94			0.94		
U-Turn %HV	2				2			2			2		
Flow Rate	180	188	205		13	253	393	219	585	29	246	688	205
No. Lanes	1	1	0		0	1	1	0	2	0	0	2	0
Cnfl. Lanes	2				2			2			1		

Duration, T 0.25 hrs.

Critical and Follow-Up Headway Adjustment

	Eastbound			Westbound		
Crit. Hdwy	4.0000*	4.0000*	5.1929	4.0000*	4.0000*	5.1929
	Northbound			Southbound		
Crit. Hdwy	4.0000*	4.0000*	5.1929	4.2000*	4.2000*	5.1929
	Eastbound			Westbound		
Flup. Hdwy	2.8000*	2.8000*	3.1858	2.8000*	2.8000*	3.1858
	Northbound			Southbound		
Flup. Hdwy	2.8000*	2.8000*	3.1858	2.8000*	2.8000*	3.1858

Flow Computations

	Eastbound	Westbound	Northbound	Southbound
Circ. Flow	962	999	629	500
Exit. Flow	469	683	1163	911

Capacity and Level of Service

	Eastbound	Westbound	Northbound	Southbound

ATTACHMENT 12

	Left	Right	BP	Left	Right	BP	Left	Right	BP	Left	Right	BP
Entry Flow	186	393		271	393		419	419		572	572	
Entry Cap.	641	641		624	624		815	815		871	871	
Volume (vph)	182	385		266	385		411	411		561	561	
Cap. (vph)	629	629		612	612		796	796		848	848	
v/c Ratio	0.29	0.61		0.43	0.63		0.52	0.52		0.66	0.66	
Critical Lane		*			*			*			*	
Lane Delay	9.5	17.4		12.5	18.5		11.8	11.8		15.4	15.4	
Lane LOS	A	C		B	C		B	B		C	C	
95 % Queue	1.2	4.2		2.2	4.4		3.0	3.0		5.1	5.1	
Approach:												
Delay		14.87			16.04			11.82			15.43	
LOS		B			C			B			C	
Intersection Delay		14.52					Intersection LOS			B		

ATTACHMENT 12

Appendix 6

Bypass & STH 59 & CTH X

ATTACHMENT 12

Intersection Control Evaluation Worksheet

BUREAU OF TRAFFIC OPERATIONS

Revised: March 31, 2014

NOTE: Attach Items in BLUE as appendices

SPELL CHECK

Prepared By Shana Brummond **Date** 19-Dec-14

Intersection: Bypass & STH 59 & CTH X (North Leg) **Design Project ID:** 2788-01-00 **Project Description:** West Waukesha Bypass

Factor	**Existing Traffic Control** Traffic Signal	**Alternative 1** Dual Lane Roundabout with RT Bypass lanes for all approaches
Safety		
Crash diagram trends	55 crashes (2009-2013) - 31 rear end, 4 right angle, 7 left turn, 6 sideswipe & 7 single vehicle crashes	
Percent and type of crashes expected to be reduced by alternative		Right angle & left-turn crashes would be reduced with roundabout. These crashes account for 11 of the 55 intersection crashes (approximately 20% reduction).
Access near the intersection and side road traffic impacts		
Additional considerations	The project includes a new intersection configuration.	
Operational Analysis		
Discuss the Warrant Analysis (Attach AWSC/Signal warrants)		

LOS, delay, v/c ratio and 95th percentile queues for each movement. (Attach traffic count, forecast and analysis inputs/outputs)

AM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	2	1	3	2	1	1	2	2	1	2	1
LOS	C	D	A	D	C	A	C	D	D	D	C	A
Delay (s)	30.1	43.0	0.0	50.6	28.9	0.0	20.9	36.9	43.9	36.8	27.6	0.0
v/c Ratio	0.06	0.73	0.0	0.88	0.61	0.0	0.48	0.85	0.93	0.79	0.42	0.0
Queue (ft)	25	225	55	220	285	90	105	385	260	205	165	25
Int. LOS	D											

PM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	1	2	1	3	2	1	1	2	2	1	2	1
LOS	C	D	A	D	C	A	C	C	D	C	D	A
Delay (s)	26.0	37.4	0.0	47.7	20.6	0.0	30.0	34.3	43.5	27.1	39.5	0.0
v/c Ratio	0.04	0.73	0.0	0.89	0.44	0.0	0.47	0.48	0.82	0.63	0.85	0.0
Queue (ft)	25	270	95	255	225	75	45	165	200	160	345	25
Int. LOS	D											

Notes: With the design year (Year 2037) traffic, all movements are expected to operate acceptably at LOS D or better conditions during the peak hours.

AM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	0	2	1	0	2	1	0	2	1	0	2	1
LOS	C	D	A	F	F	B	D	D	F	F	F	A
Delay (s)	21.6	25.4	9.2	175.3	245.9	10.2	26.4	26.4	270.1	71.2	71.2	N/A
v/c Ratio	0.57	0.65	0.16	1.31	1.48	0.32	0.80	0.80	1.55	0.95	0.95	0.02
Queue (ft)	100	125	25	725	975	50	225	225	1400	250	250	25
Int. LOS	F											

PM PEAK	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
# of Lanes	0	2	1	0	2	1	0	2	1	0	2	1
LOS	F	F	C	F	C	A	B	B	F	F	F	A
Delay (s)	88.7	128	22.1	51.3	20.5	5.1	10.5	10.5	81.8	205.7	205.7	N/A
v/c Ratio	1.00	1.13	0.52	1.00	0.77	0.14	0.36	0.36	1.08	1.36	1.36	0.02
Queue (ft)	275	375	75	450	200	25	50	50	500	625	625	25
Int. LOS	F											

Notes: With the design year (Year 2037) traffic, select movements are expected to operate at LOS F conditions during the peak hours. Overall intesrection LOS is F during the peak hours. V/C ratio exceeds 0.85 for select movements during the peak hours.

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Factor	Existing Traffic Control Traffic Signal	Alternative 1 Dual Lane Roundabout with RT Bypass lanes for all approaches
Queue impact on adjacent driveways	None	None
Capacity to accommodate diverted freeway traffic for routes parallel to freeway	N/A	N/A
Impacts of railroad crossings within 1000 feet	N/A	N/A
Preliminary Layout of existing and proposed traffic control	See Appendix	See Appendix
Additional considerations (Indicate if roundabout is expected to be a spiral design)		
Right-of-Way Impacts		
Amount of acreage impacted (# of relocations, access restrictions)		
Anticipated right-of-way and real estate costs (Attach cost estimate tables)		
Additional considerations		
Costs		
Discuss estimated costs (Attach itemized cost estimate tables)		
Operations and Maintenance Costs		
Additional considerations		
Practical Feasibility		
Concerns alternative may present		
Major impacts on businesses, parking availability, real estate and utilities		
Frequency of use as an alternate route		
Additional considerations		
Pedestrians and Bicycles		
Describe the need for pedestrian and bicycle facilities		

Factor	Existing Traffic Control Traffic Signal	Alternative 1 Dual Lane Roundabout with RT Bypass lanes for all approaches
Identify nearby pedestrian generators, bike routes, transit stops and if the intersection is on a Safe Route to School (part of existing conditions exhibit)		
State if and what facilities are proposed, within, the project limits (part of preliminary layout of proposed alternatives)		
Additional considerations		
OSOW Freight Network		
Identify nearby OSOW generators		
If either intersecting road is on the freight network, is a significant diversion route or near a freight origin or destination discuss the following: • The geometric features and other design considerations to account for the OSOW vehicle path (e.g. grading, medians, islands). • Vertical and horizontal clearance to account for the OSOW vehicle path (e.g. monotubes, signing)		
Additional considerations		
Environmental Impacts		
Type (i.e. historical, archeological, wetlands or hazardous material) and amount of environmental acreage impacts		
Additional considerations		

Factor	Alternative 2	Alternative 3
Safety		
Crash diagram trends		

ATTACHMENT 12

Factor	Alternative 2	Alternative 3
Percent and type of crashes expected to be reduced by alternative		
Access near the intersection and side road traffic impacts		
Additional considerations		
Operational Analysis		
Discuss the Warrant Analysis (Attach AWSC/Signal warrants)		
LOS, delay, v/c ratio and 95th percentile queues for each movement. (include traffic count, forecast and analysis inputs/outputs)		
Queue impact on adjacent driveways		
Capacity to accommodate 5-20% of diverted freeway traffic for routes parallel to freeway		
Document railroad crossings within 1000 feet of the intersection.		
Preliminary Layout of existing and proposed traffic control	See Appendix	See Appendix
Additional considerations (Indicate if roundabout is expected to be a spiral design)		
Right-of-Way Impacts		
Amount of acreage impacted (# of relocations, access restrictions)		

Alternative 2

AM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

PM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

Notes:

Alternative 3

AM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

PM PEAK	EB			WB			NB			SB		
	-	-	-	-	-	-	-	-	-	-	-	-
# of Lanes	0	0	0	0	0	0	0	0	0	0	0	0
LOS												
Delay (s)												
v/c Ratio												
Queue (ft)												
Int. LOS												

Notes:

ATTACHMENT 12

Factor	Alternative 2	Alternative 3
Anticipated right-of-way and real estate costs (Attach cost estimate tables)		
Additional Considerations		
Costs		
Discuss estimated costs (Attach itemized cost estimate tables)		
Operations and Maintenance Costs		
Additional considerations		
Practical Feasibility		
Concerns alternative may present		
Major impacts on businesses, parking availability, real estate and utilities		
Frequency of use as an alternate route		
Additional considerations		
Pedestrians and Bicycles		
Describe the need for pedestrian and bicycle facilities		
Identify nearby pedestrian generators, bike routes, transit stops and if the intersection is on a Safe Route to School (part of existing conditions exhibit)		
State if and what facilities are proposed, within, the project limits (part of preliminary layout of proposed alternatives)		
Additional considerations		
OSOW Vehicle Routes		
Identify nearby OSOW generators		

ATTACHMENT 12

Factor	Alternative 2	Alternative 3
If either intersecting road is on the freight network, is a significant diversion route or near a freight origin or destination discuss the following: • The geometric features and other design considerations to account for the OSOW vehicle path (e.g. grading, medians, islands). • Vertical and horizontal clearance to account for the OSOW vehicle path (e.g. monotubes, signing)		
Additional considerations		
Environmental Impacts		
Type (i.e. historical, archeological, wetlands or hazardous material) and amount of environmental acreage impacts		
Additional considerations		
Recommendation		
A traffic signal is recommended to be maintained at this intersection due to the unacceptable traffic operations with a dual lane roundabout. A triple lane roundabout will not be considered for this project. The new T-intersection west of this intersection is also recommended to be signalized to operate as a coordinated system.		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	12	460	75	641	657	178	189	800	983	189	389	12
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1827	1827	1827	1810	1810	1810	1810	1810	1810	1792	1792	1792
Adj Flow Rate, veh/h	13	511	0	712	730	0	210	889	819	210	432	0
Adj No. of Lanes	1	2	1	3	2	1	1	2	2	1	2	1
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	4	4	4	5	5	5	5	5	5	6	6	6
Cap, veh/h	232	704	315	809	1196	535	439	1046	881	267	1037	464
Arrive On Green	0.02	0.20	0.00	0.17	0.35	0.00	0.10	0.30	0.30	0.10	0.30	0.00
Sat Flow, veh/h	1740	3471	1553	4860	3438	1538	1723	3438	2707	1707	3406	1524
Grp Volume(v), veh/h	13	511	0	712	730	0	210	889	819	210	432	0
Grp Sat Flow(s),veh/h/ln	1740	1736	1553	1620	1719	1538	1723	1719	1354	1707	1703	1524
Q Serve(g_s), s	0.6	13.6	0.0	14.1	17.3	0.0	8.1	23.9	28.9	8.2	10.0	0.0
Cycle Q Clear(g_c), s	0.6	13.6	0.0	14.1	17.3	0.0	8.1	23.9	28.9	8.2	10.0	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	232	704	315	809	1196	535	439	1046	881	267	1037	464
V/C Ratio(X)	0.06	0.73	0.00	0.88	0.61	0.00	0.48	0.85	0.93	0.79	0.42	0.00
Avail Cap(c_a), veh/h	319	704	315	838	1196	535	471	1046	881	280	1037	464
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.96	0.96	0.00	1.00	1.00	0.00	0.67	0.67	0.67	0.95	0.95	0.00
Uniform Delay (d), s/veh	30.0	36.8	0.0	40.1	26.6	0.0	20.4	32.2	32.2	24.0	27.3	0.0
Incr Delay (d2), s/veh	0.1	6.2	0.0	10.5	2.3	0.0	0.5	4.7	11.8	12.8	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	7.1	0.0	7.1	8.6	0.0	3.9	12.0	12.2	4.7	4.7	0.0
LnGrp Delay(d),s/veh	30.1	43.0	0.0	50.6	28.9	0.0	20.9	36.9	43.9	36.8	27.6	0.0
LnGrp LOS	C	D		D	C		C	D	D	D	C	
Approach Vol, veh/h		524			1442			1918			642	
Approach Delay, s/veh		42.6			39.6			38.2			30.6	
Approach LOS		D			D			D			C	

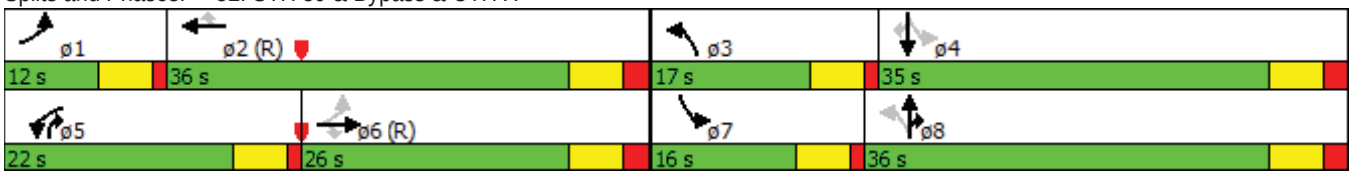
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.1	41.7	15.2	36.0	21.4	27.4	15.2	36.0
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0
Max Green Setting (Gmax), s	7.0	30.0	12.0	29.0	17.0	20.0	11.0	30.0
Max Q Clear Time (g_c+I1), s	2.6	19.3	10.1	12.0	16.1	15.6	10.2	30.9
Green Ext Time (p_c), s	0.0	5.5	0.1	11.0	0.3	2.8	0.0	0.0

Intersection Summary	
HCM 2010 Ctrl Delay	38.1
HCM 2010 LOS	D

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	12	460	75	641	657	178	189	800	983	189	389	12
Turn Type	pm+pt	NA	Perm	Prot	NA	Perm	pm+pt	NA	pt+ov	pm+pt	NA	Perm
Protected Phases	1	6		5	2		3	8	8 5	7	4	
Permitted Phases	6		6			2	8			4	4	4
Detector Phase	1	6	6	5	2	2	3	8	8 5	7	4	4
Switch Phase												
Minimum Initial (s)	7.0	12.0	12.0	7.0	12.0	12.0	7.0	10.0		7.0	10.0	10.0
Minimum Split (s)	12.0	18.0	18.0	12.0	18.0	18.0	12.0	16.0		12.0	16.0	16.0
Total Split (s)	12.0	26.0	26.0	22.0	36.0	36.0	17.0	36.0		16.0	35.0	35.0
Total Split (%)	12.0%	26.0%	26.0%	22.0%	36.0%	36.0%	17.0%	36.0%		16.0%	35.0%	35.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes			Yes			Yes			Yes		
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None		None	None	None
Act Effct Green (s)	28.1	20.1	20.1	17.2	39.8	39.8	41.9	29.8	51.9	41.6	29.6	29.6
Actuated g/C Ratio	0.28	0.20	0.20	0.17	0.40	0.40	0.42	0.30	0.52	0.42	0.30	0.30
v/c Ratio	0.05	0.73	0.14	0.85	0.53	0.16	0.49	0.87	0.58	0.80	0.43	0.02
Control Delay	18.0	44.6	34.3	51.7	25.7	21.9	19.6	43.1	14.9	45.5	30.2	25.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.0	44.6	34.3	51.7	25.7	21.9	19.6	43.1	14.9	45.5	30.2	25.7
LOS	B	D	C	D	C	C	B	D	B	D	C	C
Approach Delay		43.3			37.5			28.5			35.1	
Approach LOS		D			D			C			D	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBTL, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.87	
Intersection Signal Delay: 34.2	Intersection LOS: C
Intersection Capacity Utilization 75.8%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 52: STH 59 & Bypass & CTH X



ATTACHMENT 12

52: STH 59 & Bypass & CTH X

Queues

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	13	511	42	712	730	99	210	889	819	210	432	7
v/c Ratio	0.05	0.73	0.14	0.85	0.53	0.16	0.49	0.87	0.58	0.80	0.43	0.02
Control Delay	18.0	44.6	34.3	51.7	25.7	21.9	19.6	43.1	14.9	45.5	30.2	25.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.0	44.6	34.3	51.7	25.7	21.9	19.6	43.1	14.9	45.5	30.2	25.7
Queue Length 50th (ft)	5	162	22	158	176	38	60	292	192	80	117	3
Queue Length 95th (ft)	16	221	52	#220	284	89	m104	#382	259	#202	163	14
Internal Link Dist (ft)		3737			1463			729			3152	
Turn Bay Length (ft)	325		325	325		325	325		325	325		325
Base Capacity (vph)	264	696	311	833	1369	612	443	1031	1379	261	1007	450
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.73	0.14	0.85	0.53	0.16	0.47	0.86	0.59	0.80	0.43	0.02

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	12	635	188	837	653	127	103	345	687	215	756	12
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	12	655	0	863	673	0	106	356	531	222	779	0
Adj No. of Lanes	1	2	1	3	2	1	1	2	2	1	2	1
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	303	902	404	974	1521	680	227	748	645	354	916	410
Arrive On Green	0.02	0.25	0.00	0.19	0.43	0.00	0.07	0.21	0.21	0.11	0.26	0.00
Sat Flow, veh/h	1774	3539	1583	5003	3539	1583	1774	3539	2787	1774	3539	1583
Grp Volume(v), veh/h	12	655	0	863	673	0	106	356	531	222	779	0
Grp Sat Flow(s),veh/h/ln	1774	1770	1583	1668	1770	1583	1774	1770	1393	1774	1770	1583
Q Serve(g_s), s	0.5	16.6	0.0	16.5	13.1	0.0	4.5	8.6	17.7	9.2	20.5	0.0
Cycle Q Clear(g_c), s	0.5	16.6	0.0	16.5	13.1	0.0	4.5	8.6	17.7	9.2	20.5	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	303	902	404	974	1521	680	227	748	645	354	916	410
V/C Ratio(X)	0.04	0.73	0.00	0.89	0.44	0.00	0.47	0.48	0.82	0.63	0.85	0.00
Avail Cap(c_a), veh/h	394	902	404	1020	1521	680	234	758	652	367	938	420
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.78	0.78	0.00	1.00	1.00	0.00	0.91	0.91	0.91	0.64	0.64	0.00
Uniform Delay (d), s/veh	26.0	33.4	0.0	38.4	19.7	0.0	28.6	33.9	35.8	25.0	34.5	0.0
Incr Delay (d2), s/veh	0.0	4.0	0.0	9.3	0.9	0.0	1.4	0.4	7.7	2.1	4.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	8.6	0.0	8.4	6.6	0.0	2.3	4.2	7.5	4.6	10.6	0.0
LnGrp Delay(d),s/veh	26.0	37.4	0.0	47.7	20.6	0.0	30.0	34.3	43.5	27.1	39.5	0.0
LnGrp LOS	C	D		D	C		C	C	D	C	D	
Approach Vol, veh/h		667			1536			993			1001	
Approach Delay, s/veh		37.2			35.8			38.7			36.7	
Approach LOS		D			D			D			D	

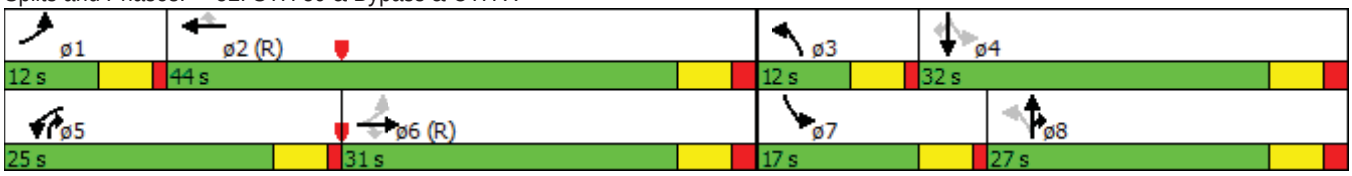
Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	7.0	50.1	11.6	31.4	24.1	32.9	16.2	26.7
Change Period (Y+Rc), s	5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0
Max Green Setting (Gmax), s	7.0	38.0	7.0	26.0	20.0	25.0	12.0	21.0
Max Q Clear Time (g_c+I1), s	2.5	15.1	6.5	22.5	18.5	18.6	11.2	19.7
Green Ext Time (p_c), s	0.0	8.9	0.0	2.6	0.6	4.0	0.1	1.0

Intersection Summary	
HCM 2010 Ctrl Delay	36.9
HCM 2010 LOS	D

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	12	635	188	837	653	127	103	345	687	215	756	12
Turn Type	pm+pt	NA	Perm	Prot	NA	Perm	pm+pt	NA	pt+ov	pm+pt	NA	Perm
Protected Phases	1	6		5	2		3	8	8 5	7	4	
Permitted Phases	6		6			2	8			4	4	4
Detector Phase	1	6	6	5	2	2	3	8	8 5	7	4	4
Switch Phase												
Minimum Initial (s)	7.0	12.0	12.0	7.0	12.0	12.0	7.0	10.0		7.0	10.0	10.0
Minimum Split (s)	12.0	18.0	18.0	12.0	18.0	18.0	12.0	16.0		12.0	16.0	16.0
Total Split (s)	12.0	31.0	31.0	25.0	44.0	44.0	12.0	27.0		17.0	32.0	32.0
Total Split (%)	12.0%	31.0%	31.0%	25.0%	44.0%	44.0%	12.0%	27.0%		17.0%	32.0%	32.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	2.0	1.0	2.0		1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	6.0	5.0	6.0		5.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes			Yes			Yes			Yes		
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None		None	None	None
Act Effct Green (s)	33.9	25.9	25.9	19.9	48.4	48.4	28.7	20.7	45.6	37.7	25.2	25.2
Actuated g/C Ratio	0.34	0.26	0.26	0.20	0.48	0.48	0.29	0.21	0.46	0.38	0.25	0.25
v/c Ratio	0.04	0.72	0.24	0.87	0.39	0.12	0.52	0.49	0.42	0.58	0.87	0.02
Control Delay	14.1	39.2	31.8	49.5	18.3	16.5	26.5	35.4	18.3	28.2	47.8	27.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.1	39.2	31.8	49.5	18.3	16.5	26.5	35.4	18.3	28.2	47.8	27.8
LOS	B	D	C	D	B	B	C	D	B	C	D	C
Approach Delay		37.8			34.7			25.3			43.3	
Approach LOS		D			C			C			D	

Intersection Summary	
Cycle Length: 100	
Actuated Cycle Length: 100	
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBTL, Start of Green	
Natural Cycle: 75	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.87	
Intersection Signal Delay: 35.1	Intersection LOS: D
Intersection Capacity Utilization 78.5%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 52: STH 59 & Bypass & CTH X



ATTACHMENT 12

52: STH 59 & Bypass & CTH X

Queues

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	12	655	97	863	673	92	106	356	531	222	779	6
v/c Ratio	0.04	0.72	0.24	0.87	0.39	0.12	0.52	0.49	0.42	0.58	0.87	0.02
Control Delay	14.1	39.2	31.8	49.5	18.3	16.5	26.5	35.4	18.3	28.2	47.8	27.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.1	39.2	31.8	49.5	18.3	16.5	26.5	35.4	18.3	28.2	47.8	27.8
Queue Length 50th (ft)	4	202	50	190	133	30	37	113	142	97	248	3
Queue Length 95th (ft)	13	267	94	#254	224	73	45	163	198	156	#343	13
Internal Link Dist (ft)		3737			1463			729			3152	
Turn Bay Length (ft)	325		325	325		325	325		325	325		325
Base Capacity (vph)	322	915	409	1001	1712	765	202	743	1217	395	920	411
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.04	0.72	0.24	0.86	0.39	0.12	0.52	0.48	0.44	0.56	0.85	0.01

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Phone: Fax:
E-Mail:

ROUNDABOUT ANALYSIS

Analyst: SKB
Agency/Co.: GRAEF
Date Performed: 12/16/2014
Analysis Time Period: AM Peak Hour
Intersection: Bypass/STH 59/CTH X
Jurisdiction: Waukesha County
Units: U. S. Customary
Analysis Year: Year 2037
Project ID: 2788-01-00 West Waukesha Bypass
East/West Street: STH 59
North/South Street: Bypass/CTH X

Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	12	460	75	641	657	178	189	800	983	189	389	12
U-Turn Vol	5			5			5			5		
% Thrus Left Lane		47			47			50			50	

	Eastbound			Westbound			Northbound			Southbound		
	Left		Right	Left		Right	Left		Right	Left		Right
Lane Assn.	LT	TR	BP	LT	TR	BP	LT	TR	BP	LT	TR	BP
RT Bypass	Yielding			Yielding			Yielding			Yielding		
PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
%HV	4	4	4	5	5	5	5	5	5	6	6	6
NumPeds	10			10			10			10		
U-Turn PHF	0.90			0.90			0.90			0.90		
U-Turn %HV	4			5			5			6		
Flow Rate	14	532	87	748	766	208	220	933	1147	223	458	14
No. Lanes	0	2	0	0	2	0	0	2	0	0	2	0
Cnfl. Lanes	2		2	2		2	2		2	2		2

Duration, T 0.25 hrs.

Critical and Follow-Up Headway Adjustment

	Eastbound			Westbound		
Crit. Hdwy	4.0000*	4.0000*	4.0000*	4.0000*	4.0000*	4.0000*
	Northbound			Southbound		
Crit. Hdwy	4.0000*	4.0000*	4.0000*	4.0000*	4.0000*	4.0000*
	Eastbound			Westbound		
Flup. Hdwy	2.8000*	2.8000*	2.8000*	2.8000*	2.8000*	2.8000*
	Northbound			Southbound		
Flup. Hdwy	2.8000*	2.8000*	2.8000*	2.8000*	2.8000*	2.8000*

Flow Computations

	Eastbound	Westbound	Northbound	Southbound
Circ. Flow	1447	1185	787	1752
Exit. Flow	760	993	953	1212

Capacity and Level of Service

	Eastbound	Westbound	Northbound	Southbound

ATTACHMENT 12

	Left	Right	BP	Left	Right	BP	Left	Right	BP	Left	Right	BP
Entry Flow	259	292	87	714	806	208	580	580	1147	343	343	14
Entry Cap.	452	452	536	546	546	646	729	729	743	363	363	628
Volume (vph)	249	281	84	680	768	198	552	552	1090	324	324	13
Cap. (vph)	435	435	515	520	520	615	693	693	706	342	342	592
v/c Ratio	0.57	0.65	0.16	1.31	1.48	0.32	0.80	0.80	1.55	0.95	0.95	0.02
Critical Lane		*		*	*			*	*		*	
Lane Delay	21.6	25.4	9.2	175.3		245.9		10.2	26.4	26.4	270.1	71.2
Lane LOS	C	D	A	F	F	B	D	D	F	F	F	A
95 % Queue	3.5	4.4	0.6	28.8	38.4	1.4	8.1	8.1	55.7	9.9	9.9	0.1
Approach:												
Delay		21.64			188.37			147.43			69.90	
LOS		C			F			F			F	

Intersection Delay 135.49 Intersection LOS F

ATTACHMENT 12

Phone: Fax:
E-Mail:

ROUNDABOUT ANALYSIS

Analyst: SKB
Agency/Co.: GRAEF
Date Performed: 12/16/2014
Analysis Time Period: PM Peak Hour
Intersection: Bypass/STH 59/CTH X
Jurisdiction: Waukesha County
Units: U. S. Customary
Analysis Year: Year 2037
Project ID: 2788-01-00 West Waukesha Bypass
East/West Street: STH 59
North/South Street:

Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	12	635	188	837	653	127	103	345	687	215	756	12
U-Turn Vol	5			5			5			5		
% Thrus Left Lane		47			47			50			50	

	Eastbound			Westbound			Northbound			Southbound		
	Left		Right BP	Left		Right BP	Left		Right BP	Left		Right BP
Lane Assn.	LT	TR		LT	TR		LT	TR		LT	TR	
RT Bypass	Yielding			Yielding			Yielding			Yielding		
PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
%HV	2	2	2	2	2	2	2	2	2	2	2	2
NumPeds	10			10			10			10		
U-Turn PHF	0.90			0.90			0.90			0.90		
U-Turn %HV	2			2			2			2		
Flow Rate	13	668	198	880	687	134	108	363	722	226	795	13
No. Lanes	0	2	0	0	2	0	0	2	0	0	2	0
Cnfl. Lanes	2		2	2		2	2		2	2		2

Duration, T 0.25 hrs.

Critical and Follow-Up Headway Adjustment

	Eastbound			Westbound		
Crit. Hdwy	4.0000*	4.0000*	4.0000*	4.0000*	4.0000*	4.0000*
	Northbound			Southbound		
Crit. Hdwy	4.0000*	4.0000*	4.0000*	4.0000*	4.0000*	4.0000*
	Eastbound			Westbound		
Flup. Hdwy	2.8000*	2.8000*	2.8000*	2.8000*	2.8000*	2.8000*
	Northbound			Southbound		
Flup. Hdwy	2.8000*	2.8000*	2.8000*	2.8000*	2.8000*	2.8000*

Flow Computations

	Eastbound	Westbound	Northbound	Southbound
Circ. Flow	1919	502	925	1693
Exit. Flow	899	801	381	1681

Capacity and Level of Service

	Eastbound	Westbound	Northbound	Southbound

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	Left	Right	BP	Left	Right	BP	Left	Right	BP	Left	Right	BP
Entry Flow	322	364	198	886	687	134	238	238	722	513	513	13
Entry Cap.	322	322	382	896	896	976	660	660	671	379	379	721
Volume (vph)	316	357	194	869	674	131	233	233	708	503	503	13
Cap. (vph)	315	315	374	872	872	951	647	647	658	371	371	707
v/c Ratio	1.00	1.13	0.52	1.00	0.77	0.14	0.36	0.36	1.08	1.36	1.36	0.02
Critical Lane		*		*	*			*	*		*	
Lane Delay	88.7	128.3	22.1	51.3	20.5	5.1	10.5	10.5	81.8	205.7		205.7
Lane LOS	F	F	C	F	C	A	B	B	F	F	F	A
95 % Queue	10.9	14.5	2.9	17.8	7.8	0.5	1.6	1.6	19.7	24.3	24.3	0.1
Approach:												
Delay		90.12			35.26			53.49			203.17	
LOS		F			E			F			F	
Intersection Delay		85.97				Intersection LOS		F				

ATTACHMENT 12

Attachment 13 – Value Engineering Study Report

Final

Value Engineering Study Report

for

West Waukesha Bypass

Waukesha, WI

April 2015

Prepared for:

Wisconsin Department of Transportation
4802 Sheboygan Avenue
Madison, WI 53707

Prepared by:

Strategic Value Solutions, Inc.

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Value Team Roster

Value Team Leader

Kyle Schafersman, PE, CVS	Strategic Value Solutions, Inc.

Value Team Members

Name	Organization	Role
Kia Ashrafzadeh, PE	AECOM	Geometrics/Roadway
Don Baker, PE, D. WRE, CPESC, AVS	Water Resources Solutions	Civil Engineer
Peter Chladil	Waukesha County DPW	Highway Operations Manager
Matthew Coupar, PE	WisDOT	Bridges/Structures
Jeanne Marchant	WisDOT	Construction Specialist

Value Team Support Staff

Anne Ruzicka	Strategic Value Solutions, Inc.	Workshop Assistant

Acknowledgements

Strategic Value Solutions, Inc. would like to express our appreciation to the WisDOT and Waukesha County staff members who assisted us in the review of this project. Particular thanks go to Doug Cain for providing valuable insights into project issues and to Daniel Tyler for assisting in the coordination and management of this study.

In addition, we would like to thank the members of the CH2M Hill and Kapur & Associates design team for sharing their knowledge about the project and for their responsiveness to our questions and requests throughout this Value Engineering study.

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SECTION 1

EXECUTIVE SUMMARY

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SECTION 1
EXECUTIVE SUMMARY

This report presents the results of a Value Engineering (VE) Study conducted by Strategic Value Solutions, Inc. (SVS) on the design of the West Waukesha Bypass project for the Wisconsin Department of Transportation (WisDOT). The project was reviewed at 50 percent design completion and was developed by CH2M Hill and Kapur & Associates.

The VE Study included a four-day (32-hour) value methodology workshop that was conducted with a multidisciplinary team in Waukesha, WI from March 2nd-5th, 2015.

The purpose of the VE Study is to identify viable alternatives to the proposed design, and the project is accomplishing all necessary functions with the most efficient use of resources. The Value Alternatives and Design Suggestions provided in this report are conceptual and advisory in nature. The VE Team makes no project decisions and has performed no detailed engineering analysis beyond that shown within this report.

Project Description Summary

The West Waukesha Bypass will construct and expand the planned route along the existing County TT alignment from Rolling Ridge Drive south to Madison Street and off alignment to connect to State Highway 59 (STH 59) in the vicinity of County Trunk Highway X (CTH X). The project spans about 4.5 miles. This project will provide safety and capacity improvements and complete a ring road around the City of Waukesha. The project is divided into three project design segments, each led by a different agency responsible for a construction segment, including the City of Waukesha, Waukesha County, and WisDOT. The ultimate project completion is estimated to occur in 2018. The total project estimate is $46 million including environmental, engineering, right-of-way (ROW), utilities, and construction costs.

Value Study Team

The team members that comprised this multidisciplinary VE Team are listed on the introductory pages of this report. All other participants of the study are provided in Appendix B.

In general, the VE Team members were independent of the project development team. This ensured maximum objectivity towards identifying alternative solutions.

Value Methodology

This VE Study used the international standard Value Methodology established by SAVE International®, the Value Society. The Value Methodology (VM) uses a six-phase process executed in a workshop format with a multidisciplinary team. Value is expressed as the relationship between functions and resources where function is measured by the performance requirements of the customer and resources are

measured in materials, labor, price, time, etc. required to accomplish that function. VM focuses on improving Value by identifying the most resource efficient way to reliably accomplish a function that meets the performance expectations of the customer.

With this process, the VE Team identifies the essential project functions and alternative ways to achieve those functions, and then selects the best alternatives to develop into workable solutions for value improvements.

Additional information about the VE Study processes used in the generation of the results presented is provided in Section 3 of this report.

Value Study Constraints

Constraints or limits on the VE Study are used to define the boundaries between project aspects that the project stakeholders will consider changing and those that cannot be changed. These constraints may result from a variety of political, technical, schedule, or environmental causes. Excessive constraints tend to inhibit the VE Team's ability to identify creative opportunities for value improvement. Inadequately defined constraints can result in the team's effort being wasted in areas where there is no possibility of change.

Constraints identified for this study were:

- Travel lanes must be at least 12 feet wide
- Pavement material will be concrete based on previous pavement design
- Traffic signals are required and cannot be replaced with roundabouts based on previously completed intersection control evaulations
- The roadway profile in the Pebble Creek area is controlled by existing groundwater conditioning and lowering. The profile could impact existing conditions
- Outside shoulders must accommodate bike riders

Cost Models

Further analysis of the project cost was conducted using cost models. These models gave the VE Team a better perspective on how the costs are distributed through the project. In particular, the VE Team was looking for those aspects of the project which account for the largest shares of the total cost. This analysis indicated that:

- Concrete pavement accounted for approximately $4.4 million (US 18 to STH 59), $1.3 million (Northview Road to US 18), and $600,000 (Rolling Ridge to Northview Road)
- Real estate accounted for approximately $4.4 million from US 18 to STH 59
- The land bridge and structure over Pebble Creek accounted for approximately $4.8 million of the total project cost

- Common excavation and borrow accounted for approximately $3.9 million from US 18 to STH 59
- The section between US 18 and STH 59 accounted for 76% of the total project cost

Workshop Results

The purpose of the workshop is to identify and develop alternative concepts that will improve the overall value of the project. In order to be successful at identifying alternatives, it is essential that the VE Team first understand the project objectives and the problems that must be solved. For this reason, the workshop began with a presentation by WisDOT's project manager to define the objectives and to provide background information on the project. This was followed by a more detailed presentation of the design by the project development team (PDT) on how the design will accomplish the project's objectives. To give the VE Team a better perspective on the project, the VE Team participated in a site visit following the presentations.

The Information Phase of the workshop was followed by an in-depth analysis of the functional requirements of the project. A complete understanding of the basic functions that must be accomplished in order to successfully achieve the mission of the project is essential for the VE Team to identify feasible alternatives to the current concept.

Using function analysis and Function Analysis System Technique (FAST) diagramming, the VE Team defined the basic functions of this project as protect resources, enhance recreation, improve safety, decrease travel time, and increase lifespan. Key secondary functions that supported these basic functions included minimize environmental impacts, connect communities, dissipate congestion, improve railroad crossing, mitigate flooding, connect routes, allow passing, and increase bearing capacity. Analysis of the functions intended to be performed by the project helped the VE Team focus on the mission of the project and, consequently, how to identify alternative concepts that would still meet the mission while exploring opportunities for value enhancement.

Analyzing the functions of this project gave the team the following key insights:

- Several design decisions were made to avoid and minimize the environmental impacts on sensitive areas
- Controlling access, improving geometry, and reducing crashes will improve the flow of traffic and, as a result, dissipate congestion
- Connecting routes and allowing passing will decrease user travel time

With an understanding of the functional requirements, the VE Team transitioned to the Creative Phase of the workshop and brainstormed on all of the possible ways to accomplish each of those functions. The VE Team generated 83 ideas for potential changes to the current design.

Based on the VE Team members' professional judgment and input from WisDOT, CH2M Hill, and Kapur & Associates representatives, seven of these ideas were selected for development into Value Alternatives.

Value Alternatives

Table 1-1, at the end of this section, includes a complete list of all the Value Alternatives developed. This table shows the number and title of each alternative as well as a summary of the cost savings. The cost savings shown are the capital or first cost savings only. Due to budget concerns, this VE Study specifically focused on reducing capital expenditures. Therefore, some of the Value Alternatives are merely cost cutting measures that could be implemented without sacrificing the functional requirements of the project.

It should be noted that VE Studies are working sessions for the purpose of developing and recommending alternative approaches to the current design. As such, the results presented are of a conceptual nature and are not intended as a final design. Detailed feasibility assessment and final design development of any of the alternatives or suggestions presented herein, should they be accepted, remain the responsibility of WisDOT, CH2M Hill, and Kapur & Associates.

Some alternatives presented in this report are variations of a common concept and others are alternatives to a specific aspect of the design. Thus, not necessarily all alternatives in this report can be implemented, as selection of some may preclude or limit the use of others.

These potential savings do not reflect any costs for redesign, which must be considered. Moreover, the full benefit and impact of many of the alternatives goes beyond the cost savings to include improved project performance of required functions.

Optimum Combination of Alternatives

After completing the development of the Value Alternatives, the VE Team reviewed the composite list of alternatives to identify what they believed to be the optimum combination of alternatives. This combination represents the best value solution for the project in the opinion of the VE Team. The review concluded that the maximum project benefits would be realized by combining the alternatives as shown in Table 1-2 – Optimum Combination.

This combination results in the following potential cost savings:

Capital Cost Savings	$2,692,000

The savings from some of the individual Value Alternatives have been adjusted to account for overlapping savings when combined with other Value Alternatives.

Design Suggestions

In addition to the Value Alternatives, the VE Team also identified seven Design Suggestions. These are suggestions for changes or clarifications to the project documents that did not have an identifiable or quantifiable cost impact that could be determined within the scope of the workshop. The Design Suggestions from this study are included in Section 5 of this report.

Additional Benefits

A VE Study typically results in benefits beyond cost savings. These benefits are generated as a part of a Value Alternative, Design Suggestion, or from an observation made by the VE Team or one of the other participants during the workshop. Below are some of the benefits realized from this study, in addition to the cost savings discussed above.

- At STH 59 and CTH X, the VE Team recommended an alternative interchange type that will improve traffic flow, particularly the triple left turn situation, by separating left turns from through traffic.
- The VE Team recommended increasing the use of ditches and bioswales to improve water quality and reduce stormwater concentration compared to the original concept.

Resolution of Value Alternatives

To finalize the VE Study it is essential that decisions are made on the resolution of each of the Value Alternatives and Design Suggestions presented in this report. This needs to be a collaborative effort between WisDOT, CH2M Hill, and Kapur & Associates. The ultimate disposition of the Value Alternatives will be documented in this report.

Implementation Results

The final phase of the VE process consisted of implementation decisions and actions. The VE Team was included in the Implementation Meeting/Discussions. The implementation results have been provided by the PDT.

An implementation meeting was conducted between WisDOT and Waukesha County.

This meeting was conducted to discuss each Value Alternative and Design Suggestion, answer questions, and decide what changes to make to the project. During the meeting, some ideas were accepted, others partially accepted or modified, and some were rejected. The decisions and the rationale for these decisions are documented in Section 6, Implementation Decisions. These decisions are also summarized in Table 1-1, Summary of Alternatives.

Accepted Savings

Estimated net savings from the Value Alternatives accepted by the PDT for implementation are:

Capital Cost Savings	$392,000

Additional Savings

Implementing additional items that are still open, undecided or require further study by the PDT could add additional savings up to:

Capital Cost Savings	$1,869,000

Total Potential Savings

If these additional alternatives are determined to be acceptable, then the total savings from this VE Study would increase from the accepted savings stated above to:

Capital Cost Savings	$2,261,000

Conclusions

This VE Study resulted in both tangible and intangible benefits to the project and to the project team. First, the VE Team configuration brought together a combination of County input, WisDOT experts, and consultant experts. This provided a forum to evaluate the planning and design decisions of the project with a fresh perspective from both inside and outside experts prior to commencing with the final design.

Secondly, the VE Study resulted in the potential for substantial capital cost savings for the project. The maximum potential costs savings can be realized by implementing:

IS-21 to slope all drainage to the outside in lieu of crowning the center of roadway

PR-04 to use fill with sheetpile and transverse drain pipes in lieu of land bridge

PR-13 to construct urban section consisting of curb and gutter adjacent to roadway from US 18 to STH 59

PR-17 to revise grade where possible to a maximum of 2.5 percent to more closely follow the existing ground

PR-20 to use precast reinforced concrete box in lieu of cast-in-place box culverts

These five recommendations, when combined, will result in nearly $2.8 million in capital cost savings.

In addition, the VE Study recommended using a double crossover intersection at STH 59 and CTH X. While this will have additional capital cost, it will improve the traffic

operations of this intersection in lieu of the triple left turn lane design of the original concept. This alternative intersection has been used successfully around the country, and it is gaining popularity.

The VE Study also included multiple Design Suggestions that will improve the management of wetlands, groundwater, and stormwater with the use of ponds, bioswales, ditches, boardwalk, and subsurface drains. These recommendations will reduce the impact to the existing environment.

Table 1-1
Summary of Alternatives

Alt. No.	Description	First Cost Savings	Decision
IS - Improve Safety			
IS-06	Use barrier wall in lieu of raised median to narrow cross-section in order to reduce right-of-way	$252,000	R
IS-21	Slope all drainage to the outside in lieu of crowning the center of roadway	$127,000	R
PR - Protect Resources			
PR-04	Use fill with sheetpile and transvere drain pipes in lieu of land bridge	$1,577,000	R/FS
PR-13	Construct urban section consisting of curb and gutter adjacent to roadway to reduce right-of-way from US 18 to STH 59	$304,000	R
PR-17	Revise grade where possible to a maximum of 2.5 percent to more closely follow the existing ground reducing the borrow required	$392,000	P
PR-19	Accommodate bike traffic on eight-foot paved shoulder and accommodate pedestrians on sidewalk from CTH D (Sunset Drive) to Madison Street and from US 18 to Northview Road in lieu of constructing a 10-foot multi-use path in this section	$466,000	R
PR-20	Use precast reinforced concrete box in lieu of cast-in-place box culverts	$292,000	FS
Design Suggestions			
DT - Decrease Travel Time			
DT-08	Synchronize (coordinate) traffic signals in lieu of operating fully actuated traffic signals		A
IS - Improve Safety			
IS-13	Construct stormwater ponds that are not adjacent to rivers as mitigation wetlands		R
IS-24	Install motion activated warning system (flashing beacon) or a traffic signal for Glacial Drumlin Trail in lieu of tunnel		R
PR - Protect Resources			
PR-11	Construct a low-impact boardwalk multi-use path over wetlands		R
PR-14	Use double crossover intersection at STH 59 and CTH X		R
PR-21	Maximize use of ditches and bioswales with sheet flow in lieu of inlets and closed storm sewer where possible		A
PR-22	Provide subsurface system to maintain groundwater flow in fen		A

A = Accepted P = Partially Accepted FS = Further Study Required R = Rejected

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Table 1-2
Optimum Combination of Alternatives

Alt. No.	Description	First Cost Savings
IS - Improve Safety		
IS-21	Slope all drainage to the outside in lieu of crowning the center of roadway	$127,000
PR - Protect Resources		
PR-04	Use fill with sheetpile and transvere drain pipes in lieu of land bridge	$1,577,000
PR-13	Construct urban section consisting of curb and gutter adjacent to roadway to reduce right-of-way from US 18 to STH 59	$304,000
PR-17	Revise grade where possible to a maximum of 2.5 percent to more closely follow the existing ground reducing the borrow required	$392,000
PR-20	Use precast reinforced concrete box in lieu of cast-in-place box culverts	$292,000
	Total	**$2,692,000**

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SECTION 2

PROJECT DESCRIPTION

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SECTION 2
PROJECT DESCRIPTION

The West Waukesha Bypass will construct and expand the planned route along the existing County TT alignment from Rolling Ridge Drive south to Madison Street and off alignment to connect to State Highway 59 (STH 59) in the vicinity of County Trunk Highway X (CTH X). The project spans about 4.5 miles. This project will provide safety and capacity improvements and complete a ring road around the City of Waukesha. The project is divided into three project design segments, each led by a different agency responsible for a construction segment, including the City of Waukesha, Waukesha County, and WisDOT. The ultimate project completion is estimated to occur in 2018.

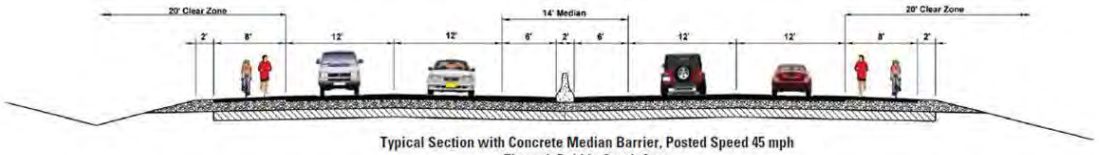
The Draft Environmental Impact Statement (EIS) was signed in October 2012. The Waukesha Bypass was initially proposed in the 1950's and the County began preserving right-of-way (ROW) in the 1970's. Waukesha County studied various corridor options in the 1990's and began the current Draft EIS in 2010. A Memorandum of Understanding (MOU) was signed in May of 2009. Waukesha County consultants are responsible for the preliminary design. WisDOT is responsible for final design and construction of the bypass from the US 18 intersection south to STH 59. Waukesha County is responsible for final design from Northview Road to US 18. The City of Waukesha is responsible for final design from Rolling Ridge Drive to Northview Road.

The proposed project is located in Waukesha County in southeastern Wisconsin along the perimeter of the City of Waukesha. The proposed improvement for CTH TT involves reconstructing the existing two-lane road into a four-lane divided suburban cross section highway. Minor slope grading will be involved to update the clear zone area to current design standards. The proposed highway will typically consist of two 12-foot lanes with six-foot inside and 10-foot outside shoulders in each direction separated by a variable width median. A median barrier will be constructed in those areas that are environmentally sensitive (CTH D to STH 59). The general concept is to utilize the existing ROW to the extent practical and purchase new ROW south of Madison Street to connect to STH 59 in the vicinity of CTH X.

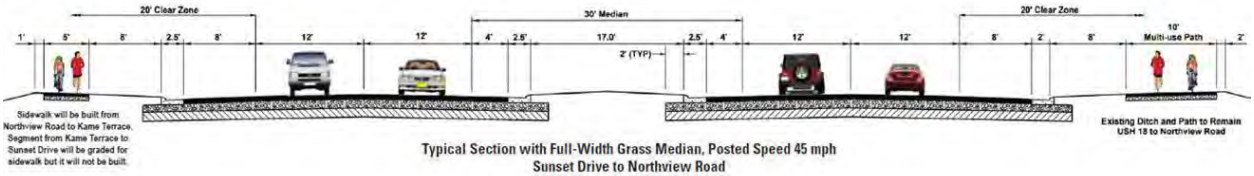
During construction, it is proposed to build new lanes adjacent to the existing CTH TT lanes from Rolling Ridge Drive to Madison Street. After Madison Street, the bypass is off alignment and can be constructed without disruption to any existing traffic. Additionally, the environmentally sensitive areas in the vicinity of Sunset Drive south to STH 59 will require special structures to minimize impacts to the natural environment and an existing multiuse recreational trail.

The total project estimate is $46 million. This total was broken down into three major sections and will be managed by three separate entities. Section 1 includes all work from Rolling Ridge Drive to the Northview Road intersection (City of Waukesha). Section 1 is estimated at $3.6 million. Section 2 (Waukesha County) includes the work between

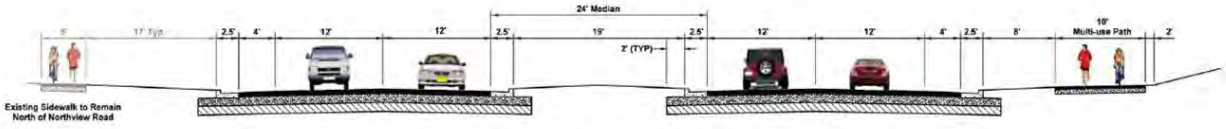
Northview Road and the US 18 intersection and was estimated at $7.3 million. Section 3 (WisDOT) includes the remainder of the bypass from US 18 to STH 59 and was estimated at $35 million. Total costs include environmental, engineering, ROW, utilities, and construction costs.



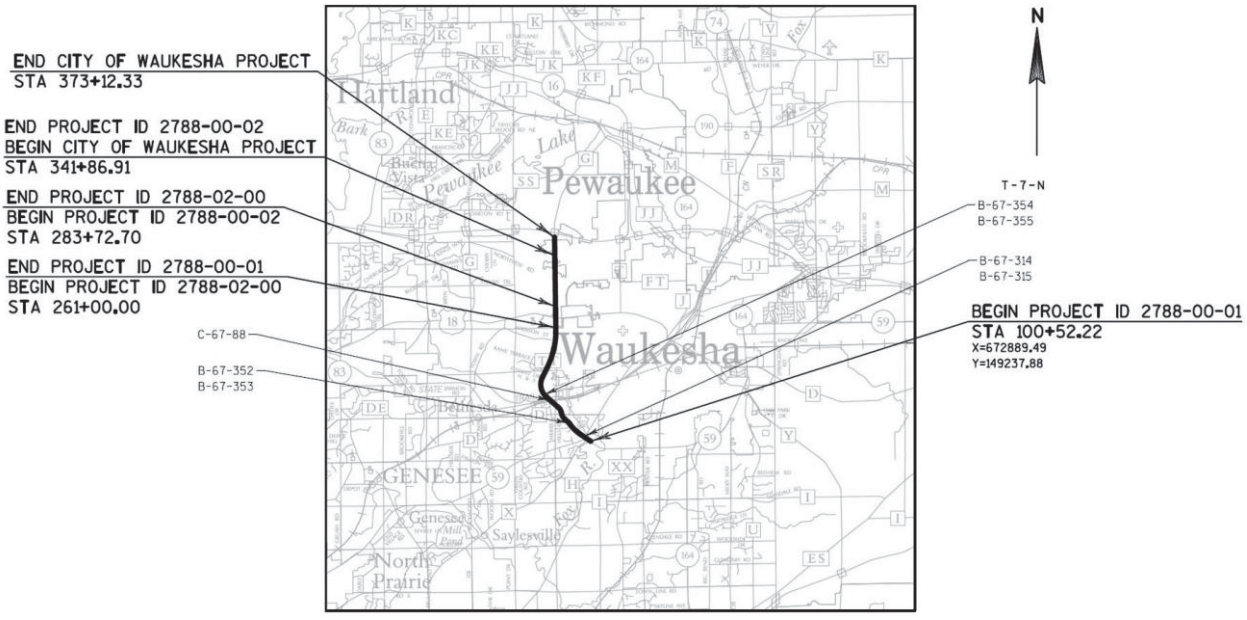
Typical Section with Concrete Median Barrier, Posted Speed 45 mph
Through Pebble Creek Area



Typical Section with Full-Width Grass Median, Posted Speed 45 mph
Sunset Drive to Northview Road



Typical Section with Full-Width Grass Median, Posted Speed 35 mph
North of Northview Road
Sunset to County X Alternative, County X to Badger Drive



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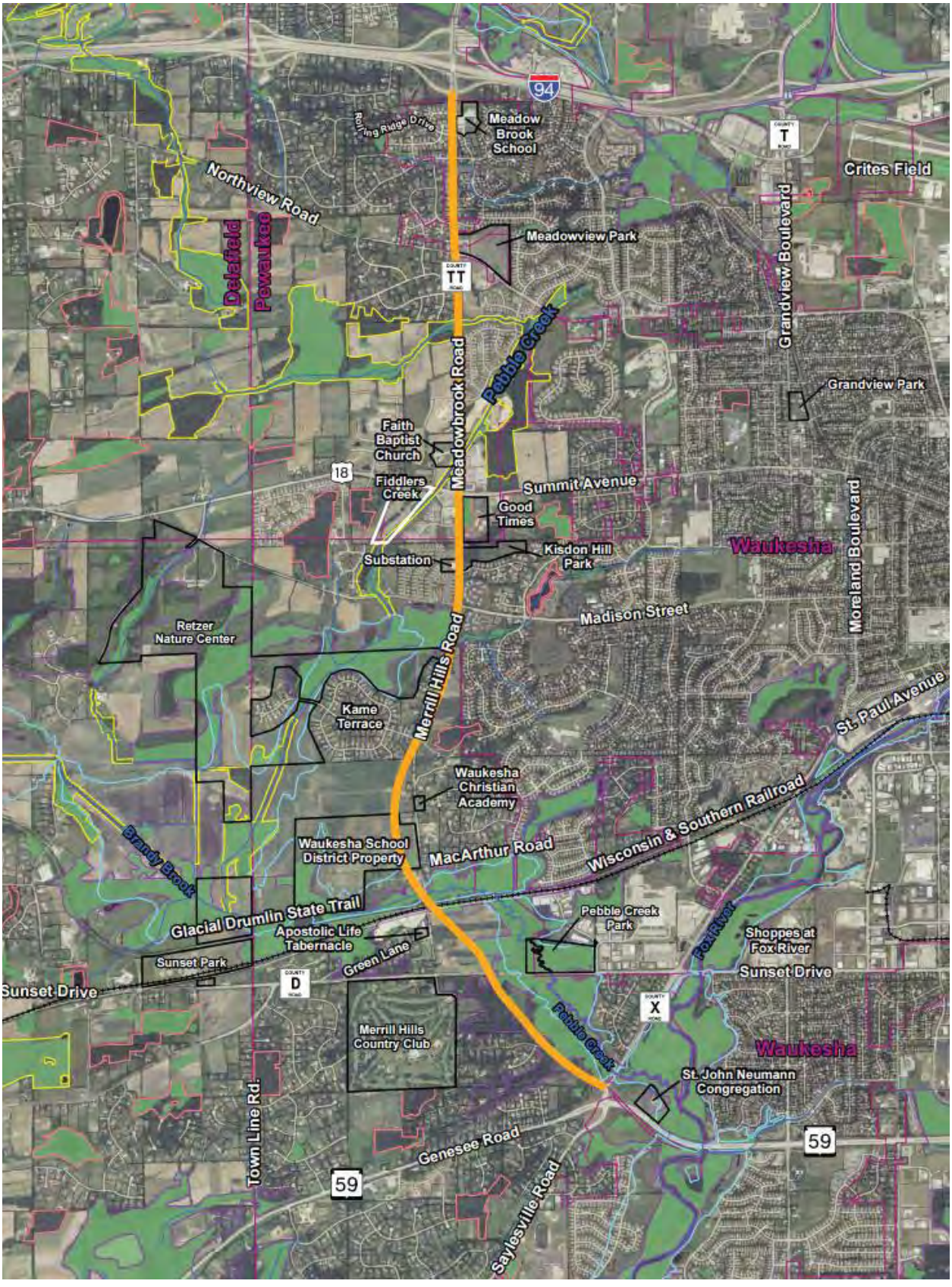

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SECTION 3

VALUE STUDY PROCESS

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SECTION 3
VALUE STUDY PROCESS

This section describes the process used to conduct this VE Study and the significant findings of the VE Team. This VE Study used the international standard Value Methodology established by SAVE International, the Value Society. The standard establishes the specific 6-Phase, sequential process, and the objectives of each of those phases, but does not standardize the specific activities in each phase.

Value Methodology (VM) is the general term that describes the structure and process for executing the Value Workshop. This systematic process was used with a multidisciplinary team to improve the value of the project through the analysis of functions and the identification of targets of opportunity for value improvement.

The **VM Job Plan** provides the structure for the activities associated with the VE Study. These activities are further organized into three major stages:

1. Pre-Workshop preparation
2. VM Workshop
3. Post-Workshop documentation and implementation

Figure 3-2 at the end of this section shows a diagram of the VM Job Plan used for this Value Study.

Defining Value

Within the context of VM, Value is commonly represented by the following relationship:

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

In this expression, functions are measured by the performance requirements of the customer, such as mission objectives, risk reduction and quality improvements. Resources are measured in materials, labor, price, time, etc. required to accomplish the specific function. VM focuses on improving Value by identifying the most resource efficient way to reliably accomplish a function that meets the performance expectations of the customer.

It can be seen from this relationship that Value is improved or increased by:

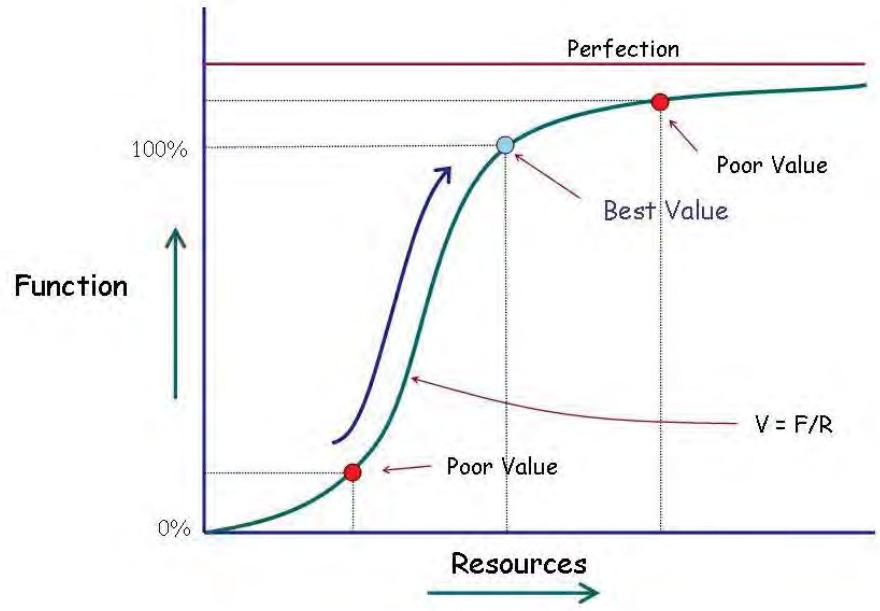
1. Increasing function without increasing resource consumption. Some increase in resources is acceptable as long as there is a greater increase in function performance.

2. Decreasing resources without decreasing function. Again, some decrease in function may be acceptable if the corresponding decrease in resources is significant enough.

Ideally, the VE Team looks for opportunities to increase function and concurrently decrease resource requirements. This will achieve the best value solution.

This value concept is illustrated in the Figure 3-1, The Value Curve. This figure shows a hypothetical curve from plotting the value expression above. This curve will asymptotically approach perfection. The best value solution for a given project or project element will be found at the knee of the curve. At this point the required function or functions have been achieved to 100% of the required level with a corresponding minimum resource commitment. To attempt to increase the function performance beyond this level will result in a resource consumption that has a higher worth than the marginal increase in function. This results in a poor value solution. Conversely, a poor value solution can also be the result of not achieving the function to 100% of the requirement. In this case, an incremental increase in resources delivers significant increase in function performance. The Value Methodology is used to identify the poor value decisions in a project and then develop alternative solutions to better align the project along this curve to achieve a best value solution.

Figure 3-1
The Value Curve™



This understanding of how Value is affected by changes in function or resources provides the foundation for all SVS Value Studies. The following paragraphs describe the process we used to understand the functional requirements and how we identified value improvement alternatives.

Pre-Workshop

Prior to the start of the workshop, the team was tasked with reviewing the most current documentation on the project development. This was done to familiarize them with the project design and to prepare them for asking questions of the project stakeholders during the project presentations at the beginning of the workshop. Much of the background information for this study was generated by CH2M Hill and Kapur & Associates. Other pre-workshop activities included:

- Coordinating workshop logistics and communicating those to the various participants
- Providing guidance to WisDOT, CH2M Hill, and Kapur & Associates on presentation content for the project introduction
- Scheduling workshop participants and assigning tasks to ensure the team is prepared for the workshop
- Gathering necessary background information on the project and making sure project documentation is distributed to the team members

Materials furnished to the VE Team by WisDOT, CH2M Hill, and Kapur & Associates are listed in the Appendix.

VM Workshop

The VM workshop was an intensive session during which the project design was analyzed to optimize the balance between functional requirements and resource commitments (primarily capital and O&M costs).

The VM Job Plan used by SVS includes the execution of the following phases during the workshop:

1. Information Phase
2. Function Analysis Phase
3. Creative Phase
4. Evaluation Phase
5. Development Phase
6. Presentation Phase

Information Phase

At the beginning of the workshop, it was important to understand the background of the project from which the design was developed. This background was provided in an oral overview by WisDOT, CH2M Hill, and Kapur & Associates. The overview and subsequent project analysis provided information on the following topics:

- Rationale why this project is necessary

- Project objectives that have governed the proposed design
- Rationale for the proposed design configuration
- Explanation of design features, criteria, and assumptions
- Value Study constraints
- Project cost

The WisDOT project management presentation provided the VE Team with an overview of the goals, issues, and expectations for the project. WisDOT and the VE Team also finalized the VE Study constraints. This was followed by CH2M Hill and Kapur & Associates's more detailed presentation on the project design and an explanation of the rationale behind key design level decisions. Further, this gave CH2M Hill and Kapur & Associates an opportunity to share their issues and concerns about the project from their perspective.

From these presentations, the VE Team noted the following key information:

- The 2% grade on crosswalks causes ADA issues at intersections on the north portion of the project
- The original concept calls for a significant amount of breaker stone material
- Significant design effort has been made to avoid impact to the wetland areas and the groundwater fen
- Plowing snow out of a channelized left turn lane is undesirable for maintenance personnel
- The land bridge and Pebble Creek crossing structure type and design has not been started yet

Site Visit

After the project presentations, representatives from the VE Team, WisDOT, and CH2M Hill and Kapur & Associates visited the project site. The purpose of the site visit was to give the VE Team members a first-hand opportunity to see the physical features of the project site and existing facility that influenced the design development.

From this site visit, the VE Team made the following observations:

- The steep grades of the existing roadway create line of sight safety concerns
- The southern portion of project area does not have a sidewalk or bike accommodation
- The portion of new bypass on new alignment will require extensive fill
- The existing road has significant traffic volume

Project Cost Analysis

To further analyze the project cost, the VE Team prepared three cost models for the project. A capital cost model of the entire project was subdivided into project sections based on responsibility.

The cost models were used by the VE Team for the following purposes:

- To identify parts of the project with the greatest costs
- To aid in focusing the efforts of the team during the study

A review of the cost models prepared for this project indicated:

- Concrete pavement accounted for approximately $4.4 million (US 18 to STH 59), $1.3 million (Northview Road to US 18), and $600,000 (Rolling Ridge to Northview Road)
- Real estate accounted for approximately $4.4 million from US 18 to STH 59
- The land bridge and structure over Pebble Creek accounted for approximately $4.8 million of the total project cost
- Common excavation and borrow accounted for approximately $3.9 million from US 18 to STH 59
- The section between US 18 and STH 59 accounted for 76% of the total project cost

The VE Team's cost models for this project are included in the Cost Information Appendix.

FAST Diagram

Function analysis was enhanced by using a graphical mapping tool known as the *Function Analysis System Technique* (FAST), which allows VE Team members to understand how the functions of a project relate to each other. The resulting FAST Diagram allowed quick visualization of the logical relationship between project functions and the project as a whole. The FAST diagram is in the Function Analysis section of the Appendix.

The FAST Diagram is structured such that moving to the right of any function answers the question, "How are we accomplishing this function?" Moving to the left of any function answers the question, "Why are we accomplishing this function?" Elements that are vertically connected occur "When" or as a consequence of the function it is connected to on the horizontal path.

The diagram shows on the far left that the ultimate function or the mission that must be accomplished by this project is to develop/operate transportation system. This is accomplished by protecting resources, enhancing recreation, improving safety, decreasing travel time, and increasing lifespan. Key secondary functions that

supported these basic functions included minimize environmental impacts, connect communities, dissipate congestion, improve railroad crossing, mitigate flooding, connect routes, allow passing, and increase bearing capacity. Analysis of the functions intended to be performed by the project helped the VE Team focus on the mission of the project and, consequently, how to identify alternative concepts that would still meet the mission while exploring opportunities for value enhancement.

Function Findings

From the function analysis of this project, the VE Team concluded that:

- Several design decisions were made to minimize the environmental impacts on sensitive areas
- Controlling access, improving geometry, and reducing crashes will improve the flow of traffic and, as a result, dissipate congestion
- Connecting routes and allowing passing will decrease user travel time

In addition to identifying the essential project functions, this phase of the workshop also serves two other objectives:

1. The unification of the individual VE Team members into a synergistic, cohesive team, and
2. The stimulation of creative ideas prior to beginning the subsequent creative phase.

The FAST diagram is included in the Appendix.

Creative Phase

This step in the VM process involved generating ideas using creativity techniques. The VE Team recorded all ideas regardless of their feasibility. In order to maximize the VE Team's creativity, evaluation of the ideas was not allowed during the creative phase. The VE Team's effort was directed toward a large quantity of ideas. These ideas were later screened in the Evaluation Phase of the workshop.

The creative ideas generated by the VE Team are included in the Appendix. The list also includes ratings for each idea based on the Evaluation Phase of the workshop. These lists should be carefully reviewed, as there may be other good ideas not developed by the VE Team because of time constraints. These should be further evaluated or modified to gain the maximum benefit for the project.

Evaluation Phase

In this phase of the workshop, the team selected the ideas with the most merit for further development.

After an initial vote, the VE Team Leader assessed how many ideas could be developed into Value Alternatives within the remaining duration of the workshop. From

this assessment, all ideas with a certain number of votes were selected for development. However, prior to the final selection, the results were revisited collectively by the VE Team to ensure that those selected by the voting process truly represented the best ideas for development. This gave the VE Team the opportunity to down-rate some ideas and to up-rate other ideas based upon team discussion of the ideas.

The criteria used for selection were:

1. The inherent value, benefit and technical appropriateness of the idea
2. The expected magnitude of the potential cost savings, both capital and life cycle
3. The potential for WisDOT, CH2M Hill, and Kapur & Associates acceptance of the idea

Ideas were selected for development as Value Alternatives based on all three criteria.

Not all ideas were developed. This evaluation process is designed to identify those ideas with the greatest potential for value improvement that can be developed into Value Alternatives within the time constraints of the workshop and the production capacity of the VE Team. The remaining ideas were eliminated from further consideration by the VE Team; however, the ideas not developed should also be reviewed, as there may still be other good ideas not developed by the VE Team because of time constraints or other factors. These could be further evaluated or modified to gain the maximum benefit for the project.

To further ensure the VE Team is focused on developing the best ideas, a mid-point review meeting is conducted with the VE Team Leader, WisDOT, and CH2M Hill representatives. This mid-point review allowed WisDOT and CH2M Hill to identify any fatal flaws in the ideas that were not apparent to the VE Team but were apparent to WisDOT and CH2M Hill because of their greater institutional knowledge of the project. These fatal flaws may be technical, operational, political, etc.

Development Phase

During the Development Phase of the workshop, each idea was expanded into a workable alternative to the original project concept. Development consisted of preparing a description of the Value Alternative, evaluating advantages and disadvantages, and making cost comparisons.

Each alternative is presented with a brief narrative to compare the original concept and the alternative concept. Sketches and brief calculations were also developed, if needed, to clarify and support the alternative. The Value Alternatives developed during the workshop are presented in Section 4 – Value Improvement Alternatives.

The VE Team Leader and, to the extent possible, other VE Team members reviewed each alternative to improve completeness and accuracy.

Redesign costs are not included in the cost comparison of alternatives. The responsibility for determining these costs is between WisDOT, CH2M Hill, and Kapur & Associates. Redesign costs, if any, should be addressed by CH2M Hill and Kapur & Associates in their response to WisDOT on the alternatives.

Post-Workshop

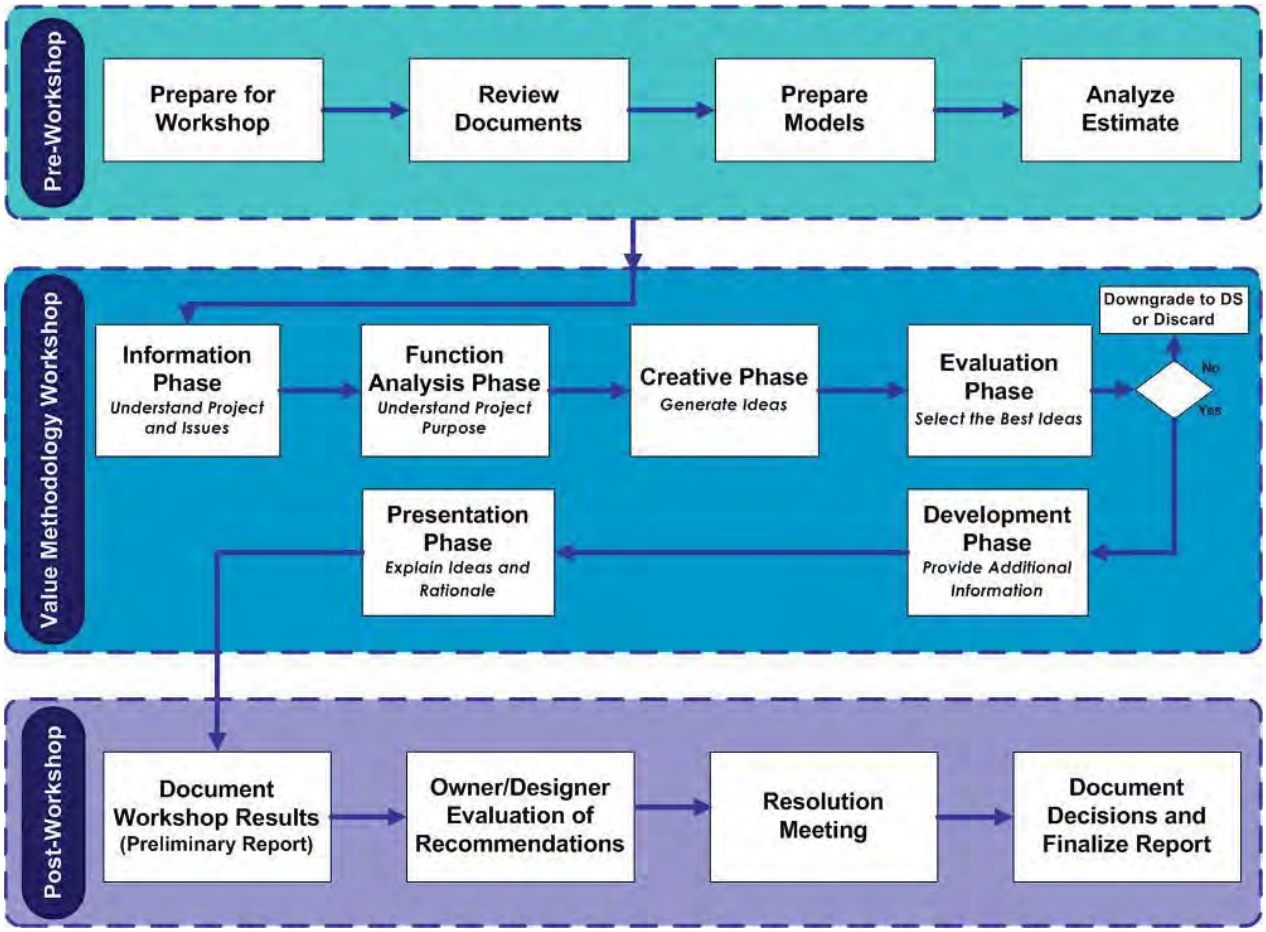
The Post-Workshop activities of this VE Study consisted of preparing the VE Study Reports and coordinating with WisDOT, CH2M Hill, and Kapur & Associates to help them make decisions regarding the acceptance of the Value Alternatives.

Shortly after the conclusion of the workshop, our Preliminary Report was submitted to WisDOT for review. The report was also provided to CH2M Hill and Kapur & Associates by WisDOT. Upon receipt of the report, representatives of WisDOT, CH2M Hill, and Kapur & Associates analyzed each Value Alternative. CH2M Hill and Kapur & Associates provided a response to WisDOT, either recommending incorporation of the Value Alternative into the design or presenting reasons for rejection.

Upon completion of the review, a memorandum was sent by the WisDOT project manager stating decisions regarding the appropriate implementation action for each Value Alternative and Design Suggestion. Those decisions are presented in Section 6 – Implementation Decisions.

This Final Value Study Report includes the Value Alternatives developed during the workshop and the subsequent implementation decisions.

Figure 3-2
Value Engineering Process Diagram



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SECTION 4

VALUE ALTERNATIVES

ATTACHMENT 13

SECTION 4
VALUE ALTERNATIVES

The results of this VE Study represent the value improvement opportunities that can be realized on this project. They are presented as individual alternatives for specific changes to the current design.

Each alternative includes:

- A summary of the original concept
- A description of the alternative concept
- A brief narrative comparing the original design and the recommended change
- Sketches, where appropriate, to further explain the alternative
- Calculations, where appropriate, to support the technical adequacy of the alternative
- A capital cost comparison
- And a life cycle cost analysis, if appropriate

Cost was the primary resource that was compared to the functions being accomplished in the project. To ensure that costs were compatible within the Value Alternatives proposed by the VE Team, the project cost estimate was used as the basis of cost.

Organization of Alternatives

The alternatives presented on the following pages are organized by project or functional categories, and then numerically within each of those categories. The divisions used to organize the alternatives are as follows:

Improve Safety (IS)

Protect Resources (PR)

These designations have been used throughout the VE process to organize the ideas.

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IMPROVE SAFETY

ATTACHMENT 13

Value Alternative

Project: West Waukesha Bypass
Location: Waukesha, WI

	Alternative No:
Title:	IS-06
Use barrier wall in lieu of raised median to narrow cross-section in order to reduce right-of-way	
Description of Original Concept:	
The original concept is a 30-foot wide raised median from Station (Sta.) 250 to Sunset Drive.	
Description of Alternative Concept:	
The alternative concept is to narrow the median to 14 feet and add a barrier wall from Sta. 250 to Sunset Drive.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☐ Increased	☐ Increased
☑ Maintained	☐ Maintained
☐ Decreased	☑ Decreased

Cost Savings Summary

First Cost Savings:	$252,000
O&M Savings:	$0
Life Cycle Cost Savings:	$252,000

Advantages/Disadvantages

Alternative No.: IS-06

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Reduces ROW acquisition • Reduces crashes associated with crossing the median to turn left • Right-in and right-out condition continues to prevent crossover conflicts	• Increases the amount of concrete barrier • Increases the number of crash cushions required at barrier wall terminations

Discussion

Alternative No.: IS-06

The original concept uses a 30-foot raised median from Sta. 250 to Sunset Drive. The alternative concept reduces the median width to 14 feet with a barrier wall.

Reducing the raised median to 14 feet will reduce ROW acquisition required. The inside shoulder will be six feet wide, similar to the typical section from Sta. 250 to Sunset Drive. Shoulder widths are adequate for safety, allowing ample room for vehicles to pull out of the traveled lane. The project would have a constant median section throughout, and an increase in quantity could reflect a decrease in the linear foot cost for barrier wall.

This alternative will increase the number of crash cushions required at each location of the barrier wall termination compared to the no barrier wall concept.

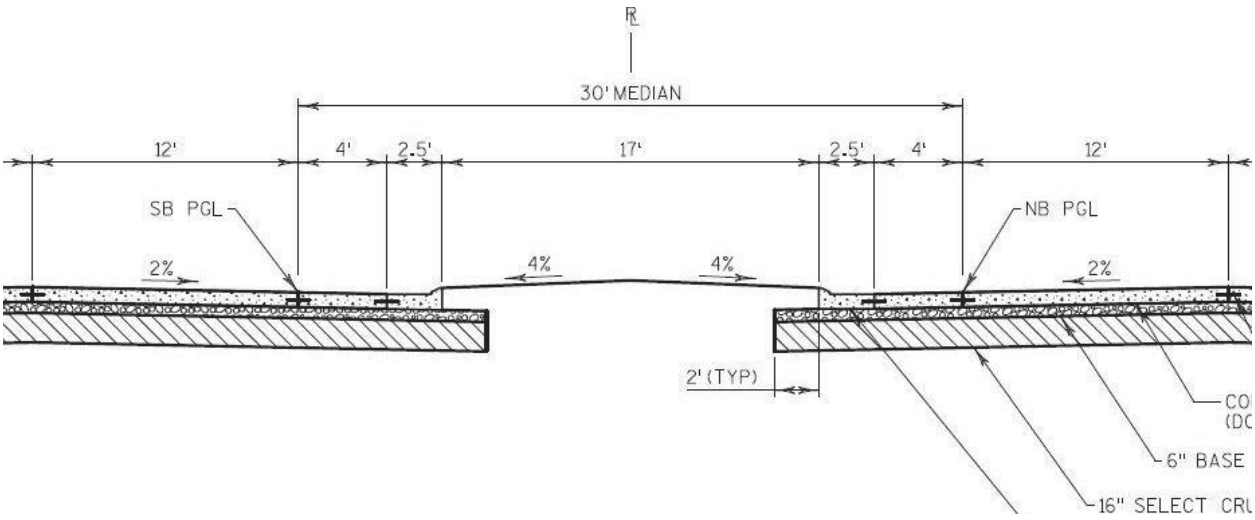
With this alternative, access to this roadway will be limited, and U-turns will be permissible at intersections. There will not be mid-block median openings. The barrier will eliminate head-on collisions except for left turn lanes at intersections where speeds are lower.

Earthwork quantities are reduced by narrowing the section width, but additional earthwork will be required throughout the new median section. The VE Team assumes the changes in earthwork will be balanced.

Sketch

Alternative No.: IS-06

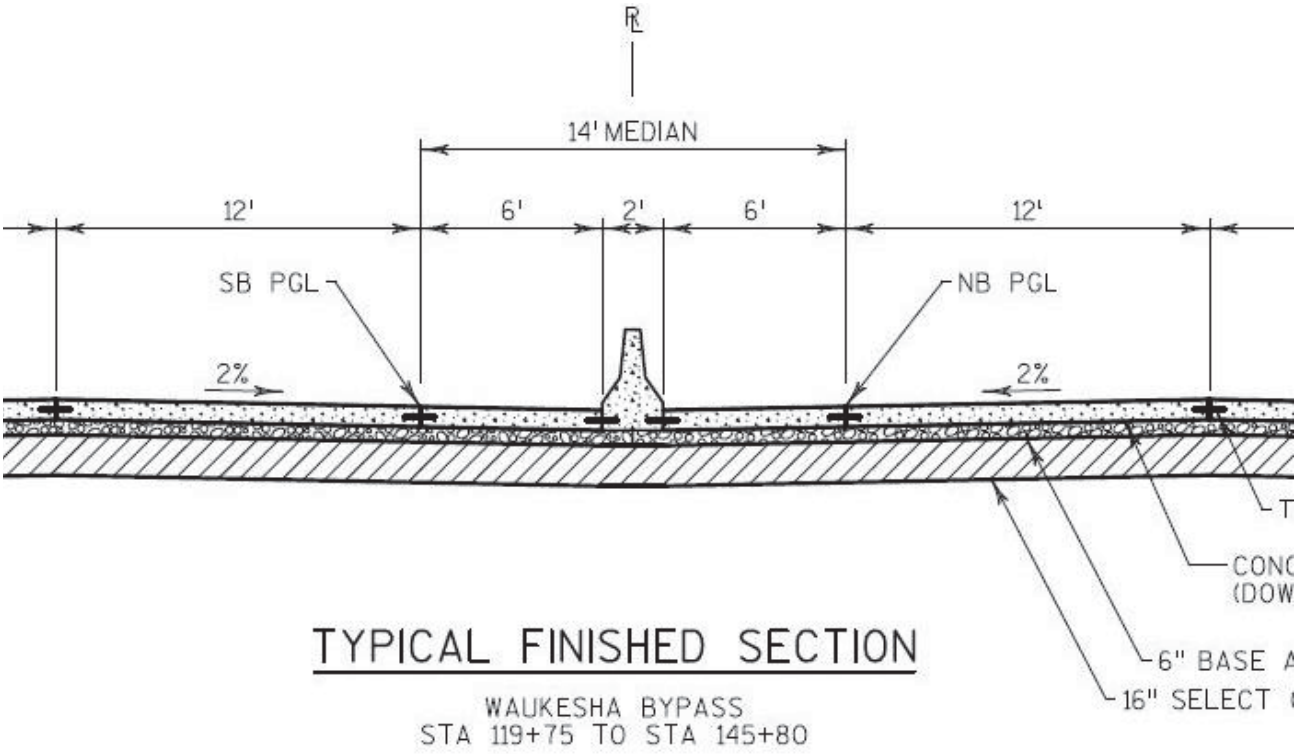
☑ Original ☐ Alternative



Sketch

Alternative No.: IS-06

☐ Original ☑ Alternative



TYPICAL FINISHED SECTION

WAUKESHA BYPASS
STA 119+75 TO STA 145+80

Calculations

Alternative No.: IS-06

☐ Original ☑ Alternative

Additional concrete barrier:

Sta. 157 - 160	300’
Sta. 170 - 180	1,000’
Sta. 190 - 216	2,600’
Sta. 225 - 230	500’
Sta. 240 - 250	1,000’
Total	5,400 LF x $35.00 = $189,000

Crash cushions (sand barrel arrays):

10 locations at $2,000 = $20,000

Real estate:

US 18 to Sta. 250+00 (5,400 LF)

Real estate cost = $4,448,345

Average cross-section = 195 width

Removing the median and using barrier wall saves 16 feet of cross-section

Average real estate SF cost = $4,448,345 ÷ (195’ x 5,400’) = $4.22/SF

Reduction in square footage = 16’ x 5,400 = 86,400 SF

Cost savings by reducing real estate = 86,400 SF x $4.22/SF = $364,608

Alternative real estate cost = $4,448,345 - $364,608 = $4,083,737

Assume curb and gutter reduced by the following:

64,000 LF - (2 inside shoulders x 5,400 LF) = 53,200 LF

Construction Cost Estimate

Alternative No.: IS-06

Item	Unit of Meas	Unit Cost	Original Concept (Deletions) Qty	Original Concept (Deletions) Total	Alternative Concept (Additions) Qty	Alternative Concept (Additions) Total
Concrete barrier	LF	35.00			5,400	$189,000
Real estate (raised median)	LS	4,448,345.00	1	$4,448,345		
Real estate (barrier wall)	LS	4,083,737.00			1	$4,083,737
Concrete curb and gutter	LF	9.00	64,000	$576,000	53,200	$478,800
Crash cushion (sand barrel arrays)	EA	2,000.00			10	$20,000
TOTALS				$5,024,000		$4,772,000
NET SAVINGS						$252,000

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Value Alternative

Project: West Waukesha Bypass
Location: Waukesha, WI

	Alternative No:
Title:	IS-21
Slope all drainage to the outside in lieu of crowning the center of roadway	
Description of Original Concept:	
The original concept specifies providing a crownpoint near the center of the roadway to allow drainage to both the median and outside of the roadway. This concept will likely include a stormwater system in the median and cross drains to route water under the roadway to the outside.	
Description of Alternative Concept:	
The alternative concept specifies providing a constant slope from the median to the outside of the roadway to allow drainage to flow to the outside of the roadway. No median stormwater system or pipes running under the roadway will be required for this alternative.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☐ Increased	☐ Increased
☑ Maintained	☐ Maintained
☐ Decreased	☑ Decreased

Cost Savings Summary

First Cost Savings:	$127,000
O&M Savings:	$0
Life Cycle Cost Savings:	$127,000

Advantages/Disadvantages

Alternative No.: IS-21

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Reduces water collecting at the median • Reduces the amount of stormwater drainage needed • Reduces maintenance of inlets and stormwater pipes • Reduces concentration and flow rate of stormwater	• Snow melting in median and collecting in lanes has the potential to result in ice on roadway • Does not allow water to get to bioswales (if included in design) to allow cleaning and cooling of runoff

Discussion

Alternative No.: IS-21

The original concept includes a crownpoint in the typical finished section that allows drainage to flow to the median and to the outside of the roadway.

The alternative concept includes a constant cross slope from the median to the outside of roadway, eliminating the crownpoint. The alternative concept would not require a stormwater system at the median or pipes running under the roadway.

There is often some concern that sheet flowing water off the roadway can cause erosion of the shoulder and clear zone. However, the energy of the non-concentrated flow is much less than that exiting a pipe system. Properly vegetated slopes, that meet requirements for recoverable slopes, are flat enough that erosion is not a concern.

The two percent cross-slope matches the original concept cross-slope, and it is hydraulically adequate to drain two lanes of roadway and the median shoulder.

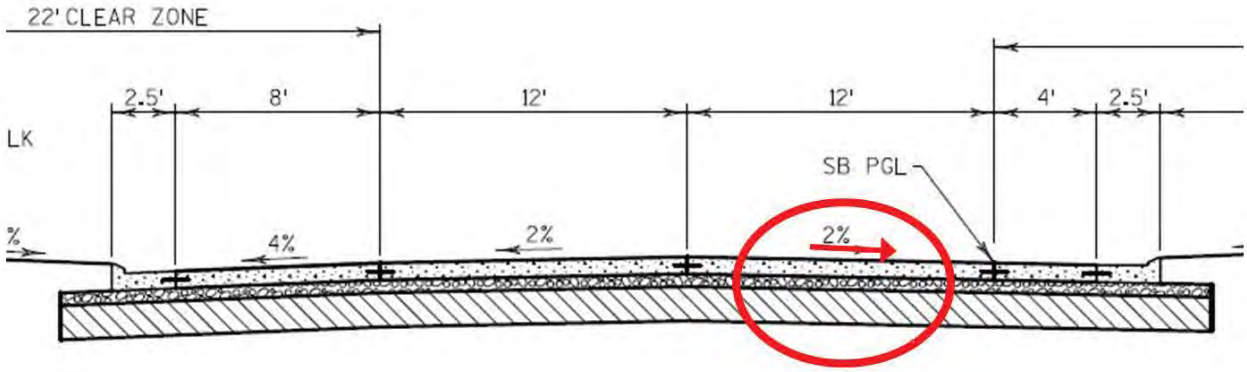
There is a concern that storage of snow in the median might create an icing issue as the snow melts and the snowmelt runs across the roadway. However, in conversations with Waukesha County maintenance staff, the VE Team learned that the County routinely does not store snow in the median where situations like this might occur. It is typical for them to push the snow to the outside shoulder.

Another concern expressed is that this type of section is not standard and is not typically done. However, a review of the current plan set shows that this type of section is common through the curves in the super-elevated sections of the roadway.

Sketch

Alternative No.: IS-21

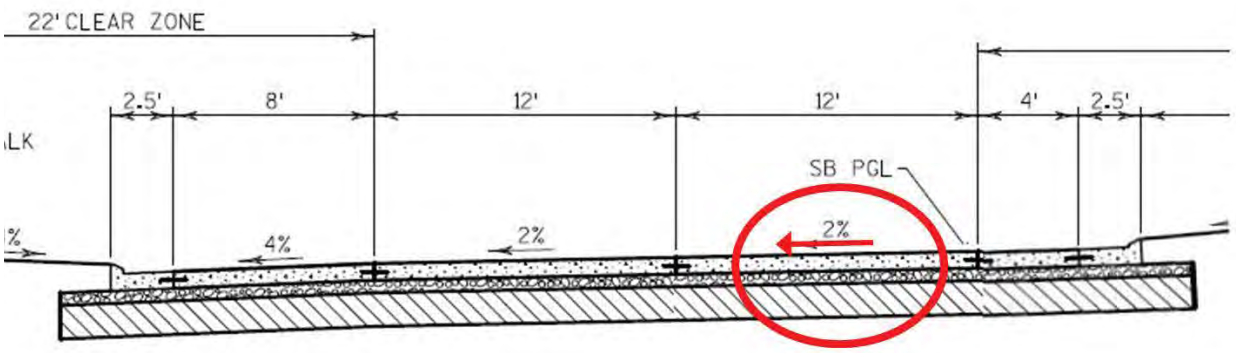
☑ Original ☐ Alternative



Sketch

Alternative No.: IS-21

☐ Original ☑ Alternative



Calculations

Alternative No.: IS-21

☐ Original ☑ Alternative

Original concept total cost of drainage = $850,000

For the proposed alternative, say storm sewer system is half of $850,000 x 0.5 = $425,000

Say the savings for not having stormwater pipes and inlets at median and pipes running under road to outside is 30% = $425,000 x 0.3 = $127,500

Construction Cost Estimate

Alternative No.: IS-21

Item	Unit of Meas	Unit Cost	Original Concept (Deletions) Qty	Original Concept (Deletions) Total	Alternative Concept (Additions) Qty	Alternative Concept (Additions) Total
Drainage	LS	850,000.00	1.00	$850,000		
Outside drainage only	LS	722,500.00			1.00	$722,500
TOTALS				$850,000		$723,000
NET SAVINGS						$127,000

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PROTECT RESOURCES

ATTACHMENT 13

Value Alternative

Project: West Waukesha Bypass
Location: Waukesha, WI

	Alternative No:
Title:	PR-04
Use fill with sheetpile and transverse drain pipes in lieu of land bridge	
Description of Original Concept:	
The original concept is to construct a land bridge from approximately Sta. 127+00 to Sta. 129+50 to minimize impacts to an environmentally sensitive area.	
Description of Alternative Concept:	
The alternative concept is to construct a fill section from approximately Sta. 127+00 to approximately Sta. 129+50 using sheetpile as the retaining wall in lieu of the land bridge. The alternative also includes transverse cross drain pipes to maintain the surface water communication.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☐ Increased	☐ Increased
☑ Maintained	☐ Maintained
☐ Decreased	☑ Decreased

Cost Savings Summary

First Cost Savings:	$1,577,000
O&M Savings:	$0
Life Cycle Cost Savings:	$1,577,000

Advantages/Disadvantages

Alternative No.: PR-04

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Reduces the amount of complex bridge structure construction • Reduces the area of impact to the environmentally sensitive area by reducing the width of the impact to 86 feet	• Conveyance pipe may not communicate groundwater flow through the wetland area as well as the land bridge

Discussion

Alternative No.: PR-04

The original concept includes the construction of a land bridge to minimize impacts to an environmentally sensitive area from approximately Sta. 127+00 to Sta. 129+50. Based on information presented to the VE Team, this area is considered by the regulatory agencies destruction of the wetland and woodland area since the bridge will cover the area.

The alternative concept is to construct a fill section through the same reach using a sheetpile retaining wall. It is anticipated that an aesthetic facia will be required for the face of the exposed sheetpile. The width of the alternative concept is 82 feet based on the road section in the plans to be used from Sta. 119+75 to Sta. 145+80.

In order to construct this fill section, sheetpile retaining walls will need to be installed. Based on the boring information from boring SB-20, it is assumed that the length of sheetpile would be 30 feet deep.

Once the retaining walls are constructed, the marsh area must be excavated approximately six feet to get to more competent sandy soil. The excavation will be backfilled with borrow material. Select crushed material would be placed on the compacted borrow with six inches of base aggregate on top. The pavement sections would then be placed on this base.

The alternative concept reduces the impacts to the sensitive environmental area from 100 feet wide to 86 feet wide.

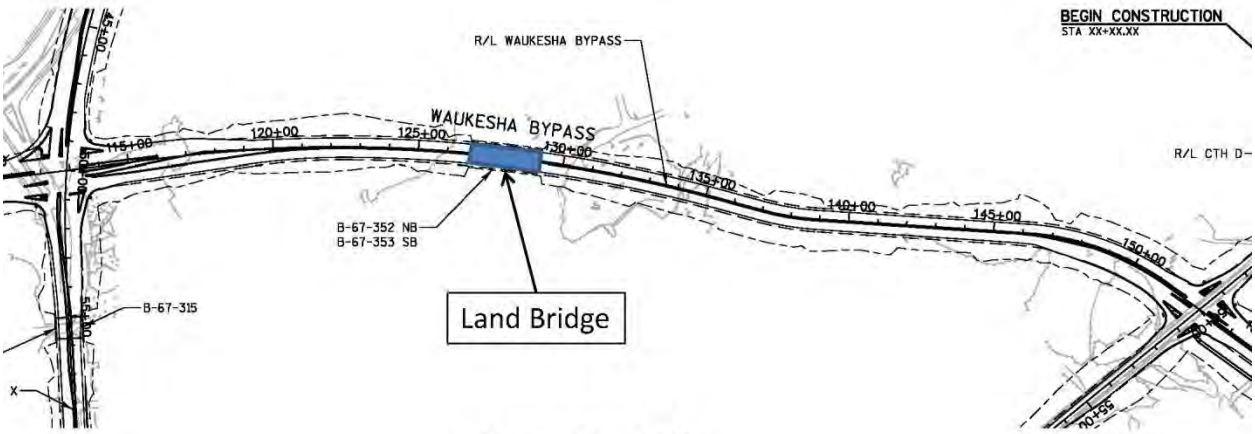
If there is a concern that the sheetpile wall will interrupt groundwater flow through the wetland area, then drain pipes could be constructed through the sheetpile wall to provide connectivity through the fill section. The VE Team believes that groundwater will continue to flow through the interlocks of the sheetpile even without the conveyance pipes.

For the purposes of this VE alternative, the cost of the transverse conveyance pipes has not been included in the cost analysis since it is an optional modification to the concept.

Sketch

Alternative No.: PR-04

☑ Original ☐ Alternative

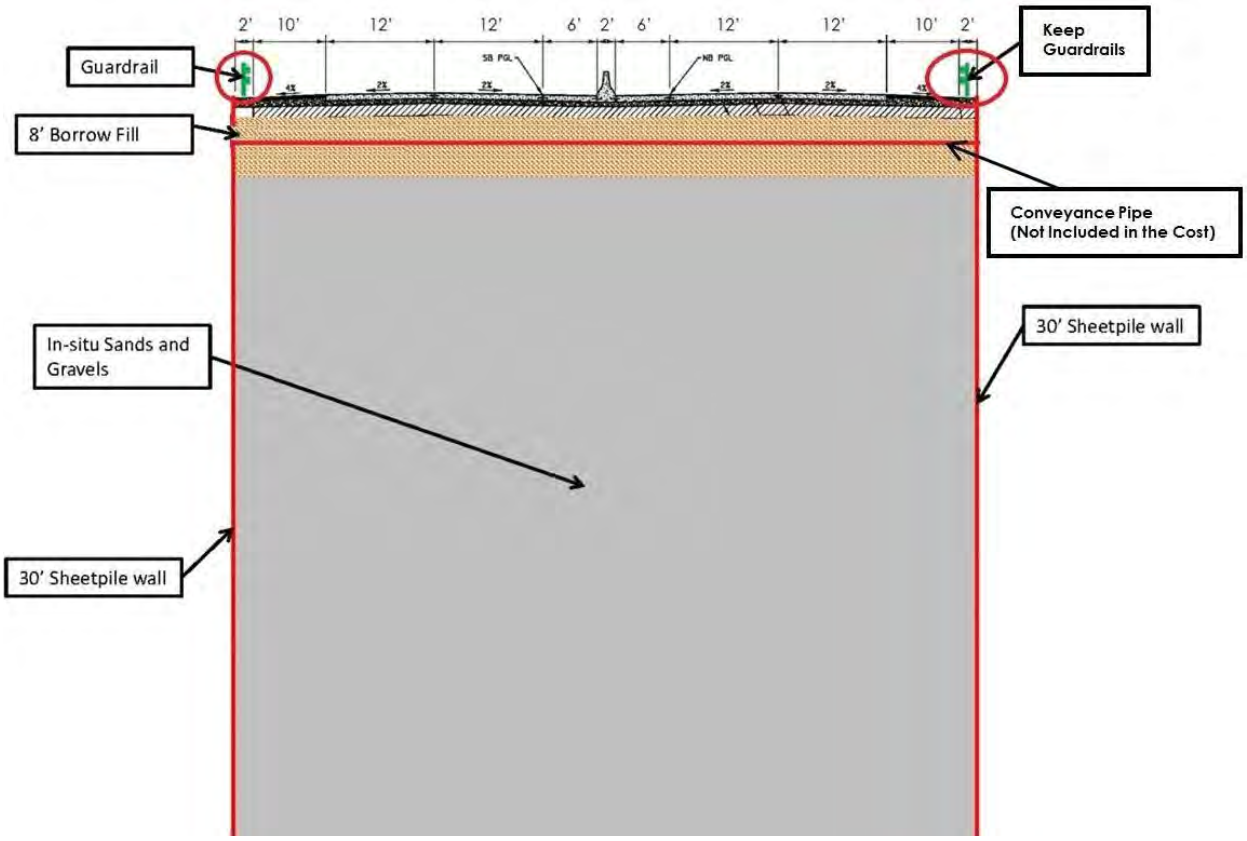


Original Concept

Sketch

Alternative No.: PR-04

☐ Original ☑ Alternative



Calculations

Alternative No.: PR-04

☑ Original ☐ Alternative

GESTRA

SOIL BORING LOG

PAGE NUMBER: 1 of 2

PROJECT NAME: Waukesha By-Pass	DATE DRILLING STARTED: 3/8/2013
PROJECT LOCATION: Waukesha, WI	DATE DRILLING ENDED: 3/8/2013
BORING DRILLED BY: FIRM: Gestra; CREW CHIEF: R. Jackson	FIELD LOG: D. Born; LAB LOG / QC: L. Gliniecki
NORTHING:	EASTING:
BORING NUMBER: SB-20	PROJECT NUMBER: 10031-10
DRILLING RIG: Diedrich D50 ATV	DRILLING METHOD: 3¼" HSA
SURFACE ELEVATION: 828.98 ft	

Number and Type	Recovery (in)	Blow Counts	N - Value	Depth (ft)	Elevation	Soil Description and Geological Origin for Each Major Unit	USCS Classification	Graphic	Well Diagram	Unconfined Comp. Strength (Q_u or q_p) (tsf)	Liquid Limit	Plasticity Index	Moisture Content (%)	Comments
						TOPSOIL, (5") 0.4								Frost depth 12"
SS - 1	12	0 0 0	0			SILTY CLAY WITH SAND, black, very moist, very soft to medium stiff, trace organic matter				<0.25			21	LOI = 1.4%
							CL-ML							
SS - 2	18	0 0 3	3	5						0.25-0.5			48	LOI = 9.3%
						6.3								
SS - 3	10	0 6 10	16			SAND WITH CLAY AND GRAVEL, brown, very moist, medium dense	SP-SC							
						7.7 GRAVEL WITH SAND, brown, wet, medium dense								
SS - 4	9	8 8 14	22	10			GPS							Rig chatter at 8.5'
						10.1 SAND WITH SILT, brown, wet, medium dense, trace gravel								Rig chatter at 10'
SS - 5	9	10 12 15	27				SP-SM							
						12.6 GRAVEL WITH SILT AND SAND, brown, wet, dense								
SS - 6	8	12 13 17	30	15			GP-GM							
						15.1 SAND WITH SILT, brown, wet, medium dense								
SS - 7	12	15 15 11	26				SP-SM							
SS - 8	14	14 12 13	25	20										

WATER & CAVE-IN OBSERVATION DATA

▽	WATER ENCOUNTERED DURING DRILLING: 8.5 ft.	▽	CAVE DEPTH AT COMPLETION: N/A	WET ☐ DRY ☐
▼	WATER LEVEL AT COMPLETION: 4 ft.	■	CAVE DEPTH AFTER 0 HOURS: N/A	WET ☐ DRY ☐
▼	WATER LEVEL AFTER 0 HOURS: N/A		NE = Not Encountered; NMR = No Measurement Recorded	

NOTE: Stratification lines between soil types represent the approximate boundary; gradual transition between in-situ soil layers should be expected.

Calculations

Alternative No.: PR-04

☐ Original ☑ Alternative

Road section width for Sta. 119+75 to Sta. 145+80 is 86 feet.

Based on the boring information from SB-20, approximately 6 feet of marsh excavation will be required to get to competent sands and gravels.

Based on an exposed sheetpile height of 10 or 11 feet, it is assumed that a total height of sheetpile is 30 feet.

Marsh excavation volume = 6' deep x 250' long x 86' wide = 129,000 cf = 4,778 CY

Borrow fill = 8' deep x 86' wide x 250' long = 172,000 cf = 6,370 CY

Base aggregate = 6" deep x 86' wide x 250' long = 10,750 cf = 398 CY = 796 tons

Select crushed aggregate = 18" deep x 86' wide x 250' long = 32,250 cf = 1,194 CY = 2,278 tons

HMA pavement = 6" deep x 16' wide x 250' long = 2,000 cf = 74 CY = 148 tons

Concrete pavement area = 60' wide x 250' long = 15,000 SF = 1,667 SY

Sheetpile area = 30' deep x 500' long = 15,000 SF

Conversion from CY to tons = 2 tons / cubic yard

Construction Cost Estimate

Alternative No.: PR-04

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
Bridge (land bridge over wetlands)	SF	100.00	25,000	$2,500,000		
Marsh excavation	CY	6.00			4,778	$28,668
Borrow	CY	5.00			6,370	$31,850
Base aggregate dense 1 1/4-inch	TON	8.50			796	$6,766
Select crushed material	TON	8.75			2,278	$19,931
HMA pavement Type E-3	TON	50.00			148	$7,407
Concrete pavement 8-inch	SY	25.00			1,667	$41,667
Concrete barrier	LF	35.00			250	$8,750
Sheetpile	SF	50.00			15,000	$750,000
Guardrail	LF	25.00			500	$12,500
Decorative treatment sheetpile	SF	60.00			260	$15,600
TOTALS				$2,500,000		$923,000
NET SAVINGS						$1,577,000

Value Alternative

Project: West Waukesha Bypass
Location: Waukesha, WI

	Alternative No:
Title:	PR-13
Construct urban section consisting of curb and gutter adjacent to roadway to reduce right-of-way from US 18 to STH 59	
Description of Original Concept:	
The original concept is a median barrier with an offset of six feet adjacent to two 12-foot lanes and an outside eight-foot paved shoulder in both directions from US 18 to STH 59. Roadway bike accommodations are within the paved shoulder.	
Description of Alternative Concept:	
The alternative concept is to urbanize the typical section from US 18 to STH 59 consisting of eight-foot paved shoulders to curb and gutter, three-foot relief terrace, and five-foot sidewalk on both bounds. Bike accommodation will be made on the eight-foot paved shoulder.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☐ Increased	☐ Increased
☑ Maintained	☐ Maintained
☐ Decreased	☑ Decreased

Cost Savings Summary

First Cost Savings:	$304,000
O&M Savings:	$0
Life Cycle Cost Savings:	$304,000

Advantages/Disadvantages

Alternative No.: PR-13

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Eight-foot bike accommodation in both directions • Adds sidewalk for pedestrians in both directions • Pedestrian/bike continuity from Sunset Drive to STH 59 • Minimize ROW taking • Reduces common excavation	• Additional storm sewer required • Additional curb and gutter required

Discussion

Alternative No.: PR-13

This alternative would provide sidewalk and bike accommodation continuity throughout the entire project. A buffer of three feet in the terrace is provided for safety, snow storage, and installation of signs, etc.

The width from centerline to the back of the sidewalk is 46 feet plus an additional area for matching into the existing ground. The original cross-sections show a ditch cut at 56 feet from centerline plus an additional area of cut for matching into slopes.

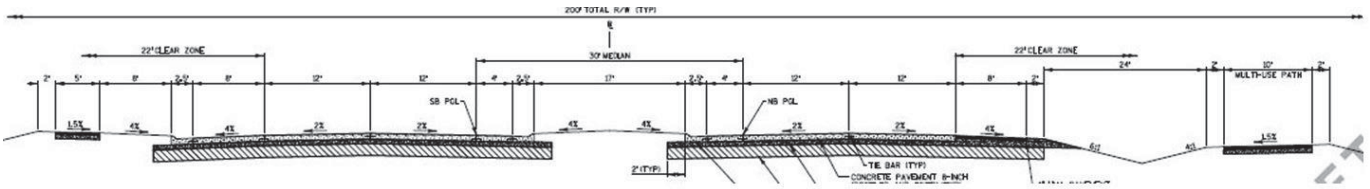
Curb and gutter will be added to both sides, and a sidewalk would be constructed on either side from Sunset Drive to STH 59. The original concept did not have sidewalk in this section.

Additional curb and gutter will be constructed on the outside of the roadway from Sunset Drive to Station 250+00 RT, continuing the urban section throughout the entire project.

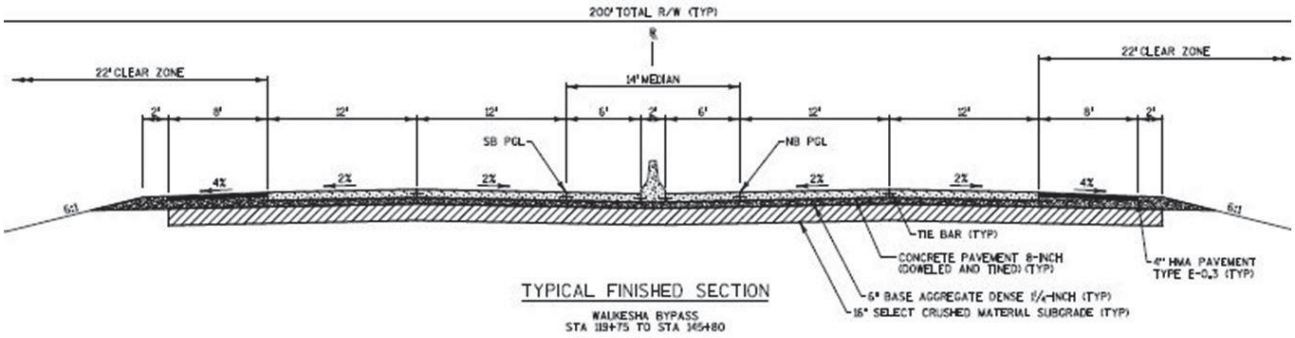
Sketch

Alternative No.: PR-13

☑ Original ☐ Alternative



Sunset Dr. to Kisdon Dr.

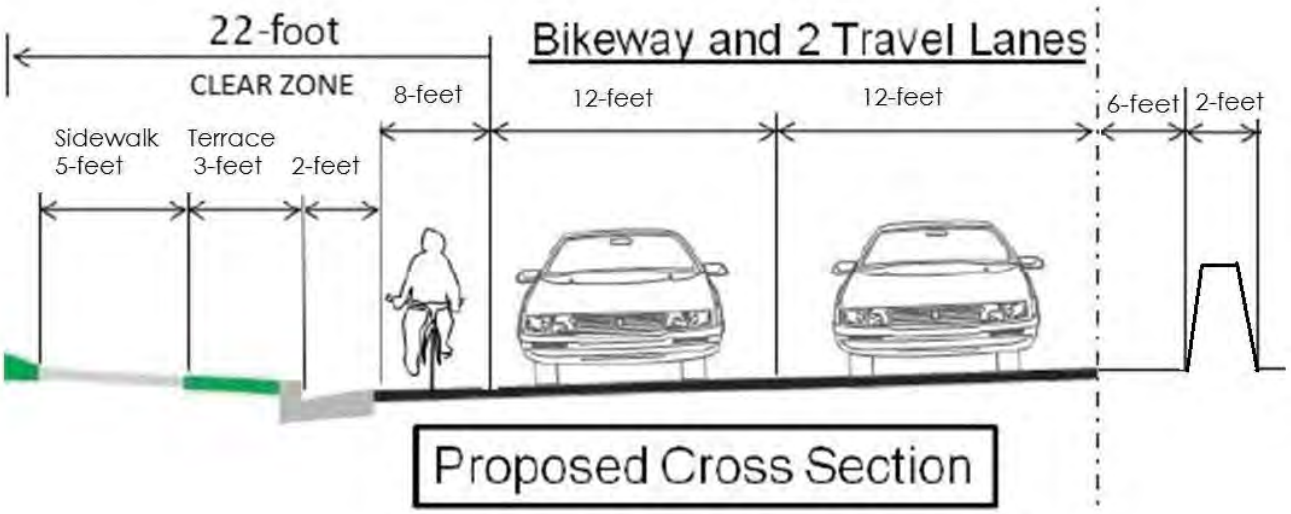


STH 59 to Sunset Dr.

Sketch

Alternative No.: PR-13

☐ Original ☑ Alternative



Typical section for both bounds from US 18 to STH 59

Calculations

Alternative No.: PR-13

☑ Original ☑ Alternative

Original

STH 59 to Sunset Drive

Asphalt shoulder

2,600' x 8/9 = 2,311 x 480 ÷ 2,000 = 554 tons x 2 = 1,109 tons

Alternative

Additional curb and gutter:

Sta. 119+45 – 145+00 LT and RT 2,600' x 2 = 5,200 LF X $9.00 = $46,800

Sta. 153+00 – 250+00 RT' 9,700'

Add bike path:

Sta. 119+45 – 145+00 RT 2,600'

Add sidewalk:

Sta. 119+45 – 145+00 RT 2,600'

Reduce earthwork:

Sta. 119+45 – 145+00 LT and RT

Reduce ROW taking:

Sta. 119+45 – 145+00 LT and RT

Sta. 153+00 – 250+00 RT

	LF	Feet saved	New total	Percent reduction
STH59 to Sunset Dr.	1,300	30	165	84%
	2,100	15	180	92%
Total	3,400			

$4,448,345 ÷ 3,400 = 1,308/LF

1,300 x 1,308/LF = $1,700,400 STH 59 to Sunset Drive

2,100 x 1,308/LF = $2,746,800 Sunset Drive to US 18

$1,700,400 x (1 – 0.84) % reduction = $272,064 STH 59 to Sunset Drive

$2,746,800 x (1 – 0.92) % reduction = $219,744 Sunset Drive to US 18

$491,808 Total real estate savings

Assume reduction in drainage unit cost from $285,000 per mile to $250,000 per mile due to reduction in impervious pavement.

Construction Cost Estimate

Alternative No.: PR-13

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
HMA pavement E-3	TON	50.00	27,200	$1,360,000	26,100	$1,305,000
Real estate original	LS	4,448,345.00	1	$4,448,345		
Real estate alternative	LS	3,941,497.00			1	$3,941,497
Common excavation	CY	5.50	358,600	$1,972,300	352,767	$1,940,219
Concrete sidewalk	SF	4.00			13,000	$52,000
Concrete curb and gutter	LF	9.00			5,200	$46,800
Concrete pavement 8-inch	SY	25.00			2,888	$72,200
Drainage original	MI	250,000.00	3.4	$850,000		
Drainage alternative	MI	285,000.00			3.4	$969,000
TOTALS				$8,631,000		$8,327,000
NET SAVINGS						$304,000

Value Alternative

Project: West Waukesha Bypass
Location: Waukesha, WI

	Alternative No:
Title:	PR-17
Revise grade where possible to a maximum of 2.5 percent to more closely follow the existing ground reducing the borrow required	
Description of Original Concept:	
The original concept has grades in the range of 1 to 2.25 percent in the area of study. These grades cause rather high fills which, in turn, increases the borrow.	
Description of Alternative Concept:	
The VE Team looked at two segments of the profile. In each of these segments, the grades were adjusted slightly, up to 2.5%, with significant reduction in the height of the embankment. This concept could be applied throughout the entire project length.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☐ Increased	☐ Increased
☑ Maintained	☐ Maintained
☐ Decreased	☑ Decreased

Cost Savings Summary

First Cost Savings:	$392,000
O&M Savings:	$0
Life Cycle Cost Savings:	$392,000

Advantages/Disadvantages

Alternative No.: PR-17

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Reduces the borrow • Improves access to adjoining property	• None apparent

Discussion

Alternative No.: PR-17

The original concept has grades that range from 1 to 2.25 percent through the southern, off alignment portion of the project, which is an acceptable design.

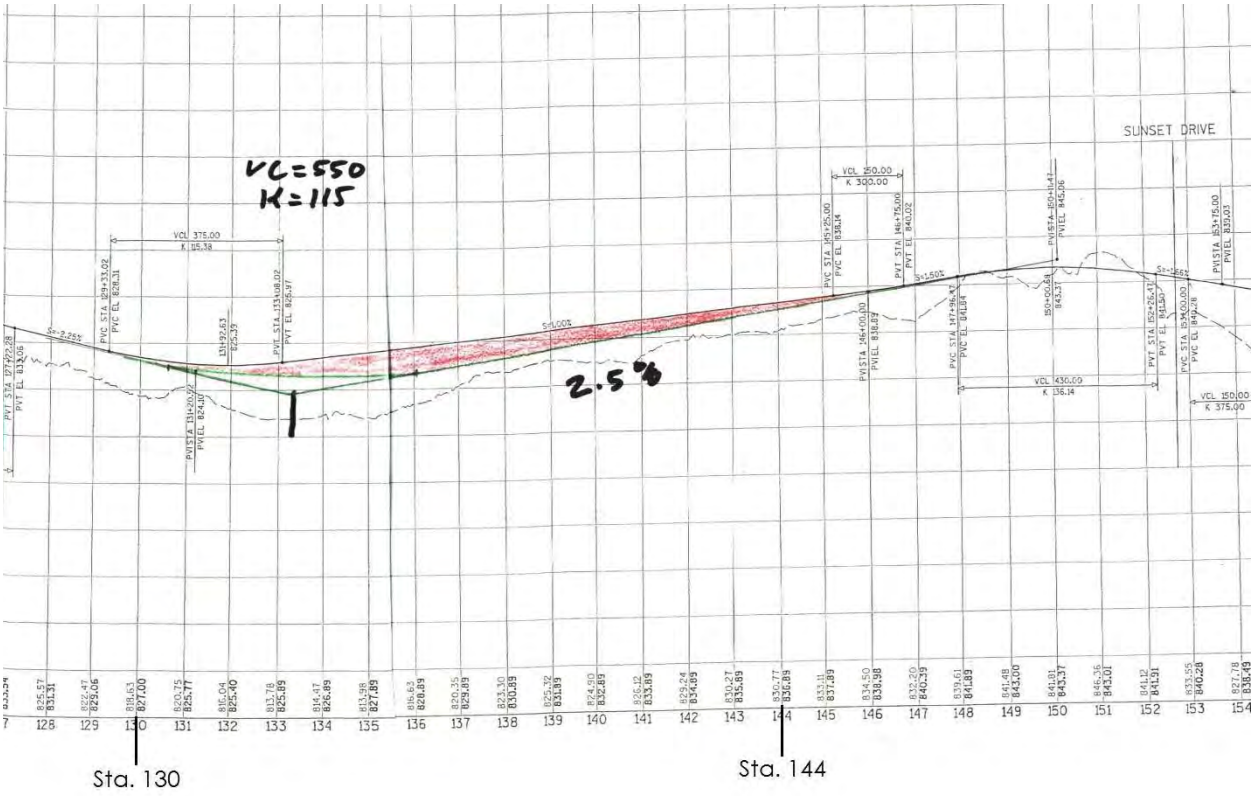
The VE Team reviewed the grades and has the following suggestions. In the area from Sta. 130+00 to Sta. 159+00 and Sta. 171+00 to Sta. 186+00, the VE Team proposes the grade changes that are indicated on the attached sketch. The maximum proposed grade is 2.5 percent. The VE Team suggests these changes be reviewed closely and, if deemed appropriate, implemented. It is possible to use the same procedure for some of the other areas on the project. It may be possible to increase the cut areas using the same procedure.

The cost savings calculated for this alternative only take into account the two specific areas above.

Sketch

Alternative No.: PR-17

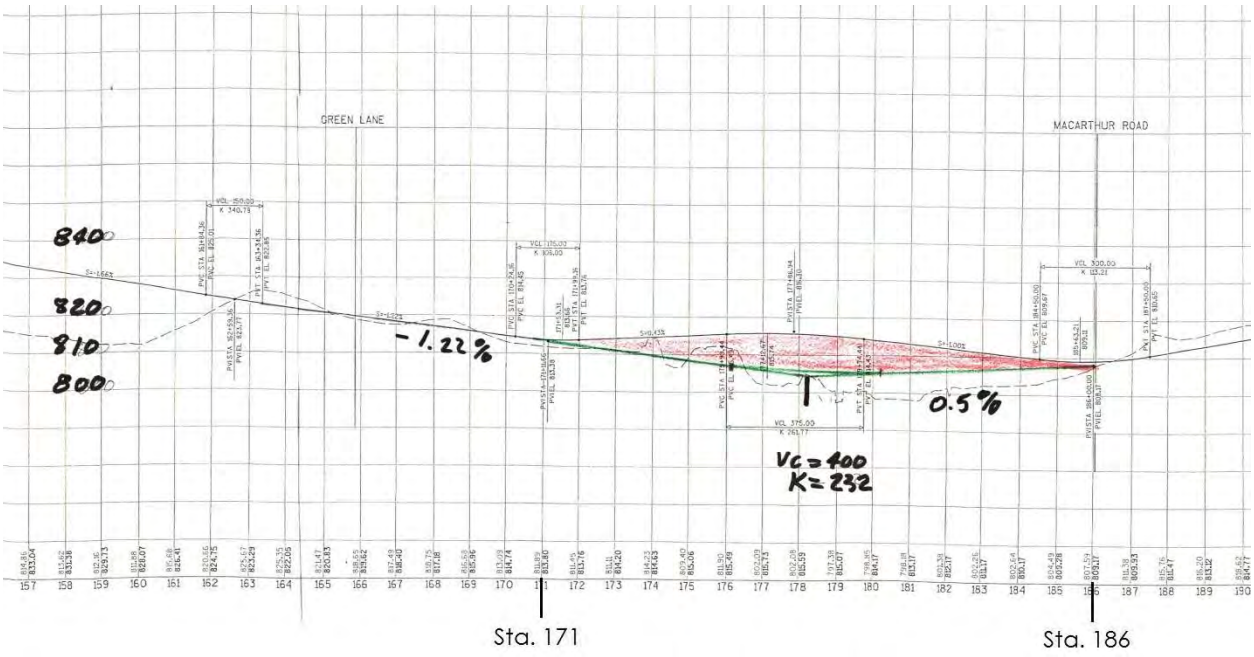
☐ Original ☑ Alternative



Sketch

Alternative No.: PR-17

☐ Original ☑ Alternative



Calculations

Alternative No.: PR-17

☐ Original ☑ Alternative

Original concept borrow quantity = 378,000 CY

Change in borrow from Sta. 171 to Sta. 186:

1,500 ft x (170 ft x (10/2) ft) ÷ 27 CY/ft^3 = 47,222 CY

Change in borrow from Sta. 130 to Sta. 144:

1,400 ft x (120 ft x 10/2) ft) ÷ 27 CY/ft^3 = 31,111 CY

Total change in borrow= 78,333 CY

Alternative concept borrow quantity = 378,000 CY - 78,333 CY = 299,667 CY

Construction Cost Estimate

Alternative No.: PR-17

Item	Unit of Meas	Unit Cost	Original Concept (Deletions) Qty	Original Concept (Deletions) Total	Alternative Concept (Additions) Qty	Alternative Concept (Additions) Total
Borrow	CY	5.00	378,000	$1,890,000	299,667	$1,498,335
TOTALS				$1,890,000		$1,498,000
NET SAVINGS						$392,000

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Value Alternative

Project: West Waukesha Bypass
Location: Waukesha, WI

	Alternative No:
Title:	PR-19
Accommodate bike traffic on eight-foot paved shoulder and accommodate pedestrians on sidewalk from CTH D (Sunset Drive) to Madison Street and from US 18 to Northview Road in lieu of constructing a 10-foot multi-use path in this section	
Description of Original Concept:	
The original concept is to provide a 10-foot multi-use path from CTH D (Sunset Drive) to Northview Road. This section is to have eight-foot paved outside shoulders. This section also has a portion of existing five-foot sidewalk and the remainder is to be graded for a future sidewalk. South of CTH D (Sunset Drive) to the project southern terminus, no multi-use path or sidewalk are included in order to reduce environmentally sensitive impacts. From Northview Road to the project northern terminus, the original concept retains existing sidewalk and multi-use path.	
Description of Alternative Concept:	
The alternative concept it to eliminate the multi-use path from CTH D (Sunset Drive) to Madison Street and from US 18 to Northview Road. Bike traffic will be accommodated within the eight-foot paved shoulder, and pedestrian traffic will be accommodated on the original concept sidewalk design.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☐ Increased	☐ Increased
☐ Maintained	☐ Maintained
☑ Decreased	☑ Decreased

Cost Savings Summary

First Cost Savings:	$466,000
O&M Savings:	$0
Life Cycle Cost Savings:	$466,000

Advantages/Disadvantages

Alternative No.: PR-19

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Eliminates 10 feet of multi-use path pavement and base course • Reduces impervious surface • Reduces stormwater runoff • Reduces need for future maintenance • Reduces ROW acquisition • Requires less grading	• May require design exception • Does not provide physical separation for bicyclists from motorized vehicles in this stretch

Discussion

Alternative No.: PR-19

This alternative eliminates 10 feet of multi-use trail pavement and base course from CTH D (Sunset Drive) to Madison Street and from US 18 to Northview Road. The alternative assumes that bike traffic will be accommodated on the eight-foot paved shoulder, and pedestrian traffic will be accommodated on the sidewalk.

The original concept already eliminated the multi-use path and sidewalk for the southernmost portion of the project, from CTH D (Sunset Drive) to STH 59, to reduce ROW impacts through an environmentally sensitive area. This alternative extends the length of this non-path section. The extended section recommended for multi-use path elimination is also impacting sensitive environmental areas (e.g., Pebble Creek, wetlands, groundwater flow, fen, etc.), so a reduction in right-of-way will reduce the level of impact.

In the original concept, the multi-use path was not connecting two logical termini (i.e. it was already incomplete). Bike riders traveling south on the new bypass would already be forced to ride on the eight-foot paved shoulder between CTH D (Sunset Drive) and STH 59. The alternative concept uses the same logic and justification to move the end point of the multi-use path further north to reduce total path length.

An additional benefit of removing the trail is the reduction in impervious surface constructed on the project site. This will reduce runoff from the site. The removal of the trail from the project eliminates the extra grading required to place the aggregate and asphalt.

Less right-of-way acquisition would be required in these areas since the land would not need to be acquired permanently to accommodate the multi-use path. Temporary limited easements for grading might be all that are needed in certain areas.

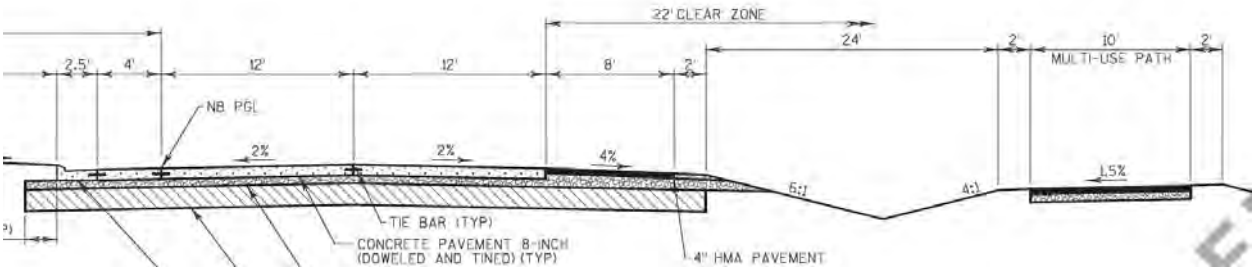
There would be no future maintenance requirements such as snow removal, crack sealing, seal coating, or replacement of pavement.

There are some drawbacks to this proposal. First, it may require a design exception. Second, it reduces the amount of multi-use path associated with this section of roadway.

Sketch

Alternative No.: PR-19

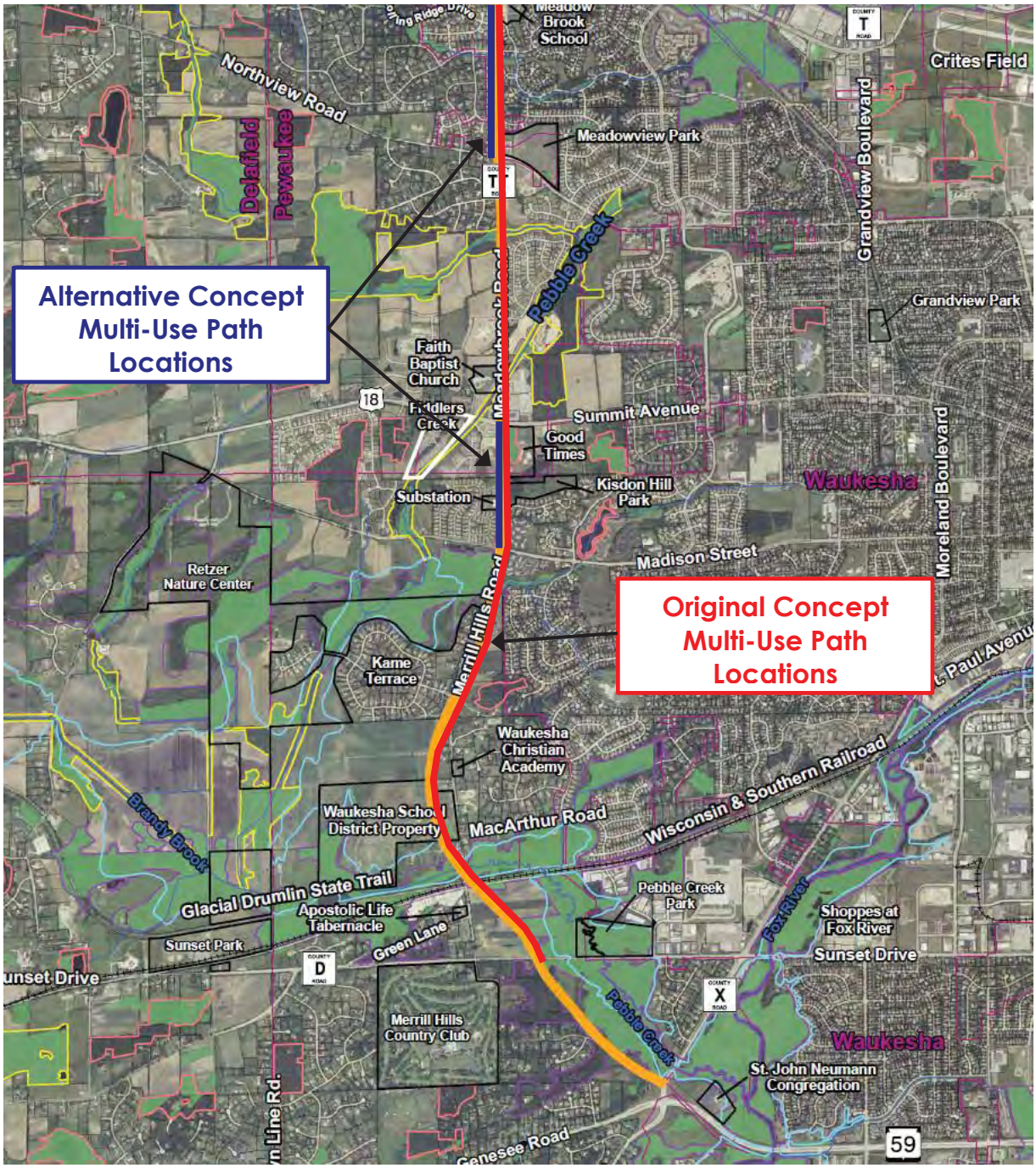
☑ Original ☐ Alternative



Sketch

Alternative No.: PR-19

☑ Original ☑ Alternative



Calculations

Alternative No.: PR-19

☑ Original ☑ Alternative

Asphalt

According to plan take offs, reduction in multi-use path total length = 13,980 LF

6,850 + 2,950 + 4,180 = 13,980 LF x 10' wide path = 139,800 SF ÷ 9 = 15,533 SY

15,533 x 480 (density of asphalt per SY for 4" pavement) = 745,600 ÷ 2,000 = 3,728 tons of asphalt deducted

Crushed aggregate select

13,980 LF of path x 12' wide x 0.33 (4") = 55,361 ÷ 27 = 2,050 CY

2,050 CY x 1.8 (density of aggregate per CY) = 3,690 tons of crushed aggregate deducted

Asphalt material PG28

3,728 tons of asphalt x 5.5% = 205 tons of asphaltic material deducted

Borrow

In general, cross sections were reviewed for areas of fill. An average section was used across the length of the fill area to calculate the CY of material.

5' high x 50' wide x 950' long = 237,500 ÷ 27 = 8,796 CY

4' high x 30' wide x 1,000' long = 120,000 ÷ 27 = 4,444 CY

7' high x 70' wide x 350' long = 171,500 ÷ 27 = 6,351 CY

For a total of 19,591 CY less borrow required

Calculations

Alternative No.: PR-19

☑ Original ☑ Alternative

Common excavation

In general, cross sections were reviewed for areas of fill. An average section was used across the length of the cut area to calculate the CY of material.

5’ high x 20’ wide x 700’ long = 70,000 ÷ 27 = 2,592 CY

5’ high x 20’ wide x 2,150’ long = 215,000 ÷ 27 = 7,962 CY

6’ high x 30’ wide x 200’ long = 36,000 ÷ 27 = 1,333 CY

9’ high x 30’ wide x 900’ long = 243,000 ÷ 27 = 9,000 CY

For a total of 20,887 CY less common excavation required

Construction Cost Estimate

Alternative No.: PR-19

Item	Unit of Meas	Unit Cost	Original Concept (Deletions) Qty	Original Concept (Deletions) Total	Alternative Concept (Additions) Qty	Alternative Concept (Additions) Total
Common excavation	CY	5.50	358,600	$1,972,300	337,713	$1,857,422
Borrow	CY	5.00	378,000	$1,890,000	358,409	$1,792,045
HMA pavement Type E-3	TON	50.00	27,200	$1,360,000	23,472	$1,173,600
Base aggregate dense 1 1/4-inch	TON	8.50	125,000	$1,062,500	121,310	$1,031,135
Asphaltic material PG58-28	TON	175.00	1,500	$262,500	1,295	$226,625
TOTALS				$6,547,000		$6,081,000
NET SAVINGS						$466,000

Value Alternative

Project: West Waukesha Bypass
Location: Waukesha, WI

	Alternative No:
Title:	PR-20
Use precast reinforced concrete box in lieu of cast-in-place box culverts	
Description of Original Concept:	
The original concept is to use cast-in-place reinforced concrete box culverts (RCBs) with a contractor option to use pre-cast. This is the standard methodology for WisDOT.	
Description of Alternative Concept:	
The alternative concept is to specify the use of pre-cast reinforced concrete box culverts in order to reduce construction time and disruption to traffic.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☐ Increased	☐ Increased
☑ Maintained	☐ Maintained
☐ Decreased	☑ Decreased

Cost Savings Summary

First Cost Savings:	$292,000
O&M Savings:	$0
Life Cycle Cost Savings:	$292,000

Advantages/Disadvantages

Alternative No.: PR-20

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Reduces open trench time for RCBs and allows roadway to be constructed quicker • Pre-cast RCBs can accommodate connection to wingwalls and headwalls • Pre-cast RCBs can accommodate bends and laying length restrictions • Allows placement of stormsewer by one contractor rather than coordination with several	• WisDOT requires the contractor to provide the design of the RCBs for review and approval prior to construction • Deviates from WisDOT standard practice

Discussion

Alternative No.: PR-20

The original concept is to use cast-in-place RCBs with a contractor option of using pre-cast RCBs. The alternative concept is to specify the use of pre-cast RCBs in lieu of the cast-in-place RCBs.

The main advantage of using pre-cast versus cast-in-place is the reduced construction time required to build the RCB. This time savings translates to reduced time of open excavation and reduced risk of flood impacts to construction.

Typically, the material and installation costs are lower for pre-cast structures than cast-in-place structures as well.

The construction of a pre-cast RCB is also constructed by a different trade than cast-in-place structures. Cast-in-pace structures require steel workers and concrete contractors in addition to earthwork contractors. Pre-cast RCB construction is essentially constructing large storm sewers. As a result, the construction can be completed by the earthwork contractor already working on the project.

In conversations with WisDOT personnel, there was a disadvantage identified that the contractor would need to design the RCBs. Typically, pre-cast RCB manufacturers either have professional engineers on staff or consultants on-call to complete these designs. For the most part, standard designs for various loadings and fill depths have already been designed. As a result, there should not be a significant burden to the contractor to design the pre-cast RCB.

Another discussion with WisDOT staff resulted in a question about pre-cast RCB connection. Typical RCBs are manufactured with tongue and groove joints. These joints can be joined using mastic material or with rubber gaskets. The addition of rubber gaskets to the tongue and groove joints does not significantly increase the cost of the RCBs.

Further discussion with WisDOT personnel questioned how wingwalls and headwalls would be constructed and paid for with pre-cast RCBs. The construction and payment of the wingwalls and headwalls does not change. Pre-cast RCBs can accommodate the connection of cast-in-place rebar to the pre-cast RCB rebar.

Pre-cast RCBs can also be constructed with bends and special lengths to accommodate different laying requirements.

Precast double-cell RCBs can be cast as double-cell structures or can be laid as two single-cell structures.

The original concept pays for the cast-in-place RCB per cubic yard. Typically, pre-cast RCBs are paid per linear foot.

Based on some information from contractors and cost estimators contacted by the VE Team, it is assumed that pre-cast RCBs can be priced 25% less than cast-in-place structures.

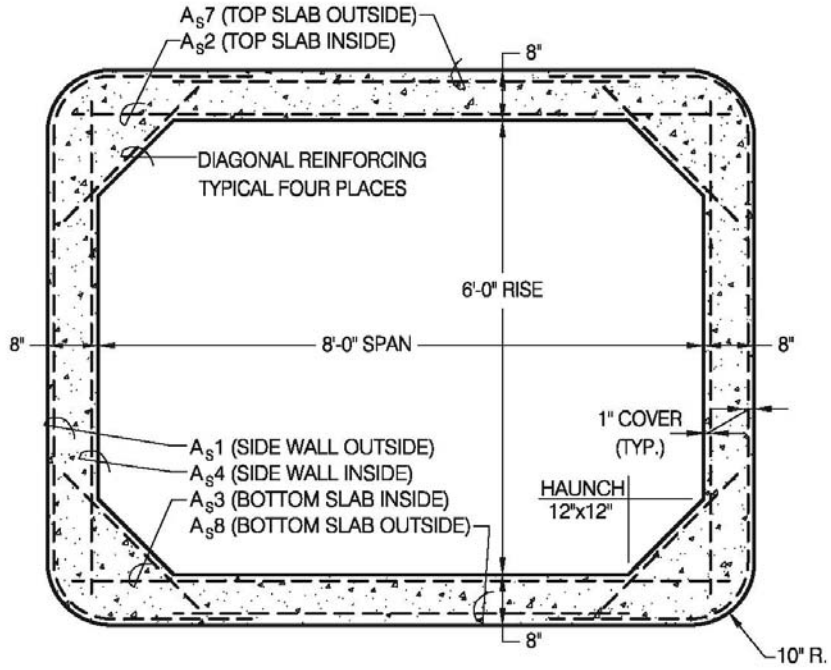
Although using pre-cast RCBs is anticipated to reduce the construction duration, no cost savings for that time was calculated or shown in this proposal due to the lack of information on these structures during the workshop.

Sketch

Alternative No.: PR-20

☐ Original ☑ Alternative

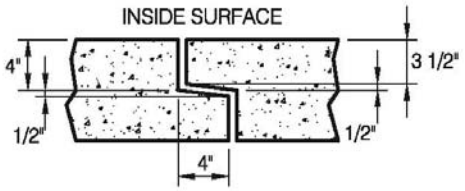
Pre-cast RCB



SECTION VIEW

WEIGHT / FT. = 3,300 LBS.

LOADING, DESIGN METHODS AND
MATERIALS COMPLY WITH ASTM C789 or C850.
Standard laying length = 6'-0"
WWF ASTM A185, fy = 65 KSI
Concrete Strength, f'c = 5 KSI
Box culvert design and analysis is performed on
the BOX CAR computer program.



TYPICAL JOINT DETAIL

Construction Cost Estimate

Alternative No.: PR-20

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
Glacial Drumlin Trail structure	LS	600,000.00	1	$600,000	0.75	$450,000
Box culverts (north of US 18)	LS	391,500.00	1	$391,500	0.75	$293,625
Box culverts (south of Northview)	LS	175,000.00	1	$175,000	0.75	$131,250
TOTALS				$1,167,000		$875,000
NET SAVINGS						$292,000

ATTACHMENT 13

SECTION 5

DESIGN SUGGESTIONS

ATTACHMENT 13

SECTION 5
DESIGN SUGGESTIONS

In addition to the Value Alternatives in the previous section, the VE Team generated several other ideas that have been termed Design Suggestions. These are presented to bring attention to areas of the design which, in the opinion of the team, should be changed. In general these ideas were designated as Design Suggestions rather than Value Alternatives for one of two reasons:

1. The value improvement opportunity is relatively small
2. The concept could not be adequately evaluated or developed within the constraints of the workshop resources

Design Suggestions typically are associated with issues such as:

Improved operation

Ease of maintenance

Easier construction

Reduced risk of construction claims

Clarification of construction documents

Or safer working conditions

Design Suggestion

	Alternative No:
Title:	DT-08
Synchronize (coordinate) traffic signals in lieu of operating fully actuated traffic signals	
Discussion:	
The VE Team recommends the traffic signals be analyzed to run in a synchronized or coordinated system during peak traffic hours. This will allow traffic to move through the corridor with decreased travel time. The VE Team recommends two separate systems. The STH 59/CTH X and CTH TT/Sunset Drive intersections in the first system. The second system should include the	

CTH TT/Madison Street, CTH TT/US 18, CTH TT/Northview Road and CTH TT/Rolling Ridge Drive intersections. The reason for the two systems is that the distance between the intersections of CTH TT/Sunset Drive and CTH TT/Madison Street is too far to provide good progression as the queue of vehicles becomes too long and spread out.

The bypass route would have the phases coordinated. The side streets would be set to actuate mode even when running in coordination. If side street demand does not exist, the traffic signal should dwell green on the coordinated phases.

During off peak hours, the VE Team recommends that the traffic signals operate in the fully actuated mode to serve the side streets more efficiently. The traffic signals should recall back to the bypass phases and dwell green on them when no other side street traffic exists.

Design Suggestion

	Alternative No:
Title:	IS-13
Construct stormwater ponds that are not adjacent to rivers as mitigation wetlands	
Discussion:	
The stormwater system is currently under design. As the space alternatives are developed to manage stormwater, detention ponds should be considered as part of the solution. These ponds can provide opportunities for wetland mitigation sites in addition to providing necessary storage and detention for stormwater. During the in-brief, the VE Team was told that stormwater ponds were not preferred in the southern portion of the project due to the potential for discharge to receiving streams. This discharge would impact trout populations in the streams. There appear to be multiple locations where ponds could be constructed in the southern portion of the project that would not discharge directly to sensitive streams. These locations should be investigated for wetland mitigation potential.	

Design Suggestion

	Alternative No:
Title:	IS-24
Install motion activated warning system (flashing beacon) or a traffic signal for Glacial Drumlin Trail in lieu of tunnel	
Discussion:	

The original concept specifies a Glacial Drumlin Trail underpass (tunnel) at CTH TT. This includes a 10-foot tall x 14-foot wide x 100-foot long culvert structure to allow pedestrians to pass under CTH TT. The alternative concept specifies an at grade crossing of Glacial Drumlin Trail and CTH TT. This includes a motion activated warning system (flashing beacon) to alert vehicles of approaching trail users. If the flashing beacon does not provide the desired level of safety, then an at grade traffic signal could be installed as a modification to this alternative.

The existing condition is an unsignalized, at grade crossing between the Glacial Drumlin Trail and CTH TT. The original concept specifies a $600,000 pedestrian underpass structure (10-foot tall x 14-foot wide x 100-foot long) for the trail at this intersection. The VE Team presents the following potential issues regarding the original concept:

- The tunnel will be below grade, which will lead to frequent flooding events
- Flooding events will fill the tunnel with sediment (e.g. sand, gravel, mud, trash, etc.) causing trail users to cross at grade
- Unknown which jurisdiction would be in responsible for tunnel maintenance (e.g. trash removal, cleaning out the mud, etc.)
- Tunnels can become habitat for wildlife which could endanger trail users
- Tunnels can be used by predators with malicious intentions
- Many municipalities across the country are removing existing pedestrian tunnels due to the perceived unsafety and potential housing of predators

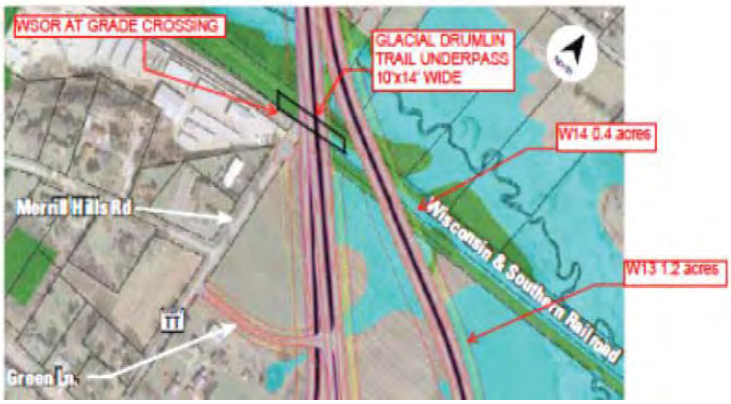
With these potential issues, people are more likely to prefer crossing the roadway at grade opposed to using a long, dark, suspicious looking tunnel.

The alternative concept eliminates the need for a pedestrian underpass structure at the intersection of Glacial Drumlin Trail and CTH TT. It also provides an at grade crossing with a motion activated early warning system. This system warns vehicles to the presence of pedestrians with a yellow caution sign and yellow flashing light. It also has a stop sign and red flashing light for trail users. The system is solar powered with battery backup and the lights are triggered by trail activity via a motion sensor. Using the early warning system at this intersection in lieu of the pedestrian underpass would save the

project approximately $570,000.

If the flashing beacon does not provide the necessary level of safety to trail users, then the VE Team recommends adding an at grade traffic signal for trail users in lieu of the yellow flashing beacons. This would provide a safe crossing by stopping all CTH TT traffic to allow trail users to pass. The cost savings for this option would be approximately $450,000 compared to the original concept.

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Reduces excavation • Reduces construction duration • Reduces maintenance to structure and from flooding events • Eliminates a structure • Provides active visual warning to drivers that pedestrians and bikes are in crossing • Provides alternative visual warning to trail users that a busy road crossing is apparent	• Increases conflicts between vehicles and pedestrians • Increases risk of fatalities • Requires slowing and stopping of vehicles in this location



ATTACHMENT 13

Cross Alert Systems, Inc. specializes in technological safety solutions.

Our patented, motion activated early warning system for recreational path/public road intersections provides an active warning to vehicles that a path user is at or near an intersection. This system provides enhanced visibility at mid-block intersections where the line of sight is poor for vehicles to see oncoming path users.

1. SIGN IS SOLAR POWERED WITH BATTERY BACKUP
2. YELLOW CAUTION SIGN AND YELLOW FLASHING LIGHT ACTIVATED FOR VEHICLES
3. STOP SIGN AND RED FLASHING LIGHT ACTIVATED FOR PATH USERS
4. LIGHTS ARE TRIGGERED BY PATH ACTIVITY VIA A MOTION SENSOR; MAXIMUM DETECTION RANGE OF 50 FEET
5. SYSTEM ON THE OPPOSITE SIDE OF THE ROAD ACTIVATED BY RADIO SIGNAL WHEN MOTION IS DETECTED
6. ONCE ACTIVATED, LIGHTS CAN RUN FOR A CONFIGURED DURATION OF TIME

Design Suggestion

	Alternative No:
Title:	PR-11
Construct a low-impact boardwalk multi-use path over wetlands	
Discussion:	

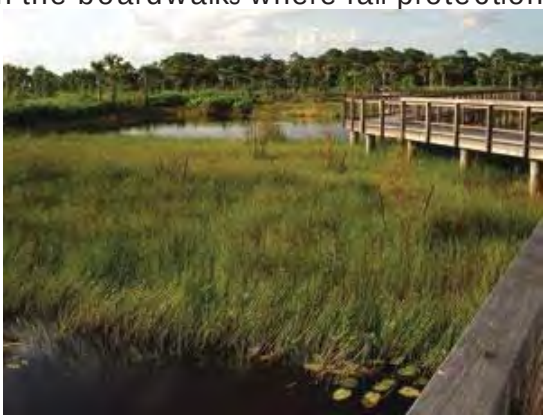
The original concept includes the construction of a multi-use path and sidewalk along the sides of the roadway. The construction of these facilities will fill wetlands that require mitigation. The alternative concept is to use low-impact boardwalks to cross the wetland areas.

The U.S. Army Corps of Engineers' jurisdiction over wetlands comes from Section 404 of the Clean Water Act that regulates the discharge of dredge and fill material into a water of the United States. As a result, the mitigation of wetland loss is based on area and volume of fill in the wetland.

The low-impact boardwalks work by reducing the fill in the wetland. Special auger piers have been developed that result in nominally zero fill to the wetland and result in no required mitigation.

Even if traditional piers are used to support the boardwalk, then the fill and the mitigation required will be significantly less.

Handrails can be used on the boardwalks where fall protection is a concern.



As stated above, the advantage of this alternative concept is reduced wetland impacts requiring mitigation. The mitigation ratios for wetland impacts are often 2:1 or 3:1. This results in significant mitigation cost, so the boardwalk may be a significant savings.

Design Suggestion

	Alternative No:
Title:	PR-14
Use double crossover intersection at STH 59 and CTH X	
Discussion:	

The original concept calls for a triple left turn from northbound STH 59 to westbound CTH X. The VE Team suggests that a double crossover intersection be constructed at this location. The value of a double crossover intersection is that it removes the conflict between the heavy left movement and the heavy southbound traffic at the main intersection. This movement is accomplished by making the crossing of these two movements at a signalized intersection away from the main intersection. This type of intersection is used at a number of locations very successfully. The attached aerial photo shows a double crossover intersection near St. Louis, Missouri at Route 30 and Summit Road. This intersection has been in operation for a number of years and has been received favorably.

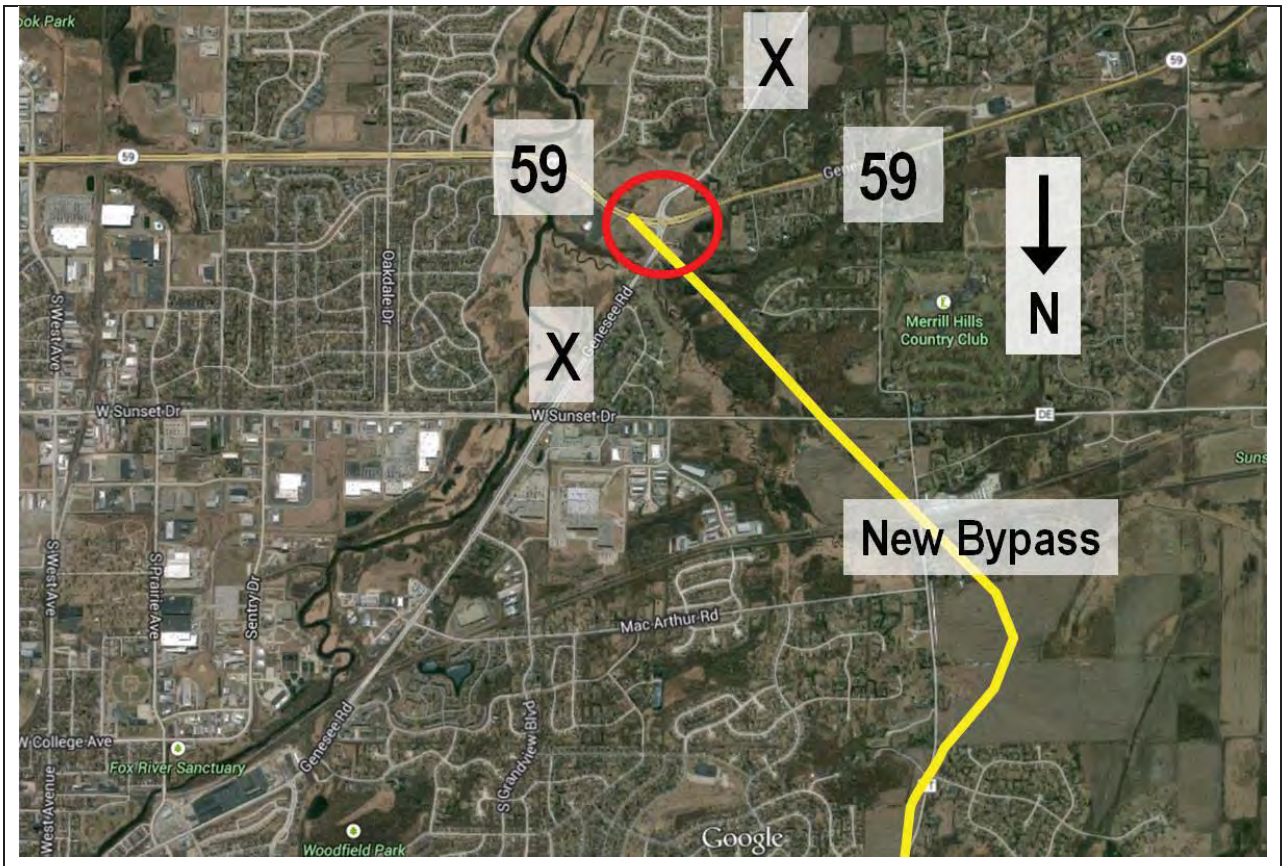
The attached sketch is a rendition of how STH 59 and CTH X intersection would look on the south side of the intersection. It appears that there is adequate right-of-way to construct a double crossover intersection at this location.

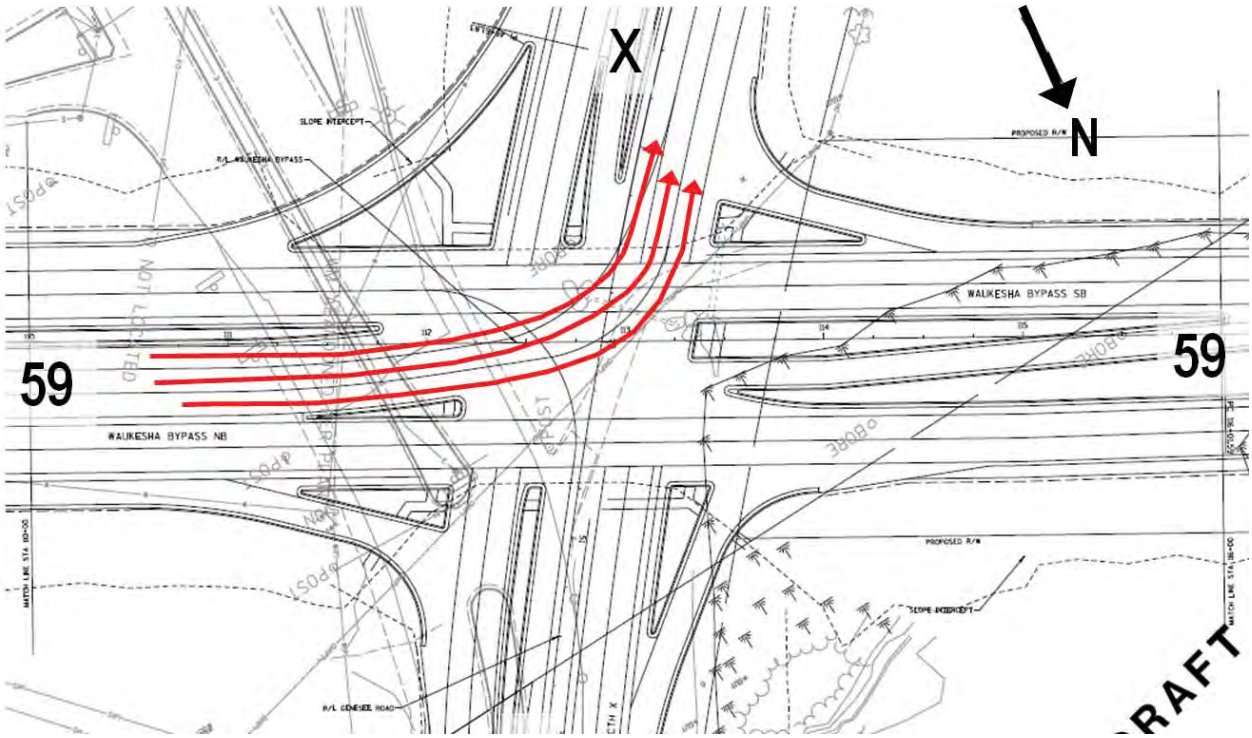
Several state transportation departments, including the Utah Department of Transportation, have implemented this concept which is called a Continuous Flow Interchange (CFI). Additional information about CFI can be found at the following websites:

http://www.continuousflowintersections.org/

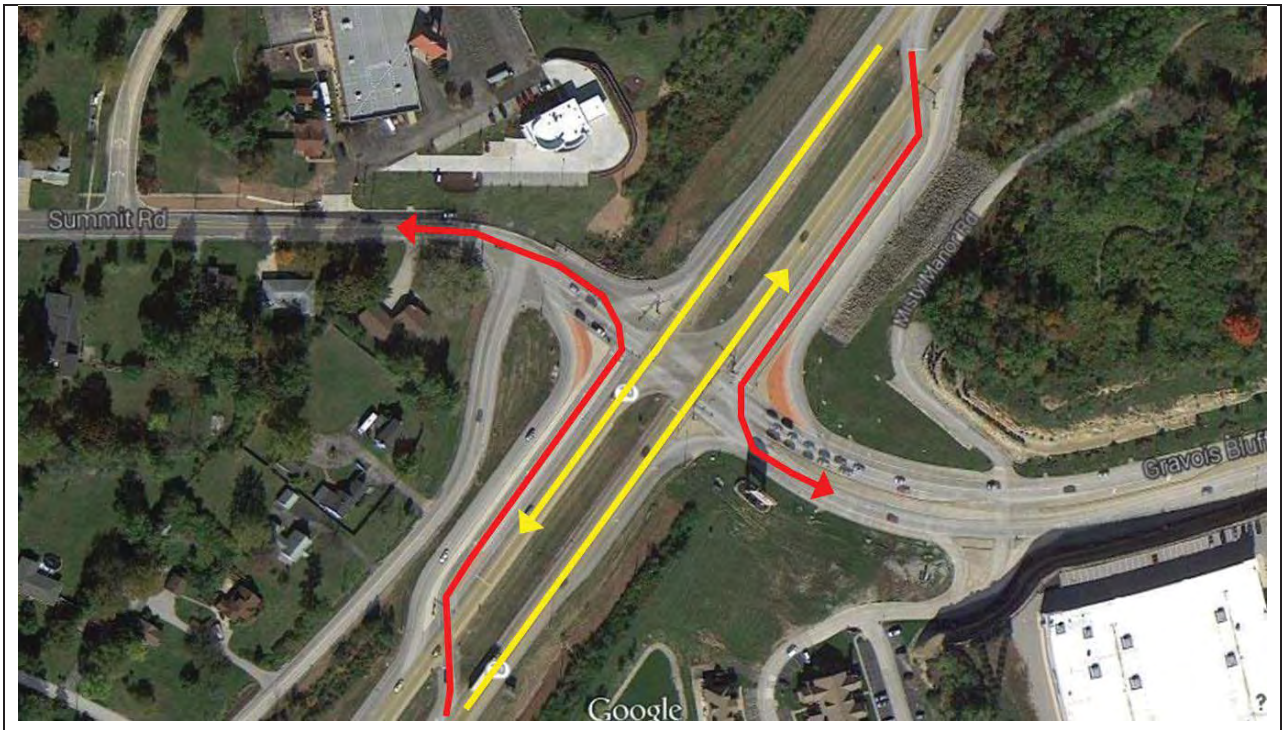
https://www.udot.utah.gov/i/udot/ucon/cfi_anim.swf

https://www.youtube.com/watch?v=By-clFzyHO4

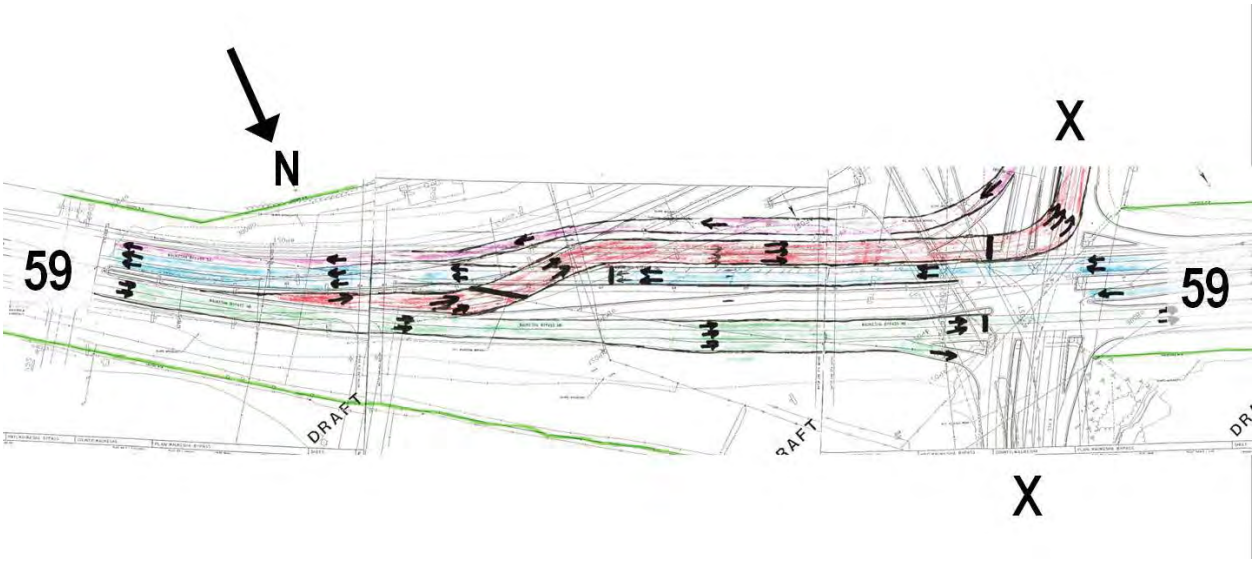




ATTACHMENT 13



Route 30 and Summit Road in St. Louis, MO



Sketch of alternative concept

Design Suggestion

	Alternative No:
Title:	PR-21
Maximize use of ditches and bioswales with sheet flow in lieu of inlets and closed storm sewer where possible	

Discussion:

To minimize runoff from the project site, the VE Team recommends the use of open ditches and the construction of bioswales in lieu of traditional closed storm sewer systems to the extent practical.

This provides several benefits. One, it removes or settles out roadway sediment, debris, and contaminants prior to the water reaching detention areas or ponds. Two, a constructed bioswale can help to cool runoff as it infiltrates through the engineered soils before it is collected and piped to a discharge area. Finally, it eliminates the time-consuming construction of underground storm sewers. By making the stormwater management system part of the earthwork, it can be seamlessly scheduled into the project plan. The elimination of the traditional stormwater systems can also simplify or eliminate utility conflicts and relocations.

There is often some concern that sheet flowing water off the roadway can cause erosion of the shoulder and clear zone. However, the energy of the non-concentrated flow is much less than that exiting a pipe system. Properly vegetated slopes that meet requirements for recoverable slopes are flat enough that erosion is not a concern.

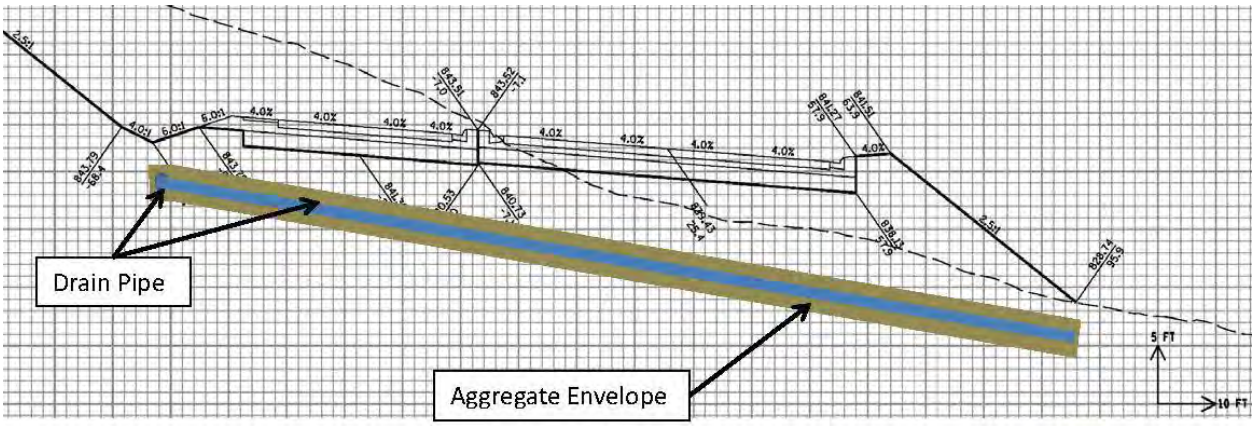
There may or may not be cost savings to construct the bioswales. However, the ability of the bioswales to clean and cool the water before discharge to environmentally sensitive areas is beneficial.

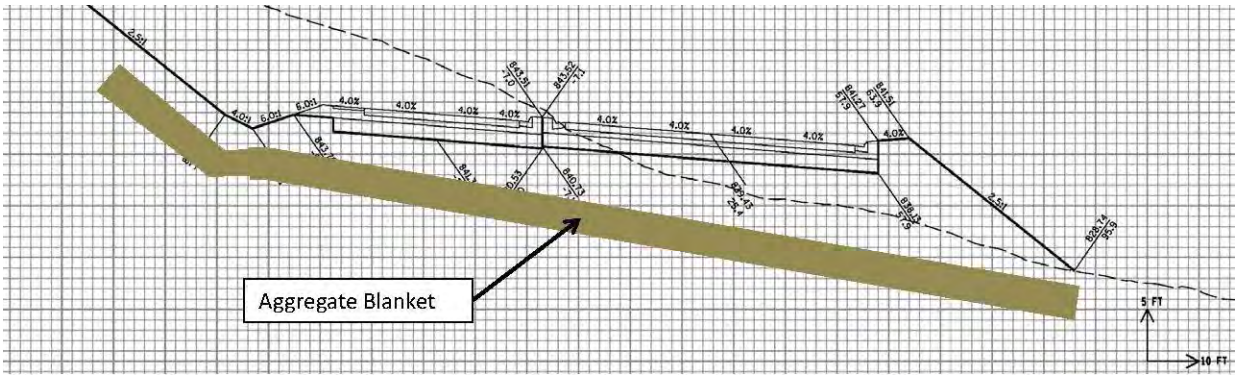
Design Suggestion

Alternative No:	
Title:	PR-22
Provide subsurface system to maintain groundwater flow in fen	
Discussion:	

The original concept is to construct a fill section through a fen located along the alignment of the West Waukesha Bypass at CTH D. An issue expressed by the PDT and WisDOT is the potential of interrupting the groundwater flow to the fen.

In order to maintain this continuity of flow, an underdrain system could be used. The drainage system could be constructed in different ways that include pipes or aggregate drains. The following figures provide concept illustrations of these options.





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SECTION 6

IMPLEMENTATION DECISIONS

ATTACHMENT 13

SECTION 6
IMPLEMENTATION DECISIONS

Value Alternatives

The last stage of the Value Study addressed implementation actions by WisDOT, CH2M Hill, and Kapur & Associates. The Value Team was not included in the Implementation Meeting/Discussions. The implementation results have been provided by WisDOT.

An implementation meeting was held to discuss each Value Alternative and Design Suggestion, answer questions, and determine implementation actions. Some alternatives were accepted, others partially accepted or modified, and some were rejected. Others were left open or undecided because additional information was needed before making a commitment for action.

The following paragraphs show the decisions reached.

Accepted Value Alternatives

These Value Alternatives were accepted for implementation generally as presented in the Value Alternative write-up included in Section 4 of this report.

Alt. No.	Description	Comments
DT-08	Synchronize (coordinate) traffic signals in lieu of operating fully actuated traffic signals	
PR-21	Maximize use of ditches and bioswales with sheet flow in lieu of inlets and closed storm sewer where possible	South of Madison Street the stormwater plan will look to maximize the use of swales and other BMP's to dissipate water without concentrated flows to minimize the thermo impacts and meet our 80% TSS goals.
PR-22	Provide subsurface system to maintain groundwater flow in fen	Profiles have been adjusted to minimize the risk of disrupting groundwater flows south of Sunset Drive. The design will also consider other means of transferring groundwater through french drains in this area.

Partially Accepted or Modified Value Alternatives

Some Value Alternatives were accepted in part or with certain modifications. These Value Alternatives and subsequent changes to these Value Alternatives are discussed below.

Alt. No.	Description	Comments
PR-17	Revise grade where possible to a maximum of 2.5 percent to more closely follow the existing ground reducing the borrow required	Profiles were adjusted between Sunset Drive and Green Lane, Sta. 155+00 – 165+00, to reduce the amount of fill. North of the land bridge, Sta. 130+00 – 145+00 were adjusted slightly but just south of Sunset Drive we need to stay above the existing groundwater flows. The profile was raised slightly near Macarthur Drive and Green Lane to help with flood plain and drainage issues.

Rejected Value Alternatives

Some Value Alternatives were rejected at the implementation meeting. A brief discussion is provided below to help explain and to document the rationale behind the rejection of these Value Alternatives.

Alt. No.	Description	Comments
IS-06	Use barrier wall in lieu of raised median to narrow cross-section in order to reduce right-of-way	Although access to properties is limited in this section there are 4 intersections in this section, Green Lane, Macarthur Road, Kame Terrace, and Merrill Hills Court. The loss of a median reduces the ability to place signs on both sides of the roadway. The concrete barrier itself is a hazard and should be limited in use.

Alt. No.	Description	Comments
IS-13	Construct stormwater ponds that are not adjacent to rivers as mitigation wetlands	Storm pond management differs from wetland management primarily due to the maintenance work needed to keep storm ponds functional. Both types of waterbodies use the same vegetation, but this is where the basic commonality ends. Storm ponds are human-made and designed to accumulate sediment to prevent pollutants from entering lakes and streams. Our region wetland ecologist does not utilize stormwater ponds with wetland mitigation.
IS-21	Slope all drainage to the outside in lieu of crowning the center of roadway	WisDOT prefers to crown multilane roadways due to concerns of icing in the winter when median runoff drains across the road. When roadways are all drained to the outside low side curb and storm sewer is still installed to catch median water. Super elevated curves do drain across the pavement but this is a small percentage of the roadway length. Cost savings would be reduced as median storm sewer still required.
IS-24	Install motion activated warning system (flashing beacon) or a traffic signal for Glacial Drumlin Trail in lieu of tunnel	Glacial Drumlin State Trial is one of the most used trials in the state. WDNR planned on grade separating the trial under County TT prior to bypass plans. Crossing a four lane divided highway with a posted speed of 45 mph is intimidating and dangerous for younger users. Maintenance of the trial will be the responsibility of WDNR. The grade separated trail provides value to the trail users.

Alt. No.	Description	Comments
PR-04	Use fill with sheetpile and transvere drain pipes in lieu of land bridge	By constructing with sheet pile and fill there are more impacts to wetlands and a barrier to shallow groundwater flows. The addition of pipes may help maintain groundwater flows but will impact the existing ground and run a higher risk of interrupting flows.
PR-11	Construct a low-impact boardwalk multi-use path over wetlands	Boardwalks over a wetland would still be accounted for as an impact. Maintenance responsibility and cost is an issue.
PR-13	Construct urban section consisting of curb and gutter adjacent to roadway to reduce right-of-way from US 18 to STH 59	From US 18 to Kame Terrace it is an urban section. At Kame Terrace the roadway goes on new alignment and will require a reduction of 80% for total suspended solids. Swales will be required to obtain this goal as ponds are discouraged in the Pebble Creek corridor due to thermal impacts. The section from Sunset Drive to STH 59 runs along the Pebble Creek environmental corridor which is a primary environmental corridor also and resource agencies have insisted on minimizing the cross section. The suggested urban section would require an additional 12' of width (20' urban -8' rural).
PR-14	Use double crossover intersection at STH 59 and CTH X	Although a unique alternative to the issues of a traditional left turn, the additional cost and right-of-way impacts eliminate this suggestion. This alternative would also require the project to go back to the public to receive input and comments which would delay the project.

Alt. No.	Description	Comments
PR-19	Accommodate bike traffic on eight-foot paved shoulder and accommodate pedestrians on sidewalk from CTH D (Sunset Drive) to Madison Street and from US 18 to Northview Road in lieu of constructing a 10-foot multi-use path in this section	Bike accommodations in the 8-foot outside shoulder will be used by more experienced riders who feel comfortable riding adjacent to vehicles. The multi-use trail is replacing sections of the existing trail and completing the connection between the Lake Country Trail north of I-94 and the Glacial Drumlin State Trail. A sidewalk would still be required by federal and state guidelines. There would only be a reduction in five feet if a sidewalk replaced the multi-use trail. The multi-use trail is a valued resource to the community which wants to keep the rural character of the area.

Open or Undecided Value Alternatives

A decision could not be made at the implementation meeting on some Value Alternatives. The following explains why a decision was not made at this meeting.

Alt. No.	Description	Comments
PR-04	Use fill with sheetpile and transvere drain pipes in lieu of land bridge	It may be possible to use pipe arches with no bottom which would not impact the existing ground. More investigation is needed on the use of pipes and the subsurface soils. The structure design will evaluate the use of bottomless pipe arches as an alternative.
PR-20	Use precast reinforced concrete box in lieu of cast-in-place box culverts	The use of precast reinforced concrete box could save in cost and more importantly time. The use of precast sections for the Glacial Drumlin State Trail and proposed stream crossing at Sta. 245+25 will be reviewed during design by WisDOT's structure section.

Cost Savings

Savings from the alternatives selected by WisDOT for implementation, including cost revisions based on modifications, are:

Accepted and Modified Value Alternatives

Alt. No.	Description	Capital Cost Savings
DT-08	Synchronize (coordinate) traffic signals in lieu of operating fully actuated traffic signals	Design Suggestion
PR-17	Revise grade where possible to a maximum of 2.5 percent to more closely follow the existing ground reducing the borrow required	$392,000
PR-21	Maximize use of ditches and bioswales with sheet flow in lieu of inlets and closed storm sewer where possible	Design Suggestion
PR-22	Provide subsurface system to maintain groundwater flow in fen	Design Suggestion
	Total	**$392,000**

Note: The savings on these Value Alternatives have been adjusted based on the results of the implementation decisions.

Some Value Alternatives are still undecided for various reasons, and there are some Value Alternatives that decisions are waiting on the results of additional analysis. Implementing these items remaining open for decision could result in additional savings as shown below:

Value Alternatives that are Open, Undecided, or require Further Study

Alt. No.	Description	Capital Cost Savings
PR-04	Use fill with sheetpile and transvere drain pipes in lieu of land bridge	$1,577,000
PR-20	Use precast reinforced concrete box in lieu of cast-in-place box culverts	$292,000
	Total	**$1,869,000**

Note: The savings on these Value Alternatives have been adjusted based on the results of the implementation decisions.

APPENDICES

ATTACHMENT 13

A – AGENDA

ATTACHMENT 13

VALUE ENGINEERING WORKSHOP AGENDA

West Waukesha Bypass
Waukesha, WI
March 2-5, 2015

Monday		**Who Should Attend**
8:00 – 8:30	VE Team Orientation	VE Team Members
9:00 – 9:20	VE Study Introduction	Stakeholders & PDT
9:20 – 10:00	Owner Presentation	Stakeholders & PDT
10:00 - 12:00	Project Development Team (PDT) Presentation	Stakeholders & PDT
12:00 – 1:00	Lunch Break	
1:00 – 3:00	Site Visit	VE Team Members
3:00 – 5:00	Project Analysis/Function Analysis	VE Team Members
Tuesday		
8:00 – 9:00	Project Analysis/Function Analysis	VE Team Members
9:00 – 12:00	Creative Idea Generation	VE Team Members
12:00 – 1:00	Lunch Break	
1:00 – 2:00	Creative Idea Generation	VE Team Members
2:00 – 4:00	Evaluation of Ideas	VE Team Members
4:00 – 5:00	Value Alternative Development	VE Team Members
Wednesday		
8:00 – 12:00	Value Alternative Development (Cont.)	VE Team Members
11:00 – 12:00	Mid-Point Review of Ideas	Stakeholders & PDT
12:00 – 1:00	Lunch Break	
1:00 – 5:00	Value Alternative Development (Cont.)	VE Team Members
Thursday		
8:00 – 10:00	Value Alternative Development (Cont.)	VE Team Members
10:00 – 12:00	Prepare for Value Team Presentation	VE Team Members
12:00 – 1:00	Lunch Break	
1:00 – 3:00	Value Team Presentation of Value Alternatives	Stakeholders & PDT
3:00 – 4:00	Wrap up	VE Team Members

B – PARTICIPANTS

ATTACHMENT 13

West Waukesha Bypass
Waukesha, WI
March 2-5, 2015

Name:	Company:	Phone:	Email:	Site Visit	Introduction	Mid-Point Review	VE Presentation
Don Baker	Water Resources Solutions	913-302-1030	dbaker@wrs-rc.com	X	X		X
Kia Ashrafzadeh	AECOM	314-743-4137	kia.ashrafzadeh@aecom.com	X	X		X
Matt Coupar	WisDOT	608-266-5083	matthew.coupar@dot.wi.gov	X	X		X
Jeanne Marchant	WisDOT SE Region	262-548-6452	jeanne.marchant@dot.wi.gov	X	X		X
Dan Tyler	WisDOT BPO	608-267-7945	daniel.tyler@dot.wi.gov		X		
Peter Chladil	Waukesha County	262-548-7843	pchladil@waukeshacounty.gov	X	X		X
Kyle Schafersman	SVS	816-795-0700	kyle@svs-inc.com	X	X	X	X
Kurt Farrenkopf	Kapur and Associates, Inc.	414-751-7226	kfarrenkopf@kapur-assoc.com		X		X
Ben Eruchalu	WisDOT	262-548-8968	benedict.eruchalu@dot.wi.gov		X	X	X
Doug Cain	WisDOT	262-548-5603	douglas.cain@dot.wi.gov	X	X	X	X
Kerry Meyer	CH2M Hill	414-847-0326	kerry.meyer@ch2m.com	X	X	X	X
Anne Ruzicka	SVS	816-795-0700	anne@svs-inc.com	X	X		X
Hans Hallanger	WisDOT- TSS	262-548-6706	hans.hallanger@dot.wi.gov				X
Scott Ahles	Bloom Companies	414-292-4554	sahles@bloomcos.com				X
Adrian Lopez	WisDOT - POS	414-750-1562	adrian.lopez@dot.wi.gov				X
John Kanzenbach	WisDOT - DDS	262-548-6476	john.kanzenbach@dot.wi.gov				X
Fred Abadi	City of Waukesha	262-524-3600	fabadi@ci.waukesha.wi.us				X
Anita Pusch	WisDOT - TSS	262-548-5678	anita.pusch@dot.wi.gov				X

ATTACHMENT 13

West Waukesha Bypass
Waukesha, WI
March 2-5, 2015

				Site Visit	Introduction	Mid-Point Review	VE Presentation
Gary Evans	Waukesha County	262-548-7746	gevans@waukeshacounty.gov				X
Allison Bussler	Waukesha County	262-548-7740	abussler@waukeshacounty.gov				X
Rick Herrick	WisDOT - BPO						*X
John Bridell	WisDOT - BPO						*X
Bruce Jorenby	WisDOT - BPO						*X
Bunmi Olapo	WisDOT						*X

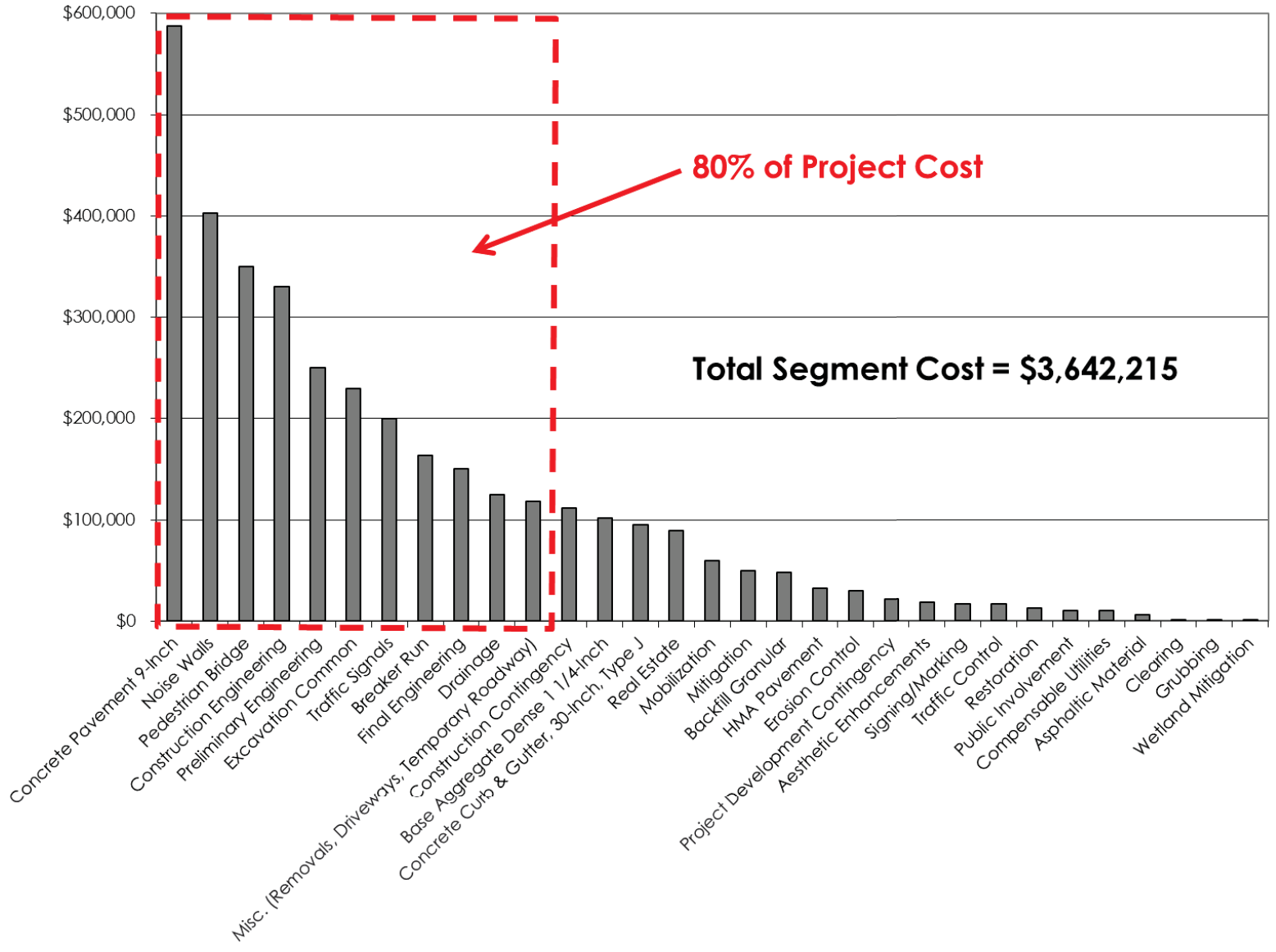
* Attended via teleconference

ATTACHMENT 13

C – COST INFORMATION

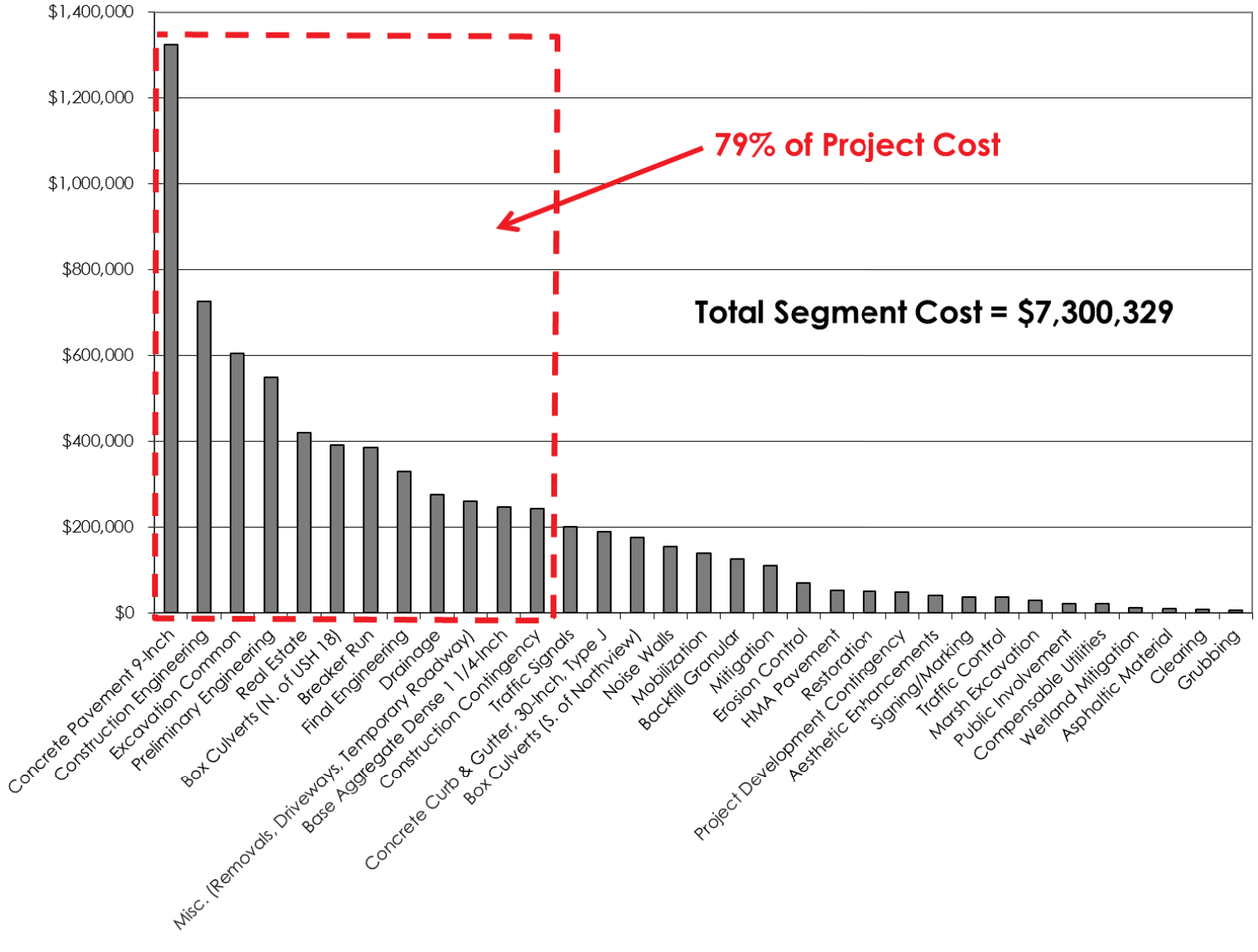
ATTACHMENT 13

Rolling Ridge to Northview Road



ATTACHMENT 13

Northview Road to US 18



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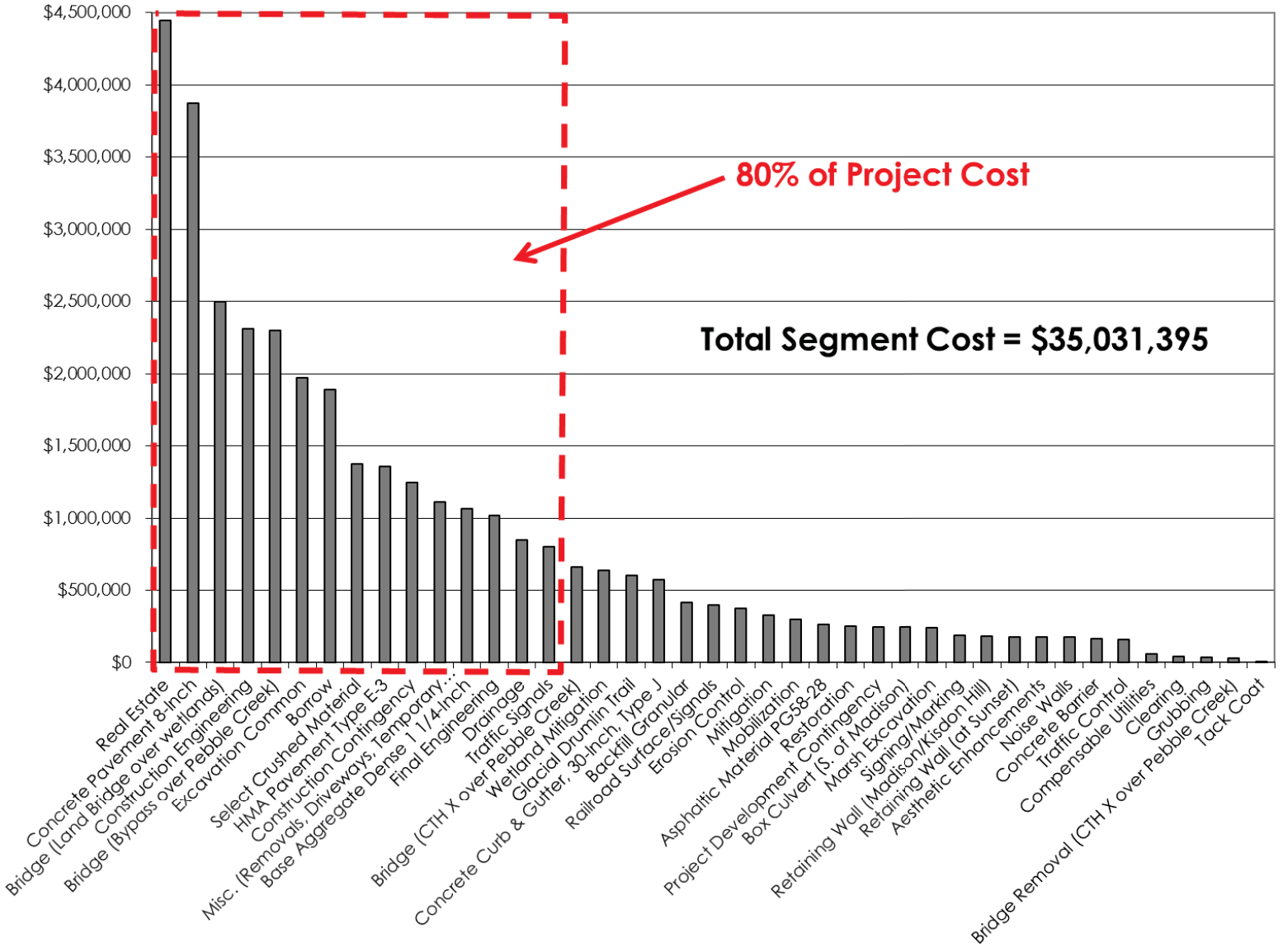
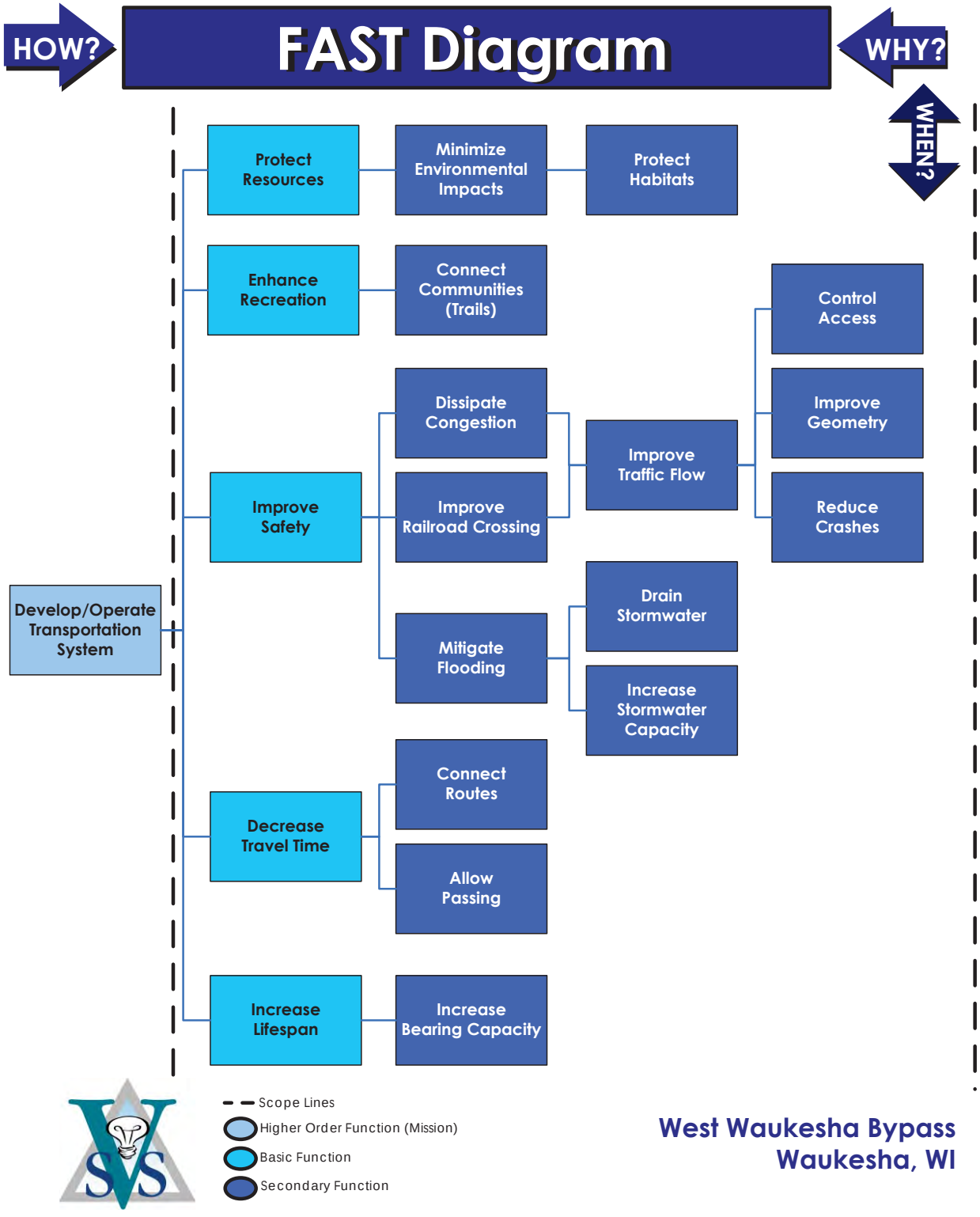
US 18 to STH 59



ATTACHMENT 13

D – FUNCTION ANALYSIS

ATTACHMENT 13


HOW?
FAST Diagram
WHY?
WHEN?
Develop/Operate Transportation System
Protect Resources
Minimize Environmental Impacts
Protect Habitats
Enhance Recreation
Connect Communities (Trails)
Improve Safety
Dissipate Congestion
Improve Railroad Crossing
Improve Traffic Flow
Control Access
Improve Geometry
Reduce Crashes
Mitigate Flooding
Drain Stormwater
Increase Stormwater Capacity
Decrease Travel Time
Connect Routes
Allow Passing
Increase Lifespan
Increase Bearing Capacity
Scope Lines
Higher Order Function (Mission)
Basic Function
Secondary Function
West Waukesha Bypass
Waukesha, WI

E – CREATIVE IDEA LISTING

ATTACHMENT 13

Creative Idea Listing

Idea No.	Description	Votes
DT - Decrease Travel Time		
DT-01	Increase speed limit through corridor	0
DT-02	Use frontage roads to connect access roads in lieu of intersections	0
DT-03	Construct interchanges in lieu of intersections	0
DT-04	Reduce number of access points where possible	0
DT-05	Construct tunnel from STH 59 to I-94 in lieu of widening CTH TT	0
DT-06	Use raised highway in lieu of widening CTH TT	0
DT-07	Use cantilevered roadway (stacked northbound and southbound lanes) in lieu of widening CTH TT	0
DT-08	Synchronize (coordinate) traffic signals in lieu of operating fully actuated traffic signals	DS
DT-09	Use three-lane section with two + one alternating middle lane	0
G - General		
G-01	Have a contest to name this new stretch of state highway	0
G-02	Verify the sidewalk is included in the cost estimate	0
G-03	Change title of project to "Expand CTH TT" in lieu of "West Waukesha Bypass"	0
G-04	Use incentives to speed construction and reduce delay to traffic	0
G-05	Ensure schedule takes into account a majority of the off-alignment components (storm sewer, bridge substructure, etc.) in the winter construction phase	1
G-06	Include staged cross-sections in the final plans	1
G-07	Ensure utility impacts are determined as soon as possible to begin relocations	1
G-08	Delay start of WisDOT (southern) section construction until June 1, 2017 to ensure completion in 2018 in lieu of October 1, 2016 which leads to three construction seasons	0
IL - Increase Lifespan		
IL-01	Use 12-inch pavement thickness in lieu of eight-inch	0
IL-02	Construct under drain the entire length of the pavement	2
IL-03	Use a white topping (concrete over asphalt) in lieu of eight inches of concrete	0
IL-04	Use asphaltic-concrete base material in lieu of six-inch dense grade base	0

Idea No.	Description	Votes
IL-05	Use lime stabilized base course in lieu of six-inch dense grade base	0
IL-06	Use fly ash stabilized base course in lieu of six-inch dense grade base	0
IL-07	Use geogrid to reduce the amount of improved breaker-run	1
IL-08	Use asphalt paving in lieu of concrete paving	2
IS - Improve Safety		
IS-01	Use roundabout in lieu of slotted left-in only for shopping center north of US 18	1
IS-02	Construct additional gas station access from US 18 in lieu of slotted left-in only turns	1
IS-03	Use two-way left turn lane in lieu of four-lane raised median section	1
IS-04	Use fly over ramp from westbound to southbound STH 59 in lieu of at-grade intersection	1
IS-05	Extend bridge over Pebble Creek in lieu of building tunnel and crossing railroad tracks at grade	1
IS-06	Use barrier wall in lieu of raised median to narrow cross-section in order to reduce right-of-way	4
IS-07	Use urban section and construct multi-use path and sidewalk with raised curb and gutter in lieu of using shoulder for bike path from STH 59 to Sunset Drive	2
IS-08	Add drop arms to the railroad crossing	1
IS-09	Decommission the railroad tracks	0
IS-10	Use perious pavement for sidewalks and multi-use path in lieu of asphalt	0
IS-11	Close road to through traffic to reduce construction duration	1
IS-12	Use partial road closures in segments to reduce construction duration	2
IS-13	Construct stormwater ponds that are not adjacent to rivers as mitigation wetlands	DS
IS-14	Use heated sidewalk and multi-use paths	0
IS-15	Use heated roadway to melt snow in lieu of scrapping and salting	0
IS-16	Use state patrol to keep traffic flowing and slowed down during construction	0
IS-17	Use traffic calming devices and techniques to reduce speeds in lieu of traditional methods	0
IS-18	Use 11-foot wide lanes in lieu of 12-foot lanes	0
IS-19	Use natural sound barrier in lieu of sound walls	RR
IS-20	Transplant existing trees to serve as sound and visual barrier	0

Idea No.	Description	Votes
IS-21	Slope all drainage to the outside in lieu of crowning the center of roadway	4
IS-22	Add lighting to median to improve driver safety	1
IS-23	Construct pedestrian land bridge in lieu of tunnel at Glacial Drumlin Trail	0
IS-24	Install motion activated warning system (flashing beacon) or a traffic signal for Glacial Drumlin Trail in lieu of tunnel	DS
IS-25	Provide a park-and-ride to reduce traffic congestion	2
IS-26	Use toll road for widening CTH TT	0
IS-27	Use lightrail in lieu of widening CTH TT	0
IS-28	Use Woodridge Lane for access and cul-de-sac Rolling Ridge Drive in lieu of intersection with CTH TT	2
IS-29	Request an exception ADA sidewalks at Rolling Ridge Drive	0
IS-30	Use 1.5% cross slope on mainline all the way to ADA ramp and work it back into side streets at Rolling Ridge Drive	1
IS-31	Use two-way left turn lane in lieu of slotted left-in only for shopping center north of US 18	1
IS-32	Use hourglass shape unseparated, four-lane section with bump outs for left turn lanes	0
IS-33	Use four-lane section with U-turn bump outs	0
IS-34	Use jugg handle intersection at US 18	0
IS-35	Remove the pedestrian bridge $403,000 from the cost estimate	0
IS-36	Use at-grade crossing for Glacial Drumlin Trail in lieu of tunnel	0
PR - Protect Resources		
PR-01	Use bioswales in lieu of traditional storm sewer and ditch	2
PR-02	Use three-foot shy distance in median and slope drainage to outside in environmental sensitive areas in lieu of six-foot	1
PR-03	Capture and convey stormwater from land bridge to bioswale in lieu of dumping directly into wetland	0
PR-04	Use fill with sheetpile and transverse drain pipes in lieu of land bridge	3
PR-05	Use multiple pipes in lieu of land bridge	0
PR-06	Use box culvert in lieu of land bridge	0
PR-07	Use three-sided culvert in lieu of land bridge	0
PR-08	Use fill section with deepened aggregate base in lieu of land bridge	0
PR-09	For the Pebble Creek structure, use a three-span (50'-100'-50') structure to stay out of waterway if necessary	0

Idea No.	Description	Votes
PR-10	Use two 100-foot spans for the Pebble Creek structure to place pier near center of waterway and reduce total impact to river	0
PR-11	Construct a low-impact boardwalk multi-use path over wetlands	DS
PR-12	Use multi-use path only in lieu of multi-use path and sidewalk	1
PR-13	Construct urban section consisting of curb and gutter adjacent to roadway to reduce right-of-way from US 18 to STH 59	4
PR-14	Use double crossover intersection at STH 59 and CTH X	DS
PR-15	Stay on existing alignment between Madison Street and Kame Terrace in lieu of shifting alignment east	0
PR-16	Reduce speed to 35 miles per hour and follow existing grade more closely	0
PR-17	Revise grade where possible to a maximum of 2.5 percent to more closely follow the existing ground reducing the borrow required	3
PR-18	Use rural median, typical, section (depressed grass median) in lieu of curb and gutter	1
PR-19	Accommodate bike traffic on eight-foot paved shoulder and accommodate pedestrians on sidewalk from CTH D (Sunset Drive) to Madison Street and from US 18 to Northview Road in lieu of constructing a 10-foot multi-use path in this section	3
PR-20	Use precast reinforced concrete box in lieu of cast-in-place box culverts	3
PR-21	Maximize use of ditches and bioswales with sheet flow in lieu of inlets and closed storm sewer where possible	DS
PR-22	Provide subsurface system to maintain groundwater flow in fen	DS

DS – Indicates the Idea was selected to be written as a Design Suggestion and is included in the Design Suggestion Section of this report

RR – Indicates the Idea received enough votes by the Value Team to be developed. However, during the Development Phase the team found that the Idea was not feasible. Therefore, it has been designated RR indicating that it was Reviewed and Rejected by the Value Team.

F – MATERIALS PROVIDED

ATTACHMENT 13

Materials Provided

Document	Prepared by	Date
Recommended Geometrics	GRāEF	12/31/2014
WisDOT Traffic Forecast Report- Pebble Creek Build	WisDOT	11/24/2014
WisDOT Traffic Forecast Report- NoBuild- SEWRPC	WisDOT	11/24/2014
Forecast Notes and Methods	WisDOT	11/24/2014
Final Environmental Impact Statement Section 1 and 2	Waukesha County	4/13/2014
Intersection Control Evaluation Comments	WisDOT	1/13/2015
Sloping Level Intersection Control Evaluations	GRāEF	12/19/2014
Intersection Control Evaluation Worksheet	WisDOT	12/19/2014
Waukesha County Map		
Waukesha County Bike Path	Waukesha County Dept. of Park and Land Use	Jan. 2012
Town Waukesha Land Use	Waukesha County Dept. of Park and Land Use	3/18/2009
City of Waukesha Land Use	Waukesha County Dept. of Park and Land Use	2/26/2009
City of Waukesha Bike Plan	Waukesha Bike Alliance	10/31/2011
City of Waukesha Bicycle and Pedestrian Plan	Alta Planning + Design	11/30/2011
Trans 75 Complete Streets Compliance Check Sheet	WisDOT	9/10/13
Boring Location Map	WisDOT	10/17/14
Soil Boring Locations	WisDOT	12/2/2014
Waukesha Bypass Preliminary Design Roadway Soils Report	CH2M Hill	2/13/2015
Memorandum to File/Pavement Design	WisDOT	1/20/2015

Document	Prepared by	Date
Preliminary Cost Estimate	WisDOT	Feb. 2015
Cost Review Workshop powerpoint presentation revision	Waukesha County	12/17/2013
FHWA Cost Estimate Review	WisDOT	Aug. 2013
www.waukeshabypass.org	CH2M Hill	2015
West Waukesha Bypass Draft Plan	CH2M Hill and Kapus & Associates	2/26/2015
Waukesha Bypass Pavement Report Final	CH2M Hill	2/19/2015
Transportation Management Plan Documentation and Request for Approval (Draft)	WisDOT	2/27/2015
Volume Exhibits		

G – RESPONSE TO RECOMMENDATIONS

ATTACHMENT 13

Waukesha Bypass
Value Engineering
Implementation Response
March 30, 2015

IS-06 Use barrier wall to narrow cross section to reduce right of way, Sunset Dr. to Sta 250+00.
Reject – Although access to properties is limited in this section there are 4 intersections in this section, Green Lane, Macarthur Road Kame Terrace and Merrill Hills Court. The loss of a median reduces the ability to place signs on both sides of the roadway. The concrete barrier itself is a hazard and should be limited in use.

IS-13 Construct storm water ponds as wetland mitigation.
Reject – Storm pond management differs from wetland management primarily due to the maintenance work needed to keep storm ponds functional. Both types of waterbodies use the same vegetation, but this is where the basic commonality ends. Storm ponds are human-made and designed to accumulate sediment to prevent pollutants from entering lakes and streams. Our region wetland ecologist does not utilize storm water ponds with wetland mitigation.

IS-21 Slope roadway drainage to the outside in lieu of crowning the center of roadway.
Reject – WisDOT prefers to crown multilane roadways due to concerns of icing in the winter when median runoff drains across the road. When roadways are all drained to the outside low side curb and storm sewer is still installed to catch median water. Super elevated curves do drain across the pavement but this is a small percentage of the roadway length. Cost savings would be reduced as median storm sewer still required.

IS 24 Install motion activated warning system for Glacial Drumlin State Trail in lieu of tunnel.
Reject – Glacial Drumlin State Trial is one of the most used trials in the state. WDNR planned on grade separating the trial under County TT prior to bypass plans. Crossing a four lane divided highway with a posted speed of 45 mph is intimidating and dangerous for younger users. Maintenance of the trial will be the responsibility of WDNR. The grade separated trail provides value to the trail users.

PR-04 Use fill with sheet pile in lieu of a land bridge.
Reject – By constructing with sheet pile and fill there are more impacts to wetlands and a barrier to shallow ground water flows. The addition of pipes may help maintain ground water flows but will impact the existing ground and run a higher risk of interrupting flows.
Keep for further study – It may be possible to use pipe arches with no bottom which would not impact the existing ground. More investigation is needed on the use of pipes and the subsurface soils. The structure design will evaluate the use of bottomless pipe arches as an alternative.

PR-11 Construct low impact boardwalk multi use path over wetlands.
Reject – Boardwalks over a wetland would still be accounted for as an impact. Maintenance responsibility and cost is an issue.

PR-13 Construct urban section consisting of curb and gutter adjacent to roadway to reduce right of way from US 18 to STH 59.
Reject – From US 18 to Kame Terrace it is an urban section. At Kame Terrace the roadway goes on new alignment and will require a reduction of 80% for total suspended solids. Swales will be required to

obtain this goal as ponds are discouraged in the Pebble Creek corridor due to thermal impacts. The section from Sunset Drive to STH 59 runs along the Pebble Creek environmental corridor which is a primary environmental corridor also and resource agencies have insisted on minimizing the cross section. The suggested urban section would require an additional 12' of width (20' urban -8' rural).

PR-14 Double crossover intersection at STH 59 and CTH X.
Reject – Although a unique alternative to the issues of a traditional left turn. The additional cost and right of way impacts eliminate this suggestion. This alternative would also require the project to go back to the public to receive input and comments which would delay the project.

PR-17 Revise profile grades where possible to a maximum of 2.5% to more closely follow the existing profile which would reduce borrow.
Partial accept – Profiles were adjusted between Sunset Drive and Green Lane, station 155+00 – 165+00, to reduce the amount of fill. North of the land bridge, station 130+00 – 145+00 were adjusted slightly but just south of Sunset Drive we need to stay above the existing groundwater flows. The profile was raised slightly near Macarthur Drive and Green Lane to help with flood plain and drainage issues.

PR-19 In areas where the eight foot paved two foot gravel shoulders are proposed, use this to accommodate the multi use activities in lieu of constructing the multi-use trail.
Reject – Bike accommodations in the 8 foot outside shoulder will be used by more experienced riders who feel comfortable riding adjacent to vehicles. The multi-use trail is replacing sections of the existing trail and completing the connection between the Lake Country Trail north of I-94 and the Glacial Drumlin State Trail. A sidewalk would still be required by federal and state guidelines. There would only be a reduction in five feet if a sidewalk replaced the multi-use trail. The multi-use trail is a valued resource to the community which wants to keep the rural character of the area.

PR-20 Use precast reinforced concrete box in lieu of a cast-in-place box culverts.
Keep for further study – The use of precast reinforced concrete box could save in cost and more importantly time. The use of precast sections for the Glacial Drumlin State Trail and proposed stream crossing at station 245+25 will be reviewed during design by WisDOT's structure section.

PR-21 Maximize use of ditches and bioswales with sheet flow in lieu of inlets and closed storm sewer.
Accept – South of Madison Street the storm water plan will look to maximize the use of swales and other BMP's to dissipate water without concentrated flows to minimize the thermo impacts and meet our 80% TSS goals.

PR-22 Provide subsurface system to maintain groundwater flow in the fen.
Accept – Profiles have been adjusted to minimize the risk of disrupting groundwater flows south of Sunset Drive. The design will also consider other means of transferring groundwater through french drains in this area.