MEDIAN DRAINAGE & STORM SEWER DESIGN
I-65 SOUTHEAST PROJECT (SR-28940)
AREA 3: STA. 2214+50 “A’ TO STA. 2411+09 “A”

STR. NO. 399 – STR. NO. 452

PREPARED FOR:

Indiana Department of Transportation
100 N. Senate Ave.
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September 21, 2018

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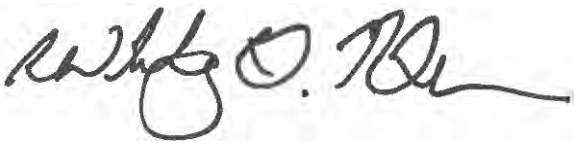

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TABLE OF CONTENTS

Introduction

The I-65 Southeast Project, between Seymour and Columbus, will transform a four-lane facility into a six-lane facility that will improve travel safety conditions for motorists. The project includes the modernization and pavement reconstruction of 14 miles of I-65 between Exit 50 (US 50) and Exit 64 (SR 58) in Bartholomew and Jackson Counties, Indiana. The construction of the project will be sub-divided into three areas.

Package A - Sta. 2530+50 “A” to Sta. 2965+50 “A”
Package B - Sta. 2214+50 “A” to Sta. 2411+50 “A”
Package C - Sta. 2411+50 “A” to Sta. 2530+50 “A”

This median drainage and storm sewer design report will include hydraulic calculations and sizing for Package B - Structure No. 399 thru Structure No. 452.

This report is prepared for the Indiana Department of Transportation (INDOT) and highlights the information and processes utilized in performing median ditch analysis, inlet capacity calculations and storm sewer design. The median drainage and storm sewer design calculations are based on the requirements set forth in Section 9 of the Technical Provisions and Chapter 203 of the Indiana Design Manual (IDM).

Technical Requirements

1. New storm sewer drain shall discharge a minimum of 12 inches above the ditch flowline elevation unless an approved hydraulic analysis indicates a 6-inch minimum eliminates adverse impacts on the hydraulic grade line requirements.

2. All existing drainage structures that will not be used in the final drainage system shall either be removed and backfilled with structure backfill, Type 5 or be filled with structure backfill, Type 5.

3. Inlet spacing, storm drain capacity, and slotted drain computations shall be performed by the Design-Build Contractor. Slotted drain is required on high side, super-elevated shoulder that is sloped toward the travel lanes where guardrail, barrier or rail prevents snow removal for the shoulder.

4. Median ditches, median inlet spacing, and median drain capacity computations shall be performed by the Design-Build Contractor for the 2% annual exceedance probability, EP, storm. The hydraulic grade line shall not encroach onto the travel lanes. All existing metal median drain pipes shall be replaced or lined if a liner can meet the hydraulic requirements. Additional median drain pipes and inlets shall be added as required to meet hydraulic requirements.

5. Type P inlets are to be used inside the clear zone for median ditch drainage.

6. A clogging factor of 50% shall be used in the hydraulic calculations for all drainage structures which do not have a curb box except for the type P inlets. The type P inlets do not require a clogging factor. Flanking inlets are required at all sag points where water ponded at a clogged inlet cannot overflow to another location with adequate capacity to receive the flow without exceeding the allowable spread.

7. See Chapter 203 of the IDM for additional requirements for median drainage and storm sewer design for this project.

Section A - Hydrologic Data

According to IDM Figure 202-3A, the Rational Method shall be used for median drainage and storm sewer design. The design storm frequency to be used for hydrologic analysis is the 50-Year design storm due to the project being part of a major interstate. The NOAA Atlas 14 Precipitation Frequency Estimates for Seymour, Indiana provide rainfall depths and rainfall intensities for various storm events to be used in design calculations.

Please refer to Appendix A for IDM figures and rainfall data used for this design.

A1 - Drainage Area

The drainage areas for the median inlets were delineated based on the roadway crown location found in the typical sections for Package B. Super-elevated sections of roadway were also incorporated into the drainage area delineations.

Please refer to Appendix A for typical section plan sheets, super-elevation diagram plan sheets, and Median Drainage Basin Delineation exhibits.

A2 - Time-Of-Concentration

A conservative assumption of 5 minutes was used as the time-of-concentration for the median drainage inlet basins. However, there are three roadside ditch pipes conveying runoff from one side of an overpass to the other that require detailed time-of-concentration calculations. Please refer to Appendix A for time-of-concentration calculation sheets.

A3 - Runoff Coefficients

Runoff Coefficients were determined for the contributing watersheds based on IDM Figure 202-2E. Under proposed conditions there are four primary land uses within the contributing Watersheds: impervious (travel lanes and shoulder), median construction material (recycled asphalt pavement (RAP) or compacted No. 53 stone), pervious (grass) and cultivated field (agriculture).

Values used in the weighted runoff coefficient calculations are: 0.90 for impervious (travel lanes and shoulder), 0.80 for the median construction material, (RAP or No. 53 stone), 0.30 for pervious (grass) and 0.50 for cultivated field (agriculture) . Early in the design process, discussions occurred between INDOT Hydraulics and DB Engineering to determine the unique runoff coefficient for the median construction material. The technical memorandum and subsequent email correspondence is included in Appendix A.

Please refer to Appendix A for weighted runoff coefficient calculations.

A4 - Rational Flow Calculations

The 50-Year design storm flow rate was determined for each drainage basin using the Rational Method. The drainage area, weighted runoff coefficient, and rainfall intensity (based on the time-of-concentration) were used in the calculations.

Please refer to Appendix A for Rational Flow calculations.

Section B - Median Drainage and Storm Sewer Design

The new travel lanes along I-65 will be added along the existing inside travel lanes. Because the crown of the road is staying in the same location, the typical median drainage basin width will not be altered. However, the median construction material will change from grass to RAP or No. 53 stone.

The new storm sewer system replaces the existing system which was not designed to handle the flow produced from the proposed conditions. Existing median structures shall be removed, and existing pipes shall be abandoned, capped, and filled with structure backfill, Type 5.

Inlet spacing shall be determined such that water will not encroach upon the travel lanes.

B1 - Median Channel Design

Storm water runoff will be collected in the median ditch and conveyed towards a downstream median inlet. The median ditch is designed to have nominal 10:1 side slopes and have a “V” bottom. For most of the project, the proposed median ditch will be 16’ wide, but will vary to 8’ wide in some locations. Graded and paved shoulders totaling 10’ in width on each side of the median provide an additional 0.40’ of depth for median ditch capacity. In areas of super-elevation, the ditch depth and location will vary based on the edge-of-pavement elevations.

According to the IDM, the minimum longitudinal slope for the median ditch is 0.2%.

Due to the northbound and southbound roadway sections being built off separate profiles, the median ditch does not have a constant depth. Therefore, the median ditch cross section varies throughout the corridor. Median ditch cross section points are included in Appendix B.

A Manning's n value of 0.025 was used for the median construction material (channel lining) throughout the project. This value was determined through correspondence with INDOT Hydraulics discussed previously (A3).

Please refer to Appendix B for the median ditch design spreadsheet.

B2 - Median Inlet Capacity

All median inlets, whether on-grade or sag, will be either a standard P-12 inlet or a modified P-12 inlet. Some inlets may need to be modified by increasing the depth of a structure to provide an adequate outlet for underdrains and/or meet cover requirements for the outlet pipe under pavement. Inlet modification is also required for structures with an 18" outlet pipe.

A spreadsheet was provided by INDOT Hydraulics to properly calculate the interception and bypass flows for the P-12 inlet on-grade, orientated along the side-slope of the median ditch. Based on the ditch cross-section, longitudinal slope, Manning's n-value and inlet hydraulic dimensions, a flow depth was determined at the inlet location. The flow depth is to be below the edge-of-travel lane for the inside travel lanes.

A spreadsheet was provided by INDOT Hydraulics to properly calculate the interception and flood depth for the P-12 inlet at a sag point. Using the weir/orifice equations, inlet hydraulic dimensions, and flood depth, a capacity flow rate is calculated. The capacity flow rate is to be at or greater than the actual flow entering the sag location while the flood depth is to be below the edge-of-travel lane for the inside travel lanes. In some instances, multiple inlets may be needed to accommodate larger flows at sag locations. Double or triple inlets are called out in the Median Ditch Analysis spreadsheet. Also, there are certain inlets that can only be installed on one side of the median ditch. The outlets for these inlets begin at the front (low side) of the structure and outlet to the opposite roadside ditch. These inlets are called out in the Median Ditch Analysis spreadsheet.

Please refer to Appendix B for the median ditch analysis summary and inlet interception calculations.

B3 - Storm Sewer Design

The storm sewer design was performed based on the 50-Year design storm. Pipe capacities were calculated using Manning's equation. These calculations are summarized in the Storm Sewer Computations Spreadsheet. Structures proposed for outside ditch conveyance are also included in the design.

B4 – South Project Limits

During existing conditions, the SOUTH basin is the area of median flow starting at the upstream existing median structure (Str. No. 102) and ending at the project limits at Sta. 2214+50 "A". The existing flow leaving the south project limits is 7.60 cfs during existing conditions. The

proposed conditions inlet-spacing and on-grade inlet capacity is designed such that the run-by flow from Str. No. 399 near the project limits at Sta. 2214+50 “A” is 7.40 cfs which is less than existing conditions.

See Appendix B for the SOUTH basin delineation and documentation referring to the existing and proposed discharge comparison between existing and proposed conditions.

Appendix A

Hydrology Calculations and Documentation

Facility Description	Methodology					
	Rational Method*	TR-20 or HEC-HMS	IDNR Coordinated Curves	USGS Gaging Information	Stream Stats	Purdue Regression Equations
Culvert	2	2	1	--	3	--
Bridge or Channel, < 5 sq mi drainage area	--	2	1	3	3	3
Bridge or Channel, ≥ 5 sq mi drainage area	--	3	1	2	3	3
Storm Drain and Inlets	1	4	--	--	--	--
Storage Facility	5	1	--	--	--	--
Pumping Station **	--	1	--	--	--	--

Notes: Must use IDNR Discharge Letter if IDNR Permit is required.

1 is the preferred method

2 is the preferred method if 1 is unavailable

3 is the secondary method

4 may be used if a complex facility exists

5 may be used for retention storage with no outlet

* Rational Method may be used only if drainage area is less than 100 ac in an urban area or less than 200 ac in a rural area.

** See HEC-24, Chapters 5.3 – 5.5.

SELECTION OF DISCHARGE-COMPUTATION METHOD

Figure 202-3A

Back

C Value for Rural Area			
Vegetation and Topography	**Open Sand Loam**	**Clay and Silt Loam**	**Tight Clay**
Woodland			
Flat, 0 ≤ slope < 5%	0.10	0.30	0.40
Rolling, 5 ≤ slope < 10%	0.25	0.35	0.50
Hilly, 10 ≤ slope ≤ 30%	0.30	0.50	0.60
Pasture			
Flat, 0 ≤ slope < 5%	0.10	0.30	0.40
Rolling, 5 ≤ slope < 10%	0.16	0.36	0.55
Hilly, 10 ≤ slope ≤ 30%	0.22	0.42	0.60
Cultivated			
Flat, 0 ≤ slope < 5%	0.30	0.50	0.60
Rolling, 5 ≤ slope < 10%	0.40	0.60	0.70
Hilly, 10 ≤ slope ≤ 30%	0.52	0.72	0.82

C Value for Urban Area	
Character of Surface	**Runoff Coefficient, *C***
Business	
Downtown	0.70 to 0.95
Neighborhood	0.50 to 0.70
Residential	
Single-Family	0.30 to 0.50
Multi-Units, Detached	0.40 to 0.60
Multi-Units, Attached	0.60 to 0.75
Residential Suburban	0.25 to 0.40
Apartment	0.50 to 0.70
Industrial	
Light	0.50 to 0.80
Heavy	0.60 to 0.90
Park, Lawn, Cemetery, Grassy Area	0.10 to 0.25
Railroad Yard	0.20 to 0.35
Unimproved	0.10 to 0.30
Pavement	
Asphalt or Concrete	0.80 to 0.95
Brick	0.70 to 0.85
Other Impervious	0.75 to 0.95
Water Impoundment	1.00

RATIONAL-METHOD RUNOFF COEFFICIENT, *C*
Adapted from Indiana LTAP, 2008

Figure 202-2E

Back

NOAA Atlas 14, Volume 2, Version 3
Location name: Seymour, Indiana, US*
Latitude: 39.0140°, Longitude: -85.8751°
Elevation: 589 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.376 (0.341–0.418)	0.449 (0.406–0.499)	0.539 (0.486–0.599)	0.609 (0.548–0.677)	0.703 (0.627–0.780)	0.776 (0.687–0.862)	0.849 (0.745–0.945)	0.925 (0.803–1.04)	1.03 (0.877–1.16)	1.11 (0.931–1.26)
10-min	0.584 (0.529–0.649)	0.701 (0.634–0.779)	0.838 (0.755–0.931)	0.941 (0.846–1.05)	1.08 (0.958–1.19)	1.18 (1.04–1.31)	1.28 (1.12–1.42)	1.38 (1.20–1.54)	1.51 (1.29–1.71)	1.61 (1.36–1.83)
15-min	0.716 (0.649–0.796)	0.857 (0.775–0.953)	1.03 (0.927–1.14)	1.16 (1.04–1.29)	1.33 (1.18–1.47)	1.46 (1.29–1.62)	1.59 (1.39–1.77)	1.72 (1.49–1.92)	1.89 (1.61–2.13)	2.01 (1.69–2.29)
30-min	0.948 (0.858–1.05)	1.15 (1.04–1.28)	1.41 (1.27–1.57)	1.61 (1.45–1.79)	1.87 (1.67–2.08)	2.08 (1.84–2.31)	2.29 (2.01–2.55)	2.51 (2.18–2.80)	2.80 (2.38–3.15)	3.02 (2.54–3.43)
60-min	1.16 (1.05–1.29)	1.41 (1.27–1.57)	1.77 (1.59–1.97)	2.05 (1.84–2.27)	2.43 (2.17–2.70)	2.74 (2.43–3.05)	3.07 (2.69–3.41)	3.40 (2.95–3.80)	3.87 (3.30–4.36)	4.24 (3.57–4.82)
2-hr	1.37 (1.24–1.53)	1.66 (1.50–1.85)	2.10 (1.89–2.34)	2.46 (2.21–2.75)	2.98 (2.65–3.33)	3.41 (3.01–3.81)	3.88 (3.38–4.35)	4.39 (3.76–4.94)	5.13 (4.31–5.82)	5.74 (4.74–6.56)
3-hr	1.46 (1.33–1.65)	1.77 (1.60–1.99)	2.25 (2.03–2.53)	2.64 (2.37–2.96)	3.22 (2.85–3.61)	3.70 (3.25–4.15)	4.23 (3.66–4.75)	4.81 (4.10–5.41)	5.66 (4.71–6.42)	6.38 (5.19–7.28)
6-hr	1.77 (1.60–2.00)	2.15 (1.94–2.43)	2.73 (2.46–3.08)	3.21 (2.88–3.62)	3.93 (3.47–4.42)	4.54 (3.96–5.11)	5.20 (4.48–5.89)	5.94 (5.03–6.75)	7.03 (5.81–8.03)	7.96 (6.45–9.15)
12-hr	2.12 (1.92–2.37)	2.56 (2.31–2.86)	3.21 (2.89–3.59)	3.74 (3.36–4.18)	4.51 (4.01–5.04)	5.16 (4.55–5.76)	5.86 (5.09–6.55)	6.61 (5.67–7.42)	7.71 (6.49–8.72)	8.63 (7.15–9.83)
24-hr	2.53 (2.33–2.76)	3.04 (2.80–3.32)	3.79 (3.49–4.14)	4.40 (4.04–4.81)	5.29 (4.82–5.77)	6.03 (5.45–6.57)	6.81 (6.12–7.44)	7.66 (6.82–8.38)	8.88 (7.80–9.77)	9.89 (8.56–10.9)
2-day	3.01 (2.78–3.29)	3.61 (3.33–3.94)	4.46 (4.10–4.86)	5.14 (4.72–5.61)	6.11 (5.57–6.66)	6.90 (6.26–7.54)	7.72 (6.96–8.46)	8.60 (7.68–9.45)	9.83 (8.68–10.9)	10.8 (9.47–12.1)
3-day	3.23 (3.00–3.49)	3.86 (3.59–4.18)	4.75 (4.40–5.13)	5.47 (5.05–5.90)	6.47 (5.96–6.99)	7.29 (6.68–7.89)	8.16 (7.42–8.85)	9.07 (8.19–9.87)	10.3 (9.23–11.3)	11.4 (10.0–12.5)
4-day	3.44 (3.22–3.69)	4.12 (3.85–4.41)	5.04 (4.71–5.40)	5.79 (5.39–6.20)	6.84 (6.34–7.32)	7.69 (7.10–8.25)	8.59 (7.89–9.24)	9.53 (8.69–10.3)	10.9 (9.77–11.8)	11.9 (10.6–13.0)
7-day	4.11 (3.86–4.39)	4.89 (4.60–5.24)	5.93 (5.56–6.35)	6.75 (6.31–7.22)	7.87 (7.33–8.43)	8.76 (8.13–9.40)	9.67 (8.93–10.4)	10.6 (9.73–11.4)	11.9 (10.8–12.9)	12.9 (11.6–14.0)
10-day	4.69 (4.38–5.01)	5.58 (5.22–5.97)	6.72 (6.28–7.19)	7.62 (7.11–8.15)	8.84 (8.22–9.46)	9.81 (9.09–10.5)	10.8 (9.94–11.6)	11.8 (10.8–12.7)	13.1 (11.9–14.2)	14.1 (12.8–15.4)
20-day	6.44 (6.06–6.83)	7.62 (7.18–8.09)	9.02 (8.49–9.58)	10.1 (9.49–10.7)	11.5 (10.8–12.2)	12.6 (11.8–13.4)	13.7 (12.8–14.6)	14.8 (13.7–15.8)	16.2 (14.9–17.4)	17.3 (15.8–18.6)
30-day	7.93 (7.50–8.36)	9.34 (8.84–9.85)	10.9 (10.3–11.5)	12.1 (11.5–12.8)	13.8 (13.0–14.5)	15.0 (14.1–15.9)	16.2 (15.2–17.2)	17.4 (16.3–18.5)	19.0 (17.6–20.3)	20.2 (18.6–21.7)
45-day	10.0 (9.50–10.6)	11.8 (11.2–12.4)	13.6 (12.9–14.3)	15.0 (14.2–15.8)	16.8 (15.9–17.7)	18.2 (17.1–19.2)	19.5 (18.3–20.6)	20.8 (19.5–22.0)	22.4 (20.9–23.9)	23.7 (21.9–25.2)
60-day	11.9 (11.3–12.5)	14.0 (13.3–14.7)	16.0 (15.2–16.8)	17.6 (16.7–18.5)	19.6 (18.6–20.6)	21.1 (20.0–22.2)	22.6 (21.3–23.8)	23.9 (22.5–25.3)	25.6 (23.9–27.2)	26.9 (25.0–28.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

NOAA Atlas 14, Volume 2, Version 3
Location name: Seymour, Indiana, US*
Latitude: 39.0140°, Longitude: -85.8751°
Elevation: 589 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**4.51** (4.09–5.02)	**5.39** (4.87–5.99)	**6.47** (5.83–7.19)	**7.31** (6.58–8.12)	**8.44** (7.52–9.36)	**9.31** (8.24–10.3)	**10.2** (8.94–11.3)	**11.1** (9.64–12.4)	**12.3** (10.5–13.9)	**13.3** (11.2–15.1)
10-min	**3.50** (3.17–3.89)	**4.21** (3.80–4.67)	**5.03** (4.53–5.59)	**5.65** (5.08–6.27)	**6.45** (5.75–7.16)	**7.06** (6.25–7.84)	**7.67** (6.73–8.54)	**8.28** (7.19–9.26)	**9.07** (7.74–10.2)	**9.66** (8.13–11.0)
15-min	**2.86** (2.60–3.18)	**3.43** (3.10–3.81)	**4.11** (3.71–4.58)	**4.63** (4.16–5.14)	**5.31** (4.74–5.90)	**5.82** (5.16–6.47)	**6.35** (5.57–7.07)	**6.87** (5.96–7.68)	**7.55** (6.44–8.51)	**8.05** (6.78–9.16)
30-min	**1.90** (1.72–2.11)	**2.29** (2.07–2.55)	**2.82** (2.54–3.13)	**3.21** (2.89–3.57)	**3.75** (3.34–4.16)	**4.16** (3.69–4.62)	**4.59** (4.02–5.11)	**5.01** (4.35–5.61)	**5.59** (4.77–6.31)	**6.03** (5.08–6.86)
60-min	**1.16** (1.05–1.29)	**1.41** (1.27–1.57)	**1.77** (1.59–1.97)	**2.05** (1.84–2.27)	**2.43** (2.17–2.70)	**2.74** (2.43–3.05)	**3.07** (2.69–3.41)	**3.40** (2.95–3.80)	**3.87** (3.30–4.36)	**4.24** (3.57–4.82)
2-hr	**0.684** (0.619–0.764)	**0.830** (0.750–0.927)	**1.05** (0.946–1.17)	**1.23** (1.10–1.37)	**1.49** (1.32–1.66)	**1.71** (1.50–1.91)	**1.94** (1.69–2.17)	**2.20** (1.88–2.47)	**2.56** (2.15–2.91)	**2.87** (2.37–3.28)
3-hr	**0.487** (0.441–0.548)	**0.590** (0.533–0.663)	**0.749** (0.675–0.842)	**0.880** (0.790–0.987)	**1.07** (0.950–1.20)	**1.23** (1.08–1.38)	**1.41** (1.22–1.58)	**1.60** (1.36–1.80)	**1.89** (1.57–2.14)	**2.12** (1.73–2.42)
6-hr	**0.296** (0.268–0.334)	**0.359** (0.324–0.405)	**0.456** (0.410–0.515)	**0.537** (0.480–0.605)	**0.656** (0.580–0.739)	**0.757** (0.662–0.853)	**0.869** (0.747–0.983)	**0.991** (0.840–1.13)	**1.17** (0.970–1.34)	**1.33** (1.08–1.53)
12-hr	**0.176** (0.159–0.197)	**0.212** (0.192–0.237)	**0.266** (0.240–0.298)	**0.311** (0.279–0.347)	**0.375** (0.333–0.418)	**0.428** (0.377–0.478)	**0.486** (0.423–0.544)	**0.549** (0.471–0.616)	**0.640** (0.538–0.724)	**0.717** (0.593–0.816)
24-hr	**0.105** (0.097–0.115)	**0.127** (0.117–0.138)	**0.158** (0.145–0.173)	**0.184** (0.168–0.200)	**0.220** (0.201–0.240)	**0.251** (0.227–0.274)	**0.284** (0.255–0.310)	**0.319** (0.284–0.349)	**0.370** (0.325–0.407)	**0.412** (0.357–0.455)
2-day	**0.063** (0.058–0.068)	**0.075** (0.069–0.082)	**0.093** (0.085–0.101)	**0.107** (0.098–0.117)	**0.127** (0.116–0.139)	**0.144** (0.130–0.157)	**0.161** (0.145–0.176)	**0.179** (0.160–0.197)	**0.205** (0.181–0.226)	**0.226** (0.197–0.251)
3-day	**0.045** (0.042–0.048)	**0.054** (0.050–0.058)	**0.066** (0.061–0.071)	**0.076** (0.070–0.082)	**0.090** (0.083–0.097)	**0.101** (0.093–0.110)	**0.113** (0.103–0.123)	**0.126** (0.114–0.137)	**0.144** (0.128–0.157)	**0.158** (0.140–0.174)
4-day	**0.036** (0.034–0.038)	**0.043** (0.040–0.046)	**0.053** (0.049–0.056)	**0.060** (0.056–0.065)	**0.071** (0.066–0.076)	**0.080** (0.074–0.086)	**0.089** (0.082–0.096)	**0.099** (0.091–0.107)	**0.113** (0.102–0.123)	**0.124** (0.111–0.136)
7-day	**0.024** (0.023–0.026)	**0.029** (0.027–0.031)	**0.035** (0.033–0.038)	**0.040** (0.038–0.043)	**0.047** (0.044–0.050)	**0.052** (0.048–0.056)	**0.058** (0.053–0.062)	**0.063** (0.058–0.068)	**0.071** (0.064–0.077)	**0.077** (0.069–0.084)
10-day	**0.020** (0.018–0.021)	**0.023** (0.022–0.025)	**0.028** (0.026–0.030)	**0.032** (0.030–0.034)	**0.037** (0.034–0.039)	**0.041** (0.038–0.044)	**0.045** (0.041–0.048)	**0.049** (0.045–0.053)	**0.055** (0.050–0.059)	**0.059** (0.053–0.064)
20-day	**0.013** (0.013–0.014)	**0.016** (0.015–0.017)	**0.019** (0.018–0.020)	**0.021** (0.020–0.022)	**0.024** (0.023–0.026)	**0.026** (0.025–0.028)	**0.029** (0.027–0.030)	**0.031** (0.029–0.033)	**0.034** (0.031–0.036)	**0.036** (0.033–0.039)
30-day	**0.011** (0.010–0.012)	**0.013** (0.012–0.014)	**0.015** (0.014–0.016)	**0.017** (0.016–0.018)	**0.019** (0.018–0.020)	**0.021** (0.020–0.022)	**0.023** (0.021–0.024)	**0.024** (0.023–0.026)	**0.026** (0.024–0.028)	**0.028** (0.026–0.030)
45-day	**0.009** (0.009–0.010)	**0.011** (0.010–0.011)	**0.013** (0.012–0.013)	**0.014** (0.013–0.015)	**0.016** (0.015–0.016)	**0.017** (0.016–0.018)	**0.018** (0.017–0.019)	**0.019** (0.018–0.020)	**0.021** (0.019–0.022)	**0.022** (0.020–0.023)
60-day	**0.008** (0.008–0.009)	**0.010** (0.009–0.010)	**0.011** (0.011–0.012)	**0.012** (0.012–0.013)	**0.014** (0.013–0.014)	**0.015** (0.014–0.015)	**0.016** (0.015–0.017)	**0.017** (0.016–0.018)	**0.018** (0.017–0.019)	**0.019** (0.017–0.020)

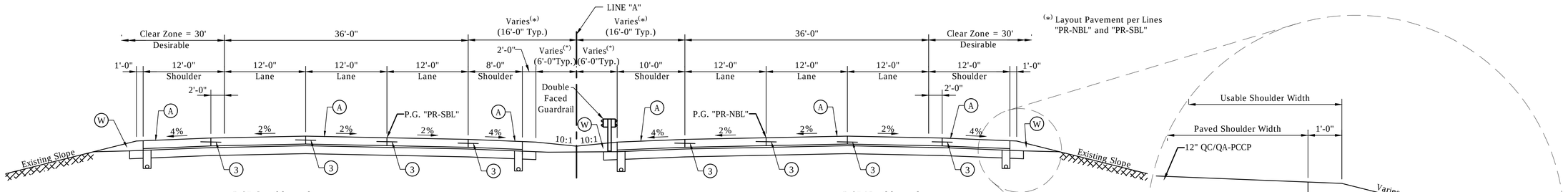
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

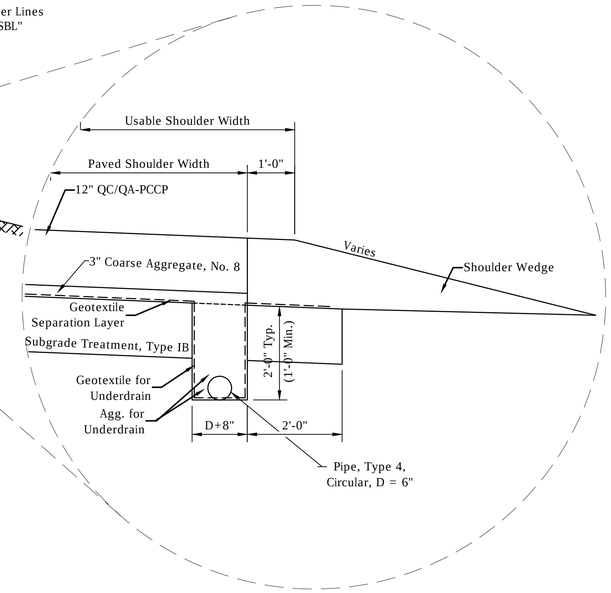


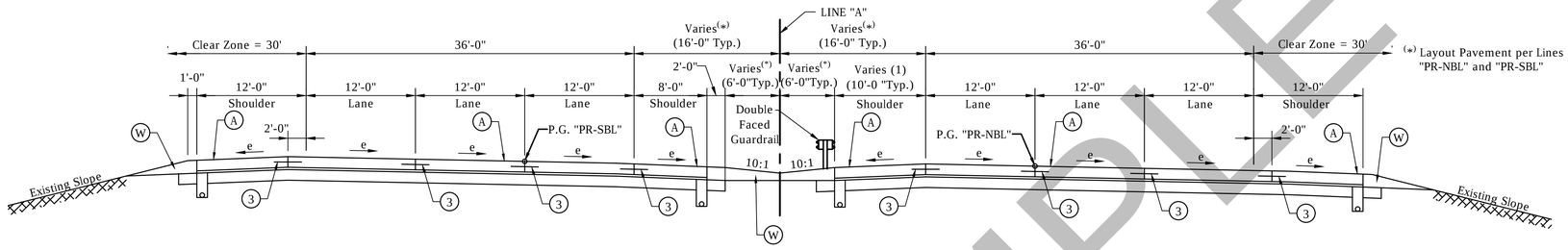
I-65 Southbound
2214+50.00 "A" to 2234+95.80 "A"
2253+92.59 "A" to 2267+36.47 "A"
2278+65.56 "A" to 2291+58.00 "A"
2330+92.00 "A" to 2381+36.00 "A"
2396+66.00 "A" to 2404+50.00 "A"

TYPICAL SECTION (RECONSTRUCTION)

2184+20.00 "A" to 2415+00.01 "A"

I-65 Northbound
2214+50.00 "A" to 2242+15.91 "A"
2253+48.42 "A" to 2267+02.64 "A"
2280+08.60 "A" to 2291+66.00 "A"
2331+36.00 "A" to 2381+36.00 "A"
2397+59.00 "A" to 2404+50.00 "A"



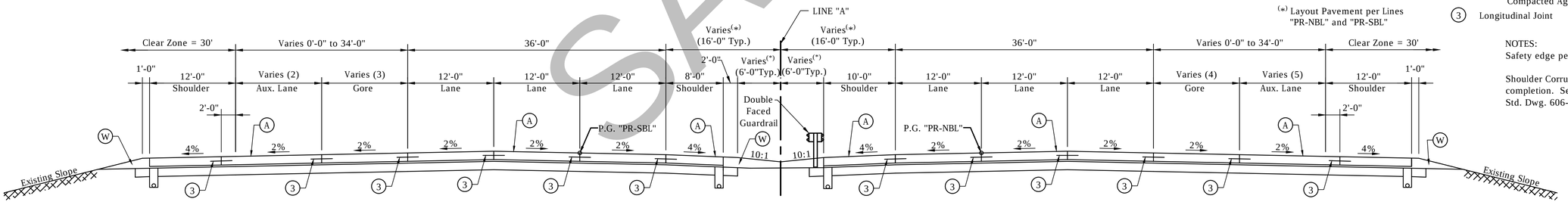


TYPICAL SUPERELEVATION SECTION

I-65 Southbound
2291+58.00 "A" to 2330+92.00 "A", e = 5.2% max. (Reverse Direction)
2381+36.00 "A" to 2396+66.00 "A", e = 3.0% max.

I-65 Northbound
2291+66.00 "A" to 2331+36.00 "A", e = 5.2% max. (Reverse Direction)
2381+36.00 "A" to 2397+59.00 "A", e = 2.8% max.

(1) 10' to 12' from 2291+16.00 to 2291+66.00 "A"
12' from 2291+66.00 to 2331+10.00 "A"
12' to 10' from 2331+10.00 to 2332+60.00 "A"



TYPICAL TANGENT SECTION - MAINLINE WITH AUXILIARY LANES

I-65 Southbound
2234+95.80 "A" to 2253+92.59 "A"
2267+36.47 "A" to 2278+65.56 "A"

(2) 0' to 12' from 2234+95.80 to 2237+95.80 "A"
14' from 2237+95.80 to 2250+21.90 "A"
(3) 0' to 20' from 2251+78.20 to 2253+92.59 "A"
20' to 0' from 2267+36.47 to 2271+27.67 "A"

I-65 Northbound
2242+15.91 "A" to 2253+48.42 "A"
2267+02.64 "A" to 2280+08.60 "A"

(4) 0' to 20' from 2249+67.02 to 2253+48.42 "A"
20' to 0' from 2267+02.64 to 2270+08.42 "A"
(5) 0' to 12' from 2242+15.91 to 2243+15.89 "A"
14' from 2243+15.89 to 2248+17.28 "A"

LEGEND

(A) Full Depth PCCP - Mainline and Shoulder
12" QC/QA-PCCP (15' D-1 Joint Spacing with 1.5" Dowel Bars at 1'-0" Center to Center) on
3" Coarse Aggregate, No. 8 on
Geotextile Separation Layer on
Subgrade Treatment, Type IB (14" Chemical Modification)

(K1) HMA for Approaches, Type B
165#/sys HMA, Surface, Type B on
495#/sys HMA, Intermediate, Type B on
4" Compacted Aggregate, No. 53, Base on
Subgrade Treatment, Type II

(W) Variable Depth Shoulder Wedge either:
Recycled Asphalt Pavement (RAP) or
Compacted Aggregate, No. 53

(3) Longitudinal Joint

NOTES:
Safety edge per Detail required.

Shoulder Corrugations to be installed at project completion. See Std. Dwg. 606-SHCG-02 (PCCP), Std. Dwg. 606-SHCG-03 (RAMP LIMITS)

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RECOMMENDED FOR APPROVAL
DESIGN ENGINEER DATE

DESIGNED: xxx DRAWN: xxx
CHECKED: xxx CHECKED: xxx

INDIANA DEPARTMENT OF TRANSPORTATION

I-65
TYPICAL SECTIONS

HORIZONTAL SCALE	BRIDGE FILE
1/8" = 1'-0"	
VERTICAL SCALE	DESIGNATION
1/8" = 1'-0"	0501212

SURVEY BOOK	SHEETS
	3 of 35
CONTRACT	PROJECT
SR-28940	0501212

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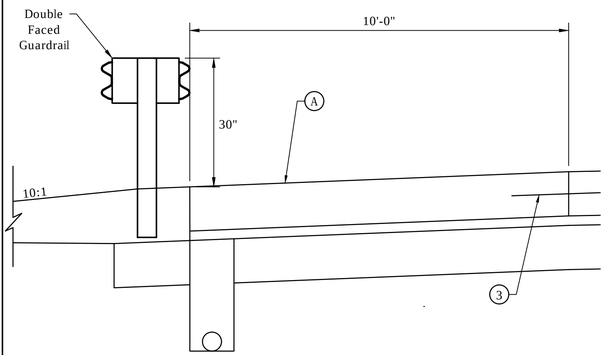
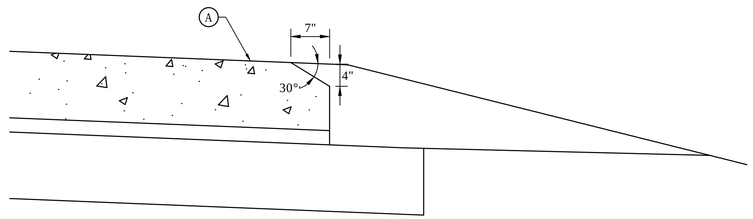
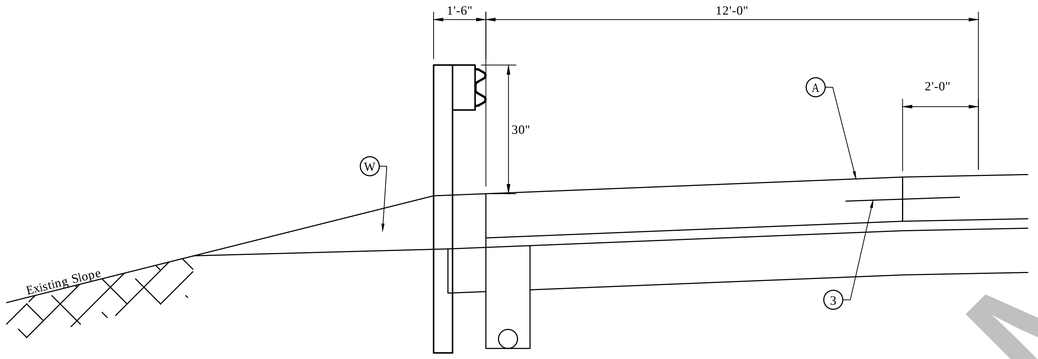


INSIDE SHOULDER WITH GUARDRAIL DETAIL

Northbound Shown; Reverse for Southbound

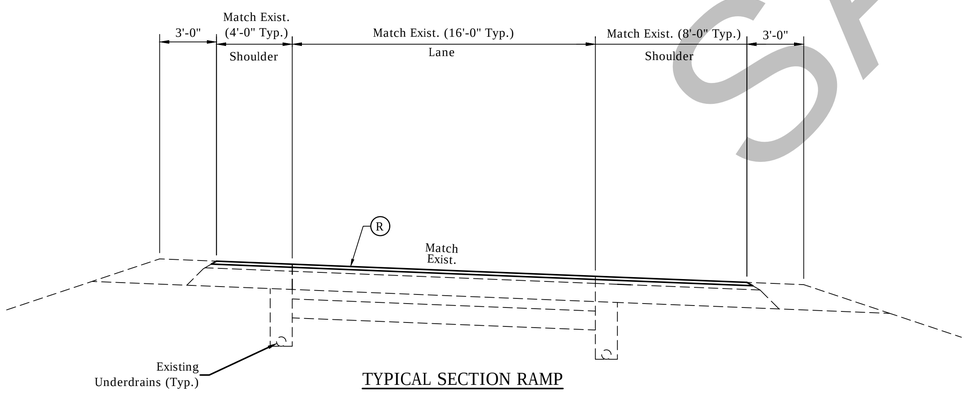


SAFETY EDGE DETAIL



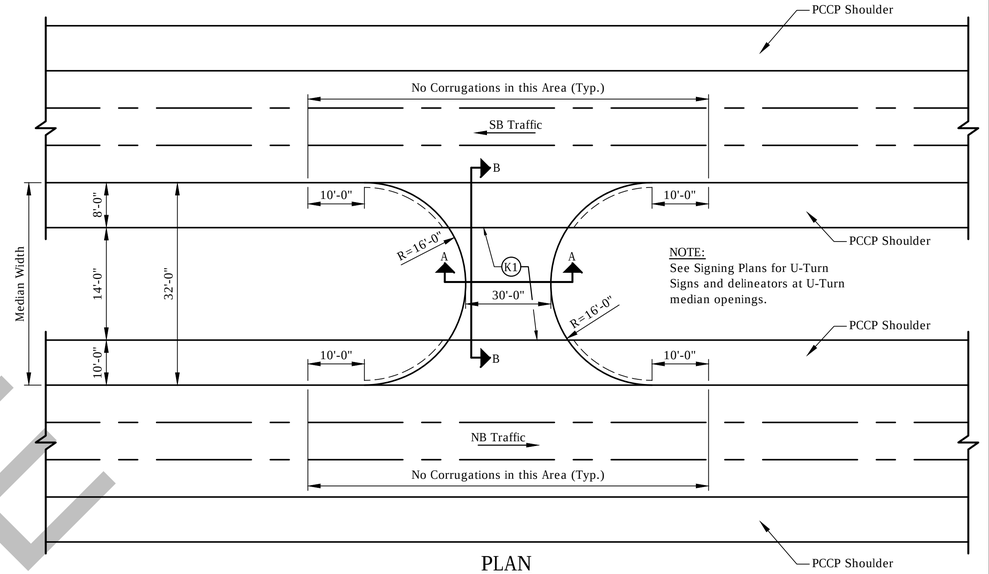
OUTSIDE SHOULDER WITH GUARDRAIL DETAIL

Southbound Shown; Reverse for Northbound



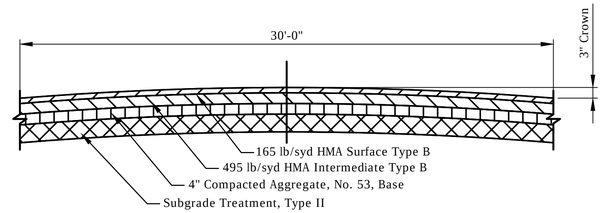
TYPICAL SECTION RAMP

No Alignments Provided for Stationing - See Locations in Construction Details



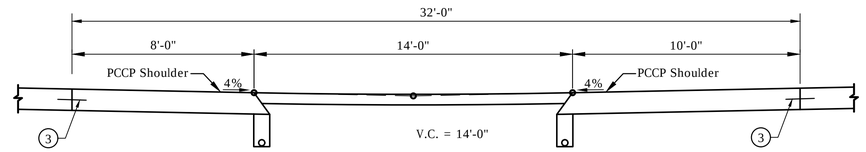
PLAN

N.T.S.



SECTION A-A

Vertical Scale Exaggerated for Clarity
N.T.S.



SECTION B-B

Vertical Scale Exaggerated for Clarity
N.T.S.

LEGEND

(A) Full Depth PCCP - Mainline and Shoulder
12" QC/QA-PCCP (15' D-1 Joint Spacing with 1.5" Dowel Bars at 1'-0" Center to Center) on
3" Coarse Aggregate, No. 8 on
Geotextile Separation Layer on
Subgrade Treatment, Type IB (14" Chemical Modification)

(K1) HMA for Approaches, Type B
165#/sys HMA, Surface, Type B on
495#/sys HMA, Intermediate, Type B on
4" Compacted Aggregate, No. 53, Base on
Subgrade Treatment, Type II

(W) Variable Depth Shoulder Wedge either:
Recycled Asphalt Pavement (RAP) or
Compacted Aggregate, No. 53

(3) Longitudinal Joint

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RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER _____ DATE

DESIGNED: xxx DRAWN: xxx

CHECKED: xxx CHECKED: xxx

INDIANA DEPARTMENT OF TRANSPORTATION

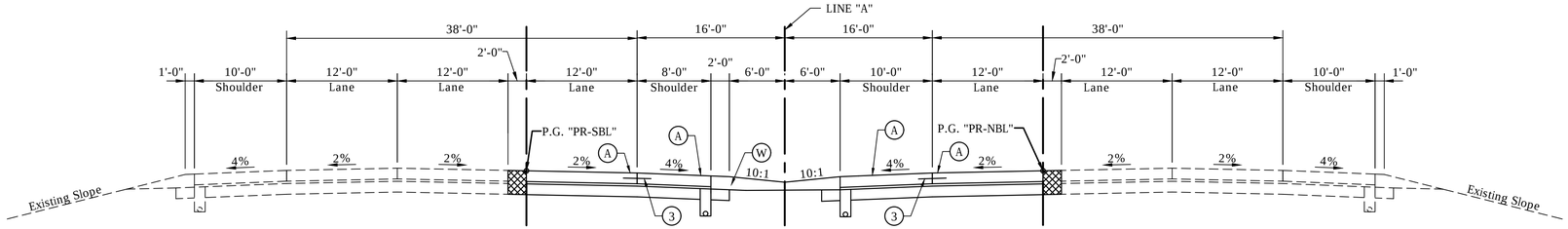
I-65

TYPICAL SECTIONS

HORIZONTAL SCALE	BRIDGE FILE
1/4" = 1'-0"	
VERTICAL SCALE	DESIGNATION
1/4" = 1'-0"	0501212

SURVEY BOOK	SHEETS
	4 of 35
CONTRACT	PROJECT
SR-28940	0501212

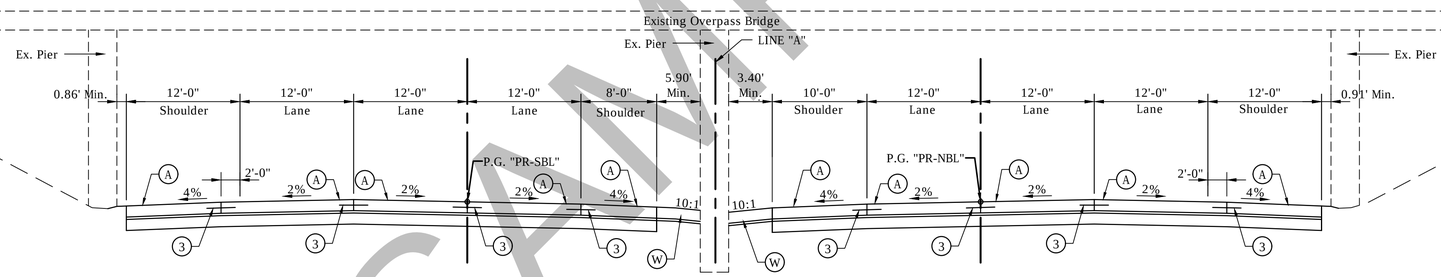
File Name: P:\C3D\17-465\Road\Dwg\Plans - Package B Begin to East Fork\TYPICALS.dwg Plot Date: 8/30/2018 Plotted By: Haefliger, Brian



I-65 Southbound
2530+20.00 "A" to 2537+00.00 "A"

TYPICAL TANGENT SECTION - INCIDENTAL CONSTRUCTION

I-65 Northbound
2530+20.00 "A" to 2537+00.00 "A"



I-65 Southbound
2556+47.66 "A" to 2556+99.98 "A"
2649+06.25 "A" to 2649+64.24 "A"
2840+56.25 "A" to 2841+11.41 "A"
2937+63.80 "A" to 2938+87.50 "A"

TYPICAL SECTION - AT OVERPASS BRIDGES

I-65 Northbound
2556+47.66 "A" to 2566+99.98 "A"
2649+06.25 "A" to 2649+64.24 "A"
2840+56.25 "A" to 2841+11.41 "A"
2937+63.80 "A" to 2938+87.50 "A"

LEGEND

(A) Full Depth PCCP - Mainline and Shoulder
12" QC/QA-PCCP (15' D-1 Joint Spacing with 1.5" Dowel Bars at 1'-0" Center to Center) on
3" Coarse Aggregate, No. 8 on
Geotextile Separation Layer on
Subgrade Treatment, Type IB (14" Chemical Modification)

(K1) HMA for Approaches, Type B
165#/sys HMA, Surface, Type B on
495#/sys HMA, Intermediate, Type B on
4" Compacted Aggregate, No. 53, Base on
Subgrade Treatment, Type II

(W) Variable Depth Shoulder Wedge either:
Recycled Asphalt Pavement (RAP) or
Compacted Aggregate, No. 53

(3) Longitudinal Joint

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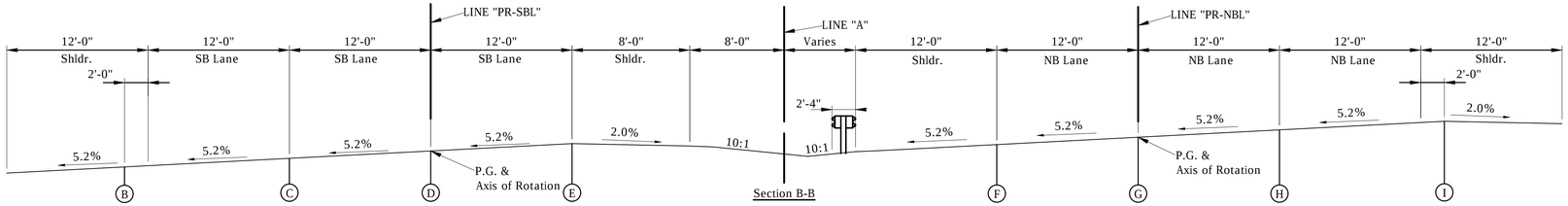
DESIGNED: BSH DRAWN: MAC
CHECKED: BJP CHECKED: BJP

INDIANA
DEPARTMENT OF TRANSPORTATION

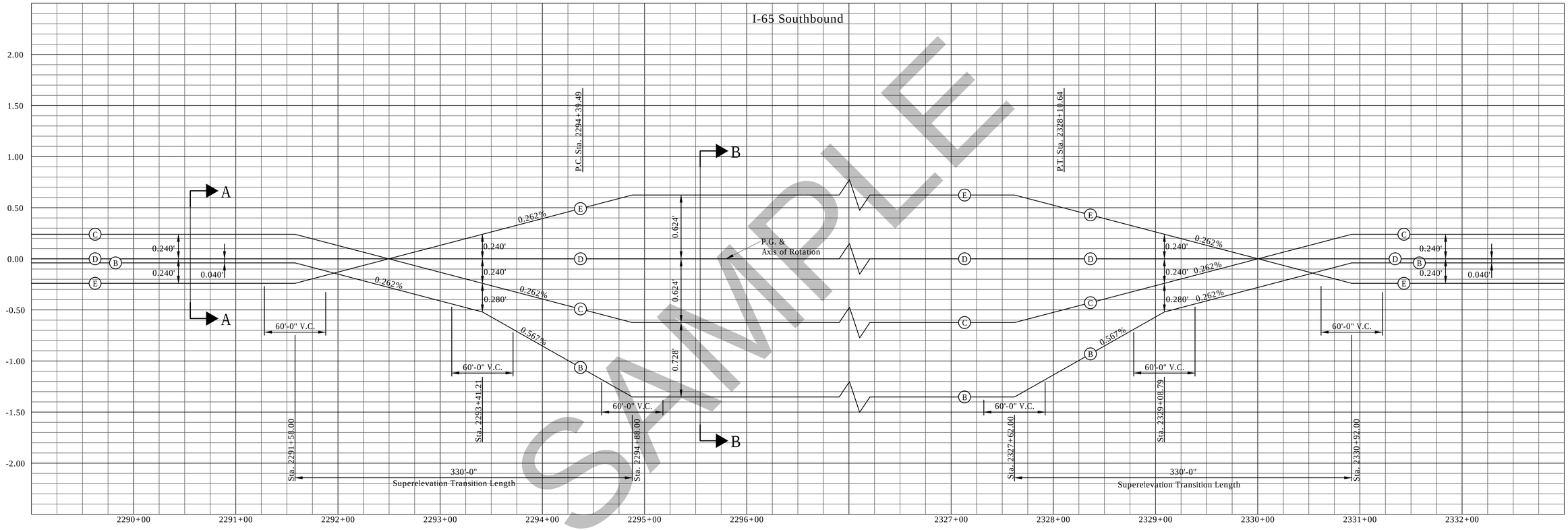
I-65
TYPICAL SECTIONS

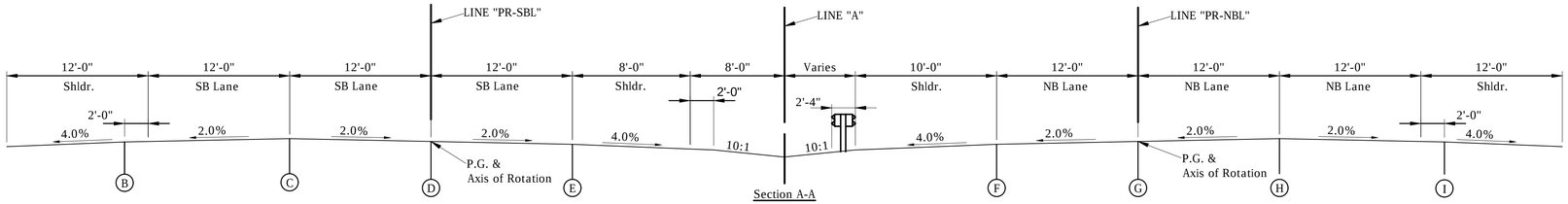
HORIZONTAL SCALE	BRIDGE FILE
1/8" = 1'-0"	
VERTICAL SCALE	DESIGNATION
1/8" = 1'-0"	0501212
SURVEY BOOK	SHEETS
	---- of 35
CONTRACT	PROJECT
SR-28940	0501212



Section B-B

I-65 LINE "A" - SUPERELEVATION SECTION
NOT TO SCALE
SE = 5.20%





Section A-A

I-65 LINE "A" - TANGENT SECTION

CURVE DATA
P.I. Sta. 2312+45.26 Line "PR-SBL"
R=3,797.00'
SE=5.20%
Design Speed=70 M.P.H.

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RECOMMENDED FOR APPROVAL
DESIGN ENGINEER DATE

DESIGNED: CAS
DRAWN: MAC
CHECKED: BJP
CHECKED: BJP

INDIANA
DEPARTMENT OF TRANSPORTATION

I-65 SUPERELEVATION
LINE "PR-SBL"

HORIZONTAL SCALE	BRIDGE FILE
1" = 50'-0"	
VERTICAL SCALE	DESIGNATION
1" = 0.5'	0501212
SURVEY BOOK	SHEETS
	32 of 35
CONTRACT	PROJECT
SR-28940	0501212

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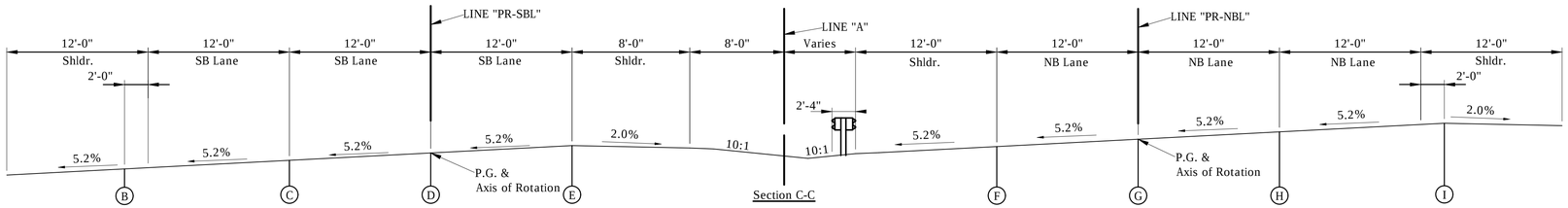
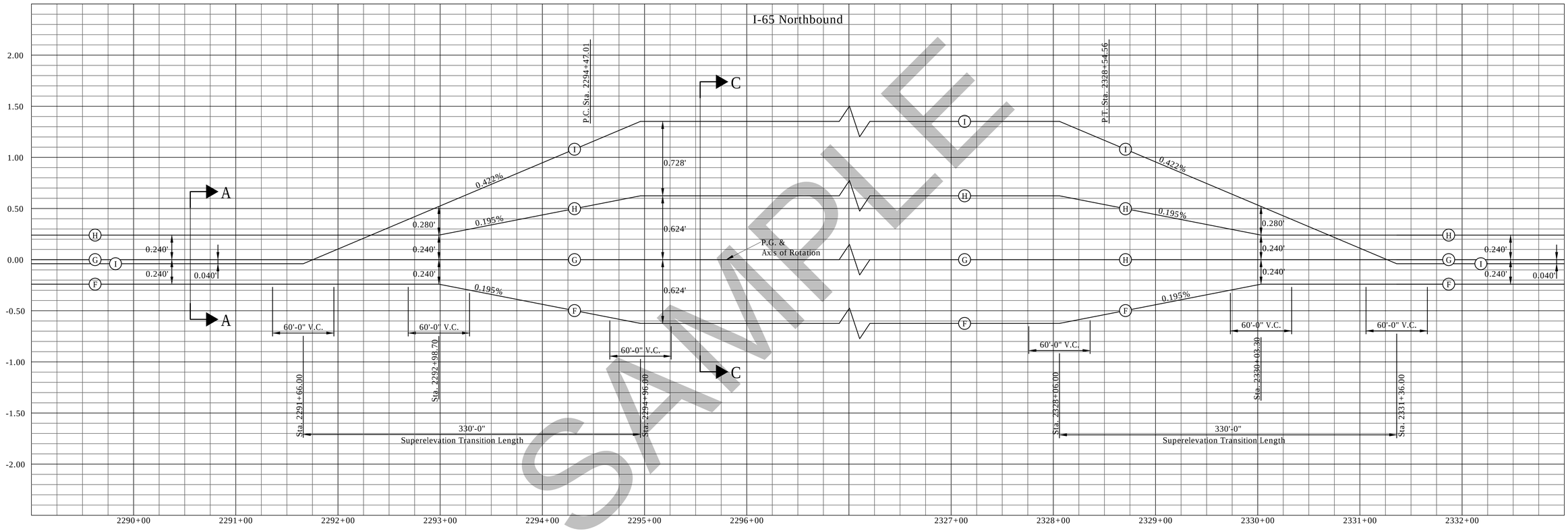
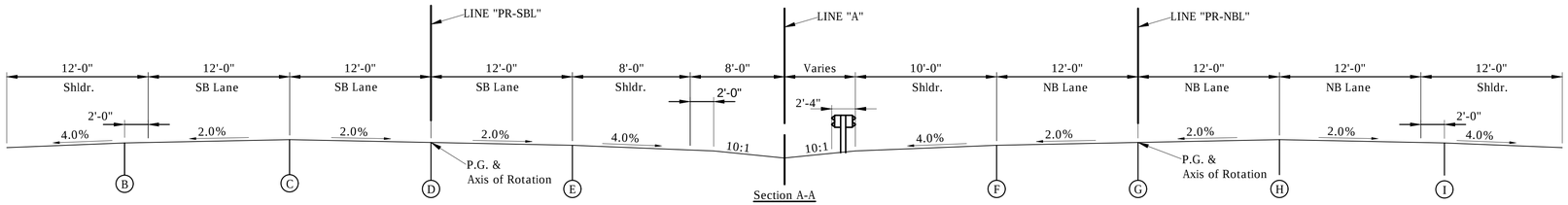


Section C-C

I-65 LINE "A" - SUPERELEVATION SECTION
NOT TO SCALE
SE = 5.20%





Section A-A

I-65 LINE "A" - TANGENT SECTION
NOT TO SCALE

CURVE DATA
P.I. Sta. 2312+72.29 Line "PR-NBL"
R=3,838.00'
SE=5.20%
Design Speed=70 M.P.H.

File Name: P:\C3D\17-465\Road\Dwg\Plans - Package B Begin to East Fork\Superelevation Details.dwg Plot Date: 8/30/2018 Plotted By: Haefliger, Brian

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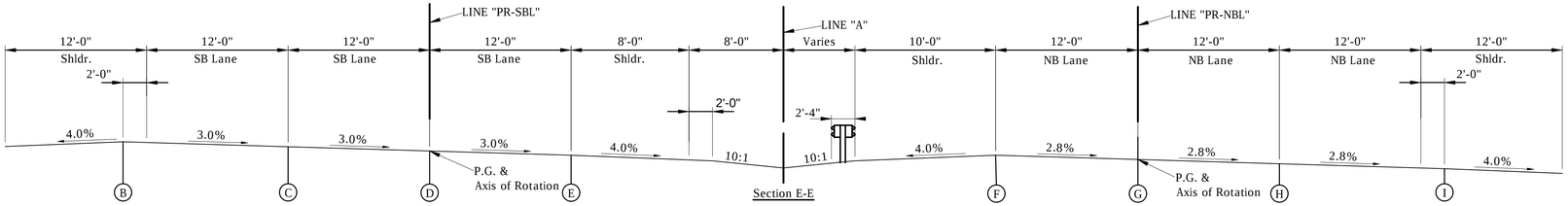
DESIGN ENGINEER — DATE

DESIGNED: CAS — DRAWN: MAC
CHECKED: BJP — CHECKED: BJP

INDIANA
DEPARTMENT OF TRANSPORTATION

I-65 SUPERELEVATION
LINE "PR-NBL"

HORIZONTAL SCALE	BRIDGE FILE
1" = 50'-0"	
VERTICAL SCALE	DESIGNATION
1" = 0.5'	0501212
SURVEY BOOK	SHEETS
	33 of 35
CONTRACT	PROJECT
SR-28940	0501212

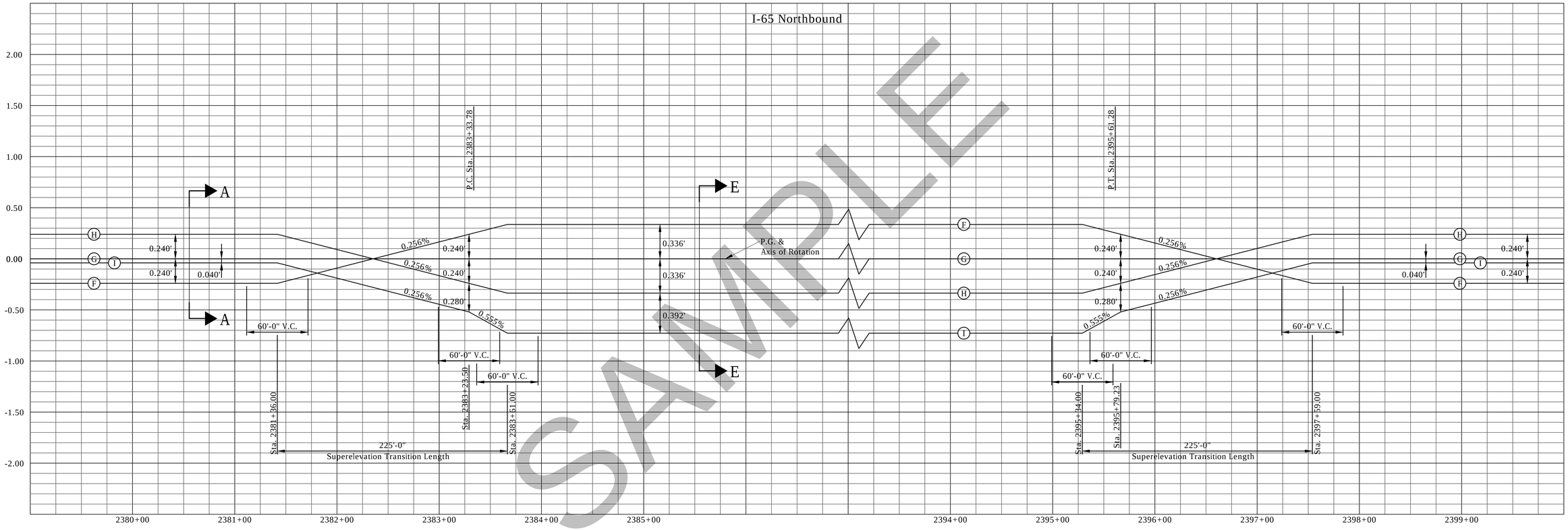


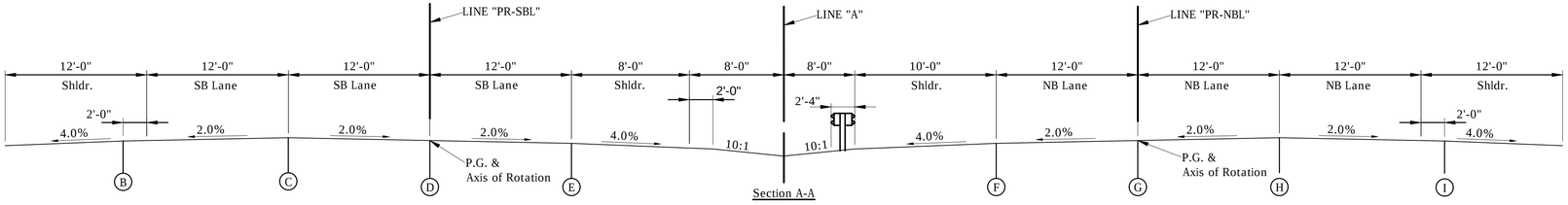
Section E-E

I-65 LINE "A" - SUPERELEVATION SECTION

NOT TO SCALE

SE = 2.80%





Section A-A

I-65 LINE "A" - TANGENT SECTION

CURVE DATA
P.I. Sta. 2389+48.80 Line "PR-NBL"
R=7,802.00'
SE=2.80%
Design Speed=70 M.P.H.

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DESIGN ENGINEER DATE

DESIGNED: CAS DRAWN: MAC
CHECKED: BJP CHECKED: BJP

INDIANA DEPARTMENT OF TRANSPORTATION

I-65 SUPERELEVATION
LINE "PR-NBL"

HORIZONTAL SCALE	BRIDGE FILE
1" = 50'-0"	
VERTICAL SCALE	DESIGNATION
1" = 0.5'	0501212

SURVEY BOOK	SHEETS
	34 of 35
CONTRACT	PROJECT
SR-28940	0501212

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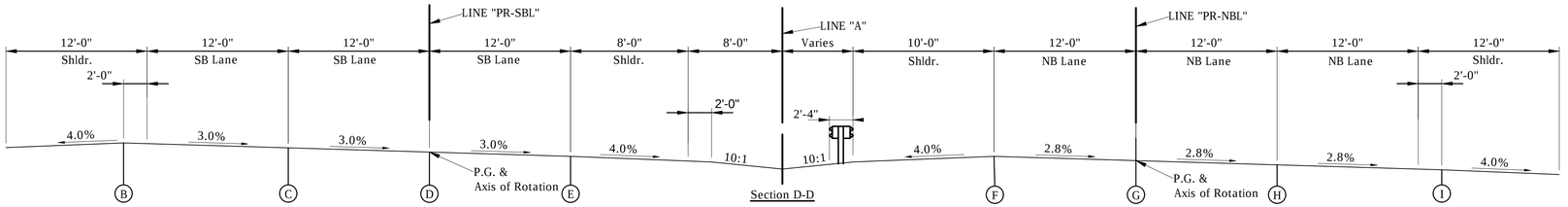
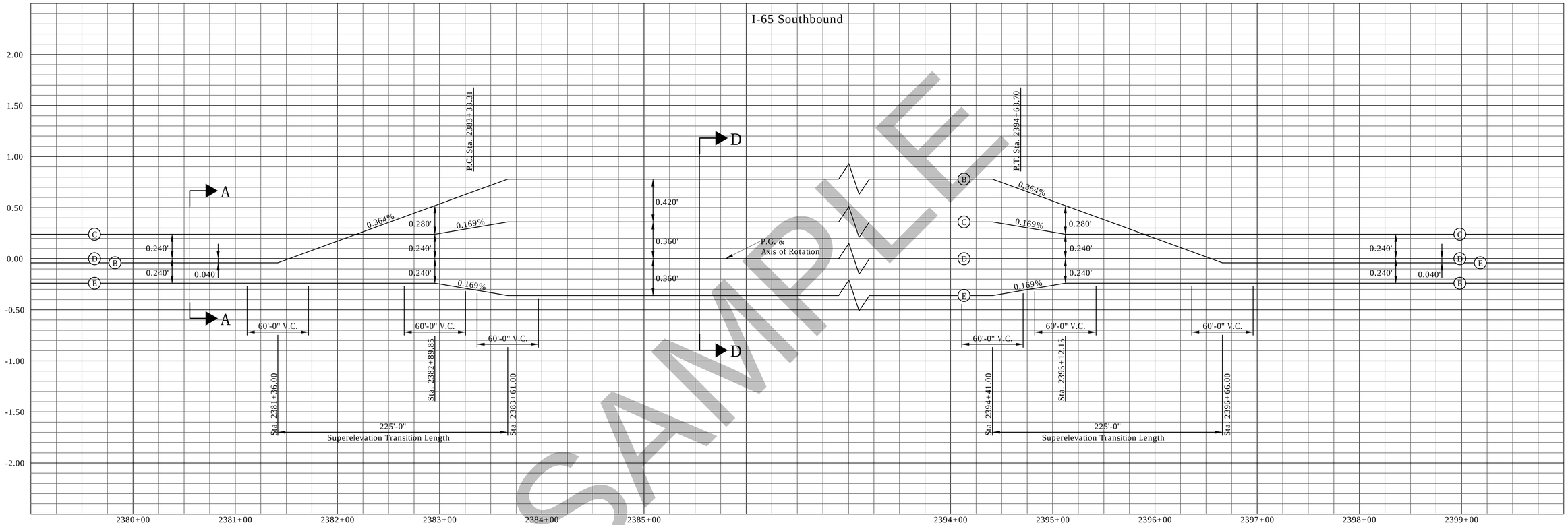


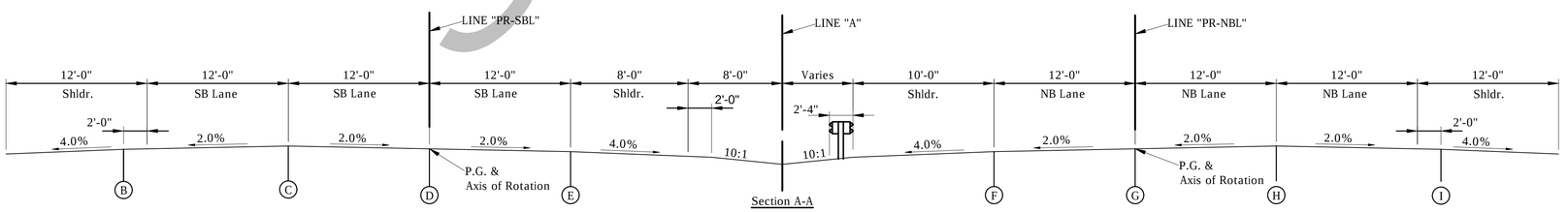
Section D-D

I-65 LINE "A" - SUPERELEVATION SECTION

NOT TO SCALE

SE = 3.00%





Section A-A

I-65 LINE "A" - TANGENT SECTION

CURVE DATA

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SE=3.00%
Design Speed=70 M.P.H.

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I-65 SUPERELEVATION
LINE "PR-SBL"

HORIZONTAL SCALE	BRIDGE FILE
1" = 50'-0"	
VERTICAL SCALE	DESIGNATION
1" = 0.5'	0501212
SURVEY BOOK	SHEETS
	35 of 35
CONTRACT	PROJECT
SR-28940	0501212

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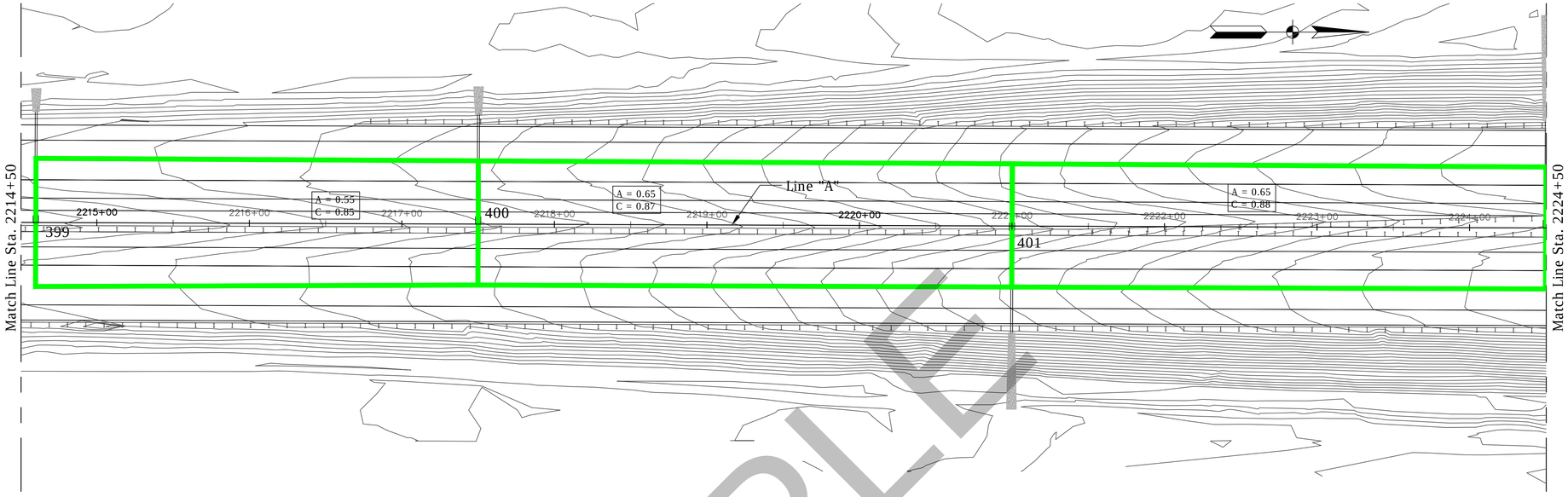

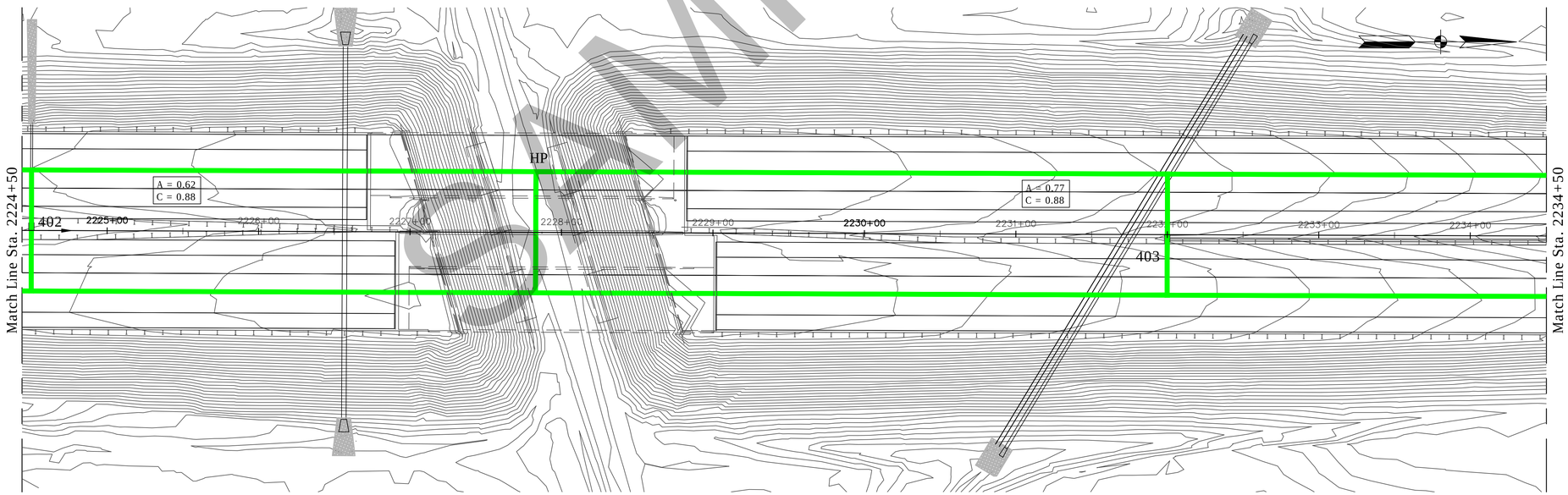

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MEDIAN DRAINAGE BASIN DELINEATION

HORIZONTAL SCALE	BRIDGE FILE
1"=20'	
VERTICAL SCALE	DESIGNATION
N/A	---
SURVEY BOOK	SHEETS
	#### of ----
CONTRACT	PROJECT
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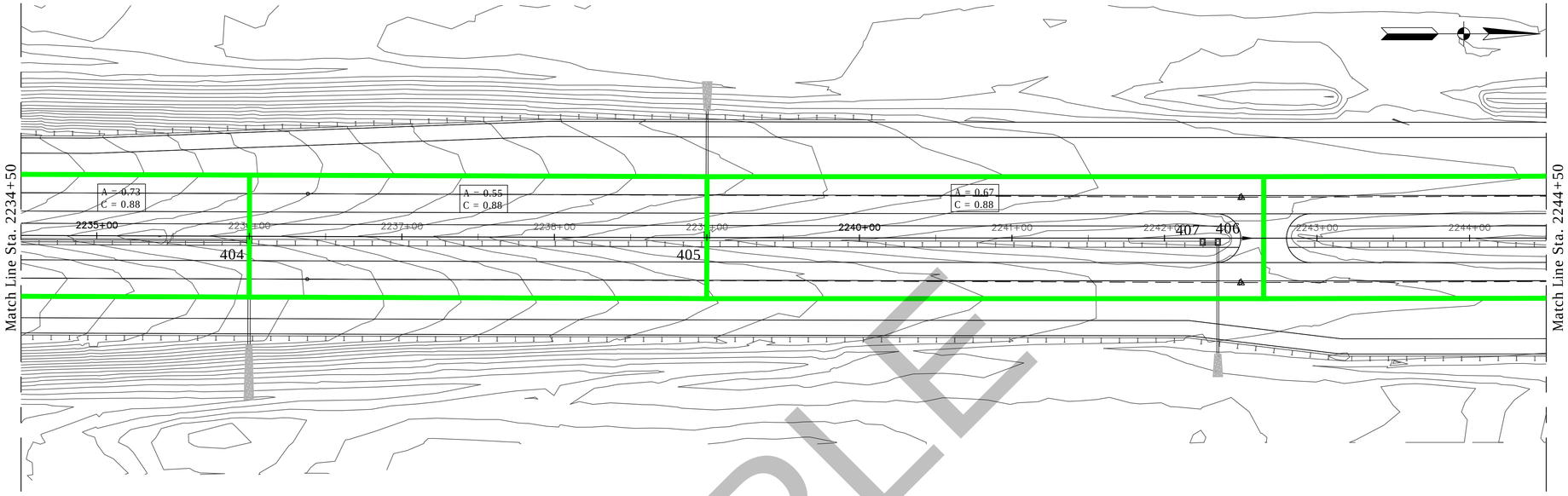

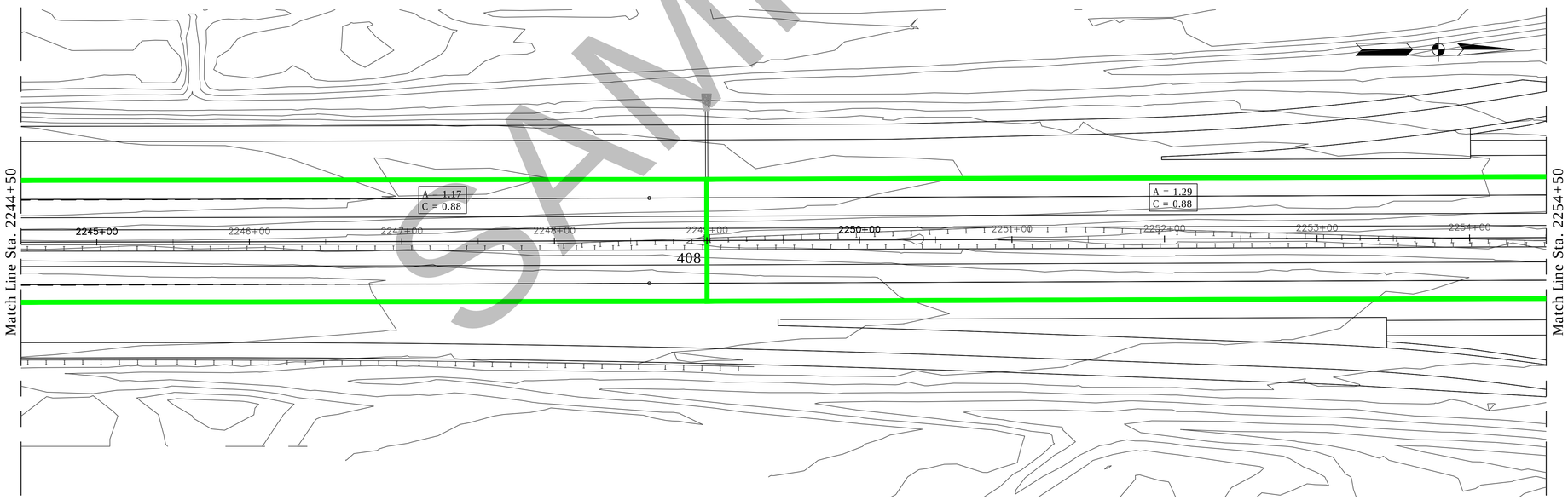

SCOPE COMPLIANCE SUBMITTAL

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INDIANA DEPARTMENT OF TRANSPORTATION

MEDIAN DRAINAGE BASIN DELINEATION

HORIZONTAL SCALE	BRIDGE FILE
1"=20'	
VERTICAL SCALE	DESIGNATION
N/A	---
SURVEY BOOK	SHEETS
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CONTRACT	PROJECT
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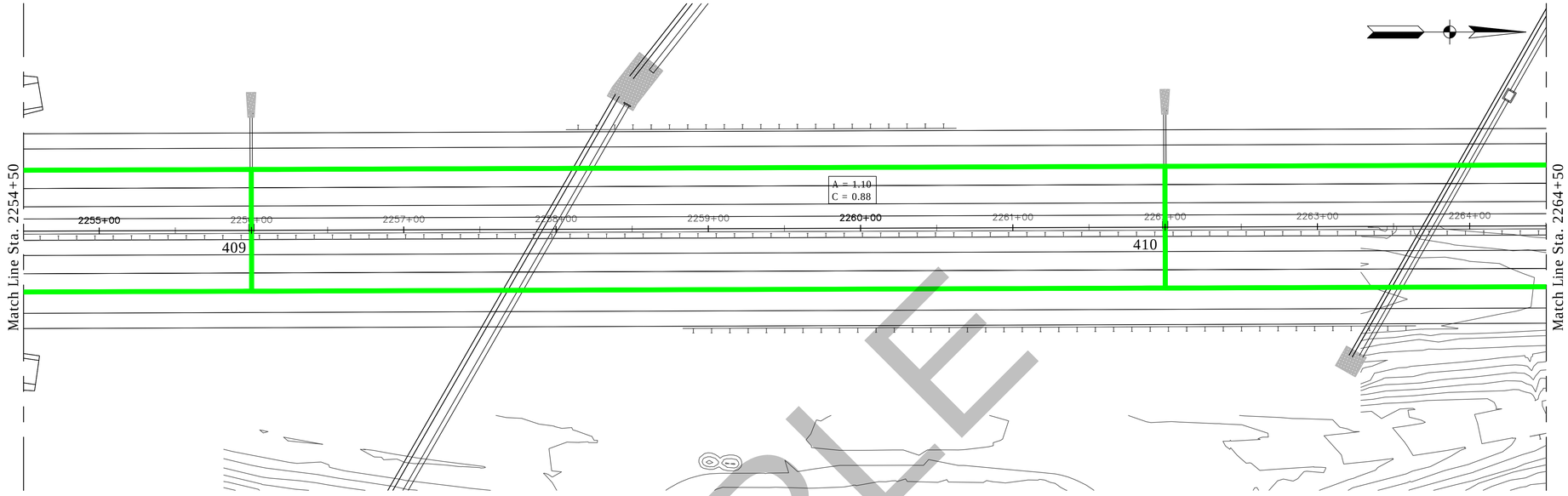

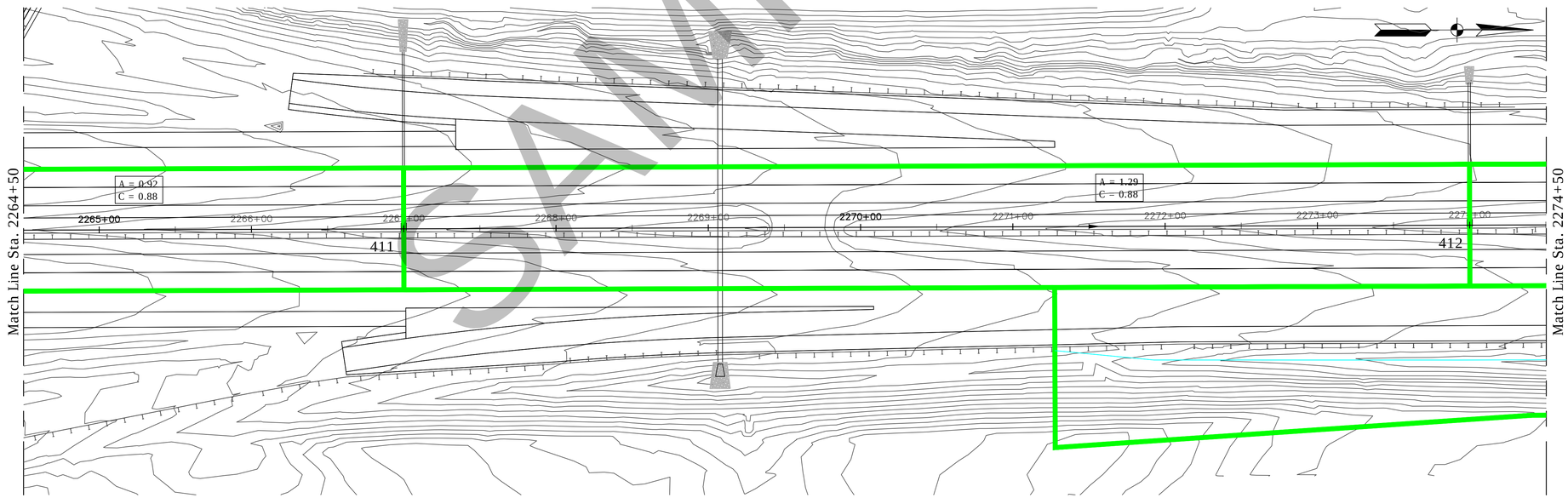

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SCOPE COMPLIANCE SUBMITTAL

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INDIANA DEPARTMENT OF TRANSPORTATION

MEDIAN DRAINAGE BASIN DELINEATION

HORIZONTAL SCALE	BRIDGE FILE
1"=20'	
VERTICAL SCALE	DESIGNATION
N/A	---
SURVEY BOOK	SHEETS
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CONTRACT	PROJECT
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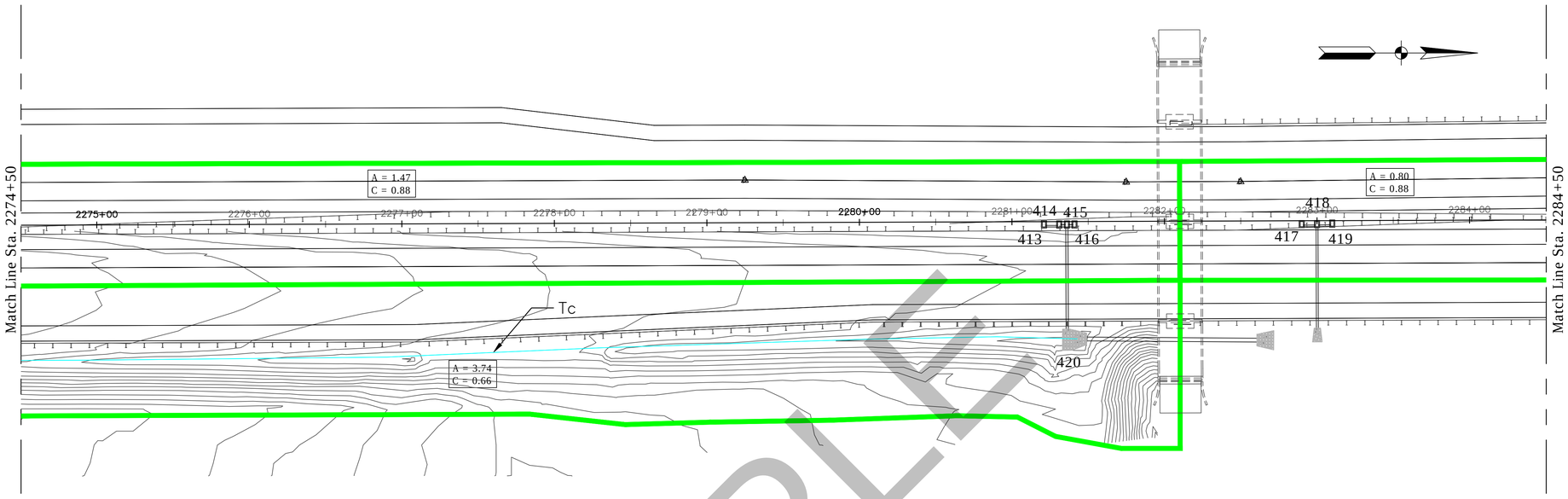

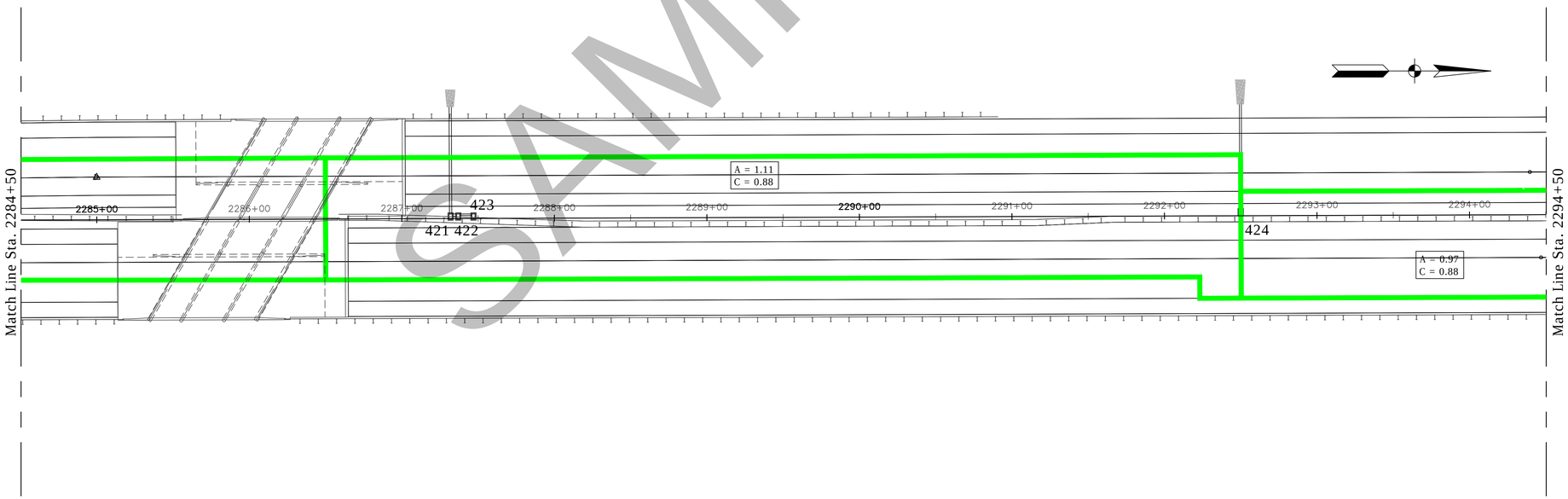

SCOPE COMPLIANCE SUBMITTAL

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DESIGNED: ---- DRAWN: ----

CHECKED: ---- CHECKED: ----

INDIANA
DEPARTMENT OF TRANSPORTATION

MEDIAN DRAINAGE BASIN
DELINEATION

HORIZONTAL SCALE	BRIDGE FILE
1"=20'	
VERTICAL SCALE	DESIGNATION
N/A	---
SURVEY BOOK	SHEETS
	#### of ----
CONTRACT	PROJECT
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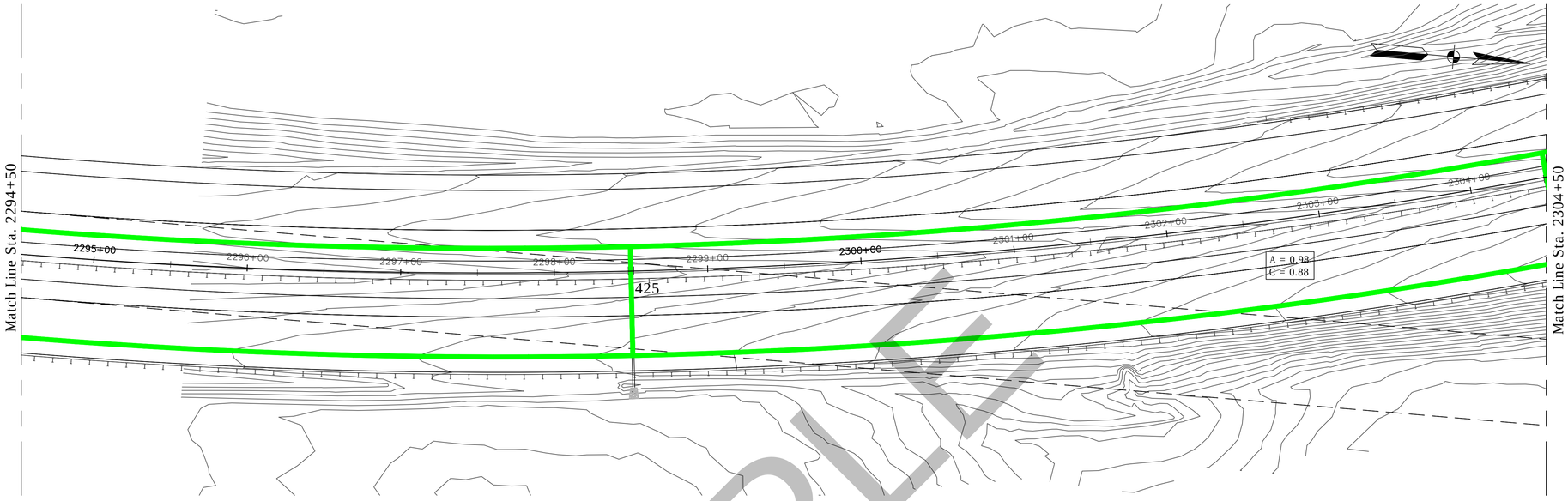

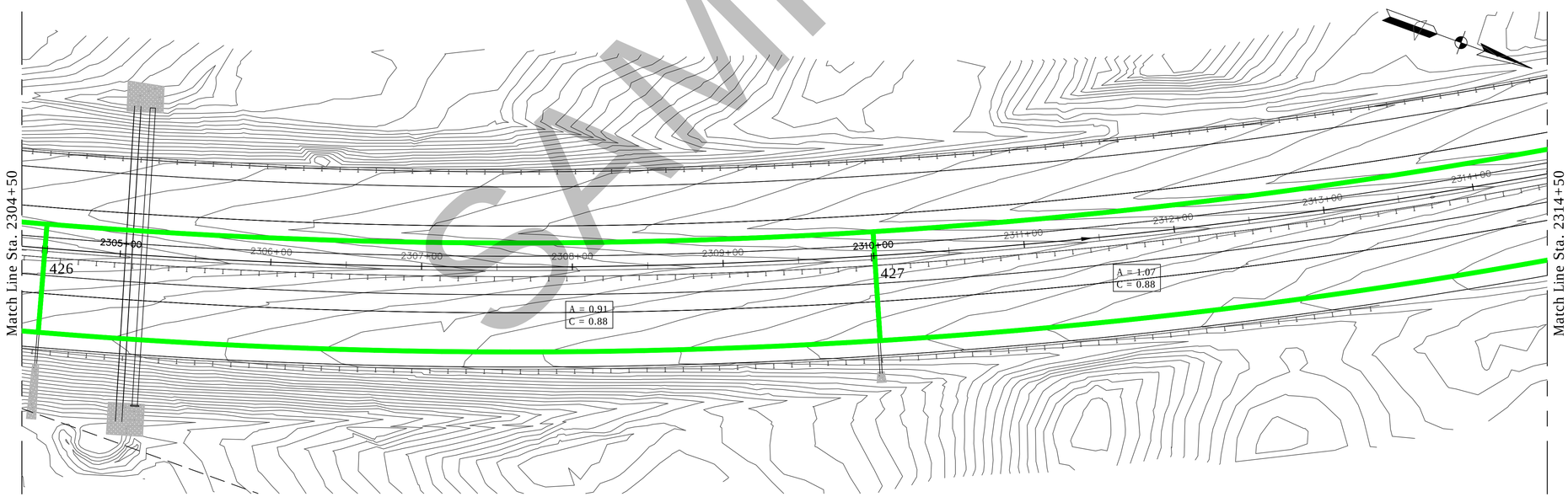

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INDIANA DEPARTMENT OF TRANSPORTATION

MEDIAN DRAINAGE BASIN DELINEATION

HORIZONTAL SCALE	BRIDGE FILE
1"=20'	
VERTICAL SCALE	DESIGNATION
N/A	---
SURVEY BOOK	SHEETS
	#### of ----
CONTRACT	PROJECT
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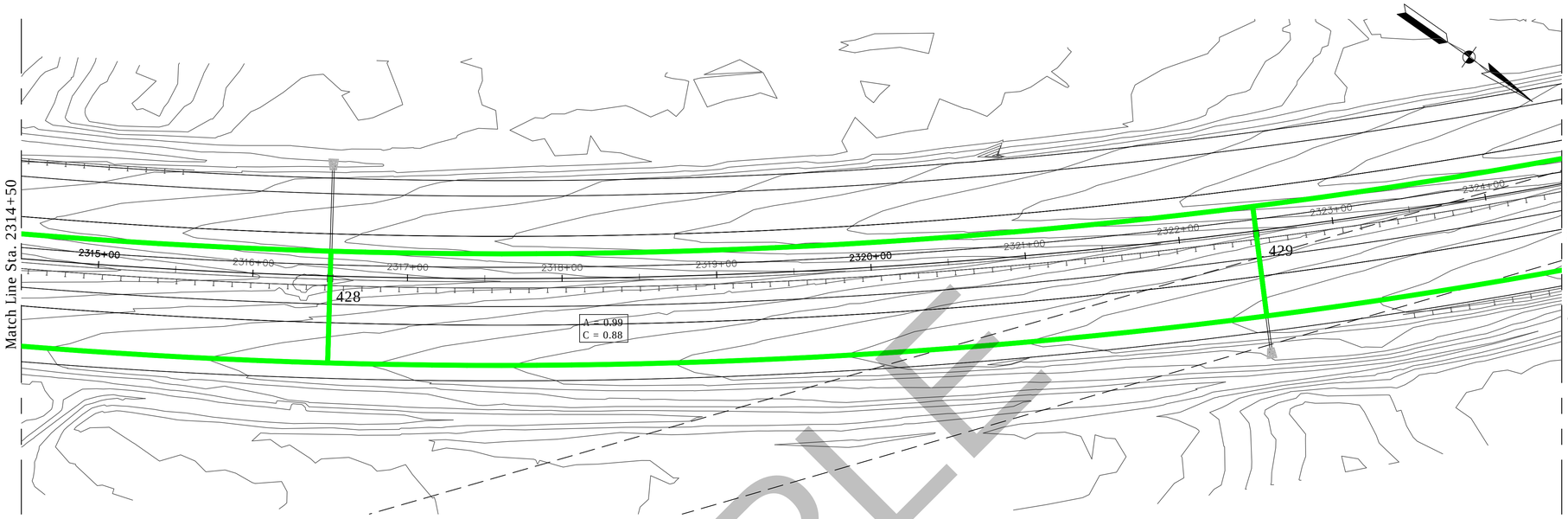

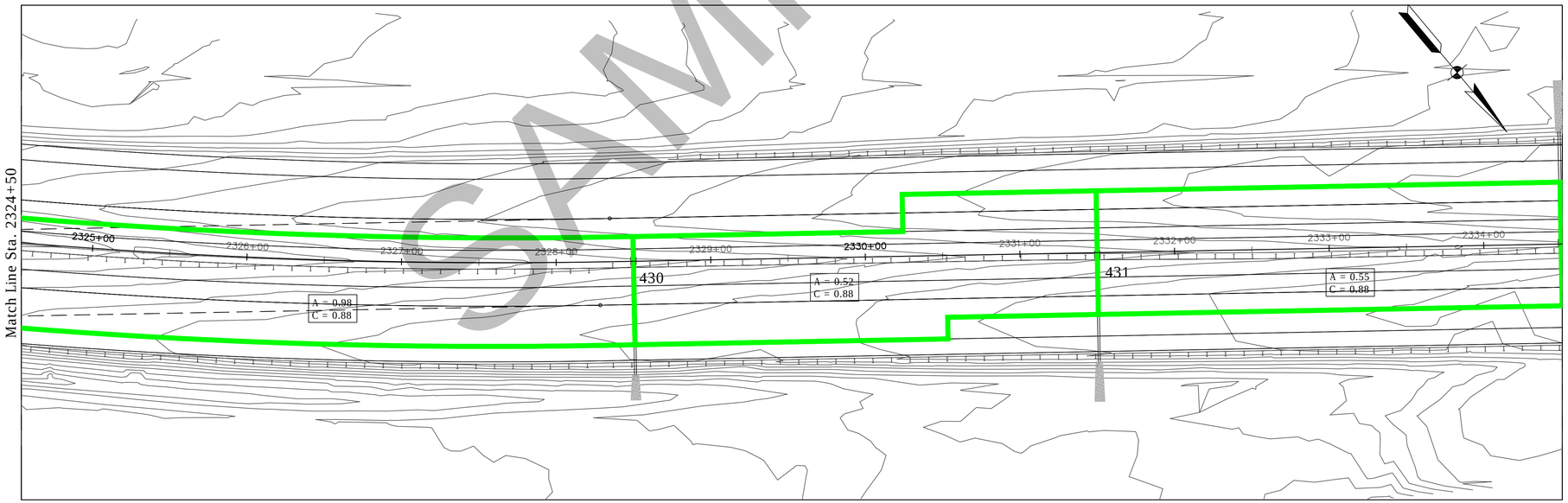

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INDIANA DEPARTMENT OF TRANSPORTATION

MEDIAN DRAINAGE BASIN DELINEATION

HORIZONTAL SCALE	BRIDGE FILE
1"=20'	
VERTICAL SCALE	DESIGNATION
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SURVEY BOOK	SHEETS
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CONTRACT	PROJECT
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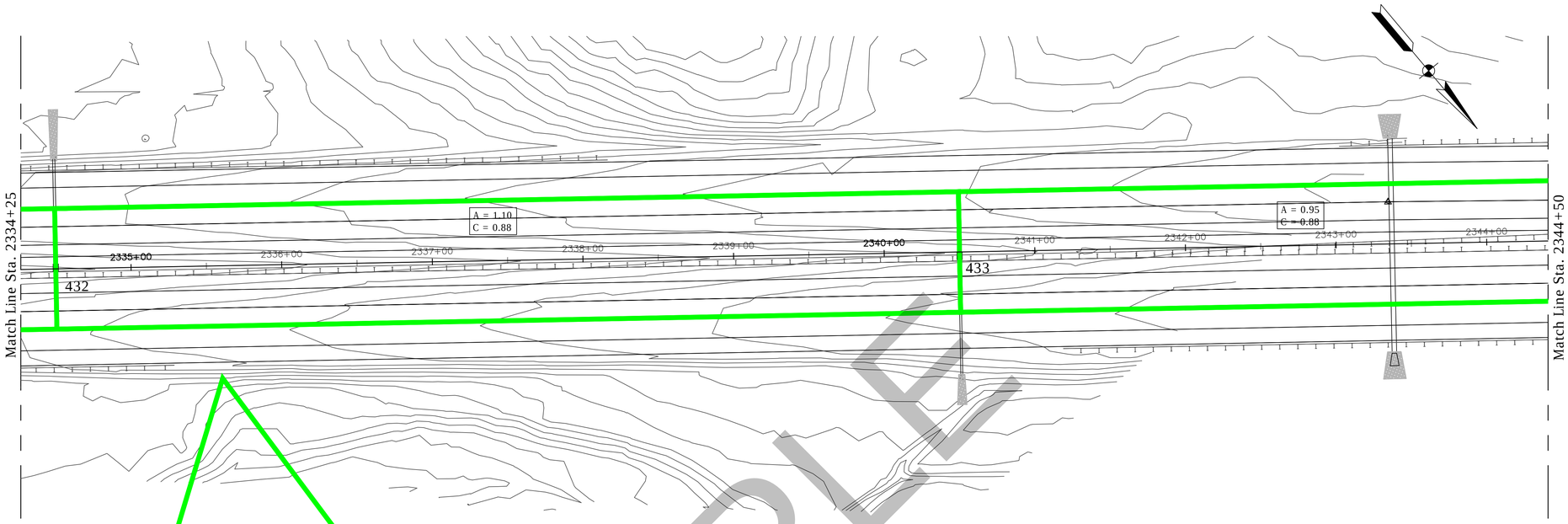

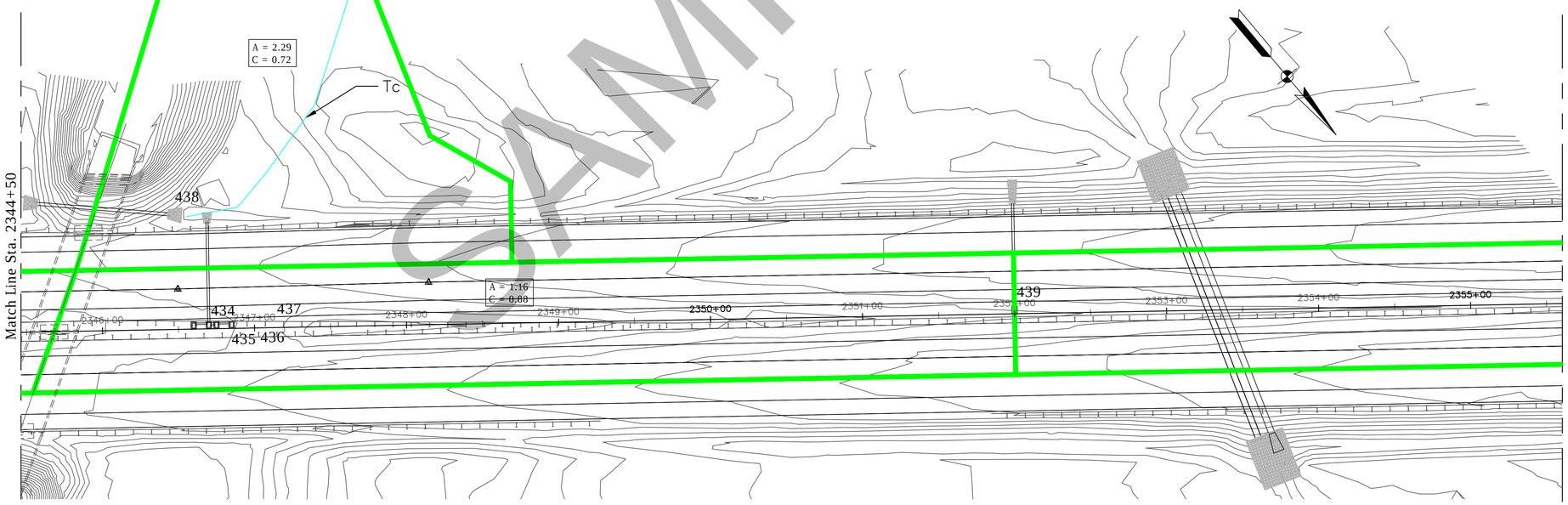

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MEDIAN DRAINAGE BASIN DELINEATION

HORIZONTAL SCALE	BRIDGE FILE
1"=20'	
VERTICAL SCALE	DESIGNATION
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SURVEY BOOK	SHEETS
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CONTRACT	PROJECT
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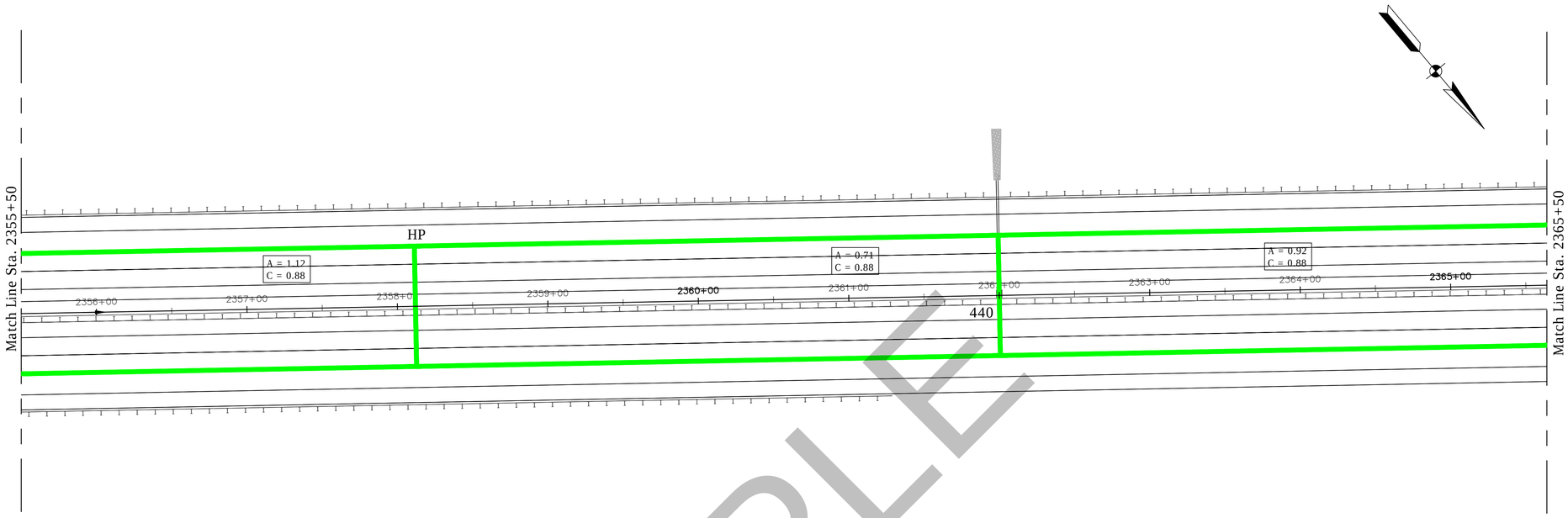

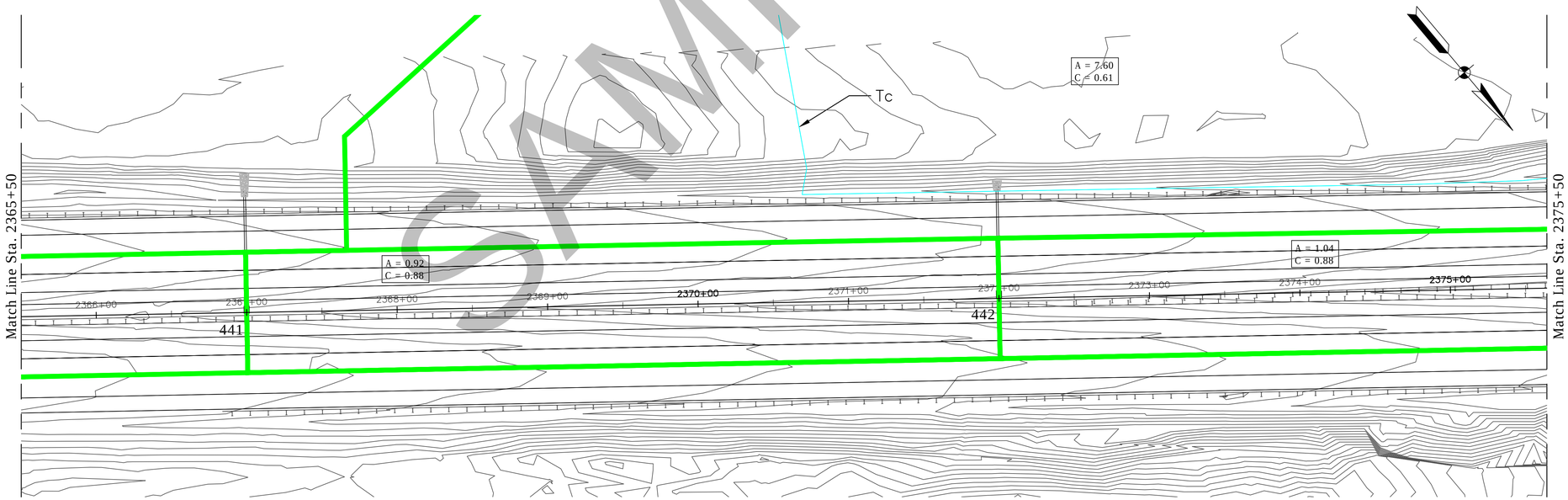

SCOPE COMPLIANCE SUBMITTAL

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MEDIAN DRAINAGE BASIN DELINEATION

HORIZONTAL SCALE	BRIDGE FILE
1"=20'	
VERTICAL SCALE	DESIGNATION
N/A	---
SURVEY BOOK	SHEETS
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CONTRACT	PROJECT
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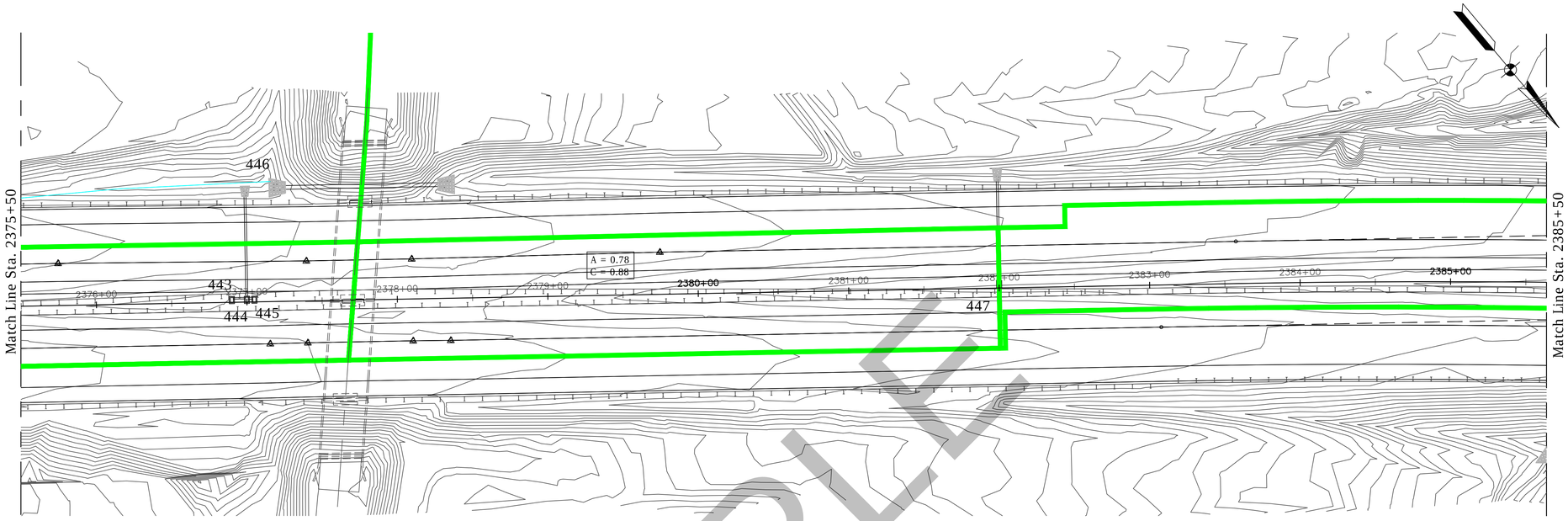

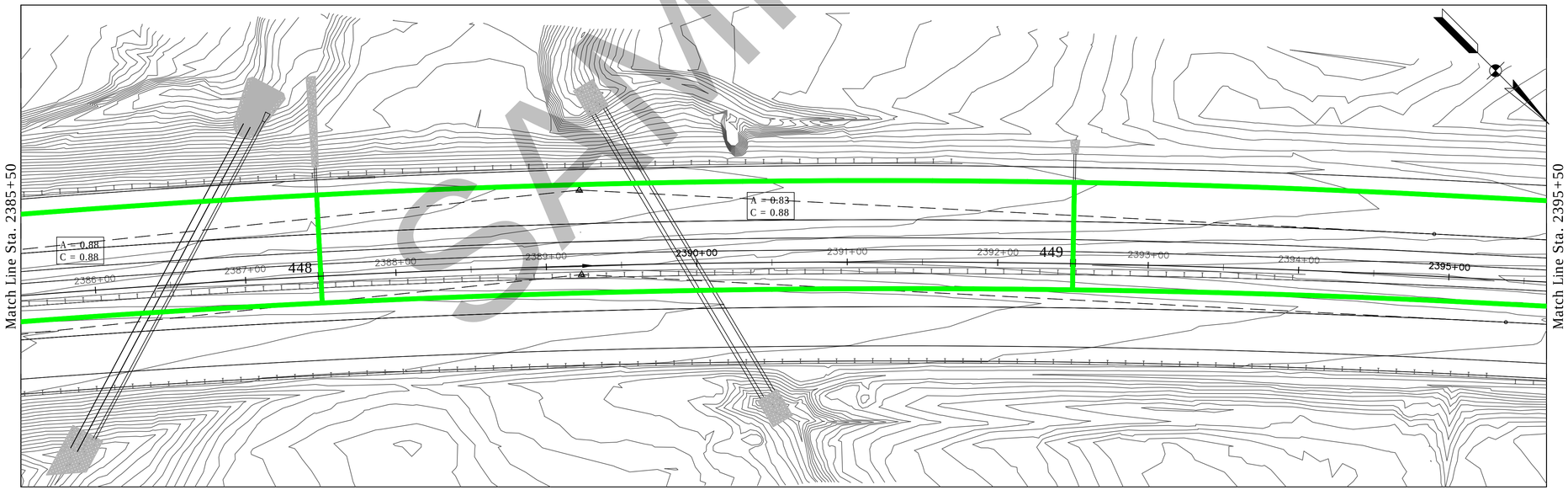

SCOPE COMPLIANCE SUBMITTAL

RECOMMENDED FOR APPROVAL ---- ENGINEER DATE

DESIGNED: ---- DRAWN: ----

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MEDIAN DRAINAGE BASIN DELINEATION

HORIZONTAL SCALE	BRIDGE FILE
1"=20'	
VERTICAL SCALE	DESIGNATION
N/A	---
SURVEY BOOK	SHEETS
	#### of ----
CONTRACT	PROJECT
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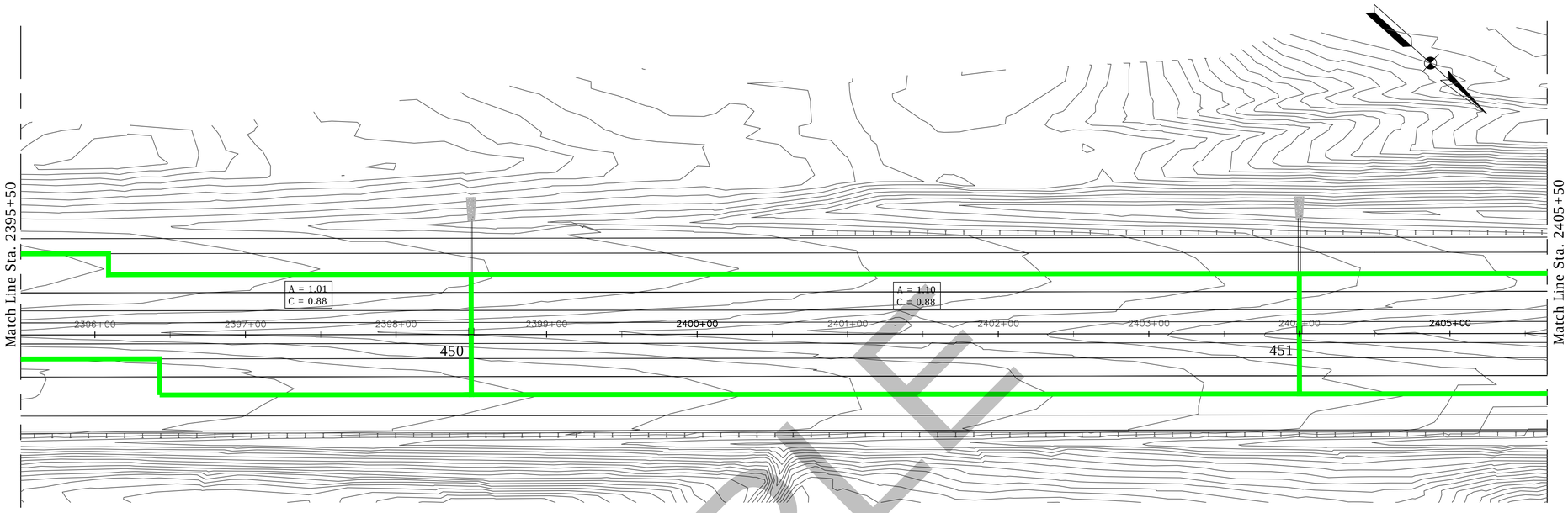

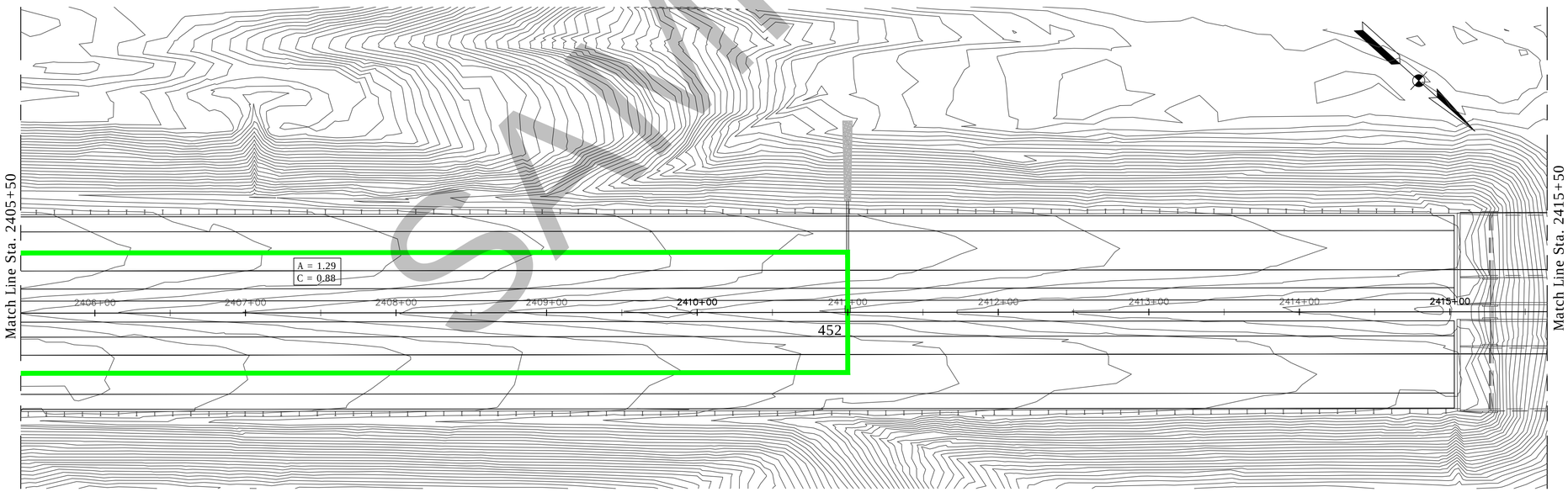

SCOPE COMPLIANCE SUBMITTAL

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INDIANA DEPARTMENT OF TRANSPORTATION

MEDIAN DRAINAGE BASIN DELINEATION

HORIZONTAL SCALE	BRIDGE FILE
1"=20'	
VERTICAL SCALE	DESIGNATION
N/A	---
SURVEY BOOK	SHEETS
	#### of ----
CONTRACT	PROJECT
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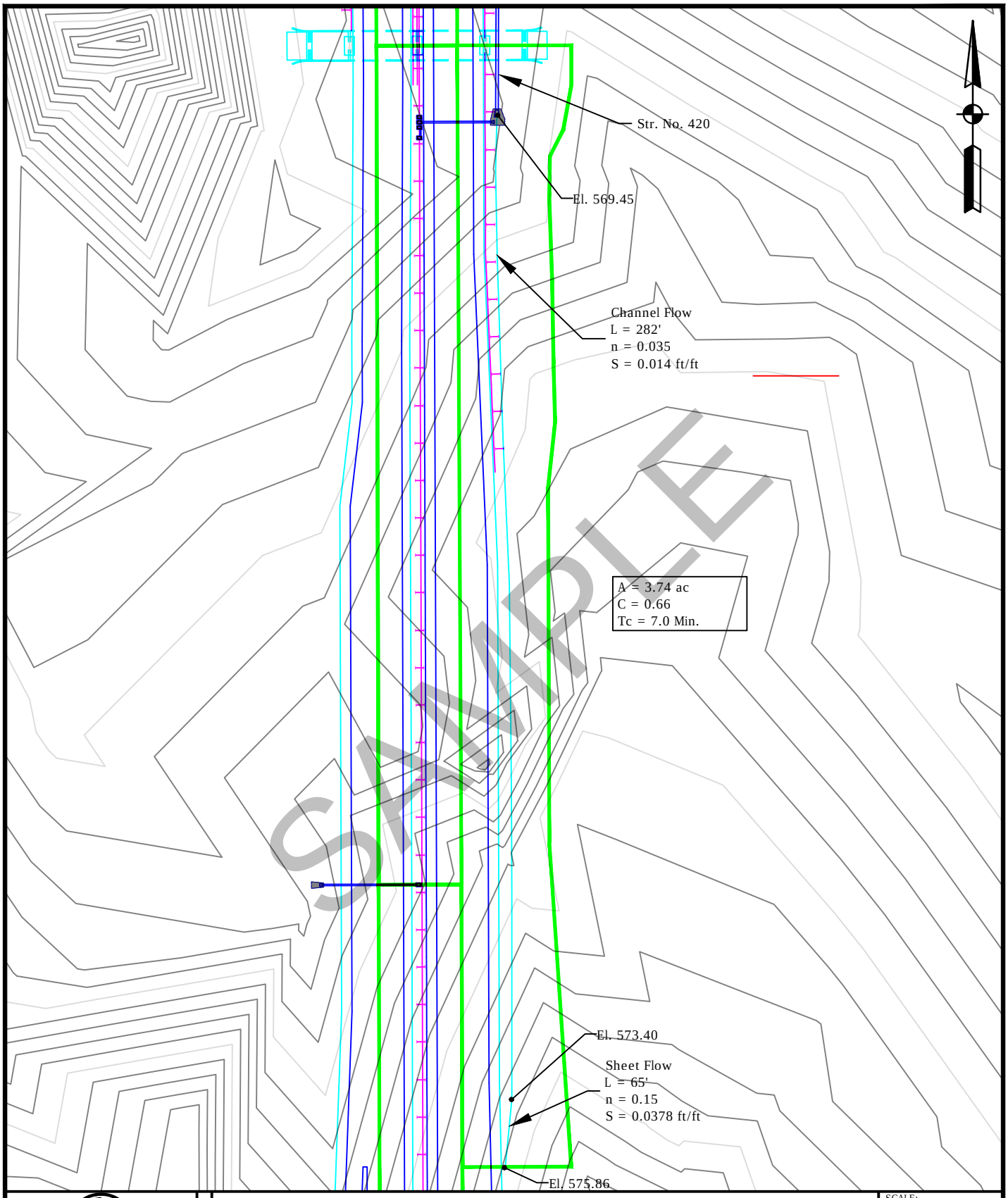


engineering
101 W. Ohio St, Suite 1515
Indianapolis, IN 46204
PH: 317.602.4765

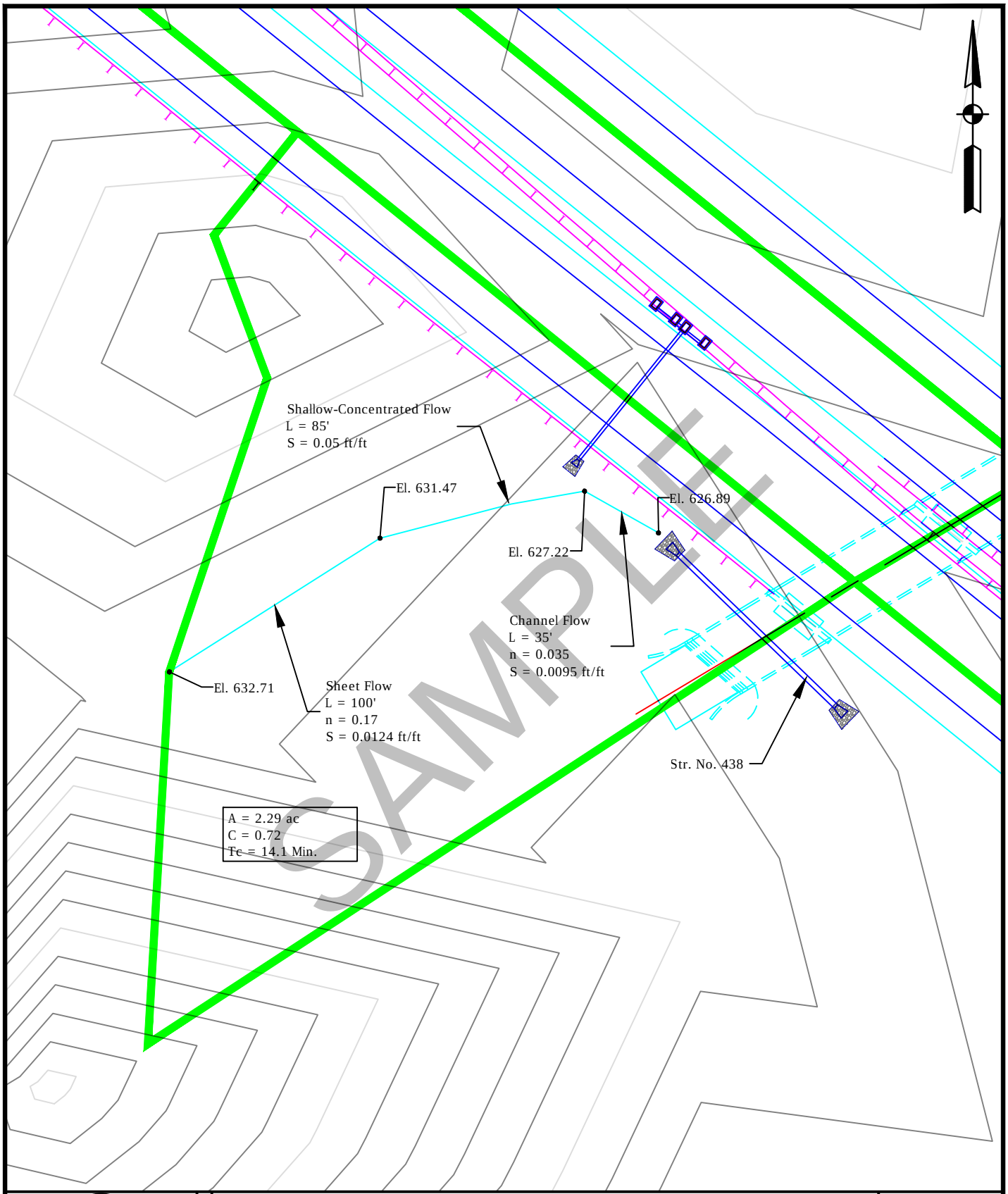
Proj. No.: SR-28940

STR. NO. 420

SCALE: 1"= 120'

Date: 8-13-18

SHEET No.



engineering
101 W. Ohio St, Suite 1515
Indianapolis, IN 46204
PH: 317.602.4765

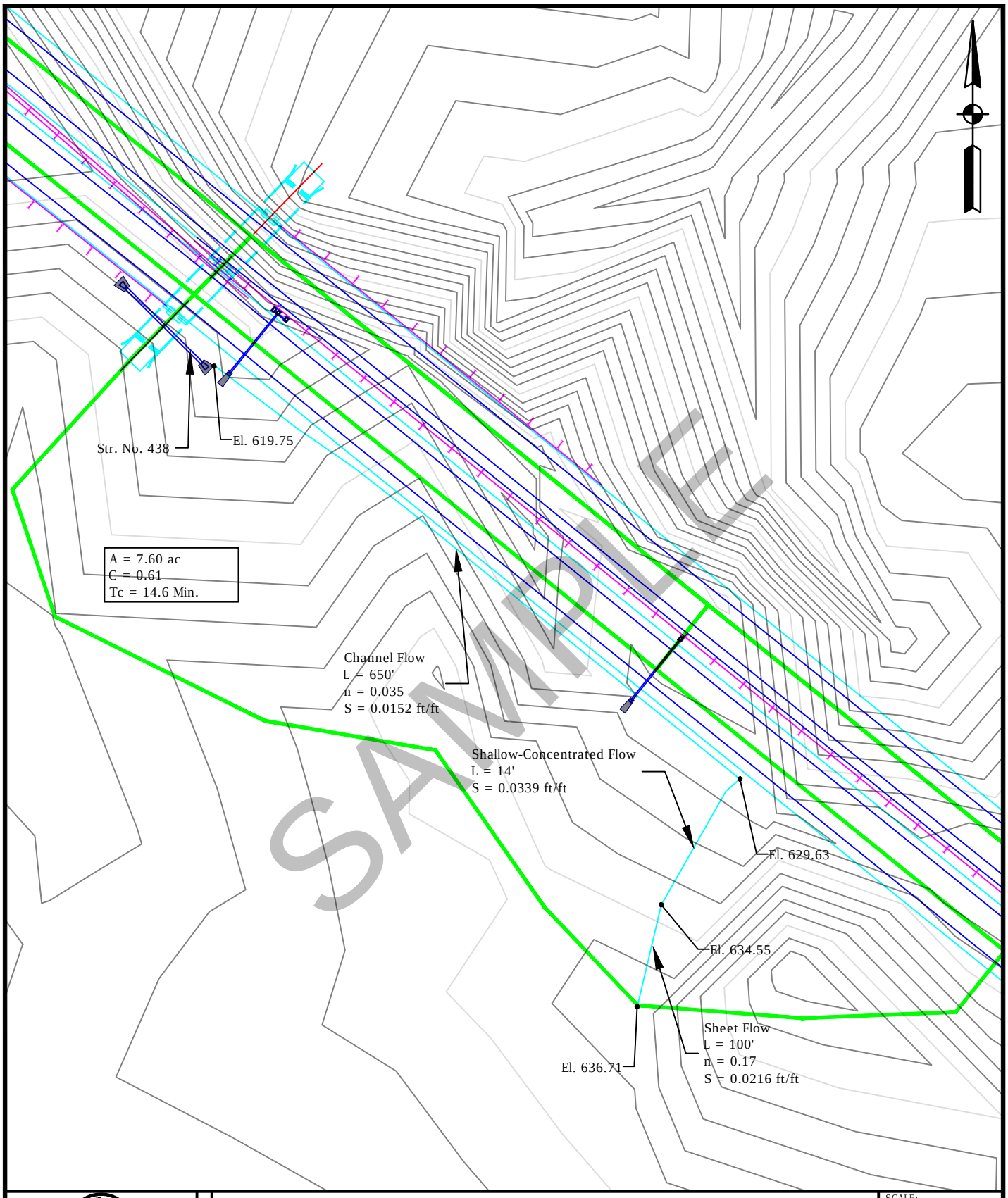
Proj. No.: SR-28940

STR. NO. 438

SCALE: 1"= 50'

Date: 8-13-18

SHEET No.



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101 W. Ohio St, Suite 1515
Indianapolis, IN 46204
PH: 317.602.4765

Proj. No.: SR-28940

STR. NO. 446

SCALE: 1"= 120'
Date: 8-13-18
SHEET No.

Whitney Neukam

From: Bailey, Mark <MBailey1@indot.IN.gov>
Sent: Tuesday, August 29, 2017 1:01 PM
To: Whitney Neukam
Cc: Pierson, Brian; Carlin, Whitney; scott.oneil@ebpaving.com
Subject: RE: I-65 Southeast Design Build - Hydrologic and Hydraulic Parameter Justification

Whitney,

- For RAP a curve number of 95 or c value of 0.8 or higher will be acceptable.
- For RAP a Manning's n of 0.025 will be acceptable.

Let me know if you have any additional questions or concerns.

-Mark

Mark Bailey, P.E.
Office of Hydraulics Manager
100 N. Senate Ave. N642-BR
Indianapolis, IN 46204
Office: (317) 233-2096
Email: mbailey1@indot.in.gov

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From: Whitney Neukam [mailto:wneukam@DB-Engineering.com]
Sent: Friday, August 18, 2017 8:56 AM
To: Bailey, Mark <MBailey1@indot.IN.gov>
Cc: Pierson, Brian <BRIANP@ucindy.com>; Carlin, Whitney <WCarlin@indot.IN.gov>; scott.oneil@ebpaving.com
Subject: I-65 Southeast Design Build - Hydrologic and Hydraulic Parameter Justification

---

Mark,

Please find attached the technical memorandum for your review. This memo serves as an explanation of our assumptions regarding the runoff coefficient and Manning's n-value for both #53 stone and recycled asphalt pavement (RAP) which will be used as median construction material throughout the project. Please respond back as soon as you can with an approval or revision from INDOT Hydraulics.

Sincerely,

Whitney D. Neukam, PE, CPESC

Senior Project Manager

DB Engineering, LLC

101 West Ohio Street, Sute 1515

Indianapolis, IN 46204

Office: (317) 829-0047

Fax: (317) 602-4766

Mobile: (317)509-9907

Email: wneukam@db-engineering.com

Technical Memorandum

Date: August 18, 2017

To: Mark Bailey – INDOT Hydraulics
100 N Senate Ave.
Room N642-BR
Indianapolis, IN 46204

Re: I-65 Southeast Design/Build
Justification of Runoff Coefficient for Hydrology Calculations
Justification of Manning's n Value for Ditch Analysis Calculations

Dear Mr. Bailey,

This memorandum serves as justification for the following:

1. The Runoff Coefficient value for compacted #53 stone and compacted recycled asphalt pavement (RAP).

2. The Manning's n value for compacted #53 stone and compacted recycled asphalt pavement (RAP)

INTRODUCTION

The I-65 Southeast Design/Build project will be sub-divided into three areas of construction. Area #1 starts at Station 2530+50 "A" and ends at Station 2965+50 "A". Area #2 starts at Station 2411+09 "A" and ends at Station 2530+50 "A". Area #3 starts at Station 2214+50 "A" and ends at Station 2411+09 "A". Construction on the project will begin with Area #1.

Both #53 Stone and Recycled asphalt pavement (RAP) will be used as median construction material for all three areas of construction.

It is important to receive approval from INDOT Hydraulics regarding the hydrologic and hydraulic parameters used to represent the presence of both median construction materials before finalizing the median drainage design.

RUNOFF COEFFICIENT JUSTIFICATION

The runoff coefficient for the median construction material is part of the weighted runoff coefficient calculation. The weighted runoff coefficient is then used in the determination of the design flow rate via the Rational Method.

DB Engineering is proposing to use a runoff coefficient of 0.75 for both compacted #53 stone and compacted RAP. Both materials are similar when comparing the size of stone material and percent fines. When compacted, both materials are still more permeable than the surrounding pavement while maintaining the structural integrity of the median channel. Both products have been used as median construction material in past successful interstate projects (I-65 ATL in Johnson County and I-69 ATL in Hamilton County).

Runoff Coefficient	Median Construction Material
C = 0.75	Compacted #53 Stone
C = 0.75	Compacted Recycled Asphalt Pavement (RAP)

Attached to this memo is IDM Figure 202-2E to show our assumptions for runoff coefficients.

MANNING'S n JUSTIFICATION

The Manning's n value used for the median construction material provides a friction factor when performing the median channel analysis for the project. It is an integral factor in determining the flow elevation during the design storm event.

DB Engineering is proposing the use of a manning's n value of 0.022 for both compacted #53 stone and compacted RAP. Both materials are similar when comparing the size of stone material and percent fines. When compacted, we feel that both materials will provide a common friction factor when determining the flow depth within the median channel. Both products have been used as median construction material in past successful interstate projects (I-65 ATL in Johnson County and I-69 ATL in Hamilton County).

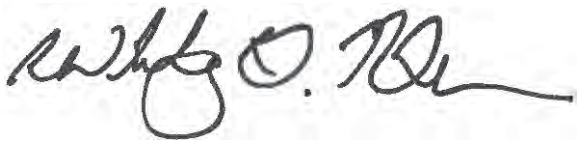
Manning's n Value	Median Construction Material
n = 0.022	Compacted #53 Stone
n = 0.022	Compacted Recycled Asphalt Pavement (RAP)

Attached to this memo is IDM Figure 203-3A to show our assumptions for manning's n values.

CONCLUSION

On behalf of E & B Paving and United Consulting, DB Engineering would like to present the above hydrology and hydraulics design parameter assumptions and justification to INDOT Hydraulics for approval. Please review and let me know if you have any questions. My contact phone number is 317-829-0047 and email address is wneukam@db-engineering.com.

Sincerely,



Whitney D. Neukam, PE
Senior Project Manager
DB Engineering, LLC

cc.	Brian Pierson, PE	United Consulting
	Whitney Carlin, PE, PLS	INDOT Seymour District
	Scott O'Neil, PE	E&B Paving, Inc.

C Value for Rural Area			
Vegetation and Topography	**Open Sand Loam**	**Clay and Silt Loam**	**Tight Clay**
Woodland			
Flat, 0 ≤ slope < 5%	0.10	0.30	0.40
Rolling, 5 ≤ slope < 10%	0.25	0.35	0.50
Hilly, 10 ≤ slope ≤ 30%	0.30	0.50	0.60
Pasture			
Flat, 0 ≤ slope < 5%	0.10	0.30	0.40
Rolling, 5 ≤ slope < 10%	0.16	0.36	0.55
Hilly, 10 ≤ slope ≤ 30%	0.22	0.42	0.60
Cultivated			
Flat, 0 ≤ slope < 5%	0.30	0.50	0.60
Rolling, 5 ≤ slope < 10%	0.40	0.60	0.70
Hilly, 10 ≤ slope ≤ 30%	0.52	0.72	0.82

C Value for Urban Area	
Character of Surface	**Runoff Coefficient, *C***
Business	
Downtown	0.70 to 0.95
Neighborhood	0.50 to 0.70
Residential	
Single-Family	0.30 to 0.50
Multi-Units, Detached	0.40 to 0.60
Multi-Units, Attached	0.60 to 0.75
Residential Suburban	0.25 to 0.40
Apartment	0.50 to 0.70
Industrial	
Light	0.50 to 0.80
Heavy	0.60 to 0.90
Park, Lawn, Cemetery, Grassy Area	0.10 to 0.25
Railroad Yard	0.20 to 0.35
Unimproved	0.10 to 0.30
Pavement	
Asphalt or Concrete	0.80 to 0.95
Brick	0.70 to 0.85
Other Impervious	0.75 to 0.95
Water Impoundment	1.00

RATIONAL-METHOD RUNOFF COEFFICIENT, *C*
Adapted from Indiana LTAP, 2008

Figure 202-2E

C = 0.75 - Compacted #53 Stone
C = 0.75 - Compacted Recycled Asphalt Pavement (RAP)

Back

Type of Channel and Description	Minimum	Normal	Maximum
EXCAVATED OR DREDGED			
1. Earth, Straight and Uniform	0.016	0.018	0.020
a. Clean, recently completed	0.018	0.022	0.025
b. Clean, after weathering	0.022	0.025	0.030
c. Gravel, uniform section, clean	0.022	0.027	0.033
2. Earth, Winding and Sluggish			
a. No vegetation	0.023	0.025	0.030
b. Grass, some weeds	0.025	0.030	0.033
c. Dense weeds or aquatic plants in deep channel	0.030	0.035	0.040
d. Earth bottom and rubble sides	0.025	0.030	0.035
e. Stony bottom and weedy sides	0.025	0.035	0.045
f. Cobble bottom and clean sides	0.030	0.040	0.050
3. Dragline, Excavated or Dredged			
a. No vegetation	0.025	0.028	0.033
b. Light brush on banks	0.035	0.050	0.060
4. Rock Cut			
a. Smooth and uniform	0.025	0.035	0.040
b. Jagged and irregular	0.035	0.040	0.050
5. Channel Not Maintained, Weeds and Brush Uncut			
a. Dense weeds, high as flow depth	0.050	0.080	0.120
b. Clean bottom, brush on sides	0.040	0.050	0.080
c. Clean bottom, highest stage of flow	0.045	0.070	0.110
d. Dense brush, high stage	0.080	0.100	0.140
NATURAL STREAM			
1. Minor Stream (top width at flood stage < 100 ft)			
a. Stream on plain			
(1) Clean, straight, full stage, no rifts or deep pools	0.025	0.030	0.033
(2) Same as above, but more stones or weeds	0.030	0.035	0.040
(3) Clean, winding, some pools or shoals	0.033	0.040	0.045
(4) Same as above, but some weeds or stones	0.035	0.045	0.050
(5) Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
(6) Same as (4), but more stones	0.045	0.050	0.060
(7) Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
(8) Very weedy reaches, deep pools, or floodway with heavy stand of timber and underbrush	0.075	0.100	0.150

n = 0.022 - Compacted #53 Stone

n = 0.022 - Compacted Recycled Asphalt Pavement (RAP)

Back

Type of Channel and Description	Minimum	Normal	Maximum
NATURAL STREAM (contd.)			
1. Minor Stream (contd.)			
b. Mountain stream, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages			
(1) Bottom: gravel, cobbles, and few boulders	0.030	0.040	0.050
(2) Bottom: cobbles with large boulders	0.040	0.050	0.07
2. Floodplain			
a. Pasture, no brush			
(1) Short grass	0.025	0.030	0.035
(2) High grass	0.030	0.035	0.050
b. Cultivated area			
(1) No crop	0.020	0.030	0.040
(2) Mature row crops	0.025	0.035	0.045
(3) Mature field crops	0.030	0.040	0.050
c. Brush			
(1) Scattered brush, heavy weeds	0.035	0.050	0.070
(2) Light brush and trees, in winter	0.035	0.050	0.060
(3) Light brush and trees, in summer	0.040	0.060	0.080
(4) Medium to dense brush, in winter	0.045	0.070	0.110
(5) Medium to dense brush, in summer	0.070	0.100	0.160
d. Trees			
(1) Dense willows, in summer, straight	0.110	0.150	0.200
(2) Cleared land with tree stumps, no sprouts	0.030	0.040	0.050
(3) Same as above, but with heavy growth of sprouts	0.050	0.060	0.080
(4) Heavy stand of timber, a few downed trees, little undergrowth, flood stage below branches	0.080	0.100	0.120
(5) Same as above, but with flood stage reaching branches	0.100	0.120	0.160
3. Major Stream (top width at flood stage > 100 ft). The *n* value is less than that for a minor stream of similar description, because banks offer less effective resistance.			
a. Regular section with no boulders or brush	0.025	n/a	0.060
b. Irregular and rough section	0.035	n/a	0.100

Source: Chow, V.T.

VALUES OF MANNING'S *n* FOR UNIFORM FLOW, Figure 203-3A

Back

RUNOFF COEFFICIENT CALCULATIONS

PREPARED BY: PH
PROJECT: I-65 Southeast Project (SR-28940) DATE: 9/14/18
LOCATION: Package B CHECKED BY: WN
COUNTY: Jackson DATE: 9/17/18

Sta. 2214+50 "A" to Sta. 2414+50 "A" (Package B)

Sub-Basin ID	Land-Use Description	Runoff Coefficient
Sub-Area 1	Pavement	0.90
Sub-Area 2	Recycled Asphalt Millings - Compacted	0.80
Sub-Area 3	Pasture	0.30

Weighted Runoff Coefficient Calculations

Structure No.	Total Area (ac)	Sub-Area 1 (ac)	Sub-Area 2 (ac)	Sub-Area 3 (ac)		Weighted Runoff Coeff. C_w
SOUTH	1.20	0.75		0.45		0.68
399	0.55	0.27	0.28			0.85
400	0.65	0.48	0.17			0.87
401	0.65	0.51	0.14			0.88
402	0.62	0.50	0.12			0.88
403	0.77	0.63	0.14			0.88
404	0.73	0.60	0.13			0.88
405	0.55	0.45	0.10			0.88
406	0.67	0.56	0.11			0.88
408	1.17	0.97	0.20			0.88
409	1.29	1.07	0.22			0.88
410	1.10	0.91	0.19			0.88
411	0.92	0.76	0.16			0.88
412	1.29	1.07	0.22			0.88
415	1.47	1.23	0.24			0.88
418	0.80	0.66	0.14			0.88
420	3.74	2.07	0.24	1.43		0.66
421	1.11	0.92	0.19			0.88
424	0.97	0.81	0.16			0.88
425	0.98	0.81	0.17			0.88
426	0.91	0.72	0.19			0.88
427	1.07	0.87	0.20			0.88
428	0.99	0.80	0.19			0.88
429	0.98	0.80	0.18			0.88
430	0.52	0.44	0.08			0.88

RUNOFF COEFFICIENT CALCULATIONS

PREPARED BY: PH
PROJECT: I-65 Southeast Project (SR-28940) DATE: 9/14/18
LOCATION: Package B CHECKED BY: WN
COUNTY: Jackson DATE: 9/17/18

Sta. 2214+50 "A" to Sta. 2414+50 "A" (Package B)

Sub-Basin ID	Land-Use Description	Runoff Coefficient
Sub-Area 1	Pavement	0.90
Sub-Area 2	Recycled Asphalt Millings - Compacted	0.80
Sub-Area 3	Pasture	0.30
Sub-Area 4	Cultivated Field	0.50

Weighted Runoff Coefficient Calculations

Structure No.	Total Area (ac)	Sub-Area 1 (ac)	Sub-Area 2 (ac)	Sub-Area 3 (ac)	Sub-Area 4 (ac)	Weighted Runoff Coeff. C_w
431	0.55	0.46	0.09			0.88
432	1.10	0.91	0.19			0.88
433	0.95	0.78	0.17			0.88
435	1.16	0.96	0.20			0.88
438	2.29	1.29	0.20	0.35	0.45	0.72
439	1.12	0.92	0.20			0.88
440	0.71	0.59	0.12			0.88
441	0.92	0.76	0.16			0.88
442	0.92	0.76	0.16			0.88
444	1.04	0.86	0.18			0.88
446	7.60	2.37	0.34	1.24	3.65	0.61
447	0.78	0.65	0.13			0.88
448	0.88	0.69	0.19			0.88
449	0.83	0.65	0.18			0.88
450	1.01	0.81	0.20			0.88
451	1.01	0.83	0.18			0.88
452	1.29	1.07	0.22			0.88

RATIONAL FLOW CALCULATIONS

PREPARED BY: PH

PROJECT: I-65 Southeast Project (SR-28940) DATE: 9/14/18

LOCATION: Package B CHECKED BY: WN

COUNTY: Jackson DATE: 9/17/18

Sta. 2214+50 "A" to Sta. 2414+50 "A" (Package B)

Rational Flow Calculations						
Structure No.	Total Area (ac)	Runoff Coef. C	Tc (min)	Intensity (in/hr)		Q_{50} Flow Rate (cfs)
SOUTH	1.20	0.68	5	9.31		7.60
399	0.55	0.85	5	9.31		4.35
400	0.65	0.87	5	9.31		5.26
401	0.65	0.88	5	9.31		5.33
402	0.62	0.88	5	9.31		5.08
403	0.77	0.88	5	9.31		6.31
404	0.73	0.88	5	9.31		5.98
405	0.55	0.88	5	9.31		4.51
406	0.67	0.88	5	9.31		5.49
408	1.17	0.88	5	9.31		9.59
409	1.29	0.88	5	9.31		10.53
410	1.10	0.88	5	9.31		9.01
411	0.92	0.88	5	9.31		7.54
412	1.29	0.88	5	9.31		10.57
415	1.47	0.88	5	9.31		12.04
418	0.80	0.88	5	9.31		6.55
420	3.74	0.66	7.0	8.41		20.76
421	1.11	0.88	5	9.31		9.09
424	0.97	0.88	5	9.31		7.95
425	0.98	0.88	5	9.31		8.03
426	0.91	0.88	5	9.31		7.46
427	1.07	0.88	5	9.31		8.77
428	0.99	0.88	5	9.31		8.11
429	0.98	0.88	5	9.31		8.03
430	0.52	0.88	5	9.31		4.26
431	0.55	0.88	5	9.31		4.51
432	1.10	0.88	5	9.31		9.01
433	0.95	0.88	5	9.31		7.78
435	1.16	0.88	5	9.31		9.50
438	2.29	0.72	14.1	6.04		9.96
439	1.12	0.88	5	9.31		9.18
440	0.71	0.88	5	9.31		5.82

RATIONAL FLOW CALCULATIONS

PREPARED BY: PH

PROJECT: I-65 Southeast Project (SR-28940) DATE: 9/14/18

LOCATION: Package B CHECKED BY: WN

COUNTY: Jackson DATE: 9/17/18

Sta. 2214+50 "A" to Sta. 2414+50 "A" (Package B)

Rational Flow Calculations						
Structure No.	Total Area (ac)	Runoff Coef. C	Tc (min)	Intensity (in/hr)		Q_{50} Flow Rate (cfs)
441	0.92	0.88	5	9.31		7.54
442	0.92	0.88	5	9.31		7.54
444	1.04	0.88	5	9.31		8.52
446	7.60	0.61	14.6	5.92		27.44
447	0.78	0.88	5	9.31		6.39
448	0.88	0.88	5	9.31		7.21
449	0.83	0.88	5	9.31		6.80
450	1.01	0.88	5	9.31		8.27
451	1.10	0.88	5	9.31		9.01
452	1.29	0.88	5	9.31		10.57

TYPE OF SURFACE	*n* VALUE
Smooth, such as concrete, asphalt, gravel, or bare soil	0.011
Rangeland	0.13
Short Grass	0.15
Cultivated Soil	0.17
Dense Grass	0.24
Light Woods and Underbrush	0.40
Dense Woods and Underbrush	0.80

MANNING'S ROUGHNESS COEFFICIENT, *n*, FOR SHEET FLOW
Adapted from Engman, 1983

Figure 202-2B

Back

Type of Surface	***n***
Fairly Regular Section	
Some grass and weeds, little or no brush	0.03 - 0.035
Dense growth of weeds, flow greater than weeds height	0.035 - 0.05
Some weeds, light brush on banks	0.035 - 0.05
Some weeds, heavy brush on banks	0.05 - 0.07
Some weeds, dense willows on banks	0.06 - 0.08
Trees within channel, branches submerged during high flow, increase value by	0.01 - 0.02
Irregular Section with Pools, Slight Channel Meander	
Increase value by	0.01 - 0.02
Steep Stream, Trees Only on Steep Banks	
Bottom of gravel, cobbles, and few boulders	0.04 - 0.05
Bottom of cobbles with large boulders	0.05 - 0.07
Floodplain	
Short grass	0.03 - 0.035
High Grass	0.035 - 0.05
Mature field crop	0.04 - 0.06
Scattered brush, heavy weed	0.05 - 0.07
Light brush and trees	0.06 - 0.08
Medium to dense brush and trees	0.10 - 0.16
Heavy stand of timber, few downed trees, little undergrowth	0.10 - 0.12

MANNING'S ROUGHNESS COEFFICIENT, *n*, FOR CHANNEL FLOW
Adapted from Chow, 1970

Figure 202-2C

Back

TIME OF CONCENTRATION CALCULATIONS

PREPARED BY: MA
PROJECT: I-65 Southeast Design Build — DATE: 8/14/18
LOCATION: Package B — CHECKED BY: WN
COUNTY: Jackson — DATE: 8/16/18

BASIN ID: 420 - Structure Along I-65 NB under CR 700N Overpass

SHEET FLOW

SEGMENT ID		SF1				
Surface Description		Grass				
Manning's Roughness Coefficient, n		0.15				
Flow Length, L	ft	65				
2-Year, 24-Hour Rainfall, P	in	3.04				
Land Slope, s	ft/ft	0.0378				
Compute T_t	hr	0.09	+		=	**0.09**

$$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$$

SHALLOW-CONCENTRATED FLOW

SEGMENT ID						
Surface Description						
Flow Length, L	ft					
Watercourse Slope, s	ft/ft					
Average Velocity, V	ft/s				IDM Fig. 202-2D	
Compute T_t	hr		+		=	

$$T_t = \frac{L}{3600V}$$

CHANNEL FLOW

SEGMENT ID		CH1				
Channel Description		Triangular				
Cross-Sectional Flow Area, a	ft^2	6.5				
Wetted Perimeter, p_w	ft	12.5				
Hydraulic Radius, r	ft	0.517				
Channel Slope, s	ft/ft	0.014				
Manning's Roughness Coefficient, n		0.035			IDM Fig. 202-2C	
Velocity, V	ft/s	3.25				
Flow Length, L	ft	282				
Compute T_t	hr	0.02	+		=	**0.02**

$$r = \frac{a}{P_w}$$

$$V = \frac{1.49 r^{2/3} s^{1/2}}{n}$$

$$T_t = \frac{L}{3600V}$$

Watershed or Sub-Area T_c **0.12** **hr**

7.0 **min**

TIME OF CONCENTRATION CALCULATIONS

PREPARED BY: MA
PROJECT: I-65 Southeast Design Build — DATE: 8/14/18
LOCATION: Package B — CHECKED BY: WN
COUNTY: Jackson — DATE: 8/16/18

BASIN ID: 438 - Structure Along I-65 SB under CR 800N Overpass

SHEET FLOW

SEGMENT ID		SF1				
Surface Description		Agriculture				
Manning's Roughness Coefficient, n		0.17				
Flow Length, L	ft	100				
2-Year, 24-Hour Rainfall, P	in	3.04				
Land Slope, s	ft/ft	0.0124				
Compute T_t	hr	0.22	+		=	**0.22**

$$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$$

SHALLOW-CONCENTRATED FLOW

SEGMENT ID		SC1				
Surface Description		UNPAVED				
Flow Length, L	ft	85				
Watercourse Slope, s	ft/ft	0.05				
Average Velocity, V	ft/s	3.61		IDM Fig. 202-2D		
Compute T_t	hr	0.01	+		=	**0.01**

$$T_t = \frac{L}{3600V}$$

CHANNEL FLOW

SEGMENT ID		CH1				
Channel Description		Trapezoidal				
Cross-Sectional Flow Area, a	ft^2	4.2				
Wetted Perimeter, p_w	ft	10.4				
Hydraulic Radius, r	ft	0.400				
Channel Slope, s	ft/ft	0.0095				
Manning's Roughness Coefficient, n		0.035		IDM Fig. 202-2C		
Velocity, V	ft/s	2.25				
Flow Length, L	ft	35				
Compute T_t	hr	0.00	+		=	**0.00**

$$r = \frac{a}{P_w}$$

$$V = \frac{1.49 r^{2/3} s^{1/2}}{n}$$

$$T_t = \frac{L}{3600V}$$

Watershed or Sub-Area T_c **0.24** **hr**

14.1 **min**

TIME OF CONCENTRATION CALCULATIONS

PREPARED BY: MA
PROJECT: I-65 Southeast Design Build — DATE: 8/14/18
LOCATION: Package B — CHECKED BY: WN
COUNTY: Jackson — DATE: 8/16/18

BASIN ID: 446 - Structure Along I-65 SB under CR 925E Overpass

SHEET FLOW

SEGMENT ID		SF1				
Surface Description		Agriculture				
Manning's Roughness Coefficient, n		0.17				
Flow Length, L	ft	100				
2-Year, 24-Hour Rainfall, P	in	3.04				
Land Slope, s	ft/ft	0.0216				
Compute T_t	hr	0.18	+		=	**0.18**

$$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5} s^{0.4}}$$

SHALLOW-CONCENTRATED FLOW

SEGMENT ID		SC1				
Surface Description		UNPAVED				
Flow Length, L	ft	145				
Watercourse Slope, s	ft/ft	0.0339				
Average Velocity, V	ft/s	2.97		IDM Fig. 202-2D		
Compute T_t	hr	0.01	+		=	**0.01**

$$T_t = \frac{L}{3600V}$$

CHANNEL FLOW

SEGMENT ID		CH1				
Channel Description		Trapezoidal				
Cross-Sectional Flow Area, a	ft^2	7.6				
Wetted Perimeter, p_w	ft	13.4				
Hydraulic Radius, r	ft	0.569				
Channel Slope, s	ft/ft	0.0152				
Manning's Roughness Coefficient, n		0.035		IDM Fig. 202-2C		
Velocity, V	ft/s	3.61				
Flow Length, L	ft	650				
Compute T_t	hr	0.05	+		=	**0.05**

$$r = \frac{a}{P_w}$$

$$V = \frac{1.49 r^{2/3} s^{1/2}}{n}$$

$$T_t = \frac{L}{3600V}$$

Watershed or Sub-Area T_c **0.24** **hr**

14.6 **min**

Appendix B

Hydraulics Calculations and Documentation

MEDIAN DITCH DESIGN/GEOMETRY

PROJECT: I-65 Southeast Project (SR-28940)
LOCATION: Sta. 2214+50 "A" to Sta. 2414+50 "A" (Package B)
COUNTY: Jackson

PREPARED BY: MA
DATE: 9/14/2018
CHECKED BY: WN
DATE: 9/17/2018

Median Inlet	Line "A" Station	Elev. Left Inside EOS			FL Elevation	Horizontal Distance to FL	Cross Slope	Line "A" Station	Elev. Right Inside EOS			FL Elevation	Horizontal Distance to FL	Cross Slope	
							10.0							10.0	
399	2214+60.00	605.98			605.40	5.8	10.00%	2214+60.00	606.01			605.40	6.1	10.00%	
				Ditch Grade	1.34%										
				Ditch Grade	1.34%		10.0							10.0	
400	2217+50.00	609.83			609.28	5.5	10.00%	2217+50.00	609.94			609.28	6.6	10.00%	
				Ditch Grade	2.45%										
				Ditch Grade	2.45%		10.0							10.0	
401	2221+00.00	618.31			617.87	4.4	10.00%	2221+00.00	618.62			617.87	7.5	10.00%	
				Ditch Grade	1.92%										
				Ditch Grade	1.92%		10.0							10.0	
402	2224+50.00	625.11			624.58	5.3	10.00%	2224+50.00	625.25			624.58	6.7	10.00%	
				Ditch Grade	0.54%										
				Ditch Grade	0.54%		10.0							10.0	
RR Bridge	2227+83.00	626.98			626.39	5.9	10.00%	2227+83.00	626.99			626.39	6.0	10.00%	High Point
				Ditch Grade	-0.72%										
				Ditch Grade	-0.72%		10.0							10.0	
403	2232+00.00	624.05			623.39	6.6	10.00%	2232+00.00	623.94			623.39	5.5	10.00%	
				Ditch Grade	-2.25%										
				Ditch Grade	-2.25%		10.0							10.0	
404	2236+00.00	615.05			614.39	6.6	10.00%	2236+00.00	614.93			614.39	5.4	10.00%	
				Ditch Grade	-2.03%										
				Ditch Grade	-2.03%		10.0							10.0	
405	2239+00.00	608.93			608.30	6.3	10.00%	2239+00.00	608.87			608.30	5.7	10.00%	
				Ditch Grade	-1.09%										
				Ditch Grade	-1.09%		10.0							10.0	
406	2242+35.00	605.28			604.64	6.4	10.00%	2242+35.00	605.19			604.64	5.5	10.00%	Low Point
407	2242+25.00			Ditch Grade	-0.32%										
			Emergency Vehicle Crossing												
				Ditch Grade	-0.32%		10.0							10.0	
408	2249+00.00	603.18			602.53	6.5	10.00%	2249+00.00	603.09			602.53	5.6	10.00%	
				Ditch Grade	-0.40%										
				Ditch Grade	-0.40%		10.0							10.0	
409	2256+00.00	600.39			599.76	6.3	10.00%	2256+00.00	600.34			599.76	5.8	10.00%	
				Ditch Grade	-0.91%										
				Ditch Grade	-0.91%		10.0							10.0	
410	2262+00.00	594.95			594.32	6.3	10.00%	2262+00.00	594.88			594.32	5.6	10.00%	
				Ditch Grade	-1.03%										
				Ditch Grade	-1.03%		10.0							10.0	
411	2267+00.00	589.81			589.16	6.5	10.00%	2267+00.00	589.70			589.16	5.4	10.00%	
				Ditch Grade	-1.08%										

MEDIAN DITCH DESIGN/GEOMETRY

PROJECT: I-65 Southeast Project (SR-28940)
LOCATION: Sta. 2214+50 "A" to Sta. 2414+50 "A" (Package B)
COUNTY: Jackson

PREPARED BY: MA
DATE: 9/14/2018
CHECKED BY: WN
DATE: 9/17/2018

Median Inlet	Line "A" Station	Elev. Left Inside EOS			FL Elevation	Horizontal Distance to FL	Cross Slope	Line "A" Station	Elev. Right Inside EOS			FL Elevation	Horizontal Distance to FL	Cross Slope	
				Ditch Grade	-1.08%		10.0							10.0	
412	2274+00.00	582.24			581.60	6.4	10.00%	2274+00.00	582.15			581.60	5.5	10.00%	
				Ditch Grade	-1.03%										
413	2281+21.00	574.43						2281+21.00	574.61						
414	2281+31.00	574.42		Ditch Grade	-1.03%		10.0	2281+31.00	574.60					10.0	
415	2281+36.00	574.42			574.00	4.2	10.00%	2281+36.00	574.60			574.00	6.0	10.00%	Low Point
416	2281+41.00	574.42						2281+41.00	574.60						
			CR 700N Overpass												
417	2282+90.00	574.77					10.0	2282+90.00	574.89					10.0	
418	2283+00.00	574.82			574.35	4.7	10.00%	2283+00.00	574.93			574.35	5.8	10.00%	Low Point
419	2283+10.00	574.87		Ditch Grade	0.42%			2283+10.00	574.97						
			Sandy Branch Bridge												
				Ditch Grade	0.42%		10.0							10.0	
421	2287+32.00	576.82			576.16	6.6	10.00%	2287+32.00	576.70			576.16	5.4	10.00%	Low Point
422	2287+37.00	576.82		Ditch Grade	0.62%			2287+37.00	576.70						
423	2287+47.00	576.90						2287+47.00	576.78						
				Ditch Grade	0.62%		10.0							10.0	
424	2292+50.00	579.92			579.37	5.5	10.00%	2292+50.00	579.82			579.37	4.5	10.00%	
				Ditch Grade	0.83%										
				Ditch Grade	0.83%		10.0							10.0	
425	2298+50.00	585.06			584.35	7.1	10.00%	2298+50.00	584.70			584.35	3.5	10.00%	
				Ditch Grade	1.22%										
				Ditch Grade	1.22%		10.0							10.0	
426	2304+50.00	592.48			591.66	8.2	10.00%	2304+50.00	591.99			591.66	3.3	10.00%	
				Ditch Grade	1.26%										
				Ditch Grade	1.26%		10.0							10.0	
427	2310+00.00	599.40			598.59	8.1	10.00%	2310+00.00	598.95			598.59	3.6	10.00%	
				Ditch Grade	1.12%										
				Ditch Grade	1.12%		10.0							10.0	
428	2316+50.00	606.73			605.87	8.6	10.00%	2316+50.00	606.16			605.87	2.9	10.00%	
				Ditch Grade	0.99%										
				Ditch Grade	0.99%		10.0							10.0	
429	2322+50.00	612.72			611.81	9.1	10.00%	2322+50.00	612.00			611.81	1.9	10.00%	
				Ditch Grade	1.00%										
				Ditch Grade	1.00%		10.0							10.0	
430	2328+50.00	618.61			617.83	7.8	10.00%	2328+50.00	618.06			617.83	2.3	10.00%	
				Ditch Grade	0.87%										
				Ditch Grade	0.87%		10.0							10.0	
431	2331+50.00	620.98			620.44	5.4	10.00%	2331+50.00	620.95			620.44	5.1	10.00%	
				Ditch Grade	0.82%										

MEDIAN DITCH DESIGN/GEOMETRY

PROJECT: I-65 Southeast Project (SR-28940)
LOCATION: Sta. 2214+50 "A" to Sta. 2414+50 "A" (Package B)
COUNTY: Jackson

PREPARED BY: MA
DATE: 9/14/2018
CHECKED BY: WN
DATE: 9/17/2018

Median Inlet	Line "A" Station	Elev. Left Inside EOS			FL Elevation	Horizontal Distance to FL	Cross Slope	Line "A" Station	Elev. Right Inside EOS			FL Elevation	Horizontal Distance to FL	Cross Slope	
				Ditch Grade	0.82%		10.0							10.0	
432	2334+50.00	623.60			622.89	7.1	10.00%	2334+50.00	623.38			622.89	4.9	10.00%	
				Ditch Grade	0.73%										
				Ditch Grade	0.73%		10.0							10.0	
433	2340+50.00	627.98			627.30	6.8	10.00%	2340+50.00	627.82			627.30	5.2	10.00%	
				Ditch Grade	0.65%										
			CR 800N Overpass												
434	2346+60.00	631.99		Ditch Grade	0.65%		6.0	2346+60.00	632.33					6.0	
435	2346+70.00	632.06			631.34	4.3	16.74%	2346+70.00	632.41			631.34	6.4	16.72%	Low Point
436	2346+75.00	632.06		Ditch Grade	0.81%			2346+75.00	632.41						
437	2346+85.00	632.17						2346+85.00	632.52						
				Ditch Grade	0.81%									10.0	
439	2352+00.00	636.17			635.65	5.2	10.00%	2352+00.00	636.33			635.65	6.8	10.00%	
				Ditch Grade	0.51%		10.0								
				Ditch Grade	0.51%										
	2358+12.00	639.44			638.77	6.7	10.00%	2358+12.00	639.21			638.77	4.4	10.00%	High Point
				Ditch Grade	-0.36%		10.0								
				Ditch Grade	-0.36%		10.0							10.0	
440	2362+00.00	638.03			637.36	6.7	10.00%	2362+00.00	637.88			637.36	5.2	10.00%	
				Ditch Grade	-0.83%										
				Ditch Grade	-0.83%		10.0							10.0	
441	2367+00.00	633.81			633.21	6.0	10.00%	2367+00.00	633.80			633.21	5.9	10.00%	
				Ditch Grade	-0.90%										
				Ditch Grade	-0.90%		10.0							10.0	
442	2372+00.00	629.27			628.72	5.5	10.00%	2372+00.00	629.37			628.72	6.5	10.00%	
				Ditch Grade	-0.88%										
443	2376+90.00	625.08		Ditch Grade	-0.88%		8.0	2376+90.00	625.10					8.0	
444	2377+00.00	625.01			624.34	5.4	12.52%	2377+00.00	625.03			624.34	5.5	12.55%	Low Point
445	2377+05.00	625.01		Ditch Grade	-0.56%			2377+05.00	625.03						
			CR 925E Overpass												
				Ditch Grade	-0.56%		10.0							10.0	
447	2382+00.00	622.05			621.52	5.3	10.00%	2382+00.00	622.18			621.52	6.6	10.00%	
				Ditch Grade	-0.49%										
				Ditch Grade	-0.49%		10.0							10.0	
448	2387+50.00	619.21			618.82	3.9	10.00%	2387+50.00	619.81			618.82	9.9	10.00%	
				Ditch Grade	-0.49%										
				Ditch Grade	-0.49%		10.0							10.0	
449	2392+50.00	616.73			616.37	3.6	10.00%	2392+50.00	617.34			616.37	9.7	10.00%	
				Ditch Grade	-0.64%										
				Ditch Grade	-0.64%		10.0							10.0	
450	2398+50.00	613.13			612.52	6.1	10.00%	2398+50.00	613.11			612.52	5.9	10.00%	

MEDIAN DITCH DESIGN/GEOMETRY

PROJECT: I-65 Southeast Project (SR-28940)
LOCATION: Sta. 2214+50 "A" to Sta. 2414+50 "A" (Package B)
COUNTY: Jackson

PREPARED BY: MA
DATE: 9/14/2018
CHECKED BY: WN
DATE: 9/17/2018

Median Inlet	Line "A" Station	Elev. Left Inside EOS			FL Elevation	Horizontal Distance to FL	Cross Slope	Line "A" Station	Elev. Right Inside EOS			FL Elevation	Horizontal Distance to FL	Cross Slope
				Ditch Grade	-0.91%									
				Ditch Grade	-0.91%		10.0							10.0
451	2404+00.00	608.04			607.50	5.4	10.00%	2404+00.00	608.17			607.50	6.7	10.00%
				Ditch Grade	-1.09%									
				Ditch Grade	-1.09%		10.0							10.0
452	2411+00.00	600.47			599.88	5.9	10.00%	2411+00.00	600.50			599.88	6.2	10.00%

Median Ditch Analysis - Channel Cross-Sections

Done By: MA
Date: 09/14/18
Checked By: WN
Date: 09/17/18

Median Ditch Cross-Section		
Str. No. 399		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
15.80	-0.98	0.025
22.00	-0.37	0.012
32.00	0.03	

Median Ditch Cross-Section		
Str. No. 400		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
15.50	-0.95	0.025
22.00	-0.30	0.012
32.00	0.10	

Median Ditch Cross-Section		
Str. No. 401		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
14.50	-0.85	0.025
22.00	-0.10	0.012
32.00	0.30	

Median Ditch Cross-Section		
Str. No. 402		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
15.30	-0.93	0.025
22.00	-0.26	0.012
32.00	0.14	

Median Ditch Cross-Section		
Str. No. 403		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
16.60	-1.06	0.025
22.00	-0.51	0.012
32.00	-0.11	

Median Ditch Cross-Section		
Str. No. 404		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
16.60	-1.06	0.025
22.00	-0.51	0.012
32.00	-0.11	

Median Ditch Cross-Section		
Str. No. 405		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
16.30	-1.03	0.025
22.00	-0.46	0.012
32.00	-0.06	

Median Ditch Cross-Section		
Str. No. 406		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
16.50	-1.05	0.025
22.00	-0.50	0.012
32.00	-0.10	

Median Ditch Cross-Section		
Str. No. 408		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
16.40	-1.04	0.025
22.00	-0.49	0.012
32.00	-0.09	

Median Ditch Cross-Section		
Str. No. 409		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
16.30	-1.02	0.025
22.00	-0.45	0.012
32.00	-0.05	

Median Ditch Analysis - Channel Cross-Sections

Done By: MA
Date: 09/14/18
Checked By: WN
Date: 09/17/18

Median Ditch Cross-Section		
Str. No. 410		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
16.40	-1.04	0.025
22.00	-0.48	0.012
32.00	-0.08	

Median Ditch Cross-Section		
Str. No. 421		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.16	0.025
16.60	-1.06	0.025
22.00	-0.52	0.012
32.00	-0.12	

Median Ditch Cross-Section		
Str. No. 411		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
16.50	-1.05	0.025
22.00	-0.51	0.012
32.00	-0.11	

Median Ditch Cross-Section		
Str. No. 424		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
15.50	-0.95	0.025
20.00	-0.50	0.012
32.00	-0.02	

Median Ditch Cross-Section		
Str. No. 412		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
16.50	-1.05	0.025
22.00	-0.49	0.012
32.00	-0.09	

Median Ditch Cross-Section		
Str. No. 425		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.20	0.025
17.10	-0.91	0.025
20.70	-0.55	0.012
32.70	0.07	

Median Ditch Cross-Section		
Str. No. 415		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
14.20	-0.82	0.025
20.10	-0.22	0.012
30.10	0.18	

Median Ditch Cross-Section		
Str. No. 426		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.20	0.025
18.10	-1.01	0.025
21.30	-0.69	0.012
33.30	-0.07	

Median Ditch Cross-Section		
Str. No. 418		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.16	0.025
14.60	-0.86	0.025
20.30	-0.29	0.012
30.30	0.11	

Median Ditch Cross-Section		
Str. No. 427		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.20	0.025
18.10	-1.01	0.025
21.60	-0.65	0.012
33.60	-0.02	

Median Ditch Analysis - Channel Cross-Sections

Done By: MA
Date: 09/14/18
Checked By: WN
Date: 09/17/18

Median Ditch Cross-Section		
Str. No. 428		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.20	0.025
18.60	-1.06	0.025
21.50	-0.76	0.012
33.50	-0.14	

Median Ditch Cross-Section		
Str. No. 433		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
16.80	-1.08	0.025
22.00	-0.56	0.012
32.00	-0.16	

Median Ditch Cross-Section		
Str. No. 429		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.20	0.025
19.10	-1.11	0.025
20.90	-0.92	0.012
32.90	-0.30	

Median Ditch Cross-Section		
Str. No. 435		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
14.40	-1.12	0.025
20.80	-0.05	0.012
30.80	0.35	

Median Ditch Cross-Section		
Str. No. 430		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
17.80	-1.18	0.025
20.00	-0.95	0.012
32.00	-0.46	

Median Ditch Cross-Section		
Str. No. 439		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
15.20	-0.92	0.025
22.00	-0.24	0.012
32.00	0.16	

Median Ditch Cross-Section		
Str. No. 431		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
15.40	-0.94	0.025
20.60	-0.43	0.012
32.00	0.03	

Median Ditch Cross-Section		
Str. No. 440		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
16.80	-1.08	0.025
22.00	-0.55	0.012
32.00	-0.15	

Median Ditch Cross-Section		
Str. No. 432		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.120
10.00	-0.40	0.025
17.10	-1.11	0.025
22.00	-0.63	0.012
32.00	-0.23	

Median Ditch Cross-Section		
Str. No. 441		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
16.00	-1.00	0.025
22.00	-0.41	0.012
32.00	-0.01	

Median Ditch Analysis - Channel Cross-Sections

Done By: MA
Date: 09/14/18
Checked By: WN
Date: 09/17/18

Median Ditch Cross-Section		
Str. No. 442		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
15.50	-0.95	0.025
22.00	-0.30	0.012
32.00	0.10	

Median Ditch Cross-Section		
Str. No. 450		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
16.10	-1.01	0.025
22.00	-0.42	0.012
32.00	-0.02	

Median Ditch Cross-Section		
Str. No. 444		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.32	0.025
15.40	-1.07	0.025
20.90	-0.38	0.012
30.90	0.02	

Median Ditch Cross-Section		
Str. No. 451		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
15.40	-0.94	0.025
22.00	-0.27	0.012
32.00	0.13	

Median Ditch Cross-Section		
Str. No. 447		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
15.40	-0.94	0.025
22.00	-0.27	0.012
32.00	0.13	

Median Ditch Cross-Section		
Str. No. 452		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
15.90	-0.99	0.025
22.00	-0.37	0.012
32.00	0.03	

Median Ditch Cross-Section		
Str. No. 448		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
13.90	-0.79	0.025
23.80	0.20	0.012
33.80	0.60	

Median Ditch Cross-Section		
Str. No. 449		
Station (ft)	Elevation (ft)	Manning's n
0.00	0.00	0.012
10.00	-0.40	0.025
13.60	-0.77	0.025
23.40	0.21	0.012
33.40	0.61	

MEDIAN DITCH & INLET ANALYSIS
DESIGN STORM = 50-YR

PROJECT: I-65 Southeast Project (SR-28940)
LOCATION: Sta. 2214+50 "A" to Sta. 2414+50 "A" (Package B)
COUNTY: Jackson

PREPARED BY: MA
DATE: 9/14/2018
CHECKED BY: WN
DATE: 9/17/2018

Structure No.	Inlet Station	Channel Geometry	Longitudinal Slope (ft/ft)	50-Yr Flow Rate Q_{50} (cfs)	Previous Bypass Flow Q_{BY} (cfs)	Total Flow Q_T (cfs)	Allowable Flow Depth (d_a) (ft)	50-Yr Flow Depth (ft)	Inlet Type	Sag or On Grade	Hydraulic Grate Width (ft)	Hydraulic Grate Length (ft)	Intercepted Flow (cfs)	Bypass Flow (cfs)	
	Line "A"														
399	2214+60	Irregular	0.0134	4.35	7.07	11.42	0.98	0.61		On Grade	1.59	3.27	4.02	7.40	
400	2217+50	Irregular	0.0245	5.26	4.95	10.21	0.95	0.51		On Grade	1.59	3.27	3.14	7.07	
401	2221+00	Irregular	0.0192	5.33	2.37	7.70	0.85	0.48		On Grade	1.59	3.27	2.75	4.95	
402	2224+50	Irregular	0.0054	5.08	0.00	5.08	0.93	0.53		On Grade	1.59	3.27	2.71	2.37	
403	2232+00	Irregular	0.0072	6.31	0.00	6.31	0.95	0.54		On Grade	1.59	3.27	2.99	3.32	
404	2236+00	Irregular	0.0225	5.98	3.32	9.30	0.95	0.51		On Grade	1.59	3.27	3.04	6.27	
405	2239+00	Irregular	0.0203	4.51	6.27	10.78	0.97	0.54		On Grade	1.59	3.27	3.35	7.43	
406	2242+35	Irregular	0.0109	5.49	7.43	12.92	0.95	0.83		Sag	1.59	3.27	12.92		Single Inlet + Flanking
408	2249+00	Irregular	0.0032	9.59	0.00	9.59	0.95	0.71		On Grade	1.59	3.27	4.82	4.77	
409	2256+00	Irregular	0.0040	10.53	4.77	15.30	0.97	0.79		On Grade	1.59	3.27	6.54	8.76	
410	2262+00	Irregular	0.0091	9.01	8.76	17.77	0.96	0.73		On Grade	1.59	3.27	5.74	12.03	
411	2267+00	Irregular	0.0103	7.54	12.03	19.57	0.94	0.74		On Grade	1.59	3.27	5.83	13.74	
412	2274+00	Irregular	0.0108	10.57	13.74	24.31	0.96	0.78		On Grade	1.59	3.27	6.70	17.61	
415	2281+56	Irregular	0.0103	12.04	17.61	29.65	0.82	0.72		Sag	1.59	3.27	29.65		Triple Inlet + Flanking
418	2283+00	Irregular	0.0042	6.55	0.00	6.55	0.86	0.60		Sag	1.59	3.27	6.55		Single Inlet + Flanking
421	2287+32	Irregular	0.0062	9.09	18.23	27.32	0.94	0.85		Sag	1.59	3.27	27.32		Double Inlet + Flanking
424	2292+50	Irregular	0.0083	7.29	18.29	25.58	0.93	0.78		On Grade	1.59	3.27	7.35	18.23	
425	2298+50	Irregular	0.0122	8.03	18.03	26.06	0.91	0.76		On Grade	1.59	3.27	7.77	18.29	Inlet Left - Outlet Right
426	2304+50	Irregular	0.0126	7.46	15.74	23.20	0.94	0.71		On Grade	1.59	3.27	5.17	18.03	Inlet Left - Outlet Right
427	2310+00	Irregular	0.0112	8.77	14.43	23.20	0.99	0.74		On Grade	1.59	3.27	7.46	15.74	Inlet Left - Outlet Right
428	2316+50	Irregular	0.0099	8.11	11.37	19.48	0.92	0.70		On Grade	1.59	3.27	5.05	14.43	
429	2322+50	Irregular	0.0100	8.03	7.50	15.53	0.81	0.61		On Grade	1.59	3.27	4.16	11.37	Inlet Left - Outlet Right
430	2328+50	Irregular	0.0087	4.26	7.95	12.21	0.72	0.58		On Grade	1.59	3.27	4.71	7.50	Inlet Left - Outlet Right
431	2331+50	Irregular	0.0082	4.51	8.50	13.01	0.94	0.66		On Grade	1.59	3.27	5.06	7.95	
432	2334+50	Irregular	0.0073	9.01	4.17	13.18	0.88	0.68		On Grade	1.59	3.27	4.68	8.50	
433	2340+50	Irregular	0.0071	7.78	0.00	7.78	0.92	0.58		On Grade	1.59	3.27	3.61	4.17	
435	2346+70	Irregular	0.0081	9.50	4.69	14.19	1.12	0.74		Sag	1.59	3.27	14.19		Double Inlet + Flanking
439	2352+00	Irregular	0.0051	9.18	0.00	9.18	0.92	0.65		On Grade	1.59	3.27	4.49	4.69	
440	2362+00	Irregular	0.0036	5.82	0.00	5.82	0.93	0.60		On Grade	1.59	3.27	3.23	2.59	
441	2367+00	Irregular	0.0083	7.54	2.59	10.13	0.99	0.62		On Grade	1.59	3.27	4.01	6.12	
442	2372+00	Irregular	0.0090	7.54	6.12	13.66	0.95	0.68		On Grade	1.59	3.27	5.16	8.50	
444	2377+00	Irregular	0.0088	8.52	8.50	17.02	1.07	0.72		Sag	1.59	3.27	17.02		Double Inlet + Flanking
447	2382+00	Irregular	0.0059	6.39	0.00	6.39	0.94	0.57		On Grade	1.59	3.27	3.23	3.16	
448	2387+50	Irregular	0.0049	7.21	3.16	10.37	0.79	0.65		On Grade	1.59	3.27	4.34	6.03	Inlet Right - Outlet Left
449	2392+50	Irregular	0.0049	6.80	6.03	12.83	0.77	0.69		On Grade	1.59	3.27	5.00	7.83	Inlet Right - Outlet Left
450	2398+50	Irregular	0.0067	8.27	7.83	16.10	0.99	0.75		On Grade	1.59	3.27	5.96	10.14	
451	2404+00	Irregular	0.0091	9.01	10.14	19.15	0.94	0.75		On Grade	1.59	3.27	6.58	12.57	
452	2411+00	Irregular	0.0109	10.57	12.57	23.14	0.99	0.78		On Grade	1.59	3.27	6.85	16.29	

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 399

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?	
Inlet side:	Left		Left:	Yes
Discharge:	11.42	cfs	Right:	Yes
Longitudinal slope:	0.0134	ft/ft		

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.025
2	Left slope	10.00	-0.40	0.025
3	Right slope	15.80	-0.98	0.025
4	Right shoulder	22.00	-0.37	0.025
5	-End point-	32.00	0.03	
-				

* Type is marked at the start of the segment

Hydraulic Grate Width:	1.59	feet (along flow direction)
Hydraulic Grate Length:	3.27	feet (along ditch slope)
No. of Open Spaces Along Flow Direction =	9	
Individual Space Width (in.) =	2.125	
No. of Open Spaces Along Ditch Slope (Ends of Grate) =	2	
Individual Space Width (in.) =	8.1875	
No. of Open Spaces Along Ditch Slope (Middle of Grate) =	3	
Individual Space Width (in.) =	7.625	

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width:	3.50	feet (along flow direction)
P-12A Inlet Length:	4.33	feet (along ditch slope)

RESULTS SUMMARY

Flow depth: 0.61 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	2.52	3.22	5.67	11.42		
Intercepted flow:	0.52	2.34	1.16		4.02	7.40

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 3.05 ft/sec

Left side flow:

Discharge:	2.52	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.21	
Q in:	0.52	cfs

Frontal flow on grate:

Discharge:	3.22	cfs
Efficiency:	0.73	
Q in:	2.34	cfs

Right side flow:

Discharge:	5.67	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.20	
Q in:	1.16	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 400

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Left		Left:	Yes	
Discharge:	10.21	cfs	Right:	Yes	
Longitudinal slope:	0.0245	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	15.50	-0.95	0.025
4	Right shoulder	22.00	-0.30	0.012
5	-End point-	32.00	0.10	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.52 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	1.88	3.22	5.11	10.21		
Intercepted flow:	0.28	2.11	0.75		3.14	7.07

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 3.84 ft/sec

Left side flow:

Discharge:	1.88	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.15	
Q in:	0.28	cfs

Frontal flow on grate:

Discharge:	3.22	cfs
Efficiency:	0.65	
Q in:	2.11	cfs

Right side flow:

Discharge:	5.11	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.15	
Q in:	0.75	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 401

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?	
Inlet side:	Right		Left:	Yes
Discharge:	7.70	cfs	Right:	Yes
Longitudinal slope:	0.0192	ft/ft		

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	14.50	-0.85	0.025
4	Right shoulder	22.00	-0.10	0.012
5	-End point-	32.00	0.30	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.48 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	3.93	2.53	1.23	7.70		
Intercepted flow:	0.73	1.79	0.23		2.75	4.95

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 3.28 ft/sec

Left side flow:

Discharge:	3.93	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.19	
Q in:	0.73	cfs

Frontal flow on grate:

Discharge:	2.53	cfs
Efficiency:	0.70	
Q in:	1.79	cfs

Right side flow:

Discharge:	1.23	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.19	
Q in:	0.23	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 402

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Left		Left:	Yes	
Discharge:	5.08	cfs	Right:	Yes	
Longitudinal slope:	0.0054	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	15.30	-0.93	0.025
4	Right shoulder	22.00	-0.26	0.012
5	-End point-	32.00	0.14	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.53 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	0.97	1.57	2.54	5.08		
Intercepted flow:	0.39	1.31	1.01		2.71	2.37

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 1.83 ft/sec

Left side flow:

Discharge:	0.97	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.40	
Q in:	0.39	cfs

Frontal flow on grate:

Discharge:	1.57	cfs
Efficiency:	0.84	
Q in:	1.31	cfs

Right side flow:

Discharge:	2.54	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.40	
Q in:	1.01	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 403

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?	
Inlet side:	Right		Left:	Yes
Discharge:	6.31	cfs	Right:	Yes
Longitudinal slope:	0.0072	ft/ft		

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	16.60	-1.06	0.025
4	Right shoulder	22.00	-0.51	0.012
5	-End point-	32.00	-0.11	
-				

* Type is marked at the start of the segment

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

RESULTS SUMMARY

Flow depth: 0.54 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	3.18	1.90	1.22	6.31		
Intercepted flow:	1.05	1.53	0.41		2.99	3.32

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 2.15 ft/sec

Left side flow:

Discharge:	3.18	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.33	
Q in:	1.05	cfs

Frontal flow on grate:

Discharge:	1.90	cfs
Efficiency:	0.81	
Q in:	1.53	cfs

Right side flow:

Discharge:	1.22	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.33	
Q in:	0.41	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 404

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?	
Inlet side:	Right		Left:	Yes
Discharge:	9.30	cfs	Right:	Yes
Longitudinal slope:	0.0225	ft/ft		

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	16.60	-1.06	0.025
4	Right shoulder	22.00	-0.51	0.012
5	-End point-	32.00	-0.11	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.51 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	4.69	3.00	1.60	9.30		
Intercepted flow:	0.75	2.02	0.26		3.03	6.27

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 3.63 ft/sec

Left side flow:

Discharge:	4.69	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.16	
Q in:	0.75	cfs

Frontal flow on grate:

Discharge:	3.00	cfs
Efficiency:	0.67	
Q in:	2.02	cfs

Right side flow:

Discharge:	1.60	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.16	
Q in:	0.26	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 405

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?	
Inlet side:	Left		Left:	Yes
Discharge:	10.78	cfs	Right:	Yes
Longitudinal slope:	0.0203	ft/ft		

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	16.30	-1.03	0.025
4	Right shoulder	22.23	-0.46	0.012
5	-End point-	32.00	-0.06	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.54 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	2.11	3.17	5.50	10.78		
Intercepted flow:	0.34	2.15	0.86		3.35	7.43

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 3.60 ft/sec

Left side flow:

Discharge:	2.11	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.16	
Q in:	0.34	cfs

Frontal flow on grate:

Discharge:	3.17	cfs
Efficiency:	0.68	
Q in:	2.15	cfs

Right side flow:

Discharge:	5.50	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.16	
Q in:	0.86	cfs

COMPUTE INTERCEPTION OF A P-12 INLET AT A SAG POINT

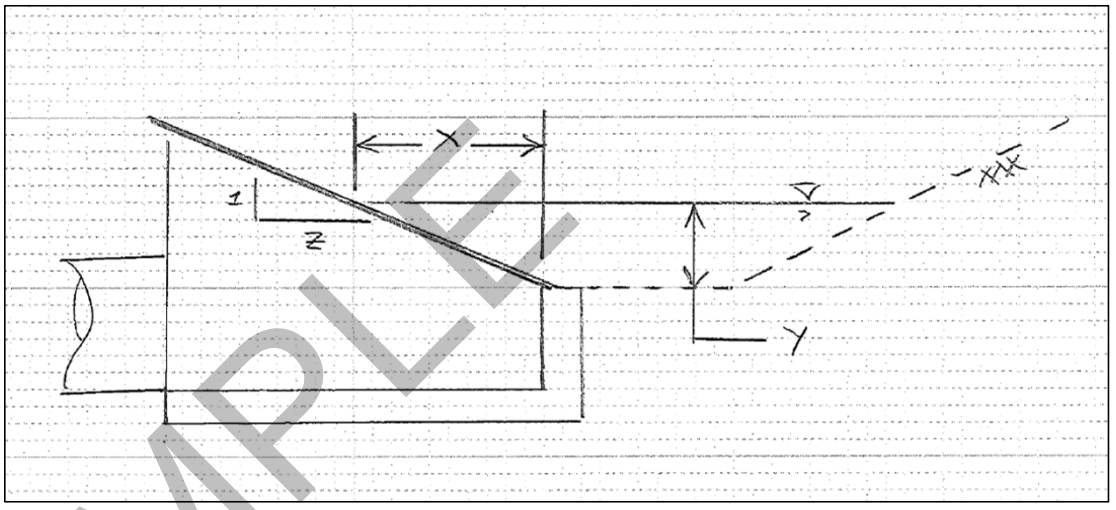
Project:	I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")				
Str. Number:	406	Designed by:	MA	Checked by:	WN
Station:	2242+35	Date:	8/12/18	Date:	8/16/18

Data Entry

Discharge:	12.92	cfs
z:	10	:1
Weir C:	n/a	
Orifice C:	0.60	

Enter trial depth: 0.828 feet (y)

(Trial and error until Computed Q = entered Discharge)



Results

X	% of Grate	Eff. Head
8.280	100.00%	0.64

Weir flow:

Base:

L	h/L	C*	Q
2.24	0.370	2.71	3.102

Sides:

L	h/L	C*	Q
7.26	0.088	2.65	9.825
		Total:	12.927

Orifice flow:

Eff. Area	Q
5.06	19.496

Computed

Q	Error
12.927	-0.007

45 openings, 2-1/8" by 7-5/8"

			Total
Weir Length along base:	2.24	feet	
Side weir length:	3.63	feet	
Area of one opening:	0.11	SF	5.06

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 408

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?	
Inlet side:	Left		Left:	Yes
Discharge:	9.59	cfs	Right:	Yes
Longitudinal slope:	0.0032	ft/ft		

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	16.40	-1.04	0.025
4	Right shoulder	22.00	-0.49	0.012
5	-End point-	32.00	-0.09	
-				

* Type is marked at the start of the segment

Hydraulic Grate Width:	1.59	feet	(along flow direction)
Hydraulic Grate Length:	3.27	feet	(along ditch slope)
No. of Open Spaces Along Flow Direction =	9		
Individual Space Width (in.) =	2.125		
No. of Open Spaces Along Ditch Slope (Ends of Grate) =	2		
Individual Space Width (in.) =	8.1875		
No. of Open Spaces Along Ditch Slope (Middle of Grate) =	3		
Individual Space Width (in.) =	7.625		

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width:	3.50	feet	(along flow direction)
P-12A Inlet Length:	4.33	feet	(along ditch slope)

RESULTS SUMMARY

Flow depth: 0.71 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	2.23	2.27	5.09	9.59		
Intercepted flow:	0.90	1.90	2.02		4.82	4.77

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 1.81 ft/sec

Left side flow:

Discharge:	2.23	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.40	
Q in:	0.90	cfs

Frontal flow on grate:

Discharge:	2.27	cfs
Efficiency:	0.84	
Q in:	1.90	cfs

Right side flow:

Discharge:	5.09	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.40	
Q in:	2.02	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 409

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?	
Inlet side:	Left		Left:	Yes
Discharge:	15.3	cfs	Right:	Yes
Longitudinal slope:	0.004	ft/ft		

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	16.30	-1.02	0.025
4	Right shoulder	22.00	-0.45	0.012
5	-End point-	32.00	-0.05	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.79 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	3.87	3.56	7.86	15.30		
Intercepted flow:	1.21	2.85	2.48		6.54	8.76

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 2.23 ft/sec

Left side flow:

Discharge:	3.87	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.31	
Q in:	1.21	cfs

Frontal flow on grate:

Discharge:	3.56	cfs
Efficiency:	0.80	
Q in:	2.85	cfs

Right side flow:

Discharge:	7.86	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.32	
Q in:	2.48	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 410

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?	
Inlet side:	Left		Left:	Yes
Discharge:	17.77	cfs	Right:	Yes
Longitudinal slope:	0.0091	ft/ft		

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	16.40	-1.04	0.025
4	Right shoulder	22.00	-0.48	0.012
5	-End point-	32.00	-0.08	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.73 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	4.24	4.21	9.32	17.77		
Intercepted flow:	0.85	3.03	1.86		5.74	12.03

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 3.13 ft/sec

Left side flow:

Discharge:	4.24	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.20	
Q in:	0.85	cfs

Frontal flow on grate:

Discharge:	4.21	cfs
Efficiency:	0.72	
Q in:	3.03	cfs

Right side flow:

Discharge:	9.32	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.20	
Q in:	1.86	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 411

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Left		Left:	Yes	
Discharge:	19.57	cfs	Right:	Yes	
Longitudinal slope:	0.0103	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	16.50	-1.05	0.025
4	Right shoulder	22.00	-0.51	0.012
5	-End point-	32.00	-0.11	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.74 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	4.58	4.44	10.55	19.57		
Intercepted flow:	0.83	3.11	1.89		5.83	13.74

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 3.34 ft/sec

Left side flow:

Discharge:	4.58	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.18	
Q in:	0.83	cfs

Frontal flow on grate:

Discharge:	4.44	cfs
Efficiency:	0.70	
Q in:	3.11	cfs

Right side flow:

Discharge:	10.55	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.18	
Q in:	1.89	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 412

Checked by: WN Date: 8/16/2018

DATA ENTRY

Ditch Type:	V-Ditch	
Inlet side:	Left	
Discharge:	24.31	cfs
Longitudinal slope:	0.0108	ft/ft

Check: Will inlet fit?
Left: Yes
Right: Yes

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	16.50	-1.04	0.025
4	Right shoulder	22.00	-0.49	0.012
5	-End point-	32.00	-0.09	
-				

* Type is marked at the start of the segment

Background

Hydraulic Grate Width:	1.59	feet (along flow direction)
Hydraulic Grate Length:	3.27	feet (along ditch slope)
No. of Open Spaces Along Flow Direction =	9	
Individual Space Width (in.) =	2.125	
No. of Open Spaces Along Ditch Slope (Ends of Grate) =	2	
Individual Space Width (in.) =	8.1875	
No. of Open Spaces Along Ditch Slope (Middle of Grate) =	3	
Individual Space Width (in.) =	7.625	

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width:	3.50	feet (along flow direction)
P-12A Inlet Length:	4.33	feet (along ditch slope)

RESULTS SUMMARY

Flow depth: 0.78 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	6.00	5.48	12.83	24.31		
Intercepted flow:	0.95	3.69	2.06		6.70	17.61

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 3.63 ft/sec

Left side flow:

Discharge:	6.00	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.16	
Q in:	0.95	cfs

Frontal flow on grate:

Discharge:	5.48	cfs
Efficiency:	0.67	
Q in:	3.69	cfs

Right side flow:

Discharge:	12.83	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.16	
Q in:	2.06	cfs

COMPUTE INTERCEPTION OF A P-12 INLET AT A SAG POINT

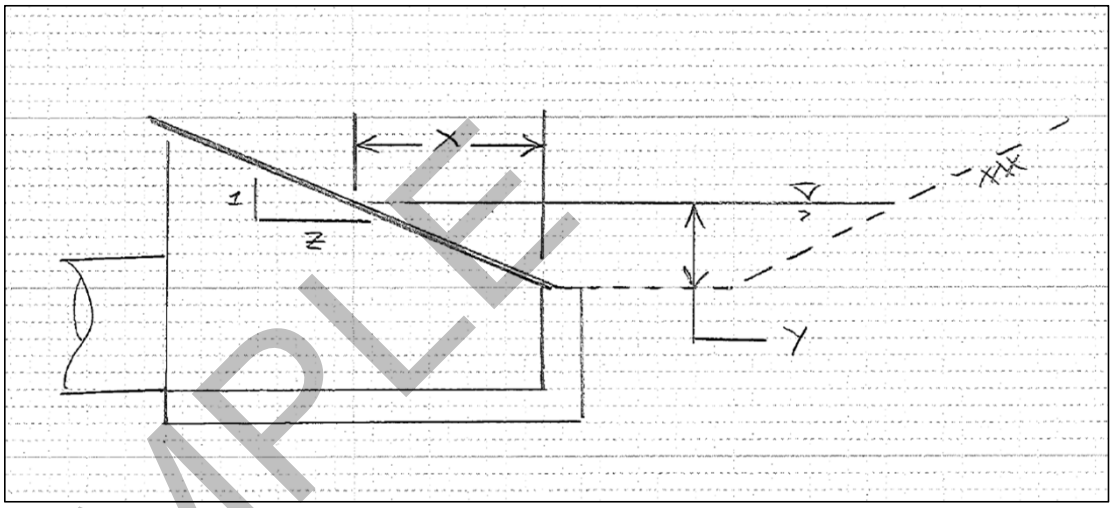
Project:	I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")				
Str. Number:	415	Designed by:	MA	Checked by:	WN
Station:	2281+56	Date:	8/12/18	Date:	8/16/18

Data Entry

Total Discharge:	29.65	cfs
Discharge:	9.88	cfs
z:	10	:1
Weir C:	n/a	
Orifice C:	0.60	

Enter trial depth: 0.724 feet (y)

(Trial and error until Computed Q = entered Discharge)



45 openings, 2-1/8" by 7-5/8"

Results

X	% of Grate	Eff. Head
7.240	100.00%	0.54

Weir flow:

Base:

L	h/L	C*	Q
2.24	0.323	2.69	2.365

Sides:

L	h/L	C*	Q
7.26	0.074	2.64	7.523
		Total:	9.888

Orifice flow:

Eff. Area	Q
5.06	17.840

Computed

Q	Error
9.888	-0.005

			Total
Weir Length along base:	2.24	feet	
Side weir length:	3.63	feet	
Area of one opening:	0.11	SF	5.06

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

PLEASE BE ADVISED:
THIS LOCATION REQUIRES A TRIPLE INLET. THE DESIGN FLOW RATE WAS CUT IN THIRDS TO SIGNIFY THE USE OF A TRIPLE INLET.

COMPUTE INTERCEPTION OF A P-12 INLET AT A SAG POINT

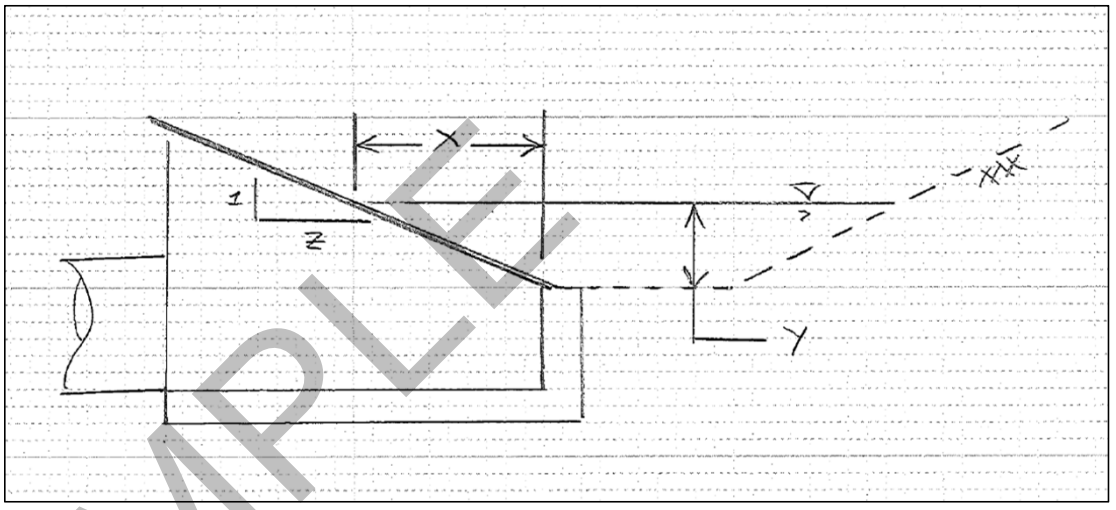
Project:	I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")				
Str. Number:	418	Designed by:	MA	Checked by:	WN
Station:	2281+56	Date:	8/12/18	Date:	8/16/18

Data Entry

Total Discharge:	6.55	cfs
Discharge:		cfs
z:	10	:1
Weir C:	n/a	
Orifice C:	0.60	

Enter trial depth: 0.597 feet (y)

(Trial and error until Computed Q = entered Discharge)



45 openings, 2-1/8" by 7-5/8"

			Total
Weir Length along base:	2.24	feet	
Side weir length:	3.63	feet	
Area of one opening:	0.11	SF	5.06

Results

X	% of Grate	Eff. Head
5.970	100.00%	0.41

Weir flow:

Base:

L	h/L	C*	Q
2.24	0.267	2.68	1.567

Sides:

L	h/L	C*	Q
7.26	0.056	2.64	5.008
		Total:	6.575

Orifice flow:

Eff. Area	Q
5.06	15.582

Computed

Q	Error
6.575	-6.575

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

COMPUTE INTERCEPTION OF A P-12 INLET AT A SAG POINT

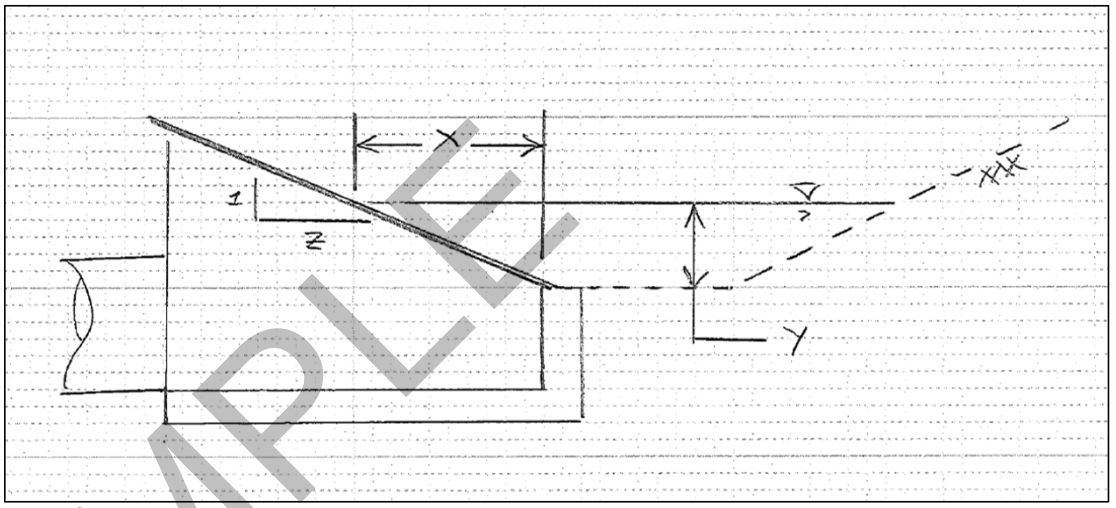
Project:	I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")				
Str. Number:	421	Designed by:	MA	Checked by:	WN
Station:	2287+32	Date:	9/14/18	Date:	9/17/18

Data Entry

Total Discharge:	27.32	cfs
Discharge:	13.66	cfs
z:	10	:1
Weir C:	n/a	
Orifice C:	0.60	

Enter trial depth: 0.852 feet (y)

(Trial and error until Computed Q = entered Discharge)



45 openings, 2-1/8" by 7-5/8"

Results

X	% of Grate	Eff. Head
8.520	100.00%	0.66

Weir flow:

Base:

L	h/L	C*	Q
2.24	0.380	2.71	3.282

Sides:

L	h/L	C*	Q
7.26	0.091	2.65	10.385
		Total:	13.667

Orifice flow:

Eff. Area	Q
5.06	19.859

Computed

Q	Error
13.667	-0.007

			Total
Weir Length along base:	2.24	feet	
Side weir length:	3.63	feet	
Area of one opening:	0.11	SF	5.06

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

PLEASE BE ADVISED:
THIS LOCATION REQUIRES A DOUBLE INLET. THE DESIGN FLOW RATE WAS CUT IN HALF TO SIGNIFY THE USE OF A DOUBLE INLET.

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 9/14/2018 Str. #: 424

Checked by: WN Date: 9/17/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Left		Left:	Yes	
Discharge:	25.58	cfs	Right:	Yes	
Longitudinal slope:	0.0083	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	15.50	-0.95	0.025
4	Right shoulder	20.00	-0.50	0.012
5	-End point-	32.00	-0.02	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.78 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	5.80	5.73	14.05	25.58		
Intercepted flow:	1.00	3.94	2.41		7.35	18.23

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 3.47 ft/sec

Left side flow:

Discharge:	5.80	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.17	
Q in:	1.00	cfs

Frontal flow on grate:

Discharge:	5.73	cfs
Efficiency:	0.69	
Q in:	3.94	cfs

Right side flow:

Discharge:	14.05	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.17	
Q in:	2.41	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 425

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Right		Left:	Yes	
Discharge:	26.06	cfs	Right:	No	
Longitudinal slope:	0.0122	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.20	0.025
3	Right slope	17.10	-0.91	0.025
4	Right shoulder	20.70	-0.55	0.012
5	-End point-	32.70	0.07	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.76 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	9.97	8.29	7.79	26.06		
Intercepted flow:	1.38	5.31	1.08		7.77	18.29

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 4.00 ft/sec

Left side flow:

Discharge:	9.97	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.14	
Q in:	1.38	cfs

Frontal flow on grate:

Discharge:	8.29	cfs
Efficiency:	0.64	
Q in:	5.31	cfs

Right side flow:

Discharge:	7.79	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.14	
Q in:	1.08	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 426

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Left		Left:	Yes	
Discharge:	23.20	cfs	Right:	No	
Longitudinal slope:	0.0126	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.20	0.025
3	Right slope	18.10	-1.01	0.025
4	Right shoulder	21.30	-0.69	0.012
5	-End point-	33.30	-0.07	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.71 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	4.58	3.82	14.80	23.20		
Intercepted flow:	0.64	2.46	2.07		5.17	18.03

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 3.97 ft/sec

Left side flow:

Discharge:	4.58	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.14	
Q in:	0.64	cfs

Frontal flow on grate:

Discharge:	3.82	cfs
Efficiency:	0.64	
Q in:	2.46	cfs

Right side flow:

Discharge:	14.80	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.14	
Q in:	2.07	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 427

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Right		Left:	Yes	
Discharge:	23.2	cfs	Right:	No	
Longitudinal slope:	0.0112	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.20	0.025
3	Right slope	18.10	-1.01	0.025
4	Right shoulder	21.60	-0.65	0.012
5	-End point-	33.60	-0.02	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.74 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	8.85	7.75	6.60	23.20		
Intercepted flow:	1.33	5.11	1.02		7.46	15.74

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 3.78 ft/sec

Left side flow:

Discharge:	8.85	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.15	
Q in:	1.33	cfs

Frontal flow on grate:

Discharge:	7.75	cfs
Efficiency:	0.66	
Q in:	5.11	cfs

Right side flow:

Discharge:	6.60	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.15	
Q in:	1.02	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 428

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Left		Left:	Yes	
Discharge:	19.48	cfs	Right:	No	
Longitudinal slope:	0.0099	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.20	0.025
3	Right slope	18.60	-1.06	0.025
4	Right shoulder	21.50	-0.76	0.012
5	-End point-	33.50	-0.14	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.70 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	3.74	3.25	12.49	19.48		
Intercepted flow:	0.64	2.23	2.18		5.05	14.43

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 3.49 ft/sec

Left side flow:

Discharge:	3.74	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.17	
Q in:	0.64	cfs

Frontal flow on grate:

Discharge:	3.25	cfs
Efficiency:	0.69	
Q in:	2.23	cfs

Right side flow:

Discharge:	12.49	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.17	
Q in:	2.18	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 429

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Left		Left:	Yes	
Discharge:	15.53	cfs	Right:	No	
Longitudinal slope:	0.01	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.20	0.025
3	Right slope	19.10	-1.11	0.025
4	Right shoulder	20.90	-0.92	0.012
5	-End point-	32.90	-0.30	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.61 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	2.27	2.56	10.69	15.53		
Intercepted flow:	0.40	1.78	1.98		4.16	11.37

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 3.40 ft/sec

Left side flow:

Discharge:	2.27	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.18	
Q in:	0.40	cfs

Frontal flow on grate:

Discharge:	2.56	cfs
Efficiency:	0.69	
Q in:	1.78	cfs

Right side flow:

Discharge:	10.69	cfs
Side slope:	0.11	ft/ft
Efficiency:	0.18	
Q in:	1.98	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 430

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Right		Left:	Yes	
Discharge:	12.21	cfs	Right:	No	
Longitudinal slope:	0.0087	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	17.80	-1.18	0.025
4	Right shoulder	20.00	-0.95	0.012
5	-End point-	32.00	-0.46	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.58 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	3.87	3.86	4.48	12.21		
Intercepted flow:	0.85	2.84	1.02		4.71	7.50

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 2.93 ft/sec

Left side flow:

Discharge:	3.87	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.22	
Q in:	0.85	cfs

Frontal flow on grate:

Discharge:	3.86	cfs
Efficiency:	0.74	
Q in:	2.84	cfs

Right side flow:

Discharge:	4.48	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.23	
Q in:	1.02	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 431

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Right		Left:	Yes	
Discharge:	13.01	cfs	Right:	Yes	
Longitudinal slope:	0.0083	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	15.90	-0.99	0.025
4	Right shoulder	22.00	-0.37	0.012
5	-End point-	32.00	0.03	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.69 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	6.66	3.36	2.99	13.01		
Intercepted flow:	1.61	2.53	0.73		4.87	8.14

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 2.74 ft/sec

Left side flow:

Discharge:	6.66	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.24	
Q in:	1.61	cfs

Frontal flow on grate:

Discharge:	3.36	cfs
Efficiency:	0.75	
Q in:	2.53	cfs

Right side flow:

Discharge:	2.99	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.24	
Q in:	0.73	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 432

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?	
Inlet side:	Left		Left:	Yes
Discharge:	13.18	cfs	Right:	Yes
Longitudinal slope:	0.0073	ft/ft		

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	17.10	-1.11	0.025
4	Right shoulder	22.00	-0.63	0.012
5	-End point-	32.00	-0.23	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.68 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	2.98	2.73	7.47	13.18		
Intercepted flow:	0.75	2.08	1.85		4.68	8.50

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 2.65 ft/sec

Left side flow:

Discharge:	2.98	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.25	
Q in:	0.75	cfs

Frontal flow on grate:

Discharge:	2.73	cfs
Efficiency:	0.76	
Q in:	2.08	cfs

Right side flow:

Discharge:	7.47	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.25	
Q in:	1.85	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 434

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?	
Inlet side:	Right		Left:	Yes
Discharge:	7.78	cfs	Right:	Yes
Longitudinal slope:	0.0071	ft/ft		

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	16.80	-1.08	0.025
4	Right shoulder	22.00	-0.56	0.012
5	-End point-	32.00	-0.16	
-				

* Type is marked at the start of the segment

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

RESULTS SUMMARY

Flow depth: 0.58 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	3.75	2.49	1.54	7.78		
Intercepted flow:	1.16	1.98	0.47		3.61	4.17

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 2.27 ft/sec

Left side flow:

Discharge:	3.75	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.31	
Q in:	1.16	cfs

Frontal flow on grate:

Discharge:	2.49	cfs
Efficiency:	0.80	
Q in:	1.98	cfs

Right side flow:

Discharge:	1.54	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.31	
Q in:	0.47	cfs

COMPUTE INTERCEPTION OF A P-12 INLET AT A SAG POINT

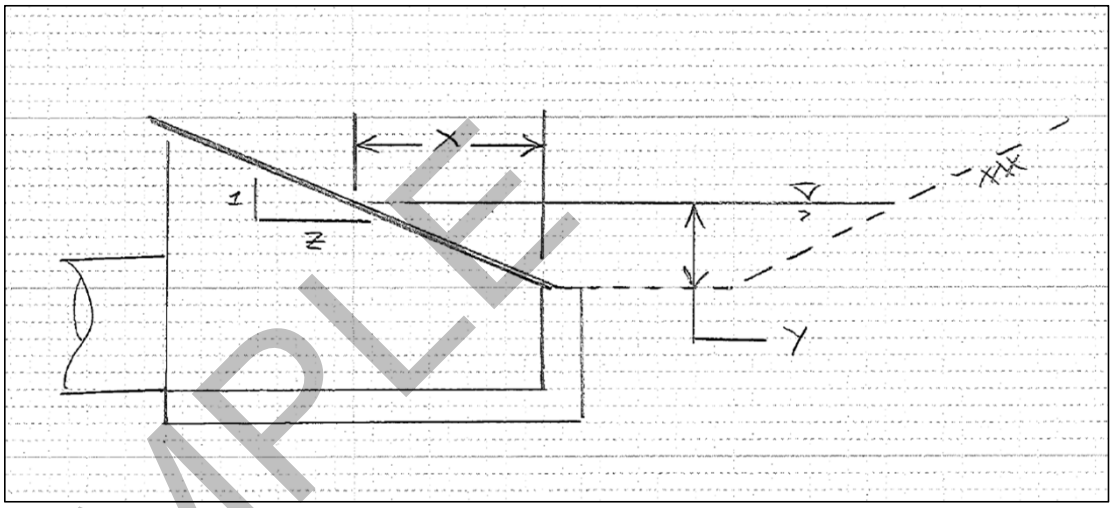
Project:	I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")				
Str. Number:	435	Designed by:	MA	Checked by:	WN
Station:	2346+70	Date:	9/14/18	Date:	9/17/18

Data Entry

Total Discharge:	14.19	cfs
Discharge:	7.095	cfs
z:	6	:1
Weir C:	n/a	
Orifice C:	0.60	

Enter trial depth: 0.744 feet (y)

(Trial and error until Computed Q = entered Discharge)



45 openings, 2-1/8" by 7-5/8"

			Total
Weir Length along base:	2.24	feet	
Side weir length:	3.63	feet	
Area of one opening:	0.11	SF	5.06

Results

X	% of Grate	Eff. Head
4.464	100.00%	0.43

Weir flow:

Base:

L	h/L	C*	Q
2.24	0.332	2.70	1.702

Sides:

L	h/L	C*	Q
7.26	0.059	2.64	5.406
		Total:	7.108

Orifice flow:

Eff. Area	Q
5.06	15.983

Computed

Q	Error
7.108	-0.013

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

PLEASE BE ADVISED:
THIS LOCATION REQUIRES A DOUBLE INLET. THE DESIGN FLOW RATE WAS CUT IN HALF TO SIGNIFY THE USE OF A DOUBLE INLET.

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 439

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Left		Left:	Yes	
Discharge:	9.18	cfs	Right:	Yes	
Longitudinal slope:	0.0051	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	15.20	-0.92	0.025
4	Right shoulder	22.00	-0.24	0.012
5	-End point-	32.00	0.16	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.65 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	2.04	2.89	4.25	9.18		
Intercepted flow:	0.70	2.34	1.45		4.49	4.69

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 2.09 ft/sec

Left side flow:

Discharge:	2.04	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.34	
Q in:	0.70	cfs

Frontal flow on grate:

Discharge:	2.89	cfs
Efficiency:	0.81	
Q in:	2.34	cfs

Right side flow:

Discharge:	4.25	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.34	
Q in:	1.45	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 440

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Left		Left:	Yes	
Discharge:	5.82	cfs	Right:	Yes	
Longitudinal slope:	0.0036	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	16.80	-1.08	0.025
4	Right shoulder	22.00	-0.55	0.012
5	-End point-	32.00	-0.15	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.60 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	1.29	1.55	2.99	5.82		
Intercepted flow:	0.57	1.32	1.34		3.23	2.59

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 1.64 ft/sec

Left side flow:

Discharge:	1.29	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.44	
Q in:	0.57	cfs

Frontal flow on grate:

Discharge:	1.55	cfs
Efficiency:	0.85	
Q in:	1.32	cfs

Right side flow:

Discharge:	2.99	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.45	
Q in:	1.34	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 441

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Left		Left:	Yes	
Discharge:	10.13	cfs	Right:	Yes	
Longitudinal slope:	0.0083	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	16.00	-1.00	0.025
4	Right shoulder	22.00	-0.41	0.012
5	-End point-	32.00	-0.01	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.62 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	2.29	2.71	5.13	10.13		
Intercepted flow:	0.60	2.08	1.33		4.01	6.12

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 2.57 ft/sec

Left side flow:

Discharge:	2.29	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.26	
Q in:	0.60	cfs

Frontal flow on grate:

Discharge:	2.71	cfs
Efficiency:	0.77	
Q in:	2.08	cfs

Right side flow:

Discharge:	5.13	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.26	
Q in:	1.33	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 8/12/2018 Str. #: 442

Checked by: WN Date: 8/16/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?	
Inlet side:	Left		Left:	Yes
Discharge:	13.66	cfs	Right:	Yes
Longitudinal slope:	0.009	ft/ft		

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	15.50	-0.95	0.025
4	Right shoulder	22.00	-0.30	0.012
5	-End point-	32.00	0.10	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.68 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	3.18	4.02	6.46	13.66		
Intercepted flow:	0.72	2.98	1.46		5.16	8.50

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 2.87 ft/sec

Left side flow:

Discharge:	3.18	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.23	
Q in:	0.72	cfs

Frontal flow on grate:

Discharge:	4.02	cfs
Efficiency:	0.74	
Q in:	2.98	cfs

Right side flow:

Discharge:	6.46	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.23	
Q in:	1.46	cfs

COMPUTE INTERCEPTION OF A P-12 INLET AT A SAG POINT

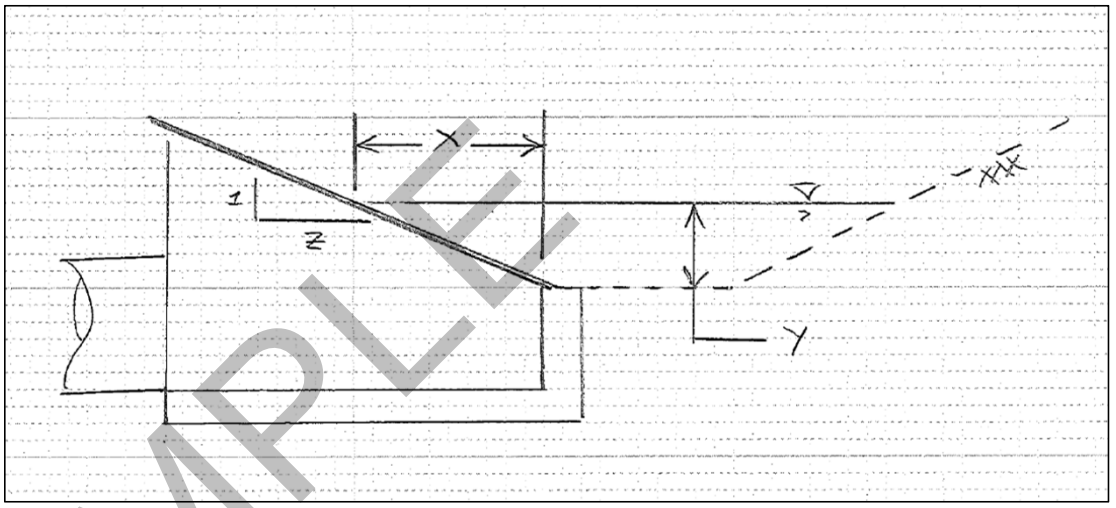
Project:	I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")				
Str. Number:	444	Designed by:	MA	Checked by:	WN
Station:	2347+00	Date:	9/14/18	Date:	9/17/18

Data Entry

Total Discharge:	17.02	cfs
Discharge:	8.51	cfs
z:	8	:1
Weir C:	n/a	
Orifice C:	0.60	

Enter trial depth: 0.721 feet (y)

(Trial and error until Computed Q = entered Discharge)



45 openings, 2-1/8" by 7-5/8"

Results

X	% of Grate	Eff. Head
5.768	100.00%	0.49

Weir flow:

Base:

L	h/L	C*	Q
2.24	0.322	2.69	2.040

Sides:

L	h/L	C*	Q
7.26	0.067	2.64	6.489
		Total:	8.530

Orifice flow:

Eff. Area	Q
5.06	16.985

Computed

Q	Error
8.530	-0.020

			Total
Weir Length along base:	2.24	feet	
Side weir length:	3.63	feet	
Area of one opening:	0.11	SF	5.06

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

PLEASE BE ADVISED:
THIS LOCATION REQUIRES A DOUBLE INLET. THE DESIGN FLOW RATE WAS CUT IN HALF TO SIGNIFY THE USE OF A DOUBLE INLET.

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 9/14/2018 Str. #: 447

Checked by: WN Date: 9/17/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Left		Left:	Yes	
Discharge:	6.39	cfs	Right:	Yes	
Longitudinal slope:	0.0059	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	15.40	-0.94	0.025
4	Right shoulder	22.00	-0.27	0.012
5	-End point-	32.00	0.13	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.57 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	1.30	1.97	3.12	6.39		
Intercepted flow:	0.47	1.62	1.14		3.23	3.16

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 1.99 ft/sec

Left side flow:

Discharge:	1.30	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.36	
Q in:	0.47	cfs

Frontal flow on grate:

Discharge:	1.97	cfs
Efficiency:	0.82	
Q in:	1.62	cfs

Right side flow:

Discharge:	3.12	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.37	
Q in:	1.14	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 9/14/2018 Str. #: 448

Checked by: WN Date: 9/17/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Right		Left:	No	
Discharge:	10.37	cfs	Right:	Yes	
Longitudinal slope:	0.0049	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	13.90	-0.79	0.025
4	Right shoulder	23.80	0.20	0.012
5	-End point-	33.80	0.60	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.65 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	6.23	2.07	2.07	10.37		
Intercepted flow:	2.01	1.66	0.67		4.34	6.03

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 2.19 ft/sec

Left side flow:

Discharge:	6.23	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.32	
Q in:	2.01	cfs

Frontal flow on grate:

Discharge:	2.07	cfs
Efficiency:	0.80	
Q in:	1.66	cfs

Right side flow:

Discharge:	2.07	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.32	
Q in:	0.67	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 9/14/2018 Str. #: 449

Checked by: WN Date: 9/17/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Right		Left:	No	
Discharge:	12.83	cfs	Right:	Yes	
Longitudinal slope:	0.0049	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	13.60	-0.77	0.025
4	Right shoulder	23.40	0.21	0.012
5	-End point-	33.40	0.61	
-				

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.69 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	8.01	2.26	2.55	12.83		
Intercepted flow:	2.45	1.79	0.76		5.00	7.83

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 2.32 ft/sec

Left side flow:

Discharge:	8.01	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.31	
Q in:	2.45	cfs

Frontal flow on grate:

Discharge:	2.26	cfs
Efficiency:	0.79	
Q in:	1.79	cfs

Right side flow:

Discharge:	2.55	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.30	
Q in:	0.76	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 9/14/2018 Str. #: 450

Checked by: WN Date: 9/17/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Left		Left:	Yes	
Discharge:	16.10	cfs	Right:	Yes	
Longitudinal slope:	0.0067	ft/ft			

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	16.10	-1.01	0.025
4	Right shoulder	22.00	-0.42	0.012
5	-End point-	32.00	-0.02	
-				

* Type is marked at the start of the segment

Hydraulic Grate Width:	1.59	feet	(along flow direction)
Hydraulic Grate Length:	3.27	feet	(along ditch slope)
No. of Open Spaces Along Flow Direction =	9		
Individual Space Width (in.) =	2.125		
No. of Open Spaces Along Ditch Slope (Ends of Grate) =	2		
Individual Space Width (in.) =	8.1875		
No. of Open Spaces Along Ditch Slope (Middle of Grate) =	3		
Individual Space Width (in.) =	7.625		

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width:	3.50	feet	(along flow direction)
P-12A Inlet Length:	4.33	feet	(along ditch slope)

RESULTS SUMMARY

Flow depth: 0.75 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	3.92	4.03	8.15	16.10		
Intercepted flow:	0.95	3.04	1.97		5.96	10.14

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 2.73 ft/sec

Left side flow:

Discharge:	3.92	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.24	
Q in:	0.95	cfs

Frontal flow on grate:

Discharge:	4.03	cfs
Efficiency:	0.75	
Q in:	3.04	cfs

Right side flow:

Discharge:	8.15	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.24	
Q in:	1.97	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 9/14/2018 Str. #: 451

Checked by: WN Date: 9/17/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?	
Inlet side:	Left		Left:	Yes
Discharge:	19.15	cfs	Right:	Yes
Longitudinal slope:	0.0091	ft/ft		

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	15.40	-0.94	0.025
4	Right shoulder	22.00	-0.27	0.012
5	-End point-	32.00	0.13	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.75 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	5.05	5.39	8.71	19.15		
Intercepted flow:	0.99	3.85	1.73		6.58	12.57

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 3.17 ft/sec

Left side flow:

Discharge:	5.05	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.20	
Q in:	0.99	cfs

Frontal flow on grate:

Discharge:	5.39	cfs
Efficiency:	0.72	
Q in:	3.85	cfs

Right side flow:

Discharge:	8.71	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.20	
Q in:	1.73	cfs

P-12A INLETS ON GRADE - FLOW INTERCEPTION

Project: I-65 SE Project (Area B - Sta. 2214+50 "A" to Sta. 2414+50 "A")

Done by: MA Date: 9/14/2018 Str. #: 452

Checked by: WN Date: 9/17/2018

DATA ENTRY **Background**

Ditch Type:	V-Ditch		Check: Will inlet fit?		
Inlet side:	Left		Left:	Yes	
Discharge:	23.14	cfs	Right:	Yes	
Longitudinal slope:	0.0109	ft/ft			

Hydraulic Grate Width: 1.59 feet (along flow direction)

Hydraulic Grate Length: 3.27 feet (along ditch slope)

No. of Open Spaces Along Flow Direction = 9

Individual Space Width (in.) = 2.125

No. of Open Spaces Along Ditch Slope (Ends of Grate) = 2

Individual Space Width (in.) = 8.1875

No. of Open Spaces Along Ditch Slope (Middle of Grate) = 3

Individual Space Width (in.) = 7.625

** Dimensions based on Standard Drawing E 720-ICCA-11 and E 720-ICCA-12.*

P-12A Inlet Width: 3.50 feet (along flow direction)

P-12A Inlet Length: 4.33 feet (along ditch slope)

Enter ditch cross section data:

Point Number	Segment Type*	X	Elevation	Mannings n
1	Left shoulder	0.00	0.00	0.012
2	Left slope	10.00	-0.40	0.025
3	Right slope	15.90	-0.99	0.025
4	Right shoulder	22.00	-0.37	0.012
5	-End point-	32.00	0.03	
-				

* Type is marked at the start of the segment

RESULTS SUMMARY

Flow depth: 0.78 feet

	Left of Grate (cfs)	On Grate (cfs)	Right of Grate (cfs)	Total Flow (cfs)	Intercepted Flow (cfs)	Bypass Flow (cfs)
Inflow:	5.97	5.92	11.25	23.14		
Intercepted flow:	0.98	4.01	1.87		6.85	16.29

By using this spreadsheet, the user agrees to take full responsibility to evaluate the results and ensure that they are correct.

INLET COMPUTATIONS

Average flow velocity: 3.58 ft/sec

Left side flow:

Discharge:	5.97	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.16	
Q in:	0.98	cfs

Frontal flow on grate:

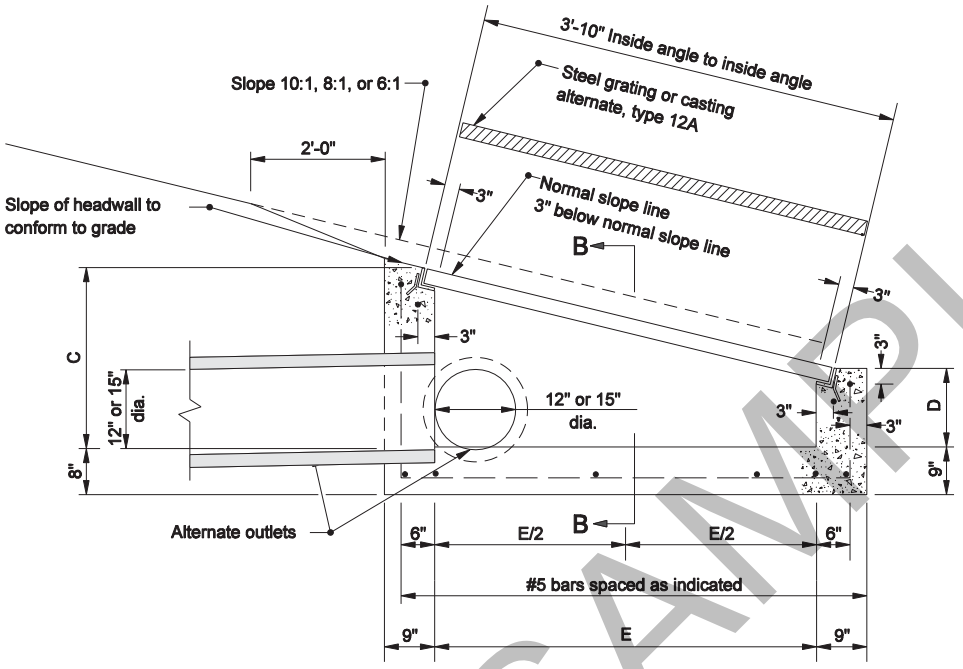
Discharge:	5.92	cfs
Efficiency:	0.68	
Q in:	4.01	cfs

Right side flow:

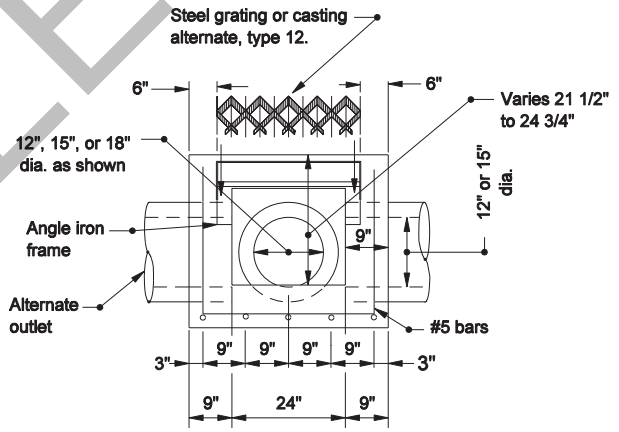
Discharge:	11.25	cfs
Side slope:	0.10	ft/ft
Efficiency:	0.17	
Q in:	1.87	cfs

NOTE:

1. See Standard Drawing E 720-ICCA-10 for steel grating Type 12 or E 720-ICCA-11 for castion Type 12 Alternate.



TYPE P INLET



SECTION B-B

TYPE P INLET									
PIPE SIZE	6:1			8:1			10:1		
	C	D	E	C	D	E	C	D	E
12"	21 1/2"	13"	3'-3 1/4"	21 1/2"	14 1/2"	3'-3 3/4"	21 1/2"	15 7/8"	3'-3 3/4"
15"	24 3/4"	16 1/4"	3'-3 1/4"	24 3/4"	18"	3'-3 3/4"	24 3/4"	19 1/8"	3'-3 3/4"

INDIANA DEPARTMENT OF TRANSPORTATION

INLET TYPE P

SEPTEMBER 2005

STANDARD DRAWING NO. E 720-INST-09

RICHARD L. VanCLEAVE REGISTERED No. 9750 STATE OF INDIANA PROFESSIONAL ENGINEER

DESIGN STANDARDS ENGINEER

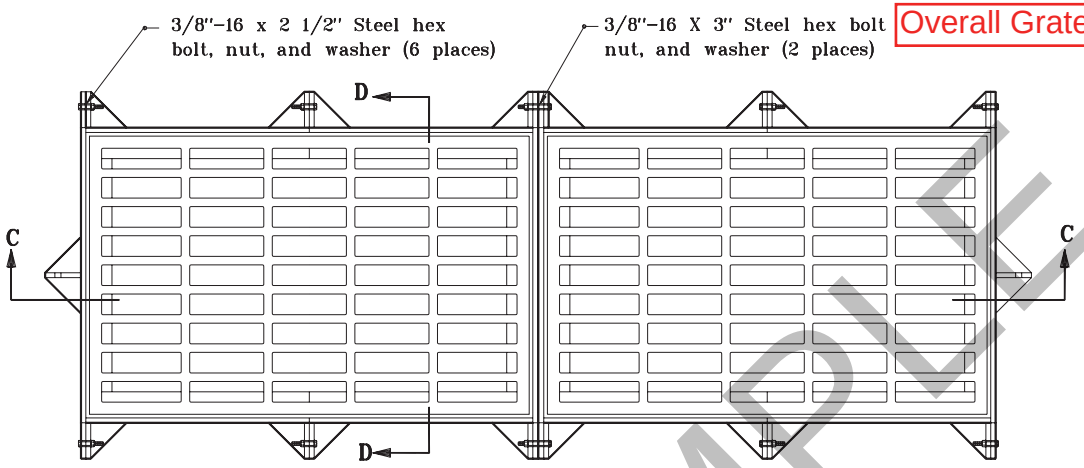
/s/ Richard L. VanCleave 9-01-05
DESIGN STANDARDS ENGINEER DATE

/s/ Richard K. Smutzer 9-01-05
CHIEF HIGHWAY ENGINEER DATE

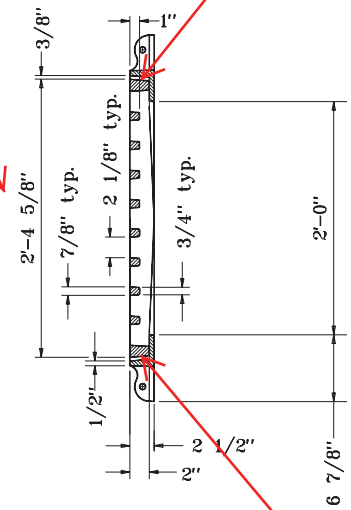
Base Weir Length = 28.625" - 2(0.875") = 26.875" = 2.24'

Bar Width = 0.875"

Overall Grate Width = 28.625"

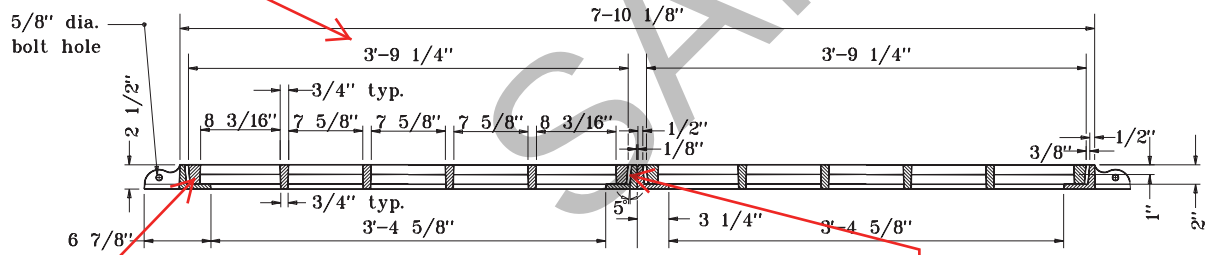


PLAN



SECTION D–D

Overall Grate Width = 45.25"



SECTION A–A

Bar Width = 0.875"

Bar Width = 0.875"

Bar Width = 0.875"

Side Weir Length = 45.25" - 2(0.875") = 43.50" = 3.63'

GRATE AND FRAME CASTING
ALTERNATE TYPE 12

INDIANA DEPARTMENT OF TRANSPORTATION

CASTING TYPE 12 (ALTERNATE) FRAME AND GRATE

SEPTEMBER 1998

STANDARD DRAWING NO. **E 720–ICCA–11**

ANTHONY L. UREMOVICH REGISTERED No. 18095 STATE OF INDIANA PROFESSIONAL ENGINEER

DESIGN STANDARDS ENGINEER

DETAILS PLACED IN THIS FORMAT 11-15-99

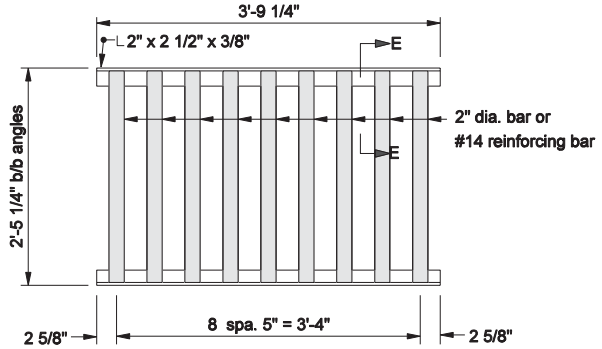
/s/ Anthony L. Uremovich 11-15-99
DESIGN STANDARDS ENGINEER DATE

/s/ Firooz Zandi 11-15-99
CHIEF HIGHWAY ENGINEER DATE

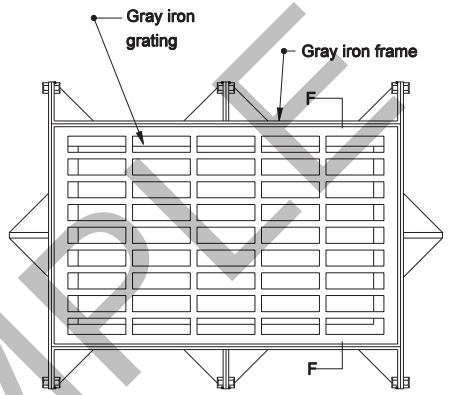
ORIGINALLY APPROVED 9-01-98

GENERAL NOTES

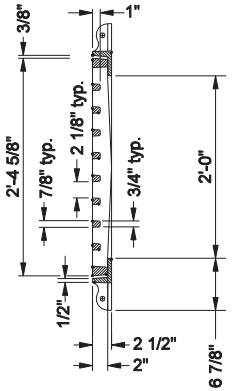
1. Spacing shall be $1\frac{7}{8}$" c. to c. min., and $2\frac{3}{8}$" c. to c. max.
2. The dimensions of the angle iron frame shall be as shown except that the A dimension may vary according to type of grating used.



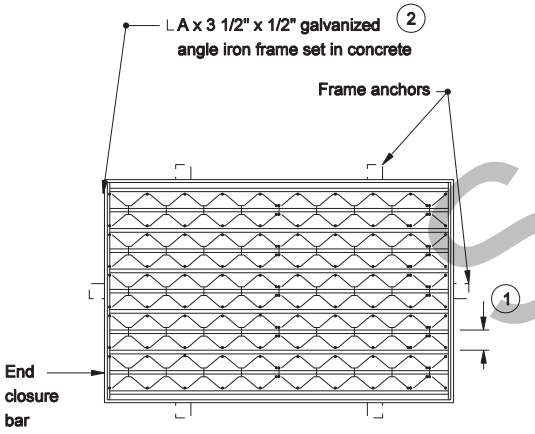
ALTERNATE STEEL GRATING
(To be used with steel frame type 12A)



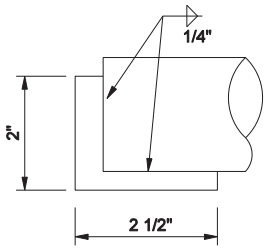
GRATE AND FRAME CASTING
ALTERNATE TYPE 12A



SECTION F-F



STEEL GRATING AND FRAME
TYPE 12A



SECTION E-E

INDIANA DEPARTMENT OF TRANSPORTATION

STEEL GRATING TYPE 12A
FRAME AND GRATE

SEPTEMBER 2005

STANDARD DRAWING NO. E 720-ICCA-12

RICHARD L. VanCLEAVE REGISTERED No. 9750 STATE OF INDIANA PROFESSIONAL ENGINEER
DESIGN STANDARDS ENGINEER

/s/ Richard L. VanCleave 9-01-05
DESIGN STANDARDS ENGINEER DATE

/s/ Richard K. Smutzer 9-01-05
CHIEF HIGHWAY ENGINEER DATE

engineering

STORM DRAIN COMPUTATIONS
DESIGN STORM = 50-YR

PROJECT: I-65 Southeast Project (SR-28940)
LOCATION: Package B
COUNTY: Jackson

PREPARED BY: MA
DATE: 9/14/2018
CHECKED BY: WN
DATE: 9/17/2018

STATION	LOCATION	STR. NO.		PIPE LENGTH (ft)	DRAINAGE AREA A (ac)		Runoff Coeff. C	A x C		Flow Time (min)			RAINFALL INTENSITY (in/hr)	Q DESIGN (cfs)	PIPE INFO								PIPE CAPACITY (cfs)	EFFICIENCY (%)	VELOCITY (fps)	HYDRAULIC GRADIENT		STR. RIM EL.	DITCH FL EL.	FB CHECK X ≥ 1'
															DIAMETER		AREA	P	SLOPE	n	Invert								
		Up	Down		Increment	Total		Increment	Total	Inlet	Pipe	Total			(in)	(ft)	(ft^2)	(ft)	(%)		Up	Down			Design	Up	Down			
2214+60	Med. Lt.	399	OUT	70	0.55	0.55	0.85	0.47	0.47	5.00		5.00	9.31	4.35	15	1.25	1.23	3.93	0.67	0.012	602.96	602.49	5.70	131%	3.54	604.30	603.74	605.40	601.17	1.32
2217+50	Med. Lt.	400	OUT	69	0.65	0.65	0.87	0.57	0.57	5.00		5.00	9.31	5.26	15	1.25	1.23	3.93	0.67	0.012	606.81	606.35	5.68	108%	4.29	608.42	607.60	609.28	602.07	4.28
2221+00	Med. Rt.	401	OUT	69	0.65	0.65	0.88	0.57	0.57	5.00		5.00	9.31	5.33	15	1.25	1.23	3.93	0.67	0.012	615.61	615.15	5.68	107%	4.34	617.24	616.40	617.87	598.96	16.19
2224+50	Med. Lt.	402	OUT	67	0.62	0.62	0.88	0.55	0.55	5.00		5.00	9.31	5.08	15	1.25	1.23	3.93	0.67	0.012	622.09	621.64	5.70	112%	4.14	623.64	622.89	624.58	602.65	18.99
2232+00	Med.	403	404	398	0.77	0.77	0.88	0.68	0.68	5.00		5.00	9.31	6.31	15	1.25	1.23	3.93	2.45	0.012	621.41	611.66	10.89	173%	9.24	617.32	614.14	623.39		
2236+00	Med. Rt.	404	OUT	68	0.73	1.50	0.88	0.64	1.32	5.00	0.72	5.72	8.99	11.86	18	1.50	1.77	4.71	1.10	0.012	611.66	610.91	11.89	100%	7.68	614.14	612.41	614.39	601.48	9.43
2239+00	Med. Lt.	405	OUT	81	0.55	0.55	0.88	0.48	0.48	5.00		5.00	9.31	4.51	15	1.25	1.23	3.93	0.67	0.012	605.81	605.27	5.68	126%	5.17	607.19	606.52	608.30	602.39	2.88
2242+35	Med. Rt.	406	OUT	73	0.67	0.67	0.88	0.59	0.59	5.00		5.00	9.31	5.49	15	1.25	1.23	3.93	0.66	0.012	602.17	601.69	5.64	103%	4.47	603.85	602.94	604.64	600.66	1.03
2242+25	Med.	407	406	8				Flanking						5.49	12	1.00	0.79	3.14	11.50	0.012	603.09	602.17	13.00	237%	15.93	603.85	603.85	604.69		
2249+00	Med. Lt.	408	OUT	83	1.17	1.17	0.88	1.03	1.03	5.00		5.00	9.31	9.59	18	1.50	1.77	4.71	0.75	0.012	599.92	599.30	9.78	102%	5.43	602.09	600.80	602.53	598.25	1.05
2256+00	Med. Lt.	409	OUT	72	1.29	1.29	0.88	1.14	1.14	5.00		5.00	9.31	10.57	18	1.50	1.77	4.71	0.90	0.012	597.13	596.48	10.75	102%	6.99	599.54	597.98	599.76	595.40	1.08
2262+00	Med. Lt.	410	OUT	72	1.10	1.10	0.88	0.97	0.97	5.00		5.00	9.31	9.01	18	1.50	1.77	4.71	0.92	0.012	591.72	591.06	10.84	120%	6.90	593.75	592.56	594.32	590.00	1.06
2267+00	Med. Lt.	411	OUT	115	0.92	0.92	0.88	0.81	0.81	5.00		5.00	9.31	7.54	15	1.25	1.23	3.93	1.30	0.012	586.87	585.38	7.92	105%	7.39	589.19	586.63	589.16	580.14	5.24
2274+00	Med. Lt.	412	OUT	90	1.29	1.29	0.88	1.14	1.14	5.00		5.00	9.31	10.57	18	1.50	1.77	4.71	2.42	0.012	579.20	577.02	17.61	167%	6.74	581.60	578.52	581.60	575.36	1.66
2281+21	Med.	413	414	8				Flanking						12.04	12	1.00	0.79	3.14	13.00	0.012	572.41	571.37	13.82	115%	19.94	574.18	574.18	574.01	574.00	
2281+31	Med.	414	415	3				Triple Inlet						12.04	18	1.50	1.77	4.71	1.33	0.012	571.37	571.33	13.07	109%	8.42	574.18	574.18	574.00	574.00	
2281+36	Med. Rt.	415	OUT	68	1.47	1.47	0.88	1.29	1.29	5.00		5.00	9.31	12.04	18	1.50	1.77	4.71	1.18	0.012	571.33	570.53	12.28	102%	7.96	574.16	571.95	574.00	569.50	1.03
2281+41	Med.	416	415	3				Triple Inlet						12.04	18	1.50	1.77	4.71	1.33	0.012	571.37	571.33	13.07	109%	8.42	574.18	574.18	574.00	574.00	
2282+90	Med.	417	418	8				Flanking						6.55	12	1.00	0.79	3.14	10.38	0.012	572.72	571.89	12.35	189%	16.04	573.85	573.85	574.32	574.36	
2283+00	Med. Rt.	418	OUT	68	0.80	0.80	0.88	0.70	0.70	5.00		5.00	9.31	6.55	15	1.25	1.23	3.93	0.91	0.012	571.89	571.27	6.64	101%	6.22	573.85	572.52	574.36	568.93	2.34
2283+10	Med.	419	418	8				Flanking						6.55	12	1.00	0.79	3.14	11.00	0.012	572.77	571.89	12.71	194%	16.39	573.85	573.85	574.37	574.36	
2282+04	Rt.	420	OUT	124	3.74	3.74	0.66	2.47	2.47	7.00		7.00	8.41	20.76	30	2.50	4.91	7.85	0.36	0.012	569.45	569.00	26.67	128%	5.04				569.00	
2287+32	Med. Lt.	421	OUT	71	1.11	1.11	0.88	0.98	0.98	5.00		5.00	9.31	9.09	18	1.50	1.77	4.71	0.68	0.012	573.56	573.08	9.31	102%	5.14	575.65	574.58	576.16	571.92	1.16
2287+37	Med.	422	421	3				Double Inlet						9.09	18	1.50	1.77	4.71	1.00	0.012	573.59	573.56	11.32	125%	7.15	575.65	575.65	576.16	576.16	
2287+47	Med.	423	422	8				Flanking						9.09	12	1.00	0.79	3.14	13.12	0.012	574.64	573.59	13.89	153%	18.95	575.65	575.65	576.24	576.16	
2292+50	Med. Lt.	424	OUT	70	0.97	0.97	0.88	0.85	0.85	5.00		5.00	9.31	7.95	15	1.25	1.23	3.93	1.37	0.012	576.98	576.02	8.15	102%	7.62	579.47	577.27	579.37	574.85	1.17
2298+50	Med. Rt.	425	OUT	76	0.98	0.98	0.88	0.86	0.86	5.00		5.00	9.31	8.03	15	1.25	1.23	3.93	1.43	0.012	582.04	580.95	8.33	104%	7.78	584.56	582.20	584.35	579.90	1.05

STORM DRAIN COMPUTATIONS
DESIGN STORM = 50-YR

PROJECT: I-65 Southeast Project (SR-28940)
LOCATION: Package B
COUNTY: Jackson

PREPARED BY: MA
DATE: 9/14/2018
CHECKED BY: WN
DATE: 9/17/2018

STATION	LOCATION	STR. NO.		PIPE LENGTH (ft)	DRAINAGE AREA A (ac)		Runoff Coeff. C	A x C		Flow Time (min)			RAINFALL INTENSITY (in/hr)	Q DESIGN (cfs)	PIPE INFO								PIPE CAPACITY (cfs)	EFFICIENCY (%)	VELOCITY (fps)	HYDRAULIC GRADIENT		STR. RIM EL.	DITCH FL EL.	FB CHECK X ≥ 1'
															DIAMETER		AREA (ft^2)	P (ft)	SLOPE (%)	n	Invert								
		Up	Down		Increment	Total		Increment	Total	Inlet	Pipe	Total			(in)	(ft)					Up	Down			Design	Up	Down			
2304+50	Med. Rt.	426	OUT	75	0.91	0.91	0.88	0.80	0.80	5.00		5.00	9.31	7.46	15	1.25	1.23	3.93	1.44	0.012	589.33	588.25	8.35	112%	7.69	591.62	589.50	591.66	574.18	14.07
2310+00	Med. Rt.	427	OUT	75	1.07	1.07	0.88	0.94	0.94	5.00		5.00	9.31	8.77	18	1.50	1.77	4.71	1.19	0.012	596.01	595.12	12.33	141%	7.60	597.99	596.62	598.59	593.90	1.22
2316+50	Med. Lt.	428	OUT	69	0.99	0.99	0.88	0.87	0.87	5.00		5.00	9.31	8.11	15	1.25	1.23	3.93	1.68	0.012	602.34	601.18	9.02	111%	8.31	604.89	602.43	605.87	600.10	1.08
2322+50	Med. Rt.	429	OUT	74	0.98	0.98	0.88	0.86	0.86	5.00		5.00	9.31	8.03	15	1.25	1.23	3.93	1.34	0.012	609.32	608.33	8.05	100%	7.49	611.84	609.58	611.81	607.30	1.03
2328+50	Med. Rt.	430	OUT	73	0.52	0.52	0.88	0.46	0.46	5.00		5.00	9.31	4.26	15	1.25	1.23	3.93	1.12	0.012	615.07	614.25	7.37	173%	4.91	616.39	615.50	617.83	610.90	3.35
2331+50	Med. Rt.	431	OUT	69	0.55	0.55	0.88	0.48	0.48	5.00		5.00	9.31	4.51	15	1.25	1.23	3.93	0.67	0.012	617.93	617.47	5.68	126%	3.68	619.32	618.72	620.44	614.33	3.14
2334+50	Med. Lt.	432	OUT	70	1.10	1.10	0.88	0.97	0.97	5.00		5.00	9.31	9.01	18	1.50	1.77	4.71	1.97	0.012	620.46	619.08	15.89	176%	6.17	622.48	620.58	622.89	617.99	1.09
2340+50	Med. Rt.	433	OUT	78	0.95	0.95	0.88	0.84	0.84	5.00		5.00	9.31	7.78	15	1.25	1.23	3.93	1.69	0.012	624.80	623.48	9.05	116%	8.33	627.21	624.73	627.30	622.00	1.48
2346+60	Med.	434	435	8				Flanking						9.50	12	1.00	0.79	3.14	11.00	0.012	629.67	628.79	12.71	134%	17.85	630.93	630.93	631.27	631.34	
2346+70	Med. Lt.	435	OUT	66	1.16	1.16	0.88	1.02	1.02	5.00		5.00	9.31	9.50	18	1.50	1.77	4.71	1.11	0.012	628.79	628.06	11.90	125%	7.50	630.93	628.74	631.34	626.93	1.13
2346+75	Med.	436	435	3				Double Inlet						9.50	18	1.50	1.77	4.71	1.33	0.012	628.83	628.79	13.07	138%	8.09	630.93	630.93	631.34	631.34	
2346+85	Med.	437	436	8				Flanking						9.50	12	1.00	0.79	3.14	12.50	0.012	629.83	628.83	13.55	143%	18.77	630.93	630.93	631.43	631.34	
2346+02	Lt.	438	OUT	97	2.29	2.29	0.72	1.65	1.65	14.10		14.10	6.04	9.96	24	2.00	3.14	6.28	0.27	0.012	626.89	626.63	12.63	127%	3.77	628.74	628.20		626.63	
2352+00	Med. Lt.	439	OUT	68	1.12	1.12	0.88	0.99	0.99	5.00		5.00	9.31	9.18	15	1.25	1.23	3.93	1.85	0.012	633.04	631.78	9.47	103%	6.50	635.29	633.28	635.65	628.44	3.34
2362+00	Med. Lt.	440	OUT	75	0.71	0.71	0.88	0.62	0.62	5.00		5.00	9.31	5.82	18	1.50	1.77	4.71	1.96	0.012	635.19	633.72	15.84	272%	5.68	636.91	634.97	637.36	628.08	5.64
2367+00	Med. Lt.	441	OUT	74	0.92	0.92	0.88	0.81	0.81	5.00		5.00	9.31	7.54	15	1.25	1.23	3.93	1.97	0.012	630.96	629.50	9.77	130%	8.84	633.27	630.75	633.21	628.40	1.10
2372+00	Med. Lt.	442	OUT	68	0.92	0.92	0.88	0.81	0.81	5.00		5.00	9.31	7.54	15	1.25	1.23	3.93	1.85	0.012	626.35	625.09	9.47	126%	8.62	628.66	626.34	628.72	624.00	1.09
2376+90	Med.	443	444	8				Flanking						8.52	12	1.00	0.79	3.14	9.62	0.012	622.81	622.04	11.89	140%	16.55	624.79	624.79	624.41	624.34	
2377+00	Med. Lt.	444	OUT	68	1.04	1.04	0.88	0.92	0.92	5.00		5.00	9.31	8.52	15	1.25	1.23	3.93	1.56	0.012	622.04	620.98	8.68	102%	6.94	624.79	622.67	624.34	619.80	1.18
2377+05	Med.	445	444	3				Double Inlet						8.52	15	1.25	1.23	3.93	1.67	0.012	622.09	622.04	8.98	105%	8.38	624.79	624.79	624.34	624.34	
2377+78	Lt.	446	OUT	117	7.60	7.60	0.61	4.64	4.64	14.60		14.60	5.92	27.44	30	2.50	4.91	7.85	0.64	0.012	619.75	619.00	35.44	129%	7.99	622.67	620.95		619.00	
2382+00	Med. Lt.	447	OUT	68	0.78	0.78	0.88	0.69	0.69	5.00		5.00	9.31	6.39	15	1.25	1.23	3.93	1.35	0.012	619.11	618.19	8.09	127%	7.35	621.01	619.44	621.52	617.15	1.04
2387+50	Med. Lt.	448	OUT	72	0.88	0.88	0.88	0.77	0.77	5.00		5.00	9.31	7.21	15	1.25	1.23	3.93	1.28	0.012	616.29	615.37	7.86	109%	7.30	618.48	616.62	618.82	600.15	15.22
2392+50	Med. Lt.	449	OUT	72	0.83	0.83	0.88	0.73	0.73	5.00		5.00	9.31	6.80	15	1.25	1.23	3.93	1.54	0.012	613.77	612.66	8.64	127%	7.84	615.81	613.91	616.37	610.52	2.14
2398+50	Med. Lt.	450	OUT	73	1.01	1.01	0.88	0.89	0.89	5.00		5.00	9.31	8.27	15	1.25	1.23	3.93	1.42	0.012	610.20	609.16	8.30	100%	7.74	612.82	610.41	612.52	608.10	1.06
2404+00	Med. Lt.	451	OUT	72	1.10	1.10	0.88	0.97	0.97	5.00		5.00	9.31	9.01	18	1.50	1.77	4.71	1.43	0.012	604.82	603.79	13.54	150%	8.25	606.85	605.29	607.50	602.70	1.09

engineering

STORM DRAIN COMPUTATIONS
DESIGN STORM = 50-YR

PROJECT: I-65 Southeast Project (SR-28940)
LOCATION: Package B
COUNTY: Jackson

PREPARED BY: MA
DATE: 9/14/2018
CHECKED BY: WN
DATE: 9/17/2018

STATION	LOCATION	STR. NO.		PIPE LENGTH (ft)	DRAINAGE AREA A (ac)		Runoff Coeff. C	A x C		Flow Time (min)			RAINFALL INTENSITY (in/hr)	Q DESIGN (cfs)	PIPE INFO								PIPE CAPACITY (cfs)	EFFICIENCY (%)	VELOCITY (fps)	HYDRAULIC GRADIENT		STR. RIM EL.	DITCH FL EL.	FB CHECK X ≥ 1'
															DIAMETER (in)	DIAMETER (ft)	AREA (ft^2)	P (ft)	SLOPE (%)	n	Invert Up	Invert Down			Design	Up	Down			
		Up	Down		Increment	Total		Increment	Total	Inlet	Pipe	Total																	
2411+00	Med. Lt.	452	OUT	71	1.29	1.29	0.88	1.14	1.14	5.00		5.00	9.31	10.57	18	1.50	1.77	4.71	2.46	0.012	597.42	595.67	17.77	168%	6.74	599.82	597.17	599.88	578.33	17.34

HYDRAULIC GRADE LINE (HGL) CALCULATIONS
DESIGN STORM = 50-YR

engineering

PROJECT: I-65 Southeast Project (SR-28940)
LOCATION: Package B
COUNTY: Jackson

DONE BY: MA
DATE: 9/14/18
CHECKED BY: WN
DATE: 9/17/18

STATION	LOCATION	STR. NO.		PIPE LENGTH (ft)	PIPE INFO								Tailwater Elev.	Flowline Elev.	Q DESIGN (cfs)	Hydraulic Grade Line Elev.		Rim Elev.	Edge of Travel Lane Elev.	HGL < ETL Y/N	Outlet Velocity (fps)	
					DIAMETER		SLOPE (%)	n	INVERT		CROWN											
		Up	Down		(in)	(ft)			Up	Down	Up	Down				Up HGL_i	Down HGL_o					
Median Outlets																						
2214+60	Med. Lt.	399	OUT	70	15	1.25	0.67	0.012	602.96	602.49	604.21	603.74	603.74	601.17	4.35	***604.30***	***603.74***	605.40	606.38	Y	3.54	
2217+50	Med. Lt.	400	OUT	69	15	1.25	0.67	0.012	606.81	606.35	608.06	607.60	607.60	602.07	5.26	***608.42***	***607.60***	609.28	610.23	Y	4.29	
2221+00	Med. Rt.	401	OUT	69	15	1.25	0.67	0.012	615.61	615.15	616.86	616.40	616.40	598.96	5.33	***617.24***	***616.40***	617.87	618.71	Y	4.34	
2224+50	Med. Lt.	402	OUT	67	15	1.25	0.67	0.012	622.09	621.64	623.34	622.89	622.89	602.65	5.08	***623.64***	***622.89***	624.58	625.51	Y	4.14	
2236+00	Med. Rt.	404	OUT	68	18	1.50	1.10	0.012	611.66	610.91	613.16	612.41	612.41	601.48	11.87	***614.44***	***612.41***	614.39	615.33	Y	7.68	
2239+00	Med. Lt.	405	OUT	81	15	1.25	0.67	0.012	605.81	605.27	607.06	606.52	606.52	602.39	4.51	***607.19***	***606.52***	608.30	609.27	Y	5.17	
2242+35	Med. Rt.	406	OUT	73	15	1.25	0.66	0.012	602.17	601.69	603.42	602.94	602.94	600.66	5.49	***603.85***	***602.94***	604.64	605.58	Y	4.47	
2249+00	Med. Lt.	408	OUT	83	18	1.50	0.75	0.012	599.92	599.30	601.42	600.80	600.80	598.25	9.59	***602.09***	***600.80***	602.53	603.49	Y	5.43	
2256+00	Med. Lt.	409	OUT	72	18	1.50	0.90	0.012	597.13	596.48	598.63	597.98	597.98	595.40	10.57	***599.54***	***597.98***	599.76	600.74	Y	6.99	
2262+00	Med. Lt.	410	OUT	72	18	1.50	0.92	0.012	591.72	591.06	593.22	592.56	592.56	590.00	9.01	***593.75***	***592.56***	594.32	595.28	Y	6.90	
2267+00	Med. Lt.	411	OUT	115	15	1.25	1.30	0.012	586.87	585.38	588.12	586.63	586.63	580.14	7.54	***589.19***	***586.63***	589.16	590.10	Y	7.39	
2274+00	Med. Lt.	412	OUT	90	18	1.50	2.42	0.012	579.20	577.02	580.70	578.52	578.52	575.36	10.57	***581.60***	***578.52***	581.60	582.55	Y	6.74	
2281+36	Med. Rt.	415	OUT	68	18	1.50	1.18	0.012	571.33	570.53	572.83	572.03	571.95	569.50	12.04	***574.16***	***571.95***	574.00	574.82	Y	7.96	TW is HW from Str. No. 420
2283+00	Med. Rt.	418	OUT	68	15	1.25	0.91	0.012	571.89	571.27	573.14	572.52	572.52	568.93	6.55	***573.85***	***572.52***	574.36	575.22	Y	6.22	
2287+32	Med. Lt.	421	OUT	71	18	1.50	0.68	0.012	573.56	573.08	575.06	574.58	574.58	571.92	9.09	***575.65***	***574.58***	576.16	577.10	Y	5.14	
2292+50	Med. Lt.	424	OUT	70	15	1.25	1.37	0.012	576.98	576.02	578.23	577.27	577.27	574.85	7.95	***579.47***	***577.27***	579.37	580.30	Y	7.62	
2298+50	Med. Rt.	425	OUT	76	15	1.25	1.43	0.012	582.04	580.95	583.29	582.20	582.20	579.90	8.03	***584.56***	***582.20***	584.35	585.26	Y	7.78	
2304+50	Med. Rt.	426	OUT	75	15	1.25	1.44	0.012	589.33	588.25	590.58	589.50	589.50	574.18	7.46	***591.62***	***589.50***	591.66	592.61	Y	7.69	
2310+00	Med. Rt.	427	OUT	75	18	1.50	1.19	0.012	596.01	595.12	597.51	596.62	596.62	593.90	8.77	***597.99***	***596.62***	598.59	599.57	Y	7.60	
2316+50	Med. Lt.	428	OUT	69	15	1.25	1.68	0.012	602.34	601.18	603.59	602.43	602.43	600.10	8.11	***604.89***	***602.43***	605.87	606.79	Y	8.31	
2322+50	Med. Rt.	429	OUT	74	15	1.25	1.34	0.012	609.32	608.33	610.57	609.58	609.58	607.30	8.03	***611.84***	***609.58***	611.81	612.62	Y	7.49	
2328+50	Med. Rt.	430	OUT	73	15	1.25	1.12	0.012	615.07	614.25	616.32	615.50	615.50	610.90	4.26	***616.39***	***615.50***	617.83	618.55	Y	4.91	
2331+50	Med. Rt.	431	OUT	69	15	1.25	0.67	0.012	617.93	617.47	619.18	618.72	618.72	614.33	4.51	***619.32***	***618.72***	620.44	621.38	Y	3.68	
2334+50	Med. Lt.	432	OUT	70	18	1.50	1.97	0.012	620.46	619.08	621.96	620.58	620.58	617.99	9.01	***622.48***	***620.58***	622.89	623.78	Y	6.17	
2340+50	Med. Rt.	433	OUT	78	15	1.25	1.69	0.012	624.80	623.48	626.05	624.73	624.73	622.00	7.78	***627.21***	***624.73***	627.30	628.22	Y	8.33	
2346+70	Med. Lt.	435	OUT	66	18	1.50	1.11	0.012	628.79	628.06	630.29	629.56	628.74	626.93	9.50	***630.93***	***628.74***	631.34	632.46	Y	7.50	TW is HW from Str. No. 438
2352+00	Med. Lt.	439	OUT	68	18	1.50	1.85	0.012	633.04	631.78	634.54	633.28	633.28	628.44	9.96	***635.29***	***633.28***	635.65	636.57	Y	6.50	
2362+00	Med. Lt.	440	OUT	75	15	1.25	1.96	0.012	635.19	633.72	636.44	634.97	634.97	628.08	5.82	***636.91***	***634.97***	637.36	638.28	Y	5.68	
2367+00	Med. Lt.	441	OUT	74	15	1.25	1.97	0.012	630.96	629.50	632.21	630.75	630.75	628.40	7.54	***633.27***	***630.75***	633.21	634.20	Y	8.84	
2372+00	Med. Lt.	442	OUT	68	15	1.25	1.85	0.012	626.35	625.09	627.60	626.34	626.34	624.00	7.54	***628.66***	***626.34***	628.72	629.67	Y	8.62	
2377+00	Med. Lt.	444	OUT	68	15	1.25	1.56	0.012	622.04	620.98	623.29	622.23	622.67	619.80	8.52	***624.79***	***622.67***	624.34	625.41	Y	6.94	TW is HW from Str. No. 446
2382+00	Med. Lt.	447	OUT	68	15	1.25	1.35	0.012	619.11	618.19	620.36	619.44	619.44	617.15	6.39	***621.01***	***619.44***	621.52	622.45	Y	7.35	
2387+50	Med. Lt.	448	OUT	72	15	1.25	1.28	0.012	616.29	615.37	617.54	616.62	616.62	600.15	7.21	***618.48***	***616.62***	618.82	619.61	Y	7.30	
2392+50	Med. Lt.	449	OUT	72	15	1.25	1.54	0.012	613.77	612.66	615.02	613.91	613.91	610.52	6.80	***615.81***	***613.91***	616.37	617.14	Y	7.84	
2398+50	Med. Lt.	450	OUT	73	15	1.25	1.42	0.012	610.20	609.16	611.45	610.41	610.41	608.10	8.27	***612.82***	***610.41***	612.52	613.51	Y	7.74	
2404+00	Med. Lt.	451	OUT	72	18	1.50	1.43	0.012	604.82	603.79	606.32	605.29	605.29	602.70	9.01	***606.85***	***605.29***	607.50	608.44	Y	8.25	
2411+00	Med. Lt.	452	OUT	71	18	1.50	2.46	0.012	597.42	595.67	598.92	597.17	597.17	578.33	10.57	***599.82***	***597.17***	599.88	600.87	Y	6.74	
Roadside Culverts																						
2282+04	Rt.	420	OUT	124	30	2.50	0.36	0.012	569.45	569.00	571.95	571.50	570.95	569.00	20.76	***571.95***	***570.95***		575.20	Y	5.04	
2346+02	Lt.	438	OUT	97	24	2.00	0.27	0.012	626.89	626.63	628.89	628.63	628.20	626.63	20.76	***628.74***	***628.20***		632.30	Y	3.77	
2377+78	Lt.	446	OUT	117	30	2.50	0.64	0.012	619.75	619.00	622.25	621.50	620.95	619.00	27.44	***622.67***	***620.95***		625.40	Y	7.99	

NOTE:
Please refer to the Median Outlet HGL.hy8 file for hydraulic modeling details pertaining to this summary spreadsheet

Rim Elevation is the bottom of grate (low side) of the P inlet located at the median ditch flowline.

PREPARED BY: PH

PROJECT: I-65 Southeast Project (SR-28940) DATE: 9/14/18

LOCATION: Package B CHECKED BY: WN

COUNTY: Jackson DATE: 9/17/18

SOUTH END OF PROJECT - FLOW LEAVING PROJECT VIA MEDIAN DITCH

Str. No. 102 is the last median inlet to intercept roadway runoff prior to leaving the project site beginning at Sta. 2214+50 "A". To be conservative, we have assumed that 102 will intercept all median drainage from the upstream drainage area that starts at the existing I-65 bridge over the CSX railroad. Therefore, the allowable discharge leaving the project site in proposed conditions is only held to the discharge produced from the existing drainage basin starting at Str. No. 102 and ending at the beginning of the project at Sta. 2214+50 "A".

Proposed median inlet spacing from the highpoint at the I-65 bridge over the CSX railroad is designed so that bypass flow from Str. No. 399 will be below the discharge leaving the project site during exisitng conditions.

Existing Conditions

Basin ID	SOUTH
Area (ac) =	1.20
C =	0.68
Tc =	5.00
Q_{50} (cfs) =	**7.60**

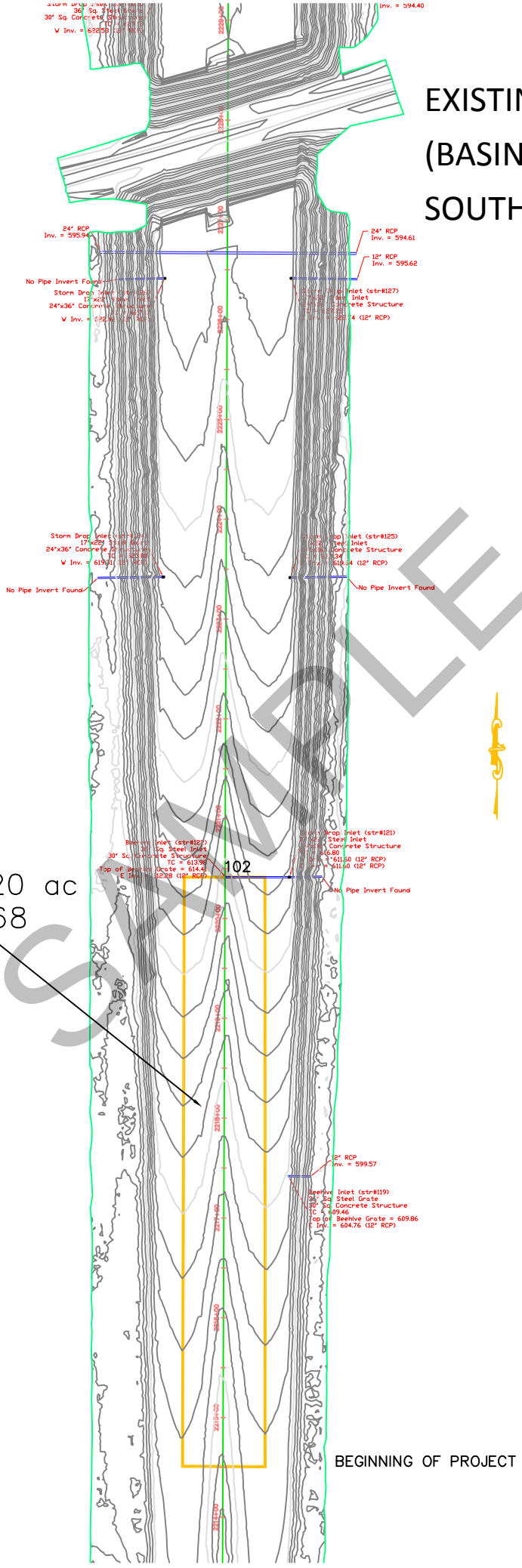
Proposed Conditions

Str. No.	399
Bypass Flow (cfs)	**7.40**

Note: Please refer to Median Ditch and Inlet Analysis spreadsheet as well as the inlet interception calculation worksheet for Str. No. 399.

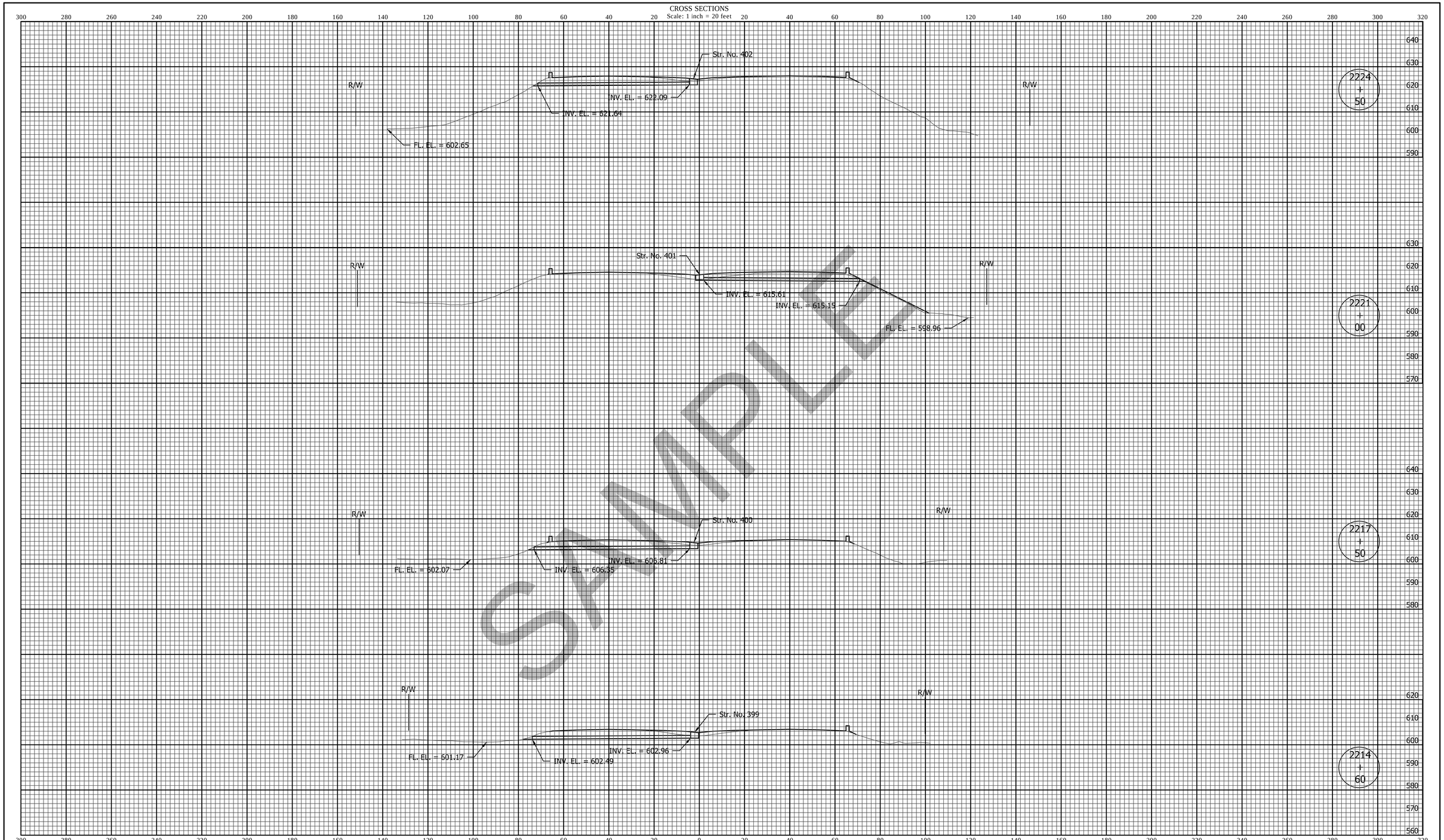
During proposed conditions, the discharge leaving the project site is 7.40 cfs as bypass flow from Str. No. 399. This is 0.20 cfs below what is leaving the project site in existing conditions.

EXISTING CONDITIONS (BASIN DELINEATION AT SOUTH END OF THE PROJECT)



CROSS SECTIONS

Scale: 1 inch = 20 feet



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CROSS SECTIONS - MEDIAN
LINE "A"

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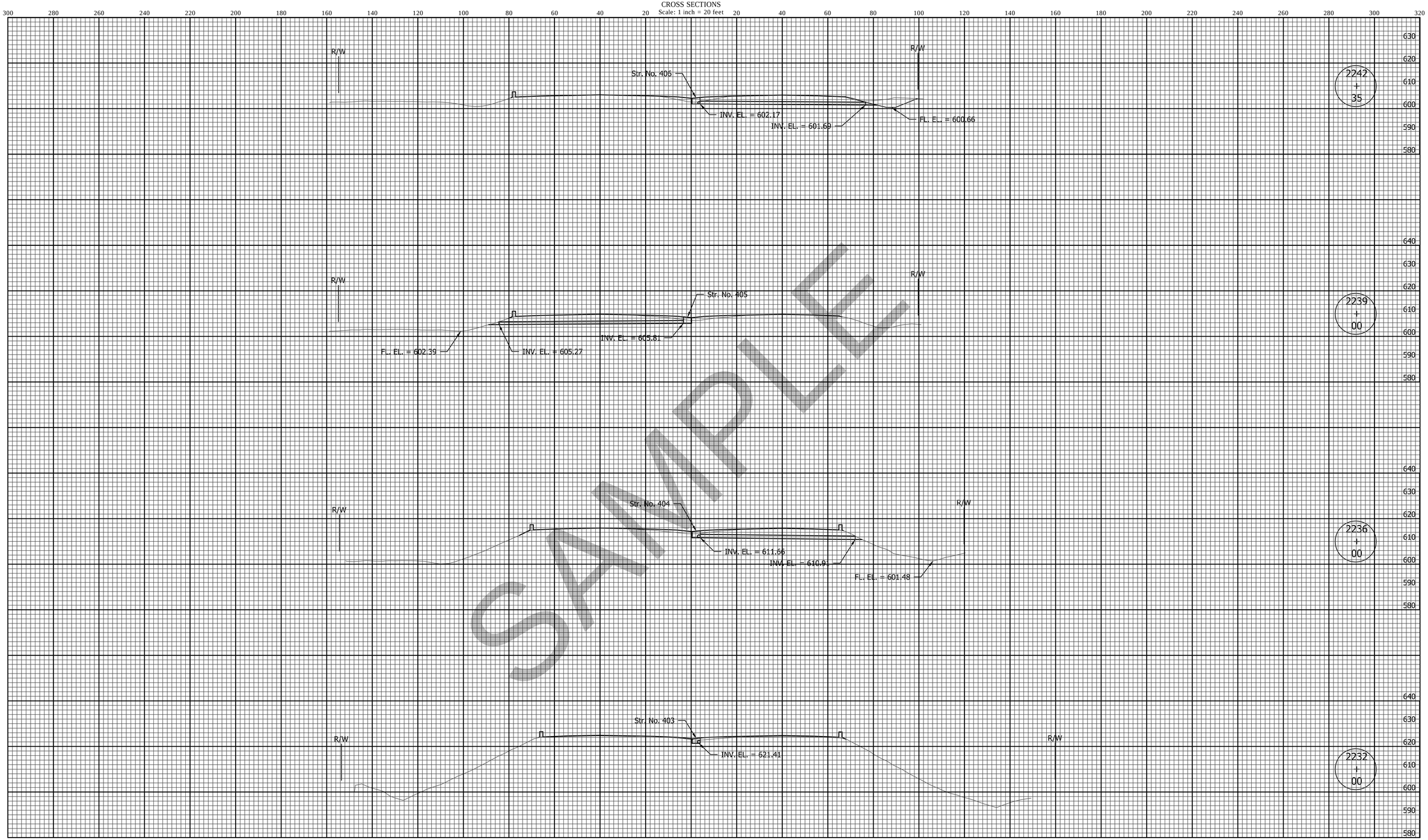

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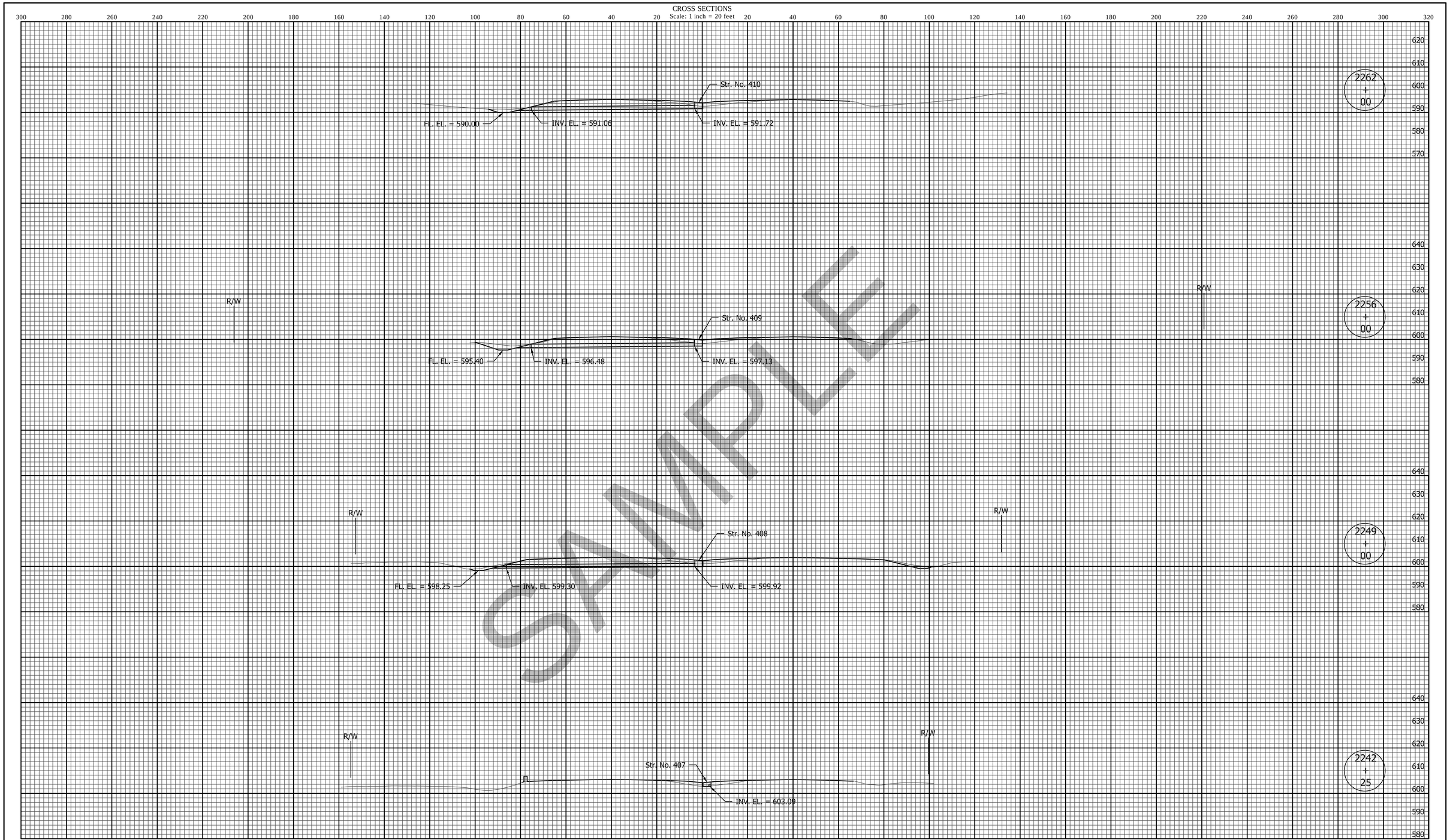

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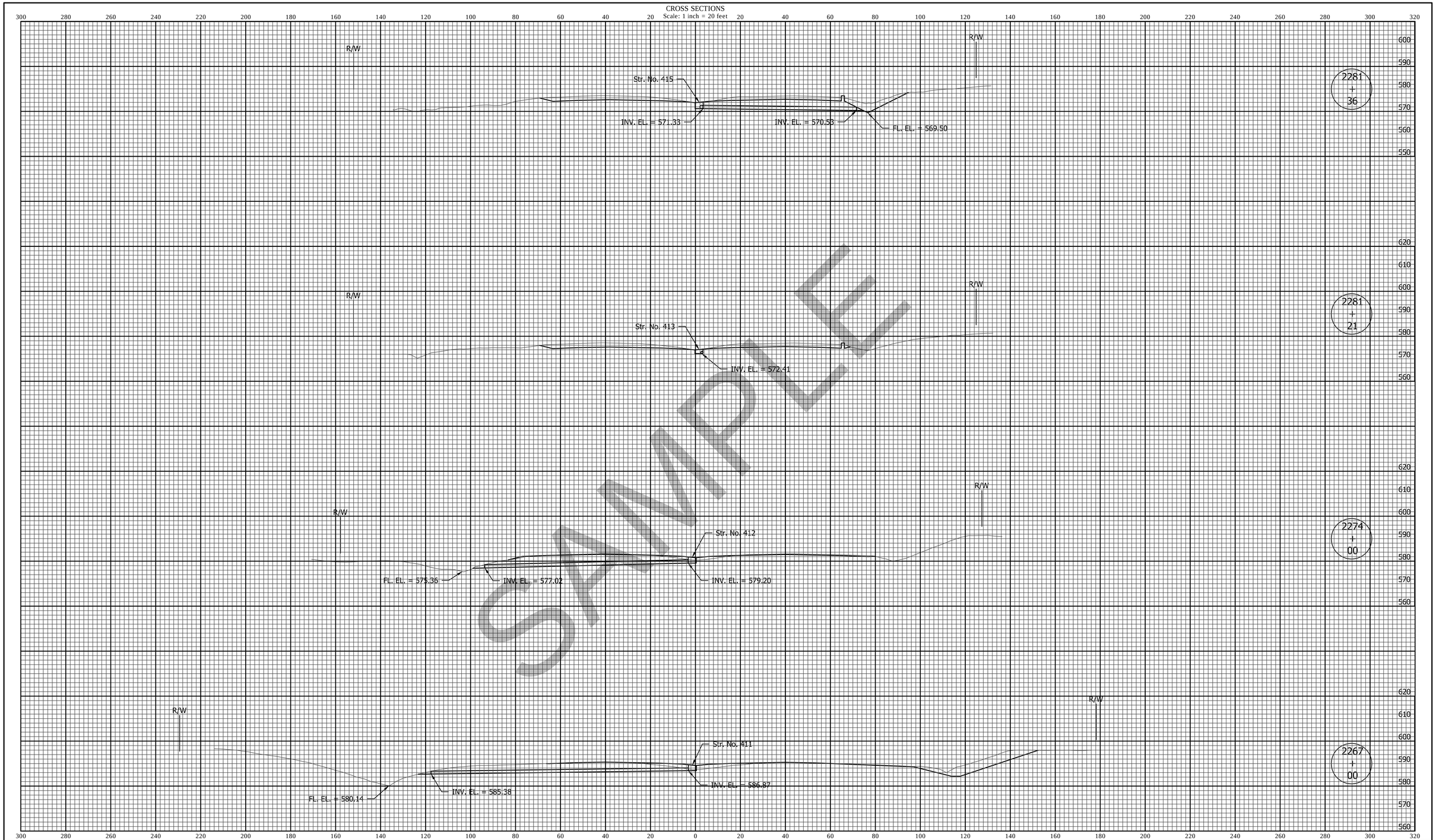

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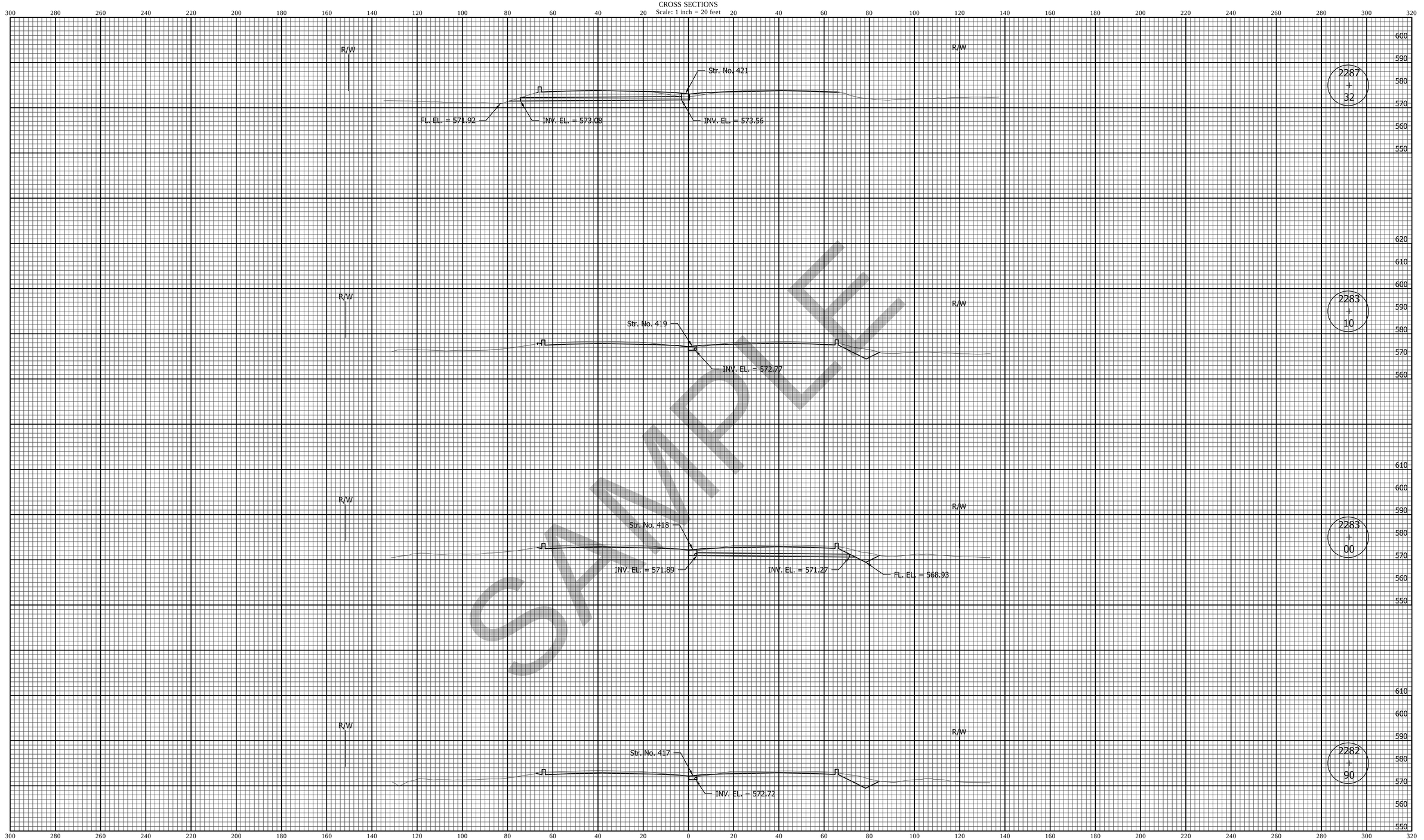

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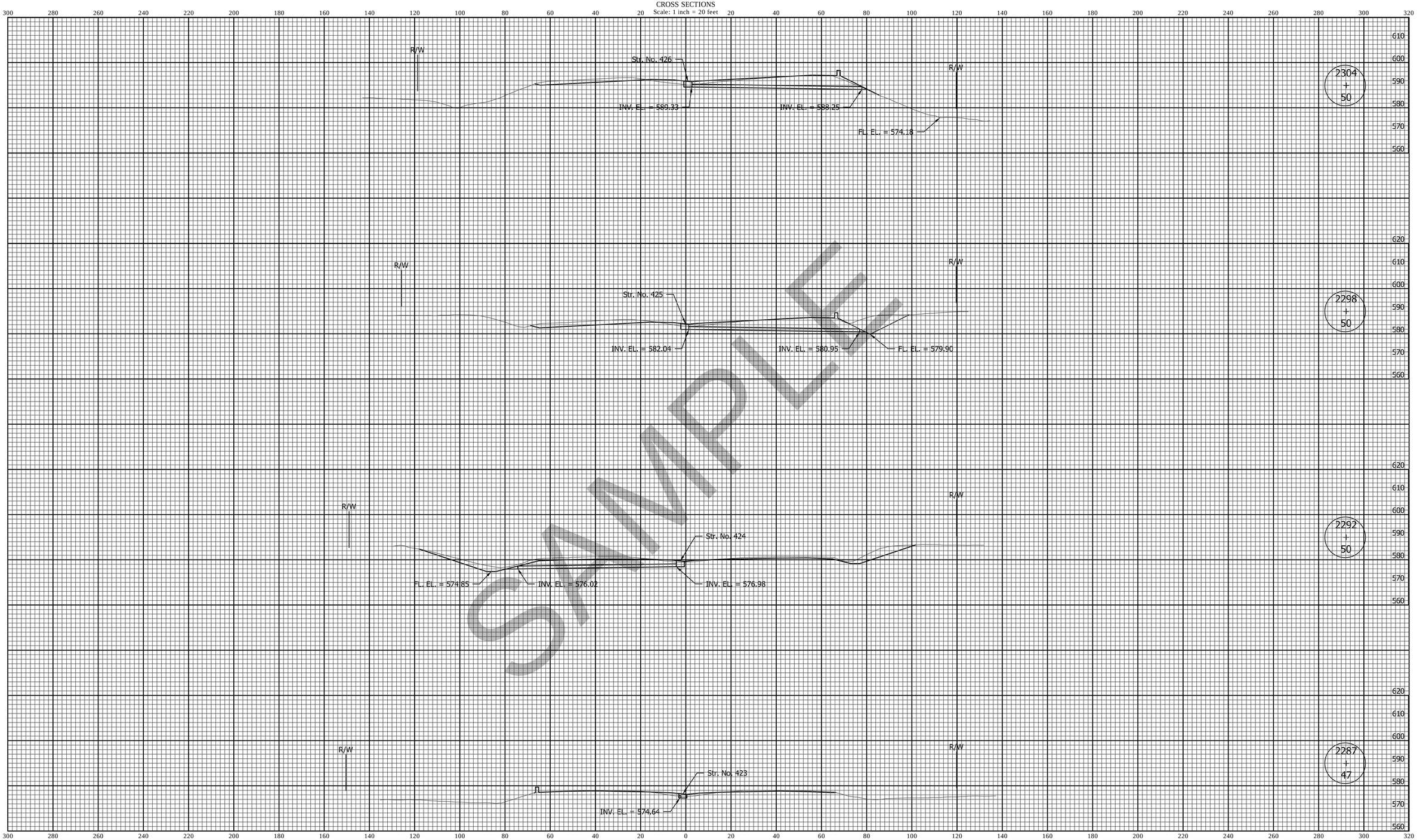

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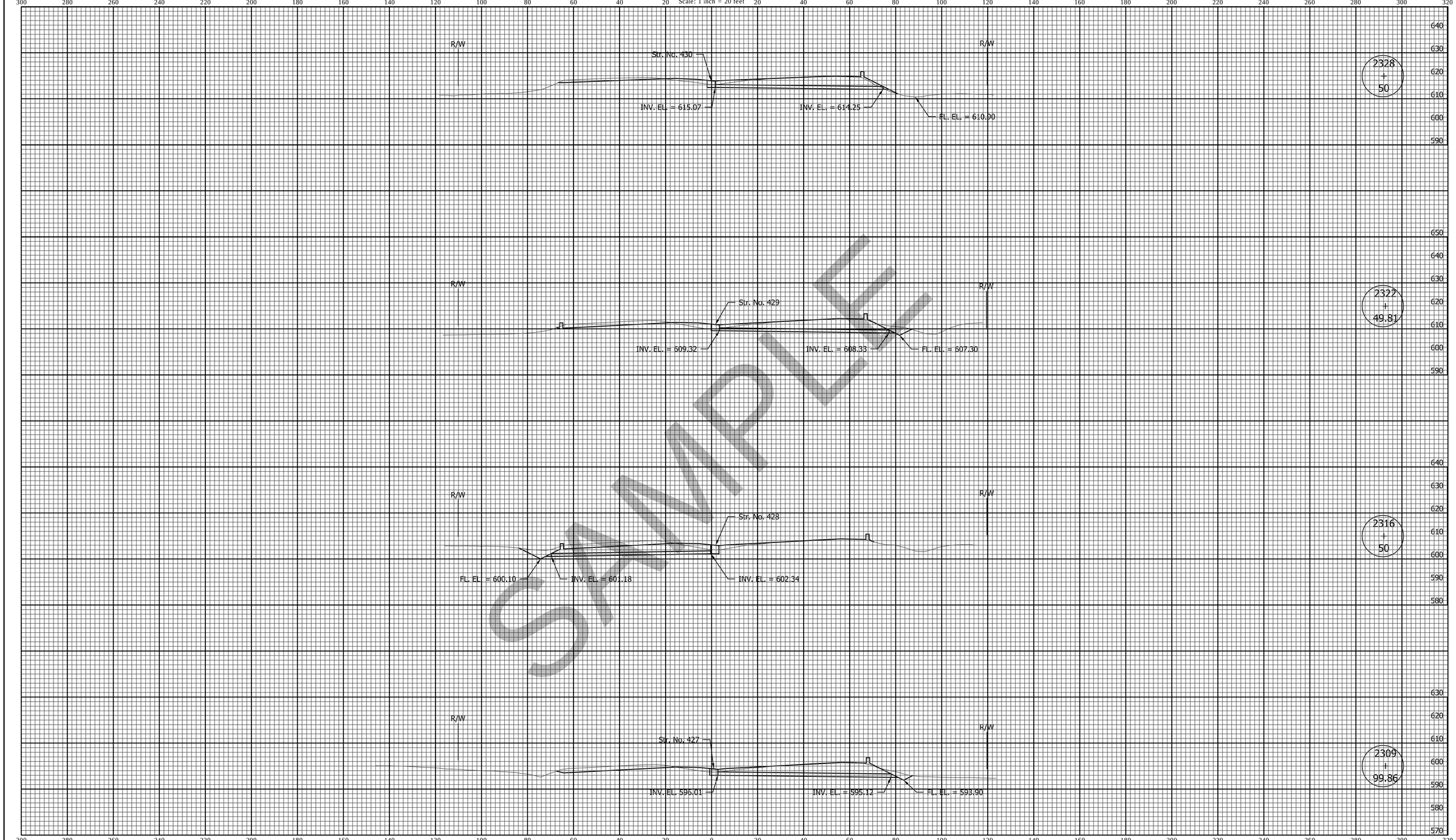

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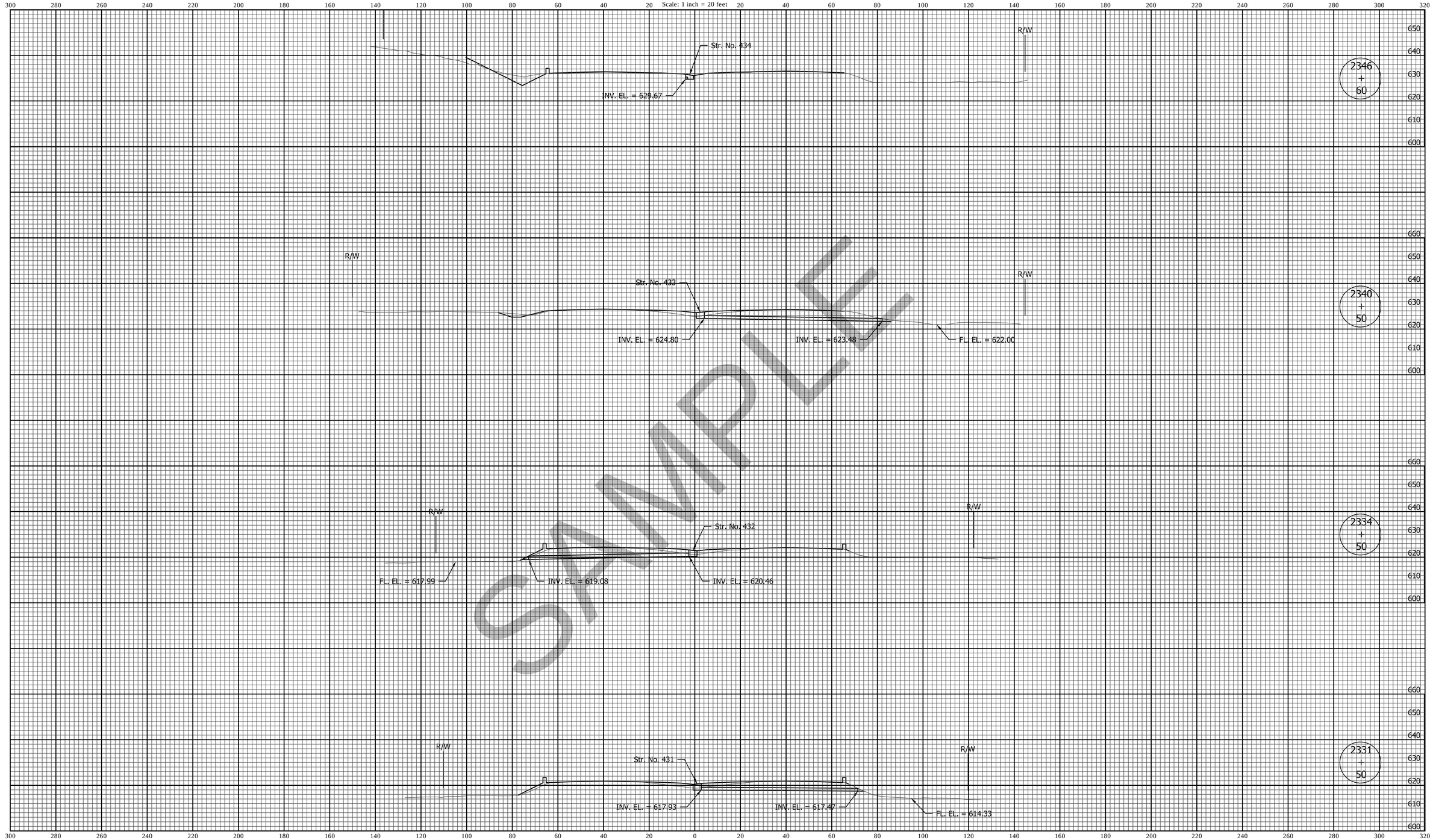

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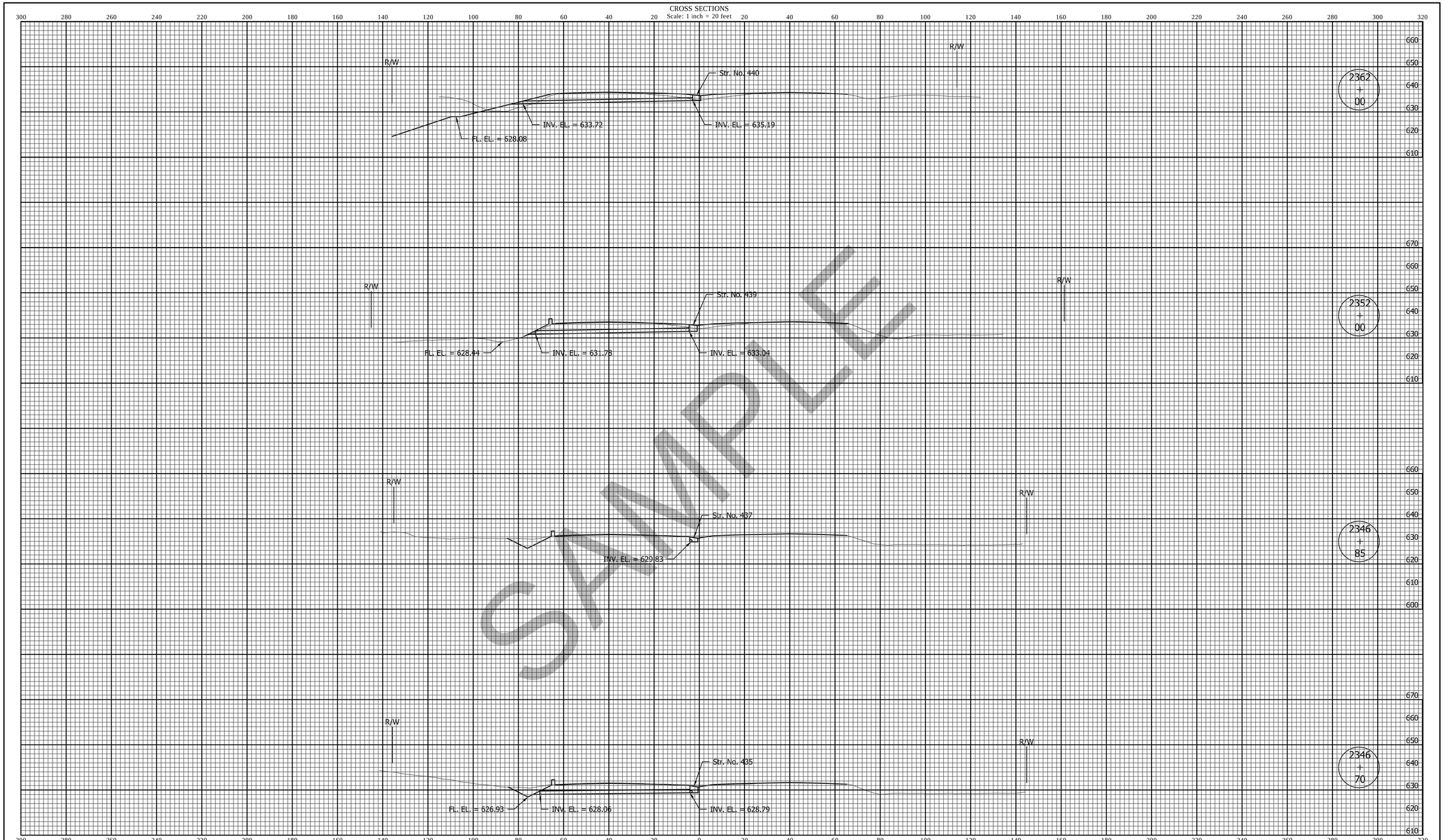

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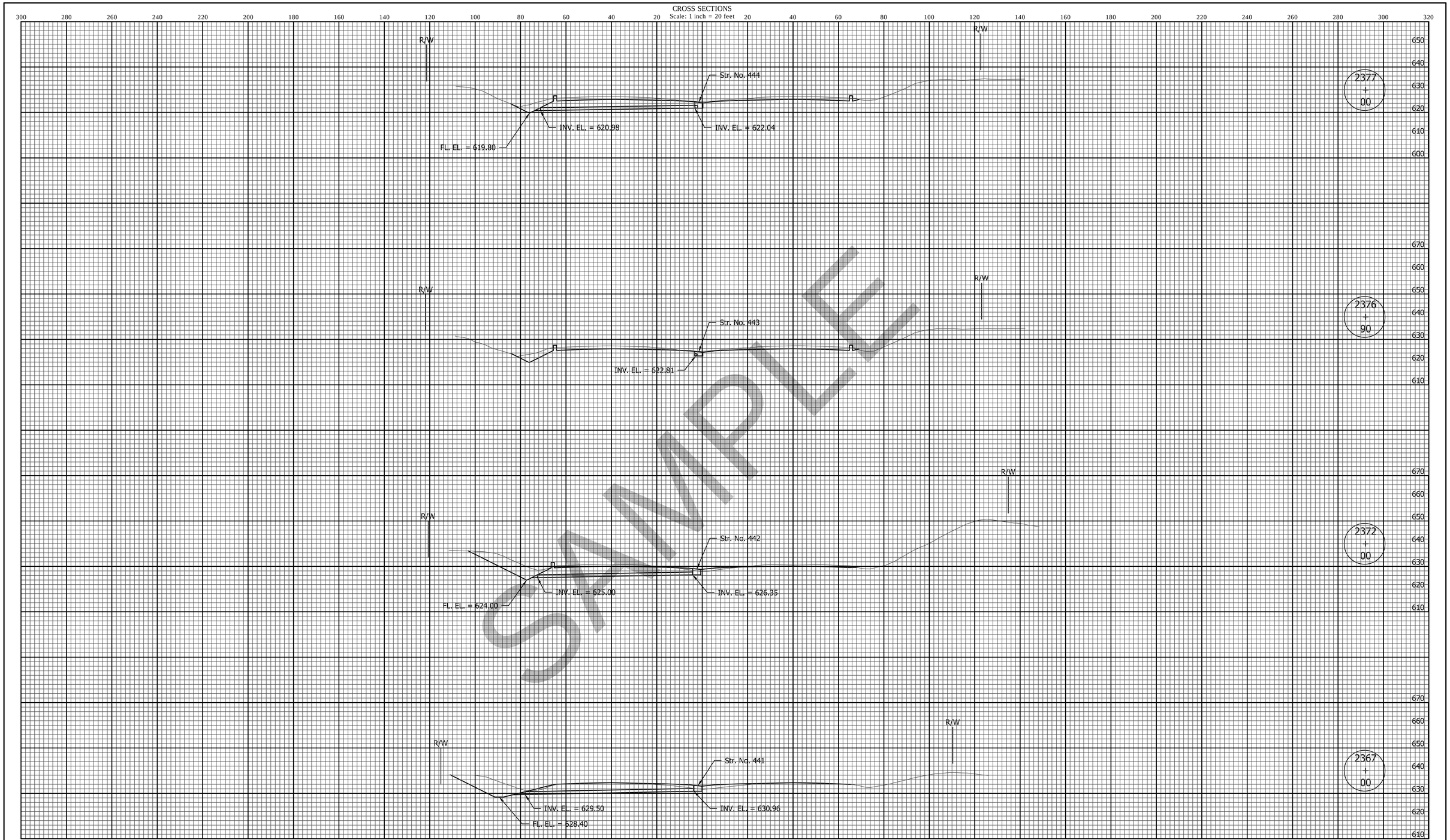

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Phone 317-895-2585
Fax 317-895-2596
www.ucindy.com

RECOMMENDED FOR APPROVAL _____ 08/08/2018
DESIGN ENGINEER DATE

DESIGNED: MA | DRAWN: DJS
CHECKED: WDN | CHECKED: WDN

INDIANA
DEPARTMENT OF TRANSPORTATION

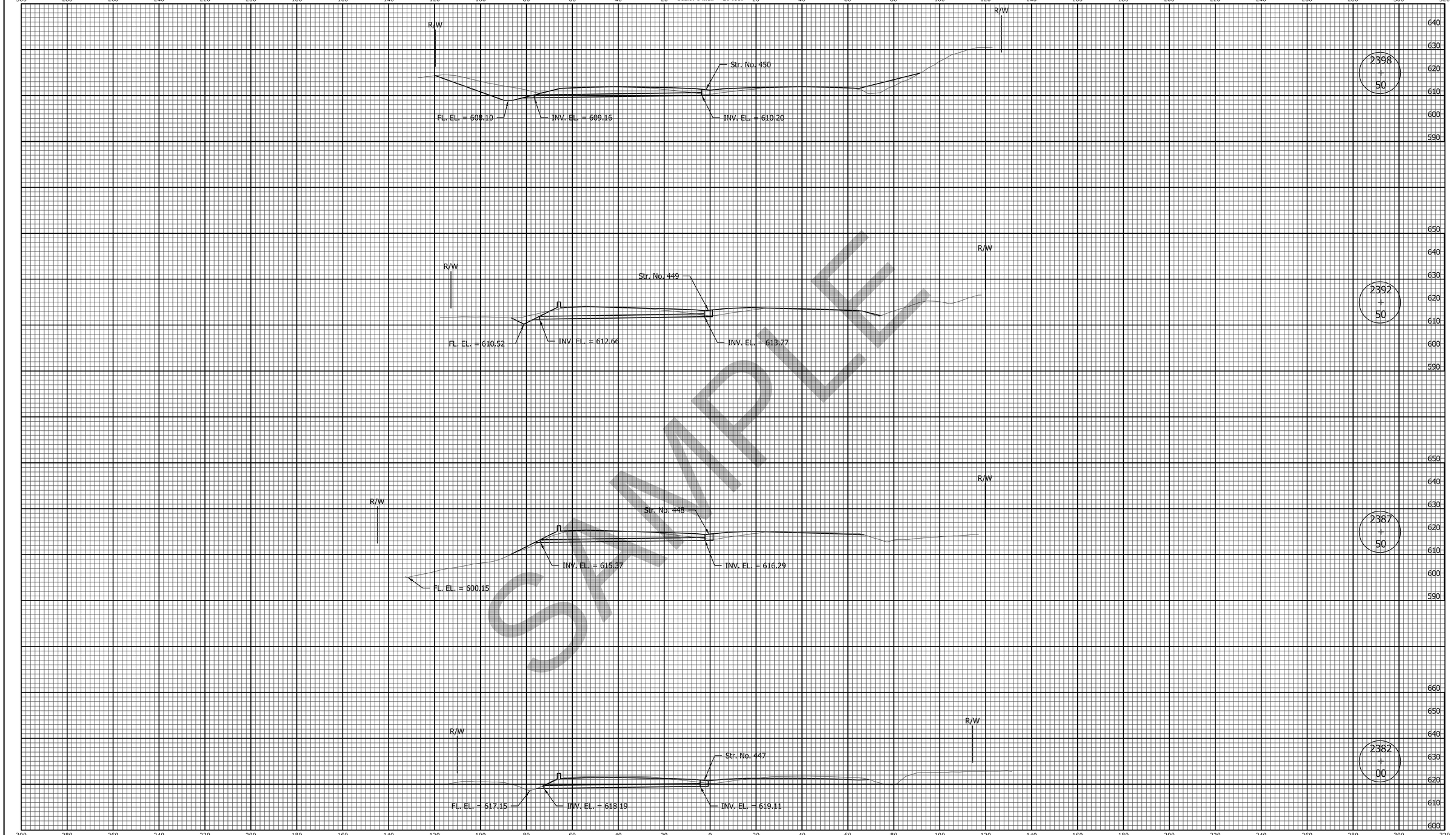
CROSS SECTIONS - MEDIAN
LINE "A"

HORIZONTAL SCALE	BRIDGE FILE
20	
VERTICAL SCALE	DESIGNATION
	0501212
SURVEY BOOK	SHEETS
	# of ####
CONTRACT	PROJECT
R-28940	0501212

File Name: M:\Projects New\042 UNI\042_17000\042_17002 I65 Design\D. Drawings\Plans\Median Drainage Cross Sections B&C.dwg Plot Date: 9/21/2018 Plotted By: Whitney Neukam

CROSS SECTIONS

Scale: 1 inch = 20 feet



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LINE "A"

HORIZONTAL SCALE	BRIDGE FILE
20	
VERTICAL SCALE	DESIGNATION
	0501212

SURVEY BOOK	SHEETS
	# of ####
CONTRACT	PROJECT
R-28940	0501212

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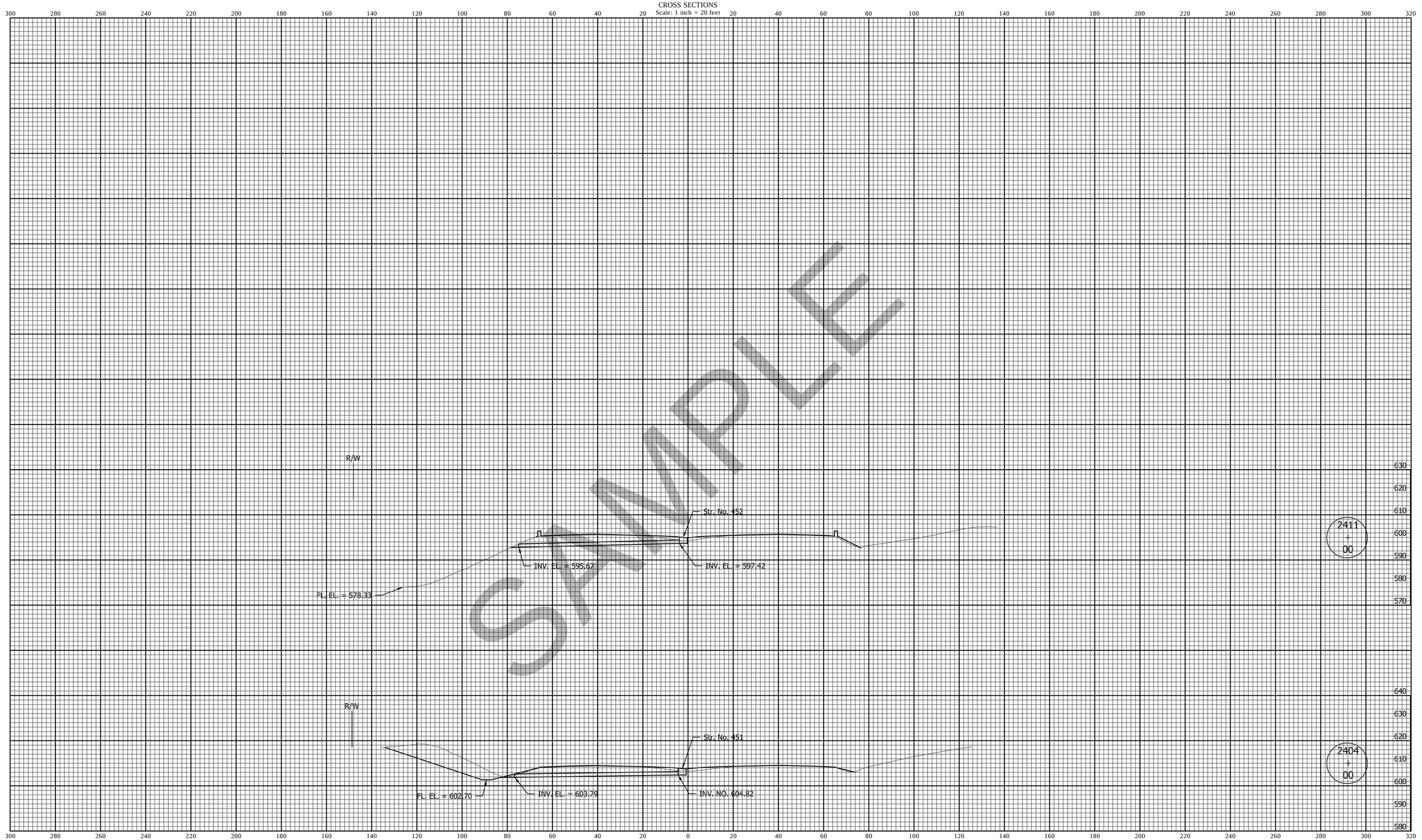
CROSS SECTIONS

Scale: 1 inch = 20 feet



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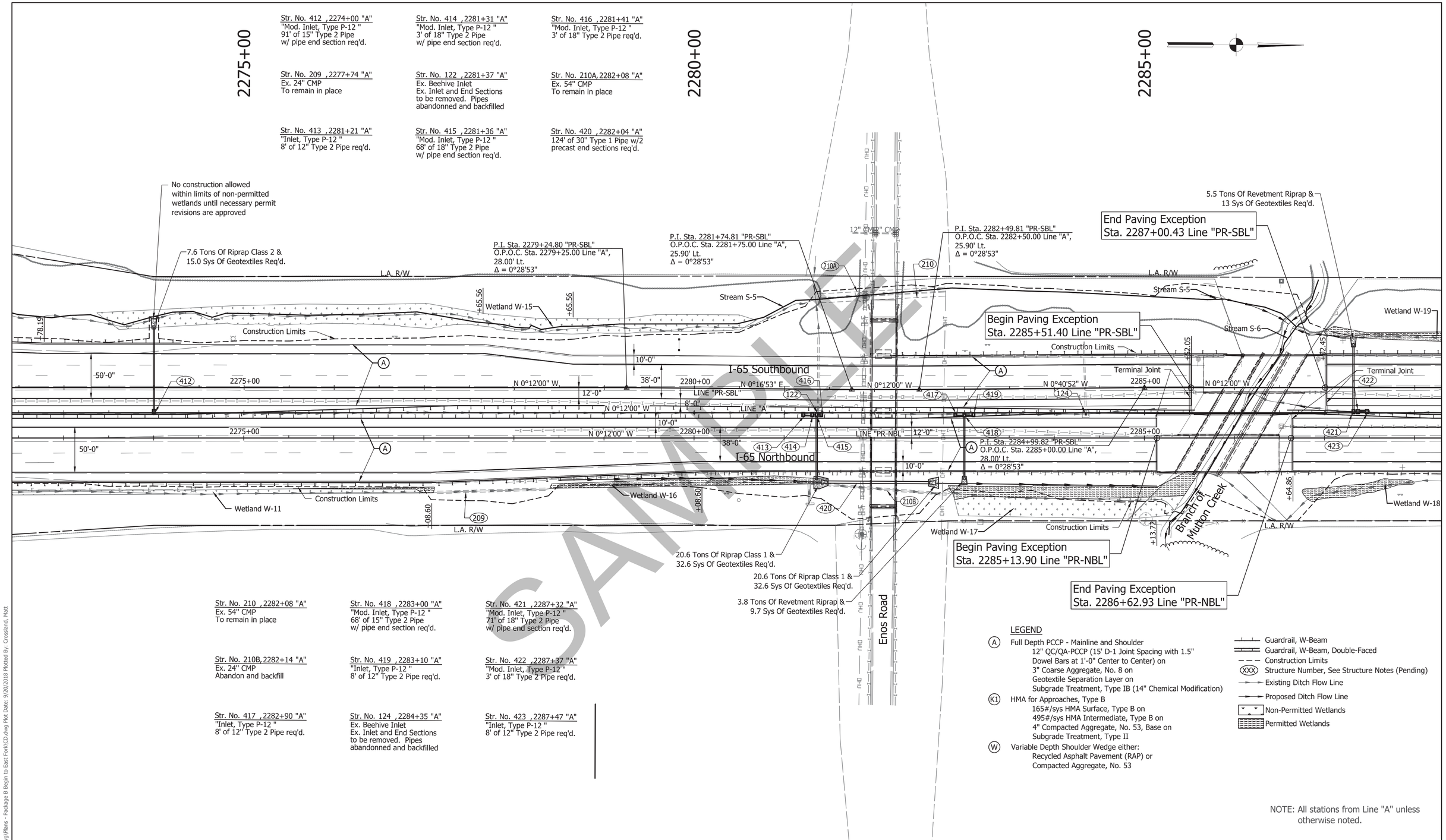
DEPARTMENT OF TRANSPORTATION

CROSS SECTIONS - MEDIAN
LINE "A"

HORIZONTAL SCALE	BRIDGE FILE
20	
VERTICAL SCALE	DESIGNATION
	0501212

SURVEY BOOK	SHEETS
	# of ####
CONTRACT	PROJECT
R-28940	0501212

File Name: M:\Projects New\042 UNI\042_17000\042_17002 I65 Design\D. Drawings\Plans\Median Drainage Cross Sections B&C.dwg Plot Date: 9/21/2018 Plotted By: Whitney Neukam



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DESIGNED: SRP DRAWN: MAC

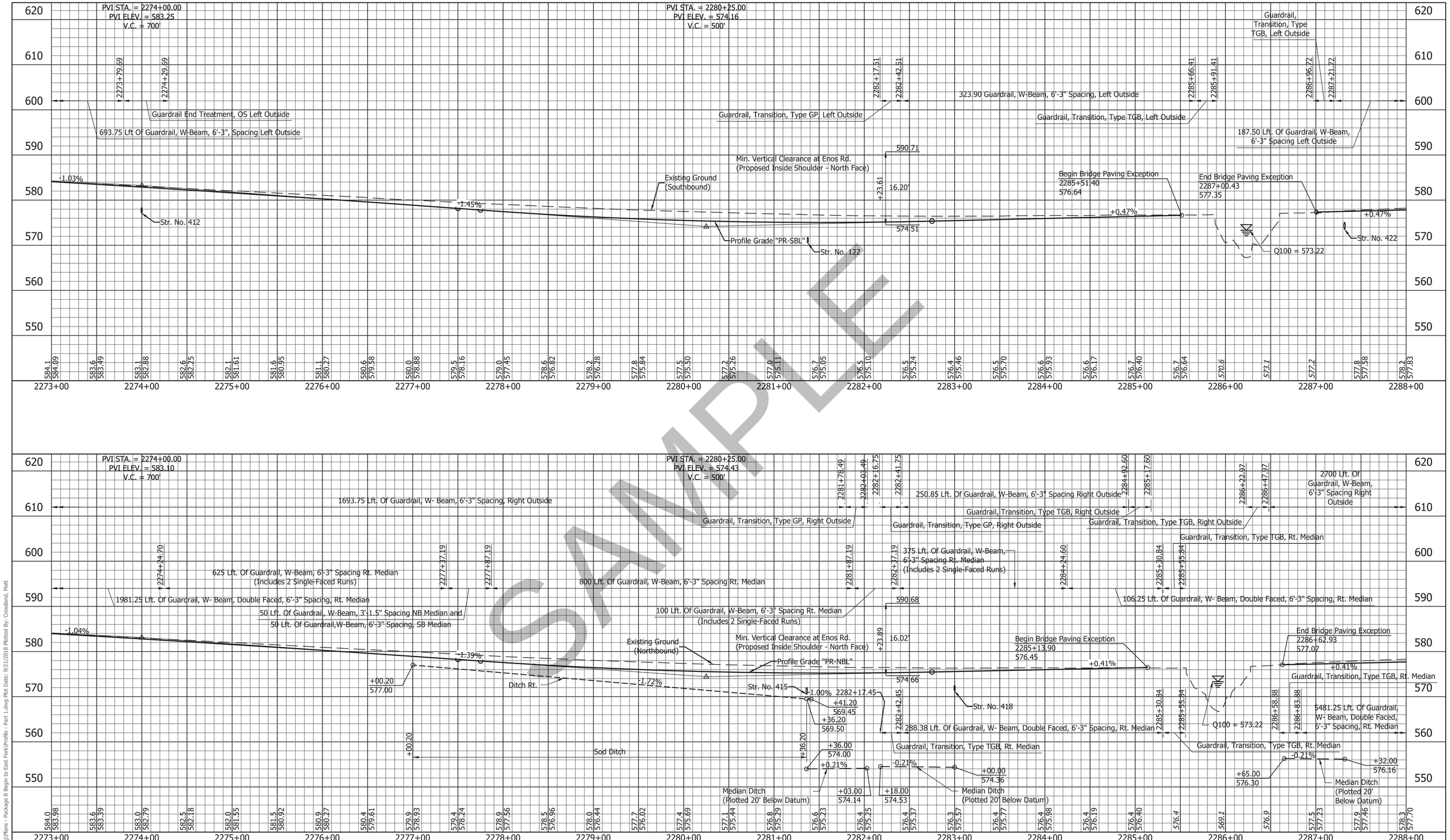
CHECKED: BJP CHECKED: BJP

INDIANA
DEPARTMENT OF TRANSPORTATION

PLAN
LINES "A", "PR-NBL", & "PR-SBL"

HORIZONTAL SCALE	BRIDGE FILE
1" = 50'	----
VERTICAL SCALE	DESIGNATION
N/A	0501212
SURVEY BOOK	SHEETS
-	68 of 165
CONTRACT	PROJECT
SR-28940	0501212

File Name: P:\C3D\17-465\Road\Dwg\Plans - Package B Begin to East Fork\CD.dwg Plot Date: 9/20/2018 Plotted By: Crossland, Matt



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DESIGNED: SRP | DRAWN: MAC

CHECKED: BJP | CHECKED: BJP

INDIANA
DEPARTMENT OF TRANSPORTATION

PROFILE
LINES "PR-NBL" & LINE "PR-SBL"

HORIZONTAL SCALE	BRIDGE FILE
1" = 50'	----
VERTICAL SCALE	DESIGNATION
1" = 10'	0501212

SURVEY BOOK	SHEETS
-	69 of 165
CONTRACT	PROJECT
SR-28940	0501212

File Name: P:\C3D\17-465\Road\Dwg\Plans - Package B Begin to East Fork\Profile - Part 1.dwg Plot Date: 9/21/2018 Plotted By: Crossland, Matt

2335+00

Str. No. 131 ,2333+83 "A"
Ex. Beehive Inlet
Ex. Inlet and End Sections to be removed. Pipes abandonned and backfilled

Str. No. 432 ,2334+50 "A"
"Mod. Inlet, Type P-12 "
71' of 15" Type 2 Pipe w/ pipe end section req'd.

Str. No. 433 ,2340+50 "A"
"Mod. Inlet, Type P-12 "
78' of 15" Type 2 Pipe w/1 Safety metal end section

Str. No. 132 ,2341+33 "A"
Ex. Beehive Inlet
Ex. Inlet and End Sections to be removed. Pipes abandonned and backfilled

Str. No. 213 ,2343+32 "A"
Ex. 18" RCP
Abandon and backfill

Str. No. 214 ,2343+37 "A"
145' of 36" Type 1 Pipe w/Precast end section & safety metal end section req'd.

Str. No. 134 ,2344+07 "A"
Ex. Drop Inlet
Ex. Inlet and End Sections to be removed. Pipes abandonned and backfilled

Str. No. 214A, 2346+02 "A"
Ex. 15" CMP
Abandon and backfill

Str. No. 438 ,2346+01 "A"
97' of 24" Type 1 Pipe w/2 precast end sections req'd.

Str. No. 434 ,2346+90 "A"
"Inlet, Type P-12 "
8' of 12" Type 2 Pipe req'd.

Str. No. 435 ,2347+00 "A"
"Mod. Inlet, Type P-12 "
67' of 15" Type 2 Pipe w/ pipe end section req'd.

Str. No. 436 ,2347+05 "A"
"Mod. Inlet, Type P-12 "
3' of 15" Type 2 Pipe req'd.

2340+00

Str. No. 437 ,2347+15 "A"
"Inlet, Type P-12 "
8' of 12" Type 2 Pipe req'd.

Str. No. 135 ,2347+28 "A"
Ex. Drop Inlet
Ex. Inlet and End Sections to be removed. Pipes abandonned and backfilled

2345+00

11.6 Tons Of Riprap Class 1 & 29.1 Sys Of Geotextiles Req'd.

L.A. R/W

Construction Limits

+60.00

+99.96

10'-0"

38'-0"

12'-0"

8'-0"

11'-0"

I-65 Southbound

I-65 Northbound

2335+00

2340+00

2345+00

N 51°04'11" W

N 50°35'01" W

N 51°33'21" W

LINE "PR-SBL"

LINE "A"

LINE "PR-NBL"

131 432 433 132 213 214 214A 134 438 435 135 434 436 437

25.0 Tons Of Revetment Riprap & 45.75 Sys Of Geotextiles Req'd.

P.I. Sta. 2343+10.46 "PR-SBL"
O.P.O.C. Sta. 2343+35.00 Line "A", 28.00' Lt.
Δ = 0°29'10"

P.I. Sta. 2344+75.47 "PR-SBL"
O.P.O.C. Sta. 2344+75.47 Line "PR-SBL", 0.00'
Δ = 0°29'10"

12.0 Tons Of Riprap Class 1 & 27.5 Sys Of Geotextiles Req'd.

3.9 Tons Of Riprap Class 1 & 9.3 Sys Of Geotextiles Req'd.

12" CMP

DHE

14.4 Tons Of Riprap Class 1 & 28.2 Sys Of Geotextiles Req'd.

Wetland W-25

Wetland W-26

Construction Limits
25.0 Tons Of Revetment Riprap & 45.75 Sys Of Geotextiles Req'd.

L.A. R/W
Wetland W-26A

Wetland W-27

CR 800 N

P.I. Sta. 2346+25.47 "PR-SBL"
O.P.O.C. Sta. 2346+50.00 Line "A", 26.60' Lt.
Δ = 0°29'10"

Overhead Electric
138 KV & 69 KV

LEGEND

(A) Full Depth PCCP - Mainline and Shoulder
12" QC/QA-PCCP (15' D-1 Joint Spacing with 1.5" Dowel Bars at 1'-0" Center to Center) on
3" Coarse Aggregate, No. 8 on
Geotextile Separation Layer on
Subgrade Treatment, Type IB (14" Chemical Modification)

(K1) HMA for Approaches, Type B
165#/sys HMA Surface, Type B on
495#/sys HMA Intermediate, Type B on
4" Compacted Aggregate, No. 53, Base on
Subgrade Treatment, Type II

(W) Variable Depth Shoulder Wedge either:
Recycled Asphalt Pavement (RAP) or
Compacted Aggregate, No. 53

Guardrail, W-Beam
Guardrail, W-Beam, Double-Faced
Construction Limits
(XXX) Structure Number, See Structure Notes (Pending)
Existing Ditch Flow Line
Proposed Ditch Flow Line
Non-Permitted Wetlands
Permitted Wetlands

NOTE: All stations from Line "A" unless otherwise noted.

SAMPLE

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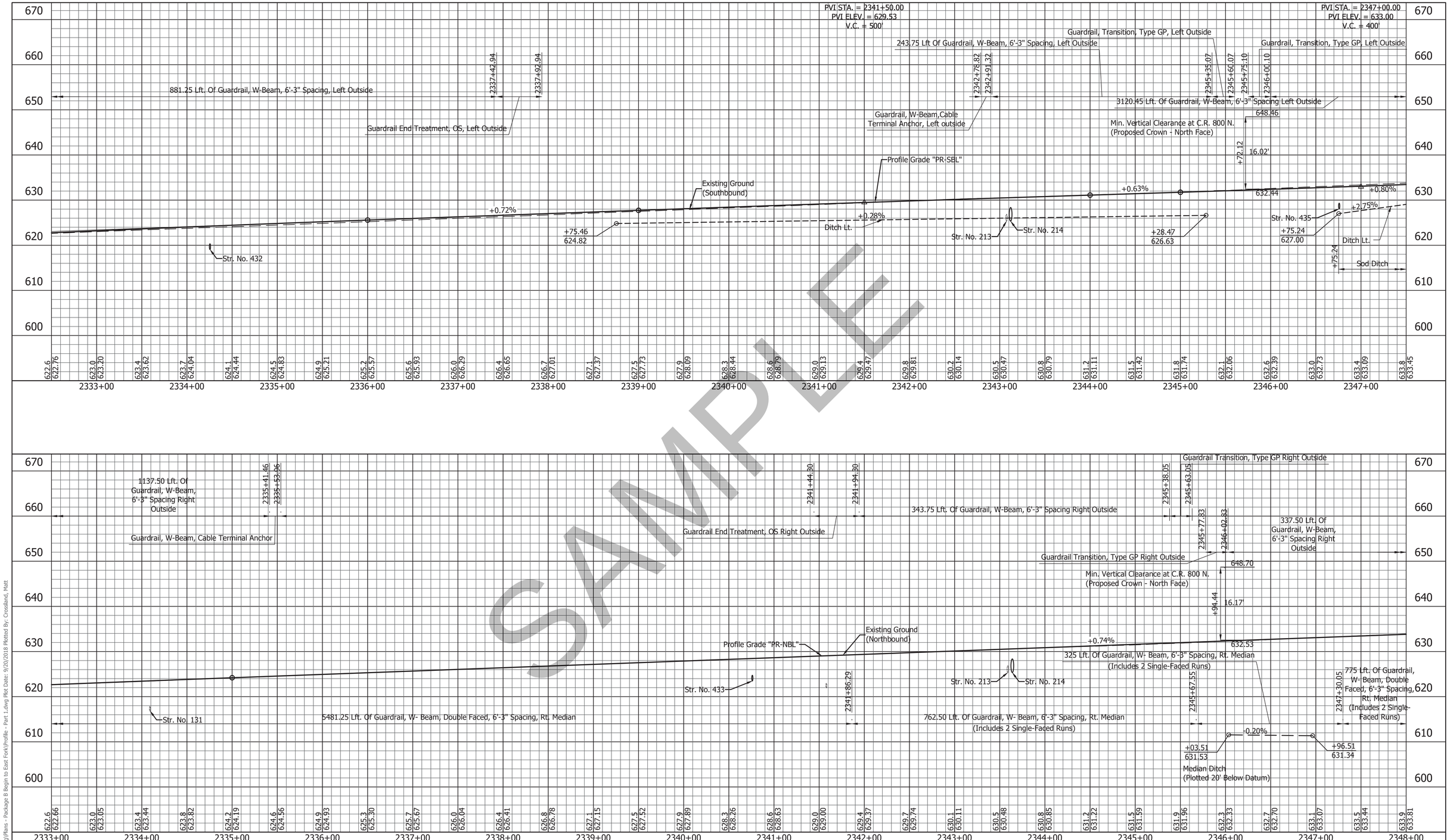
CHECKED: BJP CHECKED: BJP

INDIANA
DEPARTMENT OF TRANSPORTATION

PLAN
LINES "A", "PR-NBL", & "PR-SBL"

HORIZONTAL SCALE	BRIDGE FILE
1" = 50'	----
VERTICAL SCALE	DESIGNATION
N/A	0501212
SURVEY BOOK	SHEETS
-	76 of 165
CONTRACT	PROJECT
SR-28940	0501212

File Name: P:\C3D\17-465\Road\Dwg\Plans - Package B Begin to East Fork\CD.dwg Plot Date: 9/20/2018 Plotted By: Crossland, Matt



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DEPARTMENT OF TRANSPORTATION

PROFILE
LINES "PR-NBL" & LINE "PR-SBL"

HORIZONTAL SCALE	BRIDGE FILE
1" = 50'	----
VERTICAL SCALE	DESIGNATION
1" = 10'	0501212

SURVEY BOOK	SHEETS
-	77 of 165
CONTRACT	PROJECT
SR-28940	0501212

File Name: P:\C3D\17-465\Road\Dwg\Plans - Package B Begin to East Fork\Profile - Part 1.dwg Plot Date: 9/20/2018 Plotted By: Crossland, Matt

2365+00

2370+00

2375+00

Str. No. 139 , 2366+33 "A"
Ex. Beehive Inlet
Ex. Inlet and End Sections to be removed. Pipes abandonned and backfilled

Str. No. 441 , 2367+00 "A"
"Mod. Inlet, Type P-12 "
74' of 15" Type 2 Pipe
w/1 Safety metal end section

Str. No. 442 , 2372+00 "A"
"Mod. Inlet, Type P-12 "
74' of 15" Type 2 Pipe
w/1 Safety metal end section

Str. No. 140 , 2376+82 "A"
Ex. Drop Inlet
Ex. Inlet and End Sections to be removed. Pipes abandonned and backfilled

Str. No. 443 , 2376+90 "A"
"Inlet, Type P-12 "
8' of 12" Type 2 Pipe req'd.

Str. No. 444 , 2377+00 "A"
"Mod. Inlet, Type P-12 "
73' of 15" Type 2 Pipe
w/1 Safety metal end section

Str. No. 445 , 2377+05 "A"
"Mod. Inlet, Type P-12 "
3' of 15" Type 2 Pipe req'd.

Str. No. 215A, 2377+84 "A"
Ex. 24" CMP
Abandon and backfill

Str. No. 215B, 2377+66 "A"
Ex. 24" CMP
To remain in place

Str. No. 446 , 2377+78 "A"
117' of 30" Type 1 Pipe w/2 precast end sections req'd.

P.I. Sta. 2377+15.48 "PR-SBL"
O.P.O.C. Sta. 2377+40.00 Line "A",
26.60' Lt.
Δ = 0°29'10"

17.5 Tons Of Revetment Riprap &
37.5 Sys Of Geotextiles Req'd.

7.2 Tons Of Riprap Class 1 &
15.2 Sys Of Geotextiles Req'd.

P.I. Sta. 2375+50.47 "PR-SBL"
O.P.O.C. Sta. 2375+75.00 Line "A",
28.00' Lt.
Δ = 0°29'10"

7.2 Tons Of Riprap Class 1 &
15.2 Sys Of Geotextiles Req'd.

6.4 Tons Of Riprap Class 1 &
13.8 Sys Of Geotextiles Req'd.

Wetland W-29

Construction Limits

L.A. R/W

I-65 Southbound

I-65 Northbound

LINE "PR-SBL"

LINE "PR-NBL"

LINE "A"

N 51°04'11" W

N 50°35'01" W

N 51°31'41" W

10'-0"

38'-0"

12'-0"

8'-0"

Redding Road

P.I. Sta. 2377+41.51 "PR-NBL"
O.P.O.C. Sta. 2377+15.00 Line "A",
28.00' Rt.
Δ = 0°27'30"

P.I. Sta. 2377+66.51 "PR-NBL"
O.P.O.C. Sta. 2377+40.00 Line "A",
27.80' Rt.
Δ = 0°27'30"

LEGEND

- (A) Full Depth PCCP - Mainline and Shoulder
  12" QC/QA-PCCP (15' D-1 Joint Spacing with 1.5" Dowel Bars at 1'-0" Center to Center) on 3" Coarse Aggregate, No. 8 on Geotextile Separation Layer on Subgrade Treatment, Type IB (14" Chemical Modification)
- (K1) HMA for Approaches, Type B
  165#/sys HMA Surface, Type B on 495#/sys HMA Intermediate, Type B on 4" Compacted Aggregate, No. 53, Base on Subgrade Treatment, Type II
- (W) Variable Depth Shoulder Wedge either: Recycled Asphalt Pavement (RAP) or Compacted Aggregate, No. 53

- Guardrail, W-Beam
- Guardrail, W-Beam, Double-Faced
- Construction Limits
- (XXX) Structure Number, See Structure Notes (Pending)
- Existing Ditch Flow Line
- Proposed Ditch Flow Line
- Non-Permitted Wetlands
- Permitted Wetlands

NOTE: All stations from Line "A" unless otherwise noted.

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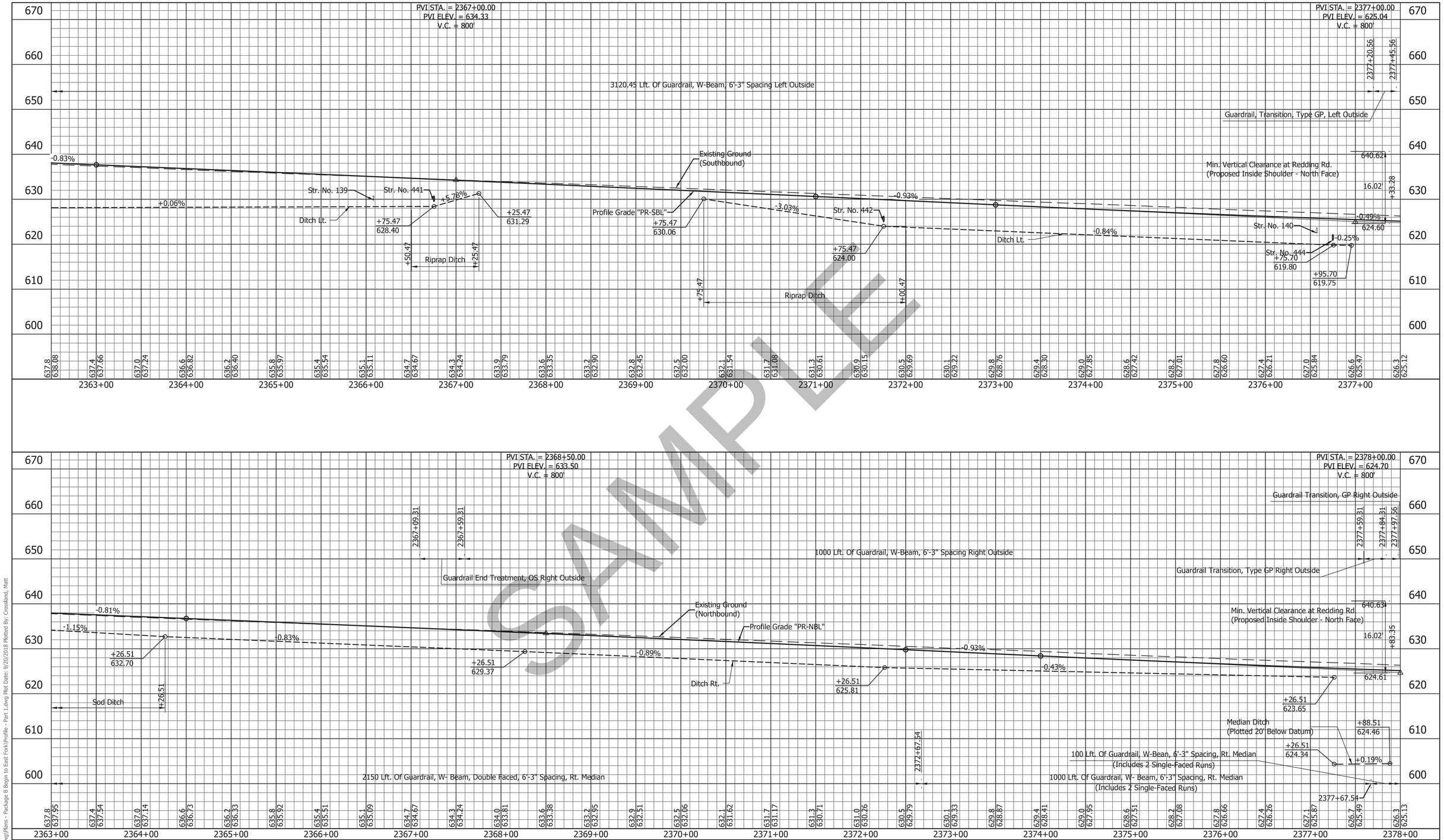
CHECKED: BJP CHECKED: BJP

INDIANA
DEPARTMENT OF TRANSPORTATION

PLAN
LINES "A", "PR-NBL", & "PR-SBL"

HORIZONTAL SCALE	BRIDGE FILE
1" = 50'	----
VERTICAL SCALE	DESIGNATION
N/A	0501212
SURVEY BOOK	SHEETS
-	80 of 165
CONTRACT	PROJECT
SR-28940	0501212

File Name: P:\C3D\17-465\Road\Dwg\Plans - Package B Begin to East Fork\CD.dwg Plot Date: 9/20/2018 Plotted By: Crossland, Matt



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INDIANA
DEPARTMENT OF TRANSPORTATION

PROFILE
LINES "PR-NBL" & LINE "PR-SBL"

HORIZONTAL SCALE	BRIDGE FILE
1" = 50'	----
VERTICAL SCALE	DESIGNATION
1" = 10'	0501212

SURVEY BOOK	SHEETS
-	81 of 165
CONTRACT	PROJECT
SR-28940	0501212

File Name: P:\C3D\17-465\Road\Dwg\Plans - Package B Begin to East Fork\Profile - Part 1.dwg Plot Date: 9/20/2018 Plotted By: Crossland, Matt