



Dan Cummins Parking Lot Addition Drainage Analysis

This report was prepared by Thoroughbred Engineering for Dan Cummins, US 27/US 68 BYPASS RD, Paris, Kentucky. The intent of the following drainage report is to analyze a drainage area totaling 4.80 acres. The stormwater detention is provided for by a detention basin located to the east of the property designed by GRW Engineers, INC. The “Paris Development Drainage Report” created by GRW on November 20, 2006 shall be referenced throughout this report. For specific information regarding the detention basin, reference the drainage analysis report mentioned above. The following report is based on field conditions and the drainage report and Pondpak data created by GRW Engineers.

Software and Methodology

Carlson Civil Suite 2017 was utilized to design the storm sewer system and model the watershed to determine the pre and post conditions. Predicted peak runoff(Q_p) was calculated using the Rational Method,

$$Q_p = CiA$$

where,

C = runoff coefficient, variable with land use

i = intensity of rainfall of chosen frequency for a duration equal to time of concentration t_c

A= area of watershed (acres)

NOAA’s National Weather Service Precipitation Frequency Data Server was used for local precipitation data.

Site Statistics

The following table lists the site statistics and hydrologic parameters:

Hydrograph Runoff Input and Results			
Hydrograph Type	Rational		Impervious Percentage 89 %
Drainage Area	4.80 acres		Pre-Development-C 0.25
Impervious Area	4.30 acres		Post-Development-C 0.86
Pervious Area	0.5 acres		GRW Design-C* 0.86

*See GRW Report for Design runoff coefficient



The planned development of the site is as follows:

Lot area=	4.80 acres	
Impervious area =	4.30 acres;	C = 0.95
Vegetative area =	0.50 acres;	C = 0.25
Total Weighted runoff coefficient		<u>C=0.86</u>

Existing Detention Summary

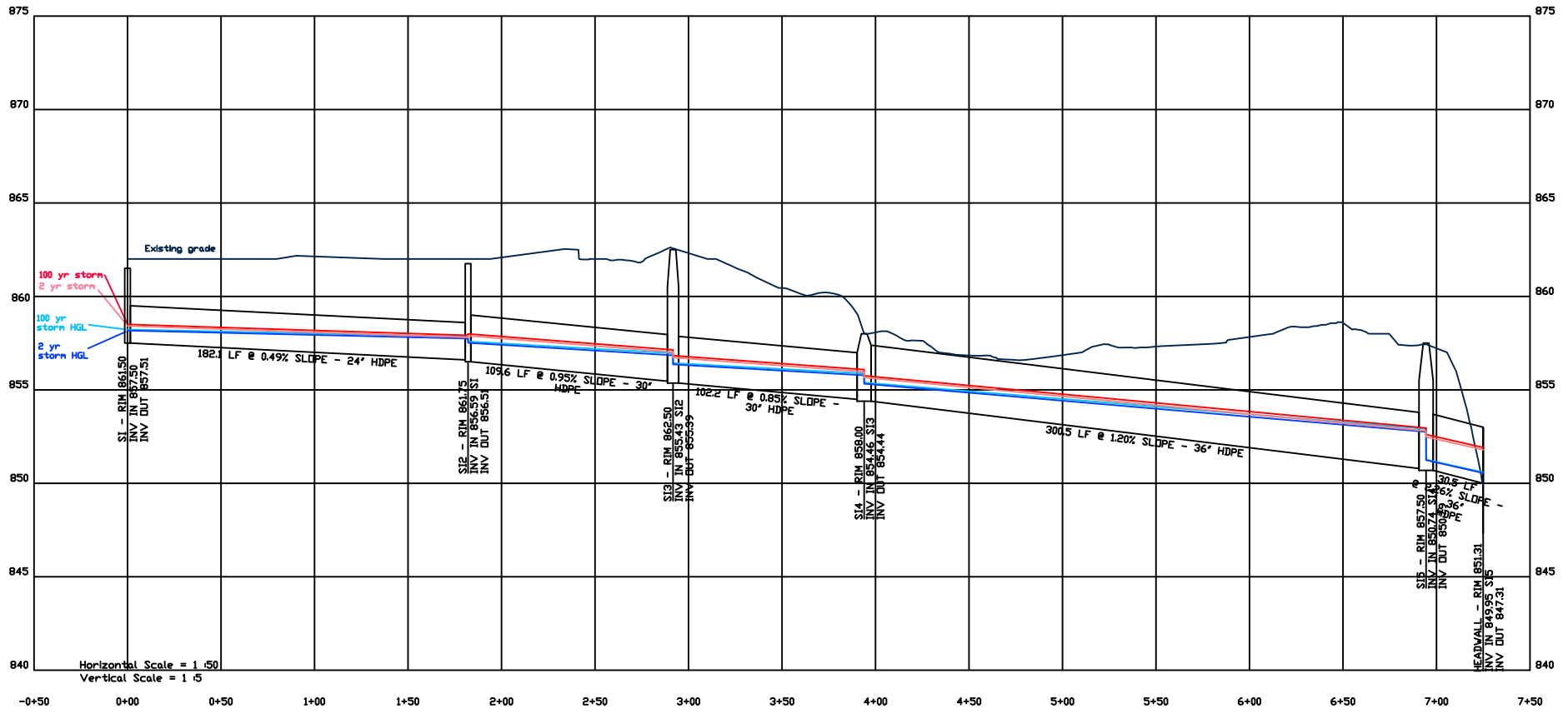
The existing detention pond was designed by GRW Engineering to capture the runoff from for a developed property with runoff coefficient (C) of 0.86. The actual runoff coefficient of the developed property is 0.86. Since the actual runoff coefficient is not greater than the planned developed condition with a runoff coefficient of 0.86, no additional detention is required.

If you have any questions, please feel free to contact us.

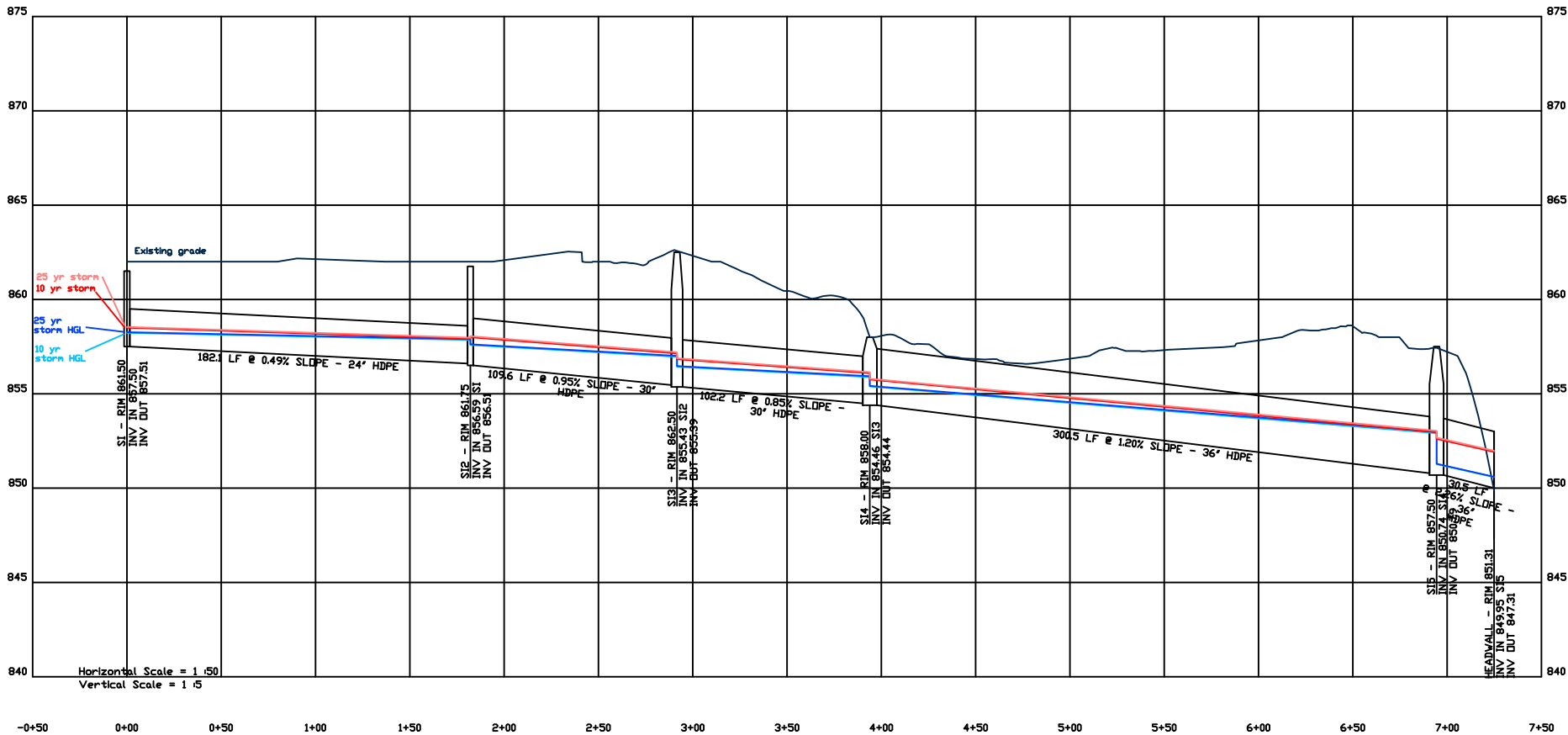
Sincerely,
Thoroughbred Engineering

Daniel Rehner, P.E.
Project Engineer

Darrin Croucher, P.E.
Principal Engineer



2-yr/100yr Storm events



10-yr/25yr Storm events

Sewer Network Report – Drainage

Thu Aug 09 14:38:17 2018

Sewer Network File: C:\Users\djreh\Dropbox (RTC360)\thoroughbred engineering\projects\Dan Cummins – Paris\Civil\Storm Design\Storm djr.sew
 Ground Surface File: C:\Users\djreh\Dropbox (RTC360)\thoroughbred engineering\projects\Dan Cummins – Paris\Civil\Tin Files\FG Merged.tin
 Design Method: Peak Discharge Calculation
 Hydro Method: Rational Method
 Rainfall ID: NWS
 Return Period: 2 YEAR

System A
 Sewer Line From Upstream to Downstream

Structure Name	Area (Acres)	Area (SF)	Area (SqMiles)	Runoff Coefficient	Tc (min)	Compound Tc (min)	Tc (min)	Intensity (in/hr)	Discharge (cfs)
SI	2.44	106204.00	0.00	0.92	10.00	10.00		4.07	9.13
SI2	1.86	81200.00	0.00	0.91	10.00	11.03		3.92	6.90
SI3	0.00	0.00	0.00	0.00	10.00	11.47		3.86	0.00
SI4	0.00	0.00	0.00	0.00	10.00	11.88		3.80	0.00
SI5	0.00	0.00	0.00	0.00	10.00	13.43		3.58	0.00
HEADWALL	0.00	0.00	0.00	0.00	0.00	13.49		3.57	0.00

Return Period: 10 YEAR
 System A
 Sewer Line From Upstream to Downstream

Structure Name	Area (Acres)	Area (SF)	Area (SqMiles)	Runoff Coefficient	Tc (min)	Compound Tc (min)	Tc (min)	Intensity (in/hr)	Discharge (cfs)
SI	2.44	106204.00	0.00	0.92	10.00	10.00		5.26	11.80
SI2	1.86	81200.00	0.00	0.91	10.00	10.97		5.09	8.92
SI3	0.00	0.00	0.00	0.00	10.00	11.39		5.01	0.00
SI4	0.00	0.00	0.00	0.00	10.00	11.78		4.94	0.00
SI5	0.00	0.00	0.00	0.00	10.00	13.28		4.68	0.00
HEADWALL	0.00	0.00	0.00	0.00	0.00	13.33		4.67	0.00

Return Period: 25 YEAR
 System A
 Sewer Line From Upstream to Downstream

Structure Name	Area (Acres)	Area (SF)	Area (SqMiles)	Runoff Coefficient	Tc (min)	Compound Tc (min)	Tc (min)	Intensity (in/hr)	Discharge (cfs)
SI	2.44	106204.00	0.00	0.92	10.00	10.00		5.90	13.23
SI2	1.86	81200.00	0.00	0.91	10.00	10.94		5.72	10.01
SI3	0.00	0.00	0.00	0.00	10.00	11.36		5.63	0.00
SI4	0.00	0.00	0.00	0.00	10.00	11.74		5.56	0.00
SI5	0.00	0.00	0.00	0.00	10.00	13.21		5.27	0.00
HEADWALL	0.00	0.00	0.00	0.00	0.00	13.26		5.26	0.00

Return Period: 100 YEAR
 System A
 Sewer Line From Upstream to Downstream

Structure Name	Area (Acres)	Area (SF)	Area (SqMiles)	Runoff Coefficient	Tc (min)	Compound Tc (min)	Tc (min)	Intensity (in/hr)	Discharge (cfs)
SI	2.44	106204.00	0.00	0.92	10.00	10.00		6.85	15.36
SI2	1.86	81200.00	0.00	0.91	10.00	10.91		6.64	11.62
SI3	0.00	0.00	0.00	0.00	10.00	11.32		6.55	0.00
SI4	0.00	0.00	0.00	0.00	10.00	11.69		6.47	0.00
SI5	0.00	0.00	0.00	0.00	10.00	13.12		6.14	0.00
HEADWALL	0.00	0.00	0.00	0.00	0.00	13.17		6.13	0.00

Sewer Network Report – Simple

Thu Aug 09 14:40:42 2018

Sewer Network File: C:\Users\djreh\Dropbox (RTC360)\thoroughbred engineering\projects\Dan Cummins – Paris\Civil\Storm Design\Storm djr.sew
 Ground Surface File: C:\Users\djreh\Dropbox (RTC360)\thoroughbred engineering\projects\Dan Cummins – Paris\Civil\Tin Files\FG Merged.tin
 Design Method: Peak Discharge Calculation
 Hydro Method: Rational Method
 Rainfall ID: NWS
 Return Period: 2 YEAR

System A

Sewer Line From SI To HEADWALL (Upstream to Downstream)

Name	Station Distance	Invert-In Slope(%)	Invert-Out Size(in)	Rim Elev Min	Elev Cover(ft)	Area(SF) Direction	Flow Depth(in)
SI	0+00.00 182.11	0.49	857.50 24.00	861.50 2.50	106204.00	S 81°42'12" E	9.63
SI2	1+82.11 109.59	856.60 0.95	856.50 30.00	861.75 3.00	81200.00	S 84°08'55" E	16.37
SI3	2+91.70 102.22	855.46 0.85	855.36 30.00	862.50 1.01	0.00	N 17°43'14" E	19.53
SI4	3+93.92 300.51	854.49 1.20	854.39 36.00	858.00 0.15	0.00	S 69°06'42" E	18.07
SI5	6+94.42 30.50	850.79 2.26	850.69 36.00	857.50 -3.12	0.00	S 04°19'18" W	27.55
HEADWALL	7+24.93	850.00 2.26	847.31	850.00	0.00		7.43

Sewer Network Report – Simple

Thu Aug 09 14:41:33 2018

Sewer Network File: C:\Users\djreh\Dropbox (RTC360)\thoroughbred engineering\projects\Dan Cummins – Paris\Civil\Storm Design\Storm djr.sew
 Ground Surface File: C:\Users\djreh\Dropbox (RTC360)\thoroughbred engineering\projects\Dan Cummins – Paris\Civil\Tin Files\FG Merged.tin
 Design Method: Peak Discharge Calculation
 Hydro Method: Rational Method
 Rainfall ID: NWS
 Return Period: 10 YEAR

System A

Sewer Line From SI To HEADWALL (Upstream to Downstream)

Name	Station Distance	Invert-In Slope(%)	Invert-Out Size(in)	Rim Elev Min	Elev Cover(ft)	Area(SF) Direction	Flow Depth(in)
SI	0+00.00 182.11	0.49	857.50 24.00	861.50 2.50	106204.00	S 81°42'12" E	8.78
SI2	1+82.11 109.59	856.60 0.95	856.50 30.00	861.75 3.00	81200.00	S 84°08'55" E	14.96
SI3	2+91.70 102.22	855.46 0.85	855.36 30.00	862.50 1.01	0.00	N 17°43'14" E	17.96
SI4	3+93.92 300.51	854.49 1.20	854.39 36.00	858.00 0.15	0.00	S 69°06'42" E	16.66
SI5	6+94.42 30.50	850.79 2.26	850.69 36.00	857.50 -3.12	0.00	S 04°19'18" W	25.39
HEADWALL	7+24.93	850.00 2.26	847.31	850.00	0.00		6.95

Sewer Network Report – Simple

Thu Aug 09 14:41:50 2018

Sewer Network File: C:\Users\djreh\Dropbox (RTC360)\thoroughbred engineering\projects\Dan Cummins – Paris\Civil\Storm Design\Storm djr.sew
 Ground Surface File: C:\Users\djreh\Dropbox (RTC360)\thoroughbred engineering\projects\Dan Cummins – Paris\Civil\Tin Files\FG Merged.tin
 Design Method: Peak Discharge Calculation
 Hydro Method: Rational Method
 Rainfall ID: NWS
 Return Period: 25 YEAR

System A

Sewer Line From SI To HEADWALL (Upstream to Downstream)

Name	Station Distance	Invert-In Slope(%)	Invert-Out Size(in)	Rim Elev Min	Elev Cover(ft)	Area(SF) Direction	Flow Depth(in)
SI	0+00.00 182.11	0.49	857.50 24.00	861.50 2.50	106204.00	S 81°42'12" E	9.14
SI2	1+82.11 109.59	856.60 0.95	856.50 30.00	861.75 3.00	81200.00	S 84°08'55" E	15.55
SI3	2+91.70 102.22	855.46 0.85	855.36 30.00	862.50 1.01	0.00	N 17°43'14" E	18.62
SI4	3+93.92 300.51	854.49 1.20	854.39 36.00	858.00 0.15	0.00	S 69°06'42" E	17.26
SI5	6+94.42 30.50	850.79 2.26	850.69 36.00	857.50 -3.12	0.00	S 04°19'18" W	26.30
HEADWALL	7+24.93	850.00 2.26	847.31	850.00	0.00		7.16

Sewer Network Report – Simple

Thu Aug 09 14:42:24 2018

Sewer Network File: C:\Users\djreh\Dropbox (RTC360)\thoroughbred engineering\projects\Dan Cummins – Paris\Civil\Storm Design\Storm djr.sew
 Ground Surface File: C:\Users\djreh\Dropbox (RTC360)\thoroughbred engineering\projects\Dan Cummins – Paris\Civil\Tin Files\FG Merged.tin
 Design Method: Peak Discharge Calculation
 Hydro Method: Rational Method
 Rainfall ID: NWS
 Return Period: 100 YEAR

System A

Sewer Line From SI To HEADWALL (Upstream to Downstream)

Name	Station Distance	Invert-In Slope(%)	Invert-Out Size(in)	Rim Elev Min	Elev Cover(ft)	Area(SF) Direction	Flow Depth(in)
SI	0+00.00 182.11	0.49	857.50 24.00	861.50 2.50	106204.00	S 81°42'12" E	9.63
SI2	1+82.11 109.59	856.60 0.95	856.50 30.00	861.75 3.00	81200.00	S 84°08'55" E	16.37
SI3	2+91.70 102.22	855.46 0.85	855.36 30.00	862.50 1.01	0.00	N 17°43'14" E	19.53
SI4	3+93.92 300.51	854.49 1.20	854.39 36.00	858.00 0.15	0.00	S 69°06'42" E	18.07
SI5	6+94.42 30.50	850.79 2.26	850.69 36.00	857.50 -3.12	0.00	S 04°19'18" W	27.55
HEADWALL	7+24.93	850.00 2.26	847.31	850.00	0.00		7.43

Sewer Network File: C:\Users\djreh\Dropbox (RTC360)\thoroughbred engineering\projects\Dan Cummins - Paris\Civil\Storm
 Design\Storm djr.sew
 Ground Surface File: C:\Users\djreh\Dropbox (RTC360)\thoroughbred engineering\projects\Dan Cummins - Paris\Civil\Tin Files\FG
 Merged.tin
 Design Method: Peak Discharge Calculation
 Hydro Method: Rational Method
 Rainfall ID: NWS
 Return Period: 100 YEAR

Sewer Line From Upstream to Downstream

Pipe from SI to SI2, system A

Material: HDPE
 Section Type: Circular
 Section Area: 3.14 sq.ft
 Diameter: 24.00 in
 Manning's n: 0.012
 Length: 182.11 ft
 Slope: 0.49 %
 Full Flow: 17.28 cfs
 Maximum Flow: 18.58 cfs
 Total Flow: 5.18 cfs
 Peak Time: 10.91 min
 Travel Time: 0.91 min
 Initial Travel Time: 0.63 min
 Initial Flow Velocity: 4.80 fps
 Full Flow Velocity: 5.50 fps

	Invert Elev(ft)	Rim Elev (ft)	Cover (ft)	HGL (ft)	EGL (ft)	Flow Depth(in)	Velocity (ft/s)
Downstream	856.60	861.75	3.15	857.96	858.04	16.37	2.27
Upstream	857.50	861.50	2.00	858.30	858.60	9.63	4.40

Pipe from SI2 to SI3, system A

Material: HDPE
 Section Type: Circular
 Section Area: 4.91 sq.ft
 Diameter: 30.00 in
 Manning's n: 0.012
 Length: 109.59 ft
 Slope: 0.95 %
 Full Flow: 43.40 cfs
 Maximum Flow: 46.69 cfs
 Total Flow: 12.11 cfs
 Peak Time: 11.32 min
 Travel Time: 0.41 min
 Initial Travel Time: 0.24 min
 Initial Flow Velocity: 7.62 fps
 Full Flow Velocity: 8.84 fps

	Invert Elev(ft)	Rim Elev (ft)	Cover (ft)	HGL (ft)	EGL (ft)	Flow Depth(in)	Velocity (ft/s)
Downstream	855.46	862.50	4.54	857.09	857.29	19.53	3.58
Upstream	856.50	861.75	2.75	857.67	858.12	14.02	5.38

Pipe from SI3 to SI4, system A

Material: HDPE
 Section Type: Circular
 Section Area: 4.91 sq.ft
 Diameter: 30.00 in
 Manning's n: 0.012
 Length: 102.22 ft
 Slope: 0.85 %
 Full Flow: 41.10 cfs
 Maximum Flow: 44.22 cfs
 Total Flow: 11.75 cfs
 Peak Time: 11.69 min
 Travel Time: 0.37 min
 Initial Travel Time: 0.23 min
 Initial Flow Velocity: 7.28 fps
 Full Flow Velocity: 8.37 fps

EGL	Invert Flow Elev(ft)	Rim Elev Velocity (ft)	Cover (ft)	HGL (ft)	(ft)
Depth(in)	(ft/s)				
Downstream	854.49	858.00	1.01	856.00	
856.22	18.07	3.80			
Upstream	855.36	862.50	4.64	856.51	
856.95	13.80	5.33			

Pipe from SI5 to HEADWALL, system A

Material: HDPE
 Section Type: Circular
 Section Area: 7.07 sq.ft
 Diameter: 36.00 in
 Manning's n: 0.012
 Length: 30.50 ft
 Slope: 2.26 %
 Full Flow: 108.97 cfs
 Maximum Flow: 117.22 cfs
 Total Flow: 10.15 cfs
 Peak Time: 13.17 min
 Travel Time: 0.05 min
 Initial Travel Time: 0.05 min
 Initial Flow Velocity: 9.98 fps
 Full Flow Velocity: 15.42 fps

EGL	Invert Flow Elev(ft)	Rim Elev Velocity (ft)	Cover (ft)	HGL (ft)	(ft)
Depth(in)	(ft/s)				
Downstream	850.00	850.00	-3.00	850.62	
852.06	7.43	9.64			
Upstream	850.69	857.50	3.81	851.31	
852.75	7.43	9.64			

Pipe from SI4 to SI5, system A

Material: HDPE
 Section Type: Circular
 Section Area: 7.07 sq.ft
 Diameter: 36.00 in
 Manning's n: 0.012
 Length: 300.51 ft
 Slope: 1.20 %
 Full Flow: 79.30 cfs
 Maximum Flow: 85.30 cfs
 Total Flow: 11.42 cfs
 Peak Time: 13.12 min
 Travel Time: 1.43 min
 Initial Travel Time: 0.62 min
 Initial Flow Velocity: 8.07 fps
 Full Flow Velocity: 11.22 fps

EGL	Invert Flow Elev(ft)	Rim Elev Velocity (ft)	Cover (ft)	HGL (ft)	(ft)
Depth(in)	(ft/s)				
Downstream	850.79	857.50	3.71	853.09	
853.15	27.55	1.97			
Upstream	854.39	858.00	0.61	855.46	
855.86	12.86	5.03			

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 Ground Surface File: C:\Users\djreh\Dropbox (RTC360)\thoroughbred engineering\projects\Dan Cummins - Paris\Civil\Tin Files\FG Merged.tin
 Design Method: Peak Discharge Calculation
 Hydro Method: Rational Method
 Rainfall ID: NWS
 Return Period: 25 YEAR

Sewer Line From Upstream to Downstream

Pipe from SI to SI2, system A

Material: HDPE
 Section Type: Circular
 Section Area: 3.14 sq.ft
 Diameter: 24.00 in
 Manning's n: 0.012
 Length: 182.11 ft
 Slope: 0.49 %
 Full Flow: 17.28 cfs
 Maximum Flow: 18.58 cfs
 Total Flow: 4.68 cfs
 Peak Time: 10.94 min
 Travel Time: 0.94 min
 Initial Travel Time: 0.65 min
 Initial Flow Velocity: 4.67 fps
 Full Flow Velocity: 5.50 fps

	Invert Elev(ft)	Rim Elev (ft)	Cover (ft)	HGL (ft)	EGL (ft)	Flow Depth(in)	Velocity (ft/s)
Downstream	856.60	861.75	3.15	857.90	857.97	15.55	2.17
Upstream	857.50	861.50	2.00	858.26	858.54	9.14	4.26

Pipe from SI2 to SI3, system A

Material: HDPE
 Section Type: Circular
 Section Area: 4.91 sq.ft
 Diameter: 30.00 in
 Manning's n: 0.012
 Length: 109.59 ft
 Slope: 0.95 %
 Full Flow: 43.40 cfs
 Maximum Flow: 46.69 cfs
 Total Flow: 11.17 cfs
 Peak Time: 11.36 min
 Travel Time: 0.42 min
 Initial Travel Time: 0.25 min
 Initial Flow Velocity: 7.45 fps
 Full Flow Velocity: 8.84 fps

	Invert Elev(ft)	Rim Elev (ft)	Cover (ft)	HGL (ft)	EGL (ft)	Flow Depth(in)	Velocity (ft/s)
Downstream	855.46	862.50	4.54	857.01	857.20	18.62	3.49
Upstream	856.50	861.75	2.75	857.62	858.05	13.44	5.25

Pipe from SI3 to SI4, system A

Material: HDPE
 Section Type: Circular
 Section Area: 4.91 sq.ft
 Diameter: 30.00 in
 Manning's n: 0.012
 Length: 102.22 ft
 Slope: 0.85 %
 Full Flow: 41.10 cfs
 Maximum Flow: 44.22 cfs
 Total Flow: 10.85 cfs
 Peak Time: 11.74 min
 Travel Time: 0.38 min
 Initial Travel Time: 0.24 min
 Initial Flow Velocity: 7.13 fps
 Full Flow Velocity: 8.37 fps

	Invert Elev(ft)	Rim Elev (ft)	Cover (ft)	HGL (ft)	EGL (ft)	Flow Depth(in)	Velocity (ft/s)
Downstream	854.49	858.00	1.01	855.93	856.14	17.26	3.71
Upstream	855.36	862.50	4.64	856.46	856.88	13.24	5.20

Pipe from SI4 to SI5, system A

Material: HDPE
 Section Type: Circular
 Section Area: 7.07 sq.ft
 Diameter: 36.00 in
 Manning's n: 0.012
 Length: 300.51 ft
 Slope: 1.20 %
 Full Flow: 79.30 cfs
 Maximum Flow: 85.30 cfs
 Total Flow: 10.56 cfs
 Peak Time: 13.21 min
 Travel Time: 1.47 min
 Initial Travel Time: 0.64 min
 Initial Flow Velocity: 7.89 fps
 Full Flow Velocity: 11.22 fps

	Invert Elev(ft)	Rim Elev (ft)	Cover (ft)	HGL (ft)	EGL (ft)	Flow Depth(in)	Velocity (ft/s)
Downstream	850.79	857.50	3.71	852.98	853.04	26.30	1.91
Upstream	854.39	858.00	0.61	855.42	855.80	12.35	4.92

Pipe from SI5 to HEADWALL, system A

Material: HDPE
 Section Type: Circular
 Section Area: 7.07 sq.ft
 Diameter: 36.00 in
 Manning's n: 0.012
 Length: 30.50 ft
 Slope: 2.26 %
 Full Flow: 108.97 cfs
 Maximum Flow: 117.22 cfs
 Total Flow: 9.42 cfs
 Peak Time: 13.26 min
 Travel Time: 0.05 min
 Initial Travel Time: 0.05 min
 Initial Flow Velocity: 9.75 fps
 Full Flow Velocity: 15.42 fps

	Invert Elev(ft)	Rim Elev (ft)	Cover (ft)	HGL (ft)	EGL (ft)	Flow Depth(in)	Velocity (ft/s)
Downstream	850.00	850.00	-3.00	850.60	851.98	7.16	9.44
Upstream	850.69	857.50	3.81	851.29	852.67	7.16	9.44

Sewer Network File: C:\Users\djreh\Dropbox (RTC360)\thoroughbred engineering\projects\Dan Cummins - Paris\Civil\Storm Design\Storm djr.sew
 Ground Surface File: C:\Users\djreh\Dropbox (RTC360)\thoroughbred engineering\projects\Dan Cummins - Paris\Civil\Tin Files\FG Merged.tin
 Design Method: Peak Discharge Calculation
 Hydro Method: Rational Method
 Rainfall ID: NWS
 Return Period: 10 YEAR

Sewer Line From Upstream to Downstream

Pipe from SI to SI2, system A

Material: HDPE
 Section Type: Circular
 Section Area: 3.14 sq.ft
 Diameter: 24.00 in
 Manning's n: 0.012
 Length: 182.11 ft
 Slope: 0.49 %
 Full Flow: 17.28 cfs
 Maximum Flow: 18.58 cfs
 Total Flow: 4.33 cfs
 Peak Time: 10.97 min
 Travel Time: 0.97 min
 Initial Travel Time: 0.66 min
 Initial Flow Velocity: 4.58 fps
 Full Flow Velocity: 5.50 fps

	Invert Elev(ft)	Rim Elev (ft)	Cover (ft)	HGL (ft)	EGL (ft)	Flow Depth(in)	Velocity (ft/s)
Downstream	856.60	861.75	3.15	857.85	857.92	14.96	2.10
Upstream	857.50	861.50	2.00	858.23	858.50	8.78	4.17

Pipe from SI2 to SI3, system A

Material: HDPE
 Section Type: Circular
 Section Area: 4.91 sq.ft
 Diameter: 30.00 in
 Manning's n: 0.012
 Length: 109.59 ft
 Slope: 0.95 %
 Full Flow: 43.40 cfs
 Maximum Flow: 46.69 cfs
 Total Flow: 10.50 cfs
 Peak Time: 11.39 min
 Travel Time: 0.43 min
 Initial Travel Time: 0.25 min
 Initial Flow Velocity: 7.32 fps
 Full Flow Velocity: 8.84 fps

	Invert Elev(ft)	Rim Elev (ft)	Cover (ft)	HGL (ft)	EGL (ft)	Flow Depth(in)	Velocity (ft/s)
Downstream	855.46	862.50	4.54	856.96	857.14	17.96	3.43
Upstream	856.50	861.75	2.75	857.58	858.00	13.01	5.14

Pipe from SI3 to SI4, system A

Material: HDPE
 Section Type: Circular
 Section Area: 4.91 sq.ft
 Diameter: 30.00 in
 Manning's n: 0.012
 Length: 102.22 ft
 Slope: 0.85 %
 Full Flow: 41.10 cfs
 Maximum Flow: 44.22 cfs
 Total Flow: 10.21 cfs
 Peak Time: 11.78 min
 Travel Time: 0.39 min
 Initial Travel Time: 0.24 min
 Initial Flow Velocity: 7.00 fps
 Full Flow Velocity: 8.37 fps

	Invert Elev(ft)	Rim Elev (ft)	Cover (ft)	HGL (ft)	EGL (ft)	Flow Depth(in)	Velocity (ft/s)
Downstream	854.49	858.00	1.01	855.88	856.08	16.66	3.65
Upstream	855.36	862.50	4.64	856.43	856.83	12.82	5.10

Pipe from SI4 to SI5, system A

Material: HDPE
 Section Type: Circular
 Section Area: 7.07 sq.ft
 Diameter: 36.00 in
 Manning's n: 0.012
 Length: 300.51 ft
 Slope: 1.20 %
 Full Flow: 79.30 cfs
 Maximum Flow: 85.30 cfs
 Total Flow: 9.93 cfs
 Peak Time: 13.28 min
 Travel Time: 1.50 min
 Initial Travel Time: 0.65 min
 Initial Flow Velocity: 7.75 fps
 Full Flow Velocity: 11.22 fps

	Invert Elev(ft)	Rim Elev (ft)	Cover (ft)	HGL (ft)	EGL (ft)	Flow Depth(in)	Velocity (ft/s)
Downstream	850.79	857.50	3.71	852.91	852.96	25.39	1.86
Upstream	854.39	858.00	0.61	855.39	855.75	11.97	4.83

Pipe from SI5 to HEADWALL, system A

Material: HDPE
 Section Type: Circular
 Section Area: 7.07 sq.ft
 Diameter: 36.00 in
 Manning's n: 0.012
 Length: 30.50 ft
 Slope: 2.26 %
 Full Flow: 108.97 cfs
 Maximum Flow: 117.22 cfs
 Total Flow: 8.88 cfs
 Peak Time: 13.33 min
 Travel Time: 0.05 min
 Initial Travel Time: 0.05 min
 Initial Flow Velocity: 9.59 fps
 Full Flow Velocity: 15.42 fps

	Invert Elev(ft)	Rim Elev (ft)	Cover (ft)	HGL (ft)	EGL (ft)	Flow Depth(in)	Velocity (ft/s)
Downstream	850.00	850.00	-3.00	850.58	851.92	6.95	9.28
Upstream	850.69	857.50	3.81	851.27	852.61	6.95	9.28

Sewer Network File: C:\Users\djreh\Dropbox (RTC360)\thoroughbred engineering\projects\Dan Cummins - Paris\Civil\Storm Design\Storm djr.sew
 Ground Surface File: C:\Users\djreh\Dropbox (RTC360)\thoroughbred engineering\projects\Dan Cummins - Paris\Civil\Tin Files\FG Merged.tin
 Design Method: Peak Discharge Calculation
 Hydro Method: Rational Method
 Rainfall ID: NWS
 Return Period: 2 YEAR

Sewer Line From Upstream to Downstream

Pipe from SI to SI2, system A

Material:	HDPE						
Section Type:	Circular						
Section Area:	3.14		sq.ft				
Diameter:	24.00	in					
Manning's n:	0.012						
Length:	182.11	ft					
Slope:	0.49	%					
Full Flow:	17.28	cfs					
Maximum Flow:	18.58	cfs					
Total Flow:	3.64	cfs					
Peak Time:	11.03	min					
Travel Time:	1.03	min					
Initial Travel Time:	0.70	min					
Initial Flow Velocity:	4.35	fps					
Full Flow Velocity:	5.50	fps					

	Invert Elev(ft)	Rim Elev (ft)	Cover (ft)	HGL (ft)	EGL (ft)	Flow Depth(in)	Velocity (ft/s)
Downstream	856.60	861.75	3.15	857.75	857.81	13.76	1.95
Upstream	857.50	861.50	2.00	858.17	858.41	8.02	3.96

Pipe from SI2 to SI3, system A

Material:	HDPE						
Section Type:	Circular						
Section Area:	4.91		sq.ft				
Diameter:	30.00	in					
Manning's n:	0.012						
Length:	109.59	ft					
Slope:	0.95	%					
Full Flow:	43.40	cfs					
Maximum Flow:	46.69	cfs					
Total Flow:	9.20	cfs					
Peak Time:	11.47	min					
Travel Time:	0.44	min					
Initial Travel Time:	0.26	min					
Initial Flow Velocity:	7.05	fps					
Full Flow Velocity:	8.84	fps					

	Invert Elev(ft)	Rim Elev (ft)	Cover (ft)	HGL (ft)	EGL (ft)	Flow Depth(in)	Velocity (ft/s)
Downstream	855.46	862.50	4.54	856.85	857.01	16.62	3.30
Upstream	856.50	861.75	2.75	857.51	857.89	12.15	4.94

Pipe from SI3 to SI4, system A

Material:	HDPE						
Section Type:	Circular						
Section Area:	4.91		sq.ft				
Diameter:	30.00	in					
Manning's n:	0.012						
Length:	102.22	ft					
Slope:	0.85	%					
Full Flow:	41.10	cfs					
Maximum Flow:	44.22	cfs					
Total Flow:	8.96	cfs					
Peak Time:	11.88	min					
Travel Time:	0.40	min					
Initial Travel Time:	0.25	min					
Initial Flow Velocity:	6.75	fps					
Full Flow Velocity:	8.37	fps					

	Invert Elev(ft)	Rim Elev (ft)	Cover (ft)	HGL (ft)	EGL (ft)	Flow Depth(in)	Velocity (ft/s)
Downstream	854.49	858.00	1.01	855.78	855.97	15.46	3.51
Upstream	855.36	862.50	4.64	856.36	856.73	11.97	4.90

Pipe from SI4 to SI5, system A

Material:	HDPE						
Section Type:	Circular						
Section Area:	7.07		sq.ft				
Diameter:	36.00	in					
Manning's n:	0.012						
Length:	300.51	ft					
Slope:	1.20	%					
Full Flow:	79.30	cfs					
Maximum Flow:	85.30	cfs					
Total Flow:	8.73	cfs					
Peak Time:	13.43	min					
Travel Time:	1.55	min					
Initial Travel Time:	0.67	min					
Initial Flow Velocity:	7.47	fps					
Full Flow Velocity:	11.22	fps					

	Invert Elev(ft)	Rim Elev (ft)	Cover (ft)	HGL (ft)	EGL (ft)	Flow Depth(in)	Velocity (ft/s)
Downstream	850.79	857.50	3.71	852.75	852.80	23.52	1.78
Upstream	854.39	858.00	0.61	855.32	855.66	11.19	4.66

Pipe from SI5 to HEADWALL, system A

Material:	HDPE						
Section Type:	Circular						
Section Area:	7.07		sq.ft				
Diameter:	36.00	in					
Manning's n:	0.012						
Length:	30.50	ft					
Slope:	2.26	%					
Full Flow:	108.97	cfs					
Maximum Flow:	117.22	cfs					
Total Flow:	7.86	cfs					
Peak Time:	13.49	min					
Travel Time:	0.06	min					
Initial Travel Time:	0.06	min					
Initial Flow Velocity:	9.23	fps					
Full Flow Velocity:	15.42	fps					

	Invert Elev(ft)	Rim Elev (ft)	Cover (ft)	HGL (ft)	EGL (ft)	Flow Depth(in)	Velocity (ft/s)
Downstream	850.00	850.00	-3.00	850.55	851.79	6.55	8.95
Upstream	850.69	857.50	3.81	851.24	852.48	6.55	8.95