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STORMWATER CALCULATIONS

**COBBLESTONE VILLAGE
SOUTH MAIN STREET
ROLESVILLE, NORTH CAROLINA
SP 21-01 COBBLESTONE VILLAGE**



**PREPARED BY
BASS, NIXON & KENNEDY, INC.
FEBRUARY 2021
MAY 2021
REVISED MAY 2022**

*Cobblestone Village
May 2021*



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Cobblestone Village
Rolesville, North Carolina
Stormwater Control Calculations
February, 2021

The site for the Cobblestone Village project is located on the west side of Main Street (US 401) at the intersection of East Young Street (SR 1945) in Rolesville, North Carolina. The current property consists of 10 individual properties that will be recombined into one lot. The new lot will be 10.96 acres to be used for Residential, Mixed Use development. The existing properties have some old buildings with gravel drives. The property is mostly undeveloped. The site drains to the northwest and eventually to Sanford Creek, then the Neuse River.

Stormwater management is required for this site. An SCM is designed for the Cobblestone Village project. The total drainage area to the SCM is 9.33 ac with 1.63 acres bypassing the SCM. Note the SCM (Wet Pond) will be located on the west side of the property.

There is one point of interest (POI) used for the pre-development hydrologic analysis of the site. POI # 1 is the exit point at the west side of the site. Most of the site drains in that direction. For the post-development hydrologic analysis POI #1 is the portion of the site that discharges to the west side of the site. This area is routed through the SCM. We have a Post Development Detained that is a portion of the site routed through the SCM at the west side of the site. Post Development Not Detained is a portion of the site that is not captured in the SCM and this drainage drains to the west side of the site and is not captured in the SCM.

The wet pond outlet control structure is designed to control the peak stormwater run-off for the 1-year 24-hour storm to be less than the pre-existing conditions. The SCM will meet the 85% total suspended solids (TSS) requirement.

Stormwater routing was evaluated using a 10-year storm for pipe capacity sizing.

DETENTION CALCULATIONS

**STORMWATER RUNOFF SUMMARY
PRE VS. POST DESIGN PARAMETERS
SCM 1 CALCULATIONS
1, 10, AND 100 – YEAR ROUTING CALCULATIONS**

Water Quality Retention Calculations

Project Name: **Cobblestone Village**

Determine Surface Area Required for Permanent Pool:

Drainage Area: 9.33 ac
Impervious Area: 7.01 ac
Percent Impervious: 75.1%
Permanent Pool Elevation: 424.50 (¹/₂ way up vegetated shelf)
Volume: 28431.50 cf
Surface Area: 12926.00 sf
Hydraulic Depth: 3.34 ft (Option 2 Calculation BMP Manual)
SA/DA Required: 2.95%
SA/DA Provided: 3.18% **OK**

Forebay Volume Check:

Forebay Volume at Crest of Berm: 5459.50 cf
Permanent Pool Volume: 28431.50 cf
Forebay Volume % of Perm. Volume: 19.20% **OK - Approximately 20% of total perm. volume**

Calculate the Volume Required to Treat the First Flush:

Rainfall to Treat: 1 in
Runoff Coefficient (R_v) = $0.05 + 0.009 * (\% \text{ Impervious})$
Runoff Coefficient (R_v): 0.73 in/in
Runoff Volume (V) = Rainfall * (R_v) * (Drainage Area)
Runoff Volume (V): 24,588 cf

Calculate the Depth Required for the Temporary Pool:

Temporary Pool Volume (Required): 24,588 cf
Total Volume (Perm. + Temp.): 53,019 cf
Temporary Pool Elevation between: 426.00 and 427.00
Temporary Pool Elevation: 426.15
Temporary Pool Depth: 1.65 measured from Permanent Pool Elevation

Determine the Orifice Size for 2-5 Day Drawdown of Temporary Pool:

Orifice Invert Elevation: 424.50
Temporary Pool Elevation: 426.15
Orifice Diameter: 2.50 in

Use the orifice equation to determine flow and drawdown time:

Orifice Equation: $Q = CA(2gh)^{0.5}$
Volume to Draw Down: 24,588 cf
Flow for 2-Day Drawdown: 0.14 cfs
Flow for 5-Day Drawdown: 0.06 cfs
C: 0.60
g: 32.20 ft/s²
A: 0.03 sf
Number of Increments for Orifice Flow: 10 Increments
Depth of Temp. Pool from Top of Orifice: 1.44 ft

Incremental Orifice Flow Drawdown Calculations

For Temp Pool above top of orifice (Equations III-13, Malcom):

Index:	Avg Driving Head (ft)	Q (from Orifice Eq)	Drawdown Time (s)	Drawdown Time (Days)
0	1.4019	0.1943	11,054.75	0.1279
1	1.2577	0.1841	11,671.26	0.1351
2	1.1135	0.1732	12,403.93	0.1436
3	0.9693	0.1616	13,294.54	0.1539
4	0.8251	0.1491	14,409.42	0.1668
5	0.6809	0.1354	15,861.86	0.1836
6	0.5368	0.1203	17,865.86	0.2068
7	0.3926	0.1028	20,891.01	0.2418
8	0.2484	0.0818	26,264.45	0.3040
9	0.1042	0.0530	40,555.12	0.4694
Total				2.1328

For Temp Pool below top of orifice (Equations III-13, Malcom):

Index:	Avg Driving Head (ft)	Q (Malcom III-13)	Drawdown Time (s)	Drawdown Time (Days)
0	0.2083	0.0531	29249.56	0.3385
1	0.1042	0.0188	82730.25	0.9575
Total				1.2961

Drawdown Time:**3.43 days (OK - Drawdown is between 2 and 5 days)**

Stormwater Attenuation Requirements Using Rational Methodology

The following calculations summarize the pre-development and post development discharge calculations for the 1-year and 100-year 24-hr storm events using the Rational Method. The Q1 and Q100 pre-developed discharge was calculated based on the actual site pre-developed conditions. Hydraflow computer software was used for performing the analysis. Calculations were done in accordance to the Town of Knightdale standards and specifications. All hydrographs and supporting calculations are provided in the Detention Calculations section of this report. Supporting drainage area maps and rainfall data are provided in the Appendix. The following summarizes the findings of the analysis:

Description	Rational Method Storm Event (cfs)			
	Q1			Q100
Pre-Development Discharge	20.69			43.65
Post-Development Discharge	37.34			78.78
Attenuation Required	16.65			N/A
Discharge into SCM	34.37			72.50
Discharge out of SCM	0.14			0.20
Combined Discharge (including bypass)	3.77			7.90
Attenuation Provided	33.57			70.88
<p>The proposed attenuation provided by the Wet Pond provides enough stormwater attenuation so that the Q1 and Q100 post-developed discharge does not exceed the pre-development discharge.</p>				

Pre/Post Design Parameters										
POI #1	Drainage Area	Land Use Areas (ac)				Design Storm Flows (cfs)				
	ac	Impervious	Managed Pervious	Wooded Area	Off-Site 70% Imp	1"	Q1		Q100	
PR to SCM	9.33	7.01	2.32	0.00	0.00	---	33.94		71.59	
PR to Bypass SCM	1.63	0.47	1.16	0.00	0.00	---	3.68		7.76	
SCM Outfall	0.00	---	---	---	---	---	0.14		0.20	
PR Final	10.96	7.48	3.48	0.00	0.00	---	3.77		7.90	
EX	10.96	1.83	9.13	0.00	0.00	---	20.69		43.65	
Surface Area at SCM		Design Storm Surface Elevations (ft)					426.15	425.29		426.09
12,926		Freeboard (ft)					1.35	2.21		1.41

Average Depth Calculation

Project Name: Cobblestone Village

Permanent Pool Elevation:	424.50 (¹ / ₂ way up vegetated shelf)
Surface Area at Perm. Pool:	12926.00 sf
Elevation of Bottom of Shelf:	424.00
Surface Area at Bottom Shelf:	8026.00
Area at Bottom of Pond:	3739.00
Depth (from bottom of shelf to pond bottom):	4.00
Hydraulic Depth:	3.34 ft (Option 2 Calculation BMP Manual)

Hydraflow Table of Contents

02.05.21 Cobblestone Village.gpw

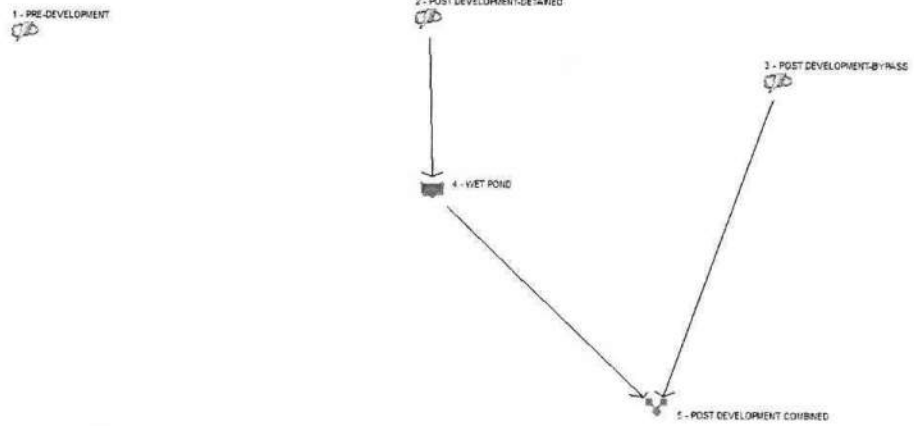
Hydraflow Hydrographs by Intelisolve v9.01

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Watershed Model Schematic

Hydraflow Hydrographs by Intelisolve v9.01



Legend

Hyd. Origin	Description
1	Rational PRE-DEVELOPMENT
2	Rational POST DEVELOPMENT-DETAINED
3	Rational POST DEVELOPMENT-BYPASS
4	Reservoir WET POND
5	Combine POST DEVELOPMENT COMBINED

Hydrograph Return Period Recap

Hydraflow Hydrographs by Intelisolve v9.01

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description	
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr		
1	Rational	-----	20.69	-----	-----	-----	-----	-----	-----	-----	43.65	PRE-DEVELOPMENT
2	Rational	-----	34.37	-----	-----	-----	-----	-----	-----	-----	72.50	POST DEVELOPMENT-DETAINED
3	Rational	-----	3.677	-----	-----	-----	-----	-----	-----	-----	7.758	POST DEVELOPMENT-BYPASS
4	Reservoir	2	0.137	-----	-----	-----	-----	-----	-----	-----	0.201	WET POND
5	Combine	3, 4	3.768	-----	-----	-----	-----	-----	-----	-----	7.899	POST DEVELOPMENT COMBINE

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.01

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	Rational	20.69	1	5	6,207	---	-----	-----	PRE-DEVELOPMENT
2	Rational	34.37	1	5	10,310	---	-----	-----	POST DEVELOPMENT-DETAINED
3	Rational	3.677	1	5	1,103	---	-----	-----	POST DEVELOPMENT-BYPASS
4	Reservoir	0.137	1	10	9,280	2	425.30	10,266	WET POND
5	Combine	3.768	1	5	10,383	3, 4	-----	-----	POST DEVELOPMENT COMBINE
02.05.21 Cobblestone Village.gpw					Return Period: 1 Year			Friday, Feb 5, 2021	

Hydrograph Report

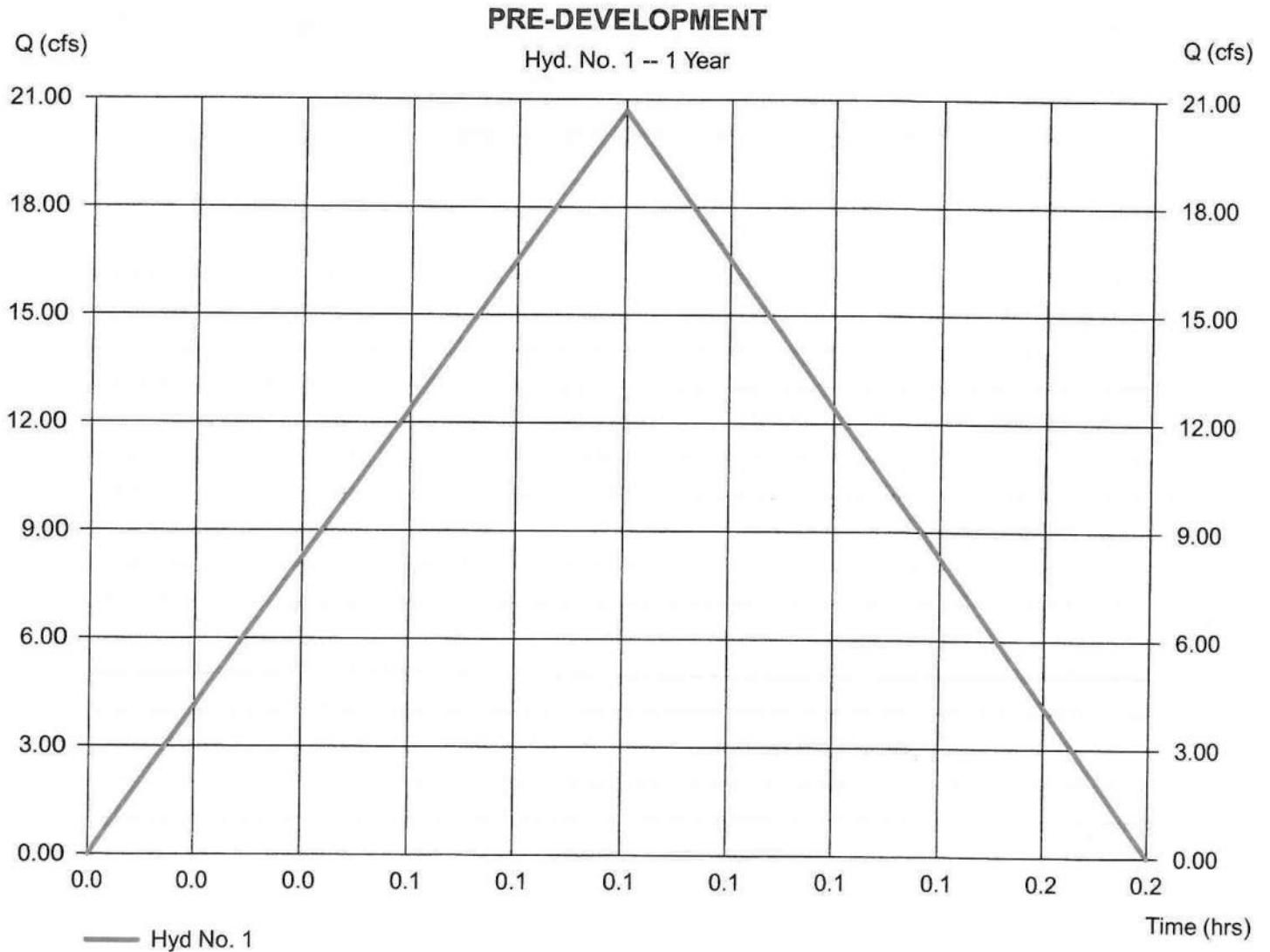
Hyd. No. 1

PRE-DEVELOPMENT

Hydrograph type = Rational
Storm frequency = 1 yrs
Time interval = 1 min
Drainage area = 10.960 ac
Intensity = 4.604 in/hr
IDF Curve = WakeCounty.IDF

Peak discharge = 20.69 cfs
Time to peak = 0.08 hrs
Hyd. volume = 6,207 cuft
Runoff coeff. = 0.41*
Tc by User = 5.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = [(1.830 x 0.95) + (9.130 x 0.30)] / 10.960



Hydrograph Report

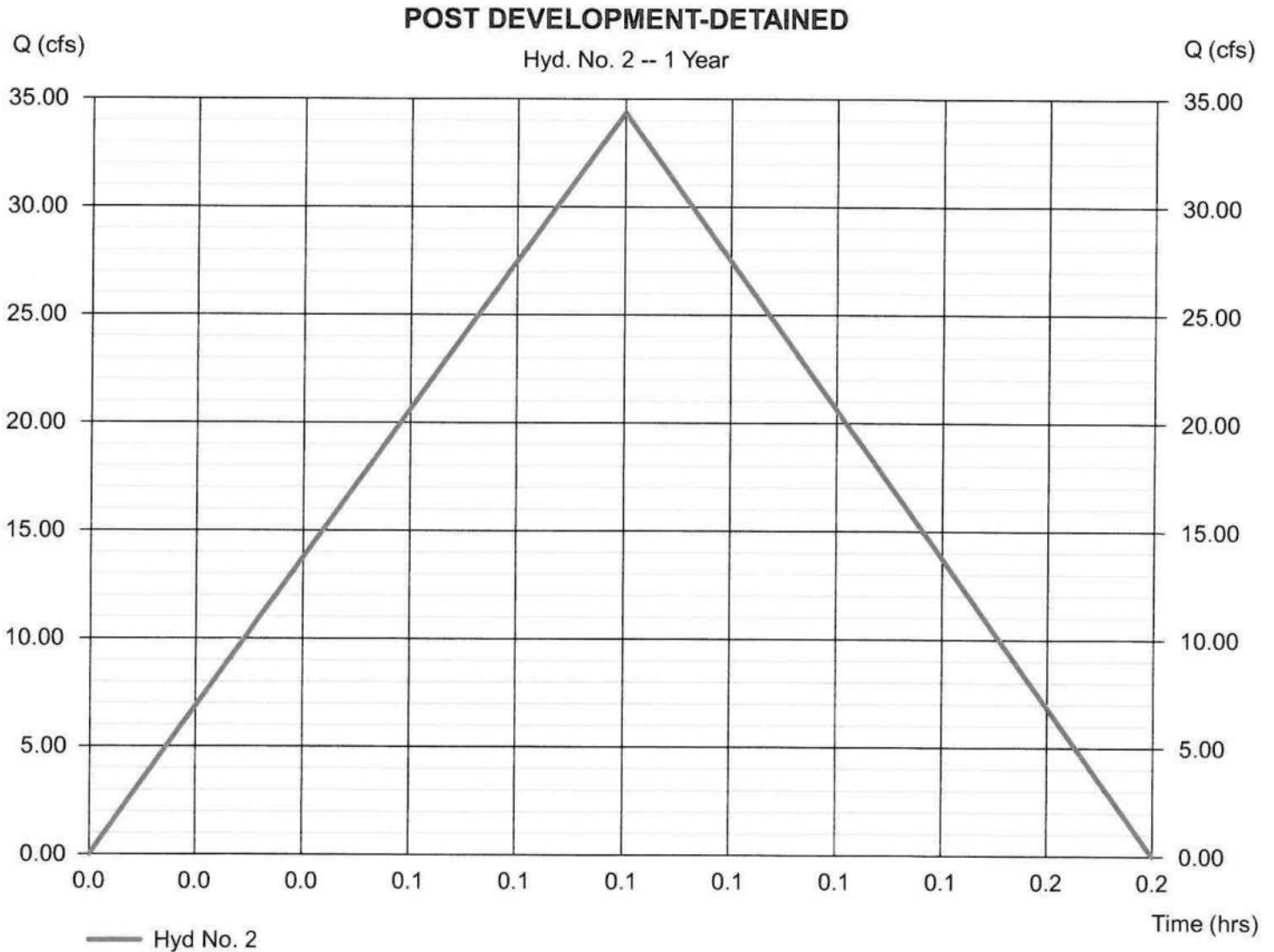
Hyd. No. 2

POST DEVELOPMENT-DETAINED

Hydrograph type = Rational
Storm frequency = 1 yrs
Time interval = 1 min
Drainage area = 9.330 ac
Intensity = 4.604 in/hr
IDF Curve = WakeCounty.IDF

Peak discharge = 34.37 cfs
Time to peak = 0.08 hrs
Hyd. volume = 10,310 cuft
Runoff coeff. = 0.8*
Tc by User = 5.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = [(2.320 x 0.30) + (7.010 x 0.95)] / 9.330



Hydrograph Report

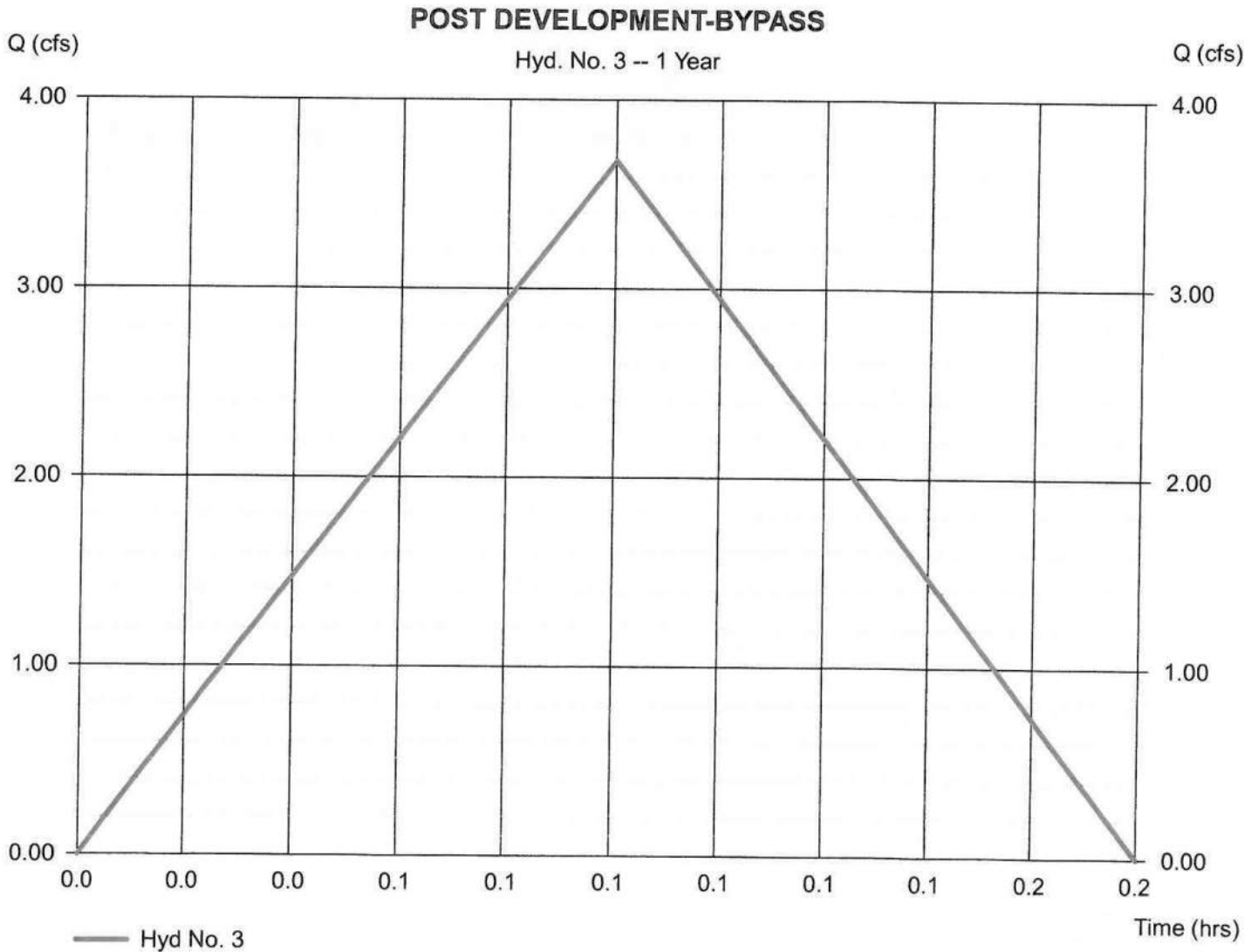
Hyd. No. 3

POST DEVELOPMENT-BYPASS

Hydrograph type = Rational
Storm frequency = 1 yrs
Time interval = 1 min
Drainage area = 1.630 ac
Intensity = 4.604 in/hr
IDF Curve = WakeCounty.IDF

Peak discharge = 3.677 cfs
Time to peak = 0.08 hrs
Hyd. volume = 1,103 cuft
Runoff coeff. = 0.49*
Tc by User = 5.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = $[(1.160 \times 0.30) + (0.470 \times 0.95)] / 1.630$



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.01

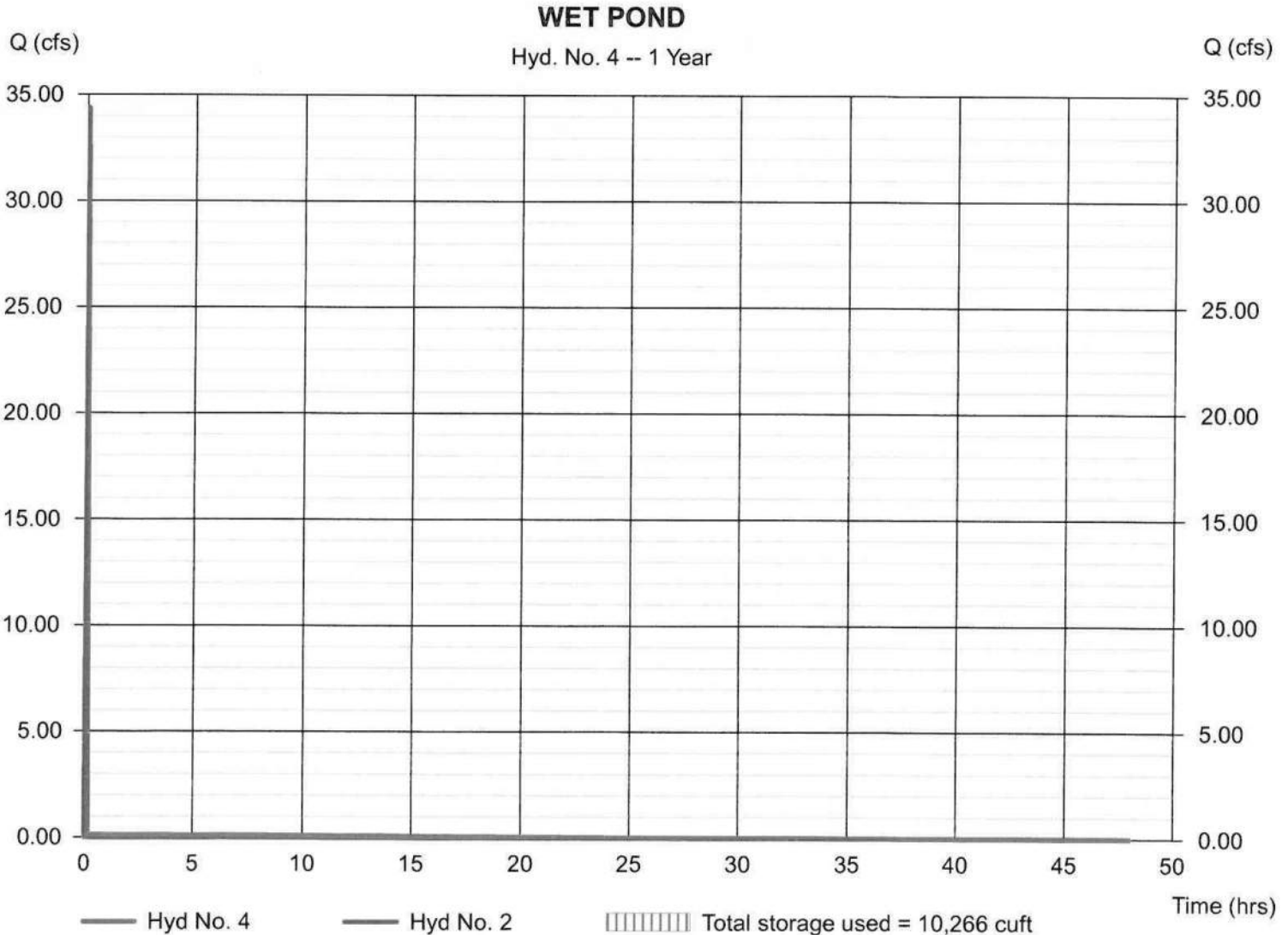
Friday, Feb 5, 2021

Hyd. No. 4

WET POND

Hydrograph type	= Reservoir	Peak discharge	= 0.137 cfs
Storm frequency	= 1 yrs	Time to peak	= 0.17 hrs
Time interval	= 1 min	Hyd. volume	= 9,280 cuft
Inflow hyd. No.	= 2 - POST DEVELOPMENT-DETAINED	Max. Elevation	= 425.30 ft
Reservoir name	= WET POND	Max. Storage	= 10,266 cuft

Storage Indication method used.



Pond Report

Hydraflow Hydrographs by Intelisolve v9.01

Friday, Feb 5, 2021

Pond No. 1 - WET POND

Pond Data

Trapezoid - Bottom L x W = 200.0 x 61.0 ft, Side slope = 3.0:1, Bottom elev. = 424.50 ft, Depth = 3.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	424.50	12,200	0	0
0.30	424.80	12,673	3,731	3,731
0.60	425.10	13,153	3,874	7,604
0.90	425.40	13,639	4,019	11,623
1.20	425.70	14,131	4,165	15,788
1.50	426.00	14,630	4,314	20,102
1.80	426.30	15,135	4,465	24,567
2.10	426.60	15,647	4,617	29,184
2.40	426.90	16,166	4,772	33,956
2.70	427.20	16,691	4,928	38,884
3.00	427.50	17,222	5,087	43,971

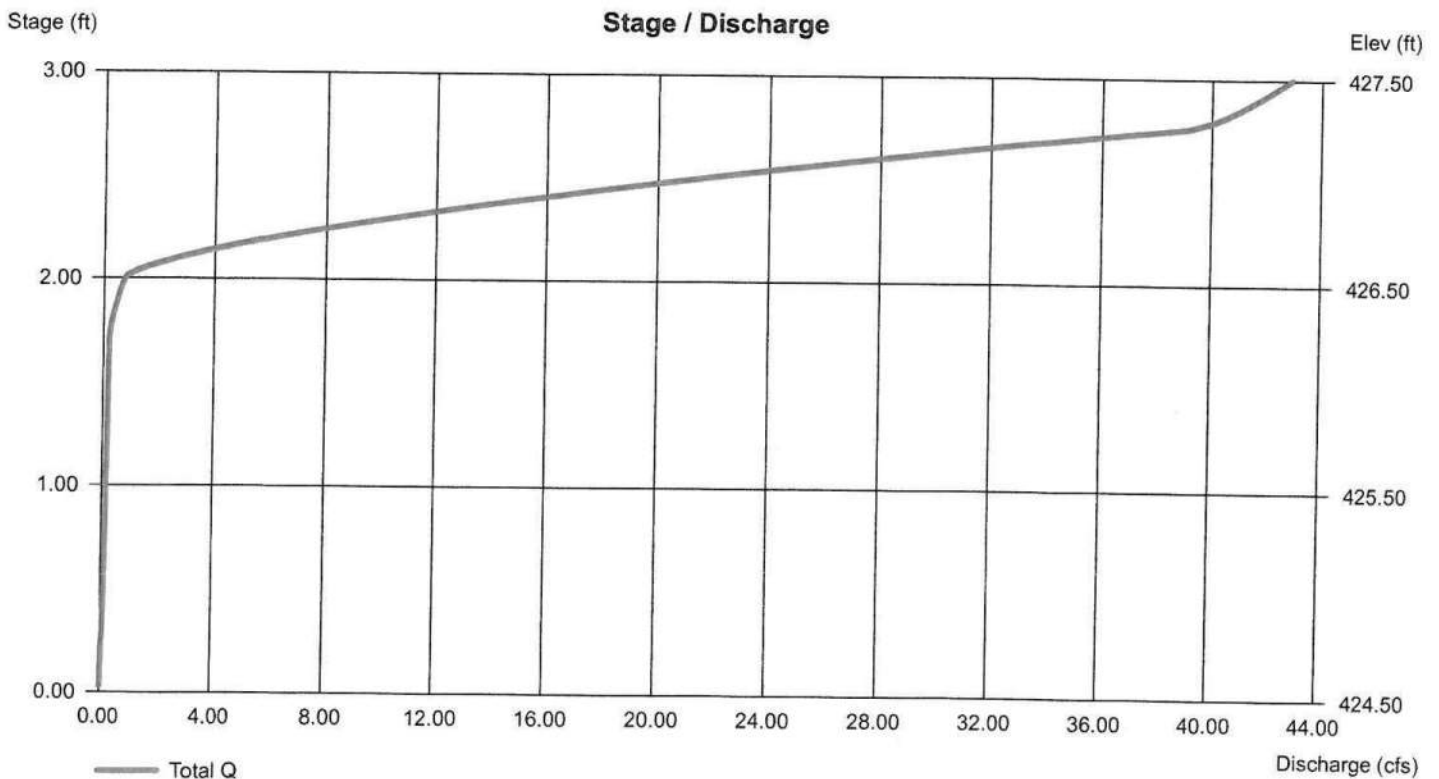
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	2.50	0.00	0.00
Span (in)	= 24.00	2.50	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 420.00	424.50	0.00	0.00
Length (ft)	= 1.00	2.00	0.00	0.00
Slope (%)	= 1.00	1.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 16.00	1.00	0.00	0.00
Crest El. (ft)	= 426.50	426.20	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Riser	Rect	---	---
Multi-Stage	= Yes	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet and outlet control. Weir risers are checked for orifice conditions.



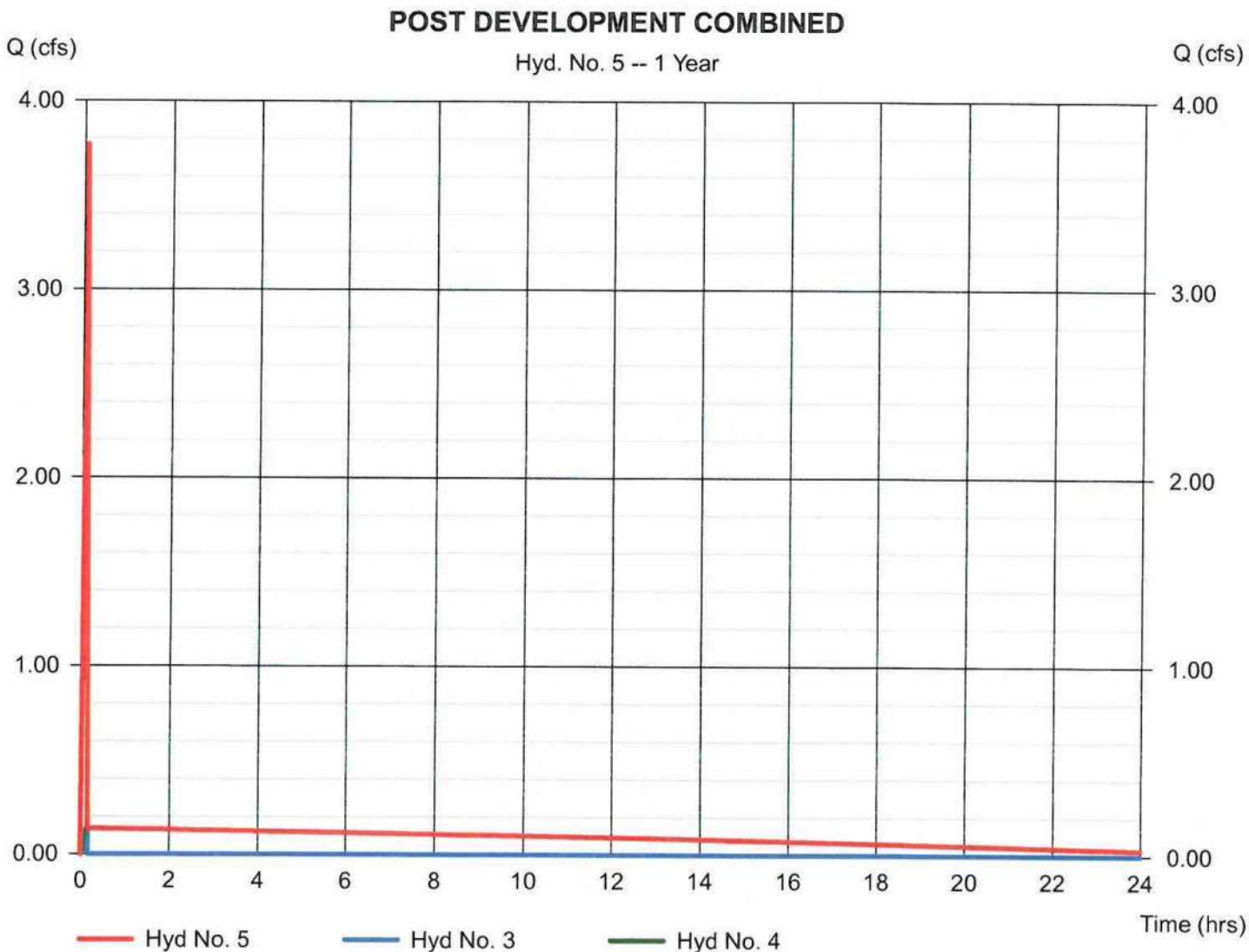
Hydrograph Report

Hyd. No. 5

POST DEVELOPMENT COMBINED

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 1 min
Inflow hyds. = 3, 4

Peak discharge = 3.768 cfs
Time to peak = 0.08 hrs
Hyd. volume = 10,383 cuft
Contrib. drain. area = 1.630 ac



Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.01

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description	
1	Rational	43.65	1	5	13,094	----	-----	-----	PRE-DEVELOPMENT	
2	Rational	72.50	1	5	21,749	----	-----	-----	POST DEVELOPMENT-DETAINED	
3	Rational	7.758	1	5	2,327	----	-----	-----	POST DEVELOPMENT-BYPASS	
4	Reservoir	0.201	1	10	19,606	2	426.11	21,678	WET POND	
5	Combine	7.899	1	5	21,933	3, 4	-----	-----	POST DEVELOPMENT COMBINE	
02.05.21 Cobblestone Village.gpw					Return Period: 100 Year			Friday, Feb 5, 2021		

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.01

Friday, Feb 5, 2021

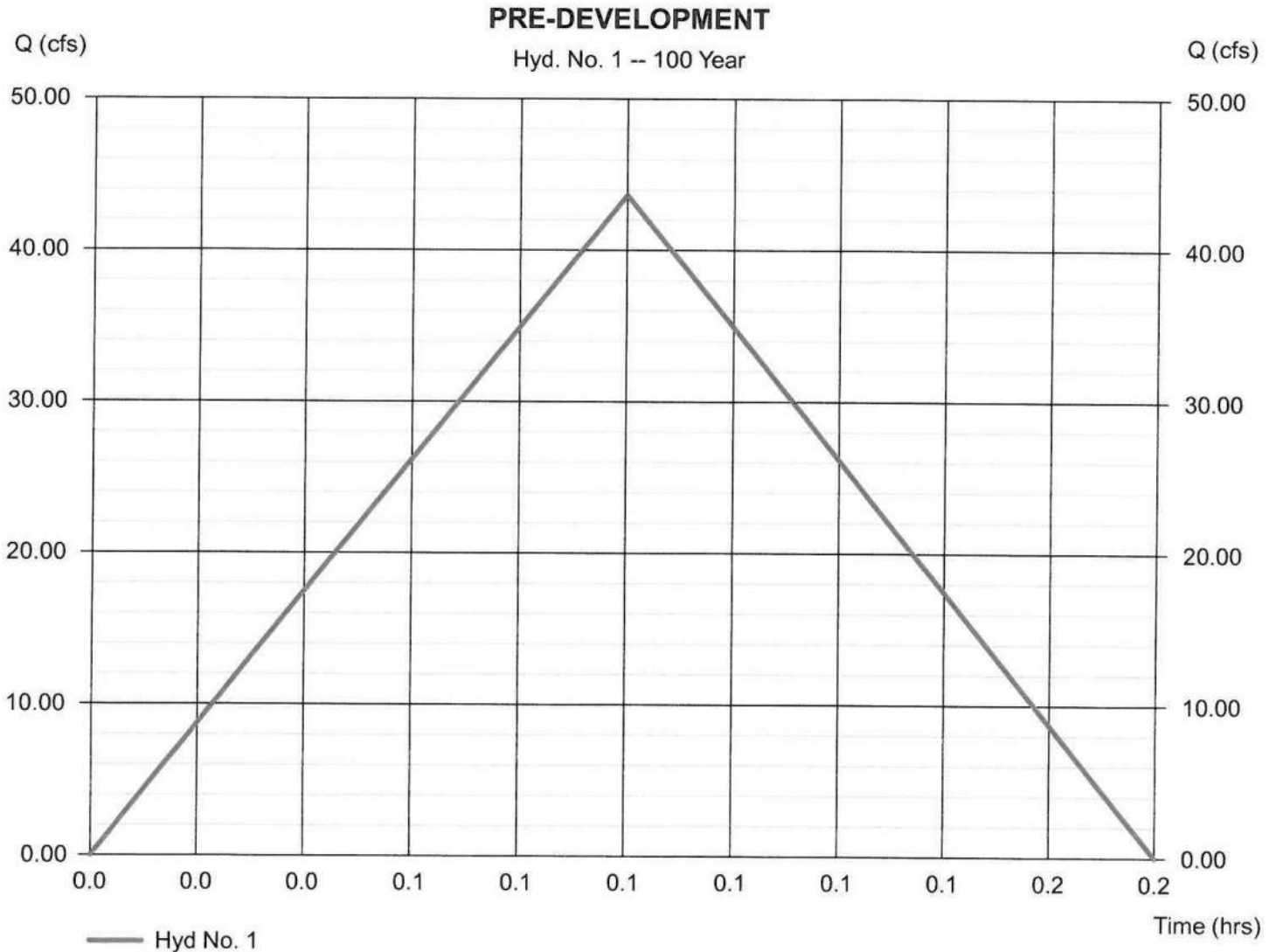
Hyd. No. 1

PRE-DEVELOPMENT

Hydrograph type = Rational
Storm frequency = 100 yrs
Time interval = 1 min
Drainage area = 10.960 ac
Intensity = 9.713 in/hr
IDF Curve = WakeCounty.IDF

Peak discharge = 43.65 cfs
Time to peak = 0.08 hrs
Hyd. volume = 13,094 cuft
Runoff coeff. = 0.41*
Tc by User = 5.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = [(1.830 x 0.95) + (9.130 x 0.30)] / 10.960



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.01

Friday, Feb 5, 2021

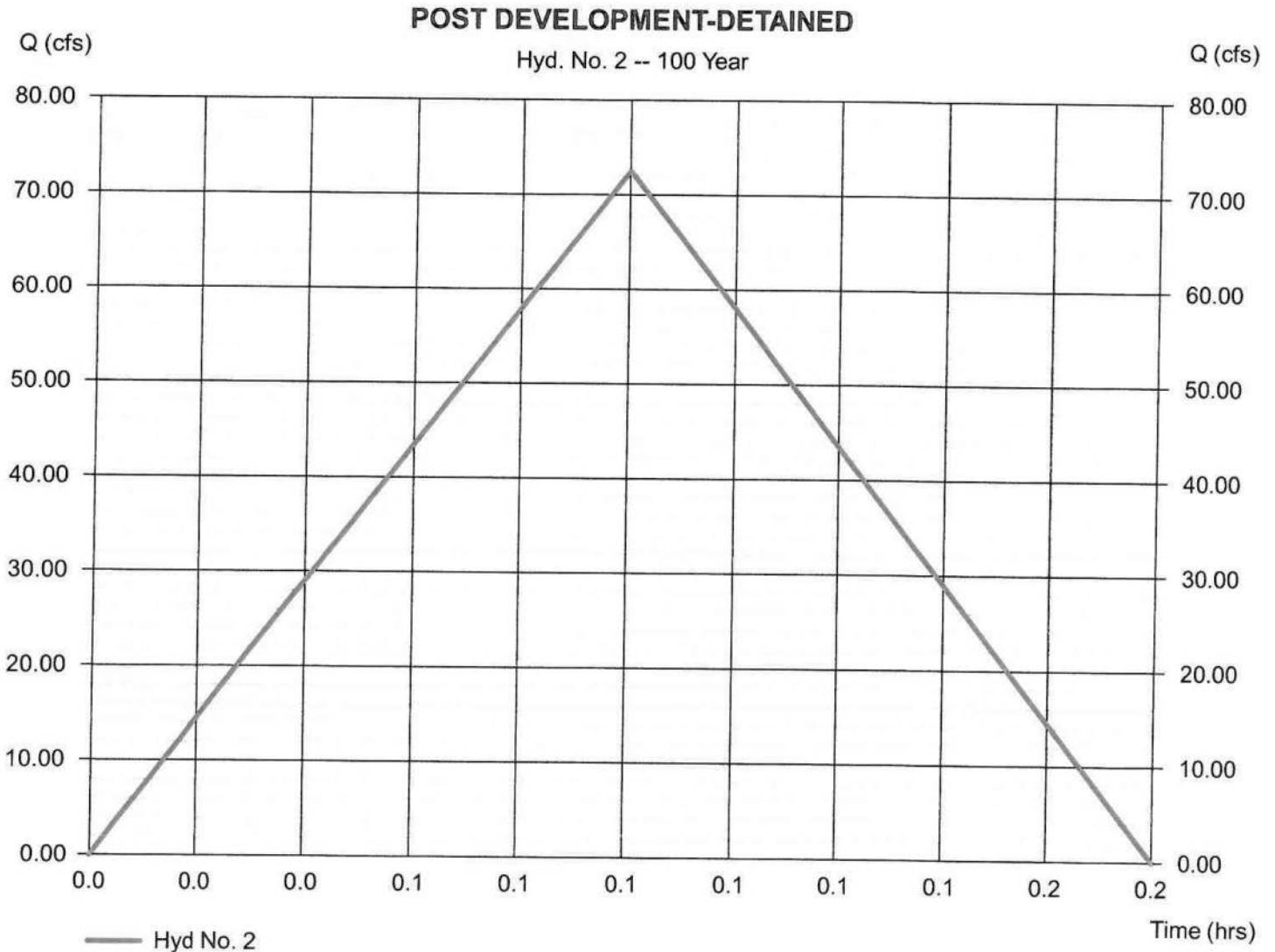
Hyd. No. 2

POST DEVELOPMENT-DETAINED

Hydrograph type = Rational
Storm frequency = 100 yrs
Time interval = 1 min
Drainage area = 9.330 ac
Intensity = 9.713 in/hr
IDF Curve = WakeCounty.IDF

Peak discharge = 72.50 cfs
Time to peak = 0.08 hrs
Hyd. volume = 21,749 cuft
Runoff coeff. = 0.8*
Tc by User = 5.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = [(2.320 x 0.30) + (7.010 x 0.95)] / 9.330



Hydrograph Report

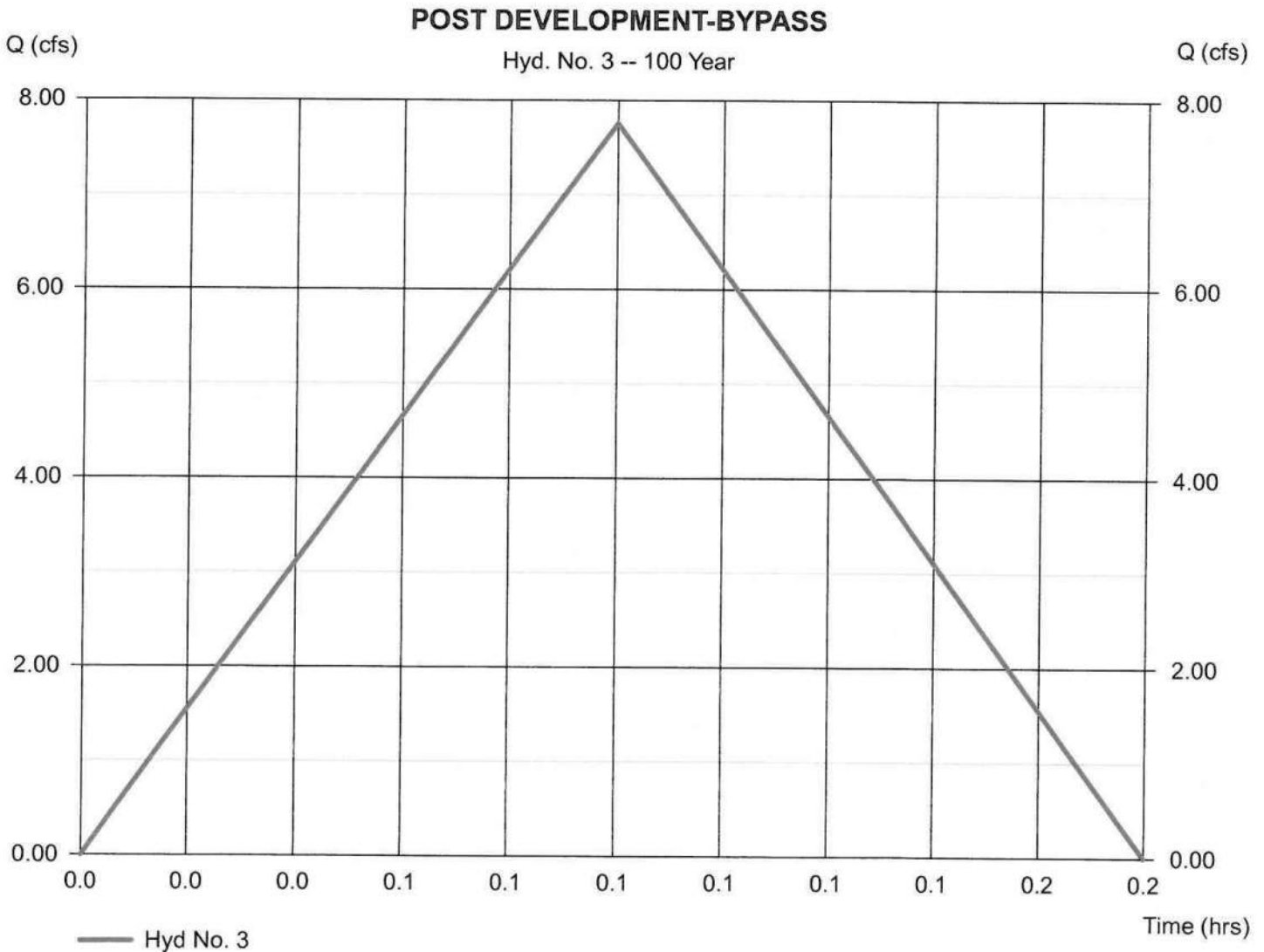
Hyd. No. 3

POST DEVELOPMENT-BYPASS

Hydrograph type = Rational
Storm frequency = 100 yrs
Time interval = 1 min
Drainage area = 1.630 ac
Intensity = 9.713 in/hr
IDF Curve = WakeCounty.IDF

Peak discharge = 7.758 cfs
Time to peak = 0.08 hrs
Hyd. volume = 2,327 cuft
Runoff coeff. = 0.49*
Tc by User = 5.00 min
Asc/Rec limb fact = 1/1

* Composite (Area/C) = [(1.160 x 0.30) + (0.470 x 0.95)] / 1.630



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.01

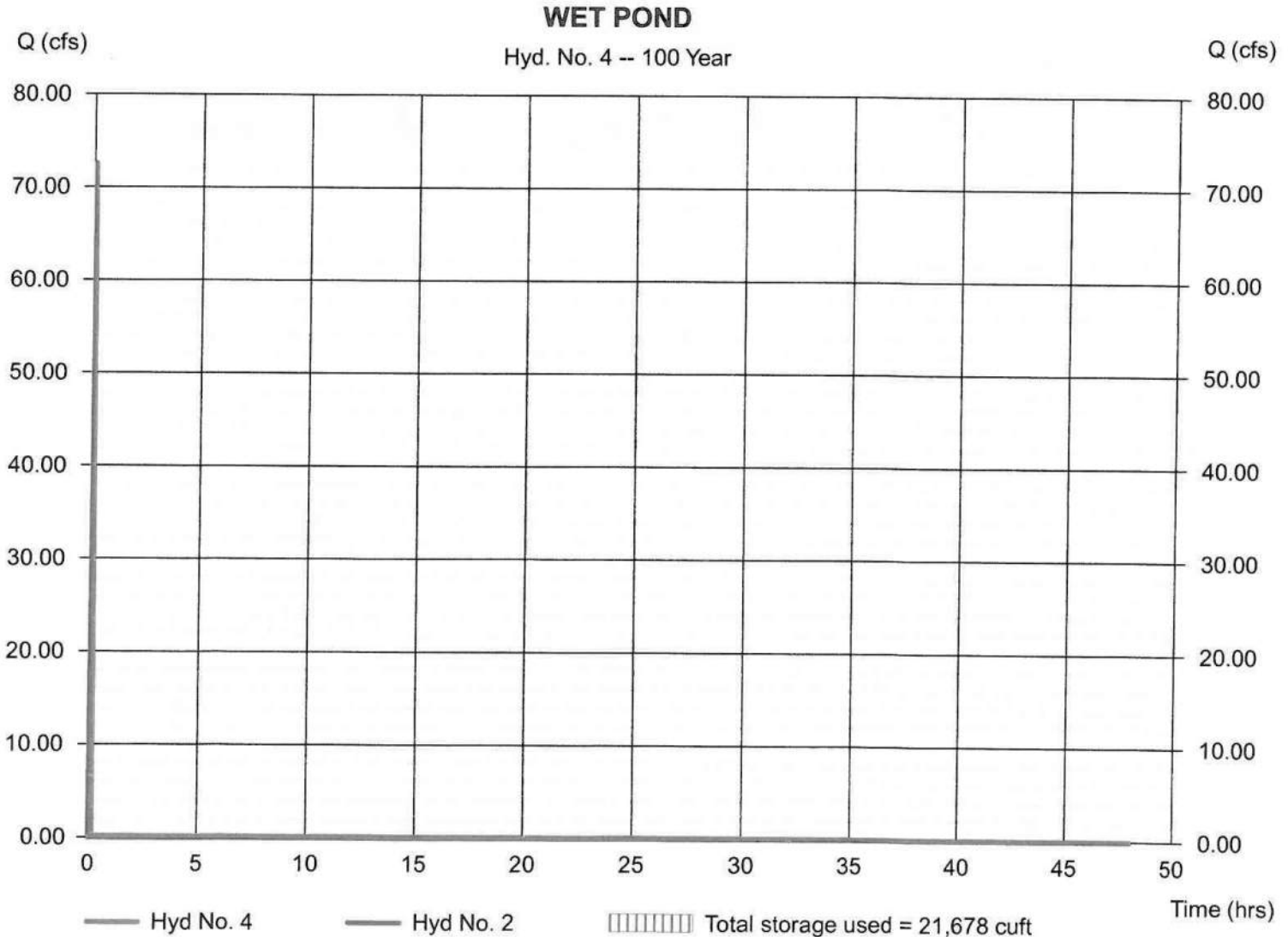
Friday, Feb 5, 2021

Hyd. No. 4

WET POND

Hydrograph type	= Reservoir	Peak discharge	= 0.201 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.17 hrs
Time interval	= 1 min	Hyd. volume	= 19,606 cuft
Inflow hyd. No.	= 2 - POST DEVELOPMENT-DETAINED	Max. Elevation	= 426.11 ft
Reservoir name	= WET POND	Max. Storage	= 21,678 cuft

Storage Indication method used.



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.01

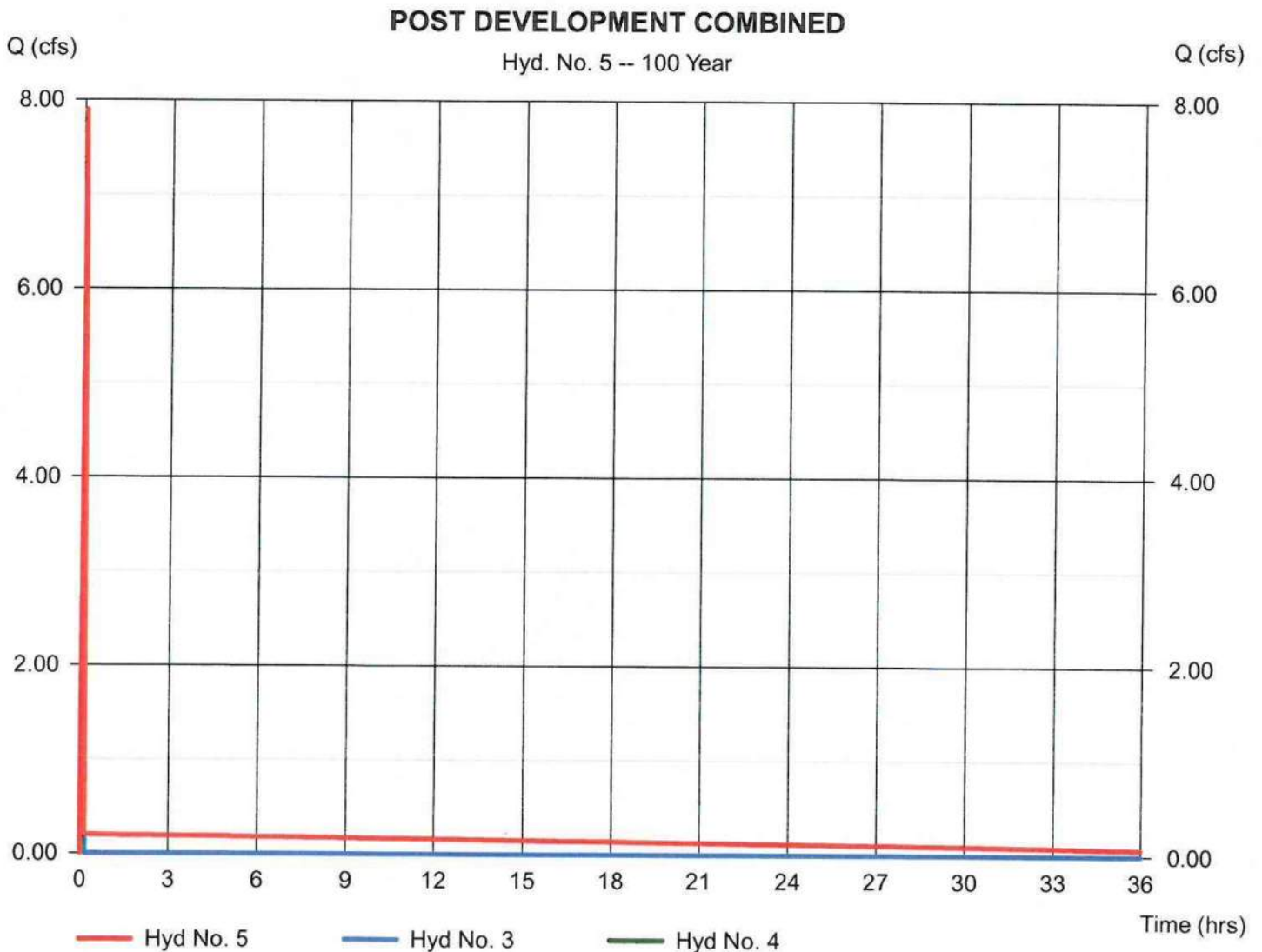
Friday, Feb 5, 2021

Hyd. No. 5

POST DEVELOPMENT COMBINED

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 1 min
Inflow hyds. = 3, 4

Peak discharge = 7.899 cfs
Time to peak = 0.08 hrs
Hyd. volume = 21,933 cuft
Contrib. drain. area= 1.630 ac

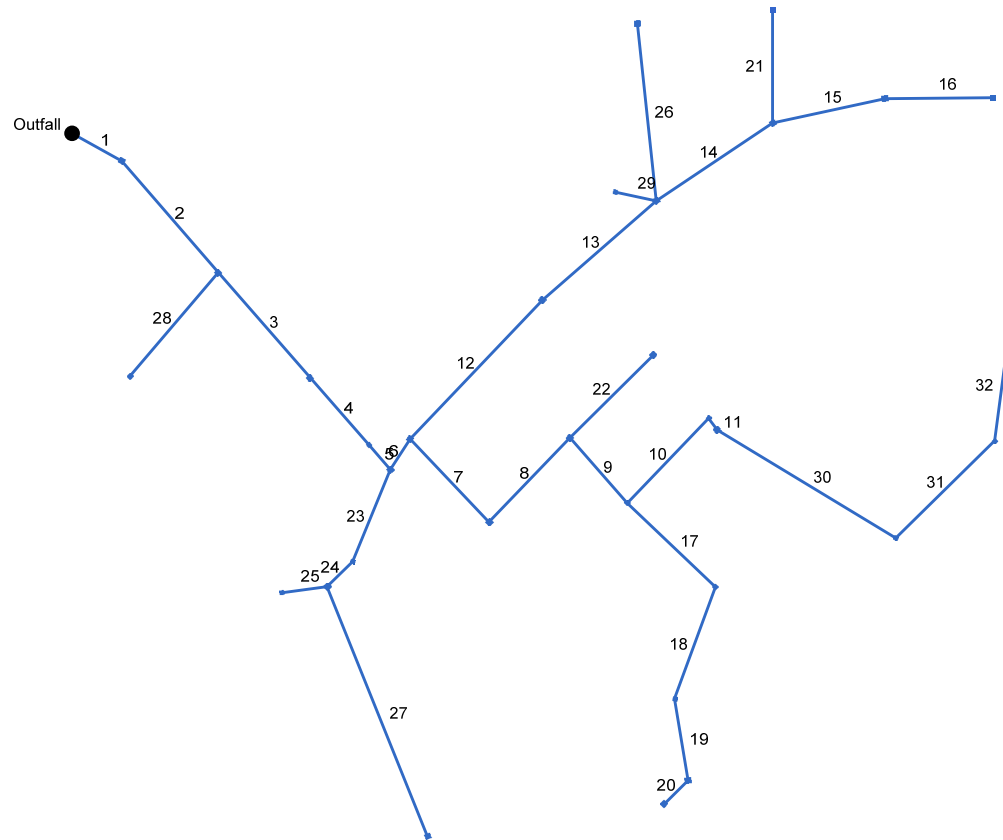


STORMWATER RUNOFF

**10-YEAR PIPE SIZING
10-YEAR HYDRAULIC GRADE LINES**

*Cobblestone Village
May 2021*

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Line No.	Inlet ID	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Inlet Time (min)	i Inlet (in/hr)	Incr Q (cfs)	Q Capt (cfs)	Q Byp (cfs)	Q Carry (cfs)	Total Area (ac)	Total Runoff (cfs)	Capac Full (cfs)	Flow Rate (cfs)	Vel Ave (ft/s)	Line Size (in)
1	INLET 4	0.04	0.86	0.03	5.0	7.19	0.25	0.25	0.00	0.00	9.83	44.93	51.32	44.93	8.16	36
2	INLET 5	0.01	0.71	0.01	5.0	7.19	0.05	0.05	0.00	0.00	9.79	45.23	51.64	45.23	8.21	36
3	INLET 5A	0.13	0.80	0.10	5.0	7.19	0.75	0.75	0.00	0.00	9.64	45.19	51.78	45.19	8.22	36
4	INLET 5B	0.27	0.80	0.22	5.0	7.19	1.55	1.55	0.00	0.00	9.51	44.86	51.54	44.86	8.14	36
5	INLET 6	0.05	0.75	0.04	5.0	7.19	0.27	0.27	0.00	0.00	9.24	43.65	51.34	43.65	7.99	36
6	INLET 7	0.33	0.83	0.27	5.0	7.19	1.97	2.49	0.00	0.53	7.62	37.29	51.93	37.29	7.38	36
7	INLET 8	0.29	0.92	0.27	5.0	7.19	1.92	1.92	0.00	0.00	3.93	20.91	22.59	20.91	7.88	24
8	INLET 9	0.52	0.84	0.44	5.0	7.19	3.14	4.32	0.00	1.18	3.64	19.40	22.59	19.40	7.38	24
9	INLET 10	0.01	0.95	0.01	5.0	7.19	0.07	0.07	0.00	0.00	2.67	14.02	22.59	14.02	5.92	24
10	INLET 24	0.01	0.95	0.01	5.0	7.19	0.07	0.07	0.00	0.00	1.21	7.21	7.91	7.21	6.87	15
11	INLET 33	0.29	0.95	0.28	5.0	7.19	1.98	1.98	0.00	0.00	1.20	7.16	6.39	7.16	5.83	15
12	INLET 16	0.29	0.80	0.23	5.0	7.19	1.67	1.19	0.53	0.05	3.37	15.50	17.55	15.50	5.53	24
13	INLET 17	0.10	0.76	0.08	5.0	7.19	0.55	0.50	0.05	0.00	3.08	14.26	17.54	14.26	5.62	24
14	INLET 18	0.10	0.83	0.08	5.0	7.19	0.60	0.60	0.00	0.00	1.06	5.56	6.46	5.56	5.73	15
15	INLET 19	0.21	0.82	0.17	5.0	7.19	1.24	2.73	0.00	1.49	0.83	4.67	6.44	4.67	5.41	15
16	INLET 20	0.62	0.80	0.49	5.0	7.19	3.54	2.05	1.49	0.00	0.62	3.54	6.46	3.54	4.48	15
17	INLET 11	0.01	0.95	0.01	5.0	7.19	0.07	0.07	0.00	0.00	1.45	7.24	10.52	7.24	5.07	18
18	INLET 12	0.62	0.70	0.43	5.0	7.19	3.12	3.12	0.00	0.00	1.44	7.29	10.51	7.29	5.90	18
19	INLET 13	0.53	0.77	0.41	5.0	7.19	2.93	2.93	0.00	0.00	0.82	4.32	6.46	4.32	4.63	15
20	INLET 14	0.29	0.71	0.20	5.0	7.19	1.47	1.47	0.00	0.00	0.29	1.47	6.46	1.47	2.67	15
21	INLET 31	0.13	0.83	0.11	5.0	7.19	0.78	0.78	0.00	0.00	0.13	0.78	6.45	0.78	1.84	15
22	INLET 32	0.45	0.95	0.43	5.0	7.19	3.07	1.89	1.18	0.00	0.45	3.07	6.45	3.07	4.75	15
23	INLET 21	0.01	0.95	0.01	5.0	7.19	0.07	0.07	0.00	0.00	1.57	6.87	22.63	6.87	2.69	24

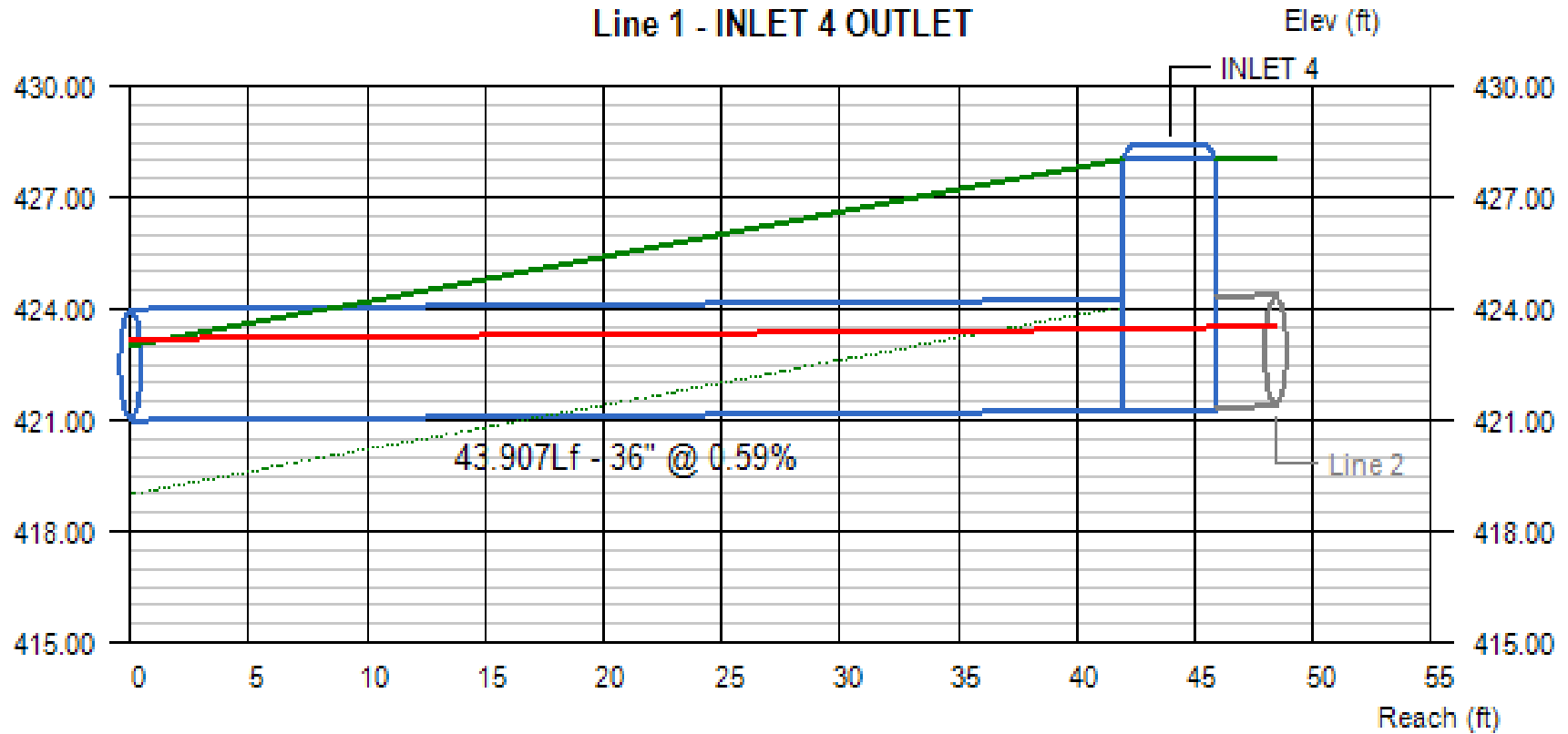
Project File: 19157 - Pipe Sizing.stm	Number of lines: 32	Date: 5/26/2022
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NOTES: Intensity = 67.84 / (Inlet time + 12.00) ^ 0.79 – Return period = 10 Yrs. ; ** Critical depth

Line No.	Inlet ID	Drng Area (ac)	Runoff Coeff (C)	Incr CxA	Inlet Time (min)	i Inlet (in/hr)	Incr Q (cfs)	Q Capt (cfs)	Q Byp (cfs)	Q Carry (cfs)	Total Area (ac)	Total Runoff (cfs)	Capac Full (cfs)	Flow Rate (cfs)	Vel Ave (ft/s)	Line Size (in)
24	INLET 22	0.53	0.83	0.44	5.0	7.19	3.14	4.46	0.00	1.32	1.56	6.83	6.50	6.83	5.56	15
25	INLET 29	0.21	0.51	0.11	5.0	7.19	0.77	0.77	0.00	0.00	0.21	0.77	6.47	0.77	3.18	15
26	INLET 30	1.47	0.64	0.94	5.0	7.19	6.76	6.76	0.00	0.00	1.47	6.76	8.15	6.76	3.83	18
27	INLET 23	0.82	0.56	0.46	5.0	7.19	3.32	2.00	1.32	0.00	0.82	3.32	6.46	3.32	3.57	15
28	INLET 15	0.14	0.58	0.08	5.0	7.19	0.58	0.58	0.00	0.00	0.14	0.58	6.44	0.58	1.55	15
29	INLET 34	0.45	0.79	0.36	5.0	7.19	2.55	2.55	0.00	0.00	0.45	2.55	3.55	2.55	4.69	12
30	INLET 35	0.42	0.90	0.38	5.0	7.19	2.74	2.74	0.00	0.00	0.91	5.49	6.46	5.49	4.91	15
31	INLET 28	0.17	0.90	0.15	5.0	7.19	1.07	1.07	0.00	0.00	0.49	3.02	6.46	3.02	3.36	15
32	INLET 27	0.32	0.90	0.29	5.0	7.19	2.07	2.07	0.00	0.00	0.32	2.07	6.47	2.07	3.00	15

Project File: 19157 - Pipe Sizing.stm	Number of lines: 32	Date: 5/26/2022
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NOTES: Intensity = 67.84 / (Inlet time + 12.00) ^ 0.79 – Return period = 10 Yrs. ; ** Critical depth



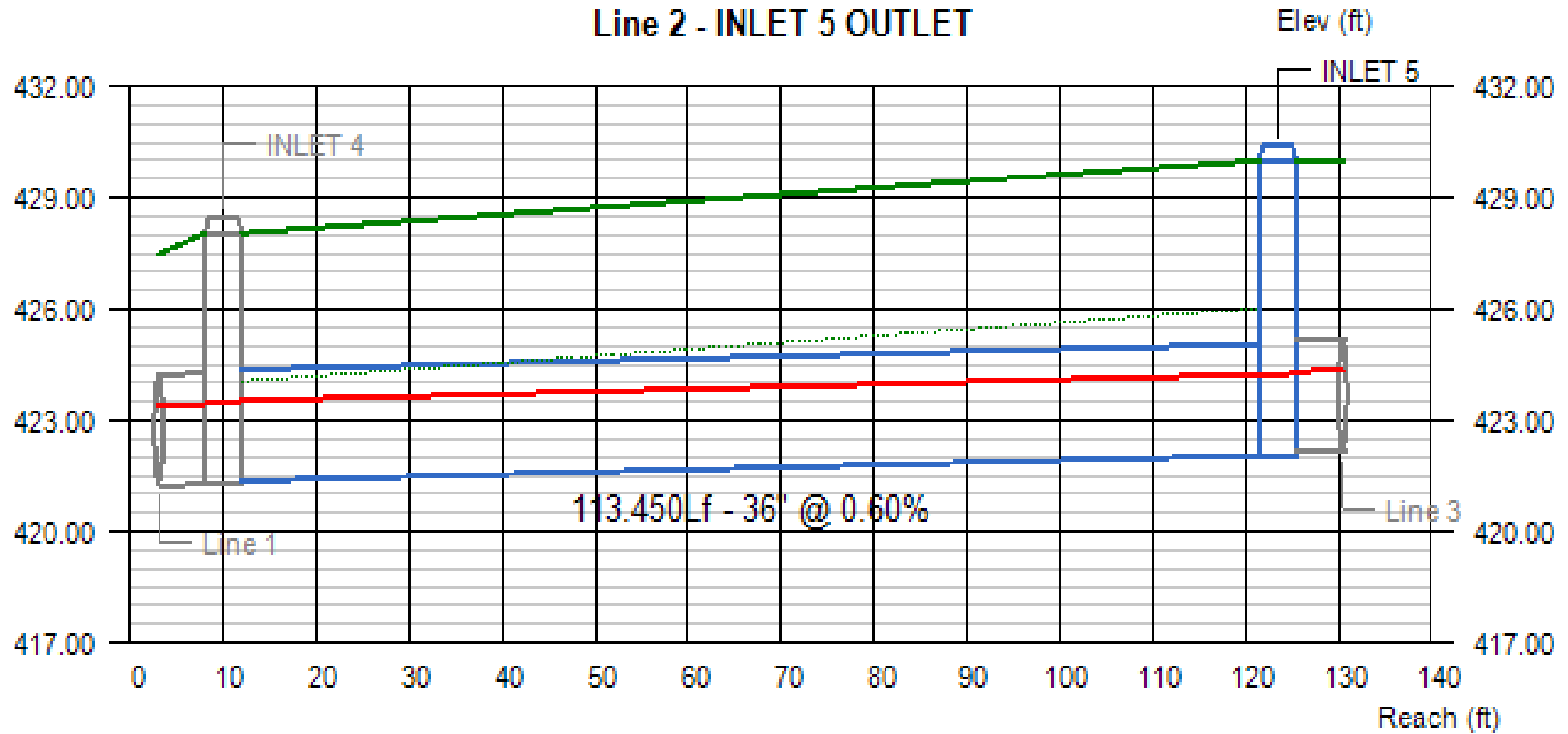
Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
1	44.93	421.00	421.26	2.18	2.18	2.18	423.18	423.44	423.44	8.17	8.16	-1.00	3.78

Project File:

No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 2) - INLET 5 OUTLET



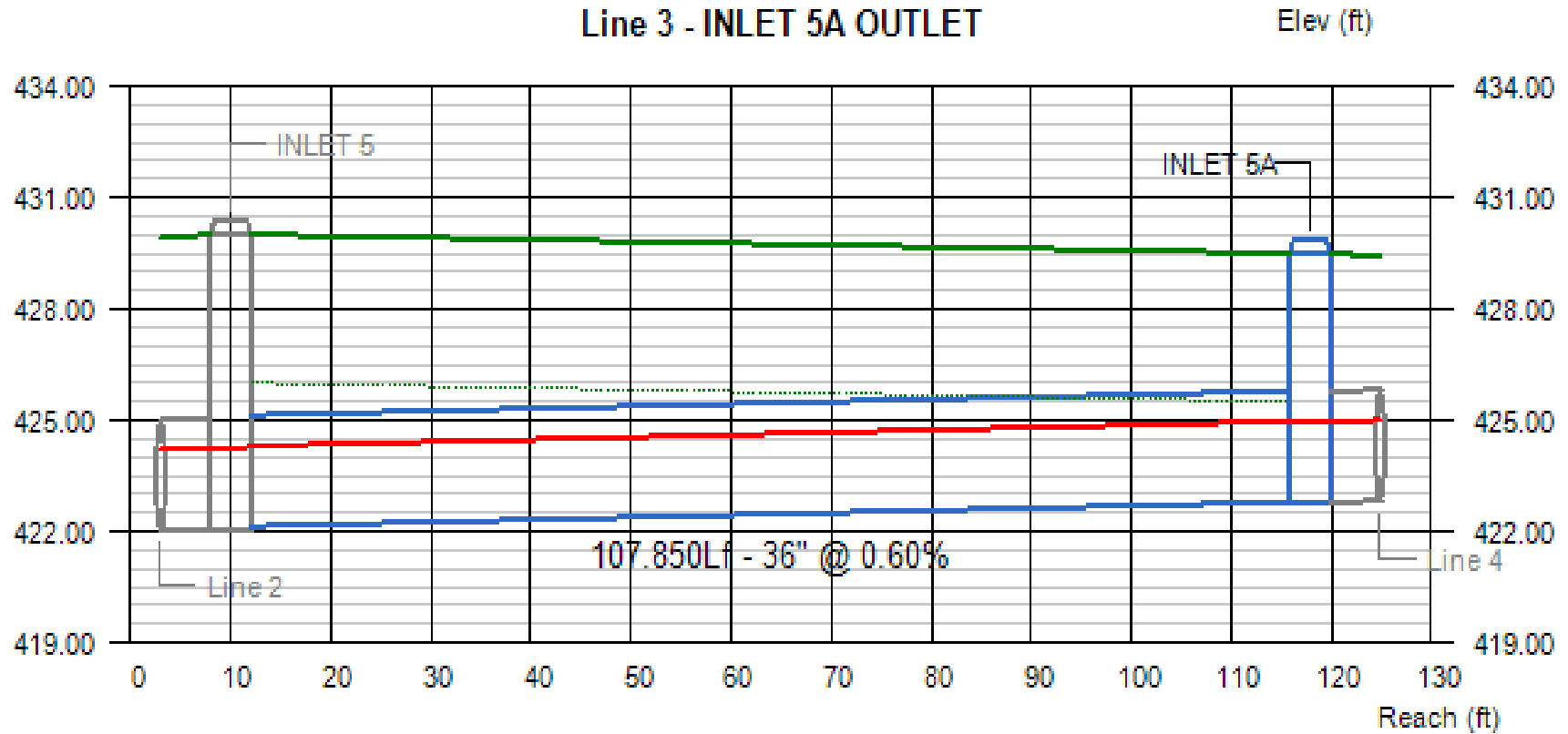
Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
2	45.23	421.36	422.04	2.18	2.19	2.19	423.54	424.23	424.23	8.24	8.19	3.68	4.96

Project File:

No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 3) - INLET 5A OUTLET



Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
3	45.19	422.14	422.79	2.17	2.19	2.19	424.31	424.98	424.98	8.25	8.18	4.86	3.71

Project File:

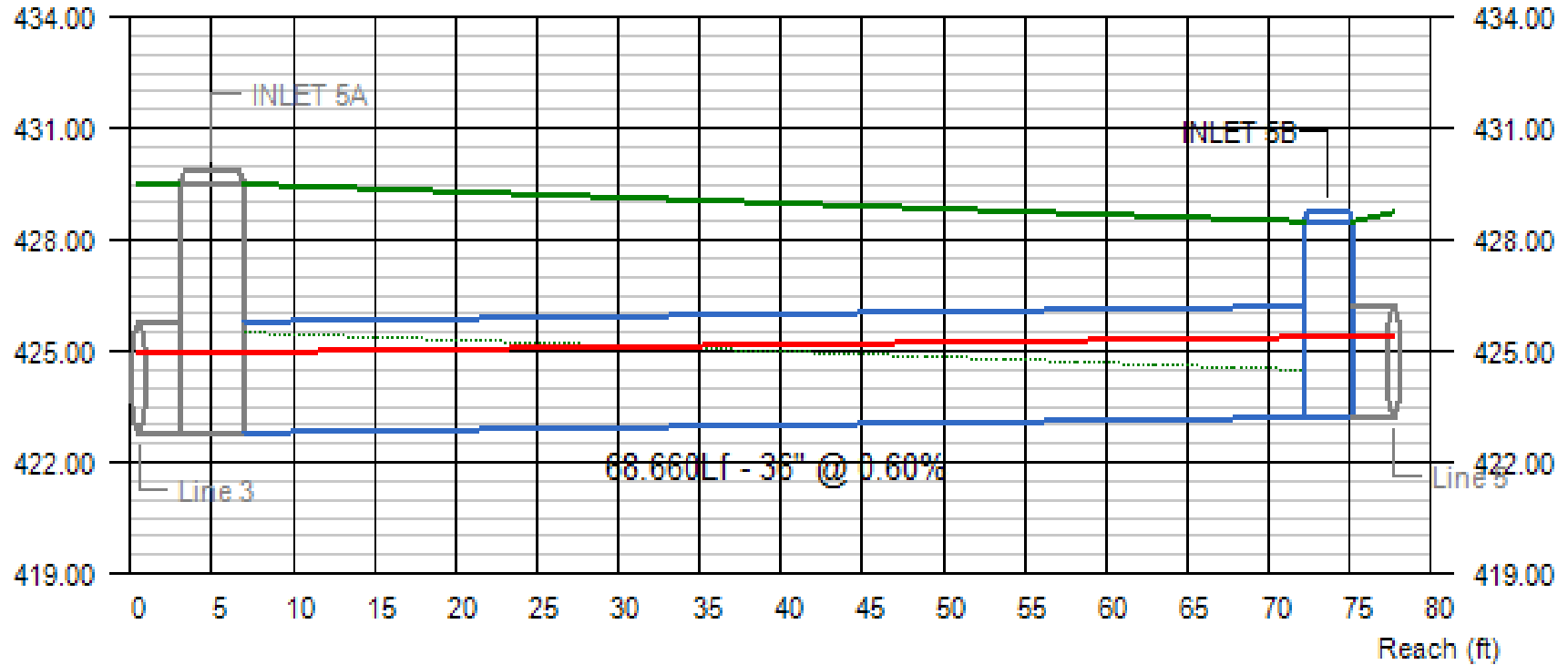
No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 4) - INLET 5B OUTLET

Line 4 - INLET 5B OUTLET

Elev (ft)

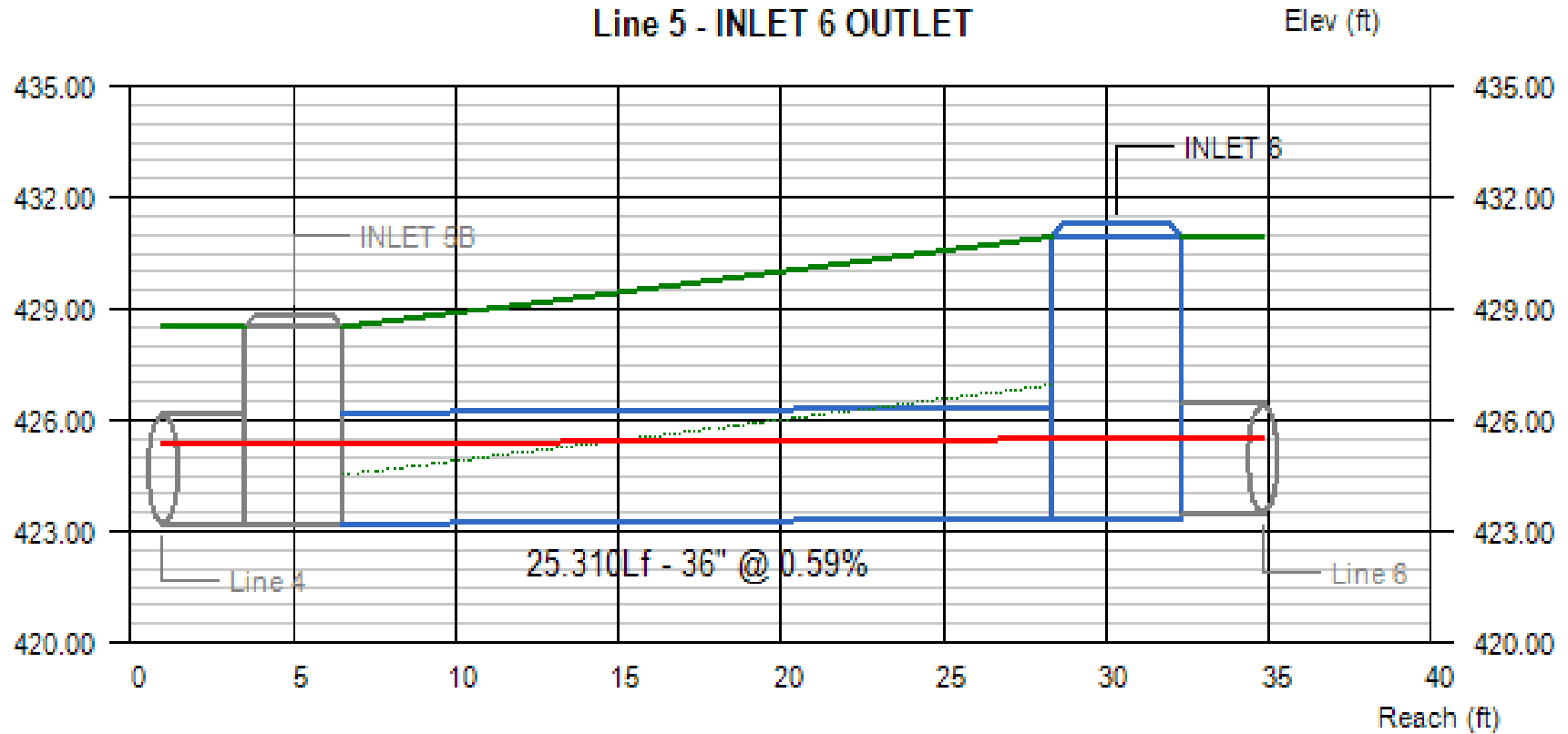


Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
4	44.86	422.79	423.20	2.19	2.18	2.18	424.98	425.38	425.38	8.12	8.15	3.71	2.30

Project File:

No. Lines: 32

Run Date: 5/26/2022



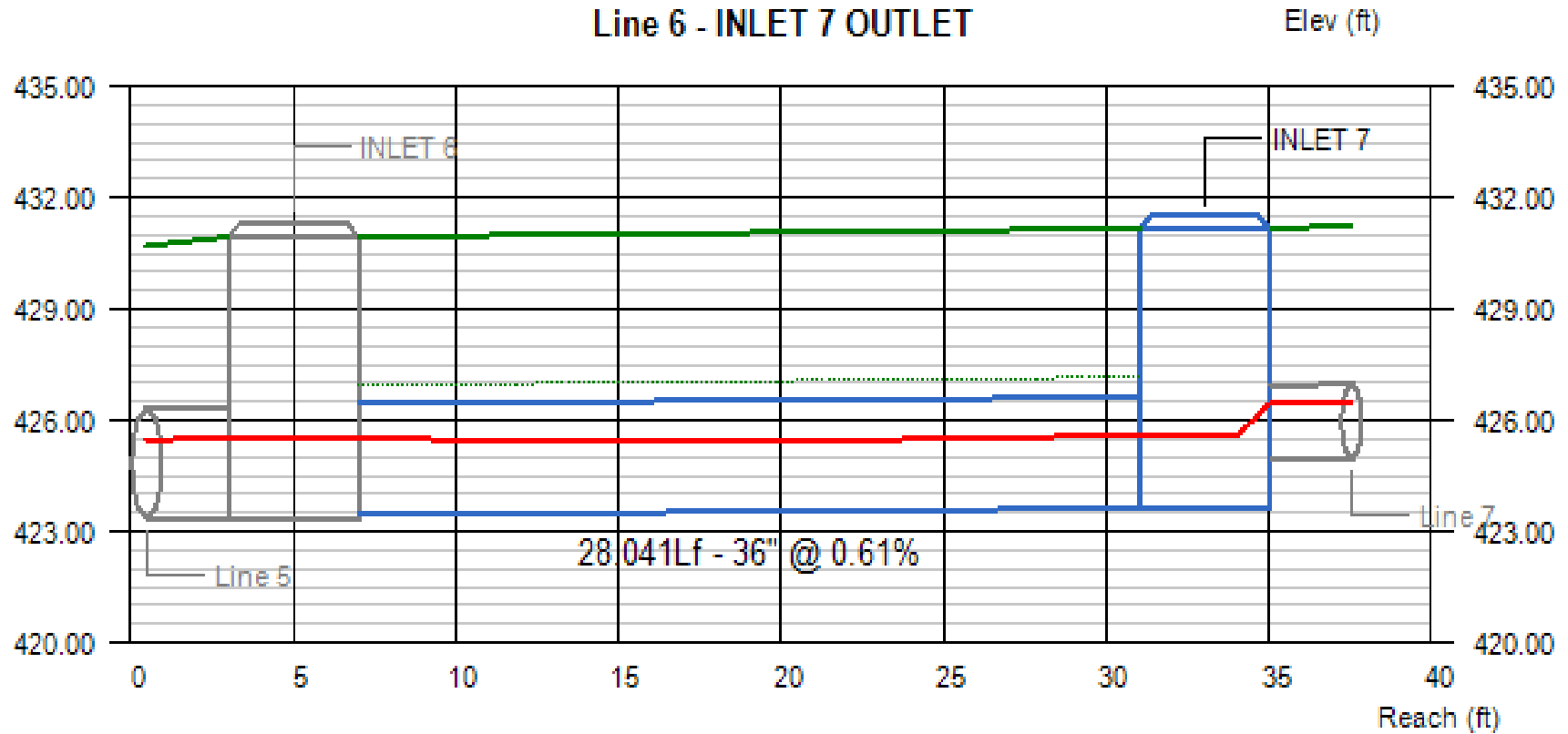
Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
5	43.65	423.20	423.35	2.18	2.15	2.15	425.38	425.50	425.50	7.93	8.05	2.30	4.59

Project File:

No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 6) - INLET 7 OUTLET

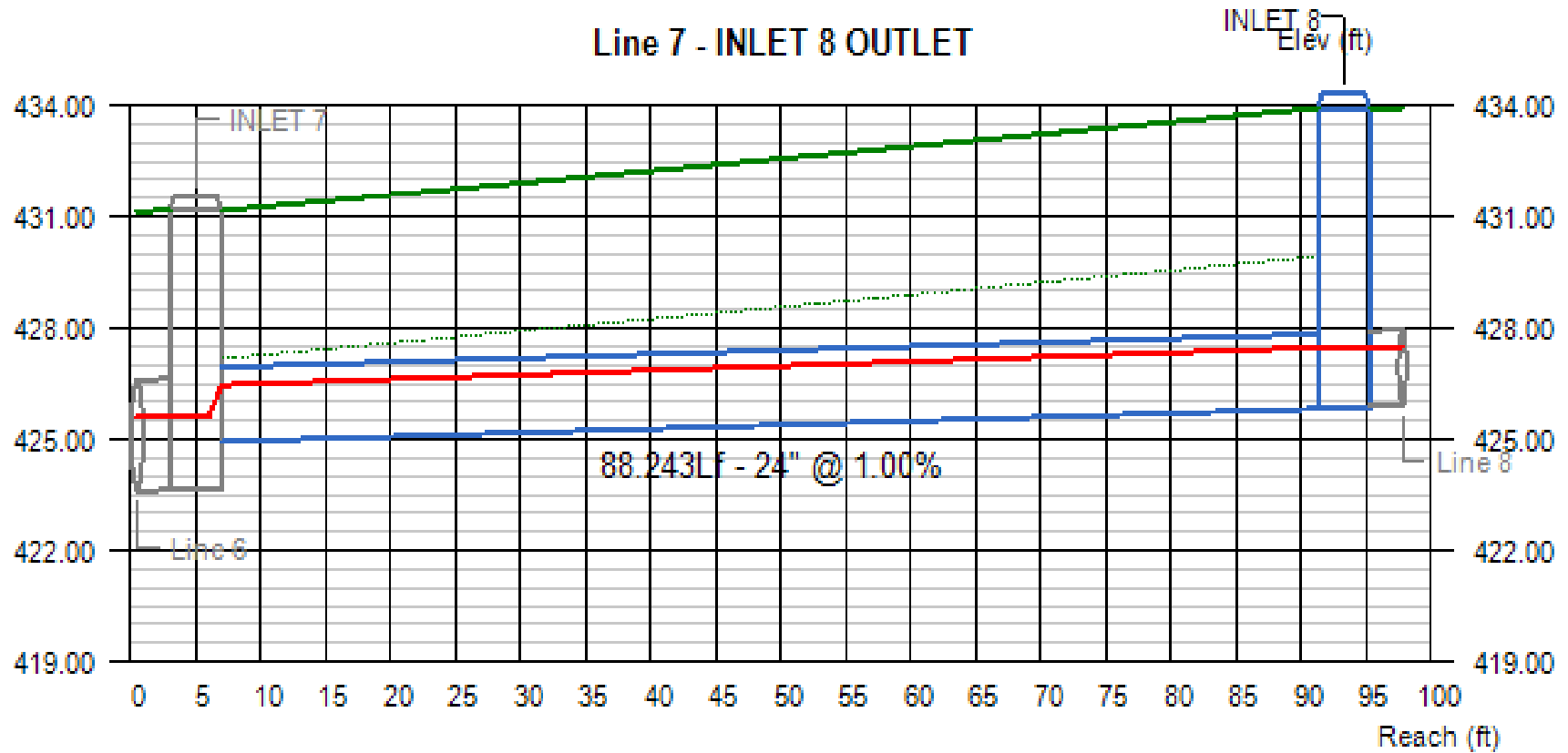


Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
6	37.29	423.45	423.62	2.05	1.98	1.98	425.50	425.60 j	425.60	7.24	7.51	4.49	4.54

Project File:

No. Lines: 32

Run Date: 5/26/2022



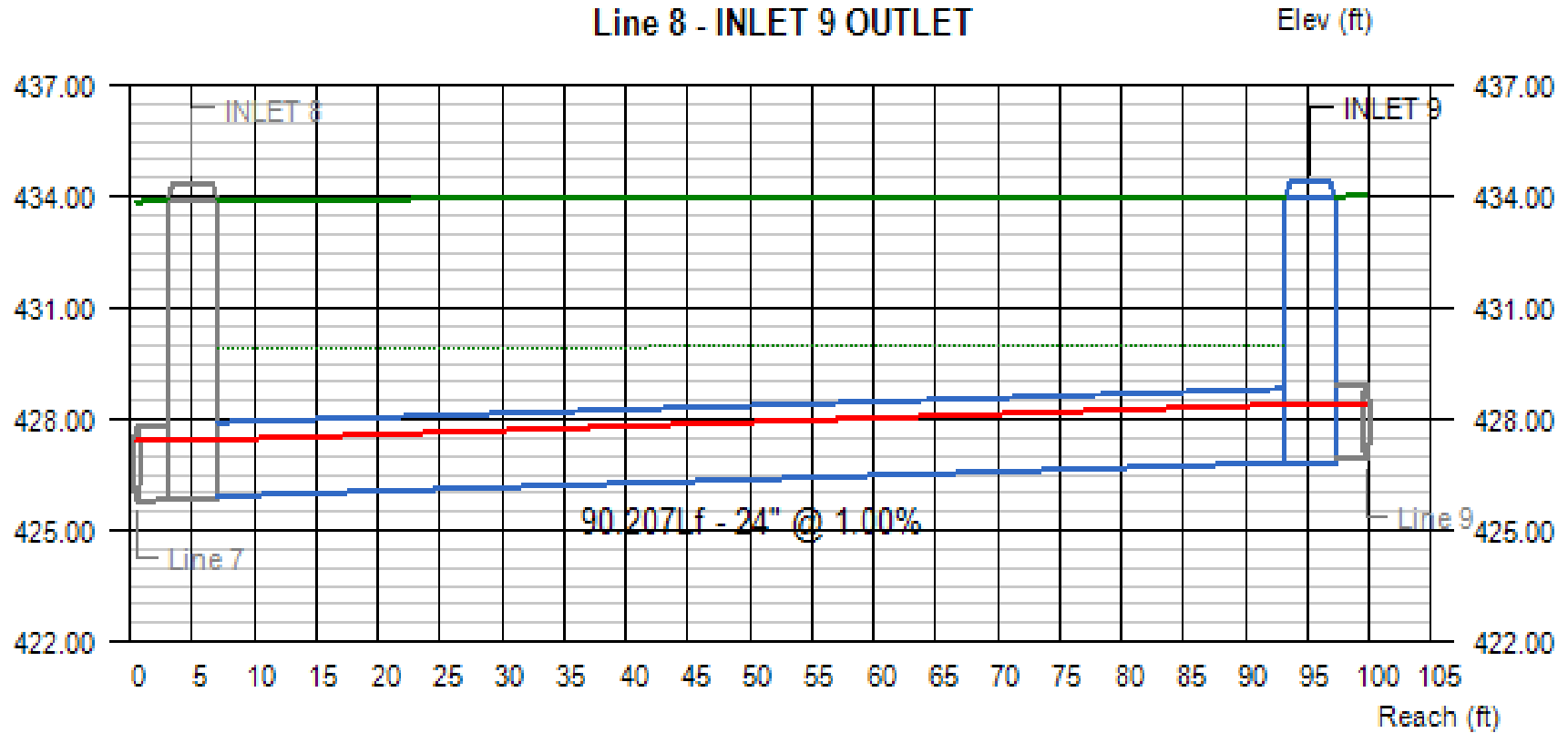
Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
7	20.91	424.94	425.82	1.52	1.64	1.64	426.46	427.46	427.46	8.16	7.60	4.22	6.10

Project File:

No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 8) - INLET 9 OUTLET

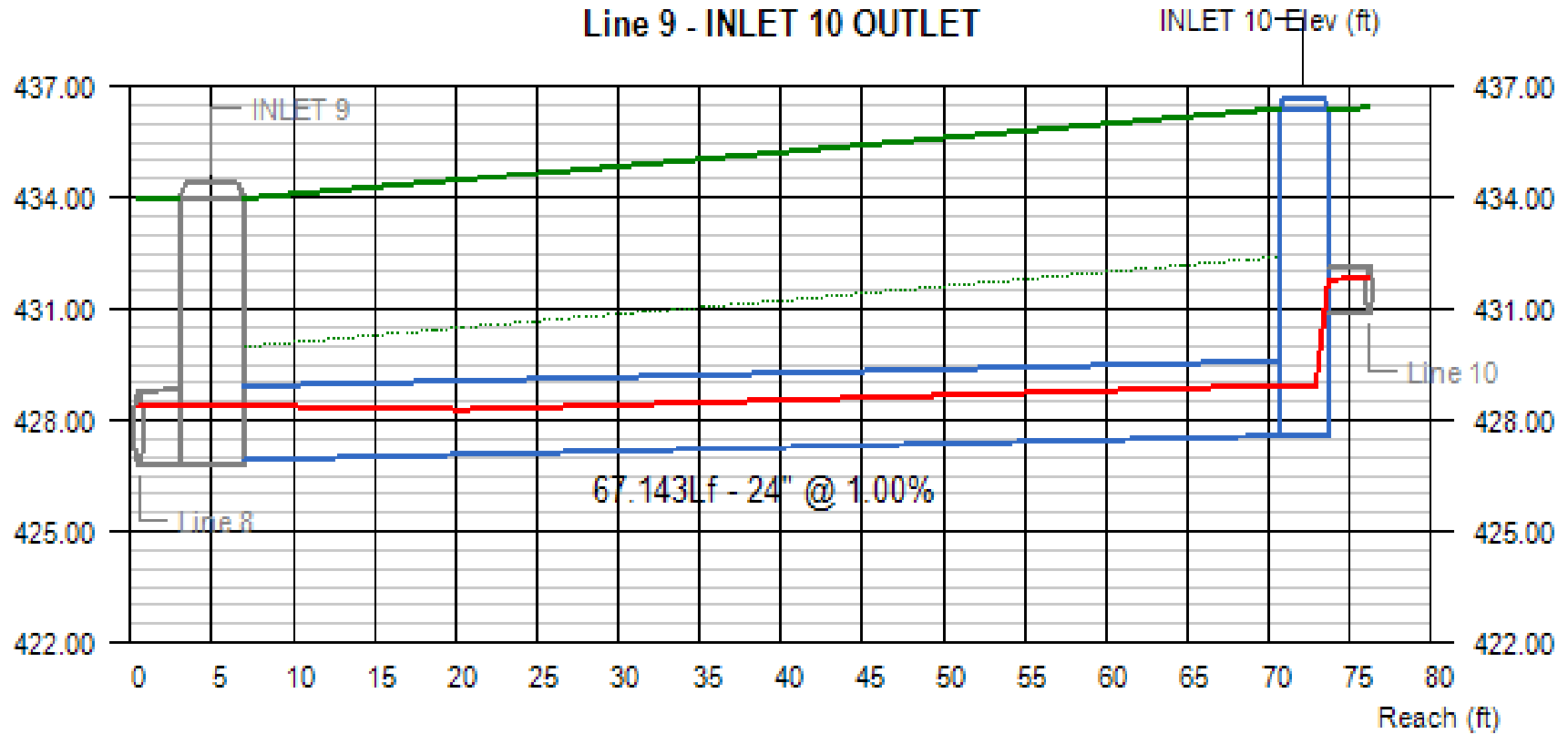


Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
8	19.40	425.92	426.82	1.54	1.58	1.58	427.46	428.40	428.40	7.49	7.28	6.00	5.15

Project File:

No. Lines: 32

Run Date: 5/26/2022



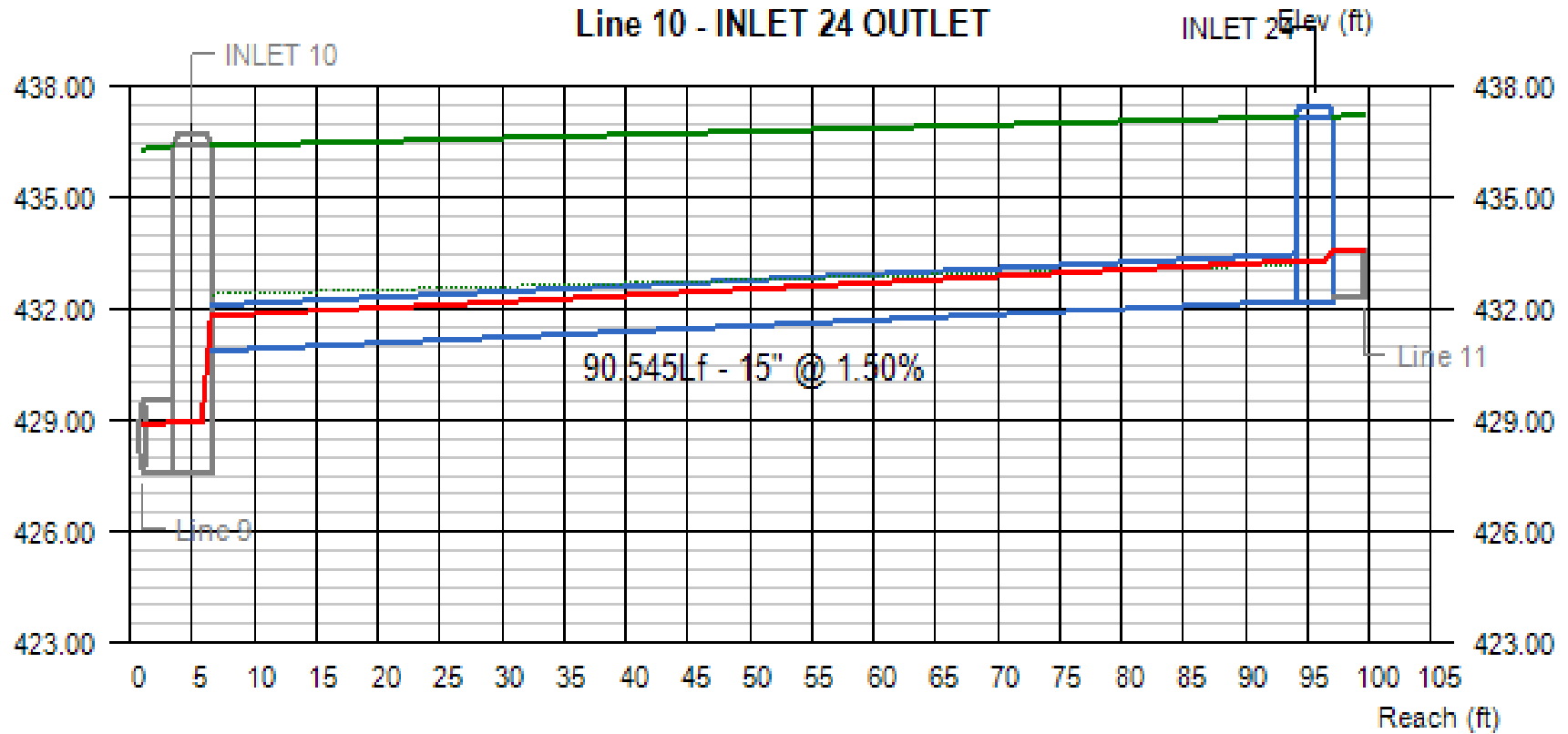
Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
9	14.02	426.92	427.59	1.48	1.35	1.35	428.40	428.94 j	428.94	5.61	6.23	5.05	6.81

Project File:

No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 10) - INLET 24 OUTLET



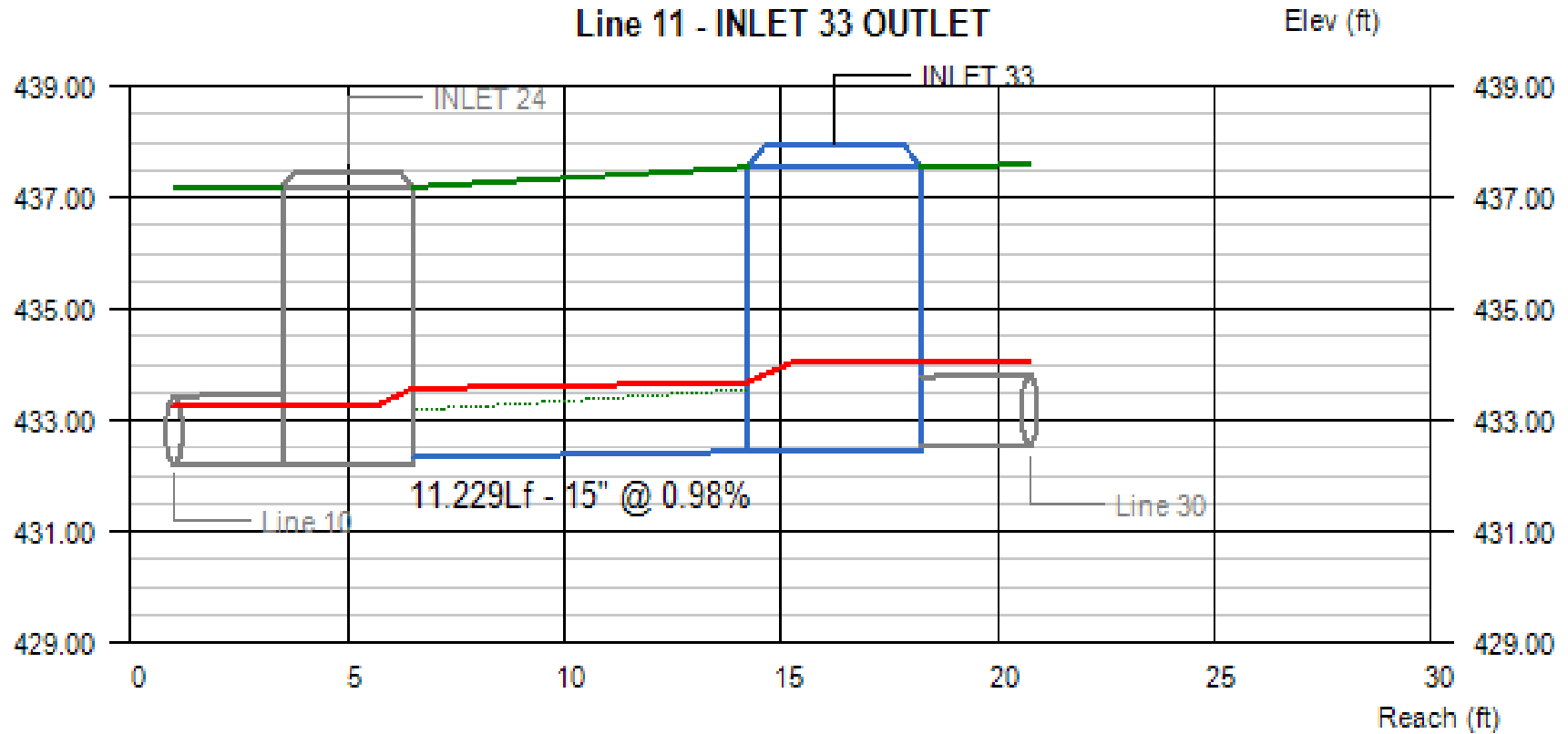
Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
10	7.21	430.86	432.22	0.94	1.07	1.07	431.80	433.29	433.29	7.31	6.44	4.29	3.71

Project File:

No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 11) - INLET 33 OUTLET



Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
11	7.16	432.32	432.43	1.25	1.25	1.60	433.57	433.68	434.03	5.83	5.83	3.61	3.87

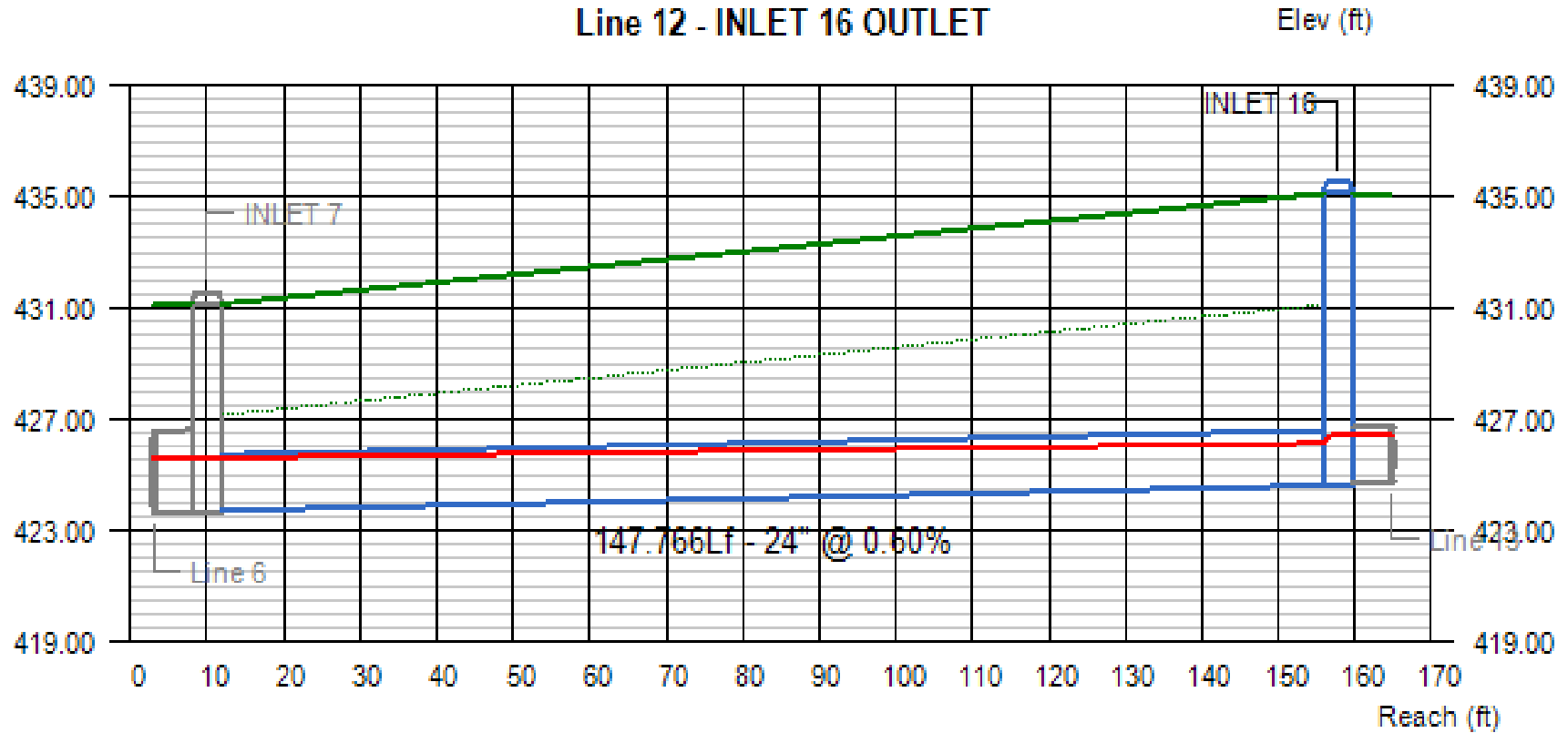
Project File:

No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 12) - INLET 16 OUTLET

Line 12 - INLET 16 OUTLET

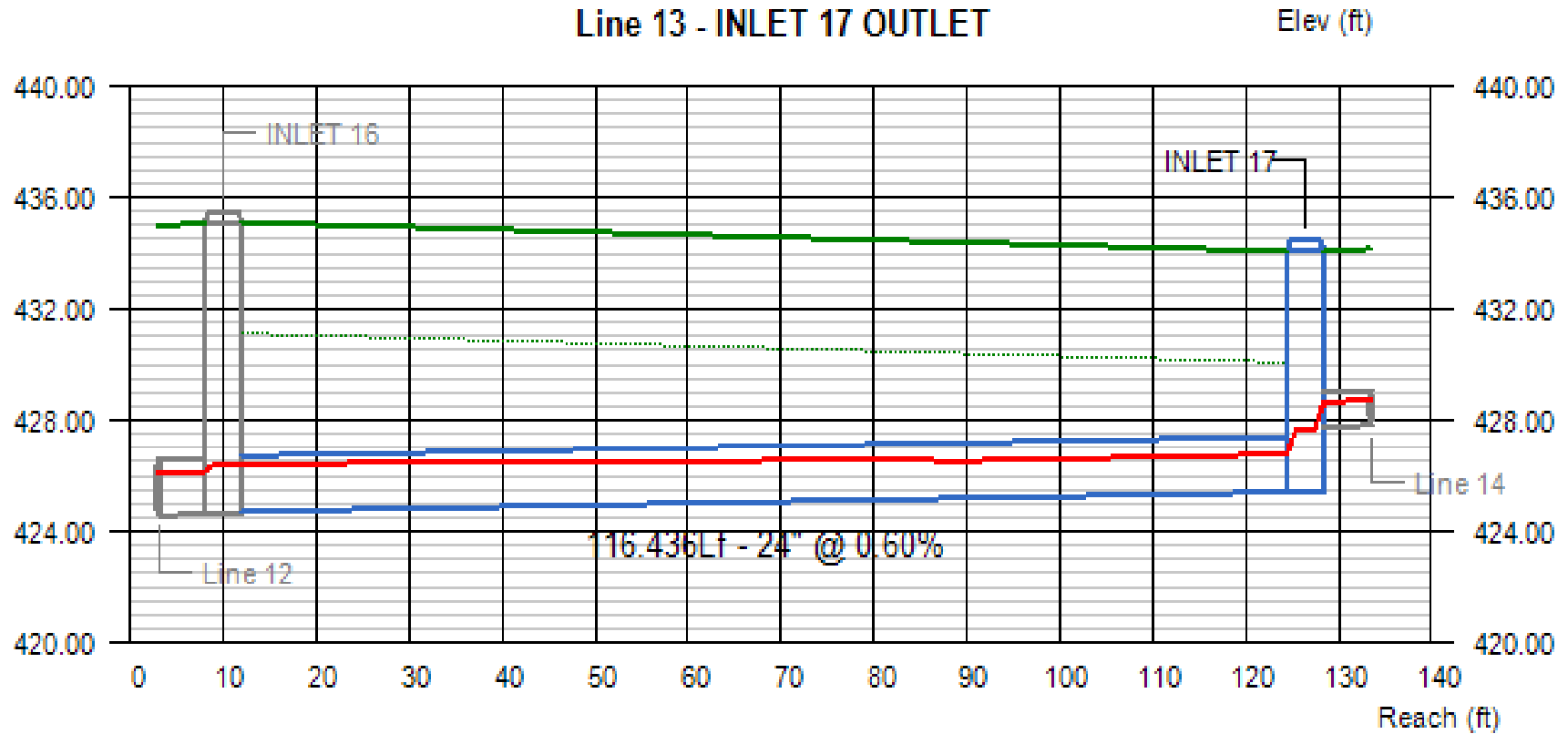


Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
12	15.50	423.72	424.61	1.88	1.53	1.81	425.60	426.14	426.42	5.05	6.02	5.44	8.49

Project File:

No. Lines: 32

Run Date: 5/26/2022



Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
13	14.26	424.71	425.41	1.71	1.36	2.27	426.42	426.77 j	427.68	4.99	6.25	8.39	6.66

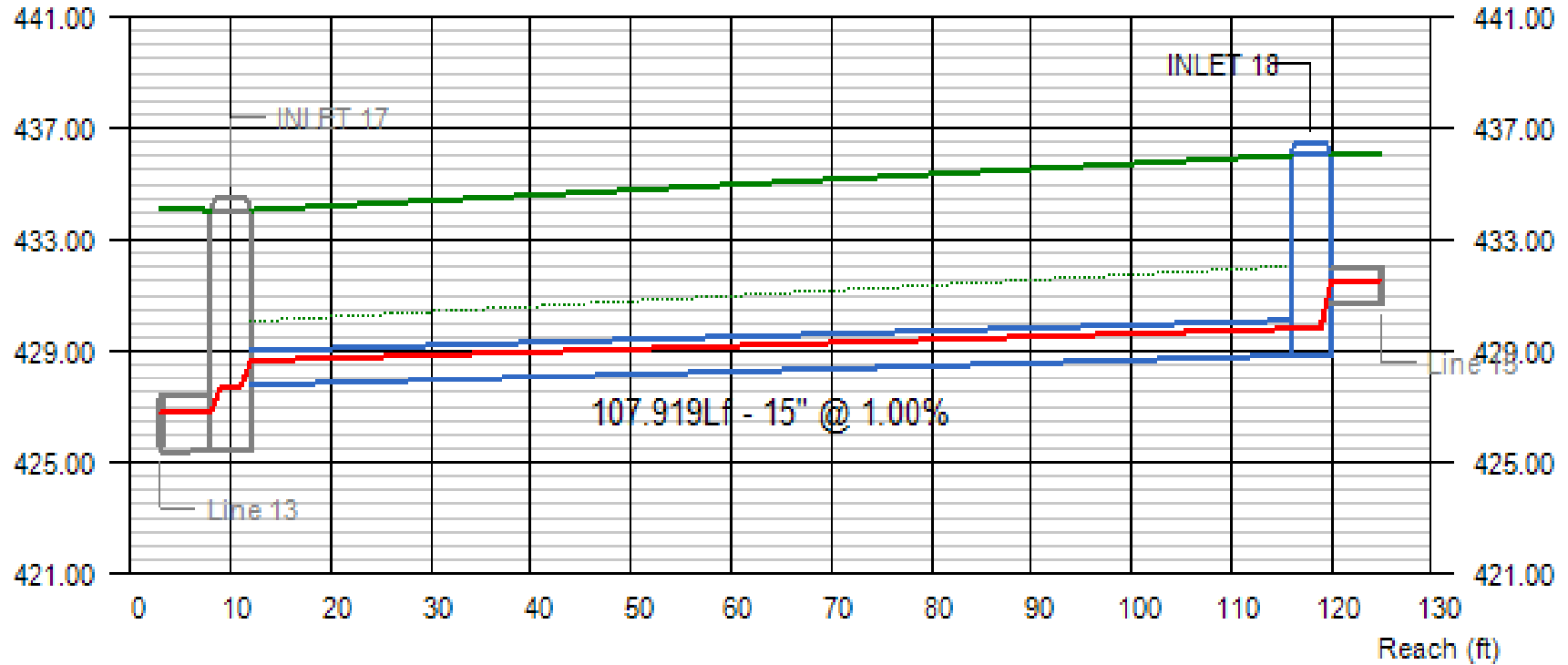
Project File:

No. Lines: 32

Run Date: 5/26/2022

Line 14 - INLET 18 OUTLET

Elev (ft)



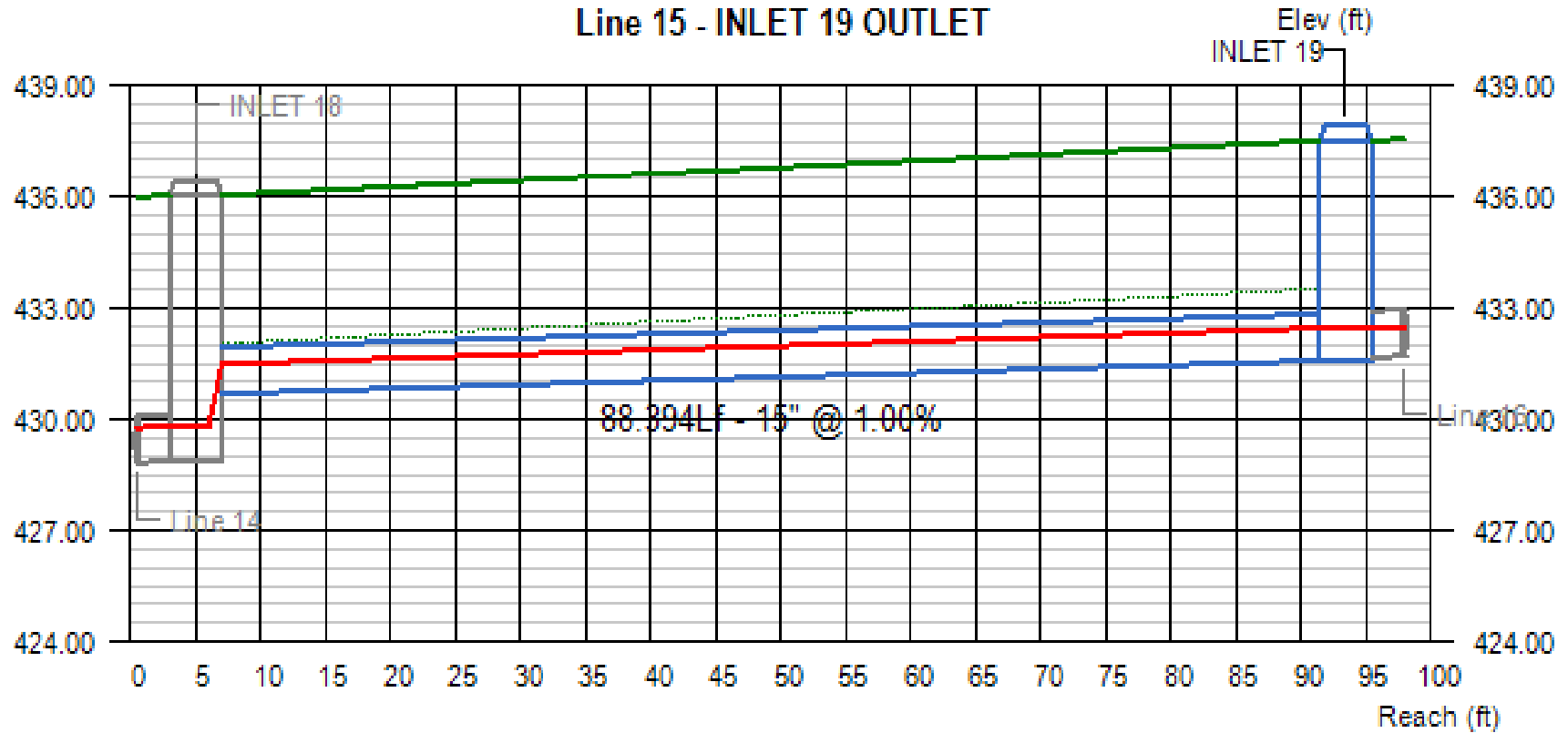
Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
14	5.56	427.77	428.85	0.89	0.95	0.95	428.66	429.80	429.80	5.92	5.53	5.05	5.93

Project File:

No. Lines: 32

Run Date: 5/26/2022

Line 15 - INLET 19 OUTLET



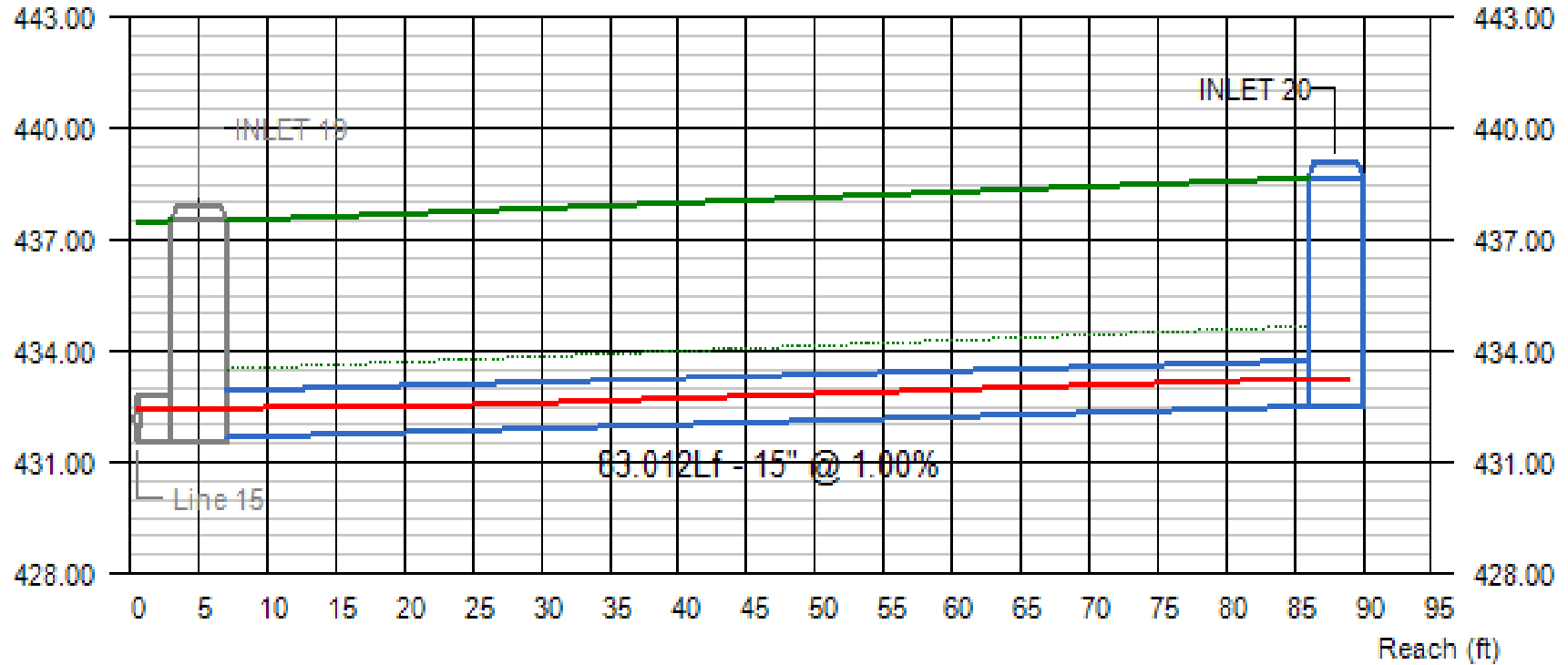
Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
15	4.67	430.69	431.57	0.79	0.88	0.88	431.48	432.45	432.45	5.72	5.09	4.09	4.70

Project File:	No. Lines: 32	Run Date: 5/26/2022
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Line Profile (Line 16) - INLET 20 OUTLET

Line 16 - INLET 20 OUTLET

Elev (ft)



Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
16	3.54	431.67	432.50	0.78	0.76	0.76	432.45	433.26 j	433.26	4.43	4.54	4.60	4.92

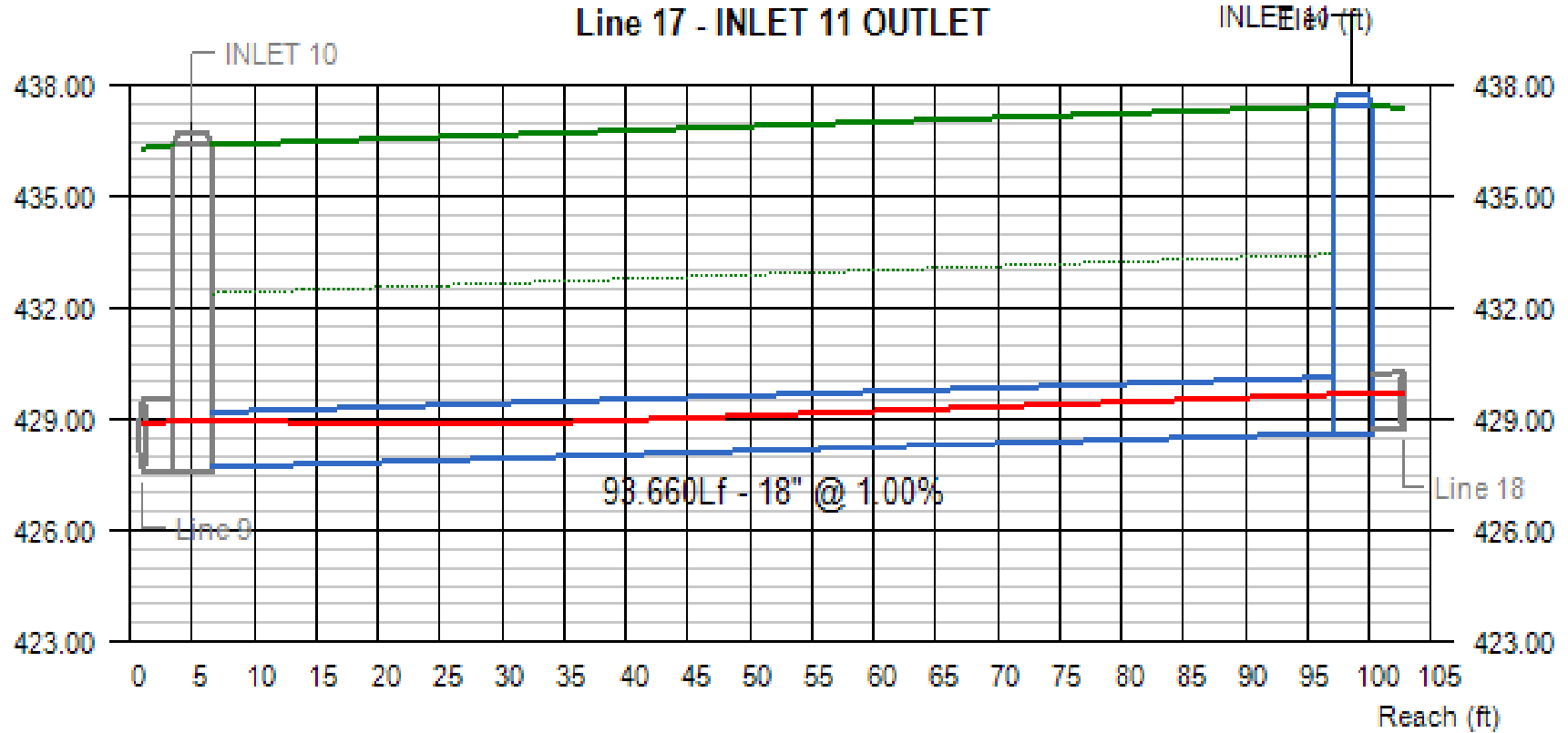
Project File:

No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 17) - INLET 11 OUTLET

Line 17 - INLET 11 OUTLET

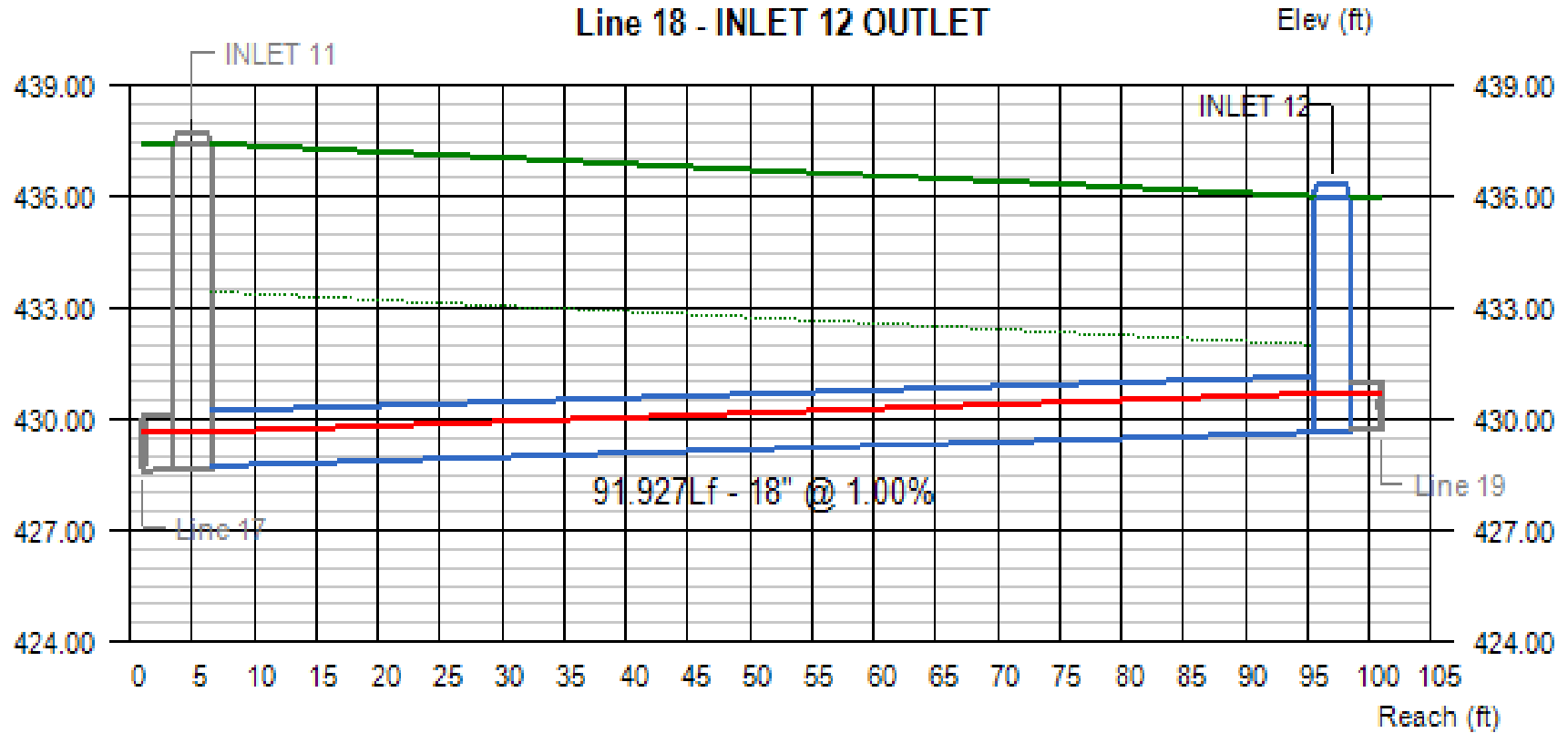


Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
17	7.24	427.69	428.63	1.25	1.04	1.04	428.94	429.67 j	429.67	4.61	5.53	7.21	7.31

Project File: _____ No. Lines: 32 Run Date: 5/26/2022

Line Profile (Line 18) - INLET 12 OUTLET

Line 18 - INLET 12 OUTLET



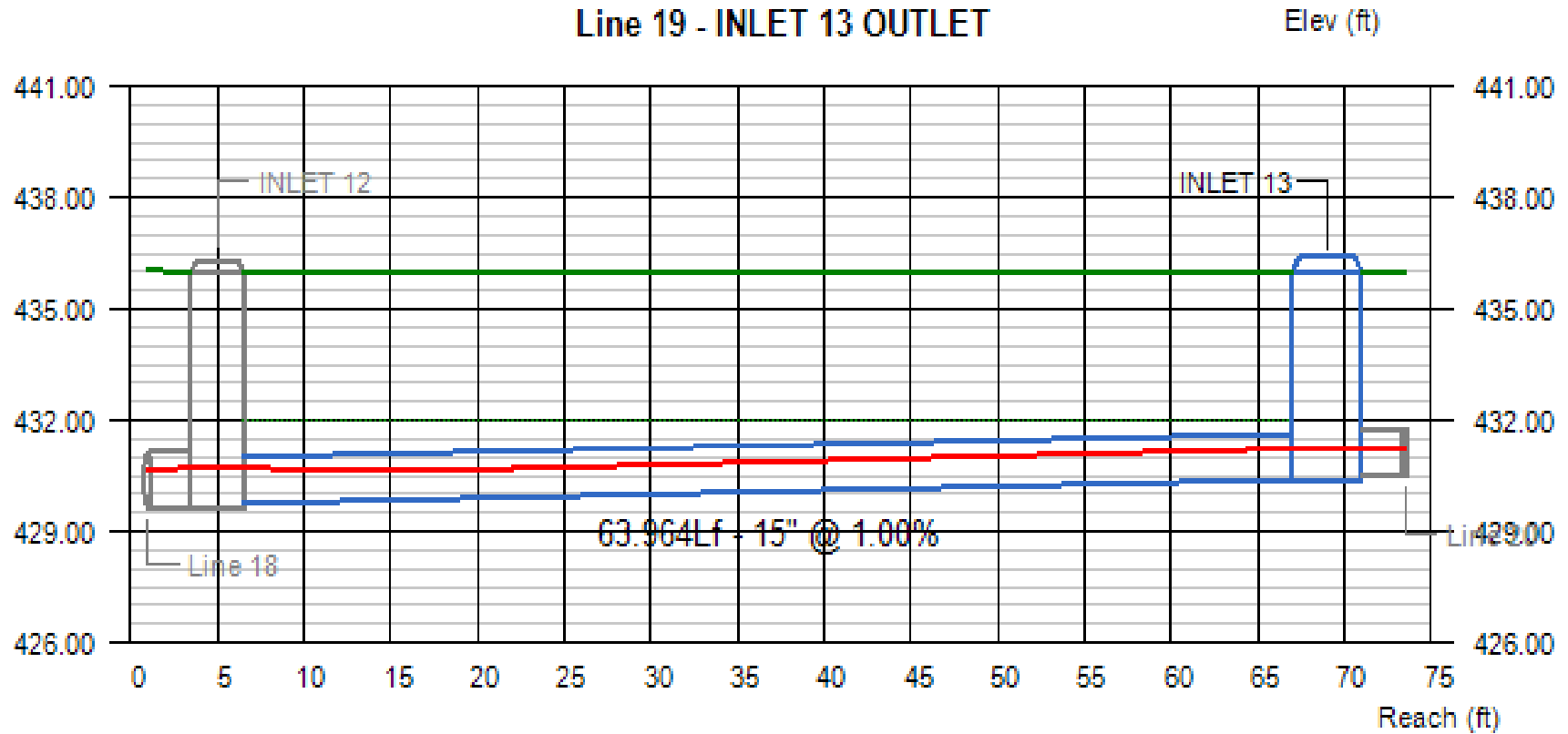
Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
18	7.29	428.73	429.65	0.94	1.04	1.04	429.67	430.69	430.69	6.25	5.55	7.21	4.85

Project File:

No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 19) - INLET 13 OUTLET



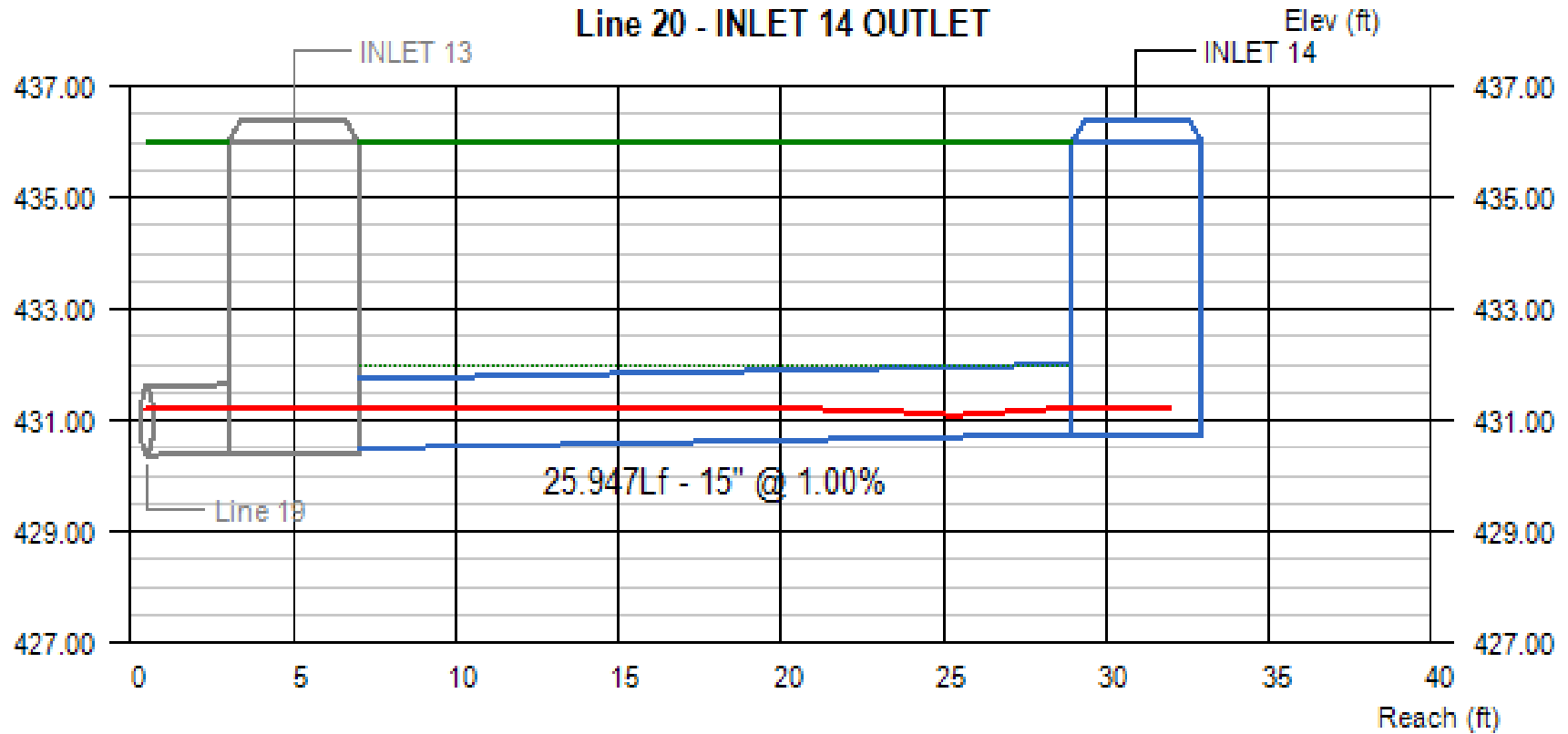
Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
19	4.32	429.75	430.39	0.94	0.84	0.84	430.69	431.23 j	431.23	4.34	4.92	5.00	4.36

Project File:

No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 20) - INLET 14 OUTLET



Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
20	1.47	430.49	430.75	0.74	0.48	0.48	431.23	431.23 j	431.23	1.94	3.39	4.26	4.00

Project File:

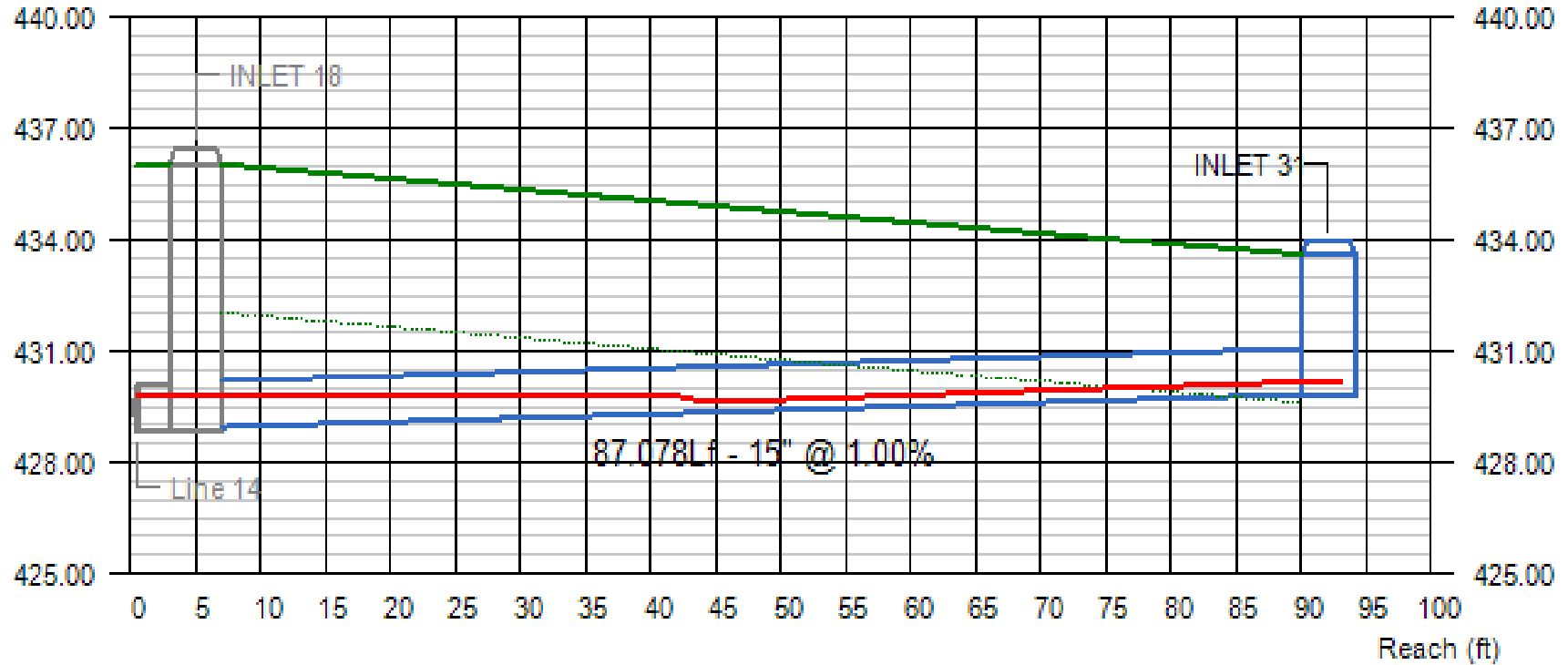
No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 21) - INLET 31 OUTLET

Line 21 - INLET 31 OUTLET

Elev (ft)



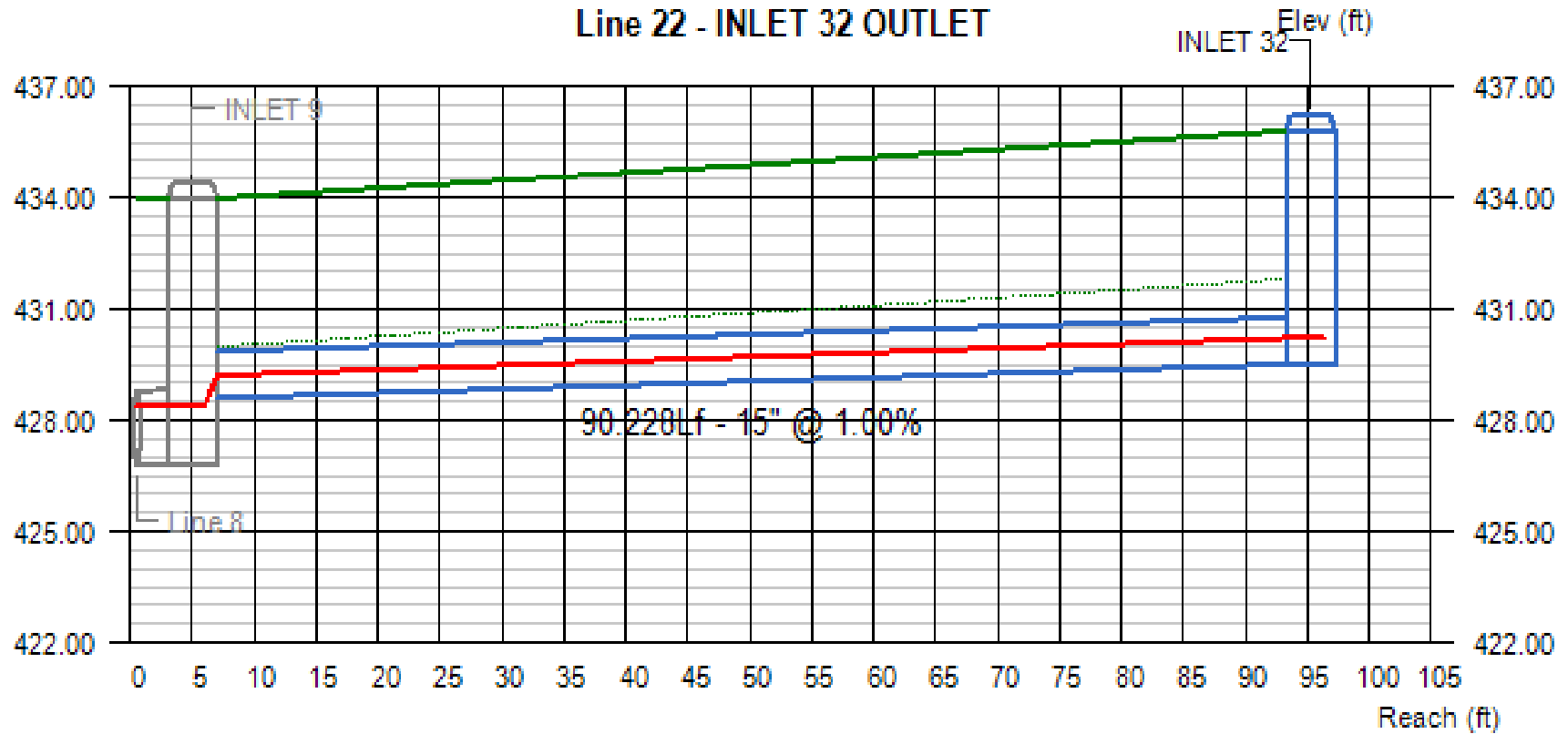
Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
21	0.78	428.95	429.82	0.85	0.34	0.34	429.80	430.16 j	430.16	0.87	2.82	5.83	2.52

Project File:

No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 22) - INLET 32 OUTLET



Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
22	3.07	428.60	429.50	0.61	0.70	0.70	429.21	430.20	430.20	5.19	4.31	4.12	5.05

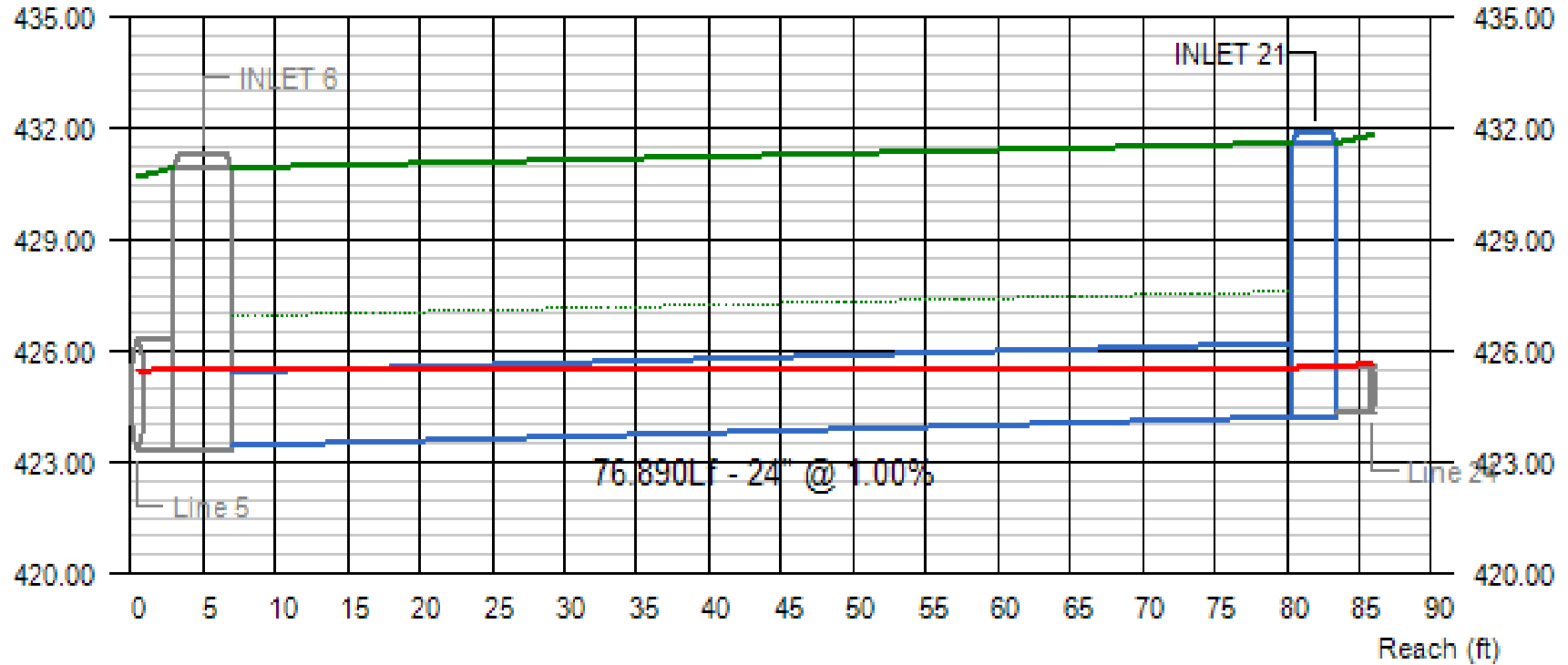
Project File:

No. Lines: 32

Run Date: 5/26/2022

Line 23 - INLET 21 OUTLET

Elev (ft)



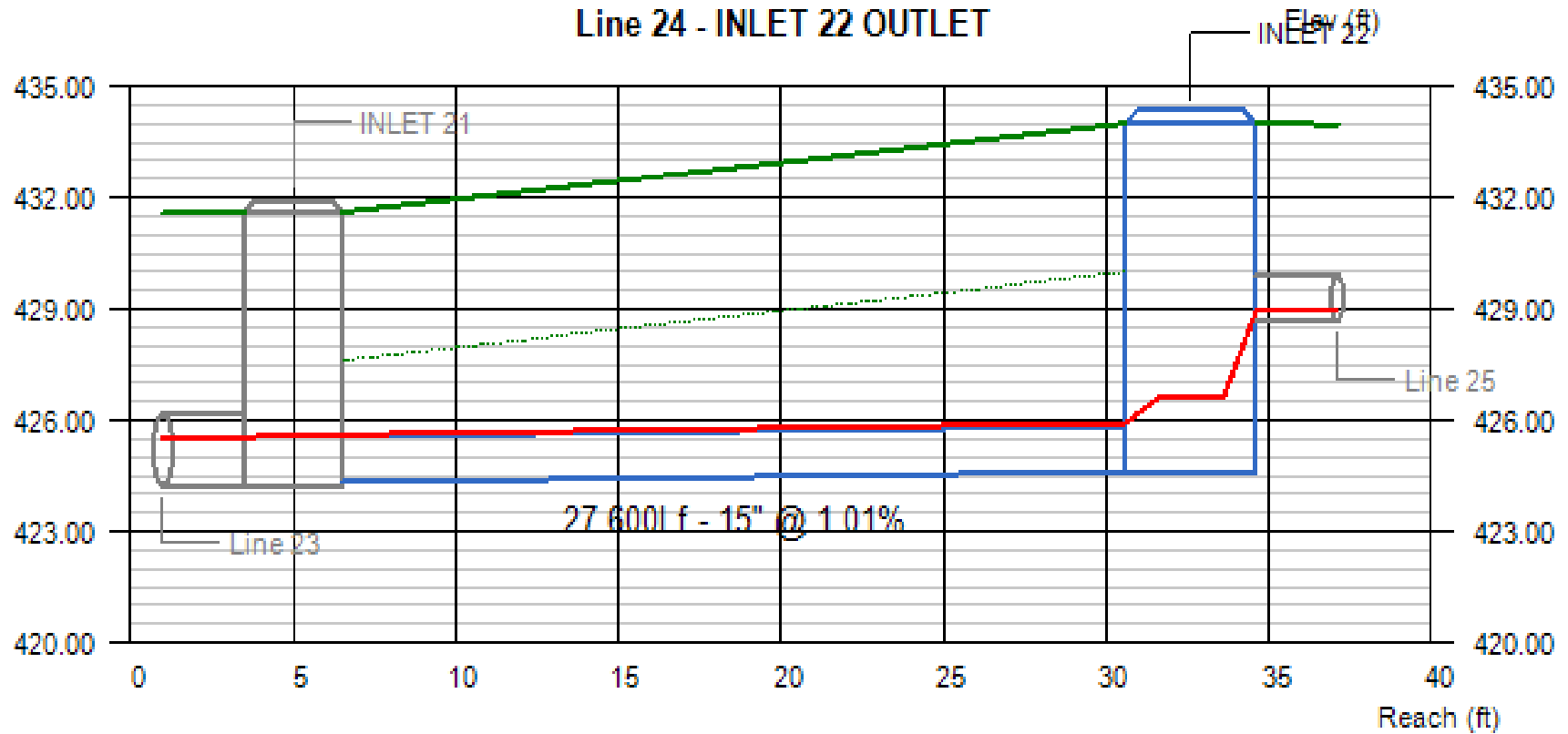
Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
23	6.87	423.45	424.22	2.00	1.29	1.40	425.50	425.51	425.62	2.19	3.19	5.49	5.38

Project File:

No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 24) - INLET 22 OUTLET



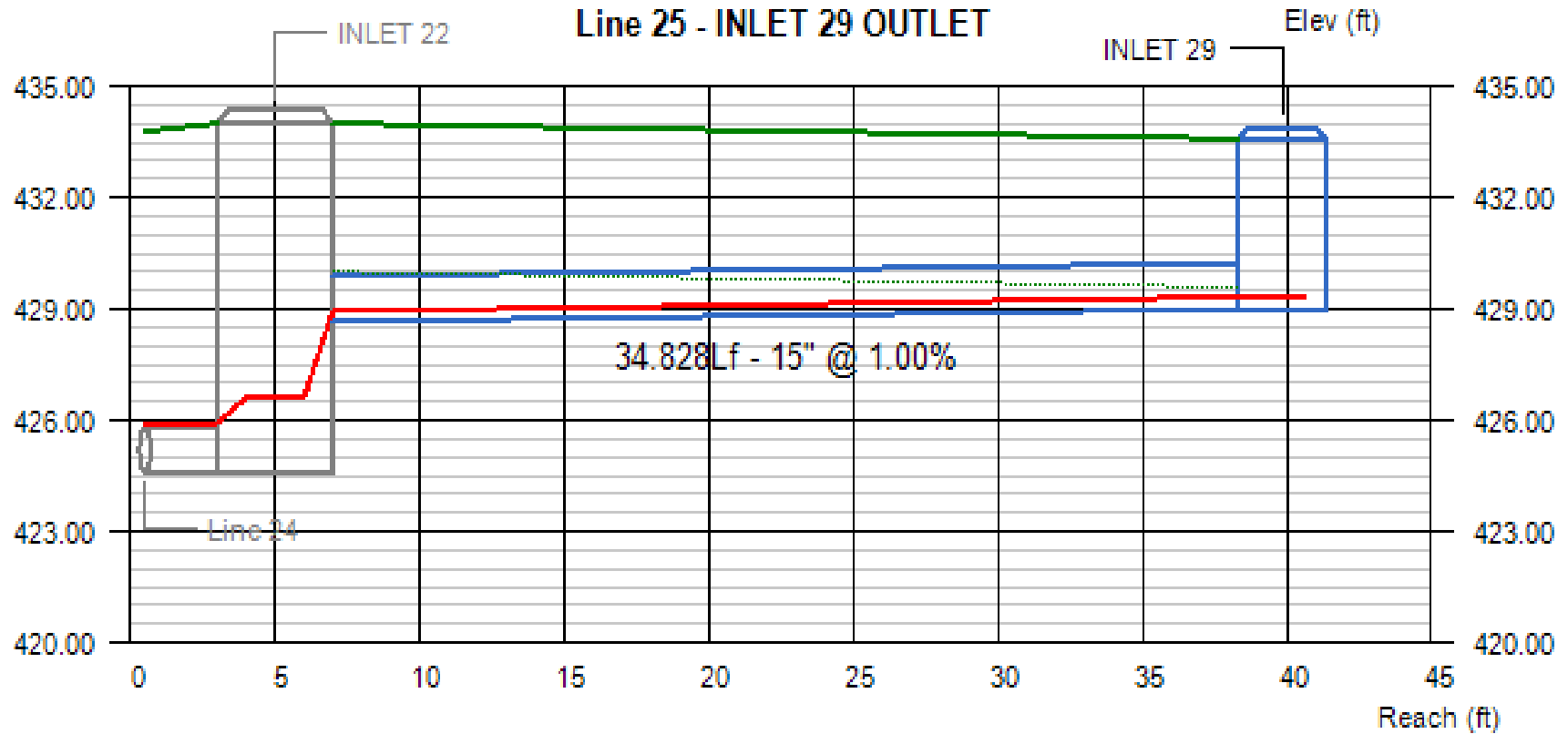
Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
24	6.83	424.32	424.60	1.25	1.25	2.01	425.62	425.93	426.61	5.56	5.56	6.03	8.15

Project File:

No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 25) - INLET 29 OUTLET



Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
25	0.77	428.64	428.99	0.29	0.34	0.34	428.93	429.33	429.33	3.54	2.81	4.11	3.35

Project File:

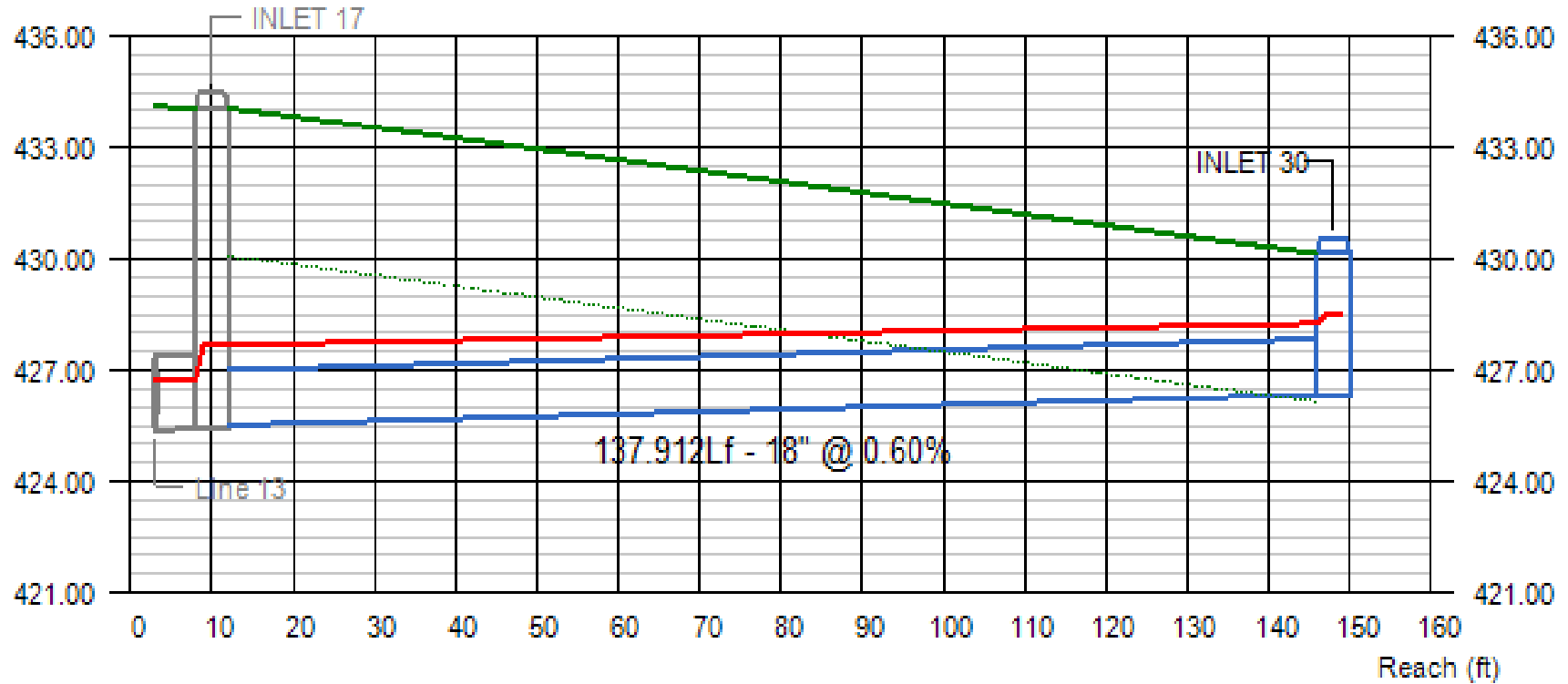
No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 26) - INLET 30 OUTLET

Line 26 - INLET 30 OUTLET

Elev (ft)

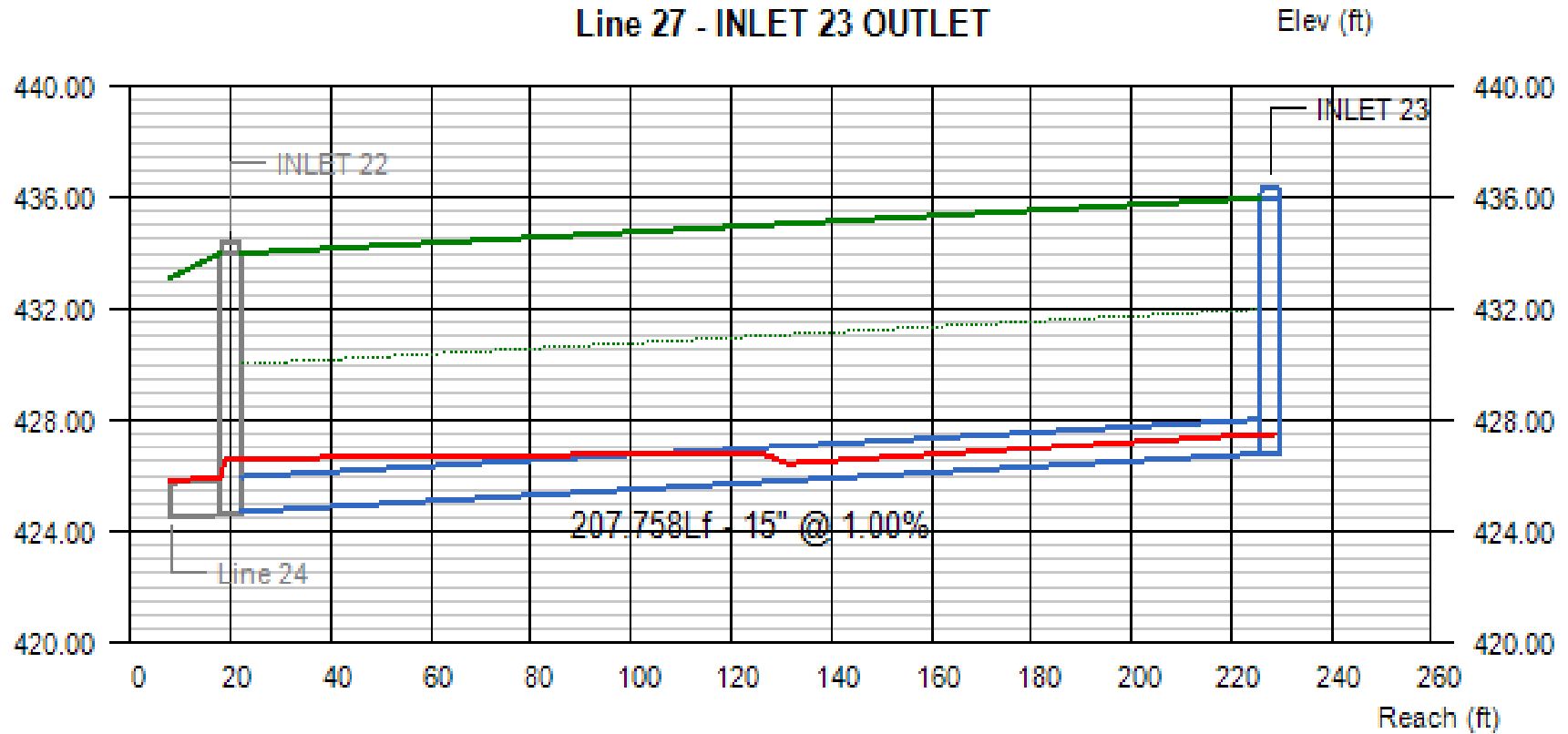


Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
26	6.76	425.51	426.34	1.50	1.50	2.14	427.68	428.26	428.48	3.83	3.83	7.06	2.31

Project File:

No. Lines: 32

Run Date: 5/26/2022



Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
27	3.32	424.70	426.78	1.25	0.73	0.73	426.61	427.51 j	427.51	2.70	4.43	8.05	7.94

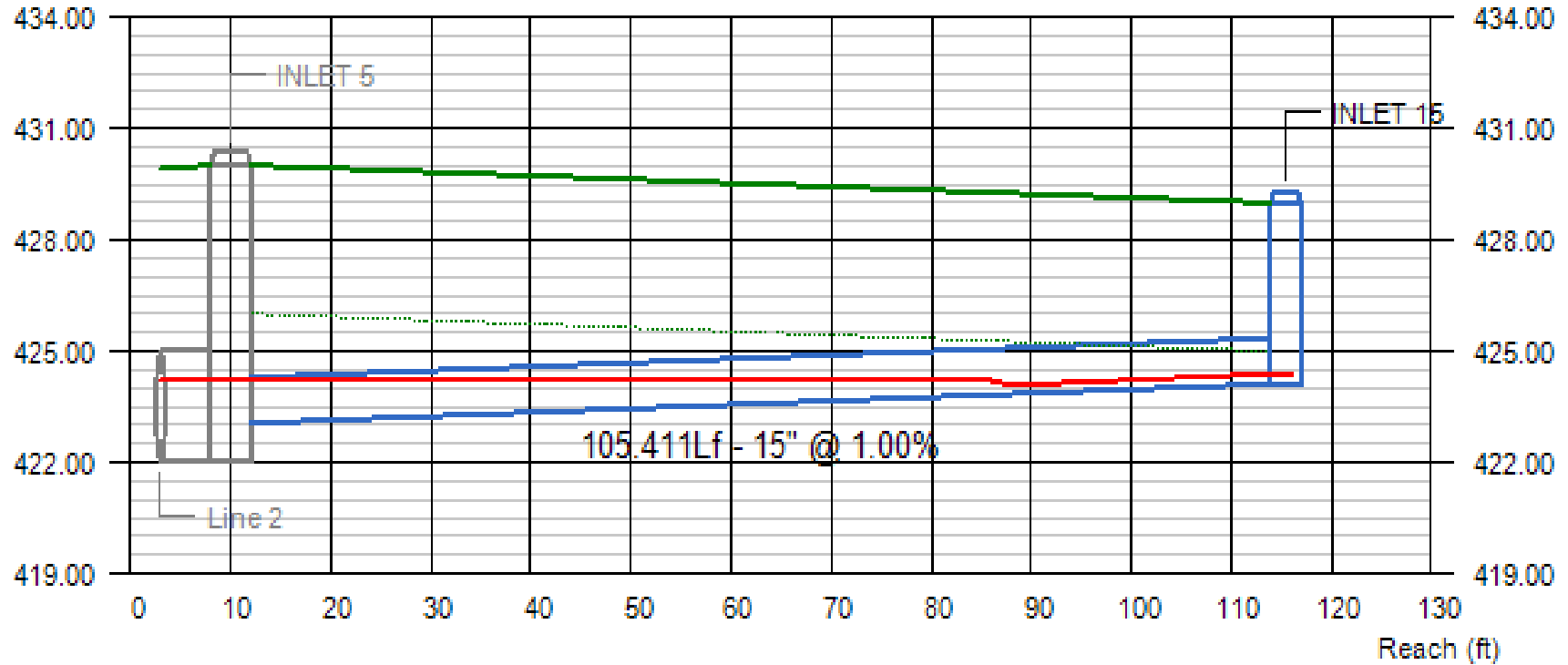
Project File:

No. Lines: 32

Run Date: 5/26/2022

Line 28 - INLET 15 OUTLET

Elev (ft)



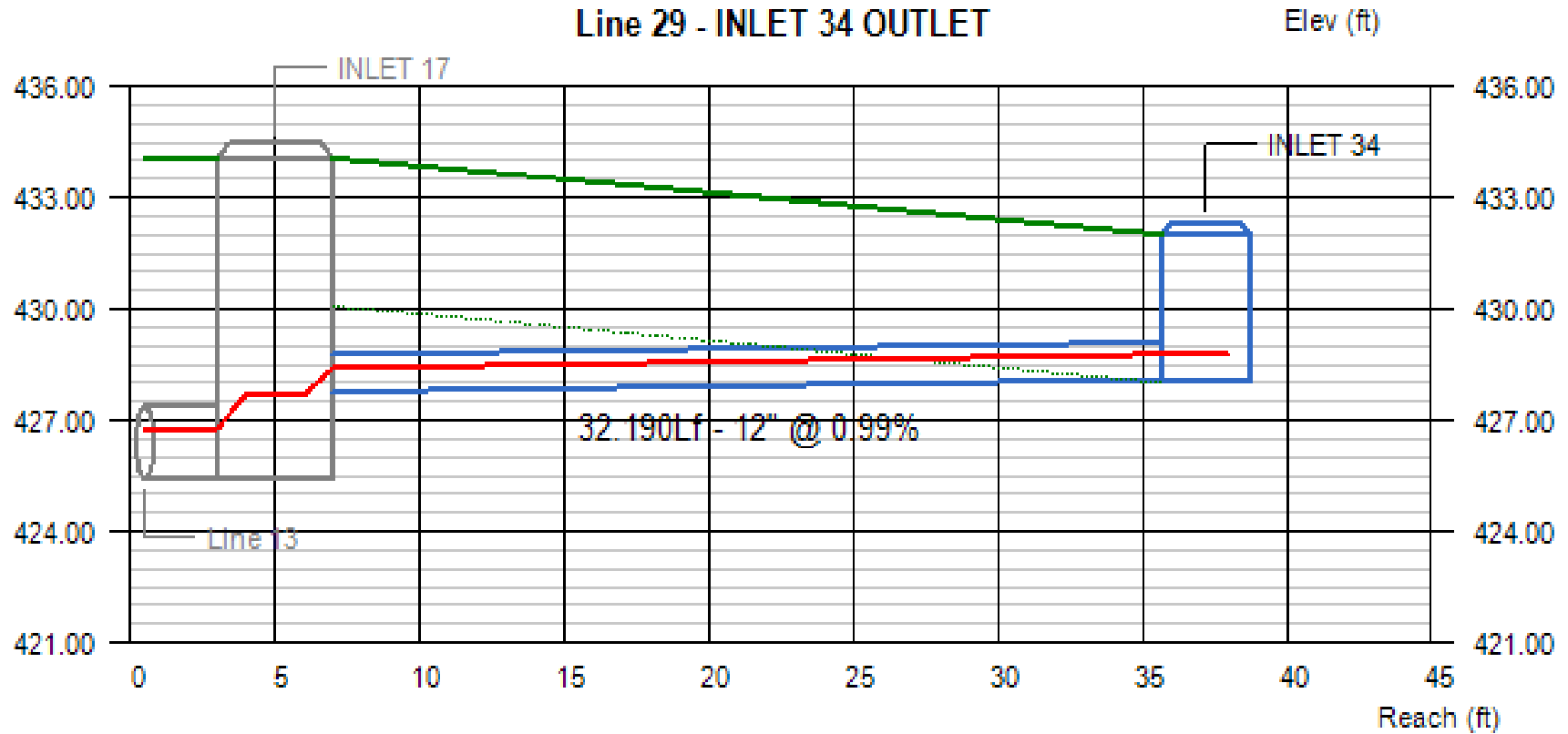
Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
28	0.58	423.05	424.10	1.18	0.30	0.30	424.23	424.40 j	424.40	0.49	2.61	5.70	3.65

Project File:

No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 29) - INLET 34 OUTLET



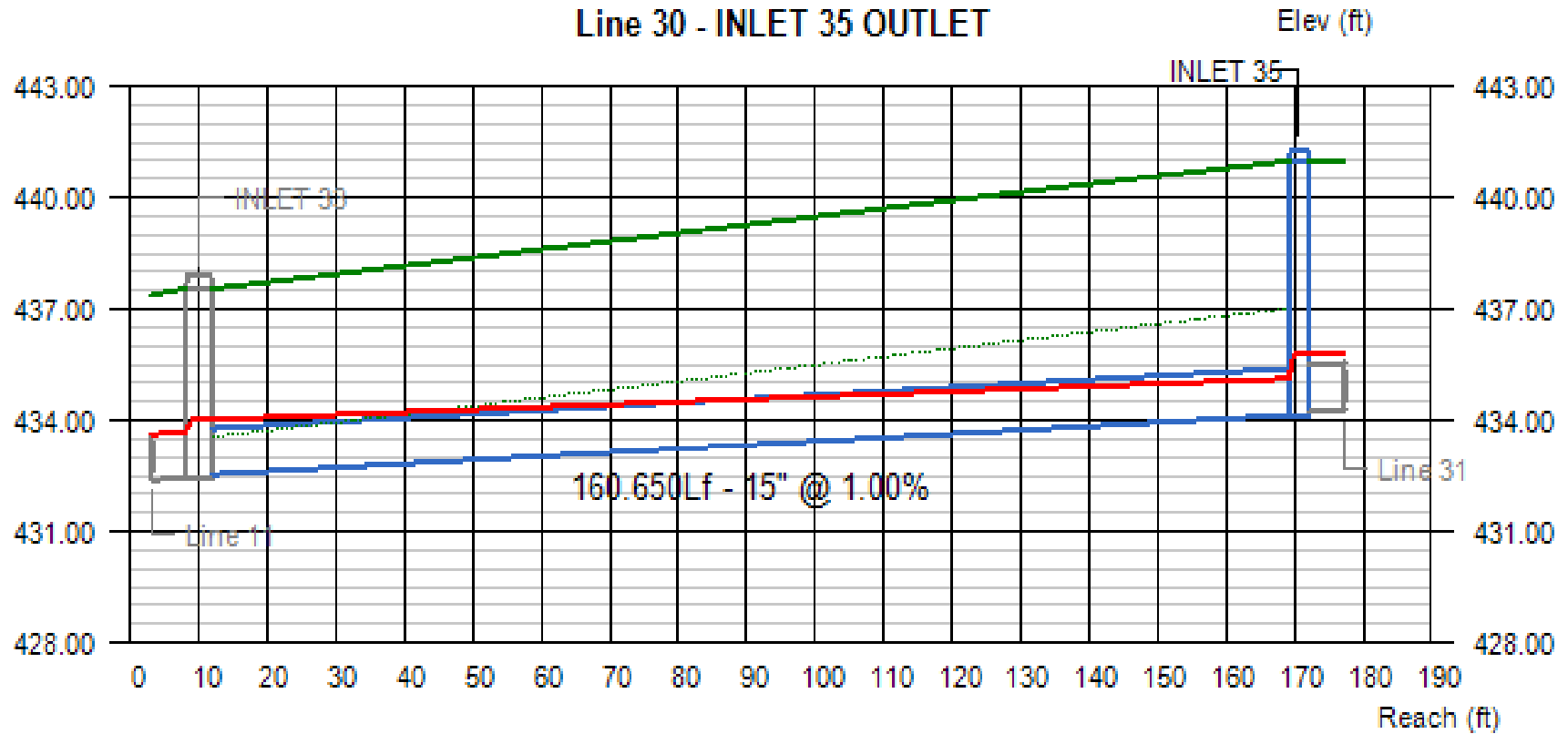
Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
29	2.55	427.77	428.09	0.63	0.68	0.68	428.40	428.77	428.77	4.92	4.46	5.30	2.91

Project File:

No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 30) - INLET 35 OUTLET



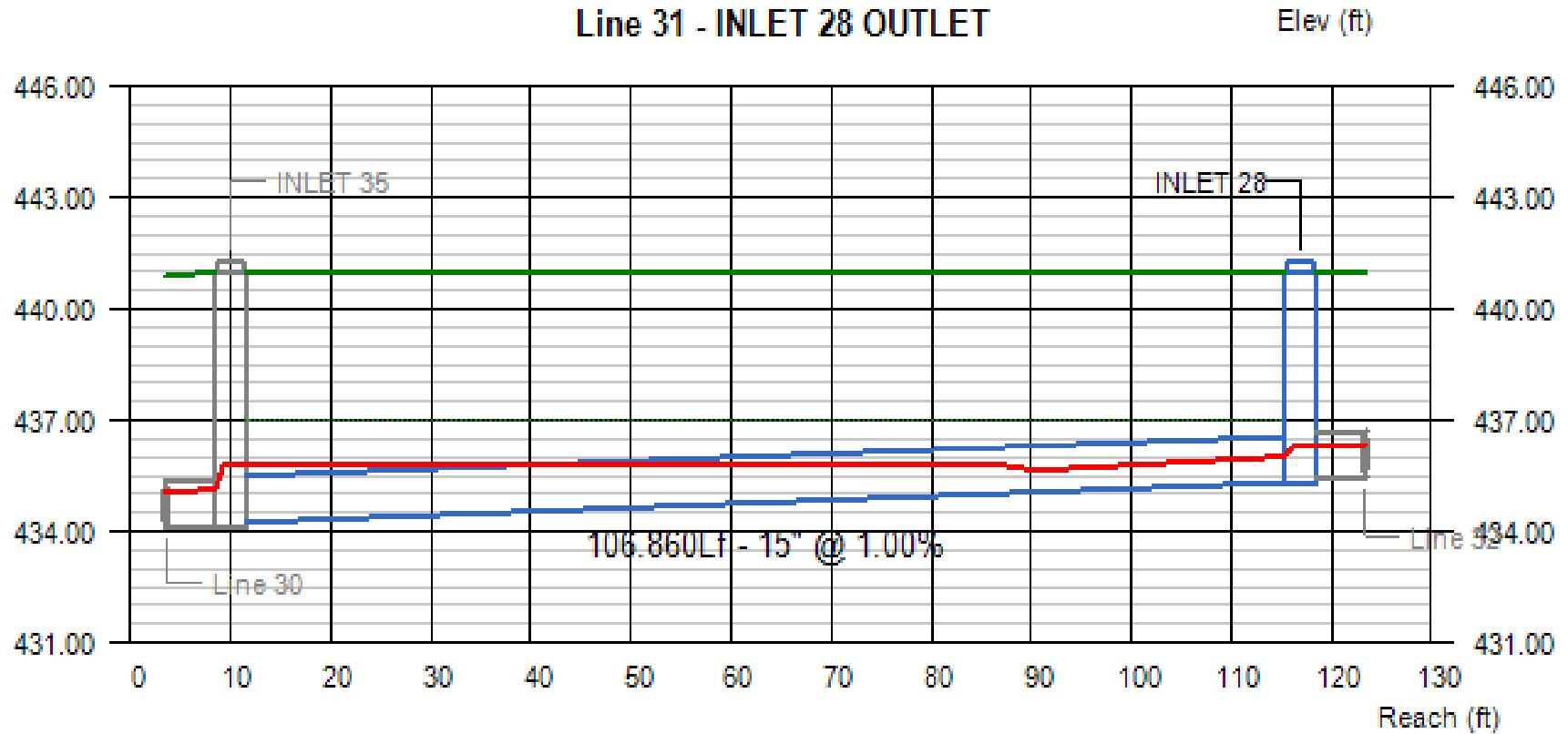
Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
30	5.49	432.53	434.14	1.25	0.97	1.62	434.03	435.11	435.76	4.47	5.34	3.77	5.61

Project File:

No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 31) - INLET 28 OUTLET



Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
31	3.02	434.24	435.31	1.25	0.70	0.98	435.76	436.01 j	436.29	2.47	4.26	5.51	4.44

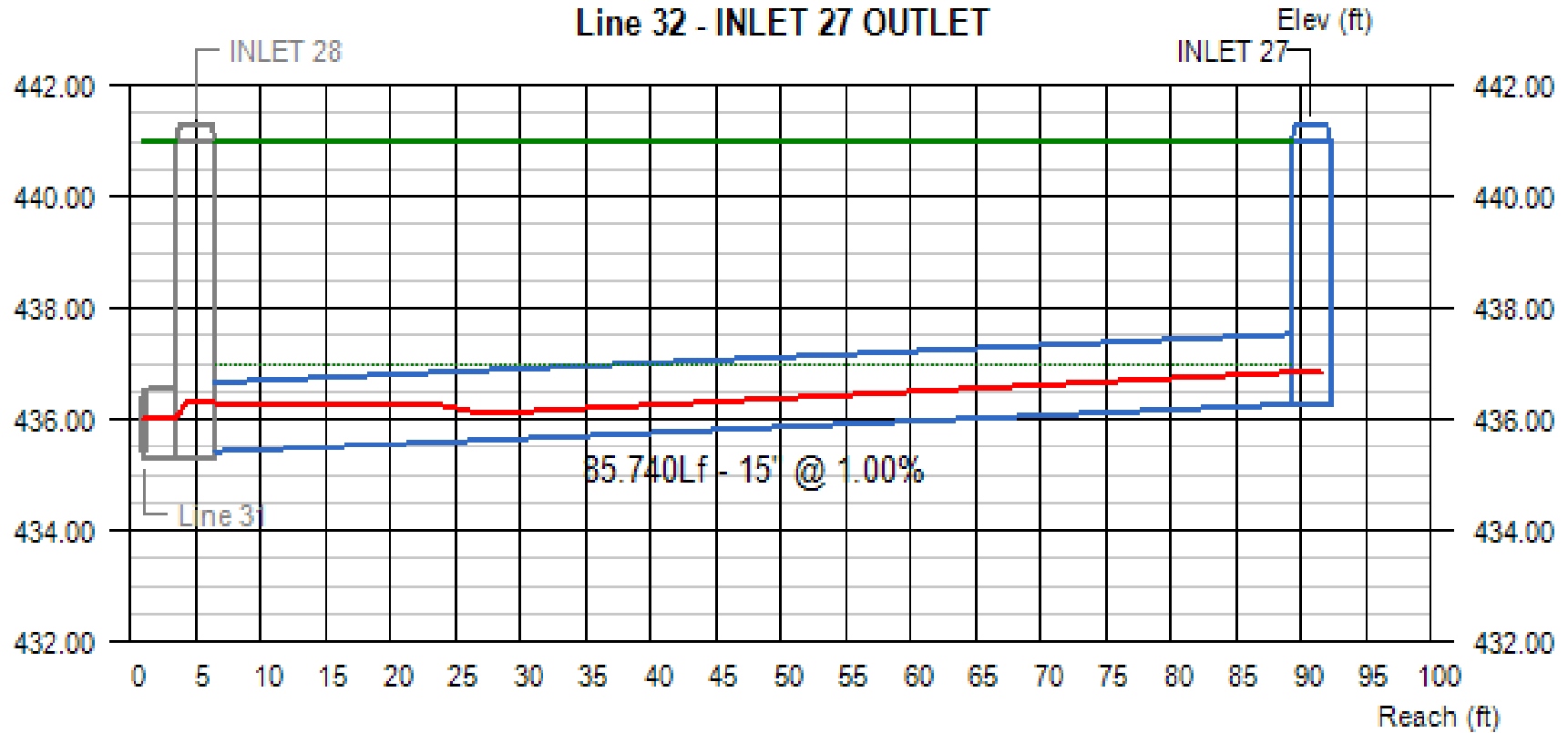
Project File:

No. Lines: 32

Run Date: 5/26/2022

Line Profile (Line 32) - INLET 27 OUTLET

Line 32 - INLET 27 OUTLET



Line #	Q (cfs)	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
		Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Hw (ft)	Dn (ft)	Up (ft)	Jnct (ft)	Dn (ft/s)	Up (ft/s)	Dn (ft)	Up (ft)
32	2.07	435.41	436.27	0.88	0.57	0.57	436.29	436.84 j	436.84	2.23	3.77	4.34	3.48

Project File:

No. Lines: 32

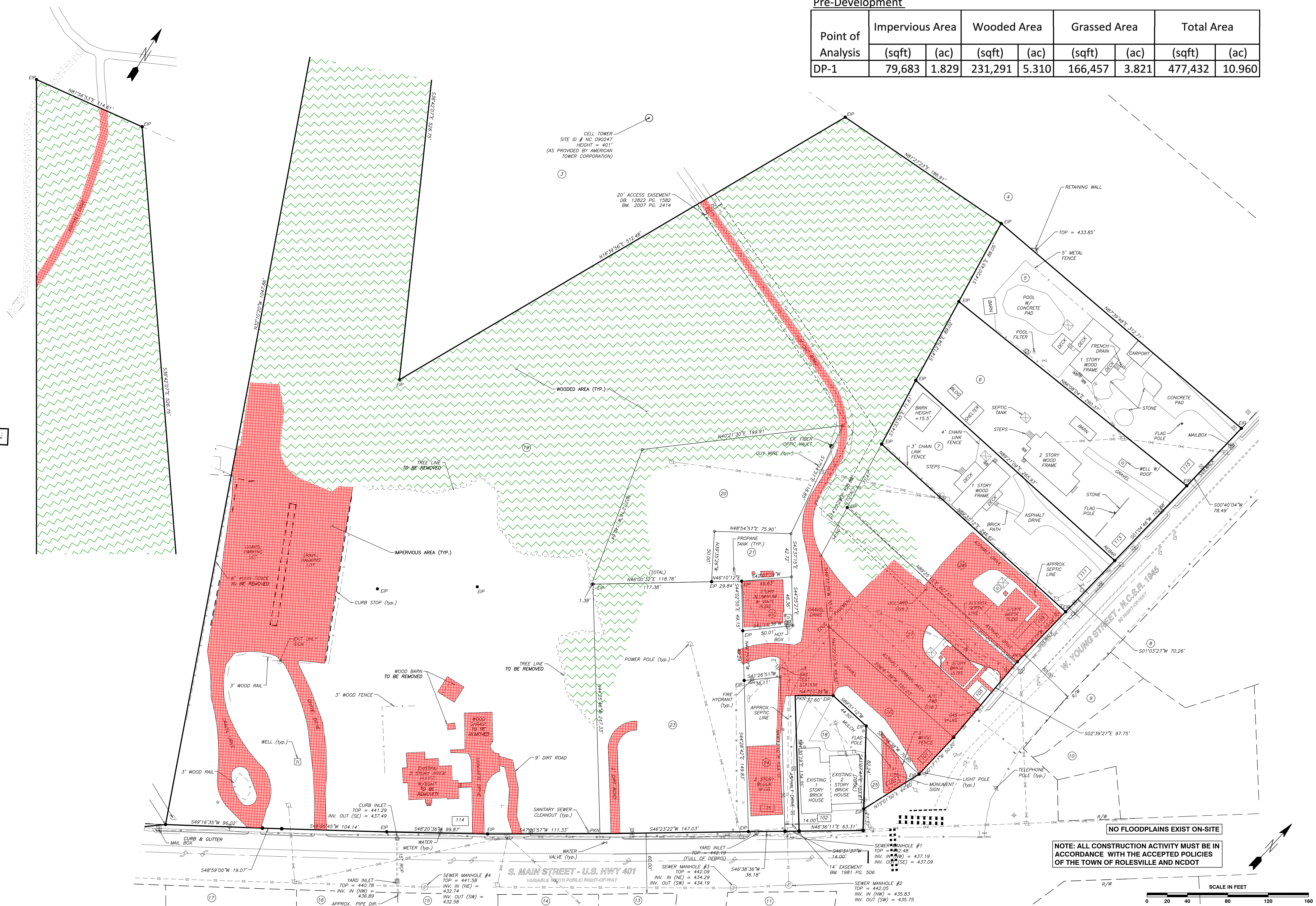
Run Date: 5/26/2022

APPENDIX

PRE-DEVELOPMENT DRAINAGE AREA MAP
POST-DEVELOPMENT DRAINAGE AREA MAP
USGS MAP
WAKE COUNTY SOILS MAP
FIRMETTE MAP
NOAA RAIN DATA

Pre-Development

Point of Analysis	Impervious Area		Wooded Area		Grassed Area		Total Area	
	(sqft)	(ac)	(sqft)	(ac)	(sqft)	(ac)	(sqft)	(ac)
DP-1	79,683	1.829	231,291	5.310	166,457	3.821	477,432	10.960



BASS, NIXON & KENNEDY, INC.
 CONSULTING ENGINEERS
 6310 CHAPEL HILL ROAD, SUITE 950, RALEIGH, NC 27607
 TELEPHONE: (919) 881-1122 FAX: (919) 881-6868
 CERTIFICATION NUMBERS: NCBELS (C-0110); NCBOLA (C-0267)

03-18881 PROGRESS RAB
 JOB NO. DATE DRAWN BY

PRE-DEVELOPMENT
 DRAINAGE MAP

SCALE: 1" = 40'
 CHK BY: MDB

COBBLESTONE
 VILLAGE
 MIXED USE DEVELOPMENT

TOWN OF ROLESVILLE, WAKE COUNTY, NORTH CAROLINA

NOT RELEASED FOR CONSTRUCTION OR BID SOLICITATION

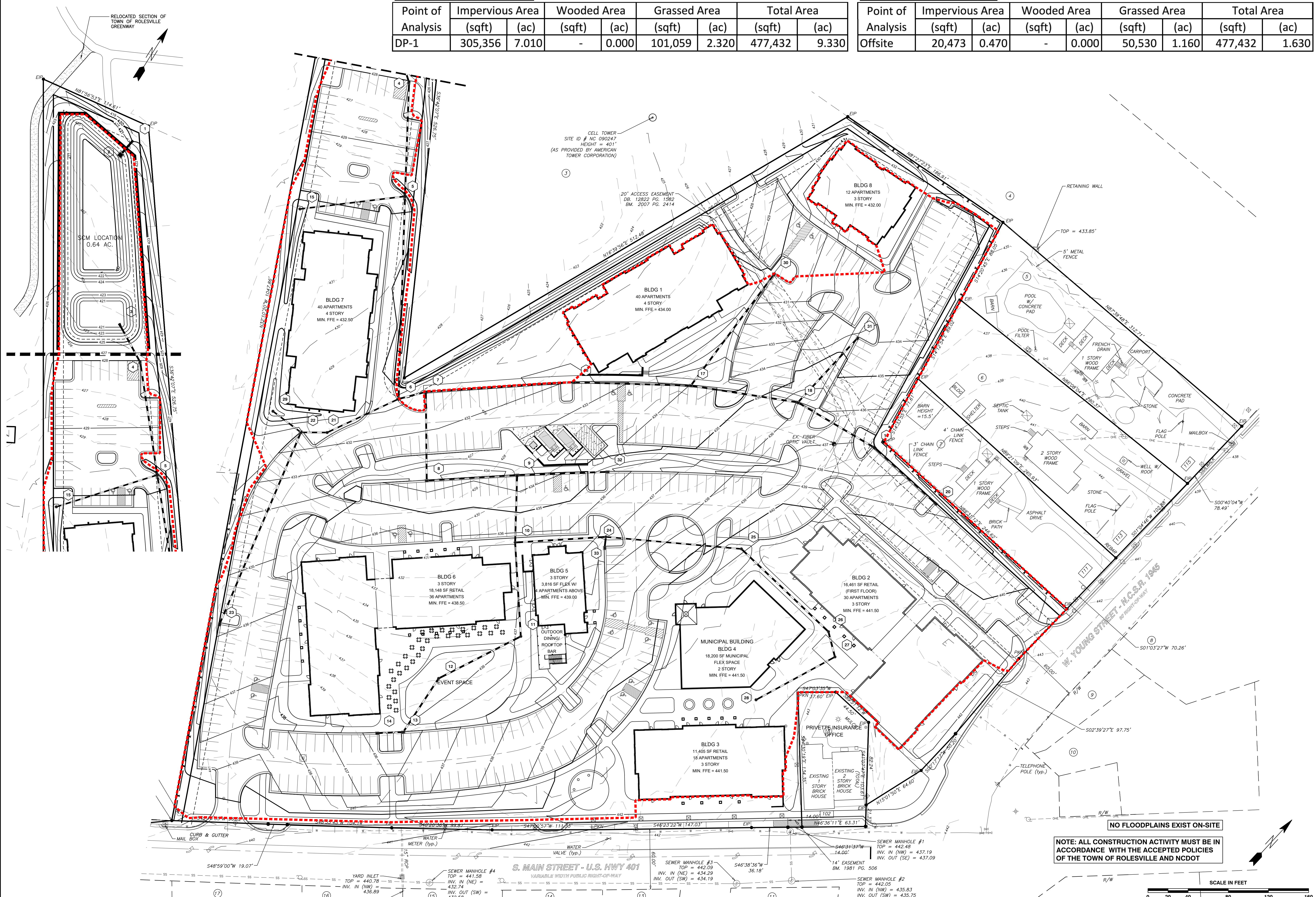
SHEET
 1 OF 3

Post-Development - to SCM

Point of Analysis	Impervious Area		Wooded Area		Grassed Area		Total Area	
	(sqft)	(ac)	(sqft)	(ac)	(sqft)	(ac)	(sqft)	(ac)
DP-1	305,356	7.010	-	0.000	101,059	2.320	477,432	9.330

Post-Development - Bypass

Point of Analysis	Impervious Area		Wooded Area		Grassed Area		Total Area	
	(sqft)	(ac)	(sqft)	(ac)	(sqft)	(ac)	(sqft)	(ac)
Offsite	20,473	0.470	-	0.000	50,530	1.160	477,432	1.630



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 CERTIFICATION NUMBERS: NCBELS (C-0110); NCBOLA (C-0267)

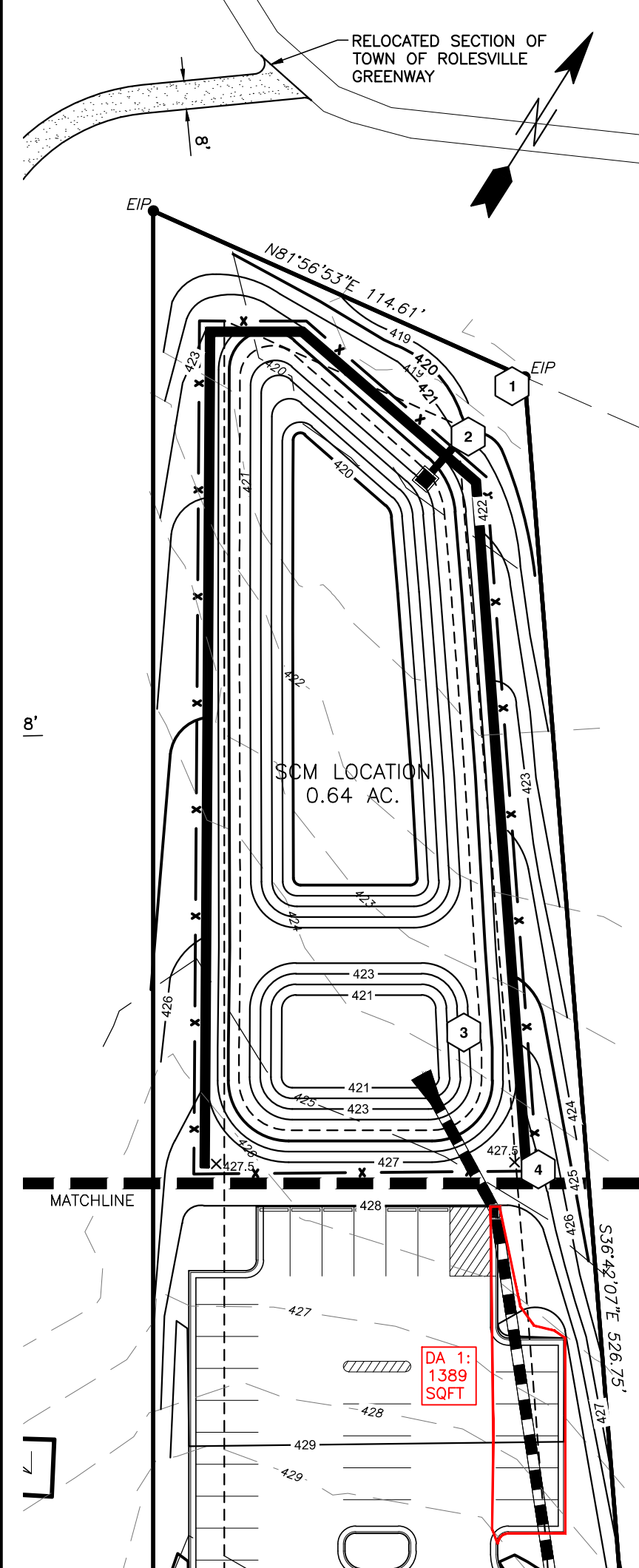
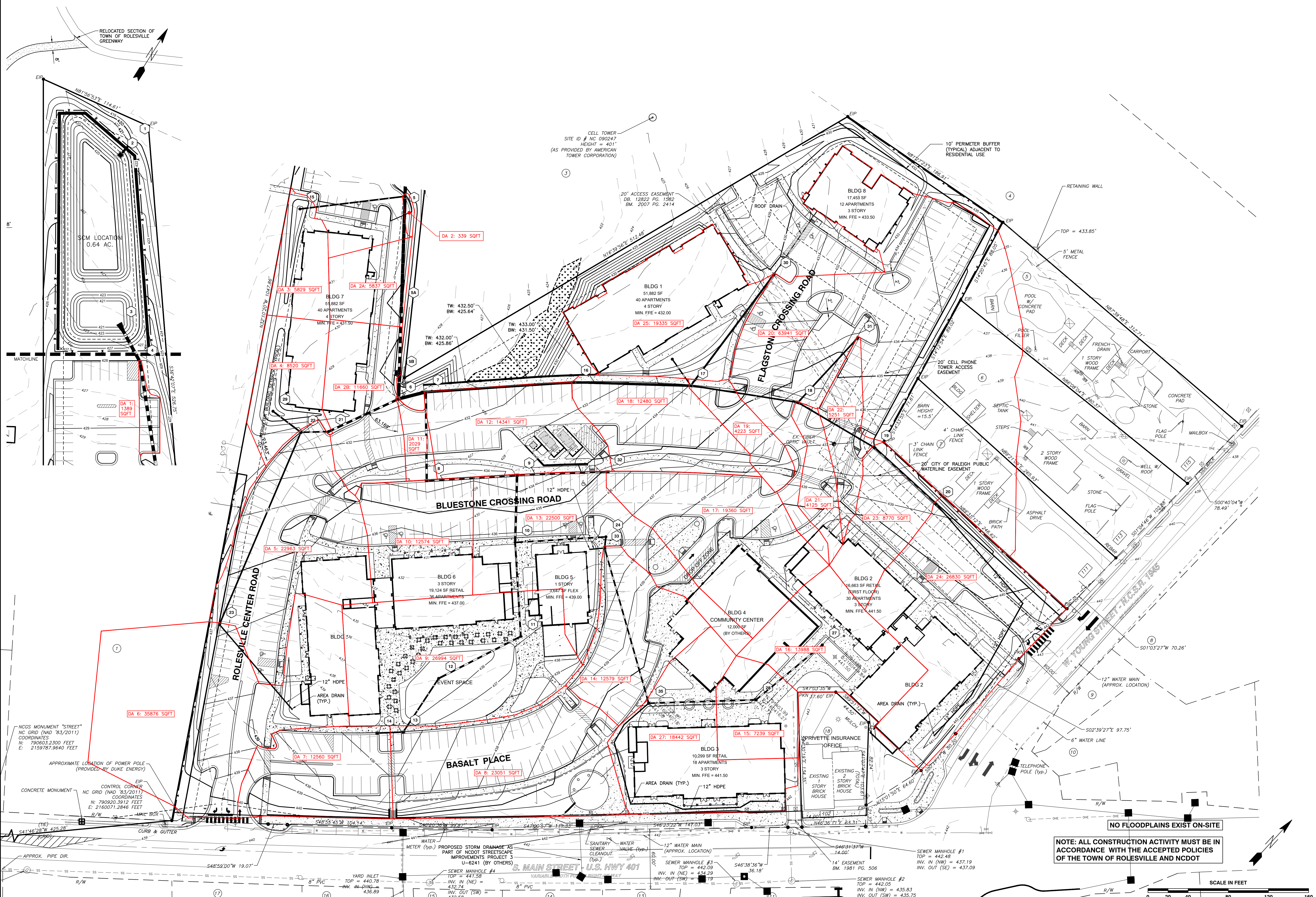
NO.	DATE	DESCRIPTION	BY

COBBLESTONE VILLAGE
MIXED USE DEVELOPMENT
 TOWN OF ROLESVILLE, WAKE COUNTY, NORTH CAROLINA

03-18881 PROGRESS RAB
 JOB NO. DATE DRAWN BY
 POST-DEVELOPMENT DRAINAGE MAP
 SCALE: 1" = 40'
 CHK BY: MDB

R:\2019\19187 - Rolesville Town Center\CIVIL\04 Construction\40 - 19187_Drainage Maps.dwg, POST DA MAP, 2/5/2021 12:24:06 PM, mrcmcmiller

NOT RELEASED FOR CONSTRUCTION OR BID SOLICITATION

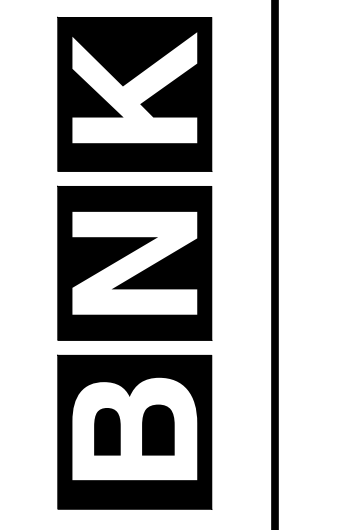
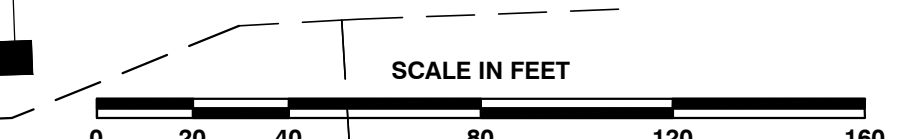


NCGS MONUMENT "STREET"
 NC GRID (NAD '83/2011)
 COORDINATES
 N: 790603.2300 FEET
 E: 2159787.9640 FEET

APPROXIMATE LOCATION OF POWER POLE
 (PROVIDED BY DUKE ENERGY)

EIP CONTROL CORNER
 NC GRID (NAD '83/2011)
 COORDINATES
 N: 790920.3912 FEET
 E: 2160071.2846 FEET
 R/W

NOTE: ALL CONSTRUCTION ACTIVITY MUST BE IN ACCORDANCE WITH THE ACCEPTED POLICIES OF THE TOWN OF ROLESVILLE AND NCDOT



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 CERTIFICATION NUMBERS: NCBELS (C-0110); NCBOLA (C-0267)

NO.	DATE	DESCRIPTION	BY

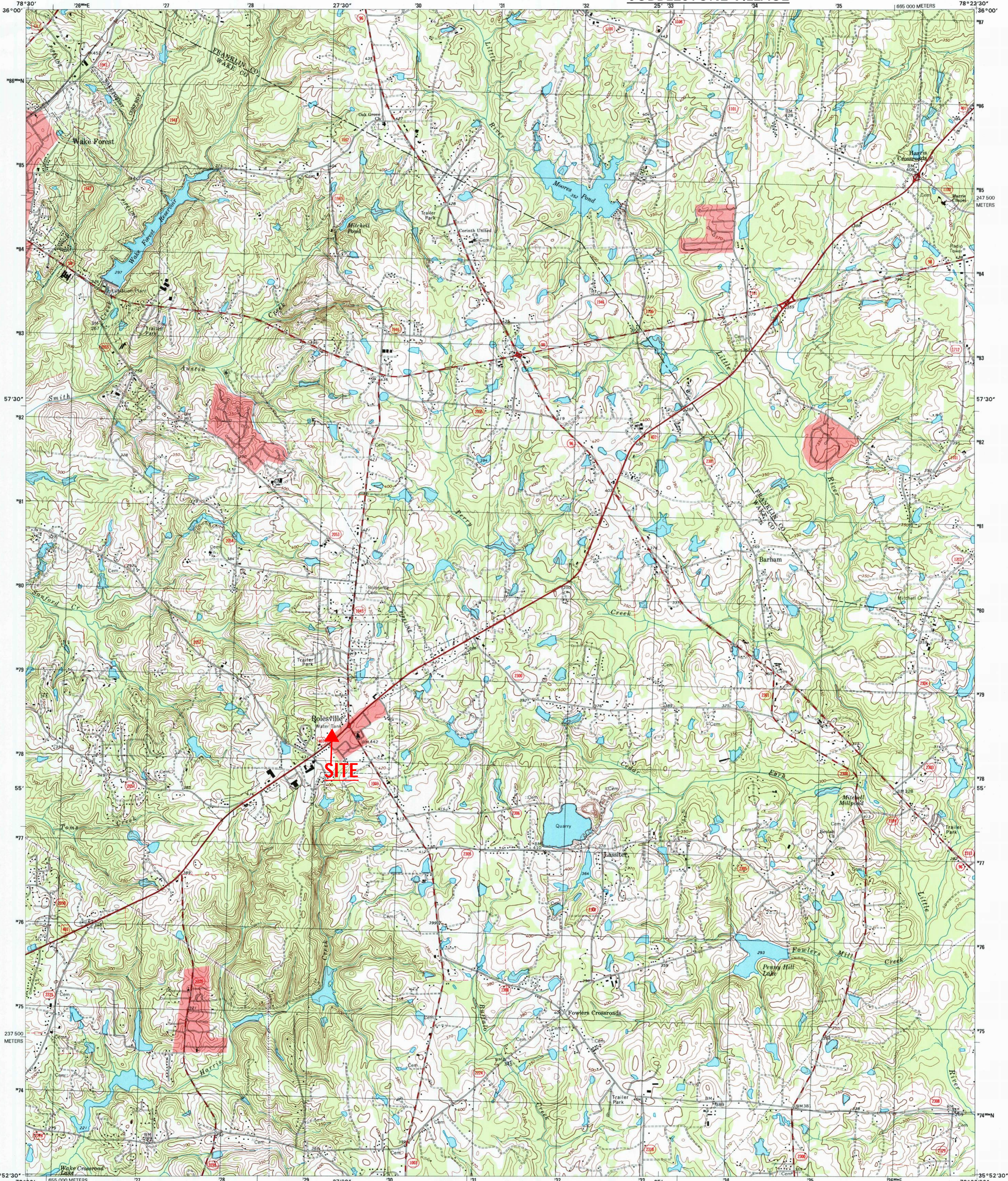
COBBLESTONE VILLAGE
MIXED USE DEVELOPMENT
 TOWN OF ROLESVILLE, WAKE COUNTY, NORTH CAROLINA

INLET DRAINAGE MAP

SCALE: 1" = 40'

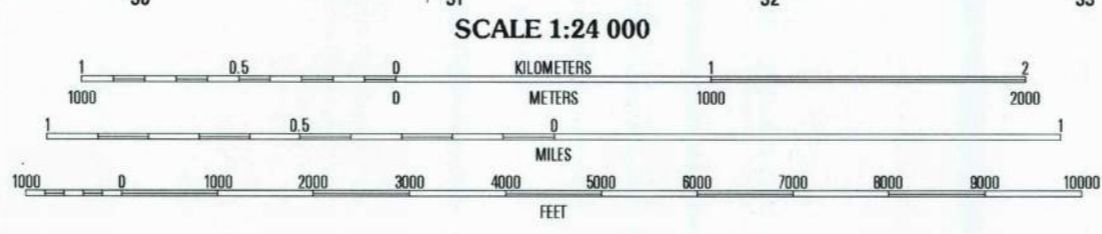
CHK BY: MDB

NOT RELEASED FOR CONSTRUCTION OR BID SOLICITATION



Produced by the United States Geological Survey in cooperation with the North Carolina Department of Environment and Natural Resources. Topography compiled 1964. Planimetry derived from imagery taken 1993 and other sources. Survey control current as of 1967. North American Datum of 1983 (NAD 83). Projection and 1 000-meter grid: Universal Transverse Mercator, zone 17. 2 500-meter ticks: North Carolina Coordinate System of 1983. North American Datum of 1927 (NAD 27) is shown by dashed corner ticks. The values of the shift between NAD 83 and NAD 27 for 7.5-minute intersections are obtainable from National Geodetic Survey NADCON software. Landmark buildings verified 1967.

UTM GRID AND 1999 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
RECEIVED
JUN 3 0 1999
USGS NMD
HISTORICAL MAP ARCHIVES



SCALE 1:24 000
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
TO CONVERT FROM FEET TO METERS, MULTIPLY BY 0.3048



ADJOINING 7.5' QUADRANGLE NAMES

1	2	3
4	5	6
7	8	

1 Gosom
2 Franklinton
3 Lenoir
4 Wake Forest
5 Bunn West
6 Raleigh East
7 Raleigh
8 Zebulon

ROAD CLASSIFICATION
Primary highway hard surface
Secondary highway hard surface
Light-duty road, hard or improved surface
Unimproved road
Interstate Route
U.S. Route
State Route

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, P.O. BOX 25286, DENVER, COLORADO 80225
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROLESVILLE, NC
1993
NIMA 5355 IV NW-SERIES V842



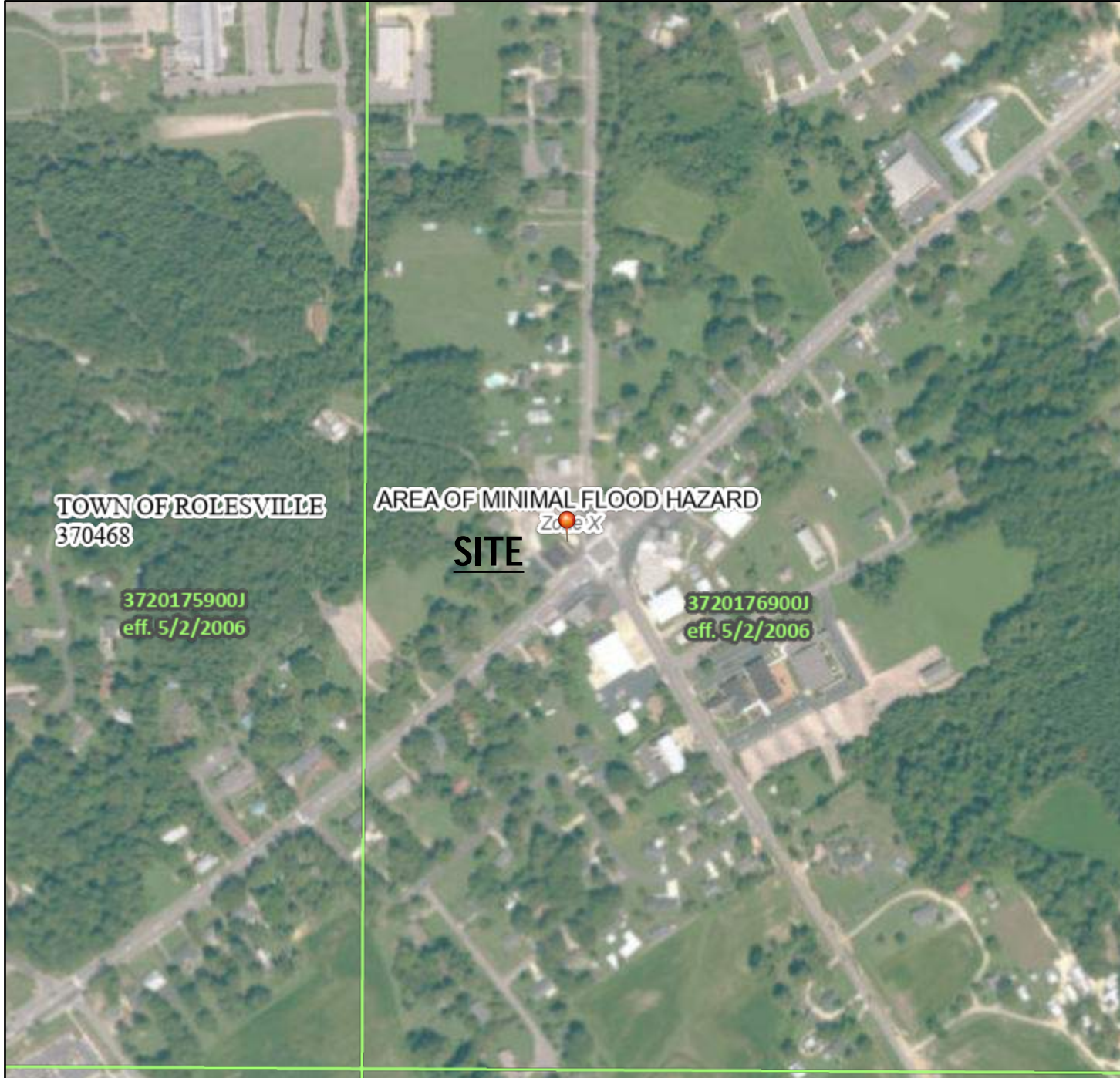


1 Mile
5000 Feet

Scale 1:15840
(Joins sheet 21)



Rolesville
Rolesville Church
SITE



1) 688 85(8) 8888

6882 6886		LWHRW %DHJRRG OHDWLRQ % -FCH\$ 9 \$
		LWK%RUHFWK -FCH\$ 8-9 \$
		SHODWRAJRRG
2682 2686		\$DQD & OHHJRRG EPUG \$JHD/ R DQDQ FROFHIO RRG ZWKDHU DH G-SWKOHV WKOQRQHRRW RU ZWKGDLDQ DUHD/ R OHV WKOQRCHV DUEHOHCH;
		XWXUH & QD VLRLQ/ \$DQD & OHHJRRG EPUG -FCH;
		\$JHZWK & GHGJRRG & VNGHWR HMH GH RVHV -FCH;
		\$JHZWKJRRG & VNGHWRHMH -FCH
2688 2692		\$JHD QLEO JRRG EPUG -FCH; (HFWLYHV
		\$JHD & GHWHUEHGJRRG EPUG -FCH
6888 6892		& OQD & OYHUW RU & VRURZU
		HMH LN RU JRRGDO
		\$JRW & FVLRQ/ ZWKSDQD & OHH
		DVHU & OHHJRRG OHDWLRQ
		& DWDD JDDQFW
		%DHJRRG OHDWLRQLQ %
		LEW R & VXG
		-XULVL FVLRQ/ & RQDUA
2698 2702		& DWDD JDDQFW %DHOLQH
		\$JRLQH %DHOLQH
		\$JURD&LFJ DVXUH
6898 6902		LJLWDD DWD\$DLODQH
		RLJLWDD DWD\$DLODQH
		8888G
		7HSLQQL VSDHGRQWKHESLV DQDSSJRLBWH SRLQV VHOHFWHG E WKH XHU DQG GRHV CRW UHSH DQDWKRLWDLV YHSURSUW O RFDWLRQ

7KLV ESFFBOLHV ZWKJVV WDDQDUG/ IRU WKHXHR
GLJWDD IO RRGES/ LI LW LV CRW YRLGDV GHVULHG BDRZ
7KHEDHESVFRQFFBOLHV ZWKJVV EDHES
DFXUR WDDQDUG/

7KHIO RRGKQJGLQRUBMLRLV GHULYHG GLUHFWO IURWKH
DVKRLWDLV YH %ZEVHUYLHV SURLGGE B 7KLV ES
ZV HSRUWHGRQ DV "3 DQG GRHV CRW
UHOHFW FROQH RU DQDQVW VEHDXQV WR WKLVDWHDQDQ
WLP 7KH %DQGHIIFWLYHLQRUBMLRLV FROQRU
EFFFVSHUWHGGE QZGDVDRYHU WLP

7KLVESLBHLV YRLGLI WKHQHURU RUHR WKHIROORZQJES
HDFQWVGRQRW DSSDU EDHESLBHU IO RRGJRODDEHV
OHFHG VRODHEU ESFJHDWLRQDWH FFRQLGQWLILHV
)SSQDQ QEHU DQG GHIIFWLYHGDMH DSLBHV IRU
X888G DQG XRGUQLJGDUHDV FROQRW EHXVHGIRU
UHKDWRUJ SUSRHV



NOAA Atlas 14, Volume 2, Version 3
Location name: Rolesville, North Carolina, USA*
Latitude: 35.9233°, Longitude: -78.4579°
Elevation: 444.08 ft**
 * source: ESRI Maps
 ** source: USGS



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	4.84 (4.43-5.29)	5.62 (5.15-6.13)	6.41 (5.87-6.98)	7.19 (6.58-7.85)	7.98 (7.27-8.70)	8.60 (7.81-9.38)	9.17 (8.26-9.98)	9.66 (8.65-10.5)	10.2 (9.07-11.1)	10.7 (9.43-11.7)
10-min	3.86 (3.54-4.22)	4.49 (4.12-4.91)	5.13 (4.70-5.60)	5.75 (5.26-6.27)	6.36 (5.79-6.93)	6.85 (6.22-7.47)	7.28 (6.56-7.93)	7.66 (6.86-8.35)	8.08 (7.18-8.82)	8.42 (7.42-9.22)
15-min	3.22 (2.95-3.52)	3.77 (3.45-4.11)	4.32 (3.96-4.72)	4.85 (4.44-5.29)	5.38 (4.89-5.86)	5.78 (5.25-6.30)	6.14 (5.53-6.68)	6.44 (5.77-7.03)	6.78 (6.02-7.40)	7.05 (6.21-7.71)
30-min	2.21 (2.02-2.41)	2.60 (2.38-2.84)	3.07 (2.82-3.35)	3.51 (3.21-3.83)	3.98 (3.62-4.34)	4.36 (3.95-4.75)	4.70 (4.24-5.12)	5.01 (4.49-5.47)	5.39 (4.79-5.89)	5.71 (5.03-6.25)
60-min	1.38 (1.26-1.51)	1.63 (1.50-1.78)	1.97 (1.81-2.15)	2.29 (2.09-2.50)	2.65 (2.41-2.89)	2.95 (2.68-3.22)	3.24 (2.92-3.53)	3.52 (3.15-3.84)	3.87 (3.44-4.22)	4.17 (3.67-4.56)
2-hr	0.804 (0.732-0.887)	0.957 (0.874-1.05)	1.17 (1.06-1.28)	1.37 (1.25-1.50)	1.61 (1.45-1.76)	1.83 (1.64-1.99)	2.03 (1.81-2.22)	2.24 (1.98-2.44)	2.51 (2.20-2.74)	2.74 (2.39-3.01)
3-hr	0.568 (0.516-0.629)	0.676 (0.617-0.746)	0.828 (0.754-0.913)	0.979 (0.888-1.08)	1.16 (1.05-1.28)	1.33 (1.19-1.46)	1.49 (1.32-1.63)	1.66 (1.46-1.82)	1.89 (1.65-2.07)	2.09 (1.81-2.30)
6-hr	0.342 (0.312-0.378)	0.407 (0.372-0.448)	0.499 (0.455-0.548)	0.591 (0.537-0.648)	0.704 (0.637-0.771)	0.807 (0.724-0.882)	0.910 (0.810-0.993)	1.02 (0.897-1.11)	1.17 (1.01-1.27)	1.30 (1.12-1.42)
12-hr	0.200 (0.183-0.221)	0.239 (0.219-0.262)	0.294 (0.269-0.322)	0.350 (0.319-0.383)	0.420 (0.381-0.459)	0.485 (0.436-0.527)	0.550 (0.489-0.597)	0.620 (0.546-0.673)	0.716 (0.621-0.778)	0.806 (0.688-0.876)
24-hr	0.119 (0.111-0.128)	0.144 (0.134-0.155)	0.181 (0.168-0.195)	0.210 (0.195-0.226)	0.250 (0.231-0.269)	0.282 (0.260-0.303)	0.314 (0.289-0.338)	0.348 (0.319-0.375)	0.395 (0.360-0.426)	0.432 (0.392-0.466)
2-day	0.069 (0.064-0.074)	0.083 (0.078-0.090)	0.104 (0.097-0.112)	0.120 (0.111-0.129)	0.142 (0.131-0.153)	0.159 (0.147-0.171)	0.177 (0.163-0.191)	0.196 (0.179-0.211)	0.221 (0.201-0.239)	0.241 (0.219-0.261)
3-day	0.049 (0.046-0.052)	0.059 (0.055-0.063)	0.073 (0.068-0.078)	0.084 (0.078-0.090)	0.099 (0.092-0.106)	0.111 (0.103-0.119)	0.124 (0.114-0.133)	0.136 (0.125-0.147)	0.154 (0.141-0.166)	0.168 (0.153-0.181)
4-day	0.039 (0.036-0.041)	0.046 (0.043-0.050)	0.057 (0.054-0.061)	0.066 (0.062-0.071)	0.078 (0.072-0.083)	0.087 (0.081-0.093)	0.097 (0.089-0.104)	0.107 (0.098-0.115)	0.121 (0.110-0.129)	0.131 (0.120-0.141)
7-day	0.026 (0.024-0.027)	0.031 (0.029-0.033)	0.037 (0.035-0.040)	0.043 (0.040-0.046)	0.050 (0.047-0.053)	0.056 (0.052-0.060)	0.062 (0.057-0.066)	0.068 (0.063-0.073)	0.076 (0.070-0.082)	0.083 (0.076-0.089)
10-day	0.020 (0.019-0.022)	0.024 (0.023-0.026)	0.029 (0.027-0.031)	0.033 (0.031-0.035)	0.038 (0.036-0.041)	0.043 (0.040-0.045)	0.047 (0.043-0.050)	0.051 (0.047-0.055)	0.057 (0.052-0.061)	0.061 (0.056-0.066)
20-day	0.014 (0.013-0.015)	0.016 (0.015-0.017)	0.019 (0.018-0.020)	0.022 (0.020-0.023)	0.025 (0.023-0.026)	0.027 (0.025-0.029)	0.030 (0.028-0.032)	0.032 (0.030-0.034)	0.036 (0.033-0.038)	0.039 (0.035-0.041)
30-day	0.011 (0.011-0.012)	0.013 (0.013-0.014)	0.016 (0.015-0.017)	0.017 (0.016-0.018)	0.020 (0.018-0.021)	0.021 (0.020-0.023)	0.023 (0.021-0.024)	0.025 (0.023-0.026)	0.027 (0.025-0.029)	0.029 (0.027-0.031)
45-day	0.010 (0.009-0.010)	0.011 (0.011-0.012)	0.013 (0.012-0.014)	0.014 (0.013-0.015)	0.016 (0.015-0.017)	0.017 (0.016-0.018)	0.018 (0.017-0.019)	0.020 (0.018-0.021)	0.021 (0.020-0.022)	0.022 (0.021-0.024)
60-day	0.009 (0.008-0.009)	0.010 (0.010-0.011)	0.011 (0.011-0.012)	0.013 (0.012-0.013)	0.014 (0.013-0.015)	0.015 (0.014-0.016)	0.016 (0.015-0.017)	0.017 (0.016-0.018)	0.018 (0.017-0.019)	0.019 (0.018-0.020)

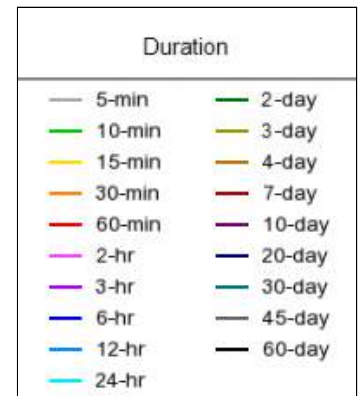
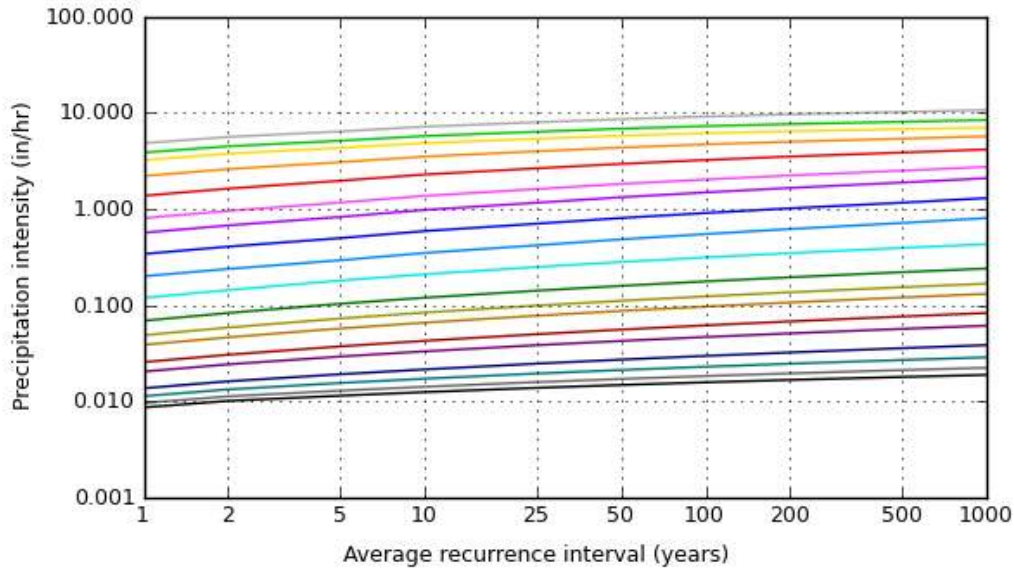
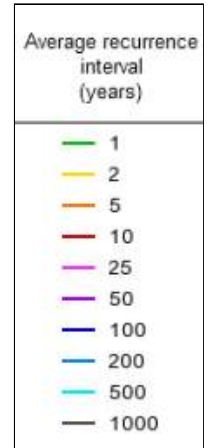
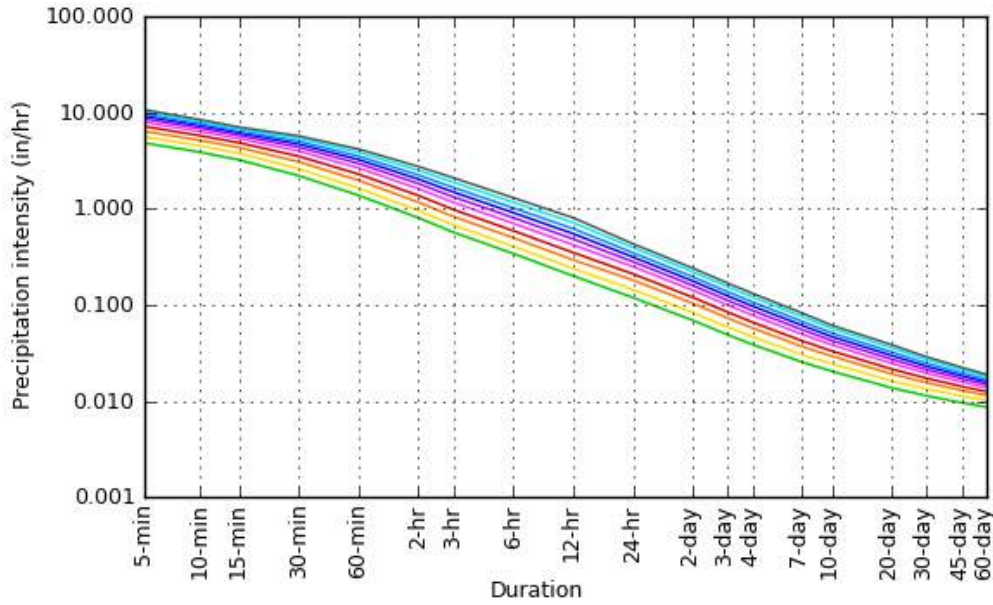
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average 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.

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PF graphical

PDS-based intensity-duration-frequency (IDF) curves

Latitude: 35.9233°, Longitude: -78.4579°



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Maps & arials

Small scale terrain



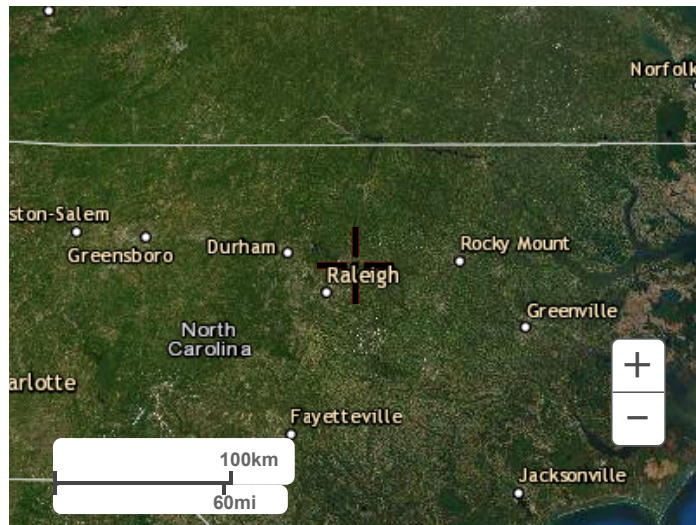
Large scale terrain



Large scale map



Large scale aerial



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