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STORMWATER CALCULATIONS

COBBLESTONE VILLAGE
SOUTH MAIN STREET
ROLESVILLE, NORTH CAROLINA
TOWN OF ROLESVILLE PROJECT # 19157

PREPARED BY
BASS, NIXON & KENNEDY, INC.
FEBRUARY 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 1CALCULATIONS
1 AND 100 – YEAR ROUTING CALCULATIONS

COBBLESTONE VILLAGE
FEBRUARY 2021

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*(% 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/s^2
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)**

COBBLESTONE VILLAGE – ROLESVILLE, NC

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:

	Rational Method Storm Event (cfs)				
Description	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**

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.

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

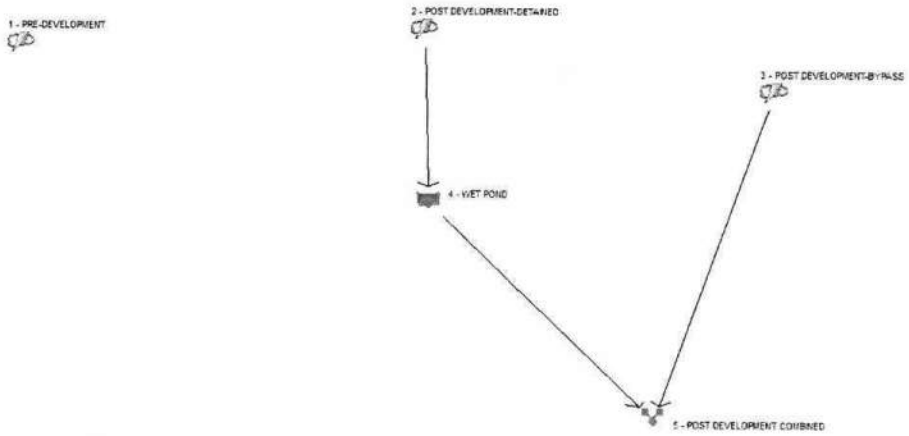
Average Depth Calculation

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

Watershed Model Schematic



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

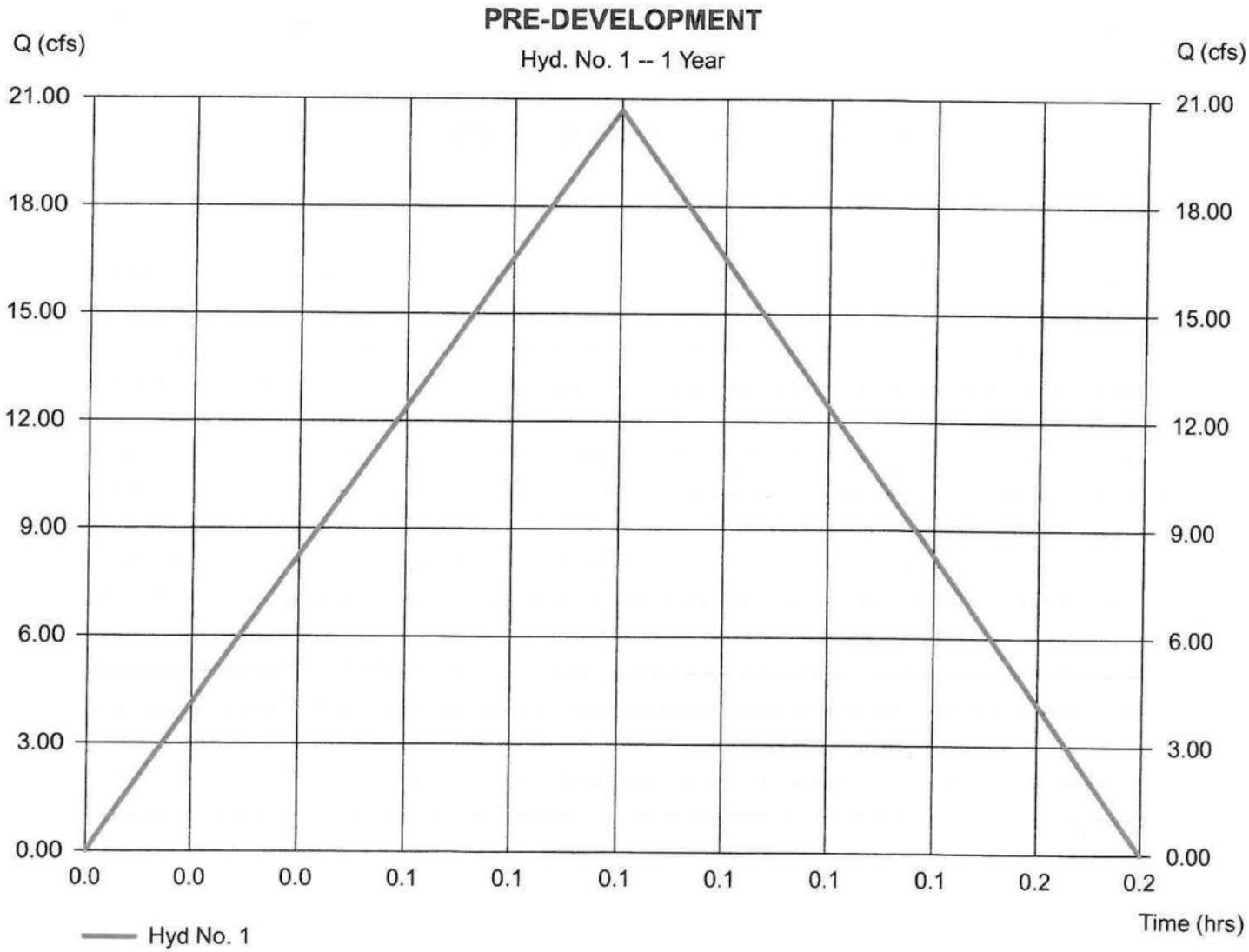
Hydrograph Report

Hyd. No. 1

PRE-DEVELOPMENT

Hydrograph type	= Rational	Peak discharge	= 20.69 cfs
Storm frequency	= 1 yrs	Time to peak	= 0.08 hrs
Time interval	= 1 min	Hyd. volume	= 6,207 cuft
Drainage area	= 10.960 ac	Runoff coeff.	= 0.41*
Intensity	= 4.604 in/hr	Tc by User	= 5.00 min
IDF Curve	= WakeCounty.IDF	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

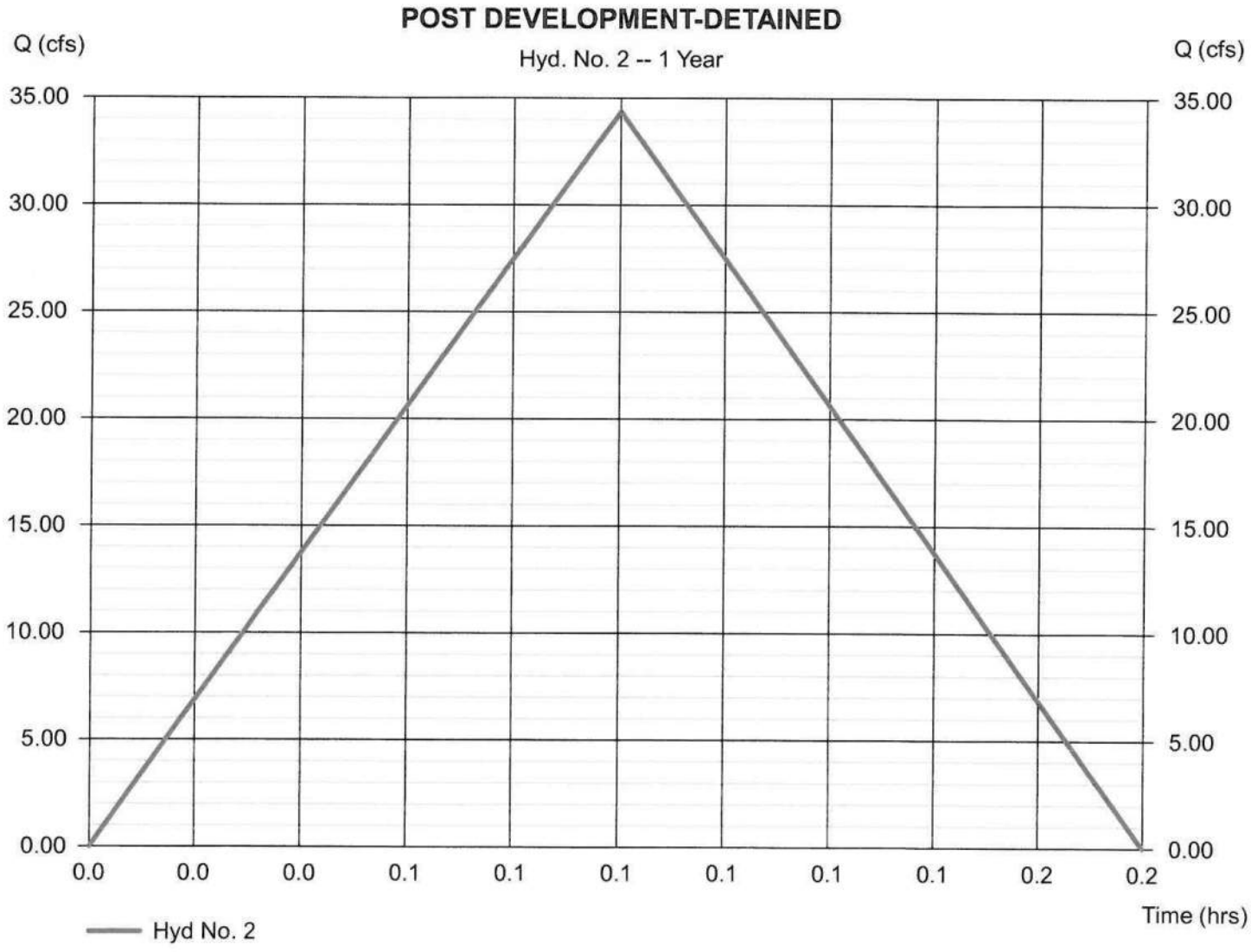
Friday, Feb 5, 2021

Hyd. No. 2

POST DEVELOPMENT-DETAINED

Hydrograph type	= Rational	Peak discharge	= 34.37 cfs
Storm frequency	= 1 yrs	Time to peak	= 0.08 hrs
Time interval	= 1 min	Hyd. volume	= 10,310 cuft
Drainage area	= 9.330 ac	Runoff coeff.	= 0.8*
Intensity	= 4.604 in/hr	Tc by User	= 5.00 min
IDF Curve	= WakeCounty.IDF	Asc/Rec limb fact	= 1/1

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



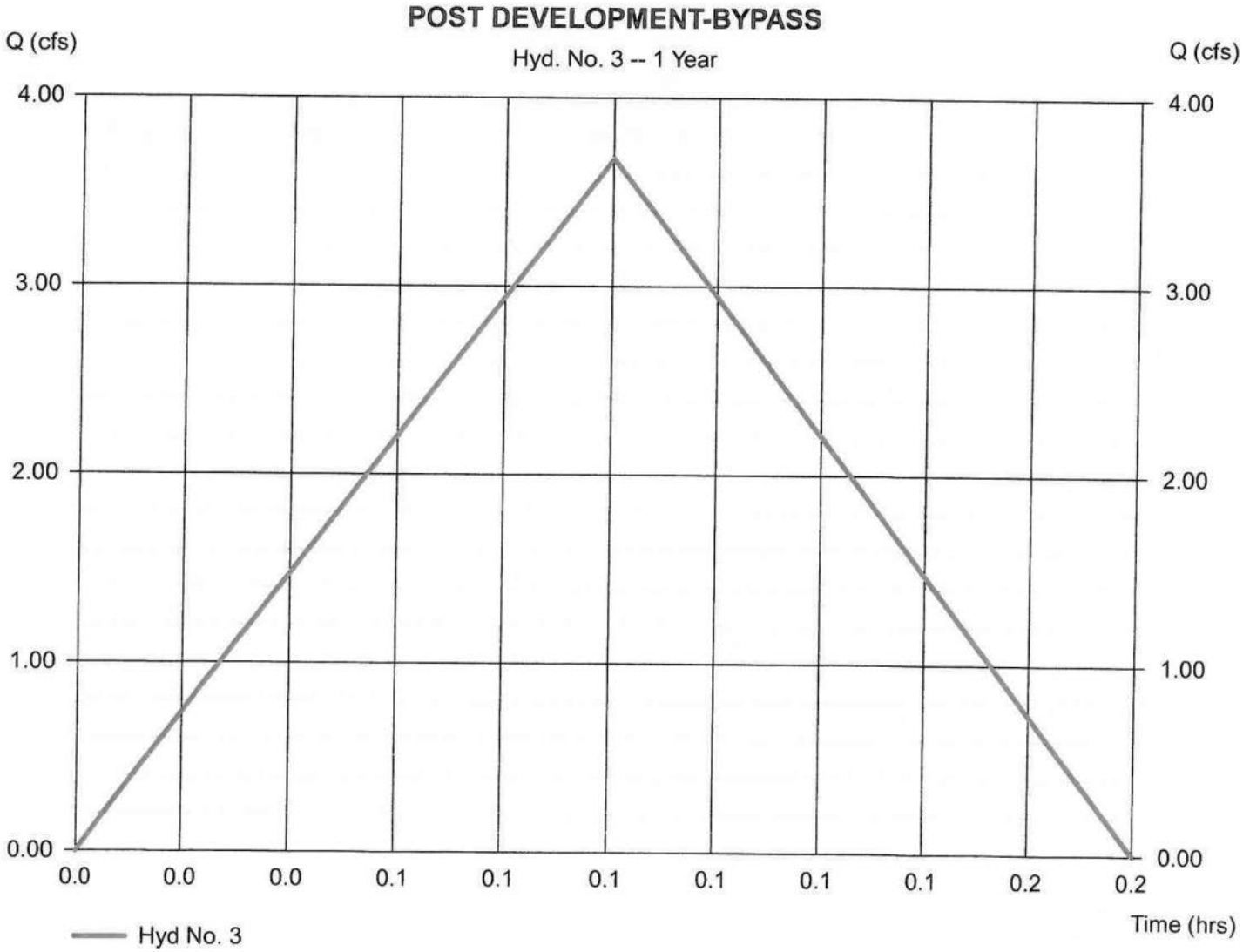
Hydrograph Report

Hyd. No. 3

POST DEVELOPMENT-BYPASS

Hydrograph type	= Rational	Peak discharge	= 3.677 cfs
Storm frequency	= 1 yrs	Time to peak	= 0.08 hrs
Time interval	= 1 min	Hyd. volume	= 1,103 cuft
Drainage area	= 1.630 ac	Runoff coeff.	= 0.49*
Intensity	= 4.604 in/hr	Tc by User	= 5.00 min
IDF Curve	= WakeCounty.IDF	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

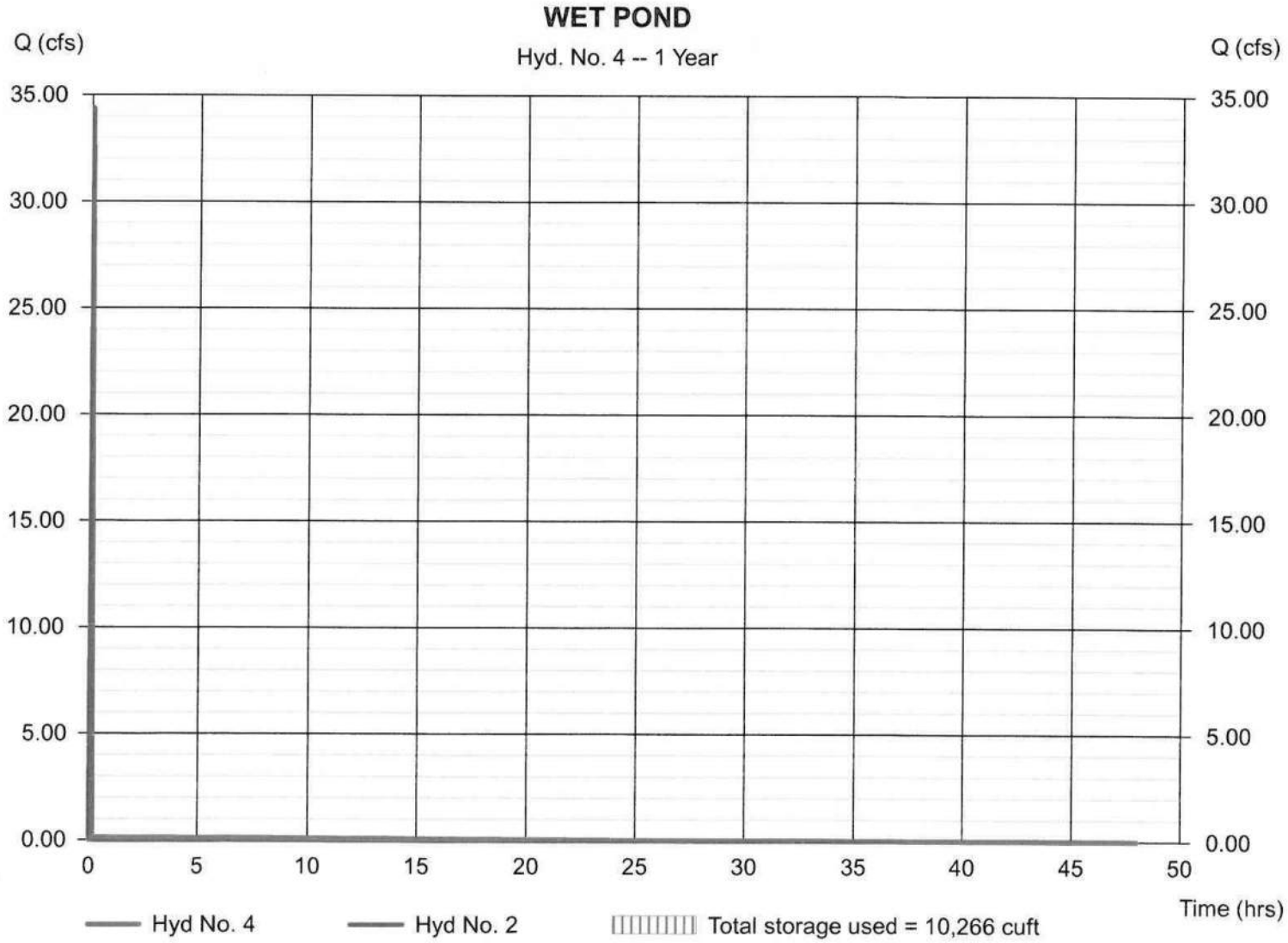
Friday, Feb 5, 2021

Hyd. No. 4

WET POND

Hydrograph type	= Reservoir	Peak discharge	= 0.137 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 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

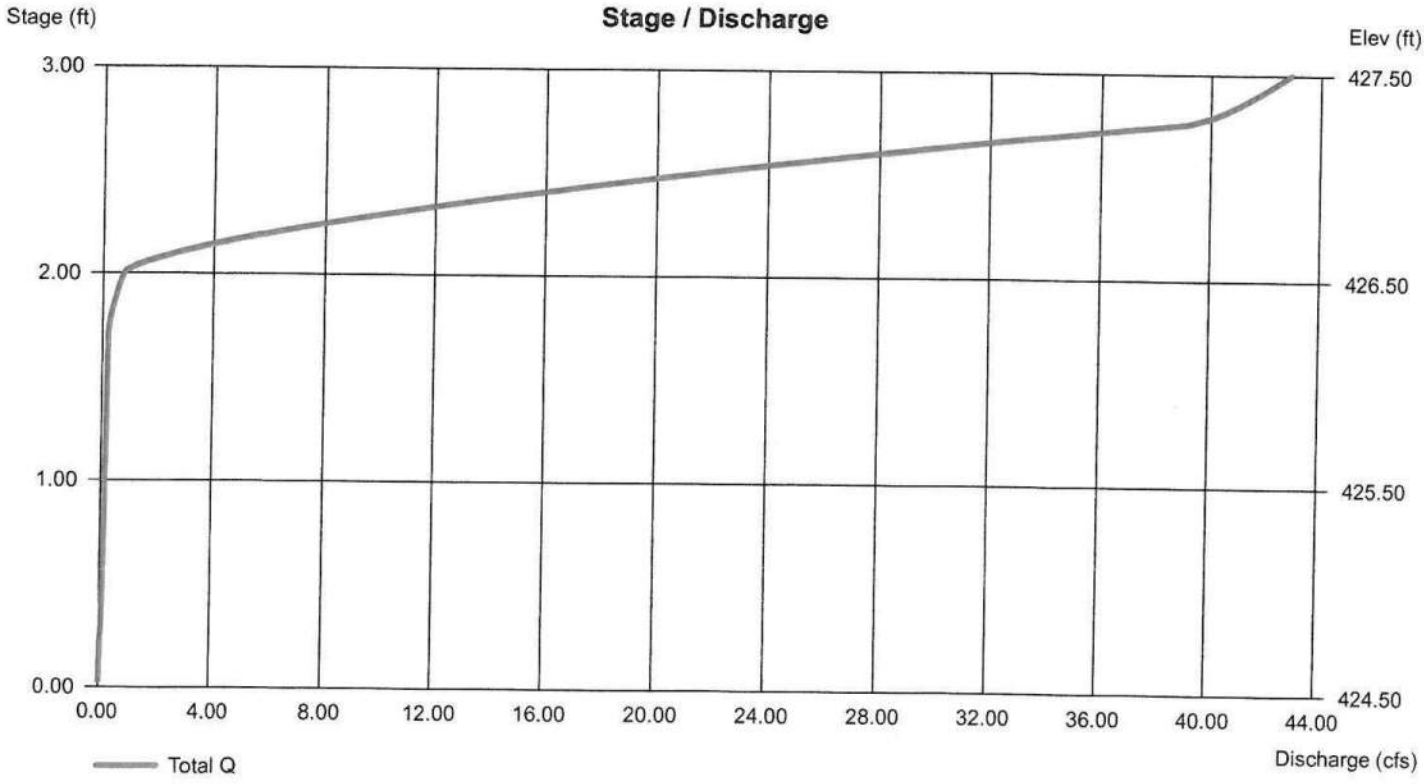
Weir Structures

	[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

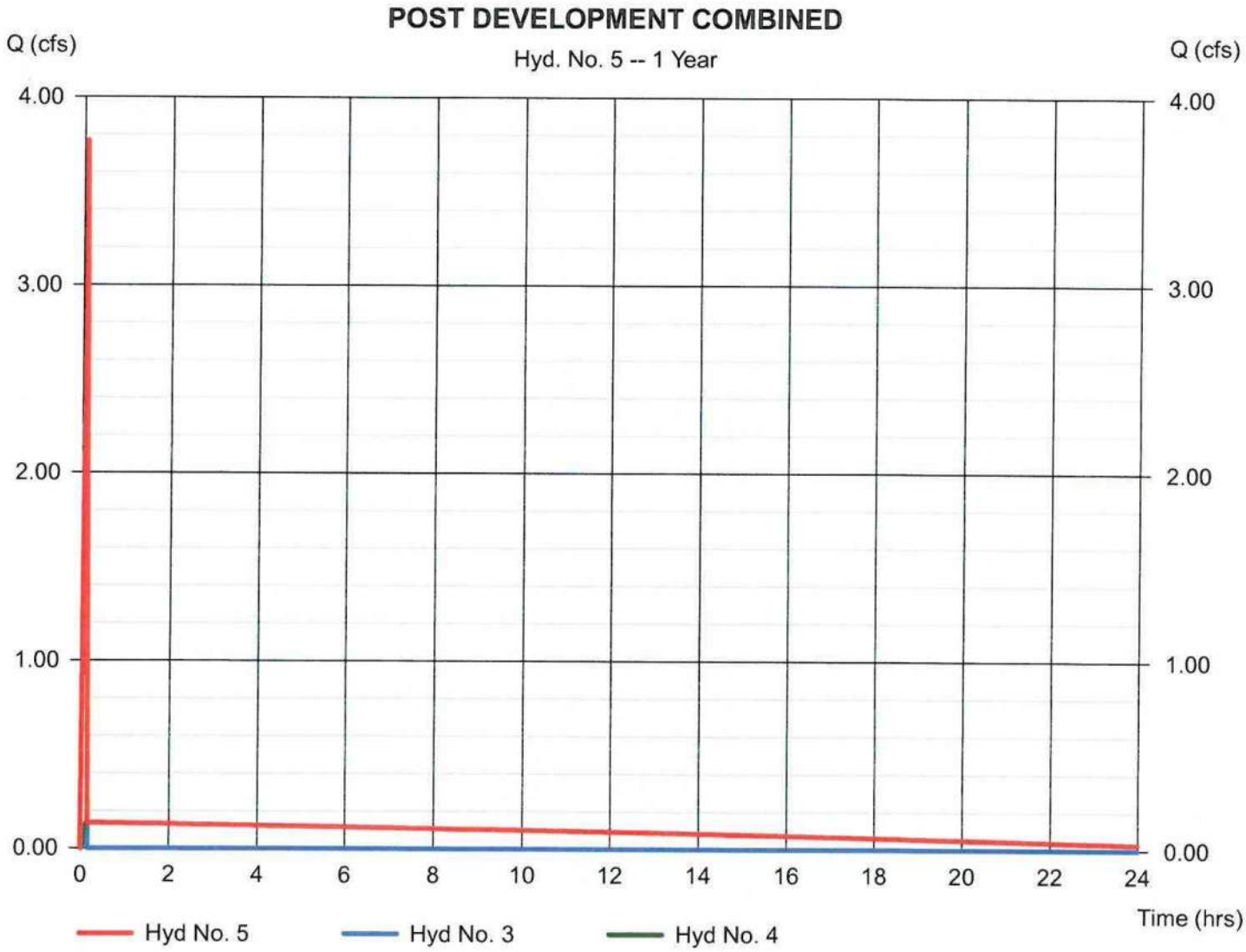
Hydraflow Hydrographs by Intelisolve v9.01

Friday, Feb 5, 2021

Hyd. No. 5

POST DEVELOPMENT COMBINED

Hydrograph type	= Combine	Peak discharge	= 3.768 cfs
Storm frequency	= 1 yrs	Time to peak	= 0.08 hrs
Time interval	= 1 min	Hyd. volume	= 10,383 cuft
Inflow hyds.	= 3, 4	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

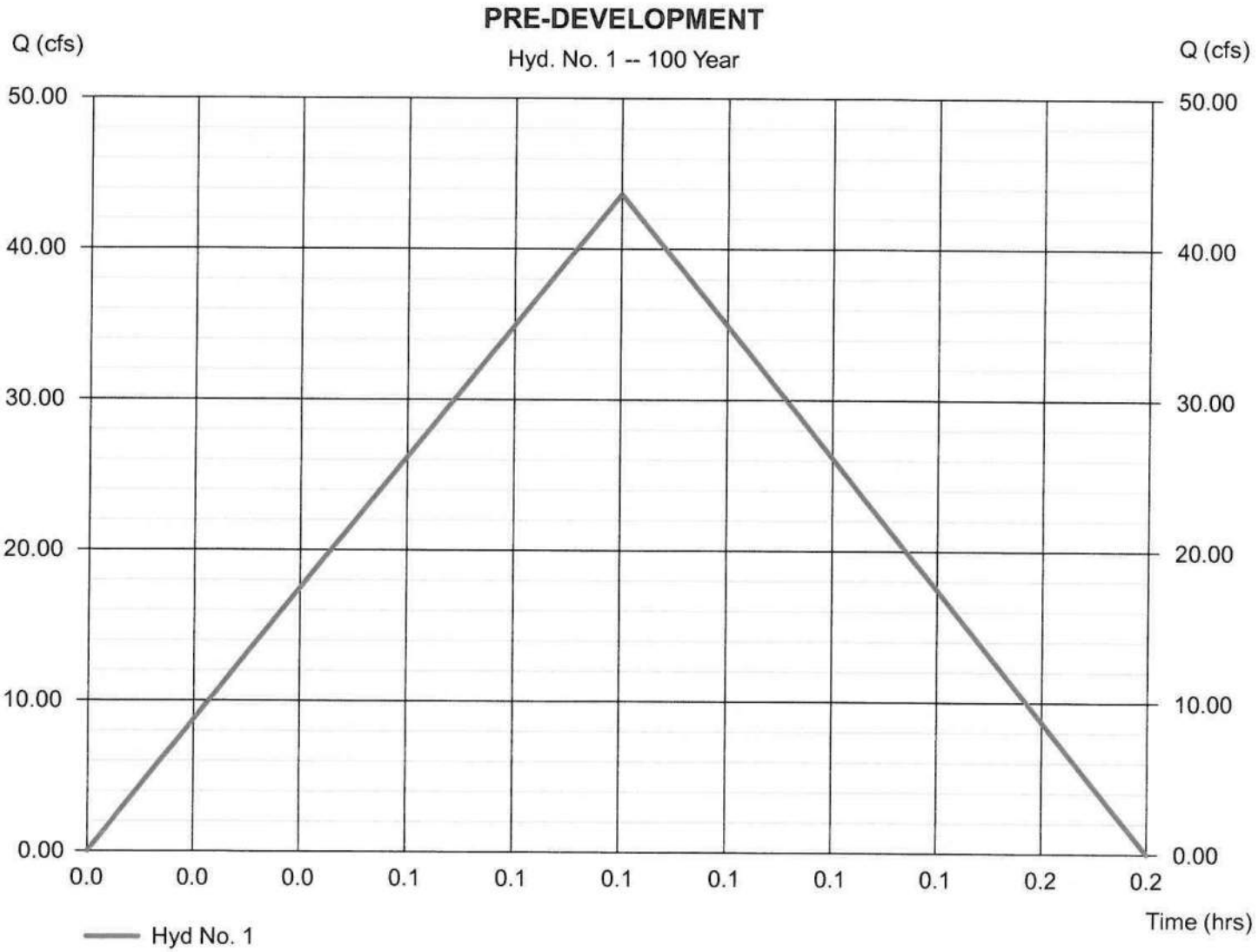
Hydrograph Report

Hyd. No. 1

PRE-DEVELOPMENT

Hydrograph type	= Rational	Peak discharge	= 43.65 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.08 hrs
Time interval	= 1 min	Hyd. volume	= 13,094 cuft
Drainage area	= 10.960 ac	Runoff coeff.	= 0.41*
Intensity	= 9.713 in/hr	Tc by User	= 5.00 min
IDF Curve	= WakeCounty.IDF	Asc/Rec limb fact	= 1/1

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



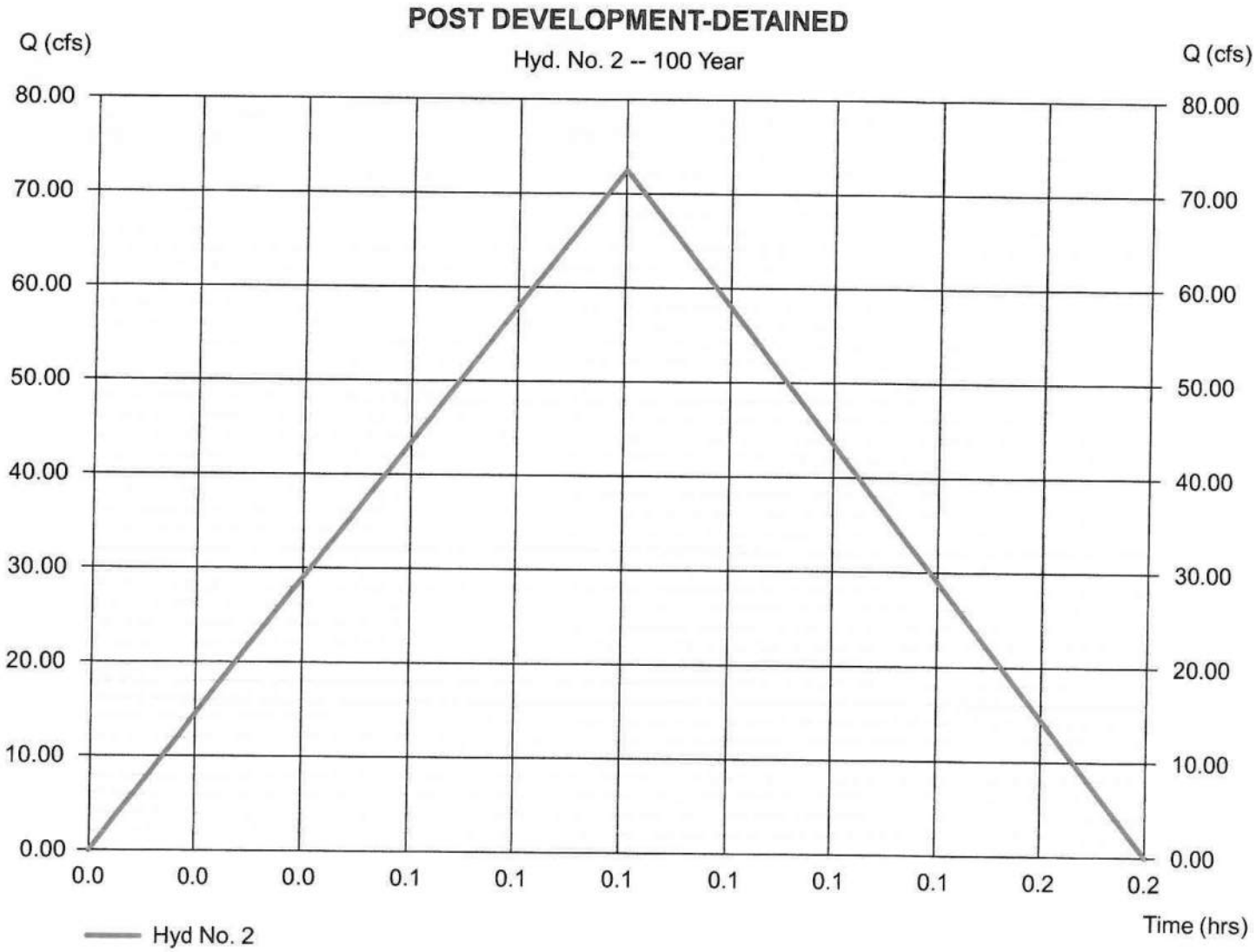
Hydrograph Report

Hyd. No. 2

POST DEVELOPMENT-DETAINED

Hydrograph type	= Rational	Peak discharge	= 72.50 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.08 hrs
Time interval	= 1 min	Hyd. volume	= 21,749 cuft
Drainage area	= 9.330 ac	Runoff coeff.	= 0.8*
Intensity	= 9.713 in/hr	Tc by User	= 5.00 min
IDF Curve	= WakeCounty.IDF	Asc/Rec limb fact	= 1/1

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



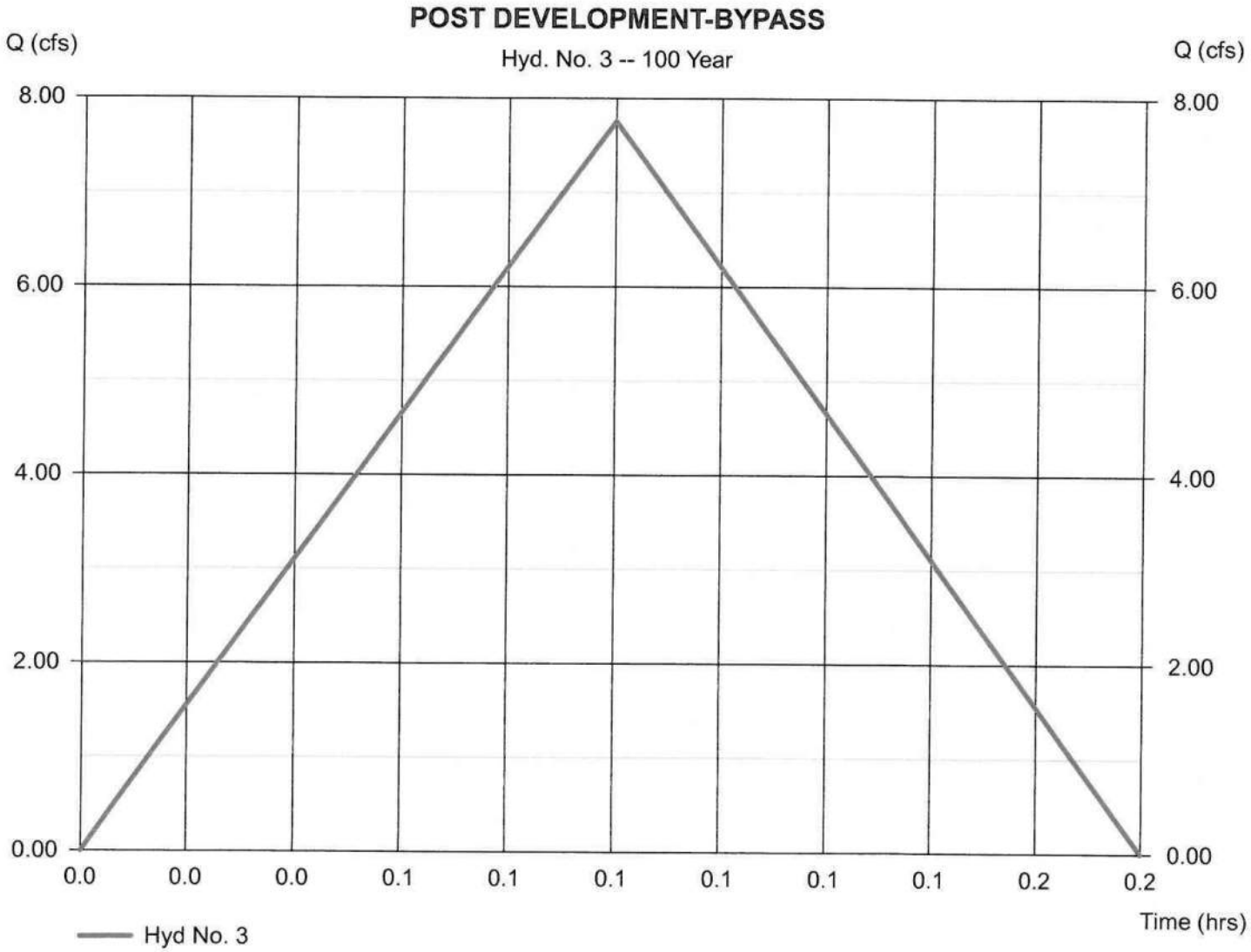
Hydrograph Report

Hyd. No. 3

POST DEVELOPMENT-BYPASS

Hydrograph type	= Rational	Peak discharge	= 7.758 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.08 hrs
Time interval	= 1 min	Hyd. volume	= 2,327 cuft
Drainage area	= 1.630 ac	Runoff coeff.	= 0.49*
Intensity	= 9.713 in/hr	Tc by User	= 5.00 min
IDF Curve	= WakeCounty.IDF	Asc/Rec limb fact	= 1/1

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



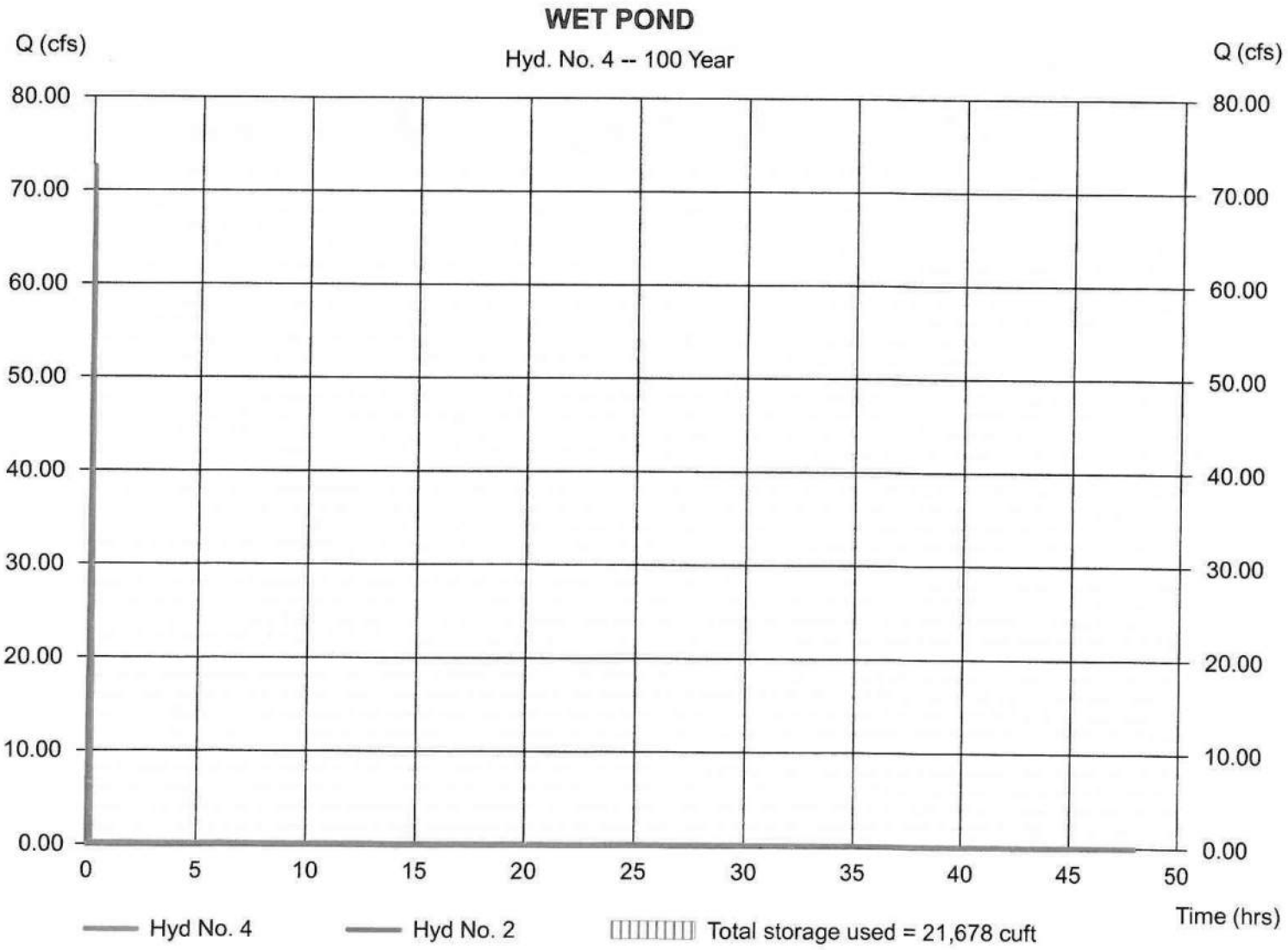
Hydrograph Report

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.

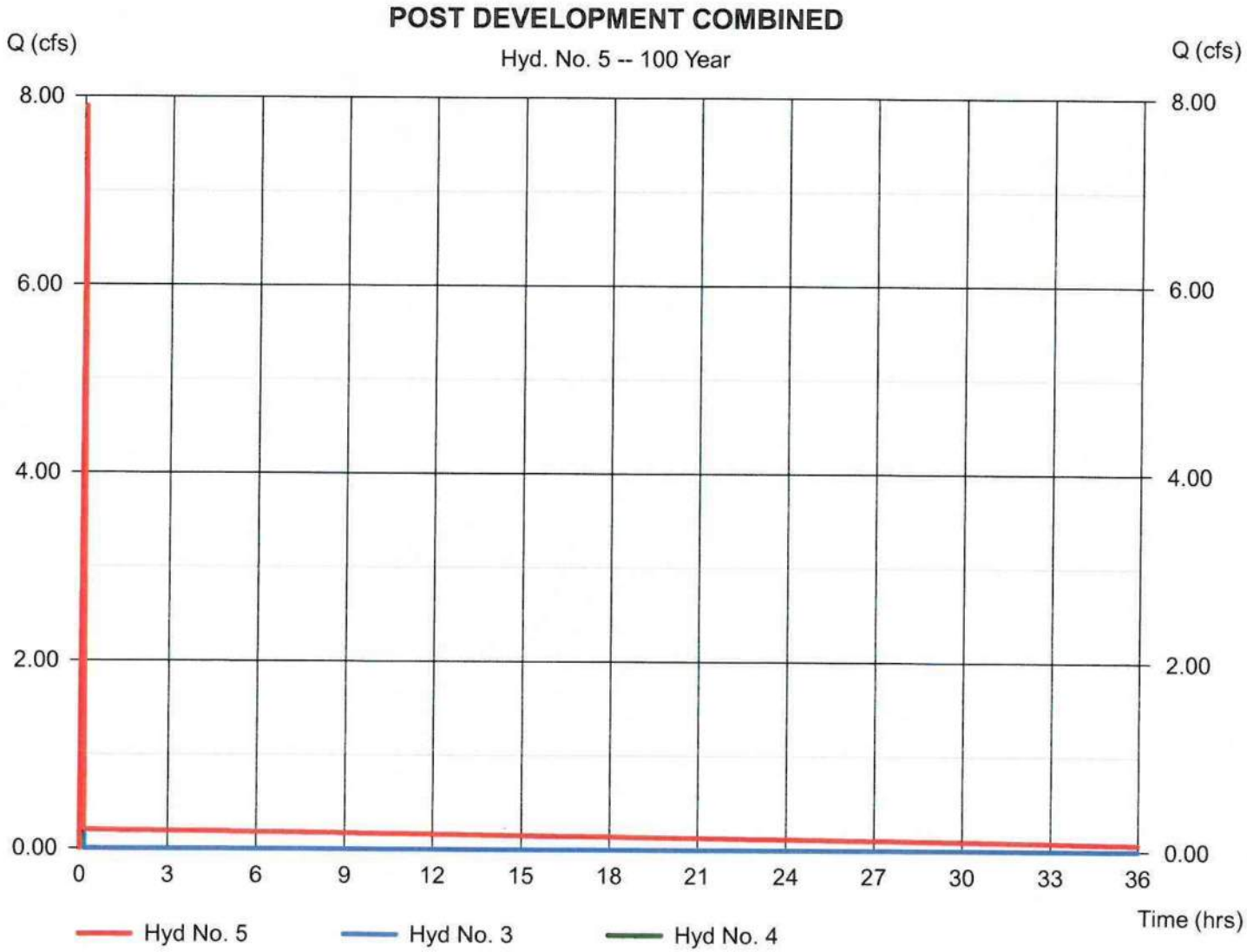


Hydrograph Report

Hyd. No. 5

POST DEVELOPMENT COMBINED

Hydrograph type	= Combine	Peak discharge	= 7.899 cfs
Storm frequency	= 100 yrs	Time to peak	= 0.08 hrs
Time interval	= 1 min	Hyd. volume	= 21,933 cuft
Inflow hyds.	= 3, 4	Contrib. drain. area	= 1.630 ac

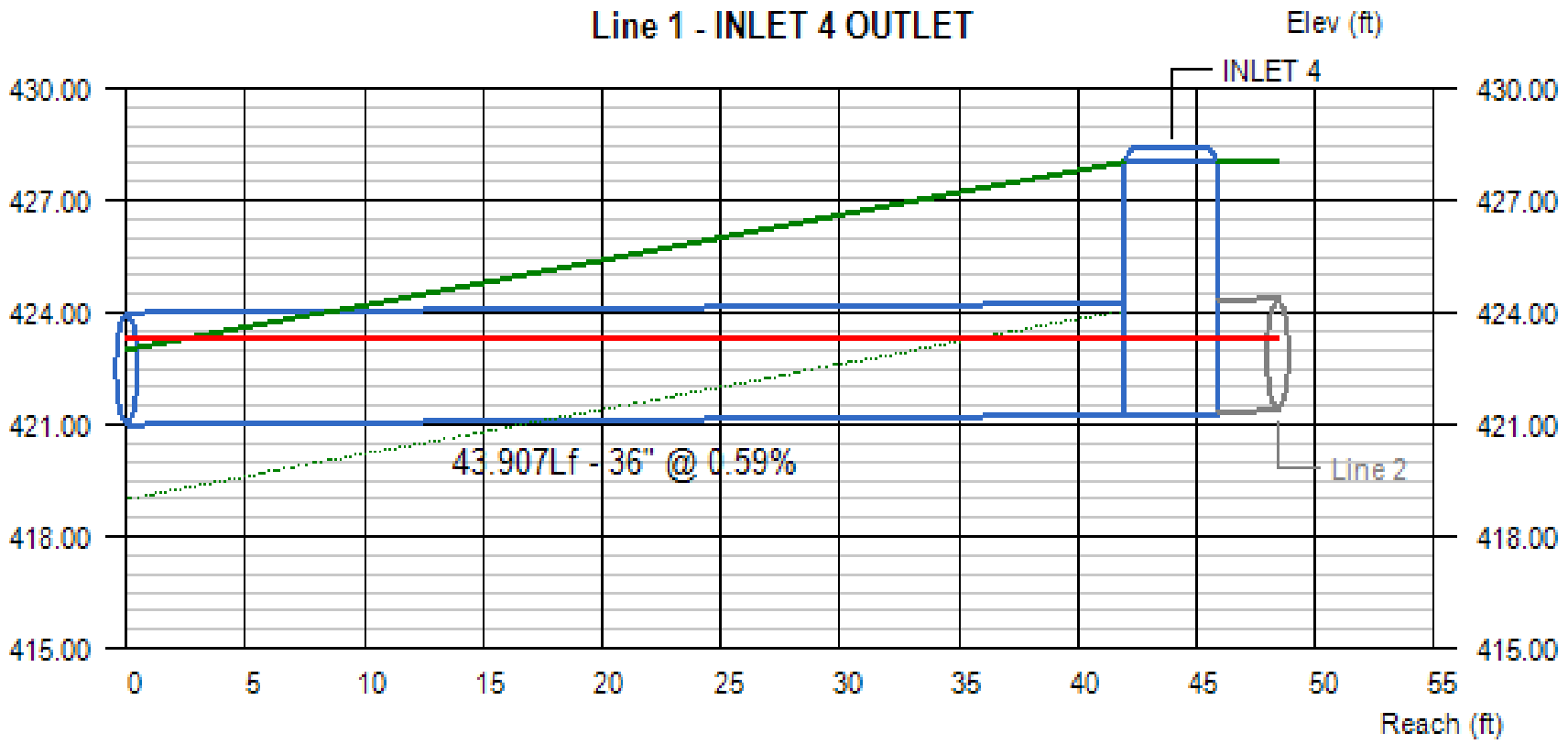


STORMWATER RUNOFF

10-YEAR PIPE SIZING
10-YEAR HYDRAULIC GRADE LINES

COBBLESTONE VILLAGE
FEBRUARY 2021

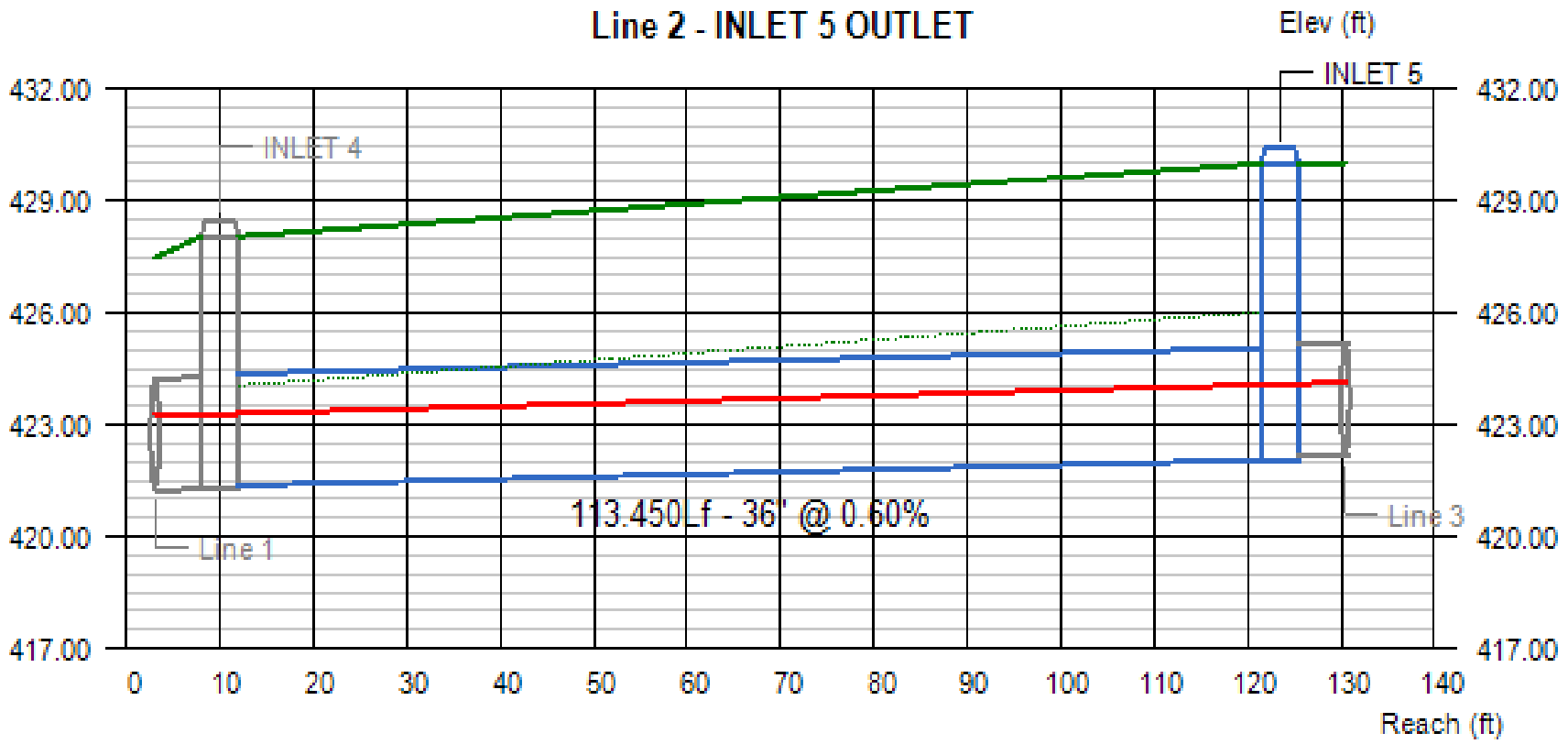
Line Profile (Line 1) - INLET 4 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	38.53	421.00	421.26	2.33	2.02	2.02	423.33	423.28	423.28	6.54	7.62	-1.00	3.78

Project File: | No. Lines: 30 | Run Date: 2/12/2021

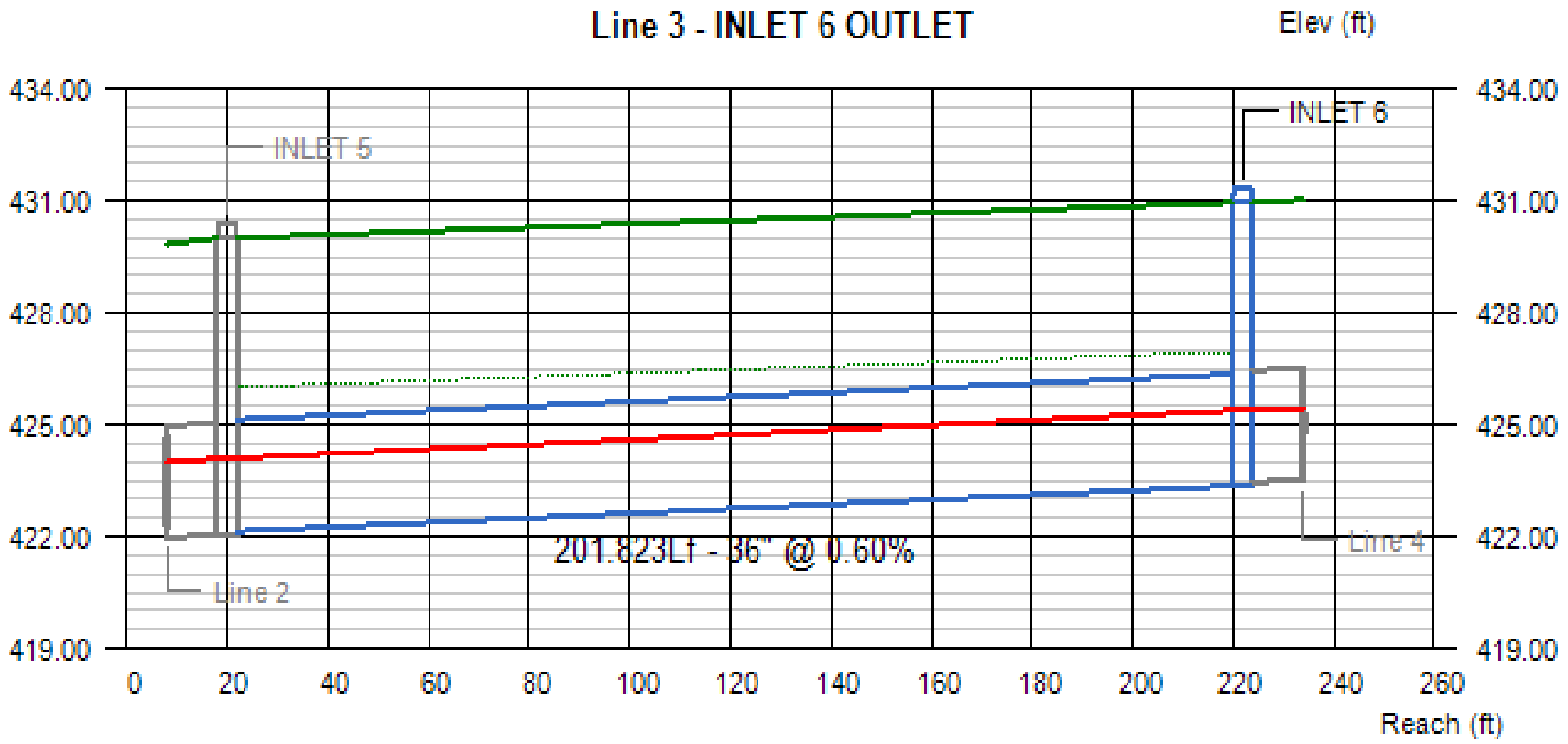
Line Profile (Line 2) - INLET 5 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	38.82	421.36	422.04	1.94	2.03	2.03	423.30	424.07	424.07	8.02	7.64	3.68	4.96

Project File: | No. Lines: 30 | Run Date: 2/12/2021

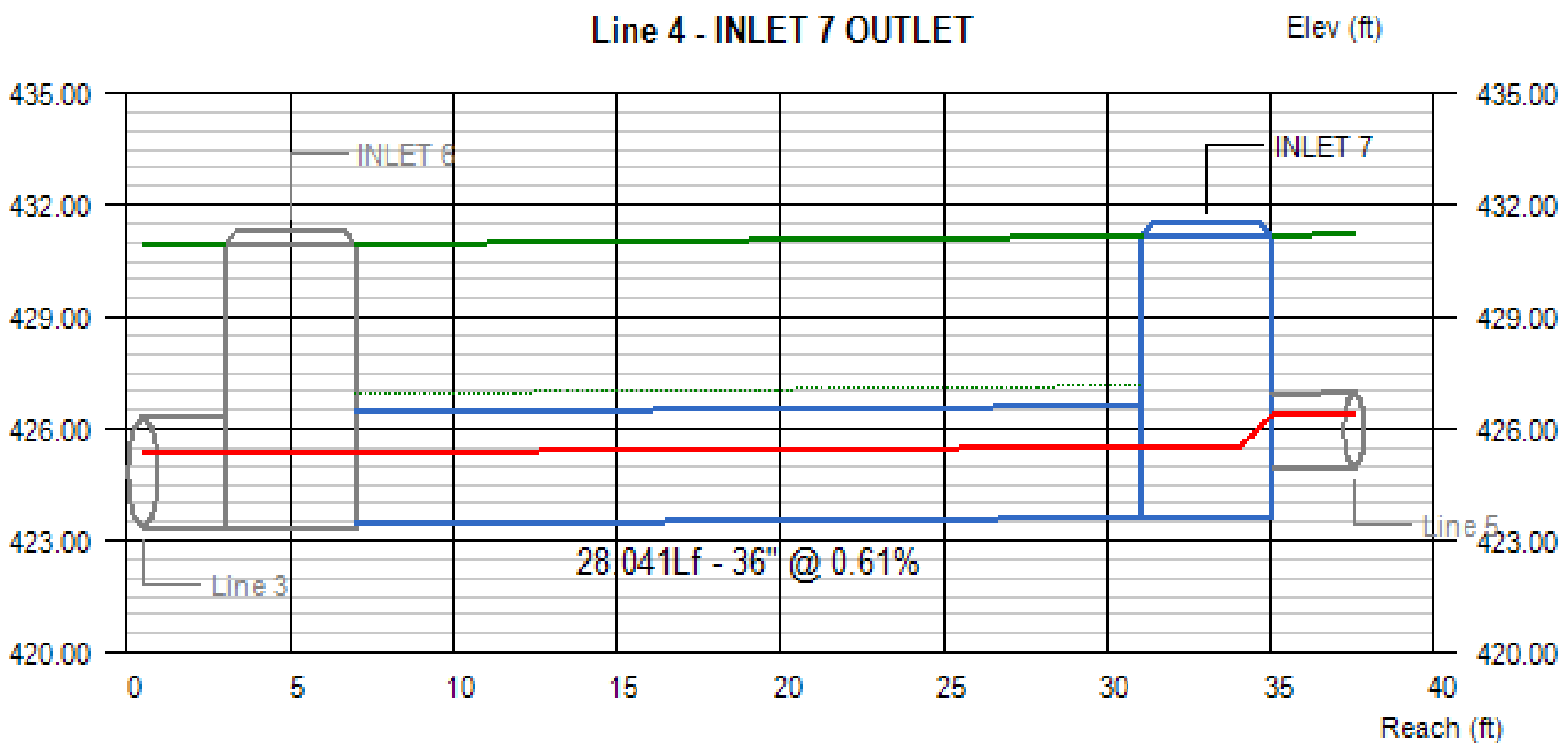
Line Profile (Line 3) - INLET 6 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	39.16	422.14	423.35	1.95	2.03	2.03	424.09	425.38	425.38	8.03	7.67	4.86	4.59

Project File: | No. Lines: 30 | Run Date: 2/12/2021

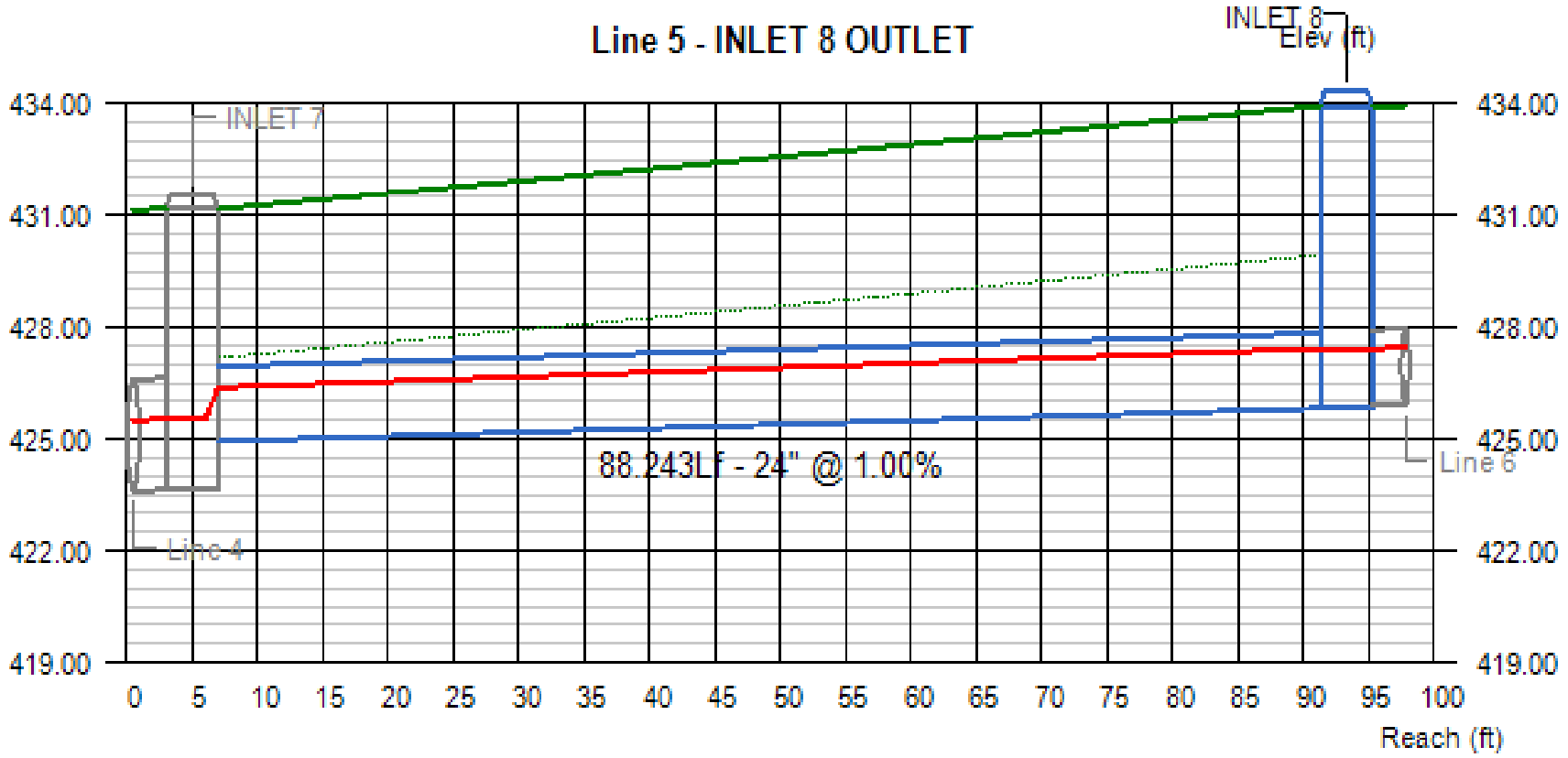
Line Profile (Line 4) - INLET 7 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	34.35	423.45	423.62	1.93	1.90	1.90	425.38	425.52	425.52	7.13	7.27	4.49	4.54

Project File: | No. Lines: 30 | Run Date: 2/12/2021

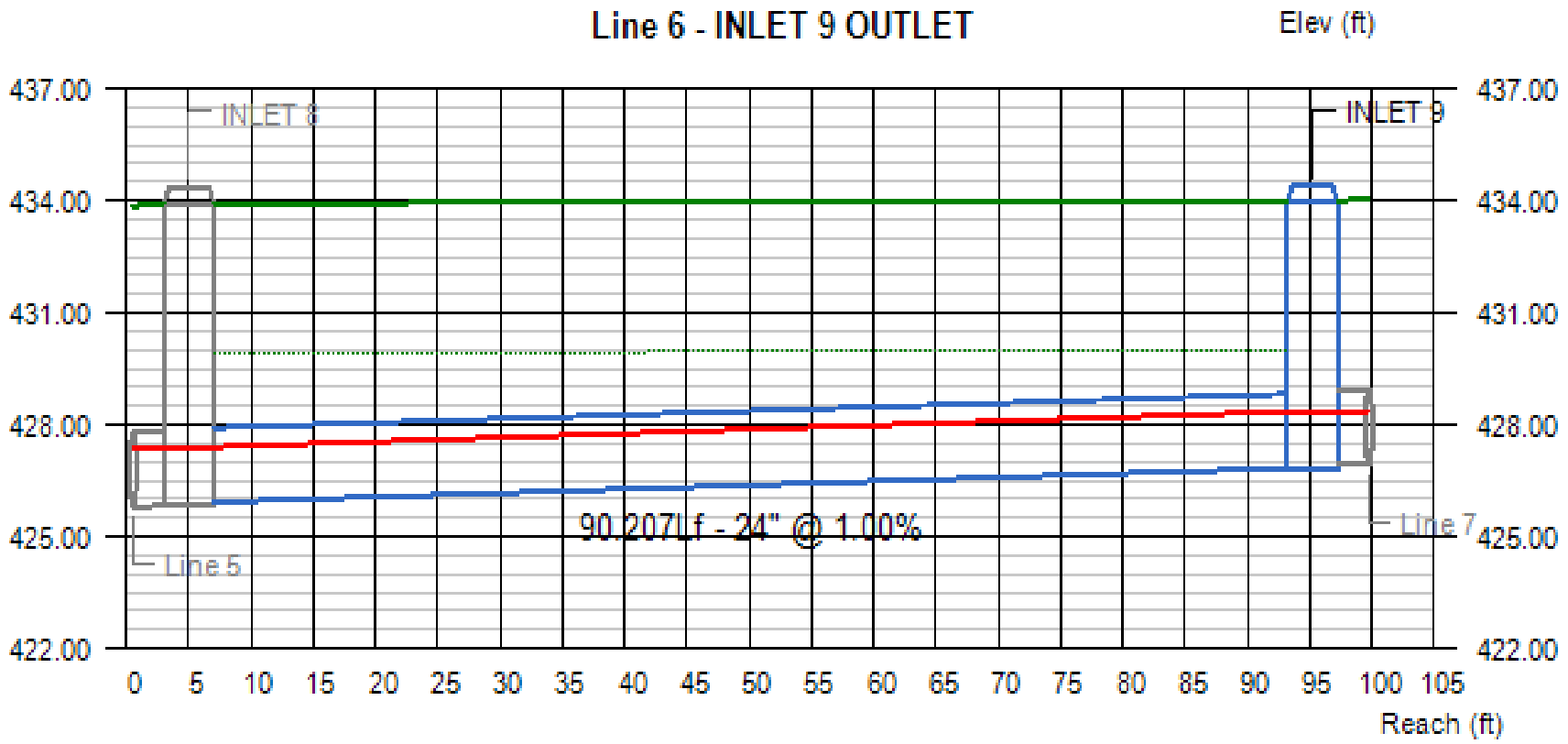
Line Profile (Line 5) - INLET 8 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	19.53	424.94	425.82	1.44	1.59	1.59	426.38	427.41	427.41	8.09	7.30	4.22	6.10

Project File: | No. Lines: 30 | Run Date: 2/12/2021

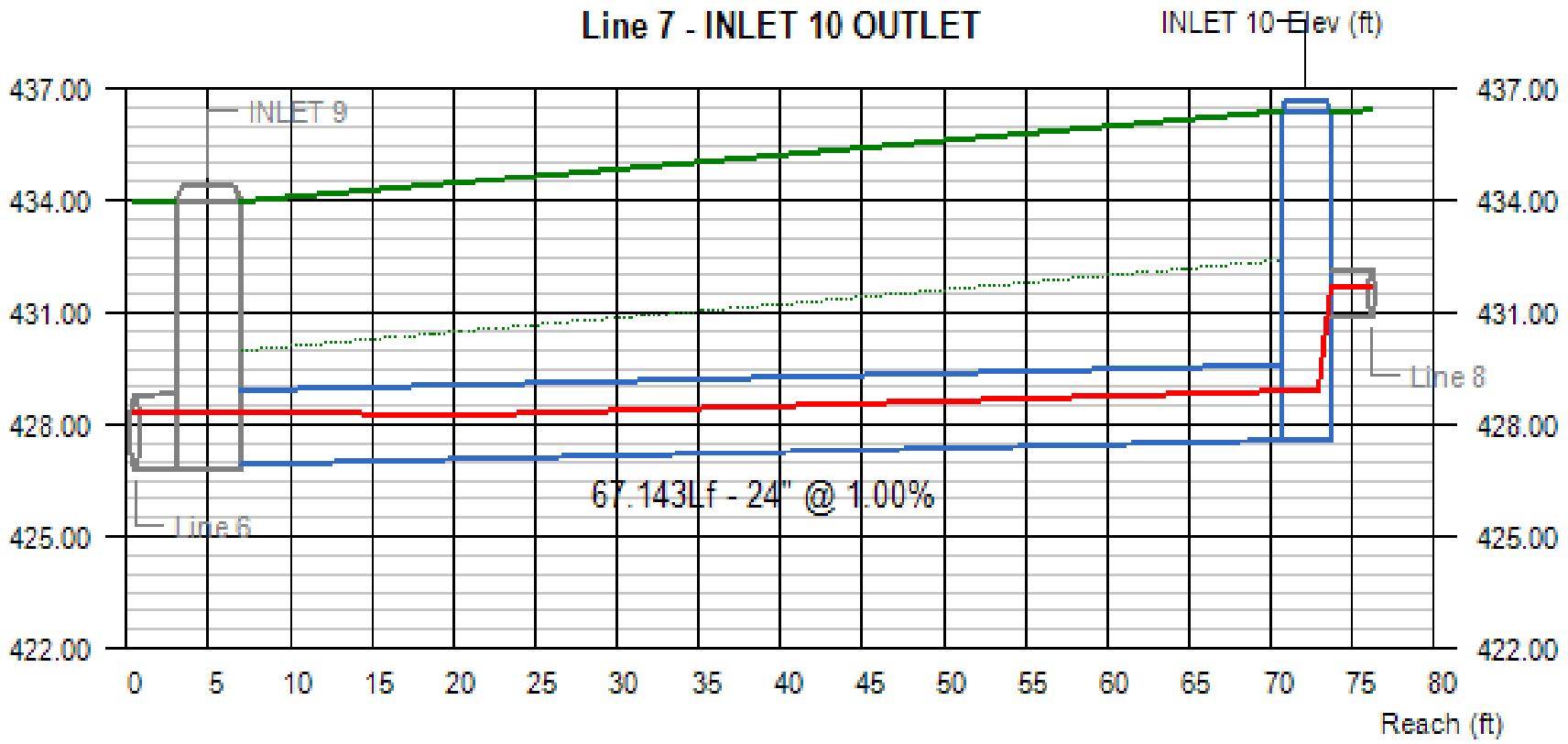
Line Profile (Line 6) - INLET 9 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	18.07	425.92	426.82	1.49	1.53	1.53	427.41	428.35	428.35	7.21	7.01	6.00	5.15

Project File: | No. Lines: 30 | Run Date: 2/12/2021

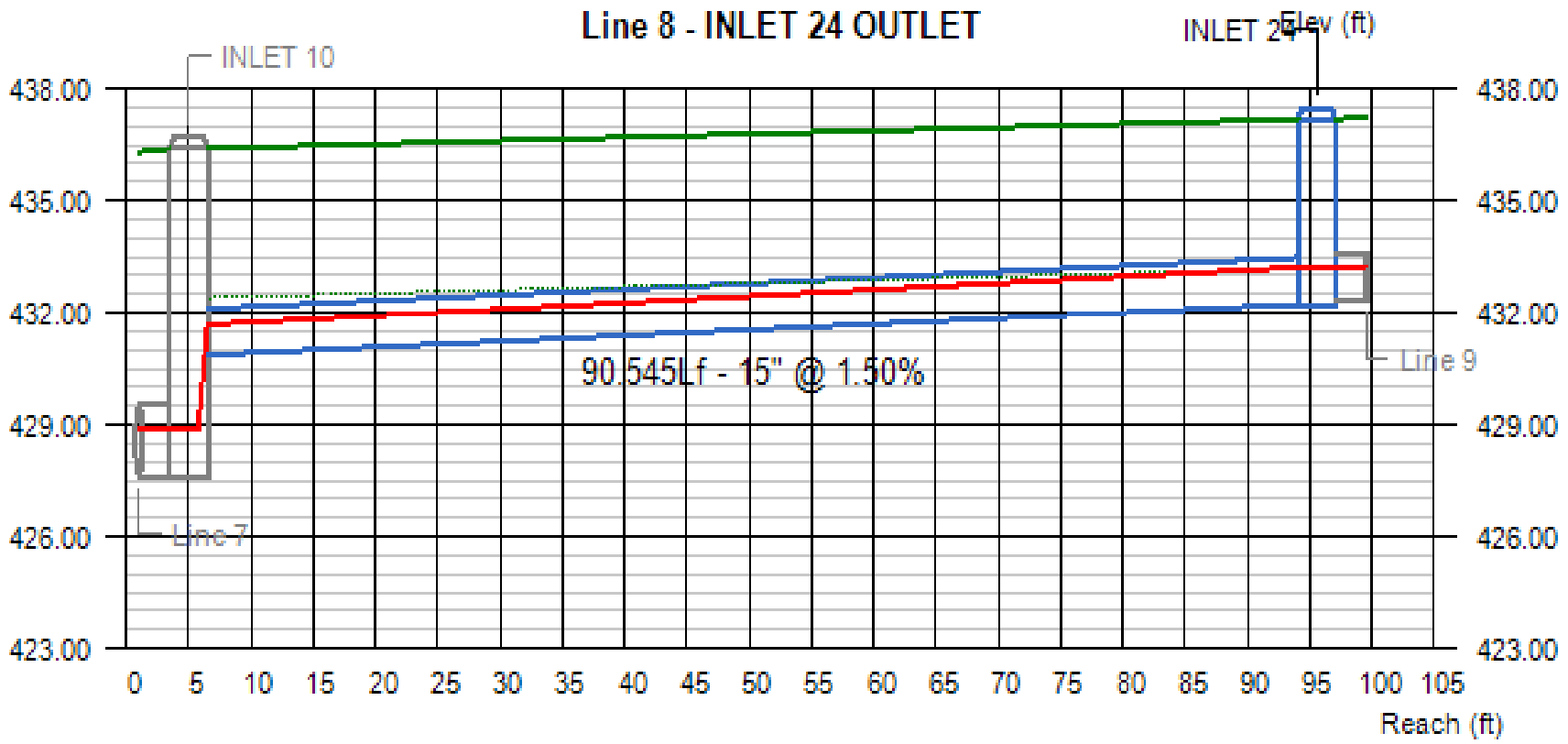
Line Profile (Line 7) - INLET 10 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	13.29	426.92	427.59	1.43	1.31	1.31	428.35	428.90 j	428.90	5.53	6.09	5.05	6.81

Project File: | No. Lines: 30 | Run Date: 2/12/2021

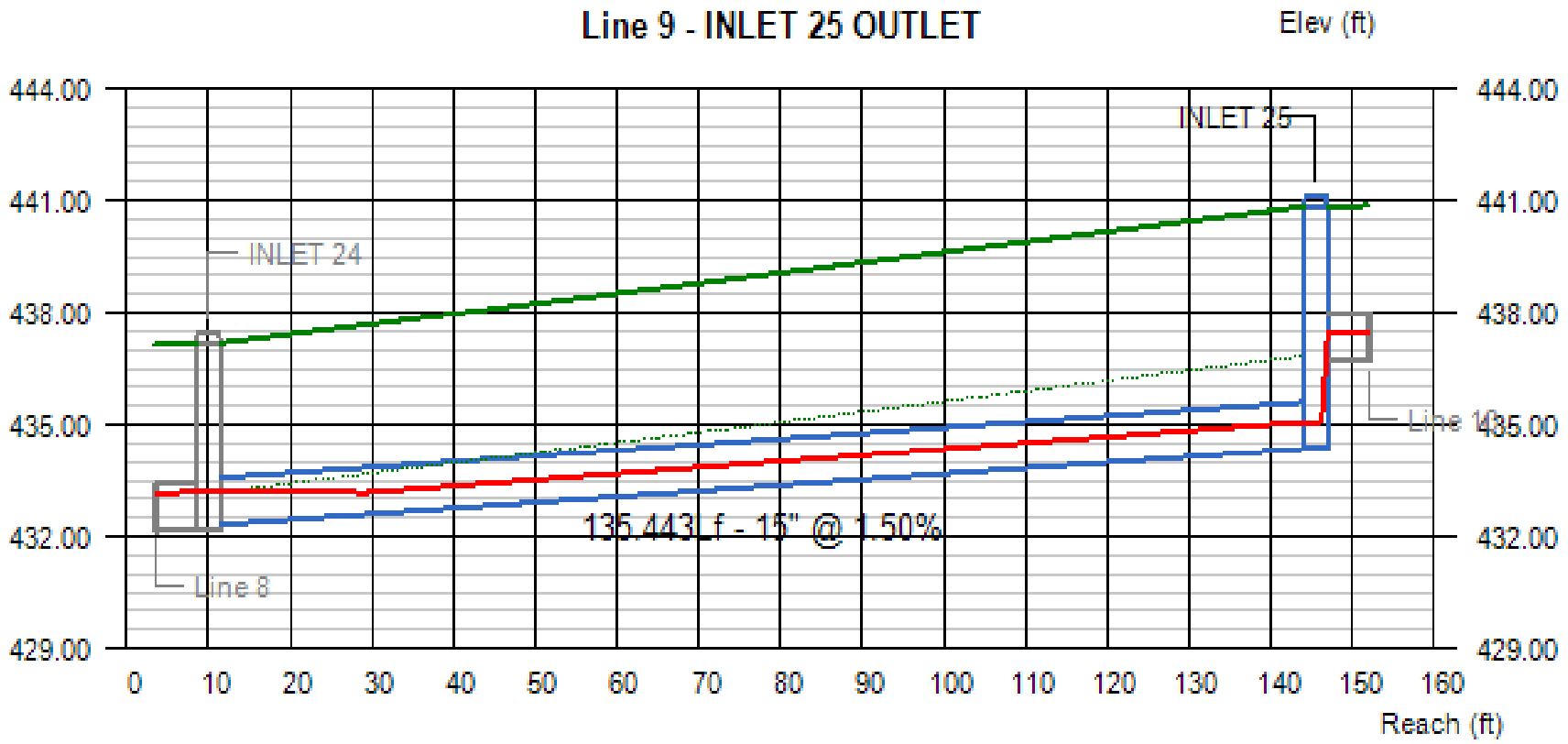
Line Profile (Line 8) - INLET 24 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	6.05	430.86	432.22	0.82	0.99	0.99	431.68	433.21	433.21	7.10	5.78	4.29	3.71

Project File: | No. Lines: 30 | Run Date: 2/12/2021

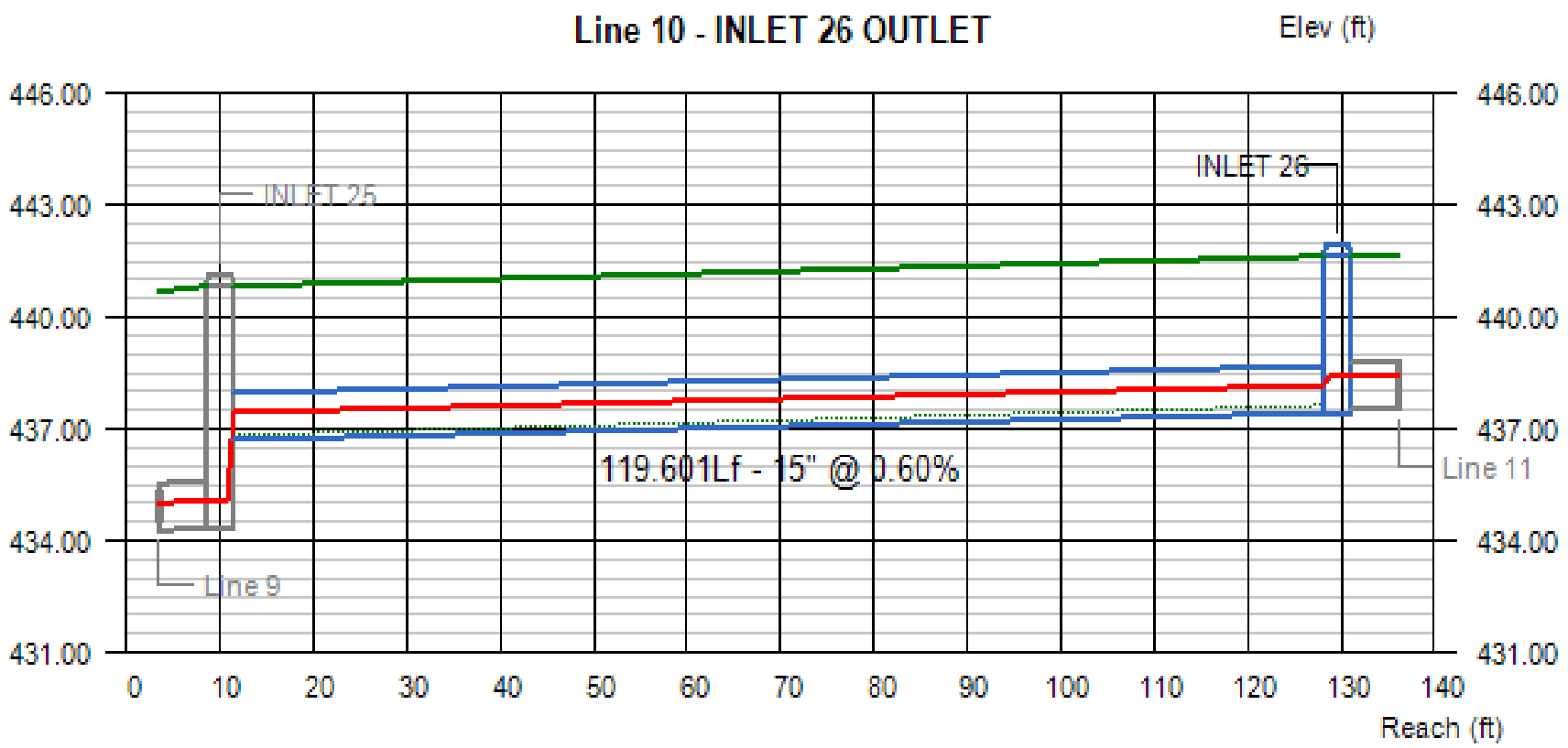
Line Profile (Line 9) - INLET 25 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	3.23	432.32	434.35	0.89	0.72	0.72	433.21	435.07 j	435.07	3.44	4.39	3.61	5.23

Project File: | No. Lines: 30 | Run Date: 2/12/2021

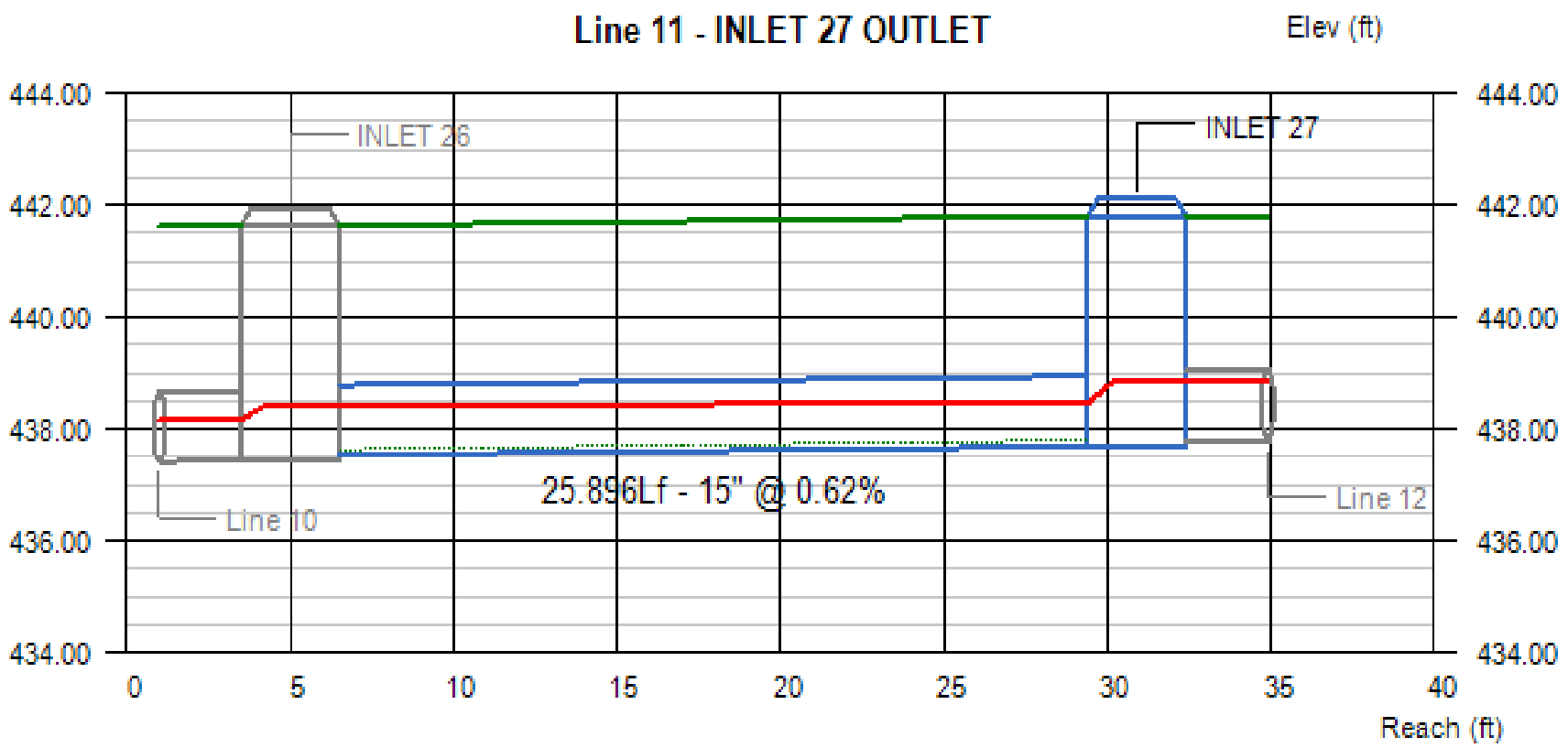
Line Profile (Line 10) - INLET 26 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	3.26	436.71	437.43	0.74	0.73	0.99	437.45	438.16	438.42	4.35	4.36	2.87	2.95

Project File: | No. Lines: 30 | Run Date: 2/12/2021

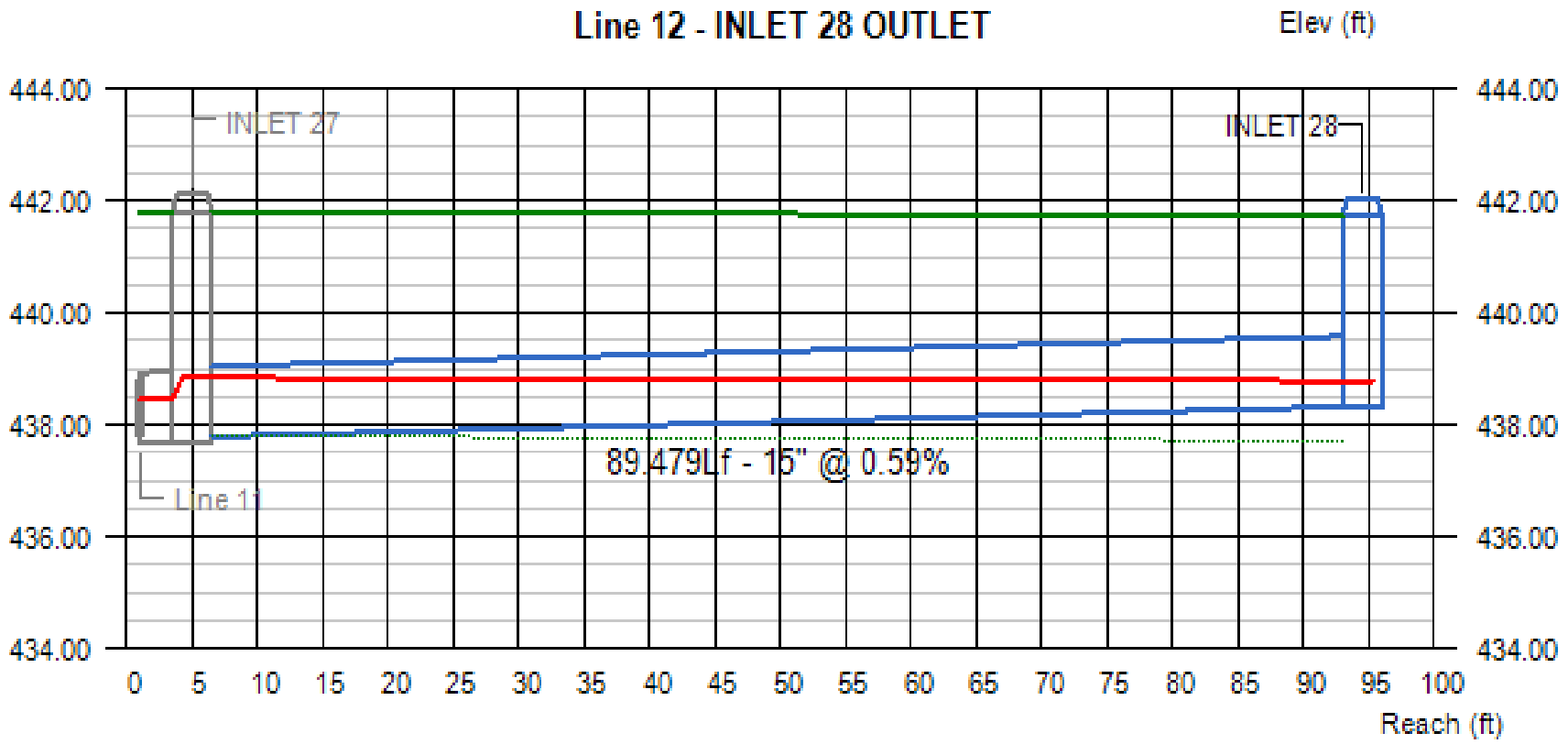
Line Profile (Line 11) - INLET 27 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	3.22	437.53	437.69	0.89	0.77	1.14	438.42	438.46	438.83	3.43	4.07	2.85	2.86

Project File: | No. Lines: 30 | Run Date: 2/12/2021

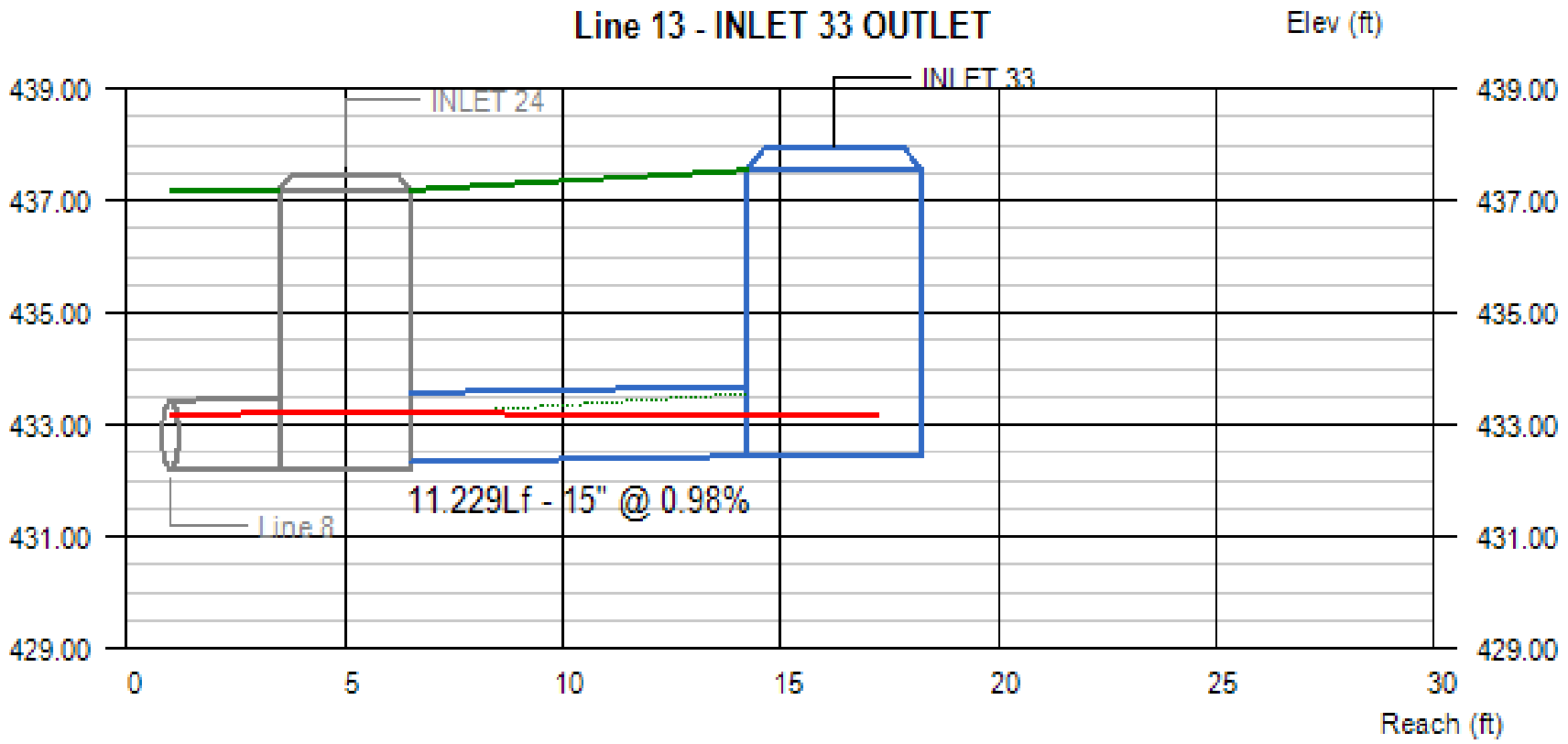
Line Profile (Line 12) - INLET 28 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	1.36	437.79	438.32	1.04	0.46	0.46	438.83	438.78	438.78	1.24	3.31	2.76	2.15

Project File: | No. Lines: 30 | Run Date: 2/12/2021

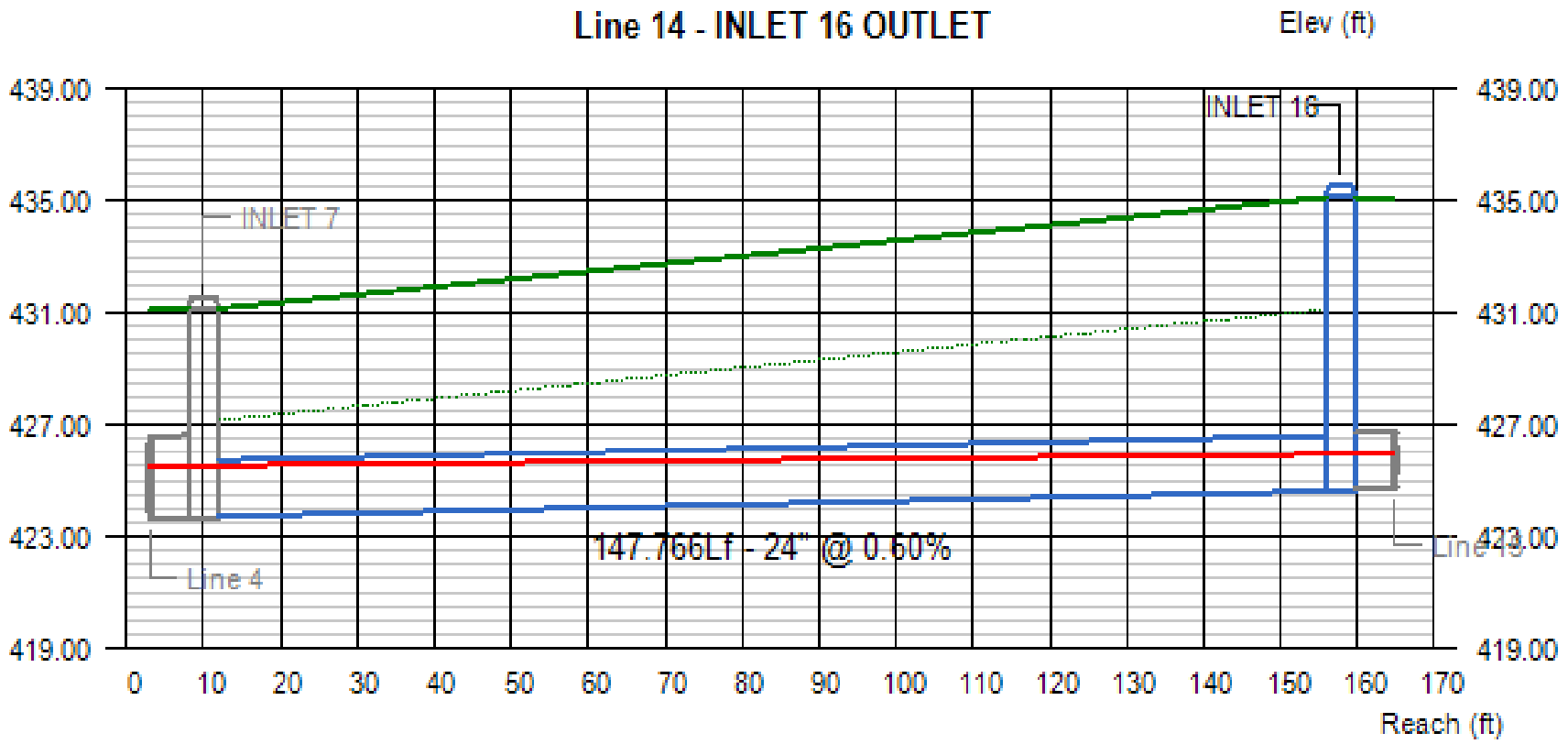
Line Profile (Line 13) - INLET 33 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	3.26	432.32	432.43	0.89	0.73	0.73	433.21	433.16	433.16	3.48	4.40	3.61	3.87

Project File: | No. Lines: 30 | Run Date: 2/12/2021

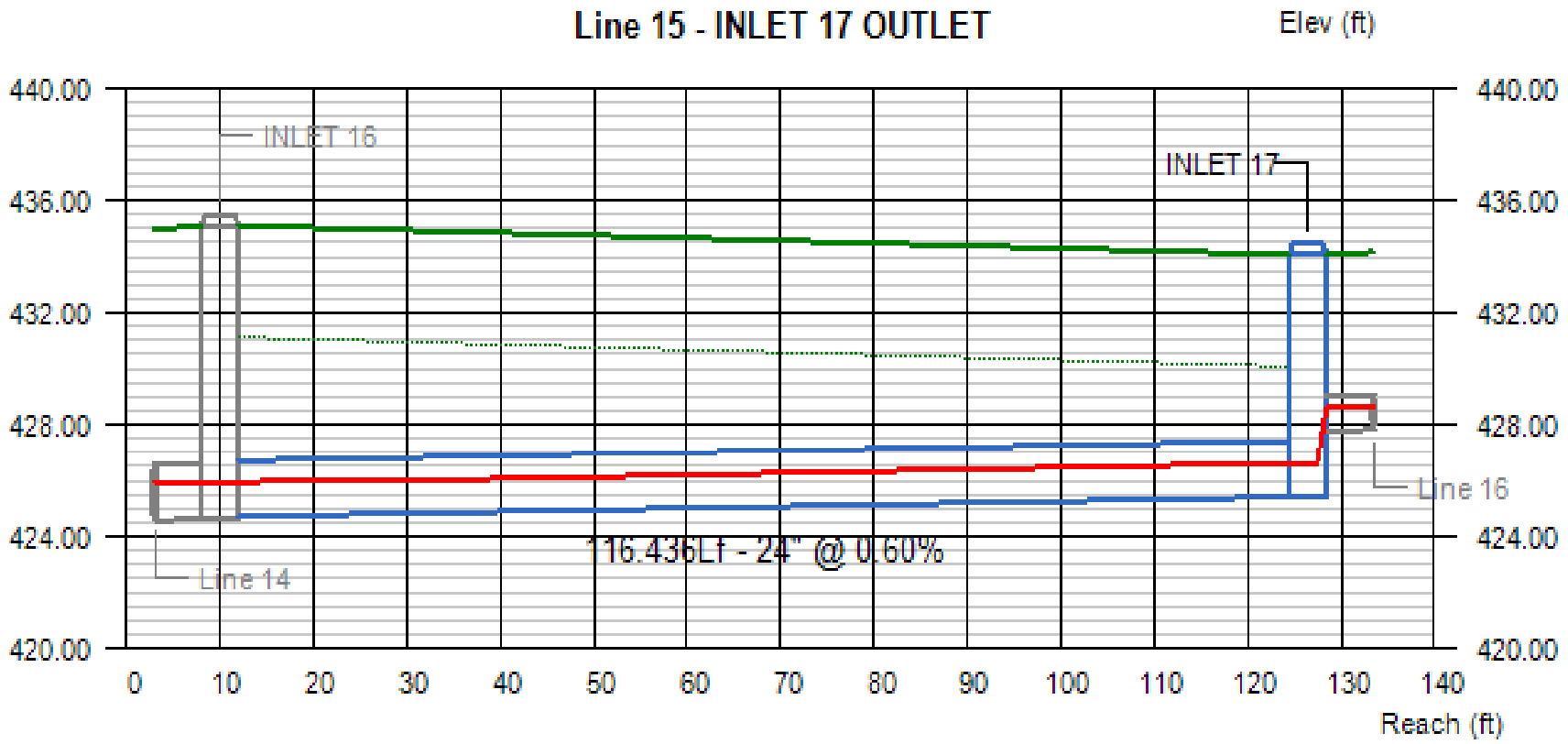
Line Profile (Line 14) - INLET 16 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	13.80	423.72	424.61	1.80	1.34	1.34	425.52	425.95	425.95	4.63	6.18	5.44	8.49

Project File: | No. Lines: 30 | Run Date: 2/12/2021

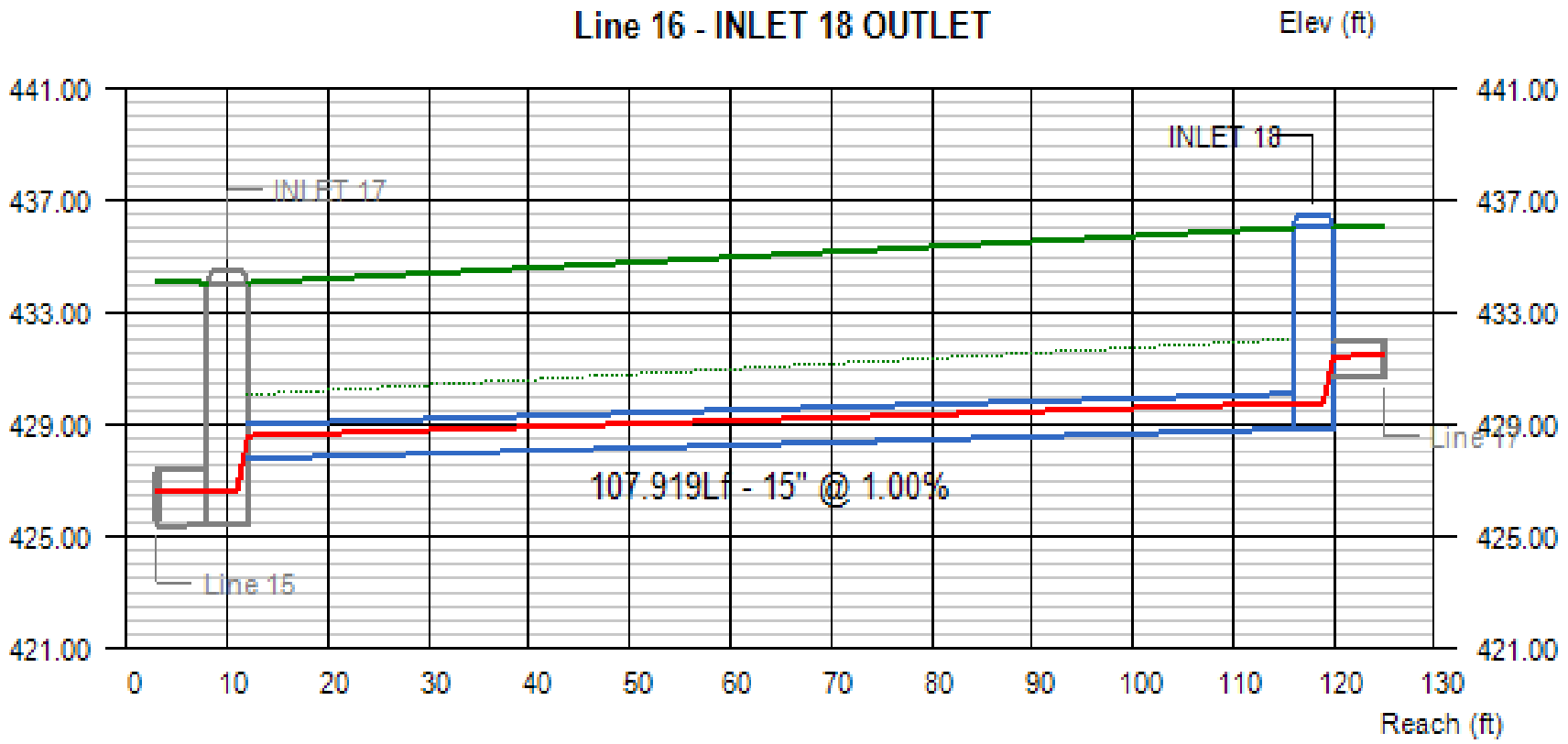
Line Profile (Line 15) - INLET 17 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	11.54	424.71	425.41	1.24	1.22	1.22	425.95	426.63 j	426.63	5.66	5.76	8.39	6.66

Project File: | No. Lines: 30 | Run Date: 2/12/2021

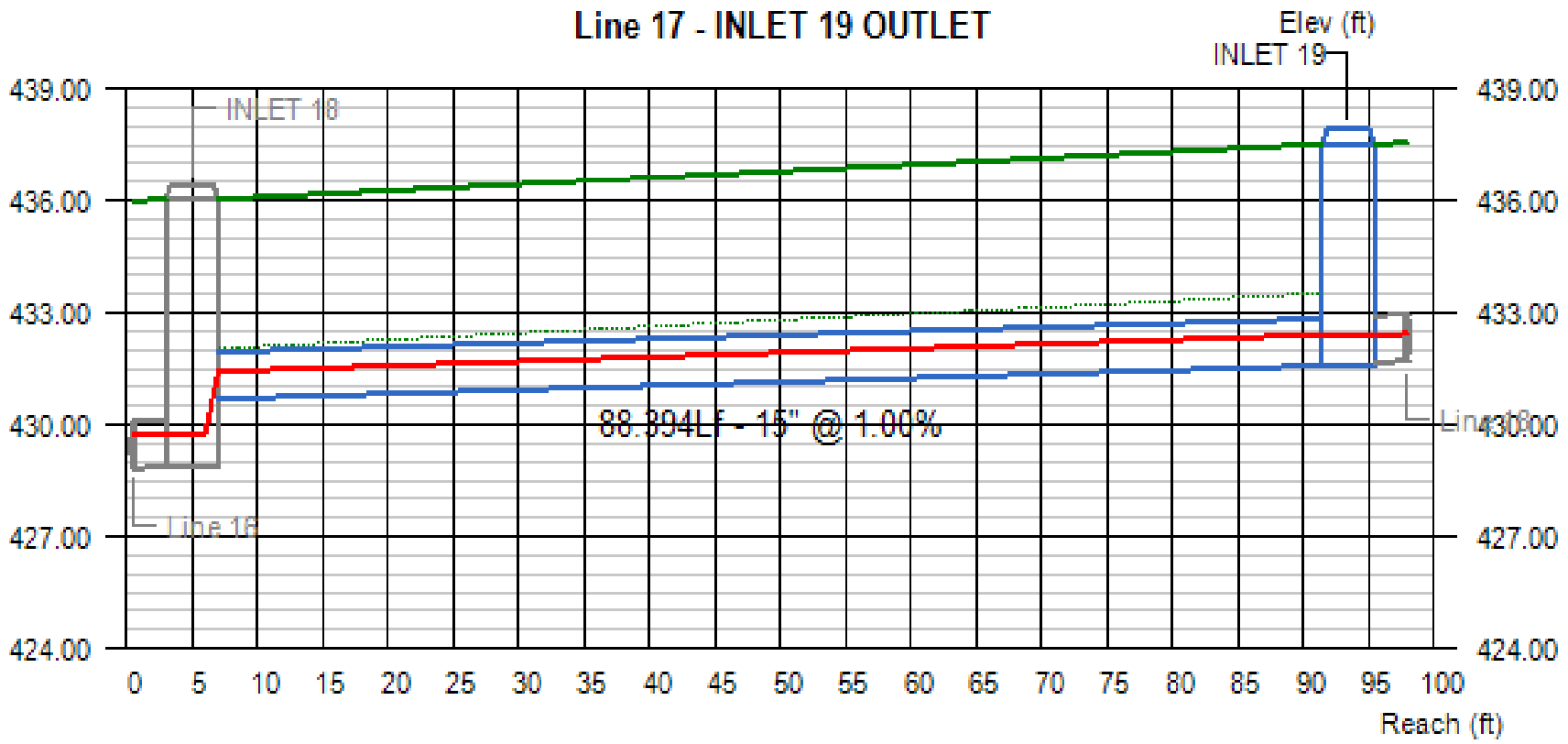
Line Profile (Line 16) - INLET 18 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	5.12	427.77	428.85	0.84	0.92	0.92	428.61	429.77	429.77	5.84	5.31	5.05	5.93

Project File: | No. Lines: 30 | Run Date: 2/12/2021

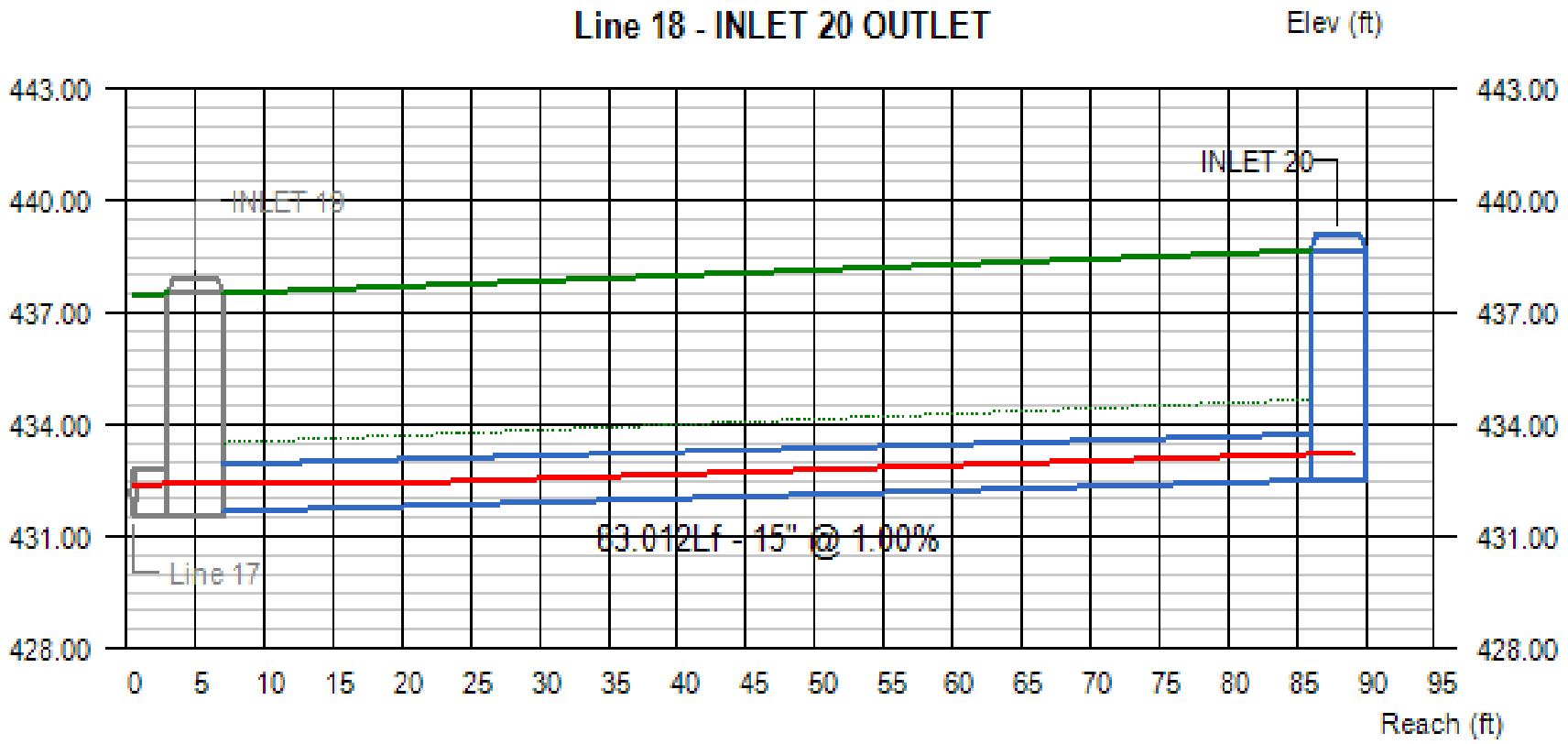
Line Profile (Line 17) - INLET 19 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	4.18	430.69	431.57	0.73	0.83	0.83	431.42	432.40	432.40	5.58	4.85	4.09	4.70

Project File:	No. Lines: 30	Run Date: 2/12/2021

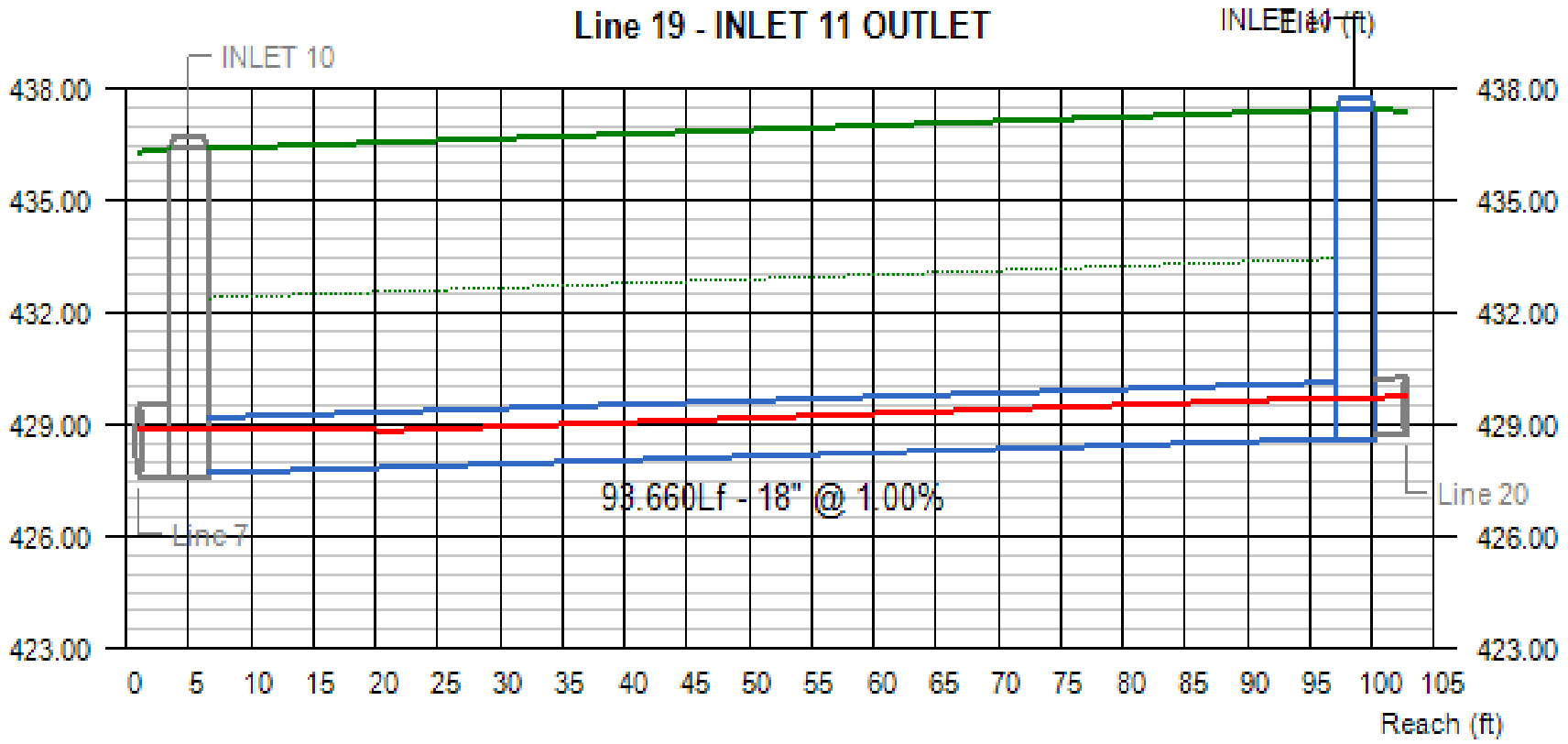
Line Profile (Line 18) - INLET 20 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	3.05	431.67	432.50	0.73	0.70	0.70	432.40	433.20 j	433.20	4.12	4.30	4.60	4.92

Project File: | No. Lines: 30 | Run Date: 2/12/2021

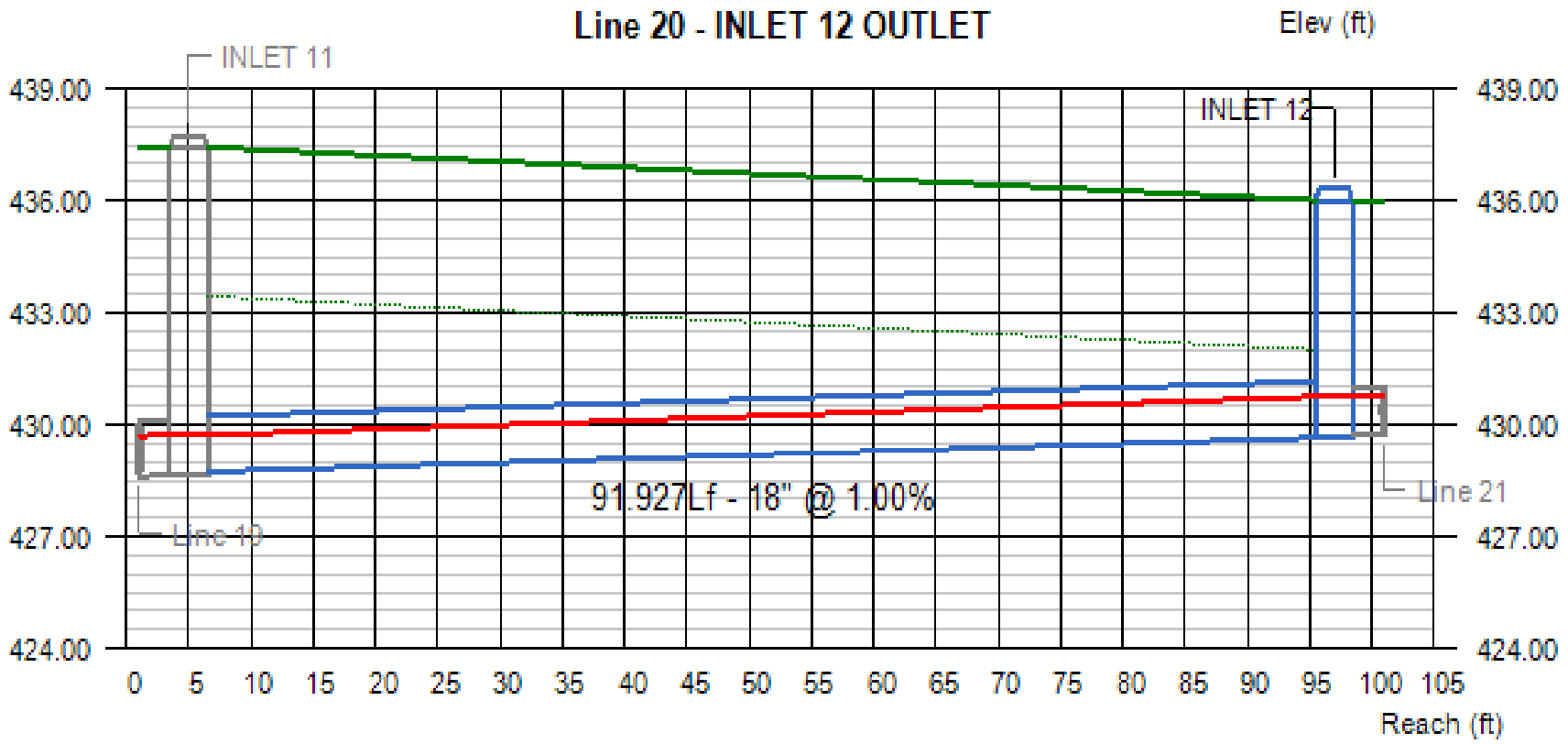
Line Profile (Line 19) - INLET 11 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	8.03	427.69	428.63	1.21	1.10	1.10	428.90	429.73 j	429.73	5.25	5.80	7.21	7.31

Project File: | No. Lines: 30 | Run Date: 2/12/2021

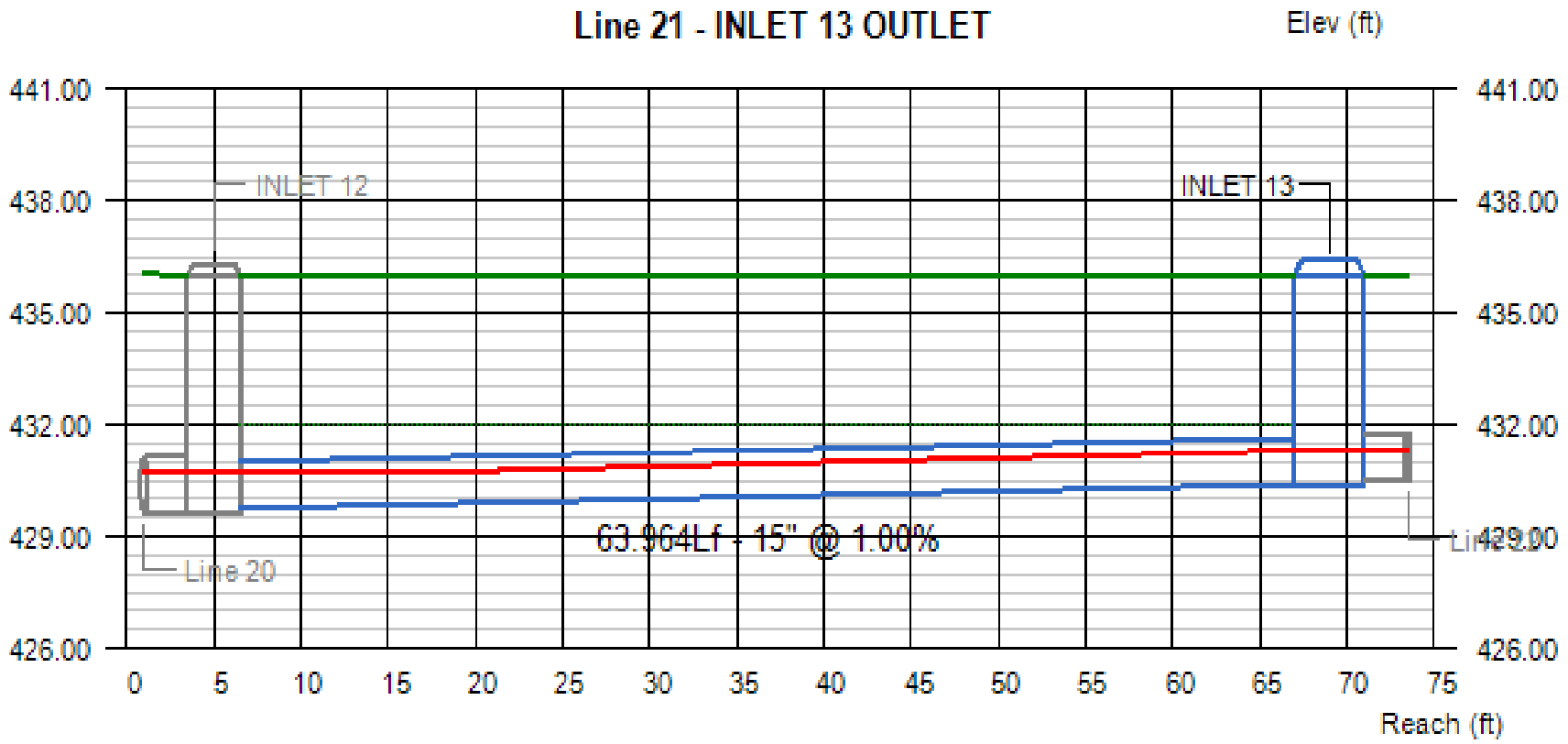
Line Profile (Line 20) - INLET 12 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	8.08	428.73	429.65	1.00	1.10	1.10	429.73	430.75	430.75	6.48	5.82	7.21	4.85

Project File: | No. Lines: 30 | Run Date: 2/12/2021

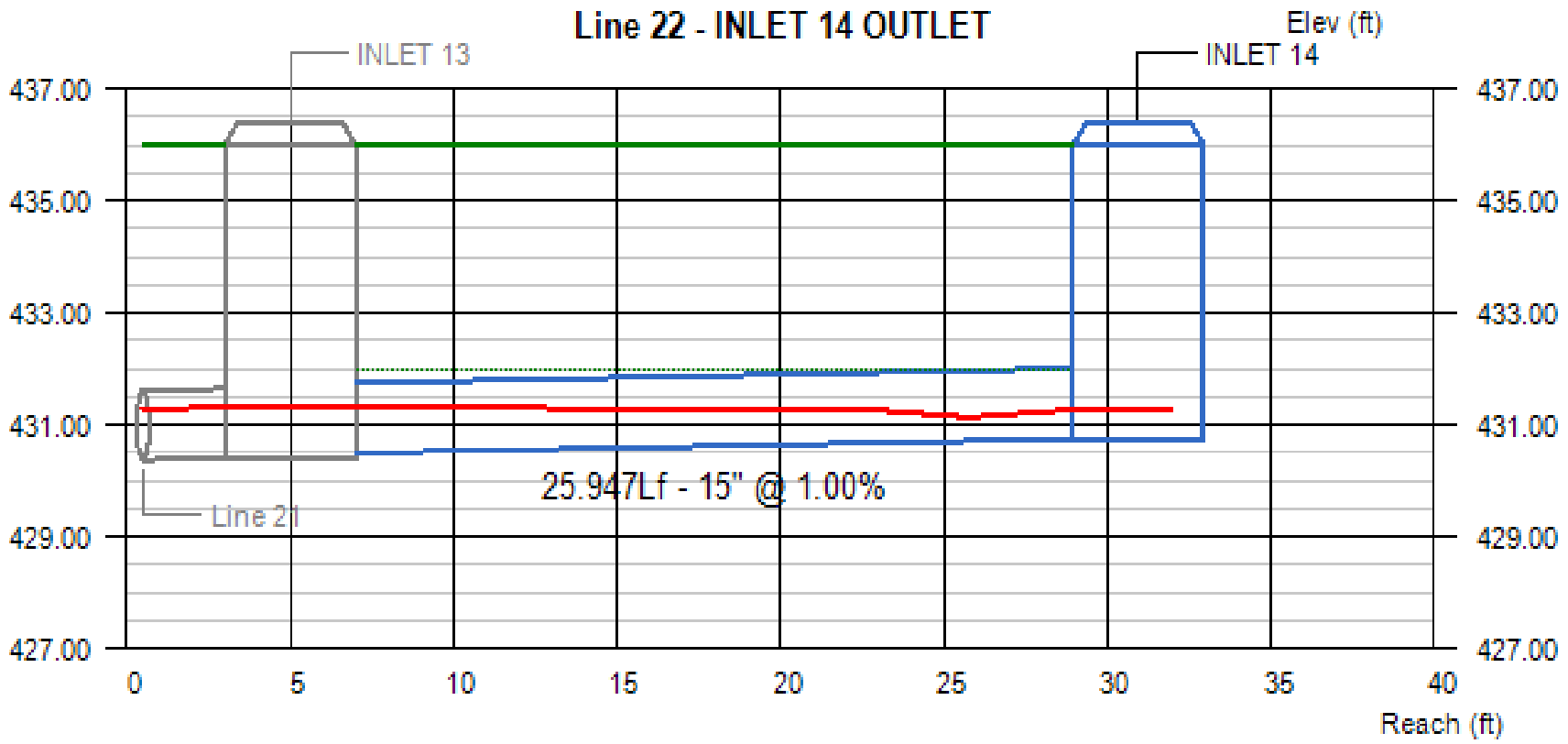
Line Profile (Line 21) - INLET 13 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	5.10	429.75	430.39	1.00	0.92	0.92	430.75	431.31 j	431.31	4.85	5.30	5.00	4.36

Project File: | No. Lines: 30 | Run Date: 2/12/2021

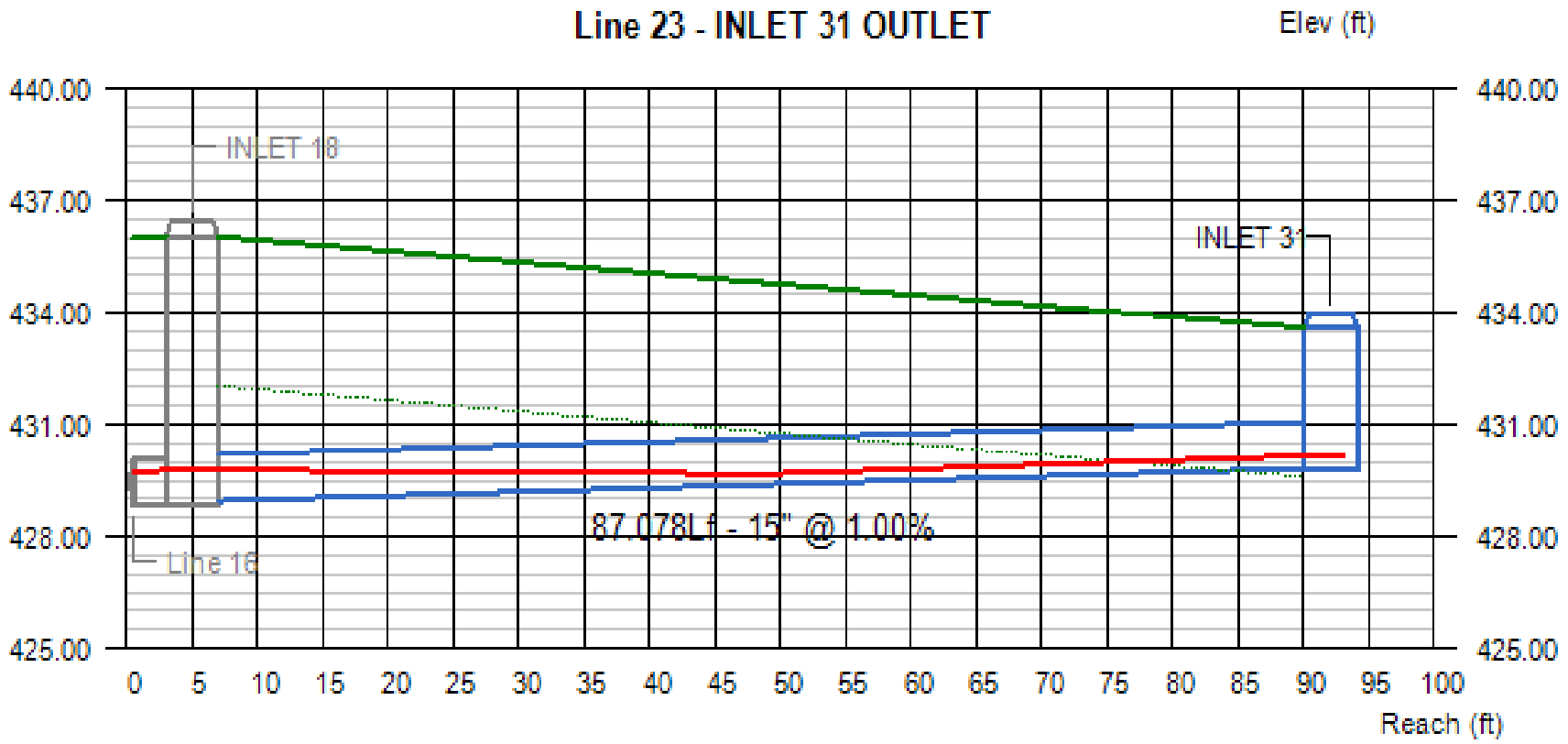
Line Profile (Line 22) - INLET 14 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	1.72	430.49	430.75	0.82	0.52	0.52	431.31	431.27 j	431.27	2.04	3.56	4.26	4.00

Project File: | No. Lines: 30 | Run Date: 2/12/2021

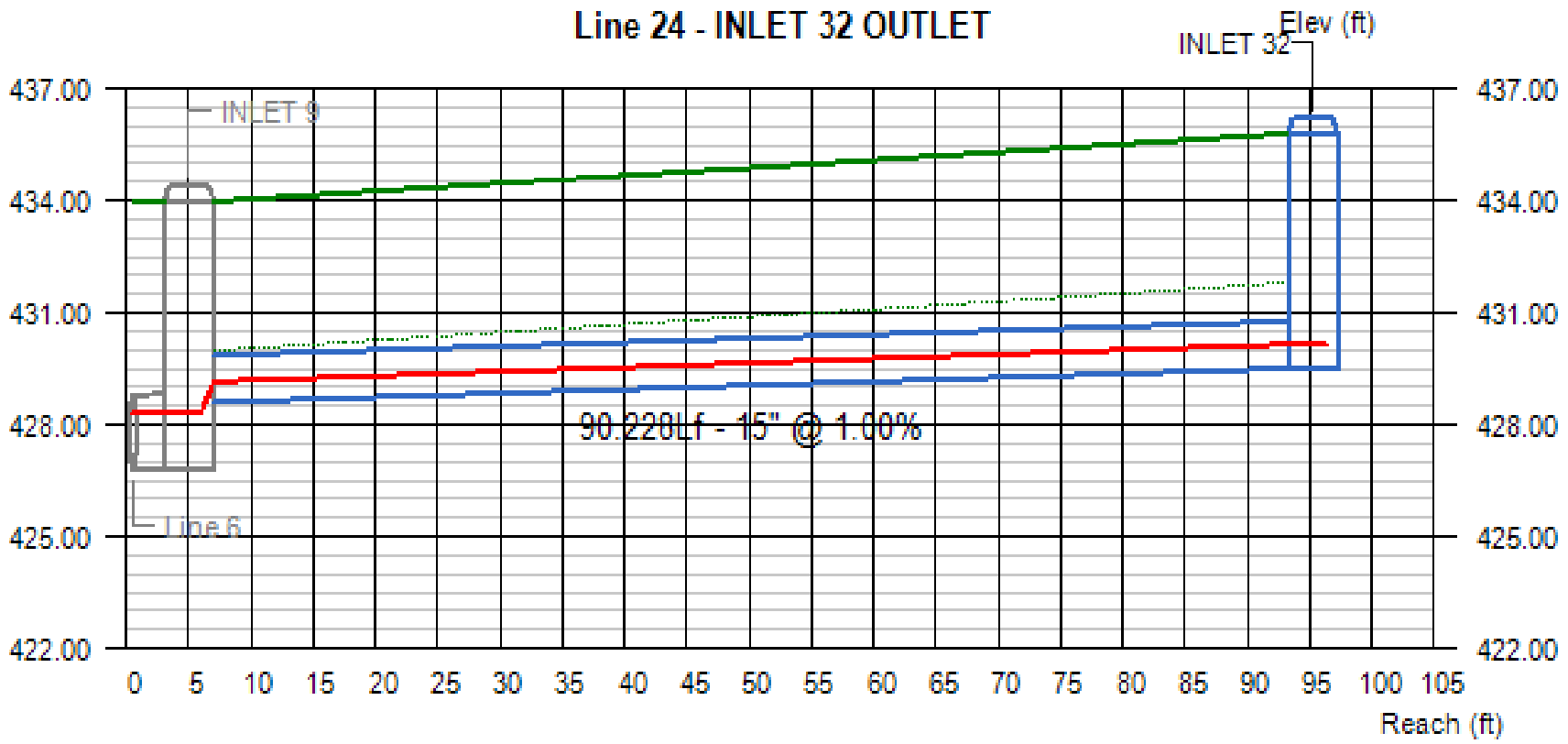
Line Profile (Line 23) - INLET 31 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	0.78	428.95	429.82	0.82	0.34	0.34	429.77	430.16 j	430.16	0.91	2.82	5.83	2.52

Project File: | No. Lines: 30 | Run Date: 2/12/2021

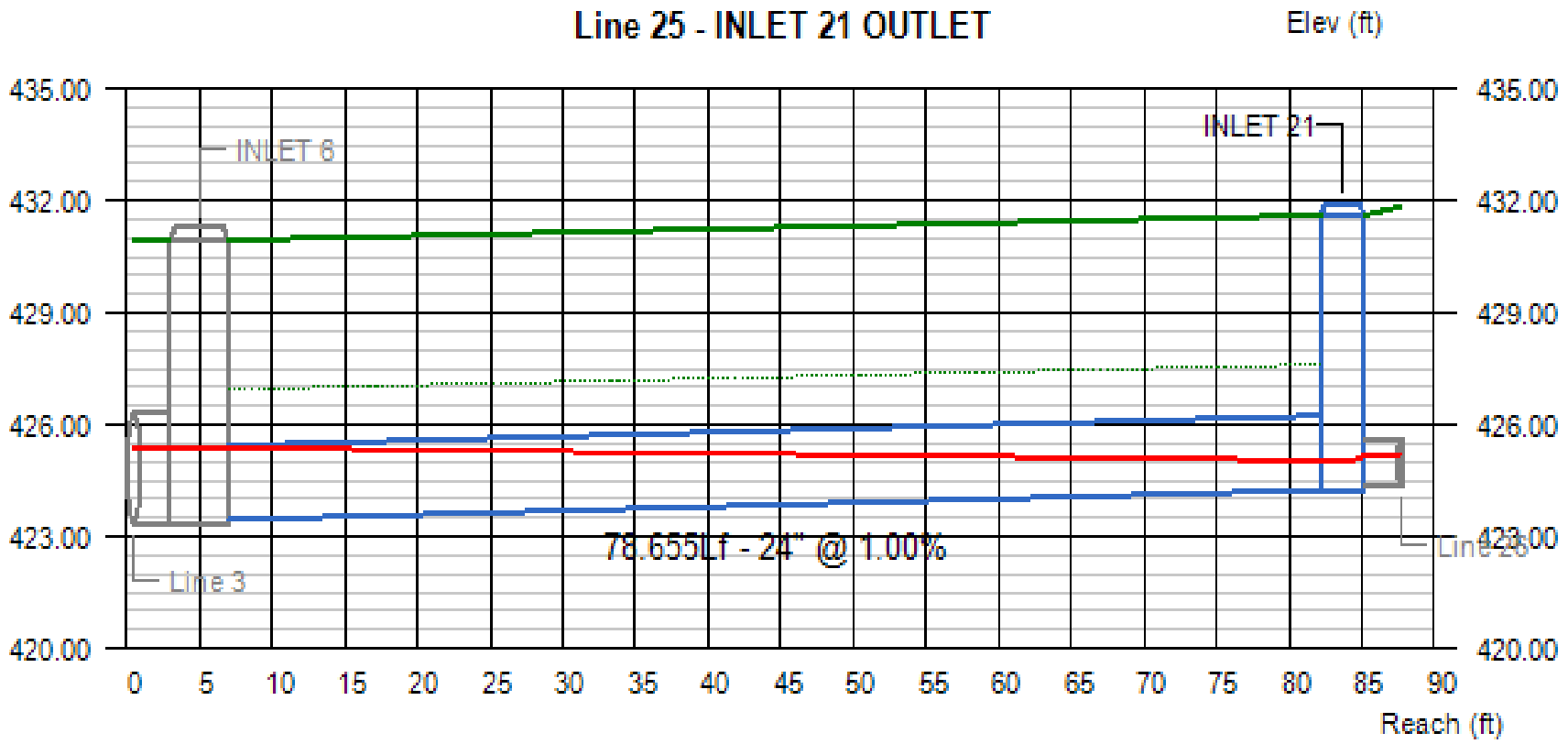
Line Profile (Line 24) - INLET 32 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	2.59	428.60	429.50	0.55	0.64	0.64	429.15	430.14	430.14	4.96	4.06	4.12	5.05

Project File: | No. Lines: 30 | Run Date: 2/12/2021

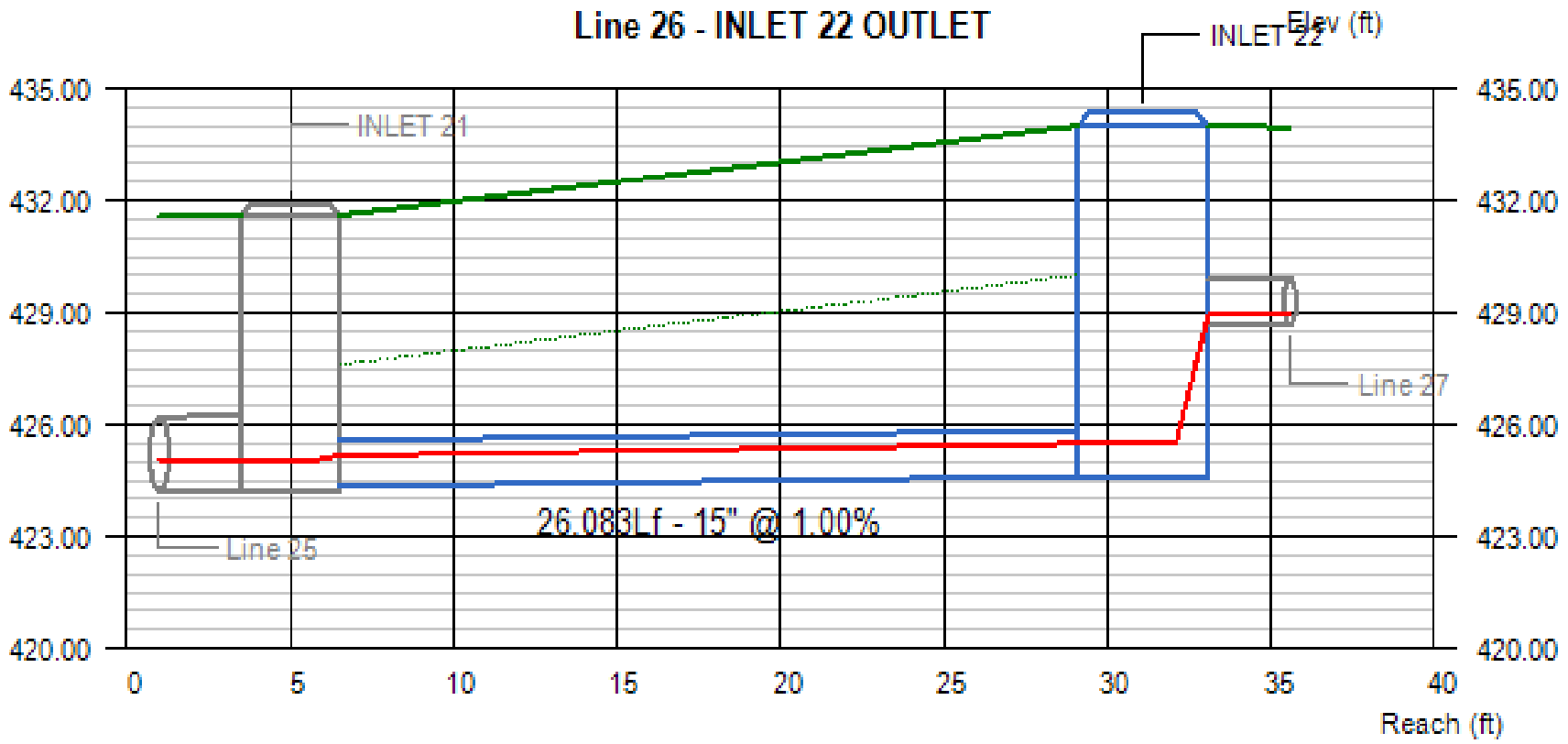
Line Profile (Line 25) - INLET 21 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	4.99	423.45	424.24	1.93	0.79	0.79	425.38	425.03	425.03	1.60	4.35	5.49	5.36

Project File: | No. Lines: 30 | Run Date: 2/12/2021

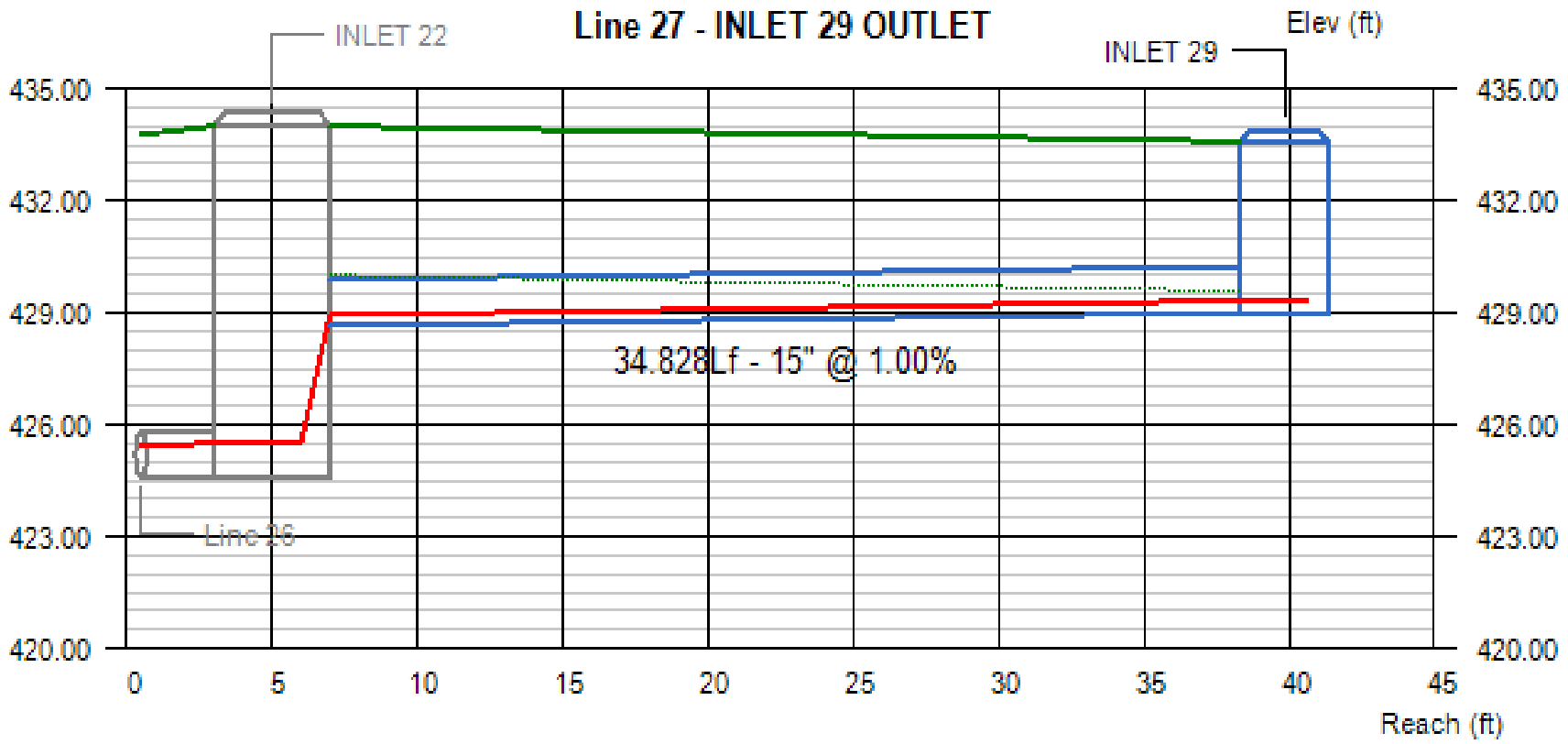
Line Profile (Line 26) - INLET 22 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	4.94	424.34	424.60	0.82	0.90	0.90	425.16	425.50	425.50	5.79	5.22	6.01	8.15

Project File: | No. Lines: 30 | Run Date: 2/12/2021

Line Profile (Line 27) - INLET 29 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
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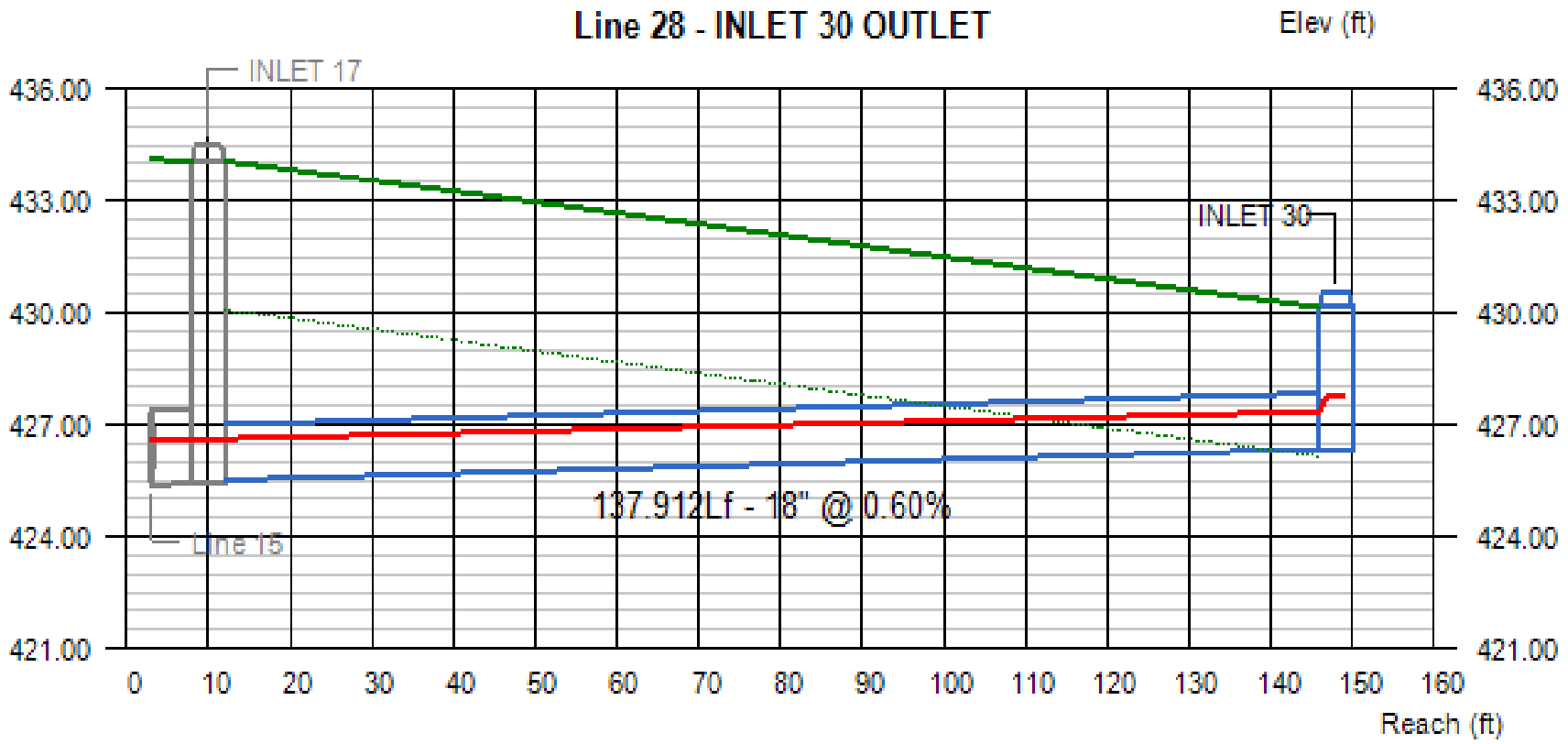
27	0.77	428.64	428.99	0.29	0.34	0.34	428.93	429.33	429.33	3.54	2.81	4.11	3.35

Project File: | No. Lines: 30 | Run Date: 2/12/2021

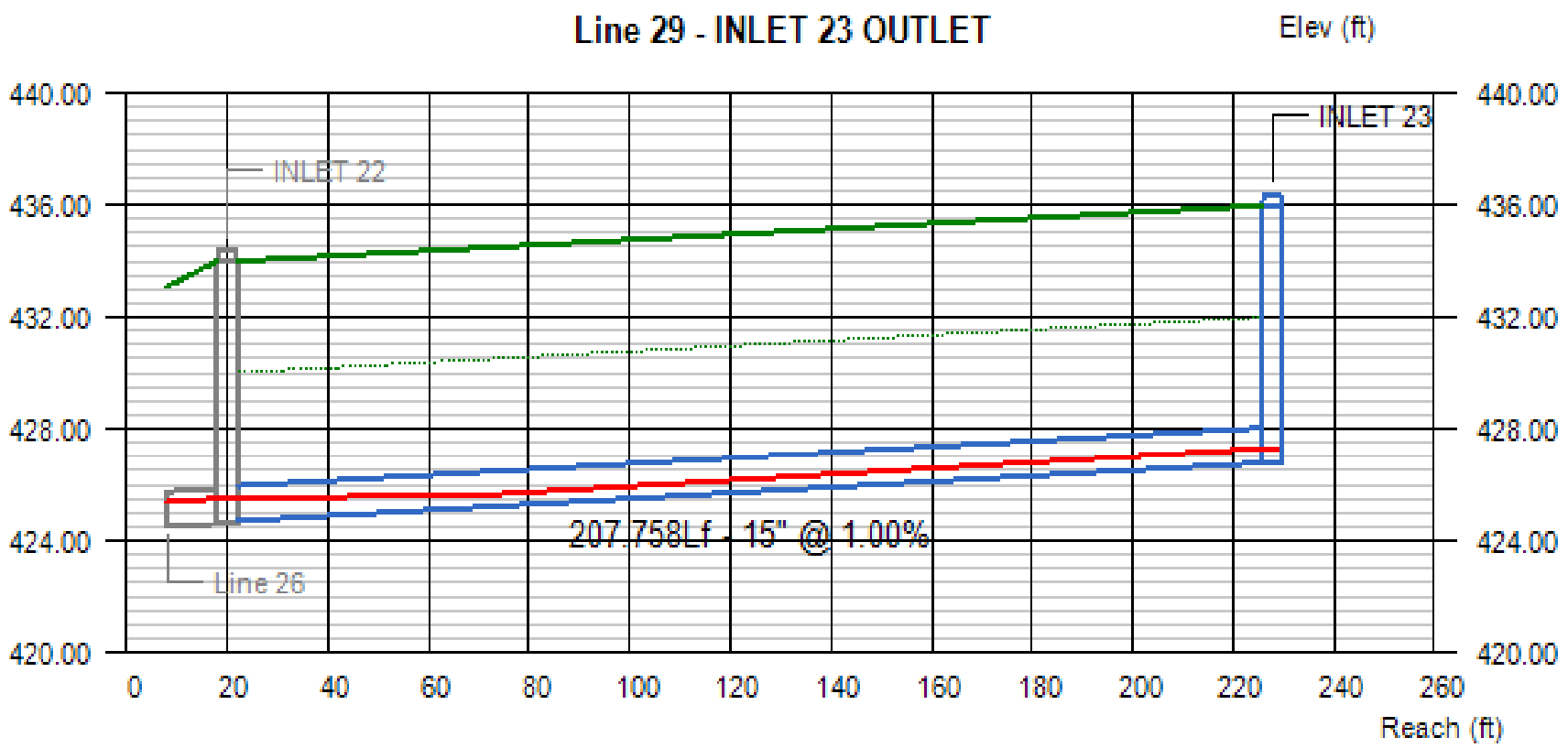
Line Profile (Line 28) - INLET 30 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	6.81	425.51	426.34	1.12	1.01	1.46	426.63	427.35	427.80	4.82	5.37	7.06	2.31

Project File: | No. Lines: 30 | Run Date: 2/12/2021

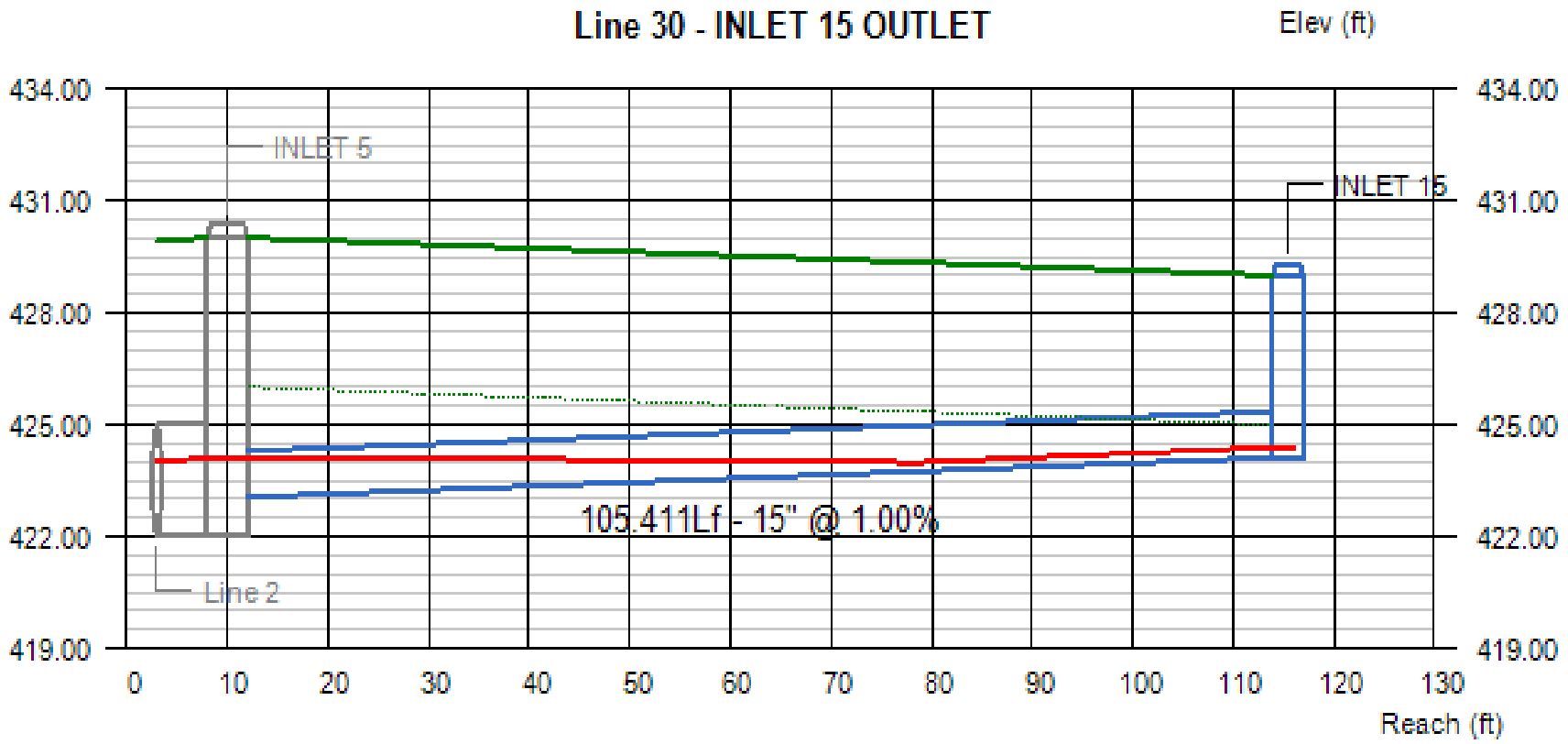
Line Profile (Line 29) - INLET 23 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	1.66	424.70	426.78	0.80	0.51	0.51	425.50	427.29 j	427.29	1.99	3.52	8.05	7.94

Project File: | No. Lines: 30 | Run Date: 2/12/2021

Line Profile (Line 30) - INLET 15 OUTLET



Line #	Q	Invert Elevation		Depth of Flow			Hydraulic Grade Line			Velocity		Cover	
	(cfs)	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	0.58	423.05	424.10	1.02	0.30	0.30	424.07	424.40 j	424.40	0.55	2.61	5.70	3.65

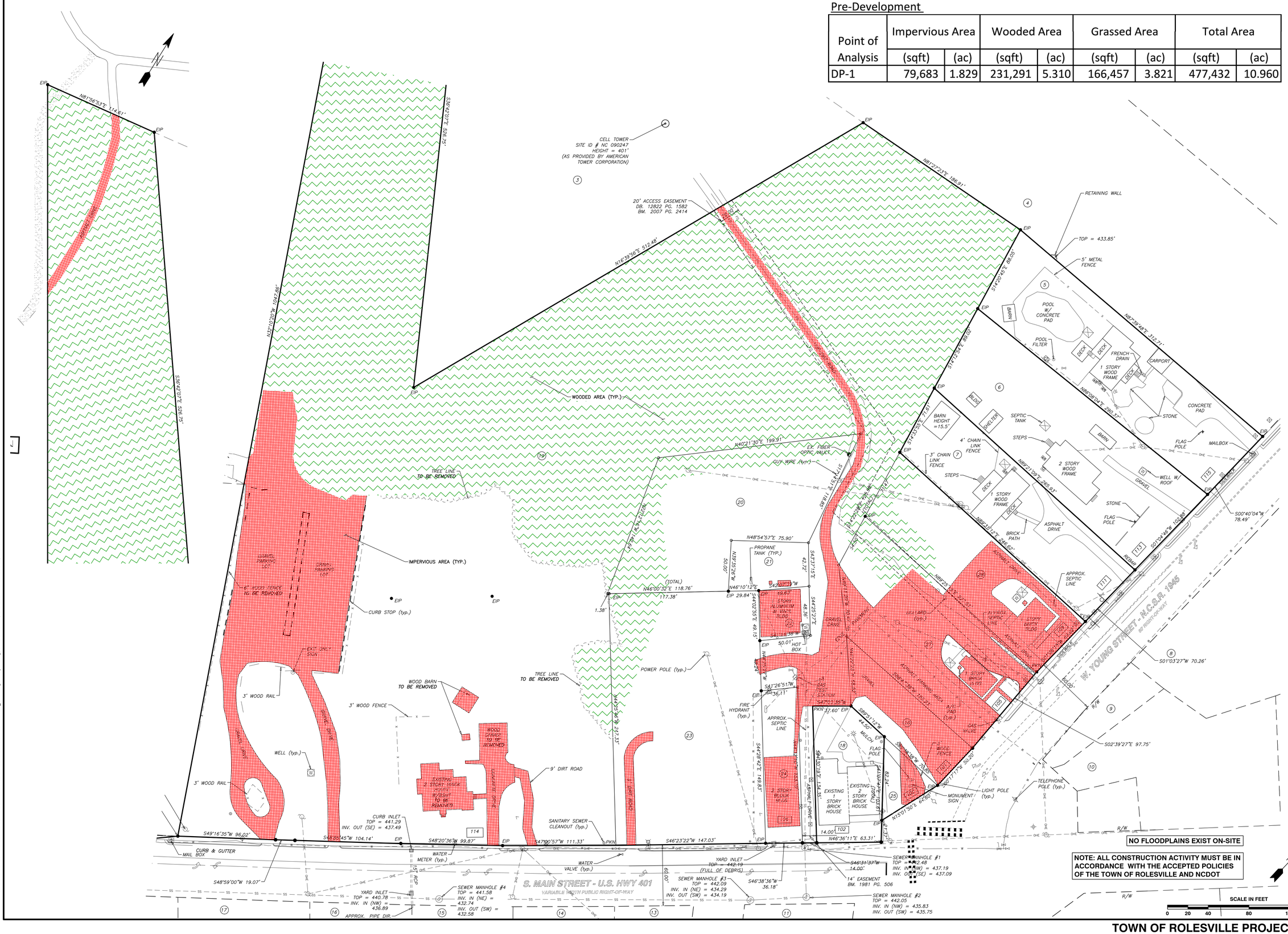
Project File: | No. Lines: 30 | Run Date: 2/12/2021

APPENDIX

PRE-DEVELOPMENT DRAINAGE AREA MAP
POST-DEVELOPMENT DRAINAGE AREA MAP
USGS 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 250, RALEIGH, NC 27607
TELEPHONE: (919)851-4422 FAX: (919)851-8968
CERTIFICATION NUMBERS: NCBELS (C-0110); NCBOLA (C-0267)

NO.	DATE	DESCRIPTION	BY
		REVISIONS	

JOB NO. 03-19081 PROGRESS
DATE DRAWN BY: RAB
CHK BY: MDB

PRE-DEVELOPMENT DRAINAGE MAP

SCALE: 1" = 40'

COBBLESTONE VILLAGE
MIXED USE DEVELOPMENT

TOWN OF ROLESVILLE, WAKE COUNTY, NORTH CAROLINA

SHEET 1 OF 3

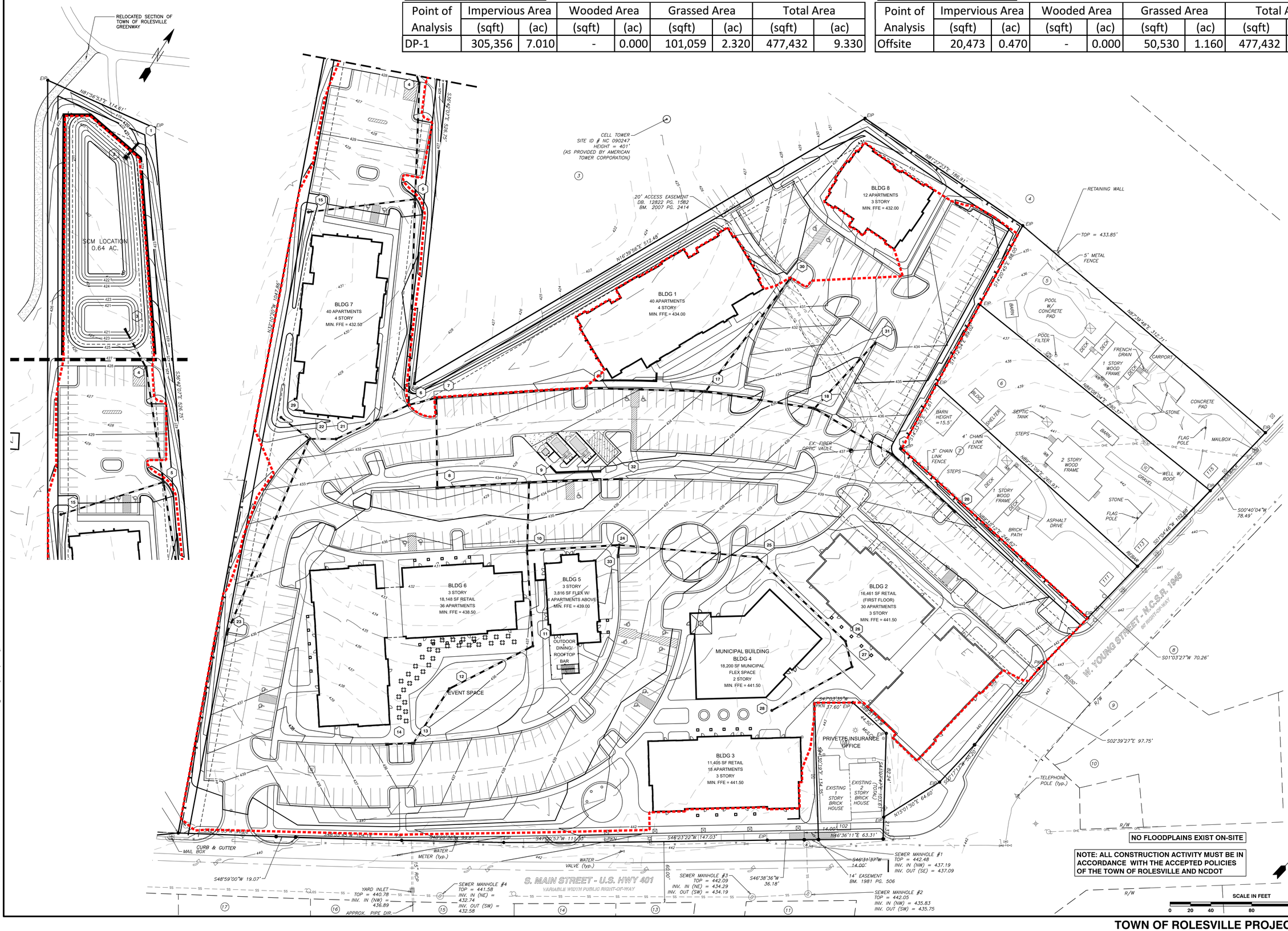
TOWN OF ROLESVILLE PROJECT NO. SUB-S-66-2018

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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TELEPHONE: (919)851-4422 FAX: (919)851-8968
CERTIFICATION NUMBERS: NCBELS (C-0110); NCBOLA (C-0267)

NO.	DATE	DESCRIPTION	BY
		REVISIONS	

JOB NO. 03-18081 DATE PROGRESS
DRAWN BY RAB
CHK BY: MDB

POST-DEVELOPMENT DRAINAGE MAP

SCALE: 1" = 40'

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

SHEET 2 OF 3

TOWN OF ROLESVILLE PROJECT NO. SUB-S-66-2018

NOT RELEASED FOR CONSTRUCTION OR BID SOLICITATION

R:\2019\19157 - Rolesville Town Center\CIVIL\04 Construction\4D - 19157_Drainage Maps.dwg, POST DA MAP, 2/5/2021 12:24:06 PM, marc.mueller

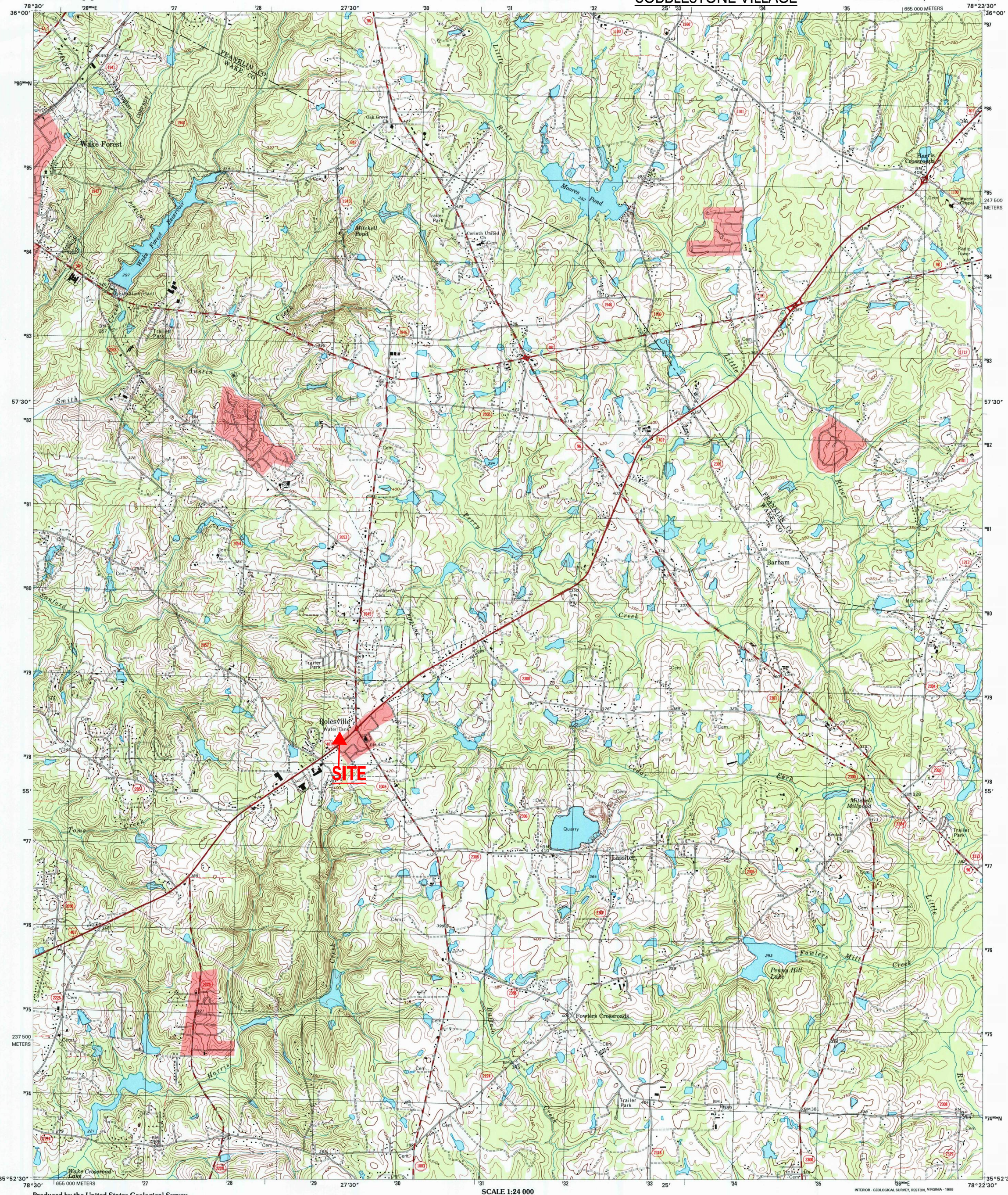
USGS
science for a changing world

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

STATE OF NORTH CAROLINA
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF LAND RESOURCES
NORTH CAROLINA GEOLOGICAL SURVEY

ROLESVILE, NC
COBBLESTONE VILLAGE

ROLESVILLE QUADRANGLE
NORTH CAROLINA
7.5-MINUTE SERIES (TOPOGRAPHIC)



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

MN 8¼° 151 MILS GN 1°30′ 27 MILS

UTM GRID AND 1999 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
1000 0 METERS 1000 2000
1 0.5 0 MILES 1
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 FEET

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
TO CONVERT FROM FEET TO METERS, MULTIPLY BY 0.3048

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

QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Grissom
2 Franklinton
3 Louisburg
4 Wake Forest
5 Bunn West
6 Raleigh East
7 Knightdale
8 Zebulon

ADJOINING 7.5' QUADRANGLE NAMES

INTERIOR - GEOLOGICAL SURVEY, RESTON, VIRGINIA - 1999

ROAD CLASSIFICATION

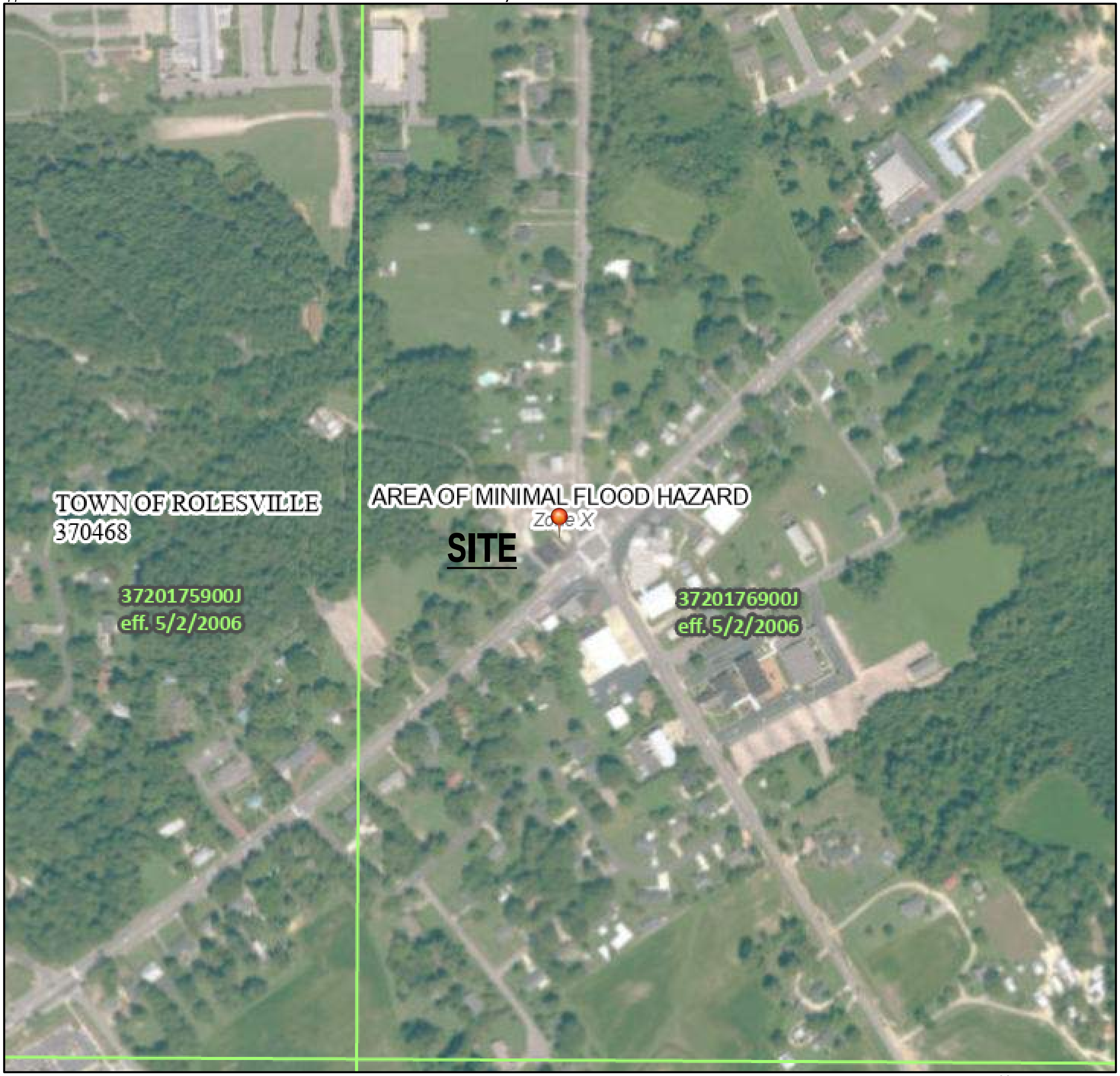
Primary highway hard surface
Secondary highway hard surface
Light-duty road, hard or improved surface
Unimproved road
Interstate Route
U.S. Route
State Route

ROLESVILLE, NC
1993
NIMA 5355 IV NW-SERIES V842

ISBN 0-607-90283-3
9 780607 902839

FEMA

ROLESVILLE, NC - COBBLESTONE VILLAGE



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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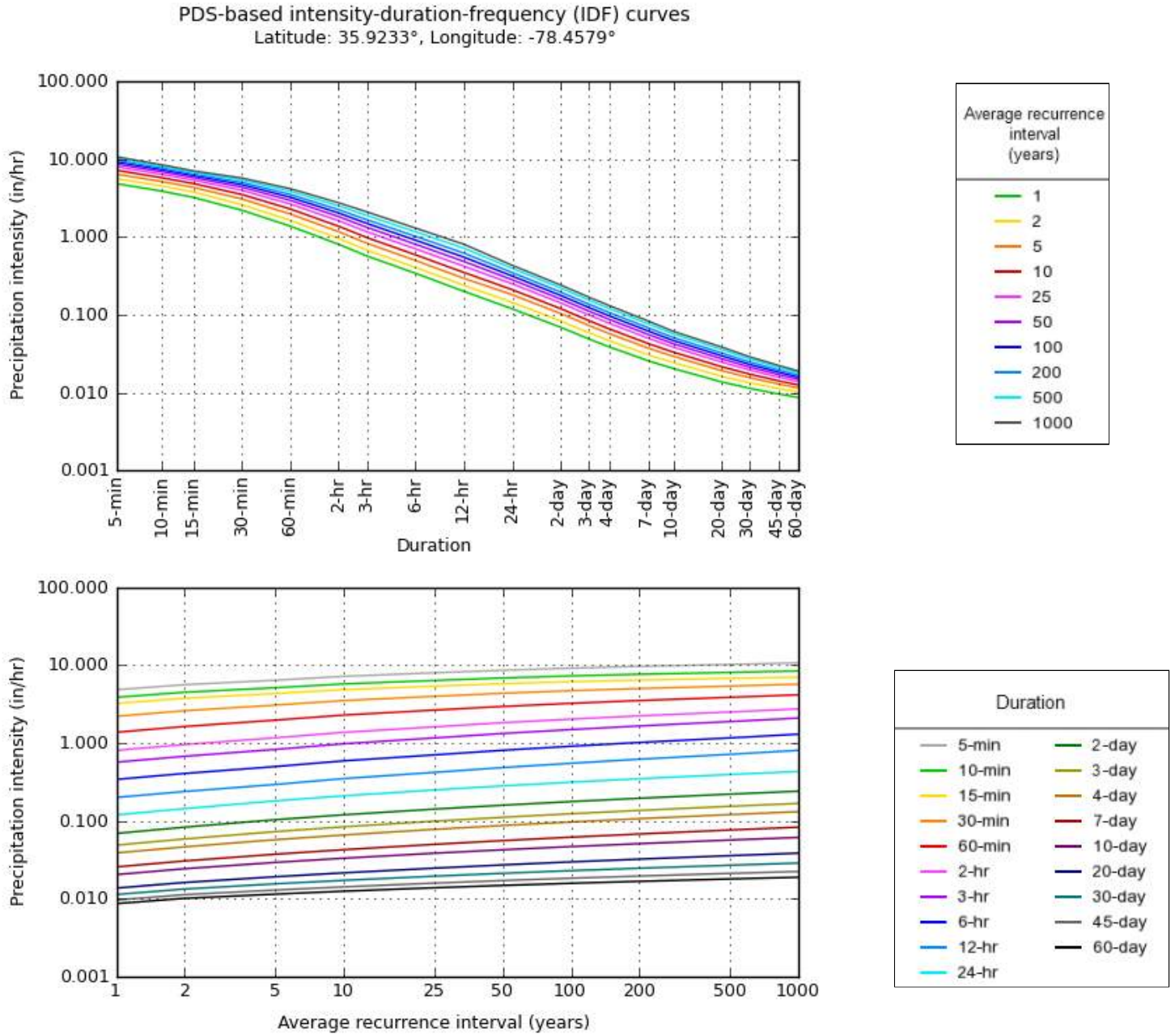
PF graphical



NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Wed Feb 3 21:38:25 2021

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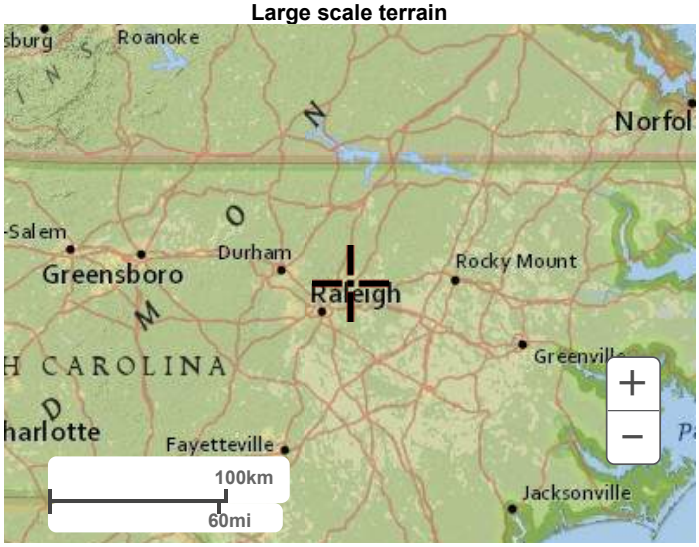
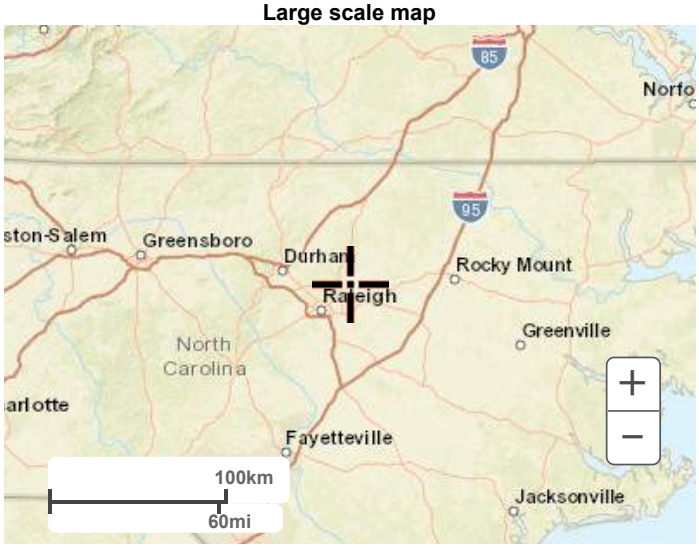
Maps & aerials

Small scale terrain

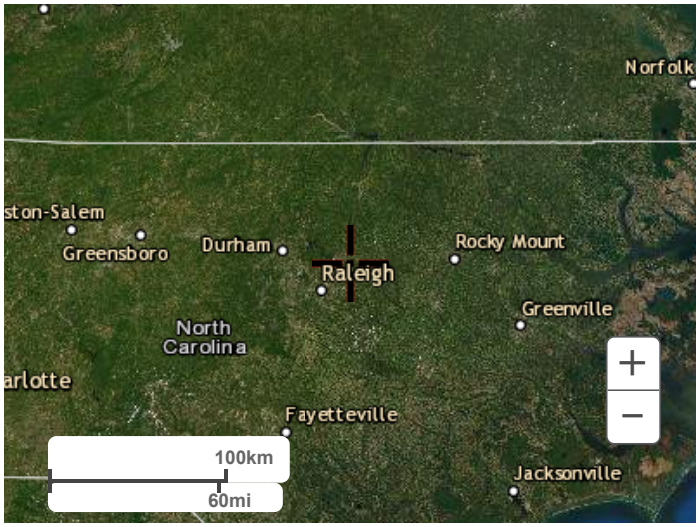
Large scale terrain



Large scale map



Large scale aerial



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