

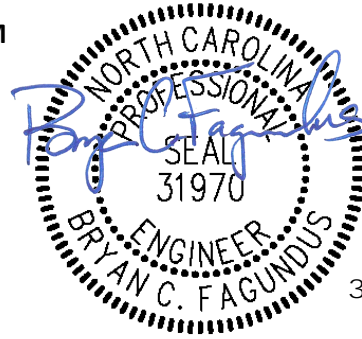
MEMORANDUM

Date: May 31, 2023
Rev. March 1, 2024

To: Town of Rolesville, NC

From: Bryan C. Fagundus, PE

Subject: Public Storm Sewer Pipe Network Design – Virginia Water Drive Extension & 7Eleven at Wallbrook – Rolesville, Wake County, NC



Project Summary

The purpose of this memorandum is to present the design calculations for the public storm sewer pipe network for Virginia Water Drive Extension and 7Eleven at Wallbrook. The total development consists of approximately 7.04 acres with approximately 0.32 acres within the public rights-of-way of Virginia Water Drive. The site is located on the North side of Main Street (US 401) in Rolesville, NC. (Reference Wallbrook Preliminary Plat PR21-04, Wallbrook Roadway Improvements – Virginia Water Drive Extension CID23-04, and 7Eleven at Wallbrook – Lot 11 SDP23-04).

Lines 8 (108-DI) and 11 (203-DI) represent the future drainage area covering the 3.13 acre Lot 10 as shown on PR 21-04 to the proposed public storm sewer system. Line 1 represents the connection to NCDOT U-6241 30" RCP storm stub serving as the outlet for Lot 11.

Calculation Methodology & Constants

- A minimum time of concentration of 5 minutes was utilized
- A minimum rational C value of 0.85 was utilized
- All pipes are RCP using a Manning's n value of 0.013
- The minimum pipe size used is 15"
- Rainfall data was taken from NOAA Atlas 14 at the Neuse 2 NE station

Analysis

The pipe networks were modeled using Autodesk Civil 3D and the model data was exported to Hydrflow Storm Sewer software for analysis. The attached results show that the drainage network meets Wake County and Town of Rolesville regulations and standards as follows:

- The gutter spread for the 1-year, approximately 4 in/hr storm, does not encroach more than 10' into the adjacent driving lane for the public storm sewer system.
- The total flow (cfs) within the storm sewer system does not exceed the flow capacity (cfs) in the pipe network in the 10-year rain event for storm sewer system.
- The 10-yr rain event HGL is contained within the public storm sewer system.

Drainage Area Map and Supporting Documents



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	4.82 (4.42-5.28)	5.62 (5.15-6.13)	6.42 (5.89-7.01)	7.18 (6.56-7.82)	7.94 (7.24-8.66)	8.53 (7.74-9.30)	9.06 (8.16-9.86)	9.50 (8.53-10.4)	10.0 (8.90-10.9)	10.4 (9.20-11.4)
10-min	3.85 (3.53-4.21)	4.49 (4.12-4.91)	5.15 (4.72-5.62)	5.74 (5.25-6.26)	6.33 (5.77-6.90)	6.79 (6.16-7.40)	7.19 (6.49-7.84)	7.54 (6.76-8.23)	7.92 (7.04-8.64)	8.22 (7.25-8.99)
15-min	3.21 (2.94-3.51)	3.76 (3.45-4.11)	4.34 (3.98-4.74)	4.84 (4.43-5.28)	5.35 (4.87-5.83)	5.74 (5.20-6.25)	6.06 (5.47-6.60)	6.34 (5.68-6.92)	6.64 (5.91-7.25)	6.88 (6.06-7.52)
30-min	2.20 (2.02-2.41)	2.60 (2.38-2.84)	3.08 (2.83-3.36)	3.51 (3.21-3.82)	3.96 (3.61-4.32)	4.32 (3.92-4.71)	4.64 (4.19-5.06)	4.93 (4.42-5.38)	5.29 (4.70-5.77)	5.57 (4.91-6.09)
60-min	1.37 (1.26-1.50)	1.63 (1.50-1.78)	1.98 (1.81-2.16)	2.28 (2.09-2.49)	2.64 (2.40-2.88)	2.93 (2.65-3.19)	3.20 (2.88-3.48)	3.46 (3.10-3.78)	3.79 (3.37-4.14)	4.07 (3.59-4.44)
2-hr	0.800 (0.728-0.883)	0.956 (0.872-1.05)	1.17 (1.06-1.28)	1.36 (1.24-1.50)	1.60 (1.44-1.75)	1.80 (1.61-1.97)	1.99 (1.77-2.17)	2.18 (1.93-2.38)	2.43 (2.13-2.65)	2.64 (2.30-2.89)
3-hr	0.565 (0.514-0.625)	0.675 (0.616-0.744)	0.829 (0.755-0.913)	0.974 (0.884-1.07)	1.15 (1.04-1.26)	1.31 (1.17-1.43)	1.46 (1.30-1.60)	1.62 (1.43-1.77)	1.83 (1.60-2.00)	2.01 (1.74-2.21)
6-hr	0.340 (0.311-0.375)	0.407 (0.373-0.447)	0.500 (0.457-0.549)	0.588 (0.536-0.644)	0.699 (0.632-0.764)	0.796 (0.716-0.869)	0.893 (0.796-0.973)	0.994 (0.877-1.08)	1.13 (0.985-1.23)	1.25 (1.08-1.37)
12-hr	0.200 (0.183-0.220)	0.239 (0.220-0.261)	0.295 (0.270-0.323)	0.349 (0.318-0.381)	0.417 (0.378-0.455)	0.478 (0.431-0.519)	0.540 (0.481-0.586)	0.606 (0.534-0.657)	0.697 (0.604-0.754)	0.778 (0.664-0.843)
24-hr	0.119 (0.111-0.128)	0.144 (0.134-0.154)	0.180 (0.168-0.193)	0.209 (0.194-0.224)	0.248 (0.230-0.266)	0.279 (0.258-0.299)	0.310 (0.286-0.333)	0.343 (0.315-0.368)	0.387 (0.355-0.415)	0.422 (0.385-0.454)
2-day	0.069 (0.064-0.074)	0.083 (0.078-0.089)	0.103 (0.096-0.111)	0.119 (0.111-0.128)	0.141 (0.131-0.151)	0.158 (0.146-0.169)	0.175 (0.162-0.188)	0.192 (0.177-0.207)	0.217 (0.199-0.233)	0.235 (0.215-0.254)
3-day	0.049 (0.046-0.052)	0.059 (0.055-0.063)	0.073 (0.068-0.078)	0.083 (0.078-0.089)	0.098 (0.092-0.105)	0.110 (0.102-0.118)	0.122 (0.113-0.131)	0.134 (0.124-0.144)	0.151 (0.139-0.162)	0.165 (0.150-0.177)
4-day	0.039 (0.036-0.041)	0.046 (0.043-0.049)	0.057 (0.054-0.061)	0.066 (0.061-0.070)	0.077 (0.072-0.082)	0.086 (0.080-0.092)	0.096 (0.089-0.102)	0.105 (0.097-0.113)	0.119 (0.109-0.127)	0.129 (0.118-0.138)
7-day	0.026 (0.024-0.027)	0.031 (0.029-0.032)	0.037 (0.035-0.040)	0.042 (0.040-0.045)	0.050 (0.046-0.053)	0.055 (0.052-0.059)	0.061 (0.057-0.065)	0.067 (0.062-0.072)	0.075 (0.069-0.080)	0.082 (0.075-0.087)
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)	0.042 (0.039-0.045)	0.046 (0.043-0.049)	0.050 (0.047-0.054)	0.056 (0.052-0.060)	0.060 (0.056-0.065)
20-day	0.014 (0.013-0.015)	0.016 (0.015-0.017)	0.019 (0.018-0.020)	0.021 (0.020-0.023)	0.024 (0.023-0.026)	0.027 (0.025-0.029)	0.029 (0.027-0.031)	0.032 (0.030-0.034)	0.035 (0.033-0.038)	0.038 (0.035-0.041)
30-day	0.011 (0.011-0.012)	0.013 (0.013-0.014)	0.015 (0.015-0.016)	0.017 (0.016-0.018)	0.019 (0.018-0.021)	0.021 (0.020-0.022)	0.023 (0.021-0.024)	0.024 (0.023-0.026)	0.027 (0.025-0.028)	0.028 (0.026-0.030)
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)	0.019 (0.018-0.020)	0.021 (0.020-0.022)	0.022 (0.021-0.023)
60-day	0.009 (0.008-0.009)	0.010 (0.010-0.011)	0.011 (0.011-0.012)	0.012 (0.012-0.013)	0.014 (0.013-0.014)	0.015 (0.014-0.015)	0.016 (0.015-0.016)	0.017 (0.016-0.017)	0.018 (0.017-0.019)	0.019 (0.018-0.020)

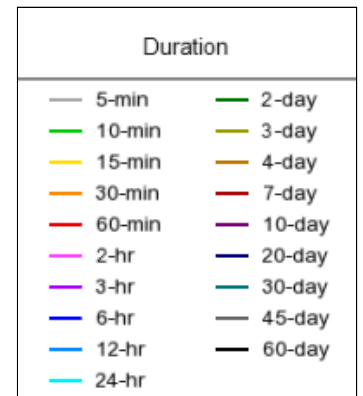
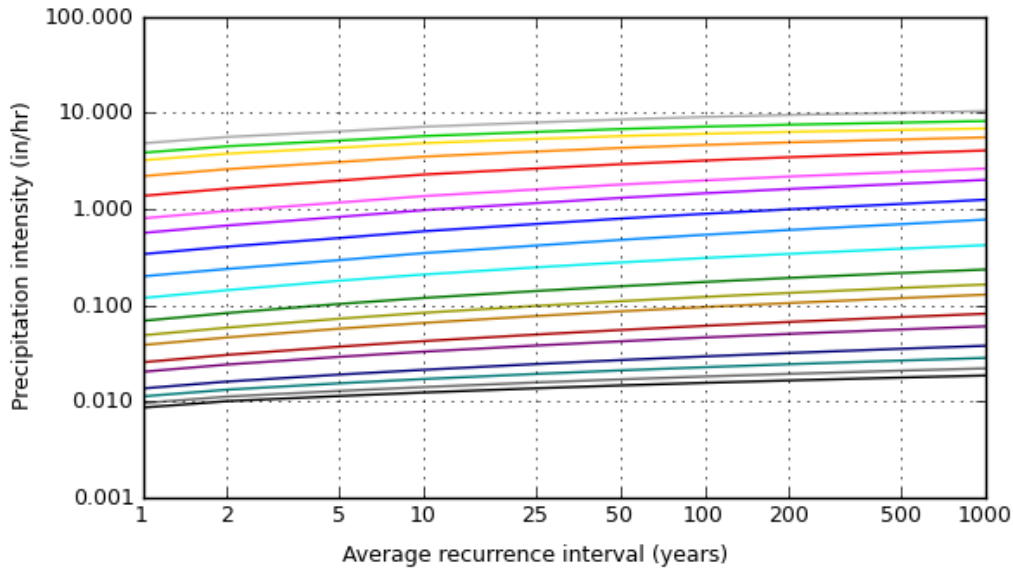
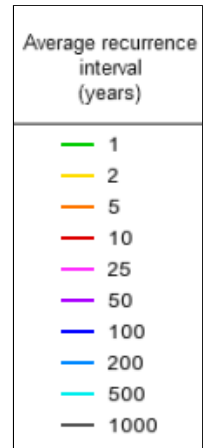
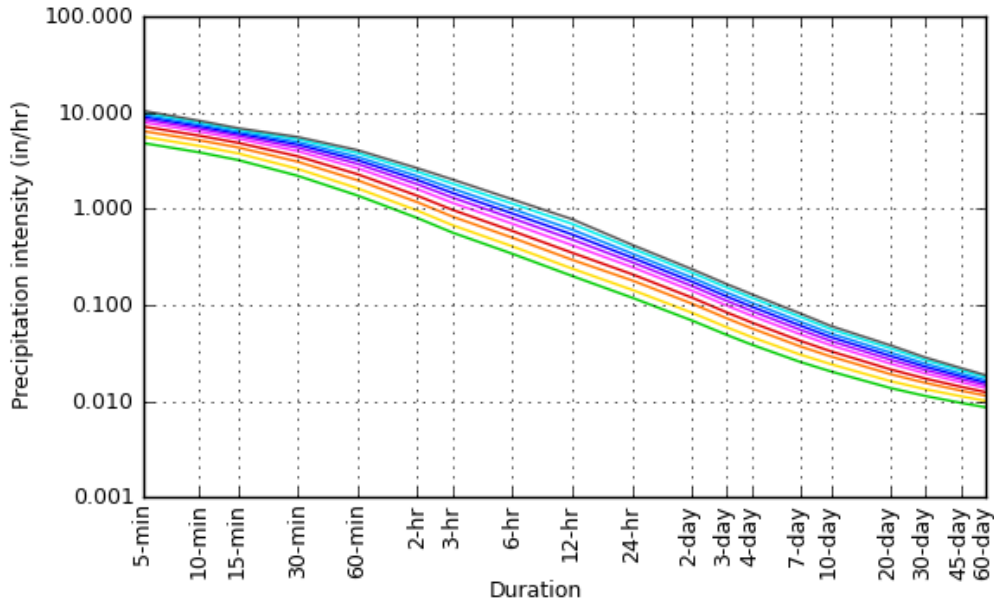
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average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

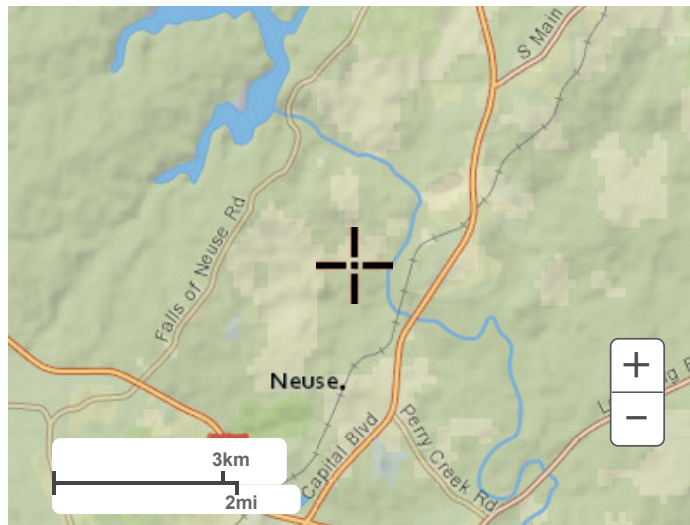
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Maps & aerials

Small scale terrain



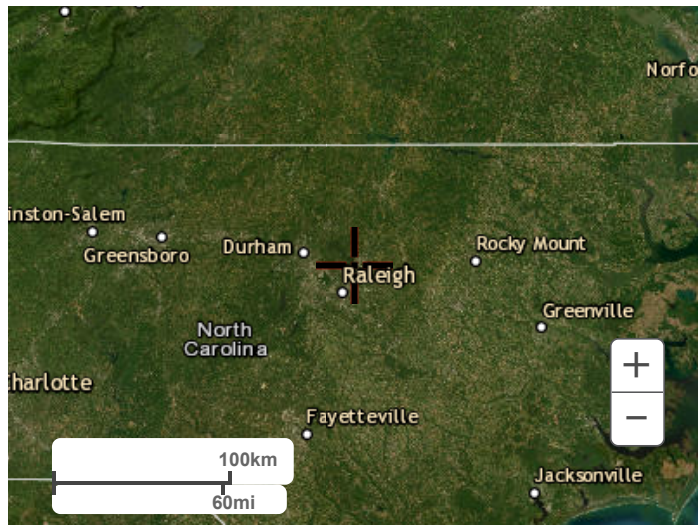
Large scale terrain



Large scale map



Large scale aerial

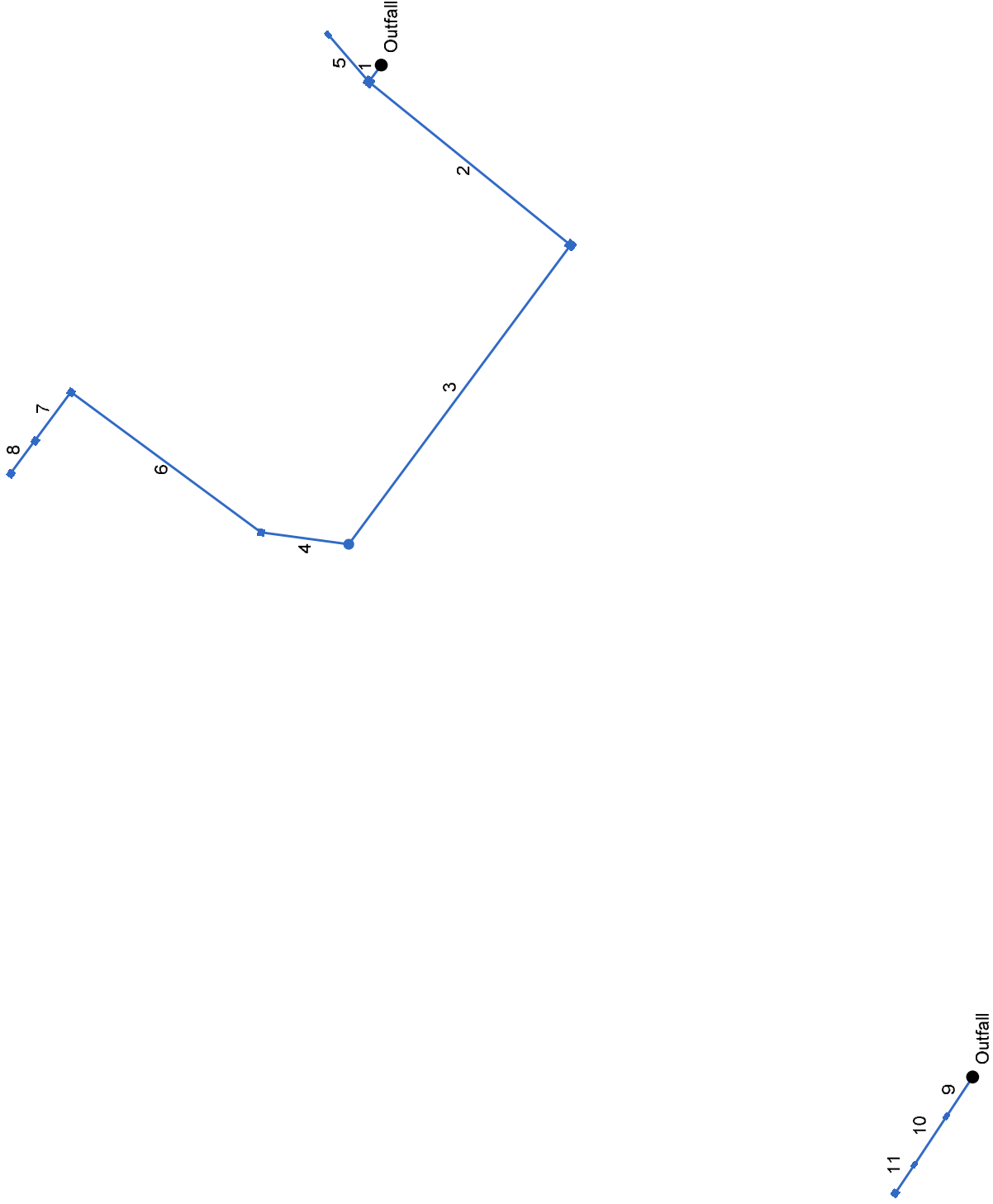


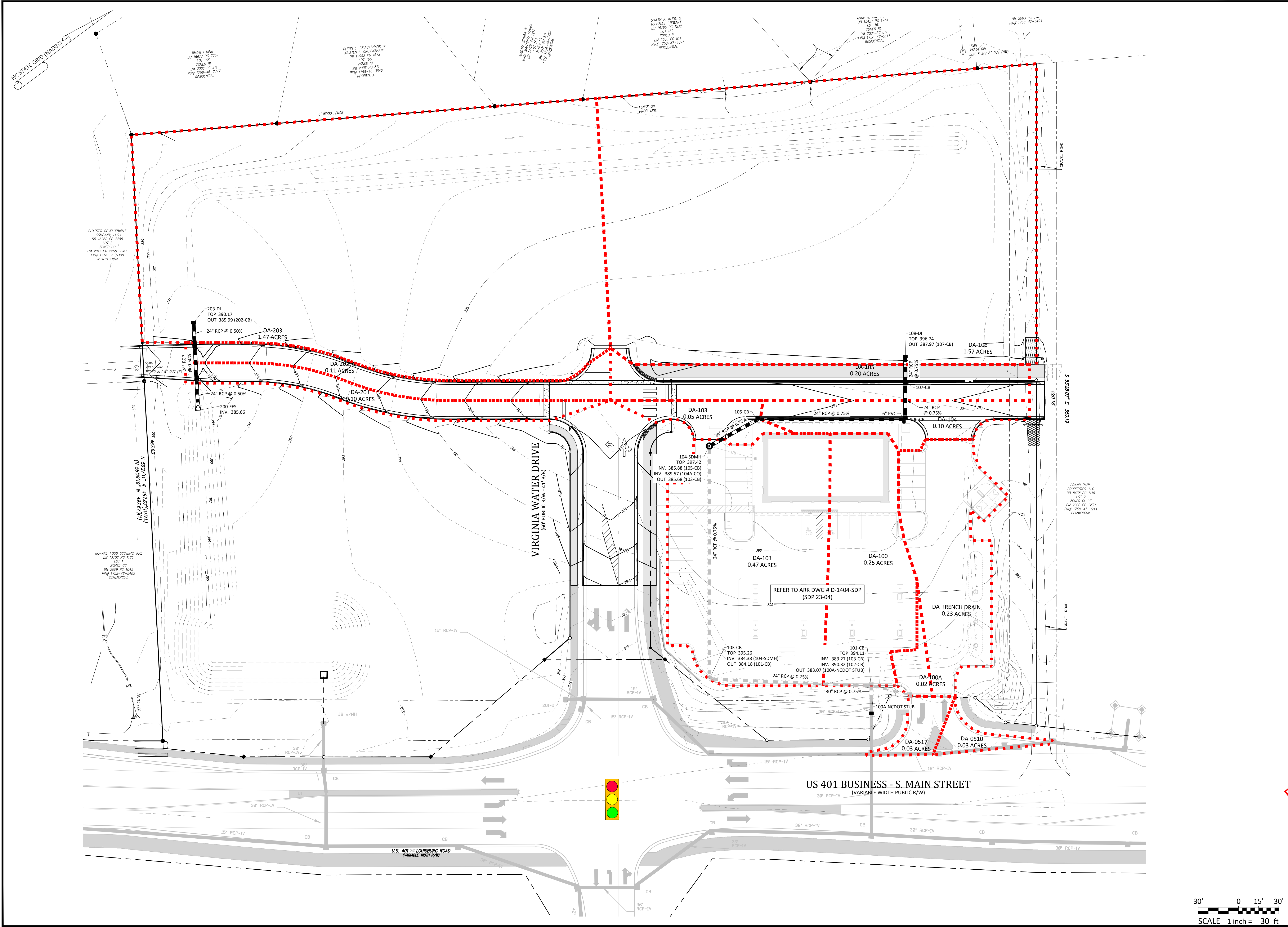
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[National Weather Service](#)
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Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan





- Final Drawing -
Issued for Permit
 Revises: 1-11-2024
 2-11-2024
 3-17-2024



DRAINAGE AREAS MAP
WALLBROOK ROADWAY IMPROVEMENTS
VIRGINIA WATER DRIVE EXTENSION (SERVING LOTS 9-11)
 Town of Rolesville Project No. CID 23-04
 US 401 Business / S. Main Street & Virginia Water Drive
 Wake Forest Township, Town of Rolesville, Wake County, North Carolina

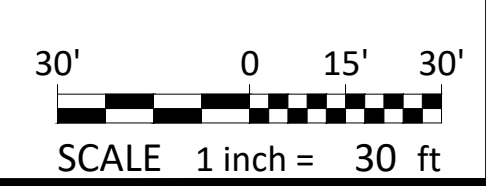
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Final Drawing
 2/21/2024

Project Manager: BCF
 Drawn By: DLC/TGN
 Checked By: TGN
 Project Number: 22049
 Drawing Number: D-1404-CID

DA

Date: May 1, 2023



1-Year Rain Event Results for Gutter Spread

Inlets

Line No.	Inlet ID	Drng Area (ac)	Inlet Time (min)	i Inlet (in/hr)	Runoff Coeff (C)	Flow Rate (cfs)	Line Type	Grate Area (sqft)	Cross SI, Sw (ft/ft)	Cross SI, Sx (ft/ft)	Local Depr (in)	Gutter Spread (ft)	Gutter Depth (ft)
1	101-CB	0.25	5.0	4.82	0.85	8.02	Cir	3.10	0.056	0.020	2.0	3.06	0.13
2	103-CB	0.47	5.0	4.82	0.85	8.65	Cir	3.10	0.056	0.030	2.0	3.56	0.16
3	104-SDMH	0.00	0.0	0.00	0.00	7.34	Cir	....	....	....	....	....	....
4	105-CB	0.05	5.0	4.82	0.85	7.44	Cir	....	0.056	0.020	2.0	1.70	0.10
5	102-CB	0.02	5.0	4.82	0.85	0.08	Cir	3.10	0.056	0.030	2.0	0.56	-0.09
6	106-CB	0.10	5.0	4.82	0.85	7.52	Cir	3.10	0.056	0.020	2.0	1.42	0.03
7	107-CB	0.20	5.0	4.82	0.85	7.19	Cir	3.10	0.056	0.020	2.0	2.18	0.12
8	108-DI	1.57	5.0	4.82	0.85	6.43	Cir	3.10	0.056	0.020	2.0	17.74	0.43
9	201-CB	0.10	5.0	4.82	0.85	6.76	Cir	3.10	0.056	0.020	2.0	1.42	0.03
10	202-CB	0.11	5.0	4.82	0.85	6.42	Cir	3.10	0.056	0.020	2.0	1.49	0.04
11	203-DI	1.47	5.0	4.82	0.85	6.02	Cir	3.10	0.056	0.020	2.0	16.76	0.41

Project File: 2024-01-15 - Wallbrook 7Eleven.stm Number of lines: 11 Date: 1/15/2024

NOTES: Intensity = 62.18 / (inlet time + 12.70) ^ 0.89 -- Return period = 1 Yrs. ; ** Critical depth

10-Year Rain Event Results

Storm Sewer Tabulation

Station	Line	To Line	Len (ft)	Drng Area		Rnoff coeff (C)	Area x C		Tc		Rain (l) (in/hr)	Total flow (cfs)	Cap full (cfs)	Vel (ft/s)	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
				Incr (ac)	Total (ac)		Incr	Total	Inlet (min)	Syst (min)					Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End		9.757	0.25	2.66	0.85	0.21	2.26	5.0	9.9	5.9	13.31	34.74	4.48	30	0.72	383.00	383.07	384.86	384.30	385.95	394.11	D-100
2	1		120.987	0.47	2.39	0.85	0.40	2.03	5.0	6.8	6.6	13.50	19.62	6.43	24	0.75	383.27	384.18	384.49	385.50	394.11	395.26	D-101
3	2		173.661	0.00	1.92	0.00	0.00	1.63	0.0	5.9	6.9	11.23	19.59	5.95	24	0.75	384.38	385.68	385.50	386.88	395.26	397.43	D-102
4	3		41.287	0.05	1.92	0.85	0.04	1.63	5.0	5.8	6.9	11.32	19.60	6.09	24	0.75	385.88	386.19	386.97	387.40	397.43	397.54	D-103
5	1		29.152	0.02	0.02	0.85	0.02	0.02	5.0	5.0	7.2	0.12	9.11	2.16	15	1.99	390.32	390.90	390.42	391.03	394.11	393.73	D-100A
6	4		110.121	0.10	1.87	0.85	0.09	1.59	5.0	5.2	7.1	11.28	19.64	6.09	24	0.75	386.39	387.22	387.48	388.42	397.54	397.03	D-104
7	6		28.000	0.20	1.77	0.85	0.17	1.50	5.0	5.1	7.1	10.75	19.59	5.99	24	0.75	387.42	387.63	388.48	388.80	397.03	397.04	D-105
8	7		19.000	1.57	1.57	0.85	1.33	1.33	5.0	5.0	7.2	9.58	19.42	5.77	24	0.74	387.83	387.97	388.82	389.08	397.04	396.74	D-106
9	End		21.986	0.10	1.68	0.85	0.09	1.43	5.0	5.2	7.1	10.14	16.00	3.95	24	0.50	385.66	385.77	387.23	387.25	387.99	390.03	D-201
10	9		27.165	0.11	1.58	0.85	0.09	1.34	5.0	5.1	7.1	9.60	15.65	3.66	24	0.48	385.77	385.90	387.38	387.41	390.03	390.14	D-202
11	10		16.303	1.47	1.47	0.85	1.25	1.25	5.0	5.0	7.2	8.97	16.80	4.27	24	0.55	385.90	385.99	387.52	387.06	390.14	390.17	D-203

Project File: 2024-01-15 - Wallbrook 7Eleven.stm

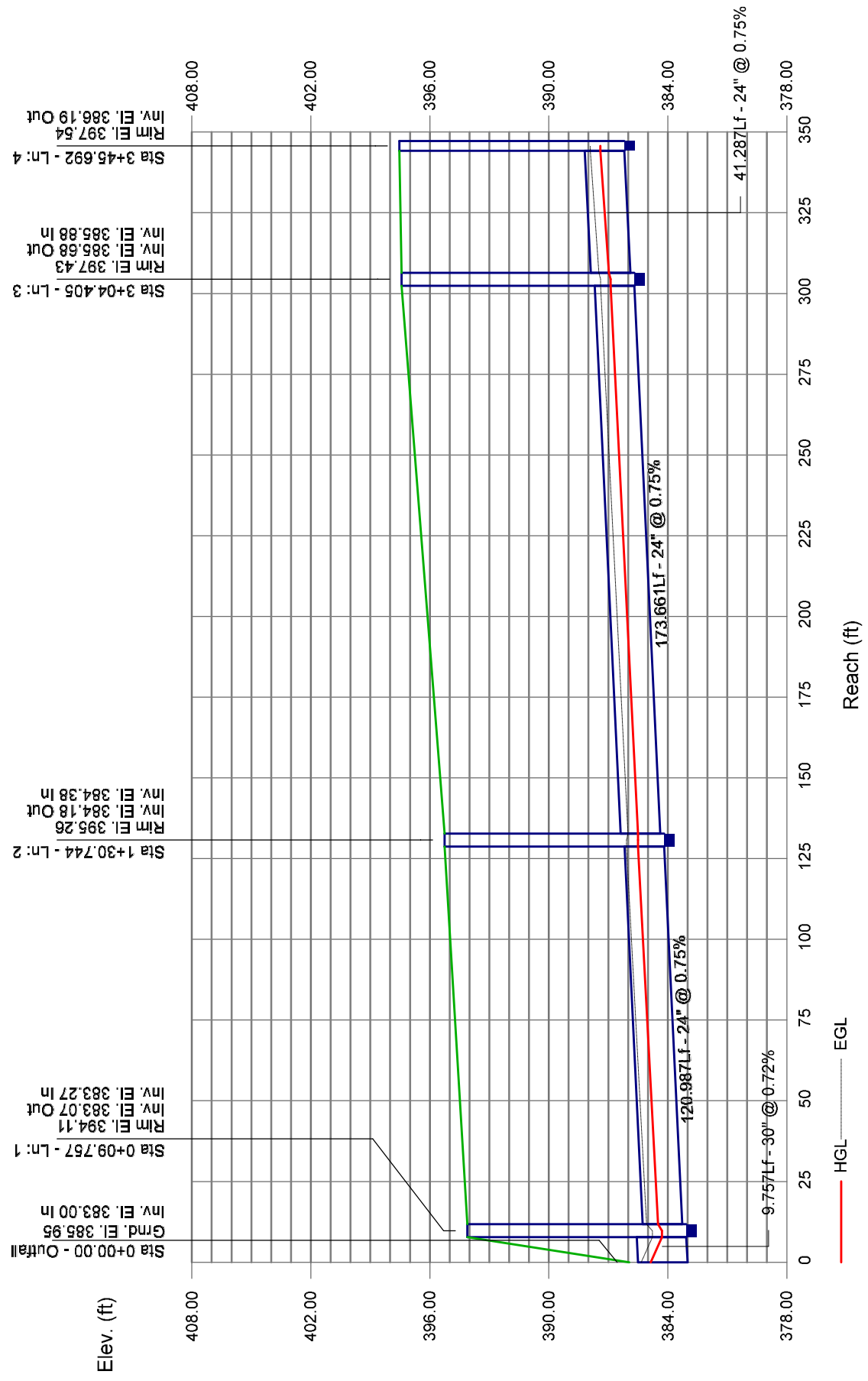
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Run Date: 1/15/2024

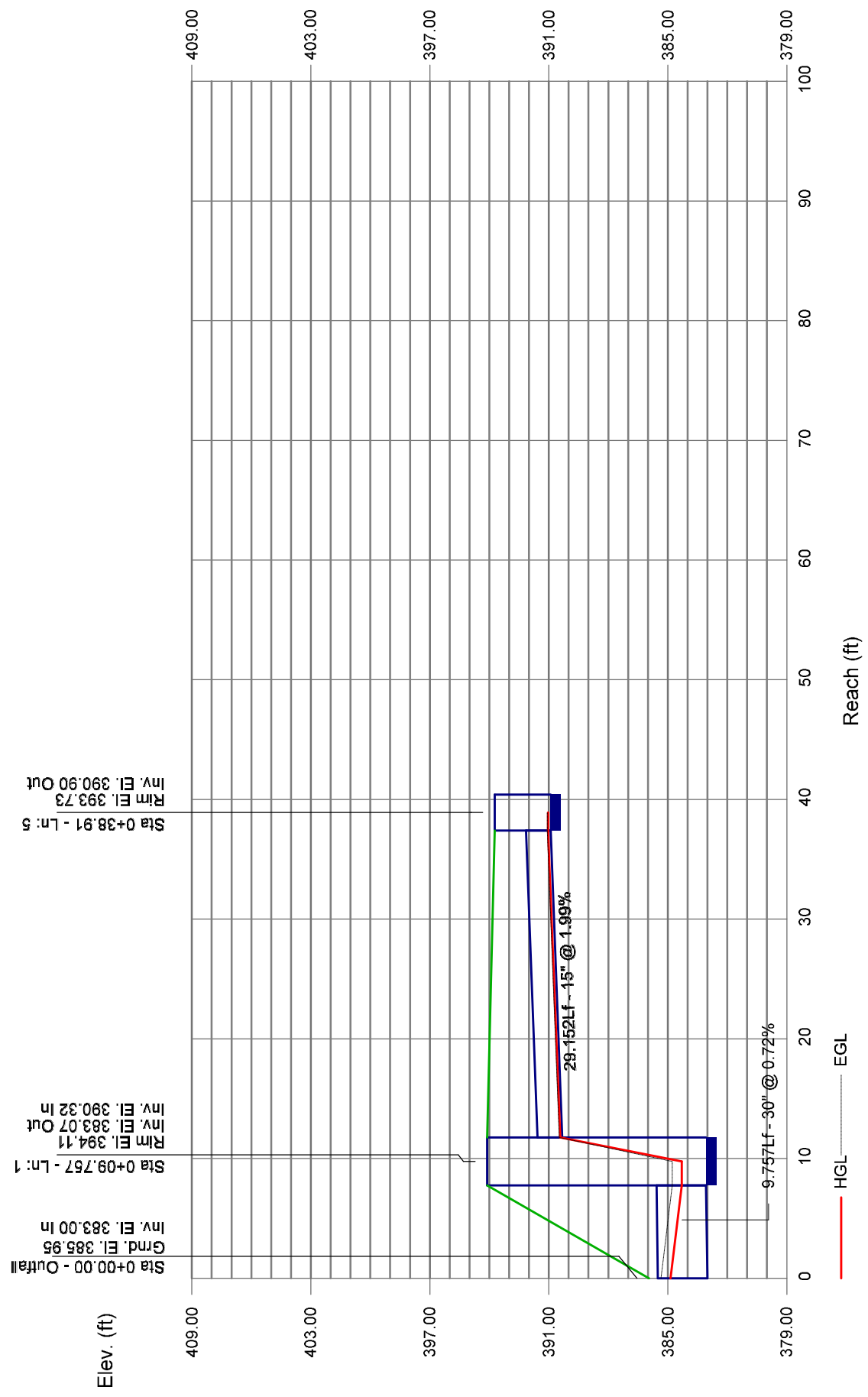
NOTES: Intensity = 73.11 / (Inlet time + 12.60) ^ 0.81; Return period = Yrs. 10 ; c = cir e = ellip b = box

10-Year Hydraulic Grade Profiles

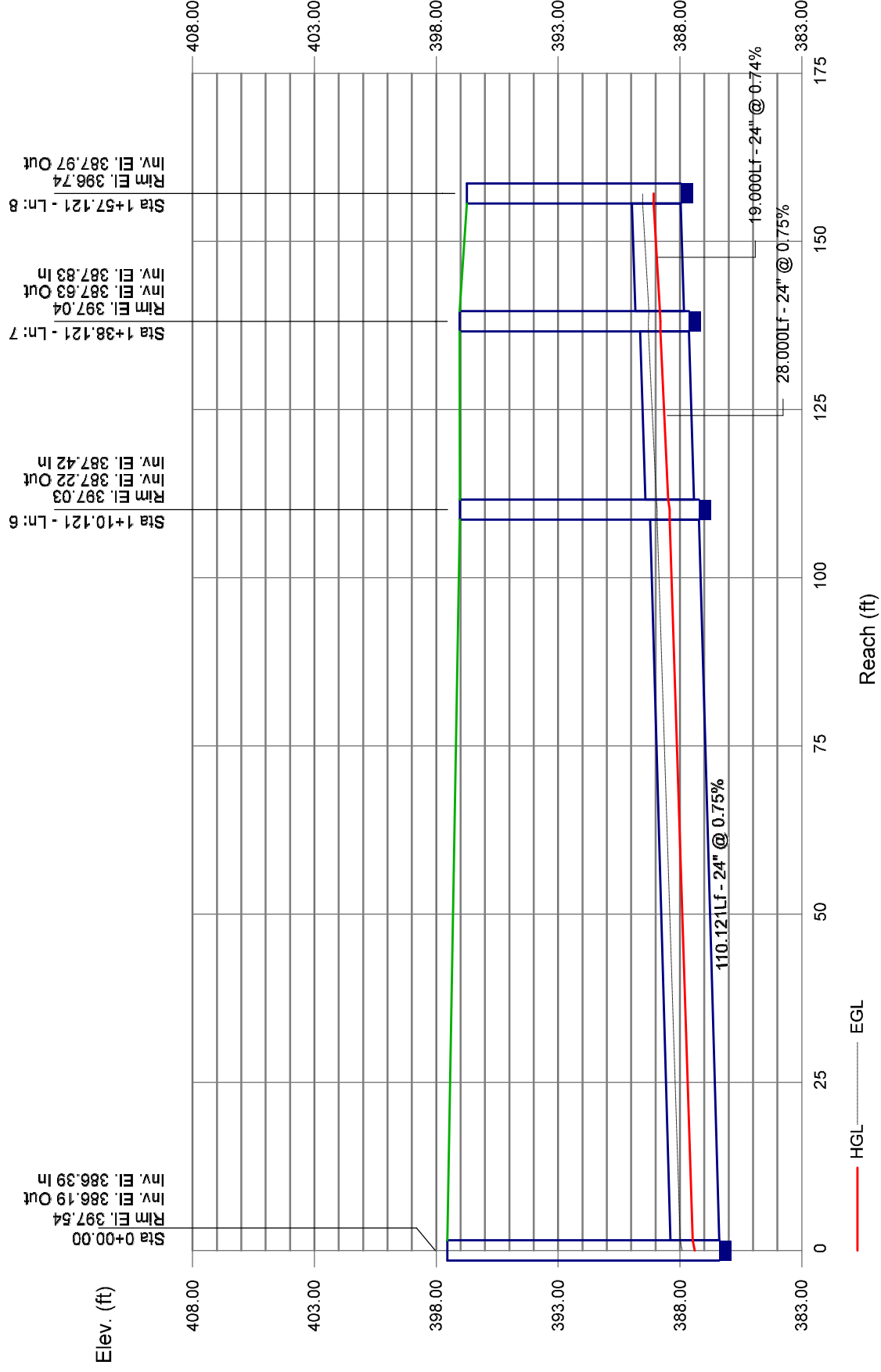
Storm Sewer Profile



Storm Sewer Profile



Storm Sewer Profile



Storm Sewer Profile

