Automatic Fire Sprinkler Systems

REGIONAL FIRE SERVICES OF NC LLC

3101-310 Poplarwood Court - Raleigh, NC 27604
Ph: 919-212-2722 Fax: 919-212-2720
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Certified Engineering Tech.
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Water-Based Systems Layout, Level III

AJITH ZACHARIAS
N.C. REGISTERED CONTRACTOR
35525
FIRE SPRINKLER SYSTEM
RALEIGH, NC

HYDRAULIC CALCULATIONS

For:

CFVHS Harnett Health Dorothea Dix Adolescent Psychiatric Unit

Crested Iris Drive
Lillington, NC 27546

Submitted by:

Thomas Crowder

Automatic Fire Sprinkler Systems

Hydraulic Overview

Job

Job Number: 25011	Designer: THOMAS CROWDER
Job Name: CFVHS - DOROTHEA DIX ADOLESCENT PSYCHIATRIC UNIT	Phone: 919-212-2722 / FAX:
Address 1: CRESTED IRIS DRIVE	State Certification/License Number:
Address 2: LILLINGTON, NC 27546	AHJ:
Address 3:	Job Site/Building:

System

Density: 0.10gpm/ft²	Area of Application: 1500.00ft² (Actual 972.09ft²)
Most Demanding Sprinkler Data: 5.6K K-Factor 14.82gpm at 7.000psi	Hose Streams: 100.00gpm
Coverage Per Sprinkler: 225.00ft²	Number Of Sprinklers Calculated: 10 / Number Of Nozzles Calculated: 0
System Pressure Demand: 61.195psi	System Flow Demand: 159.98gpm
Total Demand: 259.98gpm @ 61.195psi	Pressure Result: +77.755psi (56.0%)

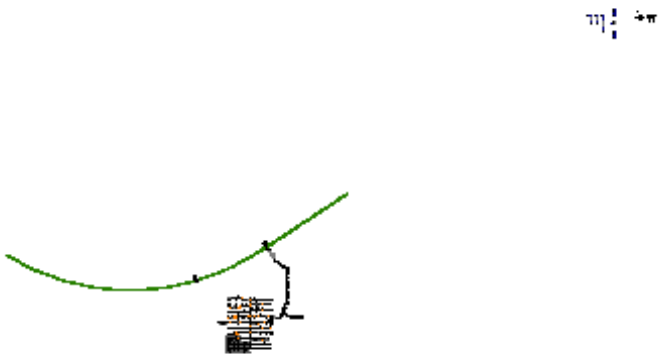
Supplies

Node	Name	Flow(gpm)	Hose Flow(gpm)	Static(psi)	Residual(psi)
1	Water Supply	1592.00gpm	100.00gpm	140.000psi	110.000psi

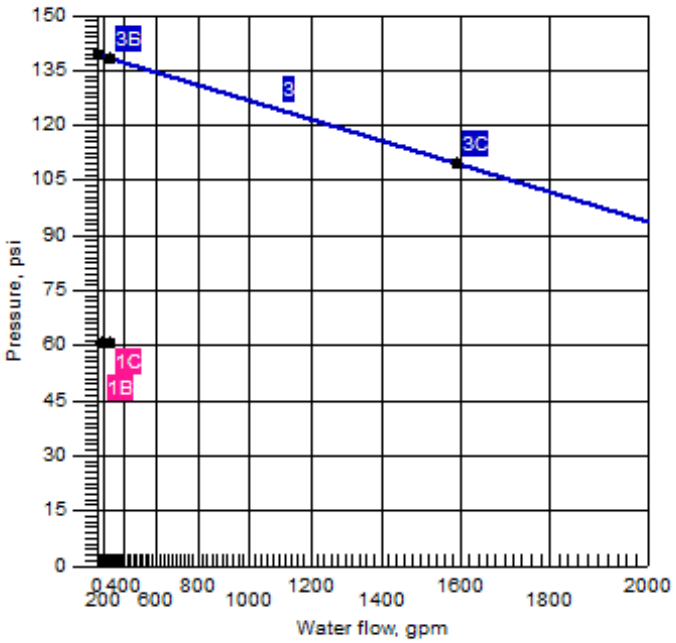
Check Point Gauges

Identifier	Pressure(psi)	K-Factor(K)	Flow(gpm)
BOR (16)	49.194psi	22.81K	159.98gpm

25011_CPVHS HARNETT DOROTHEA DIX BH.cad



Water Supply at Node 1 (1592.00gpm, 0.00gpm, 140.000psi, 110.000psi)



Hydraulic Summary

Job

Job Number: 25011	Designer: THOMAS CROWDER
Job Name: CFVHS - DOROTHEA DIX ADOLESCENT PSYCHIATRIC UNIT	State Certification/License Number:
Address 1: CRESTED IRIS DRIVE	AHJ:
Address 2: LILLINGTON, NC 27546	Job Site/Building:
Address 3:	Drawing Name: 25011_CPVHS HARNETT DOROTHEA DIX BH.cad

System

Most Demanding Sprinkler Data: 5.6K K-Factor 14.82gpm at 7.000psi

Hose Allowance At Source: 100.00gpm

Additional Hose Supplies

Node	Flow(gpm)

Total Hose Streams: 100.00gpm

System Flow Demand	Total Water Required (Including Hose Allowance)
159.98gpm	259.98gpm

Maximum Pressure Unbalance In Loops: 0.000psi

Maximum Velocity Above Ground: 14.05fps between nodes 13 and 10

Maximum Velocity Under Ground	
1.66fps between nodes 9 and 16	

Volume capacity of Wet Pipes	Volume capacity of Dry Pipes
4690.10gal	

Remote Area(s)

Occupancy	Job Suffix
Light Hazard	CFVH Dorothea Dix

Density	Area of Application
0.10gpm/ft²	1500.00ft² (Actual 972.09ft²)

Number Of Sprinklers Calculated	Number Of Nozzles Calculated	Coverage Per Sprinkler
10	0	225.00ft²

AutoPeak Results: Pressure For Remote Area(s) Adjacent To Most Remote Area

Supplies

Node	Name	Hose Flow (gpm)	Static (psi)	Residual (psi) @ Flow (gpm)	Available (psi) @ Total Demand (gpm)	Required (psi)	Safety Margin (psi)
1	Water Supply	100.00gpm	140.000psi	110.000psi @ 1592.00gpm	138.950psi @ 259.98gpm	61.195psi	77.755psi

Contractor

Contractor Number: 21		Contact Name: THOMAS CROWDER	Contact Title: PM
Name of Contractor: REGIONAL FIRE SERVICES OF NC, LLC		Phone: 919-212-2722	Extension:
Address 1: 3101-310 POPLARWOOD COURT		FAX:	
Address 2: RALEIGH, NC 27604		E-mail: THOMAS@REGIONALFIRENC.COM	
Address 3:		Web-Site:	

Water Supply at Node 1

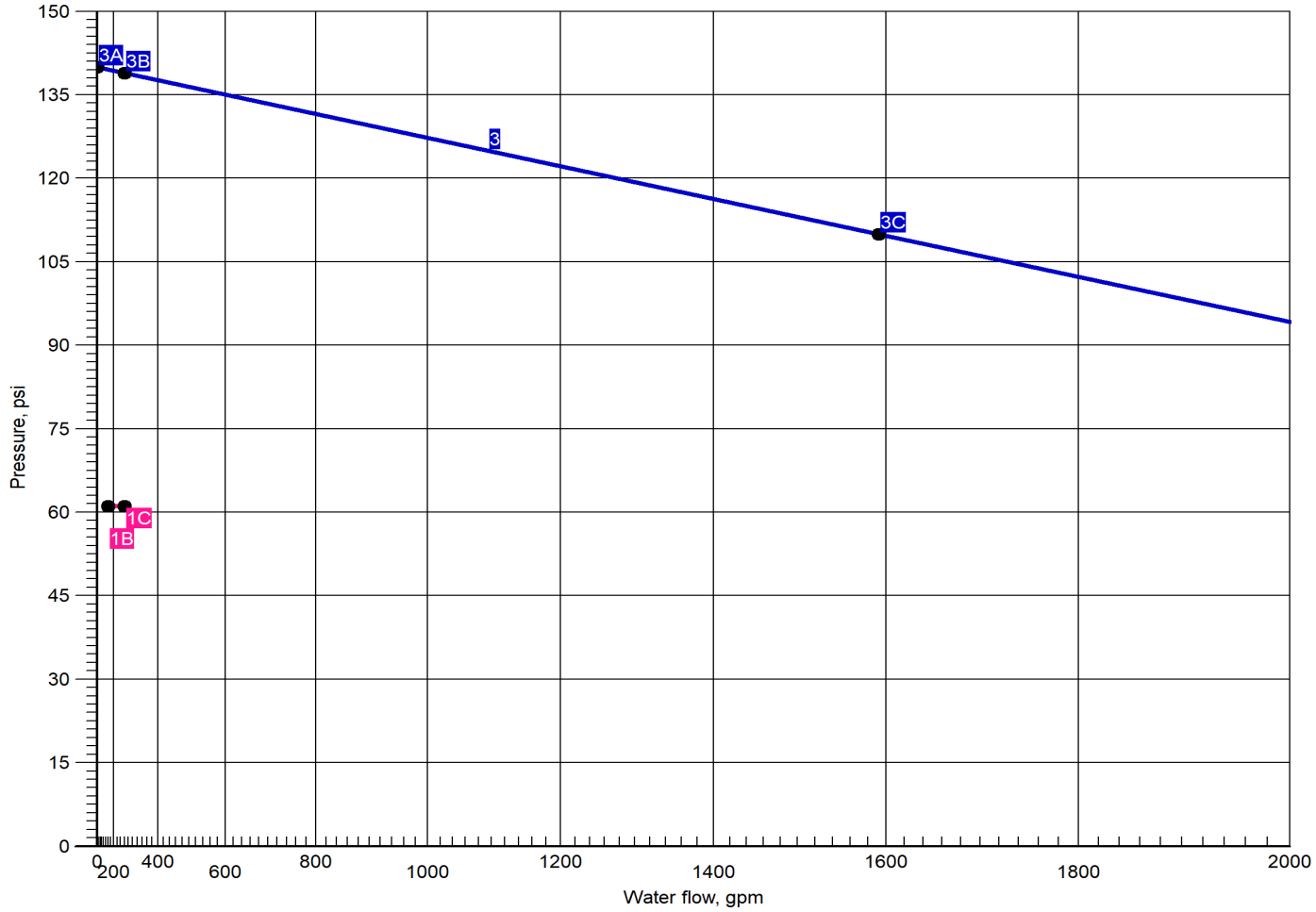
1 System Demand
3 Available Water Supply

Job Name: CFVHS - DOROTHEA DIX ADOLESCENT PSYCHIATRIC UNIT

Job Number: 25011 - CFVH Dorothea Dix

Report Description: Light Hazard (1)

Remote Area Number: 1



Curve	Data Point	Hydraulic Calculation Results	Additional Data
1	1B	Required Pressure at System Demand: 61.195psi @ 159.98gpm	Available Flow @ 20 PSI: 3365.55gpm
	1C	Required Pressure at System Demand (Including Hose Allowance at Source): 61.195psi @ 259.98gpm	
3	3A	Available Static Pressure at Water Supply at Node 1: 140.000psi	
	3B	Available Residual Pressure at System Demand: 110.000psi @ 1592.00gpm	
	3C	Available Residual Pressure & Flow at Water Supply at Node 1: 110.000psi @ 1592.00gpm	

Summary Of Outflowing Devices

Device	Actual Flow (gpm)	Minimum Flow (gpm)	K-Factor (K)	Pressure (psi)			
Sprinkler 101	17.52gpm	14.82gpm	5.6K	9.783psi			
Sprinkler 102	18.69gpm	14.82gpm	5.6K	11.138psi			
Sprinkler 103	14.94gpm	14.82gpm	5.6K	7.119psi			
Sprinkler 104	14.89gpm	14.82gpm	5.6K	7.070psi			
Sprinkler 105	15.30gpm	14.82gpm	5.6K	7.464psi			
Sprinkler 106	14.83gpm	14.82gpm	5.6K	7.016psi			
Sprinkler 107	15.25gpm	14.82gpm	5.6K	7.419psi			
Sprinkler 108	**14.82gpm**	**14.82gpm**	**5.6K**	**7.000psi**			
Sprinkler 109	17.06gpm	14.82gpm	5.6K	9.285psi			
Sprinkler 110	16.68gpm	14.82gpm	5.6K	8.873psi			

⇨ Most Demanding Sprinkler Data

Node	Elevation(Foot)	Fittings	Pressure(psi)	Discharge(gpm)	
1	-3'-0	S	61.195psi	159.98gpm	
101	9'-1½	Spr(-9.783psi)	9.783psi	17.52gpm	
102	9'-0	Spr(-11.138psi)	11.138psi	18.69gpm	
103	9'-0	Spr(-7.119psi)	7.119psi	14.94gpm	
104	9'-0	Spr(-7.070psi)	7.070psi	14.89gpm	
105	9'-0	Spr(-7.464psi)	7.464psi	15.30gpm	
106	9'-0	Spr(-7.016psi)	7.016psi	14.83gpm	
107	9'-0	Spr(-7.419psi)	7.419psi	15.25gpm	
108	9'-0	Spr(-7.000psi)	7.000psi	14.82gpm	
109	9'-0	Spr(-9.285psi)	9.285psi	17.06gpm	
110	9'-0	Spr(-8.873psi)	8.873psi	16.68gpm	
2	9'-8	PO(5'-0)	11.860psi		
3	9'-8	PO(5'-0)	12.113psi		
4	9'-8	E(2'-0)	7.437psi		
5	9'-8	PO(5'-0)	7.629psi		
6	9'-8	PO(5'-0)	8.048psi		
7	9'-8	E(2'-0)	7.391psi		
8	9'-8	PO(5'-0)	7.580psi		
9	-3'-0	T(47'-3½)	61.192psi		
10	9'-8	PO(6'-0)	15.216psi		
11	9'-8	PO(5'-0)	10.064psi		
12	9'-8	PO(5'-0)	7.994psi		
13	1'-2		49.122psi		
14	9'-8	PO(5'-0)	10.170psi		
15	9'-8	PO(6'-0)	14.065psi		
16	1'-0	BOR	49.194psi		
17	9'-8	PO(6'-0)	13.779psi		

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure	
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary	
Upstream							Total Length		
• • • • • Route 1 • • • • •									
DR	1.0490	14.82gpm	5.50fps	120		0.074703	2'-7½	Pf	0.868psi
108	9'-0	14.82gpm	5.6K	7.000psi		Sprinkler,	9'-0	Pe	-0.288psi
8	9'-8			7.580psi		2E(2'-0), PO(5'-0)	11'-7½	Pv	
BL	1.3800	29.65gpm	6.36fps	120		0.070906	5'-10	Pf	0.414psi
8	9'-8	14.83gpm		7.580psi		Flow (q) from Route 2		Pe	
12	9'-8			7.994psi			5'-10	Pv	
BL	1.3800	44.90gpm	9.63fps	120		0.152808	14'-3	Pf	2.176psi
12	9'-8	15.25gpm		7.994psi		Flow (q) from Route 5		Pe	0.000psi
14	9'-8			10.170psi			14'-3	Pv	
BL	1.3800	61.58gpm	13.21fps	120		0.274129	7'-2	Pf	3.609psi
14	9'-8	16.68gpm		10.170psi		Flow (q) from Route 7	6'-0	Pe	
17	9'-8			13.779psi		PO(6'-0)	13'-2	Pv	
CM	2.1570	61.58gpm	5.41fps	120		0.031140	9'-2	Pf	0.286psi
17	9'-8			13.779psi				Pe	
15	9'-8			14.065psi			9'-2	Pv	
CM	2.1570	123.78gpm	10.87fps	120		0.113291	10'-2	Pf	1.150psi
15	9'-8	62.19gpm		14.065psi		Flow (q) from Route 3		Pe	
10	9'-8			15.216psi			10'-2	Pv	
CM	2.1570	159.98gpm	14.05fps	120		0.182113	89'-7	Pf	30.213psi
10	9'-8	36.20gpm		15.216psi		Flow (q) from Route 9	76'-3½	Pe	3.693psi
13	1'-2			49.122psi		2T(12'-3½), 5E(6'-2), sCV(13'-6 ½), BV(7'-4½)	165'-11	Pv	
DY	6.2800	159.98gpm	1.66fps	140		0.000752	0'-0	Pf	0.000psi
13	1'-2			49.122psi				Pe	0.072psi
16	1'-0			49.194psi		BOR	0'-0	Pv	
UG	6.2800	159.98gpm	1.66fps	140		0.000752	178'-5	Pf	10.263psi
16	1'-0			49.194psi			171'-9½	Pe	1.734psi
9	-3'-0			61.192psi		3E(22'-1), 4EE(11'-0½), 3GV(4'-8 ½), BFP(-10.000psi), T(47'-3½)	350'-2	Pv	
UG	12.4600	159.98gpm	0.42fps	140		0.000027	139'-7½	Pf	0.004psi
9	-3'-0			61.192psi				Pe	
1	-3'-0			61.195psi		S	139'-7½	Pv	
		100.00gpm				Hose Allowance At Source			
1		259.98gpm							
• • • • • Route 2 • • • • •									
DR	1.0490	14.83gpm	5.51fps	120		0.074866	2'-10	Pf	0.663psi
106	9'-0	14.83gpm	5.6K	7.016psi		Sprinkler,	6'-0	Pe	-0.288psi
7	9'-8			7.391psi		3E(2'-0)	8'-10	Pv	
BL	1.3800	14.83gpm	3.18fps	120		0.019690	9'-7½	Pf	0.189psi
7	9'-8			7.391psi				Pe	
8	9'-8			7.580psi			9'-7½	Pv	
• • • • • Route 3 • • • • •									
DR	1.0490	14.89gpm	5.53fps	120		0.075394	2'-3	Pf	0.847psi
104	9'-0	14.89gpm	5.6K	7.070psi		Sprinkler,	9'-0	Pe	-0.288psi
5	9'-8			7.629psi		2E(2'-0), PO(5'-0)	11'-3	Pv	
BL	1.3800	29.83gpm	6.40fps	120		0.071710	5'-10	Pf	0.419psi
5	9'-8	14.94gpm		7.629psi		Flow (q) from Route 4		Pe	
6	9'-8			8.048psi			5'-10	Pv	
BL	1.3800	45.13gpm	9.68fps	120		0.154245	13'-1	Pf	2.016psi
6	9'-8	15.30gpm		8.048psi		Flow (q) from Route 6		Pe	-0.000psi
11	9'-8			10.064psi			13'-1	Pv	
BL	1.3800	62.19gpm	13.34fps	120		0.279179	8'-4	Pf	4.001psi
11	9'-8	17.06gpm		10.064psi		Flow (q) from Route 8	6'-0	Pe	
15	9'-8			14.065psi		PO(6'-0)	14'-4	Pv	
• • • • • Route 4 • • • • •									
DR	1.0490	14.94gpm	5.55fps	120		0.075872	2'-0	Pf	0.607psi
103	9'-0	14.94gpm	5.6K	7.119psi		Sprinkler,	6'-0	Pe	-0.288psi
4	9'-8			7.437psi		3E(2'-0)	8'-0	Pv	
BL	1.3800	14.94gpm	3.20fps	120		0.019955	9'-7½	Pf	0.192psi
4	9'-8			7.437psi				Pe	0.000psi
5	9'-8			7.629psi			9'-7½	Pv	
• • • • • Route 5 • • • • •									
DR	1.0490	15.25gpm	5.66fps	120		0.078827	1'-11½	Pf	0.864psi
107	9'-0	15.25gpm	5.6K	7.419psi		Sprinkler,	9'-0	Pe	-0.288psi
12	9'-8			7.994psi		2E(2'-0), PO(5'-0)	10'-11½	Pv	
• • • • • Route 6 • • • • •									

Pipe Type / Downstream / Upstream	Diameter / Elevation	Flow / Discharge	Velocity / K-Factor	HWC / Pt / Pn	Friction Loss / Fittings	Length / Eq. Length / Total Length	Pressure Summary
DR	1.0490	15.30gpm	5.68fps	120	0.079271	2'-0	Pf 0.872psi
105	9'-0	15.30gpm	5.6K	7.464psi	Sprinkler,	9'-0	Pe -0.288psi
6	9'-8			8.048psi	2E(2'-0), PO(5'-0)	11'-0	Pv
• • • • • Route 7 • • • • •							
DR	1.0490	16.68gpm	6.19fps	120	0.093024	6'-0½	Pf 1.585psi
110	9'-0	16.68gpm	5.6K	8.873psi	Sprinkler,	11'-0	Pe -0.288psi
14	9'-8			10.170psi	3E(2'-0), PO(5'-0)	17'-0½	Pv
• • • • • Route 8 • • • • •							
DR	1.0490	17.06gpm	6.33fps	120	0.097013	2'-0	Pf 1.067psi
109	9'-0	17.06gpm	5.6K	9.285psi	Sprinkler,	9'-0	Pe -0.288psi
11	9'-8			10.064psi	2E(2'-0), PO(5'-0)	11'-0	Pv
• • • • • Route 9 • • • • •							
DR	1.0490	17.52gpm	6.50fps	120	0.101812	9'-8½	Pf 2.312psi
101	9'-1½	17.52gpm	5.6K	9.783psi	Sprinkler,	13'-0	Pe -0.234psi
2	9'-8			11.860psi	4E(2'-0), PO(5'-0)	22'-8½	Pv
BL	1.3800	17.52gpm	3.76fps	120	0.026777	9'-5	Pf 0.252psi
2	9'-8			11.860psi			Pe 0.000psi
3	9'-8			12.113psi		9'-5	Pv
BL	1.3800	36.20gpm	7.77fps	120	0.102603	24'-3	Pf 3.103psi
3	9'-8	18.69gpm		12.113psi	Flow (q) from Route 10	6'-0	Pe -0.000psi
10	9'-8			15.216psi	PO(6'-0)	30'-3	Pv
• • • • • Route 10 • • • • •							
DR	1.0490	18.69gpm	6.94fps	120	0.114798	2'-0	Pf 1.262psi
102	9'-0	18.69gpm	5.6K	11.138psi	Sprinkler,	9'-0	Pe -0.288psi
3	9'-8			12.113psi	2E(2'-0), PO(5'-0)	11'-0	Pv

Equivalent Pipe Lengths of Valves and Fittings (C=120 only)

$$\left(\frac{\text{Actual Inside Diameter}}{\text{Schedule 40 Steel Pipe Inside Diameter}}\right)^{4.87} = \text{Factor}$$

C Value Multiplier

Value Of C	100	130	140	150
Multiplying Factor	0.713	1.16	1.33	1.51

Pipe Type	Diameter	Flow	Velocity	HWC		Friction Loss	Length	Pressure
Downstream	Elevation	Discharge	K-Factor	Pt	Pn	Fittings	Eq. Length	Summary
Upstream							Total Length	

Pipe Type Legend

AO	Arm-Over
BL	Branch Line
CM	Cross Main
DN	Drain
DR	Drop
DY	Dynamic
FM	Feed Main
FR	Feed Riser
MS	Miscellaneous
OR	Outrigger
RN	Riser Nipple
SN	Swing Nipple
SP	Sprig
ST	Stand Pipe
UG	Underground

Units Legend

Diameter	Inch
Elevation	Foot
Flow	gpm
Discharge	gpm
Velocity	fps
Pressure	psi
Length	Foot
Friction Loss	psi/Foot
HWC	Hazen-Williams Constant
Pt	Total pressure at a point in a pipe
Pn	Normal pressure at a point in a pipe
Pf	Pressure loss due to friction between points
Pe	Pressure due to elevation difference between indicated points
Pv	Velocity pressure at a point in a pipe

Fittings Legend

ALV	Alarm Valve
AngV	Angle Valve
b	Bushing
BalV	Ball Valve
BFP	Backflow Preventer
BV	Butterfly Valve
C	Cross Flow Turn 90°
cplg	Coupling
Cr	Cross Run
CV	Check Valve
DelV	Deluge Valve
DPV	Dry Pipe Valve
E	90° Elbow
EE	45° Elbow
Ee1	11¼° Elbow
Ee2	22½° Elbow
f	Flow Device
fd	Flex Drop
FDC	Fire Department Connection
fE	90° FireLock(TM) Elbow
fEE	45° FireLock(TM) Elbow
flg	Flange
FN	Floating Node
fT	FireLock(TM) Tee
g	Gauge
GloV	Globe Valve
GV	Gate Valve
Ho	Hose
Hose	Hose
HV	Hose Valve
Hyd	Hydrant
LtE	Long Turn Elbow
mecT	Mechanical Tee
Noz	Nozzle
P1	Pump In
P2	Pump Out
PIV	Post Indicating Valve
PO	Pipe Outlet
PrV	Pressure Relief Valve
PRV	Pressure Reducing Valve
red	Reducer/Adapter
S	Supply
sCV	Swing Check Valve
SFx	Seismic Flex
Spr	Sprinkler
St	Strainer
T	Tee Flow Turn 90°
Tr	Tee Run
U	Union
WirF	Wirsbo
WMV	Water Meter Valve
Z	Cap

Check Point Gauge Data

Gauge	Available Static Pressure (psi)	Available Residual Pressure (psi)	Required Residual Pressure (psi)	K-Factor(K)	Flow(gpm)	Elevation(Foot)
BOR (16)	128.266psi	126.949psi	49.194psi	22.81K	159.98gpm	1'-0

Hydrant Flow Test Report

Test Date 2/26/2025 **Test Time** 10:10 AM

Location

Crested Iris Drive

Tested by

Thomas Crowder & Ajith Zacharias
Regional Fire Services of NC, LLC
Witnessed by: Apex Fire Department

Notes

Witnessed by Harnett Regional Water Department

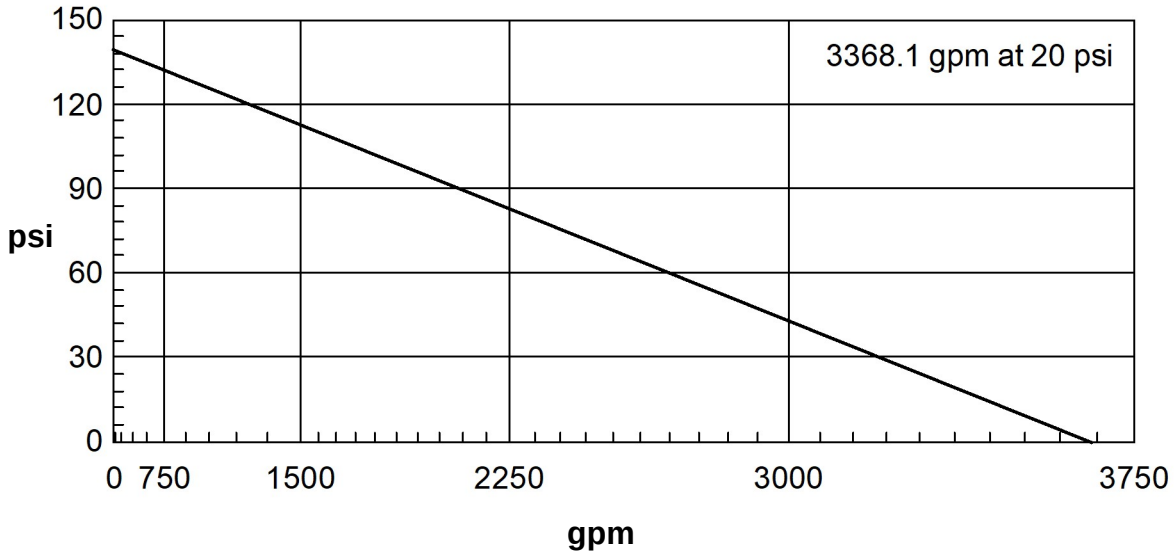
Read Hydrant

140 psi **static pressure**
110 psi **residual pressure**
hydrant elevation

Flow Hydrant(s)

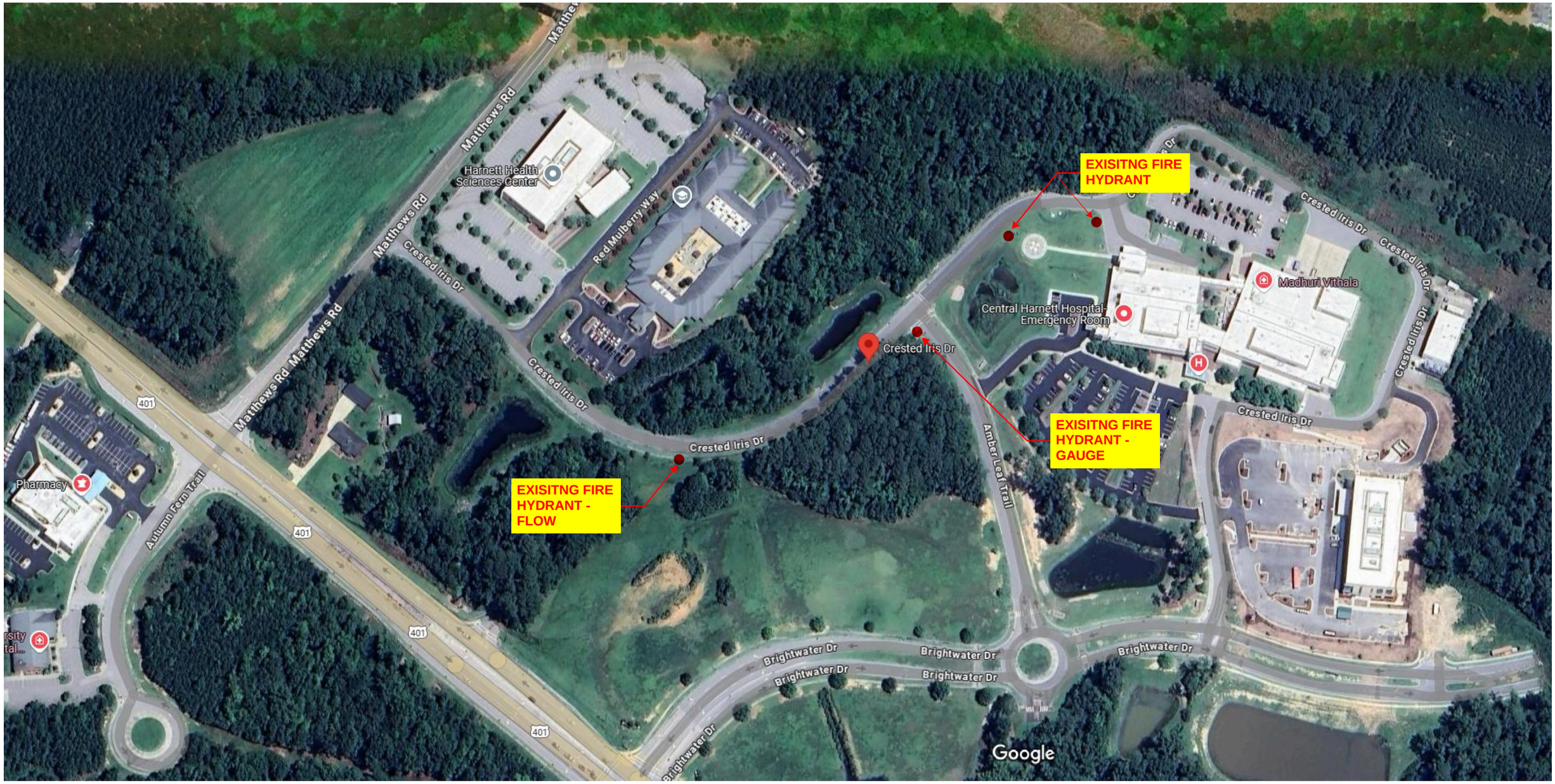
Outlet	Elev	Size	C	Pitot Pressure	Flow
#1		2.5	.9	90	1592 gpm

Flow Graph



Google Maps

Crested Iris Dr



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